

## **PART 2, CHAPTER 2**

### **TRAFFIC ANALYSIS**

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## PART 2, CHAPTER 2

### TRAFFIC ANALYSIS

#### 2.1 OVERVIEW

This chapter provides guidance for conducting the traffic analysis and preparing a **Project Traffic Analysis Report (PTAR)** for Project Development and Environment (PD&E) Studies. Specifically, the chapter covers scoping the traffic analysis effort, traffic data requirements, analysis methodology and documentation.

Traffic analysis is an evaluation of the interaction between demand and supply of a transportation facility to determine how efficient the facility is serving the demand. This analysis forms the basis for evaluating the performance of project alternatives and design concepts based on demand, capacity, operational performance, environmental impacts, and safety concerns. Traffic analysis is one of the methods used to evaluate transportation needs during the Planning phase and PD&E Study. Additionally, traffic analysis produces data needed to support project-level environmental analyses such as noise and air quality impacts.

Traffic analysis is one of the critical activities for a PD&E Study and can impact the project schedule; the Project Manager should understand the effort associated with traffic data collection, forecasting, and analysis. Each project is unique and the approach for individual projects might differ. As such, when developing the project traffic data and performing the corresponding analysis, there must always be a balance between the project's goals and objectives, available schedule and budget, and the complexity of the analysis to be performed. The Project Manager should reach an early agreement with project reviewers on the traffic analysis approach and parameters for the analysis. Such agreement is vital to project success as it helps to avoid misunderstanding between traffic analysts and reviewers of traffic analysis reports that may negatively impact the project development schedule.

The chapter is intended for transportation practitioners who perform traffic analyses for Florida Department of Transportation (FDOT) projects and possess sufficient knowledge of traffic flow theory and traffic engineering including guidance documented in FDOT and national publications.

##### 2.1.1 Definitions

The following definitions apply to terminology used in this chapter:

**Annual Average Daily Traffic (AADT)** - The total volume of traffic passing a point or a segment of a highway facility in both directions for one year, divided by the number of days in the year.

**Average Daily Traffic (ADT)** - The total traffic volume during a given period in whole days (greater than one day and less than a year) divided by the number of days in that period.

**Axle Correction Factor** - The factor developed to adjust axle counts into vehicle counts. It is developed from classification counts by dividing the total number of vehicle counts by the total number of axles on these vehicles.

**Crash Modification Factor (CMF)** – A multiplicative factor used to compute the expected number of crashes after implementing a given design element or treatment at a specific site. For example, a CMF of 0.95 for a design element would suggest that application of that element or treatment would decrease crashes by 5%.

**Design Hour** - An hour with a traffic volume that represents a reasonable value for designing the geometric and control elements of a facility.

**Design Year** - The year for which the project is designed; usually 20 years from the Opening Year but may be any time within a range of years from the present (for restoration type projects) to 20 years in the future (for new construction type projects).

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

**Directional Distribution (D Factor)** - The percentage of the total two-way peak hour traffic that occurs in the peak direction.

**Level of Service (LOS)** - A quantitative stratification of a performance measure or measures that represents quality of service of a transportation facility measured on an A-F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst.

**Model Output Conversion Factor (MOCF)** - A factor used to convert the traffic volumes generated by a travel demand forecasting model in Peak Season Weekday Average Daily Traffic (PSWADT) to AADT. The MOCF is the average of the 13 consecutive weeks during which the highest weekday volumes occur and when the sum of Seasonal Factors (SF) for those 13 weeks are the lowest. MOCF is used during model validation to convert AADT to PSWADT for the base year model network should also be used for adjusting future year model volumes from PSWADT to AADT.

**Peak Season Weekday Average Daily Traffic (PSWADT)** - The average weekday traffic during the peak season. Some Florida Standard Urban Transportation Model Structure (FSUTMS) traffic assignment volume represents PSWADT projections for the roadways represented in the model highway network. For ***Project Traffic Forecasting Reports***, the PSWADT should be converted to AADT using a MOCF. Although not all FSUTMS models report traffic assignment volume in PSWADT, there are currently several model outputs throughout the State that require conversion from PSWADT to AADT using MOCF.

**Peak Spreading** - The expansion of peak period of traffic, from the traditional one-hour peak to multi-hour peak period, as the demand to use the facility surpasses capacity.

**R-Squared Value** - A statistical measure, expressed as a percentage, of how well a regression model fits the real data points.

**Regression Analysis** - A statistical process for determining the strength of the relationship among one dependent variable and one or more independent variables.

**Safety Performance Function (SPF)** - A statistically derived equation that predicts the average number of crashes per year at a location as a function of traffic exposure (e.g., volumes of vehicles, bicyclists, pedestrians).

**Saturation** - Traffic operating conditions in which the traffic demand is equal to the capacity of a facility.

**Over-saturation** - Traffic operating conditions in which the traffic demand exceeds the capacity or saturation of a facility.

**Seasonal Factor (SF)** - Parameters used to adjust base counts which consider travel behavior fluctuations by day of the week and month of the year. The SF used in Florida is determined by interpolating between the Monthly SFs for two consecutive months.

**Standard K (K Factor)** - A factor used to convert AADT to a peak hour volume. Standard K values are statewide fixed parameters that depend on the general area types (location) and facility types (roadway characteristics). Values less than 9% typically represent a multi-hour peak period rather than a peak hour. Standard K does not apply to emergency evacuation routes and managed lanes. Recommended FDOT Standard K Factor ranges are available in FDOT's [Project Traffic Forecasting Handbook](#).

**Truck Factor (T<sub>24</sub>)** - The percentage of truck traffic during a 24-hour period.

## 2.2 PROCEDURE

Traffic analysis for a PD&E Study includes developing objectives of analysis, identifying key performance measures to evaluate the project alternatives, determining analysis approach and tools to be used, determining data needs, collecting and analyzing data and documenting the results. Guidance for traffic analysis can be found in the following publications:

- **Highway Capacity Manual (HCM)** – Published by the Transportation Research Board (TRB), the **HCM** contains concepts, guidelines and methods for computing Level of Service (LOS) for freeways, highways (two-lane and multilane), urban streets and intersections (roundabout, signalized and unsignalized).
- [FDOT Traffic Analysis Handbook](#) – The **FDOT Traffic Analysis Handbook** provides guidance and general requirements for the uniform application of traffic analysis tools for roadway corridor, interchange, and intersection projects.

- [\*\*Procedure No. 525-030-120, Project Traffic Forecasting\*\*](#) – FDOT’s **Project Traffic Forecasting** procedure offers guidelines and techniques for forecasting traffic (with and without a travel demand model), calculating Annual Average Daily Traffic (AADT) from short term counts, calculating Directional Design Hourly Volumes (DDHVs), estimating intersection turning movements and calculating Equivalent Single Axle Load (ESAL) forecasts.
- Traffic Analysis Tools – Federal Highway Administration (FHWA)’s **Traffic Analysis Tools** is a program that produces and maintains different guidance documents which support different aspects of traffic and transportation analyses. The Traffic Analysis Tools program also provides guidance on the selection of and application of traffic analysis tools, interpretation of performance measures and other pertinent information.
- [\*\*Traffic Engineering Manual \(TEM\), Topic No. 750-000-005\*\*](#) – FDOT’s **TEM** provides traffic engineering standards and guidelines to be used for the State Highway System (SHS) by FDOT. It provides guidance for signs, signals, markings and specialized traffic operational topics.
- [\*\*Manual of Uniform Traffic Studies \(MUTS\), Topic No. 750-020-007\*\*](#) – The purpose of FDOT’s **MUTS** is to establish minimum standards for conducting traffic engineering studies for roads under the jurisdiction of FDOT. In addition, local government traffic engineering agencies are recommended and encouraged to use the **MUTS** as a guideline for conducting studies within their area of responsibility.
- [\*\*Manual on Intersection Control Evaluation, Topic No. 750-010-003\*\*](#) – FDOT’s **Manual on Intersection Control Evaluation** provides procedures for evaluating alternative intersection control strategies. These procedures contain spreadsheet tools to conduct operations and safety analysis to determine the best intersection control strategy.
- [\*\*2023 Multimodal Quality/Level of Service Handbook \(Q/LOS Handbook\)\*\*](#) - FDOT’s **Q/LOS Handbook** is intended to be used by engineers, planners, and decision-makers to evaluate roadway users’ quality/level of service (Q/LOS) at generalized planning levels. It also introduces Level of Traffic Stress (LTS) for evaluating bicycle and pedestrian quality of service.
- [\*\*Interchange Access Request Users Guide \(IARUG\)\*\*](#) – FDOT’s **IARUG** provides guidance on how to prepare documents that support requests for new or modified access to the Florida Interstate system and non-interstate limited access facilities on the SHS.
- Highway Safety Manual (HSM) – American Association of State Highway and Transportation Officials (AASHTO)’s **HSM** provides a variety of methods and tools for quantitatively estimating crash frequency or severity in the project development process. The **HSM** assists practitioners in selecting countermeasures and

prioritizing projects, comparing alternatives, and quantifying and predicting the safety performance of roadway elements.

- ***Transit Capacity and Quality of Service Manual (TCQSM), Transit Cooperative Research Program Report 165*** - The ***TCQSM*** provides quantitative techniques for calculating the capacity and other operational characteristics of bus, rail, demand-responsive, and ferry transit services, as well as transit stops, stations, and terminals.

## 2.2.1 Traffic Analysis Objectives

Given the importance of traffic forecasting and analysis in the PD&E Study schedule, the Project Manager should meet with the project team prior to starting the analysis to establish the traffic analysis objectives. The composition of the project team will vary depending on the type of project but will generally include FDOT planning and PD&E staff and consultant traffic staff. The objectives of the traffic analysis must reflect the purpose and need for the project and be measurable. Measurable objectives are essential for a comparable evaluation of project alternatives.

Before establishing traffic analysis objectives, the Project Manager and project team must review the purpose and need for the project, which is documented in previously completed planning studies and the Efficient Transportation Decision Making (ETDM) ***Programming Screen Summary Report***.

## 2.2.2 Level of Traffic Analysis

### 2.2.2.1 Traffic Analysis Scope

PD&E Studies vary in size and type, resulting in project traffic forecasting and analysis with varying levels of detail. FDOT's Project Manager should develop the scope of the traffic analysis effort based on the need for the project and the analysis objectives. The items that inform the traffic analysis scope are traffic study limits, design years, level of congestion and traffic flow characteristics, safety concerns, and multimodal considerations.

Traffic forecasts and analysis may be prepared as part of a planning study or advanced prior to the PD&E Study. Therefore, FDOT's Project Manager must review and consider previously completed traffic analysis activities when determining the scope or level of analysis needed during the PD&E phase.

The level of traffic analysis includes the methodology, analysis tools, and documentation. Decisions regarding scope and level of effort should be made in conjunction with the office responsible for the review of the traffic analysis, such as the Systems Planning Office. These decisions should be made after reviewing any previously completed planning and traffic operational studies in the project area. Additionally, the following items must be reviewed when determining the level of effort needed to conduct traffic analysis:

- Elements of the transportation problem being analyzed and the project's purpose and need.
- Traffic analyses conducted prior to the PD&E phase to determine their adequacy for inclusion in the PD&E Study as per **23 Code of Federal Regulations (CFR) Part 450** and **23 United States Code (U.S.C.) § 168**. See [Part 1, Chapter 4, Project Development Process](#) for more guidance.
- Existing operating conditions to determine the degree of saturation and traffic analysis area of influence.
- Facility type and geographic context. This includes a review of current or future major traffic generators in the vicinity of the project.
- Presence of Intelligent Transportation Systems (ITS) technology.
- Proposed improvements for the project.
- Need for tolling.

The Project Manager should begin with an understanding of what level of analysis is needed and use that information to develop the scope of traffic analysis. For instance, regarding future traffic projections, a PD&E Study for a rural corridor may only require the forecast of daily traffic demand to evaluate alternatives. An express lanes PD&E Study would require the forecast of peak period traffic volumes for both general use lanes (non-tolled lanes) and for the express lanes (variable tolled lanes). Additionally, a PD&E Study for an over-saturated intersection or corridor may require extending both geographic area of analysis and analysis time periods to accommodate actual traffic demand and bottlenecks.

The Project Manager should work with the reviewers and decision makers of the traffic analysis report to understand the expected outcome of the study. This will help to reach agreement on analysis methods and assumptions early in the process which is vital to the success of the project. Additionally, the Project Manager must consider other analyses (economic, air and noise) which are dependent on the output of the traffic analysis and incorporate them into the scope.

### **2.2.2.2 Adopting Planning Phase Traffic Analyses**

Project traffic analysis may be prepared prior to the PD&E phase as part of a corridor study, Master Plan, feasibility study, or Interchange Access Request (IAR) process. In addition, traffic analyses are conducted to determine transportation problems as part of a system-wide transportation needs plan. These planning studies may also be used to support the purpose and need for projects (see [Part 1, Chapter 4, Project Development Process](#)). Some of the traffic operational analyses performed prior to the PD&E phase have the same level of detail as those conducted during a PD&E Study. For instance, an IAR traffic analysis for the interstate system follows a process that is agreed upon by

FHWA, FDOT, and the interchange access applicant. During the project scope development stage, the Project Manager should explore opportunities to reuse or incorporate by reference detailed planning analyses (such as those prepared in support of an IAR) in the PD&E Study.

**Title 23 U.S.C. § 168** and **23 CFR Part 450** allow for decisions and analyses conducted during transportation planning to be used for the **National Environmental Policy Act (NEPA)** study. More information on how to adopt planning products is found in [Part 1, Chapter 4, Project Development Process](#). It is essential for FDOT's Project Manager to review the traffic analysis conducted during the Planning phase and determine its applicability in the PD&E Study early in the scope development stage. The Project Manager should also coordinate with planning staff when determining applicability of the planning products.

### 2.2.3 Performance Measures of Effectiveness

Comparative evaluation of project alternatives requires the selection of performance Measures of Effectiveness (MOEs) that fit the goals and objectives of the analysis. The traffic analysis computes MOEs that are used to quantify the existing and future operating conditions of the project. The appropriate MOEs help to compare the performance of various alternatives in achieving a project's traffic operational and safety objectives.

One of the primary MOEs is Level of Service (LOS). However, LOS is not effective when the facility is characterized with oversaturated conditions where the demand to use the facility exceeds capacity. In urban areas, traffic analysis may result in LOS F for all alternatives, which will not help in differentiating between alternatives. Under such conditions, the Project Manager must select the appropriate MOEs based on the needs and context of the individual project. It is important that all stakeholders associated with the project agree to the selected MOEs before the project team begins the analysis, since data requirements and the choice of traffic operational and safety analysis tools depend on MOEs.

A traffic analysis can also use the following MOE. Additional performance MOE and additional MOE details can be found in **Chapter 9** of the [FDOT Traffic Analysis Handbook](#).

- Throughput
- Vehicle Miles of Travel
- Volume/capacity ratio
- Demand-to-Capacity ratio
- Follower Density
- Arterial LOS

- Travel time
- Travel speed
- Control delay at intersections
- Queue length
- Number of stops
- Density
- Travel time reliability measures
- Hours of congestion
- Bicycle LTS
- Pedestrian LTS
- Network performance measures
- Latent Demand
- Experienced Travel Time

Typical MOEs for safety analysis include:

- Crash frequency
- Predictive crash frequency
- Crash rate
- Number of fatalities and serious injuries
- Economic loss
- Number of conflict points

Typical MOEs for transit analysis include:

- Ridership
- Person throughput
- On-time performance

- Passenger load factor
- Travel time
- Average headway
- Percent of population served
- Passenger wait time
- Travel reliability measures
- Cost (per passenger or per mile)

Additional MOEs for environmental/economic analyses include:

- Vehicle Miles of Travel
- Vehicle Hours of Delay
- Vehicles Hours of Travel
- Travel speed
- Mobile Source Emissions (e.g., amount of emissions)
- Number of crashes
- Travel time

## 2.2.4 Traffic Analysis Tools

Traffic analysis can vary from looking up generalized service volume tables for LOS to detailed microsimulation analysis. The tools selected for conducting the traffic analysis must correlate the complexity of the project and the magnitude of the traffic problem. Sophisticated tools and methods such as microsimulation must be used only for very complex problems such as those that require interactions of road users or involve oversaturated, congested conditions. The default tool for the analysis should be **HCM**-based tools, as they are least complex and require less data. The traffic analyst must also consider limitations of the tools when selecting proper analysis methods that meet the project needs. The Project Manager and project team should refrain from selecting a tool that does not fit the analysis objectives.

The following tools may be used for different levels of analysis:

- Generalized Service Volume Tables, found in the [Q/LOS Handbook](#) may be used for general planning level analyses and high-level concepts screening. This tool should not be used for detailed operational analyses.

- Microsimulation tools can be used to analyze areas that require an understanding of interactions between various users or transportation systems or experience oversaturated, congested conditions. These tools can also analyze unconventional project concepts or the performance of the entire network/system.
- Capacity Analysis for Planning of Junctions (CAP-X) can be used to evaluate the operational performance of different intersection control types. It is used in Stage 1 ICE analysis.
- Safety Performance for Intersection Control Evaluation (SPICE) can be used to assess predicted crash frequency and severity for different intersection control types in a Stage 1 and Stage 2 ICE analysis.
- **HSM Part C** tools such as spreadsheets, Enhanced Interchange Safety Analysis Tool (ISATe), Crash Modification Factors (CMFs), and Interactive Highway Safety Design Model (IHSDM) can be used to conduct quantitative safety analyses.

The [FDOT Traffic Analysis Handbook](#) contains guidance for selecting the proper traffic analysis tools. Depending on project conditions or needs, the analysis may use tools other than those listed in this section or discussed in the [FDOT Traffic Analysis Handbook](#). Prior to using alternative tools not listed in the [FDOT Traffic Analysis Handbook](#), the traffic analyst must submit a request and provide justification to FDOT's Project Manager.

## 2.2.5 Data Collection

Data required for traffic analysis depends on various factors such as project context, project limits, analysis methods, and MOEs. At the beginning of the project, FDOT's Project Manager and project team must gather existing available traffic information from FDOT databases, past studies, prior projects, and other analysis performed within the project area. This information is essential to obtaining general knowledge of the project area and identifying any gaps in data that would be included in a data collection plan. Even when review of existing data indicates the data is sufficient, the project team must conduct field reviews. Field observations are necessary to confirm data and review driving characteristics and operational conditions. Aerial imagery and online street views can provide useful information about physical characteristics of the analysis area but they should not replace field reviews. FDOT's [Manual of Uniform Traffic Studies \(MUTS\), Topic No. 750-020-007](#) contains additional requirements for collecting data to support traffic signal warrant studies, travel time studies, and speed studies.

The data collection effort should consider all modes of transportation that exist or are planned within the project limits. FDOT's [Complete Streets Policy, Topic No. 000-625-017](#) requires that roadways consider all modes and users of all ages and abilities. Therefore, depending on project context, data collection should include information about transit stops, boarding and alighting, headways, pedestrian counts, and bicycle counts, as appropriate. Collection of data related to pedestrian generators and attractors should be considered in urban contexts.

The tools used to develop and analyze alternatives also affect the data collection effort. Microsimulation analyses require more detailed data than analytical methods or **HCM**-based tools. The data collection plan for a microsimulation analysis must contemplate and include data needed for the proper calibration and validation of the model to be used in the analysis.

The data collection plan must include the traffic analysis area of influence, which may exceed the project limits. Examples of traffic studies where the data collection plan must extend beyond the PD&E Study limits are:

- **Interchange Access Requests** - Interchange access requests require analysis of the interchanges upstream and downstream of the project location and the crossroad up to one half-mile in either direction of the proposed access change. The geographic breadth of the analysis should be coordinated with the District's Interchange Review Coordinator (DIRC), Systems Implementation Office (SIO), and FHWA. See the [IARUG](#) for more guidance.
- **New Corridor Studies** - New corridor studies require a general understanding of the total demand, operations, and safety for the corridor traffic analysis area, which includes roadways parallel to or intersecting with the proposed roadway.
- **Bottlenecked and Oversaturated Roadway Facilities** - The analysis area must include operational constraint locations (with limited physical capacity) that restrict the roadway from serving the traffic demand, thus causing recurring congestion. The constraints may require extension of the analysis area beyond the predefined area of influence. Downstream bottlenecks cause queue spillbacks into the project area, while upstream bottlenecks may meter the flow and cause demand starvation within the project area.
- **Coordinated Arterials** - Project sections or points that are part of a coordinated arterial, or [Integrated Corridor Management \(ICM\)](#) network may require extension of the traffic analysis area to include coordinated signals.
- **Lane Repurposing** - Project converting (repurposing) existing lanes to dedicated bus lanes, parking lanes, or bicycle lanes may require a system or network analysis to evaluate the impact of traffic diverting to adjacent major roadways. See FDOT's [Lane Repurposing Guidebook](#) for more information.
- **Projects with Transit Routes** - Transit ridership on a project is based on several factors including accessibility (a measure of how an individual can pursue a desired mode at a desired location and time). Accessibility can include park and ride lots and transfer between modes, which may be located outside the PD&E Study limits. Additionally, terminal stations where transfers take place may be located outside the PD&E Study limits.

## 2.2.5.1 Types of Data Collection

The data collection effort can be divided into three categories—roadway characteristics, multimodal travel characteristics, and operations and safety characteristics. The type of traffic analysis will determine the requirement and level of detail in which elements in each category are to be collected. The following are the data elements for each category:

### Roadway Characteristics

- Number of lanes
- Lane widths
- Length of auxiliary lanes
- Intersection types (signalized, stop controlled, roundabout, grade separated)
- Predominant land use types (existing and future) adjacent to corridor
- Roadway geometrics (curvature, intersection configuration, grades)
- Number of turn lanes
- Turn lane storage lengths
- Merge/diverge lengths
- Interchange and intersection spacing/density
- Presence of on-street parking
- Presence of transit lanes
- Type of transit stops (bus bays or bus stops)
- Bicycle lane width
- Sidewalks width
- Sidewalk distances from travel lanes
- Shoulder widths
- Lateral and vertical clearances
- Railroad crossings
- Toll plaza type (electronic vs. cash collection) and location

- Right of way map, tax map, parcel maps
- As built plans
- AADT

### **Multimodal Travel Characteristics**

- Vehicle classification and vehicle mix
- Truck percentages
- Turning movements counts
- Pedestrian counts
- Bicycle counts
- Boarding and alighting at transit stops or stations
- Transit hours of operation
- Transit headways
- Route ridership
- Running time
- Utilization of special facilities (e.g., bus on freeways, transit centers, transit stops)
- Frequency of train service at railroad crossings

### **Operations and Safety Characteristics**

- Peak hour factors (PHF)
- Origin-destination (OD) data
- Posted speed limits
- Average travel speeds
- Average travel times
- Signal density
- Signal timings

- Signal Phasing
- Locations of detectors and traffic signal heads
- Queue locations and queue lengths
- Number of crashes and location of crashes
- Severity of crashes (fatal, injury or property damage) and their contributing causes

FDOT and other agencies have developed the following databases containing several roadway, traffic, safety and operations characteristics, which can supplement the data collection effort:

- [Florida Traffic Online \(FTO\)](#)
- [FDOT Forecasting Resource HUB](#)
- [FDOT Roadway Characteristic Inventory \(RCI\) Database](#)
- [Regional Integrated Transportation Information System \(RITIS\) at University of Maryland](#)
- [Signal Four Analytics](#)
- [FDOT State Safety Office Geographic Information System \(GIS\) Query Tool \(SSOGIS\)](#)
- [FDOT Transportation Data Portal](#)
- [Motor & Equipment Manufacturers Association \(MEMA\) vehicle fleet data](#)

### 2.2.5.2 Data Collection Schedule

The Project Manager and the project team should determine the appropriate duration of the data collection effort. Data collected over multiple days provides a higher degree of confidence and is more robust if random events like traffic crashes or equipment failure occur while collecting data. Data collection cost increases with duration, therefore, the Project Manager must balance these competing considerations with the goals of the project. The project team must first review existing data sources, such as the ones from FTO, to determine 24-hour demand profiles. Demand profiles are a useful tool to estimate the duration of the data collection. In the absence of existing data, use Chapter 3 of the *HCM* for examples of monthly, weekly, and hourly variation in traffic volumes for rural and urban routes to determine the length of the data collection period. Chapter 2 of the FDOT [Project Traffic Forecasting Handbook](#) describes traffic adjustment factors and the variability of traffic counts.

The data collection effort should be accomplished in accordance with the FDOT [Project Traffic Forecasting Handbook](#).

The FDOT recommends that traffic counts be collected on Tuesday, Wednesday, or Thursday. To ensure the data is representative of average (typical) traffic conditions, traffic counts should not be collected during the summer or on holidays, since travel patterns during these times cannot be assumed to be representative of typical weekdays. However, for studies near recreational facilities weekend, or summer may provide the traffic analyst with more accurate “typical” pattern of travel.

A 72-hour period is recommended for traffic counts that are generated by automatic technologies such as tube counts, screen line counts, or temporary camera data counts. Collection of data over a 72-hour period is preferred over single-day to avoid poor and faulty data due to equipment failures, human errors, and traffic incidents, among other reasons. However, if the roadway is a typical commuter traffic route and there is adequate history (5 to 10 years) of traffic counts, a 24-hour to 48-hour count may be sufficient. A 24-hour to 48-hour traffic count should be verified against historical counts.

Classification counts from a Telemetered Traffic Monitoring Site (TTMS) or Portable Traffic Monitoring Site (PTMS) can be used as long as such site exists within the vicinity of the project. In absence of a TTMS or PTMS site, 72 consecutive hours of vehicle classification counts should be collected.

Intersection turning movements should generally be collected during the AM and PM peak periods for at least three days. For urban arterials serving predominantly commuter traffic, turning movement counts less than 3 days may be sufficient, provided there is historical data. Typical 8-hour intersection turning movement counts are collected over a day. The traffic analyst may review the FTO traffic synopsis report and collect more than 8-hour per day if the area experiences heavy peak periods throughout a typical weekday. Truck counts should also be collected as part of the intersection turning movement count.

Intersection turning movement counts must include bicycles and pedestrians. Bicycle and pedestrian usage varies considerably with location. Peak period counts may be adequate in areas with light pedestrian/bicycle usage. Downtown areas, university campuses, and areas with heavy pedestrian and/or bicycle usage should be counted for an 8-hour period.

Roadways serving commercial uses, shopping centers, and schools may peak during the midday period or during the weekends. The traffic analyst should review the traffic count synopsis report from the FTO to determine if midday turning movement counts are required.

If there is no history of traffic counts near the study intersection, conduct 72-hour approach and departure counts at the intersection to allow extrapolation of the peak hour turning movements from the daily turning movements.

Crash data should be obtained for the latest five full calendar years of historic crash data as well as the current year up to the date the analysis is performed. If five years of crash data are not available, use a minimum of three years with a corresponding explanation.

Transit projects can vary from new fixed guideway systems to Bus Rapid Transit (BRT) projects. The data collection for such projects depends on the type of project. For areas with existing transit service, the traffic analyst should consult with the local transit agency before beginning any data collection effort. Transit agencies and providers are required to develop a 10-year Transit Development Plan (TDP). TDP usually contains a significant amount of data that can be used for transit studies, such as demographic data, transportation system characteristics, market research and system surveys, and public transportation service performance and trends, among other useful information. The data collection effort may vary among routes depending on the ridership. For example, low ridership routes may only require a 7 to 10-day period of data collection to capture a sufficiently robust sample of responses. The Project Manager should coordinate with the District Transit Office for any projects which include transit.

## 2.2.6 Project Traffic Forecasting

Project traffic forecasting is the process of estimating the future year traffic demand for a given project. It includes estimating daily volumes and peak hour demand volumes. Daily volumes are represented by AADT while peak hour demand is represented as Design Hour Volume (DHV). Transportation practitioners use AADT and DHV to determine geometric features of the roadway, assess operational performance of the facility, and calculate the Equivalent Single Axle Loads (ESALs) for pavement design.

There are two options for forecasting traffic volumes:

- With a Travel Demand Model
- Without a Travel Demand Model

The [\*\*Project Traffic Forecasting Handbook\*\*](#) details FDOT's traffic forecasting process for both options. Documentation of traffic forecasts and analysis should detail the selection of the preferred forecasting method and its application.

### 2.2.6.1 Forecasting using a Travel Demand Model

Traffic forecasting for a project should begin with the most recently adopted version of a travel demand model. This model should have been used to develop the most recent Long Range Transportation Plan (LRTP). This model represents the latest planning assumptions regarding population, employment, land use, transportation plans, and revenue, and is referred to as the "adopted model".

Before using any travel demand model, the traffic analyst should determine if the model meets the area wide validation standards established by FDOT's Systems Traffic Modeling Office and published in the ***FSUTMS-Cube Framework Phase II – Model Calibration and Validation Standards Report***.

With the development of the Florida Statewide Model, all 67 counties within Florida are covered by at least one travel demand model. The determination of the preferred model for each study is dependent on several factors, such as project location, analysis years,

available data, transportation mode (e.g., freight, transit, automobile). Coordination should take place with the District Planning Office on the preferred travel demand model prior to commencing the traffic forecasting process and document the decision in the **Project Traffic Assumption Form, Form No. 650-050-39** in [Figure 2-1](#).

Finally, most of the travel demand models are validated to Peak Season Weekday Average Daily Traffic (PSWADT). The PSWADT traffic volumes generated by the model should be converted to AADT using the Model Output Conversion Factor (MOCF). In such cases, the following formula is applied:

$$\text{AADT} = \text{PSWADT} \times \text{MOCF}$$

### **Subarea or Corridor Validation**

Some travel demand models may require subarea or corridor validation to improve the forecast within the project limits. Subarea validation is needed when a model meets area-wide validation standards but fails within a specific area or corridor under study. In a subarea or corridor validation, a smaller area or corridor is extracted from the regional model and the validation process is restarted with the goal of improving statistics such as demand/count ratios, Root Mean Square Error (RMSE). The subarea or corridor validation effort is not as intensive as a regional, Metropolitan Planning Organization (MPO) or county model validation, because it uses a smaller roadway network. Further information about the Subarea/Corridor Validation standards can be found in the **FSUTMS-Cube Framework Phase II – Model Calibration and Validation Standards**.

### **Time of Day Model**

Travel demand models were originally designed to produce future travel demand at the daily level. Most of the analysis done to determine geometric requirements of roadways and intersections is done for the design hour. Until recently, the process of converting AADT to peak hour assumed that 10% of the AADT occurred during the peak hour. While this process produces reasonable results in smaller urbanized areas where the peak period is limited to one hour, it fails in highly congested urban areas where the peak period spreads beyond the typical one hour.

The broadening of traffic flow profiles to multiple-hour peak periods is referred to as peak spreading. As the traffic congestion worsens during the peak hour, many drivers either leave early or delay the trip to avoid the peak hour. In some cases, they seek an alternative route or switch modes. As a result, the traffic generally traveling during the peak hour shifts to the adjacent shoulder hours.

To account for multi-hour congestion problems, many urban areas have developed a Time of Day (TOD) model that forecast traffic for the AM peak period, midday period, PM peak period and night/rest of the day period. Most TOD models add trip assignments for all time periods together to approximate daily traffic. TOD models require traffic count data by time of day to ensure accurate validation by each period. This adds to the level of complexity for validation checks and the Project Manager should consult with District Planning Office or MPO traffic modeling staff before using the TOD model.

Additional details regarding forecasting using a travel demand model can be found in Chapter 3 of the [Project Traffic Forecasting Handbook](#).

### **2.2.6.2 Forecasting without Travel Demand Models**

Projects located in areas without an MPO travel demand model or in areas where the Florida Statewide Model or the MPO travel demand model is not performing well may have to rely on a combination of historic traffic trends or population growth for traffic forecasting.

#### **Historic Trend Projections**

The historic trends analysis should be based on a minimum of 10 years of data. A regression analysis is performed on the most recent 10 years of traffic counts to obtain a trend equation. Any obvious outliers should be removed from the data set and an explanation provided. Only trend equations with an R-square value of at least 75% should be used to estimate the future year traffic volumes. Trend analysis is not sensitive to capacity constraints or new capacity; therefore, care should be exercised when projected traffic demand exceeds capacity.

#### **Growth Rates**

Historic trends analysis works well for areas with stable land use, transportation network and growth patterns. In areas that are experiencing substantial growth, construction of parallel facilities and changes in land use should consider growth rates based on population and employment growth.

Once the growth rate has been determined and checked for reasonableness, it can then be applied to the existing year counts and projected forward to the future analysis years.

For additional details, see Chapter 4 of the [Project Traffic Forecasting Handbook](#).

### **2.2.6.3 Calculating Annual Average Daily Traffic and Directional Design Hour Volume**

#### **Annual Average Daily Traffic (AADT)**

Traffic counts are usually collected over a 48- to 72-hour period through the placement of portable traffic counters. These counters are usually rubber hoses placed across the roadway to record the number of axles.

The short-term traffic count collected over 48 to 72 hours is called the Average Daily Traffic (ADT) or “raw count”. Due to the seasonal variations in traffic, the count should be adjusted by the Seasonal Factor (SF). In addition, the traffic counter only counts the number of axles and not vehicles, therefore the raw traffic count or ADT should be adjusted using the Axle Correction Factor (ACF) as follows:

$$\text{AADT} = \text{ADT} \times \text{Seasonal Factor} \times \text{Axle Correction Factor}$$

It is worth noting that there are methods for placing tubes in a pattern that will allow collection of classification counts based on axle spacing. Therefore, the analyst should review the data before applying the ACF.

### **Standard K Factor Range**

The K Factor is critical in traffic forecasts because it defines the volume of traffic for which the road is being designed. K factors are developed based on field-collected data over long periods of time. Standard K factor range is established statewide for specific areas, roadway context classification, and facility types, using the data measured at permanent traffic monitoring sites, and should be applied to AADT to determine the DHV. K factors less than 9.0% essentially represent multi-hour peak period (or peak spreading) rather than typical peak hour conditions. See Chapter 2 of the [Project Traffic Forecasting Handbook](#) for the latest FDOT Standard K factor range.

### **D Factor**

The Directional Distribution (D Factor) is the percentage of the total, two-way design hour traffic traveling in the peak direction. The D Factor is an essential parameter used to determine the DDHV. The D Factor is obtained from traffic counts and checked against the value from the FTO website.

To determine if a D Factor is acceptable for project traffic forecasting, its value should be cross-referenced against the acceptable range of values for D Factors listed in Chapter 2 of the [Project Traffic Forecasting Handbook](#).

### **Design Hour Volume (DHV) and Directional Design Hour Volume (DDHV)**

The DHV is the traffic volume expected to use the roadway segment during the design hour of the design year. The DHV is calculated using the following formula:

$$\text{DHV} = \text{AADT} \times \text{K Factor}$$

The DDHV is the traffic volume expected to use the roadway segment during the design hours of the design year in the peak direction. The DDHV is calculated using the following formula:

$$\text{DDHV} = \text{AADT} \times \text{K Factor} \times \text{D Factor}$$

### **T Factor (Percent Trucks)**

The T Factor measures the percentage of trucks on a daily basis and is the most critical factor in pavement design. The structural design of a roadway is primarily dependent upon on the heavy axle loads generated by commercial traffic and the T Factor measures the percentage of trucks on a daily basis.

For traffic analysis, the Design Hour Truck (DHT) Factor is used to convert trucks to passenger car equivalents. The DHT is calculated by dividing the T Factor by 2 because the percentage of trucks in the traffic is not evenly distributed throughout the day.

#### **2.2.6.4 Re-evaluating Traffic Analysis**

Most of traffic forecasting and analysis should be completed during the PD&E phase, if not already completed during the Planning phase. Once the traffic forecast and analysis are completed, the subsequent phases (Design and Construction) should use the same traffic data for design and operational purposes such as designing turn lanes, signal timing, or traffic control plans.

As transportation projects advance, they may require a Re-evaluation as described in [Part 1, Chapter 13, Re-evaluations](#). During the Design phase, the Project Manager and the project team should decide if the traffic forecast and analysis prepared for the project needs to be updated.

The validity of traffic forecasts and analysis depends on changed conditions brought on by:

- Substantial “macro-level” changes in the economy and driving habits since the project traffic forecast was prepared. Examples include the effects of economic recession, a substantial change in gas prices potentially affecting travel demand or implementation of an alternative travel mode.
- Substantial change in land uses or growth within the study area. For example, large scale developments, such as sector plans, approved near the study area which have the potential to change traffic generation and/or travel patterns.
- Substantial changes in the scope of work. For example, the addition of a new alternative that was not previously considered when the travel demand model or microsimulation model was developed. Model adjustment may be necessary to incorporate changes in trip patterns anticipated within the study area.
- Substantial changes in the transportation network near the study area. For example, the construction of major beltways or bypass routes. Traffic reports prepared before and after the network was changed may contain substantial differences in trip distribution patterns.
- Adoption of a new LRTP and regional travel demand model when the project traffic forecast is more than five years old. An update of the LRTP represents the latest planning assumptions regarding population, employment and land use, and coordinates transportation planning activities within and outside of the MPO area. If the traffic forecast is more than five years old and the MPO has adopted a new LRTP, the Project Manager and the traffic analyst should perform a sensitivity analysis of revised input and model assumptions to determine the magnitude of differences from prior analyses and their effects on past project decisions.

- Requirements specific to the documentation types. As an example, when re-evaluating an IAR, state and federal policy requires re-evaluations when an IAR does not progress to the construction phase within three years of approval.

The Project Manager should use conditions discussed above as a guide to determine the validity of previously completed traffic analysis. The project team may conduct sensitivity tests to assess the magnitude of differences from prior analyses resulting from use of new data and their effects on past decisions. The Project Manager and project team must consider any difference in the results to deliver the project decision. The focus should be on consistent conclusions from the analysis, rather than on any minor numerical differences between two different travel demand models outputs. If there is no substantial change in the traffic forecast, the study team would simply document the change and the sensitivity analysis results in the project file and proceed with the next phase of the project.

If there is a substantial change in the traffic forecast, the Project Manager must coordinate with the District Environmental Office, Office of Environmental Management (OEM), and the Systems Planning Office as appropriate to address the need for re-evaluating the traffic analysis for the project. The update of traffic analysis may require changes to the analysis methodology, data inputs and assumptions to update the traffic analysis to be consistent with the latest LRTP. The Project Manager should document decisions reached with the District Environmental Office and other project stakeholders.

## 2.2.7 Intersection Control Evaluation Analysis

ICE analysis is conducted in accordance with the [Manual on Intersection Control Evaluation](#). It is conducted for a PD&E Study when either existing or future signalized at-grade intersections are involved and should be based on the design year volumes. The Stage 1 analysis uses the build condition's basic lanes for the analysis. The CAP-X tool uses a critical lane volume analysis method to determine the volume to capacity ratios for a variety of intersection control strategies using **HCM** methodologies. The inputs for the CAP-X analysis are the AM and PM peak hour design hourly volumes and the future conditions basic lanes. The Stage 1 SPICE analysis uses **HSM** predictive methods for an opening year and design year crash prediction. The primary inputs are the opening year and design year AADTs. Not all intersection control strategies have predictive methods. In this case, the Safe System Intersection (SSI) method is used for comparative safety analysis. The SSI method is based on safe systems principles such as kinetic energy management and simplified decision making for road users. The SSI scores characterize the extent an intersection alternative, in a given context, aligns with the safe system principles. SPICE is also used in ICE Stage 2 for predictive safety analysis where more detailed CMFs are applied based on the concept development. Crash data can be applied if applicable.

The Stage 1 ICE analysis is used to determine viable at-grade intersection alternatives from a comparative operations and safety analysis perspective to be further analyzed in the PD&E's alternatives evaluation process. The [Stage 1 ICE Form](#) is to be completed and approved by the District Traffic Operations Engineer (DTOE) and District Design

Engineer (DDE) prior to conducting the public hearing. However, Stage 1 ICE may be completed prior to an Alternatives Public Workshop when needed to inform intersection alternatives for public feedback and as determined by the District. Stage 1 ICE analysis must be documented in the **PTAR**.

Stage 2 ICE may be deferred until the project proceeds into final design and documented in the Re-evaluation. However, Stage 2 ICE analysis can be performed during the PD&E Study when:

- PD&E scope includes a final design component or PD&E Study is immediately followed by final design
- Project is a combined PD&E and Design project.
- PD&E is programmed as a Design-Build project.

Stage 2 ICE, if conducted in the PD&E Study under the conditions listed above, is documented in the **Preliminary Engineering Report (PER)**. When Stage 2 ICE is conducted during the PD&E phase, Stage 1 ICE is to be conducted prior to an Alternatives Public Workshop (if held), so the results can be presented as part of the meeting's Comparative Evaluation Matrix. Stage 2 ICE is to be completed prior to the public hearing. The DTOE and DDE approved [Stage 2 ICE Form](#) is included in the **PER's** appendix.

If Stage 2 ICE has been deferred until final design initiates, the Stage 2 ICE is conducted using the design year volumes from traffic re-evaluation, if available. If these traffic volumes support changes in the **Stage 1 ICE Form** completed in the PD&E phase, the changes will be addressed in the Re-evaluation. The DTOE and DDE approved **Stage 2 ICE Form** is included in the Re-evaluation.

## 2.2.8 Traffic Analysis

Traffic analysis includes capacity and operational analysis to determine how well the project alternatives are meeting the project purpose and need. Detailed evaluation of project alternatives should only proceed on viable or feasible project alternatives (see [Part 2, Chapter 3A, Alternative Analysis](#)). Also, the same assumptions and a similar set of tools should be consistently applied to perform traffic analysis for different alternatives in a project.

Depending on the project, the analysis may use the methodologies in the **HCM** or a more sophisticated tool such as microsimulation to analyze the interactions between different users on an entire network.

The decision on selecting the appropriate tool for the project depends on the analysis objectives and the available resources or data. Chapter 4 of the [FDOT Traffic Analysis Handbook](#) describes the various tools available and provides guidance on selecting the proper analysis tools.

### 2.2.8.1 Capacity Exceeds Traffic Demand

In scenarios where the roadway capacity exceeds traffic demand, all the traffic is accommodated during the time interval under study. As a result, there is no spillback of queues or congestion from one segment affecting adjacent segments.

In such a situation, analytical tools that can compute LOS and other operational MOEs for individual segments or isolated points should be used. These tools can compute LOS for uninterrupted flow facilities, interrupted flow facilities and multimodal transportation facilities (e.g., pedestrian, bicycle, and transit). *HCM* guidance on how to conduct analytical analysis is available in the *HCM* and supporting software.

### 2.2.8.2 Traffic Demand Exceeds Capacity

In scenarios where the traffic demand exceeds roadway capacity, the traffic demand is not accommodated during the time interval under study. As a result, congestion and queues spillback to adjacent segments and time intervals. The analysis should thoroughly analyze the period when traffic demand exceeds roadway capacity, including both the buildup and dissipation of congestion.

In such scenarios, a microsimulation traffic analysis should be used. Microsimulation tools use computer models to simulate the interaction of individual users, such as cars, based on specified driver behavior parameters. Microsimulation tools must be calibrated to local traffic conditions before being applied in the alternatives analysis. Chapter 7 of the [FDOT Traffic Analysis Handbook](#) and *FHWA Traffic Analysis Toolbox Volumes III and IV* provide guidance on the development, calibration and application of microsimulation tools.

### 2.2.9 Safety Analysis

Safety analysis includes analyzing crash history (usually five years) within the project limits to assess the existing safety performance and evaluating the potential safety implications of a project. Depending on project context, safety assessment of the project may use *HSM* methodologies and tools according to the [Highway Safety Manual Implementation Policy, Topic Number 000-500-003](#). The *HSM* is a collection of analytical procedures and techniques for identifying the causes of crashes and developing solutions for certain types of roadways. Certain data which is compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings, or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data, per **23 U.S.C. § 148** and **23 U.S.C. § 409**. Additional guidance for safety analysis can be found in the [FDOT Safety Analysis Guidebook for PD&E Studies](#).

### 2.2.9.1 Historical Crash Analysis

A historical crash analysis involves descriptive analysis of five years of crash data with respect to crash characteristics such as severity, types, frequency, rates, density, patterns, clusters, and their relationships with crash contributing causes. The results of the historical crash analysis are used to identify or confirm safety problems in the project study area. An understanding of crash characteristics along with crash contributing factors helps to determine and evaluate corrective actions or countermeasures that can be applied to the project alternatives. Crash countermeasures must be selected based on their appropriateness and effectiveness to address specific safety issues and project goals.

Historical crash analysis may be used to analyze existing conditions by comparing the crash rate of a project location to the statewide average. Locations with crash rates above the statewide average require further investigation to determine the cause of crashes and appropriate crash countermeasures. Appropriate crash countermeasures could still be determined in locations with crash rates below the statewide average.

The future conditions analysis should examine the safety performance of the alternatives based on project context which includes future traffic volumes, proposed geometrics, modal needs, and traffic control conditions as appropriate. Future conditions analysis must include a discussion of the proposed design context, traffic operational performance and users of the facility. Additionally, safety assessment for future conditions must examine how the proposed alternatives improve upon any existing or potential safety problems. This will include comparing the safety performance of existing conditions with both future no-build and build conditions.

### 2.2.9.2 Quantitative Safety Analysis

Quantitative safety analysis, also known as data-driven safety analysis, is a predictive analysis that uses crash, roadway, and traffic volume data to provide estimates of an existing or proposed roadway's expected safety performance in terms of crash frequency and severity. It uses **HSM** predictive methods that incorporate site specific characteristics and mathematical functions such as Safety Performance Functions (SPFs) and CMFs.

The **HSM** predictive methods are detailed and require a thorough knowledge and experience in their applications. The advantage of these methods is their ability to make relative comparisons between project alternatives based on the change in the number of crashes or crash severities. Additionally, **HSM** methods can assist transportation analysts to quantify safety impacts associated with proposed design elements, operational treatments, or future changes in the facility. Therefore, these methods can help analysts make more informed project development decisions that weigh safety with other project goals and evaluation criteria. In some conditions, the **HSM** methods may not quantify the safety performance of a design element or crash countermeasure as data, research, scientific knowledge, or current best practice may not be incorporated in the **HSM** predictive methods. It is therefore important to understand the limitations of the **HSM** methods when deciding on the safety analysis approach for the project.

The **HSM** continues to evolve and does not offer the ability to evaluate safety performance for every project scenario or context. In some cases, the SPF may require adjustments to Florida conditions because they were developed using national data and may not reflect typical Florida conditions. Users of the **HSM** should refer to the State Safety Office for publication of the current Florida specific SPF calibration factors.

**HSM** can be used to support the following project development activities:

- Evaluate purpose and need for the project
- Develop and refine the project alternatives
- Analyze and evaluate project alternatives

When the PD&E Study contains existing or future signalized intersections, the Stage 1 ICE analysis shall be conducted. The SPICE tool is used for the intersection predictive safety analysis. If the analysis moves to Stage 2, the SPICE analysis becomes more robust with concept development and associated SPFs or CMFs plus the use of crash data where appropriate.

The **HSM Part C** predictive methods can calculate historic and anticipated future safety performance of the project. **HSM Part C** is applicable to rural two-lane highways, rural multilane highways, suburban and urban arterials, freeways, and interchanges. **HSM** has specific guidance regarding how to estimate future crashes with and without safety improvements. Additionally, the human factors fundamentals published in the **HSM** can help traffic analysts identify safety-specific needs for a project and estimate the potential benefits for safety improvements.

Safety performance should be included in the project goals if the project's purpose is to address a safety problem. **HSM** predictive methods can support evaluation of the purpose and need for a project by predicting crashes that would occur in the project or identifying potential countermeasures and strategies that would improve safety performance when incorporated in the project.

Development and evaluation of alternatives can use **HSM** predictive methods to quantify the anticipated change in crash frequency or severity as the result of changes in geometric features or traffic conditions. If an assessment for a safety-specific project shows that some alternatives would have a negligible adverse effect on safety performance, those alternatives can be eliminated. Additionally, **HSM** predictive methods can be used to inform and evaluate project decisions on design changes implemented to address avoidance and minimization of potential impacts to environmental resources. The documentation needed to support evaluation of alternatives and environmental decision making could therefore include the information derived from the **HSM** methods.

Another method for quantifying safety impacts of project alternatives is a relative comparison of CMFs. This method estimates the relative magnitude of potential safety impacts based on the anticipated percent change in crash frequency based on applicable CMFs. CMFs are published in the **HSM Part D** and **FHWA's Crash Modification Factors**

**Clearinghouse website** which include a star rating to indicate their quality. CMFs are also used to compare relative safety benefits of potential mitigation measures when selecting a treatment or strategy to address an identified safety issue. This method is relatively simple to apply, and when used appropriately can objectively support proposed improvements. CMFs are applicable to roadway segments, intersections, interchanges, special facilities, and various geometric situations.

### 2.2.9.3 Selecting Safety Analysis Method

The following should be considered when selecting appropriate safety analysis method for the project:

1. Capability (and limitations) of the method to answer the questions that the project is addressing
2. Data that is typically available in relation to the data required to use the safety analysis method correctly
3. Related project development tasks (such as purpose and need, interchange access, alternatives analysis, design exception) that may benefit from the same analysis method
4. The type of project and associated design or operational treatments that are the focus of safety analysis

It is important to discuss these considerations with the reviewers of the safety analysis during methodology development to set clear expectations for the level of analysis and documentation needed. The need to collect additional data to support analyses should also be discussed so that the desired safety analyses can be performed on time and within budget.

### 2.2.10 Environmental Analyses

Environmental impact analyses such as land use, air quality, and noise rely on the results of traffic forecasting and analysis. The most common traffic data required for environmental analyses are AADT, peak hour volumes, peak hour truck volumes and vehicle classification. Typical MOEs from the traffic analysis that are used for environmental analyses are listed in [Section 2.2.3](#). The Project Manager should work with the District Environmental Manager and other environmental subject matter experts to determine the traffic data needed for various environmental analyses.

### 2.2.11 Project Traffic Analysis Report

The **Project Traffic Analysis Report (PTAR)** documents the assumptions, methods, traffic forecasts, design traffic, safety analysis, and results of the traffic analysis for the project in plain language and in an easily understood format. It summarizes the data collection effort, input parameters, traffic and safety analysis tools, existing conditions, development of future traffic forecasts, and traffic operational and safety analyses of

project alternatives. The report must use the **Technical Report Cover Sheet Requiring PE Signature, Form No. 650-050-38b** as the cover sheet of the report. Traffic analysis reports support decisions regarding project actions. Therefore, the report should concisely present the results of the traffic analysis in a manner that can be readily understood by a variety of audiences. Discussion of the analysis results should be focused and avoid unnecessary information. Additionally, the report should include text that discusses information presented in tables and figures (charts, maps, and diagrams). MOEs presented in tables and figures should be clear, concise, and simple. The report should include other supporting technical data and output from analysis tools in the appendices. Additionally, highly detailed information such as data used to prepare figures and tabular summaries should be placed in the appendices.

The scope of the report depends on the size and complexity of the project, and whether traffic analyses conducted prior to the PD&E phase are going to be incorporated. Regardless of the complexity, the traffic analysis report should summarize the items presented in [Section 2.2.11.2](#). The **PTAR** should be signed and sealed by a professional engineer in accordance with **Chapter 471, Florida Statutes (F.S.)**.

Traffic analysis reports for projects that are not complex can include the results of traffic forecasting. The approach to documentation (i.e., one **PTAR** or multiple technical memoranda) should be included in the scope and agreed upon by the FDOT Project Manager and project team. For complex projects, traffic forecasting and traffic analysis may be prepared under different project tasks and teams. For such projects, it is recommended that traffic forecasting results and traffic analysis be documented in different technical memoranda or reports. See the [Project Traffic Forecasting Handbook](#) on how to prepare a **Project Traffic Forecasting Memorandum**.

Depending on the size and complexity of the project, safety analysis may be documented either in a standalone technical memorandum or as part of the **PTAR**.

Documentation of safety analysis should include discussion of high crash locations, crash types, patterns, severity levels and crash contributing factors; potential countermeasures; quantitative analysis (assumptions, method and steps followed) for both existing and proposed conditions; summary of the findings; and recommendations of the analysis. Discussion of safety analysis results should be supported with data, relevant findings, and best practices. Additional guidance for safety analysis can be found in the [FDOT Safety Analysis Guidebook for PD&E Studies](#).

Quality control review for **PTARs** should include reviewing methods and assumptions used to develop the analysis, inputs, reasonableness of results, and completeness of the results. The review of reasonableness of traffic projections should include comparing observed (and projected) traffic volumes with historical trends, examining proposed roadway and transit network improvements, and reviewing demographic data and land use projections. Refer to the [FDOT Traffic Analysis Handbook](#) for checklists that may aid the review process.

### 2.2.11.1 Traffic Analysis Assumptions

The assumptions used to prepare the traffic analysis including traffic projections should be documented so that a reviewer can easily understand the methodology, input values, and analysis results. It is essential for the Project Manager to reach consensus with the project team and lead agency regarding the assumptions during the scope development stage of the project. The ***Project Traffic Assumption Form, Form No. 650-050-39*** in [Figure 2-1](#), can be used to summarize the assumptions.

The following should be included in the traffic analysis assumptions summary as appropriate.

1. Traffic Forecasting Assumptions Summary

- a. Traffic forecast method - travel demand model, historic trend, or growth rates
- b. For the travel demand model:
  - i. Date of adoption of LRTP
  - ii. Model base year
  - iii. Horizon year of the travel demand model
  - iv. MPO website which includes documentation of the LRTP
- c. Changes in land use, economy, population, and employment since the travel demand model was built.
- d. Data Collection Year
- e. Analysis years – opening year, design year and interim year (for phased projects)
- f. MOCF
- g. K Factor
- h. D Factor
- i. T Factor

2. Traffic (operational and safety) analysis assumptions summary should include:

- a. Study area (i.e., project limits, traffic study area, influence area)
- b. Key input parameters
- c. Calibration and validation parameters

- d. Analysis methods and tools
- e. Analysis periods
- f. Performance MOEs

### **2.2.11.2 Project Traffic Analysis Report Outline**

The following is an outline for the **PTAR**. The report should have headings and subheadings to effectively delineate the sections appropriate to the level of analysis.

1. Executive Summary – Summary of analysis results.
2. Traffic Analysis Assumptions – Summary of assumptions for input parameters, analysis years, analysis methodology.
3. Introduction – Brief description of the project with a project location map and traffic analysis objectives.
4. Traffic Analysis Method – Discussion of assumptions and analysis methodology including analysis years, traffic study area, data required, analysis tools including version, and MOE.
5. Existing Conditions Analysis – Summary of balanced turning movement counts for the study intersections/interchanges under existing conditions. Summary of operational and safety analyses for the existing conditions. Microsimulation analysis should also include base model development and calibration documentation. Calibration may be submitted as a standalone document.
6. Development of Future Year Traffic Forecast – Depending on the scale of the project, this may be developed and submitted as a standalone document, in which case it should be referenced within the **PTAR**.
7. Alternatives Analysis – Description of project alternatives, assigning of project traffic volumes to alternatives. Summary of operational and safety analyses for each project alternative. For existing and/or future signalized intersections a summary of the Stage 1 Intersection Control Evaluation (ICE) analysis in determining intersection alternatives.
8. Summary of Analysis Results – Discussion of advantages and disadvantages of alternatives with respect to the traffic analysis objectives and goals.
9. Appendix – Raw data used to prepare input and analysis summaries. Other supporting data/information. DTOE/DDE approved **Stage 1 ICE Form**.

### **2.2.11.3 Using Interchange Access Request as Project Traffic Analysis Report**

In PD&E Studies that involve interchanges on Interstate Highway System, an IAR document can serve the purpose of **PTAR** if the PD&E Study limits are the same as the Area of Influence limits for the IAR. When the PD&E Study limits exceed the Area of Influence of an IAR, a **PTAR** will be needed in addition to an IAR. Coordination at the beginning of the project with the District Environmental Office, OEM, and Systems Planning Office is required for this topic.

## 2.3 REFERENCES

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## 2.4 FORMS

Project Traffic Assumption Form, Form No. 650-050-39

Technical Report Cover Sheet Requiring PE Signature, Form No. 650-050-38b

[FDOT Forms are found in the Procedural Document Library](#)

<b>Traffic forecast for the project was developed using:</b>	
<input type="checkbox"/> Travel Demand Model	<input type="checkbox"/> Growth Rates
<b>Type of Travel Demand Model Used:</b> <input type="checkbox"/> Metropolitan Planning Model <input type="checkbox"/> Other Model _____	<i>Refer to appropriate section of Project Traffic Analysis Report that discusses growth rates</i>
<b>Is the travel demand model based on the latest adopted Long Range Transportation Plan?</b>	
<input type="checkbox"/> YES	<input type="checkbox"/> NO
_____ Date when MPO adopted the latest Long Range Transportation Plan	Explain why?
_____ Base Year of Travel Demand Model	
_____ Horizon Year of Travel Demand Model	
Long Range Transportation Plan documentation is available at (provide web address): _____	
<b>Traffic Data and Factors</b>	
K Factor = _____ D Factor = _____ T <sub>Daily</sub> = _____	Data Collection Year = _____ Opening Year = _____ Interim Year = _____ Design Year = _____
Discuss any changes in land use, economics, population and employment data since the model was built	
<b>Traffic Analysis Assumptions</b>	
Discuss study area, data calibration/validation parameters, analysis tools, analysis periods and MOEs	

**Figure 2-1 Sample Project Traffic Assumption Form**