Webinar Participants

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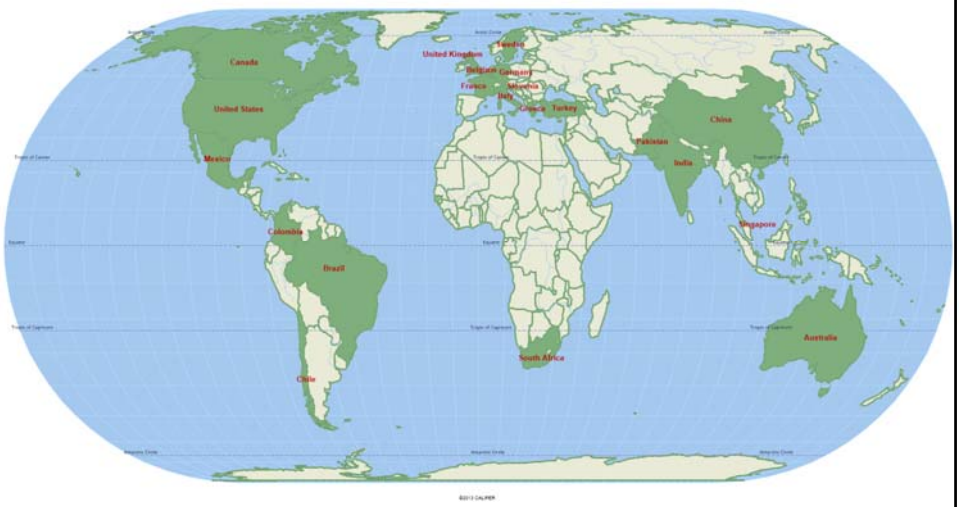

Mechanics of the Seminar

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- The webinar is being recorded, the URL will be sent out to participants and posted at www.coe-sufs.org
- Participants from the US and Canada can:
  - Use Adobe Connect to receive the audio (PRIMARY method)
  - Dial 1-888-446-7584, access code 1120583
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  - Use Adobe Connect to receive the audio (PRIMARY method)
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Now Offering Professional Development Hours

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- Professional Development Hours (PDH) for Professional Engineers (PE) now available
  - 1.0 PHD for this webinar
- Credits issued through the NYS Department of Education. Please confer with the state or country in which you register as a PE to determine whether or not the credit will transfer.
- For more information on obtaining PDH please email wojtoj@rpi.edu

CoE-SUFS

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- Funded by the Volvo Research and Educational Foundations (VREF)
- Main Goal: To jumpstart an integrative process, involving cities, private sector, and researchers to develop new freight systems paradigms that:
  - Are sustainable
  - Increase quality of life
  - Foster economic competitiveness and efficiency
  - Enhance environmental justice

CoE-SUFS Network

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CoE-SUFS Dissemination Programs

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- **Peer-to-Peer (P2P) Exchange** to share global best practices and real world examples of sustainable urban freight systems.
- Next P2P (February, 2017):
  - The Impacts of Congestion on Supply Chains: Recent Results from an Inter-American Development Bank Initiative
- **Workshops** to bring together public/private sectors and academia, to jointly work to address urban freight issues.
  - Already held at: India, Brazil, Colombia, Canada, Mexico, Chile, Australia, and New York City.

Why Goods Movement Matters

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- Highlights the importance of goods movements and provides an overview of the research the VREF Initiative on Urban Freight centers have completed
- Produced by Regional Plan Association, in cooperation with the research centers and VREF, as members of the editorial committee
- Available in: English/ Spanish/ French/ Chinese
- See: **www.goodsmovementmatters.org**

Freight and Service Trip Generation Models: Applications to Curb Management

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Outline of Presentation

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- Key principles of sound curb management
- Estimation of Freight and Service Activity (FSA)
  - Freight Trip Generation Models (FTG)
  - Service Trip Generation Models (STG)
- Application of FSA models to curb management
- Role of Freight Demand Management

Key Principles of Sound Curb Management

Key Principles

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- Curbside space is a public good that must be allocated to all users in proportion to their needs
- Sufficient parking for FSA must be provided, otherwise
  - Commercial vehicles circle around → Increasing traffic
  - Commercial vehicles double park → Reducing capacity
  - If curb allocation is insufficient → Not possible to conduct the activity within the law → Unjust law/ordinances
- Optimal Allocation for freight/service vehicles
  - Private Optimal: Parking close to their customers → minimize parking duration, maximize productivity
  - Social Optimal: Parking close to customers → Parking farther away increases space needs: by 44% (one block away), by 79% (two blocks away)

Estimation of Freight and Service Activity

Background

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- Freight and Service Activity (FSA) encompasses:
  - Freight flows: Generated by the needs of commercial establishments for cargo for processing, manufacturing, storage, of sales to final consumers
  - Freight trips: Generated by the need to transport the cargo from points of origins to their destinations
  - Service trips: Generated by the demand for services to be performed at commercial establishments
    - Service only
    - Freight delivery+service (e.g., installations, repairs)
  - Freight and Service Trips have major impacts on:
    - Parking, congestion, emissions, etc.

General Concepts – FTG/STG

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- Freight Trip Generation (FTG): the number of freight vehicle trips generated by a commercial establishment
  - Freight Trip Attraction (FTA): number of freight vehicle trips arriving at the establishment
  - Freight Trip Production (FTP): number of freight vehicle trips departing from the establishment
- Service Trip Generation (STG): the number of service trips generated by a commercial establishment
  - Service Trip Attraction (STA): number of vehicle trips that arrive at the establishment to perform a service activity
  - Service Trip Production (STP): number of vehicle trips that leave service establishments to perform services elsewhere

(Note: Each attracted/produced trip generates another trip because most vehicles return to their home locations. This trip must be added.)

Background

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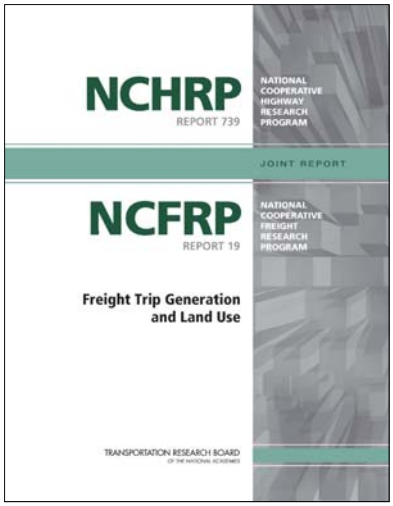
- For more than 10 years:
  - Collected thousands of surveys
  - Establishment level
- Estimated freight-trip generation models
  - Establishment-level
  - Economic based
- Developed aggregation techniques
- Validated them
  - Good models, though imperfect
  - Transferable in US conditions



An updated report will be released this year with models from CFS, etc. etc. etc.

Types of Models Estimated

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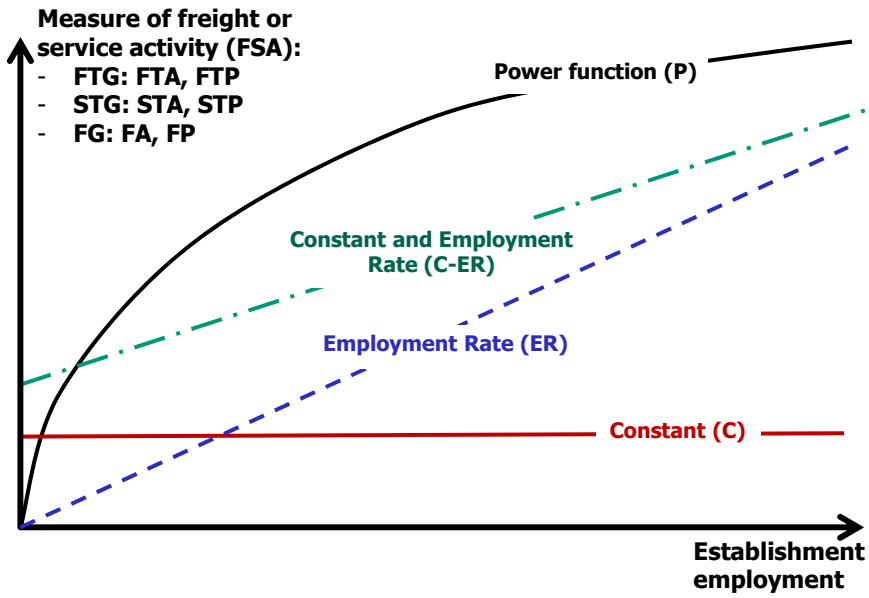

Breakdown of Models Obtained

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	Linear Models			Non-Linear
Measure of Freight and Service Activity (FSA)	Constant (C)	Employ-ment Rate (ER)	Constant + Emp. Rate	Power (P)
Freight Trip Attraction	9	4	22	35
Freight Trip Production	6	11	14	31
Service Trip Attraction	34	19	6	59

58% of STA models

55% of FTG models

FTG for FIS, and STA for all sectors

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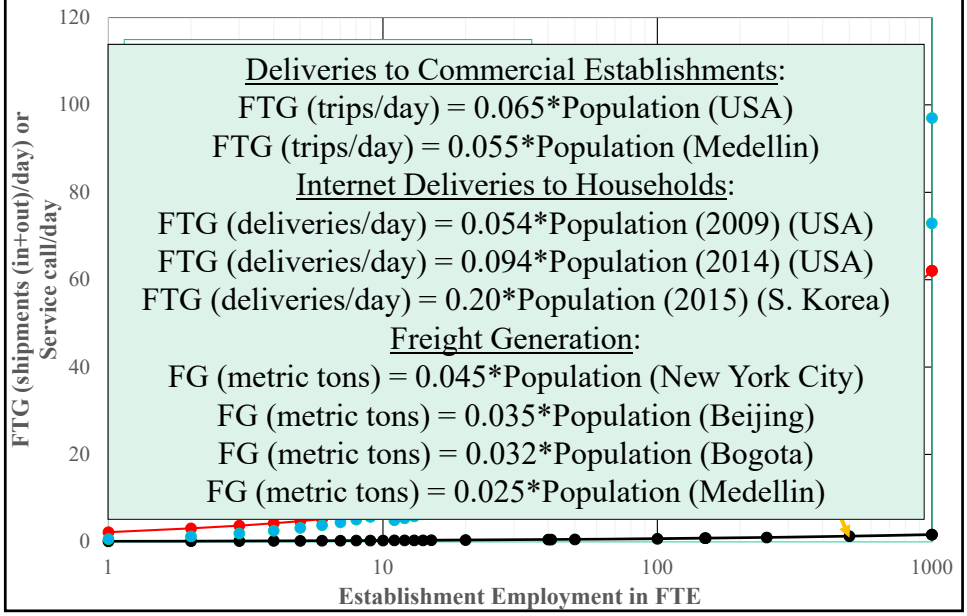

Deliveries to Commercial Establishments:
FTG (trips/day) = 0.065*Population (USA)
FTG (trips/day) = 0.055*Population (Medellin)
Internet Deliveries to Households:
FTG (deliveries/day) = 0.054*Population (2009) (USA)
FTG (deliveries/day) = 0.094*Population (2014) (USA)
FTG (deliveries/day) = 0.20*Population (2015) (S. Korea)
Freight Generation:
FG (metric tons) = 0.045*Population (New York City)
FG (metric tons) = 0.035*Population (Beijing)
FG (metric tons) = 0.032*Population (Bogota)
FG (metric tons) = 0.025*Population (Medellin)

Practical Uses of the FG/FTG/STG Models

Description	Freight Trip Generation			Service Trip Generation			Freight Generation		
	FTA	FTP	FTG	STA	STP	STG	FA	FP	FG
Traffic Impact Analysis	✓	✓	✓	✓	✓	✓			
# of parking spaces needed by freight	✓	✓	✓						
# of parking spaces needed by				✓	✓	✓			
# of parking spaces needed by FSA	✓	✓	✓	✓	✓	✓			
Analysis of trends in freight activity	✓	✓	✓						
Analysis of trends in FSA	✓	✓	✓	✓	✓	✓			
Estimation of freight trip generation	✓	✓	✓						
Estimation of service trip generation				✓	✓	✓			
Estimation of freight generation							✓	✓	✓

Application to Curb Management

SoHo Area, Downtown NYC

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- A commercial area located in lower Manhattan, NYC
- 21 establishments surveyed
- 19 retail stores and 2 restaurants
- On-street parking is the only option for FSA vehicles

Results: Impacts on Parking Duration

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- Sensitivity analysis to assess the impacts of changes in parking duration on the parking needs for FSA vehicle

Mea-sure of FSA	Daily total	Peak hour %	Veh. /hr (peak)	Minimum		Average		Maximum	
				Parking time (hours)	Parking spaces	Parking time (hours)	Parking spaces	Parking time (hours)	Parking spaces
FTA	127.6	25.00%	31.89	0.25	7.97	0.50	15.95	2.00	63.79
STA	7.72	12.50%	0.97	0.75	0.72	1.50	1.45	6.00	5.79
Total	135.3		32.86		8.70		17.39		69.58

- Existing parking supply for freight is inadequate
- A simplified simulation was conducted for SoHo to assess the impacts of alternative freight demand management measures

Impacts of Freight Demand Management

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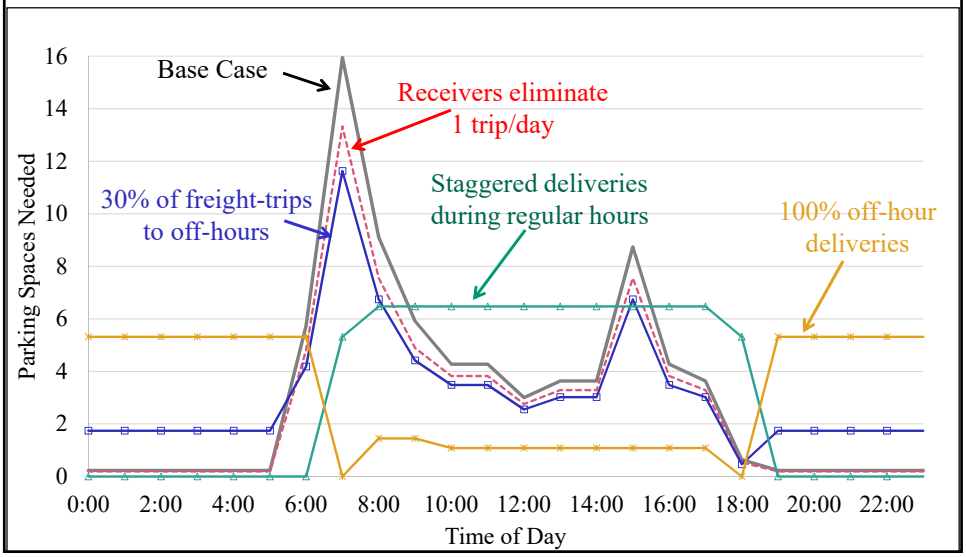

Implications

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- The number of parking spaces needed to satisfy the needs of FSA generated by commercial establishments is very large
- The increasing needs created by internet deliveries to households will increase curb demand tremendously
- Curbside management must be complemented with freight demand management to reduce peak needs

Using FTG Models in Planning Decisions

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How to Create a Sustainable Urban Freight System?

Help to get the product to the consumer at the right time, place and price

Proper use of Public Space/Infrastructure

Implementation in Dense Urban Areas

The District (Dense Urban Area)

29

- Approximately 640,000 residents
- Washington, DC Metro Region is the 7th largest consumer market
- Land use pressure; increase in mixed-use development projects
- Improvement to transportation system and modal options (Bridges, Bikes, Boats, Streetcar)
- Transitioning demographics
- District residents are highly sensitive to freight uses

Challenges

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- Limited freight data at block level
- High demand for curb space
- Ambiguity within the process for allocating curbside space for freight needs

Loading Zones Supporting Local Economy

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- **$16.3 billion** or **27%** of city's revenues are generated within 200 feet of existing loading zones (580 total loading zones in DC)
- **129,950** jobs directly or tangentially affected by truck represent **15.8%** of the 823,000 jobs in the District (in 2011)
- Business revenues citywide are **$60.1 billion**
  - Generated by roughly 60,000 businesses
- Average revenues per business is **$1.2 million**

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System of Loading Zones in DC

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- **Commercial Loading Zone Program**
  - Established new regulation requiring carriers to pay for parking in loading zones
  - Inventoried of over 580 loading zones in the city
  - Conducted extensive industry outreach
  - Developed data collection and evaluation procedures
  - Provided detail information for each loading zone for carriers
  - Developed new signage

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Program Outcomes (products)

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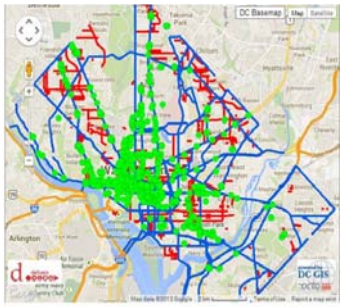
Interactive Freight Map



Asset Management

New Signage

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FTG Uses: Loading Zone Analysis

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Commercial Vehicle Loading Zone Analysis Model:			
Business SIC Category:	58	Business SIC Category:	54
Occupancy Rate	37.17%	Occupancy Rate	17.17%
Total Number of Deliveries	13	Total Number of Deliveries	4
Total Delivery Time (Minutes)	223	Total Delivery Time (Minutes)	90.5
On Average Each Delivery is: (Auto-Populated)	17.15384615	On Average Each Delivery is: (Auto-Populated)	22.625
Please Enter # of Businesses in This SIC Category:	1	Please Enter # of Businesses in This SIC Category:	1
Total Deliveries/Day: (Auto-Populated)	13	Total Deliveries/Day: (Auto-Populated)	4
Minutes Utilization: (Auto-Populated)	223	Minutes Utilization: (Auto-Populated)	90.5
Delivery Utilization Index: (Auto-Populated)	37.17%	Delivery Utilization Index: (Auto-Populated)	
Total Index:(Auto-Populated)	0.743	Total Index:(Auto-Populated)	
Is an alley available for loading and unloading?(Y or N)	N		
Is a loading dock available for loading and unloading? (Y or N)	N		
Block Make-up Index	2.748		
Should This Block Have a Commercial Vehicle Loading Zone?	LoadingZoneNotNeeded		

- A sustainable, consistent, and repeatable process to uniformly evaluate curbside loading zone needs.
- Freight Trip Generation (FTG) models are used to estimate the delivery needs for business establishments at a block face level.

FTG Benefits

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- Begins to better understand impact of deliveries on transportation network
- Improved data will aid with right-sizing curb space
- Supports justification of procedures and policies
- Feeds into other program initiatives
  - Project development
  - Off-Hours Delivery Program

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DC Deliveries

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In DC:

SIC Code	# of Businesses	% of Total	FTG	% of Total	Industry
58	2949	6.15%	11043.398	17.54%	Eating and Drinking
80	5829	12.16%	6339.238	10.07%	Health Services
59	1358	2.83%	5063.175	8.04%	Miscellaneous Retail
81	5186	10.82%	4571.491	7.26%	Legal Service
54	706	1.47%	3578.336	5.68%	Food Stores

FTG = Number of Curbside Deliveries

Implementation in Less Dense Urban Areas

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Houston's Regional Freight System

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- Over 6 Million residents
- 12,500 Square miles
- 4 major deep water ports
- 315 million tons port cargo
- 25,000 miles of roadway
- 21,500 miles of pipeline
- 3 Class I Railroads
- 2 major airports
- Approximately half of region's employment is generated by freight industry

Major Issue: Congestion

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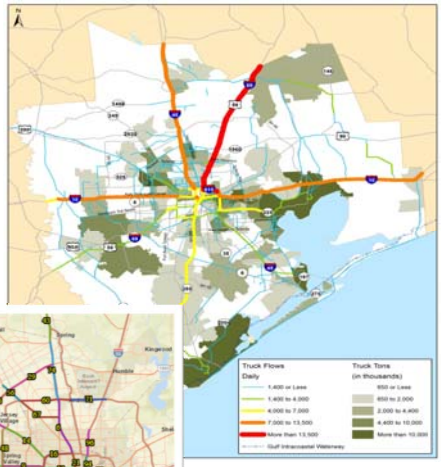
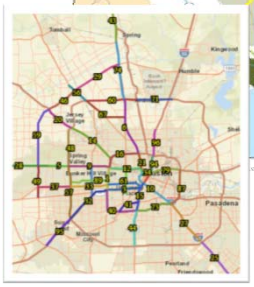
- 173 million miles driven daily
- Truck traffic is forecasted to increase by 77% by 2040
- 45 of the top 100 most congested roads in the state
- Over 4.9 billion in annual truck congestion cost





FTG Uses/Benefits: Regional Model Development

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- Improves data for travel demand model
  - Refines trip rates for attractions
- Aides with tour based truck model
- Primary truck route and critical urban freight corridor designation
- Aides with analyzing projects for freight funding eligibility

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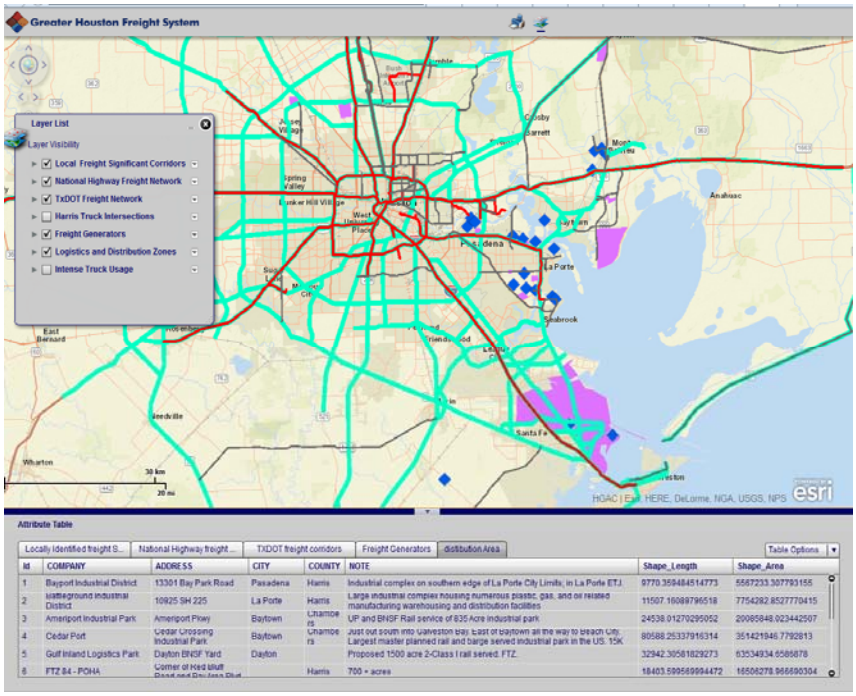

Closing Remarks

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- Equitable allocation of curbside space requires an understanding of the number of freight and service trips that take place, and their parking durations
- The increasing numbers of internet deliveries to households, together with traditional + internet deliveries to businesses stress the importance of proper curb management
- The availability of FTG and STG models that use public data provides tremendous support to curb space management

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Thanks!
Questions?

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