ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX B | ALTERNATIVES DEVELOPMENT REPORT

March 2019

Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

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1. INTRODUCTION

The Federal Railroad Administration (FRA), in conjunction with the Georgia Department of Transportation (GDOT), has initiated the Atlanta to Charlotte Passenger Rail Corridor Investment Plan (PRCIP) to identify a comprehensive approach for enhancing passenger rail service for the Atlanta, Georgia to Charlotte, North Carolina corridor. The PRCIP includes a Tier 1 Environmental Impact Statement (EIS), as required by the National Environmental Policy Act (NEPA), and a Service Development Plan (SDP). The Tier 1 EIS presents an evaluation of potential environmental impacts associated with each of the potential alternatives followed by a recommendation of a preferred alternative. The SDP performs a refined operational analysis of the preferred route and service alternative.

The preferred alternative is a generalized representation of a passenger rail route between Atlanta and Charlotte. Future Tier 2 NEPA analysis and preliminary engineering will provide more detailed evaluation of specific alignments along the preferred route.

This Alternatives Development Report (ADR) documents the initial identification, screening, and evaluation of alternatives. The ADR documents the estimated capital costs, operating costs, ridership and revenues, and level of service in terms of travel times, frequency and operating schedules for each alternative. Select information from this ADR will be used in conjunction with environmental impact analysis findings contained in the Tier 1 EIS to recommend a preferred alternative.

1.1 STUDY BACKGROUND AND STUDY AREA

The U.S. Department of Transportation (USDOT) designated the proposed Atlanta to Charlotte corridor as an intercity passenger rail corridor as a part of the Southeast High Speed Rail (SEHSR) Corridor. The SEHSR Corridor, originally established in 1992, connects Washington, D.C., to Charlotte. In 1998, the USDOT extended the SEHSR Corridor to Atlanta; Macon, Ga.; and Jacksonville, Fla. **Exhibit 1-1** illustrates the current SEHSR Corridor network.

In 2008, the Volpe Center published a report, "Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor (Volpe Report)[1]," that evaluated a variety of corridor and technology options. The Volpe Report formed the basis of the alternatives screening and evaluation process and identification of potential alternatives and technologies for the Atlanta to Charlotte corridor.

The Atlanta to Charlotte intercity passenger rail corridor connects the cities of Atlanta and Charlotte for an approximate distance of 280 miles. The corridor's termini are the Hartsfield-Jackson Atlanta International Airport (H-JAIA) area in Atlanta and the proposed Charlotte Gateway Station in Charlotte.[2] At the termini cities, this ADR addresses connectivity to the proposed Georgia Multimodal Passenger Terminal (MMPT)[3] in downtown Atlanta and Charlotte Douglas International Airport (Charlotte-Douglas). This ADR also considers connectivity to the existing and planned Charlotte to Raleigh passenger rail service and SEHSR[4] Corridor through Washington, D.C., currently under study by the North Carolina Department of Transportation (NCDOT) Rail Division and Virginia Department of Rail and Public Transportation (DRPT).

This ADR commonly references the major stations and termini along the Project corridor as follows: H-JAIA, Georgia MMPT, Greenville-Spartanburg International Airport (GSP Airport), Charlotte Douglas International Airport (Charlotte-Douglas), and Charlotte Gateway Station.

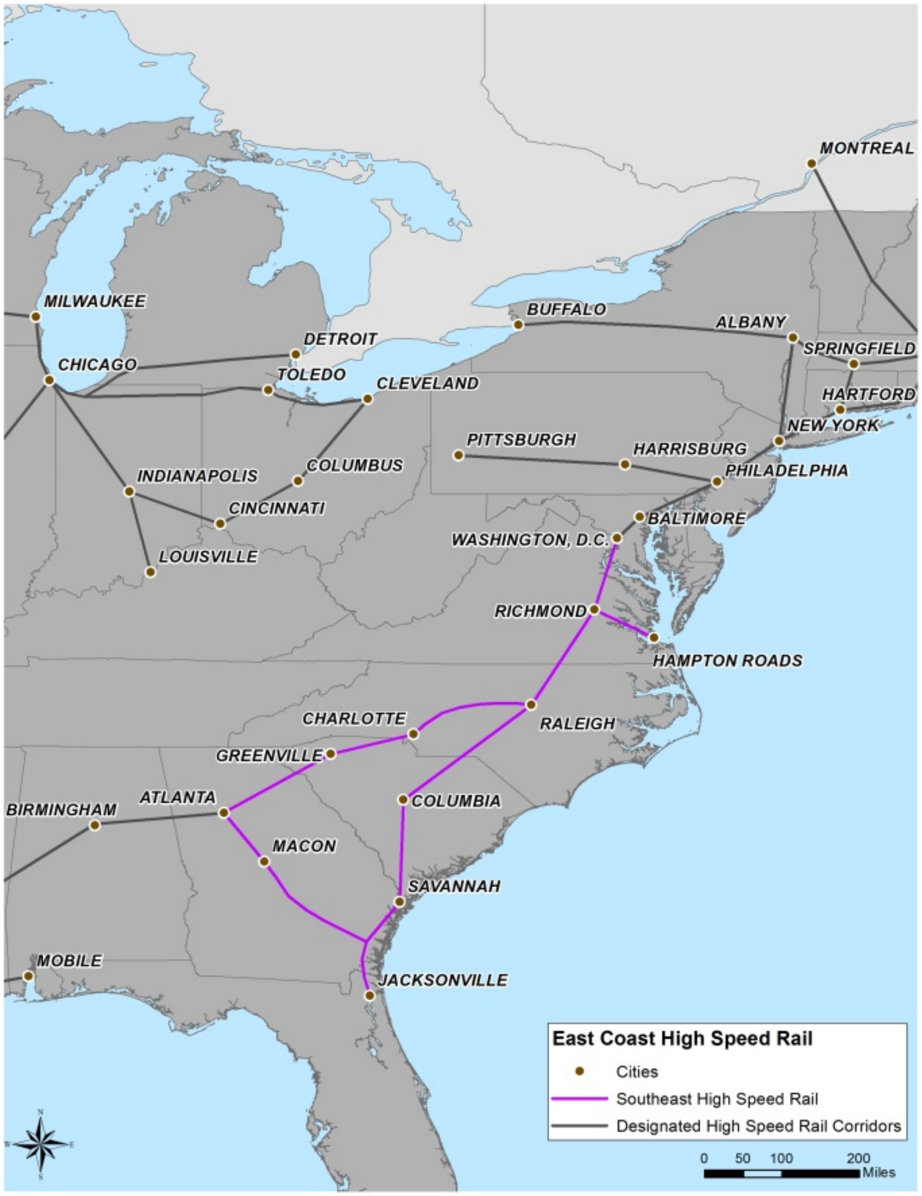
[1] *2008. The Volpe Center. "Evaluation of High Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor."* http://www.sehsr.org/reports/hsr/eval_hsr_options.pdf (accessed on 02/27/15)

[2] http://charmeck.org/city/charlotte/cats/planning/facilities/gatewaystation/Pages/default.aspx (accessed on 02/27/15)

[3] http://www.dot.ga.gov/doingbusiness/p3/projects/mmpt/Pages/default.aspx (accessed on 02/27/15)

[4] http://www.sehsr.org/ (accessed on 02/27/15)

Exhibit 1-1: SEHSR Corridor



1.2 COORDINATION WITH STAKEHOLDERS

The Atlanta to Charlotte corridor includes a variety of transportation agencies and stakeholders potentially affected by the outcomes of the study. Two Class I railroads that operate within the corridor: Norfolk Southern (NS) and CSX Transportation (CSXT). Both Class I's own railroad right-of-way (ROW) between Atlanta and Charlotte. This ADR considered these railroad ROWs, especially in regards to connectivity in the terminal cities to access potential stations, such as the Georgia MMPT and the Charlotte Gateway Station. Currently, Amtrak operates roundtrip passenger rail service once daily along the NS railway connecting passengers from the southeastern to the northeastern U.S. The corridor also includes the I-85 ROW between the two cities under the jurisdiction of the Federal Highway Administration (FHWA), GDOT, the South Carolina Department of Transportation (SCDOT) and NCDOT. Alternatives also have the potential to impact the operations of metropolitan planning organizations, airports, private charter companies, departments/divisions of economic development and local municipalities. Currently 20 flights per day operate between Atlanta and Charlotte, and eight and ten flights operate between Atlanta and Greenville-Spartanburg and Charlotte and Greenville-Spartanburg respectively. There are nine to eleven intercity bus trips per day between Atlanta and Charlotte with most stopping in either Greenville or Spartanburg. This Tier 1 NEPA process includes an extensive public involvement and stakeholder outreach effort. The *Public Participation and Agency Coordination Plan*[5] detail these activities.

1.3 PURPOSE AND NEED FOR PRCIP

The purpose of the Atlanta to Charlotte PRCIP is to improve intercity travel and mobility between Atlanta and Charlotte by expanding the region's transportation capacity and reliable mode choices through improvements in passenger rail services.

This corridor will also be an important extension to the planned SEHSR Corridor system in developing important linkages to other metropolitan areas along the East Coast (Washington, D.C., New York and Boston). Investment in passenger rail is an essential part of the region's multimodal transportation system and its ability to support population and economic growth throughout the SEHSR Corridor network.

The intention of intercity passenger rail is to provide improved transportation service for travelers that is competitive with other modes of travel in terms of travel time, convenience and safety. The proposed Atlanta to Charlotte intercity passenger rail service would satisfy the following needs:

- Provide Regional Linkage – Improve overall regional connectivity by providing an intercity passenger rail linkage between Atlanta and Charlotte and other proposed SEHSR locations, as well as enhance multimodal transportation connections;
- Improve Capacity – Supplement Interstate highways and commercial airports to provide increased corridor capacity to support passenger movement;
- Improve Travel Times – Decrease travel times between major urban centers compared to auto and total air travel times;
- Provide an Alternative Mode – Provide travelers with an alternate choice to automobile, bus, conventional rail and air travel that is safe, reliable and efficient;
- Enhance Energy Efficiency – Improve energy efficiency by reducing dependence on foreign oil and decreasing greenhouse gas emissions; and
- Promote Economic Development – Increase economic activity and employment opportunities via improved transportation connectivity resulting in a more productive and competitive economy with an expansion of the labor pool market along the corridor.

[5] http://www.dot.ga.gov/travelingingeorgia/rail/AtlantatoCharlotte/Pages/default.aspx (accessed on 02/27/15)

1.4 PURPOSE AND STRUCTURE OF THE ADR

The purpose of this ADR is to support the alternatives analysis portion of the Tier 1 EIS. The ADR begins with a screening evaluation to reduce the number of initial route alternatives from the broad range of those that are "reasonable" to a refined range of those that are "feasible". Following the screening, the ADR provides detailed, refined operational analyses for each of the feasible route alternatives. This ADR is organized in the following manner:

- Chapter 2 describes the overall alternatives analysis process;
- Chapter 3 identifies and screens the initial alternatives;
- Chapter 4 identifies and evaluates the potential route alignments within Atlanta
- Chapter 5 explains the refinement of the route alternatives and their associated operating characteristics, costs and financial outlook;
- Chapter 6 provides an overview of possible implementation and phasing options for an intercity passenger rail corridor; and
- Chapter 7 summarizes the next steps for the Atlanta to Charlotte PRCIP.

2. ROUTE IDENTIFICATION, SCREENING, AND REFINEMENT PROCESS

The evaluation and screening of route alternatives in the Atlanta to Charlotte corridor follows a three phase process with increasingly detailed considerations within each phase. The results of the route alternatives screening will lead to the recommendation of a preferred route alternative in the Tier 1 EIS for selection in a Record of Decision (ROD) and the preparation of a detailed SDP.

The three phases of analysis are:

1) Identifying and evaluating six reasonable route alternatives leading to a set of three feasible route alternatives;
2) Refining the three feasible route alternatives; and
3) Comparing and evaluating the three feasible route alternatives to recommend one preferred route alternative.

This ADR documents phases 1 and 2.

As the first step in the screening and evaluation process, the initial universe of potential alternatives was identified within the study area. As mentioned in Section 1.1, the 2008 Volpe Report provided a point of departure for this work along with a review of additional rail, highway and other routes. These route alternatives were compared and evaluated by a quantitative and qualitative process to select an initial set of reasonable route alternatives for further evaluation.

After the initial selection, these reasonable route alternatives were further refined by evaluating appropriate levels of service,[6] operating technologies and alignment options for each route. This phase relies heavily on technical and engineering considerations. The completion of this phase resulted in a refined list of feasible alternatives for detailed evaluation. The results of the analysis are presented in the ADR; however, a selection of a preferred alternative (phase 3) will occur after the evaluation of the alternatives from an environmental impact perspective.

[6] *Level of service refers to schedules, frequencies and station stops.*

3. PHASE I: ROUTE IDENTIFICATION AND SCREENING

3.1 REASONABLE ROUTE ALTERNATIVE IDEFNTIFICATION

Three types of route corridor characteristics comprise the Atlanta to Charlotte corridor:

1) Shared Use with Freight Railroad : follows a Class I railroad corridor utilizing available right-of-way (ROW) where applicable;
2) Interstate: follows an interstate corridor utilizing available ROW where applicable; and
3) Greenfield: follows a new corridor on new ROW where no transportation infrastructure currently exists.

3.1.1 Route Alternatives

The first phase of the screening process identified six reasonable route alternatives between Atlanta and Charlotte. In the Atlanta metro area, each of these routes would serve the proposed Georgia MMPT in downtown Atlanta and would terminate at the H-JAIA area. In the Charlotte metro area, each route alternative would terminate at the Gateway Station in "uptown" Charlotte. The six route alternatives are illustrated in **Exhibit 3-1.**

3.1.1.1 Alternative 1: Southern Crescent

The Southern Crescent alternative (Alternative 1) is a shared-use alternative[7] primarily along the NS ROW on which Amtrak currently operates daily passenger service between Atlanta and Charlotte. Within the downtown Atlanta area, Alternative 1 utilizes a Class I railroad corridor between H-JAIA and Howell Junction, which is the intersection of NS and CSXT railroads approximately one mile north of the Georgia MMPT. Tier 2 NEPA analysis will define specific alignment detail.

3.1.1.2 Alternative 2: I-85

The Interstate-85 (I-85) alternative (Alternative 2[8]) is a dedicated-use alternative[9] predominately within the I-85 ROW. Within the approaches to both terminal cities, Alternative 2 transitions to a shared-use Class I railroad corridor in order to access the respective downtown stations including the Georgia MMPT, H-JAIA, Charlotte-Douglas and Charlotte Gateway Station.

3.1.1.3 Alternative 3: Greenfield

The Greenfield alternative (Alternative 3) is a dedicated-use alternative primarily on new ROW. The geometry of the route minimizes curves with the goal of achieving faster speeds in the 180 to 220 mph range. Similar to Alternative 2, Alternative 3 transitions to a shared-use Class I railroad corridor in order to access downtown stations in Atlanta and Charlotte.

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[7] *"Shared use" refers to the sharing of track in an existing and active freight rail corridor.*

[8] *It should be noted that at the beginning of Scoping in June 2013 the I-85 alternative was labeled as Alternative 3 whereas the Greenfield alternative was Alternative 2. At the end of scoping, the Alternative numbers have changed to what is presented in this ADR.*

[9] *Dedicated use refers to the use of track dedicated solely for the purpose of providing passenger rail service. The addition of freight operations was not evaluated in this report. This does not necessarily preclude the operation of temporally separated freight operations in that the engineering design standards used for the dedicated route alternative can support freight use where capacity is available. Heavy freight use will increase the maintenance costs associated with these tracks.*

3.1.1.4 Alternative 4: I-20 and I-77

The Interstates-20 and 77 (I-20 and I-77) alternative (Alternative 4) is similar to the dedicated-use Alternative 2, as they both utilize interstate ROW serving Augusta, Ga., and Columbia, S.C., following the I-20 and I-77 ROW. Within the Atlanta area, it transitions to shared-use Class I railroad corridor in order to access the inner-city stations. In Charlotte, the transition to NS ROW is just south of the proposed Charlotte Gateway Station. This alternative does not directly access Charlotte-Douglas.

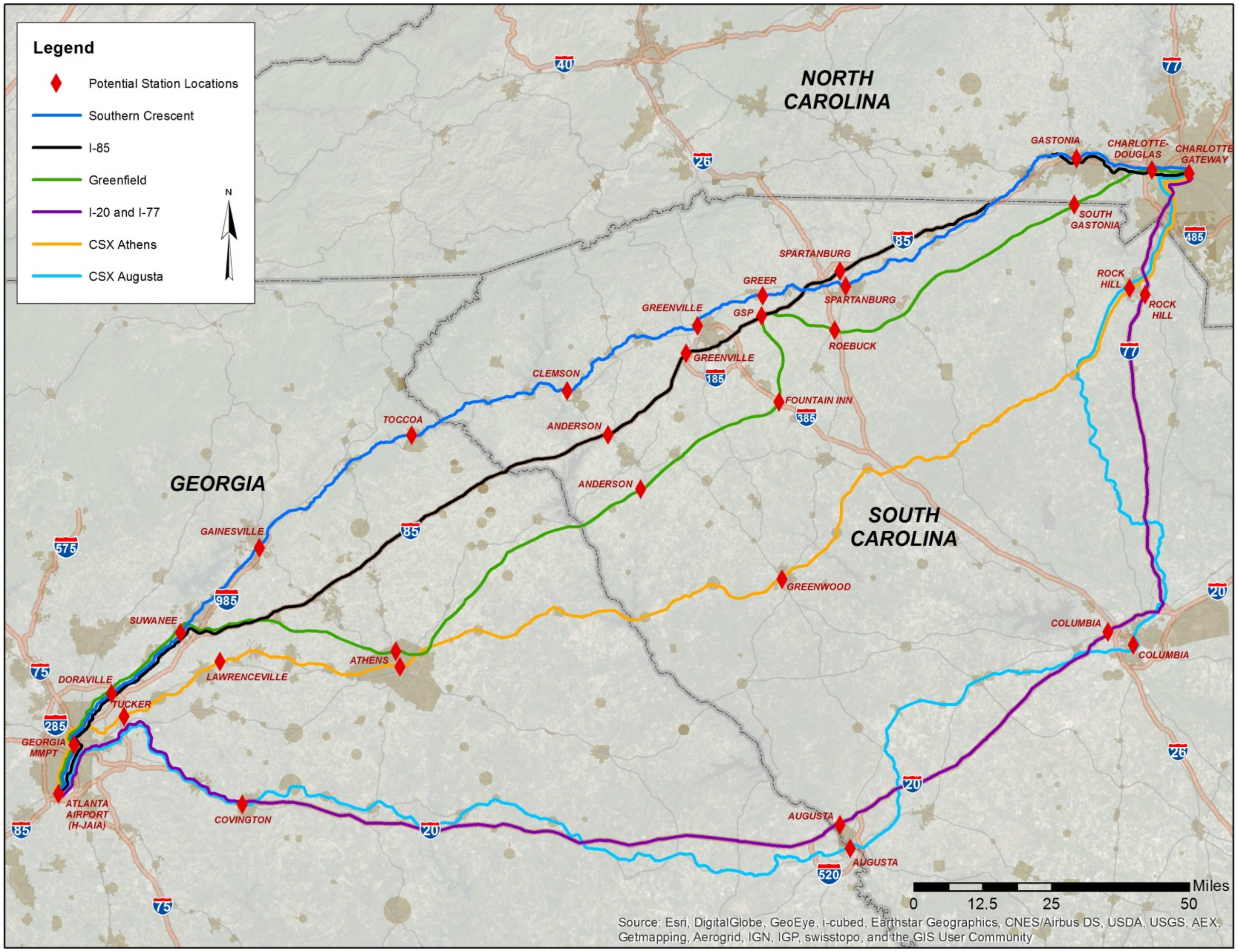
3.1.1.5 Alternative 5: CSXT and NS via Augusta

The CSXT and NS via Augusta alternative (Alternative 5) is a shared-use alternative that follows the CSXT ROW from Atlanta heading east to Augusta, Ga., where the alternative transitions to the NS ROW; it then continues through Columbia, S.C., and heads north to Charlotte. Similar to Alternative 4, Alternative 5 does not directly access Charlotte-Douglas.

3.1.1.6 Alternative 6: CSXT and NS via Athens

The CSXT and NS via Athens alternative (Alternative 6) is a shared-use alternative that utilizes the CSXT ROW from Atlanta heading east towards Athens, Ga., and into South Carolina. In Chester, S.C., Alternative 6 transitions to the NS ROW through Rock Hill, S.C., and into the proposed Charlotte Gateway Station. Similar to Alternatives 4 and 5, Alternative 6 does not directly access Charlotte-Douglas.

Exhibit 3-1: Reasonable Route Alternatives



3.2 EVALUATION AND SCREENING

The purpose of the Phase 1 screening is to evaluate the universe of reasonable alternatives at a high level. The evaluation includes both quantitative and qualitative metrics where a score and rating were assigned based on the performance of an alternative when compared to the performance of the other alternatives. Based on these metrics, the top performing route alternatives moved forward to Phase 2: Alternative Refinement.

3.2.1 Criteria

There were seven metrics included in the Phase 1 evaluation.

1) **Purpose and Need:** a qualitative measure of how well each alternative meets the primary goals and objectives of the Atlanta to Charlotte PRCIP. Those routes which best meet the goals and objectives of the stated purpose and need of the project rank the highest.
2) **Route Length (miles):** a measure of potential improvement costs and indication of travel time. A longer route will require more miles of improvements and associated costs, all things being equal. A longer route will typically have a longer travel time and higher capital cost than a shorter route. Therefore, shorter routes rank higher than longer routes in this analysis.
3) **Route Travel Time (minutes):** a high-level estimate of travel times from H-JAIA to Charlotte Gateway Station. Reduced travel time between the Atlanta metro area and Charlotte is an explicit goal of the purpose and need of the project and is a measure of the relative mobility benefits of one route versus another. The lower the travel time, the higher the ranking of a given route.
4) **Route Geometry (Curves > 1 degree 30 minutes) and Limiting Speed:** a measure of potential limiting speeds by curvature. One degree 30 minutes was selected as the baseline curvature screening criteria that could be used to compare route geometry impacts across all technologies consistently. Typically it limits a non-tilt train to approximately 90 mph and a tilt train to 110 mph. Those alternatives with geometric curves greater than 1 degree 30 minutes will negatively affect travel time; therefore, those alternatives with a higher number of curves within a given route, the lower the ranking.
5) **Population Served:** a measure of potential residential market access and ridership. A route that serves a larger market ranks higher than a route serving a smaller market.
6) **Employment Served:** a measure of potential employment market access and ridership. Employees are major users of intercity train and other forms of public transportation. The larger the employment market for a given route, the higher the ranking.
7) **Regional and Intermodal Links:** a qualitative measure of how well each alternative provides connectivity to regional rail systems, airports and multimodal terminals. A qualitative evaluation of rail connectivity and access to H-JAIA, Charlotte-Douglas, GSP Airport and the proposed SEHSR Corridor at Charlotte Gateway Station was used. The better the connectivity and access, the higher the ranking of a given route.

3.2.2 Rankings

Each of the route alternatives were scored and rated based on each of the criterion. **Exhibit 3-2** outlines scoring and rating categories of the metrics.

Exhibit 3-2: Scoring Criteria

Performance Relative to the Best Performing Corridor	Score	Rating
Best performing corridor(s) (between 91 and 100%)	4.1 - 5.0	Best
Between 81 and 90% of the best performing corridor	3.1 - 4.0	Very Good
Between 71 and 80% of the best performing corridor	2.1 - 3.0	Good
Between 61 and 70% of the best performing corridor	1.1 - 2.0	Fair
60% or less of the best performing corridor[10]	0.0 - 1.0	Poor

The best performing alternative receives 100% and the highest score (5.0), each subsequent alternative's score is in proportion to the best performing alternative score. Each evaluation criterion includes a specific metric(s) used as a basis for the percentages and scores.

3.2.2.1 Consistency with Purpose and Need

Each of the six route alternatives were qualitatively compared to the purpose and need statement[11] as a measure of how well they meet each of the eight goals of the Atlanta to Charlotte PRCIP. The goals include:

1) Provides regional linkages between Atlanta and Charlotte - This criterion was met by all route alternatives.
2) Integrates with the SEHSR Corridor between Charlotte and Washington, D.C. - To fully meet this goal, a route has to both provide seamless consistency with the 110 mph diesel technology employed by the SEHSR Corridor[12] and also provide a direct connection to Gateway Station in Charlotte. The shared-use Southern Crescent route, CSXT and NS via Augusta and CSXT and NS via Athens (Alternatives 1, 5 and 6) using diesel-electric technology and a direct connection to the Gateway Station all meet both of these criteria. While providing a direct connection to the Gateway Station, the full build out of I-85, Greenfield and I-20/77 route alternatives (Alternatives 2, 3 and 4) utilize electrified equipment technology and require a cross platform transfer and partially meet this criterion.
3) Is consistent with a Federally designated high-speed rail (HSR) corridor - Federal designation as a HSR corridor by the USDOT Secretary shows that a route has been reviewed by USDOT and is eligible for certain types of Federal funding. It also is an indication that a route has substantial state support, given that states submit designation requests. This does not necessarily preclude a route without designation from receiving funding.
4) Promotes economic development - All alternatives improve passenger rail service and increase accessibility to communities, as well as provide a degree of positive economic development. A qualitative analysis measured this criterion.
5) Improves travel time over current passenger rail service - Routes with travel times between Charlotte Gateway Station and H-JAIA that were estimated to be better than current Amtrak service were scored as

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[10] *Negative percentages receive a score of zero.*

[11] *http://www.dot.ga.gov/IS/Rail/AtlantatoCharlotte* (accessed on 02/27/15)

[12] *The Tier 1 EIS for the SESHR Corridor between Washington, D.C. and Charlotte selected a preferred alternative with a maximum allowable speed of 110 mph, using diesel technology. However, the SESHR Corridor Tier I EIS also recommended inclusion of provision for future electrification.*

meeting this criterion. All route alternatives, with the exception of CSXT and NS via Augusta (Alternative 5), meet this criterion.

6) Supports multimodal hubs - This refers to access to both Georgia MMPT and Charlotte Gateway Station. All routes were scored as meeting this criterion.

7) Improves/supplements highway and airport capacity - All route alternatives were scored as supplementing highway capacity, given that new or improved rail service generates the majority of its riders from existing auto travelers. Those alternatives not serving all major airports along the corridor were scored as only partially meeting this criterion (i.e., three alternatives do not have direct access to Charlotte-Douglas).

8) Improves air quality and emissions - Because intercity passenger rail service has lower emissions per passenger mile than auto and air modes, all routes were scored as meeting improved air quality and emission goals.

Exhibit 3-3 outlines each alternative and the eight specific criteria of the Purpose and Need. Each alternative was evaluated for each of the eight criterion above and assessed whether it meets (a score of 1.0), partially meets (a score of 0.5), or does not meet (a score of zero) the criteria.

Exhibit 3-3: Purpose and Need Criteria

Alternative	Criteria	Consistency (Meets, Partially Meets, Does not Meet)	
Alternative 1: Southern Crescent	1. Regional linkage of Atlanta and Charlotte	1. Meets	1.0
	2. Integration with SEHSR Corridor	2. Meets	1.0
	3. USDOT Designated HSR Corridor	3. Meets	1.0
	4. Promotes economic development	4. Meets	1.0
	5. Improves travel time	5. Meets[13]	1.0
	6. Supports multimodal hubs	6. Meets	1.0
	7. Improves/supplements highway and airport capacity	7. Meets	1.0
	8. Improves air quality and emissions	8. Meets	1.0
			8.0
Alternative 2: I-85	1. Regional linkage of Atlanta and Charlotte	1. Meets	1.0
	2. Integration with SEHSR Corridor	2. Partially Meets	0.5
	3. USDOT Designated HSR Corridor	3. Meets	1.0
	4. Promotes economic development	4. Meets	1.0
	5. Improves travel time	5. Meets	1.0
	6. Supports multimodal hubs	6. Meets	1.0
	7. Improves/supplements highway and airport capacity	7. Meets	1.0
	8. Improves air quality and emissions	8. Meets	1.0
			7.5
Alternative 3: Greenfield	1. Regional linkage of Atlanta and Charlotte	1. Meets	1.0
	2. Integration with SEHSR Corridor	2. Partially Meets	0.5
	3. USDOT Designated HSR Corridor	3. Meets	1.0
	4. Promotes economic development	4. Meets	1.0
	5. Improves travel time	5. Meets	1.0
	6. Supports multimodal hubs	6. Meets	1.0
	7. Improves/supplements highway and airport capacity	7. Meets	1.0
	8. Improves air quality and emissions	8. Meets	1.0
			7.5

[13] *Refer to individual travel times (Exhibit 3-6) for specific travel times.*

Alternative	Criteria	Consistency (Meets, Partially Meets, Does not Meet)	
Alternative 4: I-20 and I-77	1. Regional linkage of Atlanta and Charlotte	1. Meets	1.0
	2. Integration with SEHSR Corridor	2. Partially Meets	0.5
	3. USDOT Designated HSR Corridor	3. Does Not Meet	0.0
	4. Promotes economic development	4. Meets	1.0
	5. Improves travel time	5. Meets	1.0
	6. Support multimodal hubs	6. Meets	1.0
	7. Improves/supplements highway and airport capacity	7. Partially Meets	0.5
	8. Improves air quality and emissions	8. Meets	1.0
			6.0
Alternative 5: CSXT and NS via Augusta	1. Regional linkage of Atlanta and Charlotte	1. Meets	1.0
	2. Integration with SEHSR Corridor	2. Meets	1.0
	3. USDOT Designated HSR Corridor	3. Does Not Meet	0.0
	4. Promotes economic development	4. Meets	1.0
	5. Improves travel time	5. Does Not Meet	0.0
	6. Supports multimodal hubs	6. Meets	1.0
	7. Improves/supplements highway and airport capacity	7. Partially meets	0.5
	8. Improves air quality and emissions	8. Meets	1.0
			5.5
Alternative 6: CSXT and NS via Athens	1. Regional linkage of Atlanta and Charlotte	1. Meets	1.0
	2. Integration with SEHSR Corridor	2. Meets	1.0
	3. USDOT Designated HSR Corridor	3. Does Not Meet	0.0
	4. Promotes economic development	4. Meets	1.0
	5. Improves travel time	5. Meets	1.0
	6. Supports multimodal hubs	6. Meets	1.0
	7. Improves/supplements highway and airport capacity	7. Partially Meets	0.5
	8. Improves air quality and emissions	8. Meets	1.0
			6.5

Exhibit 3-4 outlines the results of the Purpose and Need evaluation and assigns the performance, score and rating for each of the alternatives.

Exhibit 3-4: Consistency with Purpose and Need Summary

Alternative	Consistency with Purpose and Need Statement	Performance Relative to Best Performing Alternative	Purpose and Need Performance Score	Rating
Alternative 1: Southern Crescent	8.0	100%	5.0	Best
Alternative 2: I-85	7.5	94%	4.4	Best
Alternative 3: Greenfield	7.5	94%	4.4	Best
Alternative 4: I-20 and I-77	6.0	75%	2.5	Good
Alternative 5: CSXT and NS via Augusta	5.5	69%	1.9	Fair
Alternative 6: CSXT and NS via Athens	6.5	81%	3.1	Very Good

3.2.2.2 Route Length

Route length is a relative measure of potential route improvement costs and an indication of travel time. Typically, the route length is directly related to travel time (e.g., longer distance equals longer travel time). Therefore, those routes with shorter travel times score higher. **Exhibit 3-5** illustrates the corridor distances between Atlanta and Charlotte for each of the alternatives and rates them with shorter distances scoring higher.

Exhibit 3-5: Mileage by Alternative

Alternative	Mileage	Performance Relative to Best Performing Alternative	Mileage Performance Score	Rating
Alternative 1: Southern Crescent	273	88%	3.8	Very Good
Alternative 2: I-85	244	100%	5.0	Best
Alternative 3: Greenfield	267	91%	4.1	Best
Alternative 4: I-20 and I-77	321	68%	1.8	Fair
Alternative 5: CSXT and NS via Augusta	373	47%	0.7	Poor
Alternative 6: CSXT and NS via Athens	281	85%	3.5	Very Good

3.2.2.3 Travel Time

Travel time is a relative measure of mobility benefits associated with an alternative. For the three shared-use with freight railroad alternatives (Alternatives 1, 5 and 6), the initial technology application was high performance tilting diesel-electric with top speeds capable of 110 mph. For the interstate highway alternatives (Alternatives 2 and 4) an initial application was high performance tilting diesel-electric with a top speed of up to 125 mph. For the Greenfield alternative (Alternative 3), the initial technology application was fully electrified with a top speed of 220 mph. It should be noted that these speeds categories are associated with top speeds and the average speeds for each alternative were less due to geometry and topography of the route. **Exhibit 3-6** provides the estimated travel times for each route alternative and the associated ratings.

Exhibit 3-6: Travel Times by Alternative[14]

Alternative	Top Speed	Travel Time (hours:minutes)	Performance Relative to Best Performing Alternative	Travel Time Performance Score	Rating
Alternative 1: Southern Crescent	110 mph	4:35	-4%	0.0	Poor
Alternative 2: I-85	125 mph	3:04	64%	1.4	Fair
Alternative 3: Greenfield	220 mph	2:15	100%	5.0	Best
Alternative 4: I-20 and I-77	125 mph	4:24	4%	0.1	Poor
Alternative 5: CSXT and NS via Augusta	110 mph	8:01	-156%	0.0	Poor
Alternative 6: CSXT and NS via Athens	110 mph	5:00	-22%	0.0	Poor

[14] *It should be noted that the Southern Crescent (Norfolk Southern) approach alignment was applied to Alternatives 1-3 in the Atlanta area to calculate end to end travel times. A detailed evaluation of alignments in the Atlanta area will be evaluated in a Tier 2 NEPA analysis.*

3.2.2.4 Route Geometry and Limiting Speed

Geometry refers to the number of curves along an alternative corridor as a measure of potential speed restrictions and the potential costs associated with mitigating them. Passenger trains can handle a certain degree of curvature before having to slow the overall speed (thus increasing travel times). One degree 30 minutes was selected as a screening criterion that could be used to compare route geometry impacts across all technologies consistently. Typically it limits a non-tilt train to approximately 90 mph and a tilt train to 110 mph. **Exhibit 3-7** illustrates the number of curves that meet or exceed the 1.5 degree threshold for each alternative.

Exhibit 3-7: Route Geometry by Alternative

Alternative	Curves >1.5 degrees	Performance Relative to Best Performing Alternative	Route Geometry Performance Score	Rating
Alternative 1: Southern Crescent	309	-168%	0.0	Poor
Alternative 2: I-85	107	73%	2.3	Good
Alternative 3: Greenfield	85	99%	4.9	Best
Alternative 4: I-20 and I-77	84	100%	5.0	Best
Alternative 5: CSXT and NS via Augusta	393	-268%	0.0	Poor
Alternative 6: CSXT and NS via Athens	334	-198%	0.0	Poor

3.2.2.5 Population Served

One of the main determinants of passenger ridership and associated revenues is the population within a given distance of stations along a route. To calculate population served by each alternative, a 30-mile boundary was drawn around each of the stations along the corridor.[15] Overlapping boundary areas between stations were removed to avoid any double counting. The station access analysis then summed for total population served by each route alternative. **Exhibit 3-8** illustrates the populations served for each alternative, rating those with the highest population access as the more attractive alternatives.

Exhibit 3-8: Population Served by Alternative

Alternative	Total Population Within 30 Miles of Stations[16]	Performance Relative to Best Performing Alternative	Population Served Performance Score	Rating
Alternative 1: Southern Crescent	8,407,259	100%	5.0	Best
Alternative 2: I-85	8,202,807	98%	4.8	Best
Alternative 3: Greenfield	8,198,597	98%	4.8	Best
Alternative 4: I-20 and I-77	7,655,253	91%	4.1	Best
Alternative 5: CSXT and NS via Augusta	7,654,945	91%	4.1	Best
Alternative 6: CSXT and NS via Athens	7,234,398	86%	3.6	Very Good

[15] *30 miles was selected as a boundary as this is a planning-industry practice of a maximum distance people are typically willing to travel to access a station.*

[16] Source: U.S. Census Bureau, 2010 Census.

3.2.2.6 Employment Served

A secondary variable of demand and revenue forecasting is the employment (number of jobs) within a certain distance of stations from which to draw ridership and support economic development.[17] Employees on business trips are major users of intercity rail and other forms of public transportation. Employees on business and work-related trips typically have a higher "value of time." They are less willing to travel long distances to access an intercity passenger rail station from a job as compared to from a residence. This is mostly due to the value of time while at work versus at home and the willingness to spend time traveling during work hours. Therefore, a 10-mile boundary was drawn around each of the stations along the corridor to assess employment access. Overlapping boundary areas between stations were removed to avoid any double counting of employment. The station access analysis then summed for total employment served by each alternative. **Exhibit 3-9** illustrates the employment (number of jobs) served for each alternative, rating those with the highest employment access as the more attractive alternatives.

Exhibit 3-9: Employment Served by Alternative

Alternative	Total 2010 Employment Within 10 Miles of Stations[18]	Performance Relative to Best Performing Alternative	Employment Served Performance Score	Rating
Alternative 1: Southern Crescent	3,011,643	100%	5.0	Best
Alternative 2: I-85	2,917,905	97%	4.7	Best
Alternative 3: Greenfield	2,676,204	89%	3.9	Very Good
Alternative 4: I-20 and I-77	2,028,344	67%	1.7	Fair
Alternative 5: CSXT and NS via Augusta	2,035,819	68%	1.8	Fair
Alternative 6: CSXT and NS via Athens	2,327,325	77%	2.7	Good

3.2.2.7 Regional and Intermodal Linkages

Regional and intermodal linkage refers to the connectivity between the alternative and modal hubs within the study area including airports, multimodal facilities, and interaction/transition with other passenger rail services. Similar to the Purpose and Need evaluation, each alternative is compared using a list of specific criteria, including how well the alternative:

1) Provides direct connectivity to the SEHSR Corridor via Charlotte Gateway Station - All alternatives provide direct access to Charlotte Gateway Station via the NS Southern Crescent Corridor.

2) Integrates with the SEHSR Corridor technology between Charlotte and Washington, D.C. - To fully meet this goal, a route has to provide seamless consistency with the 110 mph diesel technology employed by the SEHSR Corridor. Alternative 1 (Southern Crescent), Alternative 5 (CSXT and NS via Augusta) and Alternative 6 (CSXT and NS via Athens) use diesel-electric technology and all meet this criterion. The full build out of I-85, Greenfield, and I-20 and I-77 route alternatives utilize electrified equipment technology. The SEHSR Corridor has a provision for future electrification and therefore partially meets this criterion since this provision is not definite.

3) Provides direct connectivity to Charlotte-Douglas - Alternatives 1, 2 and 3 provide the opportunity for connectivity to Charlotte-Douglas. Alternatives 4, 5 and 6 do not provide direct connectivity.

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[17] *U.S. Census Bureau. 2012. OnTheMap Application. Longitudinal-Employer Household Dynamics Program.* http://onthemap.ces.census.gov (accessed on 02/27/15)

[18] *U.S. Census Bureau. 2012. OnTheMap Application. Longitudinal-Employer Household Dynamics Program.* http://onthemap.ces.census.gov (accessed on 02/27/15). *Employment data is taken from the following sources: Unemployment Insurance Wage Records, Office of Personnel Management, and The Quarterly Census for Employment and Wages.*

4) Provides connectivity to GSP Airport - Alternatives 1 and 2 could provide equal accessibility to the GSP Airport, since final station locations will not be determined until a Tier 2 NEPA analysis. Alternative 3 is located across I-85 from GSP Airport and would likely require a shuttle or people mover connection resulting in a score of "partially meeting" the criterion. Alternatives 4, 5 and 6 do not provide connectivity.

5) Provides connectivity to Georgia MMPT and H-JAIA - All alternatives provide connectivity to the Georgia MMPT and H-JAIA.

Each alternative was evaluated against the five specific criteria and assessed whether it meets (a score of 1.0), partially meets (a score of 0.5), or does not meet (a score of zero) the criteria. **Exhibit 3-10** outlines the five criteria and the associated evaluation for each route alternative.

Exhibit 3-10: Regional and Intermodal Linkage Evaluation

Alternative	Criteria	Consistency (Meets, Partially Meets, Does not Meet)	
Alternative 1: Southern Crescent	1. Provides direct connectivity to SEHSR Corridor via Gateway Station 2. Technology is consistent with SEHSR Corridor 3. Provides connectivity to Charlotte-Douglas 4. Provides connectivity to GSP Airport 5. Provides connectivity to Georgia MMPT and H-JAIA	1. Meets 2. Meets 3. Meets 4. Partially Meets 5. Meets	1.0 1.0 1.0 0.5 1.0 4.5
Alternative 2: I-85	1. Provides direct connectivity to SEHSR Corridor via Gateway Station 2. Technology is consistent with SEHSR Corridor 3. Provides connectivity to Charlotte-Douglas 4. Provides connectivity to GSP Airport 5. Provides connectivity to Georgia MMPT and H-JAIA	1. Meets 2. Does Not Meet 3. Meets 4. Meets 5. Meets	1.0 0.5 1.0 1.0 1.0 4.5
Alternative 3: Greenfield	1. Provides direct connectivity to SEHSR Corridor via Gateway Station 2. Technology is consistent with SEHSR Corridor 3. Provides connectivity to Charlotte-Douglas 4. Provides connectivity to GSP Airport 5. Provides connectivity to Georgia MMPT and H-JAIA	1. Meets 2. Does Not Meet 3. Meets 4. Partially Meets 5. Meets	1.0 0.5 1.0 1.0 1.0 4.5
Alternative 4: I-20 and I-77	1. Provides direct connectivity to SEHSR Corridor via Gateway Station 2. Technology is consistent with SEHSR Corridor 3. Provides connectivity to Charlotte-Douglas 4. Provides connectivity to GSP Airport 5. Provides connectivity to Georgia MMPT and H-JAIA	1. Meets 2. Does Not Meet 3. Does Not Meet 4. Does Not Meet 5. Meets	1.0 0.5 0.0 0.0 1.0 2.5
Alternative 5: CSXT and NS via Augusta	1. Provides direct connectivity to SEHSR Corridor via Gateway Station 2. Technology is consistent with SEHSR Corridor 3. Provides connectivity to Charlotte-Douglas 4. Provides connectivity to GSP Airport 5. Provides connectivity to Georgia MMPT and H-JAIA	1. Meets 2. Meets 3. Does Not Meet 4. Does Not Meet 5. Meets	1.0 1.0 0.0 0.0 1.0 3.0
Alternative 6: CSXT and NS via Athens	1. Provides direct connectivity to SEHSR Corridor via Gateway Station 2. Technology is consistent with SEHSR Corridor 3. Provides connectivity to Charlotte-Douglas 4. Provides connectivity to GSP Airport 5. Provides connectivity to Georgia MMPT and H-JAIA.	1. Meets 2. Meets 3. Does Not Meet 4. Does Not Meet 5. Meets	1.0 1.0 0.0 0.0 1.0 3.0

Exhibit 3-11 illustrates the total scores for each route alternative and the associated ratings.

Exhibit 3-11: Regional and Intermodal Linkages Rating

Alternative	Regional and Intermodal Linkages	Performance Relative to Best Performing Alternative	Linkage Performance Score	Rating
Alternative 1: Southern Crescent	4.5	100%	5.0	Best
Alternative 2: I-85	4.5	100%	5.0	Best
Alternative 3: Greenfield	4.5	100%	5.0	Best
Alternative 4: I-20 and I-77	2.5	44%	0.6	Poor
Alternative 5: CSXT and NS via Augusta	3.0	67%	1.7	Fair
Alternative 6: CSXT and NS via Athens	3.0	67%	1.7	Fair

3.2.2.8 Cumulative Evaluation

The scores from each of the criteria were summed for a total alternative score, assuming all metrics are weighted equally. **Exhibit 3-12** outlines the cumulative scores for each reasonable alternative as well as the comparative performance for each alternative.

Exhibit 3-12: Total Cumulative Score and Evaluation

Alternative	Score	Performance Relative to Best Performing Alternative	Overall Performance Rating
Alternative 1: Southern Crescent	23.8	74%	Good
Alternative 2: I-85	27.6	86%	Very Good
Alternative 3: Greenfield	32.1	100%	Best
Alternative 4: I-20 and I-77	15.8	49%	Poor
Alternative 5: CSXT and NS via Augusta	10.2	32%	Poor
Alternative 6: CSXT and NS via Athens	14.6	45%	Poor

The results show that Alternatives 1, 2 and 3 perform well when compared to the universe of reasonable alternatives, whereas Alternatives 4, 5 and 6 all performed far below the other alternatives.

3.2.3 Feasible Alternatives

3.2.3.1 Technical Results

Based on the cumulative score of the initial screening:

- Alternative 3 (Greenfield) scored the “best.”
- Alternative 2 (I-85) scored “very good” and was within 14 percent of Alternative 3.
- Alternative 1 (Southern Crescent) scored “good” and was within 26 percent of Alternative 3.

The results table (**Exhibit 3-12**) illustrates a large spread between Alternatives 1, 2 and 3’s scores and Alternatives 4, 5 and 6’s scores. Alternatives 4, 5 and 6 (I-20 and I-77, CSXT via Augusta and CSXT via Athens) scored “poor” and were more than 60 percent less than Alternative 3, noting that Alternative 5 (CSXT via Augusta) scored the worst at 65 percent below Alternative 3.

3.2.3.2 Public Input

In June 2013, FRA and GDOT held public scoping open houses in Georgia, South Carolina and North Carolina. The results of the Phase 1 evaluation were presented on which participants could comment. **Exhibit 3-13** displays the initial screening results presented at the public scoping meetings. There were minimal comments on selecting alternatives to move forward to Phase 2 (Alternative Refinement) of the project analysis during the scoping process. Chapter 7 of the Final Scoping Report provides a more detailed summary of comments received from the public and the responses from GDOT and FRA.[19]

3.2.3.3 Initial Screening Conclusion

Based on the public comments and technical results of the Phase 1 analysis, Alternatives 1, 2 and 3 were found as feasible route alternatives and were recommended to move through to Phase 2: Alternatives Refinement.

[19] *http://www.dot.ga.gov/travelingingeorgia/rail/AtlantatoCharlotte/Pages/default.aspx* (accessed on 02/27/15)

Exhibit 3-13: Screening Results

Initial Alternative	Purpose and Need	Route Length (miles)	Travel Time (hours, minutes) and Average Speed (mph)	Geometry (Number of curves greater than 1 degree, 30 minutes)	Population Served (population within 30 miles of stations)	Employment Served (employees within 15 miles of stations)	Regional and Intermodal Linkages	Overall Performance
Alternative 1: Southern Crescent	●	◕	○	○	●	●	●	◑
Alternative 2: I-85	●	●	◔	◑	●	●	●	◕
Alternative 3: Greenfield	●	●	●	●	●	◕	●	●
Alternative 4: I-20 and I-77	◑	◔	○	●	●	◔	○	○
Alternative 5: CSX Augusta / NS Columbia, Rock Hill	◔	○	○	○	●	◔	◔	○
Alternative 6: CSX Athens / NS Chester, Rock Hill	◕	◕	○	○	◕	◑	◔	○

Rating	
Best	●
Very Good	◕
Good	◑
Fair	◔
Poor	○

GDOT Georgia Department of Transportation

U.S. Department of Transportation Federal Railroad Administration

ATLANTA to CHARLOTTE PASSENGER RAIL CORRIDOR INVESTMENT PLAN

4. ATLANTA APPROACH ANALYSIS

Multiple sub-route alternatives exist in the Atlanta terminal area, including the use of two freight railroad corridors as “last mile” approaches. As indicated in **Exhibit 4-1**, three alternatives (Alternative 1, 2 and 3) have the ability to transition to either approach alignment: the Southern Crescent ROW (operated by NS), which is consistent with Alternative 1 from northeast of Suwanee, Ga., into Atlanta; or the CSXT ROW, which is consistent with Alternative 6 from northeast of Lawrenceville, Ga., into Atlanta. Both approach alignments converge at Howell Junction, where all alternatives follow the Class I railroad ROW along the NS/CSX corridor to access the proposed Georgia MMPT and H-JAIA. Both approaches utilize shared tracks under Alternative 1. Under Alternatives 2 and 3, both approaches utilize dedicated tracks within the freight railroad ROW.

Due to the complex environment on the approaches to and through Atlanta, this Tier 1 EIS will defer the selection of the preferred approach alignment to a future Tier 2-level study. For the corridor level of review for this ADR, the operational and environmental evaluation will analyze the Southern Crescent ROW as the representative common approach alignment into Atlanta. The selection of the Southern Crescent ROW as the representative common approach alignment will provide a consistent comparison of the corridor alternatives within this ADR.

For a preliminary comparison of the two alignment options for the Atlanta approach, each alternative was evaluated using both freight railroad corridor approach options. The evaluation criteria included:

1) Overall alternative travel time (terminal to terminal);
2) Overall alternative ridership projections (terminal to terminal);
3) Overall alternative revenue projections (terminal to terminal);
4) Approach alignment infrastructure cost (individual approach limits);
5) Approach alignment at-grade and grade-separated crossings (individual approach limits); and
6) Approach alignment environmental factors for each individual approach limits:[20]
    - Potential noise impacts;
    - Potential historic and cultural resources impacts;
    - Potential ROW acquisition;
    - Potential environmental justice (EJ) impacts;
    - Potential natural environmental impacts; and
    - Potential 4(f) resources impacts.

Exhibits 4-2, **Exhibit 4-3**, and **Exhibit 4-4** illustrate the results of the analysis for each alternative and each approach alignment within the Atlanta area.

[20] *Environmental factors were based on the evaluation methodology found in the Draft Environmental Impact Methodology Technical Memorandum dated May 2013 (www.dot.ga.gov/AtlantaCharlotteHSR)* (accessed on 02/27/15)

Exhibit 4-1: Alternative 1, 2 and 3 Atlanta Alignment Options

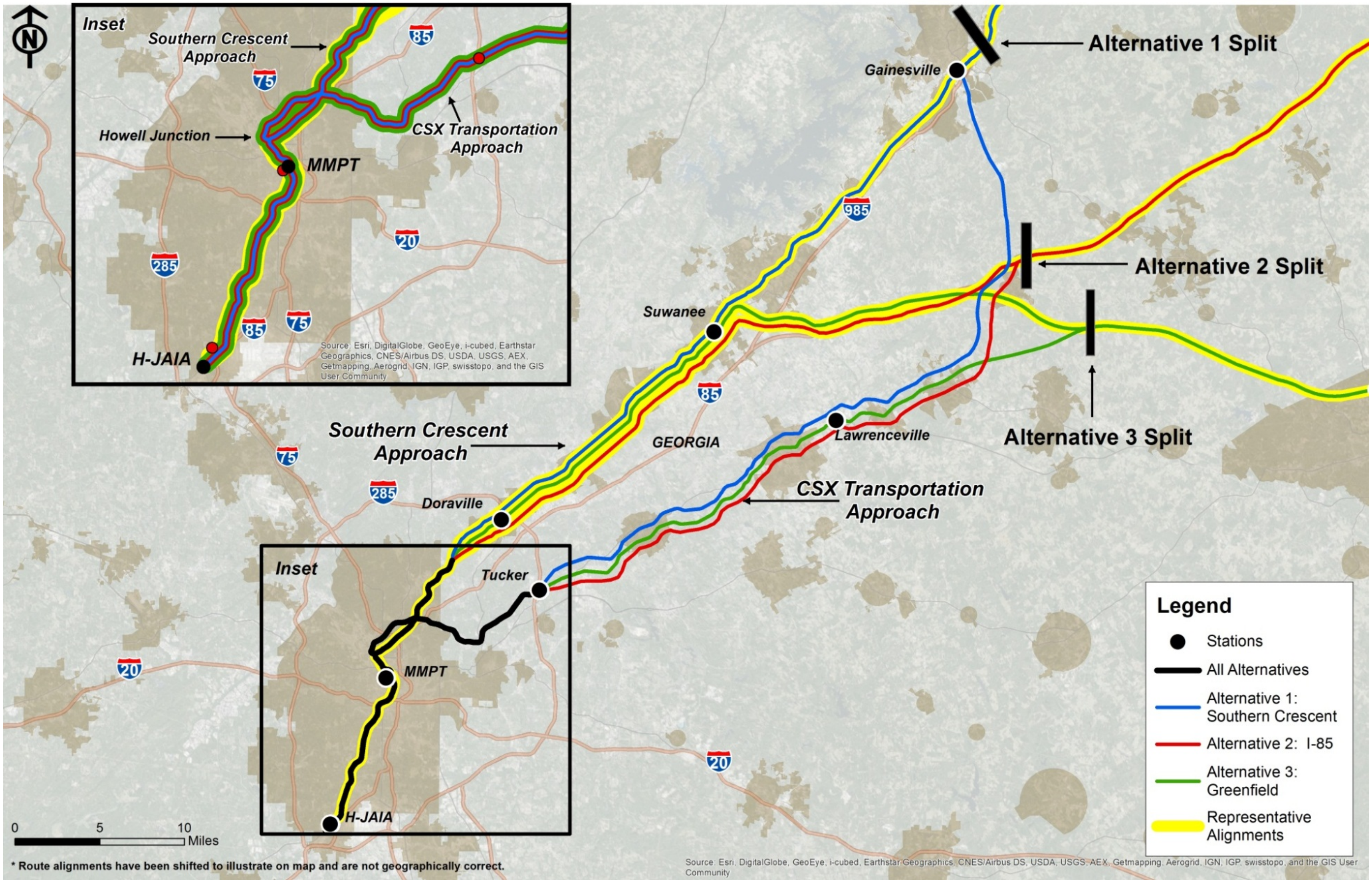


Exhibit 4-2: Alternative 1 Atlanta Approach Alignment Evaluation Results

Alternative 1: Southern Crescent			
Criteria	Southern Crescent Approach Alignment	CSXT Approach Alignment	Difference CSXT vs. Southern Crescent
Travel Time (up to 79/110mph)[21]	4 hrs, 54 min/3 hrs, 53 min	5 hrs, 16 min/4 hrs, 7 min	22 min/14 min
Ridership (millions/year)	1.3	1.2	0.1
Revenue (2012$ millions/year)	$95.6	$93.3	$2.3
Total Capital Cost (2012$ millions)	$280.4	$726.6	-$446.2
At Grade Crossings (#)	20	44	-24
Noise Impacts (# properties impacted)	4,328	3,763	565
Historic/Cultural Resources (# properties impacted)	28	23	5
Archeological Sites (# sites identified)	7	11	-4
Section 4(f) (# properties impacted - Potential/Potential w/ de minimis)	5/3	6/6	-1/-3
ROW Acquisition (acres/relocations/$ millions)	0/0/$0	242/59/$10.4	-242/-59/-$10.4
Environmental Justice (% minority)	49%	46%	3%
Environmental Justice (% low income)	14%	11%	3%
Wetlands (acres)	16	47	-58
Streams (linear feet)	12,980	80,325	-67,345
Lakes/Ponds (acres)	8	17	-9
Threatened and Endangered Species	11	12	-1

[21] *Travel time, ridership and revenue were calculated for the entire route alternative. The remaining criteria were calculated just for the Atlanta in-town section. It should be noted that a travel time for the CSXT approach was not conducted until the feasible alternatives were in refinement. For better comparison, the refined NS approach travel times were also used.*

Exhibit 4-3: Alternative 2 Atlanta Approach Alignment Evaluation Results

Alternative 2: I-85			
Criteria	Southern Crescent Approach Alignment	CSXT Approach Alignment	Difference CSXT vs. Southern Crescent
Travel Time (125/220mph)	3hrs, 15 min/3 hrs, 6 min	3 hrs, 21 min/3 hrs, 12 min	6 min/6 min
Ridership (millions/year)	4.0	3.9	0.1
Revenue (2012$ millions/year)	$258.2	$250.9	$7.3
Total Capital Cost (2012$ millions)	$1,505	$1,482	$23.0
At Grade Crossings (#)	16	19	-3
Noise Impacts (# properties impacted)	3,940	3,739	201
Historic/Cultural Resources (# properties impacted)	28	23	5
Archeological Sites (# sites identified)	7	10	-3
Section 4(f) (# properties impacted - Potential/Potential w/ de minimis)	5/2	6/6	-1/-4
ROW Acquisition (acres/relocations/$ millions)	81/32/$52.6	103/29/$6.3	-22/3/$46.3
Environmental Justice (% minority)	45%	46%	-1%
Environmental Justice (% low income)	12%	10%	2%
Wetlands (acres)	8	69	-61
Streams (linear feet)	12,867	75,517	-62,650
Lakes Ponds (acres)	7	11	-4
Threatened and Endangered Species	11	11	0

Exhibit 4-4: Alternative 3 Atlanta Approach Option Evaluation Results

Alternative 3: Greenfield			
Criteria	Southern Crescent Approach Alignment	CSXT Approach Alignment	Difference CSXT vs. Southern Crescent
Travel Time (125/220mph)	2 hrs, 58 min/2 hrs, 24 min	3 hrs, 2 min/2 hrs, 27 min	-4 min/-3 min
Ridership (millions)	4.7	4.6	0.1
Revenue (2012 $millions)	$334.6	$327.9	$6.7
Total Capital Cost (2012$ millions)	$1,612	$1,462	$150.0
At Grade Crossings (# of crossings affected)	16	19	-3
Noise Impacts (# properties impacted)	4,329	3,972	357
Historic/Cultural Resources (# properties impacted)	28	23	5
Archeological Sites (# sites identified)	7	10	-3
Section 4(f) (# properties impacted - Potential/Potential w/ de minimis)	6/3	8/4	-2/-1
ROW Acquisition (acres/relocations/$ millions)	190/59/$53.9	130/23/$2.7	60/36/$51.2
Environmental Justice (% minority)	44%	46%	-2%
Environmental Justice (% low income)	12%	11%	1%
Wetlands (acres)	18	60	-42
Streams (linear feet)	15,212	74,324	-59,112
Lakes/Ponds (acres)	6	11	-5
Threatened and Endangered Species	11	11	0

Based on the criteria and results presented, the Southern Crescent approach alignment performs somewhat better than the CSXT approach from the key perspectives of travel time, ridership and revenues, with a relatively small infrastructure cost premium. Given this performance and the information available at the time, the Southern Crescent is identified as the representative approach alignment for all three refined alternatives in and out of the Atlanta terminal area. This approach alignment is representative of the alignment in and out of the Atlanta area for the refinement analyses that follow.

5. PHASE 2: ALTERNATIVE REFINEMENT

Three of the initial six reasonable alternative routes advanced through Phase 1 as feasible routes. Phase 2 analyses refined each of the three feasible route alternatives and the service plans associated with each. Areas of refinement consisted of route alignment adjustments, selecting final station stops, refining travel time calculations, and establishing schedules including detail on stopping patterns.

5.1 ROUTE REFINEMENT

Following the public scoping meetings, the three feasible routes were evaluated for any adjustments to improve the effectiveness and efficiency of the service. These refinements took into consideration cities with substantial population and employment, natural barriers and efficiencies in travel time. After reviewing the three feasible routes, the only route alternative that required an adjustment in route alignment was Alternative 3: Greenfield. This route was altered within Georgia to travel further south in order to access the Athens, Ga., area. It was found that after preliminary travel time and ridership projections, the increase in ridership that the Athens area provides will exceed the minimal additional overall travel time for the alternative from terminal end to terminal end. Additionally, it was asserted during the public scoping meetings that providing a station within the Athens area would provide additional benefits to the University of Georgia, which has a large student population from the Atlanta metropolitan area. The Athens-Clarke County Metropolitan Statistical Area (MSA) had an estimated population of approximately 197,501 in 2013,[22] which was an increase of approximately 19% from the 2000 census. The sizeable population of the Athens-Clarke County area, with a large mobile student population, and distant access to a major airport showed a strong potential for intercity passenger rail ridership.

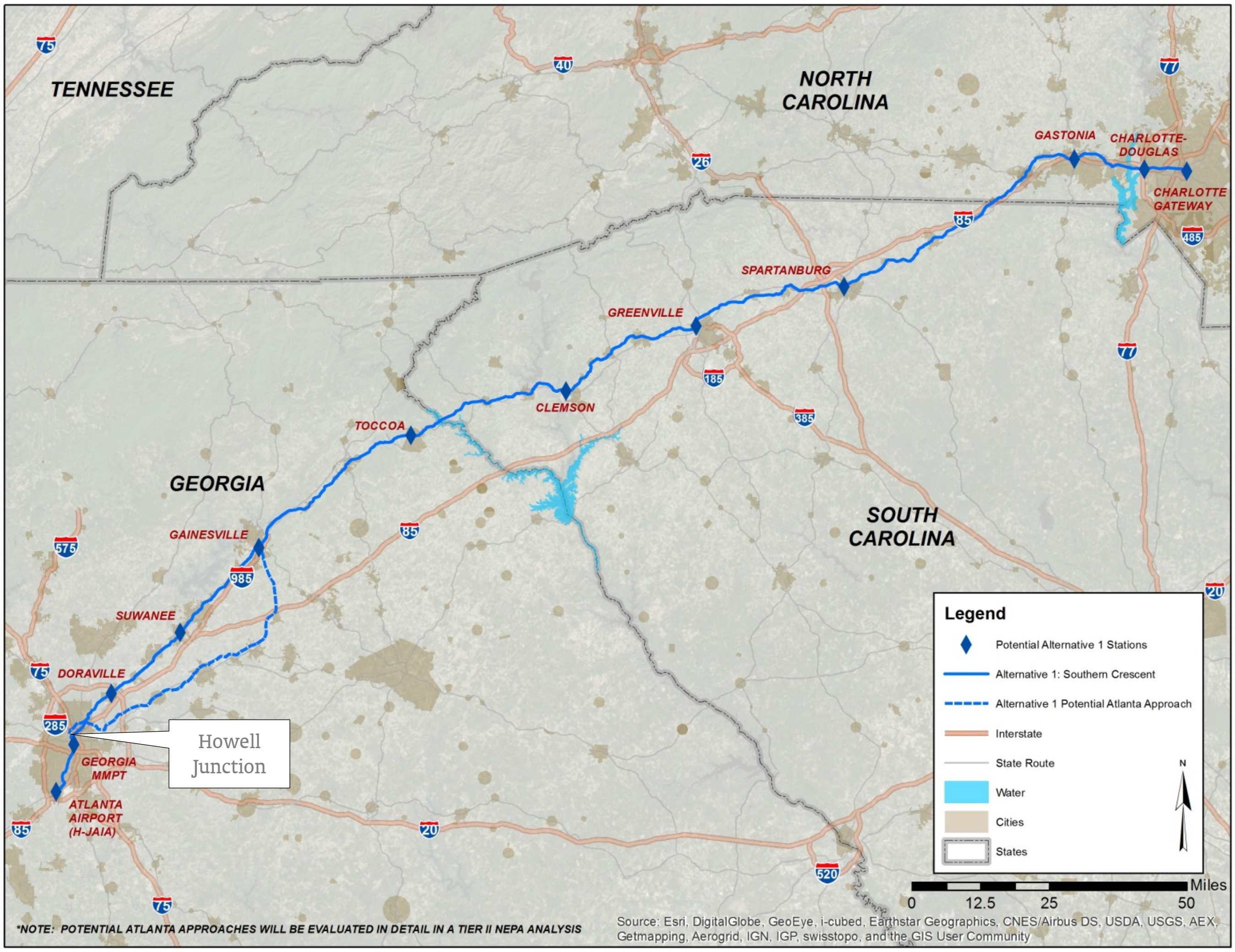
The following sections provide the refined route descriptions.

5.1.1 Alternative 1: Southern Crescent

Alternative 1 is an existing freight rail ROW that connects Atlanta and Charlotte. The existing freight rail ROW hosts the current Amtrak Crescent service that travels from New York, N.Y., to New Orleans, La. This corridor follows the NS Piedmont Division mainline track from Charlotte in a southwest direction through Gastonia, N.C.; Spartanburg and Greenville, S.C.; Toccoa and Gainesville, Ga.; before reaching Atlanta on the NS Georgia Division (refer to **Exhibit 5-1**). On the approach to the Georgia MMPT, located in Atlanta's downtown business district, the route travels through Howell Junction before transitioning to the Class I representative alignment (CSXT/NS corridor) and then into the Georgia MMPT. The route continues south from the Georgia MMPT onto the NS Griffin line to East Point, Ga., before transitioning to the CSXT Atlanta and West Point A&WP mainline track to approach the H-JAIA area station.

[22] *U.S. Census Bureau (http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk)*, (accessed on 2/18/15)

Exhibit 5-1: Alternative 1: Southern Crescent



The existing freight corridor can be separated into three segments:

1) The first segment is from Charlotte Gateway Station to Howell Junction in Atlanta and comprises the majority of Alternative 1. The segment is a mixture of existing single (33%) and double (66%) track sections, with a freight density ranging from 14 to 30 trains per day. The existing geometrics limit the curvature, which limits the ability to achieve desirable passenger speeds.

2) The second segment is from Howell Junction to the Georgia MMPT within Atlanta. The existing geometrics include extensive curvature, which limits the ability to achieve desirable passenger speeds. This segment follows the representative alignment along the NS/CSXT corridor. In addition, this entire segment is depressed and grade separated from all roadway crossings.

3) The third segment is from the Georgia MMPT to H-JAIA within Atlanta. This segment transitions on the NS/CSXT representative alignment until East Point, Ga., where the representative alignment transitions to CSXT A&WP ROW for the route's approach to the H-JAIA area station.

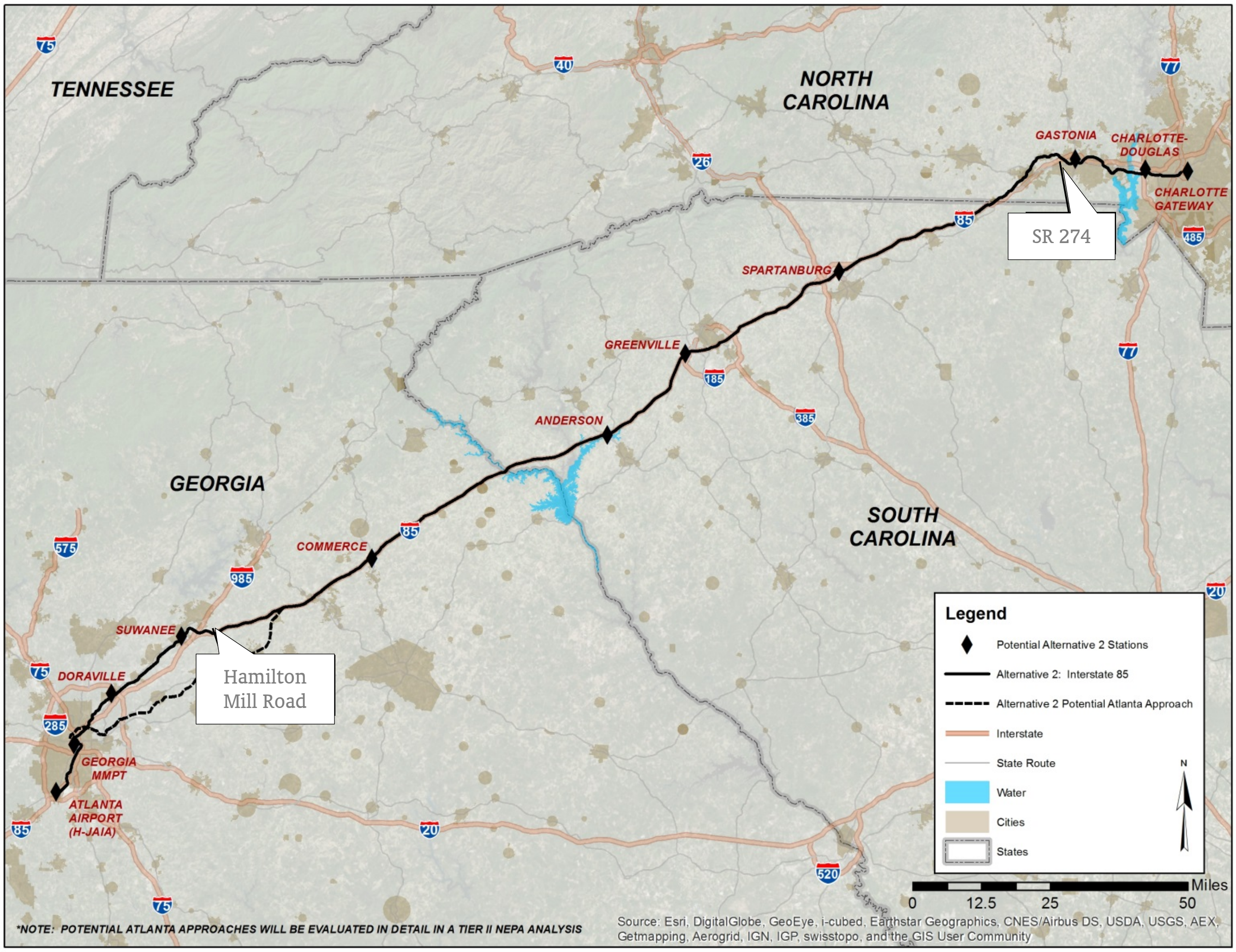
5.1.2 Alternative 2: I-85

Alternative 2 generally follows I-85 between Atlanta and Charlotte. The exception is in the "last mile" approaches into each terminus. The route alternative can be separated in the four segments:

1) The first segment follows the NS Piedmont Division mainline track from Charlotte in a western direction through Gastonia, N.C., until the I-85 and State Highway 274 interchange where the route transitions to following the I-85 ROW.
2) The second segment continues in the southwest direction through Spartanburg, Greenville and Anderson, S.C., and onto Commerce, Ga. Southwest of Hamilton Mill Road and the I-85 interchange (I-85, Exit 120), where the route transitions to a greenfield before it begins to join the NS Piedmont and Georgia Division ROW corridor near Suwanee, Ga.
3) The third section continues within the NS Piedmont and Georgia Division ROW heading into Atlanta. On the approach to the Georgia MMPT, the route travels through Howell Junction along the representative alignment (NS/CSXT corridor) into the station.
4) The fourth segment is from the Georgia MMPT onto the representative alignment (NS/CSXT corridor) Griffin ROW until East Point, Ga., where the representative alignment transitions to CSXT A&WP ROW for the route's approach to the H-JAIA area station.

Exhibit 5-2 illustrates route Alternative 2.

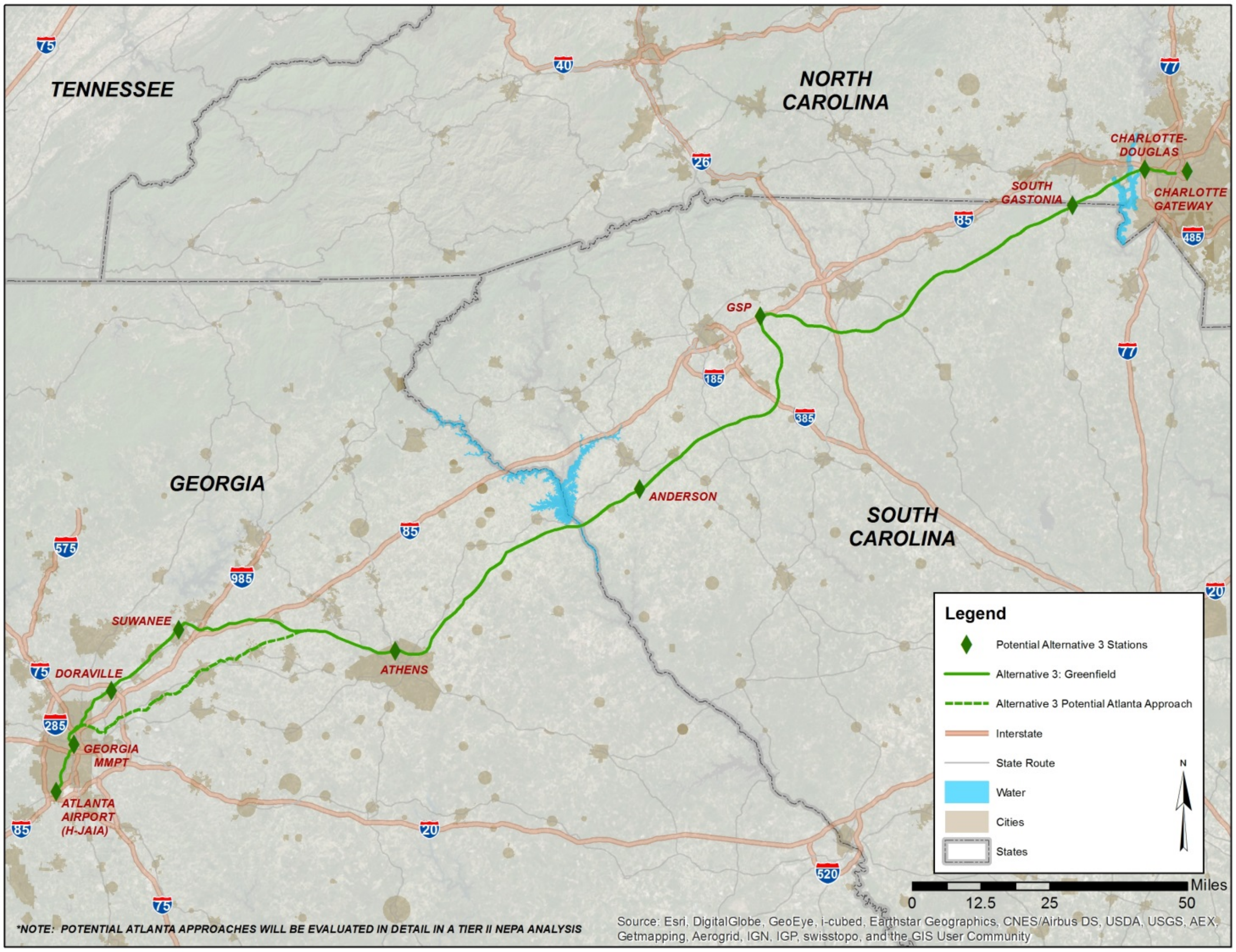
Exhibit 5-2: Alternative 2: I-85



5.1.3 Alternative 3: Greenfield

Alternative 3 is a new rail line on a new corridor alignment (Greenfield) that is designed to allow for higher speeds and eliminate interference with other modes of travel. The Greenfield route alignment was laid out to maximize tangent (straight) track segments and to minimize the number of curves, with those few necessary curves generally limited to 15 minutes of curvature, which will allow an operating speed up to 220 mph (refer to **Exhibit 5-3**). The Greenfield route would be fully grade-separated from the existing highway transportation system. The Greenfield route is more feasible in areas that are less developed and with less mountainous terrain. The Greenfield route has been identified between the Atlanta and Charlotte metropolitan area south of the I-85 corridor. However, due to the dense development around Atlanta and Charlotte, the construction of a new dedicated ROW for passenger rail service within these urban areas would result in high costs and potential impacts to the surrounding population and businesses; therefore, the route transitions to an existing rail corridor to reach the downtown areas of these metropolitan areas.

Exhibit 5-3: Alternative 3: Greenfield



The following segments comprise Alternative 3:

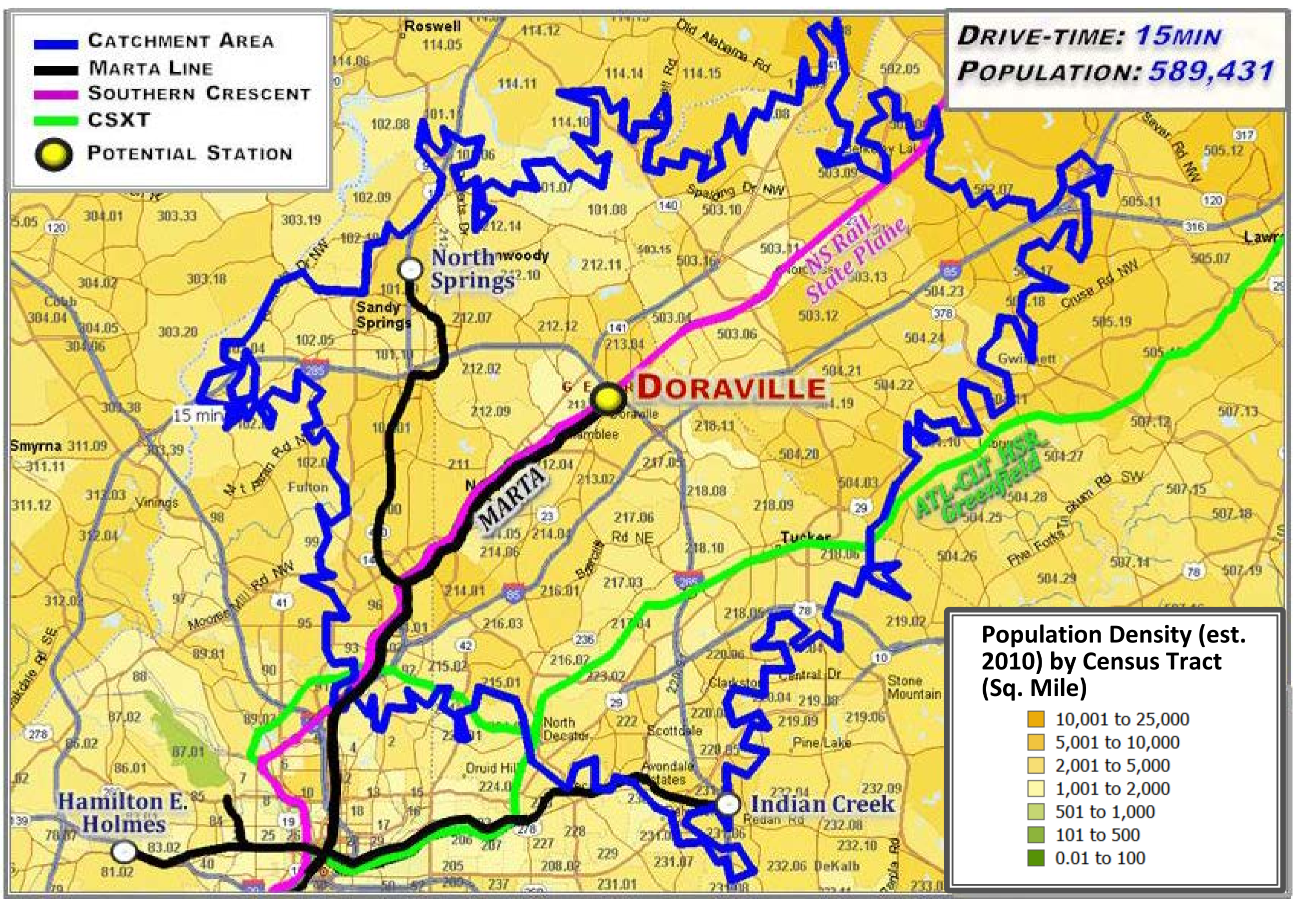
1) In the Charlotte area, the first segment follows the NS Piedmont ROW until crossing over the Catawba River in Gastonia where it transitions to greenfield.
2) The second segment follows a southwest direction, with the exception of traveling north to service a station near the GSP Airport. The route then travels southwest again towards Athens and Atlanta.
3) Near the I-85 and I-985 interchange in Suwanee, Ga., the third segment transitions onto NS ROW. In the Atlanta area, the route parallels NS Piedmont and Georgia Division ROW heading into Atlanta. On the approach to the Georgia MMPT, the route travels through Howell Junction along the representative alignment (NS/CSXT corridor) into the station.
4) The fourth segment is from the Georgia MMPT onto the representative alignment (NS/CSXT corridor) Griffin ROW until East Point, Ga., where the representative alignment transitions to CSXT A&WP ROW for the route's approach to the H-JAIA area station.

5.2 STATION REFINEMENT

Route location, frequency and accessibility of stations, and proposed train schedules influences projected ridership. Based on an assessment of the prospective rail demand, general locations and number of stations were identified for each route in Phase 1. Station locations were identified that are compatible with each route, and an operating plan was developed that reflects the frequency of service deemed most appropriate to the needs of each station. While the station assessment will not be finalized until the conclusion of a Tier 2 NEPA document, prospective station sites were refined and selected based on the operational assessment, as well as the ridership and revenue forecasts. In the refinement process, the following were considered for each prospective station site:

1) They must be readily accessible to where people live and work. A detailed drive time analysis was conducted to develop a natural catchment area for each station. In some cases where multiple station sites might be available, this analysis was performed for each site to optimize the location of each station for each route alternative. By overlaying the maps, adjacent stations can be located to minimize gaps (populated areas not well-served, too few station stops) as well as the overlaps (populated areas that have redundant stations serving them, i.e. too many station stops.) **Exhibit 5-4** provides an example of a drive time map that was produced for every station that was considered.

Exhibit 5-4: Example Drive Time Map showing Doraville, Ga. Catchment Area



2) One or more suburban stations should exist in the larger metropolitan areas with easy access to the local primary road system in order to accommodate potential riders living outside of city centers.

3) Stations should serve as a multimodal passenger terminal for all forms of regional and local transportation systems, if appropriate. This should be the case for the major downtown stations (Georgia MMPT and Charlotte Gateway Station) as well as for Doraville, Ga.; H-JAIA; GSP and Charlotte-Douglas, all of which will afford convenient transit and air access.

5.2.1 Alternative 1: Southern Crescent

Based on an iterative process between estimated operating plans, frequencies, boardings and ridership, and travel times, the potential stations were refined from those identified in Phase 1, given the requirements set forth above. While the Tier 1 EIS identifies potential station locations, the determination of the actual station locations will be addressed in a future Tier 2 NEPA document. For Alternative 1, one station was removed in Greer, S.C., as it was determined that the Greenville and Spartanburg stations would provide the local access needed for the Greer area, while decreasing travel times. Listed below are the proposed station stops identified for Alternative 1:

1) H-JAIA;
2) Georgia MMPT;
3) Doraville, Ga.;
4) Suwanee, Ga.;
5) Gainesville, Ga.;
6) Toccoa, Ga.;
7) Clemson, S.C.;
8) Greenville; S.C.;
9) Spartanburg, S.C.;
10) Gastonia, N.C.;
11) Charlotte-Douglas; and
12) Charlotte Gateway Station.

Refer to **Exhibit 5-1** for the Alternative 1 route and associated station locations.

5.2.2 Alternative 2: I-85

Similar to Alternative 1, Alternative 2: I-85 designated three stations in the Greenville/Spartanburg areas, with a central station at GSP Airport. It was found that ridership levels would remain similar by removing the GSP Airport station since end to end travel times would decrease. Therefore, it was found to be more efficient to provide stations at Greenville and Spartanburg only. Additionally, in northeast Georgia, it was found that there was a substantial demand for rail, despite being a rural area. It was found through analysis that providing a station would increase ridership levels and offset an increase in travel time. Therefore, a station was added in Commerce, Ga. to accommodate those travel demands.

Refer to **Exhibit 5-2** for the Alternative 2 route and associated stations. Proposed station stops for Alternative 2 include:

1) H-JAIA;
2) Georgia MMPT;
3) Doraville, Ga.;
4) Suwanee, Ga.;
5) Commerce, Ga.;

6) Anderson, S.C.;
7) Greenville, S.C.;
8) Spartanburg, S.C.;
9) Gastonia, N.C.;
10) Charlotte-Douglas; and
11) Charlotte Gateway Station

5.2.3 Alternative 3: Greenfield

Alternative 3: Greenfield also removed two stations and added one station. Again, in the Greenville/Spartanburg area, three stations were originally proposed (Fountain Inn, GSP Airport and Roebuck). Based on the population areas and drive time catchment areas, it was determined following public scoping that it would be most effective and efficient to have one stop for the region at the GSP Airport. This station would capture a large portion of the demand from the other two stations at Fountain Inn and Roebuck (significant overlap in drive time catchment areas), and would decrease the overall travel time by removing two stations.

As mentioned in Section 3.3.1, the Alternative 3 route alignment was shifted to the south in Georgia in order to access Athens, Ga., as proposed by public input. It should be noted that the shift did not affect any other potential station locations along the route. A station was added on the northern edge of the city to capture the travel demand in the area. Additionally, the shift increased the overall travel time by only a few minutes, which was determined to be worth the additional ridership. **Exhibit 5-3** shows Alternative 3 and its associated stations. Proposed stations for Alternative 3 include:

1) H-JAIA;
2) Georgia MMPT
3) Doraville, Ga.;
4) Suwanee, Ga.;
5) Athens, Ga.;
6) Anderson, S.C.;
7) GSP Airport;
8) South Gastonia, N.C.;
9) Charlotte-Douglas; and
10) Charlotte Gateway Station.

5.3 RAIL EQUIPMENT TECHNOLOGY OPTIONS AND ROLLING STOCK

The three alternative routes can generally be classified into two ranges of operating speed. Alternatives 1A, 1B, 2A and 3A have an anticipated maximum operating speed between 79 mph and 125 mph. Alternatives 2B and 3B have an anticipated operating speed up to 220 mph. Therefore, each route alternative has been evaluated for two operating speeds in the corridor. In addition, the alternatives have unique corridor and operational attributes that impact the rail equipment technology options. As the operational and performance requirements are different, it is appropriate to evaluate the rail equipment that best suits each alternative.

When evaluating rail equipment technology options, it is important to recognize that the rail equipment is part of the overall system. The identification of the system requirements relative to the rail equipment needs to be carefully integrated with the other elements of the railroad in order to achieve a safe, reliable, and cost effective solution. The following system attributes were considered to inform the selection process:

1) Maximum travel time/operating speed necessary to achieve the service operation plan;
2) Operational characteristics of the ROW (e.g., shared tracks, shared corridors, operations within or alongside interstate highway corridors, dedicated corridors);
3) Physical characteristics of the ROW (e.g., curve radii, gradients, spacing of station stops);
4) Initial/future electrification of ROW;
5) FRA regulatory requirements; and
6) Environmental impacts.

This section provides additional details on the attributes identified above and relates these attributes to candidate rail equipment for each alternative.

5.3.1 Train Technology Assumptions

A criterion for evaluating rail corridor alternatives is the maximum travel time required to meet the proposed service plan. The operating speed of the corridor has the largest impact on travel time, and the operating speed is impacted by the physical and operational characteristics of the corridor, and the performance attributes of the rail equipment. For example, a corridor with large numbers of curves will have a negative impact on travel time as the operating speeds may have to be limited to accommodate the design speed for the equipment and provide a safe and comfortable trip for passengers. A key attribute that impacts operational speeds with regard to passenger safety and comfort is the rail equipment's capability to "tilt" through curves. The track along a curve is typically banked (one side higher than the other and referred to as "cant") which results in a balance speed for the curve (the speed at which a passenger would feel no sideways forces while traveling along the curve). Rail equipment designed with an onboard hydraulic system (active tilt) or suspension design (similar to a car and known as passive tilt) can travel at higher speeds through curves as it reduces the centrifugal forces felt by passengers.

Very high-speed trains (those operating up to 220 mph) are designed with a stiff suspension to provide a stable operation. As a result, these types of trains do not necessarily require tilting mechanisms. In addition, the allowable cant deficiency (degree of the track banking) reduces to only 2.5 degrees at 220 mph[23]. This limitation on cant deficiency at the wheel-rail interface reduces the benefit of tilt for very high-speed rail. As such, the trend associated with newly developed passenger rail alignments has to be designed with large stretches of nearly straight track. As interstate alternatives are evaluated, it is important to note that the geometric standards for these interstate alternatives generally allow for train speeds of 125-150 mph, an effective range for tilting trains. Therefore, tilting capabilities may be beneficial to specific alternatives where operating and physical conditions restrict train speeds, especially on shared segments of existing lines and approaches into urban areas.

Another requirement for determining the suitability of train technology is compliance with FRA safety requirements. FRA regulations identify minimum requirements for rail equipment construction, structural design and safety appliances. Current FRA safety regulations are categorized in two tiers:[24] Tier I for speeds up to 125 mph, and Tier II for passenger trains operating with speeds of 125 to 150 mph in territories shared with Tier I equipment. For dedicated passenger systems or train equipment that does not directly conform with FRA Tier I or Tier II specifications, FRA's Office of Railroad Safety may issue a "Rule of Particular Applicability," allowing for non-standard equipment or higher-speed train operations. The FRA Railroad Safety Advisory Committee (RSAC) recently announced "Alternative Tier I" compliance standards[25] that could make it easier to adapt overseas service-proven (e.g., European or Asian) train designs to meet United States requirements. In addition, FRA is drafting new regulations (Tier III) that would support shared-use operations at speeds not exceeding 125 mph, and in an exclusive ROW without grade

[23] UIC, Design of New Lines for Speeds of 300-350 KM/H: State of the Art, October 2001, *http://www.scribd.com/doc/24548877/High-Speed-Railway-Lines-en* (accessed on 02/27/15)

[24] *FRA's "tiered" categories for passenger train operations is a separate term from FRA's tiered environmental review process.*

[25] *Railway Track and Structures, http://www.rtands.com/index.php/track-maintenance/off-track-maintenance/rsac-recommends-passenger-rail-crashworthiness-standards-to-accommodate-hsr.html* (accessed on 02/27/15)

separations at speeds above 125 mph but not exceeding 220 mph in an exclusive ROW (Tier III). The Tier III equipment standards would make it easier to adapt other proven train designs to meet U.S. requirements.

In addition to FRA safety compliance regulations for equipment, FRA requires an approved barrier or warning system for at-grade highway crossings on railroads with speeds up to 110 mph, as defined in the *Code of Federal Regulations* (49 CFR, Section 213.347). On such HSR corridors, the railroad or system operator shall submit, for FRA approval, a complete description of the proposed barrier or warning system to address the protection of highway traffic from high-speed trains. At-grade highway crossings are permitted for speeds up to 110 mph; however, FRA guidance[26] states that public and private crossings where train speeds are between 79 and 110 mph must be equipped with special crossing protection devices, whether grade separated or closed. Specific detail is included in FRA's Track Safety Standards in the CFR.

Exhibit 5-5 illustrates potential train manufacturers for each of the alternatives based on their speed capabilities.

Exhibit 5-5: Illustrative Technology Options

	Mfr.	Model	Operating Speed	Design Speed	Associated Alternative(s)	Comments
	General Electric	P-42 DC	79 mph	115 mph (Test Speed)	Alternative 1A	• FRA Tier I compliant • Diesel-Electric locomotive • Coupled with non-tilting coaches • One locomotive proposed per set (push-pull) • Assume bi-level cars to maximize capacity
	Talgo	T-XXI	137 mph	154 mph (Test Speed)	Alternative 1B Alternative 2A Alternative 3A	• Anticipated to be FRA Tier III compliant • Diesel-hydraulic or electric power cars (concentrated power) • Integrated coach sets could also be paired with Siemens locomotives below • Talgo Pendular coaches utilize passive tilt technology • Use of tilt technology increases horizontal clearance requirements on curves

[26] http://www.fra.dot.gov/eLib/details/L02593, *"Highway-Rail Grade Crossing Guidelines for High-Speed Passenger Rail." Nov 2009* (accessed on 02/27/15)

	Mfr.	Model	Operating Speed	Design Speed	Associated Alternative(s)	Comments
No picture available	Siemens	Charger	125 mph	130 mph (Test Speed)	Alternative 1A Alternative 1B Alternative 2A Alternative 3A	• FRA Tier I compliant • Diesel-Electric • Tier 4 EPA compliant • Coupled with non-tilting coaches • First production models ordered by Illinois DOT to be delivered in 2016
	Bombardier	Zefiro 380	236 mph	260 mph	Alternative 2B Alternative 3B	• Anticipated to be FRA Tier III compliant • Distributed traction system (EMU) • Zefiro 380 train sets have been delivered to China Ministry of Railroads for high speed operation.
	Talgo	350	186 mph	218 mph	Alternative 2B Alternative 3B	• Anticipated to be FRA Tier III compliant Concentrated power (power car on leading and trailing end of train set) • Utilizes Passive Tilt technology (coaches only) • Talgo Pendular coaches • Requires increased clearance envelope on curves
	Siemens	Velaro	218 mph	218 mph	Alternative 2B Alternative 3B	• Anticipated to be FRA Tier III compliant • Distributed traction system (EMU) • Typically eight car train set configuration
	Alstom	TGV-Duplex	200 mph	200 mph	Alternative 2B Alternative 3B	• Anticipated to be FRA Tier III compliant • Concentrated power (power car on leading and trailing end of train set) • Bi-level coaches

Based on the two ranges of operating speeds identified for the alternatives (up to 125 mph and up to 220 mph), there are two "families" of train technologies under consideration for this study:

1) **Diesel** – This family of train technology is defined as FRA Tier I compliant, diesel-powered, paired with passenger coaches either with conventional (non-tilting) or tilting capability. A representative locomotive with a desired sustained speed of 79 mph, but capable of a maximum operating speed of 115 mph, is the current joint General Electric P-42 DC, which is currently in service on many Amtrak corridors in the United

States. A representative locomotive with a desired sustained speed of 110 mph, but capable of a maximum operating speed of 125 mph, is the current joint procurement by FRA and state partners of the Siemens Charger. Either of these diesel-powered locomotives is compatible with conventional Amtrak or tilt train passenger coaches. Such that diesel-powered locomotives are capable of operations up to 125 mph, the Project considers diesel technology as the primary train type for the Alternatives with operating speeds up to 125 mph (Alternatives 1A, 1B, 2A and 3A).

Conventional

Diesel HrST

2) **Electric** – This family of train technology is defined as FRA Tier II compliant, electric powered, with either conventional (non-tilting) or tilting capability. This family of train technology also includes very high-speed train technology capable of traveling up to 220 mph (FRA's proposed Tier III). Tilting train design like the Amtrak Acela would be capable of operating up to 160 mph on proposed routes between Atlanta and Charlotte, and could also operate on tracks and in corridors that are shared with freight and commuter trains. However, this concept has been superseded by the procurement of FRA proposed Tier III type train sets (e.g., Amtrak and the California HSR Authority train set procurement). It is assumed that new electric trains based on the Tier III standards will be able to operate up to 220 mph on dedicated routes between Atlanta and Charlotte and operate on shared systems with Tier I commuter and freight trains at speeds under 125 mph, as needed. Such that electric-powered locomotives are capable of operations above 125 mph, the Project considers electrified technology with either tilting train or very high speed designs as the primary train type for the Alternatives with operating speeds above 125 mph (Alternative 2B and 3B).

Electric Incremental HST

Electric Greenfield HST

5.3.1.1 Technology Considerations

The limits of diesel-electric locomotive technology are reached between 110 and 125 mph. The ability to accelerate diminishes rapidly over 90 mph, and while diesel-electric locomotives can be geared for higher speeds, it requires long stretches of tangent track to achieve top speeds. Operations above 125 mph require electric locomotives. Most countries, including the U.S., operate high-speed service using fixed train sets that are either of the concentrated power type (locomotive hauled with a power unit on both ends of the train) or of the distributed power type (electric multiple units). Amtrak's Acela can operate at up to 150 mph, with plans to raise the maximum speed to 160 mph. In Europe and Japan, high-speed trains operate between 186 and 220 mph; in China, high-speed trains operate as fast as 220 mph. The California High-Speed Train Project currently is being designed for 220 mph operations, which has led the FRA to initiate the process for setting track, equipment and other safety standards for speeds of that magnitude. It should be recognized that Alternative 2A and 2B follows an interstate highway route with curve design geometrics that limit top speeds in many areas to 160 mph or less, even though a given technology may operate at much higher speeds on tangent track.

HSR rolling stock technology will leverage lightweight construction techniques, and advanced propulsion and braking systems to achieve efficient high-speed operations. Manufacturers of high-speed train sets no longer have a primary focus on top speed, but instead, are implementing technologies that provide efficient energy management and lower energy consumption, improved control and traction systems, improvements to passenger comfort, and lighter train set weights; which contribute to a lower impact on the environment.

Additional emphasis is being placed on improved life cycle costs by reducing maintenance and operating costs. Light weight material such as aluminum extrusions and composites are being utilized in train set designs. Better passenger information and ticketing systems reduce dwell times and can improve the passenger carrying capacity of the system. Use of reliability-centered maintenance can help optimize/better inform of the need for preventative and corrective activities.

<u>Dual Mode/Dual Power</u>

Dual mode/dual power locomotives are able to operate under both diesel-electric and all-electric power. New Jersey Transit uses the latest dual mode technology, the ALP-45DP manufactured by Bombardier. In the event that a phased approach is utilized for Alternative 2, with electrification following construction of the railroad ROW, dual power locomotives could be utilized to take advantage of higher speeds in electrified territory. The benefits would depend on the duration for electrification. Examples or dual power locomotives currently in operation include:

- <u>The Talgo 250 Hybrid:</u> dual mode train set uses both a diesel engine and 25kV catenary with maximum speeds of 112 mph and 155 mph, respectively;
- <u>Bombardier's SNCF B 82500 locomotive</u>: uses both a diesel engine and either 1.5 kilovolt (kV) or 25 kV catenary. The B 82500 has a top speed of 99 mph; and
- <u>Bombardier's ALP 45DP Locomotive</u>: operates both electrically (on catenary) and on diesel with speeds of 125 mph and 100 mph, respectively.

Talgo and Hitachi market hybrid dual mode locomotives which have the potential to operate at even higher speeds in electric mode than those shown above. A more detailed discussion of design concepts for hybrid dual powered high speed passenger trains is provided in **Appendix B**.

5.3.2 Alternative 1: Southern Crescent Technology Options

There are several rail equipment technology options for Alternative 1. Two speed regimes were evaluated for Alternative 1: one with top speeds up to 79 mph (referred to as Alternative 1A) and one with top speeds of 110 mph (referred to as Alternative 1B). Although FRA's Tier I equipment standards allow for shared passenger and freight speeds up to 125 mph, this Tier 1 EIS limited the joint passenger-freight operations on the same rail line contemplated by Alternative 1 to 110 mph. The top speed of 110 mph was selected for Alternative 1B to reflect FRA's current grade crossing guidance and as an assumption to represent a freight railroad policy limiting passenger speeds within a shared freight ROW. A passenger rail operation with speeds of up to 79 mph is the lowest cost alternative compatible with FRA Class 4 track standards (refer to **Exhibit 5-6**). Operations at speeds up to 110 mph would require an upgrade of the track class to FRA Class 6, along with supplemental improvements at grade crossings and an enhanced signal system. Trains will operate at 110 mph in Alternative 1B only on sections of dedicated track within shared ROW. Both speed regimes could be accommodated with diesel locomotive technology and conventional or tilt passenger coaches. Because trains will operate within a shared passenger and freight environment, the equipment would be required by FRA regulation to be Tier I compliant.

Exhibit 5-6: Rail Track Class and Allowable Operating Speeds

Track Class	Allowable Freight Speed (mph)	Allowable Passenger Speed (mph)
Excepted	10	N/A
Class 1	10	15
Class 2	25	30
Class 3	40	60
Class 4	60	80
Class 5	80	90
Class 6	110	110
Class 7	125	125
Class 8	160	160
Class 9	220	220

It should be noted that implementation of Alternative 1 could involve the phasing of improvements and equipment technology from 79 mph to 110 mph operations. As the top speed is increased from 79 to 110 mph, either conventional or tilt equipment technology could be used. Tilt train technology, however, enables trains to operate faster through more restricting curves by reducing centrifugal force felt by the passengers. This train technology could be applied to reduce overall travel time.[27] Therefore, for Alternatives 1A and 1B, both conventional (non-tilt) and tilt technology options are available for consideration. The travel times for Alternative 1A have been calculated assuming conventional technology, and the travel times for Alternative 1B have been calculated assuming tilt technology.

Rolling stock technology that is available for the Alternative 1 options includes the Illinois DOT locomotives being manufactured by Siemens that are specified to provide a maximum operating speed of 125 mph, and the Talgo XXI high-speed train set, having a top speed of 140 mph, utilizing Talgo Pendular coaches with passive tilt. The Illinois DOT locomotive is required to meet Environmental Protection Agency (EPA) Tier 4 diesel emissions standards. The Talgo train set is anticipated to be FRA Tier III compliant. Each of these units can be used in a push-pull configuration. Representative technology used for modeling was the Talgo XXI.

5.3.3 Alternative 2: I-85 Technology Options

Several technologies are available for Alternative 2. Two speed regimes were evaluated for Alternative 2: one with speeds of 125 mph utilizing a diesel technology (Alternative 2A), and the other with top speeds of 220 mph utilizing state-of-the-art electric HSR train sets (Alternative 2B). One phasing option would be to initiate service with the slower train technology and phase in high-speed service as funding becomes available to electrify the rail line and acquire high-speed train sets.[28] Both Alternative 2A and 2B operate within a dedicated-use environment for the majority of the route, using freight rail ROW on dedicated track within the terminal areas.[29] In the terminal areas,

[27] The track in curves is typically banked (super-elevated), which results in the designation of a balance speed for each curve (a speed at which a vehicle occupant would feel no lateral (sideways) force in the curve). Up to four inches of imbalance (cant deficiency) is acceptable for passenger comfort. Beyond this, onboard tilting systems (active tilt) or car suspension designs (passive tilt) can permit higher speeds, by reducing the lateral forces felt by the passengers.

[28] Dual power options are also available (engines that can operate both by diesel and electric power). Specific brands of technology are not recommended as a part of this study.

[29] Alternative 2A and 2B were designed for dedicated passenger rail use; however, the design standards do not preclude freight operations in the future. Adding freight traffic to the Alternatives was not evaluated as a part of this PRCIP.

where freight and passenger have the potential to co-operate, passenger operations will be separate from freight operations during scheduled passenger service.

5.3.4 Alternative 3: Greenfield Technology Options

Similar to Alternative 2, two speed regimes were evaluated for Alternative 3, one with top speeds of 125 mph utilizing diesel technology (Alternative 3A) and the other with top speeds of up to 220 mph utilizing state-of-the-art electric HSR train sets (Alternative 3B). One option would be to initiate service with the slower train technology and phase in high-speed service as funding becomes available to electrify the rail line and acquire high-speed train sets. Both Alternatives 3A and 3B operate within a dedicated-use greenfield environment for the majority of the route, with shared-use operations within the terminal areas. The technologies applied to Alternatives 3A and 3B are the same as those applied to Alternatives 2A and 2B.

5.3.5 Other Rolling Stock Assumptions

Consistent with the assumptions customarily made in feasibility-level planning and Tier 1 EIS studies, the following general assumptions are proposed regarding operating requirements for the rolling stock:

- Trains will be reversible for easy push-pull operations (able to operate in either direction without turning the equipment at the terminal stations);
- Trains will have the capability to increase capacity for peak/seasonal fluctuations and will permit coupling of a minimum of two train sets;
- Train configuration will include a galley space, accommodating roll-on /roll-off carts for on-board food services. Optionally, the trains may include a bistro area where food service can be provided during the entire trip;
- On-board space is required for storage of small, but significant, quantities of mail and express packages, and also to provide for an optional checked baggage service for pre-arranged tour groups;
- Each end of the train will be equipped with a standard North American coupler that will allow for easy recovery of a disabled train by conventional locomotives;
- Trains will not require mid-route servicing, with the exception of food top-off. Refueling, potable water top-off, interior cleaning, required train inspections and other requirements will be conducted at night at the layover facilities located at or near the terminal stations. Trains would be stored overnight on the station tracks, or they would be moved to a separate train layover facility. Ideally, overnight layover facilities should be located close to the passenger stations and in the outbound direction so a train can continue after its final station stop without reversing direction;
- Trains must meet all applicable regulatory requirements including:
  - FRA regulatory requirements,
  - American Disabilities Act (ADA) requirements for accessibility for disabled persons,
  - Material standards for rail components for high-speed operations, and
  - Environmental regulations for exterior noise, waste disposal, and diesel exhaust emissions; and
- The operational assessment determined what size the trains need to be and over what portion of the route they need to run. The operating plan ensures there are enough seats to carry all of the passengers over the peak load segment while minimizing empty seat-miles, for matching supply to forecasted demand as closely as possible.
- The maximum train size was identified in order to adequately plan for stations and maintenance capacity. While the design for both will be more detailed in a Tier 2 NEPA analysis, the initial concept is to accommodate the largest train for each alternative as well as plan for future expansion. As seen in Appendix

H, Alternative 1A/B will run 1 diesel locomotive with 3 cars, Alternative 2A will run two diesel locomotives and six cars, Alternative 2B will run one electric locomotive and six cars, Alternative 3A will run two diesel locomotives and five cars, and Alternative 3B will run two electric locomotives and four cars.

5.4 TRAIN FREQUENCIES

The TEMS LOCOMOTION™ Train Performance Calculator (TPC) was used to estimate the train running times for all three alternatives.[30] For each route and train technology, this program uses route geometry and infrastructure, together with train performance characteristics, to estimate unconstrained running times. The following sections illustrate the results of the TPC; however, these exhibits are representative of all of the TPC runs. A TPC run was completed for all levels of service scenarios for each alternative, meaning those services that stop at each station along the alternative as well as those that may skip certain stations to improve travel time (also referred to as express service). The software develops train speed profiles by mile as well as the overall running time. The first step was to validate the LOCOMOTION™ simulation against existing Amtrak timetables. Then, to develop the proposed train schedules, possible future alternatives were simulated based on:

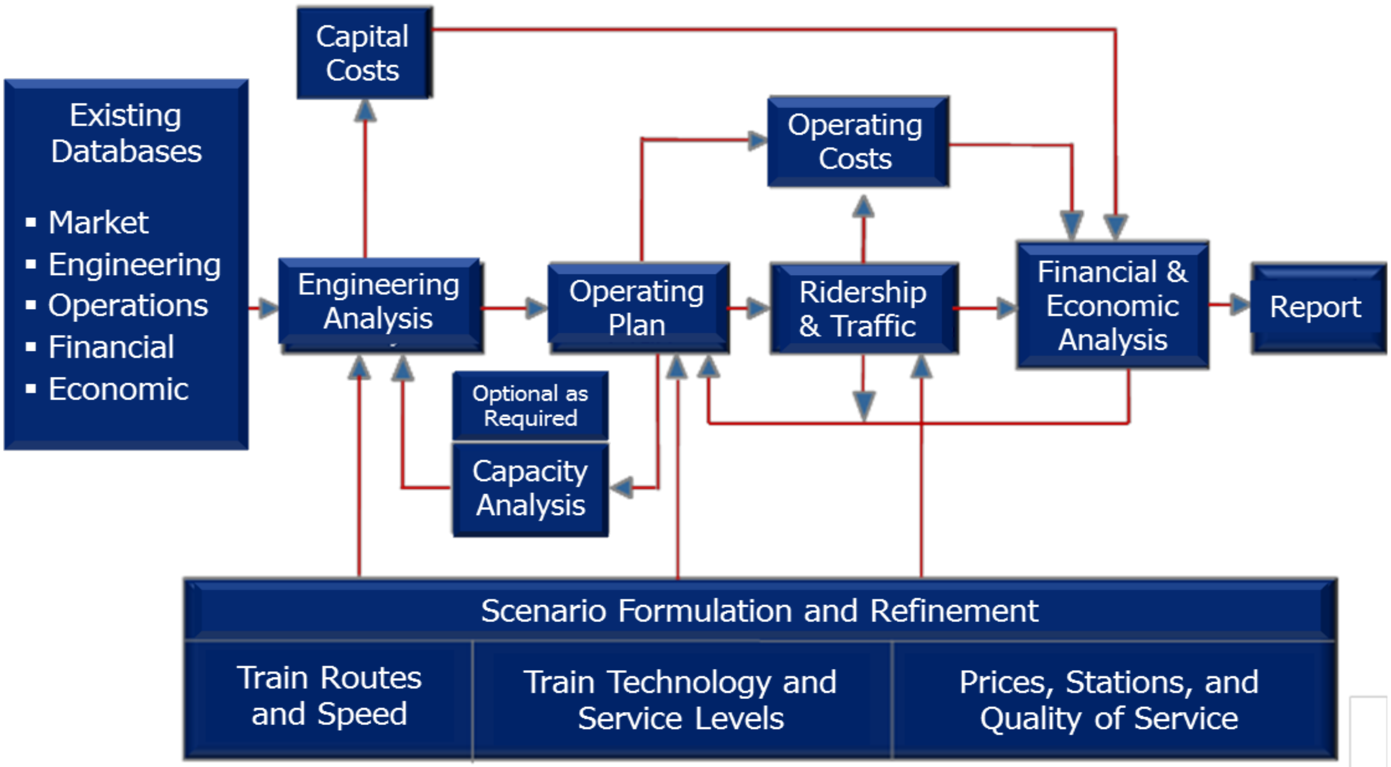
- Station stopping pattern;
- Train size and type of equipment;
- Train weight; and
- Locomotive horsepower.

5.4.1 Train Frequency Methodology

Once a basic schedule for each alternative was developed, a key requirement for developing an operating plan and costs was to work in tandem with ridership and revenue forecasts to adjust train sizes and frequency levels to appropriately match demand. In addition, there is a need to respect financial constraints on the operations of the system as outlined by the FRA guidance for high-speed rail system to produce a positive operating ratio and minimize needs for an operating subsidy. The results of this interactive analysis, as shown in **Exhibit 5-7**, were then used to identify the system operating costs.

[30] *Travel times for the refinement of feasible route alternatives are slightly different than those in Section 3.2.2.3 as more information became available for each route. The travel times outlined in this section were used in the overall evaluation of the three route alternatives.*

Exhibit 5-7: Interactive Analysis Process



For development of the operating plan as well as ridership scenarios to be tested, train size and frequencies were increased together, in a balanced way, to accommodate the expected ridership increase. Train frequency increases the ridership and revenue impact of an initial speed improvement. At the same time, ridership increases associated with higher speeds often allow the use of larger, more efficient trains. This led to an iterative approach to identify the optimal investment and operating strategy for each of the route alternatives.

Based on previous corridor study methodologies, an initial guess was made of a range of train frequencies as an initial input into the ridership model to develop an initial estimate of demand. The resulting estimates were compared to the train frequencies to develop load factors (how full the train should be) and required train sizes. If the load factors were too high, the frequencies were adjusted upward; if the train load factors were too low, frequencies were adjusted downward.

Exhibit 5-8 illustrates the first proposed frequencies used for the demand forecasting, with Alternative 1 having six round trips per day, Alternative 2 having eight round trips per day and Alternative 3 having 12 round trips per day.

Exhibit 5-8: Initial Train Frequencies by Alternative

Round Trips per Day	4	6	8	10	12
Alternative 1: NS		X			
Alternative 2: I-85			X		
Alternative 3: Greenfield					X

This process was repeated until the optimal frequency and train sizes were established for each alternative and each technology. For Alternative 1A and 1B, the final frequency of four (4) round trips per day is lower than the initial input. This is due to the track geometry of the existing NS line (e.g., a large number of speed-limiting curves) and the inability to improve the line for faster speeds. Additionally, an additional consideration was the impact of additional passenger train frequencies on a shared use line, and on freight train delays. Because of the impact on freight trains, it was more desirable to use lower service frequencies with larger passenger trains.

Alternatives 2A and 2B as well as Alternative 3A and 3B had much higher demand response that higher levels of frequencies could be supported than were originally suggested. It should be noted that on Alternative 2A and 2B, the highway geometry was found to be somewhat restrictive, resulting in the electrified option (2B) could not provide a much better travel time than the diesel option (2A). As a result, both alternatives were assessed at the same frequency (14 round trips per day), as the ridership forecasts were very similar. On the other hand, an electric train on Alternative 3 (3B) proved to be much faster than the diesel option (3A). Because this faster running time would attract higher ridership, a higher service frequency was appropriate. The final frequencies for Alternative 3A and 3B are 16 and 22 round trips per day, respectively.

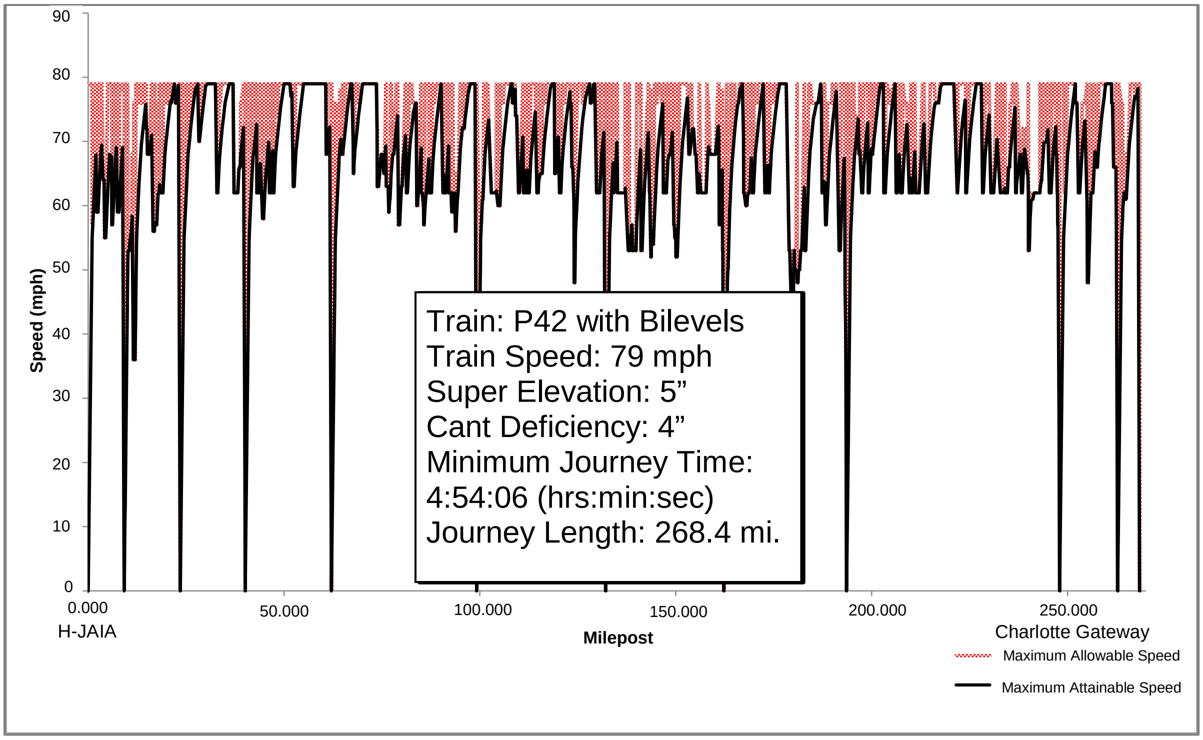
The result at the end of the iterative process was the identification of an equilibrium solution that appropriately balanced ridership demand with train frequency for each option, resulting in an effective balance between ridership demand, train size and train frequency for each alternative.

The results of the application of the Train Performance Calculator Model (TPC) for each route and technology alternative are discussed in more detail below and are displayed graphically in Exhibits 5.9 - 5.14. The TPC model is used to develop comparative travel journey times for the iterative analysis of schedule frequencies and other service variables. As discussed below, all travel journey times displayed are “unimpeded” by freight operations and other considerations including allowances for “slack” and “pad,” and are not the adjusted travel times represented in the final schedules for each alternative. The TPC graphics show each stop as locations where the speed drops to zero and also show imposed limits on top speeds associated with each technology (e.g., 79 mph, 110 mph, 125 mph, 220 mph, etc.) and other factors. Subject to these upper limits imposed by each route and technology alternative, the TPC model calculates speeds at specific points between stops based on track curvature, the acceleration and deceleration characteristics of the equipment technology used, and other factors resulting in top speeds that are often less than the upper limit shown.

5.4.2 Alternative 1: Southern Crescent

Two travel times were calculated for Alternative 1, one with top speed of 79 mph (Alternative 1A) and one with a top speed of 110 mph (Alternative 1B), which operates primarily along the NS ROW. **Exhibit 5-9** and **Exhibit 5-10** illustrate the speed performance for both technologies: Alternative 1A, GE P42 diesel-electric locomotive and conventional passenger coaches; and Alternative 1B, Talgo XXI locomotive with tilt body passenger coaches. These exhibits show the minimum unimpeded running times that were produced by the TPC model runs. The TPC used an unconstrained corridor to calculate average travel time, but a slack and pad factor was applied to each alternative to represent base-level freight train interference. It should also be noted that the TPC model does not define specific capacity requirements as this will be prepared as part of the Service Development Plan. However, operational schedules need some planned buffer. For developing schedules in this chapter, an additional 5-10% slack time was added.[31] For Alternative 1, additional time was added to allow for delays caused by freight trains.

Exhibit 5-9: Alternative 1A (79 mph) Train Performance



The existing rail ROW has geometry that limits the trains performance and speed showing only a few places where speeds exceed 65 mph.

[31] *Refer to Section 4.3.1 for a more detailed explanation of slack time.*

Exhibit 5-10: Alternative 1B (110 mph) Train Performance

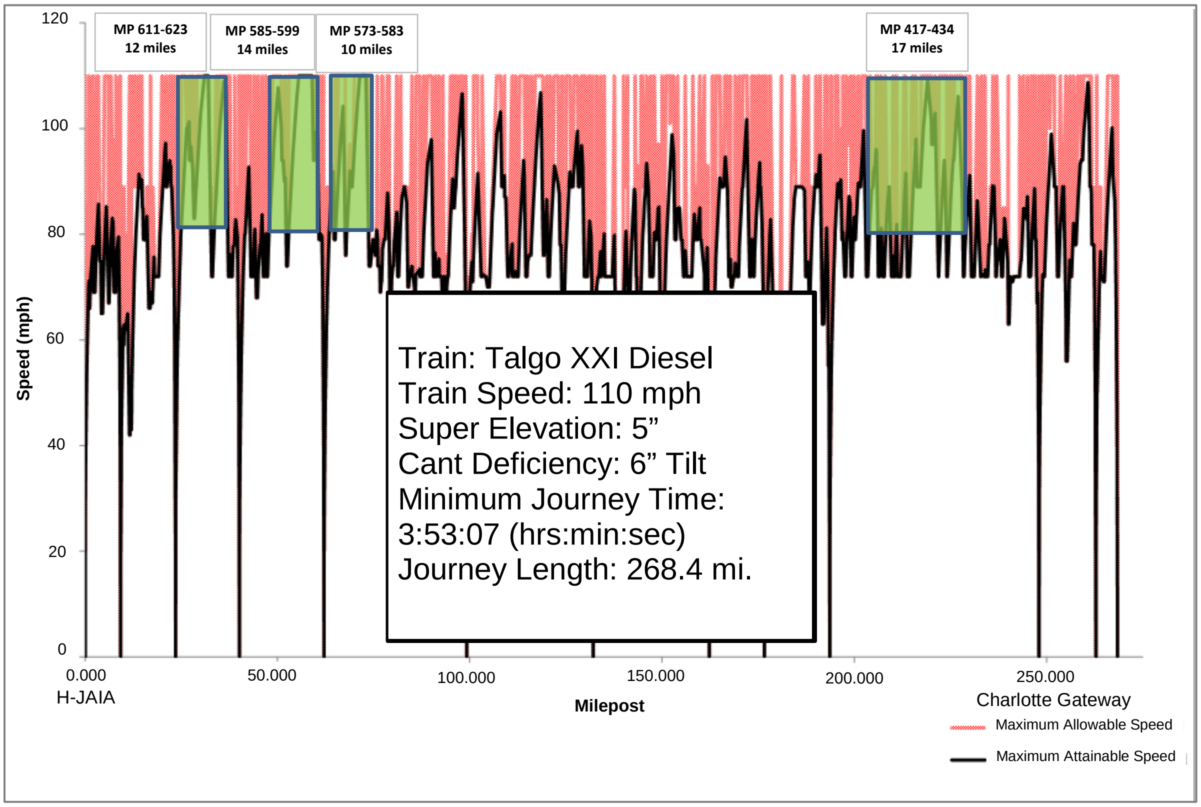


Exhibit 5-10 shows a speed profile that was developed for a 110 mph (max speed) Talgo XXI diesel tilting train. The speed limits applicable to each segment of the route, as well as the impact of curve speed limits and station stops, can be seen on the graphic. The analysis shows that with a tilting train, the speeds along the existing rail ROW are mostly restricted to 70 mph and are rarely able to get above 79 mph. However, there are four zones highlighted in green above where geometry allows for operations above 79 mph. It should be noted that this does not necessarily mean the train is able to reach 110 mph; it only shows areas where sustained speeds above 79 mph may be possible.[32] It is in these areas that the conceptual engineering proposes adding a second track dedicated to passenger trains in order to separate from freight operations. Three of the zones are located in Georgia and one is in South Carolina. The total length of these zones is 53 miles (20 percent of the total route length).

It should be noted that at the beginning of the conceptual engineering and travel time analysis, the NS line was evaluated for improving curve geometry. Each curve was evaluated in regards to obtaining higher speeds through the curve. While it was found that there were opportunities to improve geometry, these improvements did not have a significant impact on travel time and it was decided that the costs associated with improving curves could not be offset by the minimal decrease in travel time. Therefore, there are no proposed improvements to curves.

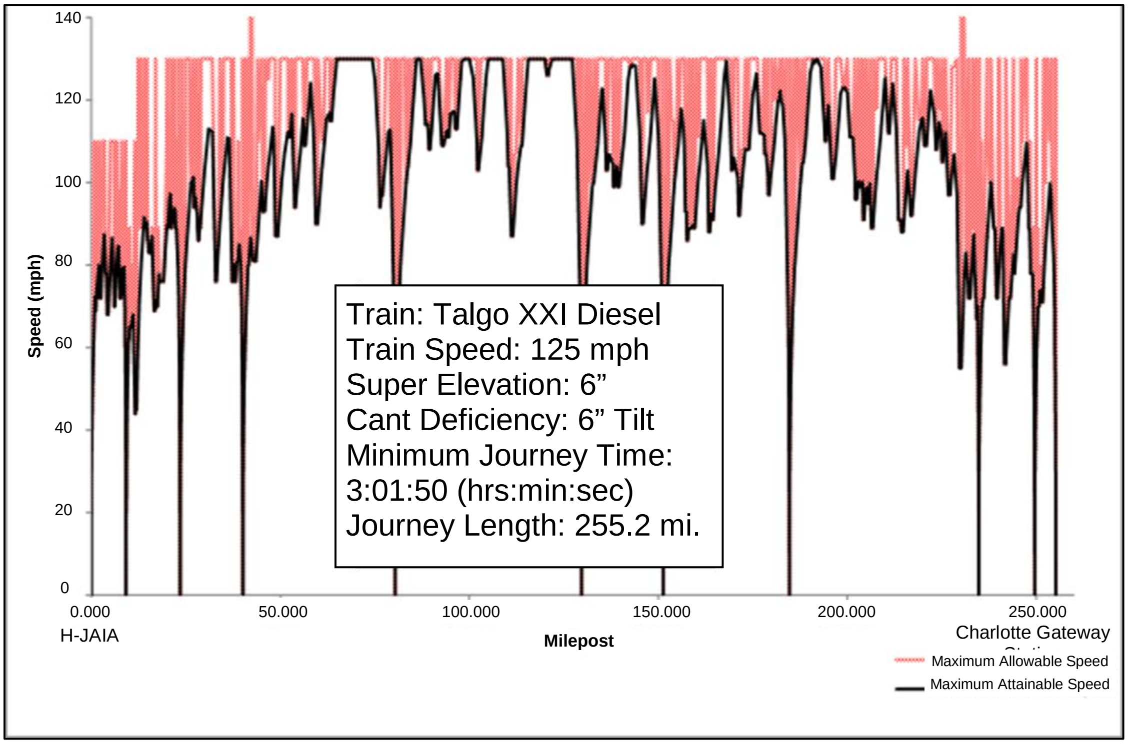
Because of the slower travel times and the amount of station locations, it was determined that there will be four roundtrips per day for both Alternatives 1A and 1B.

[32] *It was assumed for this analysis that operations above 79 mph use separate tracks. This is being considered for the four green zones, but traditionally shared operations are anticipated over the other portions of the corridor where geometry cannot allow operations at speeds above 79 mph.*

5.4.3 Alternative 2: I-85

Two sets of travel times and train performance were calculated for Alternative 2: one with a top speed of 125 mph (Alternative 2A) and one with a top speed of 220 mph (Alternative 2B), which operates predominantly in within the I-85 ROW. **Exhibit 5-11** and **Exhibit 5-12** illustrate the speed performance for both technologies: Alternative 2A, Talgo XXI locomotive and tilt body passenger coaches; and Alternative 2B, high-speed electrified train sets.

Exhibit 5-11: Alternative 2A (125 mph) Train Performance

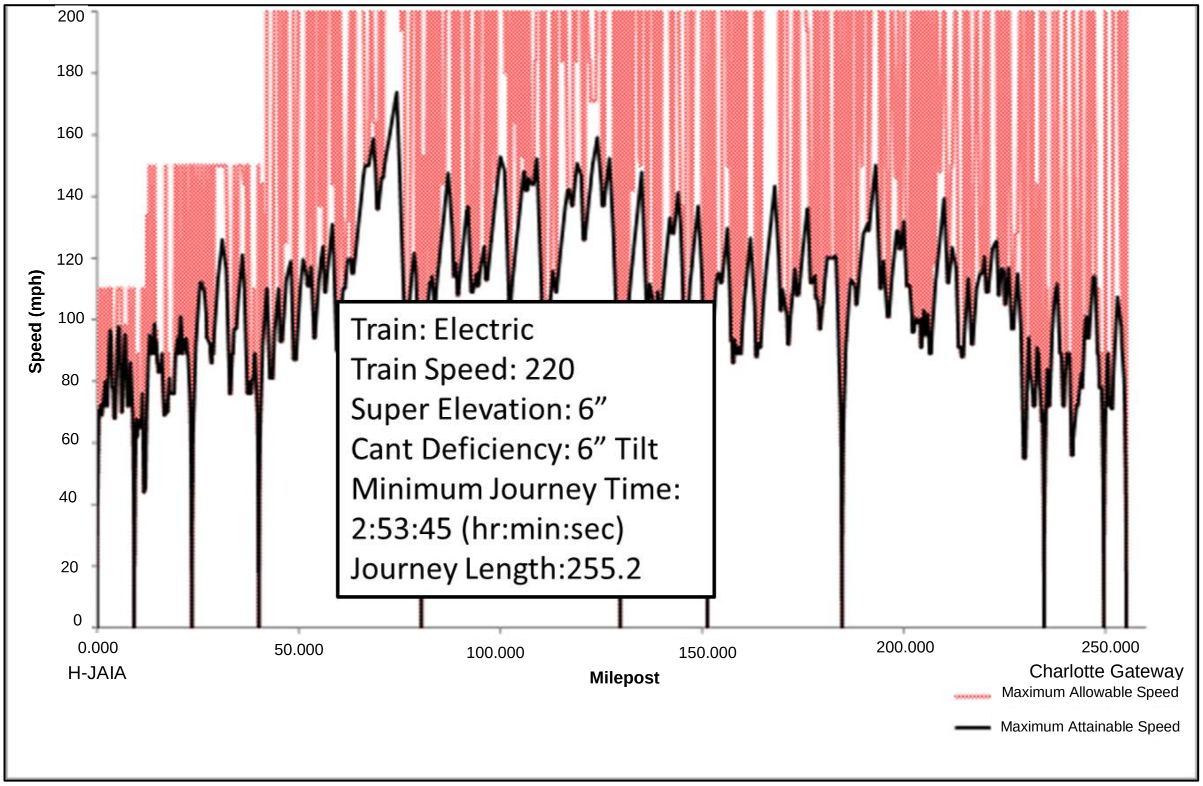


The exhibit above illustrates that higher speeds can be achieved as compared to Alternative 1; however, there are many areas where a top speed of 125 mph cannot be achieved due to curves and grades.

The exhibit below indicates that the Alternative 2B route generally allows speeds of 125-150 mph (geometric standards for interstate highway alignments generally allow speeds of 125-150 mph); however there are still geometric constraints (curves) that prevent the electrified technology (220 mph) to operate at full potential. These high-speed trains require gentle curves, which are typically only obtained through development of new greenfield alignments.

The differences in running time between Alternative s 2A and 2B was found to be very small because frequent curves along the highway prevent electric trains from reaching their full speed potential. Because the time difference is very small, both Alternatives 2A and 2B would operate 14 round trips per day. This is a substantial improvement over the four round trips offered under the diesel-electric operations in Alternative 1: Southern Crescent; however, there are still limitations to travel time due to curves that prohibit more efficient electric train service.

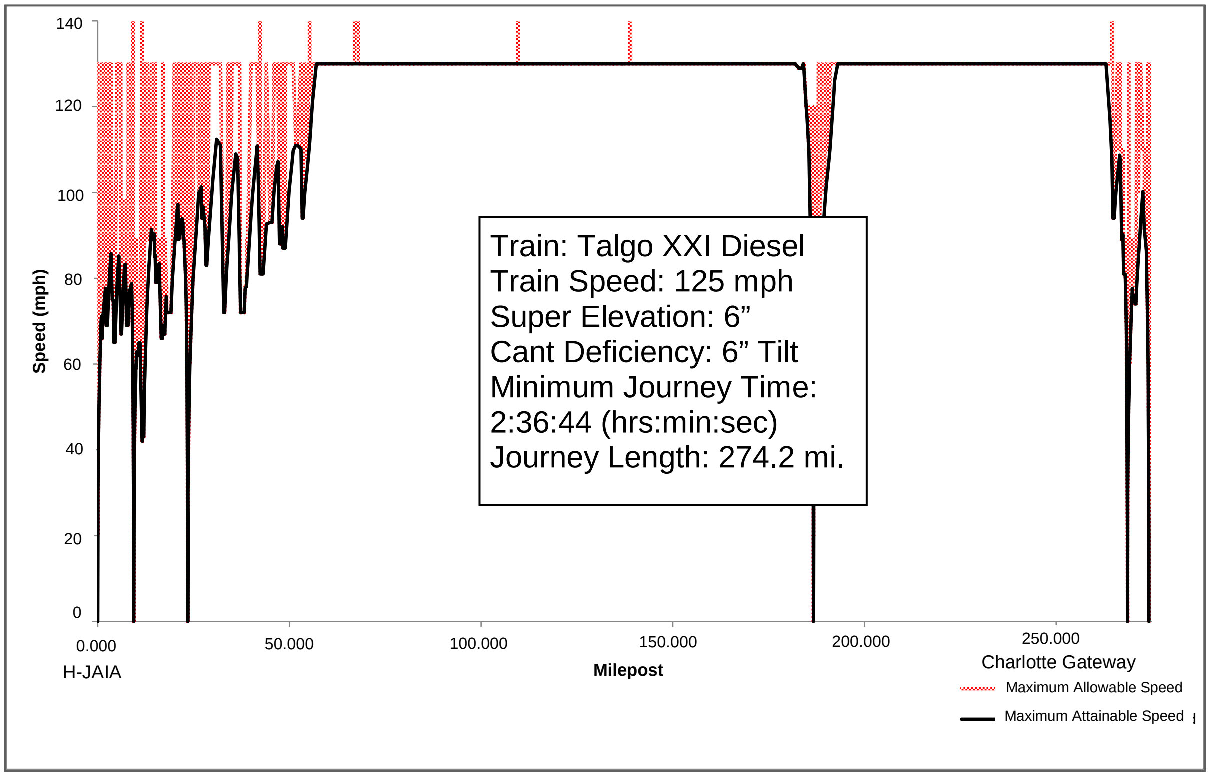
Exhibit 5-12: Alternative 2B (220 mph) Train Performance



5.4.4 Alternative 3: Greenfield

Two sets of travel times and train performance were calculated for Alternative 3: one with a top speed of 125 mph (Alternative 3A) and one with a top speed of 220 mph (Alternative 3B), on a new greenfield alignment. **Exhibit 5-13** and **Exhibit 5-14** illustrate the speed performance for both technologies: Alternative 3A, Talgo XXI locomotive and tilt body passenger coaches; and Alternative 3B, high-speed electrified train sets.

Exhibit 5-13: Alternative 3A (125 mph) Train Performance



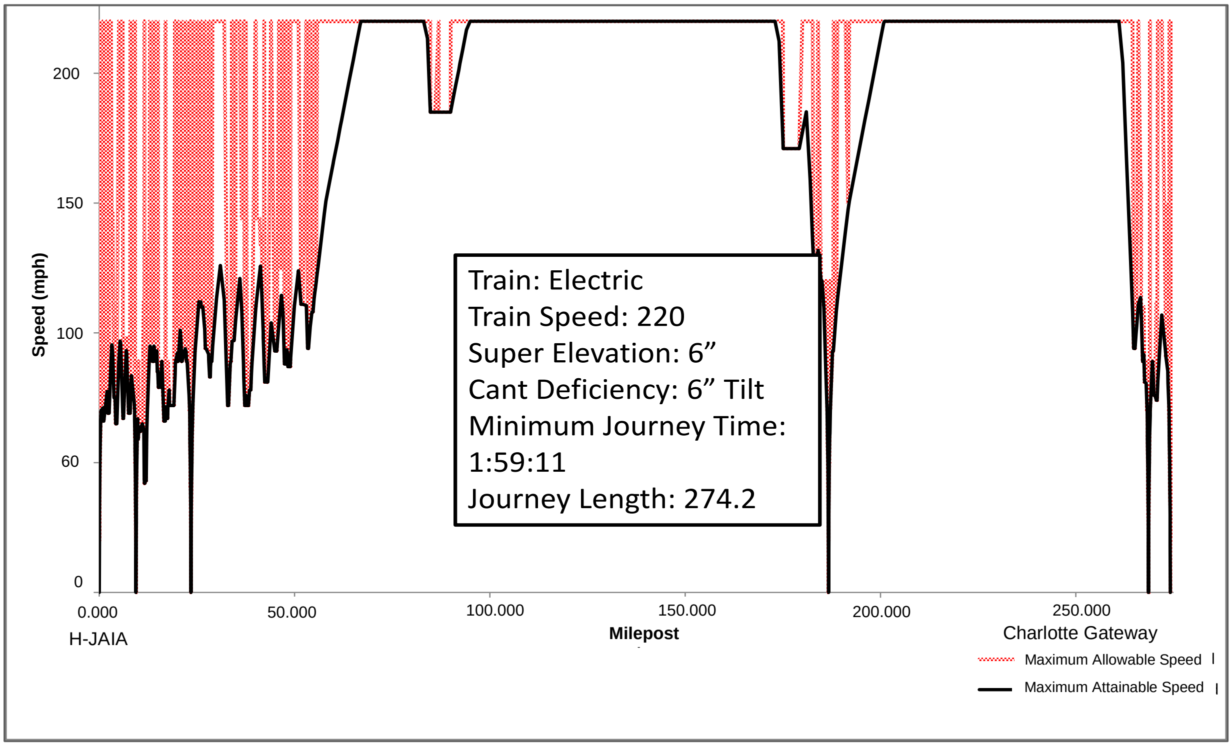
The exhibit above illustrates that the top speed can be achieved for a large portion of the corridor and travel times are minimal for the technology.

The exhibit below indicates that Alternative 3B (220 mph) generally allows for top speeds near 220 mph. While there are still geometric constraints (curves) in the terminal areas limiting speeds, the overall service performs efficiently.

Alternative 3A (125 mph) will operate 16 round trips per day and 3B (220 mph) will operate 22 round trips per day. The increased travel time and reduced ridership for the diesel-electric phasing option dictates fewer frequencies for Alternative 3A.

The result of the TPC analysis giving unimpeded optimal train running times were important inputs into the train schedule development of Chapter 4. With the inclusion of appropriate levels of schedule slack and pad time, the train schedule results will be summarized in Chapter 4, for express, semi-express and local service.

Exhibit 5-14: Alternative 3B (220 mph) Train Performance



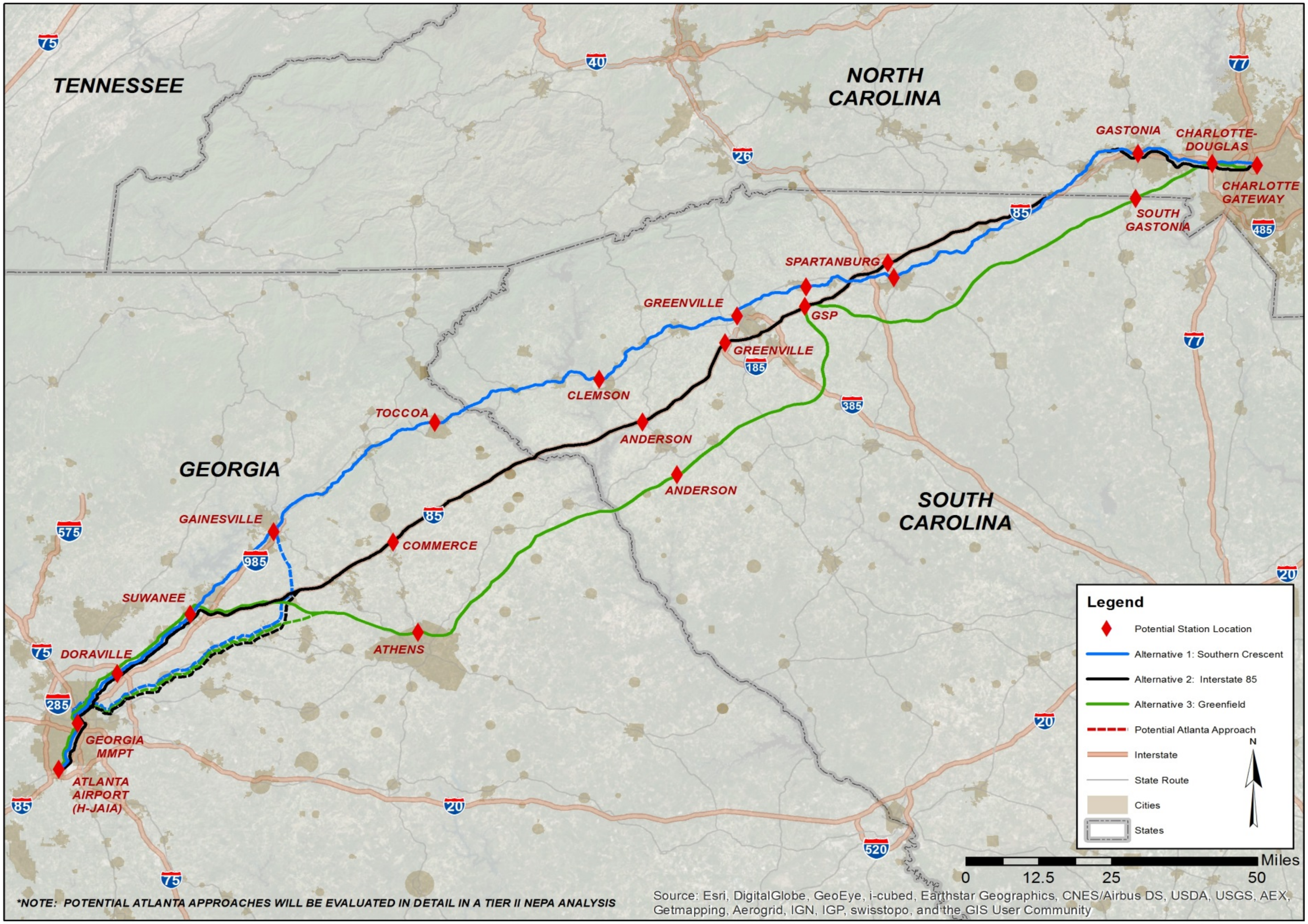
5.5 REFINED ROUTE SUMMARY

Refined routes were established for technical evaluation. Based on operational analysis and public input, the following refinements were made to each of the three alternatives.

- Alternative 1A/B: There were no changes to the route or potential station locations for Alternative 1A/B
- Alternative 2A/B: A station was added to the route alternative near Commerce, Ga. It was found that there was a decent demand from the ex-urban area into Atlanta. Additionally, a station was removed near the Greenville-Spartanburg airport as it was found that having a third station (in addition to Greenville, S.C. and Spartanburg, S.C,) did not increase the ridership demand to the point where it offsets the additional stopping time and maintenance costs.
- Alternative 3A/B: The route was shifted towards the south in Georgia to access Athens, Ga. This area, similar to Commerce, Ga. for Alternative 2, provided a substantial amount of ridership demand which did not negatively impact travel time and maintenance costs. Additionally, similar to Alternative 2, two stations near Greenville and Spartanburg (Fountain Inn and Roebuck) were removed, leaving only one station in the area (Greenville-Spartanburg Airport). This one station at the airport could handle the demand from the surrounding area.

Exhibit 5-15 illustrates the three refined route alternatives.

Exhibit 5-15: Refined Route Alternatives



5.6 RIDERSHIP AND REVENUE

Ridership and revenue forecasts were developed for all three route alternatives and their associated technologies (refer to **Section 5.2** for technologies).

5.6.1 Methodology

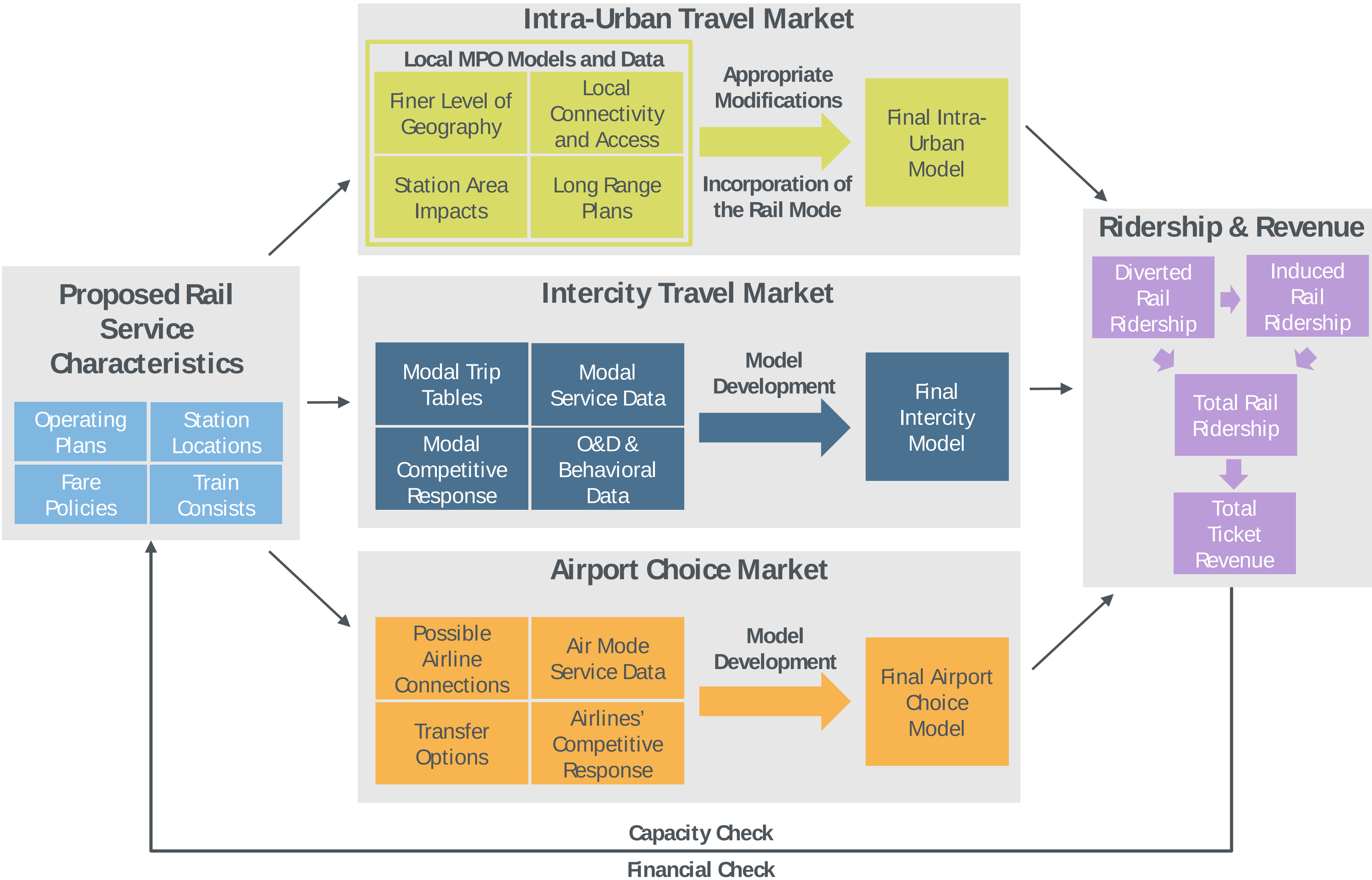
A nationally accepted travel demand forecasting methodology (described below) was employed to analyze ridership and revenue for the Atlanta to Charlotte PRCIP. **Exhibit 5-16** illustrates the forecasting approach. As displayed, it addresses four distinct travel markets:

- The intercity travel market;
- The Atlanta and Charlotte intra-urban travel markets (including the airport access market);
- The airport choice (or connect air) market; and
- The induced demand market.

It should be noted that capacity and financial checks were performed and resulted in the exclusion of the intra-urban market from the ridership and revenue results at this stage in the project. As will be mentioned in Section 5.6.1.2, the high level of intra-urban demand constrained the seat capacity available for inter-city trips which significantly reduces the revenue potential of the alternatives. Also, as mentioned in Section 5.6.1, ridership was forecasted for various operating scenarios and frequencies. This iterative process provided insight into optimal frequencies and stopping patterns.

The demand forecasting steps for each of these travel markets are briefly described below with more details provided in **Appendix D**.

Exhibit 5-16: General Ridership and Revenue Forecasting Framework



To forecast demand for a passenger rail service alternative (combination of technology, speed, route and stopping pattern), the model requires information on the alternative's service characteristics, including:

- Operating characteristics: stopping patterns, running and dwell times, schedule and frequency;
- Station-to-station fares; and
- Station locations and connectivity/accessibility/parking information.

5.6.1.1 Intercity Travel

The demand model follows the following five-step process to forecast the intercity ridership and revenue of the rail service alternatives:

1) **Establish the geographic study area and the travel zone structure:** The intercity model covers a geographic area that generally follows the Atlanta to Charlotte corridor and extends approximately 50 miles on each side of the refined alternatives (refer to Chapter 4 for alternative descriptions). The study area was divided into 189 travel zones. Within Metropolitan Planning Organization (MPO) model coverage areas (Atlanta and Charlotte), the zones are based on an aggregation of the MPO model Traffic Analysis Zones (TAZs); in other areas, the zones were based on county boundaries.
2) **Develop input data including travel characteristics for each travel mode and travel zone pair:** Modeling input data included the study area network, current and future socio-economic variables (population, employment, income, general economic conditions, visitor information and commuters), and information about the service characteristics of existing and future travel modes.
3) **Estimate the current travel market:** The intercity travel market included trips made by air, bus and private automobile. As part of the forecasting model development, data on the patterns and levels of trip making in these markets was prepared on a detailed zone-to-zone basis. While intercity air volume data is available from well-established sources, and intercity bus volumes can be adequately estimated from published schedules, the lack of detailed up-to-date information on intercity automobile travel in the study corridor was a data gap. This prompted the collection of original travel data collection, using anonymous cell phone data to understand the origins and destinations of auto travelers in the study corridor.
4) **Estimate how markets will grow in the future:** This involved the development of econometric travel growth models for the auto and bus modes, reflecting trends in socioeconomic variables such as population and employment. Future year air trip tables were prepared based on the published Federal Aviation Administration (FAA) Terminal Area Forecasts[33] of total annual airport enplanements for each of the study area airports.
5) **Estimate the potential market share that the new rail service alternatives will capture (i.e., ridership):** Logit model-based binary diversion models were used to predict diversion to the new rail mode from each of the existing modes, based on the respective service characteristics of the modes in competition between each zone pair. Service characteristics include time, cost, service frequency, reliability and quality of service. Time and costs were broken down into access, egress, transfer, terminal and line-haul components. Mode-specific constants accounted for the effects of other (not explicitly modeled) characteristics of passenger rail relative to other modes. These diversion percentages were then applied to the existing zone-to-zone travel volume by each existing mode to predict the volume of travel by the new passenger rail alternative. This process was carried out separately for the different trip purposes, and the results were aggregated to estimate total ridership.

The binary diversion models incorporated information about how travelers assess and trade off different modal service characteristics. The parameters of the binary diversion models were finalized with proper adaptation and modification of similar models that were estimated in the region for travel between Atlanta and Chattanooga using data from a Household Travel Survey conducted in 2009 as part of the Atlanta-Chattanooga High Speed Ground

[33] https://aspm.faa.gov/main/taf.asp (accessed on 02/27/15)

Transportation Tier 1 EIS.[34] These adaptations/modifications reflected the specificity of the current study corridor, using readily-available data, information developed in other studies in the study area, and experience in other passenger corridors.

5.6.1.2 Intra-Urban Travel

All three route alternatives include multiple stations in the Atlanta and Charlotte metropolitan areas, which will provide intra-urban as well as intercity service. Intra-urban ridership and revenue was originally forecasted using the Atlanta Regional Commission (ARC) and Metrolina Travel Demand Model (MDM) models for the passenger rail alternatives in Atlanta and Charlotte. The ARC model encompasses 19 counties included in the Atlanta Metropolitan Planning Organization. These include Fulton County (Atlanta), Clayton County (Hartsfield-Jackson International Airport), Dekalb County (Doraville), and Gwinnett County (Suwanee). The MDM model is the primary tool for evaluating travel demand in the greater Charlotte area. The region's four MPOs and two RPOs in included in the model. They include the Charlotte Regional Transportation Planning Organization (Mecklenburg County, City of Charlotte and the Charlotte Douglas International Airport) and the Gaston-Cleveland-Lincoln MPO (Gaston County and Gastonia).

Using these models respectively, it was decided to prepare additional analysis and include intra-urban in the final ridership and revenue outputs. The intra-urban trips were estimated at a $5.00 fare, to be in line with current transit prices in metro Atlanta. This low fare, although in line with regional economics, generated a large number of riders and low revenue. In order to meet FRA's Intercity Rail Economic Criteria within this study, these intra-urban trips negatively impact the economics of the route. Therefore, for the purposes of ridership forecasts modeling, intra-urban trips were not included. This regional type of service does not meet the purpose and need of this PRCIP, but could be studied in the future to supplement this corridor. This high level of intra-urban travel demand constrained the seat capacity available for inter-city trip demand, which that generates higher-revenues from long-distance passengers, significantly reducing the revenue potential of the alternatives. While the elimination of intra-urban travel resulted in strong intercity passenger rail performance in this modeling effort, this issue can be re-examined if necessary in future Tier 2 work associated with the selected alternative.

5.6.1.3 Airport Choice (Connect Air)

Both H-JAIA and Charlotte-Douglas International Airport are important national and international hubs due to the large number of destinations served and the presence of major carriers. Locally, they provide regional connection options for air trips that begin or end at these airports as well those generated at the GSP Airport and other significant commercial airports in the study area. Because all three route alternatives have rail stations at both H-JAIA and Charlotte-Douglas, air travelers who begin or end their trip at H-JAIA, Charlotte-Douglas or GSP Airport and change planes at H-JAIA or Charlotte-Douglas will also have the option to access H-JAIA or Charlotte-Douglas by the proposed new rail mode. The demand forecasting effort developed an airport choice model to forecast these potential shifts by connecting air travelers.

5.6.1.4 Induced Demand

"Induced travel" refers to trips that were not made before a project opens, but which come to be made as a result of the mobility and accessibility improvement that the project brings about. Induced travel resulting from the introduction of a passenger rail service was forecasted using a simple elasticity-based approach, where the elasticity is expressed as the percentage impact on travel volumes resulting from a percent change in accessibility. Accessibility, in turn, was defined in terms of a generalized cost computed from the binary diversion models.

[34] *"Atlanta-Chattanooga High-Speed Ground Transportation Tier I Environmental Impact Statement," Final Report, Georgia Department of Transportation, April 2008.*

5.6.2 Results

Outputs of the forecasting process described above applied to each of the three route alternatives and technologies detailed in this section for two forecast years: 2025 and 2050. The results reflect revenue-maximizing fares: 25 cents per mile for Alternative 1 (both 1A and 1B) and 40 cents per mile for Alternatives 2 and 3 (2A, 2B, 3A, and 3B). All fares also include a flat $5.00 boarding fee[35]. Before choosing these as the final fares, a revenue-maximization analysis was performed. This analysis is discussed further in **Appendix E**.

Airport choice diversion was only modeled for Alternatives 2A, 2B, 3A and 3B, as it was determined that the level of service provided by Alternatives 1A and 1B would not be sufficient to constitute a viable option for air travelers. Where airport choice diversion was modeled, it was assumed that passengers will have to purchase separate rail and air tickets.

5.6.2.1 Summary

Exhibit 5-17 shows the forecasted annual ridership and ticket revenue for each of the six options under consideration.

Exhibit 5-17: 2025 Forecast Summary

Alternative	Forecasted Annual Ridership	Forecasted Annual Revenue (2012$)
1A: Southern Crescent (79 mph)	0.81 M	$34.3 M
1B: Southern Crescent (110 mph)	1.01 M	$44.6 M
2A: I-85 (125 mph)	4.65 M	$283.0 M
2B: I-85 (220 mph)	4.75 M	$289.7 M
3A: Greenfield (125 mph)	4.58 M	$306.2 M
3B: Greenfield (220 mph)	5.37 M	$367.6 M

As shown in the table above, forecasted ridership and revenue are highest, as expected, for Alternative 3B, which is the fastest and most frequent service (refer to Section 4.1.4). Forecasts are fairly similar for Alternatives 2A, 2B and 3A, all of which have roughly similar levels of travel time and frequency. Alternatives 1A and 1B produce significantly lower ridership and revenue forecasts, which are consistent with these being the slowest and least frequent options.

Exhibit 5-18 presents a similar summary table of 2050 forecasts.

Exhibit 5-18: 2050 Forecast Summary

Alternative	Forecasted Annual Ridership	Forecasted Annual Revenue (2012$)
1A: Southern Crescent (79 mph)	0.94M	$40.3M
1B: Southern Crescent (110 mph)	1.18M	$52.7M
2A: I-85 (125 mph)	5.50M	$341.7M
2B: I-85 (220 mph)	5.62M	$349.3M
3A: Greenfield (125 mph)	5.38M	$368.4M
3B: Greenfield (220 mph)	6.30M	$440.6M

This table shows that the relative performance of the scenarios is quite similar to that in 2025, with all forecasts growing at a rate of 0.6-0.8 percent per year.

[35] *These rates were chosen as the result of a revenue maximizing analysis. They are the rates that result in the highest revenue for each of the alternatives. Lower rates would result in increased ridership which may maximize other benefits while increasing the ultimate financial cost of the project.*

5.6.2.2 Alternative 1 (Southern Crescent) Forecast Details

Exhibit 5-19 presents a detailed breakdown of the forecasts for both Alternative 1A and 1B for each forecast year. Ridership is broken out to illustrate diversion from air, bus, auto and airport choice trips, as well as induced ridership.

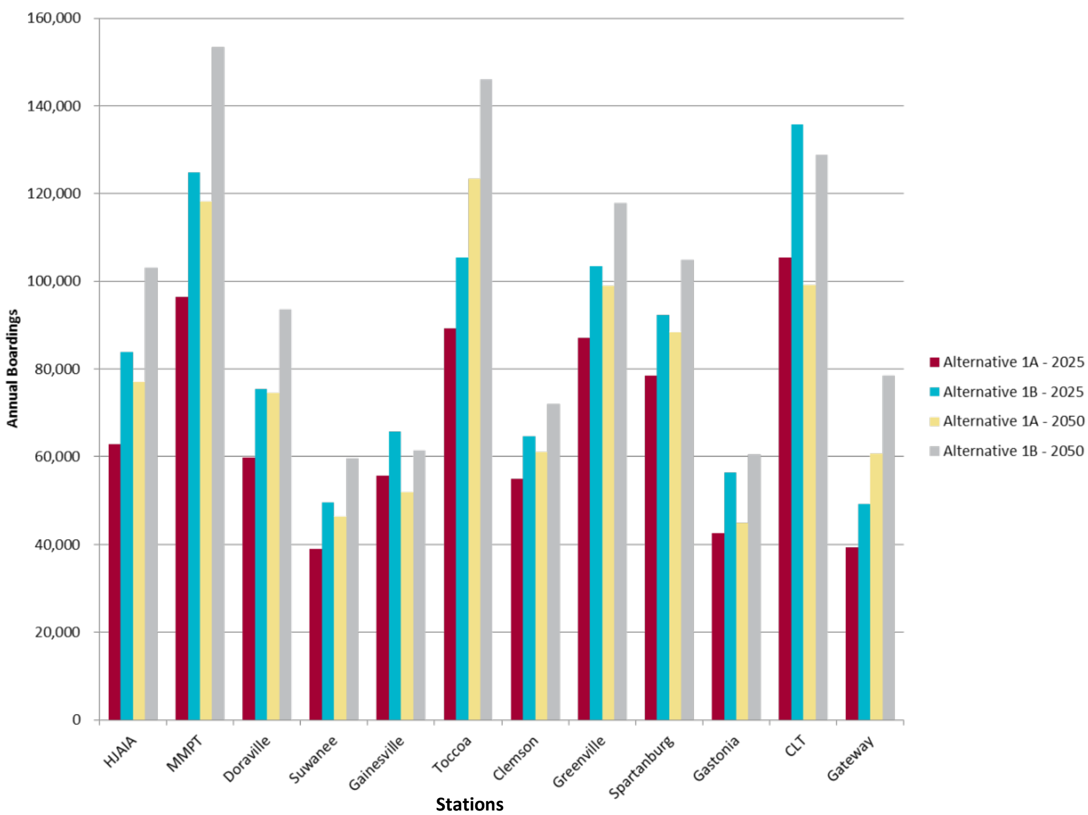
Exhibit 5-19: Alternative 1A and 1B Forecast Details

Alternative/ Forecast Year	Forecasted Annual Ridership						Forecasted Annual Revenue (2012$)
	Air Diversion	Bus Diversion	Auto Diversion	Airport Choice	Induced	Total	
1A, 2025	0.06 M	0.05 M	0.68 M	-	0.02 M	0.81 M	$34.3 M
1B, 2025	0.10 M	0.05 M	0.84 M	-	0.02 M	1.01 M	$44.6 M
1A, 2050	0.08 M	0.05 M	0.79 M	-	0.02 M	0.94 M	$40.3 M
1B, 2050	0.13 M	0.05 M	0.97 M	-	0.03 M	1.18 M	$52.7 M

The key takeaway from the table is that auto diversion is the primary driver of rail ridership. Given that there are more than 100 million intercity auto trips expected to be made annually in the Atlanta–Charlotte corridor by 2025, even a small capture rate translates into significant passenger rail demand. Alternative 1 attracts a higher diversion of bus passengers than other alternatives; however, this is a result of bus passengers' attraction to the lower fares of Alternative 1 as a more viable substitute for existing bus service.

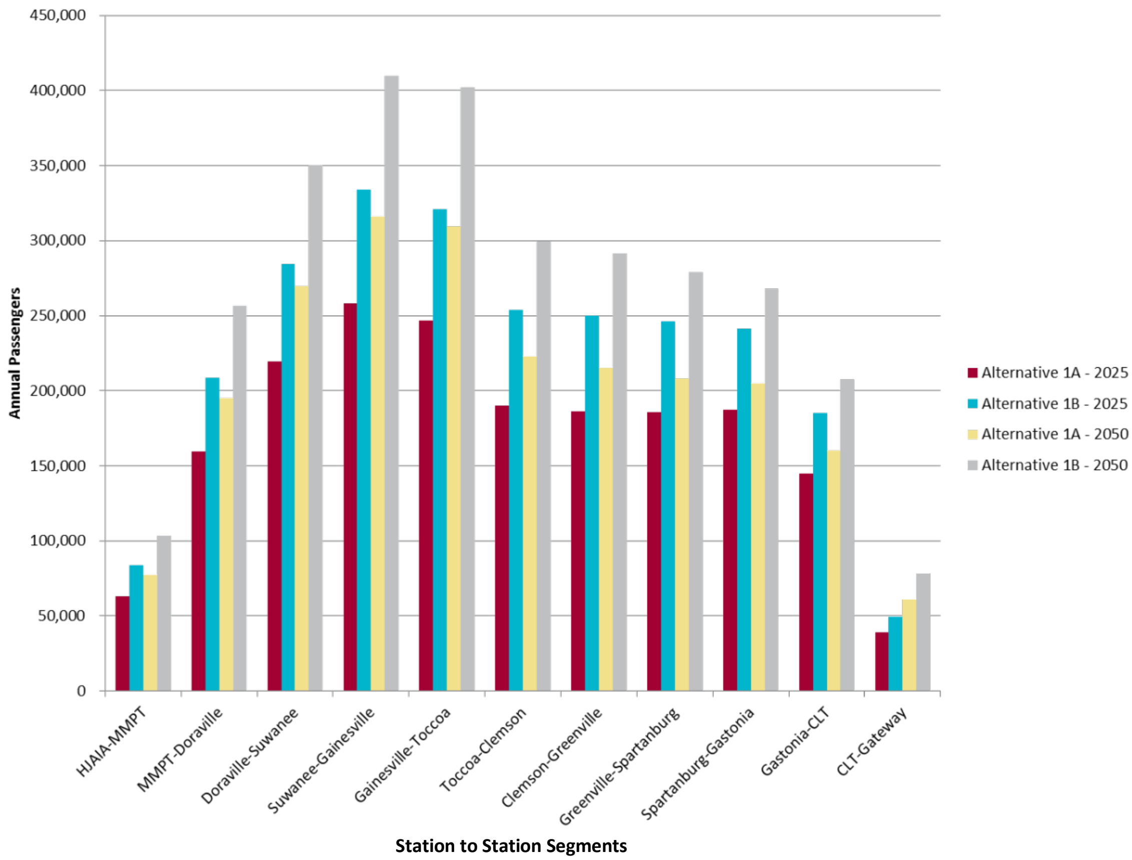
Exhibit 5-20 and **Exhibit 5-21** show the annual boardings by station and segment volumes by pair of successive stations, respectively, for Alternatives 1A and 1B options for both 2025 and 2050.

Exhibit 5-20: Alternative 1A and 1B Annual Station Boardings



The Toccoa, Ga., station is one of the busiest stations on the corridor. This is due to Toccoa being the preferred station for a relatively large group of travelers in the northeast corner of Georgia who make long-distance commute trips to the Atlanta metro area. It should be noted that Toccoa serves the ex-urban Atlanta and each alternative has a stop that serves a similar market, for Alternative 2 this is Commerce and Athens for Alternative 3.

Exhibit 5-21: Alternative 1A and 1B Annual Segment Volumes



The plot of segment volumes generally follows the same patterns as the station boardings above. Volume peaks just east of the Atlanta area, falls off sharply east of Toccoa, and decreases slowly as the service moves toward the Charlotte area. This pattern of segment volumes is related to the fact that many of the trips made under Alternative 1A and 1B are shorter-distance trips, many of which follow metro commute patters in and out of Atlanta and Charlotte.

5.6.2.3 Alternative 2 Forecast Details

Exhibit 5-22 presents a detailed breakdown of the forecasts for Alternative 2A and 2B for both 2025 and 2050.

Exhibit 5-22: Alternative 2A and 2B Forecast Details

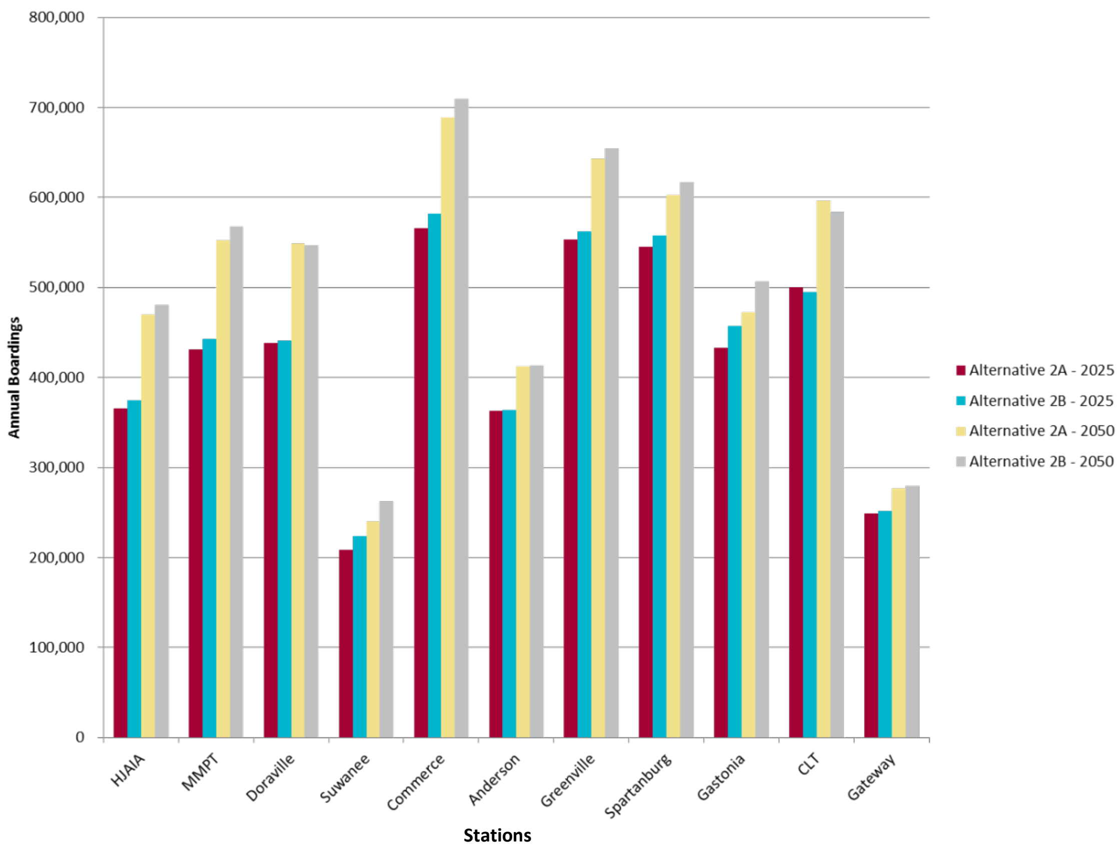
Alternative/Forecast Year	Forecasted Annual Ridership						Forecasted Annual Revenue (2012$)
	Air Diversion	Bus Diversion	Auto Diversion	Airport Choice	Induced	Total	
2A, 2025	0.41M	0.04M	3.32M	0.53M	0.35M	4.65M	$283.0M
2B, 2025	0.42M	0.04M	3.39M	0.54M	0.36M	4.75M	$289.7M
2A, 2050	0.57M	0.05M	3.80M	0.70M	0.39M	5.50M	$341.7M
2B, 2050	0.57M	0.05M	3.89M	0.71M	0.40M	5.62M	$349.3M

Similar to Alternative 1, the diversion from auto is the primary driver of passenger rail ridership. Also interesting is the airport choice diversion is greater than local air diversion. The robustness of the airport choice market is largely tied to the attractiveness of the rail service to passengers who are currently traveling by air to or from GSP, and already have to make a connection, likely in Atlanta or Charlotte.

Comparing the Alternative 2A with 2B for a given forecast year, it is seen that there is a relatively small difference in both ridership and revenue. This is due to the fact that the geometry of Alternative 2 does not enable 220 mph trains to reach top speed for much of the corridor (as previously discussed in Section 4.4.2), resulting in only a 6-minute end-to-end travel time savings over the 125 mph technology.

Exhibit 5-23 and **Exhibit 5-24** show the annual boardings by station and segment volumes by pair of successive stations, respectively, for Alternatives 2A and 2B for each forecast year.

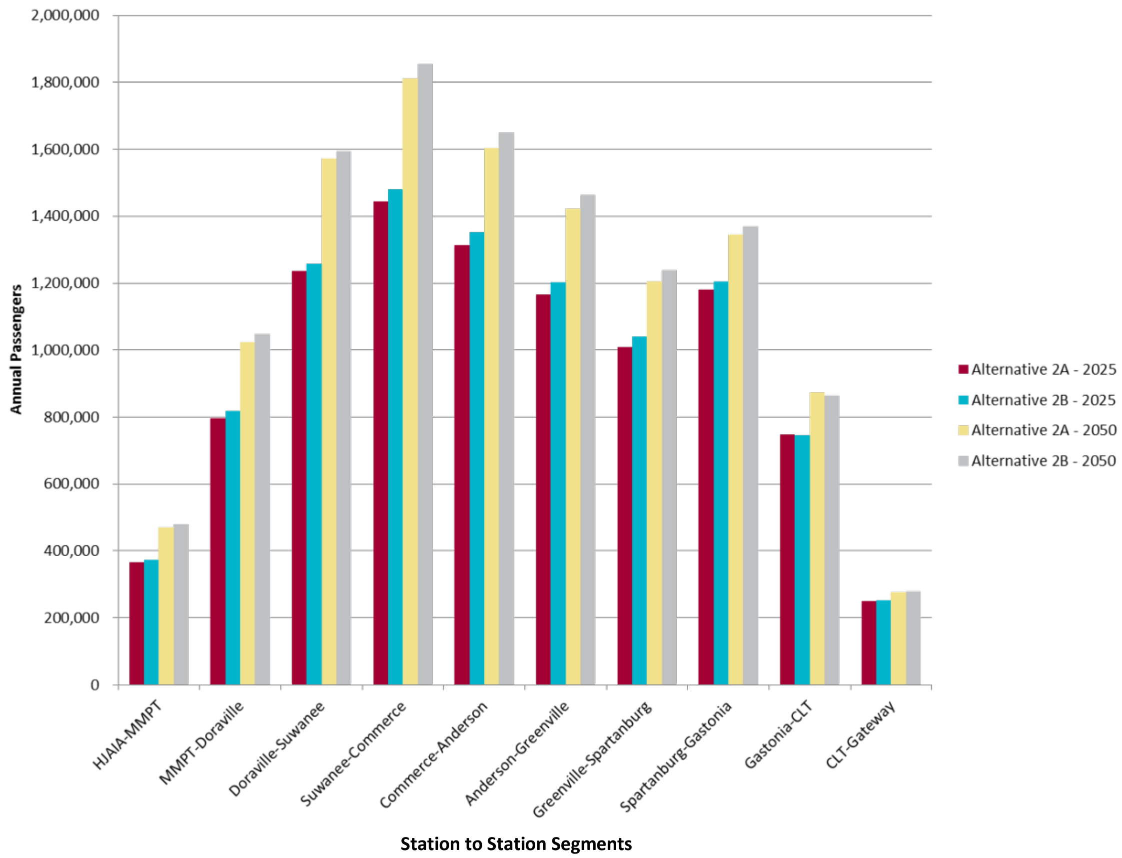
Exhibit 5-23: Alternative 2A and 2B Annual Station Boardings



The Charlotte Gateway Station shows the second fewest boardings on the corridor. This is due to the relatively low accessibility of the Gateway station to travelers who are not beginning or ending their trips in the heart of the downtown area. While travelers to and from uptown Charlotte use the Charlotte Gateway Station, most travel to suburban Charlotte where the airport or Gastonia is more accessible.[36] It should be noted that transfers from SEHSR were not included, nor were intra-urban trips that were excluded from the final analysis. A connection with SEHR will allow passengers to transfers to other rail corridors as well as shorter distance trips. The access to other rail corridors has the potential to impact connect air passengers. Instead of utilizing the Atlanta-Charlotte Corridor to access a hub airport, they may be able to reach their ultimate destination using only rail via a transfer at the Charlotte Gateway Station. Actual ridership at the Charlotte Gateway Station is estimated to be higher, due to its position as a rail hub. More information regarding connect air is described in **Section 5.5.1.3** as well as **Appendix E**.

[36] *All highway access/egress characteristics to the Gateway, CLT, and Gastonia stations are based on information used in the MRM model, which forecasts relatively quicker access/egress to/from the CLT and Gastonia stations for most of the Charlotte area zones compared to the Gateway station.*

Exhibit 5-24: Alternative 2A and 2B Annual Segment Volumes



The Alternative 2A and 2B segment volumes peak just outside of each of the major urban areas and have a relatively flat profile between the edge of the Atlanta area and the edge of the Charlotte area. The relatively flat profile between the two major urban areas is ideal, as it is conducive to efficient capacity planning for the proposed new rail service.

5.6.2.4 Alternative 3 Forecast Details

Exhibit 5-25 presents a detailed breakdown of the forecasts for each of the Alternative 3A and 3B options for each forecast year.

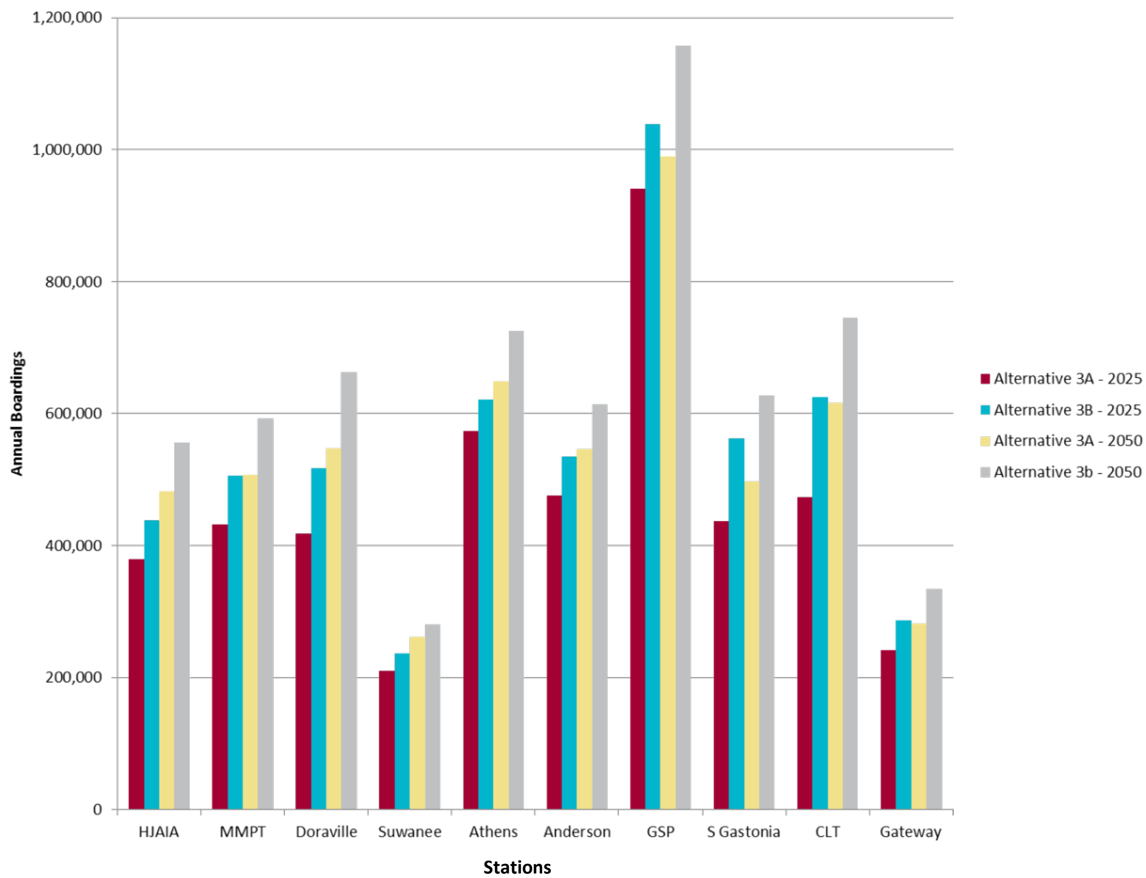
Exhibit 5-25: Alternative 3A and 3B Forecast Details

Alignment/Forecast Year	Forecasted Annual Ridership						Forecasted Annual Revenue (2012$)
	Air Diversion	Bus Diversion	Auto Diversion	Airport Choice	Induced	Total	
3A, 2025	0.41M	0.04M	3.21M	0.58M	0.34M	4.58M	$306.2M
3B, 2025	0.45M	0.04M	3.82M	0.65M	0.41M	5.37M	$367.6M
3A, 2050	0.56M	0.04M	3.64M	0.76M	0.38M	5.38M	$368.4M
3B, 2050	0.61M	0.04M	4.33M	0.86M	0.45M	6.30M	$440.6M

It should be noted that Alternatives 3A and 3B each have a slightly higher average fare (revenue per rider) than the corresponding Alternatives 2A and 2B. Since the per-mile fares are identical, this implies that the average trip length is slightly greater for Alternative 3A and 3B than for Alternative 2A and 2B. This is due to the faster travel times on Alternative 3 when compared to Alternative 2. The time savings encourage passengers to consider the closet station to their particular origin regardless of their direction of travel, as time spent travelling in the "wrong" direction may be made up on the train.

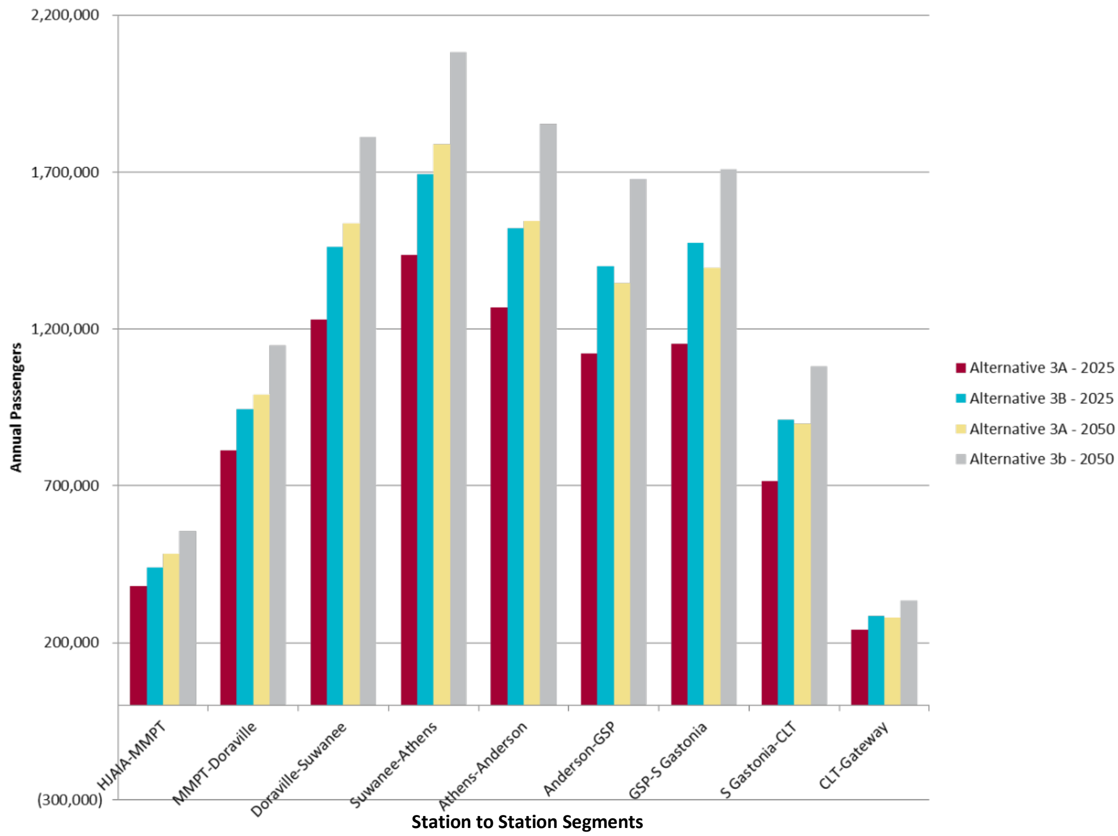
Exhibit 5-26 and **Exhibit 5-27** show the annual boardings by station and segment volumes by pair of successive stations, respectively, for each of the four technology-forecast year combinations on the Greenfield alignment.

Exhibit 5-26: Alternative 3A and 3B Annual Station Boardings



The GSP illustrates strong ridership, as the station supports a substantial population since it is the only station in a large and relatively dense area, while the population of the Atlanta and Charlotte areas is spread over multiple stations. Additionally, most of the airport choice diversion comes from people who would otherwise begin or end air trips at GSP, which further increases activity at the GSP station.

Exhibit 5-27: Alternative 3A and 3B Annual Segment Volumes



Similar to the Alternative 2 segment volumes, the Alternative 3 segment volumes peak just outside of each of the major urban areas and have a relatively flat profile between the edge of the Atlanta area and the edge of the Charlotte area.

5.6.3 Ridership Summary

There are three main trends that were discovered during the ridership and revenue analysis.

1) Although stations in smaller communities along the corridor may have a higher ridership than an individual station in an urban area, the collective population in the urban areas continues to generate the higher ridership demands. (e.g., Atlanta's three stations at H-JAIA, Georgia MMPT and Doraville, the Greenville-Spartanburg area; and Charlotte's three stations at Gateway, Charlotte-Douglas and Gastonia).
2) There is a strong intra-urban travel demand market serving the exurban Atlanta market in Gainesville, Commerce and Toccoa areas. The populations in these areas are more than 50 miles from the nearest international airport (either H-JAIA or GSP).
3) Although there was a relatively high-intercity travel trend among mid-point stations within the corridor, the urban areas were involved as either the origin or destination of the vast majority of the forecasted trips.

5.7 SCHEDULES AND FLEET PLANS

An important consideration for the proposed Atlanta to Charlotte passenger rail service is the quality of travel offered. Quality of service can have a significant impact on ridership levels, and it is critical that any new rail service offers a modern transportation environment that is comfortable, convenient, economical and safe. The approach and operating plans for each of the alternatives follows the FRA's July 2005 guidance memo, *Railroad Corridor Transportation Plans,*[37] which lays out specific FRA requirements for the following sections.

5.7.1 Scheduling Methodology

Train timetables, along with a detailed operational evaluation, were developed for the three route alternatives: Alternative 1: Southern Crescent; Alternative 2: I-85; and Alternative 3: Greenfield. Two train technology variants were evaluated for each alternative. For Alternative 1, 79 mph (Alternative 1A) and 110 mph (Alternative 1B) diesel options were considered, while for Alternatives 2 and 3, 125 mph diesel (Alternatives 2A and 3A) and 220 mph electric (Alternatives 2B and 3B) options were assessed.

The TPC was used to develop unimpeded running times for each alternative, which was validated against existing Amtrak timetables (refer to **Section 3.3.4**). Then, to develop the proposed train schedules, possible future alternatives were simulated based on:

- Station stopping pattern;
- Station dwell times;
- Train size and type of equipment;
- Train weight and locomotive horsepower; and
- Schedule slack and pad.

Station stopping patterns were developed for each alternative reflecting anticipated patterns of daily demand, comprised of a combination of express and local services. Train schedules were arranged to maximize the accommodation of riders going between both ends of the corridor as well as intermediate points. Due to low frequency (four round trips), Alternative 1: Southern Crescent is only able to provide local service (all stops). On the other hand, Alternative 2: I-85 and Alternative 3: Greenfield is able to add express service (limited stops) to augment capacity, particularly during peak travel hours. However, the first and last trains of the day make all stops along the corridor.

The assumed station dwell time is two minutes. However, additional time must be taken to slow and speed up the trains approaching and leaving stations. For Alternative 1A and 1B, the overall time loss is approximately three minutes per stop. For Alternatives 2A and 3A, this time increases slightly to a three to five minute range. Alternatives 2B and 3B would be estimated to have a loss of five to eight minutes per stop.

Although there is currently no local commuter service along the corridor, there is existing Metropolitan Atlanta Rapid Transit Authority (MARTA) heavy rail service from Doraville to downtown Atlanta and continuing on to H-JAIA. The proposed Doraville station would not only connect to the MARTA service, but would also provide for automobile access from a broad set of Atlanta suburban areas. Trains stops are only proposed at Doraville and the Georgia MMPT within Atlanta proper, and intercity service would rely on MARTA to distribute riders to intermediate points along the corridor. Proposing this pattern avoids the need for introducing additional local stops in the Atlanta area.

The FRA guidance observes that most riders prefer to depart after 6:00 a.m. or arrive before midnight. Schedules were created to attempt to avoid departing an originating station before 6:00 a.m. or arriving after midnight; however, it was found to be unavoidable in order to maintain frequencies.

For Alternatives 2 and 3, a five percent schedule slack allowance was assumed based on customary scheduling practice for passenger rail services operating on dedicated infrastructure. For the Alternative 1: Southern Crescent, a screening-level capacity analysis was performed to develop the slack and pad allowances. For this study, MISS-IT™ software was employed to develop a screening-level capacity assessment consistent with TRB's NCFRP-30 Screening Methodology. A full capacity analysis will be conducted for the recommended preferred alternative, once identified, on any existing rail corridors within that alternative. Refer to **Appendix C** for the NCFRP-30 Capacity Screening.

[37] *FRA Guidance Memo available at:* http://www.fra.dot.gov/eLib/Details/L04161 (accessed on 02/27/15)

It should be noted that these schedules are preliminary for the purposes of comparing the alternatives. The schedules will be re-evaluated within the SDP for the preferred alternative.

5.7.2 Alternative Stopping Patterns and Schedules

At this early stage of the planning process, the primary value of the schedule is that it enables a rigorous assessment of train equipment fleet and storage requirements. It is likely that schedules will continue to evolve as the project planning progresses. It should be noted that these schedules include schedule slack and pad. A summary of alternatives and travel times (include local, semi-express and express service) is illustrated in **Exhibit 5-28.** A detailed breakdown of specific schedules follows in this section.

Exhibit 5-28: Summary of Alternative Travel Times and Round Trips (hours: minutes)

Alternatives	Round Trips per Day	Local Service Travel Time	Semi-Express Travel Time	Express Travel Time
Alternative 1A	4	5:34	N/A	N/A
Alternative 1B	4	4:35	N/A	N/A
Alternative 2A	14	3:11	3:00	2:50
Alternative 2B	14	3:03	2:52	2:42
Alternative 3A	16	3:01	2:52	2:44
Alternative 3B	22	2:27	2:18	2:06

5.7.2.1 Alternative 1: Southern Crescent

For Alternatives 1A and 1B, there are four local round trips daily. **Exhibit 5-29** and **Exhibit 5-30** show the directional schedules for each of the four daily trips for Alternative 1A.[38]

Exhibit 5-29: Alternative 1A Schedule (Northbound: H-JAIA to Charlotte Gateway Station)

Station	Cumulative Miles	Schedules[39]			
H-JAIA	0.0	6:00	7:30	17:30	19:00
Georgia MMPT	9.2	6:13	7:43	17:43	19:13
Doraville	23.5	6:36	8:06	18:06	19:36
Suwanee	40.1	6:57	8:27	18:27	19:57
Gainesville	62.1	7:24	8:54	18:54	20:24
Toccoa	99.2	8:06	9:36	19:36	21:06
Clemson	132.1	8:45	10:15	20:15	21:45
Greenville	162.3	9:23	10:53	20:53	22:23
Spartanburg	193.6	10:03	11:33	21:33	23:03
Gastonia	248.0	11:03	12:33	22:33	0:03
Charlotte-Douglas	262.8	11:23	12:53	22:53	0:23
Charlotte Gateway Station	268.4	11:34	13:04	23:04	0:34

[38] *Times indicate departure times with the exception of the last station, which indicates an arrival time.*

[39] *Consideration was given to allow for same-day commutes for Alternative 1. However, Alternative 1A and 1B trip times are too slow and the schedule takes too long to make a Charlotte to Atlanta day trip feasible.*

Exhibit 5-30: Alternative 1A Schedule (Southbound: Charlotte Gateway Station to H-JAIA)

Station	Cumulative Miles	Schedules			
Charlotte Gateway Station	0.0	5:30	6:45	16:30	17:45
Charlotte-Douglas	5.6	5:41	6:56	16:41	17:56
Gastonia	20.4	6:01	7:16	17:01	18:16
Spartanburg	74.8	7:01	8:16	18:01	19:16
Greenville	106.1	7:41	8:56	18:41	19:56
Clemson	136.3	8:19	9:34	19:19	20:34
Toccoa	169.2	8:58	10:13	19:58	21:13
Gainesville	206.3	9:40	10:55	20:40	21:55
Suwanee	228.3	10:07	11:22	21:07	22:22
Doraville	244.9	10:28	11:43	21:28	22:43
Georgia MMPT	259.2	10:51	12:06	21:51	23:06
H-JAIA	268.4	11:04	12:19	22:04	23:19

The schedules indicate that the total travel time for service with top speeds of 79 mph is 5 hours and 34 minutes. **Exhibit 5-31** and **Exhibit 5-32** illustrate schedules for Alternative 1B (top speeds of 110 mph). Total travel time for service with top speeds of 110 mph is 4 hours and 35 minutes. For purposes of comparison, the auto drive time between H-JAIA to Gateway Station in Charlotte is estimated to be 3 hours and 52 minutes.

Exhibit 5-31: Alternative 1B Schedule (Northbound: H-JAIA to Charlotte Gateway Station) [40]

Station	Cumulative Miles	Schedules			
H-JAIA	0.0	6:00	7:30	17:30	19:00
Georgia MMPT	9.2	6:08	7:38	17:38	19:08
Doraville	23.5	6:23	7:53	17:53	19:23
Suwanee	40.1	6:40	8:10	18:10	19:40
Gainesville	62.1	7:02	8:32	18:32	20:02
Toccoa	99.2	7:38	9:08	19:08	20:38
Clemson	132.1	8:12	9:42	19:42	21:12
Greenville	162.3	8:45	10:15	20:15	21:45
Spartanburg	193.6	9:18	10:48	20:48	22:18
Gastonia	248.0	10:10	11:40	21:40	23:10
Charlotte-Douglas	262.8	10:26	11:56	21:56	23:26
Charlotte Gateway Station	268.4	10:35	12:05	22:05	23:35

Exhibit 5-32: Alternative 1B Schedule (Southbound: Charlotte Gateway Station to H-JAIA)

Station	Cumulative Miles	Schedules

[40] *Four train sets are required, plus at least one protect and one in shop, for a minimum fleet of six trains. ("Protect" sets refer to extra train sets available when a rotation set breaks down or needs to be taken out of operation temporarily for regular maintenance.)*

Charlotte Gateway Station	0.0	5:30	6:45	16:30	17:45
Charlotte-Douglas	5.6	5:39	6:54	16:39	17:54
Gastonia	20.4	5:55	7:10	16:55	18:10
Spartanburg	74.8	6:47	8:02	17:47	19:02
Greenville	106.1	7:20	8:35	18:20	19:35
Clemson	136.3	7:53	9:08	18:53	20:08
Toccoa	169.2	8:27	9:42	19:27	20:42
Gainesville	206.3	9:03	10:18	20:03	21:18
Suwanee	228.3	9:25	10:40	20:25	21:40
Doraville	244.9	9:42	10:57	20:42	21:57
Georgia MMPT	259.2	9:57	11:12	20:57	22:12
H-JAIA	268.4	10:05	11:20	21:05	22:20

5.7.2.2 Alternative 2: I-85

For Alternatives 2A and 2B, there are four express round trips, four semi-express round trips, and six local round trips daily. **Exhibit 5-33** illustrates the stopping patterns for each type of trip.

Exhibit 5-33: Alternative 2 Service Stopping Patterns

Stations	Express	Semi-Express	Local
H-JAIA	X	X	X
Georgia MMPT	X	X	X
Doraville	X	X	X
Suwanee			X
Commerce			X
Anderson		X	X
Greenville		X	X
Spartanburg		X	X
Gastonia			X
Charlotte-Douglas	X	X	X
Charlotte Gateway Station	X	X	X

Exhibits 5-34 through **5-35** show the directional schedules for both Alternatives 2A and 2B and each of the 14 daily trips. All tables show those stations served by each level of service (express, semi-express and local).

Exhibit 5-34: Alternative 2A Schedule (Northbound: H-JAIA to Charlotte Gateway Station)[41]

Station	Cum. Miles	Schedules													
H-JAIA	0.0	6:00	7:00	8:00	9:02	12:00	13:00	14:00	15:00	16:00	17:00	17:20	18:00	19:00	21:00
Georgia MMPT	9.2	6:08	7:08	8:08	9:10	12:08	13:08	14:08	15:08	16:08	17:08	17:28	18:08	19:08	21:08
Doraville	23.5	6:23	7:23	8:23	9:25	12:23	13:23	14:23	15:23	16:23	17:23	17:43	18:23	19:23	21:23
Suwanee	40.1	6:38	7:38		9:40			14:38						19:38	21:38
Commerce	80.4	7:05	8:05		10:07			15:05						20:05	22:05
Anderson	129.7	7:36	8:36		10:38		14:27	15:36		17:27	18:27		19:27	20:36	22:36
Greenville	151.3	7:52	8:52		10:54		14:43	15:52		17:43	18:43		19:43	20:52	22:52
Spartanburg	184.7	8:16	9:16		11:18		15:07	16:16		18:07	19:07		20:07	21:16	23:16
Gastonia	234.8	8:50	9:50		11:52			16:50						21:50	23:50
Charlotte-Douglas	249.6	9:04	10:04	10:43	12:06	14:43	15:53	17:04	17:43	18:53	19:53	20:03	20:53	22:04	0:04
Charlotte Gateway Station	255.2	9:11	10:11	10:50	12:13	14:50	16:00	17:11	17:50	19:00	20:00	20:10	21:00	22:11	0:11

[41] *For all subsequent schedules, gray indicates local service, red indicates semi-express service and white indicates express service.*

Exhibit 5-35: Alternative 2A Schedule (Southbound: Charlotte Gateway Station to H-JAIA)

Station	Cum. Miles	Schedules													
Charlotte Gateway Station	0.0	5:15	6:10	6:45	8:26	9:07	12:28	13:20	13:45	15:55	16:25	17:38	18:20	18:45	20:19
Charlotte-Douglas	5.6	5:22	6:17	6:52	8:33	9:14	12:35	13:27	13:52	16:02	16:32	17:45	18:27	18:52	20:26
Gastonia	20.4	5:36		7:06		9:28			14:06					19:06	20:40
Spartanburg	70.5	6:10		7:40		10:02		14:13	14:40	16:48	17:18		19:13	19:40	21:14
Greenville	103.9	6:34		8:04		10:26		14:37	15:04	17:12	17:42		19:37	20:04	21:38
Anderson	125.5	6:50		8:20		10:42		14:53	15:20	17:28	17:58		19:53	20:20	21:54
Commerce	174.8	7:21		8:51		11:13			15:51					20:51	22:25
Suwanee	215.1	7:48		9:18		11:40			16:18					21:18	22:52
Doraville	231.7	8:03	8:37	9:33	10:53	11:55	14:55	15:57	16:33	18:32	19:02	20:05	20:57	21:e33	23:07
Georgia MMPT	246.0	8:18	8:52	9:48	11:08	12:10	15:10	16:12	16:48	18:47	19:17	20:20	21:12	21:48	23:22
H-JAIA	255.2	8:26	9:00	9:56	11:16	12:18	15:18	16:20	16:56	18:55	19:25	20:28	21:20	21:56	23:30

The schedules indicate that the total travel times for Alternative 2A (top speed of 125 mph) are 2 hours, 50 minutes for express; 3 hours for semi-express; and 3 hours, 11 minutes for local service. **Exhibits 5-36 and 5-37** illustrate schedules for Alternative 2B (top speeds of 220 mph). Travel times for this service are 2 hours, 42 minutes for express; 2 hours, 52 minutes for semi-express; and 3 hours, 3 minutes for local service. The limited time saving between the use of 125 mph diesel-electric equipment in Alternative 2A and 220 mph fully electrified equipment in Alternative 2B is the result of numerous curves in the I-85 corridor greater than 15 minutes of curvature which are necessary for 220 mph maximum speed operations. For purposes of comparison, the auto drive time between H-JAIA to Charlotte Gateway Station is estimated to be 3 hours and 52 minutes.

Exhibit 5-36: Alternative 2B Schedule (Northbound: H-JAIA to Charlotte Gateway Station) [42]

Stations	Cum. Miles	Schedules													
H-JAIA	0.0	6:00	7:00	8:00	9:00	12:00	13:00	14:00	15:00	16:00	17:00	17:20	18:00	19:00	21:00
Georgia MMPT	9.2	6:08	7:08	8:08	9:08	12:08	13:08	14:08	15:08	16:08	17:08	17:28	18:08	19:08	21:08
Doraville	23.5	6:23	7:23	8:23	9:23	12:23	13:23	14:23	15:23	16:23	17:23	17:43	18:23	19:23	21:23
Suwanee	40.1	6:37	7:37		9:37			14:37						19:37	21:37
Commerce	80.4	7:02	8:02		10:02			15:02						20:02	22:02
Anderson	129.7	7:31	8:31		10:31		14:23	15:31		17:23	18:23		19:23	20:31	22:31
Greenville	151.3	7:46	8:46		10:46		14:38	15:46		17:38	18:38		19:38	20:46	22:46
Spartanburg	184.7	8:09	9:09		11:09		15:01	16:09		18:01	19:01		20:01	21:09	23:09
Gastonia	234.8	8:42	9:42		11:42			16:42						21:42	23:42
Charlotte-Douglas	249.6	8:56	9:56	10:35	11:56	14:35	15:45	16:56	17:35	18:45	19:45	19:55	20:45	21:56	23:56
Charlotte Gateway Station	255.2	9:03	10:03	10:42	12:03	14:42	15:52	17:03	17:42	18:52	19:52	20:02	20:52	22:03	0:03

[42] *Ten trains plus two protect and one in shop, for a minimum fleet of 13 trains.*

Exhibit 5-37: Alternative 2B Schedule (Southbound: Charlotte Gateway Station to H-JAIA)

Stations	Cum. Miles	Schedules													
Charlotte Gateway Station	0.0	5:20	6:18	6:50	8:34	9:20	12:40	13:24	13:50	16:00	16:34	17:46	18:24	18:50	20:27
Charlotte-Douglas	5.6	5:27	6:25	6:57	8:41	9:27	12:47	13:31	13:57	16:07	16:41	17:53	18:31	18:57	20:34
Gastonia	20.4	5:41		7:11		9:41			14:11					19:11	20:48
Spartanburg	70.5	6:14		7:44		10:14		14:15	14:44	16:51	17:25		19:15	19:44	21:21
Greenville	103.9	6:37		8:07		10:37		14:38	15:07	17:14	17:48		19:38	20:07	21:44
Anderson	125.5	6:52		8:22		10:52		14:53	15:22	17:29	18:03		19:53	20:22	21:59
Commerce	174.8	7:21		8:51		11:21			15:51					20:51	22:28
Suwanee	215.1	7:46		9:16		11:46			16:16					21:16	22:53
Doraville	231.7	8:00	8:37	9:30	10:53	12:00	14:59	15:53	16:30	18:29	19:03	20:05	20:53	21:30	23:07
Georgia MMPT	246.0	8:15	8:52	9:45	11:08	12:15	15:14	16:08	16:45	18:44	19:18	20:20	21:08	21:45	23:22
H-JAIA	255.2	8:23	9:00	9:53	11:16	12:23	15:22	16:16	16:53	18:52	19:26	20:28	21:16	21:53	23:30

5.7.2.3 Alternative 3: Greenfield

For Alternative 3A there are six express round trips, two semi-express round trips and eight local round trips daily. For Alternative 3B, there are eight express round trips, four semi-express round trips and 10 local round trips per day.

Different train frequencies are needed for Alternative 3 since the electric train operating over the Greenfield is significantly faster than the diesel train. As a result, the ridership forecast is much higher that additional train frequencies are needed.

Exhibit 5-38 illustrates the stopping patterns for Alternative 3.

Exhibit 5-38: Alternative 3 Service Stopping Patterns

Stations	Express	Semi-Express	Local
H-JAIA	X	X	X
Georgia MMPT	X	X	X
Doraville	X	X	X
Suwanee			X
Athens		X	X
Anderson			X
GSP Airport	X	X	X
South Gastonia		X	X
Charlotte-Douglas	X	X	X
Charlotte Gateway Station	X	X	X

Exhibit 5-39 and **Exhibit 5-40** show the directional schedules for Alternative 3A. The tables show those stations served by each level of service (express, semi-express, and local).

Exhibit 5-39: Alternative 3A Schedule (Northbound: H-JAIA to Charlotte Gateway Station)[43]

Station	Cum. Miles	Schedules															
H-JAIA	0.0	6:00	7:00	8:00	9:00	11:00	12:00	13:00	14:00	15:00	16:30	17:00	17:20	18:30	19:00	20:00	21:00
Georgia MMPT	9.2	6:08	7:08	8:08	9:08	11:08	12:08	13:08	14:08	15:08	16:38	17:08	17:28	18:38	19:08	20:08	21:08
Doraville	23.5	6:23	7:23	8:23	9:23	11:23	12:23	13:23	14:23	15:23	16:53	17:23	17:23	18:53	19:23	20:23	21:23
Suwanee	40.1	6:38	7:38				12:38	13:38			17:08				19:38	20:38	21:38
Athens	83.1	7:05	8:05		10:00		13:05	14:05			17:35		18:20		20:05	21:05	22:05
Anderson	138.8	7:37	8:37				13:37	14:37			18:07				20:37	21:37	22:37
GSP Airport	186.7	8:05	9:05	9:52	10:52	12:52	14:05	15:05	15:52	16:52	18:35	18:52	19:12	20:22	21:05	22:05	22:52
South Gastonia	253.3	8:42	9:42		11:33		14:42	15:42			19:12		19:53		21:42	22:42	23:42
Charlotte-Douglas	268.6	8:54	9:54	10:37	11:45	13:37	14:54	15:54	16:37	17:37	19:24	19:37	20:05	21:07	21:54	22:54	23:54
Charlotte Gateway Station	274.2	9:01	10:01	10:44	11:52	13:44	15:01	16:01	16:44	17:44	19:31	19:44	20:12	21:14	22:01	23:01	0:01

[43] *Ten trains plus two protect and one in shop, for a minimum fleet of 13 trains.*

Exhibit 5-40: Alternative 3A Schedule (Southbound: Charlotte Gateway Station to H-JAIA)

Stations	Cum. Miles	Schedules															
Charlotte Gateway Station	0.0	5:49	6:33	6:51	8:32	9:25	10:32	12:16	13:15	14:11	16:09	16:16	17:03	18:08	18:15	18:54	20:29
Charlotte-Douglas	5.6	5:56	6:40	6:58	8:39	9:32	10:39	12:23	13:22	14:18	16:16	16:23	17:10	18:15	18:22	19:01	20:36
South Gastonia	20.9	6:08		7:10		9:44		12:35	13:34		16:28		17:22		18:34	19:13	20:48
GSP Airport	87.5	6:45	7:25	7:47	9:24	10:17	11:24	13:12	14:11	15:03	17:05	17:08	17:55	19:00	19:11	19:50	21:21
Anderson	135.4	7:13		8:15				13:40	14:39		17:33				19:39	20:18	21:53
Athens	191.1	7:45		8:47		12:17		14:12	15:11		18:05		19:55		20:11	20:50	22:25
Suwanee	234.1	8:12		9:14				14:39	15:38		18:32				20:38	21:17	22:52
Doraville	250.7	8:27	8:54	9:29	10:53	11:54	12:53	14:54	15:53	16:32	18:47	18:37	19:32	20:29	20:53	21:32	23:07
Georgia MMPT	265.0	8:42	9:09	9:44	11:08	12:09	13:08	15:09	16:08	16:47	19:02	18:52	19:47	20:44	21:08	21:47	23:22
H-JAIA	274.2	8:50	9:17	9:52	11:16	12:17	13:16	15:17	16:16	16:55	19:10	19:00	19:55	20:52	21:16	21:55	23:30

The schedules indicate that the total travel time for Alternative 3A (top speed of 125 mph) are 2 hours, 44 minutes for express; 2 hours, 52 minutes for semi-express; and 3 hours, 1 minute for local service. **Exhibit 5-41** and **Exhibit 5-42** illustrate schedules for Alternative 3B (top speeds of 220 mph). Travel times for this service are 2 hours, 6 minutes for express; 2 hours, 18 minutes for semi-express; and 2 hours, 27 minutes for local service. For purposes of comparison, the auto drive time between H-JAIA and Gateway Station in Charlotte is estimated to be 3 hours and 52 minutes. The Alternative 3B express travel time of 2 hours and 6 minutes is likely to be competitive with air travel. An approximate direct flight time between the two cities is 56 minutes.[44] It should be noted that this reflects actual air time and does not take into consideration travel time within airports.

[44] *Flight-Durations. www.flight-durations.com/Atlanta,-Ga-to-Charlotte,-Nc* (accessed on 02/26/15)

Exhibit 5-41: Alternative 3B Schedule (Northbound: H-JAIA to Charlotte Gateway Station) [45]

Station	Cum. Miles	Schedule																					
H-JAIA	0.0	5:00	6:00	6:20	7:00	7:10	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	16:30	17:00	17:20	18:00	18:30	19:00	20:00	21:00
Georgia MMPT	9.2	5:08	6:08	6:28	7:08	7:18	8:08	9:08	10:08	11:08	12:08	13:08	14:08	15:08	16:08	16:38	17:08	17:28	18:08	18:38	19:08	20:08	21:08
Doraville	23.5	5:23	6:23	6:43	7:23	7:33	8:23	9:23	10:23	11:23	12:23	13:23	14:23	15:23	16:23	16:53	17:23	17:43	18:23	18:53	19:23	20:23	21:23
Suwanee	40.1	5:37		6:57		7:47			10:37			13:37		15:37		17:07				19:07	19:37		21:37
Athens	83.1	6:01		7:21		8:11		10:00	11:01	12:00		14:01	15:00	16:01		17:31		18:20		19:31	20:01		22:01
Anderson	138.8	6:24		7:44		8:34			11:24			14:24		16:24		17:54				19:54	20:24		22:24
GSP Airport	186.7	6:44	7:44	8:04	8:44	8:54	9:44	10:44	11:44	12:44	13:44	14:44	15:44	16:44	17:44	18:14	18:44	19:40	19:44	20:14	20:44	21:44	22:44
South Gastonia	253.3	7:09		8:29		9:19		11:00	12:09	13:00		15:09	16:00	17:09		18:39		19:20		20:39	21:09		23:09
Charlotte-Douglas	268.6	7:20	7:59	8:40	8:59	9:30	9:59	11:11	12:20	13:11	13:59	15:20	16:11	17:20	17:59	18:50	18:59	19:31	19:59	20:50	21:20	21:59	23:20
Charlotte Gateway Station	274.2	7:27	8:06	8:47	9:06	9:37	10:06	11:18	12:27	13:18	14:06	15:27	16:18	17:27	18:06	18:57	19:06	19:38	20:06	20:57	21:27	22:06	23:27

Exhibit 5-42: Alternative 3B Schedule (Southbound: Charlotte Gateway Station to H-JAIA)

Station	Cum. Miles	Schedule																					
		4:46	5:54	6:08	6:23	6:54	7:01	7:54	8:49	9:46	10:58	11:54	12:46	13:58	14:54	15:48	16:54	17:08	17:54	18:01	18:49	19:54	21:03
Charlotte-Douglas	5.6	4:53	6:01	6:15	6:30	7:01	7:08	8:01	8:56	9:53	11:05	12:01	12:53	14:05	15:01	15:55	17:01	17:15	18:01	18:08	18:56	20:01	21:10
South Gastonia	20.9	5:04		6:26	6:41		7:19		9:07	10:04	11:16		13:04	14:16		16:06		17:26		18:19	19:07		21:21
GSP Airport	87.5	5:29			7:06		7:44		9:32	10:29			13:29			16:31				18:44	19:32		21:46
Anderson	135.4	5:49			7:26		8:04		9:52	10:49			13:49			16:51				19:04	19:52		22:06
Athens	191.1	6:12		7:08	7:49		8:27		10:15	11:12	11:58		14:12	14:58		17:14		18:08		19:27	20:15		22:29
Suwanee	234.1	6:36			8:13		8:51		10:39	11:36			14:36			17:38				19:51	20:39		22:53
Doraville	250.7	6:50	7:37	8:03	8:27	8:37	9:05	9:37	10:53	11:50	12:53	13:37	14:50	15:53	16:37	17:52	18:37	19:03	19:37	20:05	20:53	21:37	23:07
Georgia MMPT	265.0	7:05	7:52	8:18	8:42	8:52	9:20	9:52	11:08	12:05	13:08	13:52	15:05	16:08	16:52	18:07	18:52	19:18	19:52	20:20	21:08	21:52	23:22
H-JAIA	274.2	7:13	8:00	8:26	8:50	9:00	9:28	10:00	11:16	12:13	13:16	14:00	15:13	16:16	17:00	18:15	19:00	19:26	20:00	20:28	21:16	22:00	23:30

[45] *Total of 11 trains plus two protect and one in shop, for a minimum fleet of 14 trains.*

5.7.3 Fleet Plan Methodology

The purpose of this section is to determine the number of train sets needed for each alternative, and the required train size or number of seats per train. It should be noted that the ridership (demand) forecast is related to a given train frequency, and travel time, which are already known as input to the fleet planning process. Therefore, given the train frequency and schedule, the task is only to determine how many train sets will be needed to handle the forecasted riders, and how many seats each train set must have.

In a broader sense, the objective of fleet planning is to provide enough train service to attract sufficient riders to financially support the service without running an uneconomical number of train-miles or too many empty seats (increasing operating and maintenance costs). In addition to timing trains to meet the anticipated needs of the market, the operational assessment helps determine the size of the trains needed. Whatever combination of train sizes and frequencies are chosen for each corridor and technology pairs, the operating plan must ensure there are enough seats to carry all of the passengers over the peak load segment. Beyond this, it is desirable to minimize empty seat-miles in order to match supply to forecasted demand as closely as possible.

A segment-loading chart is a useful tool for estimating the size of the train that will be needed. As an output of the demand forecasting process, using 2025 forecasts, this chart shows the number of passengers riding over every segment of the route, identifying the peak load segment as well as forecasting average passenger load across the entire route.

With a given frequency, the optimal required train size for the market can be estimated based on the peak load segment ridership and an assumed 85 percent peak load factor. This 85 percent peak load factor assumes that trains are scheduled at times of day to meet market demand and is achievable through the use of a reservations system like the one used in the northeast corridor; or in the absence of a reservation system, if standees are allowed during peak hours over short sections of the route. Assuming train service is reduced by half on weekends resulting in a factor of 312 operating days per year, required train size is calculated as follows:

Peak load annual segment ridership ÷ 312 (days of operation) ÷ frequency (number of round trips) ÷ 0.85 (load factor) = required seats per train

The number of train sets required for day-to-day operations for each corridor and technology has been estimated in order to develop capital cost estimates. The number of train sets must be large enough to cover all assignments in the operating plan with sufficient spares for maintenance, yet, without excess equipment sitting idle. The ridership model was not based on a specific day of the week but reflects an average day of ridership.[46] As ridership increases in later years, larger trains or additional round-trips would be required to accommodate growth.

The required fleet size has been built by utilizing an equipment cycling approach to match scheduled departures to specific train sets. Equipment cycles were built by matching train arrivals at endpoint stations to the next available departure. For developing equipment turns at the endpoint stations, dwell times were checked to ensure that enough time was provided to turn trains (15 to 30 minutes) but also to avoid unnecessarily long dwell times to maximize utilization of the train sets[47]. Keeping station dwell times within reasonable limits also reduces the need to build additional platforms or storage tracks for storing trains between trips. Round-trip equipment cycles were developed to determine the minimum number of trains that would be required to cover the operational schedules on each week day.

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[46] *While it is typical to assume reduced weekend operations for HSR corridors, sometimes this assumption is modified for special circumstances. If the ridership forecast includes any strong tourist or college attractions that generate atypical patterns of demand, colleges for example, the operating plans need to be adjusted. In North Carolina, the NCDOT has found that trains operating with equal or higher ridership on weekends as a result of discretionary travel and high ridership from local college students.*

[47] *The 15-30 minute turn time is for reversing a bi-directional electric train or a diesel train that has a locomotive and/or cab control car at both ends. This follows Amtrak's current scheduling of 20 minutes on its Keystone service. It should be noted that the scheduling methodology used optimized equipment turns for determining the minimum number of train sets that are needed for covering the actual schedule. The train operating plan generally provides for one or two active protect sets.*

After this, an allowance for additional "protect" train sets was provided for buffering mechanical problems or late inbound trains. Protect equipment may either be worked into the normal rotation (by adding more slack time to the endpoint turnaround times) or they may be set aside and strategically held on a standby basis. For Alternative s 1A and 1B, since each trail set has two diesel locomotives, in the event one locomotive breaks down, the train can still operate (at a reduced speed) using just the remaining operational locomotive. Since each train will have two locomotives it is not strictly necessary to have a backup train at every turning point. In this case, the protect train would likely be held wherever the maintenance shop is located.

Alternatives 2 and 3 are running higher train frequencies which allow for a protect set to be located at both the Atlanta and Charlotte ends of the route. In reality, these stand by sets will likely be worked into the active rotation rather than remaining idle all day. The practical advantage of rotating the protect set is that it allows more time for train cleaning and/or commissary provisioning that needs to be done.

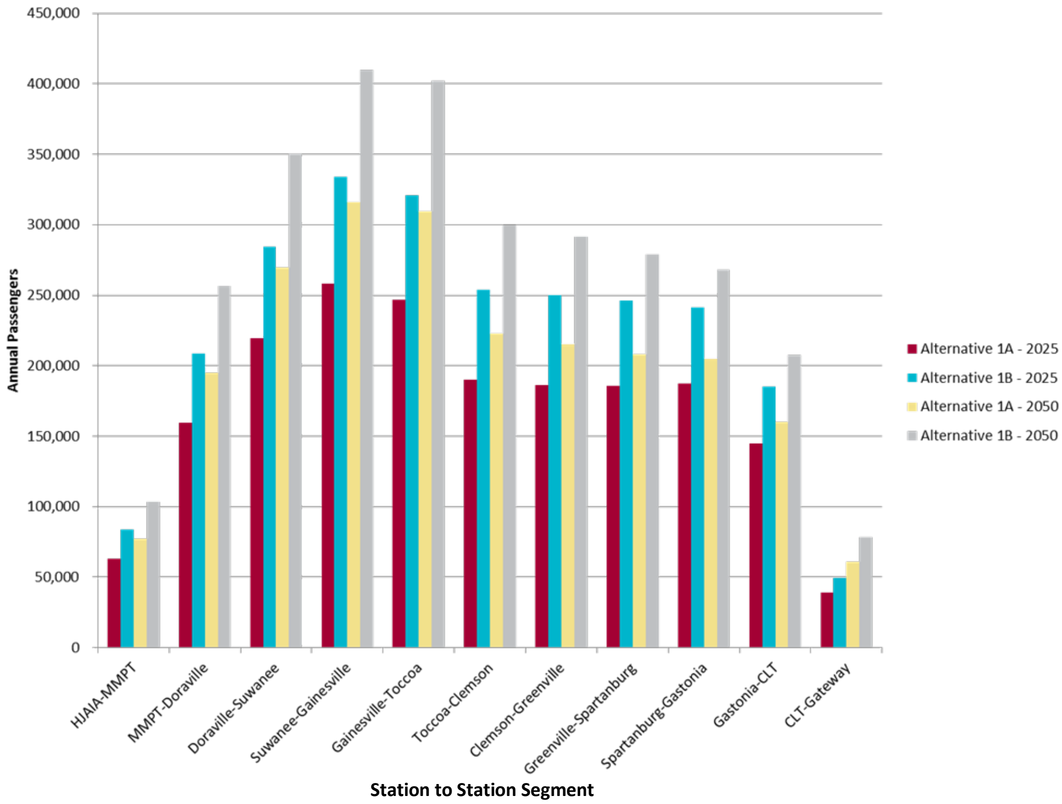
First, schedules were developed without the protect equipment, so the minimum number of trains needed to actually cover the schedule (under ideal conditions) was determined. After this, the protect trains were rotated into the schedules. In addition to protect equipment, it was assumed that one train will be in the shop for heavy repairs at any point in time. It is assumed that this train will *not* be available to protect operational requirements, so the additional fleet requirement is one to two protect trains plus one train in the shop. As a result, the reserve fleet requirement is two to three trains in addition to the basic cycling requirement.

5.7.4 Fleet Plans

5.7.4.1 Alternative 1: Southern Crescent

A segment loading chart for Alternative 1 can be seen in **Exhibit 5-43**. The chart shows the number of passengers riding over every segment of the route, identifying the peak load segment as well as forecasting average load factors across the entire route. The exhibit indicates that the peak load segment will be just north of the Suwanee station.

Exhibit 5-43: Segment Loading Chart for Alternatives 1A and 1B



Using the calculation to determine the optimal required train size for the market, Alternative 1A requires 243 seats, and Alternative 1B requires 315 seats. These train sizes are seen to be reasonable for the alternatives and are in fact, consistent with the sizes of trains that have been proposed for other corridors. For example, the Midwest Regional Rail System in 2004 proposed to deploy 300-seat trains; the Ohio Hub system proposed smaller 200-seat trains. This consistency shows that the operating, maintenance and capital costs and other relevant assumptions (such as train performance curves) developed by those previous studies can reasonably be applied to the Atlanta to Charlotte analysis as well.

As a result, a 300-seat train size and 4 round-trip train frequency equation is seen to be reasonably well balanced for the Atlanta-Charlotte corridor in 2025 for Alternative 1B. Alternative 1A is about 20 percent less than that of Alternative 1B, so only a 250-seat train would be needed. Larger trains or an additional round-trip will be required by 2050 to accommodate growth due to demographic factors, and this addition is included in the operating and maintenance costs.

Exhibit 5-44 provides a summary of the fleet requirements for Alternatives 1A and 1B given the peak segment (between Suwanee and Gainesville) and frequencies.

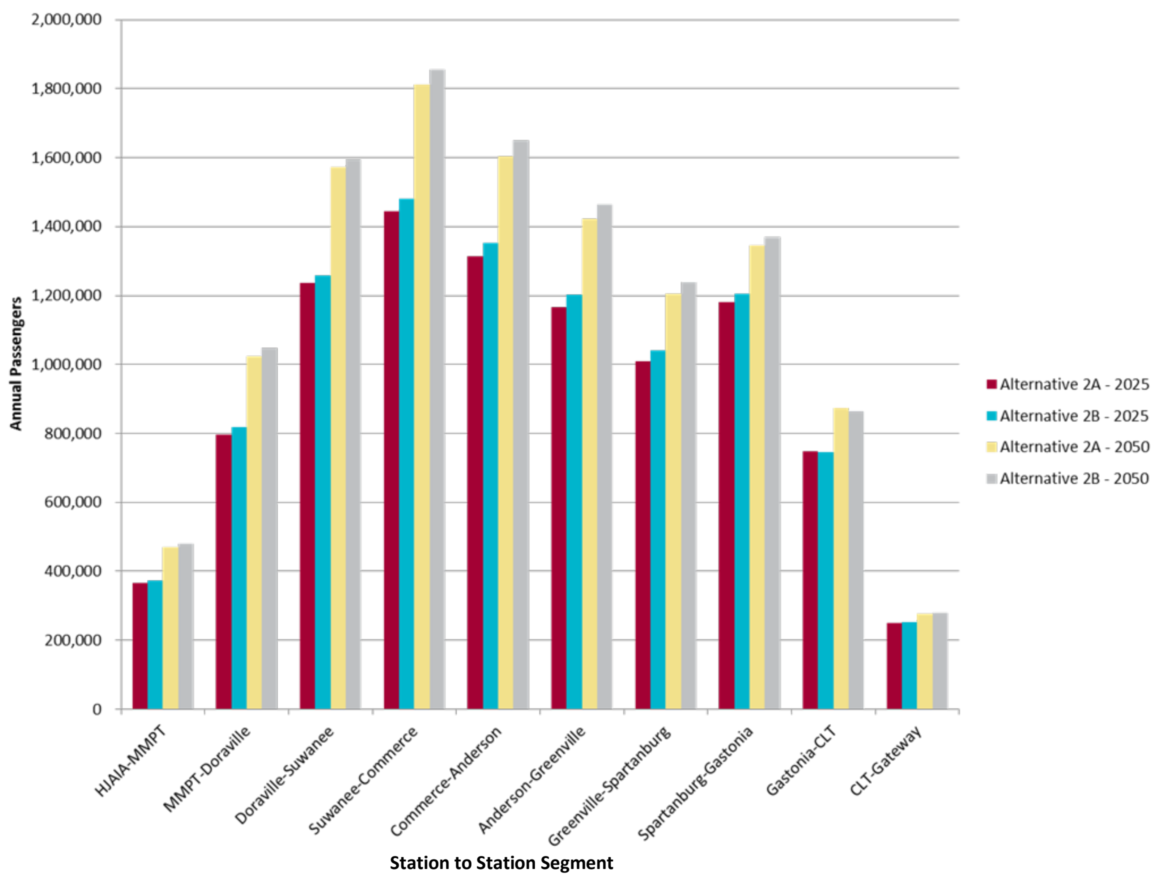
Exhibit 5-44: Alternative 1A and Alternative 1B Fleet Requirements

Alternative	Daily Roundtrips	2025 Annual Peak Segment Riders[48]	2025 Required Train Size	Rotation Sets	Protect Sets[49]	Total Sets
Alternative 1A	4	258,337	243	4	2	6
Alternative 1B	4	333,744	315	4	2	6

5.7.4.2 Alternative 2: I-85

The segment loading chart for Alternative 2 can be seen in **Exhibit 5-45**. The exhibit indicates that the peak load segment will be between the Suwanee and Commerce stations.

Exhibit 5-45: Segment Loading Chart for Alternatives 2A and 2B



Using the required seat formula, the required number of seats for Alternative 2A is 389, and for Alternative 2B is 399.

Exhibit 5-46 illustrates the load factors and fleet plans for both Alternative 2A and 2B in which the fleet size for both alternatives is 13 train sets.

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[48] *2025 peak ridership was used rather than 2050 because fleet expansion is included in operating and maintenance costs.*

[49] *Protect sets refer to extra train sets available when a rotation set breaks down or needs to be taken out of operation temporarily for regular maintenance.*

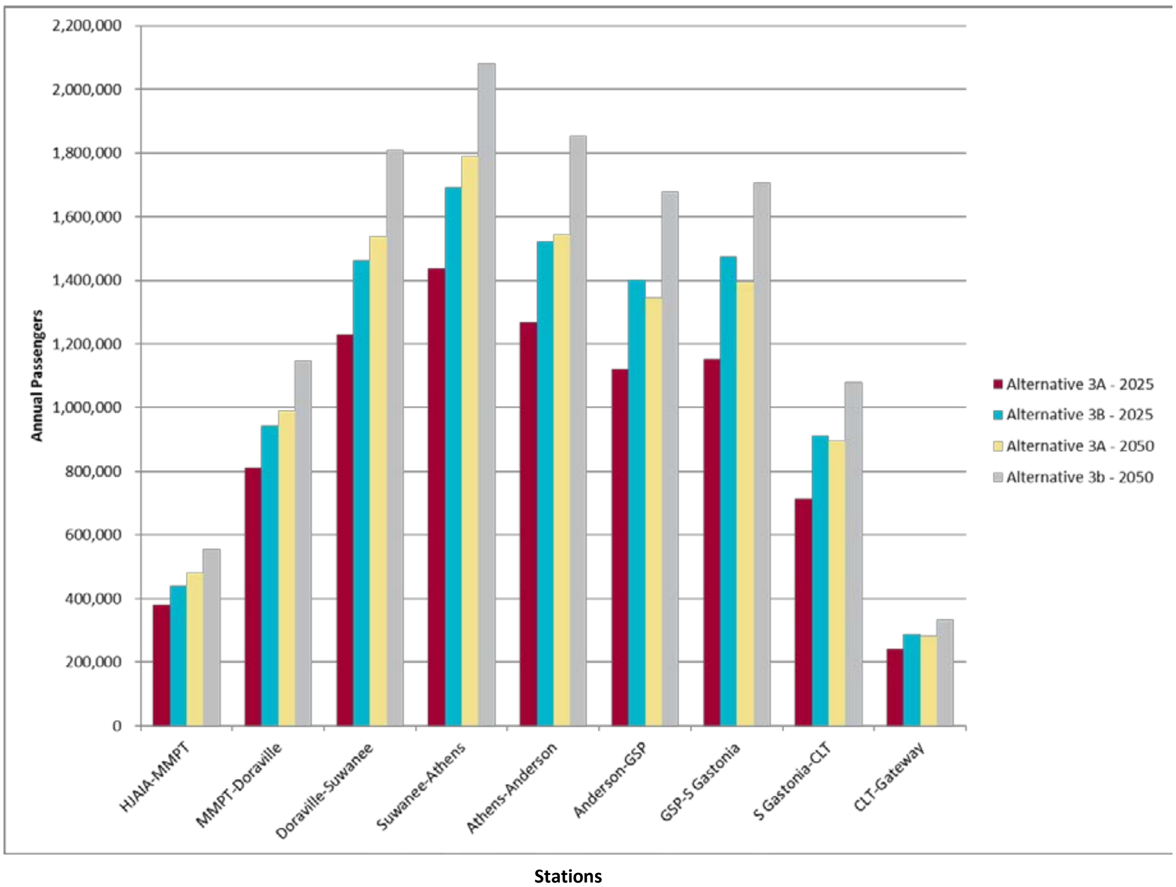
Exhibit 5-46: Alternative 2A and Alternative 2B Fleet Requirements

Alternative	Daily Roundtrips	2025 Annual Peak Segment Riders	2025 Required Train Size	Rotation Sets	Protect Sets	Total Sets
Alternative 2A	14	1,443,917	389	10	3	13
Alternative 2B	14	1,481,663	399	10	3	13

5.7.4.3 Alternative 3: Greenfield

A segment loading chart for Alternative 3 can be seen in **Exhibit 5-47**. The exhibit indicates that the peak load segment will be between the Suwanee and Athens stations.

Exhibit 5-47: Segment Loading Chart for Alternatives 3A and 3B



The seat requirements for Alternative 3A and 3B are 339 and 290, respectively.

Exhibit 5-48 illustrates the load factors and fleet plans for both Alternative 3A and 3B and indicates that Alternative 3A will require 13 train sets and Alternative 3B will require 14 train sets.

Exhibit 5-48: Alternative 3A and Alternative 3B Fleet Requirements

Alternative	Daily Roundtrips	2025 Annual Peak Segment Riders	2025 Required Train Size	Rotation Sets	Protect Sets	Total Sets
Alternative 3A	16	1,435,176	339	10	3	13
Alternative 3B	22	1,692,409	290	11	3	14

Exhibit 5-49 illustrates all alternatives for comparison.

Exhibit 5-49: Fleet Requirement Summary Table

Alternative	Daily Roundtrips	2025 Peak Segment Riders	2025 Required Train Size	Rotation Sets	Protect Sets	Total Sets
Alternative 1A	4	258,337	243	4	2	6
Alternative 1B	4	333,744	315	4	2	6
Alternative 2A	14	1,443,917	389	10	3	13
Alternative 2B	14	1,481,663	399	10	3	13
Alternative 3A	16	1,435,176	339	10	3	13
Alternative 3B	22	1,692,409	290	11	3	14

5.8 CONCEPTUAL ENGINEERING

Conceptual engineering is the first phase of design for a transportation project. It involves a high-level evaluation of design assumptions and improvements for the route alternatives and associated levels of service. This evaluation helps to identify the needs of a route alternative in order to operate at maximum efficiency. Conceptual engineering is a major component of identifying feasible alternatives for a particular corridor and is a driving force behind operations and capital improvement costs.

5.8.1 Design Criteria

The design criteria were established at the start of the alternatives development process with the objective of establishing assumptions for the various intercity passenger rail service alternatives being evaluated. Design criteria refers to minimum and maximum requirements of certain elements such as track curves, bridge clearances, at-grade crossings with roadways, water features, and station access, among others. Recommendations and assumptions were provided for design elements such as geometrics, clearances, at-grade crossing, structures, track infrastructure, hydrology and hydraulics, and stations. The full design criteria technical memorandum is provided in **Appendix F.**

This analysis includes conceptual design elements and standards; however, some engineering design elements will depend on factors that cannot be finalized at this time. Following, as a part of a Tier 2 NEPA document, a more in-depth analysis of engineering design elements will be conducted on a project level for the selected preferred alternative.

The design and operating criteria are based on typical industry standards for high-speed and intercity passenger rail. These criteria are presented for planning purposes to estimate a preliminary order of magnitude for comparison of each alternative with respect to construction, operation and maintenance costs. FRA and GDOT acknowledge that the specific design criteria for the proposed project will be further revised or confirmed with the FRA Office of Railroad Safety, participating host railroads and associated stakeholders after completion of the Tier 1 EIS for the proposed project.

5.8.2 Station Design

Although further development and design work on the corridor stations would occur during the Tier 2 NEPA study, the basic station design criteria should incorporate many factors including, but not limited to:

- Parking;
- Adjacent land
- Platform height;
- Drainage;
- Ticketing;
- Access to station;
- Site infrastructure;
- Track centerline to platform dimensions; and
- Circulation within station/platform.

5.8.2.1 Terminal Station

The north terminal station, Charlotte Gateway Station, is currently in a conceptual study phase with costs not included in this Tier 1 EIS, as this study assumes the station will be fully operational and able to manage passenger rail traffic prior to opening year of this corridor. The station is located in the downtown (Uptown) Charlotte area and will be a multi-modal station for commuter rail, HSR and other transit. Dedicated platforms for HSR are anticipated, and NCDOT is preparing the station design for connectivity to the SEHSR Corridor.

In Atlanta, the terminal station would be at the H-JAIA area station, as explained in more detail under the Airport Station section below. Directly north of the H-JAIA terminus station will be the Georgia MMPT, serving as the primary downtown station and providing multi-modal access. The Georgia MMPT is currently in the planning stage, but like Gateway, is assumed to be operational and fully capable of handling the passenger train frequency and train types, prior to construction and operation of the Atlanta to Charlotte corridor.

5.8.2.2 Intermediate Stations

Station design and layout assumptions required different options based on shared-use or dedicated passenger operations using a typical layout for each as appropriate for a Tier 1 analysis. Typical intermediate stations, in freight railroad corridors, would provide separate platform configurations for high-speed and conventional passenger trains due to the variation in rolling stock specifications. Alternative 1 proposes trains operating adjacent to or within a ROW shared with conventional passenger and freight railroad lines. Along Alternative 2, due to limited median space, stations will likely be provided outside of the highway travel lanes with access to an island platform via overhead pedestrian bridges or underground tunnels, as illustrated in **Exhibit 5-50**.

Exhibit 5-50: Median Platform Access – Rail Runner Station, Santa Fe, NM

For Alternative 3, concerns over space are less, due to the majority of the route traversing undeveloped land. Nevertheless, as with all new station locations, careful consideration for proximity to parking and a local road network is important not only for ridership, but also land development around the vicinity of the station over time. Options such as an island or side platform layout (see **Exhibit 5-51** and **Exhibit 5-52**) could work or other layouts are possible and require additional research to determine the best configuration based on site-specific data.

5.8.2.3 Airport Stations

The three airport stations include Charlotte-Douglas, GSP Airport and H-JAIA. These stations consist of higher anticipated ridership from intermediate stations but are different than terminal stations and thus were broken out into their own category for conceptual layout and cost estimating. An approximate acreage and cost was based on the California HSR January 2004 *Program EIS Capital and Operations and Maintenance Costs*, *Appendix G* and applied to Charlotte-Douglas International Airport station with the assumption that an adjacent station to the main terminal would provide significant savings. The H-JAIA area station took the Charlotte station concept, but the size was increased due to the higher populated urban area, major road crossing and infrastructure work. For the GSP Airport, with less ridership expectation, proposed size and costs were reduced from the Charlotte-Douglas station.

Exhibit 5-51: Typical Island Platform Layout – Bowling Green, NY

Exhibit 5-52: Typical Side Platform Layout – Kingston, RI

5.8.2.4 Platforms

Traditional intercity passenger rail (such as Amtrak) relies on low platform boarding, especially when sharing track with freight traffic, in order to avoid clearance conflicts between the two differing cargo types. Freight railroads discourage the use of high station platforms for the following reasons:

1) Freight cars extend beyond the horizontal width of passenger cars;
2) Freight railroads move loads with dimensions that extend beyond the sides of standard freight cars; and
3) The use of high station platforms requires the installation of a separate parallel track to separate the passenger from freight traffic.

High platforms are generally favored for HSR corridors in dedicated routes as it provides faster boarding times resulting in higher daily throughput of passengers.

In recent years, the USDOT including FRA issued a level platform rule requiring full-length, level-boarding platforms in new and heavily reconstructed passenger rail stations (49 CFR Part 37 and 38). Level boarding improves accessibility for wheeled mobility devices, the elderly, and families with children, and passengers with heavy bags. This type of boarding reduces trip times and delays in boarding.

If bi-level cars are proposed, platform height must be considered to ensure compatibility with all ADA standards. This is often accomplished through the use of low station platforms for direct accessibility and level boarding.

The Georgia MMPT is designed to be operated with high platforms in the station area based on Federal Transit Administration (FTA) encouragement of high-level boarding. A combination of low and high platforms provides challenges both operationally and financially but has been done on Utah's newly built Front Runner system. In general, the design plan for the Atlanta to Charlotte corridor stations includes high passenger platforms. If Alternative 1: Southern Crescent becomes the recommended preferred alternative, discussions over separate parallel tracks will occur for each relevant station stop.

5.8.2.5 Provisions for Passangers with Disabilities

The ADA is an important ruling factor when determining platform design. All stations and platforms will be designed to meet or exceed ADA requirements. ADA requires level boarding at all stations, specifically on any rail corridor that is publicly owned.

Under the Final Rule issued in the Federal Register on September 19, 2011, USDOT amended its ADA regulations to require intercity, commuter, and high-speed passenger railroads to ensure, at new and altered station platforms, that passengers with disabilities can get on and off any accessible car of the train. Passenger railroads must provide level-entry boarding at new or altered stations in which no track passing through the station and adjacent to platforms is shared with existing freight rail operations. For new or altered stations in which track passing through the station and adjacent to platforms is shared with existing freight rail operations, passenger railroads will be able to choose among a variety of means to meet a performance standard to ensure that passengers with disabilities can access each accessible train car that other passengers can board at the station. These means include providing car-borne lifts, station-based lifts, or mini-high platforms. USDOT will review a railroad's proposed method to ensure that it provides reliable and safe services to individuals with disabilities in an integrated manner. The rule also codifies the existing DOT mechanism for issuing ADA guidance, modifies provisions concerning the carriage of wheelchairs, and makes minor technical changes to USDOT's ADA rules.[50]

For the shared-use corridors in Alternatives 1A/1B, a low-level platform may be acceptable where the station is constructed on the privately owned freight railroad and a high level platform is determined infeasible. Where a high level platform is infeasible, the alternative platform height would be 8 inches above top of rail (ATR).

5.8.3 Maintenance Facility

When planning a passenger rail system, it is important to consider all the maintenance requirements associated with the equipment. The facility needs to take into account:

- Assembly;
- Storage;
- Maintenance;
- Overhauls;
- Testing;
- Inspection;
- Retrofitting; and
- Washing/Cleaning.

[50] http://www.gpo.gov/fdsys/pkg/FR-2011-09-19/pdf/2011-23576.pdf (accessed on 02/26/15)

In general, there are three types of maintenance facilities: overnight layup, periodic inspection and heavy maintenance. The first two mentioned include both maintenance and inspection capabilities, whereas the latter adds overhauls and component refurbishment as well.

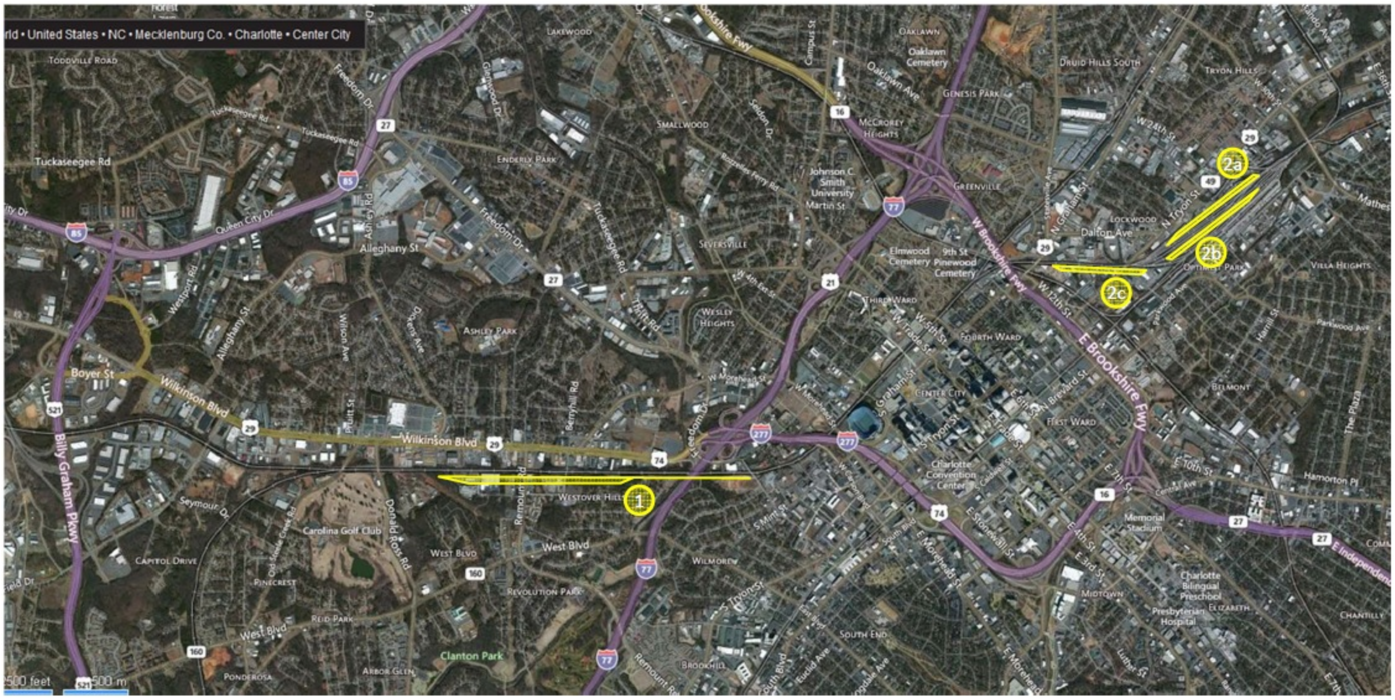
Location of these facilities should be carefully considered to take into account: ease of access to the regional road network, industrial zoning, site development availability, and safety concerns, levels of maintenance service, and operation and maintenance (O&M) costs. In addition, close proximity of the facility to the main line tracks is paramount, as is proximity to the terminal stations to avoid "deadhead" movements (moving trains without passengers). The desirable distance between the terminal station and maintenance facility is typically less than one and one half miles but can be located up to three miles away.

Recognizing that the Atlanta to Charlotte corridor is in excess of 240 miles long, the determination was to provide maintenance facilities at both ends of the corridor in close proximity to the terminal stations. The Charlotte maintenance facility, already in the engineering phase with NCDOT Rail, is planned for 2017 completion and will serve as the heavy maintenance facility for this corridor; however, current plans will not be able to accommodate the Atlanta to Charlotte system. While this ADR does not specifically evaluate certain sites for a maintenance facility, there are some potential locations that have been identified for further evaluation at a Tier 2 NEPA level. These potential locations can be seen in **Exhibit 5-53** and are described as follows:

1) South of the proposed Locomotive and Rail Car Maintenance Facility (LRMF) near the Westover Hills area;
2) North of the proposed LRMF:
    a) The NS former Coach Yard;
    b) The NS former Intermodal Yard (shared with Charlotte Area Transit System); and
    c) Liddell Street Industrial.

These sites will require a detailed evaluation to determine the best maintenance facility site for the Atlanta to Charlotte corridor based on the layover and service needs as well as the number of trains, time of day and type of service for the preferred alternative.

Exhibit 5-53: Potential Charlotte Area Maintenance Facility Locations



This ADR proposes to provide an initial layover/light maintenance facility near H-JAIA, the south terminus for the corridor, with the location able to accommodate a future heavy maintenance facility. The proposed location is directly adjacent to the proposed H-JAIA terminal station along the existing NS line as seen in **Exhibit 5-54**. Besides the advantage of the proposed maintenance facility and its proximity to the proposed terminal airport station, the proposed location also provides ample room for parking and future expansion of the facility into a medium- to heavy-maintenance facility and the ability to accommodate electrified operations and maintenance. Additional analysis will be required when the permanent layover/maintenance facility is advanced to a Tier 2 NEPA study.

Exhibit 5-54: Atlanta Maintenance Facility Area Layout

5.8.4 Infrastructure Improvements

All infrastructure improvements[51] in existing freight corridors are presented for planning purposes in order to estimate a preliminary order of magnitude for comparison of each alternative with respect to maintaining existing freight operations, preserving freight future growth, construction, and operation and maintenance costs. FRA and GDOT acknowledge that all infrastructure improvements for the proposed project will be further revised or confirmed with the FRA Office of Railroad Safety, participating host railroads and associated stakeholders after completion of the Tier 1 EIS. Shared-use operations have the potential to limit passenger schedules and on-time performance. The proposed infrastructure for each alternative seeks to minimize delays in shared-use areas through proposed construction of double tracks, grade separations, dedicated passenger track and scheduling. **Note:** For this Tier 1, the final determination of the necessary infrastructure improvements will be deferred to the Tier 2 analysis.

5.8.4.1 Alternative 1: Southern Crescent

The Alternative 1A and 1B proposed infrastructure improvements involve providing maximum operating speeds of 79 mph and 110 mph, respectively. Alternative 1B requires the same infrastructure as 1A with the exception of the inclusion of four segments along the route that allow for operations up to 110 mph.

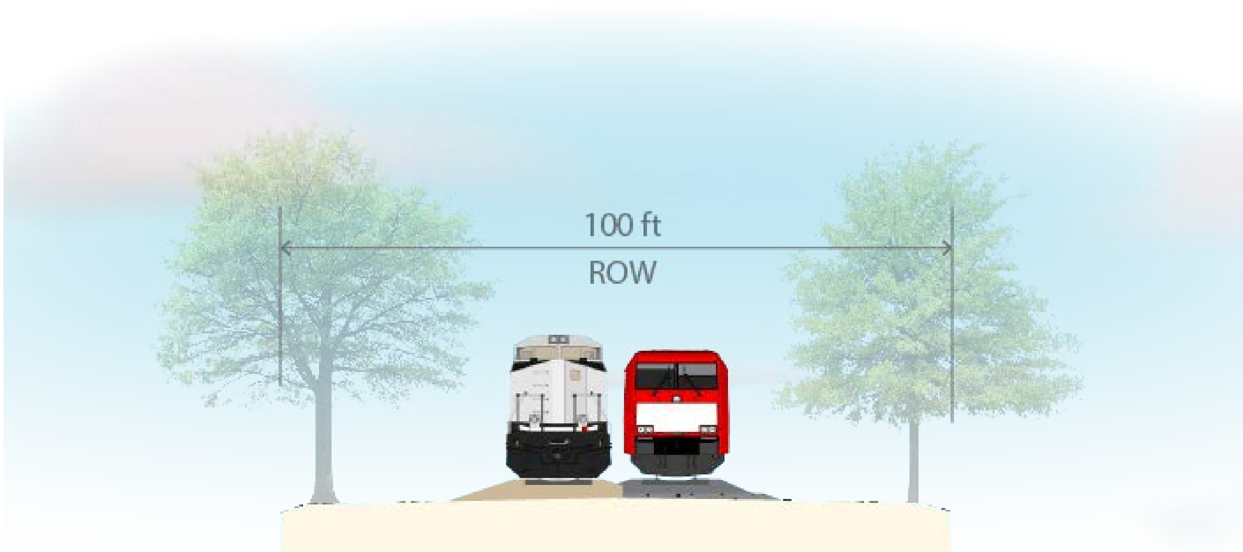
Key assumptions for proposed infrastructure improvements for Alternative 1A and 1B include:

- Upgrade NS mainline track to at least FRA-Class 4 specifications to support 79 mph conventional intercity passenger rail service, much like the current Amtrak Crescent;
- Install new dedicated passenger tracks on a 30-foot track center to FRA-Class 6 specification to support 110 mph service, where permissible, to allow for separation of freight and HSR operations;

[51] *Infrastructure improvements refer to track, track structures (e.g., viaducts, bridges), signaling, communication, and electrification.*

- Any new passenger rail infrastructure or shared-track facility installed inside the Class I railroad-owned ROW will require a refined operations modeling and coordination with the host railroad to define applicable operating rights, service outcome, or easement agreements; adding a second track in locations where currently there is no second track will be adequate for maintaining existing freight capacity as well as accommodating the estimated natural freight growth with the increase in passenger frequencies (**Exhibit 5-55**).[52] In addition, universal crossovers will be placed approximately every five to eight miles along the route. The only exception is where 110 mph dedicated passenger track is proposed. In these four segments, no second track is provided because the passenger service would be on a dedicated passenger track and have no interaction with freight traffic; and
- The top speed of 110 mph for Alternative 1B reflects FRA's current grade crossing guidance. Fifty three grade separated crossings exist along Alternative 1A and 1B: 32 railroad over road/railroad and 21 railroad under road/railroad. One hundred and four public and private at-grade crossings are to remain along the route alternative.

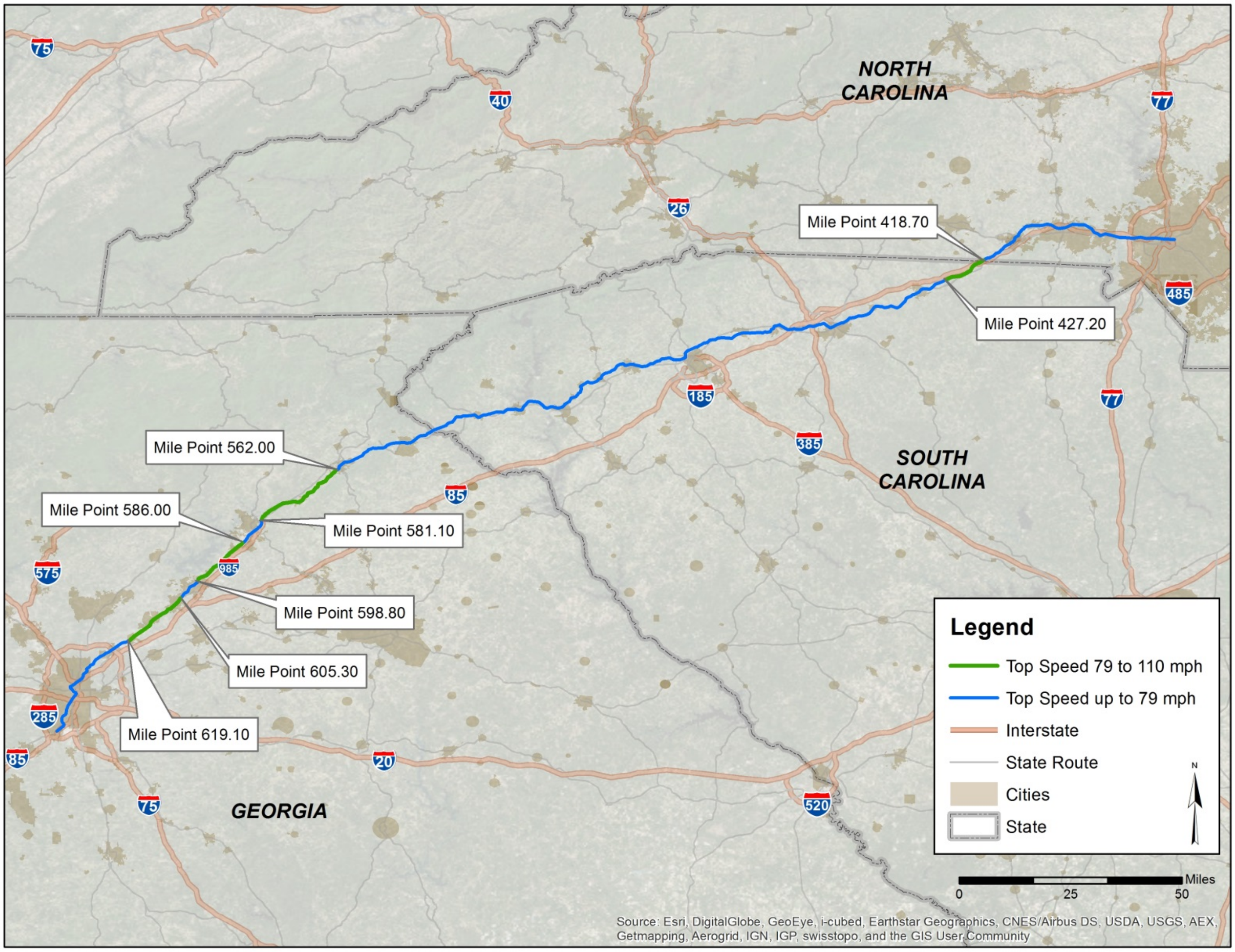
Exhibit 5-55: Alternative 1 Double Track Typical Section



- The geography and physical geometry along the corridor is conducive to service up to 110 mph in four sections of Alternative 1B. These sections are considered "Greenzones" and will be utilized as dedicated passenger tracks. These are at the following milepost ranges (see **Exhibit 5-56**):
  - Mile point 418.70 to mile point 427.20 (8.5 miles);
  - Mile point 562.00 to mile point 581.10 (19.1 miles);
  - Mile point 586.00 to mile point 598.80 (12.8 miles); and
  - Mile point 605.30 to mile point 619.10 (13.8 miles).
- The top speed of 110 mph for Alternative 1B reflects FRA's current grade crossing guidance.

[52] *Planning level conceptual engineering illustrates areas where additional track may be added. Additional analysis and coordination with host railroads will be required for more detailed engineering and design.*

Exhibit 5-56: Alternative 1B 110 mph Service Areas



5.8.4.2 Alternative 2: I-85

The Alternative 2A and 2B proposed improvements provide maximum operating speeds of up to 125 mph (diesel technology) and up to 220 mph (electrified technology) services, where feasible.

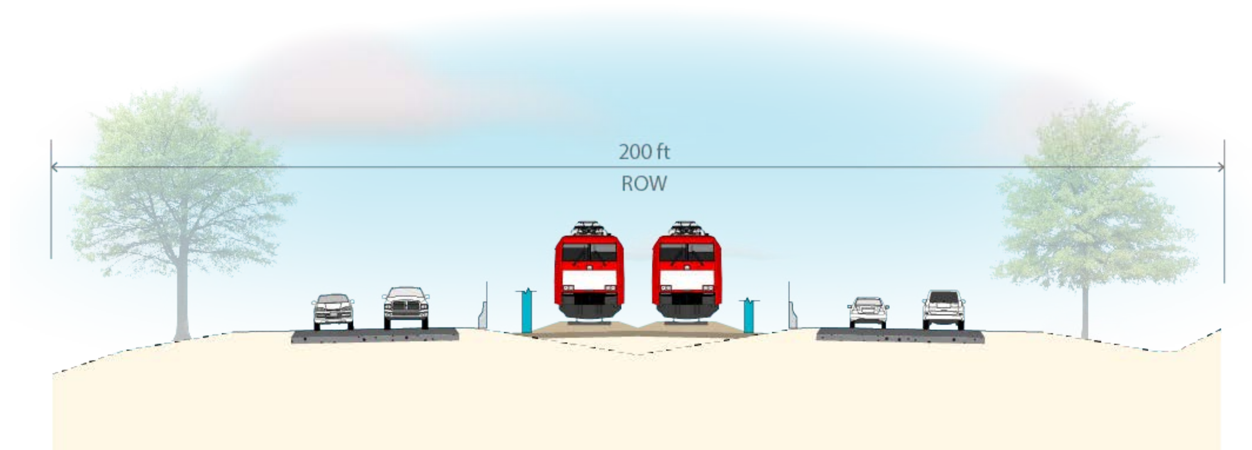
Key assumptions for proposed infrastructure improvements are:

- The typical improvements need to accommodate two passenger tracks and overhead catenary poles for electrification (for Alternative 2B);
- Grade separation between the intercity passenger rail and roads will be required in any areas where speeds above 110 mph may be achieved. One hundred and thirty one grade separated crossings exist along the corridor: 79 railroad over road/railroad and 52 railroad under road/railroad. Forty three public and private at-grade crossing are to remain in the approach segments to Atlanta and Charlotte due to approach speeds less than 110mph. For the purpose of the analysis grade separations will primarily be required between Suwannee, GA and Gastonia, NC respectfully. The total number of grade separations required in the corridor will be more defined during a Tier 2 NEPA analysis;

Highway Median Section

- The typical section (**Exhibit 5-57**) can be constructed inside the I-85 median between the following locations:
    - Gravel Springs Road (Ga.) interchange to the Ga./S.C. border (61.1 miles);
    - Ga./S.C. border to Clemson Blvd interchange (S.C.) (18.8 miles); and
    - S.C./N.C. border to York Road interchange (N.C.) (7.5 miles);

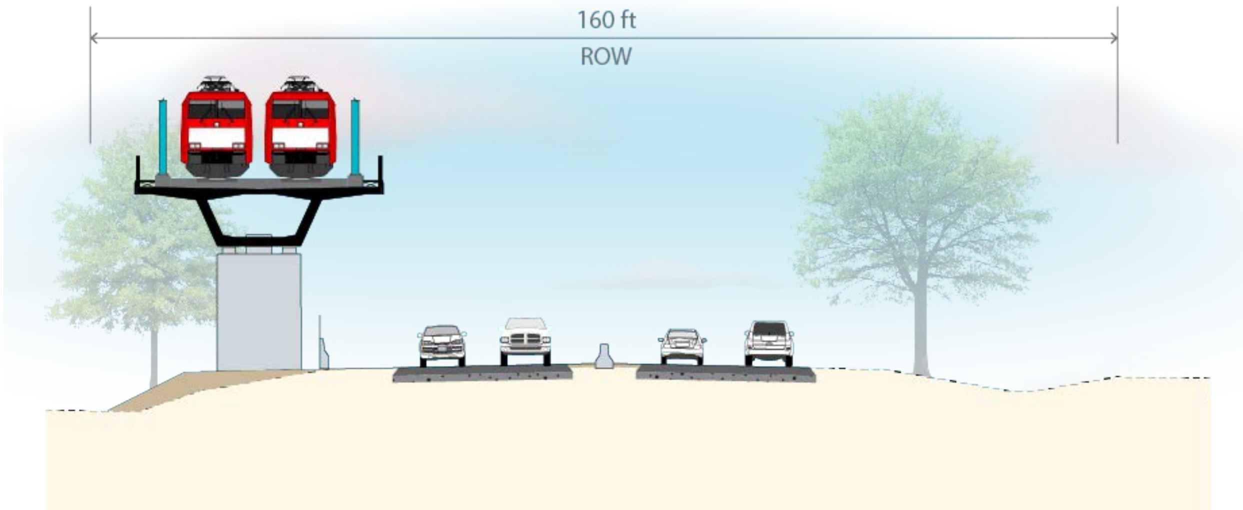
Exhibit 5-57: Alternative 2 Typical Highway Median Section



Viaduct Section

- Aerial viaduct will be required for a portion of South Carolina, specifically in the Greenville and Spartanburg metropolitan areas, primarily within the I-85 ROW (**Exhibit 5-58**). Specific infrastructure requirements in congested areas, such as viaducts, will be further evaluated in a Tier 2 NEPA document. However, based on the information available for this PRCIP, the viaduct was determined to be a good option, because I-85 existing conditions poses the following challenges:
    - There is no open median;
    - The width of existing ROW is constrained;
    - There is a close proximity of interchanges along the route; and
    - Adjacent development along the route does not allow for significant widening of the existing roadway.

Exhibit 5-58: Alternative 2 Typical Viaduct Section



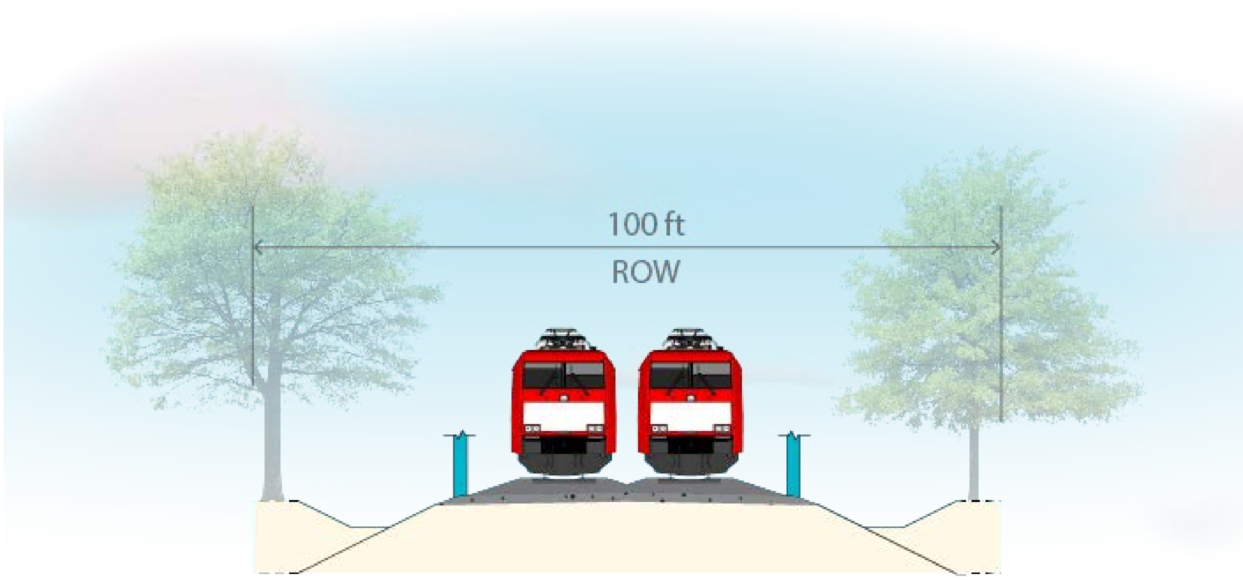
5.8.4.3 Alternative 3: Greenfield

Alternative 3A and 3B proposed infrastructure improvements involve providing maximum operating speeds of 125 mph (diesel technology) and 220 mph (electrified technology) services.

Key assumptions for proposed infrastructure improvements include:

- The typical improvements need to accommodate two passenger tracks and overhead catenary poles for electrification (Alternative 3B);
- Grade separation between the intercity passenger rail and roads will be required in any areas where speeds above 110 mph may be achieved.
- The majority of Alternative 3 would be constructed within a proposed 100-foot ROW (**Exhibit 5-59**);

Exhibit 5-59: Alternative 3 Typical Section

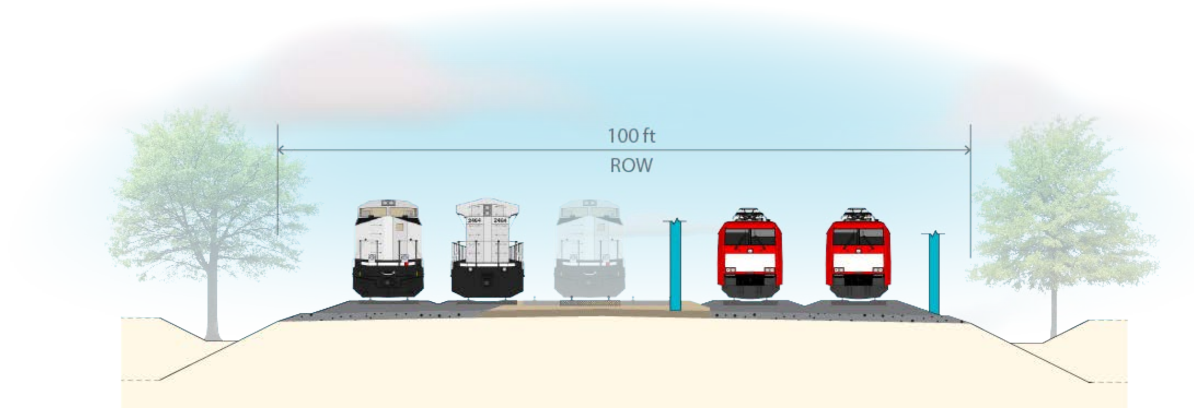


- All crossings of major roadways, select minor roadways and existing rail lines require grade separation. Two hundred and one grade separated crossings exist for Alternative 3A and 3B: 167 railroad over road/railroad and 34 railroad under road/railroad. Twenty eight public and private at-grade crossing are to remain in the approach segments to Atlanta and Charlotte due to approach speeds less than 110mph. For the purpose of the analysis grade separations will primarily be required between Suwannee, GA and terminal approach into Charlotte, NC respectfully. The total number of grade separations required in the corridor will be more defined during a Tier 2 NEPA analysis and dependent on crossing consolidation and closings;
- All other roadways would be rerouted or segmented to best minimize the necessary grade separations along the route;
- Geometry of Alternative 3 will accommodate maximum speeds of 220 mph, where feasible, unless deemed unfeasible due to existing conditions or proposed operating constraints;
- Alternative 3 will avoid major urban/suburban development, major water features (lakes, wide river crossings, etc.), and national/state/local parks and recreational areas as best as possible;
- Alternative 3 will use the same approach into Atlanta and Charlotte as Alternative 2 (refer to **Section 3.4.4**).

Shared ROW Section

- For both Alternative 2 and 3 approaches into both Atlanta and Charlotte, as described in Section 4, the representative alignment typical section will parallel existing freight tracks at a minimum of 40 feet from the nearest active freight track. Existing freight tracks will be realigned inside the ROW to best accommodate two new passenger tracks within the freight corridor (**Exhibit 5-60**).

Exhibit 5-60: Alternative 2 Shared Use Typical Section



5.9 CAPITAL COSTS

5.9.1 Methodology

It is important to provide a consistent costing methodology across all route alternatives. The capital costing methodology intends to provide an accurate conceptual cost estimate in order to:

- Make sound decisions on passenger rail technologies and level of service;
- Determine feasibility from a benefit-cost context;
- Identify Federal, state, and local capital budget needs; and
- Prepare future funding applications for environmental and preliminary engineering work.

To achieve a consistent costing methodology, the PRCIP followed the FRA Standard Cost Categories (SCC) guidance for the development of all capital cost estimates shown in **Exhibit 5-61**. All cost estimates are in 2012 dollars. Conceptual engineering was completed to identify track, signal and structure costs for each route and technology. Microstation software was used to display track improvements on aerial photographs. A planning-level capacity analysis was used to estimate track improvements needed for Alternative 1 (Southern Crescent). This analysis was also used in the freight railroad corridor approach areas of Alternatives 2 and 3 (I-85 and Greenfield).

Exhibit 5-61: FRA SCC

Standard Cost Categories
10 Track Structures and Track
20 Stations, Terminals, Intermodal
30 Support Facilities: Yards, Shops, Administration Buildings
40 Sitework, ROW, Land, Existing Improvements
50 Communications and Signaling
60 Electric Traction
70 Vehicles
80 Professional Services
90 Unallocated Contingencies[53]
100 Finance Charges

The unit costs associated with the capital cost estimates included the costs for procuring the materials, as well as taxes, contractor labor, overhead and profit. **Appendix G** provides the full capital costing methodology.

5.9.2 Capital Cost Estimates

5.9.2.1 Alternative 1A: Southern Crescent (79 mph)

Alternative 1A is the lowest cost alternative when compared against all the other service alternatives. The overall cost is approximately $2.0 billion with a per-mile cost of $7.4 million as shown in **Exhibit 5-62**. The majority of the cost associated with the alternative is in SCC 10 and SCC 50, as most of the improvements are related to track

[53] *Unallocated contingencies were not included in the cost estimates. These typically include more widespread uncertainties, such as schedule delays, changes in contracting, or other similar issues that are associated with individual construction activities.*

capacity, structures and signaling upgrades for passenger service. **Exhibits 5-63** through **Exhibit 5-65** provide a state by state breakdown of the total capital cost for Alternative 1A. **Appendix H** provides the detailed costs by category.

Exhibit 5-62: Alternative 1A Total Capital Cost by Major SCC Category (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$502,307,780	$150,692,334	$653,000,114
20	Stations, Terminals, Intermodal	$230,400,000	$69,120,000	$299,520,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$134,000,000	$40,200,000	$174,200,000
40	Sitework, Right of Way, Land, Existing Improvements	$66,657,110	$19,997,133	$86,654,243
50	Communications and Signaling	$358,753,140	$107,625,942	$466,379,082
60	Electric Traction	$-	$-	$-
70	Vehicles	$99,000,000	$29,700,000	$128,700,000
80	Professional Services	$201,570,413		$201,570,413
TOTAL COST		$1,592,688,443	$417,335,409	$2,010,023,852
TOTAL COST PER MILE (271.29 MILES)				$7,409,134

Exhibit 5-63: Alternative 1A Capital Cost by Major SCC Category: North Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$30,811,016	$9,243,305	$40,054,321
20	Stations, Terminals, Intermodal	$63,400,000	$19,020,000	$82,420,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$10,560,810	$3,168,243	$13,729,053
50	Communications and Signaling	$53,340,440	$16,002,132	$69,342,572
60	Electric Traction	$-	$-	$-
70	Vehicles	$15,177,154	$4,553,146	$19,730,300
80	Professional Services	$24,880,753		$24,880,753
TOTAL COST		$198,170,173	$53,780,490	$251,950,663
TOTAL COST PER MILE (41.95 MILES)				$6,057,963

Exhibit 5-64: Alternative 1A Capital Cost by Major SCC Category: South Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$276,015,566	$82,804,670	$358,820,236
20	Stations, Terminals, Intermodal	$40,200,000	$12,060,000	$52,260,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$29,501,150	$8,850,345	$38,351,495
50	Communications and Signaling	$161,416,953	$48,425,086	$209,842,039
60	Electric Traction	$-	$-	$-
70	Vehicles	$44,465,885	$13,339,766	$57,805,651
80	Professional Services	$79,112,852		$79,112,852
TOTAL COST		$630,712,407	$165,479,866	$796,192,274
TOTAL COST PER MILE (121.85 MILES)				$6,534,200

Exhibit 5-65: Alternative 1A Capital Cost by Major SCC Category: Georgia (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$195,481,198	$58,644,359	$254,125,557
20	Stations, Terminals, Intermodal	$126,800,000	$38,040,000	$164,840,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$134,000,000	$40,200,000	$174,200,000
40	Sitework, Right of Way, Land, Existing Improvements	$26,595,150	$7,978,545	$34,573,695
50	Communications and Signaling	$139,038,100	$41,711,430	$180,749,530
60	Electric Traction	$-	$-	$-
70	Vehicles	$39,356,961	$11,807,088	$51,164,050
80	Professional Services	$97,576,807		$97,576,807
TOTAL COST		$758,848,216	$203,032,700	961,880,916
TOTAL COST PER MILE (107.85 MILES)				$8,918,692

5.9.2.2 Alternative 1B: Southern Crescent (110 mph)

Alternative 1B is the second lowest cost alternative when compared against all the other service alternatives. The overall cost is approximately $2.3 billion with a per-mile cost of $8.5 million as shown in **Exhibit 5-66**. The increase in cost ($0.3 billion) from Alternative 1A is primarily due to the four additional "green zones"[54] proposed along the route. Similar to Alternative 1A, a majority of the costs are associated with SCC 10 and SCC 50 as most of the improvements are related to track capacity, structures and signaling upgrades for passenger service. **Exhibits 5-67** through **Exhibit 5-69** break out the capital cost estimate by state. **Appendix H** provides the detailed costs by category.

Exhibit 5-66: Alternative 1B Total Capital Cost by Major SCC Category (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$563,434,701	$169,030,410	$732,465,111
20	Stations, Terminals, Intermodal	$230,400,000	$69,120,000	$299,520,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$134,000,000	$40,200,000	$174,200,000
40	Sitework, Right of Way, Land, Existing Improvements	$66,657,110	$19,997,133	$86,654,243
50	Communications and Signaling	$477,388,115	$143,216,435	$620,604,550
60	Electric Traction	$-	$-	$-
70	Vehicles	$115,800,000	$34,740,000	$150,540,000
80	Professional Services	$229,613,268		$229,613,268
TOTAL COST		$1,817,293,195	$476,303,978	$2,293,597,172
TOTAL COST PER MILE (271.29 MILES)				$8,454,411

[54] *Green zones refer to areas along Alternative 1 where speeds of 110 mph may be achieved. Additional infrastructure is needed to support these higher speeds regarding signaling, safety and capacity.*

Exhibit 5-67: Alternative 1B Capital Cost by Major SCC Category: North Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$41,031,046	$12,309,314	$53,340,360
20	Stations, Terminals, Intermodal	$63,400,000	$19,020,000	$82,420,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$10,560,810	$3,168,243	$13,729,053
50	Communications and Signaling	$65,477,165	$19,643,150	$85,120,315
60	Electric Traction	$-	$-	$-
70	Vehicles	$17,752,671	$5,325,801	$23,078,472
80	Professional Services	$28,153,167		$28,153,167
TOTAL COST		$226,374,859	$61,475,411	$287,850,269
TOTAL COST PER MILE (41.95 MILES)				$6,921,141

Exhibit 5-68: Alternative 1B Capital Cost by Major SCC Category: South Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$270,983,934	$81,295,180	$352,279,114
20	Stations, Terminals, Intermodal	$40,200,000	$12,060,000	$52,260,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$29,501,150	$8,850,345	$38,351,495
50	Communications and Signaling	$309,382,475	$92,814,743	$402,197,218
60	Electric Traction	$-	$-	$-
70	Vehicles	$44,465,885	$13,339,766	$57,805,651
80	Professional Services	$101,410,539		$101,410,539
TOTAL COST		$795,943,983	$57,754,463	$853,698,446
TOTAL COST PER MILE (121.85 MILES)				$7,006,142

Exhibit 5-69: Alternative 1B Capital Cost by Major SCC Category: Georgia (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$251,419,722	$75,425,917	$326,845,638
20	Stations, Terminals, Intermodal	$126,800,000	$38,040,000	$164,840,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$134,000,000	$40,200,000	$174,200,000
40	Sitework, Right of Way, Land, Existing Improvements	$26,595,150	$7,978,545	$34,573,695
50	Communications and Signaling	$207,745,975	$62,323,793	$270,069,768
60	Electric Traction	$-	$-	$-
70	Vehicles	$46,035,718	$13,810,715	$59,846,434
80	Professional Services	$116,463,492		$116,463,492
TOTAL COST		$909,060,057	$242,988,400	$1,152,048,457
TOTAL COST PER MILE (107.85 MILES)				$10,681,951

5.9.2.3 Alternative 2A: I-85 (125 mph)

Alternative 2A is the second highest cost alternative when compared against all the other service alternatives. The overall cost is approximately $13.3 billion with a per-mile cost of $49.8 million as shown in **Exhibit 5-70**. The majority of the cost is associated with SCC 10 because of the need for 88 miles of aerial viaduct through a majority of South Carolina. Additionally, SCC 50 also accounts for a larger percentage of the overall cost due to a new signaling system.

Exhibits 5-71 through **Exhibit 5-73** break out the capital cost estimate by state. **Appendix H** provides the detailed costs by category.

Exhibit 5-70: Alternative 2A Total Capital Cost by Major SCC Category (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$6,964,287,854	$2,089,286,356	$9,053,574,210
20	Stations, Terminals, Intermodal	$410,000,000	$123,000,000	$533,000,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$498,817,146	$149,645,144	$648,462,289
50	Communications and Signaling	$690,073,843	$207,022,153	$897,095,995
60	Electric Traction	$-	$-	$-
70	Vehicles	$429,000,000	$128,700,000	$557,700,000
80	Professional Services	$1,358,299,619		$1,358,299,619
TOTAL COST		$10,494,348,461	$2,740,814,653	$13,235,163,114
TOTAL COST PER MILE (265.66 MILES)				$49,819,932

Exhibit 5-71: Alternative 2A Capital Cost by Major SCC Category: North Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$931,145,177	$279,343,553	$1,210,488,730
20	Stations, Terminals, Intermodal	$87,500,000	$26,250,000	$113,750,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$124,624,985	$37,387,496	$162,012,481
50	Communications and Signaling	$116,348,143	$34,904,443	$151,252,585
60	Electric Traction	$-	$-	$-
70	Vehicles	$68,566,363	$20,569,909	$89,136,272
80	Professional Services	$196,500,456		$196,500,456
TOTAL COST		$1,524,685,123	$398,455,400	$1,923,140,524
TOTAL COST PER MILE (42.46 MILES)				$45,292,994

Exhibit 5-72: Alternative 2A Capital Cost by Major SCC Category: South Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$4,963,925,844	$1,489,177,753	$6,453,103,597
20	Stations, Terminals, Intermodal	$150,000,000	$45,000,000	$195,000,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$39,192,317	$11,757,695	$50,950,012
50	Communications and Signaling	$270,751,250	$81,225,375	$351,976,625
60	Electric Traction	$-	$-	$-
70	Vehicles	$173,595,950	$52,078,785	$225,674,735
80	Professional Services	$846,123,628		$846,123,628
TOTAL COST		$6,443,588,989	$1,679,239,608	$8,122,828,597
TOTAL COST PER MILE (107.50 MILES)				$76,561,196

Exhibit 5-73: Alternative 2A Capital Cost by Major SCC Category: Georgia (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$1,069,216,833	$320,765,050	$1,389,981,883
20	Stations, Terminals, Intermodal	$172,500,000	$51,750,000	$224,250,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$334,999,843	$100,499,953	$435,499,796
50	Communications and Signaling	$302,974,450	$90,892,335	$393,866,785
60	Electric Traction	$-	$-	$-
70	Vehicles	$186,837,687	$56,051,306	$242,888,993
80	Professional Services	$315,675,536		$315,675,536
TOTAL COST		$2,526,074,349	$663,119,644	$3,189,193,993
TOTAL COST PER MILE (115.70 MILES)				$27,564,339

5.9.2.4 Alternative 2B: I-85 (220 mph)

Alternative 2B is the highest cost alternative when compared against all the other service alternatives. The overall cost is approximately $15.3 billion with a per-mile cost of $57.8 million as shown in **Exhibit 5-74**. The increase in cost from Alternative 2A ($2.2 billion) is primarily due to the addition of electrification along the route. Similar to Alternative 2A, a majority of the cost are associated SCC 10 track and structures, however, SCC 60 electrification now accounts for a large percentage of the overall total cost. **Exhibits 5-75** through **Exhibit 5-77** break out the capital cost estimate by state. **Appendix H** provides the detailed costs by category.

Exhibit 5-74: Alternative 2B Total Capital Cost by Major SCC Category (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$6,964,287,854	$2,089,286,356	$9,053,574,210
20	Stations, Terminals, Intermodal	$410,000,000	$123,000,000	$533,000,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$498,817,146	$149,645,144	$648,462,289
50	Communications and Signaling	$690,073,843	$207,022,153	$897,095,995
60	Electric Traction	$1,455,630,007	$436,689,002	$1,892,319,009
70	Vehicles	$423,800,000	$127,140,000	$550,940,000
80	Professional Services	$1,585,377,900		$1,585,377,900
TOTAL COST		$12,171,856,749	$3,175,943,655	$15,347,800,404
TOTAL COST PER MILE (265.66 MILES)				$57,772,342

Exhibit 5-75: Alternative 2B Capital Cost by Major SCC Category: North Carolina (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$931,145,177	$279,343,553	$1,210,488,730
20	Stations, Terminals, Intermodal	$87,500,000	$26,250,000	$113,750,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$124,624,985	$37,387,496	$162,012,481
50	Communications and Signaling	$116,348,143	$34,904,443	$151,252,585
60	Electric Traction	$232,627,927	$69,788,378	$302,416,305
70	Vehicles	$67,735,256	$20,320,577	$88,055,832
80	Professional Services	$232,790,412		$232,790,412
TOTAL COST		$1,792,771,900	$467,994,446	$2,260,766,346
TOTAL COST PER MILE (42.46 MILES)				$53,244,615

Exhibit 5-76: Alternative 2B Capital Cost by Major SCC Category: South Carolina (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$4,963,925,844	$1,489,177,753	$6,453,103,597
20	Stations, Terminals, Intermodal	$150,000,000	$45,000,000	$195,000,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$39,192,317	$11,757,695	$50,950,012
50	Communications and Signaling	$270,751,250	$81,225,375	$351,976,625
60	Electric Traction	$589,035,500	$176,710,650	$765,746,150
70	Vehicles	$171,491,756	$51,447,527	$222,939,283
80	Professional Services	$938,013,166		$938,013,166
TOTAL COST		$7,197,010,333	$1,874,678,991	$8,977,728,834
TOTAL COST PER MILE (107.50 MILES)				$83,513,757

Exhibit 5-77: Alternative 2B Capital Cost by Major SCC Category: Georgia (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$1,069,216,833	$320,765,050	$1,389,981,883
20	Stations, Terminals, Intermodal	$172,500,000	$51,750,000	$224,250,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$334,999,843	$100,499,953	$435,499,796
50	Communications and Signaling	$302,974,450	$90,892,335	$393,866,785
60	Electric Traction	$633,966,580	$190,189,974	$824,156,554
70	Vehicles	$184,572,988	$55,371,896	$239,944,884
80	Professional Services	$414,574,322		$414,574,322
TOTAL COST		$3,256,675,016	$852,630,208	$4,109,305,224
TOTAL COST PER MILE (115.70 MILES)				$35,516,899

5.9.2.5 Alternative 3A: Greenfield (125 mph)

Alternative 3A is the third lowest cost alternative when compared against all the other service alternatives. The overall cost is approximately $6.2 billion with a per-mile cost of $22.6 million, as shown in **Exhibit 5-78**. The majority of the cost is associated with SCC 10, 40 and 50. SCC 40 accounts for a larger percentage of the overall total because of the need to purchase ROW for a majority of the corridor. SCC 10 and 50 are due to proposing a new two track typical section and structures along with a new signaling system.[55] **Exhibits 5-79** through **Exhibit 5-81** break out the capital cost estimate by state. **Appendix H** provides the detailed costs by category.

[55] *SCC 10 is lower for Alternative 3 compared to Alternative 2 due to the ability to construct without viaducts in the Greenville and Spartanburg areas.*

Exhibit 5-78: Alternative 3A Total Capital Cost by Major SCC Category (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$2,176,316,722	$652,895,017	$2,829,211,739
20	Stations, Terminals, Intermodal	$347,500,000	$104,250,000	$451,750,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$531,171,369	$159,351,411	$690,522,780
50	Communications and Signaling	$701,300,160	$210,390,048	$911,690,208
60	Electric Traction	$-	$-	$-
70	Vehicles	$375,700,000	$112,710,000	$488,410,000
80	Professional Services	$608,424,687		$608,424,687
TOTAL COST		$4,884,282,938	$1,282,757,475	$6,167,040,414
TOTAL COST PER MILE (273.16 MILES)				$22,576,660

Exhibit 5-79: Alternative 3A Capital Cost by Major SCC Category: North Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$217,264,001	$65,179,200	$282,443,201
20	Stations, Terminals, Intermodal	$75,000,000	$22,500,000	$97,500,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$70,130,903	$21,039,271	$91,170,174
50	Communications and Signaling	$55,599,645	$16,679,894	$72,279,539
60	Electric Traction	$-	$-	$-
70	Vehicles	$29,254,426	$8,776,328	$38,030,754
80	Professional Services	$65,207,150		$65,207,150
TOTAL COST		$512,456,125	$134,174,693	$646,630,817
TOTAL COST PER MILE (21.27 MILES)				$30,401,073

Exhibit 5-80: Alternative 3A Capital Cost by Major SCC Category: South Carolina (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$888,521,040	$266,556,312	$1,155,077,352
20	Stations, Terminals, Intermodal	$112,500,000	$33,750,000	$146,250,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$99,302,328	$29,790,699	$129,093,027
50	Communications and Signaling	$316,912,420	$95,073,726	$411,986,146
60	Electric Traction	$-	$-	$-
70	Vehicles	$173,188,402	$51,956,521	$225,144,923
80	Professional Services	$221,088,783		$221,088,783
TOTAL COST		$1,811,512,974	$477,127,257	$2,288,640,231
TOTAL COST PER MILE (125.92 MILES)				$18,175,351

Exhibit 5-81: Alternative 3A Capital Cost by Major SCC Category: Georgia (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$1,070,531,681	$321,159,504	$1,391,691,186
20	Stations, Terminals, Intermodal	$160,000,000	$48,000,000	$208,000,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$361,738,138	$108,521,441	$470,259,579
50	Communications and Signaling	$328,788,095	$98,636,429	$427,424,524
60	Electric Traction	$-	$-	$-
70	Vehicles	$173,257,172	$51,977,151	$225,234,323
80	Professional Services	$322,128,755		$322,128,755
TOTAL COST		$2,560,313,840	$671,455,526	$3,231,769,366
TOTAL COST PER MILE (125.97 MILES)				$25,655,072

5.9.2.6 Alternative 3B: Greenfield (220 mph)

Alternative 3B is the third highest cost alternative when compared against the other service alternatives. The overall cost is approximately $8.5 billion with a per-mile cost of $30.9 million as shown in **Exhibit 5-82**. The increase in cost from Alternative 3A ($2.3 billion) is primarily due to the addition of electrification along the route. Similar to Alternative 3A, a majority of the cost is associated with SCC 10, 40 and 50; however, SCC 60 electrification also accounts for a large percentage of the total cost. **Exhibits 5-83** through **Exhibit 5-85** present the capital cost estimate by state. **Appendix H** provides the detailed costs by category.

Exhibit 5-82: Alternative 3B Total Capital Cost by Major SCC Category (2012$)

	Costing Category	Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$2,176,316,722	$652,895,017	$2,829,211,739
20	Stations, Terminals, Intermodal	$347,500,000	$104,250,000	$451,750,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$531,171,369	$159,351,411	$690,522,780
50	Communications and Signaling	$701,300,160	$210,390,048	$911,690,208
60	Electric Traction	$1,496,752,904	$449,025,871	$1,945,778,775
70	Vehicles	$453,600,000	$136,080,000	$589,680,000
80	Professional Services	$841,918,140		$841,918,140
TOTAL COST		$6,692,429,295	$1,755,153,347	$8,447,582,642
TOTAL COST PER MILE (273.16 MILES)				$30,925,401

Exhibit 5-83: Alternative 3B Capital Cost by Major SCC Category: North Carolina (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$217,264,001	$65,179,200	$282,443,201
20	Stations, Terminals, Intermodal	$75,000,000	$22,500,000	$97,500,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$70,130,903	$21,039,271	$91,170,174
50	Communications and Signaling	$55,599,645	$16,679,894	$72,279,539
60	Electric Traction	$116,546,838	$34,964,051	$151,510,889
70	Vehicles	$35,320,223	$10,596,067	$45,916,289
80	Professional Services	$83,388,456		$83,388,456
TOTAL COST		$653,250,066	$170,958,483	$824,208,549
TOTAL COST PER MILE (21.27 MILES)				$38,749,814

Exhibit 5-84: Alternative 3B Capital Cost by Major SCC Category: South Carolina (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$888,521,040	$266,556,312	$1,155,077,352
20	Stations, Terminals, Intermodal	$112,500,000	$33,750,000	$146,250,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$-	$-	$-
40	Sitework, Right of Way, Land, Existing Improvements	$99,302,328	$29,790,699	$129,093,027
50	Communications and Signaling	$316,912,420	$95,073,726	$411,986,146
60	Electric Traction	$689,966,048	$206,989,814	$896,955,862
70	Vehicles	$209,098,375	$62,729,512	$271,827,887
80	Professional Services	$328,723,486		$328,723,486
TOTAL COST		$2,645,023,698	$694,890,063	$3,339,913,761
TOTAL COST PER MILE (125.92 MILES)				$26,524,093

Exhibit 5-85: Alternative 3B Capital Cost by Major SCC Category: Georgia (2012$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures and Track	$1,070,531,681	$321,159,504	$1,391,691,186
20	Stations, Terminals, Intermodal	$160,000,000	$48,000,000	$208,000,000
30	Support Facilities: Yards, Shops, Admin. Buildings	$143,870,000	$43,161,000	$187,031,000
40	Sitework, Right of Way, Land, Existing Improvements	$361,738,138	$108,521,441	$470,259,579
50	Communications and Signaling	$328,788,095	$98,636,429	$427,424,524
60	Electric Traction	$690,240,018	$207,072,005	$897,312,023
70	Vehicles	$209,181,403	$62,754,421	$271,935,824
80	Professional Services	$429,806,197		$429,806,197
TOTAL COST		$3,394,155,532	$889,304,800	$4,283,460,332
TOTAL COST PER MILE (125.97 MILES)				$34,003,813

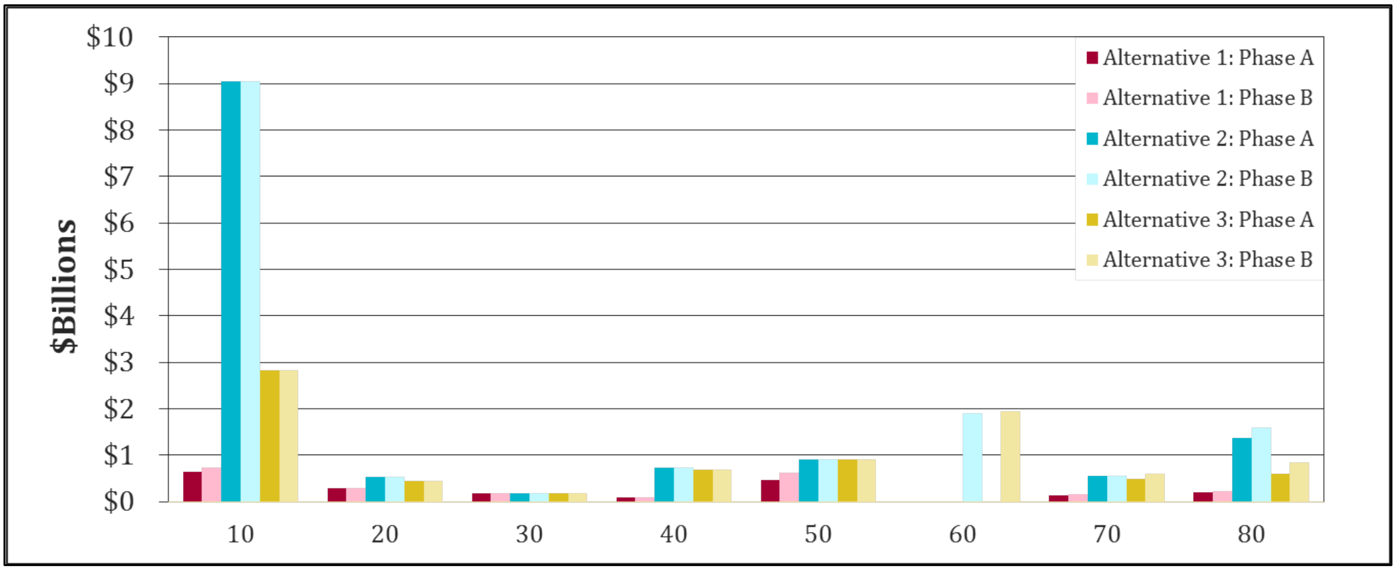
Exhibit 5-86 provides a summary of the total capital cost estimates by route alternative.

Exhibit 5-86: Route Alternatives Capital Cost Summary (in billion 2012$)

Route Alternative	Total Capital Cost
Alternative 1A	$2.0
Alternative 1B	$2.3
Alternative 2A	$13.3
Alternative 2B	$15.4
Alternative 3A	$6.2
Alternative 3B	$8.4

Additionally, **Exhibit 5-87** illustrates each alternatives capital cost estimate breakout by FRA SCCs. The exhibit indicates that the majority of costs for all alternatives fall under SCC 10 – Track Structures and Track. Another substantial cost for Alternatives 2B and 3B is SCC 60 – Electrification.

Exhibit 5-87: Route Alternatives Capital Cost Breakdown by SCC Category (2012$)



Standard Cost Categories	
10 Track Structures and Track	**50 Communications and Signaling**
20 Stations, Terminals, Intermodal	**60 Electric Traction**
30 Support Facilities: Yards, Shops, Administration Buildings	**70 Vehicles**
40 Sitework, ROW, Land, Existing Improvements	**80 Professional Services**

5.10 OPERATING AND MAINTENANCE COSTS

5.10.1 Methodology

O&M unit costs have been developed and have been used in conjunction with the operating plans to project the total operating costs of each alternative. Nine specific O&M cost areas were identified, as shown in **Exhibit 5-88**. Variable train-mile driven costs include equipment maintenance, energy and fuel, and train and onboard service (OBS) crews. Passenger-miles drive insurance liability, while ridership influences marketing and sales. Fixed costs include administrative costs, station costs, and track and ROW maintenance costs. Signals, communication and power supply are all included in the track and ROW costs.

Exhibit 5-88: Operating Cost Categories and Primary Cost Drivers

Drivers		Cost Categories
Train Miles	→	Equipment Maintenance Energy and Fuel Train and Engine Crews OBS Crews
Passenger Miles	→	Insurance Liability
Ridership and Revenue	→	Sales and Marketing
Fixed Costs	→	Service Administration Track and ROW maintenance Station Costs

This framework enables the direct development of costs based on controllable and alternative-specific factors, and allowed sensitivity analyses to be performed on the impact of specific cost drivers. It also enables direct and explicit treatment of overhead cost allocations, to ensure costs that do not belong to an alternative are not inappropriately allocated to that alternative, as would be inherent in a simple average cost-per-train mile approach. Finally, it allows benchmarking and direct comparability of Georgia costs with those developed by other studies across the nation, including those with which the Atlanta to Charlotte corridor would connect.

5.10.1.1 Unit Costs

Since there are three route alternatives, each with two technology options, it was essential to maintain consistency of costs across all alternatives. In order to develop a fair comparison, the following standards were followed:

- Unit costs that depend on the propulsion and speed reflect legitimate differences between alternatives and technologies; and
- Unit costs that do not depend on propulsion and speed remain the same across all alternatives and technologies.
- Operating costs were categorized as variable or fixed:
    - Variable costs change with the volume of activity and are directly dependent on ridership, passenger miles or train miles. For each variable cost, a principal cost driver was identified and used to determine the total cost of that operating variable. An increase or decrease in any of these will directly drive operating costs higher or lower.
    - Fixed costs are generally predetermined, but may be influenced by external factors, such as the volume of freight tonnage, or may include a relatively small component of activity-driven costs. As a rule, costs identified as "fixed" remain stable across a broad range of service intensities. Within fixed costs are two sub-categories:
        - Route costs such as track maintenance, train control and station expenses that, although fixed, can still be clearly identified for each alternative; and
        - Overhead or system costs such as headquarters, management, call centers, accounting, legal and other corporate fixed costs that are shared across routes or even nationally. A portion of overhead cost (such as direct line supervision) may be directly identifiable, but most of the cost is fixed. Accordingly, assignment of such costs becomes an allocation issue that raises equity concerns. These types of fixed costs are handled separately.

The operating unit costs have been developed based on the following premises:

- A variety of information gathered from results of recent studies, including supplier data, current operators' histories, data from testing programs and prior internal analysis from other passenger corridors, was used to develop the cost data. However, as the rail service is implemented, actual costs will be subject to negotiation between the passenger rail authority and the contract rail operator(s);

- Freight railroads will maintain track and ROW that they own, but ultimately, the actual cost of track maintenance will be resolved through negotiations with the railroads. For this study, a track maintenance cost model was used that reflects actual freight and passenger railroad cost data;
- Since some of the equipment maintenance cost is based on Talgo's experience in the Pacific Northwest, it is assumed that maintenance of train equipment will be contracted out to the equipment supplier; and
- Train operating practices follow existing work rules for crew staffing and hours of service. Average operating expenses per train-mile for train operations, crews, management and supervision were based on typical passenger rail organizational needs.

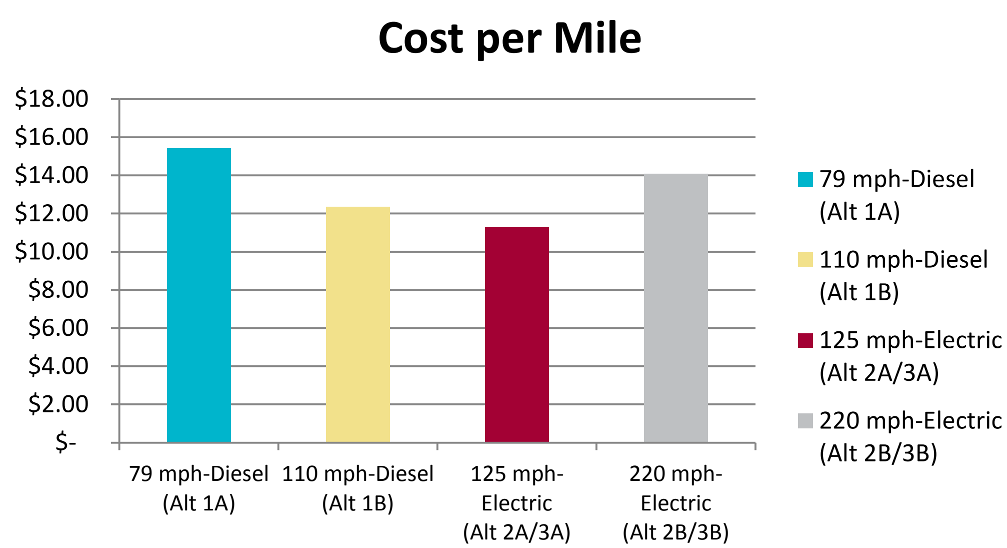
5.10.1.2 Variable Costs

Variable costs include those that directly depend on the number of train-miles operated or passenger-miles carried. They include train equipment maintenance, train crew cost, fuel and energy, onboard service and insurance costs.

Train Equipment Maintenace

Equipment maintenance costs include all costs for spare parts, labor and materials needed to keep equipment safe and reliable. The costs include periodical overhauls in addition to running maintenance. It also assumes that facilities for servicing and maintaining equipment are designed specifically to accommodate the selected train technology. **Exhibit 5-89** illustrates the unit costs for each technology for the Atlanta to Charlotte corridor.

Exhibit 5-89: Equipment Maintenance Cost per Mile ($2012)



Train and Engine Crew Costs

Following Amtrak staffing policies, the operating crew would consist of an engineer, a conductor and an assistant conductor and is subject to Federal Hours of Service regulations. Costs for the crew include salary, fringe benefits, training, overtime and additional pay for split shifts and high mileage runs. An overtime allowance is included as well as scheduled time-off, unscheduled absences and time required for operating, safety and passenger handling training. Fringe benefits include health and welfare, FICA and pensions.

Crew costs depend upon the level of train crew utilization, which is largely influenced by the structure of crew bases and any prior agreements on staffing locations. Train frequency strongly influences the amount of held-away-from-home-terminal time, which occurs if train crews have to stay overnight in a hotel away from their home base. Since a broad range of service frequencies and speeds have been evaluated as a part of this study, an approach was developed for a system average per train mile rate for crew costs. A more specific and detailed level of assessment would be appropriate for a Tier 2 NEPA study.

For this study, the unit costs include:

- An intermediate value of $4.92 per train-mile was assumed for Alternative 2A and Alternative 3A (125 mph diesel) as well as Alternative 2B (220 mph electrified), as it has very similar schedules compared to the diesel option;
- The Alternatives 1A and 1B cost $6.59 per train-mile due to inefficient crew utilization in these low–frequency scenarios. With trains operating less frequently there is less opportunity to return crews to their home base on the same day, leading to more split shifts and overnight layovers. The primary reason that crew utilization for this alternative is low is that running time is too long to permit a round trip in a normal day (even if the frequency allowed a quick turnaround).
- Alternative 3B used $4.60 per train-mile, reflecting operating efficiencies related both to higher speeds and more frequent trains in this alternative, both of which tend to reduce the need for away-from-home layovers.

Fuel and Energy

An average consumption rate of 2.42 gallons per mile was estimated for Alternatives 1A, 1B, 2A and 3A, based upon other studies conducted across the nation. Assuming $3.60 a gallon in early 2014 for diesel fuel (according to Energy Information Administration (EIA)[56] in late 2012) this translates into a cost of $8.71 per train-mile. Even taking typical peaking demands into account, electricity is typically cheaper than diesel fuel. As a result, the rapid rise of petroleum costs over the past ten years has tipped the cost advantage towards electrification.

The comparable electric cost for an Acela 150 mph locomotive-hauled electric train is $2.80 per train mile as compared to $8.71 for the diesel train. But, because it weighs less than the Acela, the 220-mph electric multiple unit (used for Alternative 2B and 3B) is even more efficient at $2.46 per train-mile. On the other hand, the 220-mph electric train does go faster. This speed increases its energy consumption, largely offsetting the weight improvement. As a result, all diesel options assume a 2013 fuel cost of $8.71 per train mile, and all electric options assume an electric cost of $2.80 per train mile. These energy costs are then adjusted each year in line with the relevant EIA forecasts.

Onboard Services

Onboard service (OBS) costs are those expenses for providing food service onboard the trains. OBS adds costs in three different areas: equipment, labor and cost of goods sold. Equipment capital and operating cost is built into the cost of the trains and is not attributed to food catering specifically. The goal of OBS franchising should be to ensure a reasonable profit for the provider of on-board services, while maintaining a reasonable and affordable price structure for passengers.

The cost of goods sold is estimated as 50 percent of OBS revenue, based on Amtrak's route profitability reports. The following outlines the estimated labor costs, including costs for commissary support and OBS supervision.

An intermediate value of $2.56 per train-mile was assumed for Alternative 2A and 3A (125 mph) as well as 2B (220 mph), which has a similar schedule to that of 2A and 3A.

Alternative 1A and 1B cost $3.66 per train-mile due to crew utilization in these low–frequency scenarios, similar to train and engine crew costs.[57]

Alternative 3B used $2.41 per train mile, reflecting operating efficiencies related both to higher speeds and more frequent trains in this alternative.

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[56] *EIA diesel retail price in 2012 excluding the taxes* http://www.eia.gov/petroleum/gasdiesel/ (accessed on 02/27/15)

[57] *Note, this cost per train-mile includes an allowance for allocated commissary support and OBS supervision. Crew costs ($6.59) do not include train crew supervision, rather oversight falls into the administration cost line.*

Insurance Costs

Liability costs were estimated at 1.4¢ per passenger-mile, based on rates from previous studies and adjusted to 2013 dollars ($2013). Federal Employees Liability Act (FELA) costs are not included in this category but are applied as an overhead to labor costs.

5.10.1.3 Fixed Costs

This cost category includes those costs that, while largely independent of the number of train-miles operated, can still be directly associated to the operation of specific alternatives. It includes such costs as track maintenance, which varies by train technology, and station operations.

Track and ROW Costs

Currently, it is industry practice for passenger train operators providing service on freight-owned ROW to pay for track access, dispatching and track maintenance. Rates for all these activities are ultimately based upon a determination of the appropriate costs that result from negotiations between the parties. The purpose here is to provide estimates based on the best available information; however, as the project moves forward, additional study and discussions with the railroads will be needed to further refine these costs.

To accommodate passenger trains, the existing NS corridor would need a substantial increase in capacity. Once constructed, these improvements must be maintained to FRA standards required for reliable and safe operations. The costing basis assumed in this report is that of incremental or avoidable costs[58] for shared tracks. Typically, the passenger operator would take full cost responsibility for maintaining any tracks that are added to the corridor either for its own use, or for mitigating delays to freight trains. The following cost components are included within the track and ROW category:

Track Maintenance Costs: Costs for track maintenance were estimated based on Zeta-Tech's January 2004 draft technical monograph,[59] "Estimating Maintenance Costs for Mixed High Speed Passenger and Freight Rail Corridors," which assessed the cost for FRA Class 4 (79 mph) Through Class 6 (110 mph) track. Zeta-Tech costs have been adjusted for inflation to 2013 dollars. Costs for Class 8 track used in the 220 mph Alternative 3B were based on a 2008 Transportation Research Board (TRB) study "Maintenance Costs of High-Speed Lines in Europe: State of the Art"[60]. It reported that, according to French experience, the maintenance cost of a dedicated high-speed track was actually lower (55%) than that of a conventional track with equivalent traffic. As a result, considering the maintenance of a 220 mph dedicated track costs as equivalent to that of a Class 6 line shared with freight trains is conservative.

Dispatching Costs and Out-of-Pocket Reimbursement: Passenger service must also reimburse a freight railroad's added costs for dispatching its line, providing employee efficiency tests and for performing other services on behalf of the passenger operator. As a result, costs for train dispatching and control are incurred on dedicated, as well as shared tracks, and are now shown under a separate "Operations and Dispatch" cost category.

Costs for Access to Track and ROW: Access fees, particularly train-mile fees incurred as an operating expense, are specifically excluded from this calculation. Any such payments would have to be calculated and negotiated on a route-specific and railroad-specific basis. Such a calculation would have to consider the value of the infrastructure improvements made to the corridor for balancing up-front capital with ongoing operating payments.[61]

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[58] *Avoidable costs are those that are eliminated or saved if an activity is discontinued. The term "incremental" is used to reference the change in costs that results from a management action that increases volume, whereas "avoidable" defines the change in costs that results from a management action that reduces volume.*

[59] *Zeta-Tech, a subsidiary of Harsco (a supplier of track maintenance machinery) is a rail consulting firm who specializes in development of track maintenance strategies, costs and related engineering economics. See a summary of this report at* http://onlinepubs.trb.org/onlinepubs/trnews/trnews255rpo.pdf (accessed on 02/27/15). *The full report is available upon request from the FRA.*

[60] *Reducing axle loads is a common design practice for 220 mph High Speed equipment. This helps keep guideway maintenance costs low and in line with the above assumed costs. According to the French railways, the justification for such a difference was due to three causes: the uniformity of TGV rolling stock, the reduced axle loading (17 metric tons) and the strict quality conditions imposed during the construction of the line. Table 6 of this same report showed that the mixture of traffic operated over a line influences track maintenance cost much more than does the top speed. This finding is consistent with United States experience as shown by the Zeta-Tech study. See: Transportation Research Record, Railways 2008:* http://trb.metapress.com/content/gg76453p458327qr/?genre=article&id=doi%3a10.3141%2f2043-02 (accessed on 02/27/15)

[61] *For 110-mph service, the level of infrastructure improvements to the corridor called for in this study should provide enough capacity to allow superior on-time performance for both freight and passenger operations*

The Zeta-Tech report estimated a flat rate of $1.56 per train-mile. Inflated to $2012 this cost allocation equals $2.37 per train-mile and is the rate assumed for shared use of NS freight tracks. An allowance of 39.5 cents ($0.395) per train-mile (in $2002) was added by Zeta-Tech for freight railroad dispatching and out-of-pocket costs. Inflated to $2012, based on the Consumer Price Index, this dispatching and out-of-pocket cost now comes to 50.8 cents ($0.508) per train-mile[62], which is applied both to dedicated and shared tracks.

Based on these factors, the following assumptions were made:

- The total cost per track-mile for maintaining 79 mph shared track in Alternative 1A is about $48,468; the cost for 110 mph or higher speed track in Alternatives 1B, 2A or 3A rises to $58,438 per track-mile;
- Adding $26,859 per track-mile for overhead electric catenary (Alternatives 2B and 3B), the overall maintenance cost for electrified dedicated track rises to $85,297 per track mile per year. This $26,859 cost accounts for both operating and capital cost[63] for power system maintenance;
- The shared-use Alternatives 1A and 1B assume that NS would not distinguish between operating versus capital costs, and it would require the full level of support each year for maintaining the additional tracks that are added to its existing rail corridor. For the financial and economic analysis the entire $48,468-$58,438 cost per mile is treated as an operating expense in Alternatives 1A and 1B;
- For the dedicated track Alternatives 2A, 2B, 3A and 3B, the cost was broken down into separate operating and capital cost components, reflecting Generally Accepted Accounting Principles (GAAP)[64]. The operating cost component was estimated by Zeta-Tech as $27,924 per track mile; the balance of $30,514 per track mile is amortized capital cost for ongoing periodical renewals. This shows up as part of the Cyclic Maintenance in the financial and economic analysis for these alternatives (refer to Section 4.9):
    - The operating cost for the diesel Alternative 2A and 3A is $27,924 per mile and the capital cost is $30,514 per track mile; and
    - For the electric alternatives, including catenary maintenance, the operating cost for electric Alternatives 2B and 3B rises to $54,783 per track mile per year, while capital cost remains $30,514 per track mile since all overhead electrical system maintenance is accounted as operating cost.

All of these assumptions can be found in the summary table (**Exhibit 5-90**) for "Track and Electrification Maintenance."

Station Operations

A simplified fare structure and heavy reliance upon electronic ticketing will minimize station personnel requirements. Station costs include personnel, ticket machines and station operating expenses.

Staffed stations will be assumed at major stations. All stations will be assumed open for two shifts. The cost for the staffed stations includes eight positions at each new location, costing $644,640 total per year, including the cost of utilities, ticket machines, cleaning and basic facility maintenance.

The cost for unstaffed stations covers the cost of utilities, ticket machines, cleaning and basic facility maintenance, costing $80,580 per year.

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[62] *It should be noted that Freight Railroad payments include track maintenance, but also several direct payment for other services that are provided by the freight railroads. The 50.8 cents is for train dispatching services only provided by the freight railroads, and has not affiliation with track maintenance.*

[63] *Electrical catenary does not receive much capital maintenance. Catenary has to be replaced if it is torn down by a pantograph, which is an operating expense. As a result, the capital cost of catenary maintenance is a nominal number which is not worth tracking separately from the operating cost. For estimation of Cost Benefit ratios, catenary is not expected to be replaced or receive significant capital upgrades within the life of the project, in contrast to track however, which does tend to have significant capital maintenance. For this reason the capital track renewals are separately accounted for as cyclic capital, but all catenary maintenance is treated as operating expense.*

[64] *For more information regarding GAAP, visit http://www.fasab.gov/accounting-standards/authoritative-source-of-gaap/.* (accessed on 02/27/15)

Operations of Alternative 1A and 1B each assume 6 staffed stations and 6 unstaffed stations for a total of $4,270,740 for all 12 stations together. However, traffic volumes for Alternatives 2 and 3 are much higher than they are for the shared-use system. As a result, all stations are assumed staffed for these alternatives including 11 staffed stations costing $7,735,680 in total each for Alternative 2A or 2B; and 10 staffed stations costing $6,446,400 in total each for Alternative 3A or 3B.

5.10.1.4 System Overhead Costs

The category of system overhead largely consists of service administration or management overheads, covering such needs as the corporate procurement, human resources, accounting, finance and information technology functions as well as call center administration. Based on the previous Midwest Regional Rail Study for which a fully detailed administrative cost structure was developed and estimated, the overall financial model for a stand-alone organization has $14.35 million annually in fixed cost for administrative, sales and marketing expenses. In addition, the system operator was allowed a 10 percent markup on certain direct costs as an allowance for operator profit.

5.10.2Unit Cost Summary

Exhibit 5-90 provides a summary of O&M unit costs for each alternative.

Exhibit 5-90: Operating Cost Categories and Primary Cost Drivers and Related Unit Costs ($2012)

Unit Cost Category	Unit Cost Driver	Alternative 1A	Alternative 1B	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
Equipment Maintenance	Train-Miles	$15.43	$15.43	$12.70	$11.27	$12.70	$14.08
Train Crew *	Train-Miles	$6.59	$6.59	$4.92	$4.92	$4.92	$4.60
Fuel or Energy *	Train-Miles	$8.71	$8.71	$8.71	$2.80	$8.71	$2.80
On Board Services (Labor) *	Train-Miles	$3.66	$3.66	$2.56	$2.56	$2.56	$2.41
On Board Services (Goods Sold) *	% of OBS Revenue	50%	50%	50%	50%	50%	50%
Insurance	Passenger-Mile	1.4¢	1.4¢	1.4¢	1.4¢	1.4¢	1.4¢
Track (Shared)	Train-Miles over Shared Track	$2.37	$2.37	N/A	N/A	N/A	N/A
Track and Electrification (Dedicated)	Dedicated Track Miles	$48,468	$58,438	$27,924 plus Cyclic Capital[65]	$54,783 plus Cyclic Capital	$27,924 plus Cyclic Capital	$54,783 plus Cyclic Capital
Operations and Dispatch *[66]	Train-Miles	50.8¢	50.8¢	50.8¢	50.8¢	50.8¢	50.8¢
Stations *	Staffed and Unstaffed Stations	$4.27 M	$4.27 M	$7.74 M	$7.74 M	$6.45 M	$6.45 M
Administration and Management (Fixed) *	Fixed	$14.35 M	$14.35 M	$14.35 M	$14.35 M	$14.35 M	$14.35 M
Administration and Management (Variable Train-Mile) *	Train-Miles	$1.84	$1.84	$1.84	$1.84	$1.84	$1.84
Administration and Management (Call Center: Variable Riders) *	Riders	70.9¢	70.9¢	70.9¢	70.9¢	70.9¢	70.9¢
Credit Card and Travel Agency Commissions *	Percent of Revenue	2.8%	2.8%	2.8%	2.8%	2.8%	2.8%
Operator Profit Markup	Selected (*) Costs	10%	10%	10%	10%	10%	10%

[65] *Cyclic capital are identified as future capital needs*

[66] *Asterisk indicates that this cost was also included in the 10% operator profit margin, as it is a cost that the operator is responsible for and can directly control.*

5.10.3 O&M Cost Results

Similar to ridership and revenue estimates, O&M costs were forecasted for two years: 2025 and 2050. The unit costs were applied to each alternative and its associated technology options to calculate total O&M costs.

5.10.3.1 Alternative 1: Southern Crescent

The highest O&M costs were in areas of administration, equipment and track costs. All of these are largely fixed costs, which suffer a lack of economies of scale due to the low service frequency and relatively inefficient asset utilization associated with Alternatives 1A and 1B. Not enough train miles are being run to reduce the fixed costs to economical levels, so the fixed share of the overall O&M cost is very high. **Exhibits 5-91** and **5-92** illustrate the total annual O&M costs for Alternatives 1A and 1B, respectively.

Exhibit 5-91: Alternative 1A Annual O&M Costs for 2025 and 2050

O&M Costing Category	2025	2050
Train Crew	$4,414,812	$4,414,812
OBS	$3,829,929	$4,063,929
Equipment	$10,336,958	$10,336,958
Fuel	$5,955,642	$9,821,115
Track	$6,817,425	$6,817,425
Operations and Dispatch	$340,322	$340,322
Insurance	$1,443,984	$1,696,829
Call Center	$575,125	$669,926
Ticket Agents and Credit Card Communications	$960,400	$1,128,400
Stations	$4,270,740	$4,270,740
Administration	$15,582,664	$15,582,664
Operator Profit	$3,592,364	$4,029,191
TOTAL COST	$58,114,366	$63,172,313

Exhibit 5-92: Alternative 1B Annual O&M Costs for 2025 and 2050

O&M Costing Category	2025	2050
Train Crew	$4,414,812	$4,414,812
OBS	$4,235,929	$4,559,929
Equipment	$10,336,958	$10,336,958
Fuel	$5,955,642	$9,821,115
Track	$8,042,738	$8,042,738
Operations and Dispatch	$340,322	$340,322
Insurance	$1,888,831	$2,234,871
Call Center	$719,941	$836,429
Ticket Agents and Credit Card Communications	$1,248,800	$1,475,600
Stations	$4,270,740	$4,270,740
Administration	$15,582,664	$15,582,664
Operator Profit	$3,676,285	$4,130,161
TOTAL COST	$60,707,664	$66,046,341

5.10.3.2 Alternative 2: I-85

Alternative 2 has its largest costs in equipment, fuel administration and track. It should be noted that the percentages of track (10 percent of total cost) are less than the percent of track for Alternative 1 (12 percent of total cost). This is notable because Alternative 2 accounts for a double track infrastructure, whereas Alternative 1 has about one-third dedicated (single added) track and the rest is proposed as shared with existing freight track infrastructure. **Exhibit 5-93** and **Exhibit 5-94** provide the costs for Alternatives 2A and 2B for 2025 and 2050.

Exhibit 5-93: Alternative 2A Annual O&M Costs for 2025 and 2050

O&M Costing Category	2025	2050
Train Crew	$11,842,823	$14,347,216
OBS	$17,482,119	$21,133,218
Equipment	$30,569,888	$37,034,482
Fuel	$21,398,921	$42,750,039
Track	$14,252,410	$14,252,410
Operations and Dispatch	$646,664	$646,664
Insurance	$8,087,781	$9,798,099
Call Center	$3,299,056	$3,902,143
Ticket Agents and Credit Card Communications	$7,924,000	$9,567,600
Stations	$7,735,680	$4,735,680
Administration	$18,779,023	$19,715,626
Operator Profit	$8,910,829	$11,979,819
TOTAL COST	$150,929,193	$192,862,996

Exhibit 5-94: Alternative 2B Annual O&M Costs for 2025 and 2050

O&M Costing Category	2025	2050
Train Crew	$12,130,152	$$14,678,773
OBS	$17,899,624	$21,609,736
Equipment	$27,785,938	$33,623,938
Electricity	$6,459,553	$11,128,420
Track	$27,961,243	$27,961,243
Operations and Dispatch	$646,664	$646,664
Insurance	$8,284,006	$10,024,528
Call Center	$3,369,678	$3,985,339
Ticket Agents and Credit Card Communications	$8,111,600	$9,780,400
Stations	$7,735,680	$7,735,680
Administration	$18,886,480	$19,839,623
Operator Profit	$7,523,943	$8,940,463
TOTAL COST	$146,794,561	$169,954,807

5.10.3.3 Alternative 3: Greenfield

As discussed in previous sections, Alternative 3 performs better than both Alternatives 1 and 2 from a travel time, ridership and revenue perspective due to the geometry of the corridor. O&M costs also reflect these differences. Track costs are higher, reflecting the added cost for catenary maintenance in Alternative 3B; however, this is offset by the large savings in fuel costs (in spite of their higher overall energy consumption of the electrified train sets).

Equipment maintenance cost is also higher since ridership is higher, and more trains are required. Finally, the electrified trains use more power (e.g., larger transformers, more powerful traction motors) that has to be maintained, thereby increasing the average maintenance cost per train set. **Exhibit 5-95** and **Exhibit 5-96** illustrate the costs for Alternatives 3A and 3B for 2025 and 2050.

Exhibit 5-95: Alternative 3A Annual O&M Costs for 2025 and 2050

O&M Costing Category	2025	2050
Train Crew	$13,469,055	$15,565,581
OBS	$19,112,289	$22,835,164
Equipment	$34,767,683	$40,179,446
Fuel	$24,337,378	$46,380,369
Track	$15,313,522	$15,313,522
Operations and Dispatch	$1,390,707	$1,390,707
Insurance	$8,696,013	$10,630,153
Call Center	$3,250,033	$3,812,858
Ticket Agents and Credit Card Communications	$8,472,800	$10,315,200
Stations	$6,446,400	$6,446,400
Administration	$19,387,208	$20,171,274
Operator Profit	$9,586,587	$12,691,755
TOTAL COST	$164,229,673	$205,732,429

Exhibit 5-96: Alternative 3B Annual O&M Costs for 2025 and 2050

O&M Costing Category	2025	2050
Train Crew	$17,315,401	$17,512,891
OBS	$23,775,764	$26,799,232
Equipment	$53,000,184	$53,604,677
Electricity	$9,862,250	$14,200,671
Track	$30,042,997	$30,042,997
Operations and Dispatch	$1,912,223	$1,912,223
Insurance	$10,639,655	$12,792,025
Call Center	$3,805,015	$4,463,502
Ticket Agents and Credit Card Communications	$10,292,800	$12,336,800
Stations	$6,446,400	$6,446,400
Administration	$21,276,160	$21,355,157
Operator Profit	$9,468,601	%10,502,688
TOTAL COST	$197,837,451	$211,969,263

Exhibit 5-97 illustrates a summary of annual O&M costs by alternative.

Exhibit 5-97: Summary of O&M Annual Costs for 2025 and 2050 (in millions)

	Alternative 1A		Alternative 1B		Alternative 2A		Alternative 2B		Alternative 3A		Alternative 3B	
	2025	2050	2025	2050	2025	2050	2025	2050	2025	2050	2025	2050
Train Crew	$4.41	$4.41	$4.41	$4.41	$11.84	$14.35	$12.13	$14.68	$13.47	$15.57	$17.32	$17.51
OBS	$3.83	$4.06	$4.24	$4.56	$17.48	$21.13	$17.90	$21.61	$19.11	$22.84	$23.78	$26.80
Equipment	$10.34	$10.34	$10.34	$10.34	$30.57	$37.03	$27.79	$33.62	$34.77	$40.18	$53.00	$53.60
Fuel	$5.96	$9.82	$5.96	$9.82	$21.40	$42.75	$6.46	$11.13	$24.34	$46.38	$9.86	$14.20
Track	$6.82	$6.82	$8.04	$8.04	$14.25	$14.25	$27.96	$27.96	$15.31	$15.31	$30.04	$30.04
Operations and Dispatch	$0.34	$0.34	$0.34	$0.34	$0.65	$0.65	$0.65	$0.65	$1.39	$1.39	$1.91	$1.91
Insurance	$1.44	$1.70	$1.89	$2.23	$8.09	$9.80	$8.28	$10.02	$8.70	$10.63	$10.64	$12.79
Call Center	$0.58	$0.67	$0.72	$0.84	$3.30	$3.90	$3.37	$3.99	$3.25	$3.81	$3.81	$4.46
Ticket Agents / Credit Card	$0.96	$1.13	$1.25	$1.48	$7.92	$9.57	$8.11	$9.78	$8.47	$10.32	$10.29	$12.34
Stations	$4.27	$4.27	$4.27	$4.27	$7.74	$4.74	$7.74	$7.74	$6.45	$6.45	$6.45	$6.45
Administration	$15.58	$15.58	$15.58	$15.58	$18.78	$19.72	$18.89	$19.84	$19.39	$20.17	$21.28	$21.36
Operator Profit	$3.59	$4.03	$3.68	$4.13	$8.91	$11.98	$7.52	$8.94	$9.59	$12.69	$9.47	$0.11
TOTAL COST	$58.11	$63.17	$60.71	$66.05	$150.93	$192.86	$146.79	$169.95	$164.23	$205.73	$197.84	$211.97

5.11 FINANCIAL RESULTS

The operating financial performance of the system influences economic evaluation. Financial performance refers to the overall revenues, costs, and any surplus or deficits for each alternative. Operating surpluses indicate a positive indicator of financial stability, while deficits indicate the need for assistance (e.g., public subsidy). An explanation of the revenues and costs that feed into the financial analysis is presented below:

- **System Revenues**: include the farebox revenues and revenues from onboard food sales. Revenues were derived from the ridership and revenue analysis described in **Section 5.5**.
- **Operating Costs**: These are the O&M costs associated with running the train schedules and include onboard service costs. The O&M Costs are described in **Section 5.9.3**.

As a result, the operating surplus, which is defined as revenues minus O&M costs, makes an important contribution to the overall business case for building the system.

If the operating surplus is positive, the system will not require an operating subsidy and will be able to make a contribution towards its own capital costs. In addition, because the system is generating a positive cash flow, a Public-Private Partnership (P3) or other innovative financing method can be used to construct and operate the system.

If the operating surplus is negative, the system will not only require a grant of capital to build the system, but in addition, will require an ongoing operating subsidy. Subsidies reduce the economic performance of the system and offset part of the economic benefits. **Exhibit 5-98** provides the overall revenues, costs and operating surplus for each alternative in 2025 and 2050.

Following operating surplus, the operating ratio was also calculated for each alternative. Positive operating ratios (>1.0) indicate an operating surplus, while negative ratios (<1.0) indicate an operating deficit. **Exhibit 5-99** summarizes the operating financial results, showing Net Present Value (NPV) over the 30-year life of the system as well as operating ratios. Refer to **Appendix I** for the methodology regarding NPV calculations. The NPV is strongly influenced by interest rate assumptions as it shows the “up front” amount of capital that would be equivalent to the ongoing cash flow generated from operations. In concept, this is the amount of cash that could be raised by issuing a revenue bond on the anticipated operating surplus of the system. A three percent interest rate reflects the cost of long-term government bonds. An additional rate of seven percent was also applied as a conservative approach that understates the value of the project.

Exhibit 5-98: Alternative Operating Surplus for 2025 and 2050 (in millions)

	Alternative 1A		Alternative 1B		Alternative 2A		Alternative 2B		Alternative 3A		Alternative 3B	
	2025	2050	2025	2050	2025	2050	2025	2050	2025	2050	2025	2050
Ticket Revenue	$34.3	$40.3	$44.6	$52.7	$283.0	$341.7	$289.7	$349.3	$302.6	$368.4	$367.6	$440.6
OBS Revenue	$2.7	$3.2	$3.6	$4.2	$22.6	$27.3	$23.2	$28.0	$24.2	$29.5	$29.4	$35.2
TOTAL REVENUE	$37.0	$43.5	$48.2	$56.9	$305.6	$369.0	$312.8	$377.2	$326.8	$397.9	$397.0	$475.8
TOTAL O&M COST	$58.1	$63.2	$60.7	$66.1	$150.9	$192.9	$146.8	$170.0	$164.2	$205.7	$197.8	$212.0
OPERATING SURPLUS (DEFICIT)	($21.1)	($19.6)	($12.5)	($9.1)	$154.7	$176.1	$166.1	$207.3	$162.6	$192.1	$199.2	$263.9

Exhibit 5-99: Financial Summary of Alternatives (2012$)

Alternative	3% Interest Rate NPV (in millions)	3% Interest Rate Operating Ratio	7% Interest Rate NPV (in millions)	7% Interest Rate Operating Ratio
Alternative 1A (79 mph)	($250.6)	0.67	($105.7)	0.66
Alternative 1B (110 mph)	($133.2)	0.83	($57.3)	0.82
Alternative 2A (125 mph)	$2,339.6	2.04	$969.2	2.05
Alternative 2B (220 mph)	$2,898.8	2.31	$1,193.4	2.30
Alternative 3A (125 mph)	$2,537.3	2.07	$2,040.5	2.08
Alternative 3B (220 mph	$3,691.8	2.33	$1,521.7	2.32

Alternatives 1A and 1B have an operating ratio of less than 1.00 and require an operating subsidy equivalent to $57 million to $250 million over the 30-year life of the system. This operating subsidy amount is in addition to the capital needed to construct the system.

Alternatives 2A and 2B have an operating ratio in the range of 2.04 to 2.31 and generate an operating surplus NPV over the 30-year life of the system in the $1 billion to $2 billion range, depending on the interest rate assumption.

Alternatives 3A and 3B also have an operating ratio in the range of 2.07 to 2.33 and generate an operating surplus NPV in the $1.5 billion to $3.7 billion range. Alternative 3B generates about 50 percent more operating surplus than Alternative 3A. This suggests that the system could fund between 17 and 44 percent of its own capital requirement directly from operating revenues in addition to any capital that might be provided by P3 partners.

5.12 DEMAND SIDE ECONOMIC ANALYSIS

The demand side economic analysis develops a cost-benefit evaluation for the project that compares the overall costs of the project (i.e., capital and O&M) and overall benefits (e.g., revenue and non-monetary such as congestion reduction) to determine if the alternative's benefit outweighs the cost. The analysis was completed using data derived from the ridership and revenue forecasts, capital cost estimates and O&M cost estimates. In addition, the benefit-cost analysis calculated other factors, including:

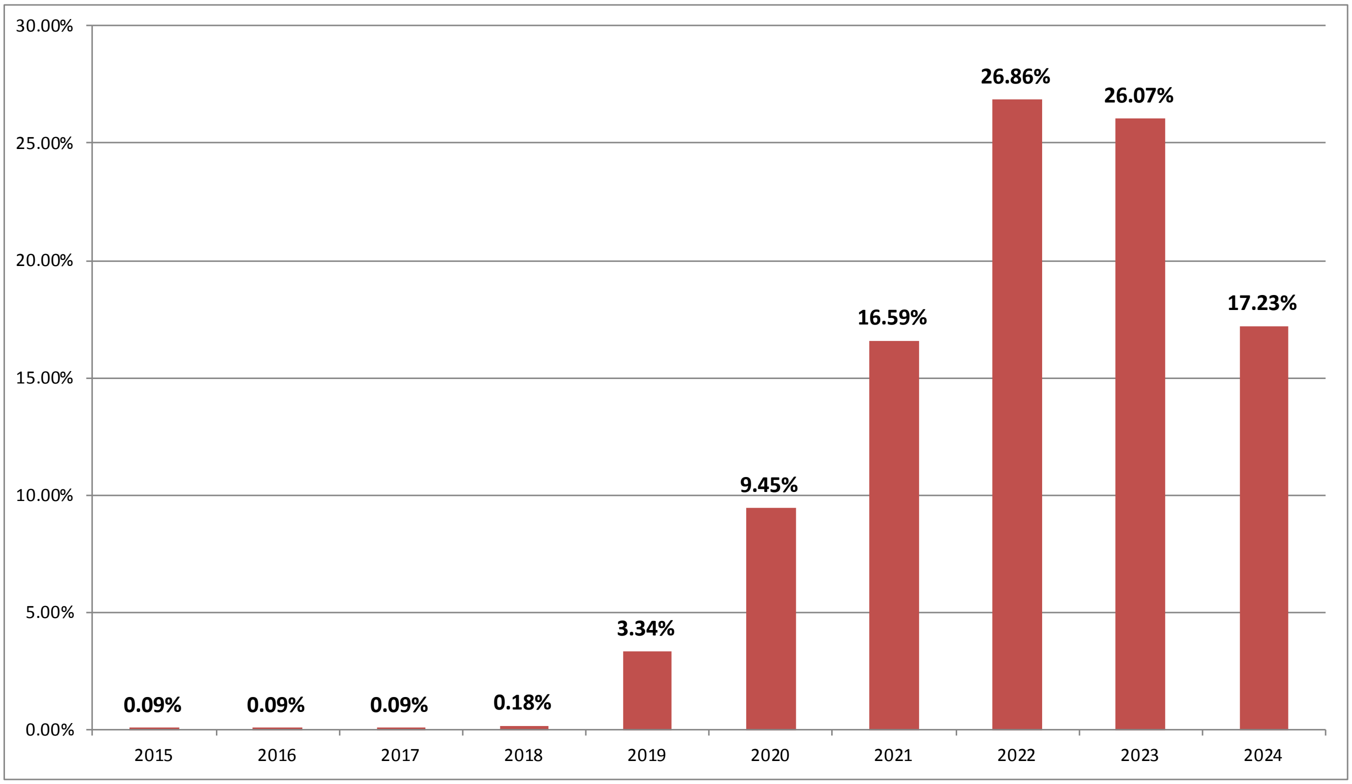
- Consumer surplus;
- Highway congestion savings;
- Airport delay savings;
- Safety benefits; and
- Reduced emissions.

The analysis evaluated economic cash flows for the period of 2025 to 2050 (the assumed life of the project). The economic cash flows were discounted at three and seven percent in line with the Office of Management and Budget (OMB) requirements. Refer to **Appendix I** for the methodology on the economic analysis and estimates for each of the factors above.

The benefit-cost ratio was used to evaluate the economic returns of the system. Similar measures, NPV and operating ratio, were used to evaluate the financial returns and the potential for franchising the operations. Benefit cost ratios are usually expressed as a Present Value of Total Benefit/Present Value of Total Cost over the lifetime of a project.

The development of each alternative requires the spending of capital over the implementation period. For the purpose of this study, it was assumed that the capital costs were spent over a 10-year period with the distribution shown in **Exhibit 5-100**. It can be seen that the costs begin small and gradually build during the planning period to 2018 and then accelerate during the design and construction period. Over 70 percent of the funds will be spent in the last three years of the implementation period as construction occurs.

Exhibit 5-100: Capital Cost Distribution



5.12.1 Alternative 1: Southern Crescent

The demand side economic analysis results for Alternatives 1A and 1B are shown in **Exhibit 5-101**. It can be seen that the present value of the benefits (outlined in Section 5.6) are lower than the present value of the capital and operating costs for both 1A (79 mph) and 1B (110 mph). As a result, the NPV for both options are negative, and the benefit-cost ratios are less than 1.0 in both scenarios. These low results are in line with the NPV and cost-benefit results where track geometry prevents competitive passenger train speeds.

Exhibit 5-101: Alternatives 1A and 1B Economic Analysis Results (in millions 2012$)

Alternatives 1A and 1B	Alternative 1A 3% Discount Rate	Alternative 1A 7% Discount Rate	Alternative 1B 3% Discount Rate	Alternative 1B 7% Discount Rate
Benefits to Users				
System Passenger Revenues	$461.77	$190.91	$601.97	$248.75
OBS	$36.94	$15.27	$48.16	$19.90
Total Operating Revenues	$498.71	$206.18	$650.13	$268.65
Users Consumer Surplus	$501.74	$207.47	$645.19	$266.65
Total User Benefits	$1,000.45	$413.65	$1,295.31	$535.30
Benefits to Public at Large				
Highway Congestion Savings	$105.34	$43.62	$128.92	$53.38
Airport Delay Savings	$51.29	$20.99	$84.49	$34.65
Safety Benefits	$160.36	$66.40	$204.29	$84.57
Highways reduced Emissions	$33.97	$1383	$43.29	$17.62
Total Public at Large Benefits	$350.95	$144.84	$460.99	$190.21
Total Benefits	$1,351.41	$558.49	$1,756.30	$725.52
Costs				
Capital Costs	$1,404.97	$958.69	$1,581.92	$1,079.43
O&M Costs	$749.35	$311.87	$783.35	$325.99
Cyclic Capital	$0.00	$0.00	$0.00	$0.00
Total Costs	$2,154.32	$1,270.56	$2,356.27	$1,405.42
Project Benefit/Cost Ratio	0.63	0.44	0.74	0.52
Benefits Less Costs	($802.91)	($712.07)	($608.97)	($679.90)

5.12.2 Alternative 2: I-85

The results for Alternatives 2A and 2B are shown in **Exhibit 5-102**. It shows that while the present value of the benefits are substantial for both Alternative 2A (125 mph) and Alternative 2B (220 mph), the present value of the benefits are lower than the present value of the costs. The infrastructure cost for Alternative 2 is quite substantial due to the lack of a median through most of South Carolina, compounded by geometric restrictions. Due to the high capital costs, Alternatives 2A and 2B result in negative NPV and cost benefit ratios less than 1.0.

Exhibit 5-102: Alternatives 2A and 2B Economic Analysis Results (in millions 2012$)

Alternatives 2A and 2B	Alternative 2A		Alternative 2B	
	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate
Benefits to Users				
System Passenger Revenues	$4,242.66	$1,750.15	$4,734.95	$1,953.45
OBS	$339.41	$140.01	$378.80	$156.28
Total Operating Revenues	$4,528.08	$1,890.16	$5,113.74	$2,109.72
Users Consumer Surplus	$4,162.47	$1,718.23	$4,678.60	$1,933.32
Total User Benefits	$8,744.54	$3,608.39	$9,792.34	$4,043.04
Benefits to Public at Large				
Highway Congestion Savings	$527.31	$218.61	$587.26	$243.45
Airport Delay Savings	$889.25	$363.49	$984.73	$402.95
Safety Benefits	$913.30	$378.48	$1,022.17	$423.60
Highways reduced Emissions	$19.44	$8.40	$21.86	$9.44
Total Public at Large Benefits	$2,349.30	$968.97	$2,616.00	$1,079.45
Total Benefits	$11,093.84	$4,577.36	$12,408.34	$5,122.49
Costs				
Capital Costs	$9,821.99	$6,702.11	$11,389.45	$7,771.68
O&M Costs	$2,242.46	$920.93	$2,214.95	$916.30
Cyclic Capital	$0.18	$0.06	$0.18	$0.06
Total Costs	$12,064.63	$7,623.10	$13,604.58	$8,688.04
Project Benefit/Cost Ratio	0.92	0.60	0.91	0.59
Benefits Less Costs	($970.79)	($3,045.73)	($1,196.24)	($3,565.55)

5.12.3 Alternative 3: Greenfield

Alternatives 3A and 3B offer a lower capital cost than Alternatives 2A and 2B. As a result, Alternatives 3A and 3B generate positive results. The NPV for both alternatives is positive with Alternative 3B resulting in higher values, although lower benefit-cost ratio than Alternative 3A (at the 7 percent discount rate). It should be noted that after 25 years, the NPV for the project will be especially positive as most elements have a much longer life than the assumed 25 years. The results are shown in **Exhibit 5-103**.

Exhibit 5-103: Alternatives 3A and 3B Economic Analysis Results (in millions 2012$)

Alternatives 3A and 3B	Alternative 3A 3% Discount Rate	Alternative 3A 7% Discount Rate	Alternative 3B 3% Discount Rate	Alternative 3B 7% Discount Rate
Benefits to Users				
System Passenger Revenues	$4,553.46	$1,877.10	$5,992.11	$2,473.29
OBS	$364.28	$150.17	$479.37	$197.86
Total Operating Revenues	$4,917.74	$2,027.27	$6,471.48	$2,671.15
Users Consumer Surplus	$4,347.96	$1,794.33	$5,737.44	$2,369.89
Total User Benefits	$9,265.70	$3,821.60	$12,208.92	$5,041.04
Benefits to Public at Large				
Highway Congestion Savings	$509.40	$211.38	$651.56	$270.36
Airport Delay Savings	$930.87	$380.92	$1,129.51	$462.11
Safety Benefits	$863.96	$358.42	$1,149.37	$476.68
Highways reduced Emissions	$182.94	$74.62	$243.39	$99.25
Total Public at Large Benefits	$2,487.18	$1,025.34	$3,173.83	$1,308.40
Total Benefits	$11,752.88	$4,846.93	$15,382.75	$6,349.44
Costs				
Capital Costs	$4,413.81	$3,011.79	$6,105.83	$4,166.36
O&M Costs	$2,380.43	$976.77	$2,779.66	$1,149.41
Cyclic Capital	$0.18	$0.06	$0.18	$0.06
Total Costs	$6,794.40	$3,988.61	$8,885.66	$5,315.83
Project Benefit/Cost Ratio	1.73	1.22	1.73	1.19
Benefits Less Costs	$4,958.48	$858.32	$6,497.09	$1,033.61

5.12.4Summary

The results of the demand side economic evaluation show that Alternative 3B (220 mph) provides the best financial and economic results. **Exhibit 5-104** shows Alternatives 1A and 1B cannot perform at a level that is competitive with other travel modes. This is a result of the numerous curves along the Southern Crescent existing rail corridor, preventing trains from attaining an auto-competitive speed. Further, the high capital costs associated with Alternatives 2A and 2B are due to long portions of the interstate highway route that lacks a median strip, resulting in high costs of an elevated viaduct along a narrow strip of land that remains within the interstate ROW.

Exhibit 5-104: Benefit-Cost Summary of Alternatives (2012$)

Alternative	3% Discount Rate NPV (in millions)	3% Discount Rate B/C Ratio	7% Discount Rate NPV (in millions)	7% Discount Rate B/C Ratio
Alternative 1				
Alternative 1A (79 mph)	($802.9)	0.63	($712.1)	0.44
Alternative 1B (110 mph)	($609.0)	0.74	($679.9)	0.52
Alternative 2				
Alternative 2A (125 mph)	($970.8)	0.92	($3,045.7)	0.60
Alternative 2B (220 mph)	($1,196.2)	0.91	($3,565.6)	0.59
Alternative 3				
Alternative 3A (125 mph)	$4,958.5	1.73	$858.3	1.22
Alternative 3B (220 mph)	$6,497.1	1.73	$1,033.6	1.19

5.13 PHASE 2: REFINEMENT SUMMARY

Exhibit 5-105 provides a summary of the refinement results presented above.

The full build out of the Southern Crescent alternative (Alternative 1B) provides the lowest level of service with four round trips and a travel time that is not competitive with the corridor highway travel time (3 hours, 52 minutes). This is reflected in ridership which is the lowest of the three route alternatives. Alternative 1B also generates a significant annual operating deficit. On the other hand, it has the lowest capital cost. In spite of its relatively low capital cost, it has the lowest benefit-cost ratio of the three alternatives.

The full build out of the I-85 alternative (Alternative 2B) provides a much improved level of service with 14 round trips and a travel time significantly less than auto. It also has the second highest ridership. On the other hand, it has the highest capital cost. It generates an annual operating surplus which could be used to finance a portion of its project costs (7.7 percent of total capital cost at a NPV discount of 7 percent). Largely because of its relatively high capital cost, the benefit-cost ratio for Alternative 2B is less than one for both 7 percent and 3 percent discount rates.

The full build out of the Greenfield alternative (Alternative 3B) provides the highest level of service with 22 round trips and an express travel time of just over 2 hours, significantly less than auto and potentially competitive with air when access and security clearance times are included. It has the highest ridership and the second highest capital cost. It generates the highest annual operating surplus which could be used to finance a significant portion of its project costs (18.1 percent of total capital cost at a NPV discount rate of 7 percent). The benefit-cost ratio for Alternative 3B is greater than one for both the 7 percent and 3 percent discount rates.

Exhibit 5-105: Summary of Results

Alternative	Frequency	End to End Travel Time (hrs:min)	2025 Ridership	2025 Revenue [67]	Capital Cost (2012$)	2025 Annual O&M Cost (2012$)	2025 Operating Surplus (Deficit) (2012$)	2025 Operatin g Ratio	NPV Operating Surplus (3%/7% Rate) (2012$)	Benefit/Cost Ratio (3%/7% Rate)
Alternative 1A: Southern Crescent (79 mph)	4	5:34	0.81M	$37.0M	$2.0B	$58.1M	($21.1M)	0.64	($250.6)/($105.7)M	0.63/0.44
Alternative 1B: Southern Crescent (110 mph)	4	4:35	1.01M	$48.2M	$2.3B	$60.7M	($12.5M)	0.79	($133.2)/($57.3)M	0.74/0.52
Alternative 2A: I-85 (125 mph)	14	2:50	4.65M	$305.6M	$13.3B	$150.9M	$154.7M	1.98	$2,339.6/$969.2M	0.92/0.60
Alternative 2B: I-85 (220 mph)	14	2:42	4.75M	$312.8M	$15.4B	$146.8M	$166.1M	1.88	$2,898.8/$1,193.4M	0.91/0.59
Alternative 3A: Greenfield (125 mph)	16	2:44	4.58M	$326.8M	$6.2B	$164.2M	$162.6M	2.03	$2,537.3/$2,040.5M	1.73/1.22
Alternative 3B: Greenfield (220 mph)	22	2:06	5.37M	$397.0M	$8.4B	$197.8M	$199.2M	1.99	$3,691.8/$1,521.7M	1.73/1.19

[67] *Revenue includes tickets and on-board services*

6. IMPLEMENTATION AND PHASING

Implementation and phasing plans are important to every passenger rail corridor, as it provides a means to help reduce initial capital costs, making these investments more feasible for USDOT as well as states and other funding sources. It should be noted that while this ADR discusses potential phasing and implementation strategies, none are recommended for the alternatives. Once a preferred alternative is recommended in the Tier 1 EIS, more specific strategies will be discussed as a part of the SDP. Further, a detailed implementation and phasing plan will be developed as a part of the Tier 2 NEPA documentation once the specific alignment is identified.

6.1 CORRIDOR PHASING

6.1.1 Technology Phasing

As noted earlier in the ADR, the first phasing opportunity for all three alternatives (and any corridor alternative) is the phasing of technologies. This report outlines two technology options for each alternative, with the strategy to start service with a lower (less expensive) technology and upgrade to the higher speed technologies as ridership and revenue increase. It was seen in Chapter 4 of the ADR that the electrification of Alternatives 2 and 3 had significant costs. Starting service with a diesel technology would allow for the addition of this electrification (and its associated costs) for a later date when more capital investment may be identified. Similarly, infrastructure improvements could be made over time to allow top speeds for Alternative 1 to increase from 79 to 110 mph.

6.1.2 Section Phasing

Another option for phasing the alternatives is to construct certain sections first as "Independent Operating Sections" to deliver HSR service on the corridor as capital funding becomes available or to accommodate the transportation needs of the three states along the route. As discussed in Section 4 of this ADR, the Tier 1 EIS contemplates the benefits of the full corridor service from Charlotte Gateway Station to H-JAIA; however, the Tier 1 EIS will defer the selection of the physical approach alignment into Atlanta to a Tier 2-level study. Depending on the results of the Tier 2-level study for the Atlanta approach, each alternative could be developed with an initial phase while constructing the main corridor alignments between Atlanta and Charlotte. Conversely, depending on the results of the Tier 2 study, a common urban alignment from H-JAIA to suburban Atlanta or the ex-urban region (Gainesville, Commerce or Athens) could be implemented in an earlier phase. On the north end of the corridor, an earlier section could connect with the existing passenger rail service in Charlotte and extend to Gastonia or into South Carolina. A central segment along the corridor in South Carolina could also be considered.

6.1.3 Frequency Phasing

In order to reduce O&M costs in the first few years of operation while ridership "ramps up" or gradually increases to full estimated volumes, service frequencies could be reduced from what is projected in this ADR and future operating plans. This allows the frequency to meet the demand and help reduce these annual costs, helping to prevent an operating subsidy. As ridership increases, frequencies can also increase to meet the demand.

6.2 INTERIM ACTIVITIES

In addition to phasing, there are interim activities that can occur along a corridor to help with the successful implementation of passenger rail service.

The first is to develop official maps to preserve routes, especially in areas where ROW must be acquired. The first step would be to incorporate the preferred route into a state document (e.g., State Rail Plan), and then coordinate with MPOs, districts, regions, counties and local municipalities to include in their transportation plans and land use plans. This will help preserve the corridor (although may not prevent) from future development or construction of other transportation infrastructure.

In conjunction with preserving the corridor, another activity that can start once a preferred alternative is identified, is beginning the process of acquiring the necessary additional ROW associated with that route. This can be a long process, especially for routes where significant ROW is needed; therefore, in order to help expedite the implementation, the earlier this task can get started, the more likely construction will stay on schedule.

Finally, highway and bridge programs may be adjusted in the future to reflect the structure and ROW needs for passenger rail routes. For example, as bridges require replacement, the program may be adjusted so that those bridges along a future passenger rail corridor fit the design specifications to accommodate passenger trains. Additionally, should interstates expand with additional lanes, the program could be adjusted to take into account the space needed for passenger rail.

While all of these options may help with implementation of passenger rail, details regarding a specific implementation and phasing plan will not occur until the preferred alignment within a route is identified in Tier 2 NEPA documentation.

7. ATLANTA TO CHARLOTTE PRCIP NEXT STEPS

Following this ADR, the Atlanta to Charlotte corridor will undergo Phase 3 of the process in which the refined alternatives will be evaluated and compared to one another and will include an environmental analysis in the Tier 1 EIS. An Administrative Draft EIS (DEIS) will be completed including all environmental technical reports. Following an Administrative DEIS, revisions will be made and a full DEIS will become available to the public for comment. During this comment period, a series of public meetings will be held along the corridor. Once all comments are received, revisions will again be made to develop the Final EIS (FEIS). The FRA will then take the FEIS and draft a Record of Decision (ROD).

Concurrently to the FEIS process, the SDP will be developed for the preferred alternative to outline an updated operating plan and forecasts. The SDP will describe the major aspects of the proposed service required to support a funding decision. The SDP will include the following elements for the preferred alternative:

- Refined/updated conceptual engineering and capital cost estimates;
- Refined/updated operating plan (includes rolling stock, fleet plan, maintenance facility(ies), and stations);
- Refined/updated ridership and revenue estimates;
- Refined/updated user and non-user benefits;
- Detailed corridor phasing and implementation plan describing future environmental, design, equipment procurement and construction with annual estimates of associated capital costs ; and
- Financial plan including a schedule of required capital funding and suggested funding sources for future planning, design, construction and capital maintenance based on the phasing and implementation plan.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX

Georgia Department of Transportation

Prepared on behalf of the

U.S. Department of Transportation
Federal Railroad Administration

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX A: ALTERNATIVE DEVELOPMENT TECHNICAL MEMORANDUM (Methodology)

May 2013

GDOT
Georgia Department of Transportation

Prepared on behalf of the

U.S. Department of Transportation
Federal Railroad Administration

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1. OVERVIEW

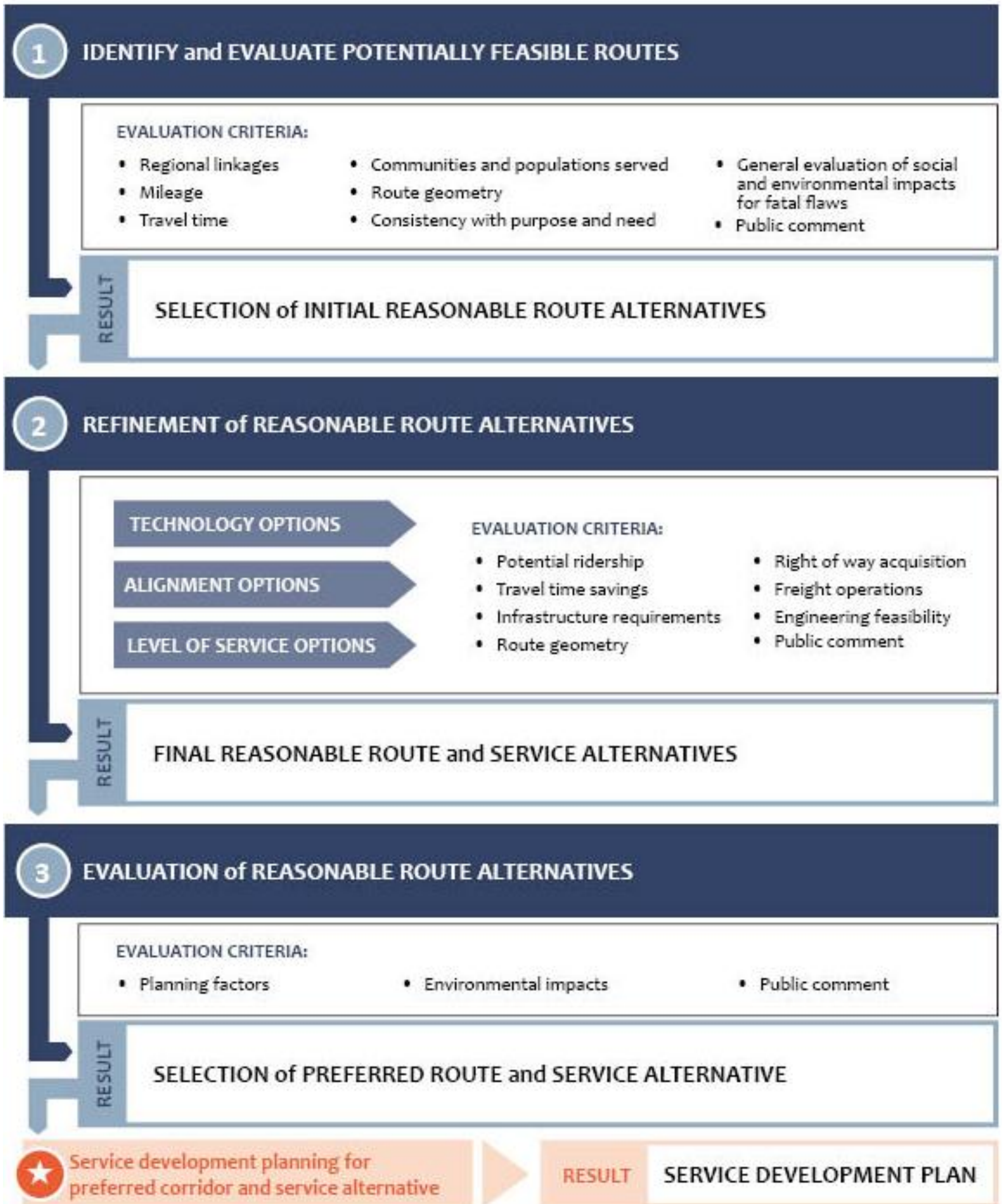
The Alternatives Screening and Evaluation Methodology for the Atlanta to Charlotte Passenger Rail Corridor Investment Plan (PRCIP) is focused on identifying and evaluating corridor alternatives that provide high-speed intercity passenger rail service terminating in the Atlanta, GA and Charlotte, NC metropolitan areas. The evaluation of corridor alternatives occurs at three levels (phases) following increasingly detailed consideration of technical and environmental factors leading to the selection of a preferred alternative and the preparation of a detailed Service Development Plan (SDP). Three phases of analysis are: 1) the identification and evaluation of potentially feasible corridors leading to the selection of an initial subset of reasonable corridor alternatives, 2) the refinement of reasonable corridor and service alternatives[1], and 3) the comparative evaluation of the reasonable corridor alternatives to select a preferred alternative.

A flow chart summary of the overall alternatives evaluation methodology is shown in Figure 1 on the following page.

This analysis will be performed in compliance with the Federal Railroad Administration's (FRA) Procedures for Considering Environmental Impacts 64 FR 101 (26 May 1999) pp. 28545-28556, the Council on Environmental Quality (CEQ) Regulations (40 CFR parts 1500 et seq.), and the U.S. Department of Transportation (USDOT) Order 5610.1C. Since one of the alternatives being considered is within and adjacent to I-85 and other alternatives will cross interstates, Federal Highway Administration (FHWA) environmental impact and related procedures (23 CFR 771) will be considered as well as USDOT FHWA Advisory T6640.8A, Guidance for Preparing and Processing Environmental Documents and Section 4(F) Documents; Federal-Aid Policy Guide 23 CFR 770, 772, and 777; and SAFETEA-LU, and other applicable state and federal regulations.

[1] *Service alternatives refers to the frequency, speed, station stops, and other operating characteristics of the high-speed intercity passenger rail service.*

Figure 1-1: Summary of Alternatives Screening and Evaluation Methodology[2]



2 *Refer to Section 4, Table 4-1 for the various planning factors and environmental impacts (Step 3) to be used in the evaluation*

2. IDENTIFICATION AND EVALUATION OF THE POTENTIALLY FEASIBLE ROUTES (PHASE I)

As a first step, the project team will identify an initial universe of potentially feasible corridor alternatives within the study area.

The 2008 Volpe Center Report "Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor" evaluated a variety of corridor and technology options. Based on this work, two build alternatives have been initially identified: 1) the existing freight rail route owned by Norfolk Southern Railroad (NS), which is currently used by Amtrak to provide passenger rail service and 2) the I-85 interstate highway route which offers the opportunity to take advantage of grade-separated, publicly owned right-of-way between Atlanta and Charlotte. A yet to be identified "greenfield" corridor is a third build alternative which offers the opportunity to define a fully grade separated corridor which has optimal geometric characteristics for high-speed passenger rail service. Other potential possible corridors may also be identified as part of the scoping and public and stakeholder input process if they meet the basic requirements of the Purpose and Need Statement for the study area.

2.1 PHASE I EVALUATION CRITERIA

The universe of potentially feasible build alternatives will be compared and evaluated by a *qualitative* process to select an initial set of reasonable alternatives for further evaluation based on the following qualitative and quantitative criteria:

2.1.1 Consistency with Purpose and Need

Does the alternative support the basic requirements of the Purpose and Need Statement for the study area. Are there any aspects of the proposed alternative which are inconsistent to the Purpose and Need?

2.1.2 Regional Linkages and Connectivity

Does the alternative provide efficient and feasible connectivity between Atlanta and Charlotte, as well as other significant metropolitan areas? Does the alternative have the potential to provide connectivity between the existing and planned regional and national rail network? Does the alternative provide intermodal connectivity to other modes such as auto, air and local transit?

2.1.3 Communities and Population Centers Served

As a measure of regional linkages and connectivity, which communities, population centers and trip generators in the study area are served by the alternative? Are there important population/community centers that are not served?

2.1.4 Mileage

What is the alternative's length? A comparison of alternative route lengths can serve as a measure of potential infrastructure costs, as well as possible indirection. A more direct route will have better regional linkages and connectivity. Route length also can serve as an indicator of travel time.

2.1.5 Travel Time

What is the estimated travel time for the alternative assuming various rail technologies? A train performance calculator will be used to calculate travel times as appropriate for shared-use operations on FRA Class 6 track, diesel-electric operations on FRA Class 7 fully grade separated dedicated track, and electrified operations on FRA Class 9 dedicated track. Next Generation Passenger Rail Equipment specifications will be reviewed to aid in establishing equipment performance profiles for train performance calculations. See below to Section 3.1 for a more detailed description of the FRA Railroad Classes.

2.1.6 Alternative Geometry

What is the number and severity of curves in the alternative which might limit top speeds and travel times? To evaluate this, the number and mileage of curves greater than 1 degree 30 minutes will be identified for shared-use alternatives and those greater than 15 minutes will be identified for grade separated alternatives. Limiting grades will also be identified as appropriate.

2.1.7 General Evaluation of Environmental and Social Impacts for Potential Fatal Flaws

Does the alternative have environmental or social impacts which could be considered fatal flaws, removing it from further consideration?

2.2 PHASE I SELECTION OF REASONABLE ROUTE ALTERNATIVES

A matrix will be developed comparing each build alternative by the above criteria and other criteria as appropriate. The matrix will be established so that the alternatives can be comparatively evaluated for each of the criteria and a subset of initial "reasonable" alternatives can be selected. Per guidance from the Council of Environmental Quality, "reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant".[3]

3. REFINEMENT OF REASONABLE ALTERNATIVES (PHASE II)

After the initial selection, the reasonable alternatives will be further refined from a number of perspectives before they are comparatively evaluated. This includes consideration of the technologies that will be assigned to each alternative, detailed route options for each alternative and level of service alternatives in terms of schedules, frequencies and station stops. This refinement activity will largely be based on technical, engineering, and level of service considerations.

3.1 PHASE II TECHNOLOGY OPTIONS

Each build alternative will be evaluated to determine its suitability for the application of three broad operating technologies:

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[3] *46 Fed. Reg. 18026, "NEPA's Forty Most Asked Questions"*

1. Diesel-electric equipment, operating primarily on right-of-way owned by existing freight railroads on a shared-use basis (Class 6 track).
2. Diesel-electric equipment, operating on a grade-separated route designed to geometric standards which would allow full electrification at a later date (Class 7 track).
3. Electrified high speed rail equipment, operating on a fully graded-separated route (Class 9 track).

Next Generation Passenger Rail Equipment specifications will be reviewed as a point of departure for each of these equipment categories.

Evaluation Criteria:

- Alternative geometry (number and severity of curves greater than technology standard),
- Land takings required to meet minimal geometric standards,
- Impact on freight rail operations, and
- Engineering feasibility.

3.2 PHASE II ALIGNMENT OPTIONS

Within each route alternative, there are a number of potential route options that may be considered for access to potential station locations.

3.2.1 Access to Atlanta and Charlotte Terminal Areas

Multimodal Passenger Terminal (MMPT) in Atlanta: While the NS or CSX right-of-way may offer connectivity to the downtown Atlanta area for the I-85 route and greenfield alternatives, the alternative routes providing direct access into the MMPT will be determined as a part of the MMPT master development project.

Charlotte Gateway Station (CGS): There may be multiple approaches that could be used to access the CGS from the NS, I-85 or greenfield routes.

Evaluation Criteria:

- Engineering feasibility,
- Impact on freight rail operations, and
- Impact on existing development including right-of-way acquisition.

3.2.2 Intermediate Station Access

Alternative routes will be examined with regard to providing access to potential station locations in intermediate cities and towns.

Evaluation Criteria:

- High level analysis of suburban, central business district and other locations based on:
- Ridership potential,
- Intermodal connectivity, and
- Engineering feasibility

3.2.3 Connectivity to Atlanta, Charlotte, and Greenville-Spartanburg Airports

The Hartsfield-Jackson Atlanta International Airport (H-JAIA) is a major trip generator and intermodal connectivity to high-speed rail service at the MMPT can provide additional mobility to intercity travelers originating from a variety of national and international locations. The termination of the service at H-JAIA also offers a possible location for a maintenance and layover facility away from the high density downtown area. The Charlotte Douglas International Airport's location is relatively close to the NS rail corridor and may also offer travelers an opportunity for intermodal connectivity. Also in Charlotte, the NC Department of Transportation is planning for a full maintenance facility for passenger rail approximately ½ mile south of the proposed CGS site. The Greenville-Spartanburg Airport additionally offers the possibility of single station stop midway between both cities.

Evaluation Criteria:

- Ridership potential,
- Intermodal connectivity, and
- Engineering feasibility.

3.2.4 Geometric Improvements

The presence of numerous and/or severe curves can substantially impact top speeds and travel times regardless of the equipment technology used. Curves can be eased either within existing right-of-ways, or by leaving existing highway or freight railroad right-of-ways for some limited distance and then returning in tangent sections.

Evaluation Criteria:

- Potential travel time improvements,
- Land taking outside of existing right-of-way, and
- Engineering feasibility.

3.2.5 Interchange treatments for highway alignments

One of the most costly and challenging aspects of establishing a passenger rail within an existing publicly owned highway right-of-way is designing a cost-effective route through or around existing highway interchanges and other high cost structures. There are a number of design options that can be pursued depending on the complexity of the interchange structure, the amount of development nearby and the impact on rail alignment geometry. Basic approaches must be identified for interchange treatments must be defined to develop build alternative capital cost estimates which can then be refined as required for a preferred alternative.

Evaluation Criteria:

- Travel time savings,
- Review of best practice design options,
- Land takings outside of publicly owned right-of-way,
- Disruption of highway operations, and
- Engineering feasibility.

3.3 PHASE II LEVEL OF SERVICE OPTIONS

A realistic service schedule and operating plan must be established to evaluate build alternatives comparatively with regard to ridership, revenues, operating costs and capital costs. The development of an initial schedule and operating plan will consider station stops, frequencies, and schedule.

3.3.1 Station Stops

High-speed intercity passenger rail service planning for station stops involves balancing the ridership derived from a given station stop against the overall impact on corridor ridership and revenues associated with an increase in corridor travel times. Intercity passenger rail riders typically have a high value of time and are willing to pay a premium for fast end-to-end corridor service. Local and express skip-stop schedules will be evaluated to balance local and express service needs.

Evaluation Criteria:

- Potential ridership, and
- Travel time impacts

3.3.2 Frequencies

Maximum ridership and revenues are generated by a train schedule that offers multiple and convenient departures and arrival times. The provision of additional train frequencies is tempered by increased operating costs which must be offset by increased revenues. The number of frequencies offered is also affected by train seating capacity and the infrastructure required to address freight and passenger rail capacity.

Evaluation Criteria:

- Potential ridership,
- Train consist size and other operational issues, and

- Potential infrastructure requirements associated with increased frequencies.

3.3.3 Schedule Stopping Patterns

Schedule planning using local and express schedules for various frequencies throughout the day is one approach to maximizing mobility offered by passenger rail service while still maintaining competitive travel times.

- Express Schedule: Endpoint service with very limited intermediate stops
- Local Schedule: Stops at all potential intermediate stations
- Combined Express and Local Schedules: Alternating express and local stop schedules with express service generally serving peak morning and evening travel periods

Evaluation Criteria:

- Potential ridership,
- Communities served,
- Line capacity
- Schedule reliability and
- Travel time.

3.4 FINAL REASONABLE BUILD ALTERNATIVES

Based upon the technical, engineering and operations planning work conducted, each of the initial reasonable alternatives will be refined as appropriate to provide a final list of reasonable alternatives for further evaluation.

4. COMPARATIVE EVALUATION OF REASONABLE ALTERNATIVES (PHASE III)

Each reasonable build alternative will be analyzed in detail to provide *quantitative (where data is available) and qualitative* planning and environmental impact information which can be used to aid in the selection of a preferred alternative. The key planning and environmental impact criteria which will be comparatively analyzed for each alternative are listed below in Table 1. Others may be identified as the evaluation proceeds. Detailed documentation will be developed for each with regard to methodology, assumptions and results. GIS databases will be used extensively in the evaluation process with detailed field evaluation work generally being conducted at a later project level environmental analysis. A matrix approach will be used to summarize and aid in comparing the findings for each alternative, which will be presented to the public in the Draft Environmental Impact Statement (DEIS).

Table 4-1: Summary of Planning and Environmental Evaluation Criteria

Planning Evaluation Criteria	Environmental Evaluation Criteria
• Capital Costs • Ridership • Operating Revenues • Operating Costs • Operating Surplus (Deficit) • Intermodal Connectivity • Regional and National Rail System Connectivity • Implimentability • Benefit-Cost Ratio	Impacts to: • Air Quality • Vibration and Noise • Water Quality • Wetlands • Endangered Species/Wildlife • Flood Hazards/Floodplain Management • Coastal Zone Management • Energy Resources • Natural Resources • Aesthetic and Design Quality • Elderly and Handicapped • Land Use • Environmental Justice • Public Health • Public Safety • Recreational Opportunities • 4(f) Protected Properties[4] • Environmental Sustainability • Socioeconomic Environment • Transportation • Historic, Archeological, Architectural or Cultural Sites • Construction Period

The project team will conduct a comparative evaluation of the above planning and environmental impact factors which along with public comments on the DEIS will be used to develop a preliminary prioritization of reasonable alternatives and make recommendation for the preferred alternative.

5. SERVICE DEVELOPMENT PLANNING FOR THE PREFERRED ROUTE ALTERNATIVE

Service development planning will continue after the preferred alternative is selected. This will involve refining various aspects of the preferred alternative to develop a SDP. The SDP will document:

1 Final alternative route: station access and facilities, track alignment, curve and geometric improvements, and required structures;

2 Final schedules and stopping patterns;

3 Final operating plan addressing maintenance requirements and facility needs;

4 Final capital cost estimates for infrastructure, facilities and equipment;

[4] *For this Tier 1 EIS, the study team will identify locations of those potential 4(f) properties and will limit the properties to Parks/Recreation and historic sites on the National Register of Historic Places (NRHP) or identified by the state(s) as eligible for the NRHP.*

5 Final operating equipment requirements and specifications and cost estimates;

6 Final ridership, revenue and operating cost forecasts; and

7 An implementation and financial plan and schedule.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX B: DUALPOWER/DUALMODE TECHNICALMEMORANDUM

May 2014

GDOT Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

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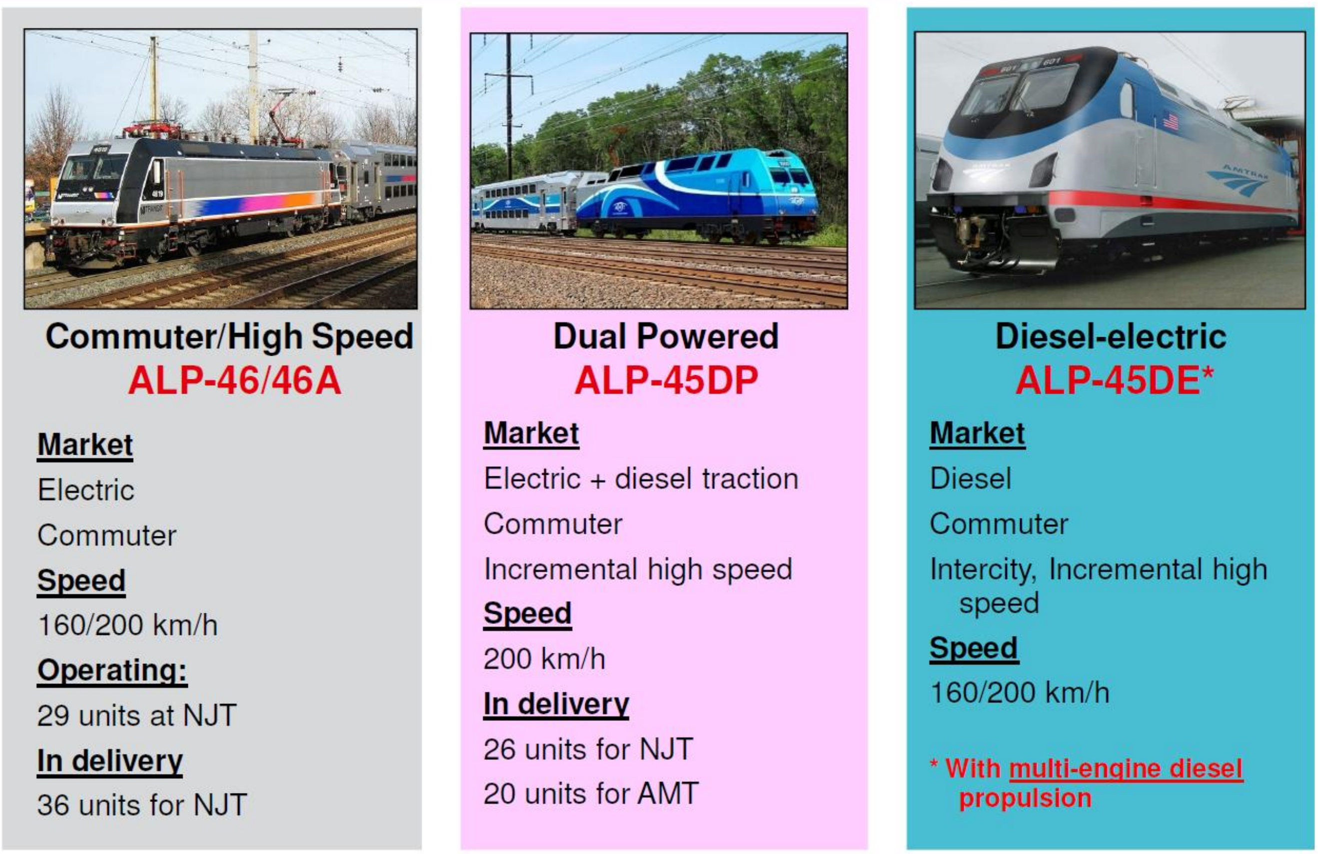
1. DESIGN CONCEPTS FOR A HYBRID DUAL-POWERED HIGH-SPEED PASSENGER TRAIN

There have been a number of recent innovations that establish the technical feasibility of a hybrid diesel-electric train technology. Hybrid dual powered trains have been produced by Talgo, Hitachi and Bombardier. Bombardier, for example, is marketing diesel, electric or hybrid passenger locomotive options, all based on its common "ALP" platform. See Exhibit 1-1 below, which was taken from a Bombardier marketing brochure.

Exhibit 1-1: ALP Locomotive Variations



As can be seen in Exhibit 1-2, the ALP locomotive is an electric locomotive that has supplemental diesel "Gen-set" capability for providing power, so the locomotive is able to draw power either from the overhead catenary (using the main transformer) or provide its own power using the supplementary Gen-sets. Gen-sets are a relative recent innovation and consist of a diesel engine coupled to an alternator. The ALP-45 DP has two smaller high-speed Caterpillar diesel engines that can be individually started or stopped as needed.

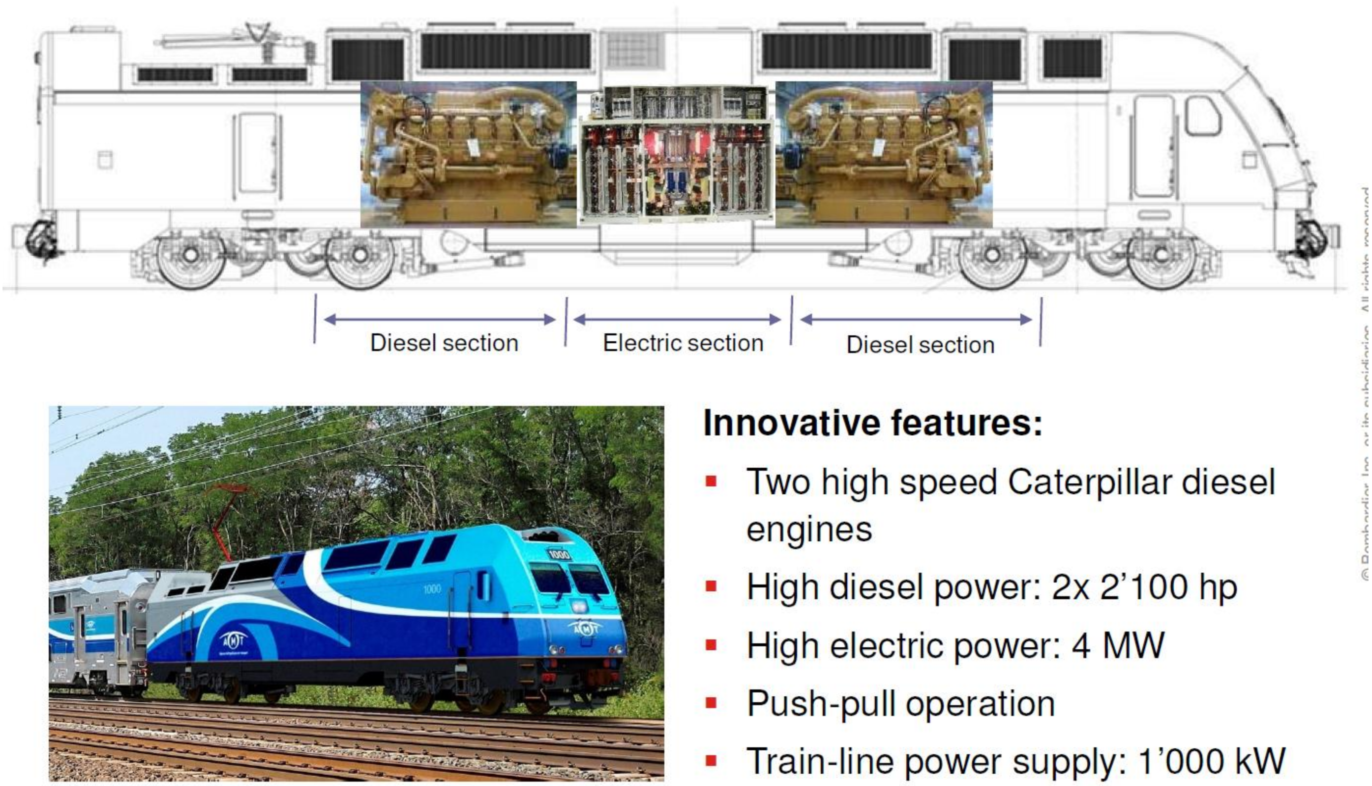
Having multiple small engines instead of a single large engine enables fuels savings and enhances reliability, since redundancy is automatically built into the system. However, a dual power locomotive could equally be developed using a more traditional single larger diesel engine. This is a detail that could be left open to the individual manufacturer. This does not affect the overall concept for a dual power train set.

The downfall of the ALP-45DP is its weight, which make the current design unsuitable for use as a high-speed locomotive. The ALP-45DP carries its two Gen-sets, fuel and main transformer on the same chassis, so the result is an extremely heavy locomotive:

- The ALP-45DP weighs 129 metric tons with an axle loading of 29 metric tons.
- The straight electric Tier I ALP-46 weighs 90 metric tons with an axle loading of 22.5 metric tons.
- The Acela Power Car, as a Tier II compliant locomotive, weighs only 93 metric tons. So it can be seen that Tier II compliance has only added a few tons to the weight of this locomotive as compared to its Tier I counterpart.
- The TGV Atlantique power car weighs 68 metric tons with an axle loading of 17 metric tons. This meets SNCF's maximum axle loading limit of 17 metric tons which it enforces on all of its high-speed (186-mph and 220-mph) rail lines.

As a result, it can be seen that the ALP-45DP weighs almost twice as much as the TGV Atlantique power car. Its axle loading is unacceptably heavy for a High-Speed train.

Exhibit 1-2: ALP Locomotive Design Concept



However, this weight limitation could easily be overcome simply by moving the diesel power units to an adjacent car and using a jumper cable to bring the power on board the electric locomotive. This is what Talgo has done with its Talgo 250 Hybrid design. This train has a top speed of 155 mph. It operates at up to 112 mph on non-electrified lines, but the top speed could likely be increased by adding more Gen-sets to provide additional power. There is no reason why Bombardier or any other manufacturer could not replicate this concept.

Exhibit 1-3: Talgo 250 Hybrid Power Tender

The hybrid concept however, is not limited to locomotive hauled trains. Hitachi has developed a distributed power hybrid concept[1] with traction motors under the coaches. It is based on the Shinkansen design and marketed as “A-Train” or “Hitachi Super Express” as seen in Exhibit 1-4. To keep the weight down, there are no traction motors under the Hitachi lead diesel car, so it functions as a power tender.

[1] *See:http://www.agilitytrains.com/assets/pdf/AT-090205-Key_Facts-Released-1_5.pdf*

http://www.railwaystrategies.co.uk/article-page.php?contentid=16439&issueid=463

Exhibit 1-4: Hitachi Super Express Hybrid Train

The Talgo 250 and Hitachi Super Express are both examples of existing dual mode high-speed trains, but Hitachi's concept perhaps offers a better technical basis for raising the speed to 220 mph. This is since all the latest generation of 220 mph electric trains, like Hitachi's A-Train, are based on distributed traction motors underneath the cars or electric-multiple-unit (EMU) technology. Distributing the traction motors allows more power to be placed under the train and reduces the weight. Since all the other manufacturers also have EMU designs, it should in principle be very easy to adapt these designs to accept a leading or trailing diesel power tender car. And Hitachi could itself adapt its A-Train concept to higher speeds, since the A-Train platform is fundamentally based on the high-speed Shinkansen design concept.

It should also be noted that there are no current instances of a locomotive hauled 220 mph train. This speed range is represented exclusively by EMU designs. The transition from electric to diesel power can be accomplished seamlessly and even at speed[2]. A true dual mode or hybrid train has no need for changing of locomotive or even stopping the train to accomplish a power transition.

Perhaps the greatest challenge in developing a dual mode high-speed train will be in holding the axle loading of the diesel power tender underneath the 17 metric ton limit. However, a preliminary investigation

[2] *See: http://www.rssb.co.uk/sitecollectiondocuments/pdf/reports/research/T778_rpt_final.pdf*

has suggested that this can be done. It is recommended that this be discussed with the equipment manufacturers to validate this key assumption.

2. CAPITAL COSTING ASSUMPTIONS FOR TRAINS

A key objective for any high-speed train design is to maintain a low center of gravity (for tilting capability) and a low axle load. This would be facilitated by the use of aluminum rather than steel in the trailing cars; and for dual power equipment, by distributing the weight of the diesel engines and fuel onto separate power tender cars, rather than trying to mount both the diesels and electric equipment on a single chassis. Keeping the train's weight down will also help with the dynamic performance of the train, especially when operating under diesel power.

A benchmarking exercise has been conducted to estimate likely train equipment costs. There are no directly comparable benchmarks for the envisioned dual mode hybrid train. This cost will need to be built up based on costs for straight diesel and straight electric trains. This is a newly emerging technology and although several different manufacturers do have products that could meet the proposed specification, the train technology is so new that there are few established benchmarks for it. Key sources include the Georgia Department of Transportation High-Speed Rail Feasibility Study[3], the RMRA study[4] and the Railway Technology journal[5]. However, these sources themselves are based on a long history of experience with train equipment manufacturer and costs (for example the Equipment Workshop[6] that was conducted as a part of the Midwest Regional Rail System study.)

The diesel powered train is designed to function in the diesel-only mode as a high speed train capable of operation at speeds up to 130 mph. In addition, the concept includes provision for the installation of pantographs, high voltage transformers and power conversion packages for use in the dual-mode and the all-electric versions of the train. The dual-mode and all-electric versions of the train are to be capable of operation at speeds up to 220 mph in the electric mode; therefore, the suspension system must be capable of operating satisfactorily at this speed although the maximum speed for the diesel-only version is to be 130 mph.

The passenger cars should be equipped with a simplified tilt system that provides two inches of tilt when required on curves. This level of tilt would allow for operation of the trains at seven inches of cant deficiency around curves. Tilt capability beyond this is not needed, because operations at higher than seven inches of cant deficiency would impose significant additional requirements on track maintenance which are likely to be resisted by the freight railroads. From the perspective of truck (or bogie) design it is anticipated that this very moderate level of tilt can be accommodated, without limiting the high-speed capability of the train.

[3] *See: http://www.dot.state.ga.us/travelingingeorgia/rail/Documents/HighSpeedRail/Final%20Report.pdf*

[4] *See: http://rockymountainrail.org/documents/RMRA_HSRBP_Appendix_H_03.2010.pdf*

[5] *See: http://www.railway-technology.com/features/feature1097/*

[6] *See: http://www.dot.state.mn.us/planning/railplan/docs/mwrri/7_Operating_Plan_and_Operating_Costs.pdf pp 7-13.*

The one U.S. cost benchmark that does exist is for Bombardier's ALP-45DP locomotive. This locomotive sold at a substantial premium over conventional electric or diesel locomotives and cost nearly as much as two separate locomotives would have. The negotiated price inevitably included an Engineering/Design charge for heavy customizations spread over a very limited production run. However, since the Engineering design for the ALP-45DP now exists, we believe that Bombardier could also meet the assumed costs parameters on a competitive basis for incremental production quantities.

The assumed cost is $112 thousand per seat for a train carrying 420 to 450 passengers. To develop this estimate, $8.4 million was added to the cost of the 220 mph electric train for adding two diesel power tender cars, based on Hitachi's and Talgo's approach. Each power tender would incorporate a driving position at the outer end. One or more diesel generator set(s) having a total power output of 2,500 horsepower would need to be installed in each power tender for operation at the maximum speed of 130 mph. For operation at the alternative maximum speed of 110 mph, diesel generator set(s) having a power output of 1,750 horsepower would be required for each power tender. For propulsion, electrical power in the form of direct current at approximately 1,000-2,000 volts would be fed from each of the power tenders at the ends of the train, into a bus line that runs the length of the train.

It should be noted that these power requirements are based on "worst case" conservative assumptions that each of the cars and power tenders will weigh 75 tons, the maximum allowable to meet the European 17 (metric) ton axle load limitation. However, many of the modern high speed trains (e.g. Bombardier Zefiro or Siemens Velaro) weigh substantially less than this. If the train weighs less, then the power requirement will be correspondingly reduced and/or a longer train with greater seating capacity could be operated.

A fuel tank capacity of 1,500 gallons should be more than sufficient to allow the unit to operate all day without requiring refueling; and provide an adequate fuel reserve for any unexpected delays or inclement weather. (The Talgo T-21 locomotive concept proposed only a 700 gallon fuel tank.) Potential safety issues regarding the carriage of fossil fuel on board a high-speed train will need to be addressed. Firstly, although diesel fuel is flammable, unlike gasoline it does not explode and does not release a large amount of flammable vapor[7]. There are two recent high profile derailments of passenger trains that involved diesel locomotives:

- The recent Santiago de Compostela derailment in Spain8 resulted in a fuel tank breach and a fire; and
- The Chatsworth collision in the United States[9] also involved a fuel tank breach which caused a fire.

It should be noted that both of these accidents occurred on conventional lines at conventional speeds. Both were considered human failures that could have been prevented by signal system enhancements. Additionally, grade crossing hazards on conventional lines are known to pose a risk to trains. Obviously this matter will be of concern to safety regulators and equipment designers who should try to mitigate these risks as much as possible. However, it should be noted that high-speed rail in general has a fantastic safety record, so the probability of an incident on a high-speed line would appear to be vanishingly small.

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[7] *See: http://en.wikipedia.org/wiki/Diesel_engine*

[8] *See: http://en.wikipedia.org/wiki/Santiago_de_Compostela_derailment*

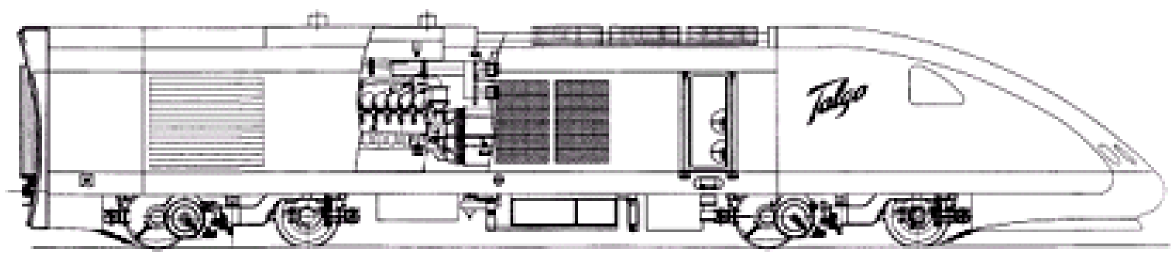
[9] *See: http://en.wikipedia.org/wiki/2008_Chatsworth_train_collision*

If it were decided to include dual mode trains in a Tier II environmental review for the Atlanta-Charlotte corridor, a formal risk assessment for this technology would be recommended as a part of that study. However, it could be assumed that the mains risks associated with power tenders would be mostly associated with the portion of the operation that would be conducted on conventional lines and at conventional speeds. Those risks are not much different than those associated with conventional diesel train operations. The best risk mitigation strategy would seek to develop dedicated high-speed infrastructure from end to end at the earliest possible date.

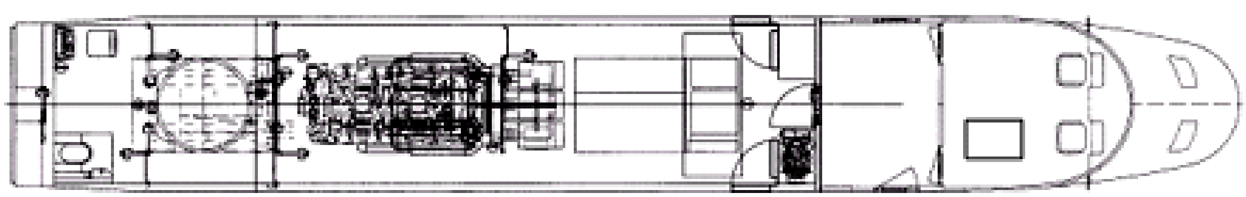
The weight of the diesel power tender has been benchmarked to comparable diesel locomotives:

- As shown in the figure below, Talgo and Siemens proposed a diesel locomotive concept (2,720 HP) for a US Tier I compliant T-21 train that would weigh in at 180,000 pounds for each four axle locomotive – 90 short tons.
- The British HST -125 locomotives diesel (2,250 HP) are reported as 70-tons[10] or 77 short tons, at 17.5 tons axle load these locomotives would be very close to the 17 ton load limit for high-speed rail lines lines.
- TRAXX diesel locomotive (3,000 HP) F140 DE [11]weighs 88 short tons. As an existing locomotive this is very similar to the weight and power that was proposed for T-21 for the MWRRS, shown in Exhibit 5.

Exhibit 2-1: Talgo T-21 Proposed Locomotive Concept



TALGO LOCOMOTIVE SIDE VIEW



TALGO LOCOMOTIVE TOP VIEW

[10] See: http://en.wikipedia.org/wiki/InterCity_125#cite_note-9

[11] See: http://en.wikipedia.org/wiki/TRAXX#TRAXX_dual-mode_version

None of these existing diesel locomotives meets the 17 ton weight limit, although the HST-125 comes close. However, the power tender does not need traction motors since these will be underneath the adjoining rail cars. By removing the four traction motors and related power control equipment (estimated at 3 tons each, 12 tons total) the weight of the TRAXX diesel locomotive would be reduced to 76 short tons. If the HST-125 locomotive were used as the starting point, removing the traction motors would reduce its weight to 65 tons, which comes well under the 17 ton axle load limitation for high speed lines. Obviously, these calculations could be refined through more detailed engineering. While it is apparent that keeping the axle loading of the power tender under 17 tons is going to be a challenge, based on these benchmarks it does appear to be a plausible design concept.

Because a more powerful tender will weigh more and will need more fuel, clearly the ability to minimize the weight of the train has a strong impact on the power tender requirements. For example, Siemens' Velaro E12 has 8 cars and 404 seats. It weighs 439 metric tons empty, or 483 short tons. A full passenger load (404 x 180 lbs./passenger) is 36 tons, so the total train weight is 519 tons, or 65 tons per car. This is substantially less than the 75 tons per car upon which the train performance calculations have been based. If this type of train were used as the base for the proposed dual-mode train, the power requirements might be reduced. This will help in keeping the weight of the power tender beneath the 17 metric tons standard that is required for 220-mph top speed operation.

[12] *See: http://www.siemens.com/press/pool/de/materials/industry/imo/velaro_e_en.pdf*

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX C: NCFRP-30 CAPACITY SCREENING

July 2014

Georgia Department of Transportation

Prepared on behalf of the

U.S. Department of Transportation

Federal Railroad Administration

Contents

1. NCFRP-30 CAPACITY SCREENING

Consistent with the goal of developing a reasonably conservative screening-level assessment, we note FRA's observation that, "very high annual growth rates (six to 10 percent) are usually not sustained in a mature economy." Recognizing the Atlanta-Charlotte corridor's strategic position as part of Norfolk Southern's double-stack "Crescent Corridor" initiative, freight traffic volume was estimated as follows:

- 14 through trains plus six local trains equals 20 freight trains in 2013 Base Year, based on the FRA grade crossing database;
- Applying a 2.5 percent annual traffic growth rate results in 30 trains in 2030: 15 freight trains in each direction; and
- According to the grade crossing database, 2/3 of traffic volume occurs at night (6:00 p.m. to 6:00 a.m.) and 1/3 occur during the day (6:00 a.m. to 6:00 p.m.).

A conservative estimate of 8 passenger round trips per day was also included in the screening assessment. Although only four daily round trips are currently being proposed, this could allow train frequencies to be increased to up to 8 round-trips per day, and the results of the screening assessment would still be valid. The analysis resulted in a 10 percent slack and pad requirement.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX D: RIDERSHIP AND REVENUE METHODOLOGY TECHNICAL MEMORANDUM

May 2013

GDOT
Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

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1. INTRODUCTION

This Ridership and Revenue Methodology Technical Memorandum (Tech Memo) presents an overview of the modeling methodology to develop ridership forecasts for the proposed high-speed rail (HSR) service in the Atlanta to Charlotte corridor, which passes through parts of Georgia, North Carolina, and South Carolina. This work is being performed for the Georgia Department of Transportation (GDOT) as part of the Atlanta to Charlotte Passenger Rail Corridor Improvement Plan (PRCIP).

This study will, to the extent feasible, draw upon the Volpe National Transportation Systems Center's Charlotte to Macon study[1] (Feasibility Study). This study will also draw upon the recent GDOT study of high-speed ground transportation services between Atlanta and Chattanooga[2], and another recent work assessing the feasibility of high-speed passenger rail service in the Atlanta–Birmingham, Atlanta–Jacksonville, and Atlanta–Louisville corridors[3]. This includes both the methodology and source data, including findings from the behavioral surveys undertaken as part of the *Atlanta–Chattanooga High Speed Ground Transportation Tier I Environmental Impact Statement* (EIS).

This Tech Memo documents, at a high level, the results of the initial investigation into available and relevant travel demand forecasting model systems and data, which are some of the resources from which the ridership forecasting model for the project will be constructed. Familiarity with recent studies and available relevant data is necessary to orient the modeling methodology at the beginning of the modeling process, and for informed and efficient decision-making during the model development. The Tech Memo also highlights the key travel demand modeling issues that have been identified and that will need to be addressed during the forecasting analysis. Lastly and most importantly, the Tech Memo outlines the intended approach for developing a ridership forecasting model system for this study.

While the modeling activities will follow the general approach that is described in this document, some adjustments to specific details may be necessary based on knowledge gained during the course of this study effort. This Tech Memo will, in some cases, simply list a variety of methods that will be considered and investigated to address specific modeling issues; final selection of a method to be used in the study will be based on assessment of the results of the investigations as they are undertaken.

This chapter provides an overview of the approach, through the following sections:

- Modeling geography;
- Key potential markets; and
- General modeling approach.

1.1 MODELING GEOGRAPHY

The study corridor includes portions of three states (Georgia, North Carolina, and South Carolina). In addition to trips to/from Atlanta and Charlotte, trips to/from Greenville, SC and Spartanburg, SC will likely be candidates for diversion to high-speed rail due to the on-corridor locations of these cities.

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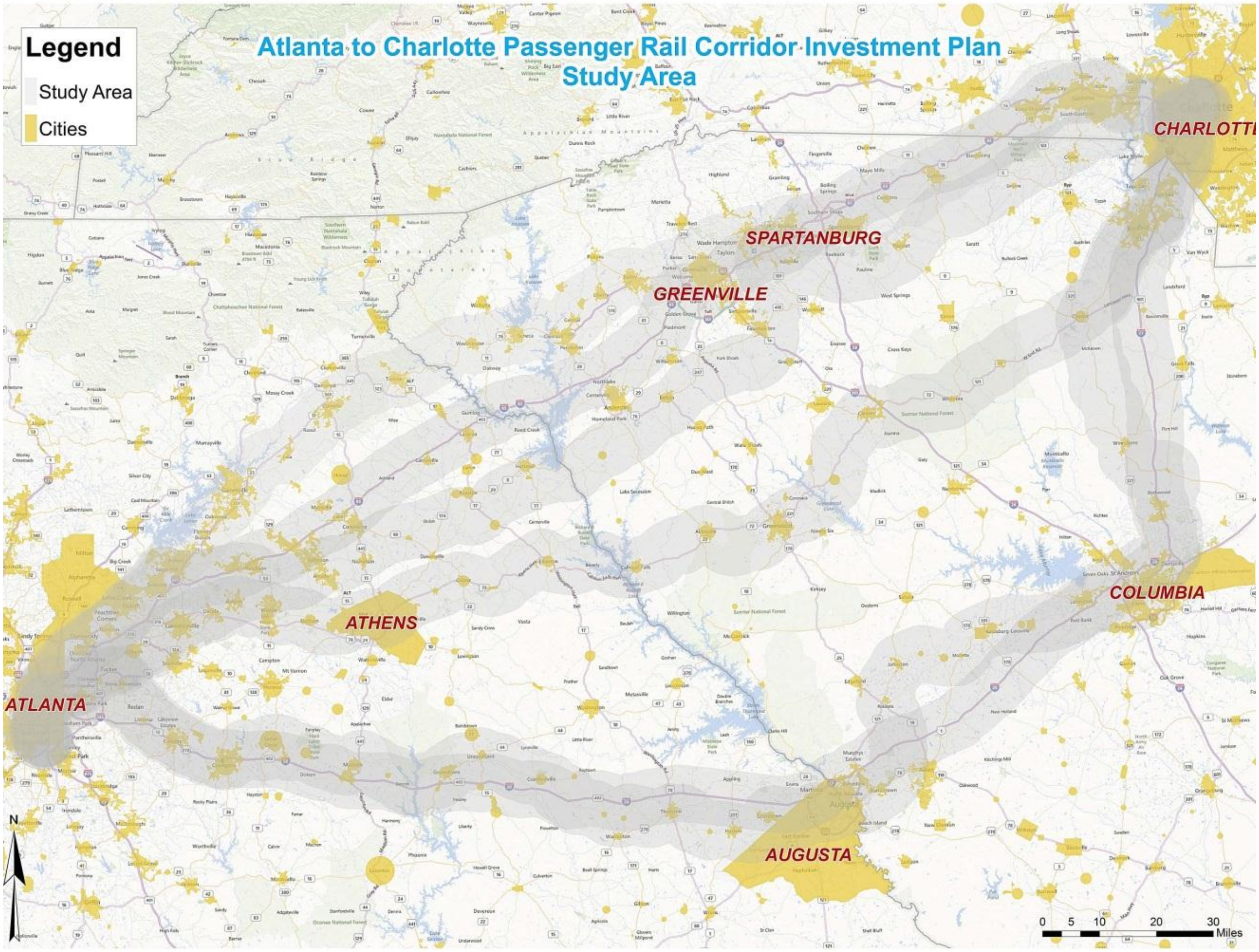
[1] *"Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor", The Volpe Center, August 2008*

[2] *"Atlanta-Chattanooga High-Speed Ground Transportation Tier I Environmental Impact Statement", Final Report, Georgia Department of Transportation, April 2008*

[3] *High Speed Rail Planning Services , Final Report, Georgia Department of Transportation, December 2011.*

The study corridor is illustrated in Figure 1-1. This transportation infrastructure and the services that use it will be discussed in depth in subsequent chapters.

Figure 1-1: Corridor Context Map



1.2 KEY POTENTIAL MARKETS

A useful way of thinking about the development of a travel demand model for this study is in terms of the issues the model will have to address. These issues can be characterized as follows:

- Competition between the rail service and other modes (including auto, air, bus, and existing rail) for inter-urban travel;
- Competition between the rail service and other modes (including auto and public transit) for intra-urban travel in large metropolitan areas, specifically Atlanta and Charlotte. These local markets may also include airport access travel, if the proposed rail routes have stations that serve the major study corridor airports (see Section 2.3); and

- Commercial air trips that shift to other airports due to changes in airport accessibility resulting from the introduction of the rail service.

In cases where route alternatives include one or multiple stations in a metropolitan downtown area and relative suburbs (as is likely to be the case in Atlanta and Charlotte), the methodology includes modified versions of the local travel demand models to forecast demand for the local rail travel market, which will be overlaid on the inter-urban forecasts. Modifications to the Atlanta and Charlotte models will, at a minimum, involve the addition of a new high-speed passenger rail mode.

Similarly, with respect to airport choice modeling, the team recognizes that air passengers typically choose the airport they will use to start (or end) a long-distance trip based on factors that include: access distance and travel time; the range of destinations offered; and flight frequencies, times, and fares. Hub airports offer more choices to passengers and are therefore particularly attractive. Hartsfield-Jackson Atlanta International Airport (ATL) and Charlotte/Douglas International Airport (CLT) are major hub airports and, with improved rail access, passengers currently flying to them from feeder airports like Greenville-Spartanburg International Airport (GSP) might divert from feeder air to rail. Note that passengers driving to these airports or between cities fall into one of the other two markets described above.

1.3 GENERAL MODELING APPROACH

1.3.1 Inter-Urban Model Overview

The proposed approach to forecasting the potential ridership and revenue of the proposed rail services entails six broad steps:

- *Step 1: Estimate the current market of potentially divertible trips (including trips by air, bus, train, and automobile).* These estimates are developed on a zone-to-zone basis as outlined in Section 1.3.4 and are disaggregated by trip purpose.
- *Step 2: Estimate how this market will grow in the future.* These estimates will reflect forecast socio-economic trends (such as changes in population and employment) and assumptions regarding the sensitivity of changes in trip making behavior to these trends.
- *Step 3: Estimate the Level of Service (LOS) characteristics for each mode and each zone pair.* For a trip by common carrier (including the proposed HSR service), this takes into account the in-vehicle time, frequency of service, fare, and time/cost needed to access and egress the mode’s station from the trip’s actual origin and destination respectively (i.e., the traveler’s home, place of work, or leisure destination). For a trip by automobile, this takes into account the origin-destination travel time (including any delays due to road congestion) and vehicle operating costs (largely fuel cost).
- *Step 4: Estimate the potential market share that the new service will capture (i.e. the ridership).* This is estimated using the LOS characteristics calculated in the previous step and the established mode choice models and modeling methodology. This process is explained in detail in Chapter 4.
- *Step 5: Estimate the level of induced demand.* These are new inter-urban trips not made in the no-project situation, but occur as a result of the improved service provided by the proposed project.

- *Step 6: Estimate the rail farebox revenue.* This is calculated using the ridership calculated in the previous two steps and the fare assumptions used for the new rail service from Step 3 above. Note that the level of ridership is sensitive to fares.

These forecasting steps assume a number of additional tasks the team will carry out. These include collecting and analyzing data; preparing input assumptions and tables; specifying, building and testing the forecasting model; producing and reviewing forecasts; and running sensitivity tests.

1.3.2 Intra-Urban Model Overview

Local Metropolitan Planning Organization (MPO) model systems—the Atlanta Regional Commission (ARC) Model and Metrolina Regional Model (MRM)—will be used for intra-urban (local) travel in the Atlanta and Charlotte metro areas, respectively. This is discussed in more detail in Chapter 4.

1.3.3 Airport Choice Model Overview

The introduction of HSR services can enable easier access to major hub airports, which can in turn cause some air passengers to shift trips from the airport they would otherwise choose. The methodology describes the approach to forecasting airport choice shifts. This is discussed in more detail in Chapter 4.

1.3.4 Geographic Scope and Zoning Structure

The intercity model will cover a geographic area that generally follows the corridor and extends approximately 50 miles on each side of the proposed route alternatives, which is a typical planning assumption for access catchment for HSR services. However, the 50-mile distance is indicative rather than absolute, and may be adjusted as appropriate in specific instances.

The area within the geographic boundary created by the process described above will be split into a number of zones. Given the size of the model coverage area, the methodology will base the zoning structure on counties for the area between, and not included within, the Atlanta and Charlotte area travel demand models, and on aggregations of traffic analysis zones (TAZs) for the areas covered by the two models.[4] On this basis, the project team estimates that the total model coverage area will include approximately 100 zones[5]; this strikes a good balance between having sufficient granularity to reflect the differences in LOS characteristics for residents of adjacent areas, and the need to model a large area for a study in its initial phase. This also provides a more detailed representation of the urban areas, while maintaining a manageable number of zones. Figure 1-2 illustrates the MPO model coverage areas by county for the most populated centers in the study area.

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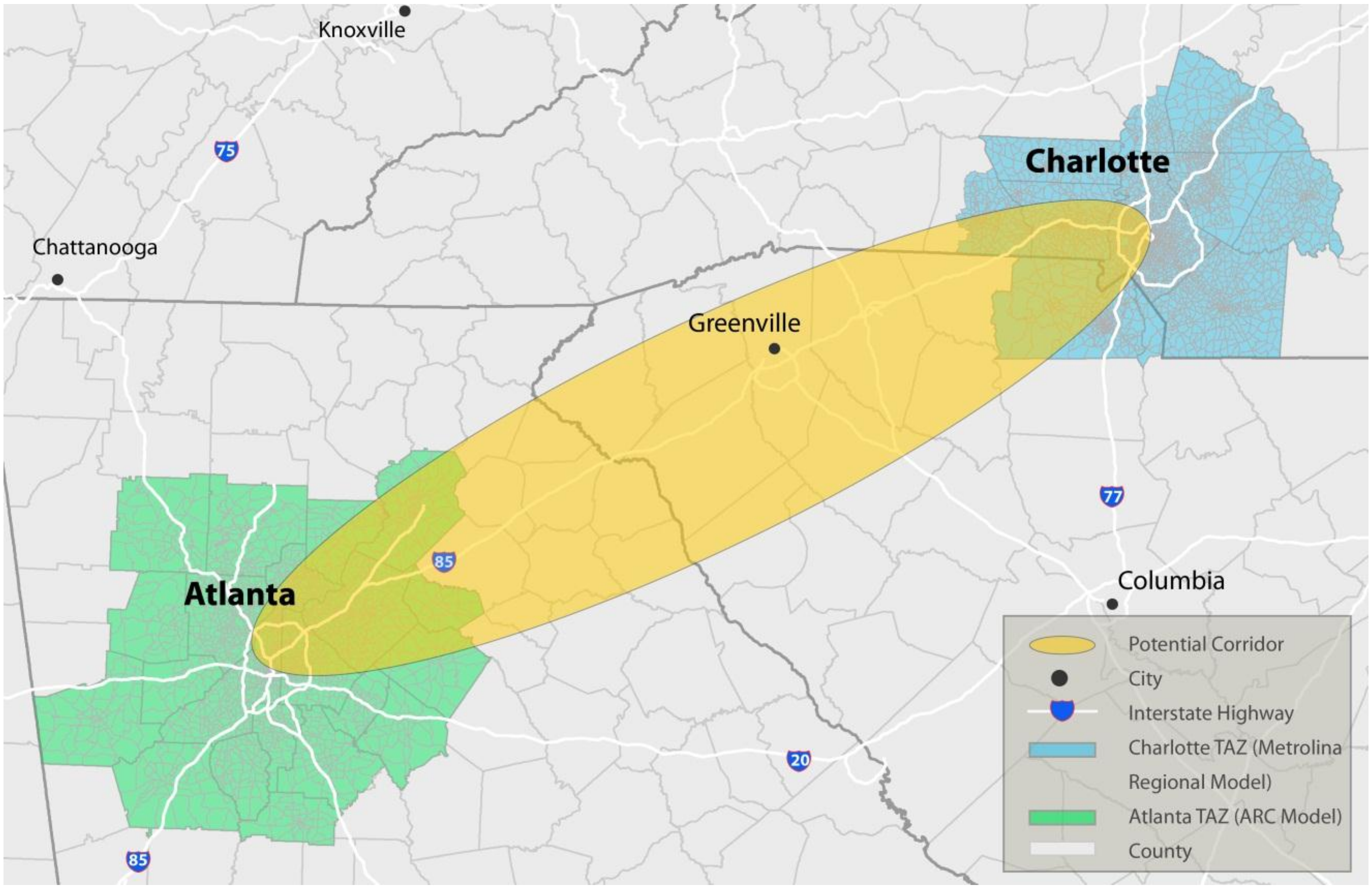
[4] *For the intra-urban (local) travel markets in the Atlanta and Charlotte metro areas, the same geographic zone (same numbers of TAZs) structures as used in the respective MPO model systems (ARC and MRM) will be used. This is discussed in more detail later in Chapter 4.*

[5] *As discussed later in Chapter 4, the cell phone data based inter-urban auto trip tables will also be developed for the same 100 geographic zones.*

Figure 1-2: MPO Model Coverage Map



There are two common approaches to estimating travel times employed in travel forecasting. The first is to prepare a representation of the network using network modeling software and then use this to estimate travel times. The second is to estimate the times using actual travel time data sources, for example commercial trip planning software (MapQuest and Google Maps) supplemented with real time travel alert websites (www.sigalert.com, or www.beatthetraffic.com). These can then be combined with other assumptions (regarding vehicle operating costs, fares or service frequencies) to estimate LOS characteristics between all relevant zone pairs.

Regardless of the method used to calculate the LOS characteristics, network modeling software can be useful for developing forecasts, as it offers the capability to hold and manipulate the large volumes of data created in preparing demand forecasts, and has other useful functionality. In addition, travel times calculated from network modeling software can be used to check the travel times obtained through other processes.

1.3.5 Modeling Alternatives

1.3.5.1 Routes, Technology, and Service Patterns

The forecasting model will be flexible and able to model a range of project alternatives. At a minimum, the model will be able to accommodate:

Multiple corridor alternatives within the study area as described earlier;

Multiple train speeds (for example, 79mph, 90-110 mph incremental HSR and 150 to 220 mph express HSR, which will deliver different station-to-station travel times); and

Multiple service patterns (including the number of stops en route—all stop vs. skip stop services, frequency of service, and fare levels).

Note that there are limits to this flexibility. For example, alternatives with more than one station within the same zone could not be easily modeled via the approach proposed here.[6]

Ridership and revenue forecasts will be produced for two years: the base year of 2025 where the rail service is assumed to become operational, and the horizon year of 2050. As reliable forecasts of socio-economic data for study area counties are only available through 2040 from third party vendors such as Woods and Poole, socio-economic forecasts beyond 2040 will be extrapolated. Revenues for the base and horizon years will be reported in 2012 constant dollar values. Ridership and revenue forecasts for all years between 2025 and 2050 will be produced by interpolation. Following this, an adjustment will be made to account for ramp-up in the early years of the service.

The model will be applied to forecast corridor ridership, revenue and related travel impacts in the base and horizon years. At least two forecast runs for each of the three route and station alternatives will be made for each the base and horizon year. In addition, up to two additional forecast runs will be performed for the final preferred alternative to inform the service development plan.

1.3.5.2 Sensitivity Analysis

In addition to being able to model project alternatives, the model will be specified to carry out a range of sensitivity analyses to determine the effects of the changes in the values of key variables (e.g. fares and level of service attributes, competitive factors, fuel prices[7] and stopping patterns) on ridership and revenue and consequently on project finances and other project impacts. This capability also provides a useful tool for checking the model's reasonableness and robustness.

1.4 STRUCTURE OF THE TECHNICAL MEMORANDUM

The remainder of this Tech Memo is structured as follows:

- Chapter 2 discusses the key travel markets and their characteristics;
- Chapter 3 discusses the main data sources available;
- Chapter 4 reviews the principal issues regarding the study modeling methodology and their resolution using the data sources discussed in the previous sections; and

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[6] *Note, however, that as initially set out in section 1.2, the modeling methodology will allow more than one station in a city, for example, a downtown station and a suburban or airport station.*

[7] *Sensitivity to fuel price will be based on auto operating cost, which is in turn based on forecast fuel prices and forecast fuel efficiency based on U.S. Energy Department forecasts.*

- Chapter 5 summarizes the contents of this report and outlines the next steps to be taken in the modeling effort.

2. CURRENT TRAVEL MARKETS

This chapter describes the characteristics of three main travel markets:

- Inter-urban travel market;
- Local travel market including airport access market; and
- Airport choice market.

2.1 INTER-URBAN TRAVEL MARKET

For the purposes of this discussion, the inter-urban market includes travel between the major cities in the proposed corridor including Atlanta, Greenville, Spartanburg and Charlotte.

There are four travel modes by which inter-urban trips can currently be made:

- Automobile travel;
- Bus service;
- Air service; and
- Rail service.

2.1.1 Automobile Travel

Automobile is the predominant travel mode in the corridor. Although some information exists on specific aspects of inter-urban travel (such as journey-to-work data available from the year 2000 Census Transportation Planning Package [CTPP] and 2006-2008 American Community Survey [ACS]), there is no complete and detailed source of information on inter-urban automobile volumes within the corridor. Traffic count data are available on major roadways—including I-85—but no readily available source provides an estimate of the volume of automobile travel between the major areas identified above or other specific origins and destinations in the corridor.

Table 2-1 sets out some recent relevant traffic count data (annual average daily traffic – AADT) on I-85, the main inter-urban highway between Atlanta and Charlotte. It is important to note that these are total traffic volumes on the designated highway sections, and not the origin-destination demand from one section endpoint to the other.

Table 2-1: Selected Traffic Counts

Location	AADT	Year and Count Site Reference
I-85 Between Atlanta and Greenville	40,000	2011, I-85: Hart County, Traffic Counter: 0287
I-85 between Greenville and Spartanburg	93,000	2011, I-85: Greenville County, Station: 2303
I-85 between Greenville and Charlotte	42,000	2010, I-85: Cherokee County, NC State Line, Station: 2351

Notes: Counts are totals for both directions of travel. The traffic counts should not be interpreted as the volume of trips between these cities. AADTs are rounded to the nearest thousand vehicles. These traffic count values have been validated against those from adjacent count locations to ensure they are not outliers.
Source: websites for state DOTs: http://www.dot.ga.gov/statistics/stars/Pages/default.aspx, http://www.dot.state.sc.us/getting/annualTraffic.aspx

Table 2-2 shows automobile travel distances and times between the major city pairs in the study corridor. The data are sourced from commercial journey planning software and reflect speed limits and representative congestion levels on each route.

Table 2-2: Travel Times and Distances between City Pairs

Route	Distance (miles)	Time (min)
Atlanta–Charlotte	245	249
Atlanta–Greenville	146	148
Atlanta–Spartanburg	173	180
Charlotte–Greenville	102	109
Charlotte–Spartanburg	76	83
Greenville–Spartanburg	30	40

Source: maps.google.com
Note: These travel times are believed to be based on current speed limits, and do not account for traffic congestion or rest stops. Regardless, these values are presented for illustrative purposes only.

2.1.2 Bus Service

A summary of the bus services between Atlanta and Charlotte is set out in Table 2-3. The locations of the main bus (and train) stations, and their proximity to downtown areas, are set out in Table 2-4 for context.

Table 2-3: Bus Service Summary

City Pair	Type[2]	Operator	Travel time	Frequency	Full fare[1]
Atlanta–Charlotte	city to city	Megabus	4h 15m	2x/day	$3-12
Atlanta–Charlotte	city to city	Greyhound	4h 05m to 6h 00m (depending on stops)	7-9x/day	$17-71

Notes (1) Full or standard weekday and weekend fares. Rounded to nearest dollar
(2) See Table 4 for descriptions of the locations of the bus stations.
Source: company websites, including www.greyhound.com and us.megabus.com.

The table shows two bus services operating in the corridor, operating a total of 9–11 trips per day. Fares vary widely, ranging from $3 for the least expensive Megabus fares to $71 for the most expensive Greyhound fares. Megabus trips only serve Atlanta and Charlotte, while many of the Greyhound trips serve intermediate stops. As a result, travel times vary significantly by trip.

There may also be some charter bus operators; however, these operations are not included in the analysis.

Table 2-4: Bus and Train Station Locations

City	Service	Description of Station Location / Pick-up Points
Atlanta	Greyhound	Very central (at Forsyth St SW and Brotherton St SW); near transit hub
	Megabus	Very central (at Civic Center MARTA station on West Peachtree St NW); about 2 miles from the Greyhound stop
	Amtrak	North of the city center (at Peachtree St NW and Deering Rd NW); not close to other transit stops
Charlotte	Greyhound	In the city center (at W Trade St and Wilkes Pl); very close to the transportation center
	Megabus	In the city center (E Trade St and S Brevard St); at transit hub; about 0.5 miles from the Greyhound stop
	Amtrak	Northwest outside city center (on N Tryon St); near transit hub; about 4 miles from the Greyhound stop
Greenville	Greyhound	Very central (at W McBee St and S Laurens St); near Amtrak
	Amtrak	Very central (at W Washington St and Mulberry St)
Spartanburg	Greyhound	In the city center (at Liberty St and Dunbar St)
	Amtrak	Near the city center (at Magnolia St and N Daniel Morgan Ave); 1 mile from the Greyhound stop

The table shows that locations (and related convenience) of bus and rail stations vary across the cities along the corridor.

No ridership data is available, but given the service frequencies set out in the table above, bus ridership on the corridor is likely to be significantly smaller than the potential auto market.

2.1.3 Air Service

The study corridor contains two large hub airports, located in Atlanta and Charlotte, and a regional airport in the Greenville area. Table 2-5 sets out a number of key characteristics of these airports. The table includes each airport's ranking among U.S. airports in terms of 2011 domestic passenger enplanements, scheduled departures, passenger carriers operating at the airport, and enplanements per departure.

Of particular importance are the two major hub airports: ATL is the busiest airport in the U.S., and a major hub for Delta and AirTran (which was acquired by Southwest in 2010), while CLT is also among the busiest in the U.S., and is a major hub for U.S. Airways. Both of these airports serve as gateways for passengers throughout the southeast to connect to flights to numerous domestic and international destinations, as well as connection points for many longer-distance trips.

Table 2-6 shows the total number of true origin-destination trips between each pair of study area airports by direction, with outbound passenger volumes shown to the left of the diagonal and inbound passenger volumes shown to the right of the diagonal. Greenville GSP Airport is primarily served by 'feeder' flights to hubs that serve various carriers; this obliges passengers traveling to other destinations to make a connection. Services between GSP and the various hub airports are provided with a combination of mainline and regional aircraft.

From Table 2-6, it is evident that the Atlanta–Charlotte air market is by far the largest in the corridor. There is little origin–destination traffic between GSP and either of the major hub airports, which makes intuitive sense, as most travelers on these markets would be likely to drive, given the short distance.

Table 2-5: 2011 Airport Characteristics, Domestic Flights Only

Code	Airport	Passenger Enplanements	Rank Among US Airports, Enplanements	Scheduled Departures	Passenger Carriers	Enplanements per Departure
ATL	Hartsfield-Jackson Atlanta Int., GA	39,574,000	1	414,601	29	95
CLT	Charlotte Douglas International, NC	17,604,000	8	234,631	25	75
GSP	Greenville-Spartanburg International, SC	875,000	89	18,492	22	47

Source: Airport Snapshots from www.bts.gov

Table 2-6: True Origin-Destination Air Trips by Direction, Q1 2001 to Q4 2011

Destination/Origin	ATL	CLT	GSP
ATL		76,840	3,260
CLT	82,820		910
GSP	2,950	290	

Source: DB1B Market data for number of passengers between airport pairs for 2011 Q1 to 2011 Q4, extracted from www.bts.gov

2.1.4 Rail Service

Amtrak's Crescent service currently serves the Atlanta–Charlotte corridor. The Crescent service includes one daily train in each direction between New York and New Orleans. The southbound train leaves Charlotte at 2:45am and arrives at Atlanta at 8:13am, calling at Greenville at 4:54am en route. The northbound train leaves Atlanta at 8:04pm and arrives at Charlotte at 1:21am, calling at Greenville at 10:53pm. Thus, the scheduled services take between 5 hours 17 minutes and 5 hours 28 minutes. The adult one-way fare quoted on the Amtrak website is between $65 and $85. The service offers the typical facilities provided on Amtrak's long-distance trains and reservations are required.

Amtrak maintains detailed station-to-station trip data. However, given the low frequency of service and likely focus of Amtrak's marketing for this service towards longer-distance (or even end-to-end) trips, the mode share of conventional rail for trips between Atlanta and Charlotte is estimated to be negligible.

2.2 LOCAL TRAVEL MARKET

There are likely to be three main types of local trips:

- Journeys to work (most likely to originate in the suburbs and terminate in the city center);
- Trips for leisure purposes; and
- Trips to access the airport, as part of a longer trip (where the ultimate destination is outside the study corridor and where the longer trip itself is not a candidate for diversion to the new rail service).

As the potential corridor alternatives have not yet been finalized in detail, the project team must assume the need to test the attractiveness of stations located in the suburbs of each major city. In addition, it is currently unknown if cities other than Atlanta will have stations both close to their airports and in the city center.

Trips within the Atlanta and Charlotte urban markets will be modeled using modified versions of the existing MPO travel demand models. The resulting forecasts will then be overlaid onto the forecasts of inter-city trips. Table 2-7 lists the main transit options available in the main cities in the corridor and describes some of the key service characteristics.

Table 2-7: Local Transit Services in the Main Cities

City	Types of Services	Coverage	Typical Fares	Unlinked Trips (2011)	Unlinked Trips per Capita (2011)
Atlanta	Metropolitan Atlanta Rapid Transit Authority (MARTA)—bus	Central Station in downtown with routes generally covering area inside I-285	$2.50/ride	63.10M	13.96
	MARTA—rail	Four heavy rail lines extending from downtown to points near I-285 in the north, northeast, east, southwest, and west	$2.50/ride	76.23M	16.88
Charlotte	Charlotte Area Transit System (CATS)—bus/trolley	Extensive coverage in city; a number of routes extend farther out into the county and its neighbors	$1.75–$3.50/ride	21.77M	17.42
	CATS—light rail	A 9.6-mile line running from Uptown Charlotte south to I-485	$2.00/ride	4.77M	3.82
Greenville	Greenlink—bus	Entire downtown region covered, a few routes extend out of the city to the north and west	$1.50/ride	0.50M	1.24
Spartanburg	Spartanburg Area Regional Transit Agency (SPARTA)—bus	Entire downtown region covered, there are routes extending west to I-26 and north to I-85B	$1.25/ride	0.51M	2.84

Sources: http://www.itsmarta.com, http://charmeck.org/city/charlotte/cats/Pages/default.aspx, http://www.greenvillesc.gov/RideGreenlink/, http://www.spartabus.com, and the FTA National Transit Database (http://www.ntdprogram.gov)

Notes: Per capita calculations are based on population of the urbanized area served, as specified by the relevant NTD Transit Profile.

2.3 AIRPORT CHOICE MARKET

To establish the potential size of the airport choice market, the team has examined data on the total number of passengers traveling between the key city pairs. This differs from the data shown in Table 6, which includes only passengers traveling strictly between each point, and does not include those making connecting flights to other national and international destinations.

Table 2-8 presents segment-level traffic information for the three corridor airport pairs. The table includes total passengers, scheduled seats, scheduled departures, average daily frequency, average seats per flight, and average passengers per flight for 2011.

Table 2-8: Segment-Level Air Services Summary

City Pair	Passengers	Seats	Scheduled Departures	Flights / Day	Seats / Flight	Passenger / Flight
ATL-CLT	801,635	970,669	7,344	20	132	109
ATL-GSP	198,427	248,496	3,519	10	71	56
CLT-GSP	107,393	135,753	2,800	8	48	38

Source: T-100 segment data for scheduled passengers in study corridor for 2011 Q1 to 2011 Q4, extracted from www.bts.gov
Notes: Segment-level volumes represent all passengers traveling between two consecutive airports in any travel itinerary as opposed to true OD volumes, which are presented in Table 2-6.

While the Atlanta–Charlotte airport pair is primarily served by mainline aircraft (with typically more than 100 seats), each of the airport pairs that include GSP are primarily served by regional aircraft.

Comparing passenger counts on these routes with the true origin-destination traffic on the same airport pairs presented above (Table 6) demonstrates how many of the passengers are connecting. This comparison shows a high share of passengers on each of these three airport pairs—particularly those that include GSP—are making connections.

Given the high share of connecting traffic and short travel distances (ATL-GSP: ~150 miles, CLT-GSP: ~100 miles) between the airports, it seems plausible for air travelers in Greenville-Spartanburg to consider Atlanta or Charlotte as a possible alternate origin/destination of their air trips as long as they can get to ATL or CLT quickly and easily using the proposed HSR system. Given the large volume of connecting traffic, there may also be a number of air travelers who switch between ATL and CLT when HSR is introduced.

3. MAIN DATA SOURCES

This chapter sets out the main primary sources of data for the highway, air and other transportation markets. In addition to these data sources, the team will explore potential secondary data sources (specifically matrices developed for other studies) that could be useful as supplementary sources.

3.1 HIGHWAY AND SOCIO-ECONOMIC DATA

This section highlights various sources of data on the highway network and travel patterns in the corridor to be used as part of this study. The sources are:

- State Department of Transportation (DOT) traffic count data;
- American Travel Survey (ATS) and National Household Travel Survey (NHTS) data;
- CTPP and ACS data;
- Socio-economic data from existing MPO travel demand models;
- Other socio-economic data (i.e., population and employment data from Woods & Poole); and
- Journey planning software.

3.1.1 State DOT Traffic Count Data

The state DOTs maintain GIS-based applications that present traffic count data. These applications provide a web-based interface displaying traffic counts derived from permanent traffic count stations and portable traffic count locations on major roads. The type of counts and the robustness of each source will vary from state to state and count site to count site. In preparing the data for use in the model, these differences will be addressed so the data will be consistent across all states within the corridor. This data will primarily be used to validate the trip tables to be developed.

3.1.2 ATS and NHTS

The ATS was completed in 1995 and contains information on long-distance (greater than 100 miles) trip volumes and patterns as well as other journey characteristics: for example, journey purpose, vehicle occupancy, trip durations, and the number of stops en route. The ATS data was collected over a period of one year from 80,000 households across the U.S. that were interviewed during four survey waves. Although the ATS is dated it is also the most recent long-term, large-scale source of U.S. long-distance trip information.

The NHTS was first completed in 2001 and has been updated periodically, with the last round of data collection in 2009. The survey differs from the longer term ATS, with the key difference that the NHTS is focused on trips taken in a 24-hour period, which is much shorter than the year used in the ATS. This is important because long-distance trips are typically completed less frequently and thus may be under represented in the NHTS.

The 2009 NHTS must be used in conjunction with other data sources outlined in this chapter to gain meaningful insights on the specificities of trip travel patterns in a region; but it is a useful data source for adjusting trip tables and for better understanding trends in personal daily travel.

3.1.3 Census and Related Data

The CTPP is a set of special tabulations of census data tailored to meet the data needs of transportation planners. Tabulations are provided for various levels of geography including counties. Three sets of tabulations are provided, with those in the third set of particular interest because of the detail that it provides about travel choices (e.g. mode, departure time) and network conditions (mean and median travel time) associated with the journey to work (JTW).[8] The geographic detail allows information on longer-distance (including interstate) JTW trips to be obtained.

Through year 2000, the CTPP and earlier related census data products were compiled using data from the long form of the decennial census survey, sent to around 15% of households. The long form has now been replaced by the ACS, as described below.

The ACS is a continuous statistical survey carried out by the U.S. Census Bureau that is sent to approximately 3 million households annually. It is a replacement to the long form decennial census questionnaire and is used as a source of more up-to-date information than is possible from a decennial census. The ACS provides less statistically significant data than did long form data due to its smaller sample size; nevertheless, 3- and 5-year summaries of the ACS data are a source of reasonably up-to-date and statistically significant data. Going forward, the CTPP will be prepared from ACS data. The U.S. Census Bureau is in the process of using the 2006-2010 ACS data to develop a CTPP based on a 5-year summary; this will be the first CTPP using ACS data with tabulations at a more detailed geographic level. In July 2010, the Census Bureau delivered the newest update of the CTPP to the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA) using the 3-year summary of ACS records, and AASHTO is working to make all the tables web-accessible. This update of the CTPP will include JTW data aggregated at the county level, but is restricted to counties with at least 20,000 residents[9].

In addition, some information from the 2010 Census may become available within the timescale for this study. The team will attempt to use this data where possible; however, because there is no certainty this data will be released in time to be useful to the study, the team will develop the methodology based on the ACS data.

3.1.4 Socio-Economic Data from Existing MPO Travel Demand Models

One of the primary sources of socio-economic data for the Atlanta and Charlotte areas will be the existing MPO travel demand models: the ARC model (Atlanta) and the MRM (Charlotte). Both models contain socio-economic data, including estimates of population, households, and employment at the traffic analysis zone level for each model year, along with other potentially useful attributes, such as median income.

The study will use the socio-economic data from the two MPO models in both the inter-urban and intra-urban modeling phases.

3.1.5 Other Socio-Economic Data

3.1.5.1 County Business Patterns Data

County business patterns data[10] is an annual series developed by the U.S. Census Bureau that provides disaggregate economic employment information: employment by county by industry and

[8] *Tables in CTPP Part 3 provide information on the workers traveling from place of residence to place of work, along with characteristics of their households and their JTW.*

[9] *There are at least fifteen counties with fewer than 20,000 residents in the vicinity of the study corridor. The majority of these are located in Georgia.*

[10] *www.census.gov//econ/cbp//index.html*

business size. The data has been collected continuously since 1964 and the most recently published data is for 2008.

The aggregated nature of the data helps to maintain confidentiality, but in some instances, data is suppressed to meet this requirement. The series also excludes some categories of employed persons (i.e. self-employed individuals, employees of private households, railroad employees, agricultural production employees, and most government employees).

3.1.5.2 Woods and Poole Data

This commercially-prepared source[11] contains data for population, households, employment and income by county. The data includes historical data from 1970 and forecasts to 2040. The data is disaggregated by many factors, for example, population is disaggregated by age and race, employment by industry, earnings of employees by industry, personal income by source, and households by income bracket. This data, supplemented with growth elasticities from previous studies[12], can be used to estimate future year trip tables.

Each of the major MPOs in the corridor prepares population and employment forecasts. Given the resource and timing constraints for this project, and the need to ensure consistency of assumptions, Woods and Poole data is likely to be the best single source of comprehensive socio-economic data for the entire study area. However, it will be important to understand the differences between the locally developed MPO forecasts and those used in the model. These differences can potentially be used to define sensitivity tests.

3.1.5.3 Trip Planning Software

A variety of commercial journey planning software can be used to estimate point-to-point travel times, including Mapquest and Google Maps. These can be used to estimate both county-to-county automobile drive times and county-to-common carrier access point (i.e. airports and stations) drive times. County seats will be used as the center of each zone, unless better information about the actual county population center becomes available. This data will be supplemented with data from real time travel alert websites (e.g. www.sigalert.com, www.beatthetraffic.com), which can furnish more representative estimates of congestion and delay on specific links. Network modeling software (e.g. TransCAD) can also be used to check the travel times derived from these sources.

3.2 AIR DATA

This section will highlight various sources of data on corridor airports and air travel patterns that the project team intends to use as part of this study. The sources are:

- Airline Origin and Destination Survey (DB1B) data;
- Form 41 T-100 air travel data; and

[11] *www.woodsandpoole.com/main.php?cat=country*

[12] *For example, previous studies considering trip patterns in the study corridor, or the Interim Traveler Response to Transportation System Changes handbook, http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_webdoc_12.pdf*

- Airline schedules/websites.

3.2.1 DB1B Data

The Bureau of Transportation Statistics' (BTS) DB1B database[13] contains a 10% sample of airline tickets from reporting carriers (where reporting carriers are those above a certain size threshold). Data includes origin, destination and other itinerary details of passengers transported for both domestic and international trips (only the domestic data is required for this study). This database is used to determine air travel patterns, air carrier market shares, and passenger flows.

Data is available for individual travel segments (i.e. each leg of a passenger's air trip) as well as for markets (i.e. the entire air component of a passenger's trip). Data for non-reporting carriers can be estimated from other data sources (e.g. the T-100 discussed below) and appended.

3.2.2 T-100 Data

The BTS' Air Carrier Statistics database, also known as the T-100 data bank, contains domestic and international airline market and segment data. Certificated U.S. air carriers report monthly travel information using Form T-100. This data contains fewer variables than DB1B, but includes all relevant air carriers and thus can be used to in-fill for data missing in DB1B.

3.2.3 Airline Schedules/Websites

Airline websites contain information on their services, including scheduled flight times, frequency of services and fares. Note that these will typically be the schedules and an available fare based on the current schedule the airline is operating. Historic pricing information and some service information is available in the BTS databases described above. Assumptions will be made based on historic trends regarding future airline pricing and service levels.

4. PROPOSED MODELING METHODOLGY

As noted in Chapter 1, development of a ridership forecasting model system suitable for predicting high-speed rail ridership volumes in the study corridor will require the resolution of a number of modeling issues. The following sections summarize key issues and indicate the proposed methodology for addressing them.

As noted in the introduction, model development is an inherently exploratory process. While the modeling methodology will follow the general direction indicated here, it is expected that adjustments and modifications will be required as the model is developed and tested.

4.1 MODELING INTER-URBAN TRAVEL

In this section, the two following issues are discussed:

- Establishing the current pattern of inter-urban trip-making in the corridor: the zone-to-zone volume of trips by mode and trip purpose; and

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[13] *www.transtats.bts.gov*

- Predicting the effects on inter-urban mode splits of introducing new rail services in the corridor.

4.1.1 Current Pattern of Inter-Urban Trip-Making

4.1.1.1 Air Trips

Current true origin-destination volumes and patterns of corridor travel by air (local air trips) can be determined by reference to standard sources such as the DB1B and T-100 databases from the BTS. These local airport-to-airport volumes can be allocated to the zonal level and their trip purpose (business vs. non-business) distribution can be estimated using data on trip-making characteristics from the Census, County Business Patterns, and Woods and Poole data.

Similarly, air passengers who are connecting between the three corridor airports during their first or final legs of their trips can also be quantified from segment level data of the T-100 databases.

4.1.1.2 Bus Trips

As outlined in Chapter 2, bus ridership can be estimated indirectly using service frequencies, vehicle capacities and estimated load factors.

4.1.1.3 Rail Trips

Trip tables for existing rail services can be prepared using station pair level data from Amtrak, and allocated to zones and trip purposes as described above. However, given the relative sizes of this market, as estimated in Chapter 2, the team proposes the passengers currently making trips using rail are not modeled explicitly within the modeling framework to be developed. The project team believes it would be more advantageous to focus modeling resources on the modes that seem likely to be carrying the overwhelming majority of current inter-urban trips, and to address rail through post-model adjustments.

4.1.1.4 Auto Trips

There is no standard up-to-date source of information about inter-city auto trip making in the U.S. that is sufficiently detailed to be used in project-level forecasting; however, the accuracy of the auto trip tables strongly influences the accuracy of ridership and revenue forecasts for new rail services.

The ARC Model and the MRM each incorporate a representation of auto trips that enter/exit the model area from/to external locations, but neither contains detailed locations of the external ends of these trips. This information on external trip making is important and useful: for example, examination of the trips at external stations on I-85 in the ARC and MRM models will suggest an upper bound on the volume of auto travel between Atlanta and Charlotte. However, data in the individual models is not specific enough by itself to allow the individual model trip tables to be "woven" together into a single trip table covering the entire corridor and providing information on, for example, the number of auto trips from a particular zone in Atlanta to a particular zone in Charlotte.

Of course, traffic volume and classification counts are available for the major corridor roadways. The problem is the traffic counts combine both travel within the corridor and longer-distance travel, and travel for different purposes, without distinction.

Conducting new survey work to establish inter-city automobile travel patterns and levels suffers from various issues that may limit the usefulness of results. On the one hand, intercept surveys conducted directly on interstates would likely encounter logistical difficulties and other obstacles, while surveys of drivers at off-mainline locations such as rest stops tend to give highly biased results. On the other hand, interview or travel diary surveys of randomly-selected households in the corridor would be an inefficient way of collecting information on inter-urban travel because of the relative infrequency of these longer-distance trips.

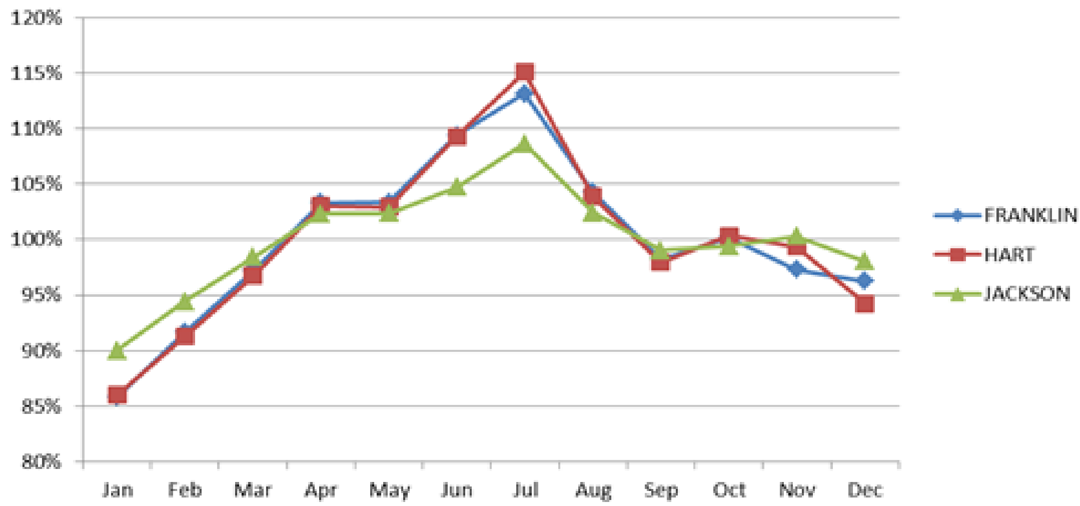
Given the available data collection options, it was decided that a limited program of cell phone based data collection is the best alternative to better understand the origins and destinations of the auto travelers in the corridor. For this effort, the project team will work with AirSage, a firm under contract with Verizon to collect and analyze data that identifies Verizon's subscribers' locations whenever data is transmitted to or from their mobile devices. Data from Verizon is available from January 2012 onward. AirSage has patented, developed and deployed their Wireless Signal Extraction (WiSE) technology which mines anonymous signaling data from wireless networks to detect the location and movement of mobile devices.

The team will work with AirSage to use this time-stamped location data of Verizon subscribers to analyze their movements through the corridor. This is a newly available rich source of data with great potential given the scale of the sample size, wide geographic coverage, and continual collection without intervention by users or network operations staff. It is important to understand different cell phone usage patterns without the ability to review individual subscriber's data points because of privacy concerns. This is necessary in order to correctly classify users and properly grow the sample trip table to the full population. Though because of its unique qualities and potential it is being used as the basis for development of auto trip tables for several long-distance intercity studies of rail (e.g. the Chicago-St. Louis HSR Corridor Tier-1 EIS study and the XpressWest HSR corridor) and other modes around the United States.

As part of the agreed upon scope of work with AirSage, AirSage will produce a zone to zone intercity auto trip table for 100 geographic zones (to be defined) for a 30-day period (to be defined) for resident and non-resident travel in the corridor. The 100 zones will be selected in such a way so that they conform with the existing county, TAZ (in the MPO models) or other commonly used (e.g. Census tracts) geographic units. Care will be taken to have finer level of detail representations of the zones in the major urban metro areas (i.e., Atlanta and Charlotte) compared to the more rural parts of the corridor. Further market segmentation (in addition to the resident, non-resident provided by AirSage) of the intercity auto trip table will include business and nonbusiness trip purposes based on information on the business/nonbusiness splits obtained from existing studies (e.g. the Volpe Study) or the MPO models.

Error! Reference source not found.4-1 illustrates the seasonality in traffic over the course of 2011 for three locations on I-85 in northeastern Georgia. Using this distribution and other historical traffic count data, the 30-day period (May-June, 2012) based on the locations that best represent primarily intercity traffic on I-85 between Atlanta and Charlotte will be selected. The representative month will be the one when the traffic level will be closest to the average level of rural interstate traffic for the most recent year for which traffic count data is available on I-85. The monthly intercity auto trip table will be converted to annual figures using the traffic count distribution mentioned above.

Figure 4-1: 2011 I-85 Traffic Seasonality by Location



Source: Georgia Department of Transportation, Steer Davies Gleave

The intercity trip table thus developed will be validated against available traffic count data on I-85, trip tables from the Volpe Study (if available), as well as from a variety of other sources as discussed in Chapter 3 including ATS and NHTS; data derived from the Census and subsequent surveys, such as the ACS; other socio-economic data.

4.1.2 Predicting Effects of Rail Services on Inter-Urban Mode Splits

Well-tested rail/HSR forecasting methodology will be applied to this study. This methodology is practical, transparent and easily evaluated for the reasonableness and accuracy of its relationships, and it reflects a theoretically satisfying choice structure. The approach is similar to that adopted in the *Atlanta–Chattanooga High Speed Ground Transportation Tier I EIS*, in the Volpe Center's *Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor*, and in many other studies around the United States. Forecasts produced using this methodology have been benchmarked against Amtrak's Acela Express and Northeast Direct ridership and revenue in the Northeast Corridor.

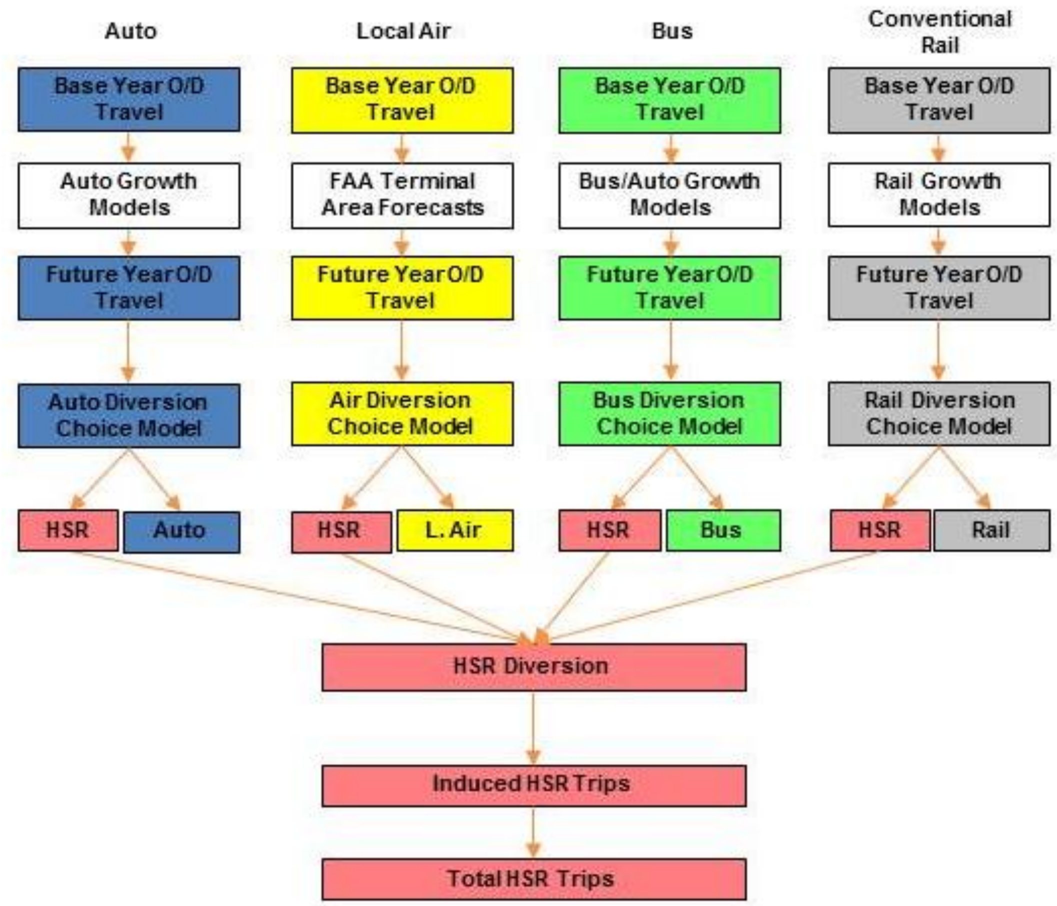
The key feature of the ridership and revenue forecasting methodology is its use of binary diversion models to calculate HSR ridership. It uses separate binary (two-mode) logit relationships to predict traveler diversions from each existing mode to the improved rail/HSR service. This forecasting approach is graphically shown in Figure 4. Travel market segments are carefully defined based on a combination of current mode, trip purpose and other traveler and trip characteristics. Market segments typically include:

- Inter-city private vehicle travel (business and non-business);
- Local air travel (business and non-business);
- Inter-city bus travel (business and non-business); and

- Conventional rail travel (business and non-business).

Figure 4-2 below shows the typical model segmentation.[14]

Figure 4-2: Typical Model Segmentation Structure



Source: Steer Davies Gleave

The auto travel market is further segmented into three groups: those who need a vehicle at their final destination ("destination-captive"); those who do not ("non-captive"); and those who need to make automobile trips at intermediate stops during their trip ("en route-captive")[15]. The likelihood of selecting rail for inter-city travel will be different for the three groups. Empirical work suggests that many auto travelers are in fact both en-route and destination captive.

Each diversion model shown in Figure 4 computes, for each combination of trip purpose, market segment and current mode, the probability a traveler would choose HSR over his or her current mode of travel as a function of the respective modal service attributes. These probabilities are then multiplied by trip volumes

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[14] *As noted earlier in this chapter, the project team expects that the PRCIP will focus on the current auto, air (both local and connect), and bus markets, but not conventional rail due to the low ridership volumes as outlined in Section 2.1.4.*

[15] *The en route-captive group includes travelers making stops for leisure or business purposes, and does not include travelers who only make stops for fuel, food, bathroom breaks, etc.*

of existing modes to predict the volume of travel that will divert to HSR. Induced (new) travel on the HSR mode is separately forecast (described later) using models based on generalized costs. Total HSR ridership is obtained by summing the predictions for individual market segments.

Modal service attributes include time, cost, frequency, reliability and quality of service with time and cost disaggregated into their access, egress, terminal and line haul components. Mode-specific constants account for the effects of other (not explicitly modeled) characteristics of HSR relative to other modes. These constants represent the inherent attractiveness of a mode, everything else (e.g. time, cost, and other LOS attributes) equal. These are considered to represent the average effect of all factors that influence any given mode's attractiveness but are not explicitly included in the utility specification. For example, factors such as modal comfort, safety, privacy, and reliability may be accounted for in this way.

The general utility function specification for each diversion model is as follows:

$$U = \alpha + \beta_1\text{Cost} + \beta_2\text{Travel Time} + \beta_3\text{Access/Egress Time} + \beta_4\text{Waiting Time}$$

where α represents the modal constant, waiting time represents a transformation of service frequency, and the βs represent a set of fixed-value coefficients for the different level of service variables.

In order to estimate and calibrate these model parameters, the project team will draw heavily on the recent Household Travel Survey conducted in 2009 as part of the *Atlanta-Chattanooga High Speed Ground Transportation Tier I EIS*. This survey sampled approximately 1,000 households in the Atlanta-Chattanooga corridor. Indeed, similar inter-urban binary mode choice models (as described above) were estimated for travel between Atlanta and Chattanooga using the survey data. These models will be used as starting points for this analysis. However, the models will be adapted and modified as required to reflect the specificity of the current study corridor, using engineering judgment, readily-available data, and information developed in other studies in the study area and experience in other rail/HSR corridors.

This is a reasonable demand forecasting approach because it allows for different intercity market segments to exhibit realistic differences in their tradeoffs between attributes such as time, cost, and comfort; therefore accounting for the diversity of travel behavior in the study corridor. The approach also makes it easy to carry out a wide range of sensitivity analyses to determine the effects of various changes on competitiveness, financial viability, and benefits.

The primary advantage of this approach is the confidence derived from the adoption of a model that has already demonstrated its utility and applicability in studies elsewhere. Its robustness and reasonableness in these other applications provide considerable assurance it will be a useful and credible tool for this Corridor Investment Plan.

4.2 MODELING INDUCED INTER-URBAN TRAVEL

Induced travel refers to trips that formerly were not made because of dissuasive travel conditions, but which materialize as a result of a transportation system improvement. Total rail ridership is obtained by summing the induced demand and the diverted rail trips described above for the individual market segments.

Two approaches can be adopted to forecast induced demand resulting from new high-speed rail service:

- A simple elasticity-based approach, where elasticity is expressed as the percentage impact on travel volumes resulting from a one percent change in accessibility. Accessibility, in turn, will be defined in terms of a generalized cost or logsum variable computed from the mode choice model.

Reasonable elasticity values (or a range of values for sensitivity testing) will be used to calculate the induced demand component.

- Evidence from the introduction of other high-speed rail services, and from assumptions utilized in other studies.

The project team recommends using the elasticity-based approach if the necessary data is able to be obtained, supplemented by evidence from the introduction of other high-speed rail services.

4.3 MODELING INTRA-URBAN TRAVEL

The HSR alternatives being considered as part of this study would possibly include stops at ATL and CLT and other stops in the Atlanta and Charlotte metropolitan areas. Hence, the proposed HSR mode would provide urban transportation service from the terminus at ATL and CLT to the Atlanta and Charlotte metropolitan areas as well as within these metro areas via other metro stations.[16] These stations will be located in the geographic area covered by the ARC and MRM regional travel demand forecasting models. For trips that begin and end within these areas, the HSR mode would compete with the variety of available urban transportation modes – various kinds of suburban bus services; MARTA heavy rail; MARTA buses; CATS buses; LYNX light rail transit (LRT); and with possible future modes such as streetcars, bus rapid transit (BRT), LRT and commuter rail—as well as with auto.

The current ARC Model has been developed to predict the mode choices and volumes of travelers in the Atlanta metro area. The model explicitly recognizes four “premium” transit modes—heavy rail and LRT, commuter rail, express bus, and BRT—together with their access/egress options. In effect, for any particular origin-destination trip, the ARC Model assesses the mode choices by considering, for each available mode, its time, cost and other service attributes, together with a mode specific constant that reflects travelers’ intrinsic preferences for that mode, other things equal. The modal constants for heavy rail and express bus were estimated statistically, in part from surveys of current users of these modes; those that represent traveler preferences for BRT/LRT and commuter rail (which do not currently exist in the metro Atlanta area) were derived using engineering judgment, by analogy to the corresponding constants for existing modes.

The current MRM has been developed to predict mode choices and volumes of travelers in the Charlotte metro area. The model recognizes a “premium” transit mode—which includes LRT, trolley, and commuter bus—together with its access/egress options. In effect, for any particular origin-destination trip, the MRM assesses mode choices by considering, for each available mode (of auto, bus, and premium transit), its time, cost and other service attributes, together with a mode specific constant reflecting travelers’ intrinsic preferences for that mode, other things equal. MRM mode choice coefficients are asserted from existing studies, and adjusted to better represent traveler preferences in the Charlotte area.

It is proposed to model metro Atlanta and Charlotte travel demands for HSR using the ARC and the MRM, respectively, treating HSR as an additional travel mode in competition with the other available modes by making appropriate modifications in their mode choice models or transit assignment procedures, as applicable. This approach makes maximum use of detailed knowledge of Atlanta- and Charlotte-area travel

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[16] It is highly unlikely that the Greenville and Spartanburg urban areas will have more than one HSR station each. Hence, the proposed HSR mode will not be an option for travel within each of these urban areas. However, possible travel by the HSR mode between these urban areas will be adequately covered by the proposed inter-urban travel modeling approach described earlier.

patterns and behavior already embodied in the ARC and MRM model systems. This choice does require, however, a decision about the appropriate incorporation of HSR within the current mode choice models in the ARC and MRM model systems. HSR service characteristics such as speed and fare translate directly into the model's service attribute variables such as travel time and cost, and so will be accurately represented. However, the HSR modal constant, which translates travelers' intrinsic preferences for HSR compared to other modes, other things equal, would need to be determined. Two contrasting methodological options are:

- Conduct stated preference surveys designed to generate data that would allow the HSR modal constant to be estimated statistically. The surveys could either be stand-alone efforts, or integrated with other survey work that might be carried out as part of this study, such as the market research internet panel survey mentioned in the preceding section;
- Apply professional judgment to derive the HSR modal constant (for example, this was done in the current ARC mode choice model for BRT/LRT and commuter rail modes). In the extreme case, for the purposes of predicting urban travel demand, HSR might be assumed to have the same modal constant as one of the modes already recognized by the mode choice model, such as commuter rail, albeit with very different modal service characteristics.

The proposed methodology for modeling urban travel is to extend and adapt the ARC and MRM mode choice models. This adaptation will be done using a combination of references to similar adaptations made to the model(s) to represent other non-existent modes, references to other HSR mode choice models, and engineering judgment.

4.4 MODELING AIRPORT CHOICE

It may prove challenging to model the behavior of air travelers who begin/end their trip at ATL, CLT or the Greenville Spartanburg (GSP) airports and who have the option of taking a connecting flight to/from ATL or CLT to/from their destination/origin, because of the attractiveness of HJAIA and CLT as hubs. The connection at ATL/CLT to/from the destination/origin may be obligatory (because no other flight from ATL/CLT/GSP is viable) or optional (because of nonstop flights from ATL/CLT/GSP or viable connecting flights via other hubs accessible from ATL/CLT/GSP). When considering a connection at ATL/CLT, the choice is then whether to begin/end the trip at ATL/CLT/GSP, fly to/from CLT/ATL and connect there to the onward leg; or to access/egress ATL/CLT via the proposed HSR mode and begin/end the air leg there. Note that an airport shift requires an HSR station at the new connecting airport.

Table 4-1 shows the potential size (i.e. to determine the volume of connecting trips between ATL-CLT, GSP-ATL and GSP-CLT) of this airport choice market. However, this does not cover travelers who begin/end their trip in the Atlanta/Charlotte/Greenville/Spartanburg areas but choose to access CLT/ATL via a surface mode. These trips will primarily be included in the inter-urban trip tables for the surface modes as discussed earlier.

Table 4-1: Segment-Level Air Services Summary

City Pair	Passengers	Seats	Scheduled Departures	Flights / Day	Seats / Flight	Passenger / Flight
ATL-CLT	800,496	969,408	7,344	20	132	109
ATL-GSP	197,064	249,849	3,519	10	71	56
CLT-GSP	106,400	134,400	2,800	8	48	38

Source: T-100 segment data for scheduled passengers in study corridor for 2011 Q1 to 2011 Q4, extracted from www.bts.gov
Notes: Segment-level volumes represent all passengers traveling between two consecutive airports in any travel itinerary as opposed to true OD volumes, which are presented in Table 2-6.

The project team proposes to derive a model of airport choice from available research on this topic and from similar models that other studies have developed.

HSR access to/from ATL/CLT may affect trips from Atlanta/Charlotte/Grenville/Spartanburg that have other air travel options (direct flights or connecting flights via other hubs). This is highly dependent on the competitive response of the air carriers to the presence of HSR service between ATL and CLT. The analysis will include highest volume airport destinations from ATL/CLT/GSP and, for each of these, compare the connecting by air option to a connection accessed via HSR at ATL/CLT. The comparison will incorporate trip cost, together with access, wait, transfer and line haul times, appropriately weighted, and will be based on a simple model estimated from current volume shares of different routes, as obtained from DB1B sources.

5. NEXT STEPS

At a strategic level, the proposed methodology is likely to follow the master program agreed upon by the project team.

The immediate next steps are to:

- Obtain approval from GDOT and FRA on this modeling methodology;
- Improve the team's understanding of the potential alternatives and alignments;
- Agree on scenarios and alternatives to test;
- Review existing studies in the corridor;
- Collect and start to process all of the data sources outlined in this plan;
- Develop various model elements described in this plan; and
- Apply models with the underlying data to produce detailed ridership and revenue forecasts.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX E: RIDERSHIP AND REVENUE RESULT DETAILS

May 2014

GDOT
Georgia Department of Transportation

Prepared on behalf of the

U.S. Department of Transportation
Federal Railroad Administration

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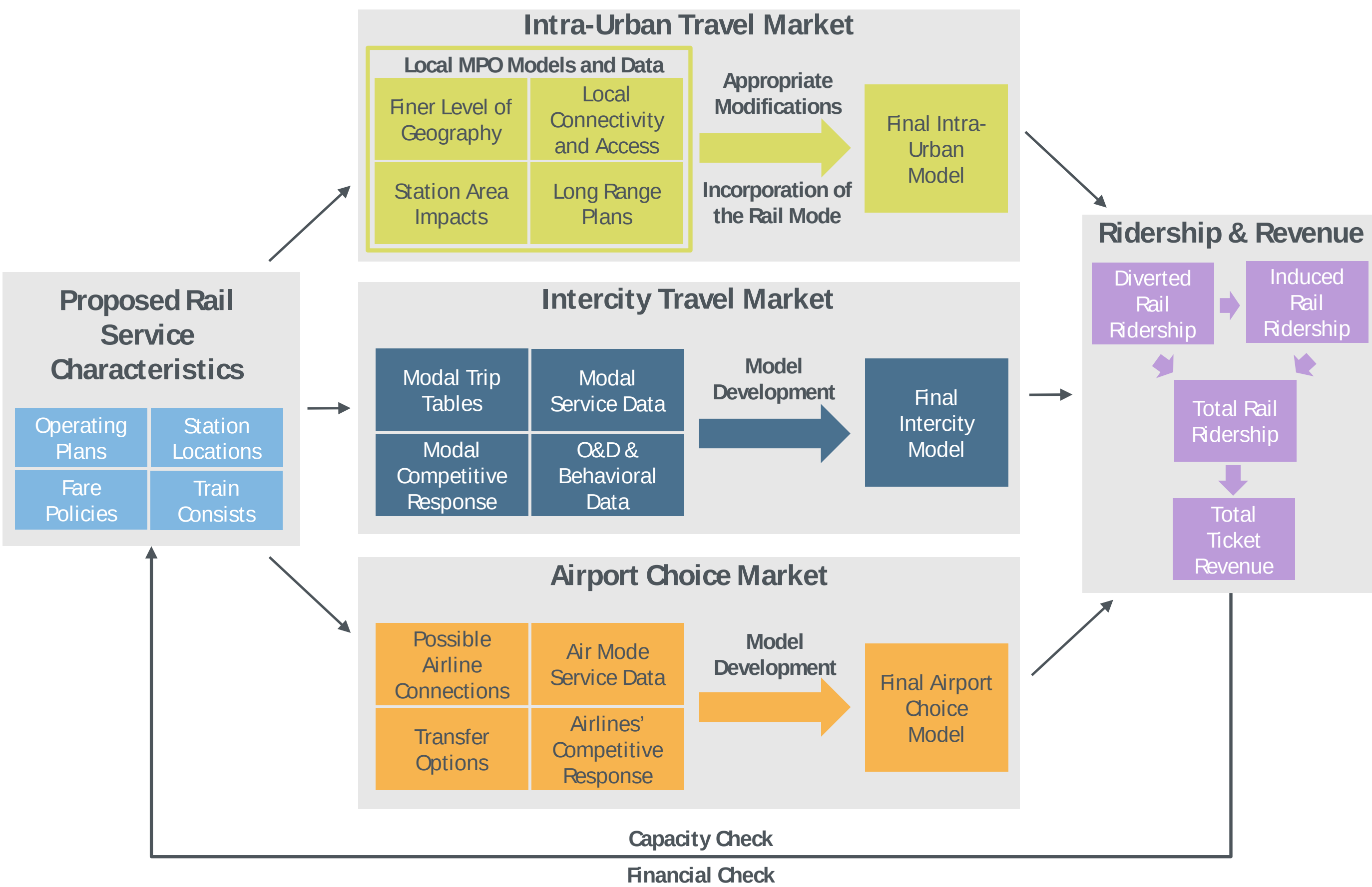
1. OVERVIEW OF THE RIDERSHIP AND REVENUE FORECASTING FRAMEWORK

A well-established travel demand forecasting methodology was applied to analyze ridership and revenue for the Atlanta to Charlotte Passenger Rail Corridor Improvement Plan (PRCIP). Figure 1-1 graphically illustrates the forecasting approach. As can be seen, it addresses four distinct travel markets (discussed below):

- The intercity travel market;
- The Atlanta and Charlotte-area intra-urban travel markets, including the airport access market;
- The airport choice (or connect air) market; and
- The induced demand market.

Figure 1-1: General ridership and revenue forecasting framework



To forecast demand for a rail service option (combination of technology and speed, alignment, and stopping pattern), the model requires information on the option's service characteristics. These include:

- Operating characteristics: stopping patterns, running and dwell times, schedule or frequency;
- Station-to-station fares; and
- Station locations and connectivity/accessibility/parking information.

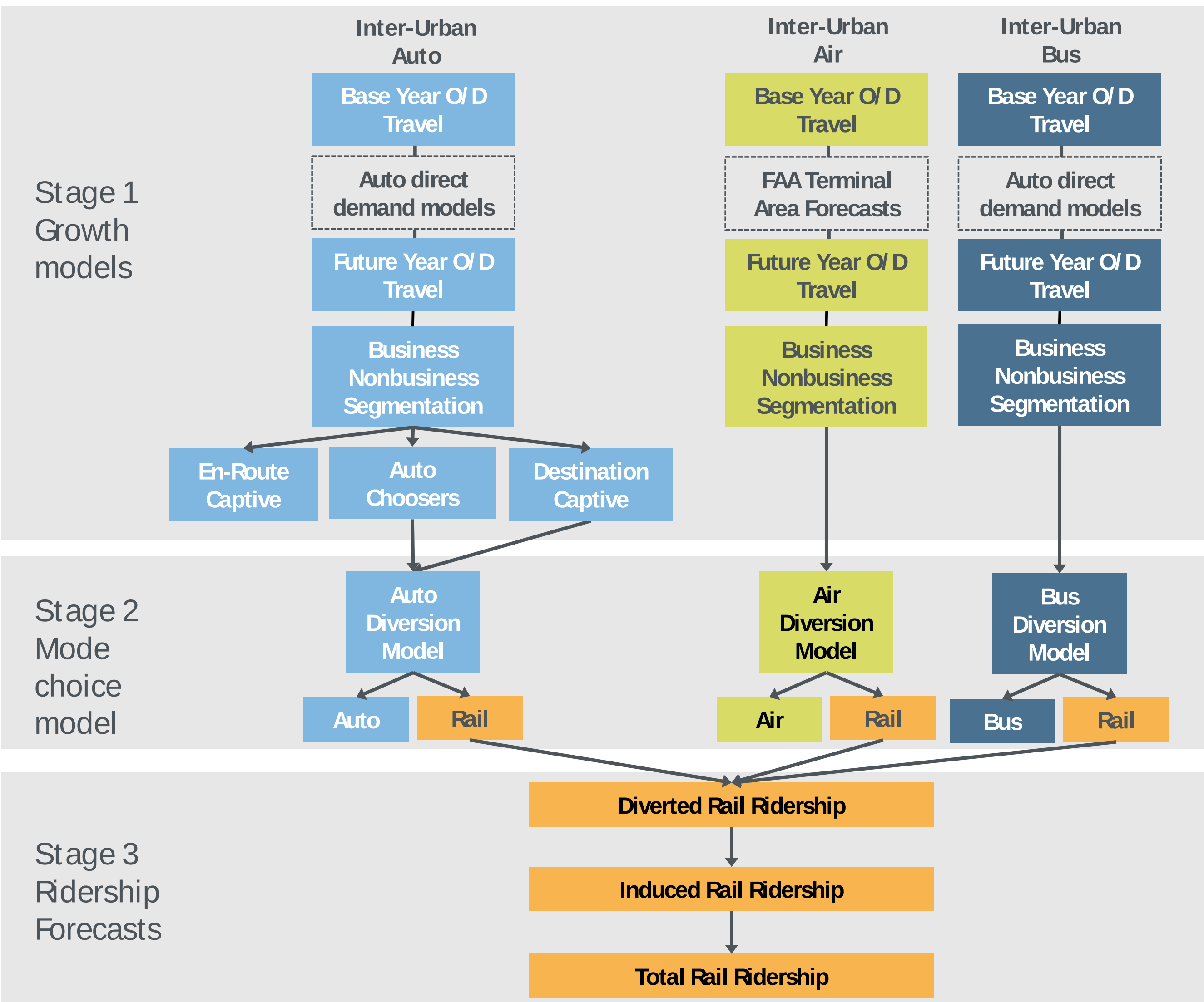
2. RIDERSHIP AND REVENUE MODELING FOR THE INTERCITY TRAVEL MARKET

The following describes in detail the travel demand forecasting process, the input data, and the travel demand models used to produce ridership and revenue forecasts for the intercity travel market.

2.1 DEMAND FORECASTING PROCESS

The travel demand model implements a well-established three-stage process for forecasting intercity ridership and revenue for several proposed rail options on the Atlanta-Charlotte corridor as illustrated in Figure 2-1.

Figure 2-1: The Intercity Ridership and Revenue Forecasting Process



- Forecast the analysis horizon year (2025 and 2050) demand for travel between corridor origin-destination (OD) pairs by each existing mode based on exogenous growth;
- Quantify the amount of travel diversion from each existing mode to the proposed rail mode; and
- Forecast the amount of induced travel on the proposed rail mode.

To implement this approach, the travel market was divided into a set of mutually exclusive segments (defined by mode and trip purpose) that exhibit distinct patterns of travel behavior:

- Air travel (by trip purpose);
- Private vehicle (auto) travel (by trip purpose); and
- Bus travel (by trip purpose).

This market segmentation approach to High-Speed and Intercity Passenger Rail (HSIPR) mode choice modeling is based on the recognition that mode choices of intercity travelers reveal a great deal about their preferences for the various features of those modes. For this reason, it was expected that a market segmentation based in part on the current preferences of intercity travelers in the Atlanta to Charlotte corridor for intercity air, auto, and bus also captured significant differences between the segments in their attitudes and preferences toward the proposed rail mode. Incorporating trip purpose in the market segmentation further captured known behavioral differences between people traveling for different purposes.

The market segmentation is further refined by differentiating between three groups of auto travelers: (1) those who need a vehicle at their final destination ("destination-captive"), (2) those who do not ("non-captive"), and (3) those who need to make stops en route during their trip ("en route-captive"). Many analyses of intercity travel assume that intercity trip makers are not captive to a particular mode, but empirical work indicates that this is not the case, particularly for auto travelers. The likelihood of selecting rail for intercity travel will be very different for the three groups of auto travelers since, for example, those who need a vehicle at their final destination (Group 1) will have to arrange for other transportation, typically by paying for the additional cost of renting a vehicle for the duration of their stay and spending extra time renting and returning the vehicle. In addition, auto travelers who need to make stops en route during their trip (group 3) are not "choosers"; that is, they are not eligible for diversion to the proposed rail mode.

- **Stage 1**: estimated the 2025 and 2050 OD travel volume of all relevant intercity modes by growing base year OD volumes to 2025 and 2050. The base year auto intercity trip table[1] is grown to 2025 and 2050 using growth rates obtained from direct demand models estimated for this study (described later in this chapter). A direct demand model calculates the volume of OD travel by a particular mode as a function of socio-economic (e.g. population, income, employment) and level of service (e.g. time and cost) data for the OD pair. This way mode-specific trip tables are developed for 2025 and 2050.
- **Stage 2**: applied mode choice models (described in detail later in this section) to predict the share of each considered mode in the future years, considering their respective Level of Service (LOS) characteristics. Market-specific mode choice models were applied to predict, for 2025 and 2050 and for each OD pair, the share of travelers who will use the proposed new rail mode; separate models are applied for different travel purposes. For each combination of trip purpose and existing intercity

[1] *Obtained from anonymous cell phone movement data in the study area and described in detail later in Section 3.*

mode, the relationships were calibrated of the following general form as part of the mode choice modeling that express the fraction of travelers who would divert from the existing mode to the proposed rail mode as a function of the respective modal service attributes. These relationships are then applied to predict the volume of travel on the modes that will divert to rail.

$$S_{OD}^{m,Rail} = f(time_{OD}^{m,Rail}, cost_{OD}^{m,Rail}, freq_{OD}^{m,Rail}, QOS_{OD}^{m,Rail}, const_{OD}^{m,Rail})$$

where

$S_{OD}^{m,Rail}$ = share of existing mode m trips between O and D that will divert to rail;

$time_{OD}^{m,Rail}$ = access, egress, line-haul, and processing time components for mode m and rail;

$cost_{OD}^{m,Rail}$ = access, egress, and line-haul travel cost components for mode m and rail;

$freq_{OD}^{m,Rail}$ = measures of the frequency for mode m and rail;

$QOS_{OD}^{m,Rail}$ = quality of service measures (comfort, reliability, etc.) for mode m and rail; and

$const_{OD}^{m,Rail}$ = effect of unquantified characteristics of rail relative to the existing mode.

As shown in Figure 2-1, a set of binary (two-mode) logit models were used to predict diversion to rail for each mode and trip purpose; each model compared the attractiveness of rail against one existing mode (air, auto, and bus, as applicable) for one trip purpose. This approach avoids many of the issues and difficulties that some other HSIPR modeling approaches typically encounter. The modeling approach also incorporated alternative system configurations, service levels, service features, and capacity.

These binary models are based on adaptations/modifications of similar models that were used in the Atlanta-Chattanooga High Speed Ground Transportation Tier I EIS study. The Atlanta-Chattanooga models were estimated using data from a Household Travel Stated Preference (SP) Survey conducted in 2009 as part of that study. In that SP survey, travelers expressed their choices in hypothetical situations presented to them as well as information pertaining to their travel characteristics in actual travel situations for reference trips. These sources were supplemented by results from other high-speed and intercity passenger rail studies in the U.S. and elsewhere.

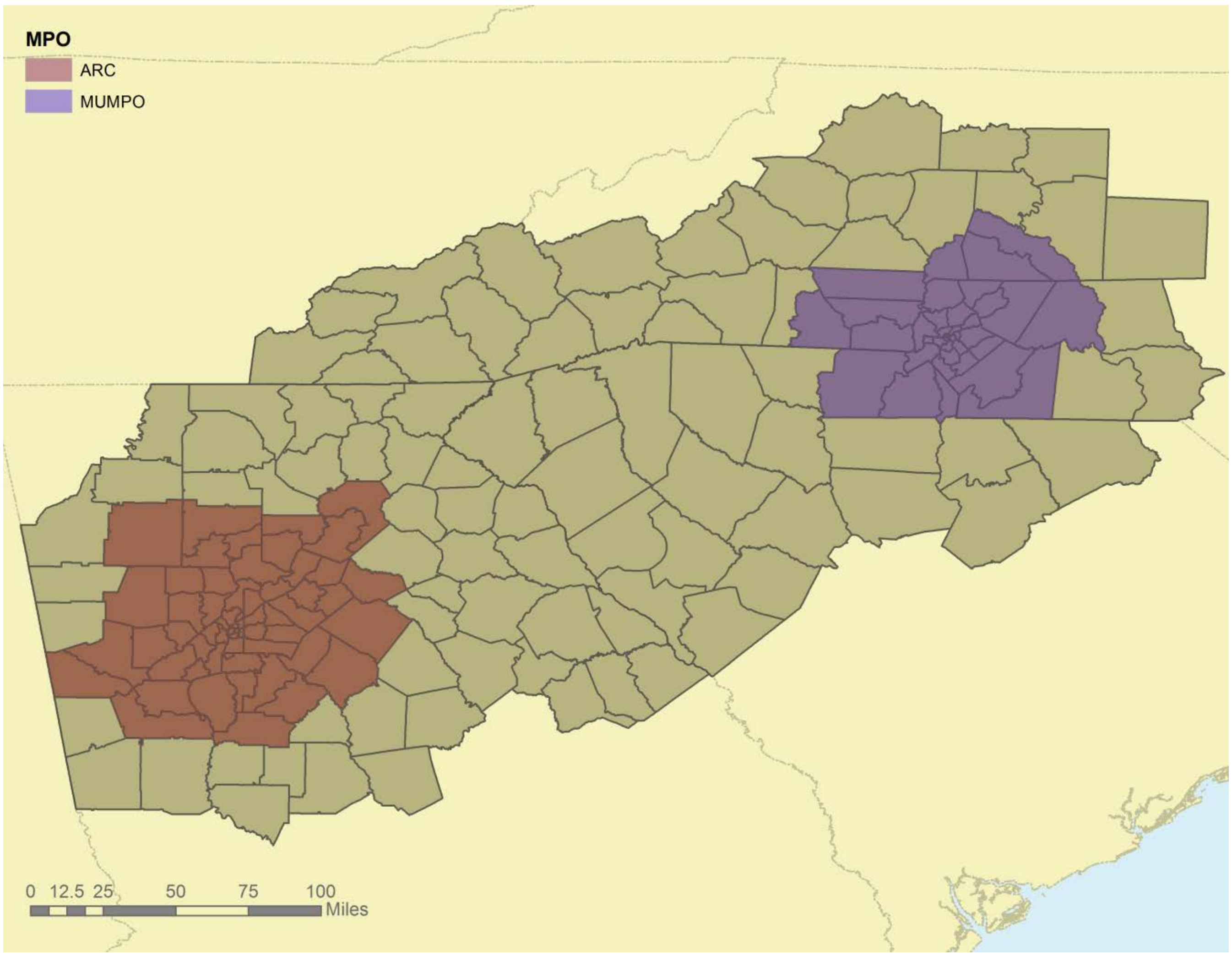
- **Stage 3**: estimated the volumes diverted to the new rail mode from each intercity mode by relating the diversion percentages to the modal travel volume. It also estimated the volume of new trips that result from travel condition improvements (induced travel). The rail diversion percentages computed in Stage 2 were applied to the modal trips estimated in Stage 1 to obtain the corresponding rail mode's ridership; this computation is carried out for each OD pair and separately for each market. Induced travel volumes were also calculated in this stage; elasticity-based induced demand models, which relate a percentage change in demand to a corresponding percentage change in generalized cost, were developed and applied for this purpose. The generalized costs used in the induced demand models were calculated from the binary diversion models used in Stage 2. For each OD pair and travel purpose, the combined results of the mode choice and induced travel models for 2025 and 2050 provide the new rail mode's demand forecasts for those years. These OD level ridership forecasts are then multiplied by the corresponding fares (for each OD pair, and separately by travel purposes) to calculate the ticket revenue. Forecasts for individual OD pairs and purposes are then aggregated to calculate intercity ridership/revenue for the Atlanta-Charlotte corridor as a whole.

2.2 INPUT DATA

2.2.1 Study Area

The intercity model study area is shown in Figure 2-2. The study area extends approximately 50 miles from the proposed rail alignments and is divided into geographic units called zones. Zones are important to the modeling process because they represent the smallest level of geography defined as trip origins and destinations.

Figure 2-2: Intercity Model Zone System



The zone system is developed in part by combining the zones used in the travel demand models of the study area Metropolitan Planning Organizations (MPOs): the Atlanta Regional Commission (ARC), and the Mecklenburg-Union Metropolitan Planning Organization (MUMPO). For the portion of the study area that is not covered by an MPO model, county lines are used as zonal boundaries. Zones in the MPO model areas were further aggregated to form intercity model zones. After these adjustments, the number of zones in the study area totals 189. The breakdown of zones by original travel demand model is detailed in Table 2-1.

Table 2-1: Intercity Model Zones by Source

Source	Zones
ARC Model	60
MRM Model	38
Outside ARC and MRM Boundaries	91
Total	**189**

2.2.2 Socioeconomics

Socioeconomic variables, including population, employment, and mean household income, were fundamental to forecasting ridership and revenue. Socioeconomic variables serve as inputs into the intercity auto direct demand model, which determines the growth factors used to grow the intercity auto trip tables from 2012 to 2025 and 2050. As a result, the 2025 and 2050 trip tables are sensitive to county-level changes in demographic characteristics.

The MPO travel demand models used to develop the zone system contain corresponding socioeconomic data at the zone level. Because each model employs a unique methodology for estimating socioeconomic variables and contains different base and forecast years, other sources are also used where necessary to establish consistency across the entire study area. These other sources are shown in Table 2-2.

Table 2-2: Socioeconomic Data Sources

Data	Source
Population	2010 Census, Woods & Poole[2]
Employment	Woods & Poole
Mean Household Income	Woods & Poole

Census 2010 data was used for base year population and was aggregated from the block group to the zone level. In order to get population for 2025, growth rates calculated from Woods & Poole socioeconomic forecasts were applied to the Census 2010 population. For 2025 and 2050, Woods & Poole employment and mean household income data was used. Employment and income data was allocated to the zone-level based on MPO travel demand model employment and income distributions. Table 2-3 shows the total population, total employment, mean household income, and the implied growth rates assumed for the study area.

Table 2-3: Socioeconomic Study Area Totals and Growth Rates

	2012 Total	2025 Total	2050 Total	CAGR 2012-2025	CAGR 2012-2050
Population	13,271,000	15,791,000	18,759,000	1.35%	0.91%
Employment	6,994,000	8,350,000	10,215,000	1.37%	1.00%
Mean HH Income	79,792	91,956	114,848	1.10%	0.96%

Figure 2-3, Figure 2-4, and Figure 2-5 illustrate county-level population density, employment density, and mean household income in the study area. These figures show the highest population density, employment density, and income in the Atlanta and Charlotte metropolitan areas. The maps also show that the areas of high population density generally also experience high employment density. It is interesting to note that the highest growth rate in the variables considered (especially population) occurs outside of the

[2] *Woods & Poole is a well-reputed private company the develops socioeconomic projections through 2050 at the county-level for the entire US.*

metropolitan areas. Consequently, this trend leads to higher growth rates for trips originating or ending in suburban/rural zones from 2012-2025 and 2012-2050.

Figure 2-3: 2025 Population Density and Growth by County

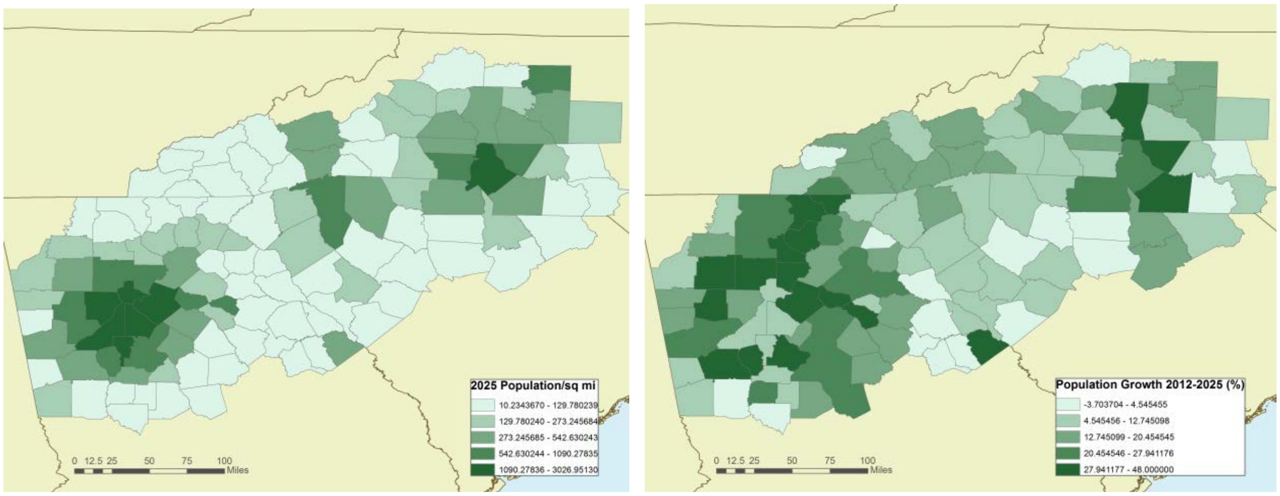


Figure 2-4: 2025 Employment Density and Growth by County

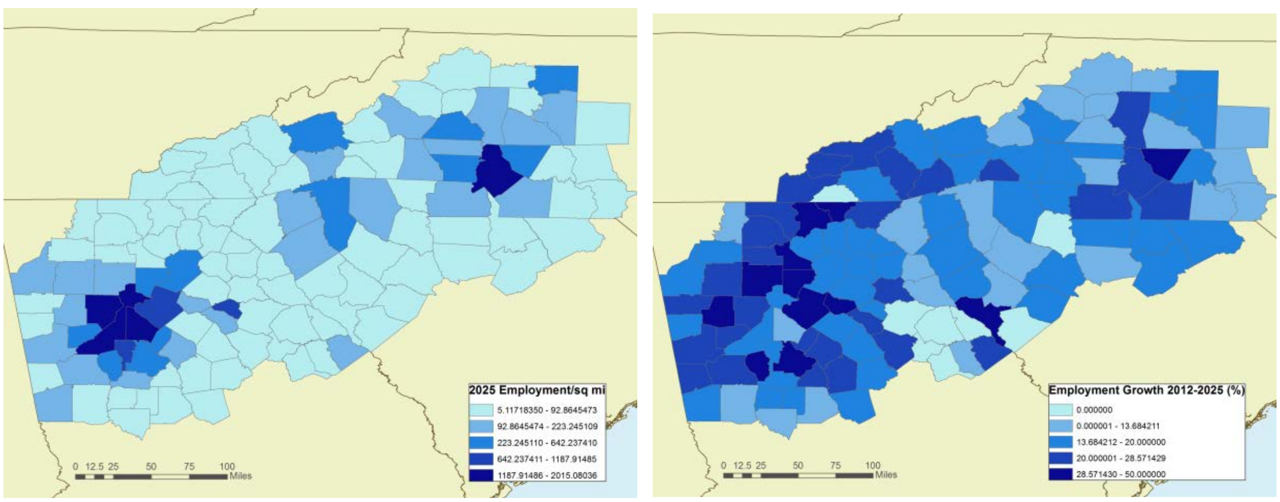
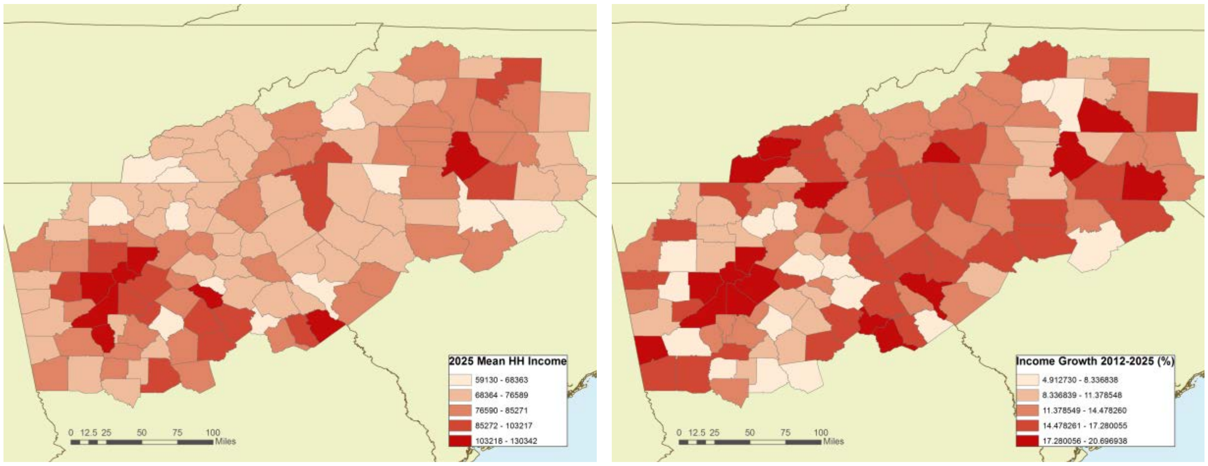


Figure 2-5: 2025 Mean Household Income and Growth by County



2.2.3 Market Segments

Two distinct market segments based on trip purposes were identified for intercity travel within the study area. Each traveler is grouped into one of these two market segments—business and non-business. Table 2-4 shows the breakdown of study area trips by mode and market segment.

Table 2-4: Study Area Trips by Mode and Market Segment

Mode	Business	Non-Business
Auto	12%	88%
Air	25%	75%
Bus	0%	100%

2.2.4 Trip Tables

Trip tables are critical inputs into the mode choice models that calculate the diversion from the existing intercity modes (i.e. auto, air and bus) to the proposed rail mode. Separate trip tables were prepared for intercity auto, bus, and air travel. The following describes trip table data sources, zone catchment areas, and 2025 and 2050 input trips by mode.

2.2.4.1 Catchment Areas

For each of the common carrier modes (air and bus), catchment areas are defined for each of the airports and bus stops. Catchment size varies by mode to reflect representative access/egress distances. The catchment area around the corridor's largest airport, Hartsfield-Jackson Atlanta International Airport (H-JAIA) was defined as a 50-mile radius, while the catchment areas for the smaller Charlotte Douglas International (CLT) and Greenville-Spartanburg International (GSP) airports were given radii of 30 miles. Additional adjustments were made to the airport catchment areas to take into account geography and competing airports outside of the study corridor. Bus catchment areas were limited to the city centers, with radii of approximately five miles around the bus stops. Trips are distributed to zone pairs in their corresponding catchment area based on zonal population.

2.2.4.2 Growing Base Year (2012) Trip Tables

The base year OD trip tables for bus and auto were grown to 2025 and 2050 trips by applying growth factors calculated from the auto direct demand models described later in this appendix. The direct demand models produced distinct year-to-year growth factors for each zone pair. Air trips were grown to 2025 and 2050 using growth in enplanements by study area airport, as provided in the Federal Aviation Administration (FAA) Terminal Area Forecasts (TAF).

2.2.4.3 Auto Trip Table Development

Base year (2012) OD auto trips were developed based on data from cell phone movements in the study area. This data was obtained from AirSage, a company that tracks and analyzes cell phone movement while preserving user anonymity. Detailed discussion on AirSage data and development of the base year intercity auto trip tables is included in Chapter 3 of this appendix. For the long distance intercity market, only trips of 75 miles or longer are considered candidate trips that may divert to the rail mode. Based on the market segment definitions described above, the auto trip tables were separated into two trip purposes: business and non-business.

The trip tables were also divided into captive and non-captive trips. Captive trips are defined as auto trips that need to make en-route stops, thus requiring an automobile for the entire length of the trips. These trips were therefore not considered eligible for diversion to rail and are removed from the trip table before application of the mode choice model. As illustrated in Table 2-5, the percentage of captive trips varies by trip purpose. These values were based on survey data collected as part of the Atlanta-Chattanooga Tier 1 EIS study and previous experience modeling intercity travel in the Southeastern U.S..

Table 2-5: Captive Trips by Trip Purpose

Trip Purpose	Percent Captive Trips
Business	35%
Non-Business	40%

Auto trips that are eligible for diversion ("in-scope") to the rail mode are finalized after screening out some trips that are considered not to be intercity long-distance in nature and not realistic candidates for rail diversion. Trips removed from the "in-scope" intercity trip tables include:

- All trips less than 75 miles; and
- All trips where the sum of access and egress distance exceeded auto distance and/or line-haul rail distance.

Because access and egress characteristics vary by the rail options that are analyzed, the number of trips eligible for diversion in the intercity mode choice model also changes accordingly.

Table 2-6 shows the overall intercity auto trips split by trip purpose after trips with distances less than 75 miles are removed. It does not exclude en-route captive trips, or trips removed based on access/egress distance criteria described in the preceding text.

Table 2-6: Input Auto Trips by Purpose

Year	Business Trips (millions)	Non-Business Trips (millions)
2012 Base Trips	12.4	82.9
2025 Forecast Trips	13.0	95.7
2050 Forecast Trips	14.0	105.0
2012-2050 CAGR	*0.30%*	*0.37%*

2.2.4.4 Bus Trip Table Development

Supply side information (i.e. frequency of service) from operators' websites and capacity and load factor assumptions were used to estimate intercity bus trip volumes by station pair. Greyhound and Megabus were the only bus services considered. The station-pair level trips estimated from this analysis were distributed to zones within 5 miles of each station, the assumed catchment area for bus trips. The resulting base year OD trip tables were grown to 2025 and 2050 using growth factors from the auto direct demand model, as no separate direct demand model is developed for bus as bus volumes are quite insignificant compared to auto. Base and future input bus trips are shown in Table 2-7.

Table 2-7: Input Bus Trips

Year	Trips (millions)
2011 Base Trips	0.22
2025 Forecast Trips	0.23
2050 Forecast Trips	0.26
2012-2050 CAGR	*0.42%*

2.2.4.5 Air Trip Table Development

The study area is served by two large hub airports, H-JAIA and CLT, and one regional airport, GSP. Table 2-8 sets out a number of key characteristics of each of these airports, including its ranking among U.S. airports in terms of 2012 domestic passenger enplanements, scheduled departures, passenger carriers operating at the airport, and enplanements per departure.

Of particular importance are the two major hub airports: H-JAIA is the busiest airport in the U.S., and a major hub for Delta and AirTran (which was acquired by Southwest in 2010), while CLT is also among the busiest in the U.S., and is a major hub for US Airways. Both of these airports serve as gateways for passengers throughout the Southeastern U.S. to connect to flights to numerous domestic and international destinations, as well as connection points for many longer-distance trips. GSP is primarily served by "feeder" flights to hub airports; this obliges passengers traveling to other destinations to make a connection. Services between GSP and the various hub airports were provided with a combination of mainline and regional aircraft.

Table 2-8: Study Area Airport Characteristics

Code	Airport	US Airport Rank	2011 Passenger Enplanements	2011 Scheduled Departures	2011 Passenger Carriers	Enplanements per Departure
H-JAIA	Hartsfield-Jackson Atlanta International	1	39,574,000	414,601	29	95
CLT	Charlotte Douglas International	8	17,604,000	234,631	25	75
GSP	Greenville-Spartanburg International	89	875,000	18,492	22	47

Source: Airport Snapshots from www.bts.gov

Error! Reference source not found.2-9 shows the total number of true OD (i.e. end to end, not connecting) trips between study area airport pairs by direction, with outbound passenger volumes shown to the left of the diagonal and inbound passenger volumes shown to the right of the diagonal. The data shown here is as reported in the DB1B airline ticket sample database, without additional processing.

Table 2-9: 2011 Origin-Destination Air Trips by Direction

	H-JAIA	CLT	GSP
H-JAIA		76,840	3,260
CLT	82,820		910
GSP	2,950	290	

Source: DB1B Market data for number of passengers between airport pairs for 2011 Q1 to 2011 Q4, extracted from www.bts.gov

2.2.5 Level of Service Characteristics

The Level of Service (LOS) characteristics for any mode (e.g. time, cost, service frequency) affect individuals' choices of travel mode. Consequently, LOS characteristics are critical in predicting ridership and revenue for the new rail mode. This section describes in detail the LOS characteristics, sources, and assumptions for each mode considered for the intercity travel market.

2.2.6 Auto LOS characteristics

Auto LOS characteristics include travel time, distance, and toll cost between zone pairs in the study area. LOS characteristics are obtained from the projected 2025 and 2050 highway networks that was created for this study from the study area MPO models as well as the National Highway Planning Network (NHPN). The highway network created this way contains segment-level data on speed, distance, and toll cost. The highway route/path between each zone pair is determined by minimizing time of all the possible paths. Per mile auto operating costs (~$0.16/mile) were calculated from historical and projected fuel price and fuel price efficiency data obtained from the Energy Information Administration (EIA) website, shown in Table 2-10. This operating cost value was used for all the non-business and/or non-work related travel for the study. For business-related travel, an operating cost per mile value of $0.32/mile was used to represent higher perceived out-of-pocket auto costs for business travelers.

Table 2-10: Auto Operating Cost by Purpose

Purpose	Auto Operating Cost
Business	$0.32/mile
Non-business	$0.16/mile

2.2.6.1 Auto Travel Time

Travel time was calculated from the speed and distance data associated with the highway network. In areas covered by the MPO models, congested speed was used to calculate auto travel time. In other areas, free flow speed was assumed. The speed fields used to calculate time in the intercity model are shown in Table 2-11.

Table 2-11: Highway Speed Assumptions by Source Travel Demand Model

Model	Network Year	Congested Speed Field	Adjustments
ARC	2040	CGSTDSPD	Model run only with 2025 improvements for 2025 speeds
MUMPO	2025/2035	SPpeak	None
Outside ARC and MRM Boundaries	N/A	Free flow assumed	None

Two of three highway networks used for this study, as mentioned above, provide highway networks and corresponding data, and therefore did not require travel time adjustments. However, the NHPN does not provide travel times, so highway travel times were obtained from each state's highway speed limit laws. Additional congestion on the NHPN links (highway links outside the ARC and MRM boundaries) was modeled as part of the sensitivity analysis (discussed in detail later).

To get the travel time for each zone pair, the average of both directional travel times was assumed to represent average daily conditions. Table 2-12 shows approximate auto distance, travel time, and auto cost assumptions for select station pairs in 2025 and 2050. Reductions in auto travel time in 2050 compared to 2025 for some of the city pairs are an artifact of highway improvements that are planned for the study area, per the relevant long-range transportation plans.

Table 2-12: 2025 and 2050 Auto Distances and Travel Times

City Pair	Distance (miles)	2025 Travel Time (minutes)	2050 Travel Time (minutes)
Atlanta-Charlotte	243.8	314.9	300.0
Atlanta-Greenville	148.4	196.2	179.1
Charlotte-Greenville	102.3	105.6	106.9

2.2.6.2 Auto Cost

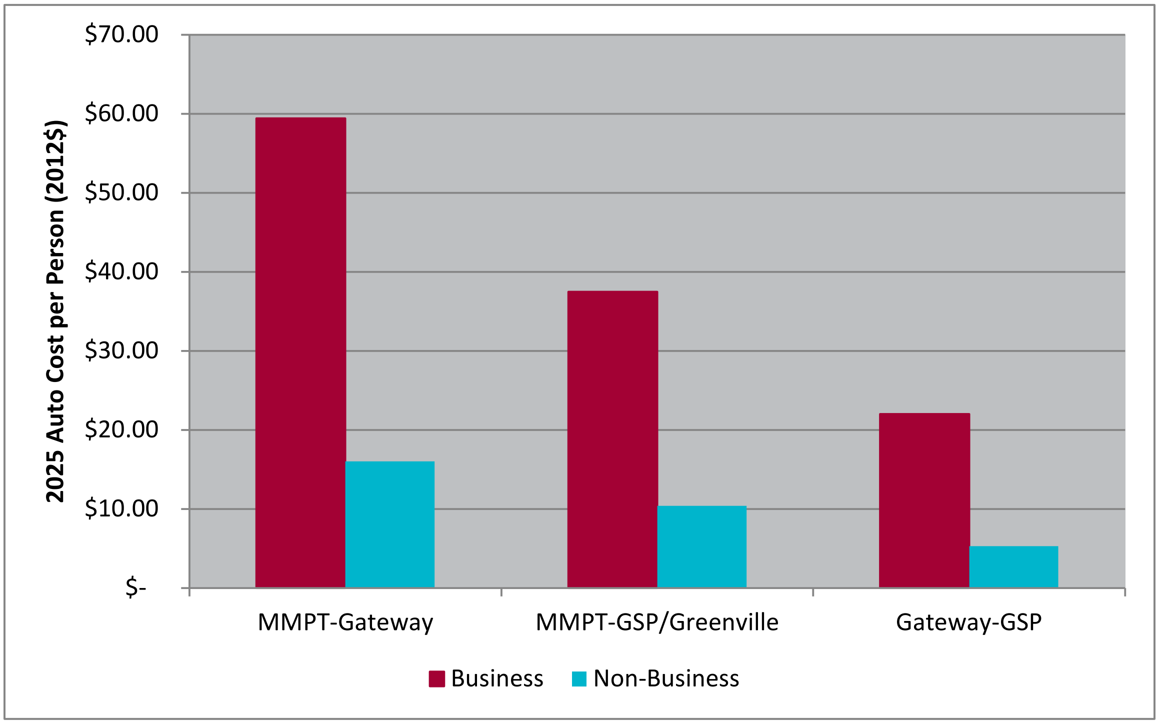
Auto cost is the sum of vehicle operating cost, and toll cost. In order to convert auto cost per vehicle to auto cost per person, auto cost was divided by the average auto occupancy, or travel group size as shown in

Table 2-13. These values vary by trip purpose, and are based on previous intercity passenger rail modeling work throughout the U.S. Figure 2-6 illustrates auto cost per person by trip purpose for major station pairs.

Table 2-13: Average Auto Occupancy by Trip Purpose

Purpose	Auto Occupancy
Business	1.5
Non-Business	3.1

Figure 2-6: 2025 Auto Cost per Person by Trip Purpose



2.2.7 Rail LOS characteristics

The rail LOS characteristics are critical input data necessary to forecast diversion to the rail mode, and in turn 2025 and 2050 ridership and revenue. The LOS characteristics were used to calculate the utility of the rail, auto, bus, and air modes between each OD pair in the study area. As explained in the mode choice section, these utilities were used to calculate the diversion from each of the existing modes—the probability that a traveler on an existing mode will divert to the new rail mode depends on the relative utilities of the various modes available for his/her travel.

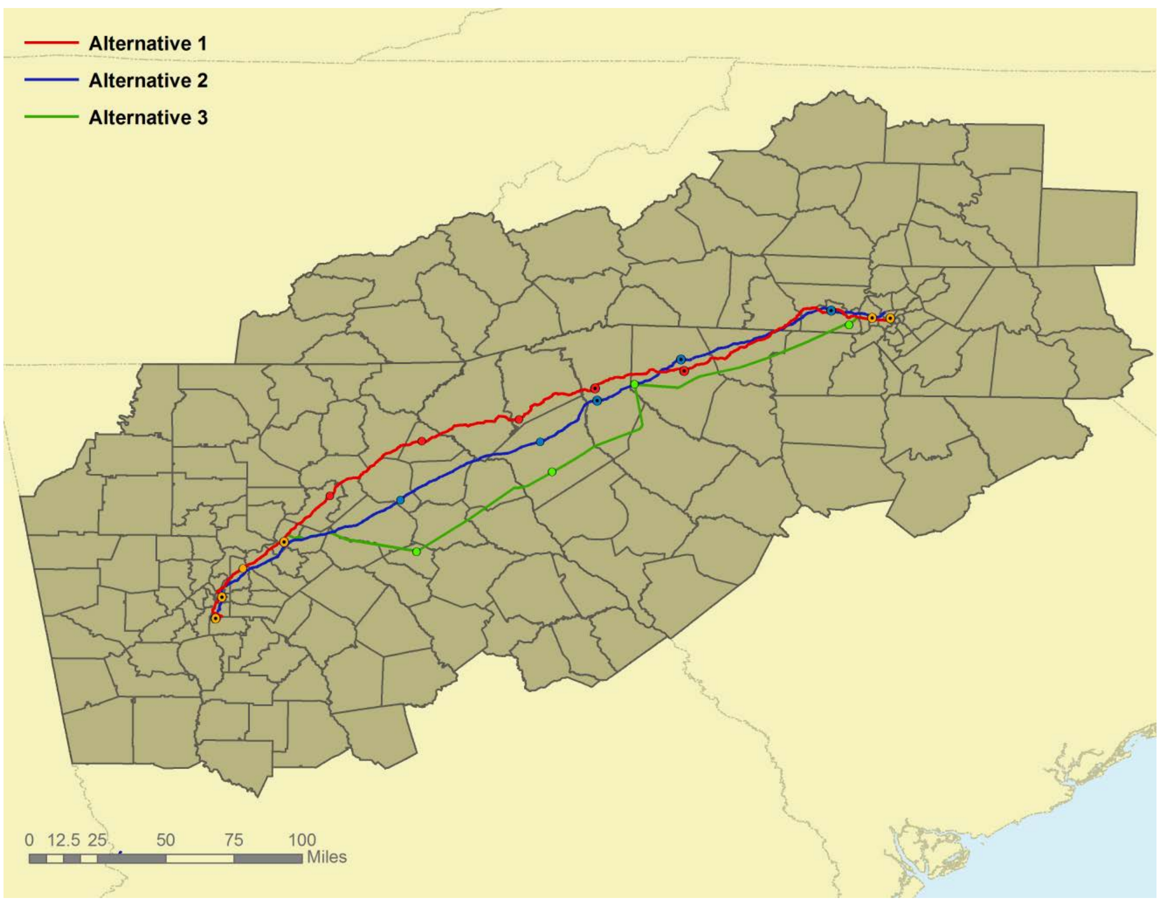
A person traveling by the rail (or other common carrier mode) actually has several trip components—accessing a rail station from an origin zone, accessing the station platform, waiting for the train to arrive, taking rail from an origin station to destination station, alighting from the train to go a departure point within the station, and the ultimate egress from the destination station to a destination zone. In the mode choice models, each zone is assigned to the best station in terms of travel time, such that each zone pair is associated with a nearby station pair to fulfill the trip by the rail option. To account for all the trip components mentioned above, the rail utility in the mode choice models was a function of rail in-vehicle time, transfer time, terminal times (both access and egress), fare, and frequency (in the form of wait time), as well as access and egress time. Different components of travel times used for rail LOS characteristics were weighted differently in the mode choice model, based on how travelers usually perceive them. For example, travelers may perceive wait times to be longer than in-vehicle time. These differential weights for the various travel time components were represented by the respective mode choice model coefficients and are discussed further in Section 2.3.2.

2.2.7.1 Rail In-Vehicle Time

Station to station rail in-vehicle times are calculated from timetables developed for each option by the project team. Using the zone-to-station correspondence, each zone pair was assigned the rail in-vehicle time of the station pair it is associated with. The following paragraph presents a brief summary of each option, along with the station pair travel time comparisons.

There are three alternatives, each with two technology options. Figure 2-7 shows a map of the route alternatives. Alternative 1A: Southern Crescent has a maximum speed of 79 mph while Alternative 1B has a maximum speed of 110 mph. Within Alternatives 2 (I-85) and 3 (Greenfield), Alternatives 2A and 3A have maximum speeds of 130 mph while Alternatives 2B and 3B have maximum speeds of 220 mph.

Figure 2-7: Atlanta to Charlotte Alternatives



The alternatives also differ on the total number of stops with Alternative 1 having the most (12) and Alternative 3 having the least (10). A comparison of end-to-end travel times for all of the options compared to auto is shown in Table 2-14. Alternative 1 utilizes existing track, and is therefore limited in operating speed, resulting in end-to-end travel times that are similar to the auto mode. Alternative 2 follows I-85, and has end-to-end travel times much faster than auto. Alternative 3 produces the fastest end-to-end travel times, with Alternative 3B producing an end-to-end travel time nearly 3 hours faster than auto.

Table 2-14: End-to-End Travel Times, Auto and Rail

Option	Travel Time (minutes)
Auto	315
Alternative 1A	334
Alternative 1B	275
Alternative 2A	182(170)
Alternative 2B	176(162)
Alternative 3A	174(164)
Alternative 3B	138(126)

2.2.7.2 Access and Egress Time

Two methods of station assignment were used to determine access and egress time for each zone or zone pair. For alternatives with maximum speed of at least 130 mph, the following method was used. Every rail station pair that results in a valid rail trip is considered a possible trip for a given zone pair. Valid rail trips must have a total access and egress distance that is less than both the rail line-haul distance and the auto distance between the same zones. Once the valid rail trips have been determined, the station pair that minimizes total trip time is used for the zone pair in question.

This method cannot be applied to Alternatives 1A and 1B due to their slower speeds. In these instances, each zone in the study area is assigned a rail station that is closest to it in terms of shortest access time. In the event of unrealistic station assignments, the process is refined by making manual adjustments. Auto characteristics are used to obtain rail station access/egress time assuming auto access for the intercity market.

Just as is done to develop auto OD distances and times, zone-to-station access times and distances, and station-to-zone egress times and distances were extracted from the highway network. The station assignment is updated for each scenario to reflect changes in the operating plan across each alternative and technology.

2.2.7.3 Frequency/Wait Time

Daily frequencies for each rail option are shown in Table 2-15. In the mode choice model, rail frequencies were converted to time equivalents to represent the time an average passenger would wait at a station before a train arrives. As expected, the wait time decreases as train frequency increases. In the intercity mode choice model, wait time was calculated as one-fourth of the train headway.

Table 2-15: Station Pair Daily Rail Frequency[3]

Station Pair	Alternative 1A	Alternative 1B	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
MMPT-Gateway	4	4	14	14	16	22
MMPT-GSP/Greenville	4	4	10	10	16	22
MMPT-Suwanee, GA	4	4	6	6	8	10
Gateway-GSP/Greenville	4	4	10	10	16	22

2.2.7.4 Rail Cost

The total cost to travel by the rail mode from an origin zone to a destination zone includes the auto operating cost of accessing and egressing a station, access and egress toll costs, and the rail fare between the origin and destination stations. The station pair fare is the major driver of the cost of traveling via the rail mode. Station pair fares were calculated based on the station pair distances and a distance-based fare of $0.25 for Alternative 1, and $0.40 per mile for Alternatives 2 and 3. These distance-based fares were determined from revenue-maximizing analysis that is discussed in detail in Chapter 6 of this appendix. A $5 boarding fee was applied to all fares.

Figure 2-8 compares the end-to-end total per-person costs between representative origin and destination stations for the intercity auto and rail modes in the resident non-business market. Figure 2-9 shows a similar comparison for the resident business market. Even though the station pair-level rail fares were the same across market segments, the auto operating cost per person varies by market segment type. For the same station pair, the auto operating cost per person is lower in the non-business market than in the business market. As explained in the auto LOS section, the auto operating cost was calculated based on distance, assuming an operating cost of $0.32 per mile for business trips, and $0.16 per mile for non-business trips. Auto cost is typically significantly lower than the rail fare between any given OD pair, and rail competes primarily with auto on travel times.

Access and egress travel cost are the final cost components of a rail trip. For the access and egress auto operating cost and toll cost, auto travel characteristics were used. Just as was done to develop auto OD costs, zone-to-station auto access costs, station-to-zone auto egress costs, and access and egress toll costs are extracted from highway network skims.

[3] *Note that the terminal station in Atlanta is H-JAIA; however, MMPT was used as the Atlanta station to show Central Business District (CBD) to CBD connections.*

Figure 2-8: Person Trip Non-Business Cost Comparison

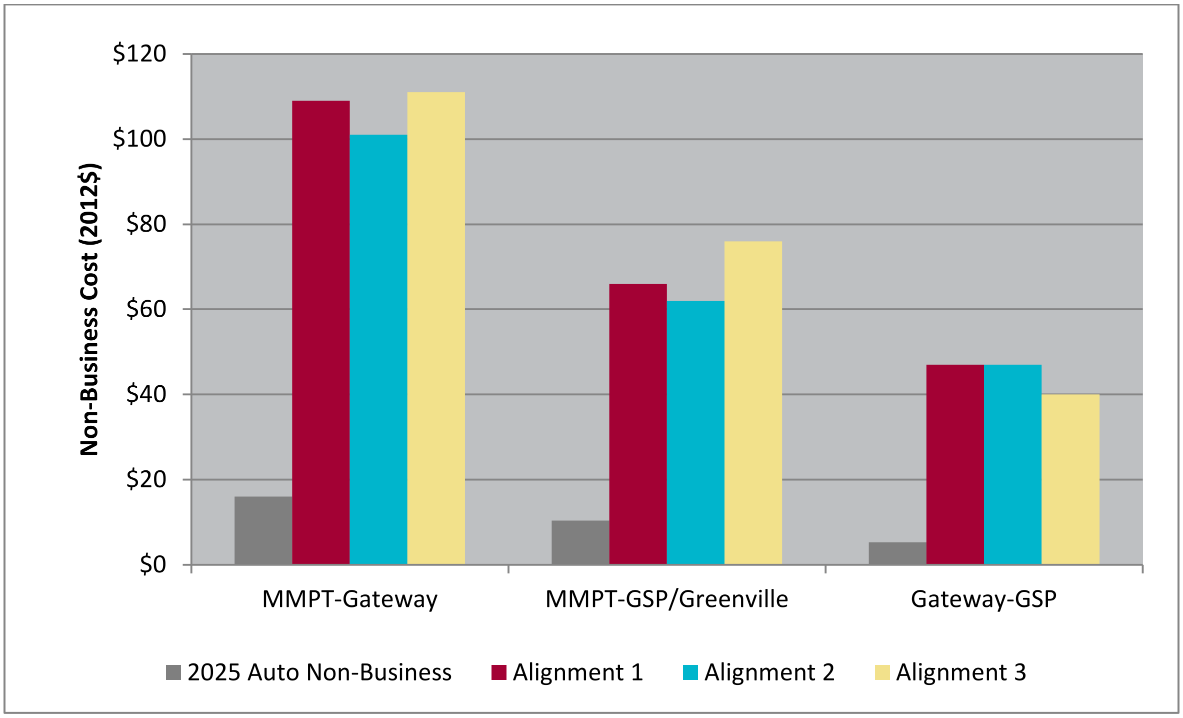
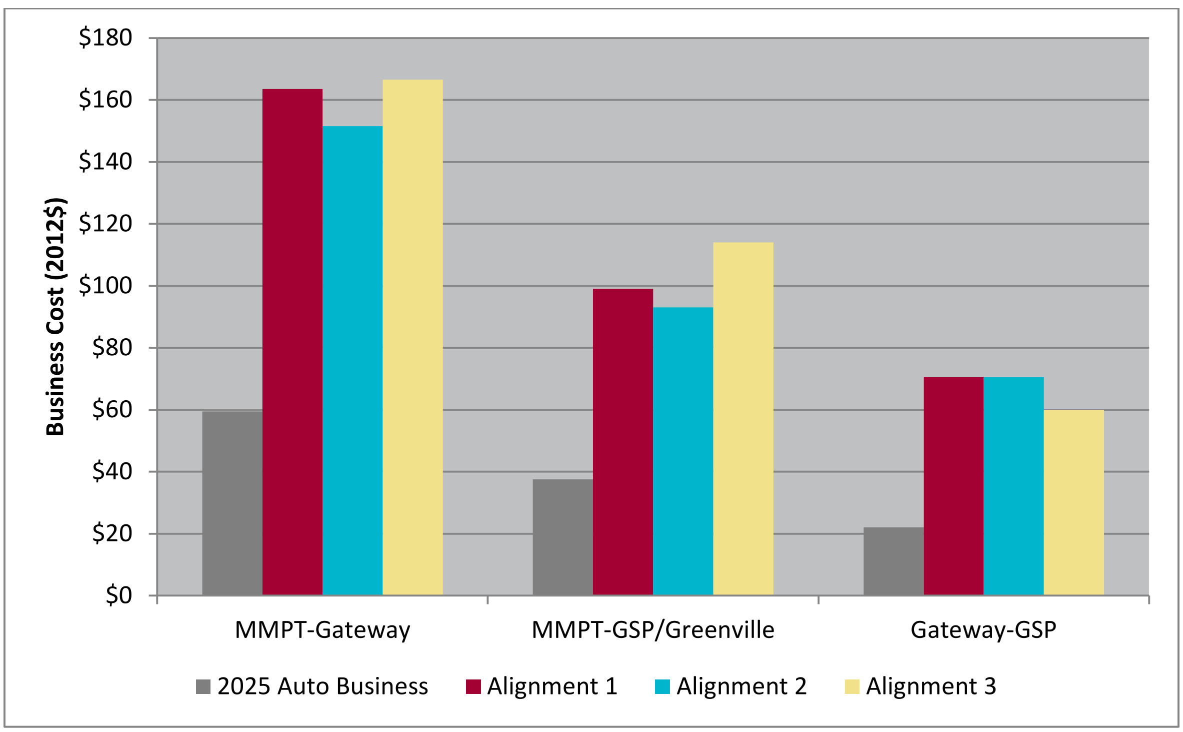


Figure 2-9: Person Trip Business Cost Comparison



2.2.8 Bus LOS Characteristics

Bus station pair-level travel time, distance, fare, and frequency were based on published schedules from operators' websites. Options that require transfers at intermediate bus stations to travel from origin to destination were not considered because they are less likely to occur due to the very high travel times inherent in such cases. Table 2-16 presents present one-way bus LOS characteristics for city pairs. In addition to these characteristics, access/egress time and cost are also inputs into the bus model.

Table 2-16: Bus LOS Characteristics

City Pair	In-Vehicle Travel Time (Minutes)	Daily Frequency	Fare (2012$)
Atlanta–Charlotte	282	10	$20
Atlanta–Greenville	216	4	$31
Charlotte–Greenville	120	4	$26

All Bus LOS characteristics for 2025 and 2050 were assumed to be the same as at present, except for station access/egress characteristics, which were determined using the 2025 and 2050 highway networks developed from MPO travel demand models, described in more detail in the auto LOS discussion.

2.2.9 Air LOS Characteristics

Airport pair travel time, fare and frequency were based on the DB1B airline ticket sample database. Table 2-17 presents the one-way air LOS characteristics for the airport pairs. The in-vehicle travel time is determined from the published departure and arrival times. In addition to these characteristics terminal access/egress time, airport access/egress time and costs are also inputs into the air model. The terminal access time was approximated at 60 minutes while the terminal egress time was approximated at 15 minutes.

Table 2-17: Air LOS Characteristics

City Pair	In-Vehicle Travel Time (Minutes)	Daily Frequency	Non-business Fare (2012$)	Business Fare (2012$)
Atlanta–Charlotte	77	22	$121	$310
Atlanta–Greenville	65	9	$187	$410
Charlotte–Greenville	48	8	$192	$568

All Air LOS characteristics for 2025 and 2050 were assumed to be the same as at the present, except for airport access/egress characteristics, which were determined using the 2025 and 2050 highway networks developed from MPO travel demand models, described in more detail in the auto LOS discussion.

2.3 FORECASTING MODELS

As discussed earlier, three sets of models were used to produce the ridership and revenue forecasts for the intercity travel market. These include:

- **Growth models:** Used to calculate the growth rates for the modal trip tables to grow them to the years 2025 and 2050;
- **Binary diversion models:** Used to calculate the diversion percentages to the new rail mode from each of existing intercity modes in 2025 and 2050; and
- **An induced demand model:** Used to calculate induced intercity travel demand (new demand that only materializes with the addition of the new rail mode) for the rail mode.

2.3.1 Growth Models

Intercity auto travel growth factors were estimated using an auto direct demand model that was developed specifically for this study. The 2025 and 2050 travel growth factors were calculated as the ratio of 2025 to 2012 and 2050 to 2012 auto volumes, respectively as predicted by the direct demand model. These factors were then applied to the 2012 intercity auto OD trip tables developed from the cell phone movement data to grow them to 2025 and 2050. This incremental application method had the advantage of closely tying predicted 2025 and 2050 modal volumes to the 2012 volumes.

Bus travel growth factors were derived from the auto direct demand model as well, as separate direct demand models could not be estimated from the limited data available for the bus mode.

In general, direct demand (growth) models were estimated using the following input data:

- Base year auto trip tables;
- Socio-economic data (population, income, employment); and
- Auto LOS characteristics at the OD pair level.

The direct demand model had the following functional form:

$$Auto\,Volume_{OD}^{year\,2012} = \alpha * {POP_{OD}^{2012}}^{\beta_1} * {LOS_{OD}^{2012}}^{\beta_2} * exp(-LOS_{OD}^{2012}/\beta_3) * ATL^{\beta_4}$$

where

$$POP = \sqrt{POP_O^{2012} * POP_D^{2012}}$$

LOS: generalized cost of traveling between the OD pair and includes auto congestion, travel time, fuel, and toll costs;

ATL: constant representing the presence of Atlanta as a large city.

Income and employment were highly correlated with population, so it was not possible to include all three variables in the model. Nevertheless, the high correlation between these variables indicates that population provides an indirect representation of employment and income for the zones used in this study, and therefore served as a proxy for them. The other inputs to the direct demand model estimation process were socio-economic data obtained from Woods & Poole, and modal LOS data for 2012 developed as part of the study effort.

Table 2-18 shows the variables and the corresponding coefficients of the direct demand model estimated for the auto mode.

Table 2-18: Auto Direct Demand Model Coefficients

Variable	Coefficient

	Value	t-statistic
Constant	22.82	41.67
Ln of population*	0.34	27.50
Ln of generalized auto cost	-4.78	-28.98
Generalized auto cost	0.04	15.94
Atlanta dummy	0.60	24.67

$* Population = \sqrt{POP_O^{2012} * POP_D^{2012}}$

Note: [Adj. R-sq. = 27%]

Application of the auto direct demand models resulted in an average Compound Annual Growth Rate (CAGR) of 0.37% for total auto trips between 2012 and 2025, and of 0.36% between 2012 and 2050, as shown in Table 2-19.

Table 2-19: Summary of Base and Forecast Intercity Auto Trip Tables

Purpose	2012 Base Trips (Millions)	2025 Forecast Trips (Millions)	2050 Forecast Trips (Millions)	2012-2025 CAGR	2012-2050 CAGR
Business	12.4	13.0	14.0	0.35%	0.30%
Non-Business	91.2	95.7	105.0	0.38%	0.37%
Total	*103.6*	*108.7*	*118.9*	*0.37%*	*0.36%*

It is difficult to compare the predicted future volume growth in intercity trips over 50 miles with historical growth from highway traffic counts because the counts include both the short-distance local and long-distance intercity travel volumes. Moreover, historical growth rates vary considerably, with periods of high growth during good economic times followed in many cases by negative growth in times of recession. However, Table 2-20 below presents the growth in historical traffic counts at a few representative locations on I-85 (with possible high fractions of longer distance highway travel crossings) in the corridors. The traffic growths as experienced in these selected locations indicate that the growth rates implied by the direct demand model are well within the reasonable range. Moreover, an average annual growth of ~0.36% is a reasonable representation of the overall annual growth expected over 40 years.

Table 2-20: Historical Study Area Traffic Volumes

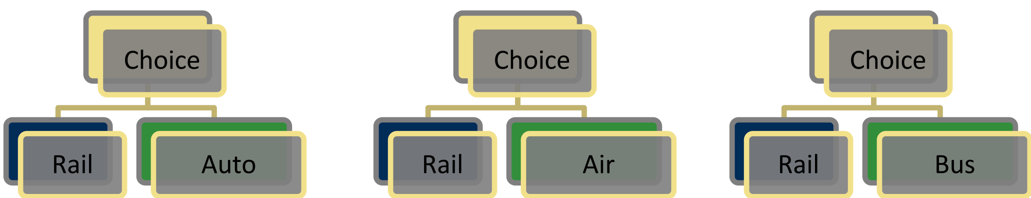
Year	I-85: Hart County, Traffic Counter: 0287	I-85: Greenville County, Station: 2303	I-85: Cherokee County, NC State Line, Station: 2351
2006		46,000	21,800
2007		48,000	22,750
2008	19,887	45,850	21,650
2009	19,793	44,700	21,100
2010	20,007	46,500	20,900
2011	19,924	46,500	20,750
2012	19,983	46,500	19,400
2006(8)-2011 CAGR	*0.12%*	*0.18%*	*-1.93%*

2.3.2 Mode Choice Models

As described earlier, Step One of the intercity travel demand forecasting process calculated the market size in both forecast years for all the existing travel modes by travel market segment. In Step Two, the diversion to the proposed rail mode from each existing intercity mode was calculated using mode choice models whose coefficients were developed based on local data and data from similar models in other corridors in the U.S.

The following binary logit mode choice models, as shown in Figure 2-10, were used in this study for the various travel purposes to forecast rail ridership in the intercity travel market.

Figure 2-10: Binary Logit Structure Used for Intercity Mode Choice Models



2.3.2.1 Modeling Framework: Random Utility Model

Random utility maximization (RUM) models are often used to forecast mode shares. These mode choice models relate the overall travel utility experienced by users of each mode to the mode's price and service levels, as well as to trip and user characteristics. The general specification of the utility for each mode i is as follows:

$$U_i = V_i + \varepsilon_i$$

where U_i is the utility of mode i, V_i the systematic (or deterministic) part of the utility; and ε_i the stochastic error term.

It is common to use a linear specification for the systematic utility term, in which case the modal utility can be further decomposed as follows:

$$U_i = \alpha_i + \sum_{n=1}^{N} \beta_{in} X_{in} + \varepsilon_i$$

where α_i is the modal constant of mode i;

$\beta_{i1}, \beta_{i2}, \dots, \beta_{iN}$ are mode-specific coefficients for N level of service variables (such as in-vehicle time, access time, costs, frequency, on time performance) or socio-economic characteristics (such as income, large cities) for mode i; and

$X_{i1}, X_{i2}, \dots, X_{iN}$ are values of the N level of service variables and socio-economic characteristics.

A traditional binary logit model for the rail intercity travel mode choice situation assumes that the stochastic error terms are uncorrelated. In this case, the probability of choosing the rail mode (or equivalently the rail mode share) can be expressed as follows:

$$Share_{rail} = \frac{e^{V_{rail}}}{e^{V_{rail}} + e^{V_{Existing\ mode}}}$$

When applying the mode choice models for each market segment, a variety of explanatory variables are included in the utility specification, including separate line-haul (in-vehicle) time, access and egress time, wait time (calculated as one-fourth of the headway), travel cost (including vehicle operating cost, parking, tolls and fare), and transfer time at terminals.

2.3.2.2 Auto, Air, and Bus Binary Diversion Models

The intercity auto, air, and bus demand forecasting approaches are very similar to each other. Market-specific mode choice models were applied to predict, for 2025 and 2050, and for each OD pair, the number of auto, air, and bus travelers who will use the proposed rail mode. All of these mode choice models used a binary diversion form and computed the probability that an OD specific intercity auto, air, and bus traveler makes a particular trip type and will choose the rail mode given the LOS characteristics for each of the existing modes. Figure 2-10 above shows the binary diversion model structure for the intercity auto, air, and bus modes used to predict the number of rail trips that will divert from these existing modes.

The coefficients of these mode choice models were asserted based on SP survey data collected in the region in 2009 as part of the Atlanta-Chattanooga High Speed Ground Transportation Tier I EIS study as well as other high-speed rail forecasting studies in the U.S. The model coefficients for the intercity auto, air and bus mode choice models are presented below in Table 2-21 through Table 2-23.

Table 2-21: Intercity Auto Mode Choice Model: Model Coefficients and Constant

Binary Diversion Models	Unit	Business Chooser	Business Destination Captive	Non-Business Chooser	Non-Business Destination Captive
Cost	utils/$ in 2012$	-0.01467	-0.01467	-0.02333	-0.02333
In-vehicle Time	utils/min	-0.00734	-0.00734	-0.00884	-0.00884
Access Time	utils/min	-0.01100	-0.01100	-0.01326	-0.01326
Wait Time	utils/min	-0.00954	-0.00954	-0.01149	-0.01149
Rail modal constant (>130mph)	Utils	-0.22005	-0.36675	-0.35360	-0.61880
Rail modal constant (<130mph)	Utils	-1.10025	-1.24695	-1.41440	-1.67960

Source: SDG analysis

Table 2-22: Intercity Air Mode Choice Model: Model Coefficients and Constant

Binary Diversion Models	Unit	Business	Non-Business
Cost	utils/$ in 2012$	-0.01478	-0.04432
In-vehicle Time	utils/min	-0.01746	-0.02886
Access Time	utils/min	-0.02619	-0.04329
Wait Time	utils/min	-0.02270	-0.03752
Rail modal constant (>130mph)	utils	0.0	0.0
Rail modal constant (<130mph)	Utils	-2.0952	-3.4632

Source: SDG analysis

Table 2-23: Intercity Bus Mode Choice Model: Model Coefficients and Constant

Binary Diversion Models	Unit	Business	Non-Business
Cost	utils/$ in 2012$	-0.03977	-0.03314
In-vehicle Time	utils/min	-0.00500	-0.00200
Access Time	utils/min	-0.00800	-0.00300
Wait Time	utils/min	-0.01000	-0.00400
Rail modal constant (>130mph)	Utils	0.01300	0.00700
Rail modal constant (<130mph)	Utils	-0.58700	-0.25630

Source: SDG analysis

2.3.2.3 Discussion of Values of Time

The coefficient values of different travel time components (in-vehicle, access, and wait) and travel cost were used to calculate the implied values of time (VOT). Table 2-24 shows traveler VOTs in each market segment for existing intercity travel mode, as calculated from the above mode choice models.

Table 2-24: Values of Time (in $2012)

Value of time ($/hr)	Business	Non-Business
Auto travelers		
In-vehicle Time	$30	$23
Access Time	$45	$34
Wait Time	$39	$30
Air travelers		
In-vehicle Time	$71	$39
Access Time	$106	$58
Wait Time	$92	$51
Bus travelers		
In-vehicle Time	$8	$4
Access Time	$12	$5
Wait Time	$15	$7

Source: SDG analysis

These values of time are consistent with the latest USDOT guidance on values of time for intercity long distance travel in the U.S. The USDOT publishes guidance on travel time valuation in the economic analysis of transportation projects[4]. The latest memorandum, dated November 2011, recommends an array of values of time for different categories of travel, according to income, purpose, mode and distance. The values of time as recommended by the USDOT and adjusted for inflation in $2011 are shown in Table 2-25 below.

[4] *"Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis", U.S. Department of Transportation, Office of the Secretary of Transportation, September 28, 2011*

Table 2-25: USDOT Value Of Time Recommendations (in $2012)

VOT (2011$/hr)	Surface Modes (except High-Speed Rail)			Air and High-Speed Rail Travel		
Range	Low	Avg.	High	Low	Avg.	High
Personal	$15.36	$17.95	$23.10	$29.45	$34.29	$44.06
Business	$19.67	$24.61	$29.55	$48.90	$61.47	$73.73

Source: 2011 USDOT VOT guidance for VOT analysis adjusted for inflation using CPI index. VOT in 2012$/hr for the median U.S. household Income of $49k (in $2009) adjusted for inflation using CPI-U US All Items between 2009 and 2012.

For the auto mode, the business and non-business values of time of $30/hour and $23/hour, respectively, are consistent with the corresponding USDOT recommendation shown in **Error! Reference source not found.**. Similarly, for the air mode, the business and non-business values of time of $71/hour and $39/hour, respectively are consistent with the corresponding USDOT recommendation.

Access time is 1.5 times more onerous than in-vehicle time for air and auto trips; while wait time is 1.3 times more onerous than in-vehicle time. Note that ratios of out-of-vehicle to in-vehicle time are generally found to be lower for intercity than for urban travel.[5] Bus wait and access times are typically weighted even more than in-vehicle time. Factors of 1.5 and 2.0 were used for access and wait times, respectively.

The USDOT recommends that surface mode walk access, wait, and transfer time in non-business travel should be valued about 1.1 to 1.6 times the in-vehicle values of time. Ratios of out-of-vehicle to in-vehicle time typically range from 0.7 to 2.0 for passenger rail studies; with wait time usually weighing less than access time. This analysis used 1.3 and 1.5 for access time to in-vehicle time and waiting time to in-vehicle time, respectively for the air and the auto modes to be consistent with the USDOT recommendations.

2.3.2.4 Modal Constants

Mode choice model utility functions often include a constant term, the mode-specific constant, which represents the inherent attractiveness of a mode, assuming everything else (e.g. time, cost, and other LOS attributes) is equal. Mode-specific constants represent the average effect of all factors that influence its attractiveness but are not explicitly included in the utility specification. For example, factors such as modal comfort, safety, privacy, and reliability.

The mode-specific constants as shown in Tables 2-20 through Table 2-22 show the attractiveness of the existing modes (auto, air and bus, respectively) relative to the rail mode. A positive mode-specific constant indicates that the existing mode is preferred to the rail mode, everything else being the same and vice versa. These constants can also be expressed as an equivalent mode-specific travel cost or travel time penalty or bonus.

Two sets of modal constants were used, one for rail service with speeds greater than 130 mph (Alternatives 2A, 2B, 3A and 3B) and another set for rail service with speeds lower than 130 mph (Alternatives 1A and 1B).

The 130 mph alternative options was perceived as slightly less attractive, equally attractive, and more attractive than the auto, air and bus options, respectively, assuming equal values for the other quantifiable LOS characteristics for the respective modes. For example, certain auto attributes (privacy, flexibility) were valued very highly relative to the rail mode. Alternative 1A and 1B were perceived to be much less attractive than auto, air, and bus options, for equal times and costs.

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[5] *Intercity travel waiting conditions are often much improved and the reliability of the scheduled service make the wait time less stressful while the access time is also a smaller portion of the overall journey for intercity travel compared to urban travel.*

Modal constants have different values for choosers and destination captive auto travelers as an additional penalty is added for the destination captives who will need to have private vehicles (e.g. rental cars) available at their final destination. This "penalty" is intended to reflect the added impedance of changing modes to complete a door-to-door trip. With this added penalty, the rail shares for the "destination captive" auto travelers are lower than the "chooser" auto travelers.

2.3.3 Induced Demand Model

The introduction of a new transportation facility typically results in new trips being made, referred to as induced trips.

The final step in the intercity rail ridership forecasting process was to forecast the volume of induced travel brought about by the proposed rail mode. Induced demand was calculated based on the impact the introduction of the rail mode has on the transportation system as a whole. For each intercity zone pair, the total generalized cost (including all travel modes) was calculated before and after the introduction of the rail mode. Differences in generalized costs pre- and post-rail were used to calculate the percent increase in total travel for each intercity OD pair as illustrated below;

New travel induced by the proposed rail mode is:

$$Induced\ travel = T_{with\ Rail} - T_{without\ Rail}$$

where $T_{with\ Rail}$ is the total travel with the rail service in place, and correspondingly for $T_{without\ Rail}$.

The volume of induced travel depends on the accessibility changes made possible by the new passenger rail service. Total travel on all modes was related to a composite generalized cost, as follows:

$$T_{OD} = SE_{OD}^{\alpha} * GC_{OD}^{q}$$

where T_{OD} is the total travel volume between a particular origin and destination on all modes;

SE_{OD} are socio-economic characteristics of the origin and destination;

GC is the generalized cost of travel between the origin and destination; and

α and q are model coefficients or elasticity values.

The composite generalized cost used in this model is known as the logsum and was calculated using the utility estimates for each mode from the mode choice model. For a logit model, the logsum is simply:

$$GC = ln(e^{U_{Existing\ modes}} + e^{U_{Rail}}).$$

Consequently, it can be written:

$$T_{without\ Rail} = SE^{\alpha} * GC_{without\ Rail}{}^{q}$$

$$T_{with\ Rail} = SE^{\alpha} * GC_{with\ Rail}{}^{q}$$

When applied to a given year, the socio-economic variables without and with the rail mode are the same and cancel each other so that the percent increase in total travel becomes:

$$Induced\ demand\ \% = \frac{T_{with\ Rail} - T_{without\ Rail}}{T_{without\ Rail}} = \frac{GC_{with\ Rail}^{q} - GC_{without\ Rail}^{q}}{GC_{without\ Rail}^{q}}$$

This calculation was completed for each travel purpose and for each OD pair. Application of the induced demand model for each OD pair and market segment for the intercity travel market produced the induced travel estimates. Total rail trips for the intercity market are then the sum of the rail trips forecast by the mode choice model and the new trips induced by the rail project.

In model applications, it was verified that the predicted induced demand percentages were reasonable. Values in the range of six percent to eight percent were typically found, and are comparable to values found in other new high-speed rail studies in the U.S.

3. NEW ORIGINAL DATA COLLECTION

3.1 DATA COLLECTION FOR THE INTERCITY AUTO TRIP TABLE DEVELOPMENT

In forecasting intercity passenger rail ridership and revenue, the accuracy of the auto trip tables strongly influenced the overall accuracy of the forecasts. However, in the U.S., relatively little data on intercity automobile travel is collected at the national level, and there currently is no standard up-to-date source of information about intercity auto trip making that is sufficiently detailed to be used in project-level forecasting.

Furthermore, in the Atlanta-Charlotte corridor study area there is no single source of information on intercity auto travel. The estimates of intercity travel volumes used in the Georgia Statewide Model may have been a possible source of such data. However, the trip tables used in the statewide model were not based on original OD surveys. Moreover, the intercity trip tables from the statewide model are now also dated, requiring an update and making their reliability for this study subject questionable.

Both the ARC and MUMPO MPO travel demand models only cover a portion of the study area geography and also incorporate a representation of internal/external and external/internal auto trips (those that enter/exit the model area from/to elsewhere), and do not provide detailed identification of the external origins and destinations. Data in the individual models is not specific enough to allow the individual model trip tables to be combined together into a single trip table covering the entire corridor and providing information on, for example, the number of auto trips from a particular zone in Atlanta to a particular zone in Spartanburg or in Charlotte.

The 1995 ATS, which focused on long distance trip making by households, was considered as a possible source of data, but is not used for several reasons. First, the information is starting to be quite dated. Moreover, the low sample size used in this survey (80,000 households across the U.S.) constrained its accuracy at a detailed geographic level, such as a corridor.

Information on journey-to-work travel in the corridor can be obtained from the year 2000 Census Transportation Planning Package (CTPP)[6]. In particular, within the limits of the Census long form sample rate (roughly 15 percent of households), the CTPP gives detailed information on work commute volumes and patterns by mode, including auto. Although the information dates from year 2000, with suitable factoring it is an adequate basis for establishing current intercity commute travel volumes and patterns, as well as checking the estimates made for other modes.

However, a significant portion of intercity travel in the corridor is auto trips for purposes other than the journey to work (e.g. leisure trips by study area residents and by non-residents; long distance business trips). As aforementioned, investigations did not reveal any readily usable source of data on these trip types.

Traffic volume and classification counts are available for the major corridor roadways. However, the traffic data combines both travel within the corridor and longer-distance travel, as well as travel for different purposes, without distinction or identification of origin and destination.

The lack of detailed up-to-date data on intercity automobile travel in the study corridor prompted the investigation of a new program of original travel data collection. Among possible data collection efforts, conducting new surveys to establish intercity automobile travel patterns and levels is result in issues that

[6] *The Census long form questionnaire from which the CTPP data is extracted was discontinued following the 2000 Census.*

may limit the usefulness of new surveys. Intercept surveys conducted directly on major roadway such as I-85 would likely encounter logistical difficulties and other obstacles, while surveys of drivers at off-mainline locations such as rest stops tend to give highly biased results. Interview or travel diary surveys of randomly selected households in the corridor would be challenging because of the relative infrequency of these longer-distance trips.

Use of anonymous cell phone data was determined to be the most effective method to understand the origins and destinations of auto travelers in the corridor, in which AirSage was engaged for this purpose. AirSage obtains the communications protocol data exchanged between mobile devices and communications towers; this data allows the movements of mobile devices to be analyzed in a way that preserves the anonymity of device owners and the privacy of their communications. Archived data is available beginning in January 2010.

3.1.1 Trip Table Data

The AirSage data is raw cell phone data that was processed to link cell phone signals to form distinct trips classified by type (resident, non-resident, and through). These trips were then geocoded and aggregated to a zone system (effectively anonymizing the data) and expanded from the sample of cell phone users to the population as a whole based on census block population and carrier sampling rates.

It was necessary to identify representative time periods for which cell phone data is obtained and processed. Based on an examination of GDOT and SCDOT data on the monthly distribution of traffic volumes at rural locations on I-85[7], it was decided to prepare intercity auto trip tables for a single month-long period in 2012. Based on cell phone location data from Verizon, AirSage provided auto trip data for 35,721 OD combinations (189x189 zone pairs) in the study area. The trip tables were segmented by:

- 4 day types:
  - Mondays-Thursdays;
  - Fridays;
  - Saturdays;
  - Sundays;
- 3 traveler classifications:
  - *Resident*: frequent signal occurrence in the study area over the sampling period;
  - *Visitor*: limited signal occurrence in the study area over the given period; and
  - *Through*: both trip origin and destination beyond the study area.

3.1.2 Trip Table Processing

The intercity model produces annual ridership and revenue forecasts and, accordingly, the input trip tables are converted to annual trip tables. Seasonality factors determined from GDOT monthly traffic count data (shown in Table 3-1) are used to convert the trip tables provided by AirSage into an annual trip table. A factor greater than 1 implies that trip volumes in that month are less than throughout the rest of the year, as is seen in January.

[7] *It is important to select traffic count locations as rural as possible on I-85, so that the traffic counts represent intercity long-distance travel in the study corridor as well as possible.*

Table 3-1: Trip Table Seasonality Indices

Month	Index
January	1.14
May	0.97
July	0.89

During the trip table calibration and validation process (refer to Section 3.1.3), some further adjustments were made to the trip table. It was determined that the AirSage trip volumes were too high for some of the markets, based on recorded traffic counts, so the following factors were applied to these markets in order to adjust the volume of trips:

- A factor of 0.25 was applied to OD auto trips between the Atlanta area and eastern South Carolina; and
- A factor of 0.53 was applied to previously unmodified OD auto trip longer than 75 miles.

3.1.3 Trip Table Validation

In order to validate the AirSage trip table, TransCAD's select link analysis was used to assign AirSage OD trips to the study area highway network and determine the volume of trips crossing three designated links. These three locations along I-85, as shown in Figure 3-1, correspond to rural GDOT and SCDOT traffic count locations. Since the raw AirSage data represent person-level trips, these trips were converted to vehicle trips by dividing by average auto occupancy. This allowed a direct comparison to be made between select link analysis after assigning the AirSage trips to the highway network and the GDOT and SCDOT counts for the same month-long period. As seen in Table 3-2, the assigned AirSage vehicle trips were within three percent of GDOT and SCDOT traffic counts for the same period.

Figure 3-1: Traffic Count Validation Locations

Table 3-2: Traffic Count Validation

Count Location	GDOT/SCDOT AADT	AirSage AADT	Percent Diff.
I-85 A	22,256	21,730	-2.4%
I-85 B	52,661	52,851	0.4%
I-85 C	19,015	19,279	1.4%

3.1.4 Trip Table Segmentation

Once validation of the AirSage trip table was complete, certain trips were removed to prepare the trip table subsequently used in the intercity mode choice model. The OD trips that were removed included:

- Auto trips within the ARC (Atlanta area) and MUMPO (Charlotte area) boundaries, as these are captured in the intra-urban modeling effort;
- Auto trips with an auto in-vehicle distance less than 75 miles, as these are considered to be too short to be diverted to an intercity rail mode;

- Truck trips (29 percent of AirSage OD trips), as determined from GDOT & SCDOT traffic count data;
- Intercity bus and air trips, as estimated based on supply side information and load factor assumptions; and
- Trips classified by AirSage as *Through* trips, as these are not divertible to rail.

4. RIDERSHIP AND REVENUE MODELING FOR THE INTRA-URBAN TRAVEL MARKET

4.1 METHODOLOGY

All the alternatives considered for this study include multiple stations inside each of the Atlanta and Charlotte metropolitan areas. As such, each alternative would provide local rail service via these stations and thus would serve as an urban travel option analogous to other existing urban transit modes (bus, light rail, and commuter rail). Accordingly, this study investigated the functioning of the proposed rail service as a local travel mode within the Atlanta and Charlotte areas.

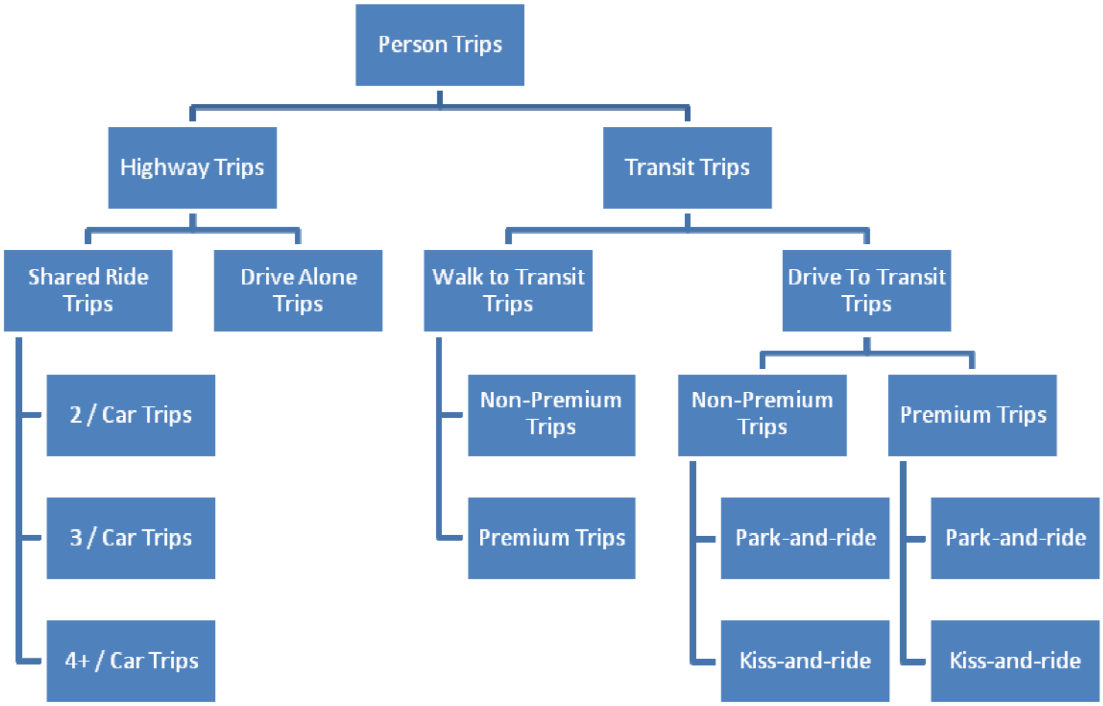
In order to examine intra-urban trips, the latest existing MPO travel demand models were modified to include the proposed passenger rail service. In both the Atlanta and Charlotte cases, intercity rail service is added as an additional transit mode within the already-defined mix of transit modes in each model, with proper adjustments, as required. This approach made maximum use of the detailed understanding of existing local travel patterns and behavior already embodied in the MPO model systems, as well as periodic updates and validation undertaken since the models were created.

The ARC and MRM models are traditional four-step travel demand models, each including the key components of trip generation, trip distribution, mode choice, and network assignment. For this study, the zonal characteristics that drive the trip generation and distribution steps remain unchanged across all scenarios. The mode choice and trip assignment outputs, on the other hand, varied based on the rail characteristics in a given scenario. Because of their relevance to the application of the travel demand models for this analysis, the mode choice component of each model is summarized below.

4.1.1 ARC Model Mode Choice Component

The ARC mode choice model probabilistically predicts the mode of travel for OD trips based on relative times and costs of auto and transit options. Mode shares are estimated for three trip purposes—Home Based Work (HBW), Home Based Other (HBO) and Non-Home Based (NHB)—by a nested logit model. This model is applied separately to four market segments based on income group and auto ownership. Figure 4-1 below shows the nesting structure of the mode choice model.

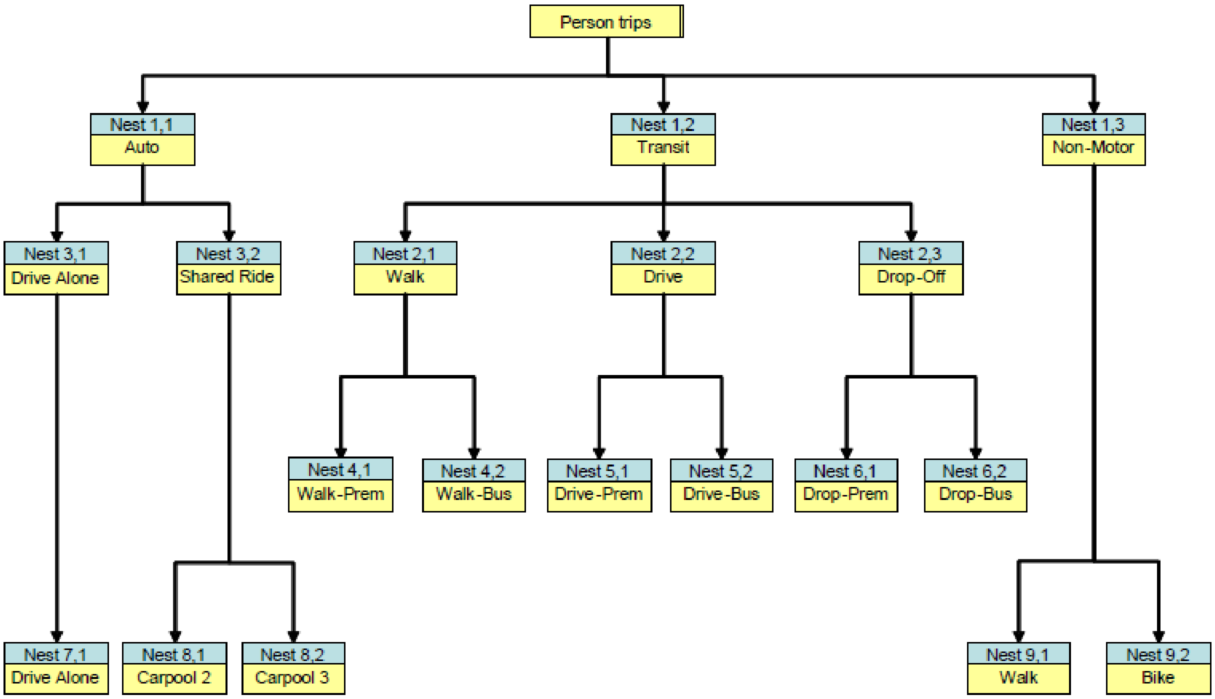
Figure 4-1: ARC Model Mode Choice Nesting Structure



4.1.2 MRM Model Mode Choice Component

Similar to the ARC mode choice model, the MRM mode choice model probabilistically predicts the mode of travel for OD trips based on relative times and costs of auto and transit options. Mode shares are estimated for the same three trip purposes (HBW, HBO and NHB). The model is applied separately to peak and off-peak trips, and for HBW and HBO trips, it is applied separately to households in each of four income groups. Figure 4-2 **Error! Reference source not found.**below shows the nesting structure of the model.

Figure 4-2: MRM Model Mode Choice Nesting Structure



4.1.3 Model Adaptation

An important goal in incorporating the rail mode within the ARC and MRM models is to make minimal changes in order to avoid compromising the model's calibration. Consequently, rail service was introduced into the models within their respective existing premium transit modes, and was treated as commuter rail service. The alternative, along with new model coefficients, within the existing mode choice models, was deemed uncertain considering the model was calibrated for its existing structure and coefficients.

Because new rail service was treated as commuter rail, the existing ARC and MRM commuter rail parameters and coefficients was applied during skimming, mode choice, and assignment. The new rail service was set apart from other routes within the commuter rail mode through travel time, frequency, and fare. These service characteristics, therefore, varied for commuter and intercity rail routes, but the variables are identically weighted during calculations of generalized cost in skimming and mode shares in mode choice.

In order to add the rail mode into the model, the proposed routes and stations were coded into the input transit network. Service characteristics were calculated based on a given option's operating plan and translated as needed into ARC and MRM model inputs:

- Routes were assigned peak and off-peak headways that correspond to 15-minute wait times;
- Rail links traversed by each route were assigned speeds corresponding to the travel time and distance between adjacent stations;
- A flat fare of $5.00 was applied to all intra-urban rail trips and

- Stations were assigned to nodes, most of which are coded as park-and-ride facilities. The nodes were also connected to highway links and nearby transit stations via walk and drive access links.

Other than the network edits associated with the addition of the rail mode, all future year ARC and MRM model inputs remain unchanged, including the zone system, socioeconomic data and forecasts, and future highway and transit project assumptions. Daily rail station pair ridership and revenues were annualized using a factor of 320.

Results of the initial runs of each model with the proposed intercity rail routes revealed that some of the rail markets—specifically from H-JAIA to downtown Atlanta, and from CLT to downtown Charlotte—receive no riders due to direct competition with heavy rail and bus. In these cases, due primarily to the lower fares and higher frequency of the existing services, the rail routes were not competitive enough to be included in the set of paths selected during the transit skim phase of the model. Given that these markets both involve airport trips, which are typically made by travelers with relatively high values of time, the assumption was made that passengers making these trips will be more sensitive to frequency than fare, and as a result, would take the first available trip, regardless of mode. Based on frequencies of the relevant modes, the probability that each mode will make the next available trip was calculated and assigned the total trips according to these probabilities.

4.2 RESULTS

Intra-Atlanta and intra-Charlotte rail trips were each forecasted separately from intercity rail trips using modified versions of the local travel demand models, as described above. Note that while results for intra-urban trips were calculated, it was decided to exclude intra-urban trips from the results due to over use of the commuter service, limiting space for intercity travel. This decision was made before technology options were finalized for each alternative; therefore, only one set of forecasts was calculated for each alternative. All intra-urban results shown are for 2025.

4.2.1 Atlanta-Area Intra-Urban Forecast Results

In the Atlanta area, each of the modeled alternatives (Alternatives 1, 2 and 3) feature the same set of stations: H-JAIA, MMPT, Doraville, and Suwanee, and travel times between stations are as follows.

- H-JAIA–MMPT: 8 minutes for all alternatives
- MMPT–Doraville: 15 minutes for all alternatives
- Doraville–Suwanee: 15 minutes for Alternatives 1 and 2, 14 minutes for Alternatives 3

Table 4-1 below presents the resulting 2025 annual ridership estimates by station for each of the alternatives.

Table 4-1: Estimated Annual 2025 Intra-Atlanta Area Boardings by Alternative

Station	Alternative 1	Alternative 2	Alternative 3
H-JAIA	146,485	155,177	170,464
MMPT	264,270	281,654	296,941
Doraville	379,130	390,219	390,219
Suwanee	446,264	466,345	466,345
Total	*1,236,149*	*1,293,395*	*1,323,968*

As the rail service is expected to be focused in the peak periods, intra-urban ridership is not very sensitive to frequency, which is the main difference in the three alternatives within the Atlanta area. The higher-frequency services do produce more ridership, but the ridership gains due to additional frequency are very small. For all three alternatives, ridership is highest between Suwanee and Doraville, because this is the only portion of the route within the urban area with no competing MARTA rail service.

4.2.2 Charlotte-Area Intra-Urban Forecast Results

In the Charlotte area, there is one minor difference in stations between alternatives. Alternatives 1 and 2 include a stop at the existing Gastonia Amtrak station, while the Alternative 3 includes a South Gastonia station instead. All alternatives include CLT and Gateway stations. Travel times between stations are as follows.

- Gateway–CLT: 7 minutes for all alternatives
- CLT–Gastonia (Alternatives 1 and 2 only): 14 minutes for both alternatives
- CLT–South Gastonia (Alternative 3 only): 11 minutes

Table 4-2 below presents the resulting 2025 annual ridership estimates by station for each of the alternatives.

Table 4-2: Estimated Annual 2025 Intra-Charlotte Area Boardings by Alternative

Station	Alternative 1	Alternative 2	Alternative 3
Gateway	123,461	125,418	84,531
CLT	14,011	15,968	17,638
Gastonia/South Gastonia	123,773	123,773	77,514
Total	*261,245*	*265,159*	*179,683*

As with the Atlanta area, intra-urban ridership is not very sensitive to frequency. Despite offering less-frequent service, Alternatives 1 and 2 attract more intra-Charlotte riders than Alternative 3, due to the relatively better location of the Gastonia station compared with the South Gastonia station.

As mentioned earlier, the study team decided to exclude intra-urban trips from the alternatives analysis process, as it created potential for low-revenue intra-urban trips to take up a significant capacity that could be used by higher-revenue intercity passengers. While adding additional capacity to serve this demand would be possible, the modest intra-urban fare revenue would not justify the investment needed. If intra-urban trips were allowed at all, a pricing strategy would need to be selected that discourages most riders from taking the rail service for short trips.

5. RIDERSHIP AND REVENUE MODELING FOR THE AIRPORT CHOICE (CONNECT AIR) MARKET

In general, the introduction of a high-speed rail service with one or more stations at hub airports can produce changes in levels and patterns of commercial air travel. Air travelers who make trips that include one flight segment along the rail corridor and a connection to another flight segment to an off-corridor destination may instead prefer to access a hub airport (possibly but not necessarily the same hub) by rail, and then connect to a flight to their destination. To forecast these potential shifts, this travel demand forecasting study effort developed a new airport choice (connect air) model.

Because of the attractiveness of H-JAIA and CLT as major hubs, there are two distinct types of connect air trips that are strong candidates for diversion to rail. The first, and most prevalent, includes passengers traveling from GSP to either H-JAIA or CLT, and then connecting to another flight. The second includes passengers traveling between CLT and H-JAIA (in either direction), and then connecting to another flight.

In both cases, the introduction of rail service presents a choice of whether to begin the trip at the current origin airport, fly to the hub, and connect there to the onward leg; or to access H-JAIA or CLT via rail, and begin the air trip there. Similar, but reversed choices, confront air travelers who end their trip with an on-corridor flight leg.

Rail access to H-JAIA and CLT may also affect trips from corridor airports that have other air travel options (nonstop flights or connecting flights via other hubs). This is highly dependent on the competitive response of the air carriers to the presence of rail service between airports. The airport choice analysis was confined to a limited number of the highest volume airport destinations from each corridor airport, and for each of these, compared the off-corridor options to options including rail-air connections at H-JAIA and CLT.

The airport choice model predicted volume shares for possible itineraries that included both air-air and air-rail connections, based on trip cost, access, wait, transfer and line haul times. Model coefficients were estimated based on current volume shares of the available itinerary options, as obtained from USDOT DB1B and T-100 databases.

5.1 CANDIDATE CONNECT AIR TRIPS FOR DIVERSION TO RAIL

A candidate connect air trip consists of an air leg (or a series of air legs) with one end outside the study corridor, connected on the other end to a rail leg within the corridor. An example of such a trip originating at GSP and ending at New York LaGuardia is shown in Figure 5-1.

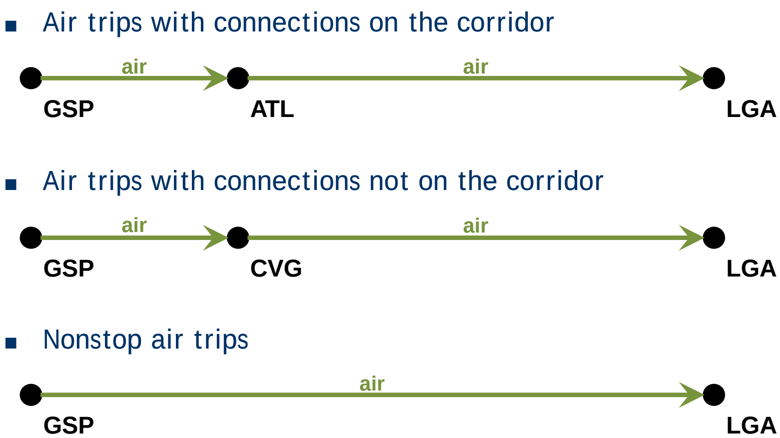
Figure 5-1: Example of a Connect Air Trip

Connect air trips require a rail station at or near the connecting airports (H-JAIA or CLT). Connect air trips can be diverted from 3 main sources:

- Air trips with connections on the corridor (e.g., GSP–H-JAIA–LGA)
- Air trips with connections not on the corridor (e.g., GSP–CVG–LGA)
- Nonstop air trips (e.g., GSP–LGA)

Each connect air trip has the potential for the on-corridor leg to be switched to rail. These sources of diverted connect air trips are illustrated in Figure 5-2 for the GSP–LGA example.

Figure 5-2: Sources of Diverted Connect Air Trips—GSP–LGA Example



Since it is unlikely that nonstop air travelers will change their travel patterns due to the introduction of intercity rail service, the main choice modeled is that of air travelers who have the option of taking a connecting flight at H-JAIA or CLT to (or from) their destination (or origin). There are currently more than 4.8 million annual connecting itineraries originating at the three corridor airports (H-JAIA, CLT, and GSP). These are shown in Table 5-1.

Table 5-1: Annual Connecting Itineraries Originating at Corridor Airports

Airport	Originating Connecting Itineraries, Q2 2011–Q1 2012
H-JAIA	2,132,100
CLT	1,903,320
GSP	810,360
Total	4,845,780

Source: USDOT DB1B data, 2012

5.2 CONNECT AIR ITINERARY CHOICE MODEL

Once the new rail service is operational, the following options are available when considering a GSP–LGA trip:

- Fly nonstop from GSP to LGA (this option is not available for most destinations);

- Fly from GSP to a hub airport (possibly H-JAIA or CLT) and connect there to a flight to LGA; or
- Take rail to H-JAIA or CLT and connect there to a flight to LGA.

An itinerary choice model was estimated to predict the share of connecting air travelers who would switch from all-air trips to air-rail trips due to the introduction of intercity passenger rail on the corridor. The model is estimated using real choices made by travelers as recorded in the USDOT's DB1B 10 percent ticket sample, and takes into account trip duration, fare, daily frequency, and the connecting airport. Table 5-2 shows the coefficients of the estimated itinerary choice model.

Table 5-2: Connect Air Itinerary Choice Model Coefficients

Variable	Coefficient Value
Trip Duration (min)	-0.00442
Fare ($)	-0.00709
Daily Frequency	0.03924
H-JAIA Connection Dummy	0.14279
CLT Connection Dummy	0.67339

The implied value of time of $38/hour validated well against the USDOT benchmark of $42/hour. Since the estimated model is based only on connecting trips, it would be expected to see a slightly lower value of time than the USDOT benchmark, which includes non-stop and connecting passengers.

Once the model as estimated, the set of possible air-only itineraries as augmented with a set of feasible connections between the rail schedule and current air services. These possible connections assumed a 90-210 minute feasible connection time window between the air and rail modes and an additional 60-minute security time for itineraries with air-to-air connections. Figure 5-3 illustrates these assumptions for a Greenville–New York LaGuardia rail-air itinerary.

Figure 5-3: Connections Between Rail and Air Services

The model was then applied to predict the probability of a traveler choosing each itinerary from the full set, given the fares, travel times, as well as other factors, for each option. The probabilities for the possible air-rail trips are then multiplied by the original OD volumes, and aggregated across OD pairs to obtain estimate of trips diverted from connect air to rail.

Once the diversion of connect air trips to the rail mode is estimated through the application of the itinerary choice model, the trips were grown to 2025 and 2050 using growth rates calculated for each of the corridor airports using the FAA's Terminal Area Forecasts. The trips are then distributed within the H-

JAIA, CLT, and GSP catchment areas according to the forecast population distribution across the relevant model zones.

6. REVENUE-MAXIMIZING ANALYSIS

Detailed analysis was performed to determine the rail fare levels that maximize rail ticket revenue. Separate analyses were carried out for each alterative and technologies and the corresponding revenue-maximizing fare levels were used as the final rail fares. As part of this analysis, only the per-mile rail fares were varied (at $0.01 per mile increments) keeping the $5 boarding fee the same for all options and fare levels tested.

Figure 6-1 through Figure 6-3 illustrates the results of the revenue-maximizing analysis for the intercity travel market for Alternatives 1, 2, and 3, respectively. As expected, with the increase in rail fare, intercity rail ridership decreases for all alternatives. However, at the revenue-maximizing fare levels for each alternative the ticket revenue generated is the highest and any further increase or decrease in fare levels from the revenue-maximizing point is accompanied by a corresponding revenue reduction.

The revenue-maximizing fare levels for the intercity travel market are approximately $0.25 per mile for the Alternatives 1A and 1B, and $0.35 per mile for the Alternatives 2A, 2B, 3A and 3B. This is quite intuitive as Alternative 1, being a much slower and less frequent option than Alternatives 2 and 3, was expected to charge a lower fare. On the other hand, the Alternative 2 and 3 options are similar in characteristics and hence can charge the same fare levels.

The ticket revenue curves for all six options are flat around the revenue-maximizing fare levels (between $0.20 and $0.30 per mile for the Alternative 1A and 1B options, and between $0.30 and $0.40 per mile for the Alternative 2A, 2B, 3A and 3B) meaning in the vicinity of the revenue-maximizing fares, the corresponding ticket revenue losses are minimal. This follows the same trend that has been observed in many other passenger rail studies around the country and abroad.

The ridership and ticket revenue for the intercity travel market for the different alternatives were different even at the same fare levels as a result of differences in other LOS characteristics in these alternatives. Alternatives 3A and 3B generated the highest revenue and ridership followed by Alternatives 2A and 2B, with Alternatives 1A and 1B significantly behind for any given fare level. This follows the same trend that was observed in the ridership and revenue results discussed in Section 5.1 of the Alternatives Development Report.

Figure 6-1: Revenue-Maximizing Fare Analysis, Alternatives 1A and 1B

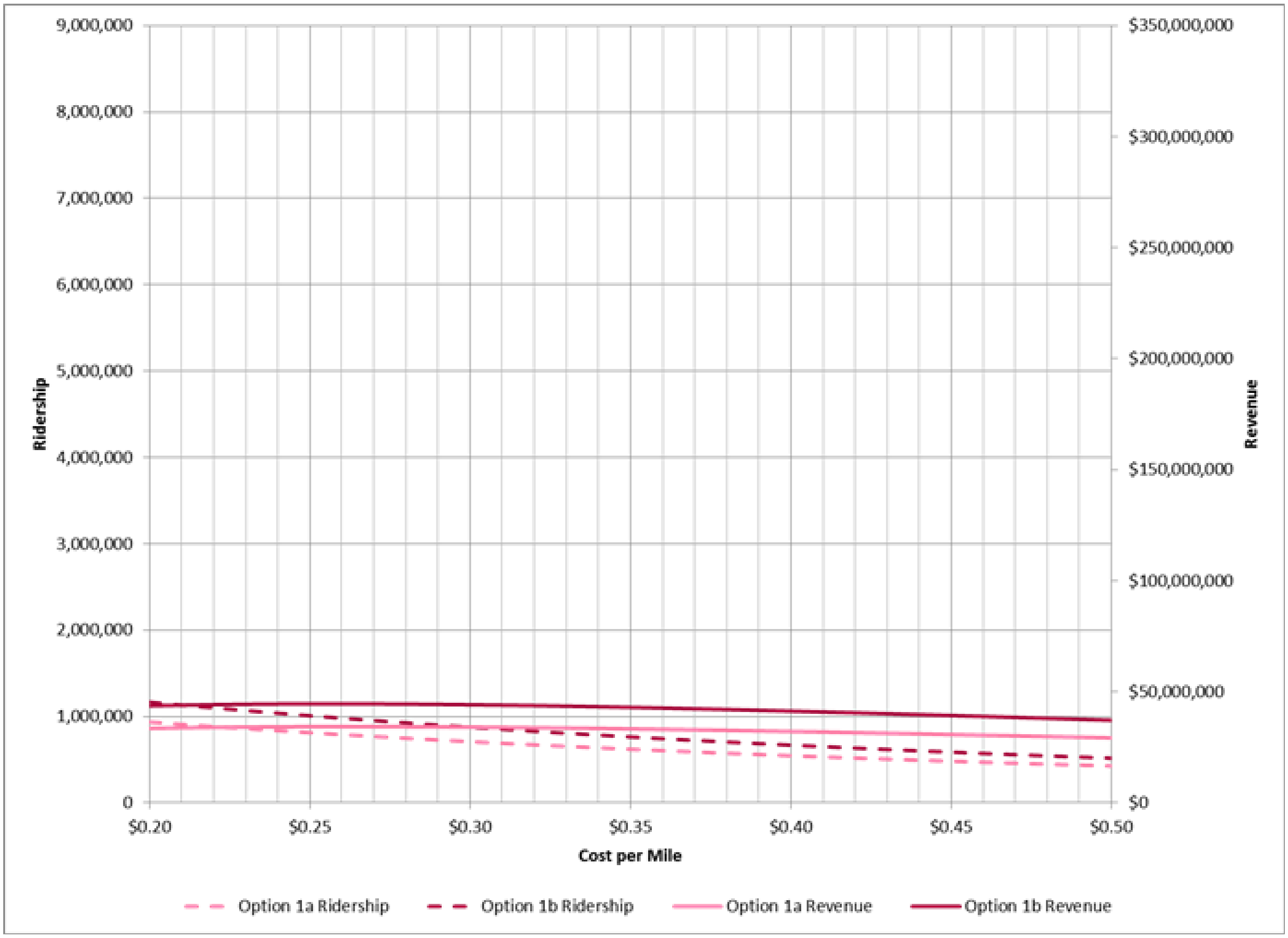


Figure 6-2: Revenue-Maximizing Fare Analysis, Alternatives 2A and 2B

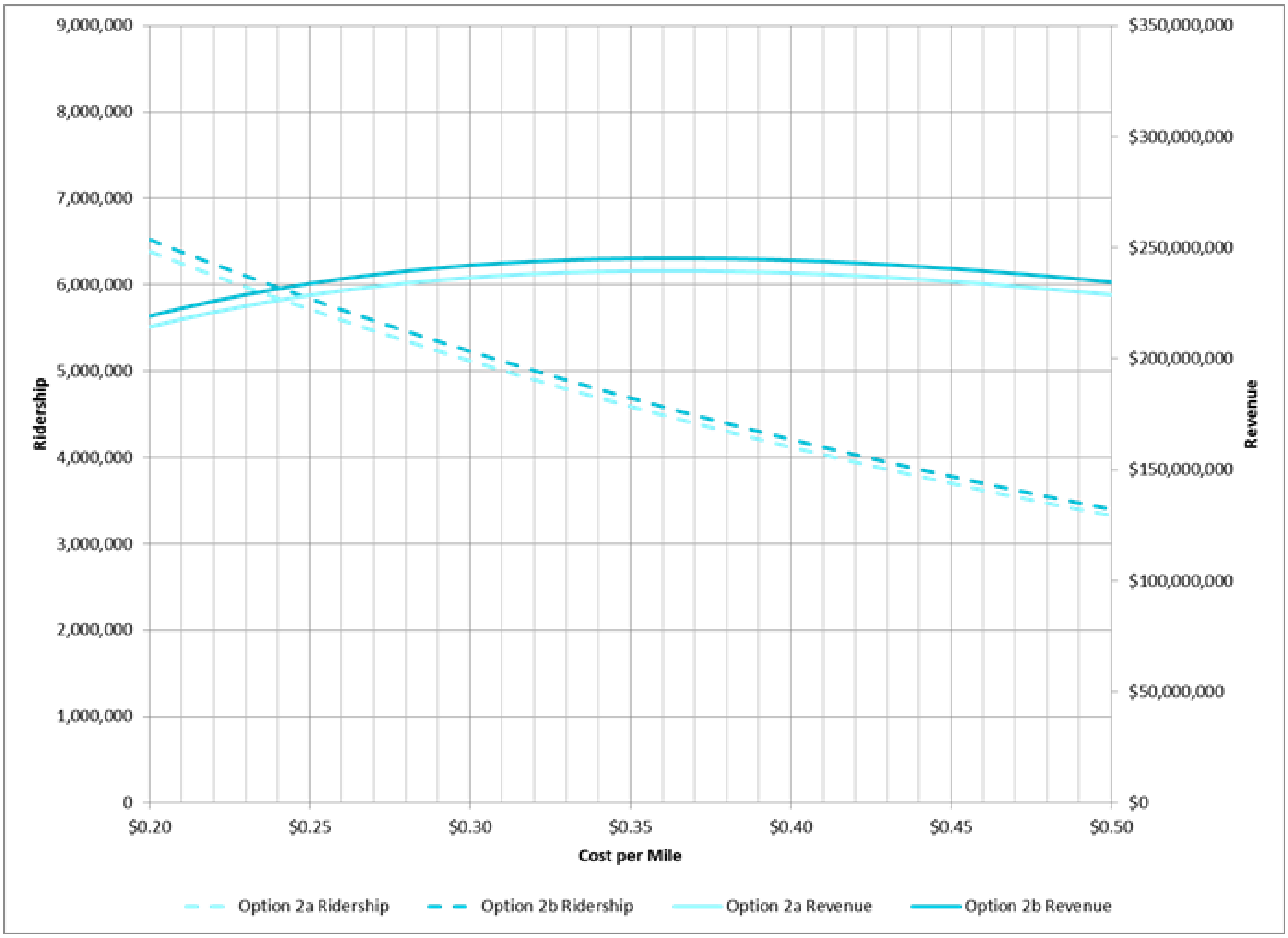
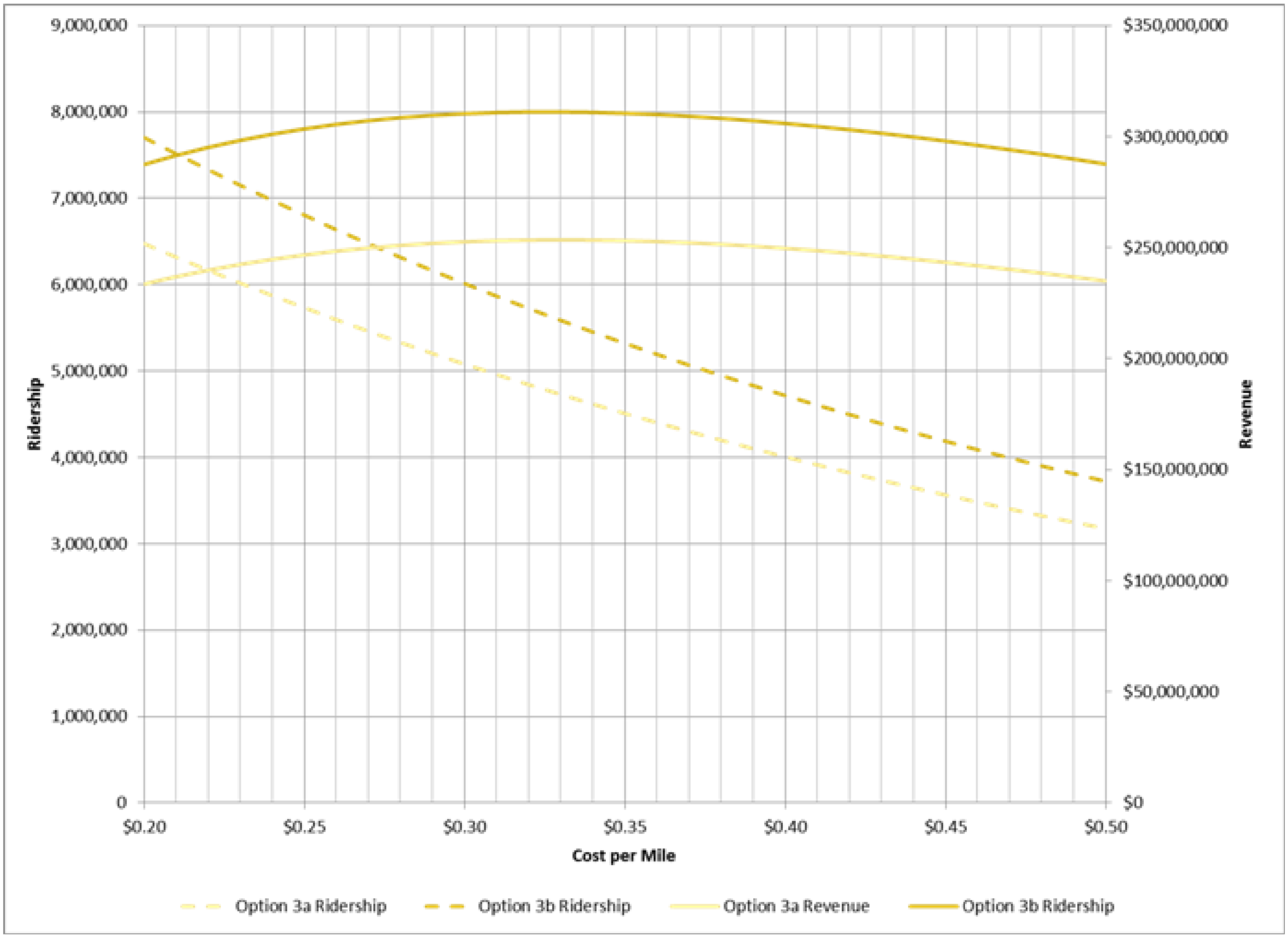


Figure 6-3: Revenue-Maximizing Fare Analysis, Alternative 3



The rail fare levels that maximize rail ticket revenue for the connect air market for the Alternative 2 and 3 options was also analyzed.[8] Table 6-1 and Table 6-2 present the ticket revenue and ridership for the intercity and connect air markets and the total market for three fare levels ($0.35, $0.40 and $0.45 per mile, all with a $5.00 boarding fee).

Travelers in the connect air market have higher values of time; as a result, if they are diverted to the proposed rail mode, they can be expected to be charged much higher fares than intercity travelers. As seen in Table 6-1 and Table 6-2, for all alternatives analyzed, maximum connect air ticket revenue was realized at the highest of the three fare levels—$0.45 per mile.

However, as discussed earlier, the highest ticket revenue values for the intercity market for all Alternatives 2A, 2B, 3A and 3B correspond to fares of $0.35 per mile. Consequently, the total ticket revenue for the

[8] *As discussed earlier, the NS alternatives were not considered competitive enough to attract market share from the connect air market.*

intercity and the connect air markets combined is maximized at $0.40 per mile for Alternatives 2A, 2B, 3A and 3B (as shown in the Total Revenue column). At $0.35 per mile, the revenue increase in the intercity market was more than offset by the corresponding decrease in connect air market revenue, resulting in a slight decrease in total revenue compared to the $0.40 per mile fare level. Similarly, comparing $0.45 per mile with $0.40 per mile, it was seen that a revenue increase for the connect air market, which is more than cancelled out by the corresponding revenue, decreased in the intercity market. The final fare for Alternatives 1A and 1B remained unchanged at a rate of $0.25 per mile.

Table 6-1: Revenue-Maximizing Fare Levels, Alternatives 2A and 2B

Fare per Mile	Alternative 2A			Alternative 2B		
	Ticket Revenue (in $ millions)					
	Intercity	Connect Air	Total	Intercity	Connect Air	Total
$0.35	**$245.1**	$42.6	$287.7	**$239.4**	$42.7	$282.1
$0.40	$244.3	$45.4	**$289.7**	$238.6	$44.4	**$283.0**
$0.45	$240.5	**$47.8**	$288.3	$234.8	**$46.9**	$281.7
	Ridership (in millions)					
$0.35	4.7	0.6	5.3	4.6	0.6	5.1
$0.40	4.2	0.5	4.7	4.1	0.5	4.6
$0.45	3.8	0.5	4.3	3.7	0.5	4.2

Table 6-2: Revenue-Maximizing Fare Levels, Alternative 3A and 3B

Fare per Mile	Alternative 3A			Alternative 3B		
	Ticket Revenue (in $ millions)					
	Intercity	Connect Air	Total	Intercity	Connect Air	Total
$0.35	**$310.5**	$56.7	$367.2	**$253.1**	$48.5	$301.7
$0.40	$305.9	$61.6	**$367.5**	$249.7	$52.8	**$302.5**
$0.45	$298.0	**$63.3**	$361.2	$243.4	**$54.2**	$297.6
	Ridership (in millions)					
$0.35	5.3	0.7	6.0	4.5	0.6	5.1
$0.40	4.7	0.7	5.4	4.0	0.6	4.6
$0.45	4.2	0.6	4.8	3.6	0.5	4.1

7. SENSITIVITY ANALYSIS

Detailed sensitivity analysis was performed to test the sensitivity of rail ridership with respect to key LOS variables, including rail fare, rail in-vehicle time, rail frequency, auto in-vehicle time, and auto operating cost. Separate sensitivity analysis was performed for each option under consideration

Figure 7-1 through Figure 7-5 shows the results of these sensitivity analyses graphically for rail fare, rail in-vehicle time, rail frequency, auto in-vehicle time and auto operating cost, respectively. For each set of sensitivity analyses, the corresponding LOS variable was varied from -90 percent to +100 percent from its base level (the value used to produce the final forecasts presented earlier) in 10 percent increments.

Rail ridership in all sensitivity analysis figures was normalized to the base ridership value (the ridership figure with the corresponding LOS variable at the base value). For example, a normalized rail volume of 1.5 corresponds to a 50 percent increase in rail ridership from the base value. Similarly, a normalized rail volume of 0.5 corresponds to a 50 percent decrease in rail ridership from the base value.

Recognizing that there are many other LOS variables other than the variable in question that impact rail ridership, the impact of changes in a single variable was isolated by holding all other LOS variables constant at their base values. However, the ridership sensitivity had significant dependence on the values of these other variables in absolute terms, as well as in relative terms to the value of the LOS variable in question, and may exhibit different sensitivity depending on these. Consequently, rail ridership sensitivity can be quite different for different values of the LOS variable (whose sensitivity is being tested) along the sensitivity curve on both sides of its base value. All of the sensitivity analyses were performed for the year 2025.

Figure 7-1: Sensitivity of Rail Ridership With Respect to Rail Fare

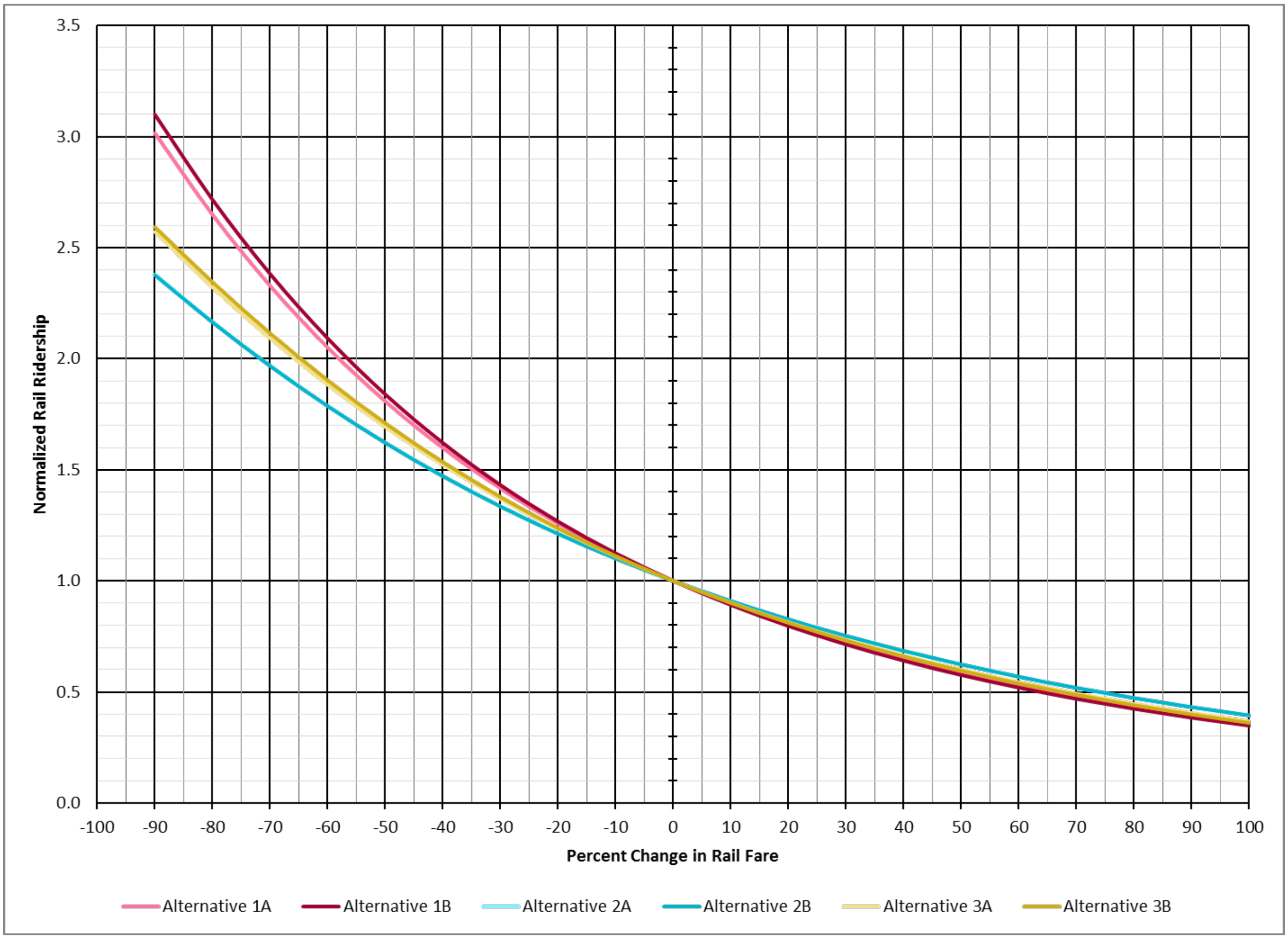


Figure 7-1 shows a plot of rail ridership sensitivity with respect to rail fare for all alternatives. As expected, Alternative 1 ridership, being much less expensive than Alternatives 2 and 3, is more sensitive to rail fares than that of the other alternatives. Moreover, ridership for all alternatives is more sensitive to rail fares when fares are below the base levels than when fares are above the base levels. This can be explained by comparing rail fares with auto costs. As even the base rail fares calculated at $0.25 or $0.40 per mile depending on the alternative (plus a $5.00 boarding fee) are significantly higher than the base auto operating cost of approximately $0.16 per mile, ridership sensitivity is relatively lower at higher-than-base rail fares. When rail fares are significantly lower than the base levels (especially for Alternative 1), rail starts to compete more effectively on cost with auto, which results in higher ridership sensitivity.

Figure 7-2: Sensitivity of Rail Ridership With Respect to Rail In-Vehicle Time

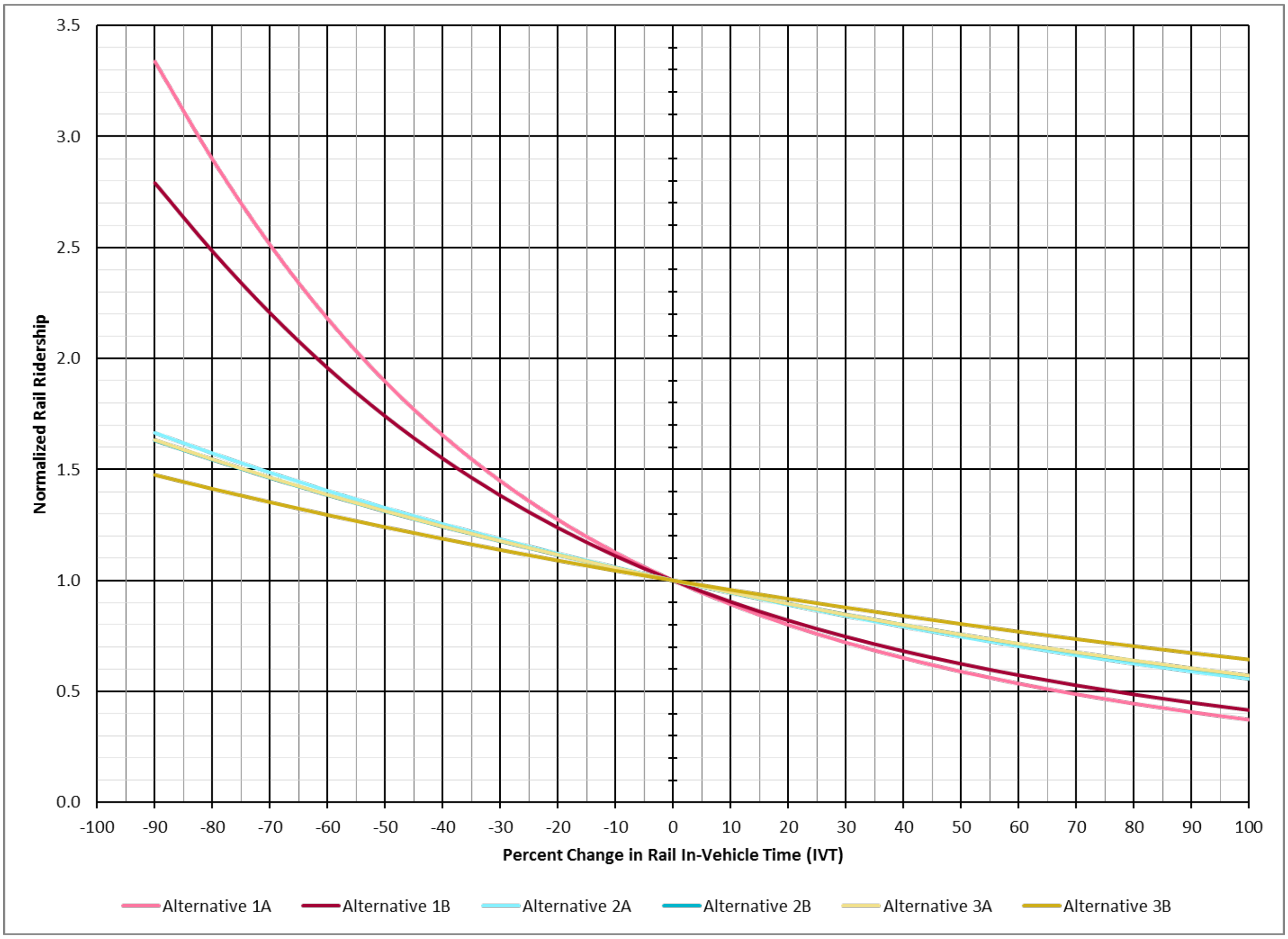


Figure 7-2 shows a plot of the sensitivity of rail ridership with respect to rail in-vehicle time. Similar to rail fares, given that Alternative 1 is a significantly slower option compared to Alternatives 2 and 3, Alternative 1 ridership is the most sensitive to changes in rail in-vehicle time. The in-vehicle times for Alternatives 2 and 3 are always significantly better than those of driving options in the corridor. Therefore, auto cannot compete with Alternatives 2 and 3 on travel time. However, Alternatives 1A and 1B are competitive to auto in terms of time, which result in greater ridership sensitivity with respect to rail in-vehicle time than the other alternatives.

Figure 7-3: Sensitivity of Rail Ridership With Respect to Rail Frequency Sensitivity

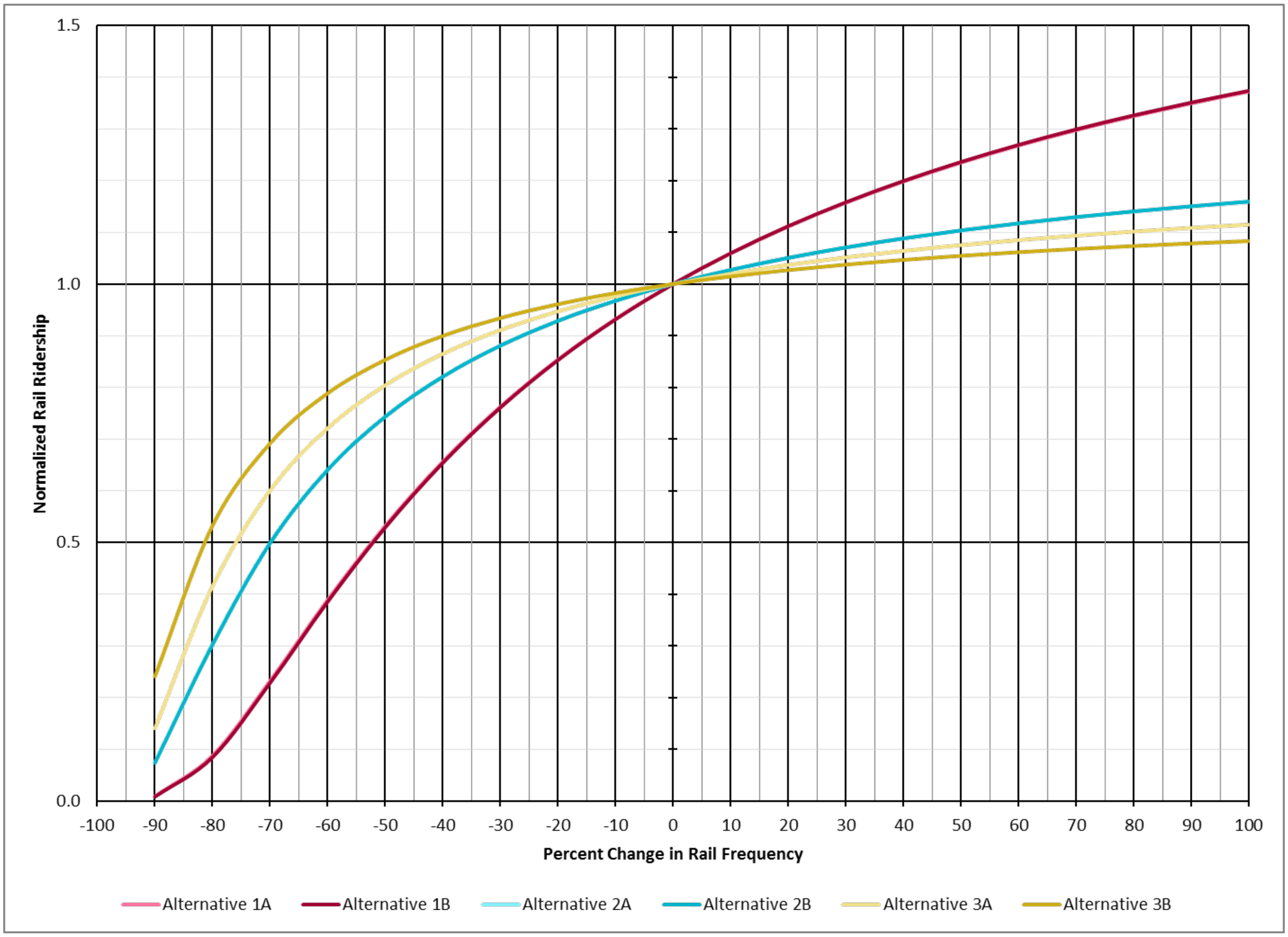
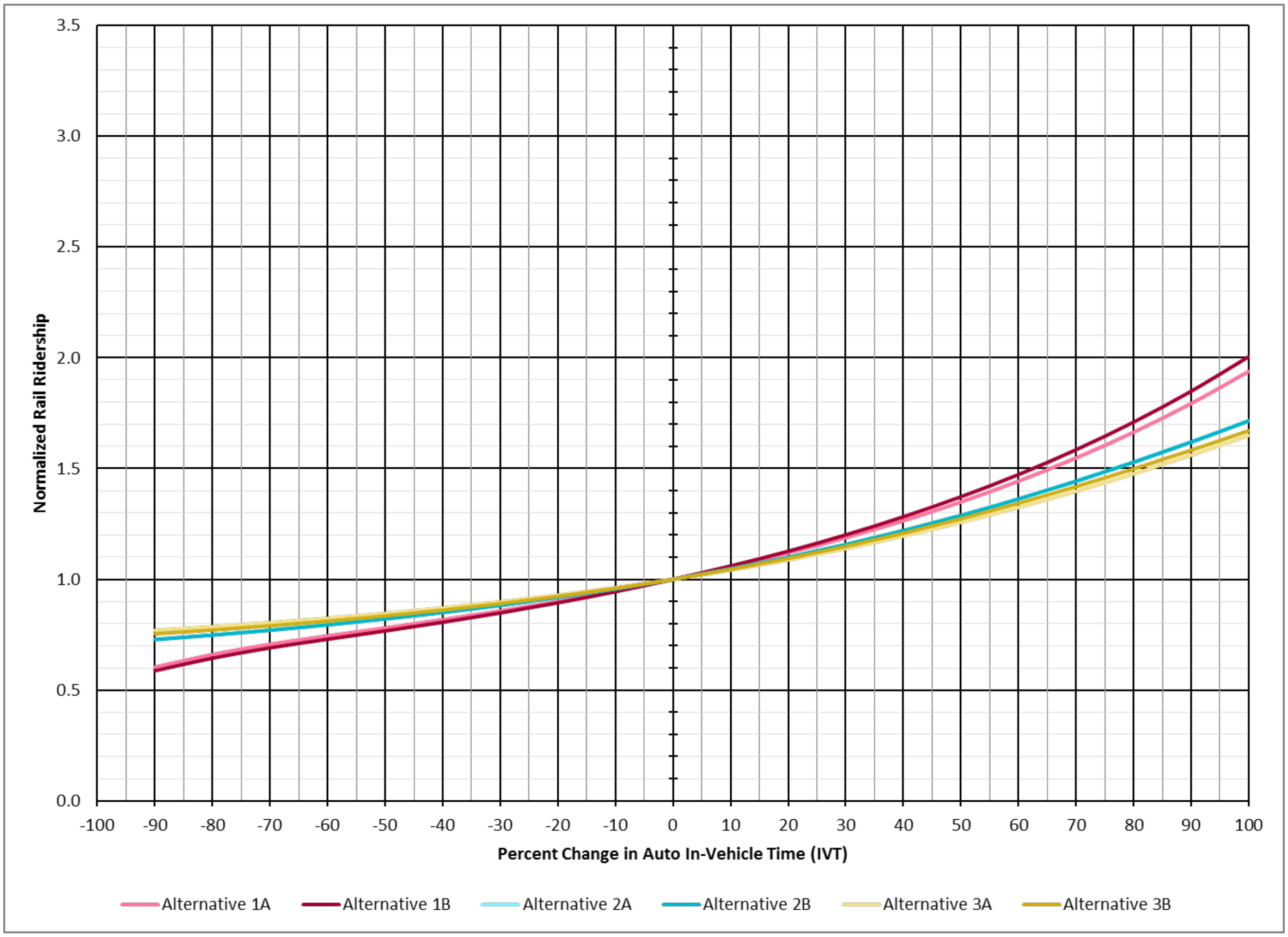


Figure 7-3 shows a plot of the sensitivity of rail ridership with respect to rail frequency. Rail ridership is less sensitive to frequency variation for frequent base service compared to sporadic service throughout the day. With more than one train an hour service on average (assuming 14 hours operation in day) for the base (trains per day ranging from 14 to 22), Alternatives 2 and 3 have frequent service already in place. As a result, any further increases in frequency for these alternatives are not accompanied by proportional increases in ridership. However, the sensitivity curves for the Alternative 2 and 3 options become quite steep near a 50 percent reduction in base frequency, when these services become more infrequent. On the other hand, Alternatives 1A and 1B exhibit considerably higher sensitivity to frequency changes. This makes sense, given the very infrequent base service frequency of Alternative 1.

Figure 7-4: Sensitivity of Rail Ridership With Respect to Auto In-Vehicle Time



Ridership sensitivity to auto in-vehicle time is shown graphically for all the alternatives in Figure 7-4. Similar to Figure 7-2, Alternative 1 ridership is more sensitive to auto in-vehicle time than the other alternatives, as Alternatives 1A and 1B run significantly slower. As auto access is assumed for the rail mode, any changes in auto in-vehicle time have two opposite impacts on rail ridership. Increases in auto in-vehicle times made the rail mode more attractive as rail competes with auto for mode share. At the same time, it also increased the access/egress times to/from rail stations, which impacted the rail mode negatively. The combined effects of these two opposite impacts dictated the ultimate sensitivity of rail ridership to changes in auto in-vehicle time.

Figure 7-5: Sensitivity of Rail Ridership With Respect to Auto Operating Cost

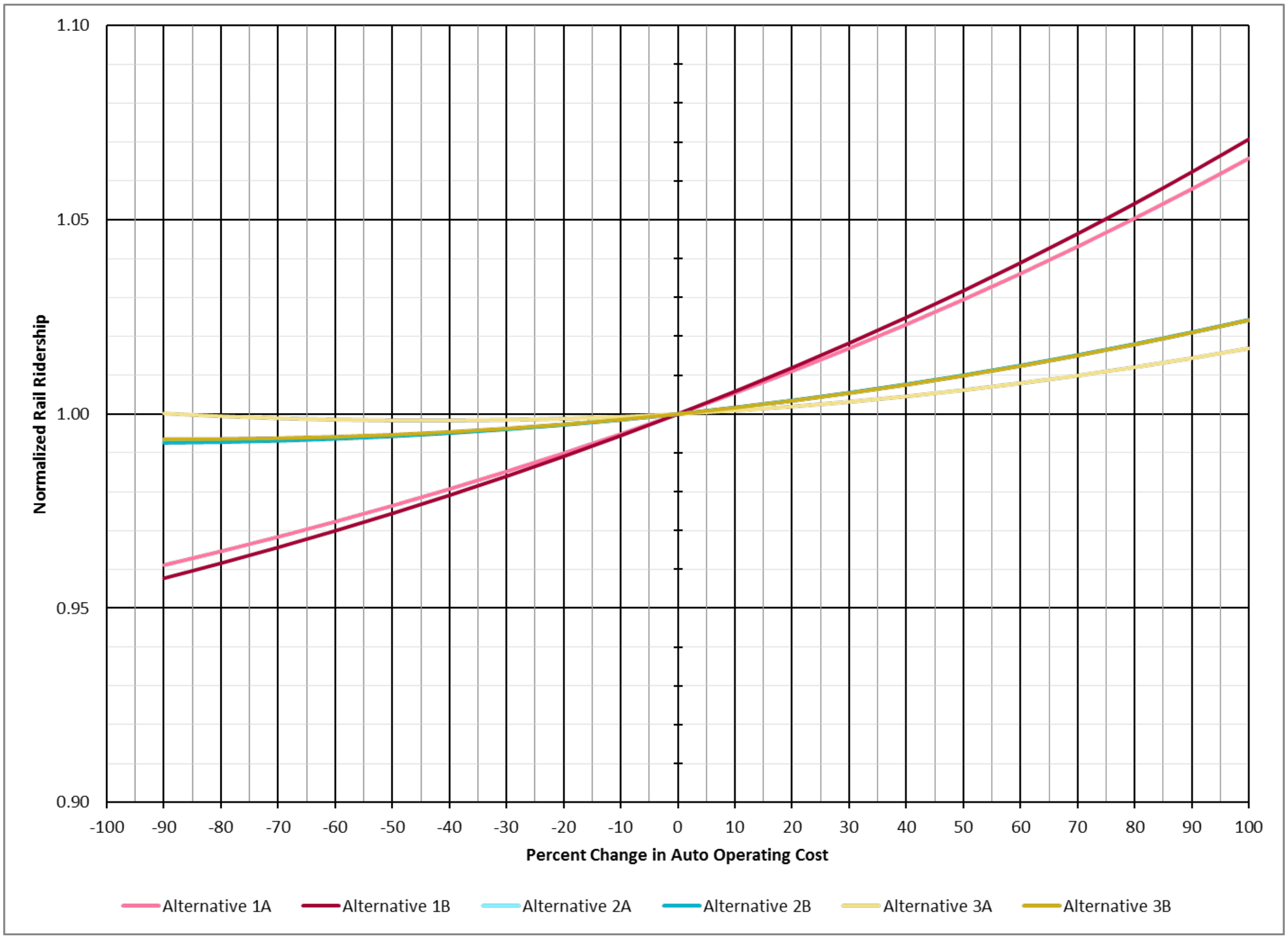


Figure 7-5 illustrates ridership sensitivity to per-mile auto operating costs for all alternatives. Rail ridership was highly insensitive to auto operating cost changes—especially for the Alternatives 2 and 3. The base auto operating cost figure of roughly $0.16 per vehicle-mile is significantly lower than the base rail fares (Alternative 1: $0.25 per mile and Alternatives 2 and 3: $0.40 per mile). This per mile auto operating cost is even lower as its get divided by the average vehicle occupancy for an average per person cost (occupancy is 3.07 for nonbusiness travel and 1.48 for business travel). Consequently, at the per person level, rail is significantly more expensive than auto. As a result, any variation in auto operating cost within the range tested in the above sensitivity analysis do not make the rail mode significantly more or less attractive than it is in the base case, hence there was very low sensitivity of rail ridership to changes in auto operating cost.

All ridership and revenue outputs presented earlier in this section assume no increase in auto travel time between now and 2025 and 2050 for those sections of the study area that are not part of the ARC and MRM

MPO model boundaries.[9] In order to test the sensitivity of ridership to increased congestion and in turn increased highway travel times outside the Atlanta and Charlotte metro areas in the future years, an additional sensitivity analysis was performed. For this analysis, a 15 percent increase in highway travel times in 2025 over the base case was assumed for all the highway links in the study area outside the ARC and MRM model boundaries and its impact on the underlying ridership and revenue were tested.

Table 7-1: Sensitivity of Highway Congestion Increase Outside Atlanta and Charlotte Metro Areas

Option	Ridership Change	Revenue Change
Alternative 1A: Southern Crescent (79 mph)	6%	7%
Alternative 1B: Southern Crescent (110 mph)	6%	7%
Alternative 2A: I-85 (130 mph)	4%	6%
Alternative 2B: I-85 (220 mph)	3%	6%
Alternative 3A: Greenfield (130 mph)	2%	6%
Alternative 3B: Greenfield (220 mph)	3%	6%

The impact of the increase in congestion was relatively small on both rail ridership (2 percent to 6 percent) and rail revenue (6 percent to 7 percent). Moreover, this impacts the longer-distance trips disproportionately, especially for Alternatives 2 and 3, as evidenced by significantly higher increases in rail revenue than ridership.

[9] The potential increase in congestion and travel times through 2025 and 2050 in the Atlanta and Charlotte metro areas and other areas of the study boundary under the jurisdiction of the ARC and MRM models are explicitly accounted for in the ridership and revenue forecasts per the Long Range Transportations Plans (LRTP) of the two metro areas as defined and modeled in the MPO model systems.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX F: DESIGN CRITERIA TECHNICAL MEMORANDUM

May 2013

GDOT
Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

Contents

Tables

1. OVERVIEW

The Federal Railroad Administration (FRA) awarded the Georgia Department of Transportation (GDOT) funds from the High Speed Intercity Passenger Rail Program (HSIPR). FRA and GDOT are preparing a Passenger Rail Corridor Investment Plan (PRCIP) to evaluate high-speed rail along the 280-mile Atlanta, GA to Charlotte, NC corridor. A Tier 1 Environmental Impact Statement (EIS) and Service Development Plan (SDP) will be completed as a part of this PRCIP. THE FRA AND GDOT, IN COOPERATION WITH SOUTH CAROLINA DOT AND NORTH CAROLINA DOT, ARE COORDINATING ON DEVELOPMENT OF BOTH DOCUMENTS.

The Atlanta to Charlotte Corridor was first introduced as a part of the Southeast High Speed Rail (SEHSR) corridor that connects Atlanta to Washington, DC. GDOT included the corridor in their most recent 2009 State Rail Plan following the 2008 Volpe Center Report *Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor* (2008 Volpe Center Report). This corridor is part of the strategic vision for passenger rail service in Georgia as well as the Southeast, and will include considerations for intermodal connections in Atlanta and Charlotte, as well as intermediate cities.

1.1 OBJECTIVE

The main objective of this methodology technical memorandum is to provide conceptual engineering design criteria and assumptions for various high-speed intercity passenger rail service alternatives being evaluated as part of the PRCIP. Included are recommendations for the evaluation of the high-speed rail service alternatives between Atlanta and Charlotte and focuses on design elements such as geometrics, clearances, at-grade crossing, structures, track infrastructure, hydrology and hydraulics, and stations.

1.2 GENERAL ASSUMPTIONS

This analysis includes conceptual design elements and standards, and some engineering design elements will depend on factors that cannot be finalized at this time. Following, as a part of a Tier 2 NEPA document, a more in-depth analysis of engineering design elements will be conducted on a project level.

The design and operating criteria contained in this technical document are based on typical industry standards for high-speed and intercity passenger rail. These criteria are presented for planning purposes to estimate a preliminary order of magnitude for comparison of each alternative with respect to construction, operation and maintenance costs. FRA and GDOT acknowledge that the specific design criteria for the proposed project will be further revised or confirmed with the FRA Office of Railroad Safety, participating host railroads, and associated stakeholders after completion of the Environmental Impact Statement (EIS) for the proposed project.

1.3 TERMS AND DEFINITIONS

- **Gage**: The measurement between the running rails at right angles to the alignment of the track 5/8" below the top of rail.
- **Circular Curve**: A curve of constant radius designed by the chord method of degree of curvature.
- **Spiral Curve**: A curve of variable radius. Spiral curves may be found between two circular curves, each of different radius, and between a circular curve and a straight tangent.

- **Superelevation (cant)**: The vertical distance of the outer rail of a curve above the inner rail. It is provided to overcome or partially overcome the effects of curvature and speed.
- **Equilibrium Superelevation**: The elevation that exactly overcomes the effect of negotiating a curve at a given speed and degree of curvature, by placing the resultant of the centrifugal force and normal force created by the weight of the equipment in a direction perpendicular to the plane of track.
- **Underbalance (cant deficiency)**: The amount of superelevation less than equilibrium superelevation for any given combination of speed and curvature.
- **Overbalance**: The amount of superelevation that exceeds equilibrium elevation and is produced by the operation of a train around a curve at less than equilibrium speed.
- **Rate of Change of cant as a function of length**: the amount by which the cant is increased or decreased in a given transition length.
- **Jerk Rate**: Value used to determine passenger comfort while transitioning a curve.
- **Maximum Permissible Speed**: Maximum speed permitted on a curve with associated transitions when radius, superelevation, underbalance, spiral length and rates of change of superelevation and other parameters have been taken into consideration.
- **Recommended Values**: Values to be applied as the basis of engineering design for each service alternative. The recommended value will also be seen as the desirable value for existing conditions during screening various route alternatives.
- **Maximum (or minimum) Limiting Values**: Extreme permissible values used at maximum speed. As these values are extreme, it is essential that the use of maximum (or minimum) limiting values is as infrequent as possible for any service alternative.
- **Horizontal Alignment**: The projection of the track center line on a horizontal plan. The horizontal alignment consists of a chain of tangents, spiral curves and circular curves.
- **Vertical Alignment**: The elevation along the horizontal alignment. The vertical alignment consists of a chain of gradients and vertical curves.

1.4 STANDARDS AND GUIDELINES

Several national and international guidelines and standards are available for reference. The primary purpose of these guidelines and standards is safety. These standards are not design standards in the traditional sense, but do affect the design of any high-speed rail infrastructure. For the purpose of this Tier I our primary references for guidelines and standards are;

- Code of Federal Regulations Part 213, Track Safety Standards, generally and also particular Subpart G – Train Operations at Track Classes 6 and Higher; and
- The Manual for Railway Engineering of the American Railway Engineering and Maintenance-of-Way Association (AREMA Manual).

2. SERVICE ALTERNATIVES

2.1 ALTERNATIVE 1: EMERGING HIGH-SPEED RAIL

FRA defines Emerging High-Speed Rail as "developing corridors of 100-500 miles, with strong potential for future Regional and/or Express High-Speed Rail service. Top speeds of up to 90-110 mph primarily on track shared by both freight and passenger trains (eventually using positive train control technology), with advanced grade crossing protection or separation. Emerging High-Speed Rail is intended to develop the passenger rail market, and provide some relief to other modes."[1]

Emerging High-Speed Rail primarily involves utilizing an existing rail corridor right-of-way owned and operated by a freight railroad. This level of service is also commonly called "Shared Use". Operating, service level and maintenance agreements need to be negotiated with the freight railroad owners for passenger service to operate. This alternative is very limited in that it is bound to the existing rail network between the points of interest and freight railroad operating criteria. In general, maximum speeds for the shared use alternative is 110 mph based acceptance by the freight railroads. Additionally, alternatives with maximum speed of 79 mph included in the study will be considered as Emerging High-Speed Rail. Emerging High-Speed Rail can typically be accommodated with conventional passenger rail equipment using diesel motive power; however, multiple diesel-electric locomotives may be required to achieve optimal performance at speeds up to 90-110 mph. Current FRA regulations support the shared operation of both freight and passenger trains at speeds up to 90-110 mph with FRA-compliant Tier-I equipment (for speeds up to 125 mph). FRA also recommends for Emerging High-Speed Rail corridors to have active protection installed at all crossings where train speeds will exceed 79 mph.

2.2 ALTERNATIVE 2: REGIONAL HIGH-SPEED RAIL

FRA defines Regional High-Speed rail as "relatively frequent service between major and moderate population centers, 100-500 miles apart, with some intermediate stops. Top speeds are 110-150 mph and the corridor is grade separated, with some dedicated and some shared track (eventually using positive train control technology). The alternative is intended to relieve highway and to some extent, air capacity constraints."[2]

This alternative primarily involves establishing a new passenger rail corridor, typically designated solely to high-speed passenger rail service. For the purposes of this PRCIP, the analysis will also take into consideration potential partnering opportunities between freight and passenger rail service. In developing corridor service alternatives for consideration, the project team will examine existing interstate and state highway corridors, private railroad rights-of-way and greenfield alignments.[3] Regional High-Speed Rail can typically be accommodated with conventional passenger rail equipment using diesel motive power for speeds up to 125 mph, and tilt/articulated equipment and electric motive power above 125 mph; however, electric locomotives are recommended to achieve optimal performance at speeds of 110-150 mph. Current FRA regulations support the shared operation of both freight and passenger trains at speeds up of 110-150

[1] *Federal Railroad Administration (2009) Vision for High-Speed Rail in America, pp. 10 (http://www.fra.dot.gov/eLib/Details/L02833)*

[2] *Federal Railroad Administration (2009) Vision for High-Speed Rail in America, pp. 10 (http://www.fra.dot.gov/eLib/Details/L02833)*

[3] *Greenfield refers to new track on new alignment*

mph with FRA-compliant Tier-I (for speeds up to 125 mph) and Tier-II (for speeds of 125 to 150 mph) equipment. Regional High-Speed Rail also requires all crossings to have protection for speeds up to 125 mph, and a fully grade-separated corridor above 125 mph.

2.3 ALTERNATIVE 3: EXPRESS HIGH-SPEED RAIL

FRA defines Express High-Speed rail as "frequent, express service between major population centers, 200-600 miles apart, with few intermediate stops. Top speeds will range from 150-220 mph on completely grade-separated, dedicated rights-of-way (with the possible exception of some shared track in terminal areas).[4] Express High-Speed rail intends to relieve air and highway capacity constraints."[5]

This alternative primarily involves establishing a new passenger rail corridor, typically designated solely to high-speed passenger rail service. For the purposes of this PRCIP, the analysis will also take into consideration potential partnering opportunities between freight and passenger rail service. In developing corridor service alternatives for consideration, the project team will examine existing interstate and state highway corridors, private railroad rights-of-way and greenfield alignments. Express High-Speed Rail requires advanced passenger rail equipment using electric motive power. Current FRA regulations do support the shared operation of both freight and passenger trains at speeds above 150 mph; however FRA Office of Railroad Safety may consider a system-specific safety plan for any proposal that is not covered under the current law.

3. DESIGN STANDARDS AND ASSUMPTIONS

Below are tables for each of the service alternatives that define the conceptual engineering design parameters relative to horizontal and vertical alignments.

Table 3-1: Alternative 1 – Emerging High-Speed Rail (90-110 mph) Horizontal Alignment

Horizontal Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Distance Between Center of Tracks	feet		15'-0"	14'-0" (min)
Equilibrium Superelevation	inch		5"	½" (min) 11" (max)
Minimum Degree of Curvature (D)	degree	(0)	0° 30' 00"	1° 45' 00" (90mph)
Maximum Actual Superelevation	inches		½"	½" (min) 5" (max)
Maximum Unbalance	inches		0"	6"[6]
Jerk Rate	feet/feet		1.63	1.22

[4] *Terminal areas refer to destination points including metropolitan areas.*
[5] *Federal Railroad Administration (2009) Vision for High-Speed Rail in America, pp. 10 (http://www.fra.dot.gov/eLib/Details/L02833)*
[6] *4" Maximum unbalance for non-tilting rolling stock.*

Horizontal Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Rate of Change	$\left(-\right)$	$\left(\frac{}{s}\right)$	N/A	0.375
Length of Spiral[7]	feet			[8]
Minimum Length of Curve and Tangent	feet		500ft	330ft [9]

V = velocity/speed (mph)
D = degree of curve (decimal & chord definition)
E = equilibrium superelevation (inch)
E_a = actual superelevation (inch)
E_u = underbalance (inch)
L_s = length of spiral
L_c = length of curve
L_t = length of tangent

Table 3-2: Alternative 1 – Emerging High-Speed Rail (90-110 mph) Vertical Alignment

Vertical Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Grade[10]	%		1%	1.5%
Vertical Acceleration Constant	——		0.10	0.60 [11]
Length of Vertical Curve	degree	————	N/A	100ft (min)
Rate of Change (R-value)	$\left(-\right)$	$\frac{\lvert\Delta\rvert}{\left(\text{———}\right)}$	0.06% (sags) 0.10 (crest)	0.40% [12]
Minimum Length of Vertical Curve and Tangent	feet		500ft	330ft

V = velocity/speed (mph)
A = vertical acceleration constant
LVC = length of vertical curve (feet)
LVT = length of vertical tangent (feet)
Δ = algebraic different in grade

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7 *Length of spiral will be rounded up to the nearest 31ft increment*

8 *Minimum spiral length should be 100ft*

9 *Minimum L_c or L_t should be 100ft*

10 *Grades will be compensated for horizontal curves. When a horizontal curve is located on a grade, the grade on the curve should be reduced at a rate of 0.04% for each degree of curvature. Example, the recommended limiting grade value for a 1° 00' 00" horizontal curve is 0.96% and the maximum limiting value is 1.46%*

11 *Maximum vertical acceleration value is for track where passenger trains operate only*

12 *Maximum R-value is for tracks where passenger trains only operate*

Table 3-3: Alternative 2 – Regional High-Speed Rail (110-150 mph) Horizontal Alignment

Horizontal Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Distance between center of tracks	feet		16'-5"	15'-0" (min)
Equilibrium Superelevation	inch		4"	½" (min) 13" (max)
Minimum Degree of Curvature (D)	degree	(0)	0° 15' 00"	1° 15' 00" (110mph)
Maximum Actual Superelevation	inches		4"	½" (min) 6" (max)
Maximum Unbalance	inches		0"	7" [10]
Jerk Rate	feet/feet		1.63	1.22
Rate of Change	(–)	(–s)	N/A	0.25
Length of Spiral[13]	feet			[14]
Minimum Length of Curve and Tangent	feet		1000ft	450ft [15]

V = velocity/speed (mph)
D = degree of curve (decimal & chord definition)
E = equilibrium superelevation (inch)
Ea = actual superelevation (inch)
Eu = underbalance (inch)
Lc = length of curve
Ls = length of spiral
Lt = length of tangent

Table 3-4: Alternative 2 – Regional High-Speed Rail (110-150 mph) Vertical Alignment

Vertical Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Grade[16]	%		1%	4%
Vertical Acceleration Constant	—		0.10	0.60
Length of Vertical Curve	degree		N/A	100ft (min)
Rate of Change (R-value)	(–)	|Δ| / (——)	0.06% (sags) 0.10 (crest)	0.40%
Minimum Length of Vertical Curve and Tangent	feet		500ft	330ft

V = velocity/speed (mph)
A = vertical acceleration constant
LVC = length of vertical curve (feet)
LVT = length of vertical tangent (feet)
Δ = algebraic different in grade

[13] *Length of spiral should be rounded up to the nearest 31ft increment*
[14] *Absolute minimum spiral length should be 100ft*
[15] *Absolute minimum L_c or L_t should be 100ft*
[16] *Grades will be compensated for horizontal curves. When a horizontal curve is located on a grade, the grade on the curve should be reduced at the rate of 0.04% for each degree of curvature. Example, the recommended limiting grade value for a 1° 00' 00" horizontal curve is 0.96% and the maximum limiting value is 1.46%*

Table 3-5: Alternative 3 – Express High-Speed Rail (150-220 mph) Horizontal Alignment

Horizontal Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Distance between center of tracks	feet		16'-5"	15'-0" (min)
Equilibrium Superelevation	inch		4″	½" (min) 13" (max)
Minimum Degree of Curvature (D)	degree	(0)	0° 15' 00"	1° 15' 00" (150mph)
Maximum Actual Superelevation	inches		4"	½" (min) 6" (max)
Maximum Unbalance	inches		0"	7"
Jerk Rate	feet/feet		1.63	1.22
Rate of Change	(–)	(–s)	N/A	0.25
Length of Spiral[17]	feet			[18]
Minimum Length of Curve and Tangent	feet		1000ft	700ft [19]

V = velocity/speed (mph)
D = degree of curve (decimal & chord definition)
E = equilibrium superelevation (inch)
Ea = actual superelevation (inch)
Eu = underbalance (inch)
Lc = length of curve
Ls = length of spiral
Lt = length of tangent

Table 3-6: Alternative 3 – Express High-Speed Rail (150-220 mph) Vertical Alignment

Vertical Alignment Design Element	Unit	Formula	Recommended Limiting Value	Maximum/Minimum Limiting Value
Grade[20]	%		1%	6%
Vertical Acceleration Constant	—		0.10	0.60
Length of Vertical Curve	degree		N/A	100ft (min)
Rate of Change (R-value)	(–)	|Δ| / ( )	0.06% (sags) 0.10 (crest)	0.40%
Minimum Length of Vertical Curve and Tangent	feet		500ft	330ft

V = velocity/speed (mph)
A = vertical acceleration constant
LVC = length of vertical curve (feet)
LVT = length of vertical tangent (feet)
Δ = algebraic different in grade

[17] *Length of spiral should be rounded up to the nearest 31ft increment*
[18] *Absolute minimum spiral length should be 100ft*
[19] *Absolute minimum L_c or L_t should be 100ft*

[20] *Grades will be compensated for horizontal curves. When a horizontal curve is located on a grade, the grade on the curve should be reduced at the rate of 0.04% for each degree of curvature. Example, the recommended limiting grade value for a 1° 00' 00" horizontal curve is 0.96% and the maximum limiting value is 1.46%*

3.1 CLEARANCES

For the purposes of the PRCIP, a conscience effort will be made to apply the best horizontal and vertical clearance possible given all constraints. Clearances for reconstruction work, or for alteration are dependent on existing physical conditions, where reasonably possible, will be improved to meet the requirements for new construction.

3.1.1 Horizontal

Each state and host railroad has different regulations regarding minimum horizontal clearance. American Railway Engineering and Maintenance-of-Way Association (AREMA) recommends a minimum horizontal clearance of 9' from centerline of rail. On curved track, the horizontal each side of the track centerline will be increased 1-1/2" per degree of curvature.

The desirable horizontal clearance of thru bridges will be 25'-0" on tangent track, anything less than 25'-0" will require a crashwall. As noted above, additional horizontal clearance is required within areas of curved track.

3.1.2 Vertical

Each state has different regulations regarding minimum vertical clearance over roadways. American Association of Highway and Transportation Officials (AASHTO) states that the minimum vertical clearance to be 16'-0" for new construction. GDOT requires a minimum vertical clearance of 16'-6" with a desirable vertical clearance 17'-0". This vertical clearance is the limiting clearance across all three states and will be used for the basis of conceptual design (rail over roadway) and applies to all three service alternatives.

The standard vertical clearance of 23'-0" was established over 40 years ago for roadway over rail and rail over rail, based on discussions and agreement between Federal Highway Administration (FHWA), AASHTO, and the Association of American Railroads (AAR). A vertical clearance of 23'-0" accounts for routine track maintenance, raising the top of the rail profile slightly per occurrence. However, the minimum vertical clearance associated with possible host railroads is 23'-4" and will be the minimum vertical clearance used for the basis of conceptual design for route alternatives that are associated with Emerging High-Speed Rail.

For possible electrification options associated with Emerging High Speed Rail, an increase height of 24'-3" will be required. The increase allows host railroads to operate "double-stack" intermodal trains and the future installation of overhead catenary electrification. It will be noted that the North Carolina Department of Transportation Rail Division (NCDOT Rail) has already proposed a policy to FRA that all new bridges built along the proposed SEHSR corridor in North Carolina will be built to the 24'-3" vertical clearance height. Pursuit of a similar initiative for the Atlanta-Charlotte high-speed rail preferred alternative corridor will be considered.

For Regional and Express High-Speed Rail, vertical clearance will be 19'-0", assuming these corridors will be exclusively passenger rail service. This clearance value allows the installation of a catenary system with sufficient electrical clearance to bridge overpasses for a 25 thousand volt (kV) power system. Clearances for existing structures may be obtained by rebuilding the structure or lowering the track elevation.

Table 3-7: Vertical Clearance Standards and Conceptual Engineering Basis

Source	Clearance Standard
Rail over Roadway	
AASHTO	16'-0"
GDOT (Required)	16'6"
GDOT (Desired)*[21]	17'-0"
Roadway over Rail/Rail over Rail	
Emerging High-Speed Rail	
FHWA/AASHTO/AAAR	23'-0"
Class I Railroads*	23'-4"
NCDOT	24'-3"
Regional/Express High Speed Rail	
Catenary Design Standard*	19'-0"

3.2 AT-GRADE CROSSINGS

Determining the treatments for at-grade crossing will be necessary for all three services alternatives. Each of the alternatives has the potential to use a shared track within terminal areas. At-grade crossing approach will be in accordance with FRA Highway-Rail Grade Crossing Guidelines for High-Speed Passenger Rail and AREMA Manual (Section 8.2) guidelines for design, construction, or reconstruction of a highway/ railway at-grade crossing.

Crossing surface types will be full depth prefabricated modular concrete panels including integrally pre-molded or elastomeric flange way fillers. Crossing surfaces will include both gauge and field panel section and be designed to fit the horizontal and vertical alignment of the track section as well as compatible with the roadway surfaces.

All grade crossing signal systems will be designed in accordance with federal, state and local laws and regulations. Grade crossing warning systems will utilize constant warning time devices to control flashing lights, automatic gates, and bells. Each at-grade crossing will require crossing protection. Existing crossing protection will be up-graded as necessary for each service alternative.

For the conceptual engineering phase the following assumptions have been made:

- Based on the service alternative being evaluated, at-grade crossing will be assessed using engineering judgment and on a case-by-case basis;
- Roadways will require re-profiling 50' from the field side of the outer most track rail if the capacity improvement requires adding additional tracks;
- Private and pedestrian crossings will remain and require crossing protection; and
- Regional and Express High-Speed Rail will require fully grade-separated corridors when operating speeds are above 110 mph and occurs outside the terminal area approaches.

[21] *Asterisks refer to the conceptual engineering standard used for the purposes of the PRCIP*

3.3 STRUCTURES

The following criteria will be used as a base for the conceptual engineering. These specifications, codes, and loads will need to be further evaluated as design progresses for the corridor. Following the alternatives development and Tier 1 EIS, specific criteria will be determined for the preferred alternative.

3.3.1 Specifications and Codes

The methodology of the various bridge components and other civil structures supporting rail live loads will be in accordance with AREMA recommended practices.

Concrete civil structure and concrete elements of a railroad bridge will be designed using the Load Factor Design method.

Steel railroad bridge structure will be designed using "Allowable Stress Design" per the AREMA code. Design of steel structural shapes or members that are not covered by AREMA guidelines will be designed using "Allowable Stress Design" in accordance with the current edition of the *American Institute of Steel Construction Steel Construction Manual* and modified as necessary to be equivalent to AREMA allowable stresses and safety factors.

Seismic considerations, as defined by AREMA guidelines, may need to be considered at a later point in design. At the conceptual engineering level no consideration for seismic design will be considered.

Structure carrying vehicular or pedestrian traffic over the railroad will satisfy the appropriate state standards. Location of the abutments for these structures will be placed at the existing or proposed railroad right-of-way. Otherwise, a desirable distance of 50' from the nearest track centerline.

3.3.2 Loads

Bridges and other civil structures supporting rail live load will be designed for all loads specified in the AREMA *Manual for Railway Engineering* (Chapters 8 and 15). These loads consist of dead load, live load, impact load and load distribution.

3.3.3 Design Considerations

All railroad bridges will be considered ballasted deck for conceptual engineering. Handrail and walkways will be provided on both sides of the bridges and designed in accordance to the AREMA Manual. Handrail horizontal clearance will be provided as outlined in previous section.

Abutments will be placed perpendicular to the track unless constraints do not allow. Special consideration will be made to keep excavation to a minimum adjacent to any active railroad tracks.

Below is a table categorizing types of bridges based on the approximate span length:

Table 3-8: Bridge Types by Span Length

Crossing	Group	Span	Type of Bridge	Comments
Roadway	Minor	≤ 76'	Deck Plate Girder	clear span
	Major	≤ 156'	Deck Plate Girder	includes center pier
	Interstate	≤ 196'	Deck Plate Girder	includes center pier

Crossing	Group	Span	Type of Bridge	Comments
Waterway	Minor	≤ 24’	Concrete Slab	clear span
	Major	≤ 120’	Deck Plate Girders	clear span
	Viaduct Guideway	≤ 60’	Concrete Box Girder	Consists of short spans typically of the same length built over land and roadways in urban areas

Note: Other structure types are available for spans less than 120’ and will need to be evaluated during later stages of engineering design.

The following assumptions have been made regarding bridges for the purposes of the PRCIP:

- For bridges crossing roadways, the structures will be sized to span the roadway and the roadway clear zone;
- For bridges crossing waterways, the structure will be sized to span the entire waterway when permissible;
- Bridge crossing over roadway will be grouped into major, minor, interstate, viaduct guideway categories; and
- Bridge crossing over waterways will be grouped into major and minor categories.

3.4 TRACK INFRASTRUCTURE

The track infrastructure consists of everything above the prepared subgrade. This includes the rail, other track materials, ties, ballast, and sub-ballast. At the conceptual design phase it is considered that all three service alternatives will require the same general track infrastructure.

Standard gage will be 56-1/2”. All rail will be continuous welded rail. The rail will be a minimum of 136 pounds. Smaller weights of rail can be evaluated at later phase of design based on the preferred alternative. For traditional ballasted track structure the rail will be supported on 8’-6” concrete ties with standard tie clip assembly. The tie will be supported on a minimum ballast thickness of 12” and sub-ballast thickness of 12”. Ballasted track structures are sufficient for all levels of service and design speeds.

There are currently several non-ballast track structure systems available for construction. Non-ballast track structures can be constructed solely on-site or with several pre-fabricated components. Primarily non-ballast track structure systems involve supporting the rails by embedment or direct fastening to concrete. It is recommended that for high-speed rail design speeds at or above 125 MPH that non-ballasted track structure be utilized.

Geotechnical data will need to be gathered in later design phase to further evaluate preferred track infrastructure cross section requirements for both ballasted and non-ballasted track structures.

3.5 HYDROLOGY AND HYDRAULICS

Criteria for design of drainage facilities (e.g., retention ponds and swales) will be evaluated at a later engineering phase based on criteria from federal, state and local authorities. For the PRCIP, the culvert will be designed to discharge 1) a 50-year event with the height of the headwater being no more than one and one-half times the culvert diameter; and 2) checked for 100-year flood that no overtopping occurs. All bridge opening will be sized so that the water surface for a 50-year event will rise no higher than two feet below the low chord of the bridge. For a 100-year event, all bridge opening will provide one-foot clearance between the water surface and bridge low chord. Any crossing of Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area may require a FEMA mandated flood study as well as community coordination. Compliance of Municipal Separate Storm Sewer Systems Permit (MS4) may be required for storm water conveying structures that are located within MS4 permitted municipalities.

At the conceptual engineering phase the project team assumes the following for all three service alternative:

- Minimum diameter of pipe for culverts under the tracks will be 36" and the minimum pipe under any roadway crossing will be 24";
- Pipes will need to be jack and/or earth bored under existing railroad tracks at a minimum of 36" diameter;
- Existing adjacent drainage structures are adequate for the above mentioned minimum criteria and will be the assumed proposed drainage structure for the alternative;
- A standard 3' X 5' wide flat bottom ditch is adequate for longitudinal drainage; and
- Scour protection in the form of rip-rap will be required for each drainage facility.

3.6 STATIONS

Stations will be sized and categorized based on the methodology outlined in the 2008 Amtrak *Station Program and Planning – Standard and Guidelines and FRA Station Area Planning for High-Speed and Intercity Passenger Rail*. Stations will be placed in a category of either minor or major and each category will have different elements of design. Design elements to be evaluated will be platform length, platform height, platform canopy, station waiting area, and parking.

End point stations are critical to the success of the high-speed rail corridor linking rail commuters with other local transit options such as bus, commuter rail, and streetcar. The Charlotte Gateway station, with procurement already underway, will provide connectivity between the Atlanta-Charlotte and SEHSR facilities allowing passengers the opportunity for a seamless trip from Atlanta to Washington, DC with future connection to Boston on the Northeast Corridor providing an east coast corridor linkage. The Charlotte Gateway Station will be a transportation hub, not just rail connections alone, but other transit as well including commuter rail, streetcar, and bus service.

Georgia's MultiModal Passenger Terminal (MMPT) will be a passenger terminal hub serving existing and proposed transportation networks, including the existing MARTA rail and bus systems, the Xpress and other regional express buses, high-speed intercity passenger rail, and commuter rail systems.

For the conceptual engineering phase, the project team assumes that any procurement already underway for the Charlotte Gateway and MMPT will be adequate for any service alternatives being evaluated for the Atlanta to Charlotte Corridor. As both the MMPT and Gateway stations continue in the planning and design phases, the high-speed rail project will be updated to reflect changes in track alignment, frequency and other factors being communicated to the team.

3.7 SIGNAL AND COMMUNICATION

The federal government recently mandated that Positive Train Control (PTC) signal system needs to be implemented for all routes carrying hazardous materials or operating passenger service. Most common existing railroad signal systems used for railroad networks are Track Warranted Controlled (TWC), Automatic Blocking System (ABS), Centralized Track Control (CTC) or PTC.

Each alternative could encounter several types of railroad signal and communications. In most cases the project team will look to upgrade the existing signal and communications to PTC if applicable. The exception to this will occur if it is known that PTC already exists on a particular section of track. Existing routes that have TWC and ABS will be completely abandoned and new PTC system infrastructure will be implemented.

CTC is the current standard for Class I railroads and is assumed to be the signal system that will primarily be encountered on existing railroad routes to be evaluated. CTC can be upgraded to PTC by installing new software and radio devices and towers. This study assumes that the existing CTC signal and communication infrastructure will be utilized in upgrading to a PTC system.

Any routes that are not part of any existing railroad signaling system will require a new PTC system. This will primarily apply to the dedicated passenger segments of Regional and Express High-Speed Rail and potentially the terminal area segments.

4. CONCLUSIONS

The design criteria and assumptions for the conceptual engineering elements of geometrics, clearances, at-grade crossings, structures, track infrastructure, hydraulics and hydrology, and stations provides a consistent approach for evaluating each the possible service alternatives and capital cost estimating. Ultimately, the alternatives development analysis will lead to a preferred alternative for the Service Development Plan in which more detailed design criteria and assumptions will be made.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX G: CAPITAL COSTING MEHTODOLOGY

August 2013

GDOT
Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

Contents

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1. OVERVIEW

The Federal Railroad Administration (FRA) awarded the Georgia Department of Transportation (GDOT) funds from the High Speed Intercity Passenger Rail Program (HSIPR). FRA and GDOT are preparing a Passenger Rail Corridor Investment Plan (PRCIP) to evaluate high-speed rail along the 280-mile Atlanta, GA to Charlotte, NC corridor. A Tier 1 Environmental Impact Statement (EIS) and Service Development Plan (SDP) will be completed as a part of this PRCIP. The FRA and GDOT, in cooperation with South Carolina and North Carolina, are coordinating on development of both documents.

The Atlanta to Charlotte Corridor was first introduced as a part of the Southeast High Speed Rail (SEHSR) corridor that connects Atlanta to Washington, DC. GDOT included the corridor in their most recent 2009 State Rail Plan following the 2008 Volpe Center Report Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor (2008 Volpe Center Report). This corridor is part of the strategic vision for passenger rail service in Georgia as well as the Southeast, and will include considerations for intermodal connections in Atlanta and Charlotte, as well as intermediate cities.

1.1 OBJECTIVE

The objective of this technical memorandum is to provide a description of the capital costing methodology used to develop cost estimates for the three proposed types of service alternatives. Section 2 describes the three types of service alternatives proposed for this PRCIP.

Creating a capital costing methodology for the three alternatives will provide an accurate conceptual cost estimate for GDOT and FRA to:

- Make sound decisions on high-speed rail technology and level of service;
- Determine feasibility in a benefit-cost context;
- Identify state budgetary and program needs; and
- Prepare future funding applications for environmental and preliminary engineering work.

2. SERVICE ALTERNATIVES

To achieve a consistent costing methodology, the PRCIP will use the FRA Standard Cost Categories (SCC) for the development of all capital cost estimates. Preparing the capital cost estimate according to current FRA SCC allows the easy transition and preparation for future funding applications. This approach will greatly reduce the need to re-evaluate quantities, unit costs and individual items for future applications.

2.1 ALTERNATIVE 1: EMERGING HIGH-SPEED RAIL

FRA defines Emerging High-Speed Rail as “developing corridors of 100-500 miles, with strong potential for future Regional and/or Express High-Speed Rail service. Top speeds of up to 90-110 mph on primarily shared track (eventually using positive train control technology), with advanced grade crossing protection or separation. Emerging High-Speed Rail is intended to develop the passenger rail market, and provide some relief to other modes."[1]

Emerging High-Speed Rail primarily uses existing rail corridor right-of-way owned and operated by a freight railroad. This level of service is also commonly called "Shared Use". Operating, service level and maintenance agreements need to be negotiated with the freight railroad owners for passenger service to operate. This alternative is very limited in that it is bound to the existing rail network between the points of interest. Maximum speeds for the shared use alternative is 110 mph and based on acceptance by the freight railroads. Additionally, alternatives with maximum speed of 79 mph included in the study will be considered as Emerging High-Speed Rail.

2.2 ALTERNATIVE 2: REGIONAL HIGH-SPEED RAIL

FRA defines Regional High-Speed rail as "relatively frequent service between major and moderate population centers, 100–500 miles apart, with some intermediate stops. Top speeds are 110-150 mph in which the corridor is grade separated, with some dedicated and some shared track (eventually using positive train control technology). This alternative intends to relieve highway and to some extent, air capacity constraints."[2]

This alternative primarily involves establishing a new passenger rail corridor, typically designated solely to high-speed passenger rail service. For the purposes of this PRCIP, the analysis will also take into consideration potential partnering opportunities between freight and passenger rail service. In developing corridor service alternatives for consideration, the project team will examine existing interstate and state highway corridors, private railroad rights-of-way and greenfield alignments.[3]

2.3 ALTERNATIVE 3: EXPRESS HIGH-SPEED RAIL

FRA defines Express High-Speed rail as "frequent, express service between major population centers, 200-600 miles apart, with few intermediate stops. Top speeds will range from 150-220 mph on completely grade-separated, dedicated rights-of-way (with the possible exception of some shared track in terminal areas).[4] Express High-Speed rail intends to relieve air and highway capacity constraints."[5]

This alternative primarily involves establishing a new passenger rail corridor, typically designated solely to high-speed passenger rail service. For the purposes of this PRCIP, the analysis will also take into consideration potential partnering opportunities between freight and passenger rail service. In developing corridor service alternatives for consideration, the project team will examine existing interstate and state highway corridors, private railroad rights-of-way and greenfield alignments.

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[1] *Federal Railroad Administration (2009) Vision for High-Speed Rail in America, pp. 10 (http://www.fra.dot.gov/eLib/Details/L02833)*

[2] *Federal Railroad Administration (2009) Vision for High-Speed Rail in America, pp. 10 (http://www.fra.dot.gov/eLib/Details/L02833)*

[3] *Greenfield is defined as new track on new alignment*

[4] *Terminal areas refer to destination points including metropolitan areas.*

[5] *Federal Railroad Administration (2009) Vision for High-Speed Rail in America, pp. 10 (http://www.fra.dot.gov/eLib/Details/L02833)*

3. METHODOLOGY

The costing methodology will serve as the backbone for all capital cost estimating. However, as the PRCIP progresses, adjustments may be required to the methodology to better reflect specific circumstances and costs encountered during the analysis.

3.1 FRA STANDARD COST CATEGORIES

FRA's Standard Costing Category (SCC) is separated into ten categories for capital projects/programs. The categories are broad enough to be applied to all three service alternatives. Below are the ten major categories:

Table 3-1: FRA Standard Cost Categories

Standard Cost Categories	
10	Track Structures and Track
20	Stations, Terminals, Intermodal
30	Support Facilities: Yards, Shops, Administration Buildings
40	Sitework, Right-of-Way, Land, Existing Improvements
50	Communications and Signaling
60	Electric Traction
70	Vehicles
80	Professional Services
90	Unallocated Contingencies
100	Finance Charges

Each category is broken down into subcategory items that expand upon the capital cost estimate of each major category. The PRCIP will only include categories 10 through 80 as categories 90 and 100 do not apply to the PRCIP general requirements. The values for these categories will be determined in subsequent evaluations associated with a Tier 2 NEPA document. Below is a list of all FRA sub-categories and definitions for categories 10: Track Structures & Track through 80: Professional Services:

Table 3-2: FRA Cost Items

	Item	Definition
10 Tract Structures and Track		
10.01	Track Structure: Viaduct	Includes elevated track structure of significant length, consisting of multiple spans of generally equal length.
10.02	Track Structure: Major/Movable Bridge	Includes all elevated track structures with a movable span, and/or a span of significant length (generally 400' or longer).
10.03	Track Structure: Undergrade Bridges	Includes elevated track structure greater than 20' that does not fall into cost categories 10.01 and 10.02.
10.04	Track Structure: Culvert and Drainage Structure	Includes all minor undergrade passageways (generally 20' or less in width).
10.05	Track Structure: Cut and Fill (greater than 4' height/depth)	Includes grading and subgrade stabilization of roadbed.
10.06	Track Structure: At-Grade (grading and subgrade stabilization)	Includes all grading and subgrade stabilization of roadbed not included under cost categories 10.01 through 10.05, and 10.07.
10.07	Track Structure: Tunnel	Definition is self-explanatory.
10.08	Track Structure: Retaining Walls and Systems	Definition is self-explanatory.
10.09	Track New Construction: Conventional Ballasted	Includes all ballasted track construction on prepared subgrade, on new or existing rights-of-way.
10.10	Track New Construction: Non-Ballasted	Includes all slab, direct fixation, embedded, and other non-ballasted track construction on prepared subgrade, on new or existing rights-of-way.
10.11	Track Rehabilitation: Ballast and Surfacing	Includes undercutting, ballast cleaning, tamping, and surfacing not associated with new track construction.
10.12	Track Rehabilitation: Ditching and Drainage	Definition is self-explanatory.
10.13	Track Rehabilitation: Component Replacement (rails and ties)	Definition is self-explanatory.
10.14	Track: Special Track Work (switches, turnouts, and insulated joints)	Includes minor turnouts and interlocking, such as crossovers and turnouts at the ends of passing tracks.
10.15	Track: Major Interlockings	Significant interlockings at major stations and where routes converge from three or more directions.
10.16	Track: Switch Heaters (with power and control)	Includes cost of power distribution equipment from commercial power source to interlocking location.
10.17	Track: Vibration and Noise Dampening	Definition is self-explanatory.
10.18	Other Linear Structures (including fence, sound walls, and crash barrier)	Definition is self-explanatory.
20 Stations, Terminals, Intermodal		
20.01	Station Buildings: Intercity Passenger Rail Only	Definition is self-explanatory.

	Item	Definition
20.02	Station Buildings: Joint Use (commuter rail and intercity bus)	Definition is self-explanatory.
20.03	Platforms	Definition is self-explanatory.
20.04	Elevators and Escalators	Definition is self-explanatory.
20.05	Joint Commercial Development	Includes construction at station sites intended to support non-transportation commercial activities (shopping, restaurants, residential, office space). Does not include cost of incidental commercial use of station space intended for use by passengers (newsstands and snack bars). Costs may not be allowable for Federal reimbursement.
20.06	Pedestrian/Bike Access and Accommodation, Landscaping, and Parking Lots	Includes sidewalks, paths, plazas, landscape, site and station furniture, site lighting, signage, public artwork, bike facilities, and permanent fencing.
20.07	Automobile, Bus, Van Accessways (including roads)	Includes all on-grade paving.
20.08	Fare Collection Systems and Equipment	Includes fare sales and swipe machines, and fare counting equipment.
20.09	Station Security	Definition is self-explanatory.
30 Support Facilities: Yards, Shops, Administrative Buildings		
30.01	Administration Buildings: Office, Sales, Storage, Revenue Counting	Definition is self-explanatory.
30.02	Light Maintenance Facility	Includes service, inspection, and storage facilities and equipment.
30.03	Heavy Maintenance Facility	Includes heavy maintenance and overhaul facilities and equipment.
30.04	Storage or Maintenance-of-Way Building	Definition is self-explanatory.
30.05	Yard and Yard Track	Includes yard construction and track associated with the yard.
40 Sitework, Right-of-Way, Land, Existing Improvements		
40.01	Demolition, Clearing, Site Preparation	Includes project/program-wide clearing, demolition and fine grading.
40.02	Site Utilities and Utility Relocation	Includes all site utilities - storm, sewer, water, gas, and electric.
40.03	Hazardous Material, Contaminated Soil Removal/Mitigation, Ground Water Treatments	Includes underground storage tanks, fuel tanks, other hazardous materials and treatments.
40.04	Environmental Mitigation: Wetlands, Historic/Archeology, Parks	Includes mitigation costs associated with environmental impacts.
40.05	Site structures (including retaining walls and sound walls)	Definition is self-explanatory.
40.06	Temporary Facilities and Other Indirect Costs During Construction	Definition is self-explanatory.
40.07	Purchase or Lease of Real Estate	If the value of right-of-way, land and existing improvements is to be used as in-kind local match to the federal funding of the project/program, include the total cost on this line item. In backup

	Item	Definition
		documentation, there will be separate cost for land and cost for improvements to the land. Costs will Identify whether items are leased, purchased or acquired through payment, or for free. Includes the costs for permanent surface and subsurface easements, and trackage rights.
40.08	Highway/Pedestrian Overpass/Grade Separations	Other than the grade separations included in this line item, highway-rail grade crossing safety enhancements generally fall under 50.06.
40.09	Relocation of Existing Households and Businesses	Costs are In compliance with Uniform Relocation Act.
50 Communication and Signaling		
50.01	Wayside Signaling Equipment	Definition is self-explanatory
50.02	Signal Power Access and Distribution	Definition is self-explanatory
50.03	On-Board Signaling Equipment	Includes on-board cab signal, Automatic Train Control (ATC), and Positive Train Control (PTC) related equipment.
50.04	Traffic Control and Dispatching Systems	Definition is self-explanatory
50.05	Communications	Definition is self-explanatory
50.06	Grade Crossing Protection	Includes all types of highway-rail grade crossing safety enhancements except for grade separation projects, which fall under 40.08.
50.07	Hazard Detectors (dragging equipment high water, and slide)	Definition is self-explanatory.
50.08	Station Train Approach Warning System	Definition is self-explanatory.
60 Electric Traction		
60.01	Traction Power Transmission: High Voltage	Definition is self-explanatory.
60.02	Traction Power Supply: Substations	Definition is self-explanatory.
60.03	Traction Power Distribution: Catenary and Third Rail	Definition is self-explanatory.
60.04	Traction Power Control	Definition is self-explanatory.
70 Vehicles		
70.00	Vehicle Acquisition: Electric Locomotive	Definition is self-explanatory.
70.01	Vehicle Acquisition: Non-Electric Locomotive	Definition is self-explanatory.
70.02	Vehicle Acquisition: Electric Multiple Unit	Definition is self-explanatory.
70.03	Vehicle Acquisition: Diesel Multiple Unit	Definition is self-explanatory.
70.04	Vehicle Acquisition: Loco-Hauled Passenger Cars w/ Ticketed Space	Includes cars with coach space and sleeping compartments.
70.05	Vehicle Acquisition: Loco-Hauled Passenger Cars w/o Ticketed Space	Includes dedicated food service, lounge, baggage and other service support cars.
70.06	Vehicle Acquisition: Maintenance-of-Way	Definition is self-explanatory.

	Item	Definition
	Vehicles	
70.07	Vehicle Acquisition: Non-Railroad Support Vehicles	Includes hi-rail bucket trucks, and other highway vehicles.
70.08	Vehicle Refurbishment: Electric Locomotive	Definition is self-explanatory.
70.09	Vehicle Refurbishment: Non-Electric Locomotive	Definition is self-explanatory.
70.10	Vehicle Refurbishment: Electric Multiple Unit	Definition is self-explanatory.
70.11	Vehicle Refurbishment: Diesel Multiple Unit	Definition is self-explanatory.
70.12	Vehicle Refurbishment: Loco-Hauled Passenger Cars w/ Ticketed Space	Includes coaches and sleeping cars.
70.13	Vehicle Refurbishment: Non-Passenger Loco-Hauled Car w/o Ticketed Space	Includes food service, lounge, baggage and other service support cars.
70.14	Vehicle Refurbishment: Maintenance-of-Way Vehicles	Definition is self-explanatory.
70.15	Spare Parts	Definition is self-explanatory.
80 Professional Services		
80.01	Service Development/Service Environmental	Definition is self-explanatory.
80.02	Preliminary Engineering/Project Environmental	Definition is self-explanatory.
80.03	Final Design	Definition is self-explanatory.
80.04	Project Management for Design and Construction	Definition is self-explanatory.
80.05	Construction Administration and Management	Definition is self-explanatory.
80.06	Professional Liability and other Non-Construction Insurance	Definition is self-explanatory.
80.07	Legal; Permits; Review Fees by Other Agencies and Cities.	Definition is self-explanatory.
80.08	Survey, Testing, and Investigation	Definition is self-explanatory.
80.09	Engineering Inspection	Definition is self-explanatory.
80.10	Start Up	Definition is self-explanatory.

The project team will expand several sub-category cost items to capture more detail. Items requiring expansion will be decided during the data gathering and capital cost estimate activities. An example of sub-category expansion is as follows:

Table 3-3: FRA Cost Item Expansion

10.09	**Track New Construction: Conventional Ballasted**	
	10.09.01	Track New Construction: 136LB CWR w/ Concrete Ties
	10.09.02	Track New Construction: 136LB CWR w/ Wood Ties

3.1.1 Right-of-Way and Real Estate

The study will include an evaluation of up to four uses of property: existing railroad rights-of-way, highway rights-of-way, power and other utility corridors and "greenfield" alignments.

The costing approach for shared use situations will involve determining the property value of the existing railroad right-of-way based on adjacent land values. This land value will be included in corridor cost estimates to address the public use of the privately-owned railroad right-of-way. The project team assumes construction of new passenger tracks that could generally occur inside existing railroad right-of-way while considering future freight growth. For situations where new passenger track does not fit inside the existing railroad right-of-way, additional width of property will be added. In isolated situations where more detailed engineering is required as a part of the conceptual analysis, this approach will be modified to better reflect the specific area.

The outright purchase of railroad rights-of-way is not the only method for railroads to receive compensation for access and trackage rights. A common option for the passenger service to operate on host railroad tracks is to provide up-front capital cost improvements to increase line capacity for more operating freight trains. This compensation is determined during negotiation with the host freight railroad.

The use of state-owned highway and interstate will assume an in-kind contribution by the state for any state owned property. The costing methodology assumes that right-of-way or air rights will be granted by the various state transportation agencies at no cost to the passenger rail system.

The costing approach for existing utility rights-of-way will also be based on adjacent property values. A right-of-way width of 100' will be assumed for passenger rail service. Ultimate compensation will be determined during negotiations with the host utility company.

Right-of-way cost approach for a greenfield situations will be based on existing property values. A minimum right-of-way width of 100' will be assumed for passenger rail service.

The project team will utilize each state's DOT right-of-way value database and other similar databases as appropriate to determine property values. The use of property will be separated into the following categories:

Table 3-4: Real Estate Cost Items

40.07	Purchase or Lease of Real Estate	
Subcategory	Item	Definition
40.07.01	Railroad Owned– Urban	Corridor alignment on urban railroad-owned property
40.07.02	Railroad Owned - Rural	Corridor alignment on rural railroad-owned property
40.07.03	Utility Owned– Urban	Corridor alignment on urban utility-owned property
40.07.04	Utility Owned– Rural	Corridor alignment on rural utility-owned property
40.07.05	State Owned	Existing interstate, highway and GRIP[6] rights-of-way
40.07.06	Land Acquisition – Urban	Purchase of urban designated property
40.07.07	Land Acquisition – Rural	Purchase of rural designated property

3.1.2 Rolling Stock

Vehicle unit cost estimates, based on developed service plans, will be prepared for three generic vehicle technologies based on FRA's HSIPR classifications: 1) 79-110 mph diesel-electric locomotive and tilt coach technology, 2) 110-150 mph diesel electric and tilt technology, and 3) 150-220 mph electric multiple unit (EMU) technology.

The diesel-electric technology used in shared-use passenger and freight corridors will be FRA Tier 1 compliant. Tilt coach technology has been selected because of the extremely large number of curves in existing freight rail routes in the Atlanta to Charlotte Corridor. Two push pull locomotives will be used for 90-110 mph operations and one locomotive will be used for 79 mph operations, where appropriate. Equipment used will be consistent with FRA Section 305 Next Generation Passenger Equipment specifications, where applicable. It is expected that top speeds for diesel-electric passenger consists with two locomotives will be in the 125 mph range depending on track geometry and whether the route used is dedicated or shared use with slightly higher speeds potentially possible on dedicated routes.

Electrified equipment will operate on dedicated right-of-ways and meet European crashworthiness standards. Vehicle purchase costs (including design) will be included in FRA standard cost category 70 on a cost-per-trainset basis. The trainset seating capacity will be based on the service plan developed for the corridor (typically 400-450 seats) and the trainset will be ADA accessible including restrooms. Each trainset will include a dining/bistro car. All train consists will feature standard amenities including 2 x 2 seating, video displays, automated station announcement/displays, audio entertainment availability, Wi-Fi internet access and 110 volt power at each seat. Costs for an appropriate number of spare cars and replacement parts will also be included in the estimate.

The cost of rolling stock includes estimation of both revenue and non-revenue vehicles. These costs are dependent on the vehicle technology that is ultimately selected and will be directly linked to the selected preferred alternative. The cost of vehicles will be determined by using publicly available data regarding

[6] *Governor's Road Improvement Program (GRIP) is a system of economic development highways that will connect 95 percent of Georgia cities with populations of 2,500 or more to the Interstate Highway System.*

recent sales of comparable equipment to other high speed rail projects around the world and by informal consultations with the manufacturers.

3.1.3 Stations

Station cost estimates will be based on typical station layouts, features and building square footage. Station locations will vary in location and number based on each route alternative. Cost will be developed for a typical minor and major station. The cost will be a lump sum of individual items associated with each typical minor and major station.

Cost estimates will not be developed for the Charlotte Gateway and Georgia MultiModal Passenger Terminal stations. It is assumed that any cost impact due to this project will be included in procurement process already underway for these projects.

3.1.4 Professional Services

The costing approach for professional services will be based on percentages of the construction cost for categories 10 through 60. Cost category 70: Vehicles will be excluded because professional services for vehicle procurement, design and manufacturing will be included in the cost of the vehicles.

These percentages are based upon common practice for programs similar to this PRCIP. The following table shows the assumed percentage values that will be used:

Table 3-5: Professional Services by Percent

80 Professional Services		
	Item	Percentage
80.01	Service Development/Service Environmental	2%
80.02	Preliminary Engineering/Project Environmental	4%
80.03	Final Design	6%
80.04	Project Management for Design and Construction	4%
80.05	Construction Administration and Management	6%
80.06	Professional Liability and Other Non-Construction Insurance	0%, Negligible
80.07	Legal; Permits; Review Fees by other agencies and cities.	0%, Negligible
80.08	Survey, testing, and investigation	2%
80.09	Engineering Inspection	2%
80.10	Start Up	Not Applicable

3.1.5 Contingencies

The contingency is included to generate a project budget cost that is realistic but conservative and can be used to cover the costs of accommodating newly acquired or revised information into the design. Overall contingencies should be adjusted as the project progresses from planning to detailed design. At the current level of project development, the contingency used will be 30% because there are many unknown conditions that may be found as the conceptual engineering progresses.

For the purposes of this project, contingency is assigned into two major categories – allocated and unallocated. Allocated contingency is added to each cost category, similar to FRA grant applications, based on an assessment of the quality of design information, means and methods, and site accessibility available for individual items of work. While the PRCIP includes a 30% assumption, future refinement and contingencies for each of the categories will adjust.

Unallocated contingency typically includes more widespread uncertainties like schedule delays, changes in contracting environment, or other such issues that are not associated with individual construction activities. For the PRCIP, unallocated contingency will not be part of the overall contingency.

The following table is the percentages the project team assumes for capital cost estimates:

Table 3-6: Allocated Contingencies

Cost Category	Percentage
10 Track Structures and Track	30%
20 Stations, Terminals, Intermodal	30%
30 Support Facilities: Yards, Shops, Administration Buildings	30%
40 Sitework, Right-of-Way, Land, Existing Improvements	30%
50 Communications and Signaling	30%
60 Electric Traction	30%
70 Vehicles	30%
80 Professional Services	0%

3.2 UNIT COSTS AND UNITS OF MEASURES

The project team will develop all unit costs in year 2012 dollars for the design and construction of high-speed passenger rail service. Unit costs will be derived from various sources and publications. The unit costs for each of the items will include cost of material, labor, overhead and profit. Below is a list of resources that will be reference in developing the unit costs:

- Published construction documents such as “RSMeans Heavy Construction Cost Data”, current edition;
- GDOT and other state transportation agencies weighted unit cost;
- Federal Transit Administration website for typical elements cost;
- California and Florida HSR feasibility studies and preliminary design documents;
- Wisconsin and Illinois planning and design documents;
- Various class 1 railroad cost estimates for similar sized projects; and
- Estimating experience and historical costs for similar projects.

Unit costs will be escalated from previous years to 2012 base year dollars. This will be done utilizing the *Engineering News Record* Construction Cost Index (CCI) for Atlanta, GA. The CCI uses local prices for portland cement and 2x4 lumber and the national average price for structural steel. It also uses local union wages (plus fringes) for carpenters, bricklayers and iron workers. The following formula will be used to escalate unit costs to 2012 dollars:

$$(Un \qquad) \quad \frac{(Dece \qquad x) \quad (Pr \qquad x)}{(Pr \qquad x)}$$

All units will be based on U.S. Customary Units defined by the National Institute of Standards and Technology. U.S. Customary Units are officially used in the United States, and are also known in the U.S. as “English” of “Imperial” units. Actual units of measure for each of the items will be determined during the capital cost estimating phase.

3.2.1 Quantities

From the various data sources in the data collection plan, the project team will develop conceptual take-off quantities for several of FRA cost categories. These quantities are related to earthwork, structures, track roadbed, rail, track materials, turnouts, stations, support facilities, sitework, right-of-way, communications and signaling, electric traction, and vehicles.

Take-off quantities will be made from drawings, typical sections and sketches created during the conceptual engineering for each alignment and level of service. Take-off quantities are estimated to be within 30% (+/-) of actual quantities.

3.3 ALTERNATIVE ANALYSIS VERSUS SERVICE DEVELOPMENT PLAN CAPITAL COST ESTIMATE

The capital cost estimate associated with the alternative analysis section of the study will not include any costs in SCC 30: Support Facilities: Yards, Shops, administration buildings in regards to maintenance facilities. Each alternative will require the same number of facilities and should not be deemed a deciding factor for choosing a preferred alternative. Detailed capital cost estimates will be created for the maintenance facilities during the service development plan phase for the preferred alternative.

Additionally, nominal costs will be assigned for stations along each alternative in SCC 20: Stations, Terminals, Intermodal. The number of stations associated with each alternative varies and will be accounted for accordingly in the alternatives development and screening analysis capital cost estimate. During the service development phase, more detailed capital cost estimates will be created for each of the station locations and included with the final capital cost estimate.

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX H: ESTIMATED CAPITAL COSTS

May 2014

GDOT
Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

ALTERNATIVE 1: NORFOLK SOUTHERN (79 MPH)

Project Name	GDOT Atlanta to Charlotte Passenger Rail Corridor Investment Plan
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 502,307,780	$ 150,692,334	$ 653,000,114	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 140,025,000.00	$ 140,025,000	$ 42,007,500	$ 182,032,500	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 135,094,264.95	$ 135,094,265	$ 40,528,279	$ 175,622,544	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	0.00	$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile	0.00	$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	track mile	95.29	$ 1,161,600.00		$ 110,685,740	$ 33,205,722	$ 143,891,462	
	10.09.02	136lb CWR on Wood Ties	track mile	20.52	$ 950,400.00		$ 19,499,580	$ 5,849,874	$ 25,349,454	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.60	$ 677,545.00		$ 406,527	$ 121,958	$ 528,485	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile	28.07	$ 966,000.00		$ 27,111,668	$ 8,133,500	$ 35,245,169	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	9.00	$ 240,000.00		$ 2,160,000	$ 648,000	$ 2,808,000	
	10.14.02	Turnout; No. 15	each	5.00	$ 260,000.00		$ 1,300,000	$ 390,000	$ 1,690,000	
	10.14.03	Turnout; No. 20	each	0.00	$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	139.00	$ 475,000.00		$ 66,025,000	$ 19,807,500	$ 85,832,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	0.00	$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	track mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 230,400,000	$ 69,120,000	$ 299,520,000	
20.01		Station buildings: Intercity passenger rail only					$			
	20.01.01	Charlotte Airport	each	1.00	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	
	20.01.02	Hartsfield Airport	each	1.00	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	
	20.01.03	Existing Intermediate Station	each	6.00	$ 13,400,000		$ 80,400,000	$ 24,120,000	$ 104,520,000	
	20.01.04	New Intermediate Station	each	2.00	$ 20,000,000		$ 40,000,000	$ 12,000,000	$ 52,000,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot	0.00	$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 66,657,110	$ 19,997,133	$ 86,654,243	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	271.29	$ 59,000.00		$ 16,006,110	$ 4,801,833	$ 20,807,943	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ -	$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 50,651,000.00	$ 50,651,000	$ 15,195,300	$ 65,846,300	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre	0.00						
	40.09.02	Relocation - Rural	acre	0.00						
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 358,753,140	$ 107,625,942	$ 466,379,082	
50.01		Wayside signaling equipment	track mile	542.58	$ 485,000.00		$ 263,151,300	$ 78,945,390	$ 342,096,690	
50.02		Signal power access and distribution	track mile	542.58	$ 5,500.00		$ 2,984,190	$ 895,257	$ 3,879,447	
50.03		On-board signaling equipment	each	0.00	$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	1.00	$ 9,000,000.00		$ 9,000,000	$ 2,700,000	$ 11,700,000	
50.05		Communications	corridor mile	271.29	$ 277,500.00		$ 75,282,975	$ 22,584,893	$ 97,867,868	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	104	$ 50,000		$ 5,200,000	$ 1,560,000	$ 6,760,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	271.29	$ 7,500.00		$ 2,034,675	$ 610,403	$ 2,645,078	
50.08		Station train approach warning system	each	8.00	$ 137,500.00		$ 1,100,000	$ 330,000	$ 1,430,000	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile	0.00	$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile	0.00	$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile	0.00	$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile	0.00	$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 1,292,118,030	$ 387,635,409	$ 1,679,753,439	
Total for Category 70: VEHICLES							$ 99,000,000	$ 29,700,000	$ 128,700,000	
70.00		Vehicle acquisition: Electric locomotive	each		$ 8,000,000.00		$ -	$ -	$ -	
70.01		Vehicle acquisition: Non-electric locomotive	each	6.00	$ 4,200,000.00		$ 25,200,000	$ 7,560,000	$ 32,760,000	
70.02		Vehicle acquisition: Electric multiple unit								
70.03		Vehicle acquisition: Diesel multiple unit								
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	18.00	$ 4,100,000.00		$ 73,800,000	$ 22,140,000	$ 95,940,000	
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts								
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 201,570,413	$ -	$ 201,570,413	
80.01		Service Development Plan/Service Environmental				$ 16,797,534.39	$ 16,797,534	$ -	$ 16,797,534	
80.02		Preliminary Engineering/Project Environmental				$ 33,595,068.78	$ 33,595,069	$ -	$ 33,595,069	
80.03		Final design				$ 33,595,068.78	$ 33,595,069	$ -	$ 33,595,069	
80.04		Project management for design and construction				$ 33,595,068.78	$ 33,595,069	$ -	$ 33,595,069	
80.05		Construction administration & management				$ 50,392,603.18	$ 50,392,603	$ -	$ 50,392,603	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 16,797,534.39	$ 16,797,534	$ -	$ 16,797,534	
80.09		Engineering inspection				$ 16,797,534.39	$ 16,797,534	$ -	$ 16,797,534	
80.10		Start up								
Subtotal (Categories 10-80)							$ 1,592,688,443	$ 417,335,409	$ 2,010,023,852	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 2,010,023,852**	
TOTAL CAPITAL COST/MILE									**$ 7,409,134**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 1: Charlotte Gateway (MP 377.70) to Greenfield Conn (MP 387.30)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 5,779,227	$ 1,733,768	$ 7,512,995	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 840,000.00	$ 840,000	$ 252,000	$ 1,092,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,529,147.10	$ 1,529,147	$ 458,744	$ 1,987,891	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	1.30	$ 1,161,600.00		$ 1,510,080	$ 453,024	$ 1,963,104	
	10.09.02	136lb CWR on Wood Ties	track mile	0.00	$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	0	$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4	$ 475,000.00		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 50,000,000	$ 15,000,000	$ 65,000,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each	1.00	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	Charlotte Airport
	20.01.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 6,677,970	$ 2,003,391	$ 8,681,361	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.83	$ 59,000		$ 579,970	$ 173,991	$ 753,961	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 6,098,000	$ 6,098,000	$ 1,829,400	$ 7,927,400	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 12,444,780	$ 3,733,434	$ 16,178,214	
50.01		Wayside signaling equipment	track mile	19.66	$ 485,000		$ 9,535,100	$ 2,860,530	$ 12,395,630	
50.02		Signal power access and distribution	track mile	19.66	$ 5,500		$ 108,130	$ 32,439	$ 140,569	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.83	$ 277,500		$ 2,727,825	$ 818,348	$ 3,546,173	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.83	$ 7,500		$ 73,725	$ 22,118	$ 95,843	
50.08		Station train approach warning system	each		$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							**$ 74,901,977**	**$ 22,470,593**	**$ 97,372,570**	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 11,684,708	$ -	$ 11,684,708	
80.01		Service Development Plan/Service Environmental				$ 973,725.70	$ 973,726	$ -	$ 973,726	
80.02		Preliminary Engineering/Project Environmental				$ 1,947,451.40	$ 1,947,451	$ -	$ 1,947,451	
80.03		Final design				$ 1,947,451.40	$ 1,947,451	$ -	$ 1,947,451	
80.04		Project management for design and construction				$ 1,947,451.40	$ 1,947,451	$ -	$ 1,947,451	
80.05		Construction administration & management				$ 2,921,177.11	$ 2,921,177	$ -	$ 2,921,177	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 973,725.70	$ 973,726	$ -	$ 973,726	
80.09		Engineering inspection				$ 973,725.70	$ 973,726	$ -	$ 973,726	
80.10		Start up								
Subtotal (Categories 10-80)							$ 86,586,686	$ 22,470,593	$ 109,057,279	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 109,057,279**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 2: Greenfield Conn (MP 387.30) to I-85 Conn (MP402.37)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 2,805,440.40	$ 841,632.12	$ 3,647,072.52	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,411,520.40	$ 1,411,520	$ 423,456	$ 1,834,977	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	1.20	$ 1,161,600.00		$ 1,393,920	$ 418,176	$ 1,812,096	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	0	$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each	0	$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each		$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each	0	$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000.00		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 892,670.00	$ 267,801.00	$ 1,160,471.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	15.13	$ 59,000.00		$ 892,670.00	$ 267,801.00	$ 1,160,471.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 19,154,580.00	$ 5,746,374.00	$ 24,900,954.00	
50.01		Wayside signaling equipment	track mile	30.26	$ 485,000.00		$ 14,676,100.00	$ 4,402,830.00	$ 19,078,930.00	
50.02		Signal power access and distribution	track mile	30.26	$ 5,500.00		$ 166,430.00	$ 49,929.00	$ 216,359.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	15.13	$ 277,500.00		$ 4,198,575.00	$ 1,259,572.50	$ 5,458,147.50	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	15.13	$ 7,500.00		$ 113,475.00	$ 34,042.50	$ 147,517.50	
50.08		Station train approach warning system	each		$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 22,852,690.40	$ 6,855,807.12	$ 29,708,497.52	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 3,565,019.70	$ -	$ 3,565,019.70	
80.01		Service Development Plan/Service Environmental				$ 297,084.98	$ 297,084.98	$ -	$ 297,084.98	
80.02		Preliminary Engineering/Project Environmental				$ 594,169.95	$ 594,169.95	$ -	$ 594,169.95	
80.03		Final design				$ 594,169.95	$ 594,169.95	$ -	$ 594,169.95	
80.04		Project management for design and construction				$ 594,169.95	$ 594,169.95	$ -	$ 594,169.95	
80.05		Construction administration & management				$ 891,254.93	$ 891,254.93	$ -	$ 891,254.93	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 297,084.98	$ 297,084.98	$ -	$ 297,084.98	
80.09		Engineering inspection				$ 297,084.98	$ 297,084.98	$ -	$ 297,084.98	
80.10		Start up								
Subtotal (Categories 10-80)							$ 26,417,710.10	$ 6,855,807.12	$ 33,273,517.22	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 33,273,518	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 3: I-85 Conn (MP 402.37) to NC/SC Border (MP 419)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 22,226,348.80	$ 6,667,904.64	$ 28,894,253.44	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 1,044,000.00	$ 1,044,000	$ 313,200	$ 1,357,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 7,528,108.80	$ 7,528,109	$ 2,258,433	$ 9,786,541	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	6.40	$ 1,161,600.00		$ 7,434,240	$ 2,230,272	$ 9,664,512	
	10.09.02	136lb CWR on Wood Ties	track mile	0.00	$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	2	$ 260,000.00		$ 520,000	$ 156,000	$ 676,000	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	12	$ 475,000.00		$ 5,700,000	$ 1,710,000	$ 7,410,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 13,400,000.00	$ 4,020,000.00	$ 17,420,000.00	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each	1.00	$ 13,400,000.00		$ 13,400,000	$ 4,020,000	$ 17,420,000	Gastonia
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 2,990,170.00	$ 897,051.00	$ 3,887,221.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	16.63	$ 59,000.00		$ 981,170.00	$ 294,351.00	$ 1,275,521.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 2,009,000.00	$ 2,009,000.00	$ 602,700.00	$ 2,611,700.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 21,741,080.00	$ 6,522,324.00	$ 28,263,404.00	
50.01		Wayside signaling equipment	track mile	33.26	$ 485,000.00		$ 16,131,100.00	$ 4,839,330.00	$ 20,970,430.00	
50.02		Signal power access and distribution	track mile	33.26	$ 5,500.00		$ 182,930.00	$ 54,879.00	$ 237,809.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	16.63	$ 277,500.00		$ 4,614,825.00	$ 1,384,447.50	$ 5,999,272.50	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	11	$ 50,000		$ 550,000	$ 165,000	$ 715,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	16.63	$ 7,500.00		$ 124,725.00	$ 37,417.50	$ 162,142.50	
50.08		Station train approach warning system	each	1.00	$ 137,500.00		$ 137,500.00	$ 41,250.00	$ 178,750.00	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 60,357,598.80	$ 18,107,279.64	$ 78,464,878.44	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 9,415,785.41	$ -	$ 9,415,785.41	
80.01		Service Development Plan/Service Environmental				$ 784,648.78	$ 784,648.78	$ -	$ 784,648.78	
80.02		Preliminary Engineering/Project Environmental				$ 1,569,297.57	$ 1,569,297.57	$ -	$ 1,569,297.57	
80.03		Final design				$ 1,569,297.57	$ 1,569,297.57	$ -	$ 1,569,297.57	
80.04		Project management for design and construction				$ 1,569,297.57	$ 1,569,297.57	$ -	$ 1,569,297.57	
80.05		Construction administration & management				$ 2,353,946.35	$ 2,353,946.35	$ -	$ 2,353,946.35	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 784,648.78	$ 784,648.78	$ -	$ 784,648.78	
80.09		Engineering inspection				$ 784,648.78	$ 784,648.78	$ -	$ 784,648.78	
80.10		Start up								
Subtotal (Categories 10-80)							$ 69,773,384.21	$ 18,107,279.64	$ 87,880,663.85	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 87,880,664**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 4: NC/SC Border (MP 419) to SC/GA Border (MP 540.85)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 276,015,566.30	$ 82,804,669.89	$ 358,820,236.19	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 106,680,000.00	$ 106,680,000	$ 32,004,000	$ 138,684,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 69,282,126.30	$ 69,282,126	$ 20,784,638	$ 90,066,764	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	58.90	$ 1,161,600.00		$ 68,418,240	$ 20,525,472	$ 88,943,712	
	10.09.02	136lb CWR on Wood Ties	track mile	0.50	$ 950,400.00		$ 475,200	$ 142,560	$ 617,760	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	1	$ 240,000.00		$ 240,000	$ 72,000	$ 312,000	
	10.14.02	Turnout; No. 15	each	2	$ 260,000.00		$ 520,000	$ 156,000	$ 676,000	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	64	$ 475,000.00		$ 30,400,000	$ 9,120,000	$ 39,520,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 40,200,000.00	$ 12,060,000.00	$ 52,260,000.00	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each	3.00	$ 13,400,000.00		$ 40,200,000	$ 12,060,000	$ 52,260,000	Spartenburg, Greenville, Clemson
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 29,501,150.00	$ 8,850,345.00	$ 38,351,495.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	121.85	$ 59,000.00		$ 7,189,150.00	$ 2,156,745.00	$ 9,345,895.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 22,312,000.00	$ 22,312,000.00	$ 6,693,600.00	$ 29,005,600.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 157,374,600.00	$ 47,212,380.00	$ 204,586,980.00	
50.01		Wayside signaling equipment	track mile	243.7	$ 485,000.00		$ 118,194,500.00	$ 35,458,350.00	$ 153,652,850.00	
50.02		Signal power access and distribution	track mile	243.7	$ 5,500.00		$ 1,340,350.00	$ 402,105.00	$ 1,742,455.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	121.85	$ 277,500.00		$ 33,813,375.00	$ 10,144,012.50	$ 43,957,387.50	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	54	$ 50,000		$ 2,700,000	$ 810,000	$ 3,510,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	121.85	$ 7,500.00		$ 913,875.00	$ 274,162.50	$ 1,188,037.50	
50.08		Station train approach warning system	each	3.00	$ 137,500.00		$ 412,500.00	$ 123,750.00	$ 536,250.00	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 503,091,316.30	$ 150,927,394.89	$ 654,018,711.19	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 78,482,245.34	$ -	$ 78,482,245.34	
80.01		Service Development Plan/Service Environmental				$ 6,540,187.11	$ 6,540,187.11	$ -	$ 6,540,187.11	
80.02		Preliminary Engineering/Project Environmental				$ 13,080,374.22	$ 13,080,374.22	$ -	$ 13,080,374.22	
80.03		Final design				$ 13,080,374.22	$ 13,080,374.22	$ -	$ 13,080,374.22	
80.04		Project management for design and construction				$ 13,080,374.22	$ 13,080,374.22	$ -	$ 13,080,374.22	
80.05		Construction administration & management				$ 19,620,561.34	$ 19,620,561.34	$ -	$ 19,620,561.34	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 6,540,187.11	$ 6,540,187.11	$ -	$ 6,540,187.11	
80.09		Engineering inspection				$ 6,540,187.11	$ 6,540,187.11	$ -	$ 6,540,187.11	
80.10		Start up								
Subtotal (Categories 10-80)							$ 581,573,561.64	$ 150,927,394.89	$ 732,500,956.53	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 732,500,957	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 5: SC/GA Border (MP 540.85) to Suwanee (MP 607)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 88,981,009	$ 26,694,303	$ 115,675,311	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 13,092,000.00	$ 13,092,000	$ 3,927,600	$ 17,019,600	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum				$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 30,877,008.75	$ 30,877,009	$ 9,263,103	$ 40,140,111	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	26.25	$ 1,161,600.00		$ 30,492,000	$ 9,147,600	$ 39,639,600	
	10.09.02	136lb CWR on Wood Ties	track mile	0.00	$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	4	$ 240,000.00		$ 960,000	$ 288,000	$ 1,248,000	
	10.14.02	Turnout; No. 15	each	1	$ 260,000.00		$ 260,000	$ 78,000	$ 338,000	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	28	$ 475,000.00		$ 13,300,000	$ 3,990,000	$ 17,290,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 26,800,000	$ 8,040,000	$ 34,840,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each	2.00	$ 13,400,000.00		$ 26,800,000	$ 8,040,000	$ 34,840,000	Toccoa, Gainsville
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 24,134,850	$ 7,240,455	$ 31,375,305	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	66.15	$ 59,000.00		$ 3,902,850	$ 1,170,855	$ 5,073,705	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 20,232,000.00	$ 20,232,000	$ 6,069,600	$ 26,301,600	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 85,420,900	$ 25,626,270	$ 111,047,170	
50.01		Wayside signaling equipment	track mile	132.3	$ 485,000.00		$ 64,165,500	$ 19,249,650	$ 83,415,150	
50.02		Signal power access and distribution	track mile	132.3	$ 5,500.00		$ 727,650	$ 218,295	$ 945,945	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	66.15	$ 277,500.00		$ 18,356,625	$ 5,506,988	$ 23,863,613	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	28	$ 50,000		$ 1,400,000	$ 420,000	$ 1,820,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	66.15	$ 7,500.00		$ 496,125	$ 148,838	$ 644,963	
50.08		Station train approach warning system	each	2.00	$ 137,500.00		$ 275,000	$ 82,500	$ 357,500	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 225,336,759	$ 67,601,028	$ 292,937,786	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 35,152,534	$ -	$ 35,152,534	
80.01		Service Development Plan/Service Environmental				$ 2,929,377.86	$ 2,929,378	$ -	$ 2,929,378	
80.02		Preliminary Engineering/Project Environmental				$ 5,858,755.73	$ 5,858,756	$ -	$ 5,858,756	
80.03		Final design				$ 5,858,755.73	$ 5,858,756	$ -	$ 5,858,756	
80.04		Project management for design and construction				$ 5,858,755.73	$ 5,858,756	$ -	$ 5,858,756	
80.05		Construction administration & management				$ 8,788,133.59	$ 8,788,134	$ -	$ 8,788,134	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 2,929,377.86	$ 2,929,378	$ -	$ 2,929,378	
80.09		Engineering inspection				$ 2,929,377.86	$ 2,929,378	$ -	$ 2,929,378	
80.10		Start up								
Subtotal (Categories 10-80)							$ 260,489,293	$ 67,601,028	$ 328,090,321	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 328,090,321**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 6: Suwanee, GA (MP 607) to Howell Jct (MP 635)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 69,653,361	$ 20,896,008	$ 90,549,369	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 18,369,000.00	$ 18,369,000	$ 5,510,700	$ 23,879,700	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum				$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 24,466,353.60	$ 24,466,354	$ 7,339,906	$ 31,806,260	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	0.60	$ 1,161,600.00		$ 696,960	$ 209,088	$ 906,048	
	10.09.02	136lb CWR on Wood Ties	track mile	17.55	$ 950,400.00		$ 16,679,520	$ 5,003,856	$ 21,683,376	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.60	$ 677,545.00		$ 406,527	$ 121,958	$ 528,485	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	4	$ 240,000.00		$ 960,000	$ 288,000	$ 1,248,000	
	10.14.02	Turnout; No. 15	each		$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	17	$ 475,000.00		$ 8,075,000	$ 2,422,500	$ 10,497,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 40,000,000	$ 12,000,000	$ 52,000,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000.00		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each	2.00	$ 20,000,000.00		$ 40,000,000	$ 12,000,000	$ 52,000,000	Suwanee, Doraville
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 1,746,400	$ 523,920	$ 2,270,320	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	29.6	$ 59,000.00		$ 1,746,400	$ 523,920	$ 2,270,320	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 38,298,600	$ 11,489,580	$ 49,788,180	
50.01		Wayside signaling equipment	track mile	59.2	$ 485,000.00		$ 28,712,000	$ 8,613,600	$ 37,325,600	
50.02		Signal power access and distribution	track mile	59.2	$ 5,500.00		$ 325,600	$ 97,680	$ 423,280	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	29.6	$ 277,500.00		$ 8,214,000	$ 2,464,200	$ 10,678,200	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	11	$ 50,000		$ 550,000	$ 165,000	$ 715,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	29.6	$ 7,500.00		$ 222,000	$ 66,600	$ 288,600	
50.08		Station train approach warning system	each	2.00	$ 137,500.00		$ 275,000	$ 82,500	$ 357,500	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 149,698,361	$ 44,909,508	$ 194,607,869	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 23,352,944	$ -	$ 23,352,944	
80.01		Service Development Plan/Service Environmental				$ 1,946,078.69	$ 1,946,079	$ -	$ 1,946,079	
80.02		Preliminary Engineering/Project Environmental				$ 3,892,157.38	$ 3,892,157	$ -	$ 3,892,157	
80.03		Final design				$ 3,892,157.38	$ 3,892,157	$ -	$ 3,892,157	
80.04		Project management for design and construction				$ 3,892,157.38	$ 3,892,157	$ -	$ 3,892,157	
80.05		Construction administration & management				$ 5,838,236.06	$ 5,838,236	$ -	$ 5,838,236	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,946,078.69	$ 1,946,079	$ -	$ 1,946,079	
80.09		Engineering inspection				$ 1,946,078.69	$ 1,946,079	$ -	$ 1,946,079	
80.10		Start up								
Subtotal (Categories 10-80)							$ 173,051,305	$ 44,909,508	$ 217,960,813	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 217,960,814	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 7: Howell Jct (MP H150) to Atlanta MMPT (MP H152.6)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 9,903,760.00	$ 2,971,128.00	$ 12,874,888.00	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures								
10.05		Track structure: Cut and Fill (> 4' height/depth)								
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 1,281,000.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	0.64	$ 1,161,600.00		$ 740,300.00	$ 222,090.00	$ 962,390.00	
	10.09.02	136lb CWR on Wood Ties	track mile	2.47	$ 950,400.00		$ 2,344,860.00	$ 703,458.00	$ 3,048,318.00	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile		$ 677,545.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	4.60	$ 966,000.00		$ 4,443,600.00	$ 1,333,080.00	$ 5,776,680.00	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each		$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	5	$ 475,000.00		$ 2,375,000	$ 712,500	$ 3,087,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	track mile		$ 122,000.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only								No Cost for MMPT
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000.00		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
	20.02.03	Birmingham Transit Station	lump sum				$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 153,400.00	$ 46,020.00	$ 199,420.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	2.6	$ 59,000.00		$ 153,400.00	$ 46,020.00	$ 199,420.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 3,291,600.00	$ 987,480.00	$ 4,279,080.00	
50.01		Wayside signaling equipment	track mile	5.2	$ 485,000.00		$ 2,522,000.00	$ 756,600.00	$ 3,278,600.00	
50.02		Signal power access and distribution	track mile	5.2	$ 5,500.00		$ 28,600.00	$ 8,580.00	$ 37,180.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	2.6	$ 277,500.00		$ 721,500.00	$ 216,450.00	$ 937,950.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	2.6	$ 7,500.00		$ 19,500.00	$ 5,850.00	$ 25,350.00	
50.08		Station train approach warning system	each		$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 13,348,760.00	$ 4,004,628.00	$ 17,353,388.00	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 2,082,406.56	$ -	$ 2,082,406.56	
80.01		Service Development Plan/Service Environmental				$ 173,533.88	$ 173,533.88	$ -	$ 173,533.88	
80.02		Preliminary Engineering/Project Environmental				$ 347,067.76	$ 347,067.76	$ -	$ 347,067.76	
80.03		Final design				$ 347,067.76	$ 347,067.76	$ -	$ 347,067.76	
80.04		Project management for design and construction				$ 347,067.76	$ 347,067.76	$ -	$ 347,067.76	
80.05		Construction administration & management				$ 520,601.64	$ 520,601.64	$ -	$ 520,601.64	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 173,533.88	$ 173,533.88	$ -	$ 173,533.88	
80.09		Engineering inspection				$ 173,533.88	$ 173,533.88	$ -	$ 173,533.88	
80.10		Start up								
Subtotal (Categories 10-80)							$ 15,431,166.56	$ 4,004,628.00	$ 19,435,794.56	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 19,435,795**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Brimingham
Date of Estimate	September 27, 2013
Technology	79MPH Shared Use Service
Segment	Segment 8: Atlanta MMPT (MP S295) to Atlanta Hartsfield Airport (MP S285)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 26,943,068	$ 8,082,920	$ 35,025,989	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum				$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum				$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum				$ -	$ -	$ -	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile		$ 1,161,600.00		$ -	$ -	$ -	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile		$ 677,545.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	23.47	$ 966,000.00		$ 22,668,068	$ 6,800,420	$ 29,468,489	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each		$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	9	$ 475,000.00		$ 4,275,000	$ 1,282,500	$ 5,557,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 60,000,000	$ 18,000,000	$ 78,000,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each	1.00	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	Hartsfield Airport
	20.01.03	Existing Intermediate Station	each		$ 13,400,000		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum				$ -	$ -	$ -	
	20.02.02	Atlanta Multi-Modal Passenger Terminal (MMPT)	lump sum				$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 560,500	$ 168,150	$ 728,650	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.5	$ 59,000		$ 560,500	$ 168,150	$ 728,650	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 12,027,000	$ 3,608,100	$ 15,635,100	
50.01		Wayside signaling equipment	track mile	19	$ 485,000		$ 9,215,000	$ 2,764,500	$ 11,979,500	
50.02		Signal power access and distribution	track mile	19	$ 5,500		$ 104,500	$ 31,350	$ 135,850	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.5	$ 277,500		$ 2,636,250	$ 790,875	$ 3,427,125	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.5	$ 7,500		$ 71,250	$ 21,375	$ 92,625	
50.08		Station train approach warning system	each		$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 233,530,568	$ 70,059,170	$ 303,589,739	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 36,430,769	$ -	$ 36,430,769	
80.01		Service Development Plan/Service Environmental				$ 3,035,897.39	$ 3,035,897	$ -	$ 3,035,897	
80.02		Preliminary Engineering/Project Environmental				$ 6,071,794.77	$ 6,071,795	$ -	$ 6,071,795	
80.03		Final design				$ 6,071,794.77	$ 6,071,795	$ -	$ 6,071,795	
80.04		Project management for design and construction				$ 6,071,794.77	$ 6,071,795	$ -	$ 6,071,795	
80.05		Construction administration & management				$ 9,107,692.16	$ 9,107,692	$ -	$ 9,107,692	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 3,035,897.39	$ 3,035,897	$ -	$ 3,035,897	
80.09		Engineering inspection				$ 3,035,897.39	$ 3,035,897	$ -	$ 3,035,897	
80.10		Start up								
Subtotal (Categories 10-80)							$ 269,961,337	$ 70,059,170	$ 340,020,507	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 340,020,508	

ALTERNATIVE 1: NORFOLK SOUTHERN (110 MPH)

Project Name	GDOT Atlanta to Charlotte Passenger Rail Corridor Investment Plan
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 563,434,701	$ 169,030,410	$ 732,465,111	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 140,025,000.00	$ 140,025,000	$ 42,007,500	$ 182,032,500	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 150,973,869.45	$ 150,973,869	$ 45,292,161	$ 196,266,030	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	0.00	$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile	0.00	$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	track mile	64.62	$ 1,161,600.00		$ 75,061,360	$ 22,518,408	$ 97,579,768	
	10.09.02	136lb CWR on Wood Ties	track mile	66.25	$ 950,400.00		$ 62,964,000	$ 18,889,200	$ 81,853,200	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	52.30	$ 677,545.00		$ 35,435,603	$ 10,630,681	$ 46,066,285	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile	25.77	$ 966,000.00		$ 24,889,868	$ 7,466,960	$ 32,356,829	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	26.00	$ 240,000.00		$ 6,240,000	$ 1,872,000	$ 8,112,000	
	10.14.02	Turnout; No. 15	each	7.00	$ 260,000.00		$ 1,820,000	$ 546,000	$ 2,366,000	
	10.14.03	Turnout; No. 20	each	0.00	$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	139.00	$ 475,000.00		$ 66,025,000	$ 19,807,500	$ 85,832,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	0.00	$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	track mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 230,400,000	$ 69,120,000	$ 299,520,000	
20.01		Station buildings: Intercity passenger rail only					$			
	20.01.01	Charlotte Airport	each	1.00	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	
	20.01.02	Hartsfield Airport	each	1.00	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	
	20.01.03	Existing Intermediate Station	each	6.00	$ 13,400,000		$ 80,400,000	$ 24,120,000	$ 104,520,000	
	20.01.04	New Intermediate Station	each	2.00	$ 20,000,000		$ 40,000,000	$ 12,000,000	$ 52,000,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot	0.00	$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 66,657,110	$ 19,997,133	$ 86,654,243	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	271.29	$ 59,000.00		$ 16,006,110	$ 4,801,833	$ 20,807,943	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ -	$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 50,651,000.00	$ 50,651,000	$ 15,195,300	$ 65,846,300	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre	0.00						
	40.09.02	Relocation - Rural	acre	0.00						
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 477,388,115	$ 143,216,435	$ 620,604,550	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	489.38	$ 485,000		$ 237,349,300	$ 71,204,790	$ 308,554,090	
	50.01.02	110MPH	track mile	53.20	$ 970,000		$ 51,604,000	$ 15,481,200	$ 67,085,200	
50.02		Signal power access and distribution	track mile	542.58	$ 5,500.00		$ 2,984,190	$ 895,257	$ 3,879,447	
50.03		On-board signaling equipment	each	0.00	$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	1.00	$ 9,000,000.00		$ 9,000,000	$ 2,700,000	$ 11,700,000	
50.05		Communications	corridor mile	271.29	$ 555,000.00		$ 150,565,950	$ 45,169,785	$ 195,735,735	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	39	$ 500,000		$ 19,500,000	$ 5,850,000	$ 25,350,000	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	65	$ 50,000		$ 3,250,000	$ 975,000	$ 4,225,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	271.29	$ 7,500.00		$ 2,034,675	$ 610,403	$ 2,645,078	
50.08		Station train approach warning system	each	8.00	$ 137,500.00		$ 1,100,000	$ 330,000	$ 1,430,000	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile	0.00	$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile	0.00	$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile	0.00	$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile	0.00	$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 1,471,879,926	$ 441,563,978	$ 1,913,443,904	
Total for Category 70: VEHICLES							$ 115,800,000	$ 34,740,000	$ 150,540,000	
70.00		Vehicle acquisition: Electric locomotive	each		$ 8,000,000.00		$ -	$ -	$ -	
70.01		Vehicle acquisition: Non-electric locomotive	each	6.00	$ 7,000,000.00		$ 42,000,000	$ 12,600,000	$ 54,600,000	
70.02		Vehicle acquisition: Electric multiple unit								
70.03		Vehicle acquisition: Diesel multiple unit								
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	18.00	$ 4,100,000.00		$ 73,800,000	$ 22,140,000	$ 95,940,000	
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts								
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 229,613,268	$ -	$ 229,613,268	
80.01		Service Development Plan/Service Environmental				$ 19,134,439.04	$ 19,134,439	$ -	$ 19,134,439	
80.02		Preliminary Engineering/Project Environmental				$ 38,268,878.08	$ 38,268,878	$ -	$ 38,268,878	
80.03		Final design				$ 38,268,878.08	$ 38,268,878	$ -	$ 38,268,878	
80.04		Project management for design and construction				$ 38,268,878.08	$ 38,268,878	$ -	$ 38,268,878	
80.05		Construction administration & management				$ 57,403,317.12	$ 57,403,317	$ -	$ 57,403,317	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 19,134,439.04	$ 19,134,439	$ -	$ 19,134,439	
80.09		Engineering inspection				$ 19,134,439.04	$ 19,134,439	$ -	$ 19,134,439	
80.10		Start up								
Subtotal (Categories 10-80)							$ 1,817,293,195	$ 476,303,978	$ 2,293,597,172	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 2,293,597,173	
TOTAL CAPITAL COST/MILE									$ 8,454,411	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 1: Charlotte Gateway (MP 377.70) to Greenfield Conn (MP 387.30)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 5,779,227	$ 1,733,768	$ 7,512,995	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 840,000.00	$ 840,000	$ 252,000	$ 1,092,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,529,147.10	$ 1,529,147	$ 458,744	$ 1,987,891	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	1.30	$ 1,161,600.00		$ 1,510,080	$ 453,024	$ 1,963,104	
	10.09.02	136lb CWR on Wood Ties	track mile	0.00	$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	0	$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4	$ 475,000.00		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 50,000,000	$ 15,000,000	$ 65,000,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each	1.00	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	Charlotte Airport
	20.01.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 6,677,970	$ 2,003,391	$ 8,681,361	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.83	$ 59,000		$ 579,970	$ 173,991	$ 753,961	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 6,098,000	$ 6,098,000	$ 1,829,400	$ 7,927,400	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 15,172,605	$ 4,551,782	$ 19,724,387	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	19.66	$ 485,000		$ 9,535,100	$ 2,860,530	$ 12,395,630	
	50.01.02	110MPH	track mile	0.00	$ 970,000		$ -	$ -	$ -	
50.02		Signal power access and distribution	track mile	19.66	$ 5,500		$ 108,130	$ 32,439	$ 140,569	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.83	$ 555,000		$ 5,455,650	$ 1,636,695	$ 7,092,345	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.83	$ 7,500		$ 73,725	$ 22,118	$ 95,843	
50.08		Station train approach warning system	each		$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 77,629,802	$ 23,288,941	$ 100,918,743	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 12,110,249	$ -	$ 12,110,249	
80.01		Service Development Plan/Service Environmental				$ 1,009,187.43	$ 1,009,187	$ -	$ 1,009,187	
80.02		Preliminary Engineering/Project Environmental				$ 2,018,374.85	$ 2,018,375	$ -	$ 2,018,375	
80.03		Final design				$ 2,018,374.85	$ 2,018,375	$ -	$ 2,018,375	
80.04		Project management for design and construction				$ 2,018,374.85	$ 2,018,375	$ -	$ 2,018,375	
80.05		Construction administration & management				$ 3,027,562.28	$ 3,027,562	$ -	$ 3,027,562	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,009,187.43	$ 1,009,187	$ -	$ 1,009,187	
80.09		Engineering inspection				$ 1,009,187.43	$ 1,009,187	$ -	$ 1,009,187	
80.10		Start up								
Subtotal (Categories 10-80)							$ 89,740,051	$ 23,288,941	$ 113,028,992	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 113,028,992**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 2: Greenfield Conn (MP 387.30) to I-85 Conn (MP402.37)
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 2,805,440.40	$ 841,632.12	$ 3,647,072.52	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,411,520.40	$ 1,411,520	$ 423,456	$ 1,834,977	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	1.20	$ 1,161,600.00		$ 1,393,920	$ 418,176	$ 1,812,096	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	0	$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each	0	$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each		$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each	0	$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000.00		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 892,670.00	$ 267,801.00	$ 1,160,471.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	15.13	$ 59,000.00		$ 892,670.00	$ 267,801.00	$ 1,160,471.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 23,353,155.00	$ 7,005,946.50	$ 30,359,101.50	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	30.26	$ 485,000		$ 14,676,100	$ 4,402,830	$ 19,078,930	
	50.01.02	110MPH	track mile	0.00	$ 970,000		$ -	$ -	$ -	
50.02		Signal power access and distribution	track mile	30.26	$ 5,500.00		$ 166,430.00	$ 49,929.00	$ 216,359.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	15.13	$ 555,000.00		$ 8,397,150.00	$ 2,519,145.00	$ 10,916,295.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	15.13	$ 7,500.00		$ 113,475.00	$ 34,042.50	$ 147,517.50	
50.08		Station train approach warning system	each		$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 27,051,265.40	$ 8,115,379.62	$ 35,166,645.02	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 4,219,997.40	$ -	$ 4,219,997.40	
80.01		Service Development Plan/Service Environmental				$ 351,666.45	$ 351,666.45	$ -	$ 351,666.45	
80.02		Preliminary Engineering/Project Environmental				$ 703,332.90	$ 703,332.90	$ -	$ 703,332.90	
80.03		Final design				$ 703,332.90	$ 703,332.90	$ -	$ 703,332.90	
80.04		Project management for design and construction				$ 703,332.90	$ 703,332.90	$ -	$ 703,332.90	
80.05		Construction administration & management				$ 1,054,999.35	$ 1,054,999.35	$ -	$ 1,054,999.35	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 351,666.45	$ 351,666.45	$ -	$ 351,666.45	
80.09		Engineering inspection				$ 351,666.45	$ 351,666.45	$ -	$ 351,666.45	
80.10		Start up								
Subtotal (Categories 10-80)							$ 31,271,262.80	$ 8,115,379.62	$ 39,386,642.42	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 39,386,643	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 3: I-85 Conn (MP 402.37) to NC/SC Border (MP 419)
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 32,446,378.30	$ 9,733,913.49	$ 42,180,291.79	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 1,044,000.00	$ 1,044,000	$ 313,200	$ 1,357,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 17,526,378.30	$ 17,526,378	$ 5,257,913	$ 22,784,292	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	6.10	$ 1,161,600.00		$ 7,085,760	$ 2,125,728	$ 9,211,488	
	10.09.02	136lb CWR on Wood Ties	track mile	0.60	$ 950,400.00		$ 570,240	$ 171,072	$ 741,312	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	0.00	$ 677,545.00		$ -	$ -	$ -	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	2	$ 260,000.00		$ 520,000	$ 156,000	$ 676,000	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	12	$ 475,000.00		$ 5,700,000	$ 1,710,000	$ 7,410,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 13,400,000.00	$ 4,020,000.00	$ 17,420,000.00	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each	1.00	$ 13,400,000.00		$ 13,400,000	$ 4,020,000	$ 17,420,000	Gastonia
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 2,990,170.00	$ 897,051.00	$ 3,887,221.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	16.63	$ 59,000.00		$ 981,170.00	$ 294,351.00	$ 1,275,521.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 2,009,000.00	$ 2,009,000.00	$ 602,700.00	$ 2,611,700.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 26,951,405.00	$ 8,085,421.50	$ 35,036,826.50	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	32.96	$ 485,000		$ 15,985,600	$ 4,795,680	$ 20,781,280	
	50.01.02	110MPH	track mile	0.30	$ 970,000		$ 291,000	$ 87,300	$ 378,300	
50.02		Signal power access and distribution	track mile	33.26	$ 5,500.00		$ 182,930.00	$ 54,879.00	$ 237,809.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	16.63	$ 555,000.00		$ 9,229,650.00	$ 2,768,895.00	$ 11,998,545.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	1	$ 500,000		$ 500,000	$ 150,000	$ 650,000	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	10	$ 50,000		$ 500,000	$ 150,000	$ 650,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	16.63	$ 7,500.00		$ 124,725.00	$ 37,417.50	$ 162,142.50	
50.08		Station train approach warning system	each	1.00	$ 137,500.00		$ 137,500.00	$ 41,250.00	$ 178,750.00	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 75,787,953.30	$ 22,736,385.99	$ 98,524,339.29	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 11,822,920.71	$ -	$ 11,822,920.71	
80.01		Service Development Plan/Service Environmental				$ 985,243.39	$ 985,243.39	$ -	$ 985,243.39	
80.02		Preliminary Engineering/Project Environmental				$ 1,970,486.79	$ 1,970,486.79	$ -	$ 1,970,486.79	
80.03		Final design				$ 1,970,486.79	$ 1,970,486.79	$ -	$ 1,970,486.79	
80.04		Project management for design and construction				$ 1,970,486.79	$ 1,970,486.79	$ -	$ 1,970,486.79	
80.05		Construction administration & management				$ 2,955,730.18	$ 2,955,730.18	$ -	$ 2,955,730.18	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 985,243.39	$ 985,243.39	$ -	$ 985,243.39	
80.09		Engineering inspection				$ 985,243.39	$ 985,243.39	$ -	$ 985,243.39	
80.10		Start up								
Subtotal (Categories 10-80)							$ 87,610,874.01	$ 22,736,385.99	$ 110,347,260.00	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 110,347,261	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 4: NC/SC Border (MP 419) to SC/GA Border (MP 540.85)
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 270,983,933.60	$ 81,295,180.08	$ 352,279,113.68	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 106,680,000.00	$ 106,680,000	$ 32,004,000	$ 138,684,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 59,166,230.10	$ 59,166,230	$ 17,749,869	$ 76,916,099	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	50.70	$ 1,161,600.00		$ 58,893,120	$ 17,667,936	$ 76,561,056	
	10.09.02	136lb CWR on Wood Ties	track mile	8.65	$ 950,400.00		$ 8,220,960	$ 2,466,288	$ 10,687,248	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	8.30	$ 677,545.00		$ 5,623,624	$ 1,687,087	$ 7,310,711	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	4	$ 240,000.00		$ 960,000	$ 288,000	$ 1,248,000	
	10.14.02	Turnout; No. 15	each	4	$ 260,000.00		$ 1,040,000	$ 312,000	$ 1,352,000	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	64	$ 475,000.00		$ 30,400,000	$ 9,120,000	$ 39,520,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	0.00	$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 40,200,000.00	$ 12,060,000.00	$ 52,260,000.00	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each	3.00	$ 13,400,000.00		$ 40,200,000	$ 12,060,000	$ 52,260,000	Spartenburg, Greenville, Clemson
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 29,501,150.00	$ 8,850,345.00	$ 38,351,495.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	121.85	$ 59,000.00		$ 7,189,150.00	$ 2,156,745.00	$ 9,345,895.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 22,312,000.00	$ 22,312,000.00	$ 6,693,600.00	$ 29,005,600.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 195,164,975.00	$ 58,549,492.50	$ 253,714,467.50	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	235.5	$ 485,000		$ 114,217,500	$ 34,265,250	$ 148,482,750	
	50.01.02	110MPH	track mile	8.20	$ 970,000		$ 7,954,000	$ 2,386,200	$ 10,340,200	
50.02		Signal power access and distribution	track mile	243.7	$ 5,500.00		$ 1,340,350.00	$ 402,105.00	$ 1,742,455.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	121.85	$ 555,000.00		$ 67,626,750.00	$ 20,288,025.00	$ 87,914,775.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	54	$ 50,000		$ 2,700,000	$ 810,000	$ 3,510,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	121.85	$ 7,500.00		$ 913,875.00	$ 274,162.50	$ 1,188,037.50	
50.08		Station train approach warning system	each	3.00	$ 137,500.00		$ 412,500.00	$ 123,750.00	$ 536,250.00	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 535,850,058.60	$ 160,755,017.58	$ 696,605,076.18	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 83,592,609.14	$ -	$ 83,592,609.14	
80.01		Service Development Plan/Service Environmental				$ 6,966,050.76	$ 6,966,050.76	$ -	$ 6,966,050.76	
80.02		Preliminary Engineering/Project Environmental				$ 13,932,101.52	$ 13,932,101.52	$ -	$ 13,932,101.52	
80.03		Final design				$ 13,932,101.52	$ 13,932,101.52	$ -	$ 13,932,101.52	
80.04		Project management for design and construction				$ 13,932,101.52	$ 13,932,101.52	$ -	$ 13,932,101.52	
80.05		Construction administration & management				$ 20,898,152.29	$ 20,898,152.29	$ -	$ 20,898,152.29	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 6,966,050.76	$ 6,966,050.76	$ -	$ 6,966,050.76	
80.09		Engineering inspection				$ 6,966,050.76	$ 6,966,050.76	$ -	$ 6,966,050.76	
80.10		Start up								
Subtotal (Categories 10-80)							$ 619,442,667.74	$ 160,755,017.58	$ 780,197,685.32	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 780,197,686	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 5: SC/GA Border (MP 540.85) to Suwanee (MP 607)
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 141,175,643	$ 42,352,693	$ 183,528,336	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 13,092,000.00	$ 13,092,000	$ 3,927,600	$ 17,019,600	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum				$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 48,521,013.75	$ 48,521,014	$ 14,556,304	$ 63,077,318	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	2.20	$ 1,161,600.00		$ 2,555,520	$ 766,656	$ 3,322,176	
	10.09.02	136lb CWR on Wood Ties	track mile	38.20	$ 950,400.00		$ 36,305,280	$ 10,891,584	$ 47,196,864	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	35.10	$ 677,545.00		$ 23,781,829	$ 7,134,549	$ 30,916,378	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	14	$ 240,000.00		$ 3,360,000	$ 1,008,000	$ 4,368,000	
	10.14.02	Turnout; No. 15	each	1	$ 260,000.00		$ 260,000	$ 78,000	$ 338,000	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	28	$ 475,000.00		$ 13,300,000	$ 3,990,000	$ 17,290,000	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 26,800,000	$ 8,040,000	$ 34,840,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each	2.00	$ 13,400,000.00		$ 26,800,000	$ 8,040,000	$ 34,840,000	Toccoa, Gainsville
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 24,134,850	$ 7,240,455	$ 31,375,305	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	66.15	$ 59,000.00		$ 3,902,850	$ 1,170,855	$ 5,073,705	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 20,232,000.00	$ 20,232,000	$ 6,069,600	$ 26,301,600	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 131,738,525	$ 39,521,558	$ 171,260,083	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	99.7	$ 485,000		$ 48,354,500	$ 14,506,350	$ 62,860,850	
	50.01.02	110MPH	track mile	32.60	$ 970,000		$ 31,622,000	$ 9,486,600	$ 41,108,600	
50.02		Signal power access and distribution	track mile	132.3	$ 5,500.00		$ 727,650	$ 218,295	$ 945,945	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	66.15	$ 555,000.00		$ 36,713,250	$ 11,013,975	$ 47,727,225	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	27	$ 500,000		$ 13,500,000	$ 4,050,000	$ 17,550,000	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	1	$ 50,000		$ 50,000	$ 15,000	$ 65,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	66.15	$ 7,500.00		$ 496,125	$ 148,838	$ 644,963	
50.08		Station train approach warning system	each	2.00	$ 137,500.00		$ 275,000	$ 82,500	$ 357,500	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 323,849,018	$ 97,154,705	$ 421,003,724	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 50,520,447	$ -	$ 50,520,447	
80.01		Service Development Plan/Service Environmental				$ 4,210,037.24	$ 4,210,037	$ -	$ 4,210,037	
80.02		Preliminary Engineering/Project Environmental				$ 8,420,074.47	$ 8,420,074	$ -	$ 8,420,074	
80.03		Final design				$ 8,420,074.47	$ 8,420,074	$ -	$ 8,420,074	
80.04		Project management for design and construction				$ 8,420,074.47	$ 8,420,074	$ -	$ 8,420,074	
80.05		Construction administration & management				$ 12,630,111.71	$ 12,630,112	$ -	$ 12,630,112	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,210,037.24	$ 4,210,037	$ -	$ 4,210,037	
80.09		Engineering inspection				$ 4,210,037.24	$ 4,210,037	$ -	$ 4,210,037	
80.10		Start up								
Subtotal (Categories 10-80)							$ 374,369,465	$ 97,154,705	$ 471,524,171	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 471,524,171**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 6: Suwanee, GA (MP 607) to Howell Jct (MP 635)
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 76,042,210	$ 22,812,663	$ 98,854,873	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 18,369,000.00	$ 18,369,000	$ 5,510,700	$ 23,879,700	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum				$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 22,819,579.80	$ 22,819,580	$ 6,845,874	$ 29,665,454	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	1.85	$ 1,161,600.00		$ 2,148,960	$ 644,688	$ 2,793,648	
	10.09.02	136lb CWR on Wood Ties	track mile	17.55	$ 950,400.00		$ 16,679,520	$ 5,003,856	$ 21,683,376	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile	8.90	$ 677,545.00		$ 6,030,150	$ 1,809,045	$ 7,839,196	*Shift Included
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	8	$ 240,000.00		$ 1,920,000	$ 576,000	$ 2,496,000	
	10.14.02	Turnout; No. 15	each		$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	17	$ 475,000.00		$ 8,075,000	$ 2,422,500	$ 10,497,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 40,000,000	$ 12,000,000	$ 52,000,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000.00		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each	2.00	$ 20,000,000.00		$ 40,000,000	$ 12,000,000	$ 52,000,000	Suwanee, Doraville
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 1,746,400	$ 523,920	$ 2,270,320	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	29.6	$ 59,000.00		$ 1,746,400	$ 523,920	$ 2,270,320	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 57,331,100	$ 17,199,330	$ 74,530,430	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	47.1	$ 485,000		$ 22,843,500	$ 6,853,050	$ 29,696,550	
	50.01.02	110MPH	track mile	12.10	$ 970,000		$ 11,737,000	$ 3,521,100	$ 15,258,100	
50.02		Signal power access and distribution	track mile	59.2	$ 5,500.00		$ 325,600	$ 97,680	$ 423,280	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	29.6	$ 555,000.00		$ 16,428,000	$ 4,928,400	$ 21,356,400	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	11	$ 500,000		$ 5,500,000	$ 1,650,000	$ 7,150,000	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each	0	$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	29.6	$ 7,500.00		$ 222,000	$ 66,600	$ 288,600	
50.08		Station train approach warning system	each	2.00	$ 137,500.00		$ 275,000	$ 82,500	$ 357,500	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 175,119,710	$ 52,535,913	$ 227,655,623	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 27,318,675	$ -	$ 27,318,675	
80.01		Service Development Plan/Service Environmental				$ 2,276,556.23	$ 2,276,556	$ -	$ 2,276,556	
80.02		Preliminary Engineering/Project Environmental				$ 4,553,112.47	$ 4,553,112	$ -	$ 4,553,112	
80.03		Final design				$ 4,553,112.47	$ 4,553,112	$ -	$ 4,553,112	
80.04		Project management for design and construction				$ 4,553,112.47	$ 4,553,112	$ -	$ 4,553,112	
80.05		Construction administration & management				$ 6,829,668.70	$ 6,829,669	$ -	$ 6,829,669	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 2,276,556.23	$ 2,276,556	$ -	$ 2,276,556	
80.09		Engineering inspection				$ 2,276,556.23	$ 2,276,556	$ -	$ 2,276,556	
80.10		Start up								
Subtotal (Categories 10-80)							$ 202,438,385	$ 52,535,913	$ 254,974,298	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 254,974,299	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 7: Howell Jct (MP H150) to Atlanta MMPT (MP H152.6)
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 7,258,800.00	$ 2,177,640.00	$ 9,436,440.00	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures								
10.05		Track structure: Cut and Fill (> 4' height/depth)								
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 1,281,000.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	1.27	$ 1,161,600.00		$ 1,474,000.00	$ 442,200.00	$ 1,916,200.00	
	10.09.02	136lb CWR on Wood Ties	track mile	1.25	$ 950,400.00		$ 1,188,000.00	$ 356,400.00	$ 1,544,400.00	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile		$ 677,545.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	2.30	$ 966,000.00		$ 2,221,800.00	$ 666,540.00	$ 2,888,340.00	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each		$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	5	$ 475,000.00		$ 2,375,000	$ 712,500	$ 3,087,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	track mile		$ 122,000.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only								No Cost for MMPT
	20.01.01	Charlotte Airport	each		$ 50,000,000.00		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each		$ 60,000,000.00		$ -	$ -	$ -	
	20.01.03	Existing Intermediate Station	each		$ 13,400,000.00		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000.00		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215.00		$ -	$ -	$ -	
	20.02.03	Birmingham Transit Station	lump sum				$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 153,400.00	$ 46,020.00	$ 199,420.00	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	2.6	$ 59,000.00		$ 153,400.00	$ 46,020.00	$ 199,420.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 4,013,100.00	$ 1,203,930.00	$ 5,217,030.00	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	5.2	$ 485,000		$ 2,522,000	$ 756,600	$ 3,278,600	
	50.01.02	110MPH	track mile	0.00	$ 970,000		$ -	$ -	$ -	
50.02		Signal power access and distribution	track mile	5.2	$ 5,500.00		$ 28,600.00	$ 8,580.00	$ 37,180.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	2.6	$ 555,000.00		$ 1,443,000.00	$ 432,900.00	$ 1,875,900.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	2.6	$ 7,500.00		$ 19,500.00	$ 5,850.00	$ 25,350.00	
50.08		Station train approach warning system	each		$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 11,425,300.00	$ 3,427,590.00	$ 14,852,890.00	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 1,782,346.80	$ -	$ 1,782,346.80	
80.01		Service Development Plan/Service Environmental				$ 148,528.90	$ 148,528.90	$ -	$ 148,528.90	
80.02		Preliminary Engineering/Project Environmental				$ 297,057.80	$ 297,057.80	$ -	$ 297,057.80	
80.03		Final design				$ 297,057.80	$ 297,057.80	$ -	$ 297,057.80	
80.04		Project management for design and construction				$ 297,057.80	$ 297,057.80	$ -	$ 297,057.80	
80.05		Construction administration & management				$ 445,586.70	$ 445,586.70	$ -	$ 445,586.70	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 148,528.90	$ 148,528.90	$ -	$ 148,528.90	
80.09		Engineering inspection				$ 148,528.90	$ 148,528.90	$ -	$ 148,528.90	
80.10		Start up								
Subtotal (Categories 10-80)							$ 13,207,646.80	$ 3,427,590.00	$ 16,635,236.80	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 16,635,237	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Brimingham
Date of Estimate	September 27, 2013
Technology	79-110 MPH Shared Use Service
Segment	Segment 8: Atlanta MMPT (MP S295) to Atlanta Hartsfield Airport (MP S285)
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 26,943,068	$ 8,082,920	$ 35,025,989	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum				$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum				$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum				$ -	$ -	$ -	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 250,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile		$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile		$ 1,161,600.00		$ -	$ -	$ -	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	50% Track Rehabilitation	track mile		$ 677,545.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	23.47	$ 966,000.00		$ 22,668,068	$ 6,800,420	$ 29,468,489	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 240,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each		$ 260,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 280,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	9	$ 475,000.00		$ 4,275,000	$ 1,282,500	$ 5,557,500	
10.15		Track: Major interlockings	each		$ 3,000,000.00		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 60,000,000	$ 18,000,000	$ 78,000,000	
20.01		Station buildings: Intercity passenger rail only								
	20.01.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.01.02	Hartsfield Airport	each	1.00	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	Hartsfield Airport
	20.01.03	Existing Intermediate Station	each		$ 13,400,000		$ -	$ -	$ -	
	20.01.04	New Intermediate Station	each		$ 20,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 215		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum				$ -	$ -	$ -	
	20.02.02	Atlanta Multi-Modal Passenger Terminal (MMPT)	lump sum				$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 560,500	$ 168,150	$ 728,650	
40.01		Demolition, clearing, site preparation	lump sum			$ -	$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.5	$ 59,000		$ 560,500	$ 168,150	$ 728,650	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 14,663,250	$ 4,398,975	$ 19,062,225	
50.01		Wayside signaling equipment								
	50.01.01	Shared-Use	track mile	19	$ 485,000		$ 9,215,000	$ 2,764,500	$ 11,979,500	
	50.01.02	110MPH	track mile	0.00	$ 970,000		$ -	$ -	$ -	
50.02		Signal power access and distribution	track mile	19	$ 5,500		$ 104,500	$ 31,350	$ 135,850	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.5	$ 555,000		$ 5,272,500	$ 1,581,750	$ 6,854,250	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
	50.06.03	Private At-Grade	each		$ 50,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.5	$ 7,500		$ 71,250	$ 21,375	$ 92,625	
50.08		Station train approach warning system	each		$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	track mile		$ 3,600,000		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 1,625,000		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 236,166,818	$ 70,850,045	$ 307,016,864	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 36,842,024	$ -	$ 36,842,024	
80.01		Service Development Plan/Service Environmental				$ 3,070,168.64	$ 3,070,169	$ -	$ 3,070,169	
80.02		Preliminary Engineering/Project Environmental				$ 6,140,337.27	$ 6,140,337	$ -	$ 6,140,337	
80.03		Final design				$ 6,140,337.27	$ 6,140,337	$ -	$ 6,140,337	
80.04		Project management for design and construction				$ 6,140,337.27	$ 6,140,337	$ -	$ 6,140,337	
80.05		Construction administration & management				$ 9,210,505.91	$ 9,210,506	$ -	$ 9,210,506	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 3,070,168.64	$ 3,070,169	$ -	$ 3,070,169	
80.09		Engineering inspection				$ 3,070,168.64	$ 3,070,169	$ -	$ 3,070,169	
80.10		Start up								
Subtotal (Categories 10-80)							$ 273,008,842	$ 70,850,045	$ 343,858,887	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 343,858,888	

ALTERNATIVE 2: I-85 (125 MPH)

Project Name	GDOT Atlanta to Charlotte Passenger Rail Corridor Investment Plan
Corridor Name	Atlanta - Charlotte via Interstate 85 and NS Atlanta Approach
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 6,964,287,854	$ 2,089,286,356	$ 9,053,574,210	
10.01		Track structure: Viaduct	corridor mile	98.31	$ 50,000,000.00		$ 4,915,500,000	$ 1,474,650,000	$ 6,390,150,000	
10.02		Track structure: Major/Movable bridge	lump sum			$ 514,934,000.00	$ 514,934,000	$ 154,480,200	$ 669,414,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 69,166,628.50	$ 69,166,629	$ 20,749,989	$ 89,916,617	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 299,171,286.99	$ 299,171,287	$ 89,751,386	$ 388,922,673	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	9.50	$ 715,000.00		$ 6,792,500	$ 2,037,750	$ 8,830,250	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	254.43	$ 960,960.00		$ 244,492,248.00	$ 73,347,674.40	$ 317,839,922.40	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	274.21	$ 2,323,200.00		$ 637,033,056	$ 191,109,917	$ 828,142,973	
	10.09.02	136lb CWR on Wood Ties	track mile	87.47	$ 950,400.00		$ 83,126,736	$ 24,938,021	$ 108,064,757	
10.10		Track new construction: Non-ballasted	corridor mile	0.00	$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28.00	$ 150,000.00		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.02	Turnout; No. 15	each	15.00	$ 175,000.00		$ 2,625,000	$ 787,500	$ 3,412,500	
	10.14.03	Turnout; No. 20	each	21.00	$ 200,000.00		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.04	Turnout; No. 24	each	202.00	$ 475,000.00		$ 95,950,000	$ 28,785,000	$ 124,735,000	
10.15		Track: Major interlockings	each	39.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	0.00	$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	256.16	$ 316,800.00		$ 81,149,904	$ 24,344,971	$ 105,494,875	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 410,000,000	$ 123,000,000	$ 533,000,000	
20.01		Station buildings: Intercity passenger rail only	each	8.00	$ 37,500,000		$ 300,000,000	$ 90,000,000	$ 390,000,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each	1.00	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	
	20.02.02	Hartsfield Airport	each	1.00	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	
20.03		Platforms	linear feet	0.00	$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 143,870,000	$ 43,161,000	$ 187,031,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000.00	$ 9,870,000	$ 2,961,000	$ 12,831,000	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 498,817,146	$ 149,645,144	$ 648,462,289	
40.01		Demolition, clearing, site preparation	lump sum			$ 55,403,829.65	$ 55,403,830	$ 16,621,149	$ 72,024,979	
40.02		Site utilities, utility relocation	corridor mile	265.66	$ 59,000.00		$ 15,673,645	$ 4,702,094	$ 20,375,739	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 302,187,670.87	$ 302,187,671	$ 90,656,301	$ 392,843,972	
	40.07.01	Railroad Owned - Urban	acre	70.50						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	274.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 125,552,000.00	$ 125,552,000	$ 37,665,600	$ 163,217,600	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre	0.00						
	40.09.02	Relocation - Rural	acre	0.00						
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 690,073,843	$ 207,022,153	$ 897,095,995	
50.01		Wayside signaling equipment	track mile	531.31	$ 970,000.00		$ 515,370,700	$ 154,611,210	$ 669,981,910	
50.02		Signal power access and distribution	track mile	531.31	$ 5,500.00		$ 2,922,205	$ 876,662	$ 3,798,867	
50.03		On-board signaling equipment	each	0.00	$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	265.66	$ 555,000.00		$ 147,438,525	$ 44,231,558	$ 191,670,083	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	42.00	$ 500,000.00		$ 21,000,000	$ 6,300,000	$ 27,300,000	
	50.06.02	Private At-Grade	each	1.00	$ 250,000.00		$ 250,000	$ 75,000	$ 325,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	265.66	$ 7,500.00		$ 1,992,413	$ 597,724	$ 2,590,136	
50.08		Station train approach warning system	each	8.00	$ 137,500.00		$ 1,100,000	$ 330,000	$ 1,430,000	
Total for Category 60: ELECTRIC TRACTION							$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile		$ 60,400.00		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile		$ 1,800,000.00		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	corridor mile		$ 3,600,000.00		$ -	$ -	$ -	
60.04		Traction power control	corridor mile		$ 19,000.00		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 8,707,048,842	$ 2,612,114,653	$ 11,319,163,494	
Total for Category 70: VEHICLES							$ 429,000,000	$ 128,700,000	$ 557,700,000	
70.00		Vehicle acquisition: Electric locomotive	each		$ 8,000,000.00		$ -	$ -	$ -	
70.01		Vehicle acquisition: Non-electric locomotive	each	26.00	$ 4,200,000.00		$ 109,200,000	$ 32,760,000	$ 141,960,000	
70.02		Vehicle acquisition: Electric multiple unit								
70.03		Vehicle acquisition: Diesel multiple unit								
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	78.00	$ 4,100,000.00		$ 319,800,000	$ 95,940,000	$ 415,740,000	
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts								
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 1,358,299,619	$ -	$ 1,358,299,619	
80.01		Service Development Plan/Service Environmental				$ 113,191,634.94	$ 113,191,635	$ -	$ 113,191,635	
80.02		Preliminary Engineering/Project Environmental				$ 226,383,269.89	$ 226,383,270	$ -	$ 226,383,270	
80.03		Final design				$ 226,383,269.89	$ 226,383,270	$ -	$ 226,383,270	
80.04		Project management for design and construction				$ 226,383,269.89	$ 226,383,270	$ -	$ 226,383,270	
80.05		Construction administration & management				$ 339,574,904.83	$ 339,574,905	$ -	$ 339,574,905	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 113,191,634.94	$ 113,191,635	$ -	$ 113,191,635	
80.09		Engineering inspection				$ 113,191,634.94	$ 113,191,635	$ -	$ 113,191,635	
80.10		Start up								
Subtotal (Categories 10-80)							$ 10,494,348,461	$ 2,740,814,653	$ 13,235,163,114	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 13,235,163,114**	
TOTAL CAPITAL COST/MILE									**$ 49,819,932**	

Project Name	GDOT Atlanta to Charlotte Passenger Rail Investment Plan
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 1: Charlotte Gateway Station to Greenfield NS Connection
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 139,368,927	$ 41,810,678	$ 181,179,605	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 61,230,000	$ 61,230,000	$ 18,369,000	$ 79,599,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 9,758,455	$ 9,758,455	$ 2,927,537	$ 12,685,992	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	9.83	$ 960,960.00		$ 9,441,432.00	$ 2,832,429.60	$ 12,273,861.60	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	18.38	$ 2,323,200.00		$ 42,688,800	$ 12,806,640	$ 55,495,440	
	10.09.02	136lb CWR on Wood Ties	track mile	9.83	$ 950,400.00		$ 9,337,680	$ 2,801,304	$ 12,138,984	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	8	$ 475,000		$ 3,800,000	$ 1,140,000	$ 4,940,000	
10.15		Track: Major interlockings	each	2	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	9.83	$ 316,800.00		$ 3,112,560	$ 933,768	$ 4,046,328	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 50,000,000	$ 15,000,000	$ 65,000,000	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each	1	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	Charlotte Airport, No cost for Gateway Station
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 41,874,430	$ 12,562,329	$ 54,436,759	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,235,572	$ 1,235,572	$ 370,672	$ 1,606,244	
40.02		Site utilities, utility relocation	corridor mile	9.83	$ 59,000		$ 579,675	$ 173,903	$ 753,578	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 17,818,182	$ 17,818,182	$ 5,345,455	$ 23,163,637	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	11						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 22,241,000	$ 22,241,000	$ 6,672,300	$ 28,913,300	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 26,695,138	$ 8,008,541	$ 34,703,679	
50.01		Wayside signaling equipment	track mile	19.65	$ 970,000		$ 19,060,500	$ 5,718,150	$ 24,778,650	
50.02		Signal power access and distribution	track mile	19.65	$ 5,500		$ 108,075	$ 32,423	$ 140,498	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.83	$ 555,000		$ 5,452,875	$ 1,635,863	$ 7,088,738	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	4	$ 500,000		$ 2,000,000	$ 600,000	$ 2,600,000	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.83	$ 7,500		$ 73,688	$ 22,106	$ 95,794	
50.08		Station train approach warning system	each	0	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 53,835,105	$ 16,150,532	$ 69,985,637	
60.01		Traction power transmission: High voltage	corridor mile	9.83	$ 60,400		$ 593,430	$ 178,029	$ 771,459	
60.02		Traction power supply: Substations	corridor mile	9.83	$ 1,800,000		$ 17,685,000	$ 5,305,500	$ 22,990,500	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.83	$ 3,600,000		$ 35,370,000	$ 10,611,000	$ 45,981,000	
60.04		Traction power control	corridor mile	9.83	$ 19,000.00		$ 186,675	$ 56,003	$ 242,678	
Construction Subtotal (Categories 10-60)							$ 311,773,600	$ 93,532,080	$ 405,305,679	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 48,636,682	$ -	$ 48,636,682	
80.01		Service Development Plan/Service Environmental				$ 4,053,056.79	$ 4,053,057	$ -	$ 4,053,057	
80.02		Preliminary Engineering/Project Environmental				$ 8,106,113.59	$ 8,106,114	$ -	$ 8,106,114	
80.03		Final design				$ 8,106,113.59	$ 8,106,114	$ -	$ 8,106,114	
80.04		Project management for design and construction				$ 8,106,113.59	$ 8,106,114	$ -	$ 8,106,114	
80.05		Construction administration & management				$ 12,159,170.38	$ 12,159,170	$ -	$ 12,159,170	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,053,056.79	$ 4,053,057	$ -	$ 4,053,057	
80.09		Engineering inspection				$ 4,053,056.79	$ 4,053,057	$ -	$ 4,053,057	
80.10		Start up								
Subtotal (Categories 10-80)							$ 360,410,281	$ 93,532,080	$ 453,942,361	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 453,942,361**	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 453,942,361**	
TOTAL CAPITAL COST/MILE									**$ 49,819,932**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 2: Greenfield NS Connection to I-85 NS Connection
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 168,706,153.31	$ 50,611,845.99	$ 219,317,999.30	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 68,301,000.00	$ 68,301,000.00	$ 20,490,300.00	$ 88,791,300.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 15,027,524.51	$ 15,027,524.51	$ 4,508,257.35	$ 19,535,781.86	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	15.13	$ 960,960.00		$ 14,539,324.80	$ 4,361,797.44	$ 18,901,122.24	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	15.13	$ 2,323,200.00		$ 35,150,016.00	$ 10,545,004.80	$ 45,695,020.80	
	10.09.02	136lb CWR on Wood Ties	track mile	26.51	$ 950,400.00		$ 25,195,104.00	$ 7,558,531.20	$ 32,753,635.20	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	12	$ 475,000.00		$ 5,700,000.00	$ 1,710,000.00	$ 7,410,000.00	
10.15		Track: Major interlockings	each	3	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	15.13	$ 316,800.00		$ 4,793,184.00	$ 1,437,955.20	$ 6,231,139.20	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 48,592,056.01	$ 14,577,616.80	$ 63,169,672.81	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,902,718.54	$ 1,902,718.54	$ 570,815.56	$ 2,473,534.10	
40.02		Site utilities, utility relocation	corridor mile	15.13	$ 59,000.00		$ 892,670.00	$ 267,801.00	$ 1,160,471.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 25,706,667.47	$ 25,706,667.47	$ 7,712,000.24	$ 33,418,667.71	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	14						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 20,090,000.00	$ 20,090,000.00	$ 6,027,000.00	$ 26,117,000.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 45,529,255.00	$ 13,658,776.50	$ 59,188,031.50	
50.01		Wayside signaling equipment	track mile	30.26	$ 970,000.00		$ 29,352,200.00	$ 8,805,660.00	$ 38,157,860.00	
50.02		Signal power access and distribution	track mile	30.26	$ 5,500.00		$ 166,430.00	$ 49,929.00	$ 216,359.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	15.13	$ 555,000.00		$ 8,397,150.00	$ 2,519,145.00	$ 10,916,295.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	15	$ 500,000.00		$ 7,500,000.00	$ 2,250,000.00	$ 9,750,000.00	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	15.13	$ 7,500.00		$ 113,475.00	$ 34,042.50	$ 147,517.50	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 82,903,322.00	$ 24,870,996.60	$ 107,774,318.60	
60.01		Traction power transmission: High voltage	corridor mile	15.13	$ 60,400.00		$ 913,852.00	$ 274,155.60	$ 1,188,007.60	
60.02		Traction power supply: Substations	corridor mile	15.13	$ 1,800,000.00		$ 27,234,000.00	$ 8,170,200.00	$ 35,404,200.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	15.13	$ 3,600,000.00		$ 54,468,000.00	$ 16,340,400.00	$ 70,808,400.00	
60.04		Traction power control	corridor mile	15.13	$ 19,000.00		$ 287,470.00	$ 86,241.00	$ 373,711.00	
Construction Subtotal (Categories 10-60)							$ 345,730,786.32	$ 103,719,235.90	$ 449,450,022.22	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 53,934,002.67	$ -	$ 53,934,002.67	
80.01		Service Development Plan/Service Environmental				$ 4,494,500.22	$ 4,494,500.22	$ -	$ 4,494,500.22	
80.02		Preliminary Engineering/Project Environmental				$ 8,989,000.44	$ 8,989,000.44	$ -	$ 8,989,000.44	
80.03		Final design				$ 8,989,000.44	$ 8,989,000.44	$ -	$ 8,989,000.44	
80.04		Project management for design and construction				$ 8,989,000.44	$ 8,989,000.44	$ -	$ 8,989,000.44	
80.05		Construction administration & management				$ 13,483,500.67	$ 13,483,500.67	$ -	$ 13,483,500.67	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,494,500.22	$ 4,494,500.22	$ -	$ 4,494,500.22	
80.09		Engineering inspection				$ 4,494,500.22	$ 4,494,500.22	$ -	$ 4,494,500.22	
80.10		Start up								
Subtotal (Categories 10-80)							$ 399,664,788.99	$ 103,719,235.90	$ 503,384,024.88	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 503,384,025	
TOTAL CAPITAL COST/MILE									$ 33,270,590	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 3: I-85 NS Connection to NC/SC Border
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 623,070,096.50	$ 186,921,028.95	$ 809,991,125.45	
10.01		Track structure: Viaduct	corridor mile	9.50	$ 50,000,000.00		$ 475,000,000.00	$ 142,500,000.00	$ 617,500,000.00	
10.02		Track structure: Major/Movable bridge	lump sum			$ 51,220,000.00	$ 51,220,000.00	$ 15,366,000.00	$ 66,586,000.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 6,253,560.00	$ 6,253,560.00	$ 1,876,068.00	$ 8,129,628.00	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 21,879,736.50	$ 21,879,736.50	$ 6,563,920.95	$ 28,443,657.45	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	17.50	$ 960,960.00		$ 16,816,800.00	$ 5,045,040.00	$ 21,861,840.00	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	17.50	$ 2,323,200.00		$ 40,656,000.00	$ 12,196,800.00	$ 52,852,800.00	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	12	$ 475,000.00		$ 5,700,000.00	$ 1,710,000.00	$ 7,410,000.00	
10.15		Track: Major interlockings	each	3.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	17.50	$ 316,800.00		$ 5,544,000.00	$ 1,663,200.00	$ 7,207,200.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 37,500,000.00	$ 11,250,000.00	$ 48,750,000.00	
20.01		Station buildings: Intercity passenger rail only	each	1	$ 37,500,000		$ 37,500,000	$ 11,250,000	$ 48,750,000	Gastonia
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 34,158,499.50	$ 10,247,549.85	$ 44,406,049.35	
40.01		Demolition, clearing, site preparation	lump sum			$ 10,955,999.50	$ 10,955,999.50	$ 3,286,799.85	$ 14,242,799.35	
40.02		Site utilities, utility relocation	corridor mile	17.50	$ 59,000.00		$ 1,032,500.00	$ 309,750.00	$ 1,342,250.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ -	$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 22,170,000.00	$ 22,170,000.00	$ 6,651,000.00	$ 28,821,000.00	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 44,123,750.00	$ 13,237,125.00	$ 57,360,875.00	
50.01		Wayside signaling equipment	track mile	35.00	$ 970,000.00		$ 33,950,000.00	$ 10,185,000.00	$ 44,135,000.00	
50.02		Signal power access and distribution	track mile	35.00	$ 5,500.00		$ 192,500.00	$ 57,750.00	$ 250,250.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	17.50	$ 555,000.00		$ 9,712,500.00	$ 2,913,750.00	$ 12,626,250.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	17.50	$ 7,500.00		$ 131,250.00	$ 39,375.00	$ 170,625.00	
50.08		Station train approach warning system	each	1	$ 137,500.00		$ 137,500.00	$ 41,250.00	$ 178,750.00	
Total for Category 60: ELECTRIC TRACTION							$ 95,889,500.00	$ 28,766,850.00	$ 124,656,350.00	
60.01		Traction power transmission: High voltage	corridor mile	17.50	$ 60,400.00		$ 1,057,000.00	$ 317,100.00	$ 1,374,100.00	
60.02		Traction power supply: Substations	corridor mile	17.50	$ 1,800,000.00		$ 31,500,000.00	$ 9,450,000.00	$ 40,950,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	17.50	$ 3,600,000.00		$ 63,000,000.00	$ 18,900,000.00	$ 81,900,000.00	
60.04		Traction power control	corridor mile	17.50	$ 19,000.00		$ 332,500.00	$ 99,750.00	$ 432,250.00	
Construction Subtotal (Categories 10-60)							$ 834,741,846.00	$ 250,422,553.80	$ 1,085,164,399.80	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 130,219,727.98	$ -	$ 130,219,727.98	
80.01		Service Development Plan/Service Environmental				$ 10,851,644.00	$ 10,851,644.00	$ -	$ 10,851,644.00	
80.02		Preliminary Engineering/Project Environmental				$ 21,703,288.00	$ 21,703,288.00	$ -	$ 21,703,288.00	
80.03		Final design				$ 21,703,288.00	$ 21,703,288.00	$ -	$ 21,703,288.00	
80.04		Project management for design and construction				$ 21,703,288.00	$ 21,703,288.00	$ -	$ 21,703,288.00	
80.05		Construction administration & management				$ 32,554,931.99	$ 32,554,931.99	$ -	$ 32,554,931.99	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 10,851,644.00	$ 10,851,644.00	$ -	$ 10,851,644.00	
80.09		Engineering inspection				$ 10,851,644.00	$ 10,851,644.00	$ -	$ 10,851,644.00	
80.10		Start up								
Subtotal (Categories 10-80)							$ 964,961,573.98	$ 250,422,553.80	$ 1,215,384,127.78	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,215,384,128	
TOTAL CAPITAL COST/MILE									$ 69,450,522	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 4: NC/SC Border to SC/GA Border
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 4,963,925,844.00	$ 1,489,177,753.20	$ 6,453,103,597.20	
10.01		Track structure: Viaduct	corridor mile	88.00	$ 50,000,000.00		$ 4,400,000,000.00	$ 1,320,000,000.00	$ 5,720,000,000.00	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 15,241,141.50	$ 15,241,141.50	$ 4,572,342.45	$ 19,813,483.95	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 127,381,502.50	$ 127,381,502.50	$ 38,214,450.75	$ 165,595,953.25	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	107.50	$ 960,960.00		$ 103,303,200.00	$ 30,990,960.00	$ 134,294,160.00	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	107.50	$ 2,323,200.00		$ 249,744,000.00	$ 74,923,200.00	$ 324,667,200.00	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	track mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	72	$ 475,000.00		$ 34,200,000.00	$ 10,260,000.00	$ 44,460,000.00	
10.15		Track: Major interlockings	each	18	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	107.50	$ 316,800.00		$ 34,056,000.00	$ 10,216,800.00	$ 44,272,800.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 150,000,000.00	$ 45,000,000.00	$ 195,000,000.00	
20.01		Station buildings: Intercity passenger rail only	each	4	$ 37,500,000		$ 150,000,000	$ 45,000,000	$ 195,000,000	Anderson, Greenville, GSP, Spartenburg
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 39,192,317.00	$ 11,757,695.10	$ 50,950,012.10	
40.01		Demolition, clearing, site preparation	lump sum			$ 32,849,817.00	$ 32,849,817.00	$ 9,854,945.10	$ 42,704,762.10	
40.02		Site utilities, utility relocation	corridor mile	107.50	$ 59,000.00		$ 6,342,500.00	$ 1,902,750.00	$ 8,245,250.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 270,751,250.00	$ 81,225,375.00	$ 351,976,625.00	
50.01		Wayside signaling equipment	track mile	215	$ 970,000.00		$ 208,550,000.00	$ 62,565,000.00	$ 271,115,000.00	
50.02		Signal power access and distribution	track mile	215	$ 5,500.00		$ 1,182,500.00	$ 354,750.00	$ 1,537,250.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	107.5	$ 555,000.00		$ 59,662,500.00	$ 17,898,750.00	$ 77,561,250.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	107.5	$ 7,500.00		$ 806,250.00	$ 241,875.00	$ 1,048,125.00	
50.08		Station train approach warning system	each	4	$ 137,500.00		$ 550,000.00	$ 165,000.00	$ 715,000.00	
Total for Category 60: ELECTRIC TRACTION							$ 589,035,500.00	$ 176,710,650.00	$ 765,746,150.00	
60.01		Traction power transmission: High voltage	corridor mile	107.5	$ 60,400.00		$ 6,493,000.00	$ 1,947,900.00	$ 8,440,900.00	
60.02		Traction power supply: Substations	corridor mile	107.5	$ 1,800,000.00		$ 193,500,000.00	$ 58,050,000.00	$ 251,550,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	107.5	$ 3,600,000.00		$ 387,000,000.00	$ 116,100,000.00	$ 503,100,000.00	
60.04		Traction power control	corridor mile	107.5	$ 19,000.00		$ 2,042,500.00	$ 612,750.00	$ 2,655,250.00	
Construction Subtotal (Categories 10-60)							$6,012,904,911.00	$ 1,803,871,473.30	$ 7,816,776,384.30	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each		$ 43,450,000.00		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each		$ 79,290,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 938,013,166.12	$ -	$ 938,013,166.12	
80.01		Service Development Plan/Service Environmental				$ 78,167,763.84	$ 78,167,763.84	$ -	$ 78,167,763.84	
80.02		Preliminary Engineering/Project Environmental				$ 156,335,527.69	$ 156,335,527.69	$ -	$ 156,335,527.69	
80.03		Final design				$ 156,335,527.69	$ 156,335,527.69	$ -	$ 156,335,527.69	
80.04		Project management for design and construction				$ 156,335,527.69	$ 156,335,527.69	$ -	$ 156,335,527.69	
80.05		Construction administration & management				$ 234,503,291.53	$ 234,503,291.53	$ -	$ 234,503,291.53	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 78,167,763.84	$ 78,167,763.84	$ -	$ 78,167,763.84	
80.09		Engineering inspection				$ 78,167,763.84	$ 78,167,763.84	$ -	$ 78,167,763.84	
80.10		Start up								
Subtotal (Categories 10-80)							$ 6,950,918,077.12	$ 1,803,871,473.30	$ 8,754,789,550.42	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 8,754,789,550	
TOTAL CAPITAL COST/MILE									$ 49,819,932	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 5A: SC/GA Border to I-85 Atlanta NS/CSX Approach
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 374,294,445	$ 112,288,334	$ 486,582,779	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 39,480,000.00	$ 39,480,000	$ 11,844,000	$ 51,324,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 39,935,007.70	$ 39,935,008	$ 11,980,502	$ 51,915,510	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 66,725,197.50	$ 66,725,198	$ 20,017,559	$ 86,742,757	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	56.50	$ 960,960.00		$ 54,294,240.00	$ 16,288,272.00	$ 70,582,512.00	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	56.50	$ 2,323,200.00		$ 131,260,800	$ 39,378,240	$ 170,639,040	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	52	$ 475,000.00		$ 24,700,000	$ 7,410,000	$ 32,110,000	
10.15		Track: Major interlockings	each	13	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	56.50	$ 316,800.00		$ 17,899,200	$ 5,369,760	$ 23,268,960	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 37,500,000	$ 11,250,000	$ 48,750,000	
20.01		Station buildings: Intercity passenger rail only	each	1	$ 37,500,000		$ 37,500,000	$ 11,250,000	$ 48,750,000	Commerce
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 18,896,681	$ 5,669,004	$ 24,565,685	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,358,181.00	$ 1,358,181	$ 407,454	$ 1,765,635	
40.02		Site utilities, utility relocation	corridor mile	56.50	$ 59,000.00		$ 3,333,500	$ 1,000,050	$ 4,333,550	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	166						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 14,205,000.00	$ 14,205,000	$ 4,261,500	$ 18,466,500	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 142,150,250	$ 42,645,075	$ 184,795,325	
50.01		Wayside signaling equipment	track mile	113	$ 970,000.00		$ 109,610,000	$ 32,883,000	$ 142,493,000	
50.02		Signal power access and distribution	track mile	113	$ 5,500.00		$ 621,500	$ 186,450	$ 807,950	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	56.5	$ 555,000.00		$ 31,357,500	$ 9,407,250	$ 40,764,750	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	56.5	$ 7,500.00		$ 423,750	$ 127,125	$ 550,875	
50.08		Station train approach warning system	each	1	$ 137,500.00		$ 137,500	$ 41,250	$ 178,750	
Total for Category 60: ELECTRIC TRACTION							$ 309,586,100	$ 92,875,830	$ 402,461,930	
60.01		Traction power transmission: High voltage	corridor mile	56.5	$ 60,400.00		$ 3,412,600	$ 1,023,780	$ 4,436,380	
60.02		Traction power supply: Substations	corridor mile	56.5	$ 1,800,000.00		$ 101,700,000	$ 30,510,000	$ 132,210,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	56.5	$ 3,600,000.00		$ 203,400,000	$ 61,020,000	$ 264,420,000	
60.04		Traction power control	corridor mile	56.5	$ 19,000.00		$ 1,073,500	$ 322,050	$ 1,395,550	
Construction Subtotal (Categories 10-60)							$ 882,427,476	$ 264,728,243	$ 1,147,155,719	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 137,658,686	$ -	$ 137,658,686	
80.01		Service Development Plan/Service Environmental				$ 11,471,557.19	$ 11,471,557	$ -	$ 11,471,557	
80.02		Preliminary Engineering/Project Environmental				$ 22,943,114.38	$ 22,943,114	$ -	$ 22,943,114	
80.03		Final design				$ 22,943,114.38	$ 22,943,114	$ -	$ 22,943,114	
80.04		Project management for design and construction				$ 22,943,114.38	$ 22,943,114	$ -	$ 22,943,114	
80.05		Construction administration & management				$ 34,414,671.57	$ 34,414,672	$ -	$ 34,414,672	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 11,471,557.19	$ 11,471,557	$ -	$ 11,471,557	
80.09		Engineering inspection				$ 11,471,557.19	$ 11,471,557	$ -	$ 11,471,557	
80.10		Start up								
Subtotal (Categories 10-80)							$ 1,020,086,162	$ 264,728,243	$ 1,284,814,405	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,284,814,405	
TOTAL CAPITAL COST/MILE									$ 22,740,078	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 5B: I-85 Atlanta NS/CSX Approach to Greenfield Connection
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 25,802,556	$ 7,740,767	$ 33,543,323	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 3,360,480.10	$ 3,360,480	$ 1,008,144	$ 4,368,624	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 5,057,948.10	$ 5,057,948	$ 1,517,384	$ 6,575,333	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	4.30	$ 960,960.00		$ 4,132,128.00	$ 1,239,638.40	$ 5,371,766.40	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	4.30	$ 2,323,200.00		$ 9,989,760	$ 2,996,928	$ 12,986,688	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4	$ 475,000.00		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	4.30	$ 316,800.00		$ 1,362,240	$ 408,672	$ 1,770,912	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 1,611,881	$ 483,564	$ 2,095,445	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,358,181.00	$ 1,358,181	$ 407,454	$ 1,765,635	
40.02		Site utilities, utility relocation	corridor mile	4.30	$ 59,000.00		$ 253,700	$ 76,110	$ 329,810	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum				$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 10,808,050	$ 3,242,415	$ 14,050,465	
50.01		Wayside signaling equipment	track mile	8.6	$ 970,000.00		$ 8,342,000	$ 2,502,600	$ 10,844,600	
50.02		Signal power access and distribution	track mile	8.6	$ 5,500.00		$ 47,300	$ 14,190	$ 61,490	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	4.3	$ 555,000.00		$ 2,386,500	$ 715,950	$ 3,102,450	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	4.3	$ 7,500.00		$ 32,250	$ 9,675	$ 41,925	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 23,561,420	$ 7,068,426	$ 30,629,846	
60.01		Traction power transmission: High voltage	corridor mile	4.3	$ 60,400.00		$ 259,720	$ 77,916	$ 337,636	
60.02		Traction power supply: Substations	corridor mile	4.3	$ 1,800,000.00		$ 7,740,000	$ 2,322,000	$ 10,062,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	4.3	$ 3,600,000.00		$ 15,480,000	$ 4,644,000	$ 20,124,000	
60.04		Traction power control	corridor mile	4.3	$ 19,000.00		$ 81,700	$ 24,510	$ 106,210	
Construction Subtotal (Categories 10-60)							$ 61,783,907	$ 18,535,172	$ 80,319,079	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 9,638,290	$ -	$ 9,638,290	
80.01		Service Development Plan/Service Environmental				$ 803,190.79	$ 803,191	$ -	$ 803,191	
80.02		Preliminary Engineering/Project Environmental				$ 1,606,381.59	$ 1,606,382	$ -	$ 1,606,382	
80.03		Final design				$ 1,606,381.59	$ 1,606,382	$ -	$ 1,606,382	
80.04		Project management for design and construction				$ 1,606,381.59	$ 1,606,382	$ -	$ 1,606,382	
80.05		Construction administration & management				$ 2,409,572.38	$ 2,409,572	$ -	$ 2,409,572	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 803,190.79	$ 803,191	$ -	$ 803,191	
80.09		Engineering inspection				$ 803,190.79	$ 803,191	$ -	$ 803,191	
80.10		Start up								
Subtotal (Categories 10-80)							$ 71,422,197	$ 18,535,172	$ 89,957,369	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 89,957,369	
TOTAL CAPITAL COST/MILE									$ 20,920,318	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 6: Greenfield Connection to NS Atlanta Approach
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 174,611,025	$ 52,383,308	$ 226,994,333	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 93,070,000.00	$ 93,070,000	$ 27,921,000	$ 120,991,000	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 4,376,439.20	$ 4,376,439	$ 1,312,932	$ 5,689,371	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 22,031,914.00	$ 22,031,914	$ 6,609,574	$ 28,641,488	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	13.20	$ 960,960.00		$ 12,684,672.00	$ 3,805,401.60	$ 16,490,073.60	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	13.20	$ 2,323,200.00		$ 30,666,240	$ 9,199,872	$ 39,866,112	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	16	$ 475,000.00		$ 7,600,000	$ 2,280,000	$ 9,880,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	13.20	$ 316,800.00		$ 4,181,760	$ 1,254,528	$ 5,436,288	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 9,076,773	$ 2,723,032	$ 11,799,805	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,911,514.00	$ 1,911,514	$ 573,454	$ 2,484,968	
40.02		Site utilities, utility relocation	corridor mile	13.20	$ 59,000.00		$ 778,800	$ 233,640	$ 1,012,440	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 6,386,459.00	$ 6,386,459	$ 1,915,938	$ 8,302,397	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	46			$ -	$ -	$ -	100' corridor width
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 33,178,200	$ 9,953,460	$ 43,131,660	
50.01		Wayside signaling equipment	track mile	26.4	$ 970,000.00		$ 25,608,000	$ 7,682,400	$ 33,290,400	
50.02		Signal power access and distribution	track mile	26.4	$ 5,500.00		$ 145,200	$ 43,560	$ 188,760	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	13.2	$ 555,000.00		$ 7,326,000	$ 2,197,800	$ 9,523,800	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	13.2	$ 7,500.00		$ 99,000	$ 29,700	$ 128,700	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 72,328,080	$ 21,698,424	$ 94,026,504	
60.01		Traction power transmission: High voltage	corridor mile	13.2	$ 60,400.00		$ 797,280	$ 239,184	$ 1,036,464	
60.02		Traction power supply: Substations	corridor mile	13.2	$ 1,800,000.00		$ 23,760,000	$ 7,128,000	$ 30,888,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	13.2	$ 3,600,000.00		$ 47,520,000	$ 14,256,000	$ 61,776,000	
60.04		Traction power control	corridor mile	13.2	$ 19,000.00		$ 250,800	$ 75,240	$ 326,040	
Construction Subtotal (Categories 10-60)							$ 289,194,078	$ 86,758,223	$ 375,952,302	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 45,114,276	$ -	$ 45,114,276	
80.01		Service Development Plan/Service Environmental				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.02		Preliminary Engineering/Project Environmental				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.03		Final design				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.04		Project management for design and construction				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.05		Construction administration & management				$ 11,278,569.05	$ 11,278,569	$ -	$ 11,278,569	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.09		Engineering inspection				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.10		Start up								
Subtotal (Categories 10-80)							$ 334,308,354	$ 86,758,223	$ 421,066,578	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 421,066,578	
TOTAL CAPITAL COST/MILE									$ 31,898,983	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 7: Atlanta NS Approach to Howell Junction
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 397,169,999.20	$ 119,150,999.76	$ 516,320,998.96	
10.01		Track structure: Viaduct	corridor mile	0.81	$ 50,000,000.00		$ 40,500,000.00	$ 12,150,000.00	$ 52,650,000.00	
10.02		Track structure: Major/Movable bridge	lump sum			$ 155,361,000.00	$ 155,361,000.00	$ 46,608,300.00	$ 201,969,300.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 29,399,519.20	$ 29,399,519.20	$ 8,819,855.76	$ 38,219,374.96	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	29.60	$ 960,960.00		$ 28,444,416.00	$ 8,533,324.80	$ 36,977,740.80	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	29.60	$ 2,323,200.00		$ 68,766,720.00	$ 20,630,016.00	$ 89,396,736.00	
	10.09.02	136lb CWR on Wood Ties	track mile	47.66	$ 950,400.00		$ 45,296,064.00	$ 13,588,819.20	$ 58,884,883.20	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28	$ 150,000.00		$ 4,200,000.00	$ 1,260,000.00	$ 5,460,000.00	
	10.14.02	Turnout; No. 15	each	5	$ 175,000.00		$ 875,000.00	$ 262,500.00	$ 1,137,500.00	
	10.14.03	Turnout; No. 20	each	13	$ 200,000.00		$ 2,600,000.00	$ 780,000.00	$ 3,380,000.00	
	10.14.04	Turnout; No. 24	each	26	$ 475,000.00		$ 12,350,000.00	$ 3,705,000.00	$ 16,055,000.00	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	29.60	$ 316,800.00		$ 9,377,280.00	$ 2,813,184.00	$ 12,190,464.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 75,000,000.00	$ 22,500,000.00	$ 97,500,000.00	
20.01		Station buildings: Intercity passenger rail only	each	2	$ 37,500,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	Doraville, Suwanee
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 9,870,000.00	$ 2,961,000.00	$ 12,831,000.00	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000.00	$ 9,870,000.00	$ 2,961,000.00	$ 12,831,000.00	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 80,165,595.82	$ 24,049,678.75	$ 104,215,274.57	
40.01		Demolition, clearing, site preparation	lump sum			$ 3,722,436.80	$ 3,722,436.80	$ 1,116,731.04	$ 4,839,167.84	
40.02		Site utilities, utility relocation	corridor mile	29.6	$ 59,000.00		$ 1,746,400.00	$ 523,920.00	$ 2,270,320.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 46,215,759.02	$ 46,215,759.02	$ 13,864,727.71	$ 60,080,486.73	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	36						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 28,481,000.00	$ 28,481,000.00	$ 8,544,300.00	$ 37,025,300.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 82,424,600.00	$ 24,727,380.00	$ 107,151,980.00	
50.01		Wayside signaling equipment	track mile	59.2	$ 970,000.00		$ 57,424,000.00	$ 17,227,200.00	$ 74,651,200.00	
50.02		Signal power access and distribution	track mile	59.2	$ 5,500.00		$ 325,600.00	$ 97,680.00	$ 423,280.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	29.6	$ 555,000.00		$ 16,428,000.00	$ 4,928,400.00	$ 21,356,400.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	15	$ 500,000.00		$ 7,500,000.00	$ 2,250,000.00	$ 9,750,000.00	
	50.06.02	Private At-Grade	each	1	$ 250,000.00		$ 250,000.00	$ 75,000.00	$ 325,000.00	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	29.6	$ 7,500.00		$ 222,000.00	$ 66,600.00	$ 288,600.00	
50.08		Station train approach warning system	each	2	$ 137,500.00		$ 275,000.00	$ 82,500.00	$ 357,500.00	
Total for Category 60: ELECTRIC TRACTION							$ 162,190,240.00	$ 48,657,072.00	$ 210,847,312.00	
60.01		Traction power transmission: High voltage	corridor mile	29.6	$ 60,400.00		$ 1,787,840.00	$ 536,352.00	$ 2,324,192.00	
60.02		Traction power supply: Substations	corridor mile	29.6	$ 1,800,000.00		$ 53,280,000.00	$ 15,984,000.00	$ 69,264,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	29.6	$ 3,600,000.00		$ 106,560,000.00	$ 31,968,000.00	$ 138,528,000.00	
60.04		Traction power control	corridor mile	29.6	$ 19,000.00		$ 562,400.00	$ 168,720.00	$ 731,120.00	
Construction Subtotal (Categories 10-60)							$ 806,820,435.02	$ 242,046,130.51	$1,048,866,565.53	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 125,863,987.86	$ -	$ 125,863,987.86	
80.01		Service Development Plan/Service Environmental				$ 10,488,665.66	$ 10,488,665.66	$ -	$ 10,488,665.66	
80.02		Preliminary Engineering/Project Environmental				$ 20,977,331.31	$ 20,977,331.31	$ -	$ 20,977,331.31	
80.03		Final design				$ 20,977,331.31	$ 20,977,331.31	$ -	$ 20,977,331.31	
80.04		Project management for design and construction				$ 20,977,331.31	$ 20,977,331.31	$ -	$ 20,977,331.31	
80.05		Construction administration & management				$ 31,465,996.97	$ 31,465,996.97	$ -	$ 31,465,996.97	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 10,488,665.66	$ 10,488,665.66	$ -	$ 10,488,665.66	
80.09		Engineering inspection				$ 10,488,665.66	$ 10,488,665.66	$ -	$ 10,488,665.66	
80.10		Start up								
Subtotal (Categories 10-80)							$ 932,684,422.88	$ 242,046,130.51	$ 1,174,730,553.39	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,174,730,553	
TOTAL CAPITAL COST/MILE									$ 39,686,843	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 8: Howell Junction to Altlanta MMPT
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 26,129,907.00	$ 7,838,972.10	$ 33,968,879.10	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 5,376,000.00	$ 5,376,000.00	$ 1,612,800.00	$ 6,988,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,909,489.40	$ 1,909,489.40	$ 572,846.82	$ 2,482,336.22	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.87	$ 960,960.00		$ 836,035.20	$ 250,810.56	$ 1,086,845.76	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	2.60	$ 2,323,200.00		$ 6,040,320.00	$ 1,812,096.00	$ 7,852,416.00	
	10.09.02	136lb CWR on Wood Ties	track mile	3.47	$ 950,400.00		$ 3,297,888.00	$ 989,366.40	$ 4,287,254.40	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	4	$ 175,000.00		$ 700,000.00	$ 210,000.00	$ 910,000.00	
	10.14.03	Turnout; No. 20	each	6	$ 200,000.00		$ 1,200,000.00	$ 360,000.00	$ 1,560,000.00	
	10.14.04	Turnout; No. 24	each		$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	2.60	$ 316,800.00		$ 823,680.00	$ 247,104.00	$ 1,070,784.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	MMPT No Cost
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 40,445,991.96	$ 12,133,797.59	$ 52,579,789.55	
40.01		Demolition, clearing, site preparation	lump sum			$ 109,409.46	$ 109,409.46	$ 32,822.84	$ 142,232.30	
40.02		Site utilities, utility relocation	corridor mile	2.60	$ 59,000.00		$ 153,400.00	$ 46,020.00	$ 199,420.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 21,818,182.50	$ 21,818,182.50	$ 6,545,454.75	$ 28,363,637.25	
	40.07.01	Railroad Owned - Urban	acre	13						
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	1						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 18,365,000.00	$ 18,365,000.00	$ 5,509,500.00	$ 23,874,500.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 6,535,100.00	$ 1,960,530.00	$ 8,495,630.00	
50.01		Wayside signaling equipment	track mile	5.20	$ 970,000.00		$ 5,044,000.00	$ 1,513,200.00	$ 6,557,200.00	
50.02		Signal power access and distribution	track mile	5.20	$ 5,500.00		$ 28,600.00	$ 8,580.00	$ 37,180.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	2.60	$ 555,000.00		$ 1,443,000.00	$ 432,900.00	$ 1,875,900.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	2.60	$ 7,500.00		$ 19,500.00	$ 5,850.00	$ 25,350.00	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 14,246,440.00	$ 4,273,932.00	$ 18,520,372.00	
60.01		Traction power transmission: High voltage	corridor mile	2.60	$ 60,400.00		$ 157,040.00	$ 47,112.00	$ 204,152.00	
60.02		Traction power supply: Substations	corridor mile	2.60	$ 1,800,000.00		$ 4,680,000.00	$ 1,404,000.00	$ 6,084,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	2.60	$ 3,600,000.00		$ 9,360,000.00	$ 2,808,000.00	$ 12,168,000.00	
60.04		Traction power control	corridor mile	2.60	$ 19,000.00		$ 49,400.00	$ 14,820.00	$ 64,220.00	
Construction Subtotal (Categories 10-60)							$ 87,357,438.96	$ 26,207,231.69	$ 113,564,670.65	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 13,627,760.48	$ -	$ 13,627,760.48	
80.01		Service Development Plan/Service Environmental				$ 1,135,646.71	$ 1,135,646.71	$ -	$ 1,135,646.71	
80.02		Preliminary Engineering/Project Environmental				$ 2,271,293.41	$ 2,271,293.41	$ -	$ 2,271,293.41	
80.03		Final design				$ 2,271,293.41	$ 2,271,293.41	$ -	$ 2,271,293.41	
80.04		Project management for design and construction				$ 2,271,293.41	$ 2,271,293.41	$ -	$ 2,271,293.41	
80.05		Construction administration & management				$ 3,406,940.12	$ 3,406,940.12	$ -	$ 3,406,940.12	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,135,646.71	$ 1,135,646.71	$ -	$ 1,135,646.71	
80.09		Engineering inspection				$ 1,135,646.71	$ 1,135,646.71	$ -	$ 1,135,646.71	
80.10		Start up								
Subtotal (Categories 10-80)							$ 100,985,199.44	$ 26,207,231.69	$ 127,192,431.13	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 127,192,431**	
TOTAL CAPITAL COST/MILE									**$ 49,819,932**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 130MPH Dedicated Service
Segment	Segment 9: Atlanta MMPT to Hartsfield Airport Station
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 71,208,900.00	$ 21,362,670.00	$ 92,571,570.00	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 40,896,000.00	$ 40,896,000.00	$ 12,268,800.00	$ 53,164,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ -	$ -	$ -	$ -	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	9.50	$ 715,000.00		$ 6,792,500.00	$ 2,037,750.00	$ 8,830,250.00	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.00	$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	9.50	$ 2,323,200.00		$ 22,070,400.00	$ 6,621,120.00	$ 28,691,520.00	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	6	$ 175,000.00		$ 1,050,000.00	$ 315,000.00	$ 1,365,000.00	
	10.14.03	Turnout; No. 20	each	2	$ 200,000.00		$ 400,000.00	$ 120,000.00	$ 520,000.00	
	10.14.04	Turnout; No. 24	each	0	$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 60,000,000.00	$ 18,000,000.00	$ 78,000,000.00	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each	1	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	Hartsfield Airport
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000.00	$ 40,200,000.00	$ 174,200,000.00	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000.00	$ 40,200,000.00	$ 174,200,000.00	
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 184,802,920.50	$ 55,440,876.15	$ 240,243,796.65	
40.01		Demolition, clearing, site preparation	lump sum				$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.5	$ 59,000.00		$ 560,500.00	$ 168,150.00	$ 728,650.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 184,242,420.50	$ 184,242,420.50	$ 55,272,726.15	$ 239,515,146.65	
	40.07.01	Railroad Owned - Urban	acre	57.5			$ -	$ -	$ -	50' width
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 27,878,250.00	$ 8,363,475.00	$ 36,241,725.00	
50.01		Wayside signaling equipment	track mile	19	$ 970,000.00		$ 18,430,000.00	$ 5,529,000.00	$ 23,959,000.00	
50.02		Signal power access and distribution	track mile	19	$ 5,500.00		$ 104,500.00	$ 31,350.00	$ 135,850.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.5	$ 555,000.00		$ 5,272,500.00	$ 1,581,750.00	$ 6,854,250.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	8	$ 500,000.00		$ 4,000,000.00	$ 1,200,000.00	$ 5,200,000.00	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.5	$ 7,500.00		$ 71,250.00	$ 21,375.00	$ 92,625.00	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 52,054,300.00	$ 15,616,290.00	$ 67,670,590.00	
60.01		Traction power transmission: High voltage	corridor mile	9.5	$ 60,400.00		$ 573,800.00	$ 172,140.00	$ 745,940.00	
60.02		Traction power supply: Substations	corridor mile	9.5	$ 1,800,000.00		$ 17,100,000.00	$ 5,130,000.00	$ 22,230,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.5	$ 3,600,000.00		$ 34,200,000.00	$ 10,260,000.00	$ 44,460,000.00	
60.04		Traction power control	corridor mile	9.5	$ 19,000.00		$ 180,500.00	$ 54,150.00	$ 234,650.00	
Construction Subtotal (Categories 10-60)							$ 529,944,370.50	$ 158,983,311.15	$ 688,927,681.65	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 82,671,321.80	$ -	$ 82,671,321.80	
80.01		Service Development Plan/Service Environmental				$ 6,889,276.82	$ 6,889,276.82	$ -	$ 6,889,276.82	
80.02		Preliminary Engineering/Project Environmental				$ 13,778,553.63	$ 13,778,553.63	$ -	$ 13,778,553.63	
80.03		Final design				$ 13,778,553.63	$ 13,778,553.63	$ -	$ 13,778,553.63	
80.04		Project management for design and construction				$ 13,778,553.63	$ 13,778,553.63	$ -	$ 13,778,553.63	
80.05		Construction administration & management				$ 20,667,830.45	$ 20,667,830.45	$ -	$ 20,667,830.45	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 6,889,276.82	$ 6,889,276.82	$ -	$ 6,889,276.82	
80.09		Engineering inspection				$ 6,889,276.82	$ 6,889,276.82	$ -	$ 6,889,276.82	
80.10		Start up								
Subtotal (Categories 10-80)							$ 612,615,692.30	$ 158,983,311.15	$ 771,599,003.45	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 771,599,003	
TOTAL CAPITAL COST/MILE									$ 49,819,932	

ALTERNATIVE 2: I-85 (220 MPH)

Project Name	GDOT Atlanta to Charlotte Passenger Rail Corridor Investment Plan
Corridor Name	Atlanta - Charlotte via Interstate 85 and NS Atlanta Approach
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 6,964,287,854	$ 2,089,286,356	$ 9,053,574,210	
10.01		Track structure: Viaduct	corridor mile	98.31	$ 50,000,000.00		$ 4,915,500,000	$ 1,474,650,000	$ 6,390,150,000	
10.02		Track structure: Major/Movable bridge	lump sum			$ 514,934,000.00	$ 514,934,000	$ 154,480,200	$ 669,414,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 69,166,628.50	$ 69,166,629	$ 20,749,989	$ 89,916,617	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 299,171,286.99	$ 299,171,287	$ 89,751,386	$ 388,922,673	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	9.50	$ 715,000.00		$ 6,792,500	$ 2,037,750	$ 8,830,250	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	254.43	$ 960,960.00		$ 244,492,248.00	$ 73,347,674.40	$ 317,839,922.40	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	274.21	$ 2,323,200.00		$ 637,033,056	$ 191,109,917	$ 828,142,973	
	10.09.02	136lb CWR on Wood Ties	track mile	87.47	$ 950,400.00		$ 83,126,736	$ 24,938,021	$ 108,064,757	
10.10		Track new construction: Non-ballasted	corridor mile	0.00	$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28.00	$ 150,000.00		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.02	Turnout; No. 15	each	15.00	$ 175,000.00		$ 2,625,000	$ 787,500	$ 3,412,500	
	10.14.03	Turnout; No. 20	each	21.00	$ 200,000.00		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.04	Turnout; No. 24	each	202.00	$ 475,000.00		$ 95,950,000	$ 28,785,000	$ 124,735,000	
10.15		Track: Major interlockings	each	39.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	0.00	$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	256.16	$ 316,800.00		$ 81,149,904	$ 24,344,971	$ 105,494,875	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 410,000,000	$ 123,000,000	$ 533,000,000	
20.01		Station buildings: Intercity passenger rail only	each	8.00	$ 37,500,000		$ 300,000,000	$ 90,000,000	$ 390,000,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each	1.00	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	
	20.02.02	Hartsfield Airport	each	1.00	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	
20.03		Platforms	linear feet	0.00	$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 143,870,000	$ 43,161,000	$ 187,031,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000.00	$ 9,870,000	$ 2,961,000	$ 12,831,000	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 498,817,146	$ 149,645,144	$ 648,462,289	
40.01		Demolition, clearing, site preparation	lump sum			$ 55,403,829.65	$ 55,403,830	$ 16,621,149	$ 72,024,979	
40.02		Site utilities, utility relocation	corridor mile	265.66	$ 59,000.00		$ 15,673,645	$ 4,702,094	$ 20,375,739	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 302,187,670.87	$ 302,187,671	$ 90,656,301	$ 392,843,972	
	40.07.01	Railroad Owned - Urban	acre	70.50						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	274.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 125,552,000.00	$ 125,552,000	$ 37,665,600	$ 163,217,600	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre	0.00						
	40.09.02	Relocation - Rural	acre	0.00						
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 690,073,843	$ 207,022,153	$ 897,095,995	
50.01		Wayside signaling equipment	track mile	531.31	$ 970,000.00		$ 515,370,700	$ 154,611,210	$ 669,981,910	
50.02		Signal power access and distribution	track mile	531.31	$ 5,500.00		$ 2,922,205	$ 876,662	$ 3,798,867	
50.03		On-board signaling equipment	each	0.00	$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	265.66	$ 555,000.00		$ 147,438,525	$ 44,231,558	$ 191,670,083	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	42.00	$ 500,000.00		$ 21,000,000	$ 6,300,000	$ 27,300,000	
	50.06.02	Private At-Grade	each	1.00	$ 250,000.00		$ 250,000	$ 75,000	$ 325,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	265.66	$ 7,500.00		$ 1,992,413	$ 597,724	$ 2,590,136	
50.08		Station train approach warning system	each	8.00	$ 137,500.00		$ 1,100,000	$ 330,000	$ 1,430,000	
Total for Category 60: ELECTRIC TRACTION							$ 1,455,630,007	$ 436,689,002	$ 1,892,319,009	
60.01		Traction power transmission: High voltage	corridor mile	265.66	$ 60,400.00		$ 16,045,562	$ 4,813,669	$ 20,859,231	
60.02		Traction power supply: Substations	corridor mile	265.66	$ 1,800,000.00		$ 478,179,000	$ 143,453,700	$ 621,632,700	
60.03		Traction power distribution: Catenary and third rail	corridor mile	265.66	$ 3,600,000.00		$ 956,358,000	$ 286,907,400	$ 1,243,265,400	
60.04		Traction power control	corridor mile	265.66	$ 19,000.00		$ 5,047,445	$ 1,514,234	$ 6,561,679	
Construction Subtotal (Categories 10-60)							$ 10,162,678,849	$ 3,048,803,655	$ 13,211,482,504	
Total for Category 70: VEHICLES							$ 423,800,000	$ 127,140,000	$ 550,940,000	
70.00		Vehicle acquisition: Electric locomotive	each	13.00	$ 8,000,000.00		$ 104,000,000	$ 31,200,000	$ 135,200,000	
70.01		Vehicle acquisition: Non-electric locomotive	each		$ 4,200,000.00		$ -	$ -	$ -	
70.02		Vehicle acquisition: Electric multiple unit								
70.03		Vehicle acquisition: Diesel multiple unit								
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	78.00	$ 4,100,000.00		$ 319,800,000	$ 95,940,000	$ 415,740,000	
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts								
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 1,585,377,900	$ -	$ 1,585,377,900	
80.01		Service Development Plan/Service Environmental				$ 132,114,825.04	$ 132,114,825	$ -	$ 132,114,825	
80.02		Preliminary Engineering/Project Environmental				$ 264,229,650.07	$ 264,229,650	$ -	$ 264,229,650	
80.03		Final design				$ 264,229,650.07	$ 264,229,650	$ -	$ 264,229,650	
80.04		Project management for design and construction				$ 264,229,650.07	$ 264,229,650	$ -	$ 264,229,650	
80.05		Construction administration & management				$ 396,344,475.11	$ 396,344,475	$ -	$ 396,344,475	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 132,114,825.04	$ 132,114,825	$ -	$ 132,114,825	
80.09		Engineering inspection				$ 132,114,825.04	$ 132,114,825	$ -	$ 132,114,825	
80.10		Start up								
Subtotal (Categories 10-80)							$ 12,171,856,749	$ 3,175,943,655	$ 15,347,800,404	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 15,347,800,404**	
TOTAL CAPITAL COST/MILE									**$ 57,772,342**	

Project Name	GDOT Atlanta to Charlotte Passenger Rail Investment Plan
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 1: Charlotte Gateway Station to Greenfield NS Connection
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 139,368,927	$ 41,810,678	$ 181,179,605	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 61,230,000	$ 61,230,000	$ 18,369,000	$ 79,599,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 9,758,455	$ 9,758,455	$ 2,927,537	$ 12,685,992	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	9.83	$ 960,960.00		$ 9,441,432.00	$ 2,832,429.60	$ 12,273,861.60	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	18.38	$ 2,323,200.00		$ 42,688,800	$ 12,806,640	$ 55,495,440	
	10.09.02	136lb CWR on Wood Ties	track mile	9.83	$ 950,400.00		$ 9,337,680	$ 2,801,304	$ 12,138,984	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	8	$ 475,000		$ 3,800,000	$ 1,140,000	$ 4,940,000	
10.15		Track: Major interlockings	each	2	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	9.83	$ 316,800.00		$ 3,112,560	$ 933,768	$ 4,046,328	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 50,000,000	$ 15,000,000	$ 65,000,000	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each	1	$ 50,000,000		$ 50,000,000	$ 15,000,000	$ 65,000,000	Charlotte Airport, No cost for Gateway Station
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 41,874,430	$ 12,562,329	$ 54,436,759	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,235,572	$ 1,235,572	$ 370,672	$ 1,606,244	
40.02		Site utilities, utility relocation	corridor mile	9.83	$ 59,000		$ 579,675	$ 173,903	$ 753,578	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 17,818,182	$ 17,818,182	$ 5,345,455	$ 23,163,637	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	11						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 22,241,000	$ 22,241,000	$ 6,672,300	$ 28,913,300	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 26,695,138	$ 8,008,541	$ 34,703,679	
50.01		Wayside signaling equipment	track mile	19.65	$ 970,000		$ 19,060,500	$ 5,718,150	$ 24,778,650	
50.02		Signal power access and distribution	track mile	19.65	$ 5,500		$ 108,075	$ 32,423	$ 140,498	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.83	$ 555,000		$ 5,452,875	$ 1,635,863	$ 7,088,738	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	4	$ 500,000		$ 2,000,000	$ 600,000	$ 2,600,000	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.83	$ 7,500		$ 73,688	$ 22,106	$ 95,794	
50.08		Station train approach warning system	each	0	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 53,835,105	$ 16,150,532	$ 69,985,637	
60.01		Traction power transmission: High voltage	corridor mile	9.83	$ 60,400		$ 593,430	$ 178,029	$ 771,459	
60.02		Traction power supply: Substations	corridor mile	9.83	$ 1,800,000		$ 17,685,000	$ 5,305,500	$ 22,990,500	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.83	$ 3,600,000		$ 35,370,000	$ 10,611,000	$ 45,981,000	
60.04		Traction power control	corridor mile	9.83	$ 19,000.00		$ 186,675	$ 56,003	$ 242,678	
Construction Subtotal (Categories 10-60)							$ 311,773,600	$ 93,532,080	$ 405,305,679	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 48,636,682	$ -	$ 48,636,682	
80.01		Service Development Plan/Service Environmental				$ 4,053,056.79	$ 4,053,057	$ -	$ 4,053,057	
80.02		Preliminary Engineering/Project Environmental				$ 8,106,113.59	$ 8,106,114	$ -	$ 8,106,114	
80.03		Final design				$ 8,106,113.59	$ 8,106,114	$ -	$ 8,106,114	
80.04		Project management for design and construction				$ 8,106,113.59	$ 8,106,114	$ -	$ 8,106,114	
80.05		Construction administration & management				$ 12,159,170.38	$ 12,159,170	$ -	$ 12,159,170	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,053,056.79	$ 4,053,057	$ -	$ 4,053,057	
80.09		Engineering inspection				$ 4,053,056.79	$ 4,053,057	$ -	$ 4,053,057	
80.10		Start up								
Subtotal (Categories 10-80)							$ 360,410,281	$ 93,532,080	$ 453,942,361	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 453,942,361**	

TOTAL CAPITAL COSTS (Categories 10-80)	**$ 453,942,361**
TOTAL CAPITAL COST/MILE	**$ 49,819,932**

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 2: Greenfield NS Connection to I-85 NS Connection
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 168,706,153.31	$ 50,611,845.99	$ 219,317,999.30	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 68,301,000.00	$ 68,301,000.00	$ 20,490,300.00	$ 88,791,300.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 15,027,524.51	$ 15,027,524.51	$ 4,508,257.35	$ 19,535,781.86	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	15.13	$ 960,960.00		$ 14,539,324.80	$ 4,361,797.44	$ 18,901,122.24	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	15.13	$ 2,323,200.00		$ 35,150,016.00	$ 10,545,004.80	$ 45,695,020.80	
	10.09.02	136lb CWR on Wood Ties	track mile	26.51	$ 950,400.00		$ 25,195,104.00	$ 7,558,531.20	$ 32,753,635.20	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	12	$ 475,000.00		$ 5,700,000.00	$ 1,710,000.00	$ 7,410,000.00	
10.15		Track: Major interlockings	each	3	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	15.13	$ 316,800.00		$ 4,793,184.00	$ 1,437,955.20	$ 6,231,139.20	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 48,592,056.01	$ 14,577,616.80	$ 63,169,672.81	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,902,718.54	$ 1,902,718.54	$ 570,815.56	$ 2,473,534.10	
40.02		Site utilities, utility relocation	corridor mile	15.13	$ 59,000.00		$ 892,670.00	$ 267,801.00	$ 1,160,471.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 25,706,667.47	$ 25,706,667.47	$ 7,712,000.24	$ 33,418,667.71	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	14						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 20,090,000.00	$ 20,090,000.00	$ 6,027,000.00	$ 26,117,000.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 45,529,255.00	$ 13,658,776.50	$ 59,188,031.50	
50.01		Wayside signaling equipment	track mile	30.26	$ 970,000.00		$ 29,352,200.00	$ 8,805,660.00	$ 38,157,860.00	
50.02		Signal power access and distribution	track mile	30.26	$ 5,500.00		$ 166,430.00	$ 49,929.00	$ 216,359.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	15.13	$ 555,000.00		$ 8,397,150.00	$ 2,519,145.00	$ 10,916,295.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	15	$ 500,000.00		$ 7,500,000.00	$ 2,250,000.00	$ 9,750,000.00	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	15.13	$ 7,500.00		$ 113,475.00	$ 34,042.50	$ 147,517.50	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 82,903,322.00	$ 24,870,996.60	$ 107,774,318.60	
60.01		Traction power transmission: High voltage	corridor mile	15.13	$ 60,400.00		$ 913,852.00	$ 274,155.60	$ 1,188,007.60	
60.02		Traction power supply: Substations	corridor mile	15.13	$ 1,800,000.00		$ 27,234,000.00	$ 8,170,200.00	$ 35,404,200.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	15.13	$ 3,600,000.00		$ 54,468,000.00	$ 16,340,400.00	$ 70,808,400.00	
60.04		Traction power control	corridor mile	15.13	$ 19,000.00		$ 287,470.00	$ 86,241.00	$ 373,711.00	
Construction Subtotal (Categories 10-60)							$ 345,730,786.32	$ 103,719,235.90	$ 449,450,022.22	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 53,934,002.67	$ -	$ 53,934,002.67	
80.01		Service Development Plan/Service Environmental				$ 4,494,500.22	$ 4,494,500.22	$ -	$ 4,494,500.22	
80.02		Preliminary Engineering/Project Environmental				$ 8,989,000.44	$ 8,989,000.44	$ -	$ 8,989,000.44	
80.03		Final design				$ 8,989,000.44	$ 8,989,000.44	$ -	$ 8,989,000.44	
80.04		Project management for design and construction				$ 8,989,000.44	$ 8,989,000.44	$ -	$ 8,989,000.44	
80.05		Construction administration & management				$ 13,483,500.67	$ 13,483,500.67	$ -	$ 13,483,500.67	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,494,500.22	$ 4,494,500.22	$ -	$ 4,494,500.22	
80.09		Engineering inspection				$ 4,494,500.22	$ 4,494,500.22	$ -	$ 4,494,500.22	
80.10		Start up								
Subtotal (Categories 10-80)							$ 399,664,788.99	$ 103,719,235.90	$ 503,384,024.88	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 503,384,025**	
TOTAL CAPITAL COST/MILE									**$ 33,270,590**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 3: I-85 NS Connection to NC/SC Border
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 623,070,096.50	$ 186,921,028.95	$ 809,991,125.45	
10.01		Track structure: Viaduct	corridor mile	9.50	$ 50,000,000.00		$ 475,000,000.00	$ 142,500,000.00	$ 617,500,000.00	
10.02		Track structure: Major/Movable bridge	lump sum			$ 51,220,000.00	$ 51,220,000.00	$ 15,366,000.00	$ 66,586,000.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 6,253,560.00	$ 6,253,560.00	$ 1,876,068.00	$ 8,129,628.00	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 21,879,736.50	$ 21,879,736.50	$ 6,563,920.95	$ 28,443,657.45	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	17.50	$ 960,960.00		$ 16,816,800.00	$ 5,045,040.00	$ 21,861,840.00	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	17.50	$ 2,323,200.00		$ 40,656,000.00	$ 12,196,800.00	$ 52,852,800.00	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	12	$ 475,000.00		$ 5,700,000.00	$ 1,710,000.00	$ 7,410,000.00	
10.15		Track: Major interlockings	each	3.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	17.50	$ 316,800.00		$ 5,544,000.00	$ 1,663,200.00	$ 7,207,200.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 37,500,000.00	$ 11,250,000.00	$ 48,750,000.00	
20.01		Station buildings: Intercity passenger rail only	each	1	$ 37,500,000		$ 37,500,000	$ 11,250,000	$ 48,750,000	Gastonia
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 34,158,499.50	$ 10,247,549.85	$ 44,406,049.35	
40.01		Demolition, clearing, site preparation	lump sum			$ 10,955,999.50	$ 10,955,999.50	$ 3,286,799.85	$ 14,242,799.35	
40.02		Site utilities, utility relocation	corridor mile	17.50	$ 59,000.00		$ 1,032,500.00	$ 309,750.00	$ 1,342,250.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ -	$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 22,170,000.00	$ 22,170,000.00	$ 6,651,000.00	$ 28,821,000.00	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 44,123,750.00	$ 13,237,125.00	$ 57,360,875.00	
50.01		Wayside signaling equipment	track mile	35.00	$ 970,000.00		$ 33,950,000.00	$ 10,185,000.00	$ 44,135,000.00	
50.02		Signal power access and distribution	track mile	35.00	$ 5,500.00		$ 192,500.00	$ 57,750.00	$ 250,250.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	17.50	$ 555,000.00		$ 9,712,500.00	$ 2,913,750.00	$ 12,626,250.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	17.50	$ 7,500.00		$ 131,250.00	$ 39,375.00	$ 170,625.00	
50.08		Station train approach warning system	each	1	$ 137,500.00		$ 137,500.00	$ 41,250.00	$ 178,750.00	
Total for Category 60: ELECTRIC TRACTION							$ 95,889,500.00	$ 28,766,850.00	$ 124,656,350.00	
60.01		Traction power transmission: High voltage	corridor mile	17.50	$ 60,400.00		$ 1,057,000.00	$ 317,100.00	$ 1,374,100.00	
60.02		Traction power supply: Substations	corridor mile	17.50	$ 1,800,000.00		$ 31,500,000.00	$ 9,450,000.00	$ 40,950,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	17.50	$ 3,600,000.00		$ 63,000,000.00	$ 18,900,000.00	$ 81,900,000.00	
60.04		Traction power control	corridor mile	17.50	$ 19,000.00		$ 332,500.00	$ 99,750.00	$ 432,250.00	
Construction Subtotal (Categories 10-60)							$ 834,741,846.00	$ 250,422,553.80	$ 1,085,164,399.80	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 130,219,727.98	$ -	$ 130,219,727.98	
80.01		Service Development Plan/Service Environmental				$ 10,851,644.00	$ 10,851,644.00	$ -	$ 10,851,644.00	
80.02		Preliminary Engineering/Project Environmental				$ 21,703,288.00	$ 21,703,288.00	$ -	$ 21,703,288.00	
80.03		Final design				$ 21,703,288.00	$ 21,703,288.00	$ -	$ 21,703,288.00	
80.04		Project management for design and construction				$ 21,703,288.00	$ 21,703,288.00	$ -	$ 21,703,288.00	
80.05		Construction administration & management				$ 32,554,931.99	$ 32,554,931.99	$ -	$ 32,554,931.99	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 10,851,644.00	$ 10,851,644.00	$ -	$ 10,851,644.00	
80.09		Engineering inspection				$ 10,851,644.00	$ 10,851,644.00	$ -	$ 10,851,644.00	
80.10		Start up								
Subtotal (Categories 10-80)							$ 964,961,573.98	$ 250,422,553.80	$ 1,215,384,127.78	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,215,384,128	
TOTAL CAPITAL COST/MILE									$ 69,450,522	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 4: NC/SC Border to SC/GA Border
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 4,963,925,844.00	$ 1,489,177,753.20	$ 6,453,103,597.20	
10.01		Track structure: Viaduct	corridor mile	88.00	$ 50,000,000.00		$ 4,400,000,000.00	$ 1,320,000,000.00	$ 5,720,000,000.00	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 15,241,141.50	$ 15,241,141.50	$ 4,572,342.45	$ 19,813,483.95	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 127,381,502.50	$ 127,381,502.50	$ 38,214,450.75	$ 165,595,953.25	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	107.50	$ 960,960.00		$ 103,303,200.00	$ 30,990,960.00	$ 134,294,160.00	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	107.50	$ 2,323,200.00		$ 249,744,000.00	$ 74,923,200.00	$ 324,667,200.00	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	track mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	72	$ 475,000.00		$ 34,200,000.00	$ 10,260,000.00	$ 44,460,000.00	
10.15		Track: Major interlockings	each	18	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	107.50	$ 316,800.00		$ 34,056,000.00	$ 10,216,800.00	$ 44,272,800.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 150,000,000.00	$ 45,000,000.00	$ 195,000,000.00	
20.01		Station buildings: Intercity passenger rail only	each	4	$ 37,500,000		$ 150,000,000	$ 45,000,000	$ 195,000,000	Anderson, Greenville, GSP, Spartenburg
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 39,192,317.00	$ 11,757,695.10	$ 50,950,012.10	
40.01		Demolition, clearing, site preparation	lump sum			$ 32,849,817.00	$ 32,849,817.00	$ 9,854,945.10	$ 42,704,762.10	
40.02		Site utilities, utility relocation	corridor mile	107.50	$ 59,000.00		$ 6,342,500.00	$ 1,902,750.00	$ 8,245,250.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 270,751,250.00	$ 81,225,375.00	$ 351,976,625.00	
50.01		Wayside signaling equipment	track mile	215	$ 970,000.00		$ 208,550,000.00	$ 62,565,000.00	$ 271,115,000.00	
50.02		Signal power access and distribution	track mile	215	$ 5,500.00		$ 1,182,500.00	$ 354,750.00	$ 1,537,250.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	107.5	$ 555,000.00		$ 59,662,500.00	$ 17,898,750.00	$ 77,561,250.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	107.5	$ 7,500.00		$ 806,250.00	$ 241,875.00	$ 1,048,125.00	
50.08		Station train approach warning system	each	4	$ 137,500.00		$ 550,000.00	$ 165,000.00	$ 715,000.00	
Total for Category 60: ELECTRIC TRACTION							$ 589,035,500.00	$ 176,710,650.00	$ 765,746,150.00	
60.01		Traction power transmission: High voltage	corridor mile	107.5	$ 60,400.00		$ 6,493,000.00	$ 1,947,900.00	$ 8,440,900.00	
60.02		Traction power supply: Substations	corridor mile	107.5	$ 1,800,000.00		$ 193,500,000.00	$ 58,050,000.00	$ 251,550,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	107.5	$ 3,600,000.00		$ 387,000,000.00	$ 116,100,000.00	$ 503,100,000.00	
60.04		Traction power control	corridor mile	107.5	$ 19,000.00		$ 2,042,500.00	$ 612,750.00	$ 2,655,250.00	
Construction Subtotal (Categories 10-60)							$6,012,904,911.00	$ 1,803,871,473.30	$ 7,816,776,384.30	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each		$ 43,450,000.00		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each		$ 79,290,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 938,013,166.12	$ -	$ 938,013,166.12	
80.01		Service Development Plan/Service Environmental				$ 78,167,763.84	$ 78,167,763.84	$ -	$ 78,167,763.84	
80.02		Preliminary Engineering/Project Environmental				$ 156,335,527.69	$ 156,335,527.69	$ -	$ 156,335,527.69	
80.03		Final design				$ 156,335,527.69	$ 156,335,527.69	$ -	$ 156,335,527.69	
80.04		Project management for design and construction				$ 156,335,527.69	$ 156,335,527.69	$ -	$ 156,335,527.69	
80.05		Construction administration & management				$ 234,503,291.53	$ 234,503,291.53	$ -	$ 234,503,291.53	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 78,167,763.84	$ 78,167,763.84	$ -	$ 78,167,763.84	
80.09		Engineering inspection				$ 78,167,763.84	$ 78,167,763.84	$ -	$ 78,167,763.84	
80.10		Start up								
Subtotal (Categories 10-80)							$ 6,950,918,077.12	$ 1,803,871,473.30	$ 8,754,789,550.42	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 8,754,789,550	
TOTAL CAPITAL COST/MILE									$ 49,819,932	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 5A: SC/GA Border to I-85 Atlanta NS/CSX Approach
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 374,294,445	$ 112,288,334	$ 486,582,779	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 39,480,000.00	$ 39,480,000	$ 11,844,000	$ 51,324,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 39,935,007.70	$ 39,935,008	$ 11,980,502	$ 51,915,510	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 66,725,197.50	$ 66,725,198	$ 20,017,559	$ 86,742,757	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	56.50	$ 960,960.00		$ 54,294,240.00	$ 16,288,272.00	$ 70,582,512.00	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	56.50	$ 2,323,200.00		$ 131,260,800	$ 39,378,240	$ 170,639,040	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	52	$ 475,000.00		$ 24,700,000	$ 7,410,000	$ 32,110,000	
10.15		Track: Major interlockings	each	13	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	56.50	$ 316,800.00		$ 17,899,200	$ 5,369,760	$ 23,268,960	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 37,500,000	$ 11,250,000	$ 48,750,000	
20.01		Station buildings: Intercity passenger rail only	each	1	$ 37,500,000		$ 37,500,000	$ 11,250,000	$ 48,750,000	Commerce
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 18,896,681	$ 5,669,004	$ 24,565,685	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,358,181.00	$ 1,358,181	$ 407,454	$ 1,765,635	
40.02		Site utilities, utility relocation	corridor mile	56.50	$ 59,000.00		$ 3,333,500	$ 1,000,050	$ 4,333,550	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	166						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 14,205,000.00	$ 14,205,000	$ 4,261,500	$ 18,466,500	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 142,150,250	$ 42,645,075	$ 184,795,325	
50.01		Wayside signaling equipment	track mile	113	$ 970,000.00		$ 109,610,000	$ 32,883,000	$ 142,493,000	
50.02		Signal power access and distribution	track mile	113	$ 5,500.00		$ 621,500	$ 186,450	$ 807,950	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	56.5	$ 555,000.00		$ 31,357,500	$ 9,407,250	$ 40,764,750	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	56.5	$ 7,500.00		$ 423,750	$ 127,125	$ 550,875	
50.08		Station train approach warning system	each	1	$ 137,500.00		$ 137,500	$ 41,250	$ 178,750	
Total for Category 60: ELECTRIC TRACTION							$ 309,586,100	$ 92,875,830	$ 402,461,930	
60.01		Traction power transmission: High voltage	corridor mile	56.5	$ 60,400.00		$ 3,412,600	$ 1,023,780	$ 4,436,380	
60.02		Traction power supply: Substations	corridor mile	56.5	$ 1,800,000.00		$ 101,700,000	$ 30,510,000	$ 132,210,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	56.5	$ 3,600,000.00		$ 203,400,000	$ 61,020,000	$ 264,420,000	
60.04		Traction power control	corridor mile	56.5	$ 19,000.00		$ 1,073,500	$ 322,050	$ 1,395,550	
Construction Subtotal (Categories 10-60)							$ 882,427,476	$ 264,728,243	$ 1,147,155,719	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 137,658,686	$ -	$ 137,658,686	
80.01		Service Development Plan/Service Environmental				$ 11,471,557.19	$ 11,471,557	$ -	$ 11,471,557	
80.02		Preliminary Engineering/Project Environmental				$ 22,943,114.38	$ 22,943,114	$ -	$ 22,943,114	
80.03		Final design				$ 22,943,114.38	$ 22,943,114	$ -	$ 22,943,114	
80.04		Project management for design and construction				$ 22,943,114.38	$ 22,943,114	$ -	$ 22,943,114	
80.05		Construction administration & management				$ 34,414,671.57	$ 34,414,672	$ -	$ 34,414,672	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 11,471,557.19	$ 11,471,557	$ -	$ 11,471,557	
80.09		Engineering inspection				$ 11,471,557.19	$ 11,471,557	$ -	$ 11,471,557	
80.10		Start up								
Subtotal (Categories 10-80)							$ 1,020,086,162	$ 264,728,243	$ 1,284,814,405	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,284,814,405	
TOTAL CAPITAL COST/MILE									$ 22,740,078	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 5B: I-85 Atlanta NS/CSX Approach to Greenfield Connection
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 25,802,556	$ 7,740,767	$ 33,543,323	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ -	$ -	$ -	$ -	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 3,360,480.10	$ 3,360,480	$ 1,008,144	$ 4,368,624	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 5,057,948.10	$ 5,057,948	$ 1,517,384	$ 6,575,333	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	4.30	$ 960,960.00		$ 4,132,128.00	$ 1,239,638.40	$ 5,371,766.40	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	4.30	$ 2,323,200.00		$ 9,989,760	$ 2,996,928	$ 12,986,688	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4	$ 475,000.00		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	4.30	$ 316,800.00		$ 1,362,240	$ 408,672	$ 1,770,912	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 1,611,881	$ 483,564	$ 2,095,445	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,358,181.00	$ 1,358,181	$ 407,454	$ 1,765,635	
40.02		Site utilities, utility relocation	corridor mile	4.30	$ 59,000.00		$ 253,700	$ 76,110	$ 329,810	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum				$ -	$ -	$ -	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum				$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 10,808,050	$ 3,242,415	$ 14,050,465	
50.01		Wayside signaling equipment	track mile	8.6	$ 970,000.00		$ 8,342,000	$ 2,502,600	$ 10,844,600	
50.02		Signal power access and distribution	track mile	8.6	$ 5,500.00		$ 47,300	$ 14,190	$ 61,490	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	4.3	$ 555,000.00		$ 2,386,500	$ 715,950	$ 3,102,450	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	4.3	$ 7,500.00		$ 32,250	$ 9,675	$ 41,925	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 23,561,420	$ 7,068,426	$ 30,629,846	
60.01		Traction power transmission: High voltage	corridor mile	4.3	$ 60,400.00		$ 259,720	$ 77,916	$ 337,636	
60.02		Traction power supply: Substations	corridor mile	4.3	$ 1,800,000.00		$ 7,740,000	$ 2,322,000	$ 10,062,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	4.3	$ 3,600,000.00		$ 15,480,000	$ 4,644,000	$ 20,124,000	
60.04		Traction power control	corridor mile	4.3	$ 19,000.00		$ 81,700	$ 24,510	$ 106,210	
Construction Subtotal (Categories 10-60)							$ 61,783,907	$ 18,535,172	$ 80,319,079	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 9,638,290	$ -	$ 9,638,290	
80.01		Service Development Plan/Service Environmental				$ 803,190.79	$ 803,191	$ -	$ 803,191	
80.02		Preliminary Engineering/Project Environmental				$ 1,606,381.59	$ 1,606,382	$ -	$ 1,606,382	
80.03		Final design				$ 1,606,381.59	$ 1,606,382	$ -	$ 1,606,382	
80.04		Project management for design and construction				$ 1,606,381.59	$ 1,606,382	$ -	$ 1,606,382	
80.05		Construction administration & management				$ 2,409,572.38	$ 2,409,572	$ -	$ 2,409,572	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 803,190.79	$ 803,191	$ -	$ 803,191	
80.09		Engineering inspection				$ 803,190.79	$ 803,191	$ -	$ 803,191	
80.10		Start up								
Subtotal (Categories 10-80)							$ 71,422,197	$ 18,535,172	$ 89,957,369	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 89,957,369	
TOTAL CAPITAL COST/MILE									$ 20,920,318	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 6: Greenfield Connection to NS Atlanta Approach
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 174,611,025	$ 52,383,308	$ 226,994,333	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 93,070,000.00	$ 93,070,000	$ 27,921,000	$ 120,991,000	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 4,376,439.20	$ 4,376,439	$ 1,312,932	$ 5,689,371	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 22,031,914.00	$ 22,031,914	$ 6,609,574	$ 28,641,488	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	13.20	$ 960,960.00		$ 12,684,672.00	$ 3,805,401.60	$ 16,490,073.60	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	13.20	$ 2,323,200.00		$ 30,666,240	$ 9,199,872	$ 39,866,112	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	16	$ 475,000.00		$ 7,600,000	$ 2,280,000	$ 9,880,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	13.20	$ 316,800.00		$ 4,181,760	$ 1,254,528	$ 5,436,288	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 9,076,773	$ 2,723,032	$ 11,799,805	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,911,514.00	$ 1,911,514	$ 573,454	$ 2,484,968	
40.02		Site utilities, utility relocation	corridor mile	13.20	$ 59,000.00		$ 778,800	$ 233,640	$ 1,012,440	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 6,386,459.00	$ 6,386,459	$ 1,915,938	$ 8,302,397	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	46			$ -	$ -	$ -	100' corridor width
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 33,178,200	$ 9,953,460	$ 43,131,660	
50.01		Wayside signaling equipment	track mile	26.4	$ 970,000.00		$ 25,608,000	$ 7,682,400	$ 33,290,400	
50.02		Signal power access and distribution	track mile	26.4	$ 5,500.00		$ 145,200	$ 43,560	$ 188,760	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	13.2	$ 555,000.00		$ 7,326,000	$ 2,197,800	$ 9,523,800	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0	$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	13.2	$ 7,500.00		$ 99,000	$ 29,700	$ 128,700	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 72,328,080	$ 21,698,424	$ 94,026,504	
60.01		Traction power transmission: High voltage	corridor mile	13.2	$ 60,400.00		$ 797,280	$ 239,184	$ 1,036,464	
60.02		Traction power supply: Substations	corridor mile	13.2	$ 1,800,000.00		$ 23,760,000	$ 7,128,000	$ 30,888,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	13.2	$ 3,600,000.00		$ 47,520,000	$ 14,256,000	$ 61,776,000	
60.04		Traction power control	corridor mile	13.2	$ 19,000.00		$ 250,800	$ 75,240	$ 326,040	
Construction Subtotal (Categories 10-60)							$ 289,194,078	$ 86,758,223	$ 375,952,302	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 45,114,276	$ -	$ 45,114,276	
80.01		Service Development Plan/Service Environmental				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.02		Preliminary Engineering/Project Environmental				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.03		Final design				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.04		Project management for design and construction				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.05		Construction administration & management				$ 11,278,569.05	$ 11,278,569	$ -	$ 11,278,569	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.09		Engineering inspection				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.10		Start up								
Subtotal (Categories 10-80)							$ 334,308,354	$ 86,758,223	$ 421,066,578	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 421,066,578	
TOTAL CAPITAL COST/MILE									$ 31,898,983	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 7: Atlanta NS Approach to Howell Junction
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 397,169,999.20	$ 119,150,999.76	$ 516,320,998.96	
10.01		Track structure: Viaduct	corridor mile	0.81	$ 50,000,000.00		$ 40,500,000.00	$ 12,150,000.00	$ 52,650,000.00	
10.02		Track structure: Major/Movable bridge	lump sum			$ 155,361,000.00	$ 155,361,000.00	$ 46,608,300.00	$ 201,969,300.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 29,399,519.20	$ 29,399,519.20	$ 8,819,855.76	$ 38,219,374.96	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	29.60	$ 960,960.00		$ 28,444,416.00	$ 8,533,324.80	$ 36,977,740.80	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	29.60	$ 2,323,200.00		$ 68,766,720.00	$ 20,630,016.00	$ 89,396,736.00	
	10.09.02	136lb CWR on Wood Ties	track mile	47.66	$ 950,400.00		$ 45,296,064.00	$ 13,588,819.20	$ 58,884,883.20	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28	$ 150,000.00		$ 4,200,000.00	$ 1,260,000.00	$ 5,460,000.00	
	10.14.02	Turnout; No. 15	each	5	$ 175,000.00		$ 875,000.00	$ 262,500.00	$ 1,137,500.00	
	10.14.03	Turnout; No. 20	each	13	$ 200,000.00		$ 2,600,000.00	$ 780,000.00	$ 3,380,000.00	
	10.14.04	Turnout; No. 24	each	26	$ 475,000.00		$ 12,350,000.00	$ 3,705,000.00	$ 16,055,000.00	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	29.60	$ 316,800.00		$ 9,377,280.00	$ 2,813,184.00	$ 12,190,464.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 75,000,000.00	$ 22,500,000.00	$ 97,500,000.00	
20.01		Station buildings: Intercity passenger rail only	each	2	$ 37,500,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	Doraville, Suwanee
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 9,870,000.00	$ 2,961,000.00	$ 12,831,000.00	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000.00	$ 9,870,000.00	$ 2,961,000.00	$ 12,831,000.00	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 80,165,595.82	$ 24,049,678.75	$ 104,215,274.57	
40.01		Demolition, clearing, site preparation	lump sum			$ 3,722,436.80	$ 3,722,436.80	$ 1,116,731.04	$ 4,839,167.84	
40.02		Site utilities, utility relocation	corridor mile	29.6	$ 59,000.00		$ 1,746,400.00	$ 523,920.00	$ 2,270,320.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 46,215,759.02	$ 46,215,759.02	$ 13,864,727.71	$ 60,080,486.73	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	36						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 28,481,000.00	$ 28,481,000.00	$ 8,544,300.00	$ 37,025,300.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 82,424,600.00	$ 24,727,380.00	$ 107,151,980.00	
50.01		Wayside signaling equipment	track mile	59.2	$ 970,000.00		$ 57,424,000.00	$ 17,227,200.00	$ 74,651,200.00	
50.02		Signal power access and distribution	track mile	59.2	$ 5,500.00		$ 325,600.00	$ 97,680.00	$ 423,280.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	29.6	$ 555,000.00		$ 16,428,000.00	$ 4,928,400.00	$ 21,356,400.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	15	$ 500,000.00		$ 7,500,000.00	$ 2,250,000.00	$ 9,750,000.00	
	50.06.02	Private At-Grade	each	1	$ 250,000.00		$ 250,000.00	$ 75,000.00	$ 325,000.00	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	29.6	$ 7,500.00		$ 222,000.00	$ 66,600.00	$ 288,600.00	
50.08		Station train approach warning system	each	2	$ 137,500.00		$ 275,000.00	$ 82,500.00	$ 357,500.00	
Total for Category 60: ELECTRIC TRACTION							$ 162,190,240.00	$ 48,657,072.00	$ 210,847,312.00	
60.01		Traction power transmission: High voltage	corridor mile	29.6	$ 60,400.00		$ 1,787,840.00	$ 536,352.00	$ 2,324,192.00	
60.02		Traction power supply: Substations	corridor mile	29.6	$ 1,800,000.00		$ 53,280,000.00	$ 15,984,000.00	$ 69,264,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	29.6	$ 3,600,000.00		$ 106,560,000.00	$ 31,968,000.00	$ 138,528,000.00	
60.04		Traction power control	corridor mile	29.6	$ 19,000.00		$ 562,400.00	$ 168,720.00	$ 731,120.00	
Construction Subtotal (Categories 10-60)							$ 806,820,435.02	$ 242,046,130.51	$1,048,866,565.53	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 125,863,987.86	$ -	$ 125,863,987.86	
80.01		Service Development Plan/Service Environmental				$ 10,488,665.66	$ 10,488,665.66	$ -	$ 10,488,665.66	
80.02		Preliminary Engineering/Project Environmental				$ 20,977,331.31	$ 20,977,331.31	$ -	$ 20,977,331.31	
80.03		Final design				$ 20,977,331.31	$ 20,977,331.31	$ -	$ 20,977,331.31	
80.04		Project management for design and construction				$ 20,977,331.31	$ 20,977,331.31	$ -	$ 20,977,331.31	
80.05		Construction administration & management				$ 31,465,996.97	$ 31,465,996.97	$ -	$ 31,465,996.97	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 10,488,665.66	$ 10,488,665.66	$ -	$ 10,488,665.66	
80.09		Engineering inspection				$ 10,488,665.66	$ 10,488,665.66	$ -	$ 10,488,665.66	
80.10		Start up								
Subtotal (Categories 10-80)							$ 932,684,422.88	$ 242,046,130.51	$ 1,174,730,553.39	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,174,730,553	
TOTAL CAPITAL COST/MILE									$ 39,686,843	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 8: Howell Junction to Altlanta MMPT
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 26,129,907.00	$ 7,838,972.10	$ 33,968,879.10	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 5,376,000.00	$ 5,376,000.00	$ 1,612,800.00	$ 6,988,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,909,489.40	$ 1,909,489.40	$ 572,846.82	$ 2,482,336.22	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.87	$ 960,960.00		$ 836,035.20	$ 250,810.56	$ 1,086,845.76	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	2.60	$ 2,323,200.00		$ 6,040,320.00	$ 1,812,096.00	$ 7,852,416.00	
	10.09.02	136lb CWR on Wood Ties	track mile	3.47	$ 950,400.00		$ 3,297,888.00	$ 989,366.40	$ 4,287,254.40	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	4	$ 175,000.00		$ 700,000.00	$ 210,000.00	$ 910,000.00	
	10.14.03	Turnout; No. 20	each	6	$ 200,000.00		$ 1,200,000.00	$ 360,000.00	$ 1,560,000.00	
	10.14.04	Turnout; No. 24	each		$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	2.60	$ 316,800.00		$ 823,680.00	$ 247,104.00	$ 1,070,784.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	MMPT No Cost
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each		$ 60,000,000		$ -	$ -	$ -	
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility								
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 40,445,991.96	$ 12,133,797.59	$ 52,579,789.55	
40.01		Demolition, clearing, site preparation	lump sum			$ 109,409.46	$ 109,409.46	$ 32,822.84	$ 142,232.30	
40.02		Site utilities, utility relocation	corridor mile	2.60	$ 59,000.00		$ 153,400.00	$ 46,020.00	$ 199,420.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 21,818,182.50	$ 21,818,182.50	$ 6,545,454.75	$ 28,363,637.25	
	40.07.01	Railroad Owned - Urban	acre	13						
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	1						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 18,365,000.00	$ 18,365,000.00	$ 5,509,500.00	$ 23,874,500.00	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 6,535,100.00	$ 1,960,530.00	$ 8,495,630.00	
50.01		Wayside signaling equipment	track mile	5.20	$ 970,000.00		$ 5,044,000.00	$ 1,513,200.00	$ 6,557,200.00	
50.02		Signal power access and distribution	track mile	5.20	$ 5,500.00		$ 28,600.00	$ 8,580.00	$ 37,180.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	2.60	$ 555,000.00		$ 1,443,000.00	$ 432,900.00	$ 1,875,900.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000.00		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	2.60	$ 7,500.00		$ 19,500.00	$ 5,850.00	$ 25,350.00	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 14,246,440.00	$ 4,273,932.00	$ 18,520,372.00	
60.01		Traction power transmission: High voltage	corridor mile	2.60	$ 60,400.00		$ 157,040.00	$ 47,112.00	$ 204,152.00	
60.02		Traction power supply: Substations	corridor mile	2.60	$ 1,800,000.00		$ 4,680,000.00	$ 1,404,000.00	$ 6,084,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	2.60	$ 3,600,000.00		$ 9,360,000.00	$ 2,808,000.00	$ 12,168,000.00	
60.04		Traction power control	corridor mile	2.60	$ 19,000.00		$ 49,400.00	$ 14,820.00	$ 64,220.00	
Construction Subtotal (Categories 10-60)							$ 87,357,438.96	$ 26,207,231.69	$ 113,564,670.65	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 13,627,760.48	$ -	$ 13,627,760.48	
80.01		Service Development Plan/Service Environmental				$ 1,135,646.71	$ 1,135,646.71	$ -	$ 1,135,646.71	
80.02		Preliminary Engineering/Project Environmental				$ 2,271,293.41	$ 2,271,293.41	$ -	$ 2,271,293.41	
80.03		Final design				$ 2,271,293.41	$ 2,271,293.41	$ -	$ 2,271,293.41	
80.04		Project management for design and construction				$ 2,271,293.41	$ 2,271,293.41	$ -	$ 2,271,293.41	
80.05		Construction administration & management				$ 3,406,940.12	$ 3,406,940.12	$ -	$ 3,406,940.12	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,135,646.71	$ 1,135,646.71	$ -	$ 1,135,646.71	
80.09		Engineering inspection				$ 1,135,646.71	$ 1,135,646.71	$ -	$ 1,135,646.71	
80.10		Start up								
Subtotal (Categories 10-80)							$ 100,985,199.44	$ 26,207,231.69	$ 127,192,431.13	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 127,192,431**	
TOTAL CAPITAL COST/MILE									**$ 49,819,932**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Interstate-85 180-220MPH Dedicated Service
Segment	Segment 9: Atlanta MMPT to Hartsfield Airport Station
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 71,208,900.00	$ 21,362,670.00	$ 92,571,570.00	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 40,896,000.00	$ 40,896,000.00	$ 12,268,800.00	$ 53,164,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ -	$ -	$ -	$ -	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	9.50	$ 715,000.00		$ 6,792,500.00	$ 2,037,750.00	$ 8,830,250.00	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.00	$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	9.50	$ 2,323,200.00		$ 22,070,400.00	$ 6,621,120.00	$ 28,691,520.00	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	6	$ 175,000.00		$ 1,050,000.00	$ 315,000.00	$ 1,365,000.00	
	10.14.03	Turnout; No. 20	each	2	$ 200,000.00		$ 400,000.00	$ 120,000.00	$ 520,000.00	
	10.14.04	Turnout; No. 24	each	0	$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 60,000,000.00	$ 18,000,000.00	$ 78,000,000.00	
20.01		Station buildings: Intercity passenger rail only	each		$ 37,500,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)								
	20.02.01	Charlotte Airport	each		$ 50,000,000		$ -	$ -	$ -	
	20.02.02	Hartsfield Airport	each	1	$ 60,000,000		$ 60,000,000	$ 18,000,000	$ 78,000,000	Hartsfield Airport
20.03		Platforms	linear feet		$ 1,080.00		$ -	$ -	$ -	
20.04		Elevators, escalators	each		$ 350,000.00		$ -	$ -	$ -	
20.05		Joint commercial development	square foot		$ 150.00		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum				$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum				$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each		$ 250,000.00		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000.00	$ 40,200,000.00	$ 174,200,000.00	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000.00	$ 134,000,000.00	$ 40,200,000.00	$ 174,200,000.00	
30.03		Heavy maintenance facility	lump sum				$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum				$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 184,802,920.50	$ 55,440,876.15	$ 240,243,796.65	
40.01		Demolition, clearing, site preparation	lump sum				$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.5	$ 59,000.00		$ 560,500.00	$ 168,150.00	$ 728,650.00	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 184,242,420.50	$ 184,242,420.50	$ 55,272,726.15	$ 239,515,146.65	
	40.07.01	Railroad Owned - Urban	acre	57.5			$ -	$ -	$ -	50' width
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre							
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ -	$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 27,878,250.00	$ 8,363,475.00	$ 36,241,725.00	
50.01		Wayside signaling equipment	track mile	19	$ 970,000.00		$ 18,430,000.00	$ 5,529,000.00	$ 23,959,000.00	
50.02		Signal power access and distribution	track mile	19	$ 5,500.00		$ 104,500.00	$ 31,350.00	$ 135,850.00	
50.03		On-board signaling equipment	each		$ 400,000.00		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000.00		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.5	$ 555,000.00		$ 5,272,500.00	$ 1,581,750.00	$ 6,854,250.00	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	8	$ 500,000.00		$ 4,000,000.00	$ 1,200,000.00	$ 5,200,000.00	
	50.06.02	Private At-Grade	each		$ 250,000.00		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.5	$ 7,500.00		$ 71,250.00	$ 21,375.00	$ 92,625.00	
50.08		Station train approach warning system	each	0	$ 137,500.00		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 52,054,300.00	$ 15,616,290.00	$ 67,670,590.00	
60.01		Traction power transmission: High voltage	corridor mile	9.5	$ 60,400.00		$ 573,800.00	$ 172,140.00	$ 745,940.00	
60.02		Traction power supply: Substations	corridor mile	9.5	$ 1,800,000.00		$ 17,100,000.00	$ 5,130,000.00	$ 22,230,000.00	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.5	$ 3,600,000.00		$ 34,200,000.00	$ 10,260,000.00	$ 44,460,000.00	
60.04		Traction power control	corridor mile	9.5	$ 19,000.00		$ 180,500.00	$ 54,150.00	$ 234,650.00	
Construction Subtotal (Categories 10-60)							$ 529,944,370.50	$ 158,983,311.15	$ 688,927,681.65	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive								
70.01		Vehicle acquisition: Non-electric locomotive								
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each		$ 43,450,000.00		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each		$ 32,500,000.00		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space								
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 82,671,321.80	$ -	$ 82,671,321.80	
80.01		Service Development Plan/Service Environmental				$ 6,889,276.82	$ 6,889,276.82	$ -	$ 6,889,276.82	
80.02		Preliminary Engineering/Project Environmental				$ 13,778,553.63	$ 13,778,553.63	$ -	$ 13,778,553.63	
80.03		Final design				$ 13,778,553.63	$ 13,778,553.63	$ -	$ 13,778,553.63	
80.04		Project management for design and construction				$ 13,778,553.63	$ 13,778,553.63	$ -	$ 13,778,553.63	
80.05		Construction administration & management				$ 20,667,830.45	$ 20,667,830.45	$ -	$ 20,667,830.45	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 6,889,276.82	$ 6,889,276.82	$ -	$ 6,889,276.82	
80.09		Engineering inspection				$ 6,889,276.82	$ 6,889,276.82	$ -	$ 6,889,276.82	
80.10		Start up								
Subtotal (Categories 10-80)							$ 612,615,692.30	$ 158,983,311.15	$ 771,599,003.45	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 771,599,003	
TOTAL CAPITAL COST/MILE									$ 49,819,932	

ALTERNATIVE 3: GREENFIELD (125 MPH)

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Version	v0

Code	Sub-code	Description	Unit (Value Inputs)	Quantity (Value Inputs)	Unit Cost (Base Yr/FY13*) (Value Inputs)	Non-Unit Based Costs (Value Inputs)	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10:		**TRACK STRUCTURES AND TRACK**					$ 2,176,316,722	$ 652,895,017	$ 2,829,211,739	
10.01		Track structure: Viaduct	corridor mile	0.81	$ 50,000,000		$ 40,500,000	$ 12,150,000	$ 52,650,000	
10.02		Track structure: Major/Movable bridge	lump sum			$ 846,391,000	$ 846,391,000	$ 253,917,300	$ 1,100,308,300	
10.03		Track structure: Undergrade Bridges	lump sum			$ 13,392,000	$ 13,392,000	$ 4,017,600	$ 17,409,600	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 21,704,439	$ 21,704,439	$ 6,511,332	$ 28,215,771	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 316,255,523	$ 316,255,523	$ 94,876,657	$ 411,132,179	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	39.23	$ 715,000		$ 28,049,450	$ 8,414,835	$ 36,464,285	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile	53.70	$ 960,960		$ 51,603,552	$ 15,481,066	$ 67,084,618	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	273.16	$ 2,323,200		$ 634,605,312	$ 190,381,594	$ 824,986,906	
	10.09.02	136lb CWR on Wood Ties	corridor mile	61.16	$ 950,400		$ 58,126,464	$ 17,437,939	$ 75,564,403	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28.00	$ 150,000		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.02	Turnout; No. 15	each	15.00	$ 175,000		$ 2,625,000	$ 787,500	$ 3,412,500	
	10.14.03	Turnout; No. 20	each	21.00	$ 200,000		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.04	Turnout; No. 24	each	129.00	$ 475,000		$ 61,275,000	$ 18,382,500	$ 79,657,500	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	87.00	$ 45,000		$ 3,915,000	$ 1,174,500	$ 5,089,500	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	263.66	$ 316,800		$ 83,527,488	$ 25,058,246	$ 108,585,734	
Total for Category 20:		**STATIONS, TERMINALS, INTERMODAL**					$ 347,500,000	$ 104,250,000	$ 451,750,000	
20.01		Station buildings: Intercity passenger rail only	each	5.00	$ 25,000,000		$ 125,000,000	$ 37,500,000	$ 162,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot	0.00	$ 215		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ 60,000,000	$ 60,000,000	$ 18,000,000.00	$ 78,000,000	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ 37,500,000	$ 37,500,000	$ 11,250,000.00	$ 48,750,000	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ 50,000,000	$ 50,000,000	$ 15,000,000.00	$ 65,000,000	
	20.02.04	Intercity Approach Building	each	2.00	$ 37,500,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30:		**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**					$ 143,870,000	$ 43,161,000	$ 187,031,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000	$ 9,870,000	$ 2,961,000	$ 12,831,000	
Total for Category 40,:		**SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS**					$ 531,171,369	$ 159,351,411	$ 690,522,780	
40.01		Demolition, clearing, site preparation	lump sum			$ 62,370,171	$ 62,370,171	$ 18,711,051	$ 81,081,222	
40.02		Site utilities, utility relocation	corridor mile	273.16	$ 59,000		$ 16,116,440	$ 4,834,932	$ 20,951,372	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 323,300,758	$ 323,300,758	$ 96,990,228	$ 420,290,986	
	40.07.01	Railroad Owned - Urban	acre	13.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	191.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 126,374,000	$ 126,374,000	$ 37,912,200	$ 164,286,200	
40.09		Relocation of existing households and businesses	lump sum			$ 3,010,000	$ 3,010,000	$ 903,000	$ 3,913,000	
	40.09.01	Relocation - Urban	acre	0.00						
	40.09.02	Relocation - Rural	acre	0.00						
Total for Category 50:		**COMMUNICATIONS & SIGNALING**					$ 701,300,160	$ 210,390,048	$ 911,690,208	
50.01		Wayside signaling equipment	track mile	546.32	$ 970,000		$ 529,930,400	$ 158,979,120	$ 688,909,520	
50.02		Signal power access and distribution	track mile	546.32	$ 5,500		$ 3,004,760	$ 901,428	$ 3,906,188	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	273.16	$ 555,000		$ 151,603,800	$ 45,481,140	$ 197,084,940	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	27.00	$ 500,000		$ 13,500,000	$ 4,050,000	$ 17,550,000	
	50.06.02	Private At-Grade	each	1.00	$ 250,000		$ 250,000	$ 75,000	$ 325,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	273.16	$ 7,500		$ 2,048,700	$ 614,610	$ 2,663,310	
50.08		Station train approach warning system	each	7.00	$ 137,500		$ 962,500	$ 288,750	$ 1,251,250	
Total for Category 60:		**ELECTRIC TRACTION**					$ -	$ -	$ -	
60.01		Traction power transmission: High voltage	corridor mile	0.00	$ 60,400		$ -	$ -	$ -	
60.02		Traction power supply: Substations	corridor mile	0.00	$ 1,800,000		$ -	$ -	$ -	
60.03		Traction power distribution: Catenary and third rail	corridor mile	0.00	$ 3,600,000		$ -	$ -	$ -	
60.04		Traction power control	corridor mile	0.00	$ 19,000		$ -	$ -	$ -	
Construction Subtotal (Categories 10-60)							$ 3,900,158,251	$ 1,170,047,475	$ 5,070,205,727	
Total for Category 70:		**VEHICLES**					$ 375,700,000	$ 112,710,000	$ 488,410,000	
70.00		Vehicle acquisition: Electric locomotive	each		$ 8,000,000		$ -	$ -	$ -	
70.01		Vehicle acquisition: Non-electric locomotive	each	26.00	$ 4,200,000		$ 109,200,000	$ 32,760,000	$ 141,960,000	
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	65.00	$ 4,100,000		$ 266,500,000	$ 79,950,000	$ 346,450,000	
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum			$ -	$ -	$ -	$ -	
Total for Category 80:		**PROFESSIONAL SERVICES (applies to Cats. 10-60)**					$ 608,424,687	$ -	$ 608,424,687	
80.01		Service Development Plan/Service Environmental				$ 50,702,057.27	$ 50,702,057	$ -	$ 50,702,057	
80.02		Preliminary Engineering/Project Environmental				$ 101,404,114.53	$ 101,404,115	$ -	$ 101,404,115	
80.03		Final design				$ 101,404,114.53	$ 101,404,115	$ -	$ 101,404,115	
80.04		Project management for design and construction				$ 101,404,114.53	$ 101,404,115	$ -	$ 101,404,115	
80.05		Construction administration & management				$ 152,106,171.80	$ 152,106,172	$ -	$ 152,106,172	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 50,702,057.27	$ 50,702,057	$ -	$ 50,702,057	
80.09		Engineering inspection				$ 50,702,057.27	$ 50,702,057	$ -	$ 50,702,057	
80.10		Start up								
Subtotal (Categories 10-80)							$ 4,884,282,938	$ 1,282,757,475	$ 6,167,040,414	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 6,167,040,414	
TOTAL CAPITAL COST/MILE									$ 22,576,660	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 1: Charlotte Gateway to NS/Greenfield Split
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 119,950,601	$ 35,985,180	$ 155,935,781	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 60,600,000	$ 60,600,000	$ 18,180,000	$ 78,780,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 513,000	$ 513,000	$ 153,900	$ 666,900	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 9,677,460	$ 9,677,460	$ 2,903,238	$ 12,580,698	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	2.00	$ 715,000		$ 1,430,000	$ 429,000	$ 1,859,000	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile	10.03	$ 960,960		$ 9,638,429	$ 2,891,529	$ 12,529,957	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	10.03	$ 2,323,200		$ 23,301,696	$ 6,990,509	$ 30,292,205	
	10.09.02	136lb CWR on Wood Ties	corridor mile	10.03	$ 950,400		$ 9,532,512	$ 2,859,754	$ 12,392,266	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4.00	$ 475,000		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	4.00	$ 45,000		$ 180,000	$ 54,000	$ 234,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	10.03	$ 316,800		$ 3,177,504	$ 953,251	$ 4,130,755	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 50,000,000	$ 15,000,000	$ 65,000,000	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ 50,000,000	$ 50,000,000	$ 15,000,000.00	$ 65,000,000	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 60,393,525	$ 18,118,057	$ 78,511,582	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,235,572	$ 1,235,572	$ 370,672	$ 1,606,244	
40.02		Site utilities, utility relocation	corridor mile	10.03	$ 59,000		$ 591,770	$ 177,531	$ 769,301	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 17,818,182	$ 17,818,182	$ 5,345,455	$ 23,163,637	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 40,748,000	$ 40,748,000	$ 12,224,400	$ 52,972,400	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 27,210,405	$ 8,163,122	$ 35,373,527	
50.01		Wayside signaling equipment	track mile	20.06	$ 970,000		$ 19,458,200	$ 5,837,460	$ 25,295,660	
50.02		Signal power access and distribution	track mile	20.06	$ 5,500		$ 110,330	$ 33,099	$ 143,429	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	10.03	$ 555,000		$ 5,566,650	$ 1,669,995	$ 7,236,645	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	4.00	$ 500,000		$ 2,000,000	$ 600,000	$ 2,600,000	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	10.03	$ 7,500		$ 75,225	$ 22,568	$ 97,793	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 54,958,382	$ 16,487,515	$ 71,445,897	
60.01		Traction power transmission: High voltage	corridor mile	10.03	$ 60,400		$ 605,812	$ 181,744	$ 787,556	
60.02		Traction power supply: Substations	corridor mile	10.03	$ 1,800,000		$ 18,054,000	$ 5,416,200	$ 23,470,200	
60.03		Traction power distribution: Catenary and third rail	corridor mile	10.03	$ 3,600,000		$ 36,108,000	$ 10,832,400	$ 46,940,400	
60.04		Traction power control	corridor mile	10.03	$ 19,000		$ 190,570	$ 57,171	$ 247,741	
Construction Subtotal (Categories 10-60)							$ 312,512,913	$ 93,753,874	$ 406,266,786	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 48,752,014	$ -	$ 48,752,014	
80.01		Service Development Plan/Service Environmental				$ 4,062,667.86	$ 4,062,668	$ -	$ 4,062,668	
80.02		Preliminary Engineering/Project Environmental				$ 8,125,335.73	$ 8,125,336	$ -	$ 8,125,336	
80.03		Final design				$ 8,125,335.73	$ 8,125,336	$ -	$ 8,125,336	
80.04		Project management for design and construction				$ 8,125,335.73	$ 8,125,336	$ -	$ 8,125,336	
80.05		Construction administration & management				$ 12,188,003.59	$ 12,188,004	$ -	$ 12,188,004	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,062,667.86	$ 4,062,668	$ -	$ 4,062,668	
80.09		Engineering inspection				$ 4,062,667.86	$ 4,062,668	$ -	$ 4,062,668	
80.10		Start up								
Subtotal (Categories 10-80)							$ 361,264,927	$ 93,753,874	$ 455,018,801	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 455,018,801	
TOTAL CAPITAL COST/MILE									$ 45,365,783	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 3: NS/Greenfield Split to SC State Line
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 97,313,400	$ 29,194,020	$ 126,507,420	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 46,560,000	$ 46,560,000	$ 13,968,000	$ 60,528,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ 1,368,000	$ 1,368,000	$ 410,400	$ 1,778,400	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 1,026,000	$ 1,026,000	$ 307,800	$ 1,333,800	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 16,605,800	$ 16,605,800	$ 4,981,740	$ 21,587,540	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	0.00	$ 715,000		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	11.24	$ 2,323,200		$ 26,112,768	$ 7,833,830	$ 33,946,598	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4.00	$ 475,000		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	4.00	$ 45,000		$ 180,000	$ 54,000	$ 234,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	11.24	$ 316,800		$ 3,560,832	$ 1,068,250	$ 4,629,082	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.01		Station buildings: Intercity passenger rail only	each	1.00	$ 25,000,000		$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 9,737,379	$ 2,921,214	$ 12,658,592	
40.01		Demolition, clearing, site preparation	lump sum			$ 3,383,865	$ 3,383,865	$ 1,015,159	$ 4,399,024	
40.02		Site utilities, utility relocation	corridor mile	11.24	$ 59,000		$ 663,160	$ 198,948	$ 862,108	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 3,745,354	$ 3,745,354	$ 1,123,606	$ 4,868,960	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 1,785,000	$ 1,785,000	$ 535,500	$ 2,320,500	
40.09		Relocation of existing households and businesses	lump sum			$ 160,000	$ 160,000	$ 48,000	$ 208,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 28,389,240	$ 8,516,772	$ 36,906,012	
50.01		Wayside signaling equipment	track mile	22.48	$ 970,000		$ 21,805,600	$ 6,541,680	$ 28,347,280	
50.02		Signal power access and distribution	track mile	22.48	$ 5,500		$ 123,640	$ 37,092	$ 160,732	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	11.24	$ 555,000		$ 6,238,200	$ 1,871,460	$ 8,109,660	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	11.24	$ 7,500		$ 84,300	$ 25,290	$ 109,590	
50.08		Station train approach warning system	each	1.00	$ 137,500		$ 137,500	$ 41,250	$ 178,750	
Total for Category 60: ELECTRIC TRACTION							$ 61,588,456	$ 18,476,537	$ 80,064,993	
60.01		Traction power transmission: High voltage	corridor mile	11.24	$ 60,400		$ 678,896	$ 203,669	$ 882,565	
60.02		Traction power supply: Substations	corridor mile	11.24	$ 1,800,000		$ 20,232,000	$ 6,069,600	$ 26,301,600	
60.03		Traction power distribution: Catenary and third rail	corridor mile	11.24	$ 3,600,000		$ 40,464,000	$ 12,139,200	$ 52,603,200	
60.04		Traction power control	corridor mile	11.24	$ 19,000		$ 213,560	$ 64,068	$ 277,628	
Construction Subtotal (Categories 10-60)							$ 222,028,475	$ 66,608,542	$ 288,637,017	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 34,636,442	$ -	$ 34,636,442	
80.01		Service Development Plan/Service Environmental				$ 2,886,370.17	$ 2,886,370	$ -	$ 2,886,370	
80.02		Preliminary Engineering/Project Environmental				$ 5,772,740.34	$ 5,772,740	$ -	$ 5,772,740	
80.03		Final design				$ 5,772,740.34	$ 5,772,740	$ -	$ 5,772,740	
80.04		Project management for design and construction				$ 5,772,740.34	$ 5,772,740	$ -	$ 5,772,740	
80.05		Construction administration & management				$ 8,659,110.51	$ 8,659,111	$ -	$ 8,659,111	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 2,886,370.17	$ 2,886,370	$ -	$ 2,886,370	
80.09		Engineering inspection				$ 2,886,370.17	$ 2,886,370	$ -	$ 2,886,370	
80.10		Start up								
Subtotal (Categories 10-80)							$ 256,664,917	$ 66,608,542	$ 323,273,459	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 323,273,459	
TOTAL CAPITAL COST/MILE									$ 28,760,984	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 8: NC State Line to GA State Line
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 888,521,040	$ 266,556,312	$ 1,155,077,352	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 335,424,000	$ 335,424,000	$ 100,627,200	$ 436,051,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ 10,224,000	$ 10,224,000	$ 3,067,200	$ 13,291,200	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 10,659,000	$ 10,659,000	$ 3,197,700	$ 13,856,700	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 161,101,140	$ 161,101,140	$ 48,330,342	$ 209,431,482	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	17.74	$ 715,000		$ 12,684,100	$ 3,805,230	$ 16,489,330	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	125.92	$ 2,323,200		$ 292,537,344	$ 87,761,203	$ 380,298,547	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	50.00	$ 475,000		$ 23,750,000	$ 7,125,000	$ 30,875,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	50.00	$ 45,000		$ 2,250,000	$ 675,000	$ 2,925,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	125.92	$ 316,800		$ 39,891,456	$ 11,967,437	$ 51,858,893	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 112,500,000	$ 33,750,000	$ 146,250,000	
20.01		Station buildings: Intercity passenger rail only	each	3.00	$ 25,000,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ 37,500,000	$ 37,500,000	$ 11,250,000.00	$ 48,750,000	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 99,302,329	$ 29,790,699	$ 129,093,027	
40.01		Demolition, clearing, site preparation	lump sum			$ 34,176,459	$ 34,176,459	$ 10,252,938	$ 44,429,396	
40.02		Site utilities, utility relocation	corridor mile	125.92	$ 59,000		$ 7,429,280	$ 2,228,784	$ 9,658,064	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 26,326,590	$ 26,326,590	$ 7,897,977	$ 34,224,567	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 29,890,000	$ 29,890,000	$ 8,967,000	$ 38,857,000	
40.09		Relocation of existing households and businesses	lump sum			$ 1,480,000	$ 1,480,000	$ 444,000	$ 1,924,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 316,912,420	$ 95,073,726	$ 411,986,146	
50.01		Wayside signaling equipment	track mile	251.84	$ 970,000		$ 244,284,800	$ 73,285,440	$ 317,570,240	
50.02		Signal power access and distribution	track mile	251.84	$ 5,500		$ 1,385,120	$ 415,536	$ 1,800,656	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	125.92	$ 555,000		$ 69,885,600	$ 20,965,680	$ 90,851,280	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	125.92	$ 7,500		$ 944,400	$ 283,320	$ 1,227,720	
50.08		Station train approach warning system	each	3.00	$ 137,500		$ 412,500	$ 123,750	$ 536,250	
Total for Category 60: ELECTRIC TRACTION							$ 689,966,048	$ 206,989,814	$ 896,955,862	
60.01		Traction power transmission: High voltage	corridor mile	125.92	$ 60,400		$ 7,605,568	$ 2,281,670	$ 9,887,238	
60.02		Traction power supply: Substations	corridor mile	125.92	$ 1,800,000		$ 226,656,000	$ 67,996,800	$ 294,652,800	
60.03		Traction power distribution: Catenary and third rail	track mile	125.92	$ 3,600,000		$ 453,312,000	$ 135,993,600	$ 589,305,600	
60.04		Traction power control	track mile	125.92	$ 19,000		$ 2,392,480	$ 717,744	$ 3,110,224	
Construction Subtotal (Categories 10-60)							$ 2,107,201,837	$ 632,160,551	$ 2,739,362,387	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 328,723,486	$ -	$ 328,723,486	
80.01		Service Development Plan/Service Environmental				$ 27,393,623.87	$ 27,393,624	$ -	$ 27,393,624	
80.02		Preliminary Engineering/Project Environmental				$ 54,787,247.75	$ 54,787,248	$ -	$ 54,787,248	
80.03		Final design				$ 54,787,247.75	$ 54,787,248	$ -	$ 54,787,248	
80.04		Project management for design and construction				$ 54,787,247.75	$ 54,787,248	$ -	$ 54,787,248	
80.05		Construction administration & management				$ 82,180,871.62	$ 82,180,872	$ -	$ 82,180,872	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 27,393,623.87	$ 27,393,624	$ -	$ 27,393,624	
80.09		Engineering inspection				$ 27,393,623.87	$ 27,393,624	$ -	$ 27,393,624	
80.10		Start up								
Subtotal (Categories 10-80)							$ 2,435,925,323	$ 632,160,551	$ 3,068,085,874	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 3,068,085,874	
TOTAL CAPITAL COST/MILE									$ 24,365,358	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 11: SC State Line to NS/CSX Split
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 341,002,250	$ 102,300,675	$ 443,302,925	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 90,000,000	$ 90,000,000	$ 27,000,000	$ 117,000,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ 1,584,000	$ 1,584,000	$ 475,200	$ 2,059,200	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 4,218,000	$ 4,218,000	$ 1,265,400	$ 5,483,400	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 63,729,200	$ 63,729,200	$ 19,118,760	$ 82,847,960	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	8.99	$ 715,000		$ 6,427,850	$ 1,928,355	$ 8,356,205	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	61.38	$ 2,323,200		$ 142,598,016	$ 42,779,405	$ 185,377,421	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	25.00	$ 475,000		$ 11,875,000	$ 3,562,500	$ 15,437,500	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	25.00	$ 45,000		$ 1,125,000	$ 337,500	$ 1,462,500	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	61.38	$ 316,800		$ 19,445,184	$ 5,833,555	$ 25,278,739	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.01		Station buildings: Intercity passenger rail only	each	1.00	$ 25,000,000		$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 38,367,156	$ 11,510,147	$ 49,877,303	
40.01		Demolition, clearing, site preparation	lump sum			$ 15,354,413	$ 15,354,413	$ 4,606,324	$ 19,960,737	
40.02		Site utilities, utility relocation	corridor mile	61.38	$ 59,000		$ 3,621,420	$ 1,086,426	$ 4,707,846	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 12,236,323	$ 12,236,323	$ 3,670,897	$ 15,907,220	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 6,055,000	$ 6,055,000	$ 1,816,500	$ 7,871,500	
40.09		Relocation of existing households and businesses	lump sum			$ 1,100,000	$ 1,100,000	$ 330,000	$ 1,430,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 154,416,130	$ 46,324,839	$ 200,740,969	
50.01		Wayside signaling equipment	track mile	122.76	$ 970,000		$ 119,077,200	$ 35,723,160	$ 154,800,360	
50.02		Signal power access and distribution	track mile	122.76	$ 5,500		$ 675,180	$ 202,554	$ 877,734	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	61.38	$ 555,000		$ 34,065,900	$ 10,219,770	$ 44,285,670	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	61.38	$ 7,500		$ 460,350	$ 138,105	$ 598,455	
50.08		Station train approach warning system	each	1.00	$ 137,500		$ 137,500	$ 41,250	$ 178,750	
Total for Category 60: ELECTRIC TRACTION							$ 336,325,572	$ 100,897,672	$ 437,223,244	
60.01		Traction power transmission: High voltage	corridor mile	61.38	$ 60,400		$ 3,707,352	$ 1,112,206	$ 4,819,558	
60.02		Traction power supply: Substations	corridor mile	61.38	$ 1,800,000		$ 110,484,000	$ 33,145,200	$ 143,629,200	
60.03		Traction power distribution: Catenary and third rail	corridor mile	61.38	$ 3,600,000		$ 220,968,000	$ 66,290,400	$ 287,258,400	
60.04		Traction power control	corridor mile	61.38	$ 19,000		$ 1,166,220	$ 349,866	$ 1,516,086	
Construction Subtotal (Categories 10-60)							$ 895,111,108	$ 268,533,332	$ 1,163,644,440	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 139,637,333	$ -	$ 139,637,333	
80.01		Service Development Plan/Service Environmental				$ 11,636,444.40	$ 11,636,444	$ -	$ 11,636,444	
80.02		Preliminary Engineering/Project Environmental				$ 23,272,888.81	$ 23,272,889	$ -	$ 23,272,889	
80.03		Final design				$ 23,272,888.81	$ 23,272,889	$ -	$ 23,272,889	
80.04		Project management for design and construction				$ 23,272,888.81	$ 23,272,889	$ -	$ 23,272,889	
80.05		Construction administration & management				$ 34,909,333.21	$ 34,909,333	$ -	$ 34,909,333	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 11,636,444.40	$ 11,636,444	$ -	$ 11,636,444	
80.09		Engineering inspection				$ 11,636,444.40	$ 11,636,444	$ -	$ 11,636,444	
80.10		Start up								
Subtotal (Categories 10-80)							$ 1,034,748,441	$ 268,533,332	$ 1,303,281,773	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 1,303,281,773**	
TOTAL CAPITAL COST/MILE									**$ 21,233,004**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 13: Greenfield to I-85
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 60,409,600	$ 18,122,880	$ 78,532,480	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 19,104,000	$ 19,104,000	$ 5,731,200	$ 24,835,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ 216,000	$ 216,000	$ 64,800	$ 280,800	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 912,000	$ 912,000	$ 273,600	$ 1,185,600	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 11,801,000	$ 11,801,000	$ 3,540,300	$ 15,341,300	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	1.00	$ 715,000		$ 715,000	$ 214,500	$ 929,500	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	9.69	$ 2,323,200		$ 22,511,808	$ 6,753,542	$ 29,265,350	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4.00	$ 475,000		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	4.00	$ 45,000		$ 180,000	$ 54,000	$ 234,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	9.69	$ 316,800		$ 3,069,792	$ 920,938	$ 3,990,730	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 8,879,700	$ 2,663,910	$ 11,543,610	
40.01		Demolition, clearing, site preparation	lump sum			$ 2,476,502	$ 2,476,502	$ 742,951	$ 3,219,453	
40.02		Site utilities, utility relocation	corridor mile	9.69	$ 59,000		$ 571,710	$ 171,513	$ 743,223	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 4,511,488	$ 4,511,488	$ 1,353,446	$ 5,864,934	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	108.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 1,050,000	$ 1,050,000	$ 315,000	$ 1,365,000	
40.09		Relocation of existing households and businesses	lump sum			$ 270,000	$ 270,000	$ 81,000	$ 351,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 24,355,815	$ 7,306,745	$ 31,662,560	
50.01		Wayside signaling equipment	track mile	19.38	$ 970,000		$ 18,798,600	$ 5,639,580	$ 24,438,180	
50.02		Signal power access and distribution	track mile	19.38	$ 5,500		$ 106,590	$ 31,977	$ 138,567	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.69	$ 555,000		$ 5,377,950	$ 1,613,385	$ 6,991,335	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.69	$ 7,500		$ 72,675	$ 21,803	$ 94,478	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 53,095,386	$ 15,928,616	$ 69,024,002	
60.01		Traction power transmission: High voltage	corridor mile	9.69	$ 60,400		$ 585,276	$ 175,583	$ 760,859	
60.02		Traction power supply: Substations	corridor mile	9.69	$ 1,800,000		$ 17,442,000	$ 5,232,600	$ 22,674,600	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.69	$ 3,600,000		$ 34,884,000	$ 10,465,200	$ 45,349,200	
60.04		Traction power control	corridor mile	9.69	$ 19,000		$ 184,110	$ 55,233	$ 239,343	
Construction Subtotal (Categories 10-60)							$ 146,740,501	$ 44,022,150	$ 190,762,651	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 22,891,518	$ -	$ 22,891,518	
80.01		Service Development Plan/Service Environmental				$ 1,907,626.51	$ 1,907,627	$ -	$ 1,907,627	
80.02		Preliminary Engineering/Project Environmental				$ 3,815,253.03	$ 3,815,253	$ -	$ 3,815,253	
80.03		Final design				$ 3,815,253.03	$ 3,815,253	$ -	$ 3,815,253	
80.04		Project management for design and construction				$ 3,815,253.03	$ 3,815,253	$ -	$ 3,815,253	
80.05		Construction administration & management				$ 5,722,879.54	$ 5,722,880	$ -	$ 5,722,880	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,907,626.51	$ 1,907,627	$ -	$ 1,907,627	
80.09		Engineering inspection				$ 1,907,626.51	$ 1,907,627	$ -	$ 1,907,627	
80.10		Start up								
Subtotal (Categories 10-80)							$ 169,632,019	$ 44,022,150	$ 213,654,169	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 213,654,169	
TOTAL CAPITAL COST/MILE									$ 22,048,934	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 16: I-85/Greenfield Merge to NS
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 174,611,025	$ 52,383,308	$ 226,994,333	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 93,070,000.00	$ 93,070,000	$ 27,921,000	$ 120,991,000	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 4,376,439.20	$ 4,376,439	$ 1,312,932	$ 5,689,371	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 22,031,914.00	$ 22,031,914	$ 6,609,574	$ 28,641,488	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	13.20	$ 960,960.00		$ 12,684,672	$ 3,805,402	$ 16,490,074	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	13.20	$ 2,323,200.00		$ 30,666,240	$ 9,199,872	$ 39,866,112	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each		$ 175,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 24	each	16	$ 475,000.00		$ 7,600,000	$ 2,280,000	$ 9,880,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	13.20	$ 316,800.00		$ 4,181,760	$ 1,254,528	$ 5,436,288	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 9,076,773	$ 2,723,032	$ 11,799,805	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,911,514	$ 1,911,514	$ 573,454	$ 2,484,968	
40.02		Site utilities, utility relocation	corridor mile	13.20	$ 59,000		$ 778,800	$ 233,640	$ 1,012,440	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 6,386,459	$ 6,386,459	$ 1,915,938	$ 8,302,397	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	46.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum				$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 33,178,200	$ 9,953,460	$ 43,131,660	
50.01		Wayside signaling equipment	track mile	26.40	$ 970,000		$ 25,608,000	$ 7,682,400	$ 33,290,400	
50.02		Signal power access and distribution	track mile	26.40	$ 5,500		$ 145,200	$ 43,560	$ 188,760	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	13.20	$ 555,000		$ 7,326,000	$ 2,197,800	$ 9,523,800	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	13.20	$ 7,500		$ 99,000	$ 29,700	$ 128,700	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 72,328,080	$ 21,698,424	$ 94,026,504	
60.01		Traction power transmission: High voltage	corridor mile	13.20	$ 60,400		$ 797,280	$ 239,184	$ 1,036,464	
60.02		Traction power supply: Substations	corridor mile	13.20	$ 1,800,000		$ 23,760,000	$ 7,128,000	$ 30,888,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	13.20	$ 3,600,000		$ 47,520,000	$ 14,256,000	$ 61,776,000	
60.04		Traction power control	corridor mile	13.20	$ 19,000		$ 250,800	$ 75,240	$ 326,040	
Construction Subtotal (Categories 10-60)							$ 289,194,078	$ 86,758,223	$ 375,952,302	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 45,114,276	$ -	$ 45,114,276	
80.01		Service Development Plan/Service Environmental				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.02		Preliminary Engineering/Project Environmental				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.03		Final design				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.04		Project management for design and construction				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.05		Construction administration & management				$ 11,278,569.05	$ 11,278,569	$ -	$ 11,278,569	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.09		Engineering inspection				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.10		Start up								
Subtotal (Categories 10-80)							$ 334,308,354	$ 86,758,223	$ 421,066,578	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 421,066,578**	
TOTAL CAPITAL COST/MILE									**$ 31,898,983**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 18: NS to Altanta
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 397,169,999	$ 119,151,000	$ 516,320,999	
10.01		Track structure: Viaduct	corridor mile	0.81	$ 50,000,000.00		$ 40,500,000	$ 12,150,000	$ 52,650,000	
10.02		Track structure: Major/Movable bridge	lump sum			$ 155,361,000.00	$ 155,361,000	$ 46,608,300	$ 201,969,300	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 29,399,519.20	$ 29,399,519	$ 8,819,856	$ 38,219,375	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	29.60	$ 960,960.00		$ 28,444,416	$ 8,533,325	$ 36,977,741	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	29.60	$ 2,323,200.00		$ 68,766,720	$ 20,630,016	$ 89,396,736	
	10.09.02	136lb CWR on Wood Ties	track mile	47.66	$ 950,400.00		$ 45,296,064	$ 13,588,819	$ 58,884,883	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28	$ 150,000.00		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.02	Turnout; No. 15	each	5	$ 175,000.00		$ 875,000	$ 262,500	$ 1,137,500	
	10.14.03	Turnout; No. 20	each	13	$ 200,000.00		$ 2,600,000	$ 780,000	$ 3,380,000	
	10.14.04	Turnout; No. 24	each	26	$ 475,000.00		$ 12,350,000	$ 3,705,000	$ 16,055,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	29.60	$ 316,800.00		$ 9,377,280	$ 2,813,184	$ 12,190,464	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.01		Station buildings: Intercity passenger rail only	each	2.00	$ 37,500,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 9,870,000	$ 2,961,000	$ 12,831,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000	$ 9,870,000	$ 2,961,000	$ 12,831,000	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 80,165,596	$ 24,049,679	$ 104,215,275	
40.01		Demolition, clearing, site preparation	lump sum			$ 3,722,436.80	$ 3,722,437	$ 1,116,731	$ 4,839,168	
40.02		Site utilities, utility relocation	corridor mile	29.6	$ 59,000.00		$ 1,746,400	$ 523,920	$ 2,270,320	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 46,215,759.02	$ 46,215,759	$ 13,864,728	$ 60,080,487	
	40.07.01	Railroad Owned - Urban	acre							
	40.07.02	Railroad Owned - Rural	acre							
	40.07.03	State Owned	acre							
	40.07.04	Land Acquisition - Urban	acre	36						
	40.07.05	Land Acquisition - Rural	acre							
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 28,481,000.00	$ 28,481,000	$ 8,544,300	$ 37,025,300	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 82,424,600	$ 24,727,380	$ 107,151,980	
50.01		Wayside signaling equipment	track mile	59.20	$ 970,000		$ 57,424,000	$ 17,227,200	$ 74,651,200	
50.02		Signal power access and distribution	track mile	59.20	$ 5,500		$ 325,600	$ 97,680	$ 423,280	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	29.60	$ 555,000		$ 16,428,000	$ 4,928,400	$ 21,356,400	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	15.00	$ 500,000		$ 7,500,000	$ 2,250,000	$ 9,750,000	
	50.06.02	Private At-Grade	each	1.00	$ 250,000		$ 250,000	$ 75,000	$ 325,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	29.60	$ 7,500		$ 222,000	$ 66,600	$ 288,600	
50.08		Station train approach warning system	each	2.00	$ 137,500		$ 275,000	$ 82,500	$ 357,500	
Total for Category 60: ELECTRIC TRACTION							$ 162,190,240	$ 48,657,072	$ 210,847,312	
60.01		Traction power transmission: High voltage	corridor mile	29.60	$ 60,400		$ 1,787,840	$ 536,352	$ 2,324,192	
60.02		Traction power supply: Substations	corridor mile	29.60	$ 1,800,000		$ 53,280,000	$ 15,984,000	$ 69,264,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	29.60	$ 3,600,000		$ 106,560,000	$ 31,968,000	$ 138,528,000	
60.04		Traction power control	corridor mile	29.60	$ 19,000		$ 562,400	$ 168,720	$ 731,120	
Construction Subtotal (Categories 10-60)							$ 806,820,435	$ 242,046,131	$ 1,048,866,566	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 125,863,988	$ -	$ 125,863,988	
80.01		Service Development Plan/Service Environmental				$ 10,488,665.66	$ 10,488,666	$ -	$ 10,488,666	
80.02		Preliminary Engineering/Project Environmental				$ 20,977,331.31	$ 20,977,331	$ -	$ 20,977,331	
80.03		Final design				$ 20,977,331.31	$ 20,977,331	$ -	$ 20,977,331	
80.04		Project management for design and construction				$ 20,977,331.31	$ 20,977,331	$ -	$ 20,977,331	
80.05		Construction administration & management				$ 31,465,996.97	$ 31,465,997	$ -	$ 31,465,997	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 10,488,665.66	$ 10,488,666	$ -	$ 10,488,666	
80.09		Engineering inspection				$ 10,488,665.66	$ 10,488,666	$ -	$ 10,488,666	
80.10		Start up								
Subtotal (Categories 10-80)							$ 932,684,423	$ 242,046,131	$ 1,174,730,553	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 1,174,730,553**	
TOTAL CAPITAL COST/MILE									**$ 39,686,843**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 20: NS/CSX to MMPT
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 26,129,907	$ 7,838,972	$ 33,968,879	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 5,376,000.00	$ 5,376,000.00	$ 1,612,800.00	$ 6,988,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,909,489.40	$ 1,909,489.40	$ 572,846.82	$ 2,482,336.22	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.87	$ 960,960.00		$ 836,035.20	$ 250,810.56	$ 1,086,845.76	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	2.60	$ 2,323,200.00		$ 6,040,320.00	$ 1,812,096.00	$ 7,852,416.00	
	10.09.02	136lb CWR on Wood Ties	track mile	3.47	$ 950,400.00		$ 3,297,888.00	$ 989,366.40	$ 4,287,254.40	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	4	$ 175,000.00		$ 700,000.00	$ 210,000.00	$ 910,000.00	
	10.14.03	Turnout; No. 20	each	6	$ 200,000.00		$ 1,200,000.00	$ 360,000.00	$ 1,560,000.00	
	10.14.04	Turnout; No. 24	each		$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	2.60	$ 316,800.00		$ 823,680.00	$ 247,104.00	$ 1,070,784.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 40,445,992	$ 12,133,798	$ 52,579,790	
40.01		Demolition, clearing, site preparation	lump sum			$ 109,409	$ 109,409	$ 32,823	$ 142,232	
40.02		Site utilities, utility relocation	corridor mile	2.60	$ 59,000		$ 153,400	$ 46,020	$ 199,420	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 21,818,183	$ 21,818,183	$ 6,545,455	$ 28,363,637	
	40.07.01	Railroad Owned - Urban	acre	13.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	1.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 18,365,000	$ 18,365,000	$ 5,509,500	$ 23,874,500	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 6,535,100	$ 1,960,530	$ 8,495,630	
50.01		Wayside signaling equipment	track mile	5.20	$ 970,000		$ 5,044,000	$ 1,513,200	$ 6,557,200	
50.02		Signal power access and distribution	track mile	5.20	$ 5,500		$ 28,600	$ 8,580	$ 37,180	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	2.60	$ 555,000		$ 1,443,000	$ 432,900	$ 1,875,900	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	2.60	$ 7,500		$ 19,500	$ 5,850	$ 25,350	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 14,246,440	$ 4,273,932	$ 18,520,372	
60.01		Traction power transmission: High voltage	corridor mile	2.60	$ 60,400		$ 157,040	$ 47,112	$ 204,152	
60.02		Traction power supply: Substations	corridor mile	2.60	$ 1,800,000		$ 4,680,000	$ 1,404,000	$ 6,084,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	2.60	$ 3,600,000		$ 9,360,000	$ 2,808,000	$ 12,168,000	
60.04		Traction power control	corridor mile	2.60	$ 19,000		$ 49,400	$ 14,820	$ 64,220	
Construction Subtotal (Categories 10-60)							$ 87,357,439	$ 26,207,232	$ 113,564,671	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 13,627,760	$ -	$ 13,627,760	
80.01		Service Development Plan/Service Environmental				$ 1,135,646.71	$ 1,135,647	$ -	$ 1,135,647	
80.02		Preliminary Engineering/Project Environmental				$ 2,271,293.41	$ 2,271,293	$ -	$ 2,271,293	
80.03		Final design				$ 2,271,293.41	$ 2,271,293	$ -	$ 2,271,293	
80.04		Project management for design and construction				$ 2,271,293.41	$ 2,271,293	$ -	$ 2,271,293	
80.05		Construction administration & management				$ 3,406,940.12	$ 3,406,940	$ -	$ 3,406,940	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,135,646.71	$ 1,135,647	$ -	$ 1,135,647	
80.09		Engineering inspection				$ 1,135,646.71	$ 1,135,647	$ -	$ 1,135,647	
80.10		Start up								
Subtotal (Categories 10-80)							$ 100,985,199	$ 26,207,232	$ 127,192,431	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 127,192,431	
TOTAL CAPITAL COST/MILE									$ 48,920,166	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 130MPH Dedicated Service
Segment	Segment 22: MMPT to Altanta Airport
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 71,208,900	$ 21,362,670	$ 92,571,570	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 40,896,000.00	$ 40,896,000.00	$ 12,268,800.00	$ 53,164,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ -	$ -	$ -	$ -	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	9.50	$ 715,000.00		$ 6,792,500.00	$ 2,037,750.00	$ 8,830,250.00	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.00	$ 960,960.00		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	9.50	$ 2,323,200.00		$ 22,070,400.00	$ 6,621,120.00	$ 28,691,520.00	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0	$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	6	$ 175,000.00		$ 1,050,000.00	$ 315,000.00	$ 1,365,000.00	
	10.14.03	Turnout; No. 20	each	2	$ 200,000.00		$ 400,000.00	$ 120,000.00	$ 520,000.00	
	10.14.04	Turnout; No. 24	each	0	$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 60,000,000	$ 18,000,000	$ 78,000,000	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ 60,000,000	$ 60,000,000	$ 18,000,000.00	$ 78,000,000	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 184,802,921	$ 55,440,876	$ 240,243,797	
40.01		Demolition, clearing, site preparation	lump sum				$ -	$ -	$ -	
40.02		Site utilities, utility relocation	corridor mile	9.50	$ 59,000		$ 560,500	$ 168,150	$ 728,650	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 184,242,421	$ 184,242,421	$ 55,272,726	$ 239,515,147	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum				$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 27,878,250	$ 8,363,475	$ 36,241,725	
50.01		Wayside signaling equipment	track mile	19.00	$ 970,000		$ 18,430,000	$ 5,529,000	$ 23,959,000	
50.02		Signal power access and distribution	track mile	19.00	$ 5,500		$ 104,500	$ 31,350	$ 135,850	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.50	$ 555,000		$ 5,272,500	$ 1,581,750	$ 6,854,250	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	8.00	$ 500,000		$ 4,000,000	$ 1,200,000	$ 5,200,000	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.50	$ 7,500		$ 71,250	$ 21,375	$ 92,625	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 52,054,300	$ 15,616,290	$ 67,670,590	
60.01		Traction power transmission: High voltage	corridor mile	9.50	$ 60,400		$ 573,800	$ 172,140	$ 745,940	
60.02		Traction power supply: Substations	corridor mile	9.50	$ 1,800,000		$ 17,100,000	$ 5,130,000	$ 22,230,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.50	$ 3,600,000		$ 34,200,000	$ 10,260,000	$ 44,460,000	
60.04		Traction power control	corridor mile	9.50	$ 19,000		$ 180,500	$ 54,150	$ 234,650	
Construction Subtotal (Categories 10-60)							$ 529,944,371	$ 158,983,311	$ 688,927,682	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 82,671,322	$ -	$ 82,671,322	
80.01		Service Development Plan/Service Environmental				$ 6,889,276.82	$ 6,889,277	$ -	$ 6,889,277	
80.02		Preliminary Engineering/Project Environmental				$ 13,778,553.63	$ 13,778,554	$ -	$ 13,778,554	
80.03		Final design				$ 13,778,553.63	$ 13,778,554	$ -	$ 13,778,554	
80.04		Project management for design and construction				$ 13,778,553.63	$ 13,778,554	$ -	$ 13,778,554	
80.05		Construction administration & management				$ 20,667,830.45	$ 20,667,830	$ -	$ 20,667,830	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 6,889,276.82	$ 6,889,277	$ -	$ 6,889,277	
80.09		Engineering inspection				$ 6,889,276.82	$ 6,889,277	$ -	$ 6,889,277	
80.10		Start up								
Subtotal (Categories 10-80)							$ 612,615,692	$ 158,983,311	$ 771,599,003	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 771,599,003**	
TOTAL CAPITAL COST/MILE									**$ 81,220,948**	

ALTERNATIVE 3: GREENFIELD (220 MPH)

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10:		**TRACK STRUCTURES AND TRACK**					$ 2,176,316,722	$ 652,895,017	$ 2,829,211,739	
10.01		Track structure: Viaduct	corridor mile	0.81	$ 50,000,000		$ 40,500,000	$ 12,150,000	$ 52,650,000	
10.02		Track structure: Major/Movable bridge	lump sum			$ 846,391,000	$ 846,391,000	$ 253,917,300	$ 1,100,308,300	
10.03		Track structure: Undergrade Bridges	lump sum			$ 13,392,000	$ 13,392,000	$ 4,017,600	$ 17,409,600	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 21,704,439	$ 21,704,439	$ 6,511,332	$ 28,215,771	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 316,255,523	$ 316,255,523	$ 94,876,657	$ 411,132,179	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	39.23	$ 715,000		$ 28,049,450	$ 8,414,835	$ 36,464,285	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile	53.70	$ 960,960		$ 51,603,552	$ 15,481,066	$ 67,084,618	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	273.16	$ 2,323,200		$ 634,605,312	$ 190,381,594	$ 824,986,906	
	10.09.02	136lb CWR on Wood Ties	corridor mile	61.16	$ 950,400		$ 58,126,464	$ 17,437,939	$ 75,564,403	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	28.00	$ 150,000		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.02	Turnout; No. 15	each	15.00	$ 175,000		$ 2,625,000	$ 787,500	$ 3,412,500	
	10.14.03	Turnout; No. 20	each	21.00	$ 200,000		$ 4,200,000	$ 1,260,000	$ 5,460,000	
	10.14.04	Turnout; No. 24	each	129.00	$ 475,000		$ 61,275,000	$ 18,382,500	$ 79,657,500	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	87.00	$ 45,000		$ 3,915,000	$ 1,174,500	$ 5,089,500	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	263.66	$ 316,800		$ 83,527,488	$ 25,058,246	$ 108,585,734	
Total for Category 20:		**STATIONS, TERMINALS, INTERMODAL**					$ 347,500,000	$ 104,250,000	$ 451,750,000	
20.01		Station buildings: Intercity passenger rail only	each	5.00	$ 25,000,000		$ 125,000,000	$ 37,500,000	$ 162,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot	0.00	$ 215		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ 60,000,000	$ 60,000,000	$ 18,000,000.00	$ 78,000,000	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ 37,500,000	$ 37,500,000	$ 11,250,000.00	$ 48,750,000	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ 50,000,000	$ 50,000,000	$ 15,000,000.00	$ 65,000,000	
	20.02.04	Intercity Approach Building	each	2.00	$ 37,500,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30:		**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**					$ 143,870,000	$ 43,161,000	$ 187,031,000	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ 134,000,000	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ 9,870,000	$ 9,870,000	$ 2,961,000	$ 12,831,000	
Total for Category 40,:		**SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS**					$ 531,171,369	$ 159,351,411	$ 690,522,780	
40.01		Demolition, clearing, site preparation	lump sum			$ 62,370,171	$ 62,370,171	$ 18,711,051	$ 81,081,222	
40.02		Site utilities, utility relocation	corridor mile	273.16	$ 59,000		$ 16,116,440	$ 4,834,932	$ 20,951,372	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ -		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 323,300,758	$ 323,300,758	$ 96,990,228	$ 420,290,986	
	40.07.01	Railroad Owned - Urban	acre	13.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	191.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 126,374,000	$ 126,374,000	$ 37,912,200	$ 164,286,200	
40.09		Relocation of existing households and businesses	lump sum			$ 3,010,000	$ 3,010,000	$ 903,000	$ 3,913,000	
	40.09.01	Relocation - Urban	acre	0.00						
	40.09.02	Relocation - Rural	acre	0.00						
Total for Category 50:		**COMMUNICATIONS & SIGNALING**					$ 701,300,160	$ 210,390,048	$ 911,690,208	
50.01		Wayside signaling equipment	track mile	546.32	$ 970,000		$ 529,930,400	$ 158,979,120	$ 688,909,520	
50.02		Signal power access and distribution	track mile	546.32	$ 5,500		$ 3,004,760	$ 901,428	$ 3,906,188	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	273.16	$ 555,000		$ 151,603,800	$ 45,481,140	$ 197,084,940	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	27.00	$ 500,000		$ 13,500,000	$ 4,050,000	$ 17,550,000	
	50.06.02	Private At-Grade	each	1.00	$ 250,000		$ 250,000	$ 75,000	$ 325,000	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	273.16	$ 7,500		$ 2,048,700	$ 614,610	$ 2,663,310	
50.08		Station train approach warning system	each	7.00	$ 137,500		$ 962,500	$ 288,750	$ 1,251,250	
Total for Category 60:		**ELECTRIC TRACTION**					$ 1,496,752,904	$ 449,025,871	$ 1,945,778,775	
60.01		Traction power transmission: High voltage	corridor mile	273.16	$ 60,400		$ 16,498,864	$ 4,949,659	$ 21,448,523	
60.02		Traction power supply: Substations	corridor mile	273.16	$ 1,800,000		$ 491,688,000	$ 147,506,400	$ 639,194,400	
60.03		Traction power distribution: Catenary and third rail	corridor mile	273.16	$ 3,600,000		$ 983,376,000	$ 295,012,800	$ 1,278,388,800	
60.04		Traction power control	corridor mile	273.16	$ 19,000		$ 5,190,040	$ 1,557,012	$ 6,747,052	
Construction Subtotal (Categories 10-60)							$ 5,396,911,155	$ 1,619,073,347	$ 7,015,984,502	
Total for Category 70:		**VEHICLES**					$ 453,600,000	$ 136,080,000	$ 589,680,000	
70.00		Vehicle acquisition: Electric locomotive	each	28.00	$ 8,000,000		$ 224,000,000	$ 67,200,000	$ 291,200,000	
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ 4,200,000		$ -	$ -	$ -	
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	56.00	$ 4,100,000		$ 229,600,000	$ 68,880,000	$ 298,480,000	
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum			$ -	$ -	$ -	$ -	
Total for Category 80:		**PROFESSIONAL SERVICES (applies to Cats. 10-60)**					$ 841,918,140	$ -	$ 841,918,140	
80.01		Service Development Plan/Service Environmental				$ 70,159,845.02	$ 70,159,845	$ -	$ 70,159,845	
80.02		Preliminary Engineering/Project Environmental				$ 140,319,690.04	$ 140,319,690	$ -	$ 140,319,690	
80.03		Final design				$ 140,319,690.04	$ 140,319,690	$ -	$ 140,319,690	
80.04		Project management for design and construction				$ 140,319,690.04	$ 140,319,690	$ -	$ 140,319,690	
80.05		Construction administration & management				$ 210,479,535.05	$ 210,479,535	$ -	$ 210,479,535	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 70,159,845.02	$ 70,159,845	$ -	$ 70,159,845	
80.09		Engineering inspection				$ 70,159,845.02	$ 70,159,845	$ -	$ 70,159,845	
80.10		Start up								
Subtotal (Categories 10-80)							$ 6,692,429,295	$ 1,755,153,347	$ 8,447,582,642	
TOTAL CAPITAL COSTS (Categories 10-80)									**$ 8,447,582,642**	
TOTAL CAPITAL COST/MILE									**$ 30,925,401**	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 1: Charlotte Gateway to NS/Greenfield Split
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 119,950,601	$ 35,985,180	$ 155,935,781	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 60,600,000	$ 60,600,000	$ 18,180,000	$ 78,780,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 513,000	$ 513,000	$ 153,900	$ 666,900	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 9,677,460	$ 9,677,460	$ 2,903,238	$ 12,580,698	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	2.00	$ 715,000		$ 1,430,000	$ 429,000	$ 1,859,000	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile	10.03	$ 960,960		$ 9,638,429	$ 2,891,529	$ 12,529,957	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	10.03	$ 2,323,200		$ 23,301,696	$ 6,990,509	$ 30,292,205	
	10.09.02	136lb CWR on Wood Ties	corridor mile	10.03	$ 950,400		$ 9,532,512	$ 2,859,754	$ 12,392,266	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4.00	$ 475,000		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	4.00	$ 45,000		$ 180,000	$ 54,000	$ 234,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	10.03	$ 316,800		$ 3,177,504	$ 953,251	$ 4,130,755	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 50,000,000	$ 15,000,000	$ 65,000,000	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ 50,000,000	$ 50,000,000	$ 15,000,000.00	$ 65,000,000	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 60,393,525	$ 18,118,057	$ 78,511,582	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,235,572	$ 1,235,572	$ 370,672	$ 1,606,244	
40.02		Site utilities, utility relocation	corridor mile	10.03	$ 59,000		$ 591,770	$ 177,531	$ 769,301	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 17,818,182	$ 17,818,182	$ 5,345,455	$ 23,163,637	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 40,748,000	$ 40,748,000	$ 12,224,400	$ 52,972,400	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 27,210,405	$ 8,163,122	$ 35,373,527	
50.01		Wayside signaling equipment	track mile	20.06	$ 970,000		$ 19,458,200	$ 5,837,460	$ 25,295,660	
50.02		Signal power access and distribution	track mile	20.06	$ 5,500		$ 110,330	$ 33,099	$ 143,429	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	10.03	$ 555,000		$ 5,566,650	$ 1,669,995	$ 7,236,645	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	4.00	$ 500,000		$ 2,000,000	$ 600,000	$ 2,600,000	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	10.03	$ 7,500		$ 75,225	$ 22,568	$ 97,793	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 54,958,382	$ 16,487,515	$ 71,445,897	
60.01		Traction power transmission: High voltage	corridor mile	10.03	$ 60,400		$ 605,812	$ 181,744	$ 787,556	
60.02		Traction power supply: Substations	corridor mile	10.03	$ 1,800,000		$ 18,054,000	$ 5,416,200	$ 23,470,200	
60.03		Traction power distribution: Catenary and third rail	corridor mile	10.03	$ 3,600,000		$ 36,108,000	$ 10,832,400	$ 46,940,400	
60.04		Traction power control	corridor mile	10.03	$ 19,000		$ 190,570	$ 57,171	$ 247,741	
Construction Subtotal (Categories 10-60)							$ 312,512,913	$ 93,753,874	$ 406,266,786	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 48,752,014	$ -	$ 48,752,014	
80.01		Service Development Plan/Service Environmental				$ 4,062,667.86	$ 4,062,668	$ -	$ 4,062,668	
80.02		Preliminary Engineering/Project Environmental				$ 8,125,335.73	$ 8,125,336	$ -	$ 8,125,336	
80.03		Final design				$ 8,125,335.73	$ 8,125,336	$ -	$ 8,125,336	
80.04		Project management for design and construction				$ 8,125,335.73	$ 8,125,336	$ -	$ 8,125,336	
80.05		Construction administration & management				$ 12,188,003.59	$ 12,188,004	$ -	$ 12,188,004	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 4,062,667.86	$ 4,062,668	$ -	$ 4,062,668	
80.09		Engineering inspection				$ 4,062,667.86	$ 4,062,668	$ -	$ 4,062,668	
80.10		Start up								
Subtotal (Categories 10-80)							$ 361,264,927	$ 93,753,874	$ 455,018,801	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 455,018,801	
TOTAL CAPITAL COST/MILE									$ 45,365,783	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 3: NS/Greenfield Split to SC State Line
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 97,313,400	$ 29,194,020	$ 126,507,420	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 46,560,000	$ 46,560,000	$ 13,968,000	$ 60,528,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ 1,368,000	$ 1,368,000	$ 410,400	$ 1,778,400	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 1,026,000	$ 1,026,000	$ 307,800	$ 1,333,800	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 16,605,800	$ 16,605,800	$ 4,981,740	$ 21,587,540	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	0.00	$ 715,000		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	11.24	$ 2,323,200		$ 26,112,768	$ 7,833,830	$ 33,946,598	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4.00	$ 475,000		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	4.00	$ 45,000		$ 180,000	$ 54,000	$ 234,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	11.24	$ 316,800		$ 3,560,832	$ 1,068,250	$ 4,629,082	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.01		Station buildings: Intercity passenger rail only	each	1.00	$ 25,000,000		$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 9,737,379	$ 2,921,214	$ 12,658,592	
40.01		Demolition, clearing, site preparation	lump sum			$ 3,383,865	$ 3,383,865	$ 1,015,159	$ 4,399,024	
40.02		Site utilities, utility relocation	corridor mile	11.24	$ 59,000		$ 663,160	$ 198,948	$ 862,108	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 3,745,354	$ 3,745,354	$ 1,123,606	$ 4,868,960	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 1,785,000	$ 1,785,000	$ 535,500	$ 2,320,500	
40.09		Relocation of existing households and businesses	lump sum			$ 160,000	$ 160,000	$ 48,000	$ 208,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 28,389,240	$ 8,516,772	$ 36,906,012	
50.01		Wayside signaling equipment	track mile	22.48	$ 970,000		$ 21,805,600	$ 6,541,680	$ 28,347,280	
50.02		Signal power access and distribution	track mile	22.48	$ 5,500		$ 123,640	$ 37,092	$ 160,732	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	11.24	$ 555,000		$ 6,238,200	$ 1,871,460	$ 8,109,660	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	11.24	$ 7,500		$ 84,300	$ 25,290	$ 109,590	
50.08		Station train approach warning system	each	1.00	$ 137,500		$ 137,500	$ 41,250	$ 178,750	
Total for Category 60: ELECTRIC TRACTION							$ 61,588,456	$ 18,476,537	$ 80,064,993	
60.01		Traction power transmission: High voltage	corridor mile	11.24	$ 60,400		$ 678,896	$ 203,669	$ 882,565	
60.02		Traction power supply: Substations	corridor mile	11.24	$ 1,800,000		$ 20,232,000	$ 6,069,600	$ 26,301,600	
60.03		Traction power distribution: Catenary and third rail	corridor mile	11.24	$ 3,600,000		$ 40,464,000	$ 12,139,200	$ 52,603,200	
60.04		Traction power control	corridor mile	11.24	$ 19,000		$ 213,560	$ 64,068	$ 277,628	
Construction Subtotal (Categories 10-60)							$ 222,028,475	$ 66,608,542	$ 288,637,017	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 34,636,442	$ -	$ 34,636,442	
80.01		Service Development Plan/Service Environmental				$ 2,886,370.17	$ 2,886,370	$ -	$ 2,886,370	
80.02		Preliminary Engineering/Project Environmental				$ 5,772,740.34	$ 5,772,740	$ -	$ 5,772,740	
80.03		Final design				$ 5,772,740.34	$ 5,772,740	$ -	$ 5,772,740	
80.04		Project management for design and construction				$ 5,772,740.34	$ 5,772,740	$ -	$ 5,772,740	
80.05		Construction administration & management				$ 8,659,110.51	$ 8,659,111	$ -	$ 8,659,111	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 2,886,370.17	$ 2,886,370	$ -	$ 2,886,370	
80.09		Engineering inspection				$ 2,886,370.17	$ 2,886,370	$ -	$ 2,886,370	
80.10		Start up								
Subtotal (Categories 10-80)							$ 256,664,917	$ 66,608,542	$ 323,273,459	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 323,273,459	
TOTAL CAPITAL COST/MILE									$ 28,760,984	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 8: NC State Line to GA State Line
Version	v0

		Value Inputs							
		Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK						$ 888,521,040	$ 266,556,312	$ 1,155,077,352	
10.01	Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02	Track structure: Major/Movable bridge	lump sum			$ 335,424,000	$ 335,424,000	$ 100,627,200	$ 436,051,200	
10.03	Track structure: Undergrade Bridges	lump sum			$ 10,224,000	$ 10,224,000	$ 3,067,200	$ 13,291,200	
10.04	Track structure: Culverts and drainage structures	lump sum			$ 10,659,000	$ 10,659,000	$ 3,197,700	$ 13,856,700	
10.05	Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 161,101,140	$ 161,101,140	$ 48,330,342	$ 209,431,482	
10.06	Track structure: At-grade (grading and subgrade stabilization)	corridor mile	17.74	$ 715,000		$ 12,684,100	$ 3,805,230	$ 16,489,330	
10.07	Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08	Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09	Track new construction: Conventional ballasted								
10.09.01	136lb CWR on Concrete Ties	corridor mile	125.92	$ 2,323,200		$ 292,537,344	$ 87,761,203	$ 380,298,547	
10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10	Track new construction: Non-ballasted								
10.11	Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12	Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13	Track rehabilitation: Component replacement (rail, ties, etc)								
10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14	Track: Special track work (switches, turnouts, insulated joints)								
10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
10.14.02	Turnout; No. 15								
10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
10.14.04	Turnout; No. 24	each	50.00	$ 475,000		$ 23,750,000	$ 7,125,000	$ 30,875,000	
10.15	Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16	Track: Switch heaters (with power and control)	each	50.00	$ 45,000		$ 2,250,000	$ 675,000	$ 2,925,000	
10.17	Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18	Other linear structures including fencing, sound walls	corridor mile	125.92	$ 316,800		$ 39,891,456	$ 11,967,437	$ 51,858,893	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL						$ 112,500,000	$ 33,750,000	$ 146,250,000	
20.01	Station buildings: Intercity passenger rail only	each	3.00	$ 25,000,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.02	Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ 37,500,000	$ 37,500,000	$ 11,250,000.00	$ 48,750,000	
20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03	Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04	Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05	Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06	Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07	Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08	Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09	Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS						$ -	$ -	$ -	
30.01	Administration building: Office, sales, storage, revenue counting								
30.02	Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03	Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04	Storage or maintenance-of-way building/bases								
30.05	Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS						$ 99,302,329	$ 29,790,699	$ 129,093,027	
40.01	Demolition, clearing, site preparation	lump sum			$ 34,176,459	$ 34,176,459	$ 10,252,938	$ 44,429,396	
40.02	Site utilities, utility relocation	corridor mile	125.92	$ 59,000		$ 7,429,280	$ 2,228,784	$ 9,658,064	
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04	Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05	Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06	Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07	Purchase or lease of real estate	lump sum			$ 26,326,590	$ 26,326,590	$ 7,897,977	$ 34,224,567	
40.07.01	Railroad Owned - Urban	acre	0.00						
40.07.02	Railroad Owned - Rural	acre	0.00						
40.07.03	State Owned	acre	0.00						
40.07.04	Land Acquisition - Urban	acre	0.00						
40.07.05	Land Acquisition - Rural	acre	0.00						
40.08	Highway/pedestrian overpass/grade separations	lump sum			$ 29,890,000	$ 29,890,000	$ 8,967,000	$ 38,857,000	
40.09	Relocation of existing households and businesses	lump sum			$ 1,480,000	$ 1,480,000	$ 444,000	$ 1,924,000	
40.09.01	Relocation - Urban	acre							
40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING						$ 316,912,420	$ 95,073,726	$ 411,986,146	
50.01	Wayside signaling equipment	track mile	251.84	$ 970,000		$ 244,284,800	$ 73,285,440	$ 317,570,240	
50.02	Signal power access and distribution	track mile	251.84	$ 5,500		$ 1,385,120	$ 415,536	$ 1,800,656	
50.03	On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04	Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05	Communications	corridor mile	125.92	$ 555,000		$ 69,885,600	$ 20,965,680	$ 90,851,280	
50.06	Grade crossing protection								
50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07	Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	125.92	$ 7,500		$ 944,400	$ 283,320	$ 1,227,720	
50.08	Station train approach warning system	each	3.00	$ 137,500		$ 412,500	$ 123,750	$ 536,250	
Total for Category 60: ELECTRIC TRACTION						$ 689,966,048	$ 206,989,814	$ 896,955,862	
60.01	Traction power transmission: High voltage	corridor mile	125.92	$ 60,400		$ 7,605,568	$ 2,281,670	$ 9,887,238	
60.02	Traction power supply: Substations	corridor mile	125.92	$ 1,800,000		$ 226,656,000	$ 67,996,800	$ 294,652,800	
60.03	Traction power distribution: Catenary and third rail	track mile	125.92	$ 3,600,000		$ 453,312,000	$ 135,993,600	$ 589,305,600	
60.04	Traction power control	track mile	125.92	$ 19,000		$ 2,392,480	$ 717,744	$ 3,110,224	
Construction Subtotal (Categories 10-60)						$ 2,107,201,837	$ 632,160,551	$ 2,739,362,387	
Total for Category 70: VEHICLES						$ -	$ -	$ -	
70.00	Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01	Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02	Vehicle acquisition: Electric multiple unit								
70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03	Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04	Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05	Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06	Vehicle acquisition: Maintenance of way vehicles								
70.07	Vehicle acquisition: Non-railroad support vehicles								
70.08	Vehicle refurbishment: Electric locomotive								
70.09	Vehicle refurbishment: Non-electric locomotive								
70.10	Vehicle refurbishment: Electric multiple unit								
70.11	Vehicle refurbishment: Diesel multiple unit								
70.12	Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13	Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14	Vehicle refurbishment: Maintenance of way vehicles								
70.15	Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)						$ 328,723,486	$ -	$ 328,723,486	
80.01	Service Development Plan/Service Environmental				$ 27,393,623.87	$ 27,393,624	$ -	$ 27,393,624	
80.02	Preliminary Engineering/Project Environmental				$ 54,787,247.75	$ 54,787,248	$ -	$ 54,787,248	
80.03	Final design				$ 54,787,247.75	$ 54,787,248	$ -	$ 54,787,248	
80.04	Project management for design and construction				$ 54,787,247.75	$ 54,787,248	$ -	$ 54,787,248	
80.05	Construction administration & management				$ 82,180,871.62	$ 82,180,872	$ -	$ 82,180,872	
80.06	Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08	Surveys, testing, investigation				$ 27,393,623.87	$ 27,393,624	$ -	$ 27,393,624	
80.09	Engineering inspection				$ 27,393,623.87	$ 27,393,624	$ -	$ 27,393,624	
80.10	Start up								
Subtotal (Categories 10-80)						$ 2,435,925,323	$ 632,160,551	$ 3,068,085,874	
TOTAL CAPITAL COSTS (Categories 10-80)								$ 3,068,085,874	
TOTAL CAPITAL COST/MILE								$ 24,365,358	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 11: SC State Line to NS/CSX Split
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 341,002,250	$ 102,300,675	$ 443,302,925	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 90,000,000	$ 90,000,000	$ 27,000,000	$ 117,000,000	
10.03		Track structure: Undergrade Bridges	lump sum			$ 1,584,000	$ 1,584,000	$ 475,200	$ 2,059,200	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 4,218,000	$ 4,218,000	$ 1,265,400	$ 5,483,400	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 63,729,200	$ 63,729,200	$ 19,118,760	$ 82,847,960	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	8.99	$ 715,000		$ 6,427,850	$ 1,928,355	$ 8,356,205	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	61.38	$ 2,323,200		$ 142,598,016	$ 42,779,405	$ 185,377,421	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	25.00	$ 475,000		$ 11,875,000	$ 3,562,500	$ 15,437,500	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	25.00	$ 45,000		$ 1,125,000	$ 337,500	$ 1,462,500	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	61.38	$ 316,800		$ 19,445,184	$ 5,833,555	$ 25,278,739	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.01		Station buildings: Intercity passenger rail only	each	1.00	$ 25,000,000		$ 25,000,000	$ 7,500,000	$ 32,500,000	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 38,367,156	$ 11,510,147	$ 49,877,303	
40.01		Demolition, clearing, site preparation	lump sum			$ 15,354,413	$ 15,354,413	$ 4,606,324	$ 19,960,737	
40.02		Site utilities, utility relocation	corridor mile	61.38	$ 59,000		$ 3,621,420	$ 1,086,426	$ 4,707,846	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 12,236,323	$ 12,236,323	$ 3,670,897	$ 15,907,220	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	0.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 6,055,000	$ 6,055,000	$ 1,816,500	$ 7,871,500	
40.09		Relocation of existing households and businesses	lump sum			$ 1,100,000	$ 1,100,000	$ 330,000	$ 1,430,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 154,416,130	$ 46,324,839	$ 200,740,969	
50.01		Wayside signaling equipment	track mile	122.76	$ 970,000		$ 119,077,200	$ 35,723,160	$ 154,800,360	
50.02		Signal power access and distribution	track mile	122.76	$ 5,500		$ 675,180	$ 202,554	$ 877,734	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	61.38	$ 555,000		$ 34,065,900	$ 10,219,770	$ 44,285,670	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	61.38	$ 7,500		$ 460,350	$ 138,105	$ 598,455	
50.08		Station train approach warning system	each	1.00	$ 137,500		$ 137,500	$ 41,250	$ 178,750	
Total for Category 60: ELECTRIC TRACTION							$ 336,325,572	$ 100,897,672	$ 437,223,244	
60.01		Traction power transmission: High voltage	corridor mile	61.38	$ 60,400		$ 3,707,352	$ 1,112,206	$ 4,819,558	
60.02		Traction power supply: Substations	corridor mile	61.38	$ 1,800,000		$ 110,484,000	$ 33,145,200	$ 143,629,200	
60.03		Traction power distribution: Catenary and third rail	corridor mile	61.38	$ 3,600,000		$ 220,968,000	$ 66,290,400	$ 287,258,400	
60.04		Traction power control	corridor mile	61.38	$ 19,000		$ 1,166,220	$ 349,866	$ 1,516,086	
Construction Subtotal (Categories 10-60)							$ 895,111,108	$ 268,533,332	$ 1,163,644,440	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 139,637,333	$ -	$ 139,637,333	
80.01		Service Development Plan/Service Environmental				$ 11,636,444.40	$ 11,636,444	$ -	$ 11,636,444	
80.02		Preliminary Engineering/Project Environmental				$ 23,272,888.81	$ 23,272,889	$ -	$ 23,272,889	
80.03		Final design				$ 23,272,888.81	$ 23,272,889	$ -	$ 23,272,889	
80.04		Project management for design and construction				$ 23,272,888.81	$ 23,272,889	$ -	$ 23,272,889	
80.05		Construction administration & management				$ 34,909,333.21	$ 34,909,333	$ -	$ 34,909,333	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 11,636,444.40	$ 11,636,444	$ -	$ 11,636,444	
80.09		Engineering inspection				$ 11,636,444.40	$ 11,636,444	$ -	$ 11,636,444	
80.10		Start up								
Subtotal (Categories 10-80)							$ 1,034,748,441	$ 268,533,332	$ 1,303,281,773	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 1,303,281,773	
TOTAL CAPITAL COST/MILE									$ 21,233,004	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 13: Greenfield to I-85
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 60,409,600	$ 18,122,880	$ 78,532,480	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 19,104,000	$ 19,104,000	$ 5,731,200	$ 24,835,200	
10.03		Track structure: Undergrade Bridges	lump sum			$ 216,000	$ 216,000	$ 64,800	$ 280,800	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 912,000	$ 912,000	$ 273,600	$ 1,185,600	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 11,801,000	$ 11,801,000	$ 3,540,300	$ 15,341,300	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile	1.00	$ 715,000		$ 715,000	$ 214,500	$ 929,500	
10.07		Track structure: Tunnel	corridor mile	0.00	$ 116,000,000		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	track mile		$ 960,960		$ -	$ -	$ -	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	9.69	$ 2,323,200		$ 22,511,808	$ 6,753,542	$ 29,265,350	
	10.09.02	136lb CWR on Wood Ties	corridor mile		$ 950,400		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted								
10.11		Track rehabilitation: Ballast and surfacing	track mile	0.00	$ 132,000		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile	0.00	$ 38,000		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile	0.00	$ 427,000		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile	0.00	$ 491,000		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile	0.00	$ 966,000		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each	0.00	$ 150,000		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15								
	10.14.03	Turnout; No. 20	each	0.00	$ 200,000		$ -	$ -	$ -	
	10.14.04	Turnout; No. 24	each	4.00	$ 475,000		$ 1,900,000	$ 570,000	$ 2,470,000	
10.15		Track: Major interlockings	each	0.00	$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each	4.00	$ 45,000		$ 180,000	$ 54,000	$ 234,000	
10.17		Track: Vibration and noise dampening	track mile	0.00	$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	9.69	$ 316,800		$ 3,069,792	$ 920,938	$ 3,990,730	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 8,879,700	$ 2,663,910	$ 11,543,610	
40.01		Demolition, clearing, site preparation	lump sum			$ 2,476,502	$ 2,476,502	$ 742,951	$ 3,219,453	
40.02		Site utilities, utility relocation	corridor mile	9.69	$ 59,000		$ 571,710	$ 171,513	$ 743,223	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 4,511,488	$ 4,511,488	$ 1,353,446	$ 5,864,934	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	108.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 1,050,000	$ 1,050,000	$ 315,000	$ 1,365,000	
40.09		Relocation of existing households and businesses	lump sum			$ 270,000	$ 270,000	$ 81,000	$ 351,000	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 24,355,815	$ 7,306,745	$ 31,662,560	
50.01		Wayside signaling equipment	track mile	19.38	$ 970,000		$ 18,798,600	$ 5,639,580	$ 24,438,180	
50.02		Signal power access and distribution	track mile	19.38	$ 5,500		$ 106,590	$ 31,977	$ 138,567	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	9.69	$ 555,000		$ 5,377,950	$ 1,613,385	$ 6,991,335	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.69	$ 7,500		$ 72,675	$ 21,803	$ 94,478	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 53,095,386	$ 15,928,616	$ 69,024,002	
60.01		Traction power transmission: High voltage	corridor mile	9.69	$ 60,400		$ 585,276	$ 175,583	$ 760,859	
60.02		Traction power supply: Substations	corridor mile	9.69	$ 1,800,000		$ 17,442,000	$ 5,232,600	$ 22,674,600	
60.03		Traction power distribution: Catenary and third rail	corridor mile	9.69	$ 3,600,000		$ 34,884,000	$ 10,465,200	$ 45,349,200	
60.04		Traction power control	corridor mile	9.69	$ 19,000		$ 184,110	$ 55,233	$ 239,343	
Construction Subtotal (Categories 10-60)							$ 146,740,501	$ 44,022,150	$ 190,762,651	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 22,891,518	$ -	$ 22,891,518	
80.01		Service Development Plan/Service Environmental				$ 1,907,626.51	$ 1,907,627	$ -	$ 1,907,627	
80.02		Preliminary Engineering/Project Environmental				$ 3,815,253.03	$ 3,815,253	$ -	$ 3,815,253	
80.03		Final design				$ 3,815,253.03	$ 3,815,253	$ -	$ 3,815,253	
80.04		Project management for design and construction				$ 3,815,253.03	$ 3,815,253	$ -	$ 3,815,253	
80.05		Construction administration & management				$ 5,722,879.54	$ 5,722,880	$ -	$ 5,722,880	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,907,626.51	$ 1,907,627	$ -	$ 1,907,627	
80.09		Engineering inspection				$ 1,907,626.51	$ 1,907,627	$ -	$ 1,907,627	
80.10		Start up								
Subtotal (Categories 10-80)							$ 169,632,019	$ 44,022,150	$ 213,654,169	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 213,654,169	
TOTAL CAPITAL COST/MILE									$ 22,048,934	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 16: I-85/Greenfield Merge to NS
Version	v0

			Value Inputs							
			Unit	**Quantity**	**Unit Cost (Base Yr/FY13*)**	**Non-Unit Based Costs**	**Total Allocated Cost (Base Yr/FY13 Dollars)**	**Allocated Contingency (Base Yr/FY13 Dollars)**	**TOTAL COST (Base Yr/FY13 Dollars)**	**Explanation Provided? (if so use *)**
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 174,611,025	$ 52,383,308	$ 226,994,333	
10.01		Track structure: Viaduct	corridor mile	0.00	$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 93,070,000.00	$ 93,070,000	$ 27,921,000	$ 120,991,000	
10.03		Track structure: Undergrade Bridges	lump sum				$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ 4,376,439.20	$ 4,376,439	$ 1,312,932	$ 5,689,371	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 22,031,914.00	$ 22,031,914	$ 6,609,574	$ 28,641,488	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	13.20	$ 960,960.00		$ 12,684,672	$ 3,805,402	$ 16,490,074	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	13.20	$ 2,323,200.00		$ 30,666,240	$ 9,199,872	$ 39,866,112	
	10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each		$ 175,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 20	each		$ 200,000.00		$ -	$ -	$ -	
	10.14.03	Turnout; No. 24	each	16	$ 475,000.00		$ 7,600,000	$ 2,280,000	$ 9,880,000	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	13.20	$ 316,800.00		$ 4,181,760	$ 1,254,528	$ 5,436,288	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 9,076,773	$ 2,723,032	$ 11,799,805	
40.01		Demolition, clearing, site preparation	lump sum			$ 1,911,514	$ 1,911,514	$ 573,454	$ 2,484,968	
40.02		Site utilities, utility relocation	corridor mile	13.20	$ 59,000		$ 778,800	$ 233,640	$ 1,012,440	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 6,386,459	$ 6,386,459	$ 1,915,938	$ 8,302,397	
	40.07.01	Railroad Owned - Urban	acre	0.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	46.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum				$ -	$ -	$ -	
40.09		Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 33,178,200	$ 9,953,460	$ 43,131,660	
50.01		Wayside signaling equipment	track mile	26.40	$ 970,000		$ 25,608,000	$ 7,682,400	$ 33,290,400	
50.02		Signal power access and distribution	track mile	26.40	$ 5,500		$ 145,200	$ 43,560	$ 188,760	
50.03		On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	13.20	$ 555,000		$ 7,326,000	$ 2,197,800	$ 9,523,800	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each	0.00	$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	13.20	$ 7,500		$ 99,000	$ 29,700	$ 128,700	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 72,328,080	$ 21,698,424	$ 94,026,504	
60.01		Traction power transmission: High voltage	corridor mile	13.20	$ 60,400		$ 797,280	$ 239,184	$ 1,036,464	
60.02		Traction power supply: Substations	corridor mile	13.20	$ 1,800,000		$ 23,760,000	$ 7,128,000	$ 30,888,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	13.20	$ 3,600,000		$ 47,520,000	$ 14,256,000	$ 61,776,000	
60.04		Traction power control	corridor mile	13.20	$ 19,000		$ 250,800	$ 75,240	$ 326,040	
Construction Subtotal (Categories 10-60)							$ 289,194,078	$ 86,758,223	$ 375,952,302	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 45,114,276	$ -	$ 45,114,276	
80.01		Service Development Plan/Service Environmental				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.02		Preliminary Engineering/Project Environmental				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.03		Final design				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.04		Project management for design and construction				$ 7,519,046.03	$ 7,519,046	$ -	$ 7,519,046	
80.05		Construction administration & management				$ 11,278,569.05	$ 11,278,569	$ -	$ 11,278,569	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.09		Engineering inspection				$ 3,759,523.02	$ 3,759,523	$ -	$ 3,759,523	
80.10		Start up								
Subtotal (Categories 10-80)							$ 334,308,354	$ 86,758,223	$ 421,066,578	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 421,066,578	
TOTAL CAPITAL COST/MILE									$ 31,898,983	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 18: NS to Altanta
Version	v0

Code	Description	Value Inputs: Unit	Value Inputs: Quantity	Value Inputs: Unit Cost (Base Yr/FY13*)	Value Inputs: Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK						$ 397,169,999	$ 119,151,000	$ 516,320,999	
10.01	Track structure: Viaduct	corridor mile	0.81	$ 50,000,000.00		$ 40,500,000	$ 12,150,000	$ 52,650,000	
10.02	Track structure: Major/Movable bridge	lump sum			$ 155,361,000.00	$ 155,361,000	$ 46,608,300	$ 201,969,300	
10.03	Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04	Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05	Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 29,399,519.20	$ 29,399,519	$ 8,819,856	$ 38,219,375	
10.06	Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07	Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08	Track structure: Retaining walls and systems	corridor mile	29.60	$ 960,960.00		$ 28,444,416	$ 8,533,325	$ 36,977,741	
10.09	Track new construction: Conventional ballasted								
10.09.01	136lb CWR on Concrete Ties	corridor mile	29.60	$ 2,323,200.00		$ 68,766,720	$ 20,630,016	$ 89,396,736	
10.09.02	136lb CWR on Wood Ties	track mile	47.66	$ 950,400.00		$ 45,296,064	$ 13,588,819	$ 58,884,883	
10.10	Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00					
10.11	Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12	Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13	Track rehabilitation: Component replacement (rail, ties, etc)								
10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14	Track: Special track work (switches, turnouts, insulated joints)								
10.14.01	Turnout; No. 11	each	28	$ 150,000.00		$ 4,200,000	$ 1,260,000	$ 5,460,000	
10.14.02	Turnout; No. 15	each	5	$ 175,000.00		$ 875,000	$ 262,500	$ 1,137,500	
10.14.03	Turnout; No. 20	each	13	$ 200,000.00		$ 2,600,000	$ 780,000	$ 3,380,000	
10.14.04	Turnout; No. 24	each	26	$ 475,000.00		$ 12,350,000	$ 3,705,000	$ 16,055,000	
10.15	Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16	Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17	Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18	Other linear structures including fencing, sound walls	corridor mile	29.60	$ 316,800.00		$ 9,377,280	$ 2,813,184	$ 12,190,464	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL						$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.01	Station buildings: Intercity passenger rail only	each	2.00	$ 37,500,000		$ 75,000,000	$ 22,500,000	$ 97,500,000	
20.02	Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03	Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04	Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05	Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06	Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07	Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08	Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09	Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS						$ 9,870,000	$ 2,961,000	$ 12,831,000	
30.01	Administration building: Office, sales, storage, revenue counting								
30.02	Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03	Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04	Storage or maintenance-of-way building/bases								
30.05	Yard and yard track	lump sum			$ 9,870,000	$ 9,870,000	$ 2,961,000	$ 12,831,000	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS						$ 80,165,596	$ 24,049,679	$ 104,215,275	
40.01	Demolition, clearing, site preparation	lump sum			$ 3,722,436.80	$ 3,722,437	$ 1,116,731	$ 4,839,168	
40.02	Site utilities, utility relocation	corridor mile	29.6	$ 59,000.00		$ 1,746,400	$ 523,920	$ 2,270,320	
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04	Environmental mitigation: wetlands, historic/archeology, parks	acre		$ -		$ -	$ -	$ -	
40.05	Site structures including retaining walls, sound walls	track mile		$ 2,561,000.00		$ -	$ -	$ -	
40.06	Temporary facilities and other indirect costs during construction	lump sum				$ -	$ -	$ -	
40.07	Purchase or lease of real estate	lump sum			$ 46,215,759.02	$ 46,215,759	$ 13,864,728	$ 60,080,487	
40.07.01	Railroad Owned - Urban	acre							
40.07.02	Railroad Owned - Rural	acre							
40.07.03	State Owned	acre							
40.07.04	Land Acquisition - Urban	acre	36						
40.07.05	Land Acquisition - Rural	acre							
40.08	Highway/pedestrian overpass/grade separations	lump sum			$ 28,481,000.00	$ 28,481,000	$ 8,544,300	$ 37,025,300	
40.09	Relocation of existing households and businesses	lump sum				$ -	$ -	$ -	
40.09.01	Relocation - Urban	acre							
40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING						$ 82,424,600	$ 24,727,380	$ 107,151,980	
50.01	Wayside signaling equipment	track mile	59.20	$ 970,000		$ 57,424,000	$ 17,227,200	$ 74,651,200	
50.02	Signal power access and distribution	track mile	59.20	$ 5,500		$ 325,600	$ 97,680	$ 423,280	
50.03	On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04	Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05	Communications	corridor mile	29.60	$ 555,000		$ 16,428,000	$ 4,928,400	$ 21,356,400	
50.06	Grade crossing protection								
50.06.01	Public At-Grade	each	15.00	$ 500,000		$ 7,500,000	$ 2,250,000	$ 9,750,000	
50.06.02	Private At-Grade	each	1.00	$ 250,000		$ 250,000	$ 75,000	$ 325,000	
50.07	Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	29.60	$ 7,500		$ 222,000	$ 66,600	$ 288,600	
50.08	Station train approach warning system	each	2.00	$ 137,500		$ 275,000	$ 82,500	$ 357,500	
Total for Category 60: ELECTRIC TRACTION						$ 162,190,240	$ 48,657,072	$ 210,847,312	
60.01	Traction power transmission: High voltage	corridor mile	29.60	$ 60,400		$ 1,787,840	$ 536,352	$ 2,324,192	
60.02	Traction power supply: Substations	corridor mile	29.60	$ 1,800,000		$ 53,280,000	$ 15,984,000	$ 69,264,000	
60.03	Traction power distribution: Catenary and third rail	corridor mile	29.60	$ 3,600,000		$ 106,560,000	$ 31,968,000	$ 138,528,000	
60.04	Traction power control	corridor mile	29.60	$ 19,000		$ 562,400	$ 168,720	$ 731,120	
Construction Subtotal (Categories 10-60)						$ 806,820,435	$ 242,046,131	$ 1,048,866,566	
Total for Category 70: VEHICLES						$ -	$ -	$ -	
70.00	Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01	Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02	Vehicle acquisition: Electric multiple unit								
70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03	Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04	Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05	Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06	Vehicle acquisition: Maintenance of way vehicles								
70.07	Vehicle acquisition: Non-railroad support vehicles								
70.08	Vehicle refurbishment: Electric locomotive								
70.09	Vehicle refurbishment: Non-electric locomotive								
70.10	Vehicle refurbishment: Electric multiple unit								
70.11	Vehicle refurbishment: Diesel multiple unit								
70.12	Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13	Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14	Vehicle refurbishment: Maintenance of way vehicles								
70.15	Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)						$ 125,863,988	$ -	$ 125,863,988	
80.01	Service Development Plan/Service Environmental				$ 10,488,665.66	$ 10,488,666	$ -	$ 10,488,666	
80.02	Preliminary Engineering/Project Environmental				$ 20,977,331.31	$ 20,977,331	$ -	$ 20,977,331	
80.03	Final design				$ 20,977,331.31	$ 20,977,331	$ -	$ 20,977,331	
80.04	Project management for design and construction				$ 20,977,331.31	$ 20,977,331	$ -	$ 20,977,331	
80.05	Construction administration & management				$ 31,465,996.97	$ 31,465,997	$ -	$ 31,465,997	
80.06	Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08	Surveys, testing, investigation				$ 10,488,665.66	$ 10,488,666	$ -	$ 10,488,666	
80.09	Engineering inspection				$ 10,488,665.66	$ 10,488,666	$ -	$ 10,488,666	
80.10	Start up								
Subtotal (Categories 10-80)						$ 932,684,423	$ 242,046,131	$ 1,174,730,553	
TOTAL CAPITAL COSTS (Categories 10-80)								$ 1,174,730,553	
TOTAL CAPITAL COST/MILE								$ 39,686,843	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 20: NS/CSX to MMPT
Version	v0

			Value Inputs							
			Unit	Quantity	Unit Cost (Base Yr/FY13*)	Non-Unit Based Costs	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK							$ 26,129,907	$ 7,838,972	$ 33,968,879	
10.01		Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02		Track structure: Major/Movable bridge	lump sum			$ 5,376,000.00	$ 5,376,000.00	$ 1,612,800.00	$ 6,988,800.00	
10.03		Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04		Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05		Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ 1,909,489.40	$ 1,909,489.40	$ 572,846.82	$ 2,482,336.22	
10.06		Track structure: At-grade (grading and subgrade stabilization)	corridor mile		$ 715,000.00		$ -	$ -	$ -	
10.07		Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08		Track structure: Retaining walls and systems	corridor mile	0.87	$ 960,960.00		$ 836,035.20	$ 250,810.56	$ 1,086,845.76	
	10.08.01	Track structure: Crash Barrier	corridor mile	1.73	$ 3,437,280.00		$ 5,946,494.40	$ 1,783,948.32	$ 7,730,442.72	
10.09		Track new construction: Conventional ballasted								
	10.09.01	136lb CWR on Concrete Ties	corridor mile	2.60	$ 2,323,200.00		$ 6,040,320.00	$ 1,812,096.00	$ 7,852,416.00	
	10.09.02	136lb CWR on Wood Ties	track mile	3.47	$ 950,400.00		$ 3,297,888.00	$ 989,366.40	$ 4,287,254.40	
10.10		Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11		Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12		Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13		Track rehabilitation: Component replacement (rail, ties, etc)								
	10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
	10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
	10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14		Track: Special track work (switches, turnouts, insulated joints)								
	10.14.01	Turnout; No. 11	each		$ 150,000.00		$ -	$ -	$ -	
	10.14.02	Turnout; No. 15	each	4	$ 175,000.00		$ 700,000.00	$ 210,000.00	$ 910,000.00	
	10.14.03	Turnout; No. 20	each	6	$ 200,000.00		$ 1,200,000.00	$ 360,000.00	$ 1,560,000.00	
	10.14.04	Turnout; No. 24	each		$ 475,000.00		$ -	$ -	$ -	
10.15		Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16		Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17		Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18		Other linear structures including fencing, sound walls	corridor mile	2.60	$ 316,800.00		$ 823,680.00	$ 247,104.00	$ 1,070,784.00	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL							$ -	$ -	$ -	
20.01		Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02		Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
	20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ -	$ -	$ -	$ -	
	20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
	20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03		Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04		Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05		Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06		Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07		Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08		Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09		Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS							$ -	$ -	$ -	
30.01		Administration building: Office, sales, storage, revenue counting								
30.02		Light maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.03		Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04		Storage or maintenance-of-way building/bases								
30.05		Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS							$ 40,445,992	$ 12,133,798	$ 52,579,790	
40.01		Demolition, clearing, site preparation	lump sum			$ 109,409	$ 109,409	$ 32,823	$ 142,232	
40.02		Site utilities, utility relocation	corridor mile	2.60	$ 59,000		$ 153,400	$ 46,020	$ 199,420	
40.03		Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04		Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05		Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06		Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07		Purchase or lease of real estate	lump sum			$ 21,818,183	$ 21,818,183	$ 6,545,455	$ 28,363,637	
	40.07.01	Railroad Owned - Urban	acre	13.00						
	40.07.02	Railroad Owned - Rural	acre	0.00						
	40.07.03	State Owned	acre	0.00						
	40.07.04	Land Acquisition - Urban	acre	1.00						
	40.07.05	Land Acquisition - Rural	acre	0.00						
40.08		Highway/pedestrian overpass/grade separations	lump sum			$ 18,365,000	$ 18,365,000	$ 5,509,500	$ 23,874,500	
40.09		Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
	40.09.01	Relocation - Urban	acre							
	40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING							$ 6,535,100	$ 1,960,530	$ 8,495,630	
50.01		Wayside signaling equipment	track mile	5.20	$ 970,000		$ 5,044,000	$ 1,513,200	$ 6,557,200	
50.02		Signal power access and distribution	track mile	5.20	$ 5,500		$ 28,600	$ 8,580	$ 37,180	
50.03		On-board signaling equipment	each		$ 400,000		$ -	$ -	$ -	
50.04		Traffic control and dispatching systems	each		$ 9,000,000		$ -	$ -	$ -	
50.05		Communications	corridor mile	2.60	$ 555,000		$ 1,443,000	$ 432,900	$ 1,875,900	
50.06		Grade crossing protection								
	50.06.01	Public At-Grade	each		$ 500,000		$ -	$ -	$ -	
	50.06.02	Private At-Grade	each		$ 250,000		$ -	$ -	$ -	
50.07		Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	2.60	$ 7,500		$ 19,500	$ 5,850	$ 25,350	
50.08		Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION							$ 14,246,440	$ 4,273,932	$ 18,520,372	
60.01		Traction power transmission: High voltage	corridor mile	2.60	$ 60,400		$ 157,040	$ 47,112	$ 204,152	
60.02		Traction power supply: Substations	corridor mile	2.60	$ 1,800,000		$ 4,680,000	$ 1,404,000	$ 6,084,000	
60.03		Traction power distribution: Catenary and third rail	corridor mile	2.60	$ 3,600,000		$ 9,360,000	$ 2,808,000	$ 12,168,000	
60.04		Traction power control	corridor mile	2.60	$ 19,000		$ 49,400	$ 14,820	$ 64,220	
Construction Subtotal (Categories 10-60)							$ 87,357,439	$ 26,207,232	$ 113,564,671	
Total for Category 70: VEHICLES							$ -	$ -	$ -	
70.00		Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01		Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02		Vehicle acquisition: Electric multiple unit								
	70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
	70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03		Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04		Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05		Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06		Vehicle acquisition: Maintenance of way vehicles								
70.07		Vehicle acquisition: Non-railroad support vehicles								
70.08		Vehicle refurbishment: Electric locomotive								
70.09		Vehicle refurbishment: Non-electric locomotive								
70.10		Vehicle refurbishment: Electric multiple unit								
70.11		Vehicle refurbishment: Diesel multiple unit								
70.12		Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13		Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14		Vehicle refurbishment: Maintenance of way vehicles								
70.15		Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)							$ 13,627,760	$ -	$ 13,627,760	
80.01		Service Development Plan/Service Environmental				$ 1,135,646.71	$ 1,135,647	$ -	$ 1,135,647	
80.02		Preliminary Engineering/Project Environmental				$ 2,271,293.41	$ 2,271,293	$ -	$ 2,271,293	
80.03		Final design				$ 2,271,293.41	$ 2,271,293	$ -	$ 2,271,293	
80.04		Project management for design and construction				$ 2,271,293.41	$ 2,271,293	$ -	$ 2,271,293	
80.05		Construction administration & management				$ 3,406,940.12	$ 3,406,940	$ -	$ 3,406,940	
80.06		Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07		Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08		Surveys, testing, investigation				$ 1,135,646.71	$ 1,135,647	$ -	$ 1,135,647	
80.09		Engineering inspection				$ 1,135,646.71	$ 1,135,647	$ -	$ 1,135,647	
80.10		Start up								
Subtotal (Categories 10-80)							$ 100,985,199	$ 26,207,232	$ 127,192,431	
TOTAL CAPITAL COSTS (Categories 10-80)									$ 127,192,431	
TOTAL CAPITAL COST/MILE									$ 48,920,166	

Project Name	GDOT High-Speed Rail Feasibility Study
Corridor Name	Atlanta - Charlotte
Date of Estimate	September 27, 2013
Technology	Greenfield 180-220 MPH Dedicated Service
Segment	Segment 22: MMPT to Altanta Airport
Version	v0

Code	Description	Unit (Value Inputs)	Quantity (Value Inputs)	Unit Cost (Base Yr/FY13*) (Value Inputs)	Non-Unit Based Costs (Value Inputs)	Total Allocated Cost (Base Yr/FY13 Dollars)	Allocated Contingency (Base Yr/FY13 Dollars)	TOTAL COST (Base Yr/FY13 Dollars)	Explanation Provided? (if so use *)
Total for Category 10: TRACK STRUCTURES AND TRACK						$ 71,208,900	$ 21,362,670	$ 92,571,570	
10.01	Track structure: Viaduct	corridor mile		$ 50,000,000.00		$ -	$ -	$ -	
10.02	Track structure: Major/Movable bridge	lump sum			$ 40,896,000.00	$ 40,896,000.00	$ 12,268,800.00	$ 53,164,800.00	
10.03	Track structure: Undergrade Bridges	lump sum			$ -	$ -	$ -	$ -	
10.04	Track structure: Culverts and drainage structures	lump sum			$ -	$ -	$ -	$ -	
10.05	Track structure: Cut and Fill (> 4' height/depth)	lump sum			$ -	$ -	$ -	$ -	
10.06	Track structure: At-grade (grading and subgrade stabilization)	corridor mile	9.50	$ 715,000.00		$ 6,792,500.00	$ 2,037,750.00	$ 8,830,250.00	
10.07	Track structure: Tunnel	corridor mile		$ 116,000,000.00		$ -	$ -	$ -	
10.08	Track structure: Retaining walls and systems	corridor mile	0.00	$ 960,960.00		$ -	$ -	$ -	
10.09	Track new construction: Conventional ballasted								
10.09.01	136lb CWR on Concrete Ties	corridor mile	9.50	$ 2,323,200.00		$ 22,070,400.00	$ 6,621,120.00	$ 28,691,520.00	
10.09.02	136lb CWR on Wood Ties	track mile		$ 950,400.00		$ -	$ -	$ -	
10.10	Track new construction: Non-ballasted	corridor mile		$ 2,709,000.00		$ -	$ -	$ -	
10.11	Track rehabilitation: Ballast and surfacing	track mile		$ 132,000.00		$ -	$ -	$ -	
10.12	Track rehabilitation: Ditching and drainage	track mile		$ 38,000.00		$ -	$ -	$ -	
10.13	Track rehabilitation: Component replacement (rail, ties, etc)								
10.13.01	30% Track Rehabilitation	track mile		$ 427,000.00		$ -	$ -	$ -	
10.13.02	60% Track Rehabilitation	track mile		$ 491,000.00		$ -	$ -	$ -	
10.13.03	100% Track Rehabilitation	track mile		$ 966,000.00		$ -	$ -	$ -	
10.14	Track: Special track work (switches, turnouts, insulated joints)								
10.14.01	Turnout; No. 11	each	0	$ 150,000.00		$ -	$ -	$ -	
10.14.02	Turnout; No. 15	each	6	$ 175,000.00		$ 1,050,000.00	$ 315,000.00	$ 1,365,000.00	
10.14.03	Turnout; No. 20	each	2	$ 200,000.00		$ 400,000.00	$ 120,000.00	$ 520,000.00	
10.14.04	Turnout; No. 24	each	0	$ 475,000.00		$ -	$ -	$ -	
10.15	Track: Major interlockings	each		$ -		$ -	$ -	$ -	
10.16	Track: Switch heaters (with power and control)	each		$ 45,000.00		$ -	$ -	$ -	
10.17	Track: Vibration and noise dampening	track mile		$ -		$ -	$ -	$ -	
10.18	Other linear structures including fencing, sound walls	corridor mile		$ 316,800.00		$ -	$ -	$ -	
Total for Category 20: STATIONS, TERMINALS, INTERMODAL						$ 60,000,000	$ 18,000,000	$ 78,000,000	
20.01	Station buildings: Intercity passenger rail only	each	0.00	$ 25,000,000		$ -	$ -	$ -	
20.02	Station buildings: Joint use (commuter rail, intercity bus)	square foot		$ 50,000,000		$ -	$ -	$ -	
20.02.01	Hartsfield-Jackson Atlanta International Airport (HJAIA)	lump sum			$ 60,000,000	$ 60,000,000	$ 18,000,000.00	$ 78,000,000	
20.02.02	Greenville-Spartanburg International Airport (GSP)	lump sum			$ -	$ -	$ -	$ -	
20.02.03	Charlotte-Douglas International Airport (CLT)	lump sum			$ -	$ -	$ -	$ -	
20.03	Platforms	linear feet	0.00	$ 1,080		$ -	$ -	$ -	
20.04	Elevators, escalators	each	0.00	$ 350,000		$ -	$ -	$ -	
20.05	Joint commercial development	square foot	0.00	$ 150		$ -	$ -	$ -	
20.06	Pedestrian / bike access and accommodation, landscaping, parking lots	lump sum			$ -	$ -	$ -	$ -	
20.07	Automobile, bus, van accessways including roads	lump sum			$ -	$ -	$ -	$ -	
20.08	Fare collection systems and equipment	each	0.00	$ 250,000		$ -	$ -	$ -	
20.09	Station security								
Total for Category 30: SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS						$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.01	Administration building: Office, sales, storage, revenue counting								
30.02	Light maintenance facility	lump sum			$ 134,000,000	$ 134,000,000	$ 40,200,000	$ 174,200,000	
30.03	Heavy maintenance facility	lump sum			$ -	$ -	$ -	$ -	
30.04	Storage or maintenance-of-way building/bases								
30.05	Yard and yard track	lump sum			$ -	$ -	$ -	$ -	
Total for Category 40,:SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS						$ 184,802,921	$ 55,440,876	$ 240,243,797	
40.01	Demolition, clearing, site preparation	lump sum				$ -	$ -	$ -	
40.02	Site utilities, utility relocation	corridor mile	9.50	$ 59,000		$ 560,500	$ 168,150	$ 728,650	
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments								
40.04	Environmental mitigation: wetlands, historic/archeology, parks	acre	0.00	$ 1.00		$ -	$ -	$ -	
40.05	Site structures including retaining walls, sound walls	track mile	0.00	$ 2,561,000.00		$ -	$ -	$ -	
40.06	Temporary facilities and other indirect costs during construction	lump sum			$ -	$ -	$ -	$ -	
40.07	Purchase or lease of real estate	lump sum			$ 184,242,421	$ 184,242,421	$ 55,272,726	$ 239,515,147	
40.07.01	Railroad Owned - Urban	acre	0.00						
40.07.02	Railroad Owned - Rural	acre	0.00						
40.07.03	State Owned	acre	0.00						
40.07.04	Land Acquisition - Urban	acre	0.00						
40.07.05	Land Acquisition - Rural	acre	0.00						
40.08	Highway/pedestrian overpass/grade separations	lump sum				$ -	$ -	$ -	
40.09	Relocation of existing households and businesses	lump sum			$ -	$ -	$ -	$ -	
40.09.01	Relocation - Urban	acre							
40.09.02	Relocation - Rural	acre							
Total for Category 50: COMMUNICATIONS & SIGNALING						$ 27,878,250	$ 8,363,475	$ 36,241,725	
50.01	Wayside signaling equipment	track mile	19.00	$ 970,000		$ 18,430,000	$ 5,529,000	$ 23,959,000	
50.02	Signal power access and distribution	track mile	19.00	$ 5,500		$ 104,500	$ 31,350	$ 135,850	
50.03	On-board signaling equipment	each	0.00	$ 400,000		$ -	$ -	$ -	
50.04	Traffic control and dispatching systems	each	0.00	$ 9,000,000		$ -	$ -	$ -	
50.05	Communications	corridor mile	9.50	$ 555,000		$ 5,272,500	$ 1,581,750	$ 6,854,250	
50.06	Grade crossing protection								
50.06.01	Public At-Grade	each	8.00	$ 500,000		$ 4,000,000	$ 1,200,000	$ 5,200,000	
50.06.02	Private At-Grade	each	0.00	$ 250,000		$ -	$ -	$ -	
50.07	Hazard detectors (dragging equipment, high water, slide, etc.)	corridor mile	9.50	$ 7,500		$ 71,250	$ 21,375	$ 92,625	
50.08	Station train approach warning system	each	0.00	$ 137,500		$ -	$ -	$ -	
Total for Category 60: ELECTRIC TRACTION						$ 52,054,300	$ 15,616,290	$ 67,670,590	
60.01	Traction power transmission: High voltage	corridor mile	9.50	$ 60,400		$ 573,800	$ 172,140	$ 745,940	
60.02	Traction power supply: Substations	corridor mile	9.50	$ 1,800,000		$ 17,100,000	$ 5,130,000	$ 22,230,000	
60.03	Traction power distribution: Catenary and third rail	corridor mile	9.50	$ 3,600,000		$ 34,200,000	$ 10,260,000	$ 44,460,000	
60.04	Traction power control	corridor mile	9.50	$ 19,000		$ 180,500	$ 54,150	$ 234,650	
Construction Subtotal (Categories 10-60)						$ 529,944,371	$ 158,983,311	$ 688,927,682	
Total for Category 70: VEHICLES						$ -	$ -	$ -	
70.00	Vehicle acquisition: Electric locomotive	each	0.00	$ 8,000,000					
70.01	Vehicle acquisition: Non-electric locomotive	each	0.00	$ -					
70.02	Vehicle acquisition: Electric multiple unit								
70.02.01	Electric Multiple Unit (EMU)	each	0.00	$ 43,450,000		$ -	$ -	$ -	
70.02.02	Maglev Unit	each	0.00	$ 79,290,000		$ -	$ -	$ -	
70.03	Vehicle acquisition: Diesel multiple unit	each	0.00	$ 32,500,000		$ -	$ -	$ -	
70.04	Veh acq: Loco-hauled passenger cars w/ ticketed space	each	0.00	$ 4,100,000					
70.05	Veh acq: Loco-hauled passenger cars w/o ticketed space								
70.06	Vehicle acquisition: Maintenance of way vehicles								
70.07	Vehicle acquisition: Non-railroad support vehicles								
70.08	Vehicle refurbishment: Electric locomotive								
70.09	Vehicle refurbishment: Non-electric locomotive								
70.10	Vehicle refurbishment: Electric multiple unit								
70.11	Vehicle refurbishment: Diesel multiple unit								
70.12	Veh refurb: Passeng. loco-hauled car w/ ticketed space								
70.13	Veh refurb: Non-passeng loco-hauled car w/o ticketed space								
70.14	Vehicle refurbishment: Maintenance of way vehicles								
70.15	Spare parts	lump sum				$ -	$ -	$ -	
Total for Category 80: PROFESSIONAL SERVICES (applies to Cats. 10-60)						$ 82,671,322	$ -	$ 82,671,322	
80.01	Service Development Plan/Service Environmental				$ 6,889,276.82	$ 6,889,277	$ -	$ 6,889,277	
80.02	Preliminary Engineering/Project Environmental				$ 13,778,553.63	$ 13,778,554	$ -	$ 13,778,554	
80.03	Final design				$ 13,778,553.63	$ 13,778,554	$ -	$ 13,778,554	
80.04	Project management for design and construction				$ 13,778,553.63	$ 13,778,554	$ -	$ 13,778,554	
80.05	Construction administration & management				$ 20,667,830.45	$ 20,667,830	$ -	$ 20,667,830	
80.06	Professional liability and other non-construction insurance				$ -	$ -	$ -	$ -	
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.				$ -	$ -	$ -	$ -	
80.08	Surveys, testing, investigation				$ 6,889,276.82	$ 6,889,277	$ -	$ 6,889,277	
80.09	Engineering inspection				$ 6,889,276.82	$ 6,889,277	$ -	$ 6,889,277	
80.10	Start up								
Subtotal (Categories 10-80)						$ 612,615,692	$ 158,983,311	$ 771,599,003	
TOTAL CAPITAL COSTS (Categories 10-80)								$ 771,599,003	
TOTAL CAPITAL COST/MILE								$ 81,220,948	

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX I: ECONOMIC AND FINANCIAL RESULTS

May 2014

Georgia Department of Transportation

Prepared on behalf of the

U.S.Department of Transportation
Federal Railroad Administration

Contents

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1. ECONOMIC ANALYSIS FRAMEWORK

The Financial and Economic Analysis describes the U.S. Department of Transportation (USDOT) Federal Railroad Administration (FRA) criteria used to assess the route and technology options. It defines the criteria and describes the process used to estimate the financial and economic benefits of the system. It provides both the financial and economic results for each option.

1.1 EVALUATION OF ALTERNATIVES

1.1.1 Study Objectives

This analysis used the same criteria (updated to include TIGER Grant criteria) and structure as the *1997 FRA Commercial Feasibility Study*. This study set out criteria for establishing a public-private partnership between the Federal government, State and local communities, and the private sector for intercity rail projects. The study described two conditions that were considered essential for receiving Federal funding support for proposed intercity passenger rail projects:

- An operating cost ratio of at least 1.0, defined as a pre-condition for an effective public/private partnership, so that once the system has been constructed, a private operator could operate the system on a day-to-day basis without requiring an operating subsidy, and
- A benefits/cost ratio greater than 1.0, to ensure that the project makes an overall positive contribution to the economy, at both the regional and national levels.

The *Commercial Feasibility Study* made it clear that “federal consideration of specific High-Speed Ground Transportation project proposals could apply additional criteria that could differ from, and be much more stringent than, this report’s threshold indicators for partnership potential.”

Operating ratios are usually expressed on a year-by-year basis, but they can also be expressed as:

Present Value of Revenue / Present Value of Operating Cost

over the lifetime of a project.

Benefit Cost ratios are usually expressed as:

Present Value of Total Benefit / Present Value of Total Cost

over the lifetime of a project.

At a feasibility level of study, analysis is based on a number of assumptions that are needed to carry out the analysis. These assumptions include such factors as:

- Rate of socioeconomic growth;
- Rate of demographic growth;
- Rate of energy price increase; and
- The capital cash flows in accordance with a multi-year, implementation plan.

Once more detailed assessments are made and more specific information on the rate of ridership and revenue growth and a system implementation plan detailing the capital cash flows become available, then that information can be included to further refine the initial estimates of the financial return and benefit cost ratio.

This appendix describes the process by which the alternatives were evaluated and how this analysis lead to the identification of financially feasible options based on the economic and financial criteria adopted.

1.2 FINANCIAL AND ECONOMIC OBJECTIVES

For each alternative being evaluated, measures of financial and economic efficiency were calculated. These measures were determined from assessments integrating the forecasted capital, operating and maintenance costs with the forecasted revenue projections over the lifetime of the project. Specifically, the analysis was based on the following components:

- Operating and implementation plans for the alternative passenger rail service options;
- Cost estimates for operations, infrastructure and acquisition of rolling stock;
- Ridership and revenue estimates based on projected travel demand[1]; and
- Cash flow analysis that includes statements of revenues and expenses for each alternative.

Two measures, net present value (NPV) and Benefit Cost ratio were used to evaluate the economic returns of the system. Similar measures, NPV and Operating ratio, were used to evaluate the financial returns and the potential for franchising the operations

Both measures require the development of a project's year-by-year financial and economic returns, which are then discounted to the base year to estimate present values (PV) over the lifetime of the project. For this analysis, a 25-year project life from 2025 to 2050 was assumed, with a ten year implementation period from 2015-2024. Revenues and cost cash flows were discounted to the 2013 base year using two discount rates: three percent and seven percent. The three percent discount rate reflects the real cost of money in the market as reflected by the long term bond markets, and the seven percent discount rate reflects the Federal government's desire to establish a benchmark comparison by discounting long term benefits at a greater rate than the market for public securities.

The operating ratios reported in the ADR follow a commercial criteria definition; but, are different from the commercial operating ratio calculations that are typically presented by freight railroads and intercity bus companies. For the current analysis, the selected feasibility criteria were as follows:

- The Operating Ratio as calculated here includes direct operating costs only. The operating ratio do not include capital costs, depreciation or interest. The costs used are incremental costs.
- The Operating Ratio presented here is defined as Revenues/Costs. It should be noted that freight railroads and intercity bus companies typically define it as the reciprocal Costs/Revenues.

As defined by this analysis, a positive operating ratio does not imply that a passenger service can attain full financial profitability by covering its capital costs, but it does allow the operation to be franchised and operated by the private sector. The definition puts passenger rail on the same basis as other passenger transportation modes, such as intercity bus and air, where the private sector operates the system but does not build or own the infrastructure it uses. It does, however, pay access fees to the freight railroads where they own the track. In the case of passenger rail, these would include track access costs. All calculations are performed using the standard financial formula, as follows:

Financial Measure:

[1] *These forecasts include assumptions regarding fare levels and oil prices, highway congestion and the responsiveness of the air industry to the introduction of the diesel 130 mph and electric 220 mph alternatives.*

$$Operating\ Ratio = \frac{Financial\ Revenues}{Operating\ Costs}$$

Economic Measures:

$$Net\ Present\ Value = Present\ Value\ of\ Benefits - Present\ Values\ of\ Costs$$

$$Benefit\ Cost\ Ratio = \frac{Present\ Value\ of\ Revenues}{Present\ Value\ of\ Costs}$$

Present Value is defined as:

$$PV = \sum_t \frac{C_t}{(1+r)^t}$$

Where:

PV	=	Present value of all future cash flows
C_t	=	Cash flow for period t
r	=	Discount rate reflecting the opportunity cost of money
t	=	Time

In terms of economic benefits, a positive NPV and benefit cost ratio imply that the project makes a positive contribution to the economy. Consistent with standard practice, benefit Cost ratios are calculated from the perspective of the overall society without regard to who owns particular assets receives specific benefits or incurs particular costs.

1.2.1 Key Assumptions

The analysis projects travel demand, operating revenues and operating and maintenance costs for all years from 2025 through 2050. The financial analysis was conducted in real terms using constant 2013 dollars. Accordingly, no inflation factor was included and a real discounting rate of three to seven percent was used. Revenues and operating costs were also projected in constant dollars over the time frame of the financial analysis. A summary of the key efficiency measure inputs are presented below.

1.2.1.1 Ridership and Revenue Forecasts

Ridership and revenue forecasts were prepared for 2025 and 2050. Revenues in intervening years were projected based on interpolations, reflecting projected annual growth in ridership. Revenues included not only passenger fares, but also onboard service revenues. Because of this, the revenues in the benefit cost calculations were slightly higher than those that were forecasted in Chapter 5.1 of the ADR.

1.2.1.2 Capital Costs

Capital costs include rolling stock, track, freight railroad right-of-way purchase or easement fees, bridges, fencing, signaling, grade crossings, maintenance facilities and station improvements. The capital cost projections are based on year-by-year projections of each cost element. A high-level implementation schedule was developed which outlined capital cash flows and funding requirements for the initial build-out of the system. Additionally, selected elements of additional capital costs as needed to support future-year capacity expansion of the system, along with projected capital needs for track maintenance have been identified as a separate "cyclic capital" category. These costs are identified as future capital needs and are included in the benefit cost calculation but not as part of operating expense. Typically, cyclic capital has only a minor impact on the benefit Cost ratios because of the discounting of capital costs that are many years in the future.

1.2.1.3 Operating and Maintenance Expenses

Major operating and maintenance (O&M) expenses include equipment maintenance, track and right-of-way maintenance, administration, fuel and energy, train crew and other relevant expenses. O&M expenses were estimated in 2013 constant dollars so that they would remain comparable to revenues. However, these costs do reflect the year-by-year increase in expense that is needed to handle the forecasted ridership growth, in terms of not only directly variable expenses such as credit card commissions, but also the need to add train capacity and operate either larger trains, or more train-miles every year in order to accommodate anticipated ridership growth.

O&M costs are included as a cost, whereas system revenues are included as a benefit in the discounting calculation over the life of the system. In this way they directly offset one another in the NPV calculation and are also reflected in the benefit cost calculation. It can be seen that a system that requires an operating subsidy (e.g., where costs exceed revenues) will tend also to reflect this in the benefit cost ratio. This is why slow speed options such as conventional Amtrak services often fail on both the operating ratio and benefit cost ratio criteria.

1.2.1.4 Implementation Period

According to the high-level construction schedule, the planning and construction period for this corridor will take up to ten years with the start-up of full system operations not occurring until 2025. This represents a very slow and conservative planning process. If the start-up can be achieved earlier, then both the financial and economic returns would be enhanced.

1.2.2 Estimate of Economic Benefits

A key requirement for successful passenger rail implementation is a need for public capital investment to be supported by the economic benefit that will be generated by the rail system. Calculation of the economic benefit includes both consumer surplus and revenues generated by the system and environmental and external mode benefits; while costs include both capital and operating costs. Similar to the way most highway projects are justified, the primary justification for intercity rail projects relies on time savings multiplied by the user's value of time. The consumer surplus term equates to the passenger user's value of time savings as being the benefit an individual receives over and above the fare charged for using the system.

Calculation of benefit cost ratios requires a detailed, year-by-year forecast to support the calculation of NPV for all the costs and benefits associated with the project. Specifically, a year-by-year estimate of system revenues, consumer surplus, operating costs, capital costs, and external benefits was needed to develop the benefit cost analysis.

In line with federal, state and municipal projections, the rate of population growth, the increasing price of oil, and the increasing congestion on highways (e.g., I-85) results in a gradual increase in rail users over the life of the project. This has several consequences for the correct calculation of benefit cost ratios for the project:

- It would be inappropriate to increase the ridership and revenue of the system in future years, without also reflecting the added operating and capital costs that will be needed to accommodate this growth in traffic; and
- The result is a steady improvement in the system financial performance that reflects improved economies of scale over the 25-year life of the system. While the benefit cost ratios calculated take this forecast growth into account, they also add the additional capital cost for providing the capacity needed to handle it. The economic benefits to be used in the analysis include two main categories:
    - User Benefits (Consumer Surplus); and
    - Other Mode and Resource Benefits.

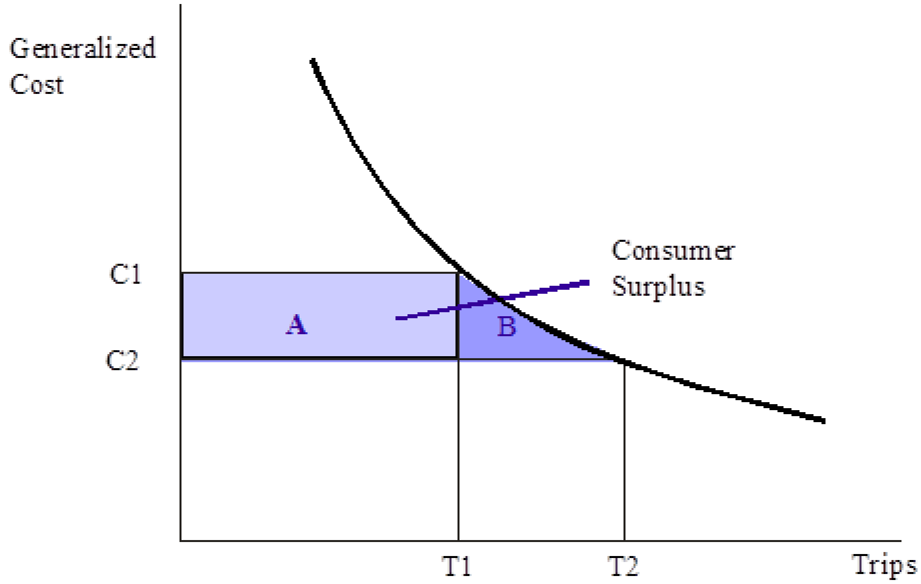
1.2.2.1 User Benefits

The analysis of user benefits for this study is based on the measurement of generalized cost of travel, which includes both time and money. Time is converted into money by the use of Values of Time (VOT). The VOT used in this study were derived from stated preference surveys conducted in previous study phases of work and used in the COMPASS™ multimodal demand model for the ridership and revenue forecasts. These VOTs are consistent with previous academic and empirical research and other transportation studies.

Benefits to users of the rail system are measured by the sum of system revenues and consumer surplus. Consumer surplus is used to measure the demand side impact of a transportation improvement on users of the service. It is defined as the additional benefit consumers (users of the service) receive from the purchase of a commodity or service (travel), above the price actually paid for that commodity or service. Consumer surpluses exist because there are always consumers who are willing to pay a higher price than that actually charged for the commodity or service (i.e., these consumers receive more benefit than is reflected by the system revenues alone). Revenues are included in the measure of consumer surplus as a proxy measure for the consumer surplus forgone as the price of rail service is not zero. This is an equity decision made by the USDOT to compensate for the fact that highway users pay zero for use of the road system (the only exception being the use of toll roads). The benefits apply to existing rail travelers, as well as new travelers who are induced (those who previously did not make a trip) or diverted (those who previously used a different mode) to the new passenger rail system.

The RENTS™ financial and economic analysis estimated consumer surplus by calculating the increase in regional mobility, traffic diverted to rail, and the reduction in travel cost measured in terms of generalized cost for existing rail users. A reduction in generalized cost generates an increase in the passenger rail user benefits. A transportation improvement that leads to improved mobility reduces the generalized cost of travel, which in turn leads to an increase in consumer surplus. Figure H-1 presents a typical demand curve in which Area A represents the increase in consumer surplus resulting from cost savings for existing rail users and Area B represents the consumer surplus resulting from induced traffic and trips diverted to rail. **Exhibit**

Figure 1-1: Consumer Surplus Concept



The formula for consumer surplus is as follows:

$$Consumer\ Surplus = (C_1 - C_2) * T1 + ((C_1\_C_2) * (T_2 - T_1))/2$$

Where:

C_1 = Generalized Cost users incur before the implementation of the system

C_2 = Generalized Cost users incur after the implementation of the system

T_1 = Number of trips before operation of the system

T_2 = Number of trips during operation of the system

The passenger rail fares used in this analysis are the average optimal fares derived from the revenue-maximization analysis that was performed for each alternative. User benefits incorporated the measured consumer surplus, as well as the system revenues, since these are benefits are merely transferred from the rail user to the rail operator.

1.2.2.2 Other Mode and Resource Benefits

In addition to rail-user benefits, travelers using auto or air also benefit from the rail investment, since the system will contribute to highway congestion relief and reduce travel times for users of these other modes. For purposes of this analysis, these benefits were measured by identifying the estimated number of auto passenger trips diverted to rail and multiplying each by the updated monetary values derived from previous stated preference studies updated to 2013.

Highway Congestion: The highway congestion delay savings is the time savings to the remaining highway users that results from diversion of auto users to the rail mode. To estimate travel time increase within the corridor, historical highway traffic volumes were obtained from the State DOTs and local planning agencies.

The average annual travel time growth in the corridor was estimated with the historical highway traffic volume data and the Bureau of Public Roads function that can be used to calculate travel time growth with increased traffic volumes.

The Airport Congestion Delay Savings: The airport congestion delay savings were based on the 1997 *Commercial Feasibility Study* and updated to 2013 value. The airport congestion delay savings included the airport operation delay saving and air passenger delay saving.

Emissions: The diversion of travelers to rail from the auto mode generates emissions savings. The calculated emissions savings are based on changes in energy use with and without the proposed rail service. This methodology takes into account the region of the country, air quality regulation compliance of the counties served by the proposed rail service, the projection year, and the modes of travel used for access/egress as well as the line-haul portion of the trip. Highway reduced emissions were estimated from the vehicle miles traveled (VMT) and flight reductions derived from the ridership model. The assumption is that a reduction in VMT or flights is directly proportional to the reduction in emissions. The pollutant values were taken from the latest TIGER III Grant Benefit-Cost Analysis Resource Guide[2].

Public Safety Benefits: Public Safety is calculated from the diverted VMT times the NHTSA[3] fatality and injury rate per vehicle mile and then multiplied by the values of fatality and injury from the latest TIGER III Grant Benefit-Cost Analysis BCA Resource Guide. This was calculated for 2025 and 2050 then interpolated for all other years.

[2] *http://www.dot.gov/sites/dot.dev/files/docs/TIGER_BCA_RESOURCE_GUIDE.pdf*

[3] *http://www.nhtsa.gov/*

ATLANTA to CHARLOTTE

PASSENGER RAIL CORRIDOR INVESTMENT PLAN

APPENDIX J: CORRESPONDENCE REGARDING OPERATIONAL ANALYSIS

May 2014

Georgia Department of Transportation

Prepared on behalf of the

U.S. Department of Transportation

Federal Railroad Administration

Russell R. McMurry, P.E., Commissioner

GEORGIA DEPARTMENT OF TRANSPORTATION
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Telephone: (404) 631-1000

April 20, 2015

Mr. John Winkle
Transportation Industry Analyst
Federal Railroad Administration
W38-311
1200 New Jersey Avenue, SE
Washington, DC 20590

RE: Atlanta to Charlotte PRICP Operational Analysis in Atlanta Area

Dear John:

The Department is seeking FRA's concurrence on the path we have proposed to complete an efficient and compliant National Environmental Policy Act (NEPA) process to advance the Atlanta to Charlotte Passenger Rail Corridor Improvement Plan (PRCIP). Listed below are the three components of the PRCIP. Maintaining adherence to the PRCIP's scope, schedule and budget are of utmost importance to the Department. However, it is important to point out that completion of the ADR, currently in draft form, is contingent upon FRA's concurrence as further detailed below.

1. Alternatives Development Report (ADR);
2. Tier 1 DEIS (DEIS); and
3. Service Development Plan (SDP).

The Department believes additional and significant impacts to the scope, schedule and budget are likely if the direction of the project regarding an operational analysis of the CSXT Atlanta approach is changed at this juncture. The approach analysis found within the ADR provides a high level comparison of the two Atlanta approaches, typical for a Tier 1 NEPA analysis, and illustrates only a marginal difference between the operational performance of these two approaches.

In consideration of FRA's concurrence, the Department commits to the following:

- Address FRA comments within the current draft **ADR** and submit it in its current format.
- Present NS and CSXT operational data equitably for both approaches within the **Tier 1 DEIS** document. The **Tier 1 DEIS** will include select data currently presented in the ADR (data only provided for both approaches, see Table 1); no additional operational analyses will occur.
- Refine the operational data currently presented in the **ADR** for the **Tier 1 DEIS** preferred alternative to reflect new input information (e.g., population projections). The **SDP** will present this analysis using a "representative" approach to Atlanta.

In an effort to reduce the risk of negative impacts to the PRCIP's budget and to ensure maximizing limited time and resources, the Department would like to suggest a temporary restriction on associated work activities until concurrence and direction of the PRICP is obtained.

The attached Background and Timeline (Exhibit 1) and Operational Data Detail (Table1) are provided to assist with your consideration of our request for concurrence on the path forward.

The Department is appreciative of FRA's continued involvement in advancing Georgia's rail passenger program and would welcome the opportunity to discuss our request for concurrence in more detail.

Please feel free to contact me or Harry Boxler following your review of the attached supporting documentation.

Sincerely,

Nancy C. Cobb, CEcD, Administrator
Division of Intermodal

Attachments:
-Exhibit 1: Background
-Table 1: Operational Data Availability

cc: Kirsten Berry, HNTB Corporation

Exhibit 1: Background / Timeline

2013

- **GDOT and FRA hold discussions on documenting the infrastructural and operational obstacles for portions of the three route alternatives within the Atlanta metro area.**
  - Norfolk Southern (NS) and CSX Transportation (CSXT), both Class I freight lines approach Atlanta from the northeast and east.
  - GDOT prepared and presented an analysis to FRA in the fall of 2013 finding *negligible differences* between the operational performance of the two railroads in the Atlanta metro area, referred to as the Atlanta Approach Analysis.
  - GDOT suggested that FRA not select a single route within the Atlanta metro area during the Tier 1 EIS, allowing for detailed analysis in Tier 2 NEPA and a more informed decision.
  - GDOT proposed the analysis use a "representative" approach[1] in the Atlanta area. The detailed operational analysis required a definition of a representative approach.
  - GDOT and FRA discussed the approach analysis in November 2013. FRA was amenable to the proposed approach analysis idea, but indicated the process required clear documentation.

2014

- **GDOT provides Alternatives Development Report to FRA**
  - GDOT satisfied this through the ADR (reviewed by FRA in fall 2014).
  - FRA noted that approaches into the proposed Georgia MMPT (specifically the CSXT line) should be shown in maps/figures even if a decision on specific approach is not decided until Tier 2 NEPA.
  - Documentation should illustrate all available options using existing railroads in the Tier 1 EIS.
  - FRA stated that this option(s) does not need to have an independent evaluation, but does need to be identified as a potential route alternative in the Atlanta area.[2]
  - GDOT moved forward, adhering to the approved Work Plan, with a detailed operational analysis using NS as a "representative" approach in Atlanta.
  - The ADR presents these findings as well as additional Atlanta approach options, including maps and documentation so as not to exclude them from future (Tier 2) evaluation.

- **FRA proposes moving logical terminus to Doraville MARTA Station**
  - FRA begins discussing the location of the Atlanta area logical terminus which was initially at Hartsfield-Jackson Atlanta International Airport (H-JAIA).
  - FRA considers moving the logical terminus to the Doraville MARTA station, assuming MARTA would provide a connection to the H-JAIA area.
  - Relocating terminus to Doraville would remove any operational analysis in the Atlanta area including connections to the proposed Georgia MMPT and H-JAIA.

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[1] The Atlanta Approach Analysis reflected the finding that the differences in operational outcomes of using either NS or CSXT as an alignment for passenger rails in and out of the metro Atlanta area were negligible. Therefore, in order to simplify the analysis, GDOT used one of the two approach options (NS) as a representation of how passenger trains would operate in the Atlanta area, with the assumption that the results and conclusions would be very similar to using the CSXT approach.

[2] Reference 2013 11 20 FRA Meeting Summary.docx (attached)

- o GDOT disagreed with the proposed re-location of the logical terminus due to inconsistency with the Purpose and Need of the Atlanta to Charlotte PRCIP and a decision on a specific approach in Atlanta would not be made until Tier 2.

<u>2015</u>

- **GDOT proposes alternative solution in January 2015 (attached)**
  - o GDOT proposes the Tier 1 EIS evaluate the environmental impacts for the NS and CSXT approaches allowing the Tier 1 Record of Decision (ROD) to environmentally clear both approaches. This proposal would allow the logical terminus to remain at the H-JAIA area but would not require a decision on a preferred approach in the Atlanta area.
  - o FRA stated that an equitable operational comparison of the CSXT and NS approaches needs to be included in the Tier 1 EIS.
  - o This memo is in response to that request.

Availability Status of Operational Data

This timeline (Exhibit 1) presents a summary of operational data and analyses developed thus far and currently available for each approach (NS and CSXT) and route alternative. All information currently resides within the draft ADR. Table 1 (attached) is intended to aid in understanding the current situation as it pertains to available operational data for each approach.

Table 1: Operational Data Availability

Data Category	NS Approach	CSXT Approach	Analysis Type: Supplemental[3] or End to End[4]	ADR Section
Initial Screening Analysis (6 alternatives (each with its own approach in Atlanta)				
Purpose and Need	✓		**N/A**	**Section 3.2**
Route Geometry	✓		**N/A**	**Section 3.2**
Route Length	✓		**N/A**	**Section 3.2**
Travel Time	✓		**N/A**	**Section 3.2**
Population/ Employment Served	✓		**N/A**	**Section 3.2**
Regional Linkages	✓		**N/A**	**Section 3.2**
Preliminary Analysis (3 alternatives, 2 Atlanta approaches)				
Travel Time	✓	✓	**End to End**	**Chapter 4**
Ridership	✓	✓	**End to End**	**Chapter 4**
Revenue	✓	✓	**End to End**	**Chapter 4**
Capital Costs	✓	✓	**Supplemental**	**Chapter 4**
At Grade Crossings	✓	✓	**Supplemental**	**Chapter 4**
Refinement Analysis (3 alternatives, 1 Atlanta approach)				
Frequencies	✓	✓	**End to End**	**Section 5.4**
Train Performance Calculator Travel Times	✓		**End to End**	**Section 5.4**
Refined Ridership	✓		**End to End**	**Section 5.6**
Refined Revenue	✓		**End to End**	**Section 5.6**
Station Stopping Patterns	✓		**End to End**	**Section 5.7.2**
Schedules	✓		**End to End**	**Section 5.7.2**
Fleet Plan	✓		**End to End**	**Section 5.7.4**
Conceptual Station Design	✓	✓	**Supplemental**	**Section 5.8.2**
Conceptual Maintenance Facility Design	✓	✓	**Supplemental**	**Section 5.8.3**
Typical Section Conceptual Design	✓	✓	**Supplemental**	**Section 5.8.4**
Refined Capital Cost by SCC	✓	✓	**Supplemental**	**Section 5.9.2**
O&M Costs	✓		**End to End**	**Section 5.10.3**
Net Present Value and Operating Ratio	✓		**End to End**	**Section 5.12**
Benefit Cost Ratio	✓		**End to End**	**Section 5.12**

[3] Supplemental refers to available information that can be added to the analysis already completed. For example, capital costs for the CSXT approach could be added to each route alternative.
[4] End to End refers to available information that has to be analyzed whole from H-JAIA to Charlotte Gateway. For example, ridership estimates are based on the entire corridor's stopping patterns and one station-to-station ridership volumes cannot be transferred between alternatives.

U.S. Department
of Transportation

Federal Railroad Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

June 11, 2015

Ms. Nancy Cobb
Administrator
Georgia Department of Transportation
600 West Peachtree Street, NW
Atlanta, GA 30308

Dear Nancy,

FRA is writing to respond to the Georgia Department of Transportation's (GDOT) memo dated April 20, 2015 regarding refined operational analysis into the Atlanta area for the Atlanta to Charlotte Passenger Rail Corridor Improvement Plan (PRCIP). FRA agrees that performing refined operational analysis on both the NS and CSXT approaches will produce minimal differences in ridership and revenue outputs. Due to the schedule and budgetary concerns that GDOT has expressed, FRA concurs with performing refined operational analysis on a representative approach into Atlanta.

FRA agrees with the following commitments GDOT outlined in the April 20th memo, with the following clarification:

- FRA comments are addressed in the Alternatives Development Report (ADR). The ADR is acceptable in its current form, with minor refinement.
  In particular, GDOT will include an explanation of the differences between the NS and CSX approach alignments from the termination of the three feasible alternatives in suburban Atlanta to Howell Junction on the common alignment within Atlanta.

- Operational performance analysis for the NS and CSXT approaches is presented equally in the Tier I Draft Environmental Impact Statement (DEIS) and no additional preliminary operational performance analysis will occur.
  FRA understands that the end-to-end corridor modeling and performance data has been prepared based on the "representative" NS approach alignment, and that the incremental difference along the CSX approach is expected to be negligible; however, FRA requests that GDOT quantify the differences between the NS and CSX approach alignments in the Tier I DEIS.

This explanation should include a theoretical extrapolation of any differences in trip time and operational performance, ridership and revenue forecasts or operations and maintenance costs. Although additional preliminary operational performance analysis is not required, GDOT shall include an evaluation of the operational capacity of both the NS and CSX approach alignments in the Tier I DEIS.

- GDOT will perform refined operational performance analysis on data included in the ADR for the preferred alternative in the Tier I DEIS, and the Service Development Plan (SDP) will present the analysis using a representative approach into Atlanta.
  The refined operational performance analysis included in the Tier I DEIS may use only the "representative" NS approach alignment; however an explanation of any quantifiable differences relative to the CSX approach alignment shall be included.

While FRA concurs with proceeding with refined operational analysis on the "representative" NS approach alignment, as previously discussed both approaches require environmental analysis and conceptual engineering to be performed and presented in equal measure for the Tier 1 DEIS and SDP.

FRA looks forward to continuing to work with GDOT on the Atlanta to Charlotte PRCIP. Please feel free to contact Jessie Fernandez-Gatti at (202) 493-0454 with any questions.

Sincerely,

David Valenstein
Chief, Environment and Systems Planning Division