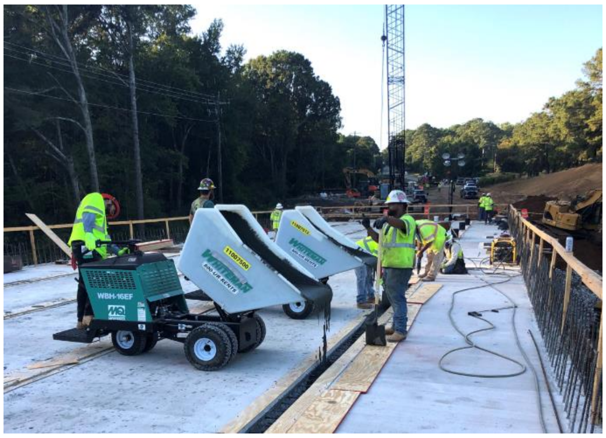
Accelerated Bridge Construction Guidance



12/13/2024

Revision 1.0

Atlanta, GA 30308

GDOT

Georgia Department of Transportation

The original Accelerated Bridge Construction Guidance was created through the public-private partnership of the Georgia Department of Transportation, Gresham Smith and Heath & Lineback Engineers. The following people have donated their time and resources to contribute to the quality of transportation engineering in Georgia:

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Revision Summary

Revision Number	Revision Date	Revision Summary
1.0	12/13/24	New manual

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List of Effective Chapters

Document	Revision Number	Revision Date
List of Effective Chapters	1.0	12/13/24
Table of Contents	1.0	12/13/24
Acronyms and Definitions	1.0	12/13/24
Chapter 1. Introduction	1.0	12/13/24
Chapter 2. Integration of ABC Into GDOT Plan Development Process (PDP)	1.0	12/13/24
Chapter 3. ABC Decision Making Process	1.0	12/13/24
Chapter 4. General Design	1.0	12/13/24
Chapter 5. Superstructure	1.0	12/13/24
Chapter 6. Substructure	1.0	12/13/24
Chapter 7. Materials	1.0	12/13/24
Chapter 8. Connections	1.0	12/13/24
Chapter 9. Bridge Move Methods	1.0	12/13/24
Chapter 10. References	1.0	12/13/24
Appendix A. ABC Decision Analysis – Stage 1	1.0	12/13/24
Appendix B. ABC Decision Analysis – Stage 2	1.0	12/13/24
Appendix C. ABC Decision Analysis – Stage 3	1.0	12/13/24
Appendix D. Details	1.0	12/13/24
Appendix E. Special Provisions	1.0	12/13/24

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Table of Contents

Chapter 1. Introduction - Contents

Chapter 1. Introduction

1.1 Policy

Accelerated Bridge Construction (ABC) is used for accelerating project delivery. A few advantages include reduction of construction times to lessen impacts to the traveling public and minimizing total project costs. The total project cost includes both direct construction costs and indirect construction costs such as maintenance and user costs associated with delays. All bridge projects should be evaluated for the use of ABC. It is the preference of the Office of Bridge Design and Maintenance (Bridge Office) to concentrate on methods that reduce road closure times to a few months over methods that limit road closures to a few days.

1.2 Benefits

ABC techniques provide many benefits, including:

- Accelerates Project Delivery
  - Removes the bridge as a critical element of the construction schedule
  - Reducing the duration of the bridge construction reduces potential project delays due to seasonal restrictions in the environmental permit.
  - Reducing the duration of the bridge construction reduces potential delays due to in-climate weather. (winter, hurricane season, etc.)
- Encourages Innovation
  - Uses alternative bridge design and construction methods to meet the project goals
- Minimizes Duration of Maintenance of Traffic
  - Adds value to the project by reducing impacts on the general public
  - Improves worker safety and safety to the traveling public
  - Increases public support
  - Increases political capital
- Reduces Project Cost
  - Reduces user costs
  - Reduces oversight and inspection cost through reduction in project duration:

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Chapter 2. Integration of ABC into GDOT Plan Development Process (PDP) - Contents

Chapter 2. Integration of ABC into GDOT Plan Development Process (PDP)

The intergration of ABC should be included in the Concept Development Phase of the PDP. It is important for ABC to be considered as early as possible in the concept development and should be discussed in the Initial Concept Meeting. At this point, potential environmental impacts, input from local officials, and possible alignments should have been discussed. Using the ABC Go/No-Go tool, the project team can determine if a project justifies the use of ABC or remaining as a conventional bridge construction project. If ABC is justified, then an ABC alternate should be included in the concept report.

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Chapter 3. ABC Decision Making Process - Contents

Chapter 3. ABC Decision Making Process

3.1 Stage 1 - Go/ No-Go Tool

The Go/No-Go tool assists engineers in identifying projects that could be potentially executed using ABC and is the first stage in the ABC decision making process. The tool can be found on the Bridge Office website. The tool uses seven measures entered by the user and combines them with established weight factors to provide an ABC Rating Score which can be used to determine the feasibility of ABC for the project. A score shall be computed for each conventional non-ABC replacement scheme that is being considered for the project.

The measures that the user needs to input are:

1. Average Daily Traffic - ADT accounts for the volume of traffic traversing the bridge site. ADT under the bridge should be adjusted for planned disruption.
2. Average Daily Truck Traffic – ADTT accounts for the volume of truck traffic traversing the bridge site. ADT under the bridge should be adjusted for planned disruption.
3. Delay/Detour Time - Delay/detour time accounts for the time impact that a project has on vehicles passing through the construction site and, therefore, the construction time delays due to detours and congestion. Use the detour delay time or the reduced lane delay time sheets in the tool to calculate this for closures on or under the bridge.
4. User Cost per Day - User costs account for the financial impact of a construction project on the traveling public. The major contributing factors in calculating user costs are delay time and ADT and ADTT. The delay time calculators also provide the user cost per day.
5. Safety - Safety accounts for the increase in safety provided to the traveling public and the work force at the construction site when using ABC. ABC reduces the exposure time of travelers and workers in work zones. Project sites requiring complex MOT schemes for extended periods are undesirable.
6. Railroad Impacts - Railroad impacts account for the impact of railroad traffic on the project. Use the number of trains and type of train traffic to measure the impact.
7. Cost – The increase construction costs for ABC may be justified by the decrease of cost associated with detours, ROW, traffic control and railroad coordination. Other costs associated with the reduced construction should also be considered. These include job-site offices, Inspection, oversite and other costs reduced by the shortened project schedule. User costs are not reflective of a real cost, but need to be considered.

Weight factors in the spreadsheet should not be changed; however, the weight factors are subject to change in the future as the ABC projects become more common in the state.

Use the ABC score and the flowchart in the tool to determine if ABC needs to be considered for this project.

During concept design, send the completed Go No-Go Tool with scores greater than 30 to (BridgeOffice@dot.ga.gov) to request a decision to proceed to Stage 2 inspection.

3.2 Stage 2 - ABC Decision Questionnaire

The ABC decision questionnaire should be completed after Go/No-Go tool indicates favorable conditions for ABC. The process has been developed to help determine project sites that are best suited to use ABC techniques. The questionnaire investigates impacts to the local community and provides a consistent method to define the parameters of the project location. The ABC Decision Questionnaire can be found in Appendix B.

3.2.1 General Site Considerations

The first section of the ABC Decision Questionnaire examines issues that may present themselves in the design phase of the proposed bridge. These issues could be present if the project is constructed utilizing traditional construction methods or accelerated techniques.

3.2.1.1 Schedule

In assessing the need for accelerated bridge construction it's important to understand what role bridge construction plays in the overall scope and duration of the project. If bridge construction is on the critical path, the additional cost associated with ABC may be beneficial.

3.2.1.2 Local Opinion

The opinion of local government, businesses, schools and residents should be considered during the concept phase to determine how construction will affect users. They may also have insight on the site conditions that may not be obvious during an initial inspection.

3.2.1.2.1 Critical Services

The need to maintain access for emergency services, school buses, transit, etc., can impact project scheduling, duration and staging alternatives. Critical services or features must be considered and whether they can be accommodated using conventional construction methods and staging. Early coordination with critical services is crucial to determine closure/staging option and to allow the critical services to have a plan in place continue service during construction.

3.2.1.2.2 Local Businesses

Road closures can be costly to business along the construction corridor. While disruption during construction cannot be eliminated, it should be considered when determining construction methods.

3.2.1.3 Environmental restrictions

The design team should work with environmental, hydraulics, and DNR representatives to determine if there are issues that may restrict the ability to use conventional construction methods or timeframes, which may lead to compressed construction schedules or reduced access to adjacent right-of-way.

3.2.1.4 Railroad Coordination

Impacts to railroads will require additional coordination with the facilities owners to ensure that their concerns are considered. The cost of flagging operations and temporary structures can be significant and may lead to extra consideration ABC alternatives. In cases of heavy train traffic, the added safety for contractors may outweigh the additional cost associated with ABC.

3.2.1.5 Utilities

The impact to utilities on the site should be considered when determining construction methods. ABC may provide an opportunity to reduce utility impacts requiring relocation. However, ABC could also increase impacts. Special consideration should be given to the potential use of extra-large cranes, which may require overhead utility relocation.

3.2.1.6 Geotechnical Consideration

Bridge limits and any existing plans should be reviewed for geotechnical issues that may affect the timing or cost of the project using any available information. The cost of poor soil mitigation can be significant and may be avoided through the use of construction staging or ABC techniques that don’t disturb the affected areas.

3.2.2 Traditional Construction Methods

Traditional construction methods shall be considered for all bridge replacements. While current industry trends gravitate towards the use of ABC techniques when there is a need to maintain traffic, the use of offset alignments or staged construction are often the most feasible solutions. While investigating design concepts, the designer shall take note of features that may be affected by staging including but not limited to the need to purchase right-of-way, extend culverts, or modify traffic signals.

3.2.3 Detours

User costs associated with detours shall be considered when determining the preferred bridge replacement technique. The use of detours should be investigated for use during ABC closure period and for construction using traditional techniques.

3.2.4 Project Site

When investigating the use of ABC in concept design, the designer shall investigate the site conditions to determine if ABC is feasible at the project site. Consideration should be given to staging locations, utilities, and unique features to the site that may benefit the use of ABC.

3.2.5 Questionnaire Review

The completed ABC Questionnaire will be reviewed by the Office of Construction, District Construction and the Office of Bridge Design and Maintenance for recommendations on the use of ABC. The State Bridge Engineer has the final decision to include ABC as the first alternative in the concept report.

3.3 Stage 3 - ABC Method Selection

The ABC Means and Methods Matrix lists out all the available ABC superstructure and substructure element types and construction techniques that are available. The matrix can also be used to determine the tier of ABC for the project based on how fast-paced the replacement needs to be. Once it has been determined that an ABC alternative is required, use the ABC Means and Methods Matrix to figure out the type of ABC and the tier that needs to be evaluated for the concept. The matrix can be found in Appendix C.

Chapter 4. General Design - Contents

Chapter 4. General Design

4.1 Design Specifications

See Chapter 2 of the GDOT Bridge and Structure Design Manual for all applicable design specifications. See AASHTO LRFD Guide Specifications for Accelerated Bridge Construction for more guidance on the ABC specific topics.

4.2 Loads

ABC Bridge Components shall be designed to meet all the load and load combination requirements of the AASHTO LRFD Bridge Design Specifications as specified by the GDOT Bridge and Structure Design Manual.

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Chapter 5. Superstructure - Contents

Chapter 5. Specific Sign Sequencing for Particular Applications

5.1 Other Precast Concrete Beams

5.1.1 General

Non-AASHTO precast beam types are being utilized by the Bridge Office to provide options for rapid delivery and rapid construction for select bridges in the state. These beam types include cored slab beams, box beams, and NExT-D beams. Additional details and guidance can be found in section 3.8 of the GDOT Bridge and Structure Design Manual.

5.1.2 Box Beam/Cored Slabs

The use of these beam types is limited to structures with very little to no horizontal curvature and a maximum of 4% superelevation. The department developed details for these beams are also limited to structures with no skew at the end or intermediate bents. The cored slab beams and box beams require either a concrete or asphalt overlay. A minimum 3 1/2" thickness is required when asphalt overlay is used.

5.1.3 NExT D-Beams

The use of the NExT D-beam should be limited to structures with very little to no horizontal curvature and a maximum of 4% superelevation. The beams are joined using Ultra High Performance Concrete (UHPC) for joint connections. An asphalt overlay can be used, but not required.

Before using this beam type, the designer should contact the Bridge Office for discussion and approval.

5.2 Full Depth Precast Deck Panels

The full depth precast deck panels can be used and designed similar to a cast-in-place deck. An additional 1/2” grinding surface should be included in the thickness to allow for smooth transition between panels. The panels are joined using UHPC for joint connections. The reinforcement steel should be detailed on 3” increments to accommodate fabrication. When placing the precast deck panels on AASHTO Bulb Tee beams, the top flange of the bulb tee should be reduced to minimize the amount UHPC required. The modified bulb tee should be analyzed for beam stability for shipping and erection handling.

If full depth precast deck panels are used, contact the Bridge Office for the current details and drawings.

5.3 Decked Bulb-Tee Units

An alternative to full depth precast deck panels, is the use of a decked bulb tee unit. Bulb tee beams are temporarily set on false work, either at the precasting plant or at an on-site lay down yard, then the deck is casted in place with open joints in each bay. The units are then moved into final position and joined using UHPC for the joint connections. The weight of the decked bulb tee unit will determine if the use of the deck bulb tee unit is feasible. The decked bulb tee unit should be analyzed for beam stability for shipping and erection handling.

Before using a decked bulb tee unit, the designer should contact the Bridge Office for discussion and approval.

5.4 Steel Modular Decked Beams (MDBs)

The use of steel modular decked beams should be discussed with the Bridge Office.

Chapter 6. Substructure - Contents

Chapter 6. Substructure

6.1 Phased/Staged Construction

It is permissible to construct substructure elements prior to demolition or closure of the existing structure to reduce closure periods. Traffic control, workzone exposure to traffic, limited overhead clearance, staging areas, utilities, interference with existing bridge components and access shall be investigated based on the proposed construction sequence.

6.2 Precast Construction

Precast substructure elements include:

1. Pile Bent Caps
2. Precast Concrete Bents
    a. Caps
    b. Columns
    c. Footings
3. Abutment Caps
4. Wing walls

See Section 8 for more details regarding connections.

6.3 Re-Use of Existing Substructure

Re-use of existing substructure for new bridge construction should be avoided and is not allowed without prior approval from the Bridge Office.

6.4 GRS-IBS

Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS) abutments are generally used on single span bridges on low volume roads. Scour at the base of the abutment shall be investigated on GRS-IBS abutments used on stream crossings.

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Chapter 7. Materials - Contents

Chapter 7. Materials

ABC may require materials that are not typically used in conventional bridge construction. The use of standard classifications of concrete are permitted for use in ABC projects as defined in the Standard Specifications.

7.1 High Early Strength Concrete

High early strength concrete can be used for closure pours between precast elements with the exception of precast deck panels. With approval from the Bridge Office, it is permissible to use high early strength concrete in cast-in-place applications where concrete curing times would delay the accelerated schedule. Possible applications include deck, substructure, barriers, approach slabs, edge beams and end walls. Curing temperature and Mass Concrete requirements shall be checked by an engineer.

7.2 Ultra-High Performance Concrete (UHPC)

UHPC should be used for all closure pours at connections between precast concrete deck panels and beams. The use of UHPC reduces the rebar splice length allowing for a minimum sized closure pour while maintaining continuity within deck reinforcing.

7.3 Flowable Fill

Flowable fill may be used to fill voids beneath precast footings or slabs. Its use may speed construction by avoiding the time consuming process of preparing the soil bed to properly seat the precast element. Flowable fill is not concrete and should not be used as a replacement for concrete.

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Chapter 8. Connections - Contents

Chapter 8. Connections

8.1 Closure Pours

Superstructure closure pours should use UHPC to minimize joint size. High early strength concrete is permissible for use in substructure elements.

8.2 Grouted Splice Couplers

Grouted splice couplers are permissible for use on ABC projects, but the quantity used should be limited to reduce costs. When used in precast elements, the couplers should be placed with a template to ensure connection locations are within tolerance. The designer shall not use grouted splice couplers within the plastic hinge region.

8.3 Corrugated Pipe Void Connection

Corrugated steel pipe can be used as an effective method for creating a void for connections in prefabricated elements. One benefit of using corrugated pipe is the corrugations in the pipe provide additional capacity in load transfer between the concrete cast within the pipe and the surrounding prefabricated concrete. The corrugated pipe must be continuous with uniform corrugations along the entire length of the pipe. Fully develop reinforcing extending into the voids. Do not reduce the development length based on confinement provided by the corrugated pipe.

Corrugated plastic pipes are allowed for nonstructural voids. The use of nonstructural voids can reduce shipping and handling weight. Corrugated pipes with low friction wall or that contain aluminum are not permissible.

8.4 Post-Tensioning

Post-tensioning may be used to reduce the size and weight of precast elements. The use of post-tensioning should be discussed with the Bridge Office.

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Chapter 9. Bridge Move Methods - Contents

Chapter 9. Bridge Move Methods

The use of bridge moves should be discussed with the Bridge Office.

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Chapter 10. References - Contents

Chapter 10. References

The following is a list of references used to create this guide and additional useful resources for ABC techniques:

1. Contact the GDOT Bridge Office for latest resources and plan examples for ABC Projects at BridgeOffice@dot.ga.gov
2. LRFD Guide Specifications for Accelerated Bridge Construction, 1st Edition
3. FHWA - Accelerated Bridge Construction Resources
4. Accelerated Bridge Construction – University Transportation Center at FIU
5. Colorado DOT - Accelerated Bridge Construction Resources
6. Connecticut DOT - Accelerated Bridge Construction Resources
7. Other State DOT Accelerated Bridge Construction Resources.

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Appendix A. ABC Decision Analysis – Stage 1

A.1 Go/No-Go Tool

Project:	Number		
By:	Initials	Checked:	Initials
Date:	0/0/00		0/0/00
Sheet No.	1	of	3

Assume a Non-ABC replacment scheme to complete this table

Enter values for each aspect of the project. Attach applicable supporting data.

Total ADT - On Bridge (Average Daily Traffic)	1	0	Less than 250
		1	250 to 5000
		2	5000 to 10000
Total Adjusted ADT - Under Bridge (Average Daily Traffic) Enter 0 for Hydraulic Crossing	2	3	10000 to 15000
		4	15000 to 20000
		5	More than 20000
Total ADTT - On Bridge (Average Daily Truck Traffic)	0	0	Less than 25
		1	25 to 500
		2	500 to 1000
Total Adjusted ADTT - Under Bridge (Average Daily Truck Traffic) Enter 0 for Hydraulic Crossing	4	3	1000 to 1500
		4	1500 to 2000
		5	More than 2000
Delay Time Calculate assuming the	3	0	No delays
		1	Less than 5 minutes
		2	5-10 minutes
		3	10-15 minutes
		4	15-20 minutes
		5	More than 20 minutes
User Costs Per Day	1	0	No user costs
		1	Less than $10,000
		2	$10,000 to $50,000
		3	$50,000 to $75,000
		4	$75,000 to $100,000
		5	More than $100,000
Safety	1	1	Short duration impact with simple MOT scheme or Off-site Detour
		2	Short duration impact with multiple traffic shifts
		3	Normal duration impact with multiple traffic shifts
		4	Extended duration impact with multiple traffic shifts
		5	Extended duration impact with complex MOT scheme
Railroad Impacts	0	0	No railroad or minor railroad spur
		3	One mainline railroad track
		5	Multiple mainline railroad tracks
Cost	3	0	ABC cost > 200% of conventional cost
		3	ABC cost < 200% of conventional cost
		5	ABC cost < 150% of conventional cost

PROJECT COST EVALUATION

	Conventional	ABC
Bridge Cost*	$2,500,000	$5,000,000
Total User Cost	$1,000,000	$0
Temporary Bridge Cost		
ROW Cost		
Traffic Control Cost		
Railroad Flagging/Shoefly Cost		
Other Costs**		
Total Project Cost* **	**$3,500,000**	**$5,000,000**

These costs are typically estimated in the concept stage and can be used here

* ABC Bridge cost can be assumed as 1.5 to 2 times conventional cost if no other information is available.

**Other costs may include utilities, overhead signs, construction inspection, drainage improvements and other approach related costs that differ between an ABC and Traditional approach.

***Total project cost here is not reflective of actual cost since user cost is included.

Project:	Number		
By:	Initials	Checked:	Initials
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Sheet No.	2	of	3

Adjusted ADT Calculator					
	ADT	ADTT	Disruption Factor	Adjusted ADT	Adjusted ADTT
Traffic Under Bridge	20000	2000	0.00	0	0

Disruption Factors	
Fully Closed	1
Lane Closures	0.75
Shoulder Reduction	0.35
MOT Impacts	0.25
No Impact	0

ABC RATING SCORE FACTORS AND WEIGHTS					
	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Total ADT - On Bridge	1	10	10	5	50
Total Adjusted ADT - Under Bridge	2	5	10	5	25
Total ADTT - On Bridge	0	10	0	5	50
Total Adjusted ADTT - Under Bridge	4	5	20	5	25
Delay Time	3	10	30	5	50
User Costs Per Day	1	15	15	5	75
Safety	1	5	5	5	25
Railroad Impacts	0	5	0	5	25
Cost	3	10	30	5	50
		Total Score	120	Max. Score	375

ABC Rating Score: 32

Project:	Number		
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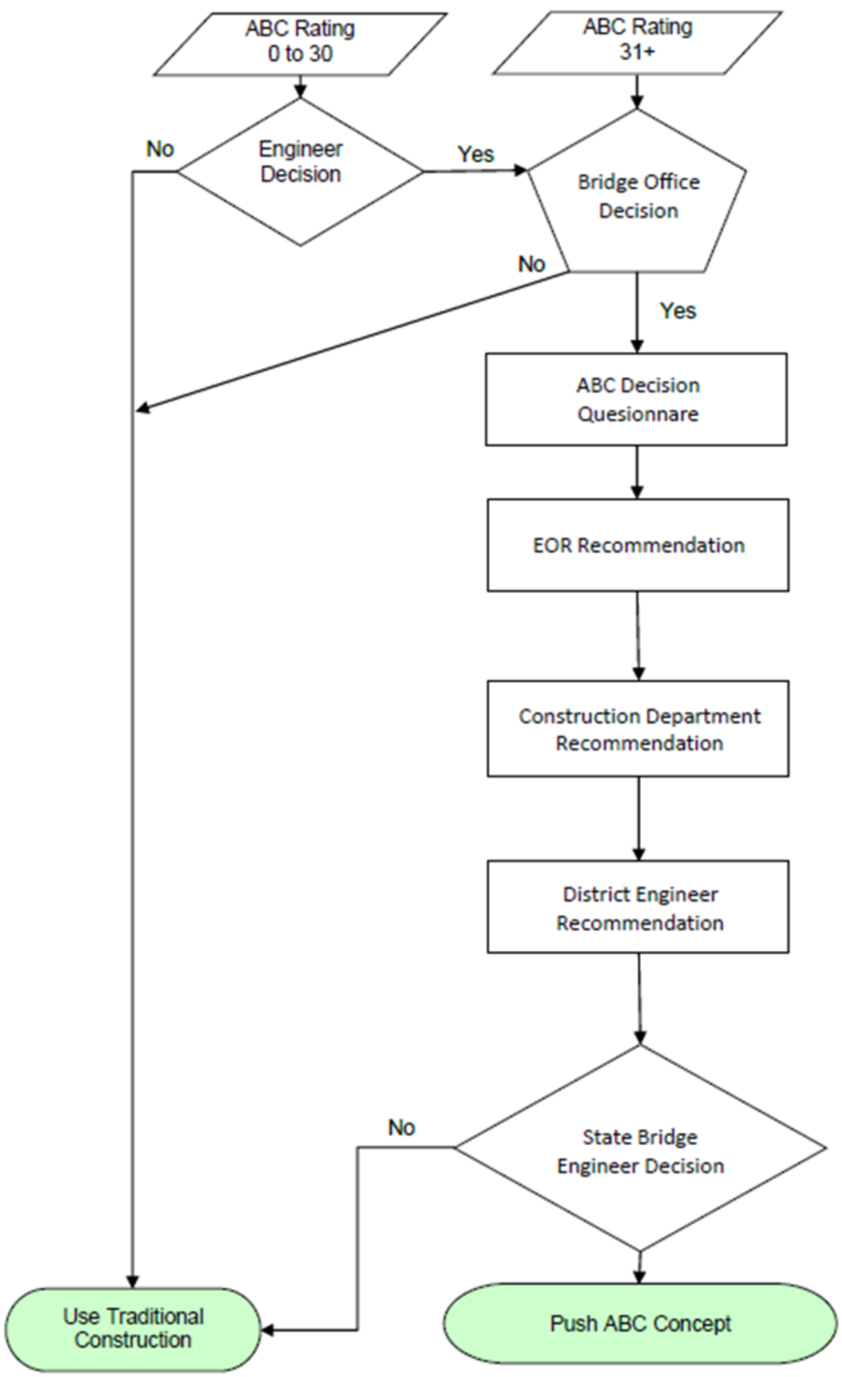
Sheet No.	3	of	3



Project:	Number		
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Sheet No.	1	of	3

ABC Decision Making Process - Detour Delay Time

ADT	6800	
Truck %	5.00%	
Workzone Time		
Workzone Length	0.5	miles
Pre-construction speed limit	45	mph
Workzone Time	0.67	minutes
Detour Time		
Detour Segment 1 Length	29	miles
Segment 1 speed limit	45	mph
Segment 1 Congestion Factor	1.25	See Note 1
Segment 1 Time	48.33	minutes
Detour Segment 2 Length		miles
Segment 2 speed limit		mph
Segment 2 Congestion Factor		See Note 1
Segment 2 Time	0	minutes
Detour Segment 3 Length		miles
Segment 3 speed limit		mph
Segment 3 Congestion Factor		See Note 1
Segment 3 Time	0	minutes
Detour Segment 4 Length		miles
Segment 4 speed limit		mph
Segment 4 Congestion Factor		See Note 1
Segment 4 Time	0	minutes
Detour Segment 5 Length		miles
Segment 5 speed limit		mph
Segment 5 Congestion Factor		See Note 1
Segment 5 Time	0	minutes
Assumptions		
Number of Stops along detour	0	stop signs or signals
Average Delays at stop signs/signals	1	minutes
Stop Delay Time	0	minutes
Detour Delay Time	**47.67**	**Minutes**
Road User Cost	**$61,450.14**	**Per Day**

Project:	Number		
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Date:	1/0/1900		1/0/1900
Sheet No.	2	of	3

ABC Decision Making Process - Detour Delay Time

Conditions on Detour Segment	Conditions at Bridge: Non-limited access highway, total ADT < 5,000	Non-limited access highway, total ADT 5,000 - 10,000	Non-limited access highway, total ADT > 10,000	Limited access highway, directional ADT < 25,000	Limited access highway, directional ADT > 25,000
Longer than 2.0 miles, ADT > 8,000 per lane	1.50	1.75	2.00	2.00	2.00
Longer than 2.0 miles, ADT< 8,000 per lane	1.25	1.50	1.75	2.00	2.00
0.5 - 2.0 miles, ADT < 3,000 - 8,000 per lane	1.25	1.25	1.50	1.75	2.00
0.5 - 2.0 miles, ADT < 3,000 per lane	1.00	1.25	1.50	1.50	1.75
Less than 0.5 mile, ADT < 3,000 per lane	1.00	1.00	1.25	1.50	1.50

Note : This factor accounts for the additional delay on the detour route due to congestion. For example, a value of 1.25 equates to a 25% increase in travel time on the detour route.

Conditions on Detour Segment - Guidance:
ADT per lane = ADT on segment / number of total available lanes on roadway
If length of detour and ADT per lane do not match one of the above categories, use higher value condition.

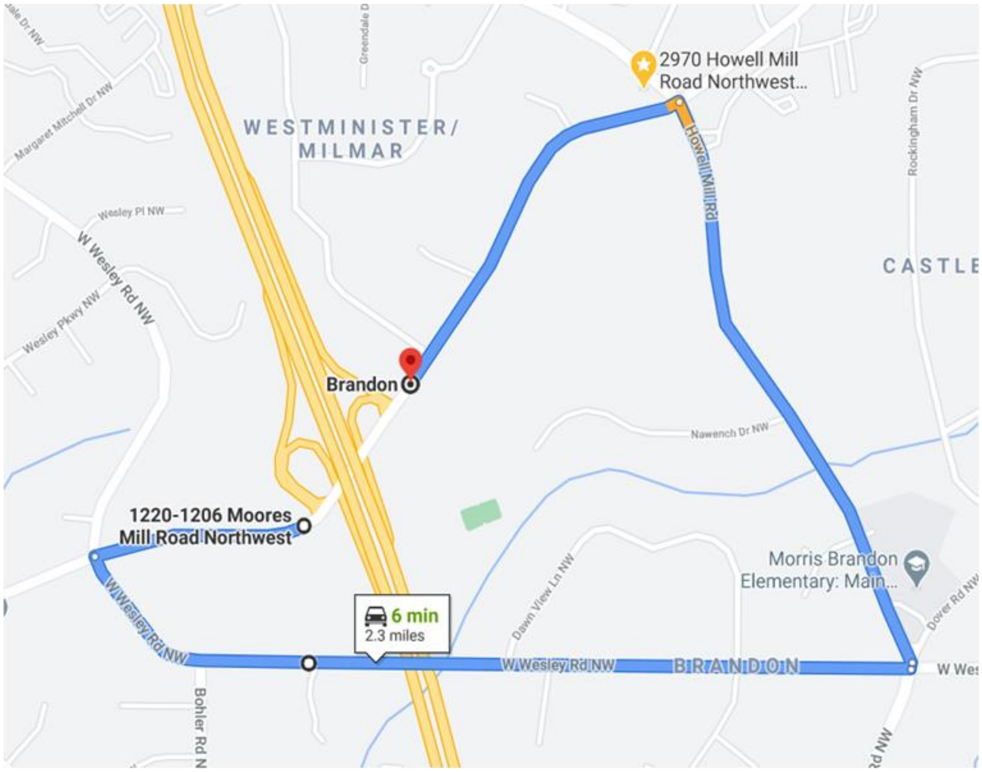
Comments:

1. These caculations would be used if a detour was planned. The adjustment factor is to account for the anticipated volume of traffic on the detour.

2. Segment Congestion Factor variables may be reduced for short term detours if the project will include special advance notice to motoring public during construction phase with the effect of reducing overall short term traffic volumes.

Project:	Number		
By:	Initials	Checked:	Initials
Date:	1/0/1900		1/0/1900
Sheet No.	3	of	3

Google Image of Planned Detour



	Project:	Number		
	By:	Initials	Checked:	Initials
	Date:	0/0/00		0/0/00
	Sheet No.	1	of	2

ABC Decision Making Process - Reduced Lane Delay Time

Posted Construction Speed Limit	35.000	MPH
Lane Reduction Delays		
Heavy Commute Peak Period 1		
Hourly volume during peak periods	2500	total vehicles per hour
Number of Lanes in service during peak	1	lanes
Peak Lane Volume	2500	vehicles per hour per lane
Average delay time per vehicle	**38.25**	**minutes**
Aggregate delay time for this peak period	95623	vehicle minutes per hour
Length of peak period	2	hours (see note below)
Aggregate delay time for this period	191246	vehicle minutes
Heavy Commute Peak Period 2		
Hourly volume during peak periods	2500	total vehicles per hour
Number of Lanes in service during peak	1	lanes
Peak Lane Volume	2500	vehicles per hour per lane
Average delay time per vehicle	**38.25**	**minutes**
Aggregate delay time for this peak period	95623	vehicle minutes per hour
Length of peak period	2	hours (see note below)
Aggregate delay time for this period	191246	vehicle minutes
Off peak periods		
Average Hourly volume during off-peak periods	750	total vehicles per hour
Number of Lanes in service during peak	1	lanes
Peak Lane Volume	750	vehicles per hour per lane
Average delay time per vehicle	**0.00**	**minutes**
Aggregate delay time for this off peak period	0	vehicle minutes per hour
Length of off peak period	20	hours (24 hours minus peak hours)
Aggregate delay time for this period	0	vehicle minutes
Average delay time		
Aggregate delay time for period 1	191246	vehicle minutes (from above)
Aggregate delay time for period 2	191246	vehicle minutes (from above)
Aggregate delay time for off peak period	0	vehicle minutes (from above)
Total Aggregate delay time	**382493**	**vehicle minutes**
Total Directional ADT	25000	vehicles
Directional Truck %	1.00%	
Average Delay time per vehicle	15.30	minutes
Directional Road User Cost	**$69,581.76**	**Per Day**

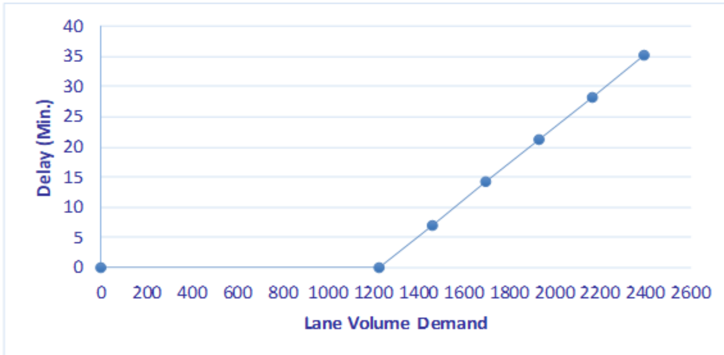
Note: Length of Peak Period: enter 1 for light traffic; 2 for medium traffic; 3 for heavy traffic

Project:	Number		
By:	Initials	Checked:	Initials
Date:	1/0/1900		1/0/1900
Sheet No.	2	of	2

ABC Decision Making Process - Reduced Lane Delay Time

Lane Volume Demand	Delay (min.)
0	0
1225	0
1460	7.05
1695	14.1
1930	21.15
2165	28.2
2400	35.25

Slope = 0.03



Comments:

1. These calculations would be used if staged construction was planned where there is a proposed reduction in the number of lanes. The basis of the delay times is that a lane can accommodate 35 vehicles per Lane per hour per MPH without delay. Increased delays would result as the lane volume increases. The calculation shoud be done in each direction to calculate Total Road User Cost.

2. The assumption is that the delay time increases linearly from 35 X the posted construction speed limit vehicles per hour (see Basis of Delay Time Plot to Right). The rate of increase can be easily adjusted by changing the slope of the linear increase (blue cell).

3. The directional ADT can be estimated to be 50% of ADT if Specific directional data is unavailible

4. The peak hourly volume can be estimated to be 10% of the directional ADT for 2 hours if specific hourly volumes are not available.

5. The off peak hourly volume can be estimated to be 3% of the directional ADT for 20 hours if specific hourly volumes are not available.

6. Reduced ADT input values may be used for short term lane reductions (2 to 3 day intervals) if special advance notice to motoring public is implemented during construction phase with the effect of temporarily reducing ADT.

Appendix B. ABC Decision Analysis – Stage 2

B.1 Questionnaire

Accelerated Bridge Construction Decision Questionnaire

Project Information			
Project Name/Location:			
PI No.:		Preliminary Submittal:	
GDOT Project Manager:		Final Submittal:	
Bridge EOR:		Let Date:	
Addition Information:			

Bridge Information			
Bridge No.:			
ADT On:		ADT Under:	
Existing Bridge Length:		Proposed Bridge Length:	
Existing Bridge Width:		Proposed Bridge Width:	

Project Description:	
Anticipated Construction Duration:	
Scope of Work:	
Addition Information:	

General Site Considerations

	Question/Issue:		Yes	Poss.	No	N/A	Comments
1	Is bridge construction on the critical path of this project?		☐	☐	☐	☐	
2	Could construction impact businesses?		☐	☐	☐	☐	
3	Do locals have an opinion on the project?		☐	☐	☐	☐	
4	Are there any issues regarding construction timeframes (e.g. fish spawning, bird nesting, high water, permits, major events)?		☐	☐	☐	☐	
5	Are there critical features or services on the route that need to be considered (e.g. hospital, emergency services, transit, school buses)?		☐	☐	☐	☐	
6	Will there be impacts to any Railroads? If Yes:		☐	☐	☐	☐	
	a.	Does railroad traffic need to be maintained during construction?	☐	☐	☐	☐	
	b.	Frequency of trains					
7	Are there Utilities on the bridge?		☐	☐	☐	☐	
8	Are there utilities in the area that will need to be relocated?		☐	☐	☐	☐	
9	Are there any known geotechnical issues that may affect construction?		☐	☐	☐	☐	
10	Score from Go/No-Go Tool						
Additional Considerations:							

Traditional Construction Methods

	Question/Issue:		Yes	Poss.	No	N/A	Comments
11	Is it likely that this project will include complex traffic control schemes, long detours, or significant user impacts due to bridge construction?		☐	☐	☐	☐	
12	Is staged construction feasible? If Yes:		☐	☐	☐	☐	
	a.	Average Delay Time					
	b.	Is additional bridge width required to accommodate staged construction?	☐	☐	☐	☐	
	c.	Will additional R/W or easements be required to accommodate staged construction	☐	☐	☐	☐	
13	Does the existing bridge have features that make it difficult to accommodate staging (truss bridge, slab span, beam spacing issues, etc.)?		☐	☐	☐	☐	
14	Could additional width be needed on culverts, bridges, or shoulders to maintain traffic on the existing route or the detour route?		☐	☐	☐	☐	
15	Is it likely that temporary bridge structures will be needed?		☐	☐	☐	☐	
16	Will temporary traffic signals be required?		☐	☐	☐	☐	
17	Does it appear that maintenance of traffic will require additional right-of-way?		☐	☐	☐	☐	
Additional Considerations:							

Detour

	Question/Issue:		Yes	Poss.	No	N/A	Comments
18	Will/Can traffic be detoured? If Yes:		☐	☐	☐	☐	
	a.	Detour Delay Time					
	b.	Local Alternative Detour Delay Time					
	c.	Will the detour route have a detrimental impact on emergency vehicles, school buses, or other sensitive traffic?	☐	☐	☐	☐	
	d.	Is the local alternate detour route in need of repairs?	☐	☐	☐	☐	
	e.	Are there load limit restrictions on the detour?	☐	☐	☐	☐	
	f.	Are there bridge width or height restrictions on the detour?	☐	☐	☐	☐	
	g.	Are there issues regarding suitability of detour route (length, speed limit, travel time, etc.)?	☐	☐	☐	☐	
	h.	Will intersection improvements be required on detour/alternate routes?	☐	☐	☐	☐	
Additional Considerations:							

Accelerated Bridge Construction

	Question/Issue:	Yes	Poss.	No	N/A	Comments
19	Are there significant risks or other factors (site complexity) that could be mitigated by accelerating bridge construction?	☐	☐	☐	☐	
20	Are there suitable staging locations?	☐	☐	☐	☐	
21	Will the use of ABC mitigate the need for utility relocation?	☐	☐	☐	☐	
Additional Considerations:						

Conclusion:

Engineer of Record

Based on the findings & conclusions above, further consideration of accelerated bridge construction is warranted: ☐ **YES** ☐ **NO** **Name:** ________________________________ **Date:** __________ **Comments:**

Office of Construction

Based on the findings & conclusions above, further consideration of accelerated bridge construction is warranted: ☐ **YES** ☐ **NO** **Name:** ________________________________ **Date:** __________ **Comments:**

District Construction

Based on the findings & conclusions above, further consideration of accelerated bridge construction is warranted:

☐ **YES** ☐ **NO** **Name: ____________________________________ Date: __________**
Comments:

Office of Bridge Design and Maintenance

Based on the findings & conclusions above, further consideration of accelerated bridge construction is warranted:

☐ **YES** ☐ **NO** **Name: ____________________________________ Date: __________**
Comments:

Accelerated Bridge Construction
Decision Questionaire

General Information/Background:
The ABC decision questionnaire should be completed after go/no-go tool indicated favorable conditions for ABC. The process has been developed to help determine project sites that are best suited to use accelerated bridge construction techniques. The questionnaire investigates impacts to the local community and provides a consistent method to define the parameters of the project location.

Instructions

Line By Line Instructions:
Project Information

It is intended that this tool be filled out and recorded by the ABC Liaison, with assistance from the Project Manager, Construction Engineer and the Bridge Office.

Bridge Information:

Record the basic bridge data, including the ADT on and under the bridge, which may help in determining appropriate staging, traffic control, and ABC alternatives. This data is on the Bridge Inventory Sheet, available from the GDOT GeoPI.
https://www.dot.ga.gov/applications/geopi/Pages/Search.aspx

Project Description:

List the major work type such as “bridge replacement”, “bridge re-deck with widening”, “superstructure replacement”, etc. If known, include the approximate construction duration using traditional construction methods. If the project includes major roadway work indicate the anticipated duration of bridge construction only. The complete focus of the project should be captured in the Scope of Work. Include any additional information that is unique to this project.

General Site Considerations

Question/Issue No. 1:

Is bridge construction on the critical path of this project?

In assessing the need for accelerated bridge construction it’s important to understand what role bridge construction plays in the overall scope and duration of the project. If the bridge work is not on the critical path, it may not be cost effective to accelerate the bridge portion of the work.

Question/Issue No. 2:

Could construction impact businesses?

The cost of mitigating impacts to local businesses can be substantial. Staging alternatives ranging from full closure to ½ at-a-time, or even nighttime construction may help moderate these concerns. List the potential business impacts.

Question/Issue No.3:

Do locals have an opinion on the project?

Locals may have insight on the bridge site that may not be obvious. They may also have a preference to a short road closure over extended stage construction or know of events that may interfere with construction.

Question/Issue No. 4:

Are there any issues regarding construction timeframes (e.g. fish spawning, bird nesting, high water, permits, major events)?

Work with environmental, hydraulics, and DNR representatives to determine if the aforementioned issues may restrict the ability to use conventional construction methods or timeframes, which may lead to compressed construction schedules or reduced access to adjacent right-of-way.

Question/Issue No. 5:

Are there critical features or services on the route that need to be considered (e.g. hospital, emergency services, transit, school buses)?

The need to maintain access for emergency services, school buses, transit, etc., can impact project scheduling, duration and staging alternatives. List the known critical services or features that must be considered and whether or not they can be accommodated using conventional construction methods and staging.

Question/Issue No.6:

Will there be impacts to any Railroads?

Impacts to railroads will require additional coordination with the facilities owners to ensure that their concerns are considered.

Question/Issue No. 6a:

Does railroad traffic need to be maintained during construction?

The cost of flagging operations and temporary structures can be significant, so it may make sense to investigate ABC alternatives, which may reduce roadway user and railroad impacts as well as construction duration.

Question/Issue No. 6b:

Frequency of trains

On a heavily traveled railroad, it may be beneficial to limit construction time to increase safety to workers and lessen impacts to train traffic.

Question/Issue No. 7:

Are there Utilities on the bridge?

Utilities located on the bridge may impact possible ABC methods. If ABC is determined to be beneficial to the project, an attempt should be made to locate utilities off of the bridge.

Question/Issue No. 8:

Are there utilities in the area that will need to be relocated?

Adjacent utilities should be examined to determine if they will need to be moved to accommodate the proposed facilities or construction access. If ABC methods appear applicable, there may be additional access requirements to accommodate multiple cranes at the same site.

Question/Issue No. 9:

Are there any known geotechnical issues that may affect construction?

Geotechnical issues may not be apparent until after the BFI is completed, but the limits and any existing plans should be reviewed for geotechnical issues that may affect the timing or cost of the project The cost of poor soil mitigation can be significant and may be avoided through the use of construction staging or ABC techniques that don't disturb the affected areas.

Question/Issue No. 10:

Record Score from Go/No-Go Tool

Question/Issue No. 11:

Is it likely that this project will include complex traffic control schemes, long detours, or significant user impacts due to bridge construction?

Long detours and complex traffic control schemes may lead to higher construction and roadway user costs, which may make spending additional funds on ABC techniques a cost-effective solution. The more complex the traffic control scheme, or the longer the detour route, the more likely ABC can be a viable alternative. Review the possible traffic staging options and detour routes for use in determining the user impacts.

Question/Issue No. 12:

Is staged construction feasible?

If there are staged construction options available, it may not be cost effective to utilize ABC methods. If staged construction is an option provide a brief comment on the intended method.

Question/Issue No. 12a:

Average Delay Time

Input the Average Vehicle Delay determined using the appropriate vehicle delay worksheet.

Question/Issue No. 12b:

Is additional bridge width required to accommodate staged construction?

Overbuilding the proposed structure to accommodate staged construction will increase project costs. If yes, comment on the approximate overbuild width.

Question/Issue No. 12c:

Will additional R/W or easements be required to accommodate staged construction?

The purchase of additional R/W or easements can be a significant project cost and lead to delays in the project schedule.

Question/Issue No. 13:

Does the existing bridge have features that make it difficult to accommodate staging (truss bridge, slab span, beam spacing issues, etc.)?

Features such as existing beam spacing (i.e. not having a beam along the centerline of the roadway) may limit the ability to use ½ at-a-time construction or other staging alternatives. Some bridge types, such as trusses are not suitable to widening.

Question/Issue No.14:

Could additional width be needed on culverts, bridges, or shoulders to maintain traffic?

If it becomes necessary to spend funds to temporarily widen existing roadways or structures, it may make sense to spend those funds on ABC alternatives, which may also reduce roadway user impacts and construction duration.

Question/Issue No. 15:

Could temporary bridge structures be required?

If early analysis indicates that ½ at-a-time construction staging, detours, or other fairly simple staging alternatives are not suitable, it may be necessary to construct a temporary bridge. Since temporary structures may cost as much as 60% of the cost of a new bridge, it may make sense to spend some additional funds on ABC alternatives, which may also reduce roadway user impacts and construction duration.

Question/Issue No. 16:

Will temporary traffic signals be required?

The cost and impact of using temporary traffic signals or traffic control systems need to be considered when determined if the extra costs associated with ABC are warranted.

Question/Issue No. 17:

Does it appear that maintenance of traffic will require additional right-of-way?

Same considerations as question No. 3c, but related to possible right-of-way acquisition.

Question/Issue No. 18:

Will/Can traffic be detoured?

If it's already been determined that traffic cannot or will not be detoured, it is not necessary to complete the remainder of question 18, otherwise proceed with the following sub-questions:

Question/Issue No. 18a:

Detour Delay Time

Input the Detour Delay determined using the appropriate vehicle delay worksheet.

Question/Issue No. *18b:*

Local Alternative Detour Delay Time

Input the Local Alternative Detour Delay determined using the appropriate vehicle delay worksheet.

Question/Issue No. *18c:*

Will the detour route have a detrimental impact on emergency vehicles, school buses, or other sensitive traffic?

Similar to question No. 5, but in regard to the proposed detour route.

Question/Issue No. *18d:*

Is the local alternate detour route in questionable condition?

Work with the District Engineer to determine if the available detour routes are in a suitable condition or if significant funds would be required to repair or restore the route.

Question/Issue No. *18e:*

Are there load limit restrictions on the detour?

Work with the Bridge Office and District Engineer to determine if the proposed work will require temporary load postings or strengthening of bridges, culverts, or roadways within the project limits. If it becomes necessary to spend funds to strengthen bridges and roadways, it may make sense to spend those funds on ABC alternatives.

Question/Issue No. *18f:*

Are there bridge width or height restrictions on the detour?

Similar to question 18e, existing bridge height and width restrictions may limit the available detour routes. Work with the District Engineer to obtain any needed restrictions.

Question/Issue No. *18g:*

Are there other issues regarding the suitability of the detour route (length, speed limit, travel time, etc.)?

List the additional characteristics of the available detour routes that may make them undesirable. Long detours, routes with reduced speed and increased travel time may result in further consideration of other construction or contract administration alternatives that eliminate or limit the need for a detour.

Question/Issue No. *18h:*

Are modifications needed at intersections on detour/alternate routes?

Consider the need for temporary signals, signing, or modifications that may be needed to existing intersections to accommodate traffic on the detour route.

Question/Issue No. 19:

Are there significant risks or other factors (site complexity) that could be mitigated by accelerating bridge construction?

List any other known risks or concerns that are not included in any of the previous questions. Examples might include lack of available concrete production facilities in the region, rapid changes in water elevation or velocity, limited construction window due to local ordinances, adjacent to vibration sensitive structures, etc. The District Engineer may also be able to provide insight regarding this issue.

Question/Issue No. 20:

Are there suitable staging locations?

Without suitable staging location the ABC option may be infeasible.

<u>Question/Issue No. 21:</u>

Will ABC mitigate utility relocation?

If ABC can mitigate utility relocation, it may be beneficial to use extra funds on ABC methods.

Additional Considerations:
Before making a final decision as to whether or not accelerated bridge construction is a viable alternative, consideration should also be given to "packaging" additional bridges in the vicinity, and acknowledgment of other planned construction work in the area.

Conclusion:
After thoroughly reviewing the responses to the questions, the Engineer of Record should give their recommendation based off the defined parameters. The ABC Decision Questionnaire may be reviewed by representatives of the Bridge Office, Construction Office, and District Construction. The State Bridge Engineer will review the analysis for a final decision on whether the project warrants ABC.

Example responses may include:

NO
"A suitable detour is available, and the traffic demands at this site do not warrant the use of ABC."
"Staging can be facilitated using ½ at-a-time construction *(or other staging method)* without the use of ABC."
"Bridge construction is not on the critical path and the overall construction schedule will not benefit by using ABC."
"Conventional bridge construction methods will adequately address the schedule and user impacts on this project."

YES
"Roadway user impacts and safety make ABC a viable alternative."
"Use of a lateral slide *(or other ABC alternative)* will be further investigated."

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Appendix C. ABC Decision Analysis – Stage 3

C.1 ABC Means and Methods Matrix

ABC Means and Methods Matrix

ABC Technologies and Techniques	ABC Bridge Element Types/Construction Techniques		
	Superstructure	Substructure	Construction
	Precast Deck Panels	Prefabricated Elements	Multiple Shifts
	Full Depth	Pier Caps	Phased Construction
	Partial Depth	Columns	Lateral Slide
	Modular Deck Beams	Foundations	Longitudinal Launch
	Decked Bulb Tees	Wing Walls	SPMT
	Steel Girder MDBs	Backwalls	Heavy Crane Lifts
	NEXT/Double Tee Beams	Approach Slabs	
	Low Impact Bridge Program (LIBP)	GRS-IBS	
	Cored Slab		
	Box Beams		

Tier	Actual Construction Time	ABC Bridge Element Types/Construction Techniques		
		Superstructure	Substructure	Construction
Tier 5	Overall project schedule is significantly reduced by months to years	All the above	All the above	All the above
Tier 4	Accelerated Construction 3 month - 6 months	Conventional Elements	Conventional Elements with Phasing	Multiple Shifts
			Prefabricated Elements	Phased Construction
			GRS-IBS	
Tier 3	Accelerated Construction 1 month - 3 months	Precast Deck Panels	Conventional Elements with Phasing	Multiple Shifts
		Modular Deck Beams	Prefabricated Elements	Phased Construction
Tier 2	Accelerated Construction 1 week- 1 month	Precast Deck Panels	Conventional Elements with Phased Construction	Phased Construction
		Modular Deck Beams	Prefabricated Elements with Phased Construction	Lateral Slide
		Conventional with Slide/Launch		Longitudinal Launch
				SPMT
Tier 1	Accelerated Construction < 1 week	Modular Deck Beams with Phased Construction	Conventional Elements with Phased Construction	Phased Construction
		Conventional with Slide/Launch	Prefabricated Elements with Phased Construction	Lateral Slide
				Longitudinal Launch
				SPMT

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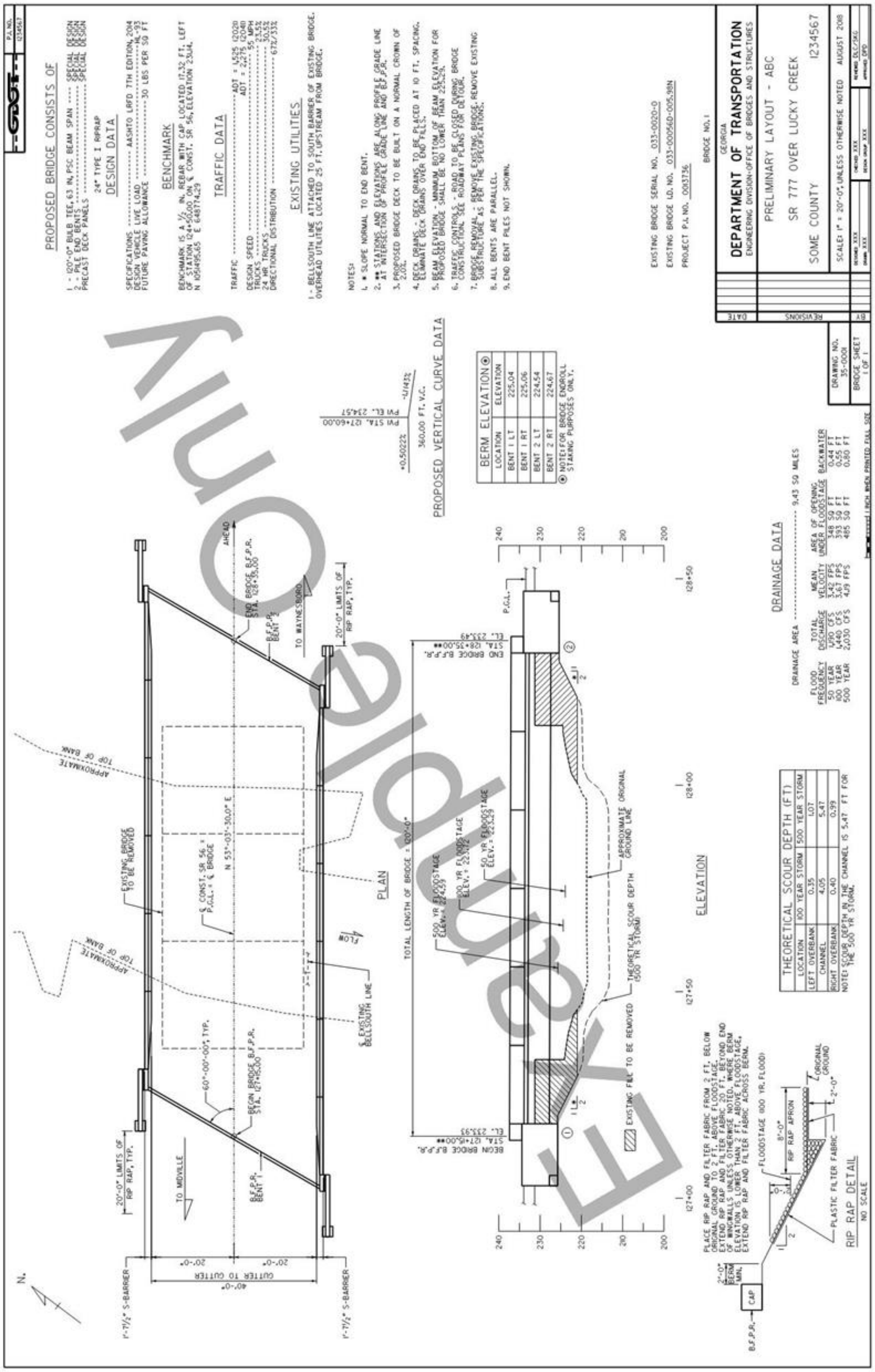
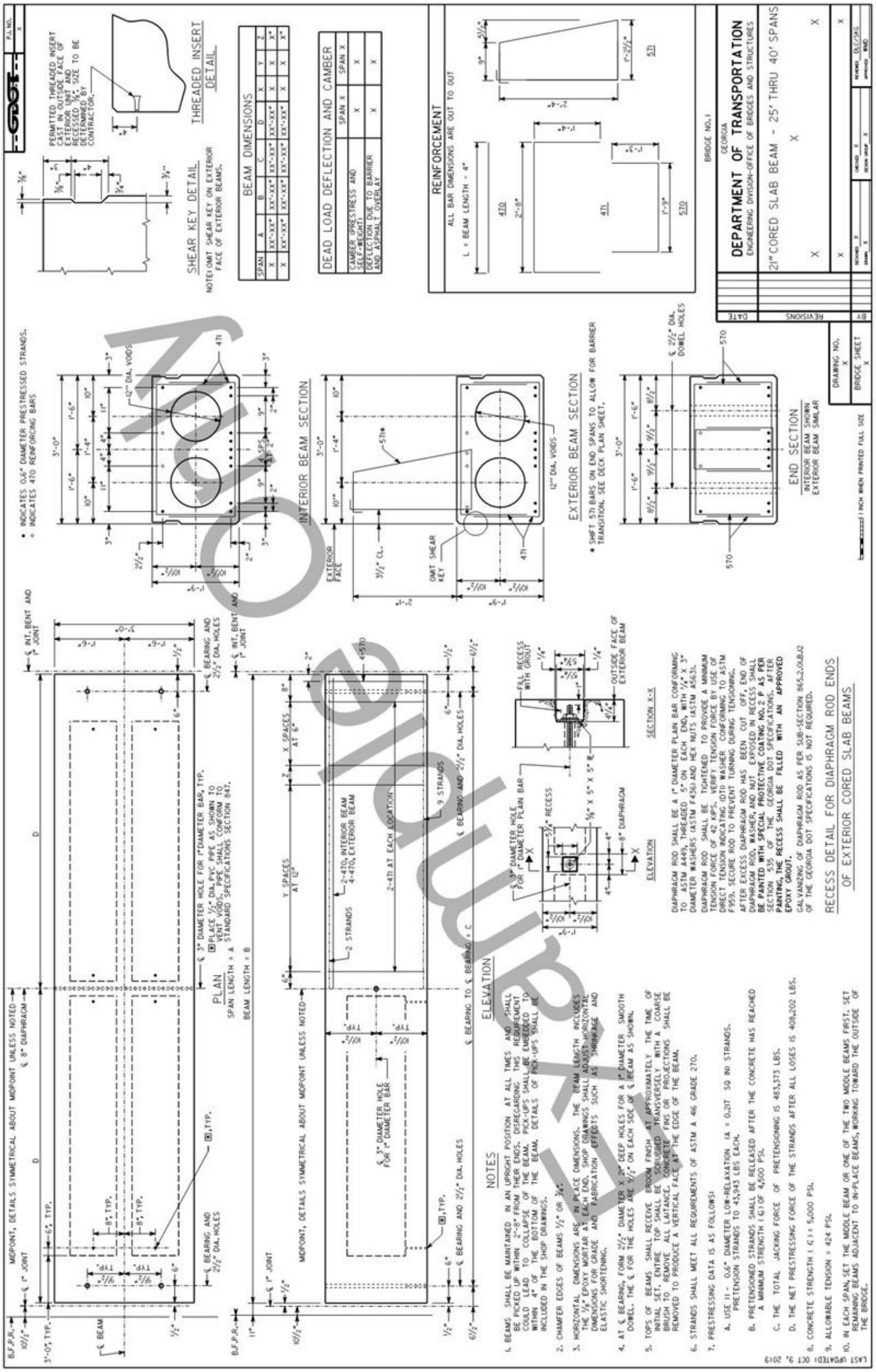
Appendix D. Details

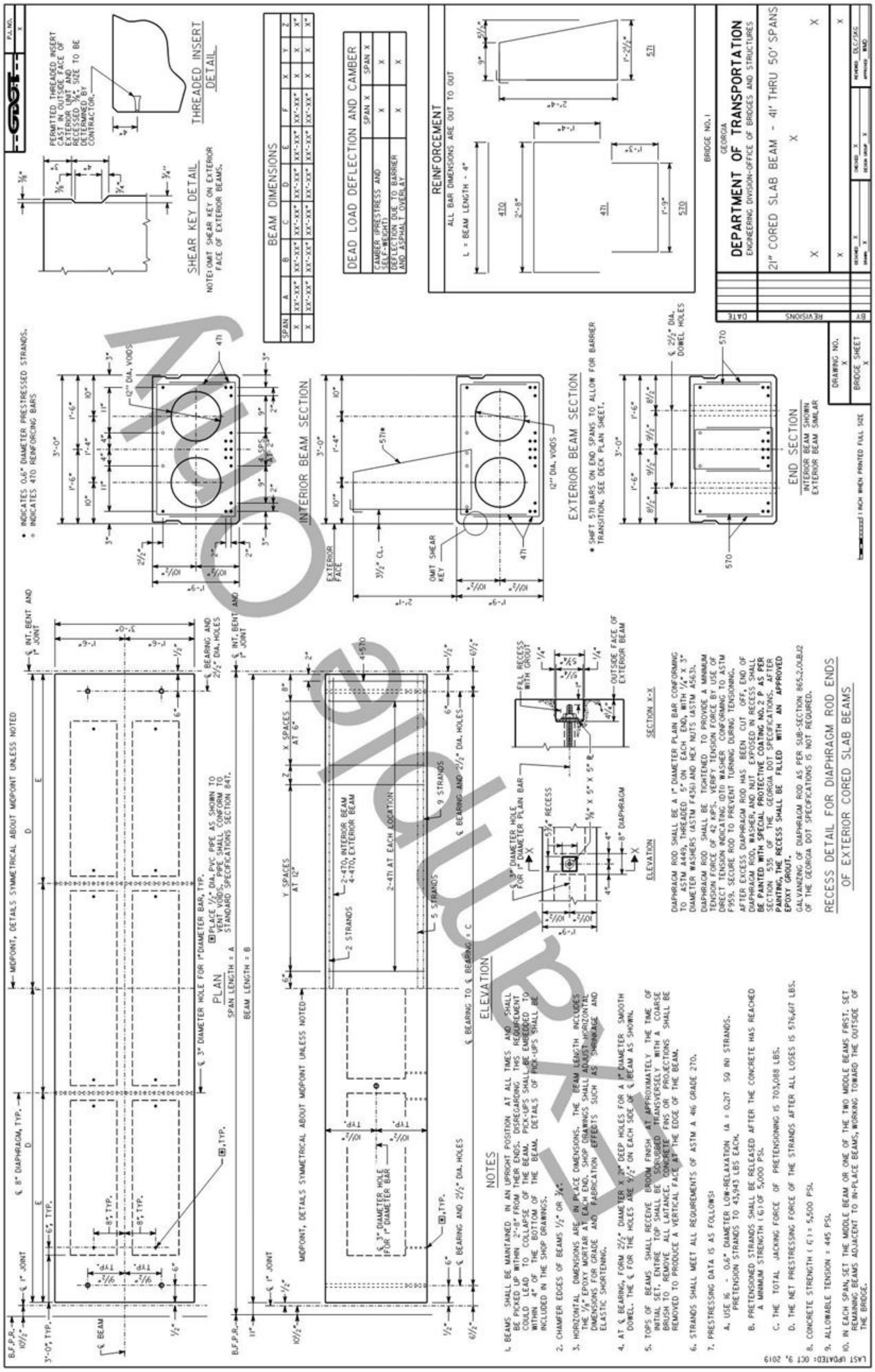
D.1 ABC Preliminary Layout



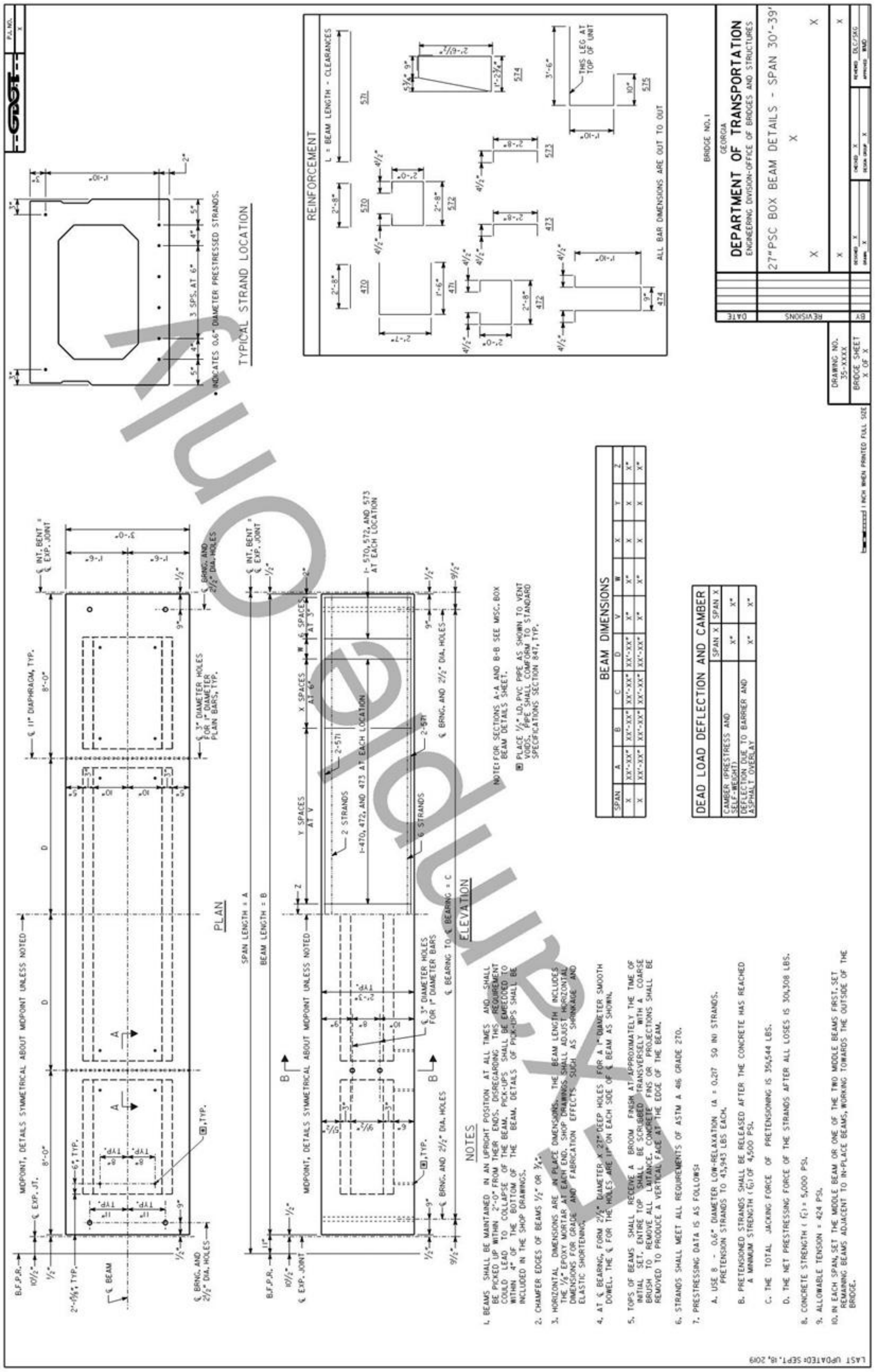
D.2 21 inch Cored Slab Beam: Span 25 – 40



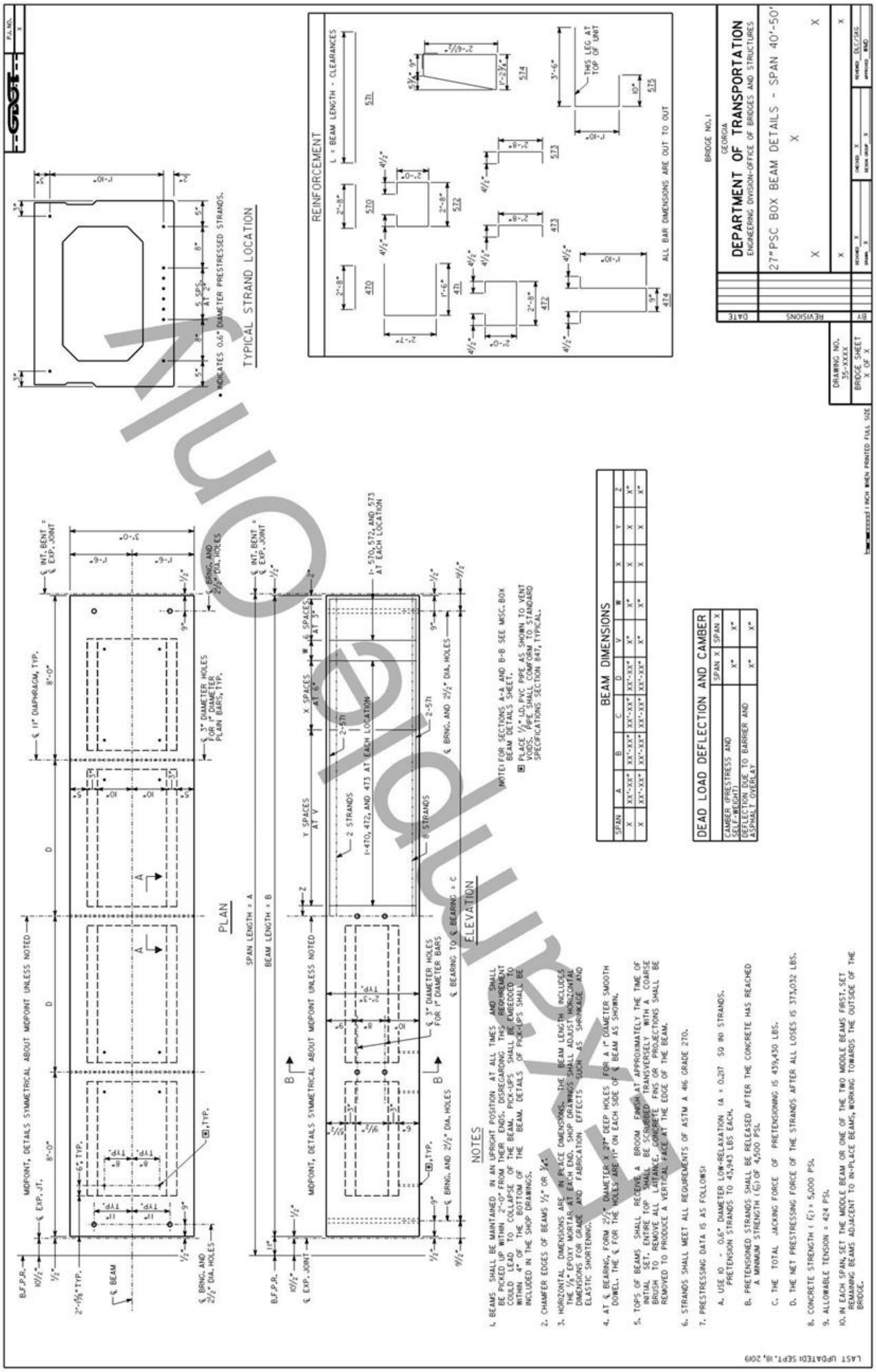
D.3 21 inch Cored Slab Beam: Span 41 – 50



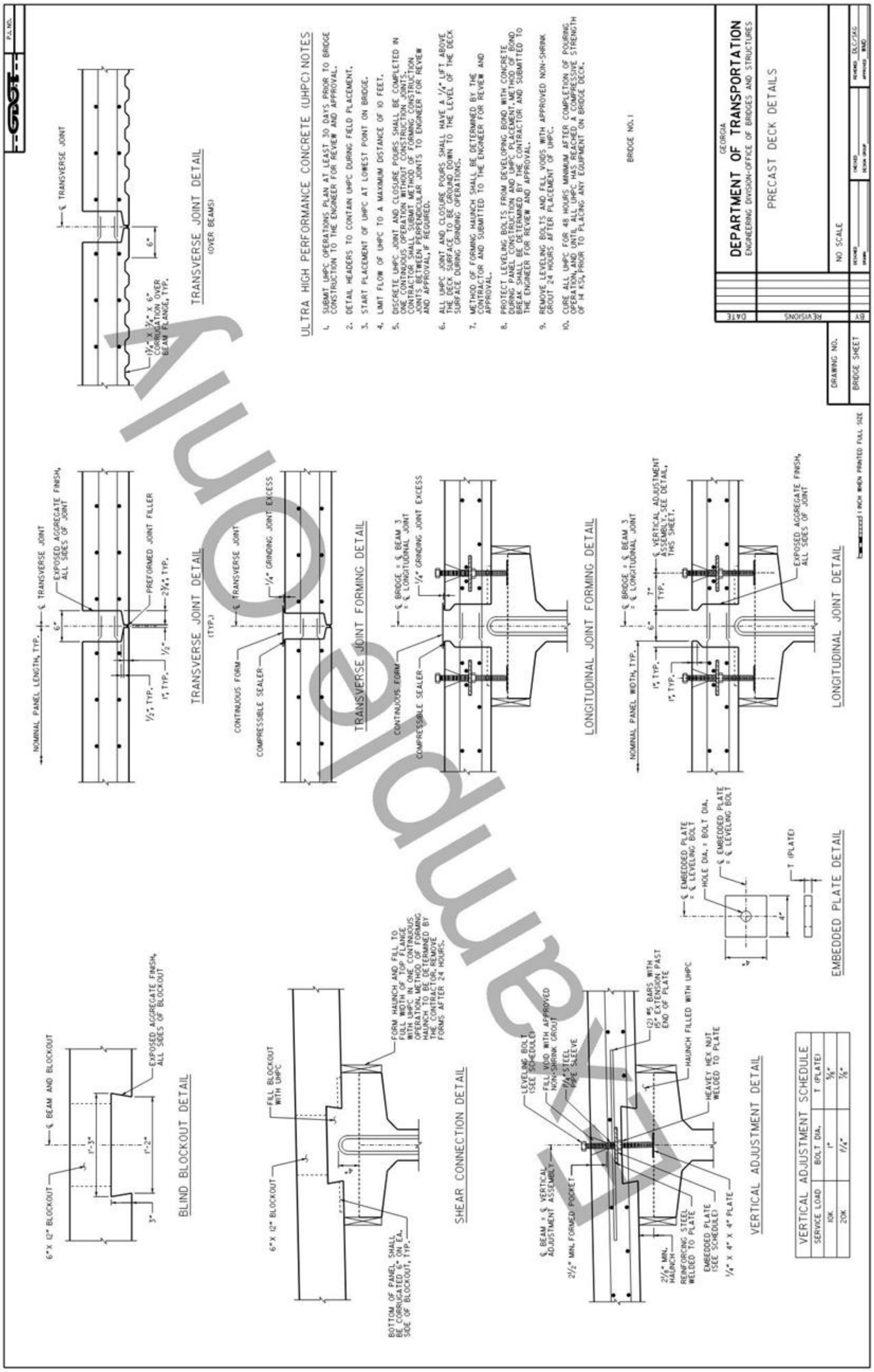
D.4 27 inch Box Beam: Span 30 – 39



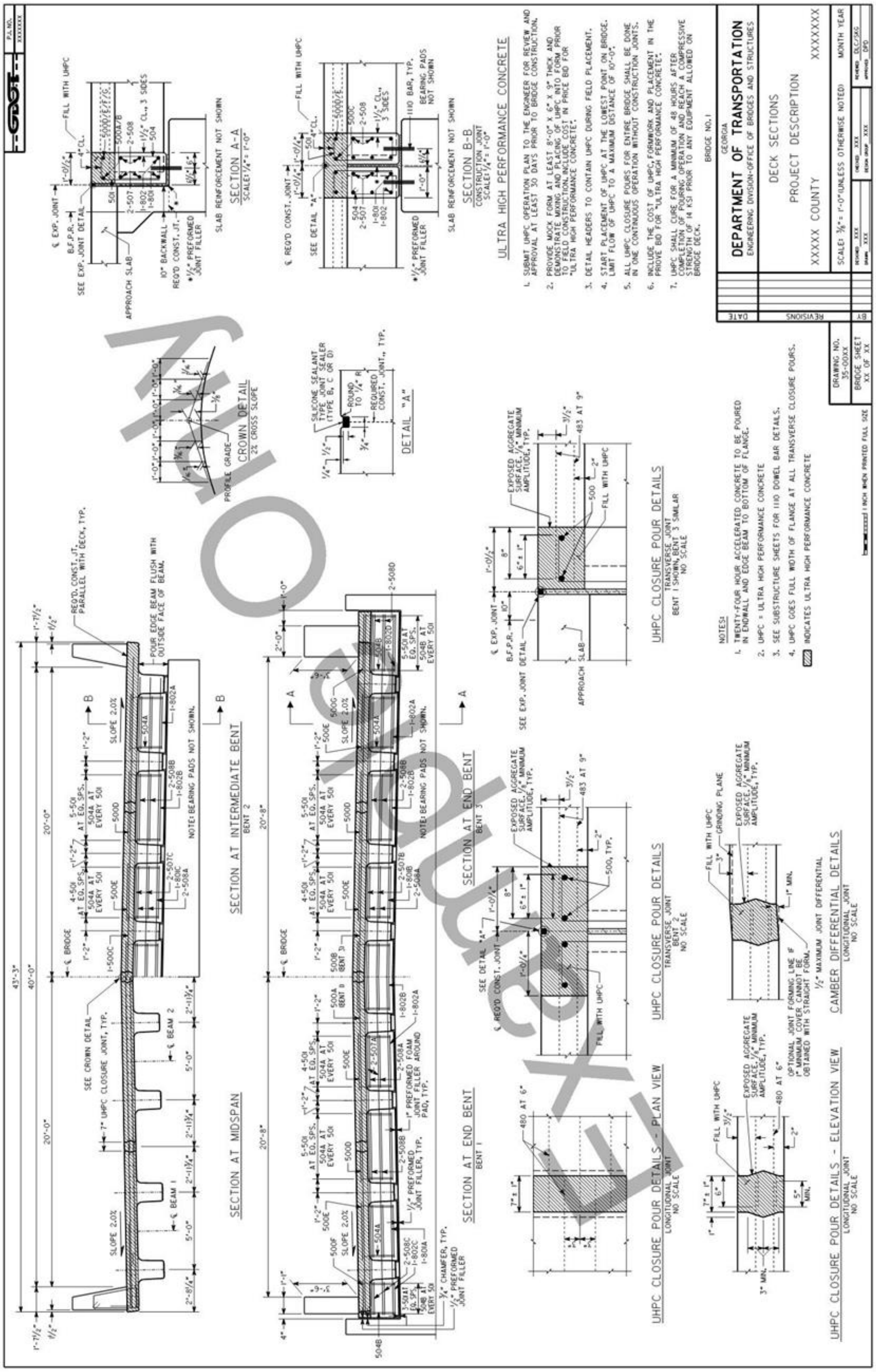
D.5 27 inch Box Beam: Span 40 – 50



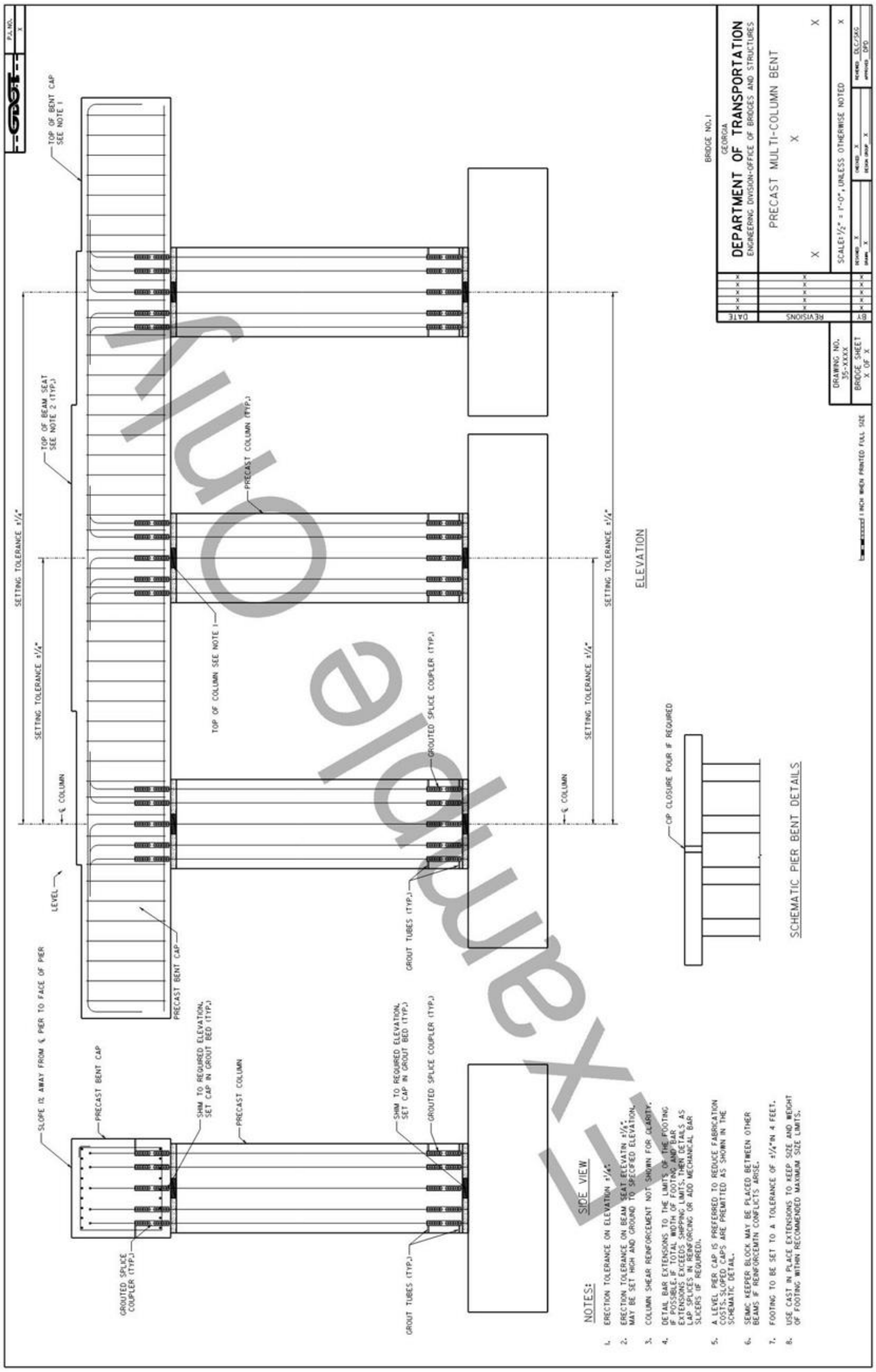
D.6 GDOT Deck Pannel Details with Narrow Beam Flange



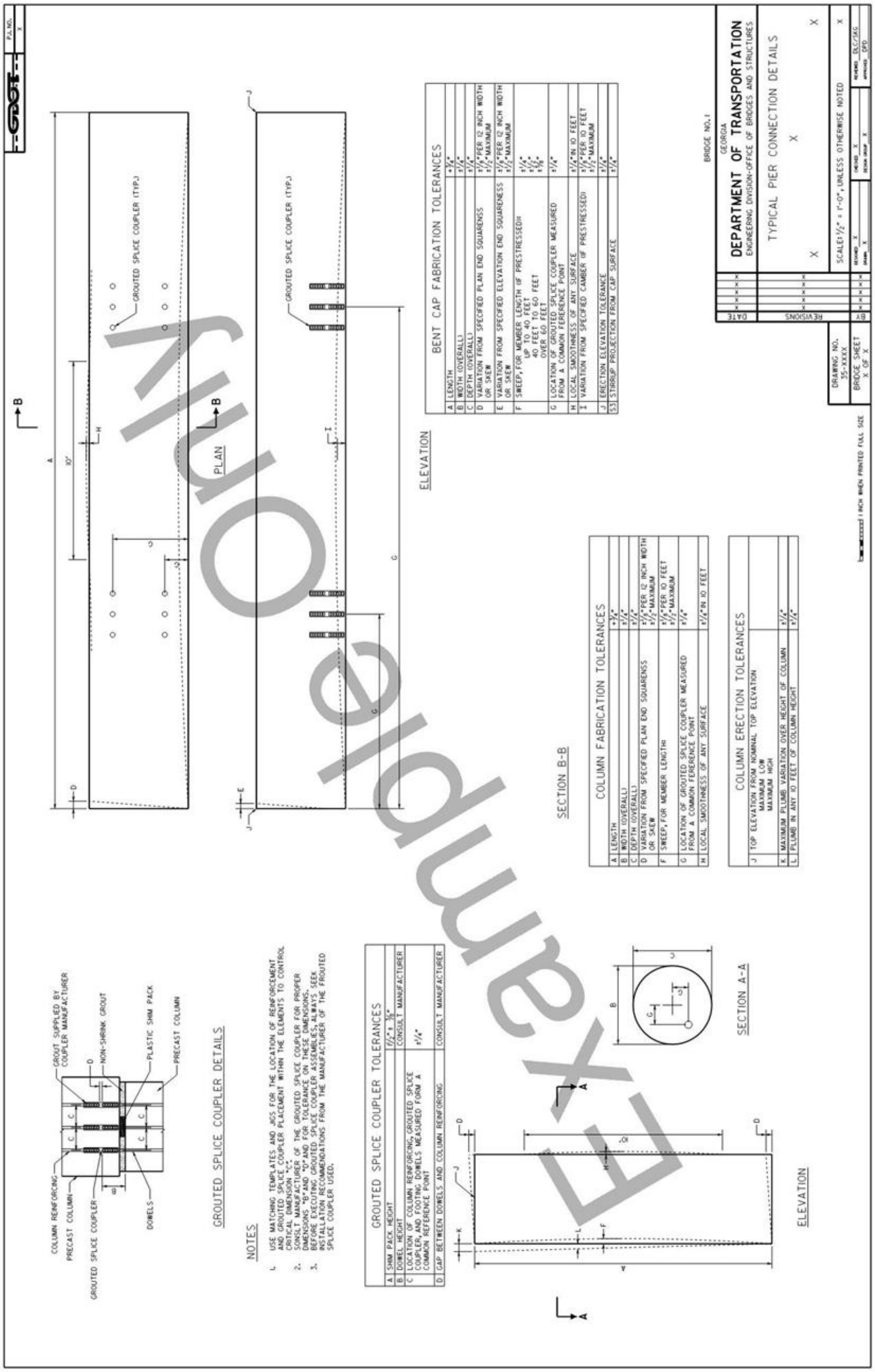
D.7 NEXT D – Beam with UHPC



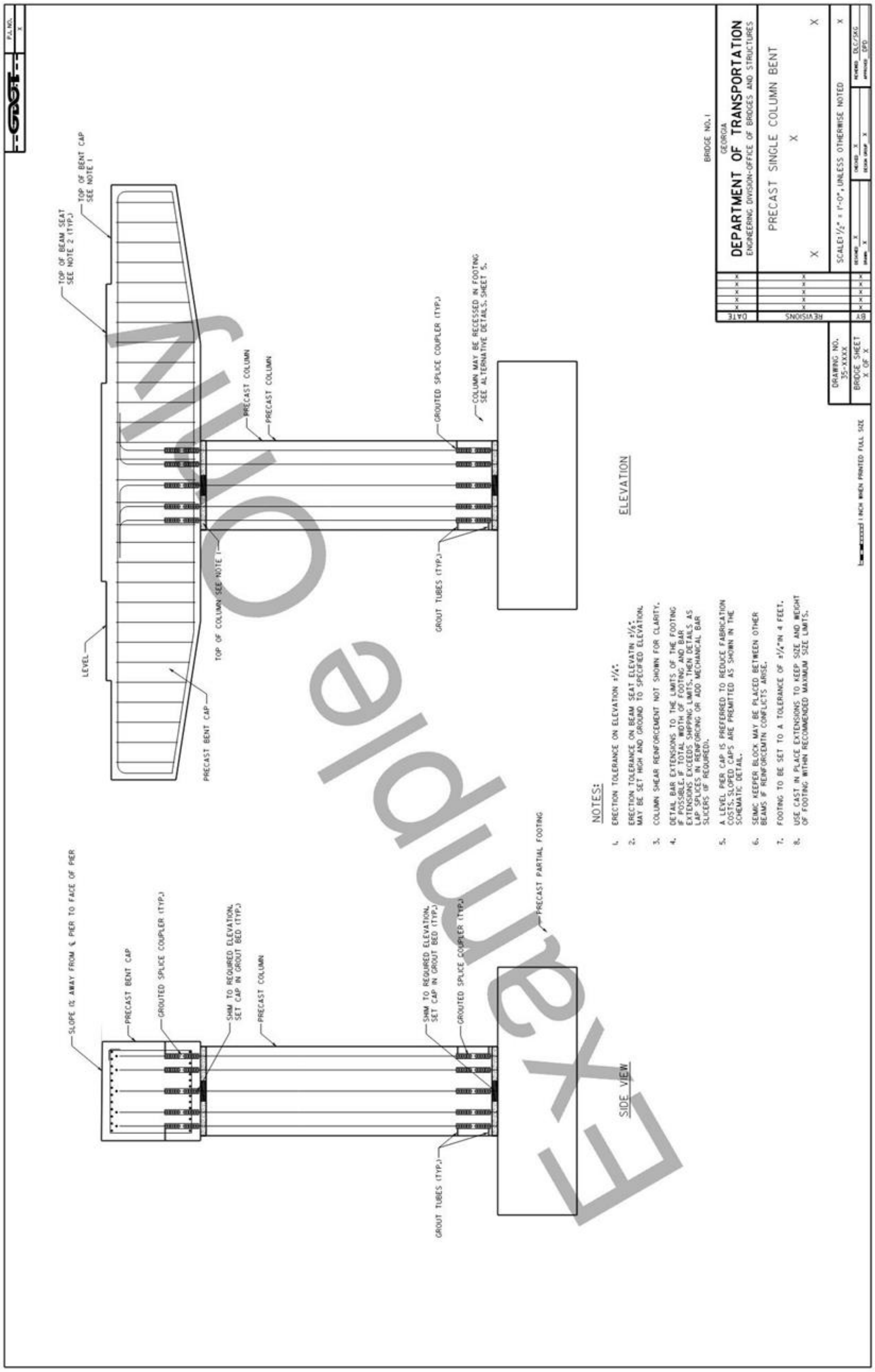
D.8 Precast Multiple Column Bent



D.9 Precast Pier Typical Details



D.10 Precast Single Column Bent



Appendix E. Special Provisions

E.1 Section 500 – Concrete Structures

Revised: January 18, 2018
First Use Date: January 18, 2018

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. No:

County Section 500—Concrete Structures

Add the following Subsections to Section 500:

500.1 General Description

This work includes furnishing ultra high performance concrete (UHPC) field cast joints to accelerate bridge construction.

500.1.02 Related References

A. Standard Specifications

Section 109—Measurement and Payment

500.1.03 Submittals

A. Ultra High Performance Concrete

1. Documented experience of manufacturing UHPC for at least five projects.
2. UHPC mix design in accordance with the material performance measures stated in this specification.
3. For UHPC mixed at the site, documentation of equipment meeting the UPHC Manufacturer's recommendations.

B. UHPC Pour Details

Provide details for placement of UHPC. Start placement of UHPC at the lowest point of bridge and limit length of UHPC pours to a maximum of 10 feet horizontal.

500.2 Materials

Ensure that materials for Ultra High-Performance Concrete (UHPC) meet the following Specifications:

The material shall be Ultra High-Performance Concrete with all components supplied by one manufacturer. Materials commonly used in UHPC include: fine aggregate, cementious material, super plasticizer, accelerator and steel fibers (deformed, specifically made for steel reinforcement of concrete). The Contractor is responsible for UHPC mix design and ensure material meets:

Minimum Compressive Strength (ASTM C39) Heat-Treated* Not Heat-Treated Not Heat-Treated 4 day	≥ 25 ksi ≥ 21 ksi ≥ 12 ksi
Prism Flexural Tensile toughness (ASTM C1018**, 10 in. span)	$I_{30} \geq 48$
Long-Term Shrinkage (ASTM C157; initial reading after set)	≤ 800 microstrain
Chloride Ion Penetrability (ASTM C1202)	≤ 250 coulombs
Chloride Ion Penetrability (AASTHO T259; 1/5 in. depth)	< 0.07 oz/ft^3
Scaling Resistance (ASTM C672)	y < 3
Abrasion Resistance (ASTM C944 2x weight; ground surface)	< 0.025 oz. lost
Freeze-Thaw Resistance (ASTM C666A; 600 cycles)	RDM > 96%
Alkali-Silica Reaction (ASTM C1260; tested for 28 days)	Innocuous
* Heat-Treated – According to manufacturer's recommendation, temperature not to exceed 250°F ** This ASTM test has been discontinued. The Department continues to require it while options are explored for its replacement.	

Provide a UHPC mix design that contains steel fibers at a minimum of 2% by total volume of UHPC.

Provide certification of UHPC.

A minimum of 12 cylinders 3 in. X 6 in. shall be cast.

All cylinders shall be cured using the same method of curing proposed to be used in the field. The temperature during curing shall be within 18°F of the low end of the proposed temperature range for curing in the field. Test 2 cylinders each testing day. Test at 4 days, 7 days, 14 days and 28 days. Measure compressive strength in accordance with ASTM C39. Compressive strength shall meet 12 ksi minimum at 4 days and 21 ksi minimum at 28 days. Only a UHPC mix design that passes these tests may be used in the work.

Cast 6 additional cylinders 12 in. diameter and 7½ in. deep. Each cylinder shall have one 32 in. long epoxy-coated reinforcing bar cast in the center of the circular face. The axis of the bar shall be perpendicular to the finished surface. Three (3) of the bars shall be #6 bars embedded 5 inches deep and 3 of the bars shall be #4 bars embedded 3 inches deep. Keep cylinders wet for 4 days prior to testing. Perform test as soon as practical once samples have reached a minimum compressive strength of 12 ksi. This test is a pullout test. The samples pass if the bars yield without the UHPC failing and without the bars pulling out of UHPC.

Results of these tests shall be conducted by a GDOT approved testing firm. Submit results for review and approval to the Engineer a minimum of 60 days prior to use of UHPC in the field.

500.3 Construction Requirements

500.3.01 Personnel

A. Supervision, Personnel, and Skilled Workers

1. Provide a manufacturer's representative supplying the approved UHPC who is knowledgeable in the supply, mixing, delivery, placement and curing of UHPC material. This representative shall be on site during all placement of UHPC.

500.3.03 Preparation

A. Pre-Pour Meeting

Prior to the initial placement of the UHPC, conduct an onsite meeting with a manufacturer's representative supplying the approved UHPC and the Engineer. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC material.

500.3.05 Construction

A. Form Work, Batching and Curing

The design and fabrication of forms shall follow approved shop drawings and shall follow the recommendations of the manufacturer. All forms for UHPC shall be constructed from plywood unless otherwise shown in the plans. The forms shall be coated to prevent absorption of water. Provide water tightness of forms to prevent loss of UHPC during pours.

Follow batching sequence as specified by the supplier and approved by the Engineer. The surface of UHPC field joints shall be filled flush to plus 1/4 in. above surface of bridge deck.

Cure UHPC in form according to Manufacturer's recommendations and as approved by the Engineer to attain 28-day strength listed herein. A continuous curing temperature of a minimum of 60°F is recommended.

500.3.06 Quality Acceptance

A. UHPC

Measure the slump flow on each batch of UHPC. The slump flow will be conducted using a minislump cone. The flow for each batch shall be between 7 in. and 10 in. Record slump flow for each batch and submit to the Engineer.

Make four sets of compressive strength test samples for each day of placement. Each set consists of 3 cylinders 3 in. X 6 in. Cure all cylinders in an environment similar to material placed and approved by the Engineer. Test the first set of cylinders as directed by the Engineer. Test second set of cylinders at 28 days. The third set of cylinders will be submitted to GDOT Office of Materials and Testing between the 4^{th} day and the 14^{th} day. The fourth set will be treated as a reserve set.

500.5 Payment

This Work will be paid for at the Contract Price per Lump Sum, complete in place and accepted.

Payment is full compensation for all things, including incidentals, and direct and indirect cost, to complete the Work.

Payment will be made under:

Item No.	Item	Payment
500	Ultra High Performance Concrete, Br No -	Per lump sum

E.2 Section 999 – Composite Deck – Beam Units with Field Cast Joints

Revised: January 18, 2018
First Use Date: January 18, 2018

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION PROJECT

NO.:

P.I. NO.:

Section 999 — Composite Deck-Beam Units with Field Cast Joints

Add Section 999 as follows:

999.1 General Description

This work includes furnishing full depth composite deck- beam units with field cast joints to accelerate bridge construction.

999.1.1 Definitions

General Provisions 101 through 150.

999.1.2 Related References

A. Standard Specifications

Section 109—Measurement and Payment

Section 500—Concrete Structures

Section 511—Reinforcement Steel

Section 801—Fine Aggregate

Section 830—Portland Cement

Section 853—Reinforcement and Tensioning Steel

B. Referenced Documents

General Provisions 101 through 150.

999.1.3 Submittals

A. Erection Drawings

Submit erection drawings detailing the installation of composite deck-beam units and procedures for adjusting composite deck-beam units to fit the bridge deck profile shown in the plans. Provide installation tolerances for placement and adjustment of composite deck-beam units.

B. Temporary Supporting False Bents

Submit shop drawing installation of temporary supporting false bents at the minimum as below:

1. Foundation support system including piling, footings, caps, concrete, reinforcement, welding, etc., as applicable.
2. Plans and details indicating locations and layout of false bents, forms, and method of construction.

C. Accelerated Bridge Construction Schedule

Submit a detailed schedule for approval of the Engineer outlining construction operations from the time the road is closed to traffic until traffic is resumed. At a minimum, this schedule shall include the removal of existing bridge, construction of substructure, installation and adjustment of composite deck-beam units, installation of formwork, placement of end walls and edge beams and slab block-outs, placement of field cast joints, placement of concrete barrier, end post and barrier transition, grinding and grooving deck, grading, placement of approach slabs and pavement, installation of guardrail, and pavement marking.

999.2 Materials

Ensure materials meet the following Specifications:

Composite Deck-Beam Units

Construct composite deck-beam units in accordance with the plans and specifications.

999.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

999.3 Construction Requirements

999.3.1 Equipment

General Provisions 101 through 150.

999.3.2 Fabrication

General Provisions 101 through 150.

999.3.3 Construction

Construct composite deck-beam units with field cast joints in accordance with the plans, Specifications and approved installation procedures.

999.3.4 Quality Acceptance

A. Composite Deck-Beam Units

See Sub-Section 500.3.06 for Quality Acceptance.

999.3.5 Contractor Warranty and Maintenance

General Provisions 101 through 150.

999.4 Measurement

This work is measured for payment as an accepted Lump Sum quantity.

999.4.01 Limits

Measurement does not include the following items that will be paid for separately as indicated on the Plans:

- Prestressed concrete beams
- Superstructure reinforcement
- Superstructure concrete
- Structural steel diaphragms
- Twenty-four hour accelerated strength concrete
- Field cast joints
- Concrete barrier Grooved concrete

999.5 Payment

This Work will be paid for at the Lump Sum price for composite deck-beam units, complete in place and accepted for all applicable spans. Payment is full compensation for preparing drawings, furnishing the necessary equipment and performing the work including installation and removal of any false bents or supports, temporary bracing, transportation and handling of deck-beam units, erection, and installation of steel diaphragms.

Payment will be made under:

Item No.	Item	Payment
999	Composite Deck-Beam Units, Br No -	Per lump sum

E.3 Section 999 – Composite Deck – Precast Concrete Bridge Deck

Revised: August 9, 2018
First Use Date: January 5, 2015

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. No: County

Section 999—Precast Concrete Bridge Deck

Add Section 999 as follows:

999.1 General Description

This work includes furnishing full depth precast concrete bridge deck panels with field cast joints to accelerate bridge construction.

999.1.01 Definitions

General Provisions 101 through 150.

999.1.02 Related References

A. Standard Specifications

Section 109—Measurement and Payment

Section 500—Concrete Structures

Section 511—Reinforcement Steel

Section 801—Fine Aggregate

Section 830—Portland Cement

Section 853—Reinforcement and Tensioning Steel

B. Referenced Documents

SOP-3, Standard Operating Procedures for Precast/Prestressed Concrete

QPL 9 – Certified Prestressed and/or Precast Concrete Plants

QPL 93 – Rebar Mechanical Butt Splices General

Provisions 101 through 150.

999.1.03 Submittals

A. Precast Concrete Deck Panel Shop Drawings

Submit shop drawings detailing the fabrication of the precast deck panels for approval of the Engineer. Include fabrication tolerances. Methods for grinding to achieve deck profile and longitudinal grooving shall be detailed in the shop drawings.

B. Erection Drawings and Field Pour Details

Submit erection drawings detailing the installation of precast deck panels and procedures for adjusting panels to fit the bridge deck profile shown in the plans. Provide installation tolerances for placement and adjustment of precast deck panels. Provide details for placement of field cast joints.

C. Accelerated Bridge Construction Schedule

Submit a detailed shedule for approval of the Engineer outlining construction operations from the time the road is closed to traffic until traffic is resumed. At a minimum, this schedule shall include the removal of existing bridge, construction of substructure, placement of beams, installation and adjustment of precast deck panels, installation of formwork, placement of endwalls and wingwalls, placement of field cast joints, placement of concrete barrier, endpost and barrier transition, placement of approach slabs and pavement.

999.2 Materials

Provide precast concrete deck panels in accordance with the plans and Specifications.

999.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

999.3 Construction Requirements

999.3.01 Personnel

General Provisions 101 through 150.

999.3.02 Equipment

General Provisions 101 through 150.

999.3.03 Preparation

General Provisions 101 through 150.

999.3.04 Fabrication

General Provisions 101 through 150.

Apply the following tolerances for precast units, unless otherwise shown elsewhere in the plans:

1. Thickness:

   Limit variation in as built panel thickness and thickness shown in the accepted shop drawings to plus 3/16 inch (4 mm) and minus 0 inches (0 mm).

2. Horizontal Dimensions:

   Limit variation between as built panels and dimensions shown in the accepted shop drawings to no more than 1/4 inch (6mm) . Squareness of the panel (measured along the diagonal length) shall be within 1/2 inch. Limit horizontal alignment (deviation from straight line parallel to centerline of member) to be no more than 1/8 inch per 10 feet, but not greater than 3/8 inch for the entire length. Greater deviation may be accepted if, in the Engineer's opinion, it does not impair the suitability of the member for its intended use.

3. Deck Surface:

   Deck surfaces must meet straightedge requirement in longitudinal and transverse directions in accordance with section 500.3.06.D of the Specifications

Fabricate the deck panels in a concrete fabrication plant that has been approved according to Laboratory SOP-3, Standard Operation Procedures for Precast Prestressed Concrete. See QPL 9 for a list of approved facilities.

999.3.05 Construction

Construct precast deck panel with field cast joints in accordance with the plans, Specifications and approved installation procedures.

Grind the bridge deck for profile improvement as required by the plans, in conformance with Section 500.3.06.E of the Specifications.

Saw cut transverse grooves into top of bridge deck using a mechanical cutting device after grinding. Saw cutting grooves shall conform to Section 500.3.05.T.9.C of the Specifications.

999.3.06 Quality Acceptance

See Sub-Section 500.3.06 for Quality Acceptance.

999.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

999.4 Measurement

Measurement is made as a unit, complete in place, for precast concrete bridge deck panels

999.4.01 Limits

General Provisions 101 through 150.

999.5 Payment

This Work will be paid for at the Contract Price per Lump Sum, complete in place and accepted. Payment is full compensation for all things, including incidentals, and direct and indirect cost, to complete the Work.

Payment will be made under:

Item No.	Item	Payment
999	Precast Concrete Bridge Deck, Br No -	Per lump sum