

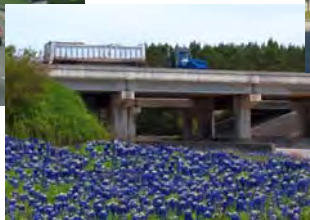
Transportation Impact Handbook Special Topics Series



Transportation Demand Modeling

Today, we will be covering

- **Role of transportation models in estimating impacts and solutions**





POLL

Who do you work for?

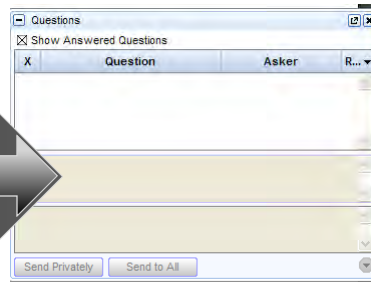


POLL

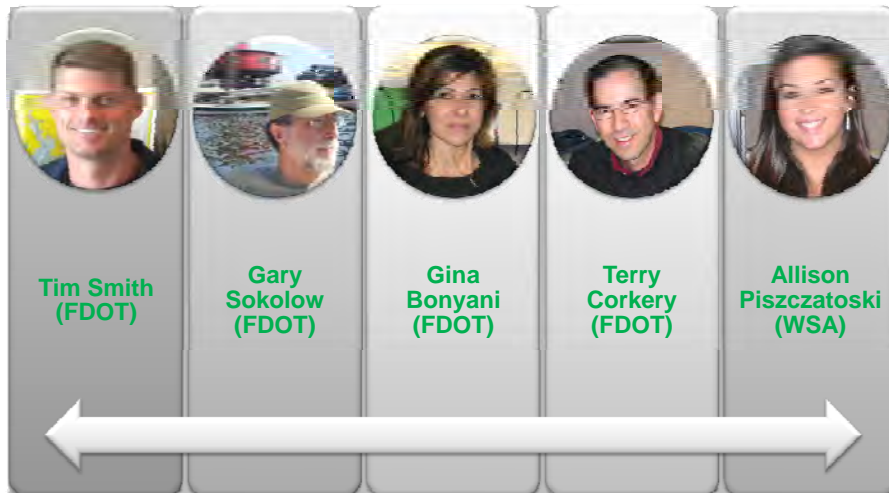
What is your experience level with the FSUTMS model?

Have a Question?

If you have a question during the following training session, please send your questions through the **QUESTIONS TAB** on your webinar side panel.



Your Panelists





Today's Webinar

3 Main Topics

Manual vs. Model Methods

Models in the Handbook

Detailed discussion on
Models

Questions - Discussion

Two Main Methodologies

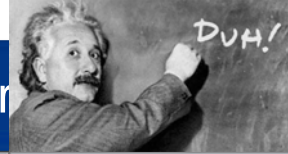
There are two main methodologies used to conduct Transportation Impact Analysis

- **Manual Methods**
- **Traffic Models**

Each method has advantages that make them more appropriate under certain circumstances

Manual Methods

In General Better



Development with trip generation totals < 500 trips

Areas near fringe of model boundaries

Areas where models are not available



With Manual Method

Traffic data such as segment volumes and turning movements are used to establish traffic patterns

Development traffic is then added to background volumes to determine future conditions

Analyst must often use judgment to fill in areas where data is lacking and or make adjustments

Traffic Models

In General Better For

Developments that generate large volumes of trips

Instances where existing traffic patterns may be disrupted



With Manual Method

Traffic patterns are adjusted based on the effect of the new trips

Potential effects of system improvements are able to be analyzed

Can be used to assist in determination of trip distribution, internal capture, modal split and trip assignment

Modeling Methods



- **FSUTMS: Florida Standard Urban Transportation Model Structure**
 - Florida's standard model used in all 26 MPOs
 - FSUTMS uses Cube Voyager software engine
- **Effective for site impact analysis when combined with non model techniques to determine development trips**

Page 38 & linked presentation

Modeling Methods

- **Even when models are used, use the trip generation from ITE for a reasonableness check and adjustment**

2.4.4 Large Scale Transportation Model Methods



The FDOT and MPOs typically maintain travel demand models that incorporate large planning areas. These models are typically calibrated to a base year and include a long-term future horizon year for the corresponding transportation system. Travel demand models can be used to assist in the identification of traffic patterns and needs associated with site development.

The model method of transportation impact analysis uses an MPO-adopted regional travel demand model to forecast the trip distribution and assignment of development-generated trips. Trip generation for the development should be calculated using *ITE's Trip Generation Report*. There are two general methods for using a FSUTMS model for distributing and assigning ITE-generated trips during a traffic impact analysis: the special generator method and the link volume factor method.

Special Generator Method: Develop a new traffic analysis zone (TAZ) or set of zones for the development and code in connectors from the new zone centroids to the transportation network.

- Connection points should be consistent with the preliminary site access plan (see [Site 10, Site Access](#)).

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Models and the Handbook

- Models are discussed at various places throughout the handbook.



Models and the Handbook

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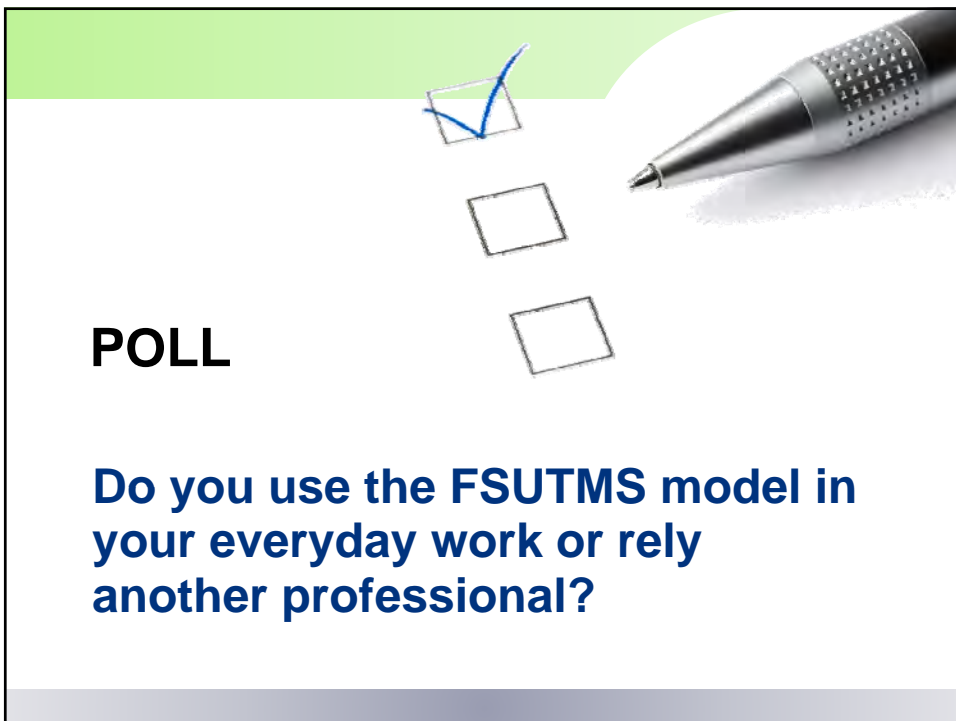
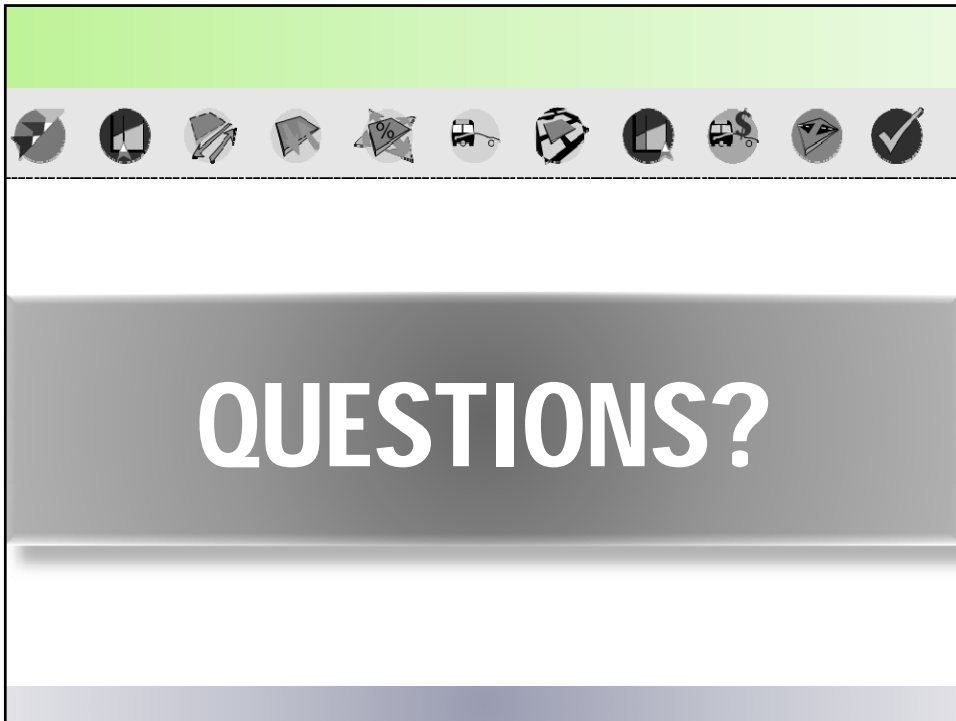
Models and the Handbook

CHAPTER 4 DEVELOPMENTS OF REGIONAL IMPACT 126

Project Approach

A. Site impact analysis to use primarily manual calculation mechanisms?	1. Manual approach appropriate for project scale and location?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
	2. Acceptable methodology described for determining future year roadway network volumes?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
B. Site impact analysis to use computer-based calculation mechanism?	a. Growth rates reasonable based on historical/current development activity?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
	1. Lates FSUTMS model for the area to be used?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
	2. Project site extracted as separate TAZ?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
	3. Zdata files for project TAZ appropriate?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
	4. Buildout year(s) of project coincidental with future years of the approved FSUTMS model?	<input type="radio"/> <input type="radio"/> <input type="radio"/>
a. If not, acceptable methodology proposed for determining interim year conditions?	<input type="radio"/> <input type="radio"/> <input type="radio"/>	
5. Described measures for project level validation of the model?	<input type="radio"/> <input type="radio"/> <input type="radio"/>	
a. Will local roadways need to be added to analyze traffic behavior at project level?	<input type="radio"/> <input type="radio"/> <input type="radio"/>	







Detailed Discussion of Traffic Models



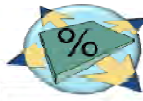
Employee Factors for Models

Turns square feet to employees

Exhibit 13
Land Use
Conversion Rates
for Traffic Impact
Assessments

Land Use	Conversion Rate*
Single-Family Dwelling Unit	3 persons per DU
Multi-Family Dwelling Unit	2 persons per DU
Office	4 service employees per 1,000 sq ft
Hospital	3 service employees per 1,000 sq ft
Retail <200k sq ft	3 commercial employees per 1,000 sq ft
Large Retail	2 commercial employees per 1,000 sq ft
Industrial	2 industrial employees per 1,000 sq ft
Warehousing	1 industrial employee per 1,000 sq ft
Hotel	1 service employee per room

2.6 Trip Distribution



The next step in the distribution is to determine the distribution of the traffic studied. Trip distribution can reflect either model results or review agencies data.

Trip Distribution/Assignment

2.6.2 Model Method and "Blended" Methods

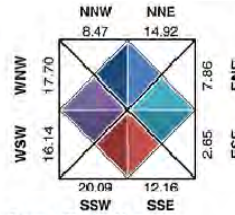
Model methods are generally preferred for development scale developments for two reasons: (1) most manual

Justification and documentation of all adjustments to the model generated distribution should be included in the traffic analysis



Exhibit 17 Major Directions of Trip Distribution from site

Trip distribution should be summarized in a figure that clearly shows the distribution of external trips from the site.



Source: Kimley Horn

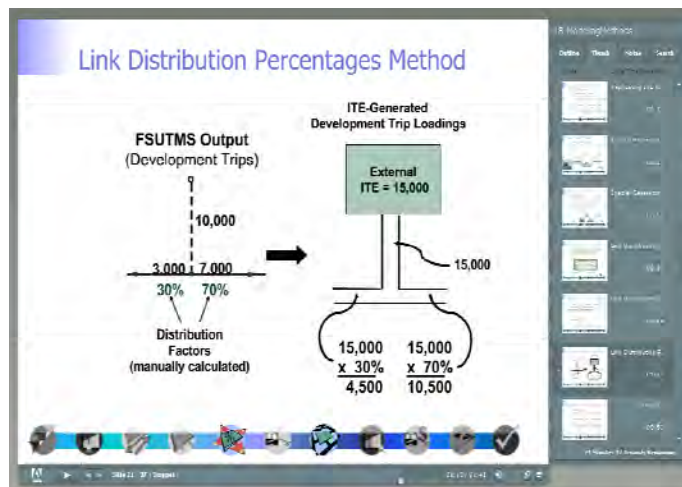
Major Directions Decided

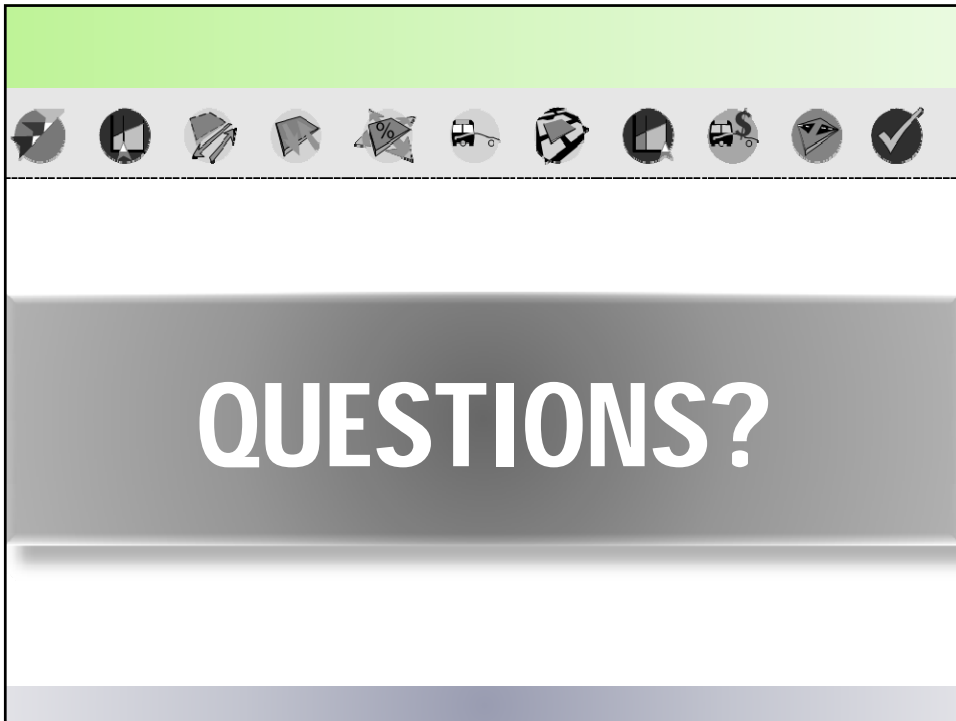
Direction	To/From NORTH	To/From EAST	To/From SOUTH	To/From WEST
ESE	23.39%	10.51%	32.25%	33.84%

common in combination with manual assignment, networks, model assignments may be a more desirable minimum time path between traffic analysis so should be approved by FDOT prior to use.

Manual trip distribution results and model outputs

Trip Distribution/Assignment





Traffic Impact Analysis Modeling Issues

- **FSUTMS Trip Generation vs. ITE**
- **Replicating ITE Trip Generation in the Model**
- **FSUTMS Trip Assignment Methodology**



FSUTMS Trip Generation vs. ITE



FSUTMS vs. ITE Trip Gen

Which is better for Site Impact Analysis?

- **Intended Purpose**

- **FSUTMS**



- Designed to replicate MPO areawide travel patterns
 - Calibration = Avg Link Volume-To-Count comparisons
 - NOT calibrated to zone-specific traffic volumes

- **ITE**



- Designed to find correlation between land use quantities and number of trips entering and exiting **specific types** of developments

FSUTMS vs. ITE Trip Gen

Which is better for Site Impact Analysis?

- **Application**

- **FSUTMS**



- Does not calculate “**Trips**” for employment sites. Rather, the model calculates “**Attractions**,” which are only measures of relative attractiveness to draw **Productions** to the zone.

- **ITE**



- Calculates the average number of trips generated by varying quantities of specified land uses.

So what is FSUTMS good for?



- **Key strengths:**

- Trip distribution and assignment
 - Non-development trips

- **Therefore...**

- The best modeling methodology for traffic impact analysis:
 - Uses the gravity model and capacity-restrained assignment
 - But, calculates the number of development trips consistent with ITE

Replicating ITE Trip Generation in the Model



Replicating ITE Results in FSUTMS

(For the proposed development's TAZs)

- **Two alternative methods:**
 - Link Distribution Percentages method
 - uses conventional ZONEDATA input file
 - single model run indicates percentage of total external development traffic traveling on each link
 - Special Generator method
 - uses model's SPECGEN input file
 - requires running the model and adjusting several times

Link Distribution Percentages Method

- **Insert dwelling unit and employment estimates into conventional ZONEDATA input file**
 - Requires converting square feet to industrial, commercial, and service employment

Employees per 1,000 sq ft—Typical Rates	
Office: 4	Industrial: 2
Hospital: 3	Warehousing: 1
Retail <200KSF: 3	Hotel: 1 per room
Large-scale retail: 2	

Source: ITE, ULI

- **Execute full FSUTMS model run**



Link Distribution Percentages Method

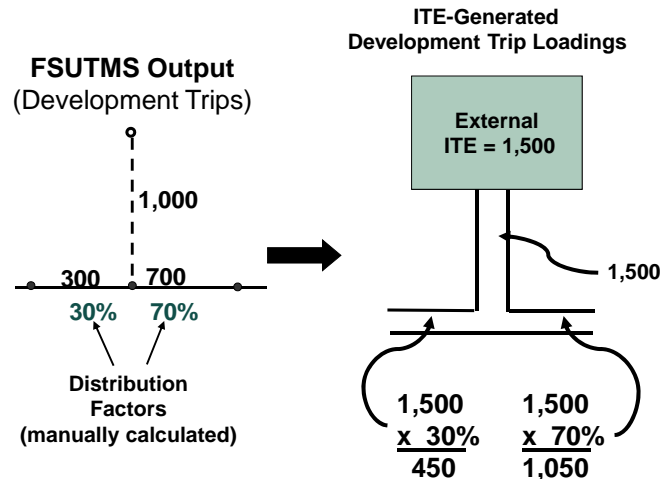
- **For each roadway segment, calculate development traffic percentage:**

$$\frac{\text{Development traffic on link}}{\text{Total external generation of site (modeled)}} = \text{Link \%}$$

- **Apply ITE total external generation to link percentages**

$$\text{Development trips for each roadway link} = \text{Link \%} \times \text{Total External ITE Generation}$$

Link Distribution Percentages Method



Internal Trips & FSUTMS

- Q . Is FSUTMS the best method for estimating the number of internal trips?
- A . FSUTMS is only a tool that may help in a manual determination of internal trips.

Caution: Size (land area) of TAZs and length of centroid connectors are the prime determinants of intrazonal trips in FSUTMS. (Longer centroid link = more intrazonal trips.) The model does not consider whether the specific land use types in the proposed development are compatible and thus, conducive to internal trip making, and it does not consider the quality of the connections between internal land uses.

FSUTMS Trip Assignment Methodology



FSUTMS Highway Assignment

- **Based on a capacity-restrained, equilibrium assignment routine**
 - **Capacity restraint** accounts for route diversion that occurs when drivers encounter congestion
 - FSUTMS decreases speeds on congested roadways after each iteration of the assignment, until:
 - **Equilibrium** is achieved when all trips in the MPO area have found the least congested, shortest-time path to their destination

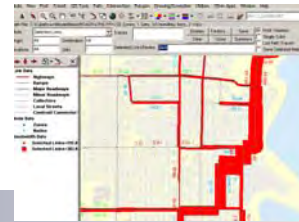
FSUTMS Site Impact Analysis

Highway Assignment

- Uses the Selected Zone analysis tool
 - Single assignment tracks total trips and development trips throughout the capacity-restrained roadway network
 - Background traffic = Total minus development trips
 - Sometimes checked against current traffic count

Selected Zone Analysis Procedures

- Input proposed development's land use into zonal data
 - Run FSUTMS
 - Display traffic that enters/exits development zone(s) on the loaded network using the traffic assignment path file
 - Save development traffic as a new link attribute for further analysis
- Check for reasonableness



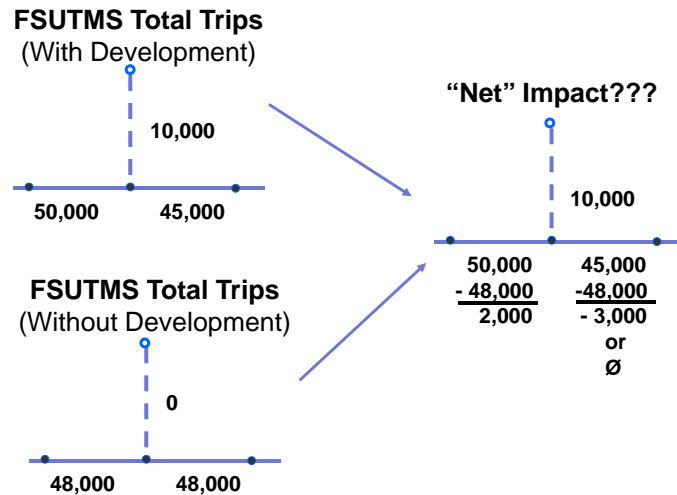
Selected Zone Versus “With & Without”

- **“With & Without” Methodology**
 - Two separate model runs, one with proposed development in place, the other with development’s zonal data zeroed out
 - Link volumes for “without” run subtracted from “with” run, yielding net impact of development on each roadway link

Selected Zone Versus “With & Without”

- **“With & Without” methodology presents a problem:**
 - Equilibrium highway assignment capacity-restraint equation diverts trips, often resulting in virtually no change in traffic volumes
 - Developer: “So, what! Diversion occurs in the real world. I should only be required to mitigate for net impacts of the development.”

“With & Without” Method



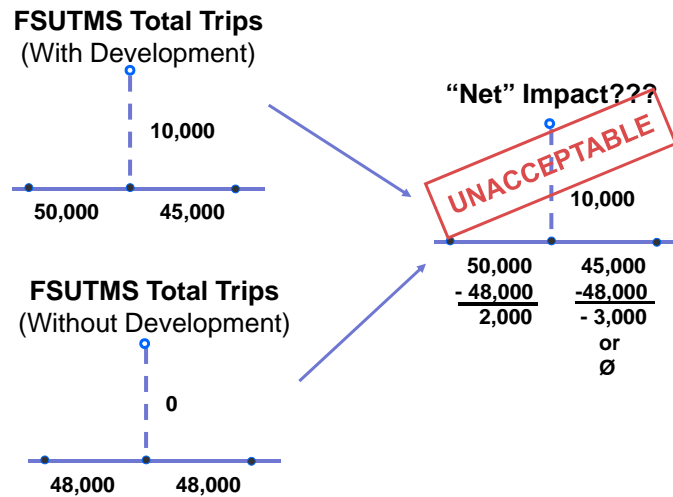
Selected Zone Versus “With & Without”

- **Court’s Ruling:**

- DRI process requires accounting for **ALL** trips caused by development, **NOT** net impact resulting from displacing existing trips to other roadways
- Rationale: if all developers used the argument that trips are diverted and net impact is negligible, no developer would be responsible for mitigation

Westinghouse Gateway Communities, et al. v. Lee County Board of County Commissioners Case Nos: 90-2636DRI and 90-2638DRI, Jan 14, 1991.

“With & Without” Method



Distribution/Assignment Summary

- **Definition: Identifying traffic volumes on each roadway link**
 - Total traffic
 - Development traffic
 - At future analysis years
- **Next step after assignment:**
 - Determine if any links are:
 - Operating at **adverse** LOS
 - AND**
 - Carrying a **significant** volume of development traffic

FSUTMS Resources

- www.fsutmsonline.net
 - Model Task Force
 - FSUTMS training workshops
 - Modeling newsletter
 - Documentation
 - Technical support



This presentation along with resources discussed can be found at:

FDOTTransportationImpactHandbook.com

Handbook Website

www.fdottransportationimpacthandbook.com



Presentations will be made available on the Handbook website under the Training Tab

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The slide features a green header bar at the top. Below it is a horizontal row of 11 circular icons representing various business and financial concepts: a pie chart, a bar chart, a line graph, a document with a checkmark, a percentage sign, a truck, a factory, a bar chart, a truck with a dollar sign, a line graph, and a checkmark. A dashed horizontal line is positioned below the icons. The central part of the slide is a large grey rectangular area containing the word "QUESTIONS?" in white, bold, uppercase letters. Below this area is a thin white horizontal line, and at the very bottom is a grey footer bar.

QUESTIONS?