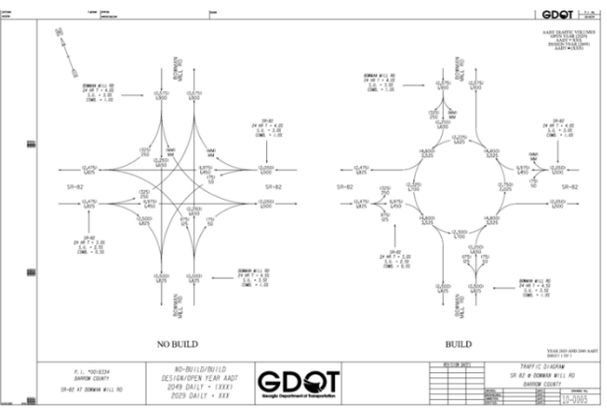
Design Traffic Forecasting Manual for Office of Traffic Operations Programmed Projects



5/12/26
Revision 1.0
Atlanta, GA 30308

GDOT
Georgia Department of Transportation

DISCLAIMER

This document was developed as part of the continuing effort to provide guidance within the Georgia Department of Transportation in fulfilling its mission to provide a safe, efficient, and sustainable transportation system through dedicated teamwork and responsible leadership supporting economic development, environmental sensitivity and improved quality of life. This document is not intended to establish policy within the Department, but to provide guidance in adhering to the policies of the Department.

Your comments, suggestions, and ideas for improvements are welcomed. Please send comments to:

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The Georgia Department of Transportation maintains this printable document and is solely responsible for ensuring that it is equivalent to the approved Department guidelines.

Revision Summary

Revision Number	Revision Date	Revision Summary
1.0	5/12/26	This manual is intended to walk users through the traffic forecasting process and the requirements necessary to complete a GDOT Office of Traffic Operations Traffic Volume Forecasting Memorandum. The intended users of this manual are Transportation Management Center (TMC) personnel, GDOT project managers, consultant project managers, and consultants.

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List of Effective Chapters

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List of Effective Chapters	1.0	5/12/26
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Acronyms and Definitions

Acronyms

Listed below are some of the most common acronyms used by traffic engineering practitioners. Additionally, there are several organizations noted that are excellent technical resources on traffic engineering. Their website locations are noted as well.

AADT – Annual Average Daily Traffic

AASHTO – American Association of State Highway and Transportation Officials (https://transportation.org/)

ACF – Axle Correction Factor

ADT – Average Daily Traffic

ARC – Atlanta Regional Commission

ATR – Automated Traffic Recorder

BLS – Bureau of Labor Statistics (https://www.bls.gov/)

CCS – Continuous Count Station

CFI – Continuous Flow Intersection

DCD – Double Crossover Diamond

DDHV – Directional Design Hour Volume

DDI – Diverging Diamond Interchange

DF – Daily Factor

DHV – Design Hour Volume

DLT – Displaced Left Turn

DTE – Designated Traffic Engineer

E+C – Existing plus Committed (Network)

EDG – Electronic Data Guidelines

FHWA – Federal Highway Administration (https://highways.dot.gov/)

GDOT – Georgia Department of Transportation (https://www.dot.ga.gov/)

GSTDM – Georgia Statewide Travel Demand Model

HCM – Highway Capacity Manual

ITE – Institute of Transportation Engineers (https://www.ite.org/)

ITS – Intelligent Transportation System

LIBP – Low Impact Bridge Program

LRTP – Long Range Transportation Plan

MF – Monthly Factor

MM – Minimal Movement

MPO – Metropolitan Planning Organization

MUT – Median U-Turn

NEPA – National Environmental Policy Act

OPB – (Governor's) Office of Planning and Budget

OPD – Office of Program Delivery

ORD – OpenRoads Designer

OTO – Office of Traffic Operations

PC/H – Passenger Cars per Hour

PDP – Plan Development Process

PE – Preliminary Engineering

PI – Project Identification

PPG – Plan Presentation Guide

QR – Quadrant Roadway

RCUT – Restricted Crossing U-Turn

REMI – Regional Economic Models, Inc

RIRO – Right-In-Right-Out

RITIS – Regional Integrated Transportation Information System

ROW – Right of Way

SPUI – Single-Point Urban Interchange

STIP – Statewide Transportation Improvement Program

SU – Single Unit Truck

SWTP – Statewide Transportation Plan (long-range transportation plan)

TADA – Traffic Analysis and Data Application

TAP – Transportation Alternatives Program

TAZ – Traffic Analysis Zone

TDM – Travel Demand Model

TFE – Traffic Forecasting Engineer

TIP – Transportation Improvement Program (for MPO areas)

TMC – Transportation Management Center

VPD – Vehicles per Day

VPH – Vehicles per Hour

VPHPL – Vehicles per Hour per Lane

WIM – Weigh-In-Motion

Definition of Terms

The following terms are commonly used in the GDOT Office of Traffic Operations (OTO) traffic data and forecasting process.

Adjusted Count – An estimate of a traffic statistic calculated from a raw traffic count that has been adjusted by application of axle, seasonal, or other defined factors.

Annual Average Daily Traffic (AADT) – The total volume of traffic passing a point or segment of a highway facility in both directions for one year divided by the number of days in the year. This volume is usually estimated by adjusting a short-term traffic count with weekly, monthly and axle correction factors.

Average Daily Traffic (ADT) – The average 24 hour volume of traffic passing a point or segment of a highway facility in both directions, being the total volume during a stated period divided by the number of days in that period.

Axle Correction Factor – The factor developed to adjust axle counts into vehicle counts. Usually used where the data collection equipment is dependent on pneumatic tubes that count axles rather than vehicles which require adjustments by applying an axle correction factor to represent vehicles. Equipment that detects vehicles directly (such as video cameras, inductive loops or vehicle classification counters) does not require axle correction factor adjustment.

Combination Truck (Comb.) – A truck which meets the requirements established for the Federal Highway Administration's (FHWA) Vehicle Classification Scheme for classes 8 through 13. Also known as Multi-Unit Truck.

Count – The data collected as a result of measuring and recording traffic characteristics such as vehicle volume, classification, speed, weight, or a combination of these characteristics.

Counter – Any device that collects traffic characteristics data. GDOT utilizes Permanent Continuous Counters, Permanent Continuous Classification and Weigh-in-Motion (WIM) Counters, Portable Axle Counters, Portable Vehicle Counters, and Automatic Traffic Recorders (ATR).

Design Hour – The 30th highest hour of the design year.

Design Hour Volume (DHV) – The traffic volume expected to use a highway segment during the 30th highest hour of the design year. The Design Hour Volume (DHV) is related to AADT by the K-Factor.

Design Year – Usually twenty years from the Opening Year and represents the year for which the roadway is designed/safety or operational improvement is implemented.

Design Year + 2 – One of the four traffic forecast scenarios required by GDOT. This scenario represents conditions two years after the Design Year.

Directional Design Hour Volume (DDHV) – The traffic volume expected to use a highway segment during the 30th highest hour of the design year in the peak direction.

Directional Distribution (D) – The proportion of traffic in the 30th highest hour of the design year traveling in the peak direction.

Estimated Traffic Growth Rate – The annual rate of growth expected at a location within a project facility based on historical traffic trends as well as estimates of expected future growth due to new development and redevelopment.

K-Factor (K) – Proportion of 24-hour volume occurring during the design hour for a given location or area.

Local Buildup – The adjacent development between two points on a roadway that causes a difference in traffic volumes between the two points.

Logical Termini (LT) – End points determined for a transportation project. Logical termini must be reasonably defined by project needs such as safety or traffic volumes.

Model Base Year – The year the municipal planning organization (MPO) or statewide travel demand model was calibrated, from which projections are made.

Multi-intersection Project – Refers to a project that encompasses multiple intersections in a study area, as well as the road segments connecting these intersections. Improvements that would be suggested by the Build scenario could encompass multiple intersections or road segments in the study area (but not necessarily all intersections/corridors in the study area would be improved). For a multi-intersection project, two deliverables are required for submittal to GDOT OTO: 1) study area count map and 2) Traffic Volume Forecasting Memorandum. The additional step of approving the study area count map is included to ensure that all participants in the volume development process agree on the limits of the proposed study area before counts are collected and traffic analysis begins.

Office of Traffic Operations (OTO) – The GDOT office that is the primary reviewer of Traffic Volume Forecasting Memorandums as part of the Safety and Operational Improvement Lump Sum Program.

Opening Year – The year a construction project is expected to be open to traffic for use. Usually determined by adding two years to the let year. Also known as the Base Year or the Open Year.

Opening Year +2 – One of the four traffic forecast scenarios required by GDOT. This scenario represents conditions two years after the Opening Year.

Origin-Destination Study (O-D Study) – A study designed to gather data on the number and type of trips in an area, including movements of vehicles and passengers or cargo, from various zones of origin to various zones of destination. (ITE)

Peak Hour Truck Percentage (T) – The percent of trucks (classes 4 through 13 of the FHWA Vehicle Classification Scheme) expected to use a highway segment during the design hour.

Raw Count – A traffic count that has not been adjusted for axle factors (effects of trucks) or seasonal (day of the week/month of the year) effects.

Raw Data – The unedited and unadjusted measurements of traffic volume, vehicle classification, and vehicle or axle weight.

Single Intersection Project – Refers to a project that encompasses one intersection and the corresponding legs of that intersection. Improvements that would be suggested by the Build scenario would encompass just that intersection, and no surrounding intersections or roadway segments. For a single intersection project, the only required deliverable is the complete Traffic Volume Forecasting Memorandum, which can be transmitted to GDOT in a single submittal.

Single Unit Truck (S.U.) – A truck which meets the requirements established for the FHWA's Vehicle Classification Scheme for classes 4 through 7. Single Unit trucks include buses (class 4).

Traffic Analysis and Data Application (TADA) – GDOT's Traffic Analysis and Data Application (TADA) website presents data collected from the Georgia Traffic Monitoring Program for public roads in Georgia. The website uses a dynamic mapping interface to allow the user to access data from the map as well as in a variety of report, graph, and data export formats.

Traffic Analysis Zone (TAZ) – The basic unit of spatial analysis used to represent geographic areas of a community for the purposes of traffic analysis and/or travel demand modeling. Each TAZ may have a series of zonal characteristics associated with it which are used to explain travel flow among zones. Typical characteristics include the number of households and the number of people that work and/or live in a particular area.

Traffic Diagrams – The graphic representations of existing traffic conditions or future traffic conditions for the forecast scenarios required by GDOT. Typical information to be contained in the traffic diagrams includes, but is not limited to: type of volume, year of analysis, north arrow, traffic parameters/factors, street names, match lines, county name, project name and number, project PI number, date of diagram development/revision, etc. Inclusion of schematic diagram layout sheets is recommended when dealing with large roadway networks or when volume diagrams for a specific scenario are spread over multiple sheets. A diagram layout sheet should help identify alignment of the highway network and provide the layout of the match-lines and the drawing numbers. The layout sheet should be included as a separate drawing for each No-Build and Build Year scenario.

Traffic Forecast Parameters – A description of the technical traffic assumptions to be used by the Traffic Forecasting Engineer in developing the forecasts of future traffic for a particular transportation project.

Traffic Forecasting Engineer (TFE) – The person responsible for interacting with the GDOT Project Manager and GDOT OTO and for overseeing the development of the design traffic forecasting deliverables that must comply with GDOT OTO's requirements.

Traffic Volume Forecasting Memorandum – The document developed by the Traffic Forecasting Engineer for submission to the GDOT OTO for review and approval that describes the process used to assess existing traffic and related conditions at the project location, the results of traffic counts conducted specifically for the project, and the forecasting activities used to develop future year volumes. This memorandum includes the existing condition traffic volumes (annual average daily traffic and directional design hour volumes) and future forecasted traffic volumes. In addition to the existing and future condition volume diagrams, this memorandum should also include information such as, but not limited to: type of data used, any assumptions, basis of engineering judgments, year of analysis, growth rate calculations, truck percentage calculations, D-factor calculations, K-factor calculations, future year scenarios, etc. It may also include additional information on the traffic forecast, such as trip generation for a particular development, traffic assignment, and rerouting assumptions. The OTO Traffic Volume Forecasting Memorandum is a different document than the Traffic Data Report and Traffic Forecasting Report submitted as part of the Office of Planning Design forecasting process.

Truck – Any heavy vehicle described in the FHWA Vehicle Classification Scheme that meets the characteristics of Classes 4 through 13 (i.e., buses and trucks with six or more tires). Classes 1 through 3 are motorcycles, automobiles, and light trucks, respectively.

24-Hour Truck Percentage (24 Hr. T) – The 24-hour percentage of trucks (classes 4 through 13 of the FHWA Vehicle Classification Scheme) expected to use a highway segment.

Unconventional Intersection/Interchange Design – Intersection and interchange designs that offer potential additional benefits compared to conventional designs, which could include roundabouts, continuous flow intersections, diverging diamond intersections, quadrant roads, and other designs. These intersection designs are often used in OTO projects.

Weigh-in-Motion (WIM) – The process of estimating a moving vehicle's static gross weight and the portion of that weight that is carried by each wheel, axle, or axle group or combination thereof, by measurement and analysis of dynamic forces applied by its tires to a measuring device.

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Executive Summary

In 2016, Georgia Department of Transportation's (GDOT's) Office of Planning released technical guidance for the process of design traffic forecasting through the **Design Traffic Forecasting Manual**. This guide explains the overall analysis process, the roles and responsibilities of those engaged in design traffic forecasting, and the required deliverables and their formats to be produced by the transportation professionals responsible for these activities. The manual also includes appendices and sample graphics to assist Office of Planning design traffic personnel, design traffic forecasting professionals, and GDOT project managers in the traffic forecasting process.

For projects included and programmed in the GDOT Office of Traffic Operations' Safety and Operational Improvement Lump Sum Program, which typically have much smaller scopes than other GDOT projects, a streamlined approach is often implemented based on the Office of Planning Design Traffic Forecasting Manual. Differences between the approaches include modifications to the submittal process and project participant responsibilities, development of existing design hourly volumes (DHVs) before existing average annual daily traffic (AADT) volumes, and more generalized growth rate rules and guidelines. For this reason, the need for a supplement to the Office of Planning Design Traffic Forecasting Manual was deemed necessary to establish consistency in deliverables submitted to the GDOT Office of Traffic Operations (OTO) by traffic forecasting engineers (TFEs).

This **Design Traffic Forecasting Manual for Office of Traffic Operations Programmed Projects** (OTO manual) is intended to serve as a supplement to the Office of Planning Design Traffic Forecasting Manual (Office of Planning manual) and more directly outlines the requirements of GDOT OTO's Traffic Volume Forecasting Memorandums. While some portions of this OTO manual differ significantly from the Office of Planning manual, many chapters maintain some level of consistency with the Office of Planning manual in terms of requirements for GDOT OTO's Traffic Volume Forecasting Memorandums. Some chapters offer no differences between the manuals, which is noted. Chapters that rely heavily on descriptions from the Office of Planning manual (but do not match completely) are noted as well. Further, chapters of the Office of Planning manual deemed unnecessary for use in development of typical GDOT OTO Traffic Volume Forecasting Memorandums simply refer the reader to the Office of Planning manual. To establish some level of consistency with the Office of Planning manual, this OTO manual is organized in the same overall manner as follows:

Chapter 1: Introduction to Design Traffic Forecasting

Chapter 2: Overview of Design Traffic Forecasting Process

Chapter 3: Traffic Data Analysis for Design Traffic Forecasts

Chapter 4: Design Traffic Forecasting Process, Standards, and Documentation

Chapter 5: Design Traffic Forecasting Tools and Conventions

Chapter 6: Required Standards and Formats for Design Traffic Deliverables

Chapter 7: Design Traffic Reviews

Subsequent uses of the term "project" in this document refer to a project that is either included in the GDOT OTO Safety and Operational Improvement Lump Sum Program or programmed by GDOT OTO.

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Chapter 1. Introduction to Design Traffic Forecasting - Contents

Chapter 1. Introduction to Design Traffic Forecasting

As discussed, this OTO manual is intended to walk users through the traffic forecasting process and the requirements necessary to complete a GDOT OTO Traffic Volume Forecasting Memorandum. The intended users of this manual are GDOT OTO and Transportation Management Center (TMC) personnel, GDOT project managers, consultant project managers, and consultant TFEs. This chapter presents the overall project responsibilities and differences in roles based on project type for GDOT OTO traffic volume forecasting tasks.

1.1 Application of Design Traffic Requirements

While the Office of Planning manual is intended for use in any type of engineering design effort, the contents of this OTO manual are specifically designed for use in projects programmed by GDOT OTO that typically have limited impacts and scope. The GDOT Project Manager and GDOT OTO should coordinate regarding the need for a Future Traffic Volume Forecasting Memorandum for a project, and whether this OTO manual is applicable for development of volumes for the project study area. The direction and methodologies described in this manual are not to be used for projects not programmed by GDOT OTO.

1.2 Roles in Traffic Forecasting Project

GDOT undertakes a wide array of projects of varying types, extents, and funding sources with project partners that include GDOT consultants, local governments, other state agencies, and consultants hired by local governments. For the projects programmed by GDOT OTO that are addressed in this document, there are a number of ways that volume development can be initiated and carried out, as well as a number of responsibilities of the different parties. First, it is important to establish the main parties involved in the development of GDOT OTO-specific Traffic Volume Forecasting Memorandums:

- **GDOT OTO** is the primary reviewer of Traffic Volume Forecasting Memorandums. OTO concurrence is required for all Traffic Volume Forecasting Memorandums.
- The **GDOT Project Manager** is the project manager for the corresponding OTO project that requires a Traffic Volume Forecasting Memorandum as a submittal. For Traffic Volume Forecasting Memorandums, the GDOT Project Manager delivers TFE submittals to OTO.
- The **TFE** is defined as the person responsible for interacting with the GDOT Project Manager and GDOT OTO and for overseeing the development of the design traffic forecasting deliverables that must comply with GDOT OTO's requirements. The TFE must be prequalified in Area Class 1.10 – Traffic Projections as outlined in GDOT's Consultant Prequalification Manual. The TFE may or may not be the Project Manager for the project.

1.3 Project Funding Source

As previously discussed, this supplemental OTO manual is specifically designed for use in projects included and programmed in the GDOT OTO Safety and Operational Improvement Lump Sum Program, as designated by GDOT OTO.

1.4 Rightsizing the Traffic Analysis Activities

For GDOT OTO-specific studies, traffic analysis projects can be distinguished by two types: single intersection projects and multi-intersection projects. The forecasting requirements for each project type are described in Chapter 3 (Table 3.1).

1.5 Four Required Traffic Forecast Conditions

Section taken directly from Office of Planning Design Traffic Forecasting Manual.

One of the major challenges in delivering transportation projects is accounting for potential changes in funding levels throughout the life of the project's development. To help reduce the negative impacts of these changing funding levels on project delivery, in 2015, GDOT instituted a new requirement for the traffic analysis and forecasting phase of its projects. For all proposed federal-aid projects that require a future traffic forecast, there are four traffic conditions that must be analyzed:

1. Opening Year (opening year of the transportation facility)
2. Opening Year + 2 Years (required by policy to help mitigate the impacts of project funding delays)
3. Design Year
4. Design Year + 2 Years

Plus 2 years traffic forecasts and traffic flow diagrams are required by GDOT policy to help mitigate the impacts of project funding delays. Plus 2 years traffic forecasts and traffic flow diagrams are not required for Scoping-Only projects or Maintenance projects. More details on this requirement can be found in Section 5.1 of this document.

1.6 Focus on Project Delivery

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

To provide the maximum benefit to the traveling public, it is GDOT's goal to deliver all of its projects as expeditiously as possible. Thus, traffic engineering practitioners should carry out the required design traffic analysis and forecasting for all GDOT projects as expeditiously as possible, consistent with GDOT project schedules. ***It should be noted that there are points in this process where GDOT approval must be obtained prior to subsequent work proceeding on the project.*** Traffic practitioners should be aware of these key milestones and educate themselves on GDOT's expectations to ensure efficient delivery of projects.

1.7 Resolution of Traffic-Related Issues

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

While GDOT's intention to expedite project delivery, it is equally committed to ensuring that project activities are carried out in a technically sound and professionally accepted manner. Once the traffic data analysis and forecasting methodology is approved by GDOT OTO, a good faith effort will be made by GDOT professionals and consultants (as appropriate) to carry out the agreed-upon activities within the approved project schedule. From time to time, there may be professional differences of

opinion among GDOT and consultant team members on matters related to design traffic analysis and forecasting. If there is a difference of opinion regarding the technical requirements for the design traffic forecasting process, the matter will be resolved by the GDOT OTO Project Manager.

1.8 OTO-Specific Details for Overall Project Process

There are two key aspects that make up the basis for volume development for projects programmed by GDOT OTO:

1. The project must be programmed; and
2. A GDOT Project Manager must be assigned to the project.

Once it is determined that volume development is necessary for the given GDOT project, the Traffic Volume Forecasting Memorandum can be considered either a GDOT deliverable or a Consultant deliverable, as defined in the scope of work provided by GDOT's Office of Program Delivery (OPD):

- **GDOT Deliverable:** For a programmed project under the responsibility of GDOT OPD, a formal request must be submitted to GDOT OTO to then request traffic forecasting from a Safety/Operations Consultant. From there, GDOT OTO will assign a Safety/Operations Consultant to collect counts and/or develop traffic volumes, as defined by OPD's needs.
- **Consultant Deliverable:** For a standalone safety/operations project, the Design Consultant is required to collect counts and develop traffic volumes according to the traffic methodology described in this document. In these cases, collection of counts and/or development of traffic volumes is defined in the scope of work.

Both instances allow the Consultant to proceed with the volume development process, including count collection, traffic volume development, and preparation of a Traffic Volume Forecasting Memorandum. Chapter 3 details the next steps for the TFE completing the volume development process. Figure 1.1 presents the overall volume development process for projects programmed by GDOT OTO, from the project initiation steps defined in this chapter to the project submittal and execution steps defined in later chapters of this document.

In some instances, the Consultant may only be required to develop a count map for GDOT OTO, as the actual Traffic Volume Forecasting Memorandum would be completed under a different scope.

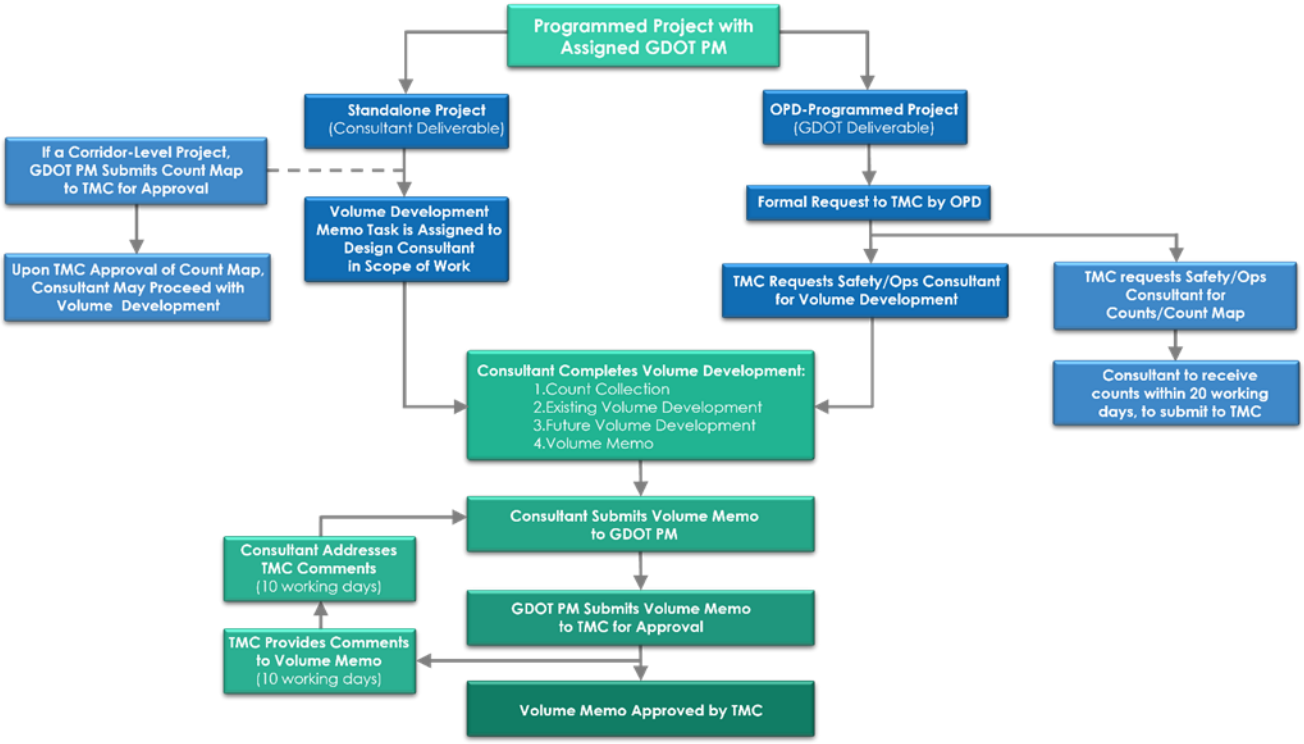

*Figure 1.1. Overall GDOT OTO Volume Development Process**

**It should be noted that this figure is applicable only to projects programmed by GDOT OTO.*

Chapter 2. Overview of Design Traffic Forecasting Process - Contents

Chapter 2. Overview of Design Traffic Forecasting Process

This chapter describes the overall process required by GDOT to complete design traffic data analysis and forecasting for GDOT projects.

2.1 Sequence of Activities

It is the responsibility of the GDOT Project Manager, GDOT OTO, and the Consultant Project Manager to collaborate for the proper scoping, budgeting, and scheduling of design traffic-related tasks and deliverables consistent with the requirements described in this document. The deliverable(s) requiring GDOT approval include:

1. Count Collection Program (including map, detailed information on the number, type, and duration of traffic data collection, and timeframe for turning movement counts) ***(required only for multi-intersection projects***)
2. Traffic Volume Forecasting Memorandum

While the particular circumstances surrounding a proposed project may differ, the following general process is used to ensure that the appropriate design traffic data analysis and forecasting process is properly completed.

2.2 Required Methodologies, Tools, and Forms

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

In order for GDOT to expedite the review of design traffic-related documents as efficiently as possible, all TFEs are required to use the required methodologies, tools, and forms described in this manual.

2.3 "Rightsizing" of Traffic Data and Forecasting Activities

The Office of Planning Design Traffic Forecasting Manual details specific deliverables and analysis requirements for project type, based on the complexity of the project. Specifically, for GDOT OTO projects, project type falls into two categories: single intersection projects and multi-intersection projects. These project types are described below and summarized in Table 3.1:

- **Single intersection projects** refer to projects that encompass one intersection and the corresponding legs of that intersection. Improvements that would be suggested by the Build scenario would encompass just that intersection, and no surrounding intersections or roadway segments. For a single intersection project, the only required deliverable is the complete Traffic Volume Forecasting Memorandum, which can be transmitted to GDOT in a single submittal.
- **Multi-intersection projects** refer to projects that encompass multiple intersections in a study area, as well as the road segments connecting these intersections. Improvements that would be suggested by the Build scenario could encompass multiple intersections or road segments in the study area (but not necessarily all intersections/corridors in the study area would be improved). For a multi-intersection project, two deliverables are required for submittal to GDOT OTO: 1) study area count map and 2) Traffic Volume Forecasting Memorandum. The

additional step of approving the study area count map is included to ensure that all participants in the volume development process agree on the limits of the proposed study area before counts are collected and traffic analysis begins.

To assist consultants responsible for design traffic forecasting, an overview of the design traffic forecasting process is included on Figure 2.1.

Table 2.1. Traffic Data and Forecasting Analysis Requirements by Project Type

Extent of Analysis	Project Type	Deliverables
Single Intersection Project	These projects encompass a single intersection and all legs associated with that intersection. Single intersection projects **do not** require count map approval.	• Traffic Volume Forecasting Memorandum (including all Appendices) • Volume Diagrams for all Existing and Future Year Scenarios
Multi-Intersection Project	These projects encompass a corridor of multiple intersections, specifically major intersections along the corridor. Multi-intersection projects **do** require count map approval.	• Study Area Count Map • Traffic Volume Forecasting Memorandum (including all Appendices) • Volume Diagrams for all Existing and Future Year Scenarios

2.4 Consultant Tasks for Performing Traffic Data and Forecasting Work

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

In order to assist consultants responsible for design traffic forecasting work, the following tasks related to this traffic data and forecasting should include, but are not limited to:

1. Discuss traffic data and forecasting needs for the project with GDOT Project Manager and GDOT OTO.
2. Analyze historical GDOT traffic data in the area (TADA website, counts collected from previous studies).
3. Analyze and determine intersection turning movement count locations.
4. Analyze and determine tube count locations including volume and classification counts.
5. Generate traffic count location map showing the planned locations, number, type, and duration of traffic data collection, and timeframe for turning movement counts (required only for multi-intersection projects).
6. Submit traffic count location map for GDOT OTO review (required only for multi-intersection projects).
7. Address GDOT review comments (as needed) (required only for multi-intersection projects; approval of the traffic count location map is required before proceeding to the next steps).
8. Submit and coordinate approved traffic count location map to traffic data collection vendor.
9. Analyze results of collected traffic counts from vendor and ensure count validity with vendor.
10. Determine key traffic factors, such as peak hours, K- and D- factors, and truck percentages.
11. Generate Existing Year traffic flow diagrams (DHV and AADT).

12. Determine study area growth rate.
13. Generate Opening Year traffic flow diagrams (DHV and AADT) for Build and No-Build Conditions.
14. Generate Design Year traffic flow diagrams (DHV and AADT) for Build and No-Build Conditions.
15. Generate Opening Year + 2 traffic flow diagrams (DHV and AADT) for Build and No-Build Conditions. Plus 2 years traffic forecasts and traffic flow diagrams are required by GDOT policy to help mitigate the impacts of project funding delays. Plus 2 years traffic forecasts and traffic flow diagrams are not required for Scoping-Only projects or Maintenance projects.
16. Generate Design Year + 2 traffic flow diagrams (DHV and AADT) for Build and No-Build Conditions. Plus 2 years traffic forecasts and traffic flow diagrams are required by GDOT policy to help mitigate the impacts of project funding delays. Plus 2 years traffic forecasts and traffic flow diagrams are not required for Scoping-Only projects or Maintenance projects.
17. Generate Traffic Volume Forecasting Memorandum.
18. Submit Traffic Volume Forecasting Memorandum (including all diagrams) to GDOT OTO for review.
19. GDOT OTO reviews Traffic Volume Forecasting Memorandum.
20. Address GDOT review comments (as needed).
21. Traffic Volume Forecasting Memorandum concurrence from GDOT OTO.

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Chapter 3. Traffic Data Analysis for Design Traffic Forecasts - Contents

Chapter 3. Traffic Data Analysis for Design Traffic Forecasts

This chapter describes the traffic data collection effort and analysis of existing volumes in the traffic forecasting effort. For GDOT OTO projects, there are no separate submittals required for existing and future volumes.

3.1 Initiation of Design Traffic Forecast

As discussed in Section 2.8, the two key aspects that form the basis of volume development for GDOT OTO projects are that (1) the project is programmed and (2) a GDOT Project Manager must be assigned to the project. Coordination regarding the proposed locations and types of traffic data to be collected is not necessary. With the exception of multi-intersection projects, for which OTO must concur with the counts map, the TFE should be following the rules outlined in Section 4.2. Upon receiving the traffic count data, the TFE may proceed with the volume development process.

3.2 Traffic Count Rules

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

Traffic count data collected for traffic forecasting purposes must be representative of "normal conditions" in the project area. Following guidance from the Office of Planning manual, for OTO projects, data collection during the following periods is not acceptable:

- Sundays, Mondays, Fridays, and Saturdays.
- When public schools are not in session (generally, late May through early August, depending on the study area – the exact timeframe should be confirmed prior to collecting traffic data).
- During first full week of school year/semester and last full week of school year/semester.
- During holiday periods when travel patterns are not routine (including from a week before Thanksgiving to a week after New Year, the weeks of Memorial Day and Labor Day, Spring Break, etc.).
- Days when special events at major traffic generators may disrupt routine traffic patterns.
- During special events that generate traffic that is not typical of everyday operations.
- During or immediately following significant inclement weather events (blizzards, tropical storms, etc.).
- During the week following a time change for the start or end of Daylight Saving Time.
- During construction in or near the project area.
- During traffic incidents (i.e., crashes) that disrupt normal traffic patterns.
- During partial/full road closures.

In general, traffic count data is considered outdated after approximately five years following the date of collection. Exceptions to this rule, however, may be considered depending on local conditions and other factors.

The TFE should confirm the count collection method with the count vendor to ensure all traffic count data requirements are met, per this OTO manual's guidance.

GDOT OTO Traffic Volume Forecasting Memorandums are subject to additional traffic count "rules" based on whether the project is a single intersection project or multi-intersection project, as indicated in the following sections.

3.2.1 Single Intersection Projects

The following general count collection rules apply for single intersection projects:

- **Turning Movement Counts:** All legs of the intersection should have one day of a minimum of 12-hour turning movement counts that cover the AM and PM peak periods (e.g., 6:30 AM – 6:30 PM).
    - While the Office of Planning Design Traffic Forecasting Manual requires 6-hour turning movement counts (3 hours in the AM and 3 hours in the PM), GDOT OTO requires 12-hour counts for later use in a signal warrant analysis.
- **Bidirectional Classification Counts:** A minimum of 24-hour bidirectional classification counts are required to be collected for all legs of the intersection. If 48-hour classification count data are available on the GDOT TADA website for the past five years for a given leg of the intersection, these data may be used in place of new collected count data.
    - If using TADA counts, be sure to use raw count data from the 'Site Data' tab on the count station dashboard.
    - TADA counts used must be for locations proximate enough to the intersection that there are no major roads between the count station and study intersection that would affect the K-factor or truck percentage.
    - Counts taken between March 2020 and July 2022 are considered to be associated with the COVID-19 (Coronavirus Disease of 2019) period and may not be used for analysis.
- Engineering judgment can be used to justify omitting the collection of bidirectional classification counts on a minor street intersection leg, if, for instance, the project is in a rural area or if heavy trucks are not evident and/or expected. This decision must be explained/justified in the Traffic Volume Forecasting Memorandum.
    - For legs where 24-hour counts are omitted, K-factors can be estimated using nearby counts.
- If 24-hour video classification turning movement counts are available, these can be used as a supplement to bidirectional counts.
- Counts from multiple years should not be used to develop existing traffic volumes. All counts should be collected in the same year, preferably during the same week. If utilizing available 48-hour classification counts for a given intersection leg in place of new collected counts, the available counts must have been collected within two years of the new counts collected for the study (and all counts must be no more than five years old).

- Counts for existing traffic should not be more than five years old. Although it is preferable to have existing traffic counts for the current year, existing traffic data from previous work can be used if the supporting traffic counts are within four years of the current year and the most recent coverage counts of the project area do not show more than a 10% deviation from the previous traffic work (not including year-to-year growth).

3.2.2 Multi-Intersection Projects

The general count collection rules for single intersection projects (Section 4.2.1) are applicable to multi-intersection projects, with the following adjustments:

- **Turning Movement Counts:** Turning movement counts are required to be collected at major intersections along the study area corridor, such as state routes, signalized intersections, highway ramps, and intersections with an expected high truck usage.
    - Turning movement counts are **not** required to be collected at all intersections in the study area.
- **Mainline Bidirectional Classification Counts:** A minimum of 24-hour bidirectional classification counts (or available 48-hour GDOT TADA counts) should be collected along "strategic points" on the mainline corridor, such as the beginning/ending of the corridor and upstream/downstream of major intersections where K-factors or truck percentages would be expected to change.
- **Minor Street Bidirectional Classification Counts:** A minimum of 24-hour bidirectional classification counts (or available 48-hour GDOT TADA counts) should be collected at major side streets in the study area (such as state routes) or locations with high expected truck use.
    - As a general rule, if a side street is eligible for an Intersection Control Evaluation (ICE) waiver (1,000 vehicles per day or less), classification counts would not be needed.
    - K-factors for legs where 24-hour counts are not collected can be estimated using count data from nearby locations.

3.3 Site Visit and Data Collection

Site visits are not required for development of OTO Traffic Volume Forecasting Memorandums unless current information from available online sources does not suffice. For information regarding site visits, please refer to Section 4.3 of the Office of Planning Design Traffic Forecasting Manual.

3.4 Traffic Adjustment Factors

Section taken directly from Office of Planning Design Traffic Forecasting Manual.

Machine traffic counts should be adjusted using a monthly factor (MF), a daily factor (DF), and an axle correction factor (ACF) to estimate existing AADT volumes. The traffic adjustment factors should be obtained from the GDOT Traffic Data website.

The TFE should use traffic adjustment factors from the year closest the count year and apply the appropriate traffic factor group based on the project location and roadway functional classification. The Factor Group table available from the GDOT Traffic Data website should also be reviewed to ensure that correct factors are chosen for this purpose. Where the Factor Group description within

the Factor Group table includes an “Atlanta” and “Non-Atlanta” designation, the “Atlanta” designation refers to the Atlanta Urban Area (Urbanized Area Code: 03817). The boundaries of the Atlanta Urban Area can also be viewed within the GDOT Functional Classification Application by toggling on the Adjusted Urban Area Boundaries layer in the map application.

It should be noted that axle correction factors were developed to adjust axle counts into vehicle counts. They are usually used where the data collection equipment is dependent on pneumatic tubes that count axles rather than vehicles which require adjustments by applying an axle correction factor to represent vehicles. Equipment that detects vehicles directly (such as video cameras, inductive loops or vehicle classification counters) does not require axle correction factor adjustment. Therefore, the TFE must confirm the traffic data collection method with the traffic count vendor to ensure appropriate application of axle correction factors. Similarly, no axle correction factors should be applied to vehicle classification counts.

The traffic adjustment factors chosen and applied to traffic counts collected for the project should be documented in the Traffic Volume Forecasting Memorandum.

3.5 Design Hourly Volumes

DHVs are needed for capacity analyses and design decisions, such as to determine the number of traffic lanes for a roadway. Volumes may vary significantly during the course of a 24-hour day with periods of maximum volume occurring during the morning or afternoon peak hours. For roadway segments, the single hour of the day that has the highest hourly volume is referred to as the “design hour.” Capacity and other traffic analyses typically focus on the design of hour traffic volumes for roadway segments. For intersection analyses, the design hour is evaluated for the AM and PM peak hours because it represents the most critical period for operations and has the highest capacity requirement. For OTO Traffic Volume Forecasting Memorandums, the DHV is estimated before the AADT volume; this differs from the methodology outlined in the Office of Planning Design Traffic Forecasting Manual. The AM or PM peak DHV may be estimated by applying the MF, DF, and ACF as follows:

DHV = Peak Hour Volume * MF * DF* ACF

The directional DHV is the traffic volume for the peak hour in the peak direction of flow. Directional distribution factors (D-factors) should be established using existing traffic counts collected at the project site.

3.6 Annual Average Daily Traffic

While peak hour DHVs are useful for capacity analyses in projects, AADT volumes are also reported for use in highway planning and the design of pavement structures. The AADT volume is defined as the average of the measured 24-hour traffic volumes at a given location over a full 365-day year, or the total number of vehicles traversing the site in a year divided by 365. An average daily traffic (ADT) volume is defined as the average of 24-hour traffic volumes for a given location for some period of time less than a year and as little as two days. While AADT is measured over a full year, ADT may be measured for six months, a season, a month, a week, or as little as two days; AADT is calculated by using corresponding MF, DF, and ACF adjustments.

In OTO Traffic Volume Forecasting Memorandums, the AADT volume is estimated as a function of the DHV; this differs from the methodology outlined in the Office of Planning manual. The AADT volume is estimated using the "K-factor," which is defined as the proportion of traffic occurring during the 30th highest hour of the year. The K-factor can be estimated from a traffic count as the ratio of the peak hour volume during the day to the total daily volume. For intersection analyses, the terms "AM K-factor" and "PM K-factor" are derived from the corresponding AM and PM peak hours. Appropriate K- and D-factors must be discussed in the Traffic Volume Forecasting Memorandum reviewed by GDOT OTO.

If there are TADA count data collected in proximity to a field-collected count, the K-factors from the two sources should be compared. If the K-factor from the field-collected count has a difference greater than 2.5% in comparison to the TADA count, the Consultant should document any adjustments or assumptions made about K-factor values in the Traffic Volume Forecasting Memorandum.

AADT is estimated as a function of K-factors and DHV using the following formula:

AADT = Average of (AM DHV / AM K) and (PM DHV / PM K)

Because AADT represents the daily volume experienced at a location, it is the general assumption that the same number of vehicles would enter and exit a specific location across the day. Therefore, the "ins" and "outs" of a specific leg of an intersection (as well as reciprocal turning movements) should be balanced across the day, such that the average of reciprocal values is used. Figure 3.1 shows the difference between an AADT and DHV diagram, detailing how opposing AADT movements should be balanced in a typical scenario. Any exceptions to balanced movements for AADT volumes should be documented in the Traffic Volume Forecasting Memorandum.

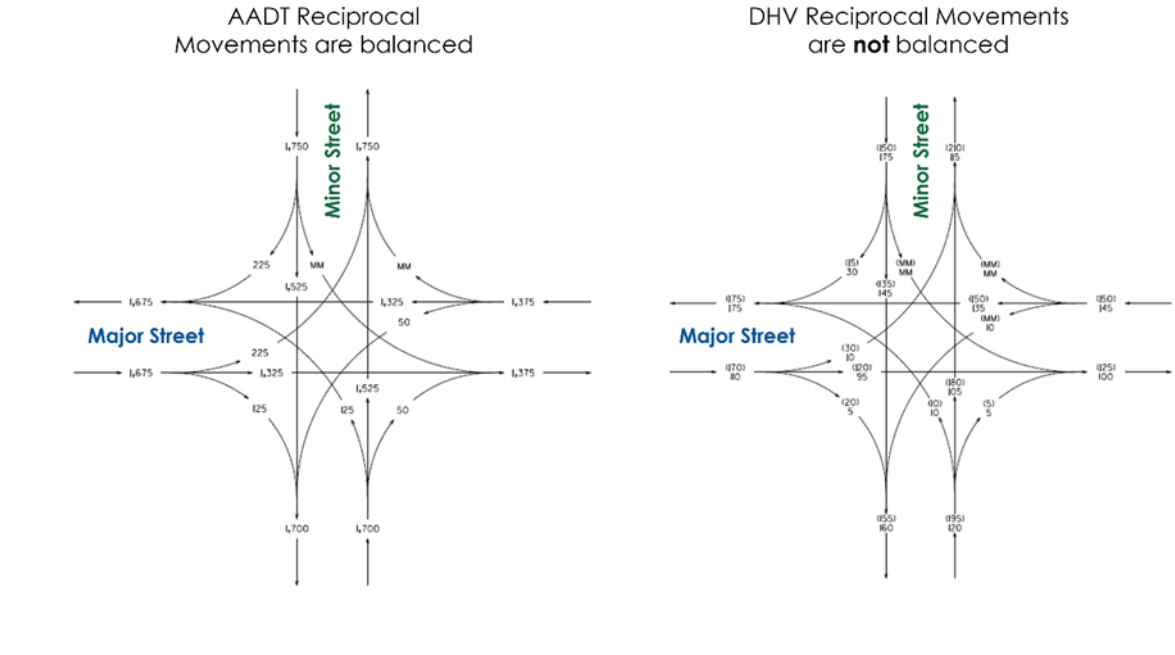

Figure 3.1. AADT Balancing Opposing Movements

Figure 3.2 shows an example of an instance where not all AADT movements would be balanced across the day. A vehicle making a westbound right turn at the traffic signal to navigate to the local business would need to make a reciprocal southbound left turn to navigate their return movement;

therefore, the opposing movements would be balanced. However, a vehicle making an eastbound left turn at the traffic signal to navigate to the local business would be able to make their southbound right return movement by utilizing the adjacent right-in-right-out (RIRO) access point. Therefore, in comparing the eastbound left turn movement to the southbound right turn movement across the day, it would not be expected that these movements would be equal, given that vehicles have an alternate route (via the RIRO access point) to make the southbound right.

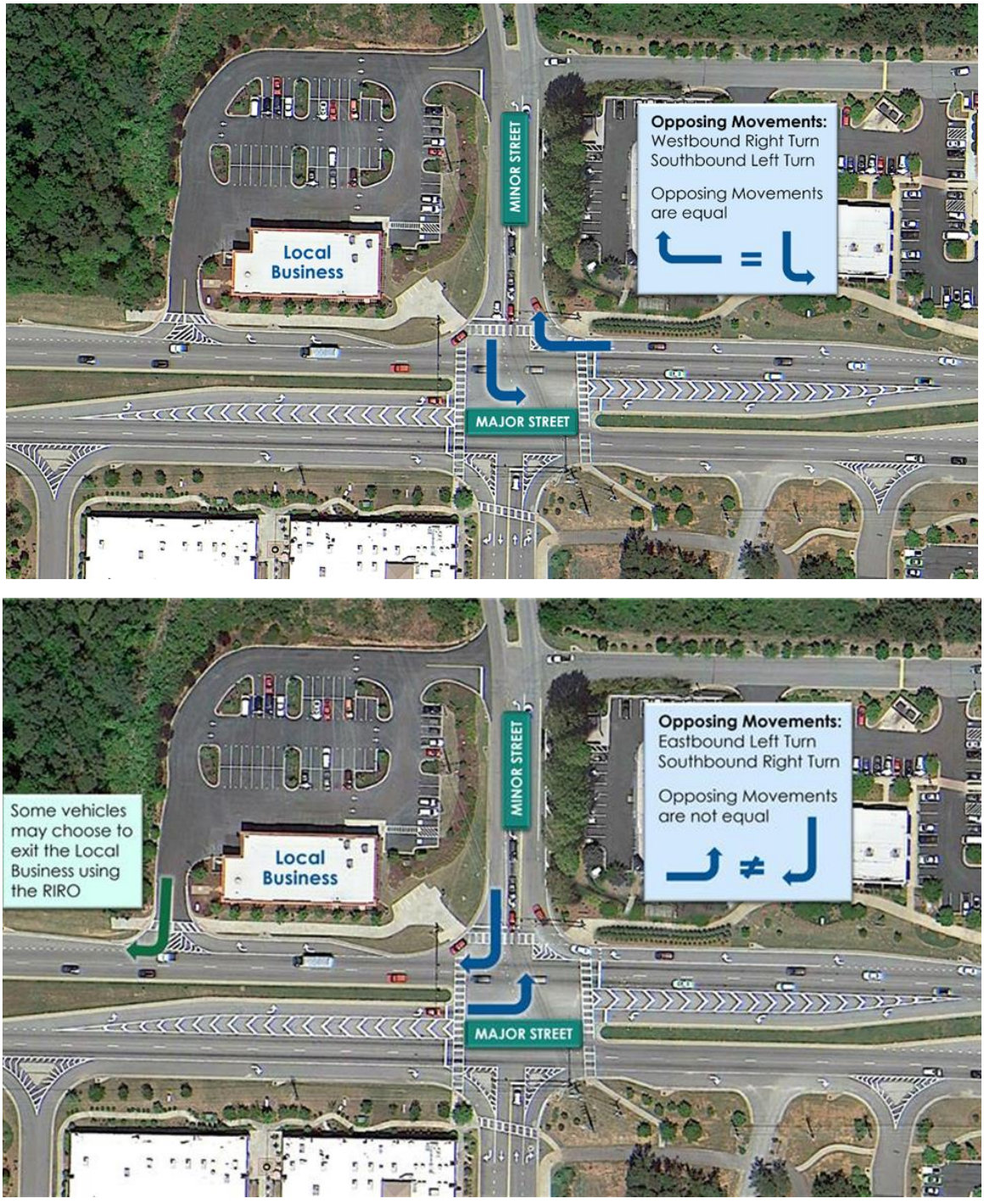

Figure 3.2. Example of AADT Balanced and Unbalanced Opposing Movements

3.7 Intersection Turning Movement Data

The existing turning movement data for the AM and PM peak periods (12-hour total period) at all major intersections in the project area must be collected through field counts. As discussed in Section 4.2, for single intersection projects, intersection turning movement data should be collected for all legs of the intersection, with the exception of minor/private driveways. For multi-intersection projects, turning movement counts are required to be collected at major intersections along the study area corridor, such as state routes, signalized intersections, highway ramps, and intersections with an expected high truck usage.

3.8 Intersection Turning Movements for AM and PM Peak Hour Volumes

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

At major intersections and at driveways leading to major activity centers, the "Design Hour" is typically identified for the morning or "AM peak hour" and "afternoon/evening" or "PM peak hour," since traffic patterns (peak volume demand for each turning volume) change between the two time periods. The peak hour turning volumes are important for estimating the intersection capacity and determining the number of lanes needed, the storage length for exclusive turning lanes required for each approach, and the most appropriate traffic controls for the intersection (including the signal timing and phasing plans). It is important to look at both AM and PM peak hour volumes independently because one turning movement may be higher in the AM peak hour, while a different movement at the same intersection may be higher in the PM peak hour. Each of these movements must be designed for their highest demand. The DHV turning movement volumes at intersections should be adjusted and estimated based on the methodology outlined in Section 4.5.

3.9 Intersection Turning Movements for AADT Volumes

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

AADT turning movement volumes must be calculated for each intersection within the project limits using project area roadway AADTs and estimated intersection turning movement patterns. These turning movement patterns should be based on the existing turning movement percentage splits from the turning movement counts collected along the project area roadways. The AADT turning movement volumes at intersections are frequently used to conduct a preliminary signal warrant analysis for future conditions.

Because the requirement for collecting turning movement counts for OTO projects is 12 hours, the daily intersection turning movements must be estimated using the raw turning movements and K-factors, as outlined in Section 4.6. It is the assumption that reciprocal daily turning movements would be balanced, unless otherwise documented in the Traffic Volume Forecasting Memorandum.

3.10 Traffic Flow Diagram Documentation Standards

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

The following standards and conventions should be used throughout the traffic data analysis and documentation activities in order to expedite approval of the documents by GDOT:

- Follow the latest versions of the GDOT Plan Presentation Guide (PPG) and the GDOT Electronic Data Guidelines (EDG) and the latest OpenRoads Designer (ORD) formats and cell libraries in developing the traffic flow diagram sheets. The orientation of the traffic flow diagram sheets should also follow PPG guidelines.
- Include company name, project ID, project identification number (P.I.#), County, and a directional arrow on all traffic sheets, and initial and date all traffic sheet updates and quality control checks in the appropriate area of the traffic sheets.
- Where a project spans multiple counties, County lines (like match lines or break lines) and County names should be added to note the county boundaries. Similarly, if multiple PI numbers exist in the same set of traffic flow diagrams, they should also be noted at the appropriate locations with match lines or break lines.
- AADT volumes should be rounded to the nearest 25. Show minimal movement volumes that are less than 25 vehicles per day as MM for AADT traffic flow diagrams.
- DDHVs should be rounded to the nearest 5. Show minimal movement volumes that are less than 3 vehicles per hour as MM for DHV traffic flow diagrams.
- Truck percentages should be rounded to the nearest 0.5%. Both Single Unit (SU) trucks (FHWA Classes 4 through 7) and Multi-Unit or Combination (Comb) trucks (FHWA Classes 8 through 13) should be provided for AADT and DHV traffic flow diagrams. When truck percentages are noted on the traffic diagrams, the TFE should include the AM and PM truck percentages and the street names where counts were collected.
- The rounding of AADT volumes, DHVs, and truck percentages should be done once and only in the last step of the calculation before reporting them on the traffic diagrams or in the Traffic Volume Forecasting Memorandum. Rounding multiple times during intermediate calculation steps may introduce errors and reduce the overall accuracy of the final estimate.
- AADT traffic flow diagrams should have the volumes represented as “(Design Year)/Opening Year” on each sheet. Do not separate Design Year and Opening Year sheets. Similarly, AADT traffic flow diagrams should have the volumes represented as “(Design Year + 2)/Opening Year + 2” on each sheet. Do not separate Design Year + 2 and Opening Year +2 sheets. In some cases where the roadway and/or intersection layout or geometry changes between the Opening Year and the Design Year (or between the Opening Year + 2 and the Design Year + 2) the sheets may be separated.
- DHV traffic flow diagrams should have the volumes represented as “(PM)/AM” on each sheet. Do not separate AM and PM sheets.
- Truck percentages should be shown on traffic flow diagrams at all locations where classification counts were collected per the approved traffic count map. When additional classification data is provided by a traffic vendor for locations originally identified as volume-only counts, the TFE may choose to include them on traffic flow diagrams at key locations without excessively cluttering the traffic flow diagrams. In all cases, truck percentage

calculations should be included in the Traffic Volume Forecasting Memorandum appendix for all count locations where classification data is available.

All TFEs and GDOT and Consultant Project Managers should monitor GDOT webpages with traffic-related resources to verify the latest standards for traffic-related documents.

To streamline the review process, traffic diagrams should be ordered as follows:

1. Existing DHV
2. Existing AADT
3. Open Year DHV (No-Build and Build)
4. Design Year DHV (No-Build and Build)
5. Open Year/Design Year AADT (No-Build and Build)
6. Open Year +2 DHV (No-Build and Build)
7. Design Year +2 DHV (No-Build and Build)
8. Open Year +2/Design Year +2 AADT (No-Build and Build)

For single intersection projects, the No-Build and Build scenarios may be shown on the same sheet. For multi-intersection projects, where No-Build and Build scenarios cannot fit on the same sheet, please show all No-Build diagrams followed by all Build diagrams. Build diagrams should reflect the actual proposed layout of the intersection, e.g., a roundabout or restricted crossing U-turn (RCUT).

3.11 Traffic Volume Forecasting Memorandum Requirements

At the conclusion of the traffic data analysis and traffic forecasting activities, the Traffic Volume Forecasting Memorandum must be submitted to GDOT OTO for review and approval. The memorandum should include the following information:

- Introduction
    - Title section, PI #, county, current date, recipients
    - Project description and project purpose
    - Overall traffic methodology and key activities performed
    - Documentation of any redevelopment of volumes if applicable (if already completed for a traffic engineering study/previous volume memorandum)
- Existing Conditions and Data Collection
    - Intersection location (relative to nearby major city) and satellite image of intersection location
    - Data collection process (i.e., how/when counts were collected and where), tabular summary of all data sources used (list all data sources such as field counts, TADA, travel demand model, etc.)
- Traffic Analysis and Projections
    - Discussion of how growth rate was calculated, and the sources used to calculate it, detailing specific assumptions used for each source
    - Explanation of growth rate source weightings (final growth rate should be bolded)

- Key Traffic Parameters
    - Discussion of truck percentages and any truck-related facilities in the project area, as well as a summary of truck percentages in a tabular format
    - K- and D-factor discussion and summary in a tabular format
- Volume Development Procedure
    - Discussion of existing volume development procedure (and the traffic factors used), including a chart of how raw counts were developed into existing volumes
    - Discussion of future No-Build volume development procedure, including a chart of how existing volumes were developed to No-Build volumes
    - Discussion of any rerouting methodology and assumptions for the Build scenario if the proposed intersection/corridor layout changes the overall routing of vehicles

The Traffic Volume Forecasting Memorandum should include the following items as appendices:

- Volume Development Procedure/Flow Chart
- Count Location Map (if multi-intersection project)
- Raw Traffic Counts (in Excel form)
- Growth Rate Data and Calculations
- Truck Percentage Calculations
- K- and D-Factor Calculations
- Traffic Factors
- Concept Layout (if available)
- Traffic Diagrams (include both PDF of diagrams and MicroStation file)
- Raw Volume Development/Growth Rate Excel Files (used for traffic volume development calculations)

Following review of the Traffic Volume Forecasting Memorandum, GDOT OTO will provide a set of consolidated comments to the TFE. The TFE is responsible for addressing the comments and submitting the final Traffic Volume Forecasting Memorandum to GDOT within a predetermined time period discussed between the Project Manager and GDOT OTO. The TFE should consult the OTO Volume Development Template for examples of required deliverables.

Chapter 4. Traffic Data Analysis for Design Traffic Forecasts - Contents

Chapter 4. Design Traffic Forecasting Process, Standards, and Documentation

This chapter provides guidance on the traffic engineering practices used to develop future volumes, specifically for GDOT OTO projects. These steps should be implemented after completing the process outlined in Chapter 4 for existing volumes. As previously mentioned, for GDOT OTO projects, separate submittals for existing and future volumes are not required.

4.1 Four Forecast Conditions

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

For all GDOT projects that require traffic forecasts, the TFE must develop forecasts for four (4) specific conditions: (1) the Opening Year; (2) the Opening Year + 2 years; (3) the Design Year; and (4) the Design Year + 2 years. The "plus 2" conditions are necessary to help address potential changes in funding levels and changes in project delivery scheduling that routinely occur and affect GDOT projects. The four forecast conditions are described below:

- The Opening Year forecast represents the conditions present at the year the project is anticipated to be open for traffic. For example, if a project is scheduled for a let date in 2020 and it is estimated that the project will take two years to construct, then the forecast will reflect traffic volumes expected at the Opening Year of 2022.
- The Opening Year + 2 forecast should reflect the conditions expected two years following the Opening Year date. The TFE should not confuse this year with the programmed fiscal year for construction, or the project let (bid award) date.
- The Design Year conditions reflect the anticipated future horizon year for the project. For most GDOT projects, the design year will correspond to the Opening Year plus 20 years. For example, the TFE would develop 2042 design year traffic volumes for a project with an Opening Year of 2022.
- The Design Year + 2 conditions are those expected two years after the Design Year of the project.

Due to the need to balance the project schedules of the hundreds of projects led by GDOT and the availability of federal and state project funding, it is extremely important that the TFE confirm the appropriate opening and design forecast years with the GDOT Project Manager at the beginning of the design traffic forecasting process.

4.2 Future Forecast Traffic Volumes

Section taken directly from the Office of Planning Design Traffic Forecasting Manual.

The Opening Year and Design Year annual average daily traffic volumes (AADT) and design hourly volumes (DHV) for the project area roadways should be calculated from the approved existing condition traffic volumes adjusted to reflect the estimated traffic growth rate.

4.3 Development of Traffic Growth Rates

The required GDOT traffic forecasting methodology relies on two important calculations:

- The historical annual traffic growth rate based on the analysis of long-term (historical) trends in traffic volumes using actual traffic counts (not just travel demand model data or output); and
- An estimated future annual traffic growth rate considering expected population and employment growth due to new development or redevelopment *based on documented, credible information sources*.

The TFE should thoroughly document all assumptions on historical trends and estimates of future population and employment growth due to new developments and redevelopments. All sources of data and information supporting the proposed traffic growth rates should be clearly identified.

For GDOT OTO volume development projects, the general formula for calculating the growth rate between two points in time is as follows:

$$\textit{Annual Growth Rate} = (\textit{End Value}/\textit{Begin Value})^{(1/\textit{End Year}-\textit{Begin Year})} - 1$$

The following Section 5.4 outlines GDOT OTO general guidelines for using historical and projected data sources to calculate growth rates, as well as guidelines for weighting the sources.

4.4 Traffic Growth Rate Sources and Weightings

For GDOT OTO volume development projects, TFEs must use four growth rate sources: two historical (TADA, Socioeconomic Data) and two projected (Travel Demand Model [TDM], Population Projections).

4.4.1 GDOT TADA – Historical Growth

The database of available historical traffic counts from GDOT count stations can be accessed from GDOT's TADA website. Data from several count stations in the vicinity of the project should be obtained to calculate the historical traffic growth trends in the project area. To represent growth patterns for a particular project roadway, growth trends based on data from count stations along that same roadway or along roadways of similar functional classification and characteristics can be calculated and averaged.

If possible, the TFE should use historical counts for the past **10 years** from the TADA website and document all assumptions as part of the traffic forecasting process. If the count station is a portable (or short-term) station, the TFE should use count data only for the years for which an actual count was performed, and not for the years for which counts were estimated. Actual counts collected can be found in the 'Site Data' tab on the count station's data dashboard.

This data should be incorporated into an electronic spreadsheet, and any apparent erroneous counts or clear outliers should be omitted, such as:

- Count stations without data from the past five years
- Count stations with less than three usable data points
- Counts that are a clear outlier to surrounding data points collected
- Count stations with exceptionally high or low growth rates compared to those around it

For each count station in the study area, an exponential trendline of all available AADT points should be created, and the growth rate can be calculated between the most recent and oldest data points. An average, weighted by volume, of all count station growth rates can then be calculated to determine a single TADA growth rate for the study area.

4.4.2 Socioeconomic Data – Historical Growth

Historical socioeconomic data for the study area should also be included in the growth rate analysis. GDOT OTO recommends utilizing the two following sources for historical socioeconomic data, for which the past 10 years of data should be available:

- Office of Planning and Budget (OPB) Population Estimates – represent population estimates by county from the past 10 years based on census data and trends in the area.
- Bureau of Labor and Statistics (BLS) Employment Statistics – represent employment data by county from the past 10 years.

If a project falls within multiple counties, or in proximity to another county, it is recommended to use a weighted average of growth rates from all counties considered.

4.4.3 Travel Demand Model – Projected Growth

For GDOT OTO volume development projects, projected growth from a TDM must be used in the growth rate calculation. For a proposed transportation improvement project on a major highway within an urbanized area, the municipal planning organization (MPO) TDM can be used to help estimate growth rates for the future forecast conditions. Roadway improvement projects in rural areas (outside MPO areas) will utilize the Georgia Statewide Travel Demand Model (GSTDM) to help estimate growth rates for the future forecast conditions.

A link-by-link analysis of relevant segments in the study area should be used to compare the model's existing year and design year scenarios. For each link analyzed, an individual growth rate should be calculated. The average, weighted by volume, of all link growth rates in the study area analyzed should be used to determine the final growth rate from the TDM.

For additional information and guidance on TDM use, as well as whether an MPO model or the GSTDM is more applicable for a given study area, refer to Chapter 6.

4.4.4 Population Projections – Projected Growth

GDOT OTO also recommends including a second source of projected growth through the Office of Planning and Budget Population Projections. OPB provides a county-level estimate of population growth, up to year 2060. The growth rate calculation should consider the growth between the Existing Year and Design Year + 2.

4.4.5 Growth Rate Weighting Guidelines

After determining individual growth rates for the two historical (TADA, Socioeconomic Data) and two projected (TDM, Population Projections) growth rate sources, a finalized average growth rate must be determined to project the future volumes for a study area. While the weighting of the individual growth rates from the four sources can be subjective to study area specifics, OTO has outlined some general principles to determine the finalized growth rate for a study area. While TFEs are not necessarily restricted to using OTO's recommended growth rate weightings, any deviations from

these growth rate weightings, as well as the justifications for the weighting adjustments, must be documented in the Traffic Volume Forecasting Memorandum.

As a general rule, GDOT OTO recommends weighing the four growth rate sources each at 25%, as exhibited in Table 4.1.

Table 4.1 OTO-Recommended Typical Growth Rate Weightings

Growth Rate Source	Type	Weighting
GDOT TADA Counts	Historical	25%
Historical Socioeconomic Data	Historical	25%
Travel Demand Model Data	Projected	25%
OPB Population Projections	Projected	25%

Engineering judgment may be used to adjust the growth rate weighting as needed. For instance, if there is no available/usable GDOT TADA count station data, the weighting for Historical Socioeconomic Data may be adjusted to 50% in place of the unavailable TADA data. Additionally, if a specific growth rate source is a clear outlier compared to the other sources, the weighting of that source may be reduced and the weighting of the other sources may be increased. As noted previously, all changes to the OTO-recommended growth weightings must be documented in the Traffic Volume Forecasting Memorandum.

The next two sections outline some additional considerations that apply if the growth rate is less than 0.5% or exceeds 2.0%.

4.4.6 Growth Rate Adjustments – Less than 0.5%

If the calculated growth rate is less than 0.5% and the TFE has determined that no further reasonable assumptions or adjustments can be made to the growth rate weighting to more accurately reflect the growth rate, GDOT OTO recommends that a minimum growth rate of 0.5% be used. For instance, if the final calculated growth rate is 0.38%, it should be rounded up to 0.5%.

In general, using a minimum growth rate of 0.5% for a study area is a justified conservative estimate to account for generalized trends in population and travel growth observed across the State of Georgia. Engineering judgment can be used by the TFE to keep a growth rate below 0.5% if supported by substantial evidence based on historical and projected trends; however, GDOT OTO must concur with this assumption. Use of a negative growth rate is not recommended for traffic forecasts.

4.4.7 Growth Rate Adjustments – Greater than 2.0%

If the calculated growth rate is greater than 2.0%, GDOT OTO requires some additional adjustments to the growth rate calculation. A growth rate of more than 2.0% is considered moderate to aggressive, and it is the general assumption that this growth rate would not be sustainable from the Existing Year through the Opening Year to the Design Year. In general, an aggressive growth rate is the result of recent historical trends that indicate a short-term higher increase in traffic volumes that would not continue over a longer period. Therefore, OTO suggests breaking the growth rates into the following:

- A **Short-Term Growth Rate** that represents growth from the Existing Year to the Opening Year (and to Opening Year + 2). Because recent historical trends are considered more likely

to continue in the short-term than in the long-term, the short-term growth rate calculation should weigh the historical data sources higher than the projected data sources. Table 4.2 outlines the general weighting guidance for a short-term growth rate.

Table 4.2. OTO-Recommended Short-Term Growth Rate Weighting

Growth Rate Source	Type	Weighting
GDOT TADA Counts	Historical	30%
Historical Socioeconomic Data	Historical	30%
Travel Demand Model Data	Projected	20%
OPB Population Projections	Projected	20%

- A **Long-Term Growth Rate** that represents growth from the Opening Year to the Design Year (and to Design Year + 2). Long-term growth rates are considered to be mostly influenced by long-term projected trends; therefore, only data from the projected growth rate sources are used in the long-term growth rate weighting. Table 5.3 outlines the general weighting guidance for a long-term growth rate.

Table 4.3. OTO-Recommended Long-Term Growth Rate Weighting

Growth Rate Source	Type	Weighting
Travel Demand Model Data	Projected	50%
OPB Population Projections	Projected	50%

As previously discussed, engineering judgment may be used to further adjust the growth rate weighting as needed. Any adjustments must be documented in the Traffic Volume Forecasting Memorandum. It is the expectation of GDOT OTO that the TFE clearly state and document the growth rate calculation process in the Traffic Volume Forecasting Memorandum in order to expedite the review process.

4.5 Accounting for Generated Traffic in Traffic Growth Rates

Generated traffic is a result of diverted traffic as well as induced vehicle travel. When an existing route is paralleled by a much more attractive new route or improved facility (on the basis of ease of travel), the total traffic on the two facilities will be greater than that on the older facility prior to the opening of the new facility. For the majority of OTO volume development projects, “generated traffic” is not considered in addition to the general growth rate for the study area. Projects programmed by GDOT OTO do not typically result in latent demand or major shifts to travel patterns in the study area; additionally, trips resulting from new developments typically do not need to be included in OTO volume development projects, unless they have a significant impact to the area where the safety/operational improvement occurs.

In the instance where accounting for generated traffic is deemed necessary for an OTO Traffic Volume Forecasting Memorandum, please refer to Section 5.5 of the Office of Planning Design Traffic Forecasting Manual.

4.6 No-Build and Build Scenarios

For GDOT OTO projects, it is important to define and distinguish the No-Build and Build scenarios for development of future year project volumes. In general, these can be defined as follows:

- **No-Build Scenario:** Scenario where the proposed safety/operational improvement has not been implemented. In most cases, the No-Build scenario's intersection/corridor configuration should match the existing conditions in the study area. The exception would be if there are other programmed projects in the study area, different from the proposed improvements, that are expected to be implemented by the Opening/Design Years (these would be included in both the No-Build and Build scenarios).
- **Build Scenario:** Scenario where the proposed safety/operational improvement has been implemented.

It is required that the OTO Traffic Volume Forecasting Memorandum include an explanation of the proposed Build scenario. Additionally, both the No-Build and Build scenarios must be included in the traffic diagrams for submittal.

4.7 Opening, Interim, and Design Years

The TFE should always confirm the correct Opening and Design Years with the GDOT Project Manager before proceeding with volume development and subsequent preparation of the OTO Traffic Volume Forecasting Memorandum. For GDOT OTO projects, no Interim Years are required for analysis, unless specified by the project team.

4.8 Traffic Forecast Calculations for Special Project Types

Section adapted from Office of Planning Design Traffic Forecasting Manual and adjusted based on OTO requirements.

In recent years, GDOT has been implementing innovative designs in transportation infrastructure across the state. Some examples of these innovative or non-traditional designs include roundabouts, diverging diamond interchanges, continuous flow intersections, quadrant roadway intersections, and restricted crossing U-turns, among others. These special project types necessitate additional considerations with respect to design traffic forecasting. Depending on the nature of certain types of projects, additional, specific procedures must be followed by the TFE to develop the design traffic forecasts for the project. Guidance on developing traffic forecasts for some of the non-traditional designs is described in this section.

4.8.1 Unconventional Roadway and Intersection Designs

"Unconventional Designs" are very popular in projects programmed by GDOT OTO, due to their ability to reduce opposing movements and certain crash types. Some examples of these designs include roundabouts, displaced left turn (DLT) intersections, restricted crossing U-turn (RCUT) intersections, median U-turn (MUT) intersections, quadrant roadway (QR) intersections, and double crossover diamond (DCD) interchanges (also called diverging diamond interchanges [DDIs]). Therefore, the Build scenario of many projects would use these designs in the Traffic Volume Forecasting Memorandum.

Although the overall traffic forecasting process does not change for an unconventional design project, it is notable that many of these designs may change what movements are allowed/not allowed at an intersection. Therefore, traffic volumes in projects that implement unconventional designs must be reassigned in the Build scenario to match the movements allowed by the new control type. This additional step must be included in the traffic forecasting process and documented by the TFE in the Traffic Volume Forecasting Memorandum.

For example, at certain MUT intersections, left turns are not allowed. Such movements have to go through the intersection and execute a U-turn at a downstream location to travel back toward the intersection where vehicles make a right turn movement. Similarly, this same left turn movement in a QR design is accomplished by a through movement followed by a series of right turn movements back towards the initial intersection, where they become a through movement on the intersecting roadway. The traffic reassignments associated with the non-traditional design must be accounted for by the TFE.

4.8.2 New Roadway Corridors, Including Bypasses

It is the general assumption that projects programmed by GDOT OTO do not include new roadway corridors, such as bypasses. If there is an exception in an OTO volume development project where a new roadway corridor is applicable, please refer to Section 5.8.2 in the Office of Planning Design Traffic Forecasting Manual.

4.9 Reasonableness of Traffic Forecasts

In general, projects programmed by GDOT OTO do not require adjustments to traffic volumes or reasonableness checks based on traffic forecasts from adjacent projects Please refer to Sections 5.9 through 5.11 in the Office of Planning Design Traffic Forecasting Manual in the instance that reasonableness checks are necessary.

4.10 Traffic Forecasting Deliverables

As noted in this manual, GDOT OTO volume forecasting projects do not require separate deliverables for existing volumes and future volumes. Please refer to Section 4.11 for Traffic Forecasting Volume Memorandum deliverable requirements.

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Chapter 5. Additional Information - Contents

Chapter 5. Additional Information

Design Traffic Forecasting Tools and Conventions

Please refer to Chapter 6 of the Office of Planning Design Traffic Forecasting Manual for additional information about using TDMs in traffic forecasting efforts.

Required Standards and Formats for Design Traffic Deliverables

Please refer to Section 4.10 and Section 4.11 for standards to be followed, traffic data analyses to be conducted, and forecasting deliverables necessary for TFEs to include as part of the Traffic Volume Forecasting Memorandum. Examples of these standards and deliverables can be found in the OTO Volume Development Template.

Design Traffic Reviews

Please refer to the OTO Review Checklist for specific guidance on OTO volume development reviews.

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