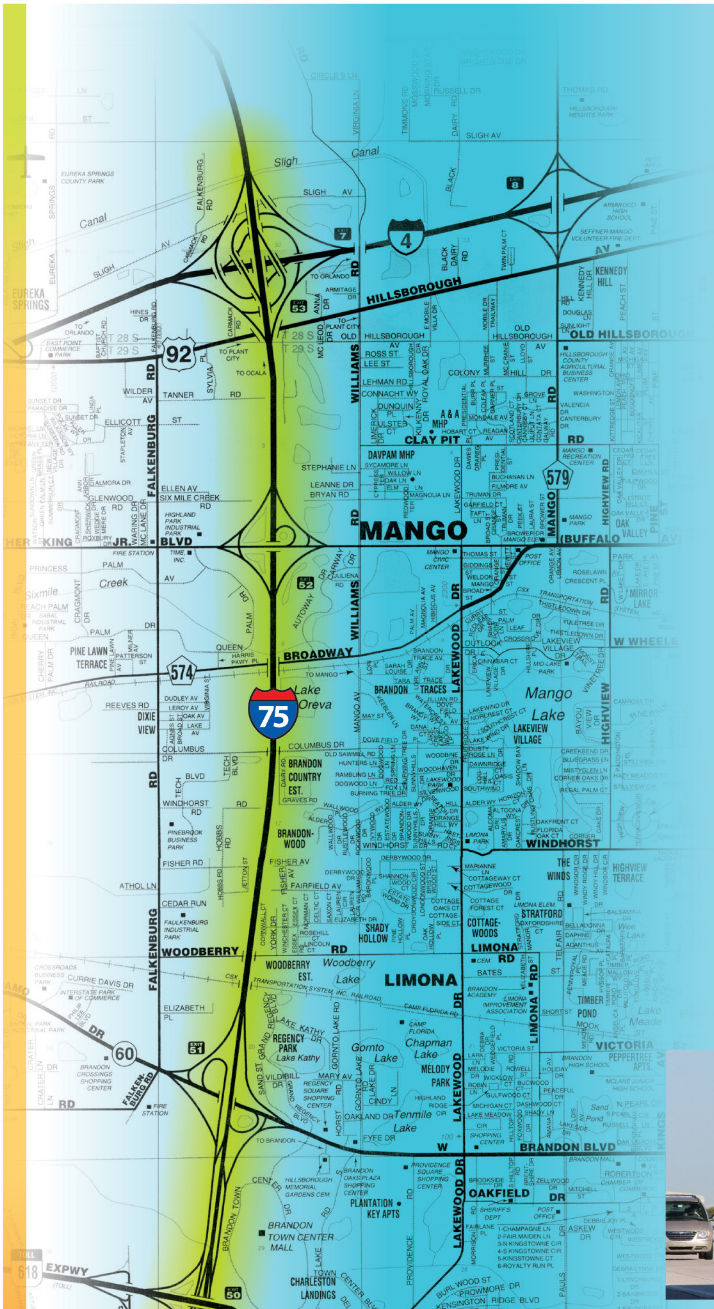
Freight Corridor and Sub-Area Study Guidelines



STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

D.7 FDOT District Seven

July 2009

Prepared by

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Section 1
INTRODUCTION

PURPOSE

The purpose of the Freight Corridor Study Guidelines is to provide direction and methods for incorporating the evaluation of freight/goods movements into corridor and/or sub-area studies. These guidelines were developed to ensure that freight issues are appropriately addressed in a cost effective, yet comprehensive manner. By focusing the comprehensive analysis on the observed freight-related problems and issues, the number of study tasks and the time needed to conduct the analysis are reduced, resulting in a cost savings to the Florida Department of Transportation (FDOT). These guidelines have been prepared using the results of a pilot (prototype) truck corridor study conducted for US 41 between Martin Luther King Boulevard and Big Bend Road in Hillsborough County, as well as a literature search of available studies, standards and procedures for the analysis of freight movements in corridors, activity centers and/or sub-areas.

The guidelines were prepared to provide an initial method for addressing freight concerns in future corridor and sub-area studies, and may be expanded or updated based on lessons learned from future studies of freight and good movements. In addition, the feedback from a committee of freight stakeholders and specialists will be instrumental in the further refinement of these study guidelines.

WHY FREIGHT STUDY GUIDELINES?

Current established methods for conducting corridor or sub-area studies lack guidance for addressing freight issues as part of a study scope. Research to identify adopted freight corridor study standards yielded little or no information regarding an established set of guidelines for addressing freight issues when conducting corridor studies. While many freight corridor or sub-area studies have been performed in the past throughout the United States and abroad, their scope has generally focused on addressing site-specific concerns and has not benefited from a defined or comprehensive scope of key study elements such as those available for typical traffic studies or Project Development and Environment (PD&E) studies. For example, studies have focused on geometrics and physical constraints at an intersection, while not addressing safety or capacity needs in the corridor. Previous studies have also focused heavily on capacity and level of service issues while overlooking safety or intersection geometrics.

BACKGROUND

District VII of FDOT, comprising Hillsborough, Pinellas, Pasco, Hernando and Citrus Counties conducted a comprehensive Regional Goods Movement Study that studied and analyzed the movements of goods throughout the region.

As part of the regional study of goods movements within District VII, FDOT conducted a freight corridor study to use as a basis for developing guidelines to address freight movement issues in all corridor studies. The initial task included a screening and selection of seven (7) corridors that included a wide range of adjacent land uses as well as a variety of physical constraints and operational issues that could affect efficient freight movement. The corridor selected for study was US 41/50th Street, between Martin Luther King Boulevard and Big Bend Road, a distance of approximately 13 miles. The study evaluated a comprehensive range of corridor characteristics and conditions that formed a basis for further study of freight issues. The evalation methods and the resulting findings and recommendations, while specific to the US 41 corridor, provide a suitable foundation for developing preliminary freight corridor and sub-area study guidelines.

These guidelines provide conditions and criteria necessary to determine the level of analysis for evaluating freight issues when conducting a corridor or sub-area study.

Section 2
METHODOLOGY FOR STUDYING FREIGHT CORRIDORS

When conducting corridor studies, a two-phased approach is recommended to determine the appropriate level of evaluation required to address freight issues and identify strategies to resolve those issues. Prior to Phase 1, a **preliminary screen** should be performed to determine if there may be freight-related issues in a corridor, especially if the corridor is in the FDOT 5-Year Work Program, in PD&E, or corridor design. A typical preliminary screening should be completed within 40 to 80 man-hours, depending on the length/complexity of the corridor.

Phase 1 consists of corridor screening activities including broadly assessing existing conditions, evaluating potential freight mobility issues identified during the preliminary screening and determining the level (scope) of study required for Phase 2 if freight related issues are present in the corridor. Phase 1 activities are generally performed prior to conducting an in-depth corridor study such as a PD&E and serve as the basis for the scope development for further study. This includes determining the type of freight study activities required and the level of effort necessary to address freight issues in the corridor study. The outcome of this activity is the development of a scope of services for conducting the corridor study that incorporates the initial analysis of freight issues identified in the previous two steps.

Phase 2 consists of in-depth freight related study requirements including collecting and analyzing data, developing potential solutions and strategies, making recommendations and follow-on activities. These activities are performed according to the scope of services developed during the Phase 1 process. In general, Phase 2 evaluations would be conducted as part of a PD&E or similar study. The scope should be specific about what freight related factors are to be studied in addition to the other scoped services.

Figure 2-1 illustrates the Phase 1 and Phase 2 steps discussed below and detailed in Sections 4 and 5, respectively. Sections 4 and 5 of these guidelines provide techniques for conducting freight corridor or sub-area studies. Appendix A contains a detailed decision/logic schematic of the process.

Data collection activities are required to support the preliminary screening as well as Phase 1 and Phase 2. Data collection activities are summarized in **Table 2-1**. The data collected in Phase 1 is used to identify potential freight mobility issues within a corridor or sub-areas that require future study. This is used to develop a scope of services for further data collection required to support detailed evaluation of these issues and the identification of strategies to resolve the issues in Phase 2.

FIGURE 2-1
FREIGHT CORRIDOR STUDY METHODOLOGY

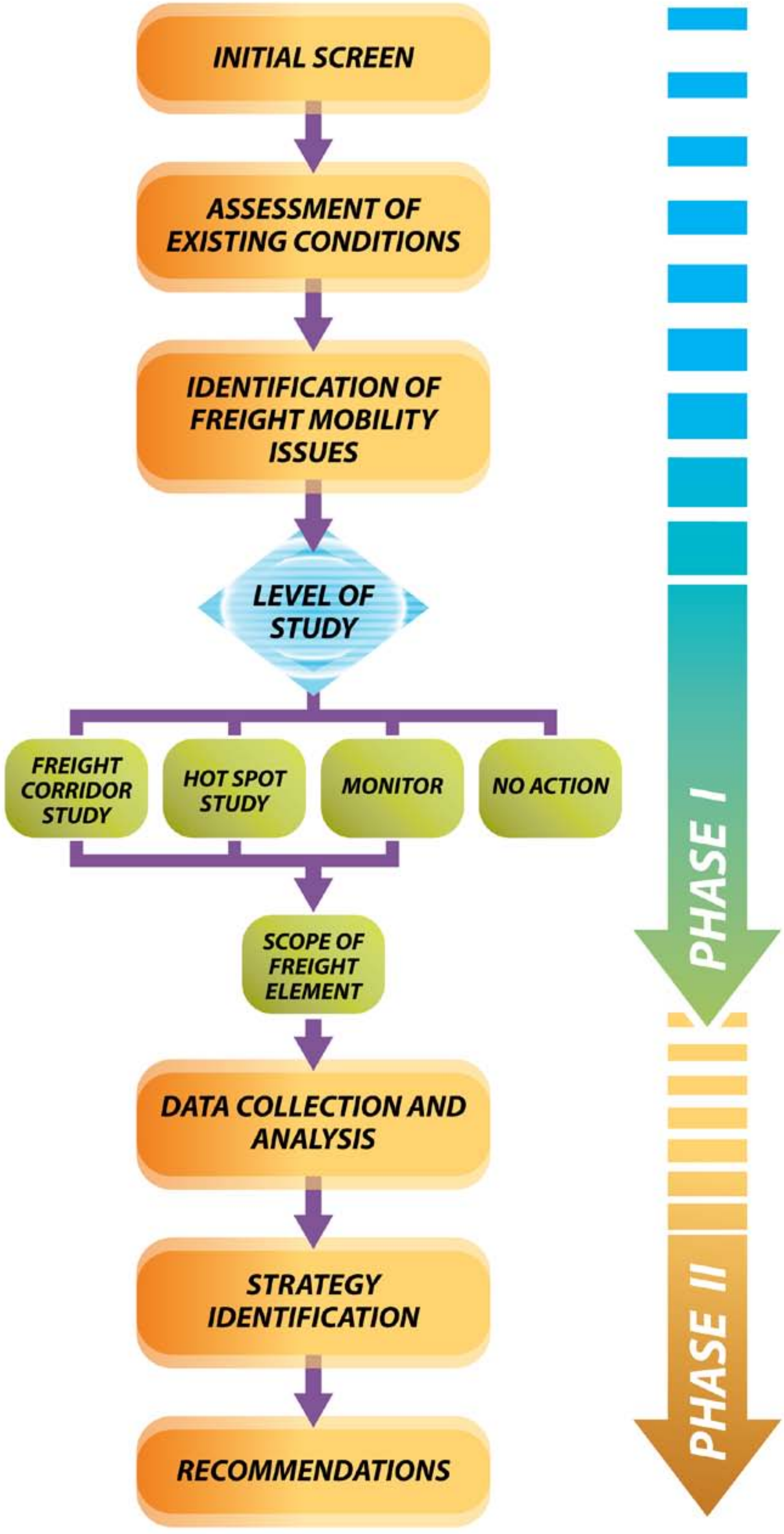


TABLE 2-1
PRELIMINARY SCREENING, PHASE 1, AND PHASE 2 DATA COLLECTION ACTIVITIES

DATA	PRELIMINARY SCREENING	PHASE 1	PHASE 2[1]
CORRIDOR OPERATIONS			
Physical Characteristics	• Visually inspect the corridor o Typical section? o Lane widths adequate for trucks? o Medians? o Turn lanes: Left / Right	• Collect available RCI data o Functional Classification o Latest Capital improvement or Rehabilitation o Typical section o Lane, shoulders, median widths o Posted speed limits • Visual observation of the corridor to verify RCI information	• Collect Additional information as needed o Driveways o Bike lanes/location limits o Sidewalk location/limits o Existing Right-of-way
Land Use	• Observe types of existing land use. • Obtain future land use map from local comprehensive plan. • Do conflicts exist that are magnified by supporting truck trips?	• Observe types of existing land use. • Obtain future land use map from local comprehensive plan. • Note if land use contributed to congestion. • Note if land use would impact roadway expansion.	• Existing land use (from visual inspection) • Planned/approved land use • Obtain aerial photograph from GIS. • Collect detailed land use/parcel information near intersections and freight "Hot Spots." • Identify specific parcels that may have an impact on project design considerations.
Traffic Counts	• Collect existing traffic counts o If ≤ 2-yrs old visually assess truck current use in the corridor	• Collect existing traffic data o If the data is < 2 Years old conduct a visual assessment of truck use in corridor. If warranted, collect classification counts. o Conduct visual observations at different times of the day. o Use existing T-factors to determine the level of truck use if classifications counts are not available.	• Based on issues identified in Phase 1, if the data is > 2 years old, collect classification counts, conduct 72-hour classification counts, preferably Tuesday-Thursday, and turning movement counts at: o Major intersections o Intersections connecting to freight terminals • Conduct turning movement counts during the truck peak hours if different from the normal traffic peaks. • Determine the gap frequency at unsignalized intersections, driveways and median openings used by turning trucks.

[1] Complete only those activities specifically indentified in the Phase 2 Scope.

TABLE 2-1 (CONTINUED)
PRELIMINARY SCREENING, PHASE 1, AND PHASE 2 DATA COLLECTION ACTIVITIES

DATA	PRELIMINARY SCREENING	PHASE 1	PHASE 2[1]
Capacity and LOS	• Collect if readily available	• Obtain existing LOS for the corridor and major intersections.	• Determine existing and future LOS for the corridor using the latest traffic count data and traffic projections. • Calculate LOS at intersections with heavy truck use.
Congestion and Delay	• Observe: Is there congestion? • Level: Moderate / Heavy? • Time of day: All hours / Peak hours?	• Observe congestion and delay and conduct quick time checks at various locations along the corridor. • Observe queue lengths at major intersections and at railroad crossings. • Estimate length of queues.	• Conduct time and delay study to determine average delay, average travel speed, and average running speed for trucks and non-truck through the corridor. • Determine queue lengths.
Signal Timing and Synchronization	• Observe queuing and delay	• Observe queuing and delays at signals. • Collect readily available signal timing information for all signalized intersections or include collection as part of Phase 2 Scope.	• Determine the average and maximum queue lengths in turn lanes by counting the number of stored vehicles during peak periods. • Count the number of vehicles completing turning movements during each cycle. • Count the number of trucks completing a turning movement during a signal cycle. • Note numbers of vehicles (including trucks) unable to cross intersection or make turn at the end of the green phase.
Maneuverability	• Observe truck turning movements o Note wide turns o Note encroachment	• Observe truck-turning movements at major intersections and corridor access points (during peak and non-peak travel periods). o Note if trucks encroach into other lanes or interfere with other drivers. o Note if trucks block traffic lanes while waiting for a gap to make a turn.	• Use data collected in Phase One.

[1] Complete only those activities specifically indentified in the Phase 2 Scope.

TABLE 2-1 (CONTINUED)
PRELIMINARY SCREENING, PHASE 1, AND PHASE 2 DATA COLLECTION ACTIVITIES

DATA	PRELIMINARY SCREENING	PHASE 1	PHASE 2[1]
Railroad Crossings	• Number and location of crossings • Note available safety features • Note crossing condition	• Identify the number and location of railroad crossings located within or adjacent to the corridor. • Observe and note vehicular delay and queuing caused by trains. • Note number of trucks delayed by trains. • Note condition of crossing. • Note safety features or lack of safety features.	• Collect information from the railroad on: o Number of daily trains using the crossing o Type of train o Average train length o Average train speed o Peak period for trains. • Conduct a rail crossing field study if a particular crossing is a problem. o Record the amount of time the gates are closed o Record the number of rail cars per train o Count the number of vehicles in the queue o Measure the distance from the gates to the back of the queue o Record the time it takes to clear the queue.
Parallel Railroad Crossings	• Note the number of crossings or parallel railroad tracks adjacent to the corridor • Note the distance between the “Stop Bar” for intersection and the nearest parallel railroad track • Note distance from EOP of roadway at the intersection and the Stop Bar of parallel railroad crossing • Note any signs telling trucks/other vehicles where to stop at crossing	• Note the number of parallel railroad crossings adjacent to the corridor. • Note available or lack of safety features. • If intersection is signalized, note changes in signal progression while the parallel crossing is closed for a passing train. (i.e., Does the signal adjust to allow for all traffic movements ***except*** those that allow vehicles to approach a closed railroad crossing during train passage?).	• Consider conducting a rail crossing field study if a particular parallel railroad crossing presents a problem for truck movements. (See above).

[1] Complete only those activities specifically indentified in the Phase 2 Scope.

TABLE 2-1 (CONTINUED)
PRELIMINARY SCREENING, PHASE 1, AND PHASE 2 DATA COLLECTION ACTIVITIES

DATA	PRELIMINARY SCREENING	PHASE 1	PHASE 2[1]
Informational signage	• Note type and location of freight/truck related signs	• Observe and note the type and location of freight related directional and informational signs along the corridor.	• Use data collected from Phase 1.
GEOMETRICS			
Turning Radii	• Observe truck turns and note problems and location	• Visually assess curbs, sidewalks, shoulders and fixed objects near corners for signs of deterioration or damage due to truck turning movements. • Note the location of stop lines on opposing approach lanes.	• Measure corner radii. • Measure distance from corner to receiving street stop lines. • Measure distance from curb to fixed objects. • Note edge of ROW (Obtain from As-built plans).
Sight Lines	• Note intersections where sight lines may be a problem	• Observe sight lines for all turning movements as well as from driveways and unsignalized side streets.	• Measure sight distances based on truck driver elevation. o Horizontal curve o Vertical curve o Skewed intersection o Obstructions to visibility
Lane Width	• Are lane widths adequate for trucks?	• Collect lane width data or measure lane widths if necessary. • Note the length of any auxiliary lanes and acceleration/ deceleration lanes.	• Determine length of auxiliary and acceleration/deceleration lanes. • Determine shoulder width. • Determine overall pavement width.
Grade	• Note location of steep grades	• Note areas where road grade may influence truck speeds and stopping distance.	• Obtain or calculate the degree and length of grade.
PAVEMENT CONDITION			
Rutting Cracking Shoulder Erosion Heaving	• Note locations with problem pavement conditions • Note locations where pavement needs to be extended to accommodate truck turns	• Observe level of pavement deterioration. • Identify the location and severity of the pavement deficiency.	• Determine the type of pavement deficiency – Rutting, cracking, heaving or shoulder erosion. • Obtain records of pavement resurfacing programs and most recent resurfacing date. • Identify possible causes of the pavement deficiency.

1 Complete only those activities specifically indentified in the Phase 2 Scope.

TABLE 2-1 (CONTINUED)
PRELIMINARY SCREENING, PHASE 1, AND PHASE 2 DATA COLLECTION ACTIVITIES

DATA	PRELIMINARY SCREENING	PHASE 1	PHASE 2[1]
ACCESS MANAGEMENT			
Median Openings	• Do median openings provide adequate access to industrial/commercial properties?	• Count the median openings on divided highways. • Determine the reason for and use of median openings (i.e., access side-streets, driveways). • Note if the median openings provide access to commercial properties requiring truck access.	• Use information from Phase One.
Driveways	• Observe and note which driveways require routine truck access	• Count and inspect all driveways along the corridor. • Determine which driveways require routine truck access. • Note if driveways contribute to congestion in the corridor.	• Note if driveway openings provide adequate access for large trucks for commercial sites.
SAFETY ISSUES			
Crash Data	• Visually determine if there are potential truck related safety issues. Where?	• Collect the last 5 years crash data for points along the corridor. • Calculate the percentage of crashes involving trucks.	• Identify contributing factors – physical, operational, etc. • Identify if the contributing factors affect trucks more than other vehicles. • Prepare collision diagrams showing the location, number, and types of collisions. • Calculate the crash rates and safety ratios for all vehicles and for crashes involving trucks.
FREIGHT TERMINAL FACILITIES			
Number of Freight Generating Facilities	• Are truck generators present along the corridor? Where? • Are truck generators nearby? Where?	• Locate/identify truck generating activities near the corridor.	• Determine the number and location of freight generating facilities within 2 miles distance of the corridor. o Transearch Data o InfoUSA Data o Aerial imagery o Field Observation.

1 Complete only those activities specifically indentified in the Phase 2 Scope.

TABLE 2-1 (CONTINUED)
PRELIMINARY SCREENING, PHASE 1, AND PHASE 2 DATA COLLECTION ACTIVITIES

DATA	PRELIMINARY SCREENING	PHASE 1	PHASE 2[1]
Interviews	N/A	N/A	• Terminal Managers o Obtain hours of terminal operation o Determine the peak operating hours o Obtain the number of trucks that serve the facility daily o Determine if there are seasonal peaks for the facility o Determine the types of trucks that access the facility • Truck Drivers o Origin and destination of trucks o Point at which trucks access the corridor o Locations of operational concern.

1 Complete only those activities specifically indentified in the Phase 2 Scope.

PRELIMINARY FREIGHT SCREEN ACTIVITIES

Prior to initiating a Phase I Freight Corridor Evaluation a preliminary screening of the corridor should be performed to assess whether or not there are potential physical or operational freight related issues. The amount of time spent on these activities should be minimal-- just enough to identify items that need to be further evaluated or vetted in Phase 1 to determine the scope of the problems that need in-depth analysis, evaluation of potential alternatives, and recommended improvement strategies in Phase 2.

The purpose of this preliminary screening process is to provide a tool and a checklist that can be used to determine if a corridor has potential for further, more detailed analysis for freight considerations. These determinations should be made in a cost-efficient manner, so as not to require detailed analysis when there is not a need for it. However, in areas where potential issues are identified, more detailed analysis would be recommended as a part of the District's ongoing efforts to assist the goods movement industries in the Tampa Bay region.

A more detailed set of goals for the preliminary screening process are as follows:

- To establish a qualitative assessment of the potential for freight and goods movement activities in the corridor,
- To identify major generators of freight and/or truck activity that may require special or further analysis,
- To identify evidence of geometric or physical constraints that may inhibit freight and truck movements,
- To identify potential safety issues associated with truck movement along a corridor, and
- To determine the appropriate level of detail to be considered for follow-on activities.

Referring to the *Freight Corridor Study Decision/Flow Process* diagram located in Appendix A, the first step in the screening is to determine if the designated corridor is currently listed in the FDOT 5-Year Work Program. If the answer is yes, then the evaluation team needs to determine if the corridor is currently under PD&E evaluation or in various stages of design. This is important because FDOT project managers and consultants need to be made aware of potential freight issues so that they may be considered in the study or incorporated into the design considerations. Following completion of the Screening Checklist refer to the *Freight Corridor Issues/"Hot Spot" Notification Matrix* (Appendix E).

If the answer to the first question is NO, then the evaluation team should determine if the corridor is a designated state or regional goods movement corridor. If the answer is NO then no further action is required. If the answer is YES, the evaluators should review the information available on the corridor in the Regional Goods Movement Database to determine if the issues noted during the screening have been documented. If not, then a Phase I Freight Corridor Evaluation should be completed.

The activities required for the screening can be found in Table 2-1. Use the *Corridor Screening Checklist* and Supplemental Intersection Checklist (if needed) located in Appendix C to complete this assessment. The checklist consists of questions designed to focus attention on potential impacts related to freight operations within the corridor.

Since this is a screening analysis, the level of detail in this phase is meant to be minimal, with follow-up corridor analyses to be completed as necessary consistent with the Phase 1 or Phase 2 analysis of these *Freight Corridor and Sub-Area Study Guidelines*, as appropriate. For this phase of the process, the goal of this preliminary screening report is to answer three questions:

- Is there sufficient freight and/or goods movement activity in the corridor to warrant a follow-up study?
- What are the major issues to be addressed in the follow-up study?
- Is there physical evidence in the corridor that demonstrates a need for further study?

This preliminary screening analysis is meant to be very brief. The results of this preliminary screening analysis can then be used for the following purposes:

- To serve as input for the project management or design process to incorporate design features or further analysis results for projects planned along the corridor;
- To serve as the impetus for further, more detailed analysis along the corridor through Planning, Traffic Operations, Safety, or Design, as appropriate; and
- To provide input to local governments for inclusion into their planning or design processes.

As a result of this preliminary screening process, two documents will be produced that can be provided to the appropriate staff at District VII for follow-up, if needed.

- A Freight Movement Screening Technical Memorandum, which summarizes key finding, conditions, and recommendations for further follow-up; and
- A copy of the Initial Freight Corridor Screening Checklist, which includes the field notes describing the conditions and findings.

If the corridor is a designated regional goods movement corridor, a copy of the reported checklist will be attached to the corridor in the Tampa Bay Regional Goods Movement Database for future reference.

PHASE 1 - CORRIDOR EVALUATION ACTIVITIES

ASSESSMENT OF EXISTING CONDITIONS

Assessing the existing conditions in the corridor provides needed information to determine the level of analysis required to address freight issues. This step includes observing the physical condition of the corridor and the immediate surroundings. This is the initial step in all corridor studies, but for truck routes or freight corridors, evaluators should take special note of conditions that may contribute to inefficiencies in freight movement. Of special concern is the existence and location of major freight generators within the area that may contribute to truck traffic along the corridor. Use the checklist in Appendix D to ensure the required data is acquired. The checklist includes a column for the name of the person assigned to collect the data and record the completion date.

IDENTIFICATION OF FREIGHT MOBILITY ISSUES

Phase 1 involves further evaluating the potential mobility issues identified corridor screening from a freight operations perspective. Consider the following topics:

- What are the problems that trucks will encounter within the corridor?
- What problems do trucks create for other vehicles?
- Are there physical or operational constraints, capacity issues, or safety concerns?
- What is the extent of the problems and where are they located?

Many freight mobility issues will be recognized while completing the initial field survey of the corridor. A professional with experience evaluating freight operations should be included on the survey team, especially if the corridor serves a high percentage of heavy trucks.

DETERMINING FREIGHT STUDY LEVEL OF ANALYSIS

The type of freight study and level of evaluation has the following four potential outcomes based on the information developed during the screening process in steps 1 and 2 above.

1. Corridor Study or Sub-area Study
2. Hot Spot Study
3. Monitor the Corridor/Study the Area
4. No Freight Study Needed

The type of freight study dictates the effort that is required to analyze and address the identified freight mobility problems. The Freight Corridor Study, Sub-Area Study, and Hot Spot Study involve the same general procedures, which include collecting and analyzing data, developing a strategy for addressing the issues/problems, and recommending a preferred solution. The level of effort or the number of elements studied is dependant on the type of issues identified and area of focus.

- ***Corridor*** studies focus on the entire corridor area or a sub-section of the corridor with a level of effort ranging from studying all physical and operational elements of the corridor to examining specific freight related issues such as roadway geometry or congestion.

- ***Sub-area*** studies generally involve a large geographical area that focuses on freight circulation within the area, and often contains many freight generating businesses because of the impact these locations have on the trans network.

- ***Hot Spot*** studies focus on a particular problem location within a corridor or sub-area such as an intersection, railroad crossing, interchange, or short segment. A hot spot study can be determined from initial evaluation of the corridor or sub-area, or can be a sub-study of these two freight study types.

- ***Monitoring*** is not specifically a freight study activity but rather, it recognizes that some level of freight activity exists within a corridor or sub-area necessitating monitoring the corridor or sub-area for potential future freight issues.

Criteria or thresholds are necessary to identify what issues or considerations warrant the need for detailed analysis of truck or freight-related conditions. Mobility issues such as roadway capacity and level of service, delays and congestion play a critical role in prioritizing the need for studies and analysis within a corridor/sub-area and would ultimately be the main factor in identifying and recommending improvements.

The scope of the freight element for the next phase of data collection and analysis will be determined by indicators and guidelines related to level of service, freight generators, physical conditions, operational issues, and safety issues.

The Freight Corridor Study Decision/Flow Process diagram located in Appendix A may be used as a guide to determine the course of action leading to specific recommendations regarding freight-related improvements to the corridor or Hot Spot. The diagram uses a series of decisions that lead to:

- Issue Identification,

- Determination of the Level of Study for Phase 2,

- Development of the Phase 2 Scope (i.e., specific issues/problems to be studied),
- Issue Evaluation,
- Solution Development, and
- Final Recommendations.

PHASE 2 - FREIGHT STUDY ACTIVITIES

DATA COLLECTION AND ANALYSIS

Not all goods movement related issues require the need for a detailed corridor or sub-area study. The intent of the Phase 1 evaluation is to identify the issues that require further in-depth investigation. Initial data collection activities will have taken place during this phase. Additional freight related data should be collected in Phase 2 only as necessary to analyze those issues identified in the Phase 1 evaluation.

After identifying elements needing further study, collect all data pertinent to the problem/issue that will enable a detailed analysis of the problem and the development of a recommended solution (see Table 2-1) if not already collected during Phase 1. Section 5 describes the various potential data requirements.

STRATEGY IDENTIFICATION

After identifying and analyzing the freight related issues, develop strategies to improve freight travel conditions within the corridor. Determine both the low-cost quick-fix type solutions and the larger capacity improvements required to address the issues. Short-term projects generally involve operational or physical changes considered normal maintenance, such as signal timing adjustments, minor paving to eliminate rutting and other minor physical problems, or lengthening turn storage lanes. Longer-term solutions include major capital improvements such as adding lanes, constructing grade separations, substantial intersection upgrades and roadway resurfacing.

RECOMMENDATIONS

Based on the strategies analyzed in the preceding step, recommend activities required for implementation. If the recommendations involve a long-term solution, with several phases, it should include a proposed action plan with short- and medium-range objectives.

Section 3
PRELIMINARY SCREENING GUIDELINES

The following sections provide the appropriate topics and considerations to be covered for the preliminary screening analysis. Judgment should be used by the analyst, with more or less emphasis to be given to any item as conditions warrant. These guidelines are meant to enable the analyst to determine the final level of appropriate detail, or the inclusion or exclusion of additional analysis factors as needed. Use the Screening Checklist located in Appendix C to document findings and to serve as an outline for the Screening Technical Memorandum.

INDENTIFY MAJOR FREIGHT MOVEMENT ACTIVITY CENTERS OR GENERATORS

Review the District's databases, and perform field review along the corridor to identify shippers, truckers, or other sites that may concentrate freight or truck traffic. The field reviewer should be aware of and identify truck route signage, business signs, post offices, shipping or freight package companies, and other activities which are likely to generate truck traffic. The reviewer should also identify where they are located, and the type of access provided to them (full access median openings, restricted median openings, signalized intersections, etc.).

In addition, the reviewer should make note of the nearest regional freight facilities, that may indicate the predominate direction of ingress/egress to the sites.

DRIVEWAY OR ACCESS OBSERVATIONS

Observe the operations at the driveways or intersections and note the degree of ease or difficulty of making turns into or out of the facility. Items to consider when making field observations include:

- Geometric issues, such as the ability to make a turn within the existing pavement without any special maneuvering required.
- Adequacy or inadequacy of gaps in traffic to allow trucks to make ingress or egress maneuvers.
- Sight distance issues for trucks or for conflicting vehicles, including:
  - Obstructions in clear line of sight triangles at intersection, (unobstructed line of sight to the left and right);
  - Vertical curvature that may inhibit visibility for trucks or conflicting vehicles;
  - Horizontal curvature that may inhibit visibility for trucks or conflicting vehicles; and

- o If the roadway is multi-lane, are trucks crossing the nearside travel lanes and waiting for gaps in farside traffic? Are they queuing in the median opening? If so, is the median opening width sufficient to allow queuing?

- For unsignalized conditions, are there conflicts within the median opening with other vehicles or other trucks?

Each of these items should be noted at each driveway or intersection and should be summarized in the Technical Memorandum.

GEOMETRIC INVENTORY OF CORRIDOR

The next step in the screening process is to perform a geometric inventory as part of the field review. The main focus of this field review is to identify areas of concern in relation to truck movements. Items to review include:

- Turning radii at intersections and driveways:
  - o Evidence of broken curbs, inlets, or off-tracking onto shoulders that indicate inadequate turn radii;
  - o Scuff marks, tread marks, or other evidence of off-tracking onto medians, islands, or other traffic control devices; and
  - o Evidence of scrapes, scuff marks or other conflicts with signs, poles, or other nearby fixtures.

- Pavement damage indicative of heavy truck traffic:
  - o Heaving, or other pavement damage, at intersections. When trucks are present in large numbers, it is common to see pavement at intersections pushed forward near the stop bar, as trucks stop at the intersection, and their momentum pushes, or heaves the pavement;
  - o Rutting is common away from intersections in areas of high truck activity; and
  - o Cracking or shoulder damage could result from off-tracking or inadequate turn radii. This is also common in areas where trucks make frequent U-turns.

- Turn lane sufficiency/queue length:
  - o In areas where truck generators are prevalent, observe operations at major driveways and/or intersections to determine if queue lengths are adequate for trucks to be fully out of the travel lanes while turning; and

  - Observe signal operations to determine if sufficient green time is available for turning movements to accommodate major truck movements.

- Railroad Crossings:
  - What safety devices are present? (Gates, lights and bells, cross bucks, etc.).
  - Is there a raised median to prevent vehicles from circumventing gates?
  - Are there crossings on tracks that are parallel and in close proximity to the road corridor?
  - What is the minimum distance between the edge of pavement and the railroad crossing “Stop Bar”? Is this adequate for large trucks? (74’ minimum distance).

CRASH DATA

Obtain crash data for the study corridor and review it for the number of crashes involving trucks. Also, review crash data for non-truck crashes involved in the proximity of freight or truck generator driveways and access points. Report trends or observations as to the types of crashes and their locations.

Based upon this review, identify any potential trouble spots that may require additional, more detailed analysis of crash data and trends.

LAW ENFORCEMENT INTERVIEWS

Interviews with law enforcement officials can be very instructive and informational in the identification of issues, trouble areas, or local conditions that may be applicable to traffic operations conditions. An attempt should be made to speak with local law enforcement with respect to overall traffic operations conditions, perceived high crash locations, speed or enforcement issues, or issues related to trucks or freight movements. Information obtained from these interviews should be summarized in the Technical Memorandum. If there are follow-up activities required as a result of the interviews, they should be noted in the Screening Technical Memorandum and the Table 1.

OTHER FACTORS

The analyst should explain other factors that may be pertinent to the need for subsequent study. Other factors include items that could have an impact on traffic operations, congestion, or freight movement, if known, such as:

- Proposed or planned new development or existing development expansions;

- Facility improvements that could change truck routes;

- Facility improvements that could affect traffic operations or congestion, positively or adversely, such as widening, parallel improvements, signalization, access management improvements, etc.;
- Emerging trends that could impact freight movement, such as expansion or contraction in the demand for particular commodities that are prevalent in the corridor; and
- Local plans that could affect the corridor, such as transit system improvements and local roadway improvements.

Bigger picture types of activities that may positively or adversely affect goods movement or traffic operations in the corridor may also be important factors and should be further investigated.

RECOMMENDATIONS

Once the above analyses have been completed and are documented in the Freight Movement Screening Technical Memorandum, recommendations for further action should be developed. Typical recommendations for further action could include:

- Conduct a follow-up study consistent with the District 7 *Freight Corridor and Sub-Area Study Guidelines*. Recommendations as to the level of detail of the follow-up study should be included. Also, areas of focus developed under this screening process will also be identified. Specific concerns or issues to be further investigated will be detailed. If possible, provide estimates required for a follow-up study. These estimates can change as the detailed follow-up work begins, but they will give those responsible for the follow-up activities an idea of the level of effort and detail envisioned.
- Provide a referral to other internal departments at District 7. This could include the recommendation for safety investigations, access management studies, or inclusion into other District production activities, such as resurfacing projects, capacity projects, intersection improvements or PD&E studies.
- Provide a referral to local agencies for follow-up activities. These activities could include items similar to the above, and could also include signage improvements, law enforcement activities, etc.

TECHNICAL MEMORANDUM

A technical memorandum will be prepared that summarizes the findings of the above screening analysis. The level of detail in the technical memorandum will commensurate with the level of detail required for the screening process.

Topics to be covered include each of the items summarized in Table 1. If there are significant issues that arise as a result of the review, they should be documented in sufficient detail so as to provide the District with an understanding of the issues, so that a determination can be made as to whether a Phase 1 or Phase 2 Corridor Study is appropriate.

Section 4
PHASE 1 – CORRIDOR SCREENING ACTIVITIES

Before beginning the evaluation process, review the Scope of Services (SCOPE) for Phase 1 Evaluations (Appendix B). The following section provides the detailed guidance needed to fulfill the requirements set forth in the Phase 1 Scope and complete the Phase 1 Checklist located in Appendix C. Note: reference numbers in brackets ([ ]) refer to the numbers on the checklist.

ASSESS EXISTING CONDITIONS

The first step in any corridor or sub-area study is collecting data to assess the existing conditions. This assessment is generally accomplished via observation. Observe the existing conditions with a freight related focus to determine the potential freight mobility issues and the level of effort needed to evaluate and address these issues. Complete the following Phase 1 activities for all corridor and sub-area studies:

- Evaluate Corridor Operations,
- Evaluate Roadway Geometry,
- Assess Existing Pavement Conditions,
- Evaluate Existing Access Management,
- Evaluate Safety Issues, and
- Assess Existing and Potential Freight Activity.

EVALUATE CORRIDOR OPERATIONS

PHYSICAL CHARACTERISTICS

Collect the following Roadway Characteristics Inventory (RCI) data:

- Roadway functional classification;
- Last Capital Improvement or Rehabilitation;
- Existing typical section(s) for roadway segments (Include lane, median, and shoulder widths); and
- Posted speed limits.

Field technicians should drive the corridor and, if feasible, videotape the corridor in both directions. Voice-overs should include the names of street intersections and other pertinent information. Key elements should be located via geo-positioning equipment or by distance measured from the beginning/end of the corridor. If videotaping is not feasible, complete the inventory by recording each of the elements and their distance from the beginning/end of the corridor or by marking a corridor map.

Other items to be included in the inventory are the type and location of all traffic control signs, locations of utility poles in relation to the edge of pavement, and the number of driveway openings (count between intersections). Note locations where the posted speed limit changes.

Review current transportation plans, including the Florida Department of Transportation (FDOT) Work Program, Local Government Capital Improvement Programs, and Metropolitan Planning Organization (MPO) Long Range Transportation Plans (LRTPs) to identify planned improvements within the corridor. Describe and map all programmed and planned improvements, including the schedule for each phase of the project implementation. Note if the planned improvements address the identified freight issues. If the planned improvements address the freight issues then there may not be a need for further study. In these instances, monitor the corridor to ensure the improvements have resulted in enhanced freight operational mobility and safety.

TRAFFIC COUNTS [1.1.0 – 1.2.3]

A sound and comprehensive set of traffic counts is essential to the proper assessment of existing and future conditions within the study corridor. These counts should properly identify the amount and classification of truck traffic. Generally, collect available vehicle classification counts from agencies with jurisdiction over the roadways in the corridor or sub-area as long as they reflect existing conditions. Counts older than two years should not be used. **If new or additional vehicle classification counts are needed, collection requirements should be included in the Phase 2 Scope.**

CAPACITY AND LEVEL OF SERVICE (LOS) [3.2.1 – 3.2.2]

Determine the existing and future capacity of the corridor in order to identify the primary issues that typically affect truck movements, which are capacity and congestion. Therefore, conduct a preliminary LOS assessment of the existing vehicular demand compared to the available capacity. This assessment should be based on the existing LOS information available from FDOT or the MPOs. **The purpose of this Phase 1 assessment is to identify segments or intersections that are currently failing or approaching failure and to ensure detailed analysis is included in the scoping for Phase 2.**

Signal timing can cause vehicles to back up into through lanes if turn lanes are not long enough to accommodate the queue.

CONGESTION AND DELAY [3.2.1 – 3.2.7]

Conduct a field review to observe congestion along the corridor. Measure delays at intersections, railroad crossings and other locations where routine delay exists. Observe and document queue lengths to identify locations in the corridor for further detailed evaluation. **If delay routinely impacts freight operations, include in Phase 2 Scope for detailed study.**

SIGNAL TIMING AND SYNCHRONIZATION [3.2.2 – 3.2.4]

Typical signal synchronization generally supports the flow of commuter traffic without consideration of truck operations. As a result, trucks often experience operational delays. Trucks do not accelerate at the same rate as smaller vehicles and as a result, experience frequent delays due to red lights from one intersection to the next along a corridor. This results in delay costs, driver frustration, higher fuel consumption and pollution. In addition, corridors with poor signal progression may increase the number incidents of red-light running. On corridors that are designated regional freight mobility corridors, truck routes, or roads that handle large numbers of trucks a signal progression that allows trucks to move as freely as possible should be considered/recommended.

Observe signal timing/phasing for all signalized intersections. Signal timing relates to the amount of time available for vehicles in the queue to turn or proceed through the intersection. Observe signal timing at congested locations and determine if the signal phasing for each movement is adequate to clear all vehicles at the end of the green phase. Review phasing and signal progression. **Ensure a signal phase analysis is included in the Phase 2 Scope if this is a problem.**

Signal timing relates to the amount of time available for vehicles in the queue to turn. In the case of intersections where there is heavy left turn movement by trucks, the left turn arrow should remain on long enough to allow several trucks to make a left turn. If the signal timing is too short, only one or two trucks may make it through resulting in operational delay impacts. When the number of incoming vehicles fills the back of the queue faster than the front of the queue clears the intersection, traffic will back into the left through lane causing additional congestion and delay if the storage lane and or signal timing are not long enough to accommodate the queue.

At busy intersections, left turn lane storage should be adequate to accommodate arriving trucks and other vehicles waiting to turn. Short turning lanes are easily identified during peak periods because turning traffic backs into and blocks the left through lane. Approaching vehicles must switch lanes or be stuck in the queue. **Ensure that a full analysis of the storage capacity is included in the Phase 2 Scope if this is an issue.**

MANEUVERABILITY [3.3.2 – 3.3.6]

Observe truck-turning movements at major intersections and corridor access points during peak and non-peak travel periods. The field surveyor should note and photograph cases of trucks encroaching into other lanes or interfering the movement of other vehicles. Document trucks tracking over curbs and sidewalks, damaged structures such as signs and poles, and the approximate location where turning trucks return to their travel lane after making a turn. At truck access points, note if trucks block travel lanes while waiting for gaps to make left turns. Note the frequency of occurrence and the approximate queue that develops due to this maneuver. **If maneuverability appears to be a problem, include in the Phase 2 Scope.**

Sidewalk and infrastructure damage resulting from insufficient turning radii and the location of utilities infrastructure.

Truck blocks three lanes of traffic waiting for gap in opposing lanes to complete left turn through median.

Truck tracks over sidewalk while making wide turn into on-coming traffic. Note the building overhand that extends over the sidewalk almost to the curb which adds to the difficulty of this turn for trucks.

RAILROAD CROSSINGS [3.2.7]

Identify the number and location of railroad crossings within or adjacent to the corridor. Observe and note vehicular delay caused by train crossings and estimate the length of the queue. Note the number of trucks delayed by trains. **If railroad crossing delay is an issue, include in the Phase 2 study scope.**

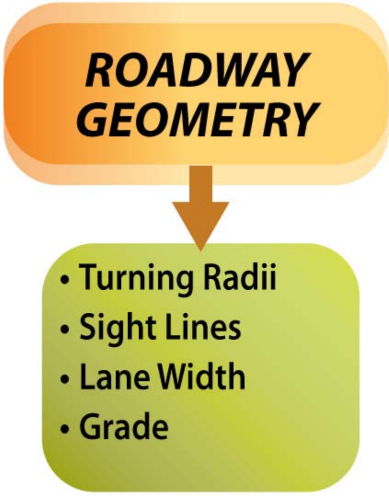
Identify any crossings on side streets at parallel railroad tracks that are in close proximity to the roadway corridor being studied. If the cross street is used by trucks, note if delay is an issue for these trucks as well as for trucks needing to turn from the roadway to the side street. Note changes in traffic signal progression when the crossing gates are down.

Railroad crossings, especially those near rail yards are a particular problem for truck operations because trains move slowly when entering the yard and often must stop to wait for track switching resulting in long delays to vehicles at the crossings.

INFORMATIONAL SIGNAGE [3.3.13]

Observe and note the number of and location of informational signage within the corridor. The location of informational signage should provide enough advanced warning so that trucks can safely perform the maneuvers required to change lanes, decelerate prior to turning/exiting, and identify routes to port facilities, intermodal facilities and other large freight activity centers.

EVALUATE ROADWAY GEOMETRY

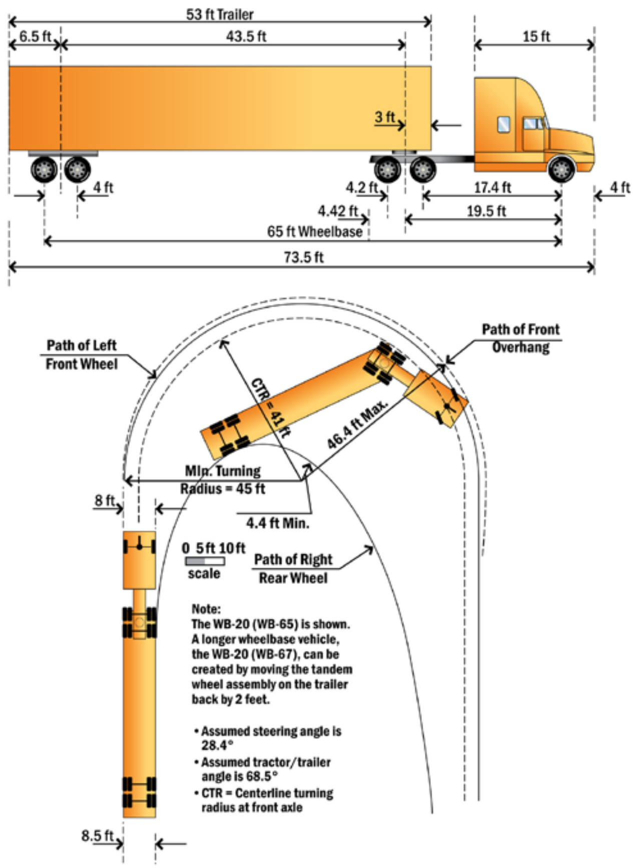


Geometric design is an important element when considering truck movement in intersections and at freeway interchanges due to the longer length of modern freight trailers and containers. Assess existing geometrics including turning radii, length of exclusive turn lanes and acceleration lanes, and the location of traffic-control pavement markings and the effect on large truck operations and maneuverability. Assess how intersection design and truck operations affect congestion and the movement of other vehicles. Also, assess interchange improvements at locations with a high percentage of heavy trucks. The appropriate evaluation criteria for assessing roadway geometry are the AASHTO standards for trucks.

TURNING RADII [3.3.1, 3.3.2, 3.3.5]

For corridors that carry large volumes of heavy trucks, the corners of intersections should include turning radii that will allow trucks to turn without damaging shoulders, curbs and sidewalks as well as to not encroach into oncoming traffic. Visually inspect and assess curbs, shoulders, and fixed objects near corners for signs of deterioration or damage due to truck turning movements. Note whether the corner curbing is designed to be mountable by large trucks. The radii of freeway ramps should be able to accommodate large trucks at the posted ramp speed. **Note deficiencies for further analysis and include in the Phase 2 Scope.**

This two-photo sequence shows how roadway geometry can affect the turning movements of trucks.



SIGHT LINES [3.3.8]

Visually identify sight line issues. Inadequate sight lines affect every type of vehicle. They are a particular problem for trucks that need large gaps to safely pull into a traffic stream across a roadway. **If problems are apparent, ensure that a detailed sight line evaluation is included in the Phase 2 Scope.**

LANE WIDTHS [3.3.3]

Collect lane width data from the RCI or measure as necessary. Lane widths on truck corridors should be a minimum of 12-ft wide. Auxiliary lanes such as turning lanes should be long enough for a truck to slow down as well as accommodate a turning queue that does not result in traffic blocking through lanes. Observes and identify corridor segments where lane widths may be contributing to operational deficiencies for trucks. **Ensure that these areas are included in the Phase 2 Scope if necessary.**

GRADE [3.3.11]

Steep grades affect not only truck stopping distance but also impact acceleration. Even a slight grade can affect the overall performance of trucks resulting in high fuel consumption, pollution, and increased congestion for other vehicles in a following position. During field review, observe and note areas where road grade may influence truck speeds and stopping distances.

VERTICAL CLEARANCE [3.3.9]

Low vehicle clearances can prevent trucks from operating over a corridor. This includes not only bridge and tunnel clearance, but also utility wire clearance as well as low hanging tree limbs. The minimum clearance for trucks is 13.5 feet (FDOT Greenbook, Table 3-2).

PAVEMENT CONDITION [3.3.12]

Identify pavement deficiencies during the visual observation of the corridor. Pavement deficiencies include:

- Rutting,
- Heaving,
- Cracking, and
- Curb or shoulder erosion.

RUTTING

Rutting and heaving deterioration caused by heavy trucks.

Note the location and severity of rutting. Pavement ruts may be due to the heavy weight of trucks especially at intersection approaches where heavy braking and standing occurs. In areas, where rutting is a particular problem, the analyst should determine if the rutting is due to trucks. For example, the pavement design may not be adequate for the volume of trucks using the facility.

HEAVING

Heaving is generally caused when water enters cracks in the pavement and expands due to freezing causing the pavement to buckle. Heaving can also be caused bv heat expansion when dirt and sand enter concrete pavement joints preventing normal expansion and causing the pavement to rise, buckle and crack at the joints.

CRACKING

Note areas where cracking has occurred. Cracking may result in the development of large potholes especially during extremely hot weather, after heavy rainfalls, or during freeze/thaw cycles with heavy truck traffic.

CURB OR SHOULDER EROSION

Identify areas of curb or shoulder erosion during the visual assessment of the corridor. Generally found at intersections, curb cracking or shoulder erosion is a result of inadequate turning radii. Trucks making right turns sometimes run off the roadway surface causing erosion of the shoulder or cracking of the curbs and adjacent sidewalks.

Examples of curb and sidewalk erosion resulting from weight semi-trailer trucks tracking over the curb due to insufficient turning radii to accommodate semi-trailer trucks.

ACCESS MANAGEMENT

Access to or from businesses can be a significant problem for heavy trucks. Recent trends indicate the use of large tractor-trailers for many local deliveries to businesses such as large retail stores and warehouses as well as smaller businesses including restaurants, convenience stores, gas stations and fast food establishments. Therefore, it is essential that driveways, turnouts, and median openings on corridors that accommodate high truck volumes be designed to ensure that truck operations are not constrained by substandard access that may result in delay and inefficient truck movement through the corridor. Substandard access may result from any of the following conditions:

- Lack of median openings for trucks to make left turns,
- Excessive median openings that result in too much cross traffic,
- Inadequate driveway openings,
- Excessive driveways that result in reducing traffic flow due to roadway access and egress maneuvers, and
- Closely-spaced driveways.

MEDIAN OPENINGS [3.3.6 – 3.3.7]

If the study corridor is a divided roadway, collect median opening data from the RCI or available roadway plans and field-verify any operational/maneuvering problems that may be suspected or occurring. Note the number of median openings available for trucks and other vehicles to access driveways opposite the direction of travel and note the intensity of use. Observe delays and/or backups for vehicles using the openings.

The length of the left turn storage lane is too short to accommodate semi-trailer trucks, which block the left through lane while waiting for an opportunity to turn left into the driveway that serves a large warehouse/distribution industrial park.

Median openings are required to provide cross traffic movement that allows left turn access to cross streets and driveways and for making U-turns. The location and number of median openings influences to the efficient movement of traffic on the facility. Reducing the number of median openings results in improved levels of service and reduced stop and go traffic.

Median openings are critical in areas where large trucks must turn left to access non-signalized streets and delivery points on the opposite side of a divided facility. In urban areas where there are numerous access points along a segment of a corridor, replacing the median with a continuous left turn lane may be advantageous. The lack of median openings in various segments may force trucks to make U-turns at intersections, which may not have adequate geometry for this maneuver, resulting in delay to other trucks and vehicles that must wait while the truck completes the U-turn.

On the other hand, excessive median openings, where not justified, result in uncontrolled cross traffic. This can result in delay and safety issues caused by traffic constantly braking for vehicles crossing the roadway through the medians.

DRIVEWAYS [3.4.1 – 3.4.3]

According to the FDOT Driveway Handbook, "Driveways should be located and designed to minimize impacts on traffic while providing safe entry and exit from the development served. The location and design of the connection must take into account characteristics of the roadway, the site, and the potential users."

Identify areas along the corridor that contain numerous driveway openings or where driveways are spaced too close together. Too many driveways, especially in commercial areas reduce the operational effectiveness of a corridor due to the large number of vehicles entering or leaving the roadway. In a heavily used freight corridor, this results in congestion, and delay.

Collect information on driveway cuts from existing roadway plans. Verify this information during the field review by inspecting all driveways along the corridor. It is important to detect new driveways added since the last update of the roadway plans. Note the type of access, such as residential or commercial, and their spacing along the corridor and whether the driveway contributes to congestion.

SAFETY ISSUES [3.5.0]

Like congestion and other mobility issues, safety considerations are pivotal in the evaluation of truck operations. Safety issues are usually identified by a higher percentage of accidents than at other locations along the corridor.

CRASH DATA [3.5.1 – 3.5.4]

Collect crash data for the last three years for points along the corridor.
Review the historical crash statistics for the corridor to help identify the locations where most crashes take place, the type of crash, number of injuries/deaths, truck involvement and the causes. Calculate the percentage of crashes involving trucks. **If the percentage of truck accidents is greater than the percentage of trucks in the corridor, include a safety audit in the Phase 2 Scope.**

RAILROAD CROSSINGS [3.5.5]

Ensure that there is a safe distance for semi-trucks to safely stop between the railroad crossing and the parallel roadway. For a typical large semi-truck, the minimum safe distance should be at least 74 feet from the edge of the pavement of the parallel roadway to the railroad crossing stop bar.

BICYCLE/PEDESTRIANCONFLICTS [3.5.7]

Note the presence of bicycle lanes on the roadway as well as marked and unmarked crosswalks. Is there adequate safety clearance for bicycles to operate in the presence of large trucks? Do right turn movements endanger pedestrians waiting at a corner to cross the street?

Bike lane on truck route. Note that trucks use all lanes. Bikers could find themselves between two large trucks at this location.

FREIGHT TERMINAL FACILITIES [2.0.0]

NUMBER OF FREIGHT GENERATING FACILITIES

Determine the general proximity and number of freight generators that may impact the corridor.

- Use aerial photograph as a first step, followed by general field observations.
- Note the names of large truck generators such as Distribution Centers, manufacturing plants, etc.
- Develop a list of sites that can be use for more detailed research in Phase 2.

IDENTIFY FREIGHT MOBILITY ISSUES

In order to determine the level of evaluation required to address freight mobility constraints within a corridor, establish a basic understanding of the potential freight mobility issues by:

- Determining the level of freight activity;
- Identifying existing and planned freight generators in the corridor; and
- Identifying physical, operational, and safety issues related to freight mobility.

LEVEL OF FREIGHT ACTIVITY

CAPACITY AND LEVEL OF SERVICE (LOS) CONSIDERATIONS: [3.2.1 – 3.2.2]

While chronic congestion is easy to identify, obtain other useful indicators of failing capacities and LOS from inventories, concurrency management systems or from an initial assessment of traffic conditions. Intersections (signalized or not) often present the most critical operating conditions and can influence the level of service of the corridor. Corridors with LOS D or worse should be given further consideration for studying the issues that may have contributed to this condition.

TRUCK VOLUMES [1.2.2 – 1.2.3]

Facilities with heavy trucks accounting for at least 5 percent daily traffic and 2 percent of total peak hour traffic indicate freight activity that may require further study. The higher the truck percentage, the more likely freight issues exist in the corridor if other contributing factors are also present.

PROXIMITY TO MAJOR FREIGHT GENERATORS [2.1.0, 2.2.0]

The proximity to major freight activity centers or truck generators is an important factor in determining the type of evaluation conducted during the corridor study. If several freight terminals or freight generating facilities are located within an area, it may be more meaningful to conduct a sub-area study that includes the roadway network in the vicinity of those generators. Generally, freight generators located within two miles should be considered within the area of influence on a corridor.

PROXIMITY TO INTERMODAL CENTERS [2.3.0, 2.4.0]

Intermodal centers (airports, seaports, rail stations) within two miles of the transportation corridor may exert significant influence at various locations along the corridor. These facilities are generally responsible for generating large numbers of trucks on regional corridors as well as on local connecting streets. In addition to including freight as part of a general corridor study, consider expanding the study to include sub-areas with intermodal activity or recommend a separate sub-area study.

PHYSICAL, OPERATIONAL AND/OR SAFETY ISSUES

GEOMETRIC DESIGN [3.3.1 – 3.3.2]

Evaluate the geometric data and information gathered during the existing conditions assessment. Determine if turning radii, site lines, lane width, and grade issues exist that create problems for the efficient movement of trucks.

PAVEMENT CONDITIONS [3.3.10]

While pavement conditions (good or poor) are a direct function of the maintaining agency's resurfacing schedule, rutted or worn out pavement, especially at intersections and on turning lanes, provide a good indicator of deficiencies. Pavement conditions are defined as:

Very Good	Newly Built or resurfaced and distress free.
Good	Smooth surface with little to no cracking or rutting.
Fair	Serviceable with shallow rutting and moderate cracks beginning to occur, but does not affect travel speed on the corridor.
Poor	Same problems as fair but worse, causing some reduction in speed.
Very Poor	Major problems with potholes etc., causing substantial reductions in speed.

ACCESS MANAGEMENT [3.3.6 – 3.3.7, 3.4.1 – 3.4.2]

Consider further evaluation of access management issues noted during the assessment of existing conditions if they affect efficient truck movement.

SAFETY/CRASH FREQUENCY [3.5.1 – 3.5.4]

The frequency of crashes involving trucks is a common parameter. In general, if the percentage of truck crashes is greater than the percentage of trucks using the corridor, or at a particular location within the corridor (Hot Spot), it provides a solid indicator of potential problems affecting trucks that would warrant a detailed safety analysis.

RECOMMENDED ACTION MATRIX

Table 4-1, provides a screening method to determine the level of analysis that is appropriate to address identified freight mobility issues in the corridor. Once the level of analysis is determined, the specific evaluation activities should be included is a corridor study scope of work and accomplished following the guidance described in Section 5.

TABLE 4-1
FREIGHT CORRIDOR ANALYSIS
INDICATORS AND RECOMMENDED ACTION MATRIX

Freight Corridor Analysis Indicators			
Meets Level of Truck Activity? Daily: ≥5% Peak: >2%	**Presence of Freight Generators?**	**Physical, Operational, Safety Problems?**	**Proposed Level of Action**
X	**X**	**X**	**Freight Corridor Study** is warranted
X		**X**	Focus on **Freight Hot Spots** or limited Freight Corridor Study
X			**Monitoring** may be warranted
X	**X**		**Limited Freight Corridor Study**—address specific problem criteria only
	X	**X**	Focus on **Freight Hot Spots** or limited Freight Corridor Study
		X	Focus on **Freight Hot Spots**
	X		**Monitoring** may be warranted
			Supplemental Freight Analysis is not warranted

DETERMINE EVALUATION EFFORT FOR FREIGHT MOBILITY ISSUES

After performing a preliminary screening analysis based on the information described above, compare the results against recommended thresholds to determine if further action is required from a freight perspective. If there are no observed (or perceived) freight problems, then no further action is required and the corridor study can proceed without an analysis of freight issues. If freight problems are determined to exist, then use the indicators to classify the freight corridor and determine what additional analysis is necessary to supplement the overall corridor study. The goal is to complete the appropriate level of analysis to ensure that freight needs are identified and analyzed. This should lead to improvements that facilitate freight movement through the corridor.

Table 4-2 summarizes the factors for consideration when determining whether a freight study should supplement a general corridor study. Note that simply having identified potential issues in any of the factors does not necessarily lead to a comprehensive freight study, but rather may indicate a targeted freight study that analyzes only the factors of concern. However, if there is a high level of trucking activity, freight generators, and existing safety and operational problems in the corridor, complete a full evaluation of freight issues as part of a general corridor study.

TABLE 4-2
GUIDELINES FOR DETERMINING FREIGHT ELEMENTS FOR CORRIDOR AND SUB-AREA STUDIES

Factor	Study Element	Study Element Not Required	Study element required in Freight Study
Level of Freight Activity	Roadway Level of Service (LOS)	LOS C or better throughout most of corridor/area	LOS D or worse throughout most of corridor/area
	Truck Volume	Less than 5% Heavy Trucks Daily	Heavy trucks >5% daily and/or > 2% peak
	Designated or Proposed Freight Mobility Corridor or Truck Route	No	Yes
Freight Generators	Proximity to major freight generators	No major freight generators within 2 miles of corridor	One or more major freight generators within 2 miles of corridor
	Proximity to Freight Intermodal Centers (Seaports, airports, rail terminals, etc.)	No intermodel centers within 2 miles of corridor	One or more intermodal centers within 2 miles of corridor
Physical, Operational and Safety Issues	Geometric Considerations	Corridor or sub-area meets AASHTO standards for trucks	Corridor or sub-area may not meet AASHTO standards for trucks turning lanes, widths etc
	Pavement conditions	New or fairly smooth pavement, shallow rutting, minor cracking	Rutting, cracking, pot holes resulting in loss of speed
	Access Management	Good access management; corridor is meeting state standards	Moderate access management; corridor or sections not meeting state standards
	Safety/Accident Frequency	Lower than statewide average crash rate for similar facility type	Higher than statewide average crash rate for similar facility type

FREIGHT/SUB-AREA STUDY

Freight/Sub-area study elements and the level of effort needed to study the issues should be determined from the information gathered in Phase 1. Only the elements (Table 4-2) that meet the established thresholds for identified deficiencies should be analyzed in depth on a sub-area-wide basis. The transportation elements within the sub-area should be evaluated regarding how they work together as a system to promote the operational efficiency of trucks.

- Roadway Level of Service (LOS).
- Truck Volume.
- Designated or Proposed Freight Mobility Corridor or Truck Route.
- Proximity to major freight generators.
- Proximity to Freight Intermodal Centers (Seaports, airports, rail terminals, etc.).
- Geometric Considerations.
- Pavement conditions.
- Access Management.
- Safety/Accident Frequency.

While a sub-area study will also consider all or some of the elements above, the focus is not on the corridor but on the freight operations and circulation within the sub-area. Often what takes place immediately outside the study corridor has a significant impact on corridor operations from a freight perspective. In many cases, operational issues in an area without freight generators in the vicinity may better be addressed with a "hot spots" study.

HOT SPOT(S) STUDY

"Hot spots" are specific locations that reduce the effectiveness of the regional goods movement system. They are specific locations with one or more of the following problems that impede freight movement:

- Severe traffic congestion.
- Inadequate traffic controls, including signs and or lack of signalization.
- Substandard signal phasing.
- Insufficient truck driver sight lines.
- Inadequate signalization timing.
- Railroad crossings with significant train movements.
- Insufficient turning radii.
- Insufficient turning lane storage.

- Narrow receiving lanes.
- Lack of or inadequate acceleration or deceleration lanes for truck traffic.
- Lack of median openings forcing truck to make U-turns at intersections.
- Excessive driveway openings.
- Road segments with merging or weaving problems.
- Poor pavement condition.
- Poor directional signage.

Identification of freight "hot spots" can come from various sources. The most important and reliable sources are professional drivers, who based on their driving experience, know where operational traffic problems exist. Identification of “hot spot” locations involves the same data collection and analysis as required for corridor and sub-area studies.

Various methods and criteria can be used to identify the location of “hot spots.” **Table 4-3** shows a sample of criteria, sources, and thresholds used to identify potential “hot spots” within a study corridor.

TABLE 4-3
EXAMPLE HOT SPOT SELECTION CRITERIA

Criteria	Data Source	Threshold
Number of traffic accidents	Review and evaluation of crash data	• Safety ratio higher than 1.0 AND truck safety ratio greater than 0.20
Level of service	Traffic counts and LOS analysis	• Level of service D or Worse
Number of truck driver complaints	Terminal manager and driver surveys	• Driver complaints ≥ 10
Travel delay	Visual evaluation Time and delay study Truck driver interviews	• Routine delay for trucks or all vehicles ≥ 5 minutes at a single location • Average Delay for trucks or all vehicles ≥ 3 minutes
Field review	Windshield Survey	• Based on visual observation and professional judgment

Consider locations for further detailed analysis that exceed the thresholds listed in Table 4-3 for one or more criteria and attempt to ascertain the physical or operational problem associated with the identified "hot spot."

MONITORING

If monitoring is determined to be the appropriate action for the corridor, develop and recommend a schedule of activities required to monitor freight operations within the corridor. This would include the various elements related to freight issues and reviewing these elements on a regular basis to identify significant changes that may require action in the future.

FAST TRACK NOTIFICATION

For the Preliminary Screen or the Phase 1 Screening of designated Goods Movement Corridors or corridors where significant freight operations have been identified, it is imperative that freight issues are carefully considered during all follow-on studies that may be underway or planned. Therefore, whenever any of the following conditions are noted, use the "Freight Corridor Issues/Hot Spot Notification Matrix" located in Appendix E to alert the appropriate FDOT Staff Managers, MPO Staff, and, if necessary, project consultants.

1. The Corridor or Hot Spot Location is included in the FDOT 5-year Work Program.
2. The Corridor has been identified in the Transportation Improvement Plan (TIP) or Capital Improvement Program (CIP) for improvements.
3. The Corridor has been identified for improvements in the LRTP Cost Affordable Plan.
4. The Corridor is currently being evaluated with a Project Development and Environmental (PD&E) Study.
5. The Corridor is currently in or is ready to begin the project design phase.

Section 5
PHASE 2 – FREIGHT ELEMENT STUDY ACTIVITIES

This section provides basic guidelines for Phase 2-Freight Element Study Activities. As described earlier these steps include:

- Data Collection and Analysis,
- Strategy Identification, and
- Recommendations

DATA COLLECTION AND ANALYSIS

The first step in Phase 2 is to collect additional data that was not collected during Phase 1 to evaluate the identified freight issues. Base the data collection activities on the Phase 2 scope of service and the level of analysis required to further understand and develop solutions for each of the issues/problems identified in the previous section. Some information collected during the Phase 1 data collection process may not be complete or sufficiently detailed to analyze the freight problems identified. For example, existing traffic counts may not include classification data required to determine the truck AADTT or turning movement counts may not have been available. In this case, the analyst must determine the type and quantities of data required and collect the supplemental data required for analyzing the problem and recommending a solution.

The actual procedures or methods for collecting the data are included in established manuals such as the Florida Department of Transportation (FDOT) *Manual for Uniform Traffic Studies*, and not repeated here. Rather, the focus is on what information is required and why. Discussed below is the type of data that may be required, depending on the depth of the freight study effort.

Once the required data is collected, the next step is to analyze the data. Focus the analysis on areas along the corridor or within the sub-area where issues or deficiencies affecting freight mobility such as congestion, geometry, safety, access control, signage and pavement condition were identified in the Phase 2 Scope.

Consider locations having one or more issues that meet the established thresholds as "hot spots" or critical areas that may warrant further evaluation. Hot spot analyses can be either stand-alone or incorporated either with the corridor or sub-area studies.

CORRIDOR OPERATIONS

PHYSICAL CHARACTERISTICS

Most of the physical characteristics data should be available from the preliminary screening and/or the Phase 1 corridor screening. Much of the data can be collected from the available roadway plans, Roadway Characteristics Inventory (RCI), most recent aerial imagery or other available databases. In some cases, additional field collection may be necessary to validate this information or to collect missing data.

Collect detailed information as needed to address the freight issue(s).

- Existing right-of-way – from roadway plans,
- Existing land use – from county plans,
- Planned/approved land uses – from county plans and amendments, and
- Location of existing drainage and utilities.

TRAFFIC COUNTS

A comprehensive set of traffic counts is essential to the proper assessment of existing and future conditions within the study corridor. These counts should identify the amount of truck traffic. Collecting existing traffic counts is generally a Phase 1 activity. However, Phase 1 counts may not be sufficient to address freight issues therefore supplemental counts such as identified in **Table 5-1** will be required during the Phase 2 activities. Targeted traffic counts may be required to document the amount of heavy trucks accessing the corridor from a specific site or street.

TABLE 5-1
TRAFFIC COUNT COLLECTION CRITERIA

Type of Count	Duration	Remarks
Classification Counts	72 Hours	Provide volume of heavy trucks by number of axels
Turning Movement Counts	4 Highest hours of travel	Include a separate column for number of trucks per turn movement
Queue Length Counts	Peak hour of Travel	Ensure all queues due to congestion, railroad crossings, inadequate gaps are measured
Delay/Gap Measurements	Peak Hour of Travel	Perform gap and delay measurements per MUTS manual

Collect the following vehicle counts if not already available.

Vehicle Classification Traffic Counts

Based on issues identified in Phase 1, conduct 72-hour classification counts between Monday and Thursday, unless there is a valid reason to believe that weekend or Friday counts may be higher. Collect counts at congested intersections identified in Phase 1, at major intersections, and key intersections connecting to freight activity centers and terminals. This information is required in order to capture the number of heavy trucks (classifications 7-13) using the corridor, the average daily usage and the days with high or low usage.

Table 5-2 shows a sample count of existing heavy truck volumes compared to total volume and percent of heavy trucks using the corridor.

TABLE 5-2
EXAMPLE AVERAGE DAILY HEAVY TRUCK VOLUMES

Location	Heavy Trucks			Total Vehicles			% Heavy Trucks
	NB	SB	Total	NB	SB	Total	
US 41 south of Big Bend Rd	271	266	537	10,800	9,900	20,700	**2.6**
US 41 north of Big Bend Rd	537	401	938	7,900	7,400	15,300	**6.1**
US 41 north of Pembroke Rd	438	290	728	8,300	7,900	16,200	**4.5**
US 41 south of Riverview Dr	543	500	1,043	11,000	11,000	22,000	**4.7**
US 41 south of Pendola Pt Rd/Madison Ave	524	432	956	9,800	10,000	19,800	**4.8**
US 41 south of SR 676 (Causeway Blvd)	788	659	1,447	11,900	12,200	24,100	**6.0**
US 41 south of Lee Roy Selmon Expressway	748	822	1,570	12,300	11,900	24,200	**6.5**
US 41 north of SR 60 (Adamo Dr)	1,296	1,405	2,701	12,800	13,300	26,100	**10.4**
US 41 south of Broadway Ave	1,072	916	1,988	11,700	12,400	24,100	**8.3**
US 41 south of Columbus Dr	932	1,098	2,030	20,000	17,500	37,500	**5.4**
US 41 north of Melbourne Blvd	339	386	725	11,600	9,600	21,200	**3.4**
Average Corridor Truck Percentage							**6.0**

Note: All traffic volumes included in this table are three-day averages.

Turning Movement Counts

Conduct manual turning movement counts during the AM and PM peak hours identified from the classification count data. Collect data for all major intersections or at intersections heavily used by trucks to enter or exit the corridor. Collect turning movement counts for off-peak or mid day when significant truck activity is identified during these times.

Queue Length Counts

As a part of the intersection turning movement counts, the average and maximum vehicular queues present on each of the turning movements is required. For congested conditions, document the number of vehicles not clearing the approaches after each signal phase. Completion of these two steps will facilitate calibrating the capacity analysis model and calculating lane storage requirements. This is particularly important when visual observation notes left-turning vehicles extending into (blocking) through traffic lanes.

Gap Counts

Gaps counts may be necessary at site access points where trucks may incur significant delays entering or exiting the corridor, or at unsignalized intersections with congestion and delay observed during the preliminary screening or Phase 1. Use this information to determine if a traffic signal is warranted.

CAPACITY AND LEVEL OF SERVICE

The primary issues that typically affect truck movements are problems with capacity and congestion. Review the preliminary LOS assessment of the existing or future vehicular demand determined during Phase 1. Accomplish the LOS assessment by using available traffic counts and applying generalized capacities from the latest FDOT Quality/Level of Service Manual or other acceptable generalized/look-up tables prepared by the jurisdiction responsible for maintaining the roadway. The analyst should ensure that the percentage of heavy trucks is properly accounted for in the generalized capacities used. If the heavy truck percentage assumed in the generalized capacities is significantly lower than what the corridor or study area presents, it may be necessary to use a more detailed analytical tool that will allow the inclusion of the actual and projected truck percentage.

Use the existing peak hour levels of service for the corridor to analyze future traffic conditions using SYNCHRO, the Highway Capacity Manual Software (HCS), or other available software. Conduct levels of service evaluations for key intersections and roadway segments identified as potentially congested. The following is a list of analysis package software approved for use by FDOT:

- ARTPLAN
- PASSER II
- PASSER III
- TRANSYT7F
- CORSIM
- VISSIM
- SYNCHRO/SIMTRAFFIC

CONGESTION AND DELAY

If appropriate, conduct a Time and Delay study to determine the average delay, average speed, and average running speed experienced by trucks compared to automobiles throughout the study corridor and to identify locations in the corridor for further evaluation. Follow the study procedures outlined in the current FDOT *Manual for Uniform Traffic Studies.*

Table 5-3 shows a sample output from a Time and Delay study including truck and all vehicle delay, travel time average speed and running speed.

Analysis of this data will help refine location and causes of freight congestion and delay.

TABLE 5-3
EXAMPLE TRUCKS VS. ALL VEHICLES ON US 41

Section	Total Trip Length	Average Trip Delay (Mins)		Average Travel Time (Mins)		Average Travel Speed (MPH)		Average Running Speed (MPH)	
		Trucks	All Veh.	Trucks	All Veh.	Trucks	All Veh.	Trucks	All Veh.
AM PEAK									
MLK-Causeway	3.9	6.4	7.5	13.1	13.5	17.9	17.4	34.7	39.3
Causeway-Big Bend	9.0	1.9	0.5	13.5	11.3	39.6	47.7	46.4	49.7
PM PEAK									
MLK-Causeway	3.9	2.3	2.6	8.7	8.6	26.8	27.2	36.5	38.7
Causeway-Big Bend	9.0	1.1	0.5	12.4	12.1	43.5	44.7	47.6	46.6
OFF PEAK									
MLK-Causeway	3.9	1.9	2.1	7.7	7.7	30.2	30.3	40.3	41.5
Causeway-Big Bend	9.0	0.5	0.5	12.3	11.1	44.0	48.9	46.4	51.5

Source: US 41, From Martin Luther King Boulevard to Big Bend Road Corridor Study, FDOT District VII, 2003

SIGNAL TIMING AND SYNCHRONIZATION

Use the signal timing information collected in Phase 1. Determine the average and maximum turn queue lengths in storage lanes by counting the number of stored vehicles during peak periods. Note the number of trucks in the queue. Count the number of vehicles completing turning movements during each cycle. Count the number of trucks completing a turning movement during each signal cycle. Count the number of vehicles/trucks remaining in the queue after the signal changes.

Truck unable to complete turn within short signal timing. If truck stops in current position, trucks turning right will be unable to negotiate the turn without running over the sidewalk.

Analysis of signal timing and synchronization through traffic modeling will help determine more optimum signal phasing and truck movement synchronization better.

MANEUVERABILITY

If maneuverability issues were identified during Phase 1, study the physical and operational characteristics of the location(s) to determine the potential improvements.

- Observe the truck movements and determine the physical constraints.
- Conduct the appropriate measurements and determine if corner radii can be improved.

- Note the location of traffic stop bars in the opposing lanes of the receiving roadway. If the stop bar is too close to the intersection, trucks may have to wait until the lane is clear in order to make a turn or drive over curbs.
- On highways, note if there is an existing acceleration lane or if there is sufficient right-of-way to add one.

Truck maneuvers around tight corner tracking over curb and narrowly missing overhang of nearby structure located at the intersection of US 301 and SR 54.

- At median openings, note if trucks block lanes while waiting for a gap in traffic to complete a turning movement.

RAILROAD CROSSINGS

Some railroad crossing data, such as the location, number of tracks and safety infrastructure, may have been collected during the initial Phase 1 corridor screening. Crossings identified as freight "hot spots" will require additional information to analyze and propose solutions to the problems identified.

Collect the following information from the railroad:

- The number of daily trains using the crossing;
- Type of trains;
- Average train length;
- Average train speed;
- Peak period for trains using the crossing; and
- Existing safety features, such as signals, gates, etc.

In addition to the railroad operational information, collect the following information by field observation for crossings identified as freight hot spots: Average and maximum vehicle queues during peak and off-peak periods and average and maximum vehicle delay during the peak and off-peak periods. Use the following procedure:

Railroad crossing delay.

- Record the time the gates close and open and calculate the total down time.
- Record the identification number of the lead locomotive and the total number of locomotives.
- Record the number of railcars per train.
- Record the number of vehicles that queue during the period the gates are down.
- Note the location of the last vehicle in the queue and record the time it takes for this vehicle to clear the crossing once the gates open to calculate the maximum delay.
- Measure and record the approximate distance from the crossing to the point where the last vehicle in the queue was stopped when the gates were down to obtain the queue length.

Table 5-4 is a sample of how to document railroad gate closure and vehicle queue information.

TABLE 5-4
(EXAMPLE) RAILROAD CROSSING CLOSURE AND QUEUE CLEARANCE (AM AND PM PEAK)

Crossing	Train Direction	Period	Total Closure (mins)	Total Train Length	Queue Length (miles)	Queue Length (vehicles)	Queue Clearance Time (mins)
US 41 south of Causeway Blvd	WB	AM	7.30	45	0.520 NB	102	3.33
					0.274 SB	41	1.13
Causeway Blvd east of US 41	SB	AM	7.50	85	0.347 EB	70	3.60
					0.864 WB	140	7.22
US 41 north of SR 60	NB	AM	2.58	2	0.111 NB	21	1.51
					0.052 SB	13	0.26
US 41 south of Causeway Blvd	EB	PM	7.00	18	0.225 NB	22	2.18
					0.359 SB	74	2.17
Causeway Blvd east of US 41	NB	PM	7.30	74	0.324 EB	67	3.11
					0.233 WB	46	2.18
US 41 north of SR 60[1]	NA	PM	NA	NA	NA	NA	NA
					NA	NA	NA

[1] No trains crossed during PM period observation
Source: US 41 From Martin Luther King Blvd to Big Bend Road, FDOT District VII, 2003.

Also, note the types of trucks using the crossing. This is important because the law requires trucks carrying certain types of hazardous cargo to stop at all crossings. A crossing near a gasoline distribution terminal for example would result in numerous fuel trucks stopping at a crossing causing delay to other vehicles and trucks.

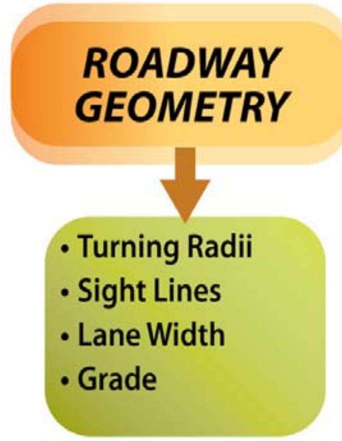
Note: If a grade separation is a potential recommendation, collect any additional data that could be used for justification.

Use the field information to calibrate a traffic model such as SYNCHRO for analysis of the crossing and surrounding streets based on different proposed mitigation strategies.

INFORMATIONAL SIGNAGE

Using information collected in Phase 1; determine if the information presented provides sufficient advanced warning for trucks to maneuver to turn and exit safely. If deficiencies exist, note areas that require improved or additional signage.

ROADWAY GEOMETRY



Collect all missing roadway geometry data as necessary, including elements of the existing typical section, right-of-way, sight lines, storage lane lengths, median opening widths, etc.

Table 5-5 shows a sample segment of a physical conditions inventory. It also shows the Long Range Plan configuration, which, in this case, indicates that no capacity improvements are planned.

TABLE 5-5
SAMPLE PHYSICAL CHARACTERISTICS INVENTORY

US 41 from Big Bend Road to Symmes Road								
		Speed Limit (mph)		Lane Width (ft)	2002		2025	
Intersections	Traffic Control	North	South	Main Line	Lanes	Config.	Lanes	Config.
Big Bend Rd	Traffic Signal	55	45	11.5	4	LD	4	LD
Powell Rd	Stop Sign	55	55	11.5	4	LD	4	LD
Pembroke Rd	Stop Sign	55	55	11.5	4	LD	4	LD
CSX	Gates	55	55	11.5	4	LD	4	LD
Adamsville Rd	Stop Sign	55	55	11.5	4	LD	4	LD
Kracker Ave	Stop Sign	55	55	11.5	4	LD	4	LD
Ohio St.	Stop Sign	55	55	11.5	4	LD	4	LD
Adams St.	Stop Sign	55	55	11.5	4	LD	4	LD
Mabrey Ave	Stop Sign	55	55	11.5	4	LD	4	LD
Florence St	Stop Sign	55	55	11.5	4	LD	4	LD
Isabel Ave	Stop Sign	55	55	11.5	4	LD	4	LD
Nena Ave	Stop Sign	55	55	11.5	4	LD	4	LD
Symmes Rd	Flashing Beacon	50	50	11.5	4	LD	4	LD

Source: US 41 From Martin Luther King Blvd to Big Bend Road, FDOT District VII, 2003.

Roadway geometry plays a crucial role in the operations of a corridor especially for trucks. Inadequate geometry can result in operational problems for heavy trucks such as turning radii, sight lines, lane widths and function, grade, and the location of signage. Damaged curbs and sidewalks, damaged or missing signposts and damaged utility poles are general indicators of roadway geometry problems. The FDOT *Manual for Uniform Traffic Studies* has procedures for determining design parameters for large trucks. The following describes what the analyst should be aware of while assessing the corridor from a freight movement perspective.

TURNING RADII

For corridors that carry large volumes of heavy trucks, the corners of intersections should have turning radii that allow trucks to turn without damaging shoulders, curbs and sidewalks and not encroach into oncoming traffic.

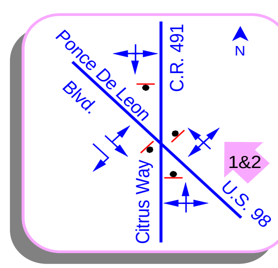
Truck makes wide swing into on-coming traffic lane. Note shoulder rutting from tracking of rear wheels of trailers.

Obtain the following measurements at intersections with turning radii deficiencies:

- Radius of corner curve,
- Distance trucks require from opposing lane on receiving roadway to complete turning movement, and
- Distance from curb/edge of corner pavement to physical structures, poles, etc. within the clear zone.

Note the location and distance of stop line for opposing approach lines on receiving roadways.

At skewed intersections that experience heavy truck traffic, truckers have difficulty seeing traffic traveling at high speeds.



- Indicates stop sign

SIGHT LINES

If potential sight line issues were identified during the preliminary screening or Phase 1, measure the following sight distances and analyze the physical aspects of sight line issues during Phase 2:

- Sight distance along curves,

- Sight distance at skewed intersections,
- Sight distance along vertical curves, and
- Sight distance to physical obstructions.

Describe physical obstructions to visibility in detail noting if they are a structure, sign, or natural (trees, shrubs, weeds, etc.) obstruction. Note whether the obstruction can be removed or relocated to improve the sight line.

LANE WIDTH AND FUNCTION

Lane widths on truck corridors should be a minimum of 12-ft wide. Auxiliary lanes should be long enough for a truck to slow down or accelerate as well as accommodate a turning queue that does not result in blocking traffic on through lanes.

- If not known, measure travel lane width.
- Measure the length of auxiliary and acceleration/deceleration lanes.
- Measure shoulder width.
- Measure overall pavement width.

GRADE

Obtain from "as built" plans or calculate the degree and length of grade. Steep grades affect not only truck stopping distance but also impact acceleration. Even a slight grade can affect the overall performance of trucks resulting in high fuel consumption, pollution, and increased congestion for other vehicles in a following position. Truck acceleration and deceleration can be determined from the *Green Book*, but NCHRP 486 Report includes a spreadsheet that allows the analyst to calculate truck speeds using various grade scenarios and weight-to-horsepower ratios to determine how long it will take a loaded truck to reach a desired speed. The spreadsheet runs the Truck Speed Profile Model (TSPM).

PAVEMENT CONDITION

If pavement conditions were identified as a particular problem during the preliminary screening, the Phase 1 evaluation, or during driver interviews, determine the following:

- The type of deficiency.
- The location and severity of the deficiency.
- Possible causes of the deficiency.
- Level of information from the RCI database regarding surfacing materials and latest resurfacing/ rehabilitation dates.

- Conduct a field inspection of the areas of concern and photograph the pavement conditions. Look for large areas of cracking or potholes. At intersections, look for rutting and potholes.

Pavement deficiencies are a significant issue to most truck drivers especially those that carry shifting loads such as liquid tankers. Pavement deficiencies include:

- Rutting,
- Heaving,
- Cracking, and
- Curb or shoulder erosion.

Rutting

After identifying the cause of the rutting deficiency, develop a strategy to resolve the problem. This could involve upgrading the pavement with materials capable of handling the heavy loads generated by routine truck use.

Heaving

Heaving is generally caused when water enters cracks in the pavement and expands due to freezing causing the pavement to buckle. Heaving can also be caused by heat expansion when dirt and sand enter concrete pavement joints preventing normal expansion and causing the pavement to rise, buckle and crack at the joints.

Cracking

Like rutting, cracking affects the smoothness of the ride, may affect the transported cargo, and often leads to further pavement deterioration. Recommend areas, where cracking is a significant problem, for improvement to high strength pavement.

Curb or Shoulder Erosion

When observed, determine if trucks are the cause. Trucks making right turns routinely track off the roadway surface and erode the shoulder or crack the curbs and adjacent sidewalks. The logical solution is to adjust the corner radius and increasing the shoulder pavement width so trucks will remain on the roadway surface while making the turn. However, in many locations this may not be possible due to ROW and other restrictions.

ACCESS MANAGEMENT

MEDIAN OPENINGS

Using the data collected during Phase 1, determine if too many or too few median openings exist. Median openings are critical in areas where large trucks must turn left to enter access points on the opposite side of the roadway. In urban areas where there are numerous access points along a segment of a corridor, replacing the median with a continuous left turn lane may be advantageous. The lack of median openings in various segments may also force trucks to make U-turns at intersections, which may not have adequate roadway geometry for this maneuver. This results in delay to other trucks and vehicles that must wait while the U-turn maneuver is completed.

Excessive median openings, where not justified, result in too much uncontrolled cross traffic. This can result in delay caused by traffic, which is constantly braking for vehicles entering the roadway through the medians. If median openings are used for U-turns by large trucks, use **Table 5-6** to determine the minimum median width required for making U-turns from a turn lane. In most cases, these median widths will be impractical especially in urban locations. Therefore, analyze and recommend other turning configurations if U-turn avoidance is not possible.

TABLE 5-6
MINIMUM MEDIAN WIDTH TO ACCOMMODATE
U-TURNS BY SEMI-TRAILERS ON FOUR-LANE ROADS

Turn Lane to Inner Turn Lane	Turn Lane to Outer Turn Lane	Turn Lane to Shoulder
83 Feet	71 Feet	61 Feet

Source: AASTO Green Book (with added 12 ft for turn lane width)

Avoiding the Need for U-Turns by Large Trucks

- Design driveways and on-site circulation to eliminate the need for U-turns.
- Establish subdivision, and site development ordinances that avoid the need for U-turns by large trucks.

(FDOT Median Handbook)

Investigate alternative median opening configurations that could improve the efficiency of left turn and U-turn movements for large trucks. These design alternatives could be used at or near truck facilities, major industrial areas or truck staging areas if sufficient right-of-way exists.

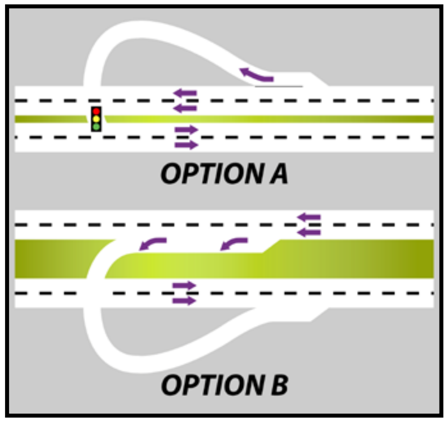
In most cases, Option "A" would require a signal (**Figure 5-1**). On the other hand, Option "B" has the following desirable operational features:

- The U-turning vehicle is stored in the median parallel to the through traffic lanes.

- A suitable gap is needed in the opposing traffic stream only.
- After completion of the U-turn, the driver can accelerate prior to merging into through traffic.

(Source: *FDOT Median Handbook*, pp 69)

FIGURE 5-1
U-TURN DESIGNS FOR LARGE VEHICLES



The FDOT Median Handbook is the source guide for all median configurations.

DRIVEWAYS

Identify areas along the corridor that contain large numbers of driveway openings or where driveways are spaced too close together. Note if driveway openings provide adequate access for large trucks into commercial sites.

Truck exits driveway blocking southbound lanes while attempting a left turn through median.

The number of driveway openings and their spacing may have a significant impact on both truck operational efficiency and safety within the study corridor. Too many driveways, especially in commercial areas reduce the operational effectiveness of a corridor due to the large number of vehicles entering or leaving the roadway. In a heavily used freight corridor, this results in congestion, delay, and unreliability. According to the FHWA, there is a direct correlation between the number of driveways and the travel speed and crash rate within a corridor that can result in a speed reduction of 2.5 to 10 miles per hour. At locations served by a large volume of trucks, consider the use of exclusive right-turn lanes and, where possible, the use of parallel access roads, to reduce congestion on the main roadway. Use the FDOT *Driveway Handbook* for guidance.

"…driveways designed specifically for trucks and busses should usually be done when it handles more than two or three trucks or buses per hour. Examples of facilities you would design for truck sized dimensions include:

- Truck facilities
- Connections serving loading docks
- Delivery and intermodal facilites (ports, railroad yards, etc.)

(FDOT Driveway Handbook)

Table 5-7 is an example of suggested driveway design criteria from the FDOT *Driveway Handbook.*

TABLE 5-7
SUGGESTED DRIVEWAY DESIGN CRITERIA BASED ON TRUCK USE[1]

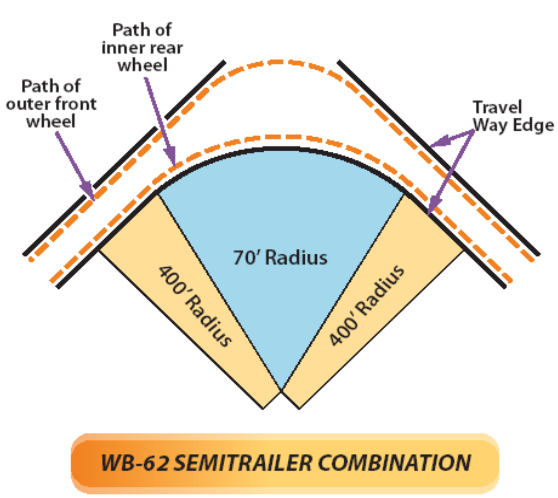
Number of Trucks Per Hour	Operation to Design for	Design Vehicle[2]
Commercial and Office Uses (shopping centers, office complexes, convenience stores)		
≤ 2 ≥ 3	Simultaneous 2-way Simultaneous 2-way	Standard passenger Vehicle[3] Single Unit vehicle such as typical FedEx or UPS truck
Industrial Uses (distribution centers, warehousing)		
	Simultaneous 2-way	Typical multi-unit tractor trailer
Other Uses		
Truck stop	Simultaneous 2-way	Largest vehicle[4]

[1] Source: *FDOT Driveway Handbook* as adapted from *Transportation and Land Development*, 2002 Stover (pp 7-12)
[2] Designed so that larger vehicles can off-track through the driveway.
[3] A standard passenger car can enter while another standard passenger car is waiting to exit.
[4] Interstate semi-trailer and turnpike double trailer will be the design vehicle in many states especially in the vicinity of freeway interchanges.

Figure 5-2 shows a diagram of a compound curve suitable for long trucks that allows for the rear wheels of the truck to track on the roadway surface instead of over the curb. Similar diagrams for other vehicle types can be found in the *AASHTO Green Book*.

FIGURE 5-2
EXAMPLE CURVE RADII FOR SEMI-TRAILER COMBINATION

EXAMPLE EQUIVALENT COMPOUND CURVE GEOMETRICS FOR DEPARTURE RADII



US CUSTOMARY 9-20 MINIMUM EDGE-OF-TRAVELED-WAY DESIGNS	
Curve Type	3-Centered Compound Symmetric
Design Vehicle	WB-62 Semi-trailer Combination
Angle of Turn	90 deg
Curve Radii	400-70-400 (ft)
Symmetric Offset	10.0 (ft)
Curve Type	3-Centered Compound Asymmetric
Design Vehicle	WB-62 Semi-trailer Combination
Angle of Turn	90 deg
Curve Radii	160-70-360 (ft)
Symmetric Offset	6.0-10.0 (ft)

Extracted from ***FDOT Driveway Handbook***, pp 27.
Original source: ***AASHTO Green Book***, Exhibit 9-20, pp 593

SAFETY

Review the historical crash statistics collected in Phase 1 for the corridor to help identify the locations where most crashes take place, the type of crash, number of injuries/deaths, truck involvement and the causes. For areas that appear to have significant problems collect copies of the accident reports, to help identify the types of accidents, if not previously collected during Phase 1. Conduct a field visit to the problem sites to visually inspect the existing conditions and obtain photographs or videotapes as necessary to help with the analysis.

Use the data collected during Phase 1 to identify the percentage of crashes in the corridor or sub-area involving trucks and compare it with the general percentage of truck trips on the road. When crash records provide compelling evidence that heavy trucks compromised operational safety, evaluate potential improvements and recommend a course of action. Follow the procedures found in the FDOT PD&E studies manual when evaluating crash records.[1] Also, consider FHWA criteria for roadway and intersection safety audits.[2] Include a detailed assessment of all accidents involving trucks including contributing causes and relative frequency of crashes when the truck accident rate is higher than that for other vehicles.

Use the following guidelines for conducting the safety analysis:

- Use the crash data collected in Phase 1
- Consult actual crash reports if further detail is needed on types and causes of crashes
- Identify contributing factors—physical, operational, lighting, signage, etc.
- Identify if the contributing factors affect trucks more than passenger vehicles
- Note the location of railroad tracks and type of safety equipment if train were involved
- Note the presence of bike lanes if cyclists were involved
- Perform a detailed analysis
- Prepare a collision diagram showing the location, number and types of collisions along the corridor.
- Compare the crash rate of non-truck accidents to that of truck crashes and calculate the crash ratios. **Table 5-8** shows a sample crash summary table.

SAFETY AUDITS

Safety Audits are a proactive look at locations prior to development of crash patterns to correct hazards before they happen.

[1] Florida Department of Transportation, Project Development and Environment Manual, Part 2, Chapter 5
[2] See Federal Highway Administration Safety website, http://safety.fhwa.dot.gov for guidance and references for conducting safety audits as well as policy guidelines.

TABLE 5-8
EXAMPLE CRASH DATA SUMMARY

Roadway Segment	Distance (Miles)	Avg. Annual Daily Traffic (AADT)*	Total Crashes 1997 Total	Total Crashes 1997 Trucks	Total Crashes 1998 Total	Total Crashes 1998 Trucks	Total Crashes 1999 Total	Total Crashes 1999 Trucks	Crash Rate 1997 Total	Crash Rate 1997 Trucks	Crash Rate 1998 Total	Crash Rate 1998 Trucks	Crash Rate 1999 Total	Crash Rate 1999 Trucks	Critical Crash Rate*** All Vehicles 1997	Critical Crash Rate*** All Vehicles 1998	Critical Crash Rate*** All Vehicles 1999
1. Big Bend Rd to Symmes Rd	2.95	15,600	25	2	39	2	29	6	1.49	0.12	2.32	0.12	1.73	0.36	1.63	1.62	1.48
2. Symmes Rd to Riverview Dr	1.74	15,600	43	4	33	3	45	3	4.34	0.40	3.33	0.30	4.54	0.30	3.21	3.15	2.86
3. Riverview Dr to Madison Ave/ Pendola Point Rd **	2.69	20,000	22	1	26	8	29	3	1.12	0.05	1.32	0.41	1.48	0.15	3.21	3.15	2.86
4. Madison Ave/ Pendola Point Rd to Causeway Blvd	1.15	23,000	41	9	49	9	46	12	4.25	0.93	5.08	0.93	4.76	1.24	4.52	4.31	3.97
5. Causeway Blvd to Adamo Dr	1.95	20,000	67	10	68	6	52	9	4.71	0.70	4.78	0.42	3.65	0.63	4.52	4.31	3.97
6. Adamo Dr to Broadway Ave/ 7th Ave	0.51	19,800	82	14	48	4	25	2	22.25	3.80	13.02	1.09	6.78	0.54	4.52	4.31	3.97
7. Broadway Ave/7th Ave to Interstate 4	0.42	35,000	59	14	39	3	35	5	11.00	2.61	7.27	0.56	6.52	0.93	4.52	4.31	3.97
8. Interstate 4 to Martin Luther King Jr. Blvd	0.91	28,500	26	5	22	3	26	2	2.75	0.53	2.32	0.32	2.75	0.21	3.21	3.15	2.86
Total	**12.32**	**177,500**	**365**	**59**	**324**	**38**	**287**	**42**									

*AADT from 2001 Traffic Information
** This segment had two accidents involving trains (one in 1998 and one in 1999).
***State Accident Rates from Central Office

Total Crashes (1997-1999)	976	100.0%
Total Crashes Involving Trucks (1997-1999)	139	14.2%
Total Crashes Involving Trains (1997-1999)	2	0.2%

Table 5-9 shows the crash rates and safety ratios for both the corridor and for trucks. The critical crash rate is the statewide average crash rate expressed in number of crashes per million vehicle miles of travel for a similar facility. The safety ratio (the ratio of the actual crash rate to the critical crash rate) is the criteria generally used to identify problem areas and high crash locations. A safety ratio greater than 1.0 indicates that the facility is experiencing more crashes than would be anticipated for this type of roadway. While the State of Florida does not maintain truck safety ratios, the calculated truck safety ratio provides a useful indicator of truck crash frequency along the corridor. The truck accident rate is the ratio of crashes involving trucks per million truck miles.

TABLE 5-9
EXAMPLE CRASH RATES AND SAFETY RATIOS

Roadway Segment	1997-1999 Average Number of Crashes (All Vehicles)	1997-1999 Average Number of Crashes (Trucks)	Actual Crash Rate		Critical Crash Rate[3]	Safety Ratio[4]	Truck Safety Ratio[5]
			All Veh[1]	Trucks[2]	All Veh		
1. Big Bend Rd to Symmes Rd	31	3	1.85	0.20	1.58	**1.17**	**0.13**
2. Symmes Rd to Riverview Dr	40	3	4.07	0.34	3.07	**1.32**	0.11
3. Riverview Dr to Madison Ave/ Pendola Point Rd**	26	4	1.31	0.20	3.07	0.43	0.07
4. Madison Ave/Pendola Point Rd to Causeway Blvd	45	10	4.70	1.04	4.27	**1.10**	**0.24**
5. Causeway Blvd to Adamo Dr	62	8	4.38	0.59	4.27	**1.03**	0.14
6. Adamo Dr to Broadway Ave/ 7th Ave	52	7	14.02	1.81	4.27	**3.29**	**0.42**
7. Broadway Ave/7th Ave to Interstate 4	44	7	8.26	1.37	4.27	**1.94**	**0.32**
8. Interstate 4 to Martin Luther King Blvd	25	3	2.61	0.35	3.07	0.85	0.11
		AVERAGE	**5.15**	**0.74**	**3.48**	**1.48**	**0.21**

Notes
[1] Actual crash rate: Number of total crashes per million vehicle-miles.
[2] Actual truck crash rate: Number of crashes involving trucks per million vehicle-miles.
[3] Critical Crash Rate: Statewide Average Crash Rate for a similar facility.
[4] Safety Ratio: Ratio of the actual crash rate to the critical crash rate.
[5] Truck Safety Ratio: Ratio of truck crash rate to the critical crash rate.

Determine safety improvements that will reduce the potential for crashes at each location and a strategy for implementing the safety improvements.

FREIGHT TERMINAL FACILITIES

Determine the number and location of freight generating facilities within approximately two miles distance of the study corridor. Collect this data from one or more of the following sources:

- Transearch Data.
- InfoUSA Data.
- Aerial imagery.
- Field observation.

Note any facilities used for intermodal transfer of cargo.

Early in the study process (preferably as an initial step before the Phase 2 data collection commences), direct communication and surveying of truck drivers operating in the corridor has proven to be one of best tools to assist in the identification of truck-related issues affecting the study area. Use the data regarding location and number of freight facilities gathered in Phase 1 as a basis for making contact and scheduling interviews with terminal managers and truck drivers.

TERMINAL MANAGERS INTERVIEWS

Hours of Operation

Obtain the hours of operation for the freight generators within the corridor identified in Phase 1.

Peak Hour(s)

Obtain the peak operating periods from the facility manager. Although most freight generators operate 24 hours/day, there are often peak periods when most trucks leave or arrive at the facility. Truck peaks are determined by the type of operation, for example is the facility a transfer point for local delivery or is it a factory that sends finished products out daily and receives raw material and parts at another time. Peak truck operations can be determined from the classification counts.

Current and Projected Truck Volumes

Contact large freight generators within and near the corridor to obtain current truck volumes generated by the facility and any potential plan that will increase of decrease this volume.

Seasonal Peaks

When interviewing managers at freight generators determine if there are seasonal peaks in their operations. For example, retail distribution warehouses may experience seasonal peaks preceding the Christmas holidays. Citrus processing facilities also experience seasonal peaks.

Expansion Plans

Determine if the freight generator has any expansion plans that could affect the number of trucks accessing the study corridor.

TRUCK DRIVER INTERVIEWS

Truck Type

Determine the types of trucks generated by the facility. For example, are they gasoline tankers, rock/bulk materials trailers, general cargo, intermodal containers, etc.

Corridor Access Point

Determine the point at which truck drivers enter or leave the corridor.

Origin and Destination Patterns

Determine a pattern of operations from driver interviews. For example, do they originate or terminate at the site or both. Do they make local deliveries or are they over the road drivers. What is the number of daily/weekly trips?

Bulk materials trucks at company yard.

Locations of Operational Concern

Professional truck drivers are perhaps the most important source of travel conditions within the corridor. Drivers can point out areas of significant reoccurring congestion, geometric problems that affect how they operate, areas of bad pavement, and other operational issues that affect freight mobility within the corridor.

INTERVIEW PROCEDURES

Information received from truckers and or terminal managers helps to refine or focus the data collection efforts required to investigate issues or problems perceived by truckers. For example, a predominance of responses from truck drivers expressing how difficult it is to turn left into a cross street will alert the engineer to location-specific substandard geometrics for heavy vehicles that may otherwise be overlooked in the data collection phase.

One of the best locations to conduct driver interviews is at the transportation company during shift change when the most drivers are available.

Identify the Type of Survey To Be Conducted

Conduct surveys at roadside, by return-mail questionnaire, or on site at freight terminals and other freight generators. The actual method used depends on the type of information required, the ease (or difficulty) in arranging for roadside interviews, and the proximity of freight generators.

Sample Size

A suggested minimum sample size is 15% of the daily truck traffic. Give emphasis to drivers operating during typical working hours. In order to 'capture' a large percentage of truck operators, conduct interviews at major freight generators or terminals at or near the study area. Note that prior notification to managers of truck terminals, intermodal yards, or freight generating industries/plants or seaports is required. Early coordination will greatly facilitate the cooperation of facility managers in accessing drivers as well as identifying the best times and locations for conducting the interviews. Conduct interviews at several locations and include a variety of freight generators (e.g. distribution warehouse, steel fabrication, gasoline distribution, bulk transporter, intermodal facilities etc) in the interview mix.

Information Required/Questions To Be Asked

The interviewer should develop the following information through the interview process, which typically includes:

- The frequency of travel,
- Origins and/or destinations,
- Routes taken, and
- Issues or concerns of truck drivers using the corridor/study area.

To help drivers identify their routes, the interviewer should provide maps showing the corridor study area. Without unduly influencing the truck driver response, the interviewer may bring up specific subjects (vehicular congestion, railroad crossings, turning in and out of sites, etc) to encourage a discussion or bring up a faster recall of issues.

Figure 5-3 is a sample Truck Driver Survey data collection form that can be used to record interview information.

Assess the Results

Depending on the size and content of the response sample, several methods can be used to process the responses. Review all individual comments in order to categorize, rank and summarize them according to issue, address, location, etc. Process the data with the aid of statistical software packages such as Access or DBASE. For large-scale surveys, computerized input and processing of surveys forms may yield faster results.

The information obtained from interviews should identify freight-related issues (operational, physical, safety, etc) within the corridor and will help refine the data collection and analysis efforts. Feedback received during the interviews in the "Strategy Identification" and "Recommendations" steps when developing proposed improvements or solutions to freight related problems within the corridor study area. **Table 5-10** shows an example of a problem identification table.

FIGURE 5-3
SAMPLE TRUCK DRIVER SURVEY INSTRUMENT

US 41 CORRIDOR STUDY TRUCK DRIVER SURVEY

Time In:__________ **Date:**______________ **Survey Location:**_______________________ **Interviewer:**_______________________

FREQUENCY **How frequently do you travel US 41/ 50th Street?** **What time of day?** *(See below for abbreviations.)*	**PATH** **On what section of US 41/50th Street do you travel?** **What roads did you use to access US 41/ 50th Street?** *(Emphasis on US 41 travel path—what roads were used to get to US 41?)*	**PROBLEMS** **What problems do you encounter traveling on US 41/ 50th Street?** **Where?** *(Give examples if driver hesitates—delay, congestion, access in or out, signing, pavement condition, maneuverability, turning.)*	**TRUCK SIZE** Classification	**COMPANY**

D = Daily (once a day) D2 = Twice a Day D3 = (more than 3 times per day) W = Once per week, W2, W3, W4 – two, three, four etc., times per week O = Other means less frequently than weekly

Time Out: __________

Trucker Interview Form Page________ of ________ Created On: 1/6/03 Modified On: 1/6/03

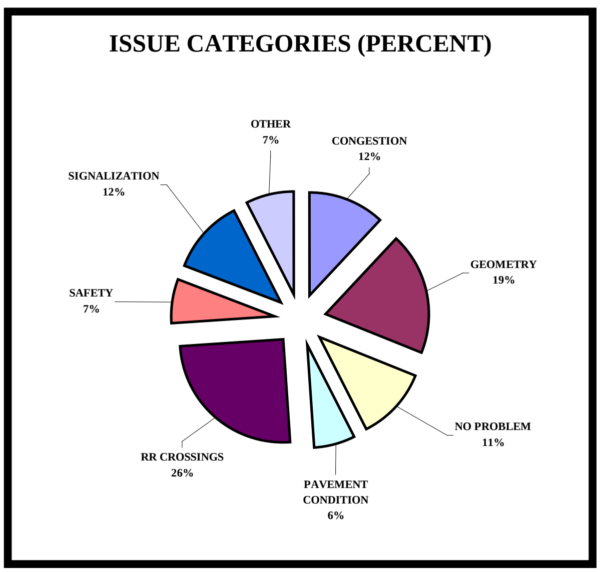
TABLE 5-10
EXAMPLE PROBLEMS IDENTIFIED DURING DRIVER INTERVIEWS

Problem	Location	Number Received
Railroad crossing delays in general at all crossings along US 41	Broadway Ave to Big Bend Rd	38
Excessive delays caused by frequent train crossings at the Rockport Railroad crossing	Rockport RR Crossing S of Causeway Blvd	16
Rough pavement at railroad crossings along the route	Broadway Ave to Big Bend Rd	13
NB US 41 to EB Broadway Ave right turn is difficult due to narrow lanes. Left turn lane on Broadway Ave prevents trucks requiring a wide swing from making the turn	Intersection with Broadway Ave	12
Heavy congestion throughout the day	Adamo Dr to I-4	10
Bump and rough pavement condition at Causeway Blvd intersection	Causeway Blvd	7
Traffic signal timing and synchronization between the Leroy Selmon Expressway and Adamo Dr	Adamo Dr	6
Signalization timing, particularly left turn green time	Broadway Ave	6
EB I-4 exit to NB US 41 crossover merge with EB Columbus Dr traffic is difficult for trucks	I-4/Columbus Dr	5

Source: US 41 From Martin Luther King Blvd to Big Bend Road, FDOT District VII, 2003.

Figure 5-4 shows an example of a problem identification graph.

FIGURE 5-4
EXAMPLE ISSUES GRAPH



Source: US 41 From Martin Luther King Blvd to Big Bend Road, FDOT District VII, 2003.

The information developed from the interviews is useful to help focus on user-identified freight movement problems. Because the responses come from those who drive the corridor on a routine basis, give appropriate weight in determining the significance of the issue identified.

Investigate the issues or problem areas identified by drivers, whether perceived or real And use special care and engineering judgment when validating the issues and problems identified during the interview process.

STRATEGY DEVELOPMENT

IDENTIFY POSSIBLE FREIGHT-FRIENDLY SOLUTIONS

This section presents guidelines for developing potential solutions to freight transportation issues/problems found within the study corridor. After identifying and analyzing the areas of concern, rank and categorize them according to established criteria and develop a range of solutions or strategies to enhance the movement of freight within the corridor or sub-area.

TYPES OF IMPROVEMENTS

The type of suggested improvements may include:

- Infrastructure,
- Operational, and
- Policy or strategic measures.

INFRASTRUCTURE

These types of improvements include rehabilitation of pavement surfaces and shoulders to eliminate rutting; geometric modifications such as storage lengths, corner radii and access drives; adding lanes to increase capacity; adding auxiliary/turning lanes at intersections; grade separations; and the development of new corridors.

OPERATIONAL

Operational improvements may include optimization and/or synchronization of existing signal timings, enhanced directional signage and implementation of intelligent transportation systems (ITS) measures.

POLICY OR STRATEGIC MEASURES

Policy or strategic measures include transportation systems management (TSM) enhancements such as restrictions on time of operation of truck traffic to off-peak hours or revising truck routing within a geographical area (e.g. adding or removing roadways within a truck route plan). Other measures include adopting site planning standards that emphasize the need to accommodate truck maneuvers and parking; the modification of access standards to optimize the movements of heavy trucks in and out of the roadway system; and the creation of freight villages or Intermodal Logistics Centers, which are areas designed for maximum ease in trucking operations and intermodal transfers.

RANGE OF SOLUTIONS

The types of improvements described above fit within the range of freight friendly solutions that can be divided into three categories: short-range, intermediate-range, and long-range. A detailed description of each of these categories follows below.

SHORT-RANGE

Short-range solutions are those that can be accomplished quickly and typically for low cost. They include minor improvements to intersection geometry, traffic signal optimization, repaving small sections of roadway, improving signage and pavement markings, extending turn-lanes, etc.

Many low cost improvements could result from problems identified by truck drivers during the interview process. Making these simple low cost improvements in a timely manner indicates to the freight community that, although the planning process is typically slow, some improvements can be made that increase freight transportation efficiency and make their jobs easier and safer.

Minor Roadway Geometry Modifications

Evaluate minor roadway geometry modifications when repairing broken curbs and sidewalks or by paving/widening hard shoulders near intersections that have high truck turning movements. Modifying the corner radius, may improve truck operations and reduce damage to infrastructure. Another effective geometric modification could simply involve moving a "stop line" further back from the intersection so that turning trucks can make wide turns without encountering stopped traffic on the receiving street.

Signal Optimization

Signal optimization is a low cost improvement that can reap immediate benefits in terms of both freight movement and the movement of non-freight vehicles while relieving congestion at targeted intersections. For example, extending the left turn green cycle at an intersection, where there are numerous trucks making left turns, will enable more vehicles including trucks to turn during the cycle. When trucks back up during peak periods they often extend the queue beyond the length of the storage lanes, block traffic in the though lanes, and contribute to congestion delays in all lanes.

Turn Lane Extensions/Multiple Left Turn Lanes

Extending the storage length of turn lanes can normally be accomplished within the existing right-of-way. Extending the left turn storage capacity allows more vehicles to queue for a left turn without blocking through traffic. If the geometry of the receiving lane permits, consider multiple left turn lanes to increase the turning capacity.

Improve Signage

Informational signage is important to all drivers but is especially important to non-local truck operators who require advanced warning of exits or turns in order to maneuver large trucks into the appropriate lane. Improving signs on truck routes can enhance truck operations by clearly identifying exits, turns and directions to key destinations such as port gates, intermodal facilities and truck routes.

Advanced technology Improvement/Enhancement Projects

Advanced technologies can increase the operational effectiveness of a corridor. For example, ITS technology that senses the speed of approaching trucks can automatically adjust the green time to allow these trucks to pass through an intersection without stopping. Reducing the number of times trucks must stop in a corridor saves fuel, reduces pollution and pavement damage, and makes the corridor more reliable and truck friendly. Variable message signs to warn of congestion and accidents and provide alternative routing for trucks can help truck operations.

Policy Changes

Policy chances which restrict trucks and their hours of operation should be carefully evaluated. While restrictions may benefit the general commuting public, they may have a detrimental impact on the efficient movement of goods and their availability to the public.

Other policy changes may include minimum standards for construction of corridors used as truck routes including minimum lane width, access standards, truck friendly geometry at intersections and median openings, and signal phasing that reduces the number of times trucks must stop at intersections.

MEDIUM-RANGE

Medium-range improvements are those that require more planning and a longer lead-time to accomplish due to the availability of funding or the acquisition of right-of-way. Described below are some intermediate term improvements that should be considered as potential solutions to freight operational issues in a corridor.

Lane Widening

Corridors that are designated truck routes should have a minimum of 12-foot wide lane widths to accommodate trucks. Narrower lanes are common in older urban areas making it difficult for trucks to maneuver, which leads to high recurring infrastructure maintenance costs and higher accident rates.

Adding Auxiliary Lanes/Intersection Improvements

Consider adding auxiliary lanes at major intersections or at intersections with high numbers of truck turning movements. Exclusive right turn lanes and acceleration lanes improve truck operations by allowing trucks to make a continuous turn without having to stop and to accelerate before merging with traffic. Left turn storage lanes with signal-protected turn arrows allow trucks to turn without having to wait for gaps in traffic, especially in congested or high-speed areas.

Resurfacing

Evaluate corridors with extensive rutting/cracking problems for resurfacing. For corridors that are also truck routes, resurfacing materials should be adequate to accommodate heavy loads without rutting, especially near intersections.

At-Grade Railroad Crossing Improvements

At-grade railroad crossings are a particular problem for trucks, especially hazardous material trucks that must stop prior to crossing the railroad tracks. Crossings tend to have deteriorated approaches with rutting, cracking and potholes as well as rough crossing surfaces over the tracks themselves. Solutions to improve these crossings include resurfacing and reinforcing approaches, reduce grade of approach, upgrading the crossing surface, and adding upgraded safety devices. Note that improvements at railroad crossings will require coordination with the operating railroad.

LONG-RANGE

Long-range improvements are those that typically require extensive planning, design, and capital and may not be exclusively for trucks, however heavy truck use could be one of the factors used to justify the proposed improvements.

Preserving Right-of-Way for Freight Uses

Right-of-way preservation and access control are key ingredients in maintaining efficient truck operations. Beyond the physical parameters of right-of-way, preservation includes allowing truck compatible development along the corridor—that is, development that minimizes impacts to truck operations. Consider designing new development access and egress along truck corridors and designated truck routes to minimize the number of driveways and median openings. Service roads that allow access to businesses along the corridor without interfering with the traffic flow on the main road facility should also be considered.

Construction of Truck-Only Facilities

As truck traffic increases and congestion increases, many drivers are concerned about impacts of trucks related to their mobility on the roadway. Consideration should be given to truck-only facilities on major heavily congested highway corridors such as interstates and freeways. These facilities are generally constructed within the existing right-of-way or use lanes designated as HOV lanes. To be effective these lanes should be separated from the main roadway by a barrier system and congestion priced tolling should be evaluated as part of the overall plan.

Truck-only facilities can also be used to connect major truck generators to highway facilities. These are generally short direct routes from facilities such as port gates or rail intermodal yards. For some of these routes, the right-of-way could become part of the terminal facility. They can also be tolled or non-tolled.

Grade Separations

Railroad Grade Separations

Grade separations eliminate conflicts at rail crossings. Evaluate rail grade separations at crossings with significant train operations that disrupt traffic flow and result in heavy congestion, and long delays for truck freight carriers. Any grade separation must meet Federal Railroad Administration regulations and must accommodate double stacked rail cars. In general, the railroad requires a minimum of 23 feet of clearance above the top of rail. The crossing structure should be wide enough to allow the railroad to expand capacity within the entire width of its right-of-way in order to avoid costly modifications in the future.

Highway Grade Separations

Like railroad crossings, major intersections with high volumes of traffic should be evaluated for grade separated interchange development. Grade separations improve the operational efficiency of the primary corridor by eliminating the stop condition and relocating all turning movements off the main roadway. Grade separations are often built in conjunction with parallel local service roads.

IDENTIFY APPROXIMATE COSTS AND BENEFITS FOR EACH POSSIBLE SOLUTION

COSTS

When developing and evaluating various solutions to improve freight operations it is important to provide generalized cost figures for use in comparing alternatives and benefits. While the objective is to find solutions to freight operational problems the general public will, in most cases, receive significant benefits from improving the overall operation of the corridor. It is important to show the cost of a recommendation as well as all of the benefits, both to goods movement and the public at large.

Use the current FDOT *Transportation Cost* publication or Long Range Estimate program to estimate the approximate costs for construction of the recommended improvements. Obtain right-of-way cost from FDOT, the county or local government. The purpose of this exercise is to help prioritize the recommended solutions within the Metropolitan Planning Organization (MPO) project selection process.

BENEFITS

Benefits can be divided into three categories:

- Public benefits,
- Transportation sector benefits, and
- Environmental benefits.

Public benefits include:

- Congestion relief that improves level of service and reduces the daily commuting time.
- Improved safety resulting in less accidents and reduced driver stress.
- Job growth in the transportation sector as well as transportation dependant businesses.

Transportation Sector benefits include:

- Improved travel speed through the corridor, which results in lower costs.
- Improved reliability, which results in reduced time necessary for operational planning and a reduced number of trucks operating on the road.

Environmental benefits include

- Reduced emissions from cars and trucks due to less lime spent in congested traffic conditions.

RECOMMENDATIONS

After developing a range of possible solutions, recommend the best solution addressing each of the issue areas for implementation. The recommendation should be:

- Basis for project justification
- Detailed presenting
  - A complete picture of the issue and the impact on freight movement;
  - The recommended solution;
  - The estimated cost of the recommended solution; and
  - The benefit of the recommended solution in terms of safety, enhanced freight movement, reduced transportation costs, congestion mitigation, and environmental considerations.

If the proposed solution is an intermediate or long-range solution, determine if some of the improvements can be completed in the near term. If appropriate, break the recommendations into smaller objectives that may be easier to finance.

MONITORING AND TRACKING RECOMMENDED SECTIONS

Monitoring tracking recommended projects for the corridor is typically performed by the responsible planning agency (FDOT, MPO, Local Government) in order to ensure the projects are validated, funded, and included in the Work Program, Transportation Improvement Program (TIP), Capital Improvement Program (CIP), or Long Range Transportation Plan (LRTP) and monitored for effectiveness once implemented. This process is normally divided into these phases as follows:

- Track and implement recommended projects.
- Monitor and track the operational effectiveness of the corridor.
- Evaluate the effectiveness of the implemented freight improvements.

TRACK AND IMPLEMENT RECOMMENDED SOLUTIONS

Once improvements are recommended, it may be necessary to assist FDOT, the MPOs, and/or local governments to ensure implementation at the earliest date. Recommended projects should be included in a Goods Movement Management System (GMMS) in order to track the programming of the improvements within the MPO project selection process. The GMMS should include a database with detailed information on all statewide and regional freight corridors within the region including:

- Corridor Name
- Corridor Description
- Level of Service
- Traffic counts and turning movement counts
- Truck counts
- Number of lanes and lane width
- Available right-of-way
- Roadway and intersection geometrics
- Location and lengths of auxiliary lanes
- Location and operation of traffic signals
- Crash statistics
- Hot Spot locations and description of problems
- Recommended Improvements/Project listing
- Improvement status/project programming and funding

MONITOR AND DOCUMENT CHANGES IN CORRIDOR

Use the GMMS to monitor the effectiveness of the implemented improvements with regard to both freight and general traffic operations. Document the results of performance factor monitoring. Monitor all of the basic elements of the corridor including:

- Pavement condition
- Access
- Geometrics

- Turn lane queuing/storage
- Signal timing and synchronization
- Maneuverability improvements
- Safety improvements

Also, note any changes in the types, numbers and locations of freight generators identified in the corridor that may result in an increase/decrease in the number of trucks using the corridor.

Monitor corridor operations such as traffic and truck traffic volumes, level of service, corridor throughput, delay, and accident rates.

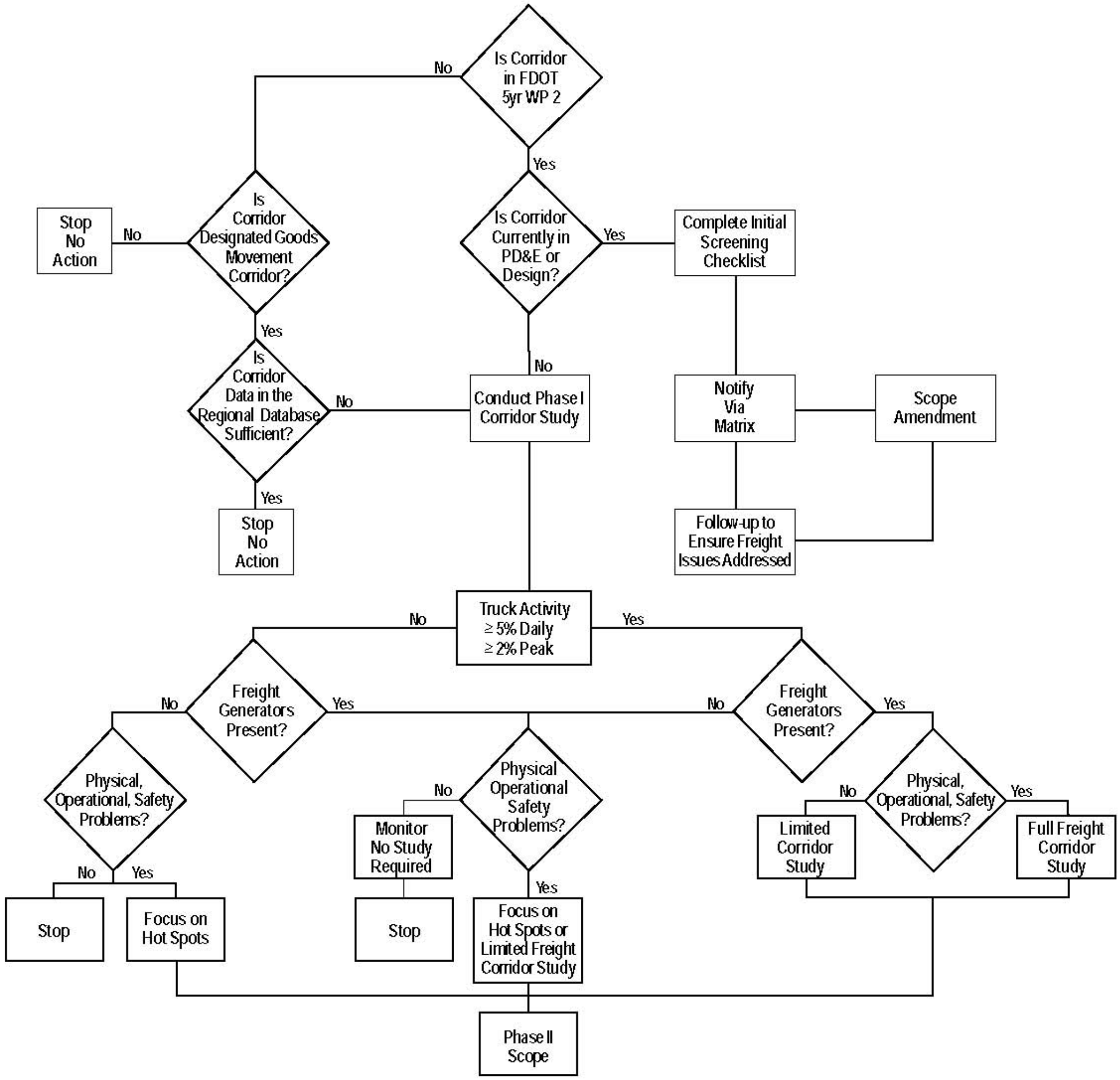
EVALUATE EFFECTIVENESS OF FREIGHT IMPROVEMENTS

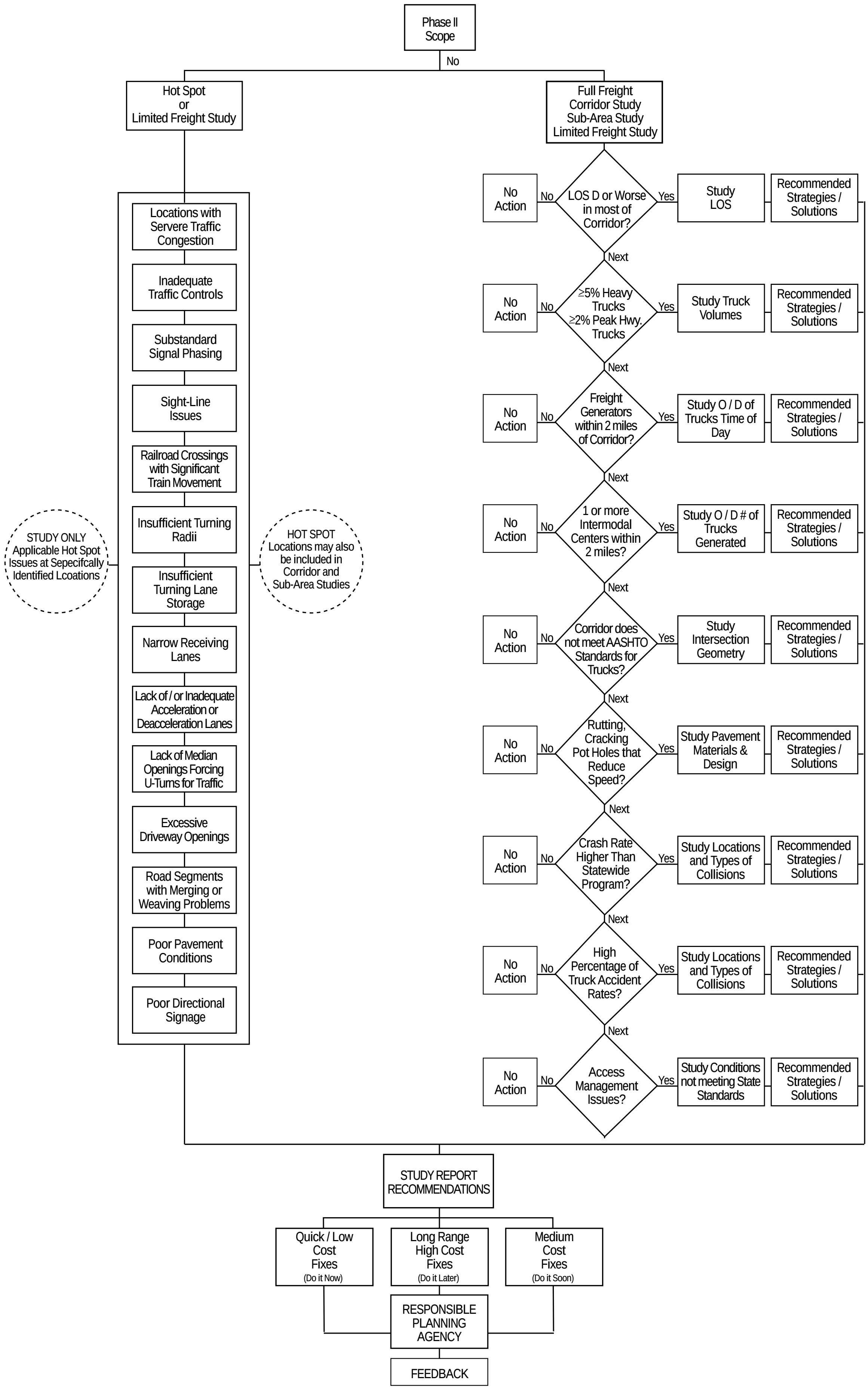
Once implemented, monitor improvements over time and periodically reevaluate for effectiveness of freight operations. Use performance measures such as truck volumes, delay affecting truck operations, corridor or intersection LOS, crash rate, etc. to accomplish this evaluation.

APPENDIX A

Freight Corridor Study Decision/Flow Process

FREIGHT CORRIDOR STUDY DECISION / FLOW PROCESS




Phase II Scope
No
Hot Spot or Limited Freight Study
Full Freight Corridor Study Sub-Area Study Limited Freight Study
Locations with Servere Traffic Congestion
Inadequate Traffic Controls
Substandard Signal Phasing
Sight-Line Issues
Railroad Crossings with Significant Train Movement
Insufficient Turning Radii
Insufficient Turning Lane Storage
Narrow Receiving Lanes
Lack of / or Inadequate Acceleration or Deacceleration Lanes
Lack of Median Openings Forcing U-Turns for Traffic
Excessive Driveway Openings
Road Segments with Merging or Weaving Problems
Poor Pavement Conditions
Poor Directional Signage
STUDY ONLY Applicable Hot Spot Issues at Sepecifcally Identified Lcoations
HOT SPOT Locations may also be included in Corridor and Sub-Area Studies
No Action
No
LOS D or Worse in most of Corridor?
Yes
Study LOS
Recommended Strategies / Solutions
Next
≥5% Heavy Trucks ≥2% Peak Hwy. Trucks
Study Truck Volumes
Freight Generators within 2 miles of Corridor?
Study O / D of Trucks Time of Day
1 or more Intermodal Centers within 2 miles?
Study O / D # of Trucks Generated
Corridor does not meet AASHTO Standards for Trucks?
Study Intersection Geometry
Rutting, Cracking Pot Holes that Reduce Speed?
Study Pavement Materials & Design
Crash Rate Higher Than Statewide Program?
Study Locations and Types of Collisions
High Percentage of Truck Accident Rates?
Study Locations and Types of Collisions
Access Management Issues?
Study Conditions not meeting State Standards
STUDY REPORT RECOMMENDATIONS
Quick / Low Cost Fixes (Do it Now)
Long Range High Cost Fixes (Do it Later)
Medium Cost Fixes (Do it Soon)
RESPONSIBLE PLANNING AGENCY
FEEDBACK

APPENDIX B

Sample Phase 1 Scope of Services

FPN Number
Task Work Order No. X

SCOPE OF SERVICES

PHASE 1 FREIGHT CORRIDOR STUDY

I. DESCRIPTION OF SERVICES

The Consultant will assist the Department in identifying specific actions and improvements to improve freight mobility along corridors in the Tampa Bay area. This will be accomplished through a Phase 1 Corridor Study for the selected Regional Freight Mobility Corridor defined below.

II. SERVICES TO BE PROVIDED

The Consultant will conduct a Phase 1 Freight Corridor Study of _________, a Regional Freight Mobility Corridor, from ______________ to _______________. The purpose of this study will be to focus on the specific freight mobility needs of these corridors identified in the Preliminary Corridor Screening in order to define, quantify, and evaluate the issues identified to determine if more detailed study is required and to develop a detailed scope of services for conducting a Phase 2 Freight Corridor Study focused on specific issues that have a significant impact on freight operations. The purpose of a Phase 2 study is, to identify the specific short range and long range improvements will be necessary to provide adequate capacity and operational efficiency to meet the needs of freight movement in the corridor.

Primarily this will be quick, low cost analyses, following the checklist in the ***Freight Corridor and Sub-Area Study Guidelines*** developed for conducting freight-focused corridor analysis.

The Phase 1 corridor study will have three primary components:

- Review of the issues identified during the preliminary screening as documented in the Preliminary Screening Tech Memo.
- Data collection and analysis – Collecting additional data as needed to evaluate the relevance of the issues and determine the specific issues and level of detail required for further study in a Phase 2 analysis.
- Develop a recommended scope of services for a Phase 2 Study focusing specifically on the physical, operational or safety problems identified during the Phase 1 study.
    - Use the Phase I Checklist found in the ***Freight Corridor and Sub-area Study Guidelines*** to help define the problems/issues and ensure they are identified in the Phase 2 Scope
    - The scope must be specific enough to eliminate the unnecessary study of issues that are costly and of no consequence to freight operations.

The Consultant will prepare a brief report summarizing the results, findings and recommendations that led to the development of the recommended Phase 2 scope of services. In addition, the Consultant may be required to prepare summary maps, tables and graphics displaying conditions and needs along the corridor that can be used during the Phase 2 analysis.

III. WORK ASSIGNMENT PROVISIONS

Work on this assignment will consist of evaluating issues identified in the preliminary corridor screening. The Phase 1 checklist found in the ***Freight Corridor and Sub-area Study Guidelines*** will be utilized under the direction and as specified by the Department's Project Manager or his designate.

IV. LENGTH OF SERVICES

All work on this assignment will be completed within 45 days of receipt of the notice-to-proceed.

APPENDIX C

Screening and Phase 1 Checklist

Initial Screening

INITIAL FREIGHT CORRIDOR SCREENING CHECKLIST

Identifying Characteristics

Corridor Name: ____________________ To: ________________________________ From: ________________________________ SIS / FIHS / Local Truck

Segment 1 To: ____ From: ____

Segment 2 To: ____ From: ____

Segment 3 To: ____ From: ____

Segment 4 To: ____ From: ____

Segment 5 To: ____ From: ____

Evaluation of Corridor Physical Characteristics

Typical Section	1) What is the Typical Section?		Notes
	2) Are lane widths adequate for trucks (minimum of 12 feet)?	Y N	Notes
Geometry	3) Are there indications that turning radii are not adequate for trucks?	Y N	Notes
Medians	4) Are medians with access openings present? Are turning bay lengths adequate to accommodate truck turning movements?	Y N	Notes

Curbs	5) Are corner curbs and concrete median curbs mountable by large trucks?	Y N	Notes
Auxiliary lanes	6) Are there auxiliary left and/or right turn lanes?	LT RT N	Notes
	7) Are auxiliary left turn lanes long enough at intersections heavily used by trucks?	Y N	Notes
	8) Are bike lanes present? Do they conflict with intersection turning movements?	Y N	Notes
Pavement	9) Is rutting, heaving, cracking, or potholes present? Where?	Y N	Notes
	10) Does pavement at intersections need to be extended to prevent shoulder rutting?	Y N	Notes

Rail Road Crossings	11) Are there railroad crossings? How many? Where?	Y N	Notes
	12) Crossing condition (Average/Rough) If more than one state location	A R	Notes
	13) How many trains use this crossing	________	Notes
Parallel Rail Roads	14) Is there adequate, safe truck storage between the roadway and the railroad tracks? (Minimum for worst case scenario is 74’ from EOP to railroad stop bar or gate.)	Y N	Notes
Vertical Cleareance	15) Is the vertical clearance adequate (16 ft.) for large trucks?	Y N	Notes

Evaluation of Operational Characteristics

Maneuverability	16) Do trucks routinely make wide right turns? Where?	Y N	Notes
	17) Do trucks encroach on approaching lanes during turns?	Y N	Notes
	18) Are the location of lane stop markings sufficient for truck turning movements?	Y N	Notes
Congestion and Delay	19) Is congestion affecting truck operations?	Y N	Notes
	20) Approximate level of congestion	L M H	Notes

Signal Timing	21) Are turn signals sufficiently timed to support truck operations?	Y N	Notes
	22) Is there excessive queuing delay of trucks due to signal timing?	Y N	Notes
	23) Are yellow conditions long enough to allow approaching trucks to safely pass through or stop?	Y N	Notes
Railroads	24) Are railroad safety features adequate? (List location and deficiencies)	Y N	Notes
Intersections	25) Average intersections per mile	________	Notes
	26) Number of signalized intersections	________	Notes
	27) Number of "Stop" signs along the Corridor	________	Notes
	28) Are there operational problems at intersections? If so, what intersections? (Use optional intersection form to describe in detail)	________	Notes

Median Openings	29) Do median openings provide adequate and safe access to industrial/commercial properties?	Y N	Notes
Driveways	30) Are any operational deficiencies created by driveways requiring routine access by trucks? (How many? Location?)	Y N	Notes
Operational Safety	31) Are there locations with potential truck related safety issues? (Where?)	Y N	Notes
	32) Are there potential safety conflicts between trucks and pedestrians or bicycles?	Y N	Notes
Existing Land Use	33) What is the primary existing land use along the corridor?	Y N	Notes
	34) Is the existing land use conducive to origin or destination truck trips?	Y N	Notes

Evaluation of Freight Facilities and Operator Issues

Freight Facilities	35*) Are there Regional Freight Activity Centers located along or near the corridor?*	*Y* *N*	*Notes*
	36) Are there other truck generators along or nearby the corridor that affect corridor operations?	Y N	Notes
	37) Are there freight intermodal facilities along or nearby the corridor?	N Y	Notes
Operator Issues	38) Does the regional database identify any "Hot Spots" on this corridor?	Y N	Notes

Crash Analysis and Other Factors

		Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	
Traffic	AADT (≤ 2 years old):	________	________	________	________	________	
	AADTT (≤ 2 years old):	________	________	________	________	________	
	% Trucks:	________	________	________	________	________	
	Capacity LOS	________	________	________	________		________
	Intersection LOS	________	Notes (See Supplemental Intersection form)				

			Notes
Safety	Total 5-year Crashes/rate Are trucks involved?	_____/__ Y / N	
Planned Improvements	Are there system improvements planned that could affect truck routing?	Y N	
Law Enforcement Interviews	Has local law enforcement been contacted? Is there anecdotal information related to safety or operations to evaluate?	Y N	

Note: Attach copies of all photos illustrating freight related problems identified during this screening.

INITIAL FREIGHT CORRIDOR SCREENING CHECKLIST
SUPPLEMENTAL INTERSECTION DATA
(Use as many of these forms as needed)

Intersection Name: ___________________________________

AADT/AADTT ________/________ **% Trucks:** ____ **LOS**: ____ **# Truck Accidents**: ____

Signal Timing: Thru Lanes: Y N (___ sec) **Left Turn**: Y N (___ sec) **Yellow Time**:___ sec

Cross Street Signal Timing: Thru Lanes: Y N (___ sec) **Left Turn**: Y N (___ sec) **Yellow Time**:___ sec

Turn Lanes (Number)? LT ( ) RT ( ) None **Lane Width Adequate?** Y N **Width** _____

Notes on Truck Related Issues

Physical? Y N **Operational?** Y N **Safety?** Y N **Congestion?** Y N **Access?** Y N

Intersection Name: ___________________________________

AADT/AADTT ________/________ **% Trucks:** ____ **LOS**: ____ **# Truck Accidents**: ____

Signal Timing: Thru Lanes: Y N (___ sec) **Left Turn**: Y N (___ sec) **Yellow Time**:___ sec

Cross Street Signal Timing: Thru Lanes: Y N (___ sec) **Left Turn**: Y N (___ sec) **Yellow Time**:___ sec

Turn Lanes (Number)? LT ( ) RT ( ) None **Lane Width Adequate?** Y N **Width** _____

Notes on Truck Related Issues (Explain below)**?**

Physical? Y N **Operational?** Y N **Safety?** Y N **Congestion?** Y N **Access?** Y N

Phase 1

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
0.0.0	**REQUIRED MAPPING**			
0.1.0	Corrdior mapping.		Obtain sufficiently scaled aerial map(s) of the corridor to recognize features and markup issues/problems found during the field evaluation. At a minimum, include the following on the map(s): Street names, parcel lines, and ROW lines.	
0.2.0	Traffic mapping.		Obtain schematic traffic diagrams showing vehicle, classification, and turning movement counts. This information will be used during the field visit to focus evaluators on congested areas.	
1.0.0	**LEVEL OF FREIGHT ACTIVITY**			
1.1.0	Collect available existing traffic counts for the corridor.		Map per 0.2.0 above	
1.1.1	Are the traffic counts 2-years or less old?	**Y / N**	If older than 2-years, i**nclude collecting updated traffic in the Phase 2 scope**.	
1.1.2	Are classification counts available?	**Y / N**	If counts are not available or are older than 2-years, **include collections efforts for 72 hour Class Counts in the Phase 2 scope.**	
1.1.3	Are turning movement counts available?	**Y / N**	If counts are not available or are older than 2-years, **include collections efforts in the Phase 2 scope.**	
1.2.0	Is the truck activity in the corridor $\geq$ 5% Daily or $\geq$ 2% Peak?	**Y / N**	Note: **Meets criteria for Truck Activity in Table 3-1**. See 3.1.1 through 3.1.5 below.	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
1.2.1	What is the AADT within the corridor?	_______	Average Annual Daily Traffic from FDOT.	
1.2.2	What is the AADTT within the corridor?	_______	Average Annual Daily Truck Traffic from FDOT.	
1.2.3	What is the percent of trucks within the corridor?	_______	Total Truck Count / Total Vehicle Count	
2.0.0	**PRESENCE OF FREIGHT GENERATORS**			
2.1.0	Are there freight generators adjacent to the corridor?	**Y / N**	Facilities that generate large numbers of truck trips. For the purposes of this evaluation freight generators are warehouse/ distribution facilities and industrial sites. **Note the location and extent on the corridor markup map (0.1.0).**	
2.2.0	Are there freight generators within 2 mi of the corridor?	**Y / N**	See Above.	
2.3.0	Are there freight intermodal centers adjacent to the corridor?	**Y / N**	Ports, rail intermodal facilities, airports. **Identify the location and extent on the corridor markup map (0.1.0).**	
2.4.0	Are there freight intermodal centers within 2 mi of the corridor?	**Y / N**	See Above.	
2.5.0	Is the corridor a connecting link between a freight intermodal center or a designated regional freight activity center?	**Y / N**	Connectors are corridors heavily traveled by trucks as part of the "first/last mile" connecting a regional freight generator to a designated freight corridor or directly to another regional freight generator.	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
			NOTE: If either of the above (2.1.0 through 2.4.0) are YES, then the criteria for freight generators in Table 3-1 is met.	
3.0.0	**CONGESTION, PHYSICAL, OPERATIONAL AND SAFETY PROBLEMS**			
3.1.0	Are there physical, operational or safety problems within the corridor? (See 3.2.0 through 3.5.4 below)	**Y / N**	**Complete 3.2.0 through 3.5.4 prior to answering this question and following the guidance in 4.1.0 though 4.5.0 at the end of this checklist, which corresponds to *Freight Corridor and Sub-Area Study Guidelines*, page 3-13, Table 3-1.**	
3.2.0	**Capacity, Congestion, and Delay**			
3.2.1	Is the corridor operating at or below LOS D?	**Y / N**	The purpose of this assessment is to identify segments that are currently failing or approaching failure. LOS of E or F requires further detailed study. **Include in Phase 2 scope.**	
3.2.2	Are there intersections with failing LOS? Which one(s)?	**Y / N**	See Above.	
3.2.3	***Field observation*** . Are traffic signals phased for efficient through truck operations?	**Y / N**	Specifically focus on truck delays due to signal synchronization and phasing. **If problem is significant, include in Phase 2 Scope.**	
3.2.4	***Field observation*** . Are traffic signals phased for efficient truck turning movements?	**Y / N**	Specifically focus on truck delays due to signal synchronization and phasing. **If problem is significant, include in Phase 2 Scope.**	
3.2.5	***Field observation*** . Are left turn auxiliary lanes sufficient to hold all vehicles without causing blocking of the through lanes? (If a problem, note time period).	**Y / N**	Left turn storage should be adequate to accommodate arriving trucks and other vehicles waiting to turn. Short turning lanes are easily identified during peak periods. **Note the location and extent on the corridor markup map (0.1.0).**	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
3.2.6	***Field observation*** . Are there other factors that may be contributing to congestion impacting freight operations?	**Y / N**	Contributing factors may include U-turns that interfere with left turn flow, vehicles turning into/out of businesses located at the intersection corners, chronic red-light running, etc.	
3.2.7	Are there railroad crossings with frequent use that contribute to congestion and delay trucking operations?	**Y / N**	Occasional or infrequent train uses is generally not a significant problem. However, frequent use by long freight trains in or near freight activity centers, intermodal facilities, or heavily used freight corridors may be a problem. **Include in the Phase 2 Scope if warranted.**	
3.3.0	**Physical Constraints**			
3.3.1	Does the corridor meet AASHTO standards for tractor-trailer trucks?	**Y / N**	Assume minimum condition of WB-65 tractor trailer combination vehicle. Compare to design standards found in the "Green Book".	
3.3.2	***Field Observation*** . Are there indications that trucks may be having difficulty completing turning movements?	**Y / N**	Visually inspect all corners for signs of inadequate turning radii. (Note: Crushed curbs/sidewalks, damage utility poles or boxes, witnessed wide turns into approaching traffic, etc. Photograph) **Identify the location(s) on the corridor markup map (0.1.0). Include intersection analysis in Phase 2 scope.**	
3.3.3	***Field observation*** : Are travel lanes wide enough for tractor-trailer trucks?	**Y / N**	Ideally travel lanes will be 12 ft wide. However in some commercial and downtown areas, lanes may have been reduced in order to accommodated added travel lanes or on-street parking within the existing ROW. Note the locations where this problem causes safety and/or congestion problems. Identify the location and extent on the corridor markup map (0.1.0). Photograph. **Include in Phase 2 scope if problem is significant.**	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

	SCREENING FACTORS		SCREENING GUIDANCE	EVALUATOR COMMENTS
3.3.4	***Field observation*** . Is there on street parking along the corridor or near intersections that affect safe truck operations? Photograph.	**Y / N**	Note the locations where this problem causes safety and/or congestion problems. **Note the location(s) and extent on the corridor markup map (0.1.0). Photograph. Include in Phase 2 scope if problem is significant.**	
3.3.5	***Field observation*** : Are receiving lanes wide enough for tractor-trailer trucks? Do stop bar markings allow enough room for trucks to make wide turns without interference from stopped vehicles? Photograph.	**Y / N**	This problem generally occurs when the typical sections of cross streets are narrow or have infrastructure constraints. As a result, receiving lanes may be narrow causing trucks to run over curbs or encroach into oncoming traffic lanes. **Note the location on the corridor markup map (0.1.0).**	
3.3.6	***Field Observation.*** Do medians have openings that provide access to truck destinations without blocking through traffic?	**Y / N**	Median openings that support truck turning movements should have storage lanes that allow trucks to wait without blocking through lanes. Also note where trucks exiting driveways block lanes while attempting turning movements. Note the location on the corridor markup map (0.1.0). Include in Phase 2 if problems significant.	
3.3.7	***Field observation*** . Where medians without openings exist, is there adequate room for trucks to safely make U-turns at intersections without damaging infrastructure? Does signal phasing safely allow for these movements? Photograph if problem exist.	**Y / N**	U-Turning trucks can cause significant delay to other trucks and commuters alike. If this condition occurs, note if there is a lack of median openings across from driveways requiring truck access. **Include in Phase 2 scope for detailed analysis.**	
3.3.8	***Field observation*** . Are sight line issues apparent? If possible assume driver level observation. Must trucks or other vehicles move ahead of stop bar or into the intersection to obtain adequate sight lines?	**Y / N**	Four conditions can affect sight lines: terrain, curves in the roadway, acute angle intersections, and infrastructure. Poor sight lines may cause trucks and autos to advance partially into an intersection or beyond stop markings in order to see approaching traffic. **Identify as a Hot Spot and/or include in Phase 2 scope.**	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
3.3.9	***Field observation.*** Are vehicle clearances adequate for large trucks?	**Y / N**	Trucks cannot operate over roads with inadequate vehicle clearance. The FDOT Greenbook states the minimal vehicle clearance for trucks is 16 ft.	
3.3.10	***Field observation***. Are there acceleration/ deceleration lanes where needed and are they adequate for trucking operations?	**Y / N**	Major highways should include acceleration lanes for trucks turning from side streets in order to allow them to reach merging speed especially on uphill grades. If present, note if the acceleration lane is long enough to accomplish the intended purpose or must trucks stop and wait to merge at the end of the lane. **Identify as a Hot Spot or include in Phase 2 scope.**	
3.3.11	***Field observation.*** Are there locations with large changes in grade along the corridor or at intersection approaches?	**Y / N**	Note locations where grade changes may affect truck operations by increasing acceleration time or increasing braking distance. **If the grade problem is significant, include in a grade evluation in the Phase 2 scope.**	
3.3.12	***Field observation, RCI data***. Are there locations along the corridor where rutting, cracking, and curb or shoulder erosian have deteriorated tthe pavement to the point that truck operating efficiency is affected? Where? Intersection approaches? Railroad crossings and approaches?	**Y / N**	While deteriroated pavement may be a nuisance to other vehicles, it is particularly problematic to trucks because rough roads may cause loads to shift or be damaged. **If pavement damage is a significant problem, note the specific location(s) on the markup map (0.1.0) and include in the Phase 2 scope.**	
3.3.13	***Field observation***. Does directional and informational signage support efficient freight operations?	**Y / N**	Do signs provide directions to key freight terminals such as the various port locations, CSX, etc.	
3.4.0	**Operational Constraints**			

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
3.4.1	***Field observation*** . Are there excessive driveway openings along all or part of the corridor? Where?	**Y / N**	Too many driveways, especially commercial driveways contribute to congestion in heavily traveled corridors. Note and photograph locations with a significant number or tightly spaced driveways along the corridor on the markup map (0.1.0). **Include in Phase 2 scope for detailed access management analysis.**	
3.4.2	***Field observation*** . Are driveways that provide truck access designed adequately for the intended use?	**Y / N**	Large tractor trailer combinations are being used for deliveries to local establishments such as restaurants, gas stations, repair shops, big box retailers, strip commercial sites, etc. In many cases the driveways and the site plan were not developed to accommodate these large vehicles. Note areas of crushed cubs and sidewalks, and locations where turning trucks block lanes while accessing facilities. **Include detailed access management analysis in Phase 2 scope.**	
3.4.3	***Field observation*** . Do trucks accessing driveways contribute to corridor congestion?	**Y / N**	See above.	
3.4.4	***Field observation*** . Are there areas where excessive weaving or merging affect efficient truck operations? Where? Describe problem.	**Y / N**	Merging and weaving movements in congested locations contribute to inefficient truck operations. Because of their size, trucks cannot maneuver easily in these situations. **Note the locations where this may be a problem and include in the Phase 2 scope.**	
3.5.0	**Safety Issues**			
3.5.1	How many crashes have occurred in the corridor in the past 5 years?	________	Obtain the crash data from the last 5 years if available. Are the number of crashes higher for the corridor than the statewide average?	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

	SCREENING FACTORS		SCREENING GUIDANCE	EVALUATOR COMMENTS
3.5.2	How many of these crashes involved trucks? Percentage?	________	Determine the location of problem areas and note the percentage of truck involvement in crashes. **If the percenatage of crashes invloving trucks is higher than the percentage of trucks in the corridor, include a safety audit in the Phase 2 scope.**	
3.5.3	What are the type of crashes? Causes? Are there fatalities? Include map and photos of the site(s).	________	Indicate the location (and number) and type of crashes on a scaled map of the corridor. During the field review assess the location and take photos of potential contributing factors due to roadway design, etc. **If there are problem locations or intersections include a directed safety audit in the Phase 2 scope. Include acquisition of crash reports to assist in the audit and problem analysis.**	
3.5.4	What is the 5-year average crash rate for the corridor?	________	Even if trucks are not involved in crashes, these problem areas may result in delays to trucks and impact freight operations and should be studied in more detail. **Include a detailed safety audit in the Phase 2 scope if the crash rate is higher than the statewide average.**	
3.5.5	Field observation. Are there adequate safety devices at railroad crossing based on the number and speed of trains?	**Y / N**	Observe each crossing on and immediately adjacent ot the corridor. Note the type of safety devices present and note if these devices are being circumvented by vehicles. Locate on markup map (0.1.0) and phtograph problem. **Include safety audit in Phase 2 scope if crossing safety issues are apparent.**	

PHASE I FREIGHT COORIDOR SCREENING CHECKLIST

SCREENING FACTORS			SCREENING GUIDANCE	EVALUATOR COMMENTS
3.5.6	***Field observation.*** For railroad crossings on tracks parallel to and in close proximity to the road corridor, is the distance between the EOP and the railroad crossing stop bar sufficient for large semi-trucks?	**Y / N**	The minimum distance should be adequate to permit a semi-truck to stop prior to the crossing without blocking the parallel roadway. The recommended distance is 74' for a 53-foot trailer, plus tractor. If the distance is not sufficient, warning signs should be placed noting the available stopping distance.	
3.5.7	***Field observation.*** Are there bicycle lanes or crosswalks present on the roadway?	**Y / N**	Bicycle lanes on heavily traveled truck routes are a potential safety issue unless there is sufficient room for a bicycle to separate from the truck lane. Bike lanes between through traffic lanes and right turn lanes are especially hazardous when trucks are present. If possible, multi-use paths should be included in future road designs.	
4.0.0	**Determining the Level of Phase 2 Freight Corridor Analsysis**			
4.1.0			If the answers to 1.2.0 and 3.1.0 are **NO** and 2.1.0 through 2.5.0 are also NO then, **STOP, no freight study needed.**	
4.2.0			If the answers to 1.2.0 and 2.1.0 through 2.5.0 are NO, but the answer to 3.1.0 is YES, **develop a Phase 2 "Hot Spots" scope**.	
4.3.0			If the answer to 3.1.0 is NO, but 1.2.0 is YES and any of 2.1.0 through 2.5.0 are also YES, go to "Limited Freight Study". **Develop specific study requirements in the Phase 2 scope.**	
4.4.0			If the answer to 1.2.0 and 3.1.0 is YES and any of 2.1.0 through 2.5.0 are also YES then, a full Freight Corridor Study is required. **Develop specific study needs in the Phase 2 scope.**	
4.5.0			If the answer to 1.2.0, 2.1.0 through 2.5.0, and 3.1.0 are all **NO**, then **no study is required but the corridor should be occasionally monitored for future freight activity.**	

APPENDIX D

Data Acquisition Checklist

DATA ACQUISITION CHECKLIST

Data Requirement	Data Collection* Initial Screening	Phase 1	Phase 2	Person Responsible	Request Submit/ Field Start Date	Data Received/ Field Finish Date	Comments
Corridor Description/Operation							
Existing/Future Land Use	O	A					
Existing Traffic/Truck Counts	A[1]	A[1]					
Supplemental Traffic Counts			M				
Capacity/LOS	A[1]	A[1]	A				
Future Traffic/LOS			C				
Congestion/Delay	O	O	M				
Traffic Signal Timing	O	O	A,C				
Railroad Crossings/Trains	O	O	A,M				
Signage	O	O					
Number of Median Openings	O	O					
Number of Driveways	O	O					
Geometrics/Physical Condition							
Turning Radii	O	O	M				
Number lanes/Lane Widths	O	O,M	M				
Turn Storage Lanes/Length	O	O,M	M				
Sight Lines		O	M				
Grade		O	C				
Pavement Conditions	O	O	O				
Safety							
Crash Data	A	A	A,C				
Freight Facilities							
Number of Freight Generators	O	O	O,A				
Estimated Number of Trucks	O	O	M				
Connector Facilities	O	O					

*Data collection: O=Observation; M=Measure/Collect; A=Acquire from available data sources; C=Calculate

[1] Existing traffic if readily available.

APPENDIX E

Freight Corridor Issues/“Hot Spot” Notification Matrix

FREIGHT CORRIDOR ISSUES / "HOT SPOT" NOTIFICATION MATRIX

WHO TO NOTIFY	Contact the Following when the Corridor Under Study is:				
	PART OF THE 5-YEAR WORK PROGRAM	IDENTIFIED IN TIP/CIP	IDENTIFIED IN LRTP COST FEASABLE PLAN	UNDER PD&E STUDY[1]	IN PROJECT DESIGN PHASE[1]
FDOT					
District Planning Manager	X	X	X	X	X
District Program Manager	X	X[2]	X	X	X
District Project Manager				X	X
District Highway Engineer				X	X
District Structural Engineer				X	X
District Rail Office[3]	X			X	X
COUNTIES[4]					
Citrus County Transportation Planning	X	X	X	X	X
Hernando MPO	X	X	X	X	X
Hillsborough MPO	X	X	X	X	X
Pasco MPO	X	X	X	X	X
Pinellas MPO	X	X	X	X	X
FDOT CONSULTANT(s)					
PD&E Study Consultant				X	
Engineering Design Consultant					X

[1]Fast track after completion of Phase I Screening Study
[2]Only for TIP
[3]Only if railroads are affected
[4]Only applicable County

APPENDIX F

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