A Guidebook for Implementing Freight Fluidity for Texas and Its Regions

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The Guidebook

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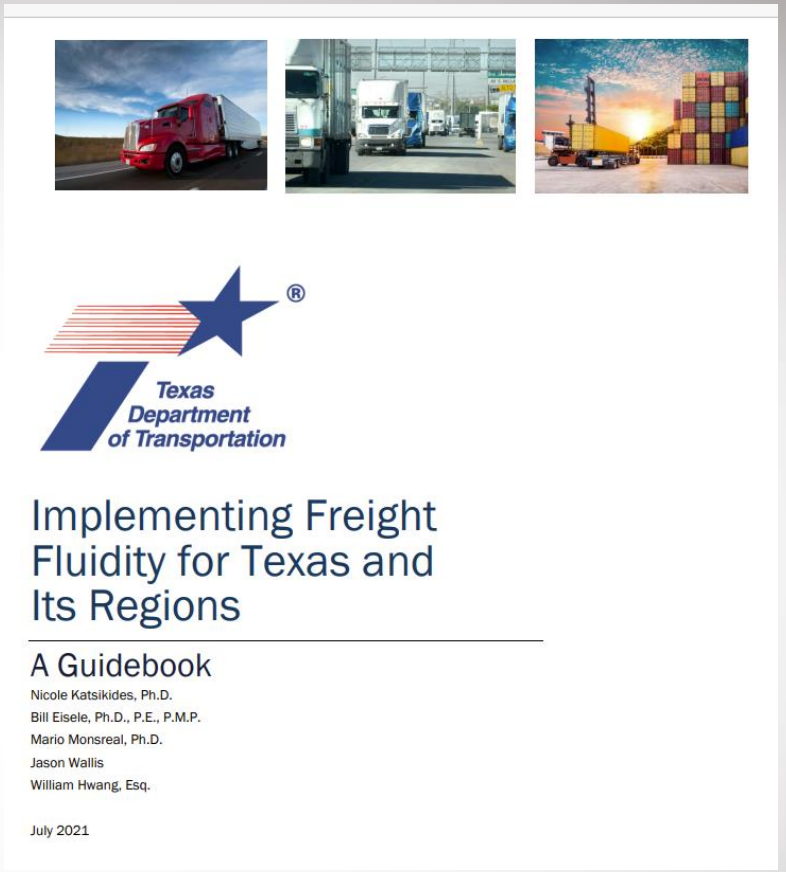

To Access: https://mobility.tamu.edu → "Projects" → "Texas Freight Fluidity"

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What is Freight Fluidity?

"Freight fluidity is measuring trip performance to determine how efficiently goods are moving in a region. It involves answering questions like: What are the goods? How do they get from point A to point B? What's the route?"

– TxDOT Freight Fluidity Guidebook

Example Transportation Element of a Supply Chain – The Trip a Good Makes

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What is Different About Freight Fluidity From Monitoring Congestion?

- Freight Fluidity puts transportation agencies together with business
- Freight Fluidity is about the trip
- It is a way of thinking about freight transportation and seeing it through the lens of a business
- Creates an awareness of the types of goods movement and/or supply chains
- Information can be integrated with safety, environment, and asset condition data to show a good's trip comprehensively
- Freight fluidity helps position an agency (TxDOT) and its regions to have defensible information for freight investments
- The agency (TxDOT) then knows more about the trip experience and how to address bottlenecks to be most effective

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Why Does it Matter?

In general…

- Freight bottlenecks impact the economy
- Mobility problems increase the cost of business
- Jobs may be impacted
- Economic growth may be limited
- Fluidity issues may impact safety
- Delay and congestion can impact the environment

- ….and freight movement is only important if you eat, or buy anything, ever

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How will the Guidebook help?

- Guidebook's relation to TxDOT's Freight Mobility Plan goals

Economic Competitiveness	Mobility and Reliability	Multimodal Connectivity	Customer Service
• Enhance economic competitiveness, productivity, and development of the state	• Reduce congestion • Improve efficiency and performance	• Provide transportation choices • Improve system connectivity for freight	• Incorporate citizen feedback • Transparency in TxDOT communications

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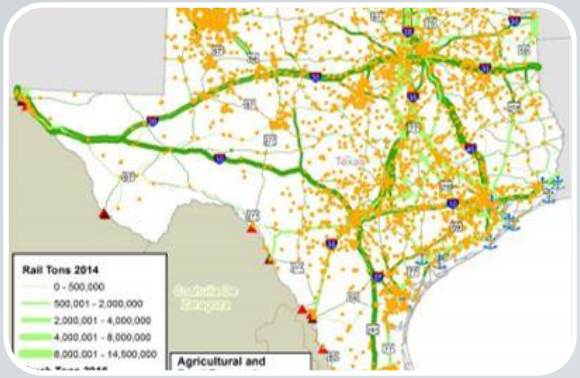
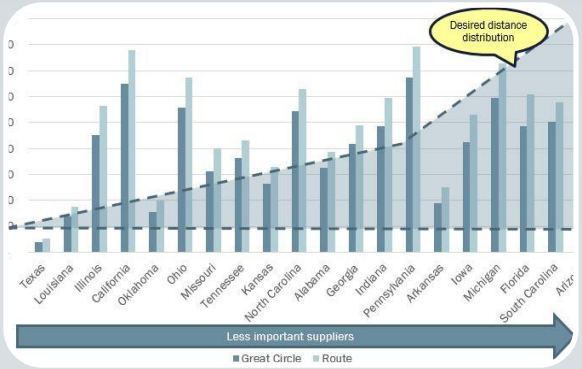
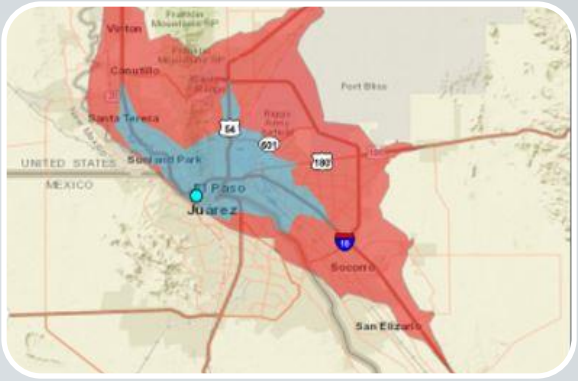
Benefits and Challenges for Freight Fluidity Analysis

- Benefits
  - Helps identify bottlenecks, provides detail for decision-making that aligns with the business experience
  - Numerous highway resources providing information such as:
    - Delay per mile ranking
    - Cost of Congestion
    - Commodity Value by Segment
    - Air Quality impacts due to Delay
- Challenges
  - Primarily highway data available, multi-modal takes some work
  - Needs to be considered with other analytics or supply chain analysis

Guidebook Examples and Resources







What are the key goods and how are they transported?

-Texas Freight Mobility Plan

-Regional Freight Transportation Plans

-Freight Analysis Framework

Where Is the Economic Opportunity?

-Census Bureau Commodity Flow Survey

-Bureau of Economic Analysis (industries, production, consumption)

How Well Are Freight Corridors Moving Freight?

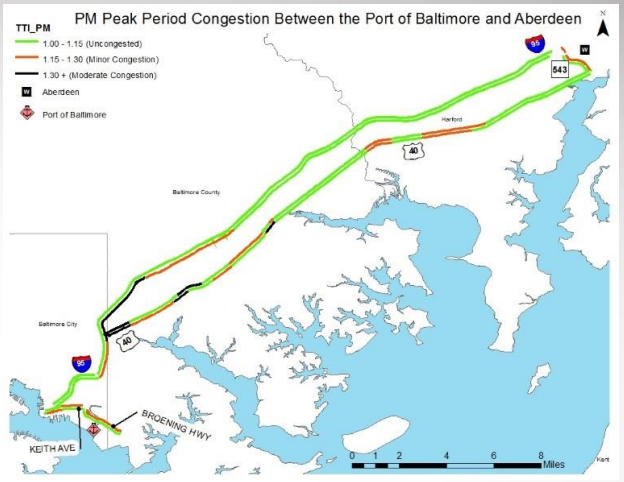
-"TX100", TCAT, UMR

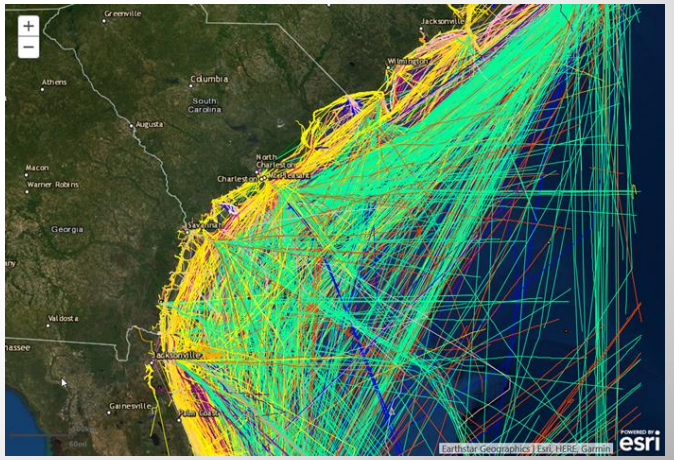
- In-Depth, Location-Specific Information using NPMRDS

- Multimodal: Port and Border Crossing Analysis

Recipe for Fluidity

- **Identify the route of the commodity** (e.g., Origin is Houston, travels by truck to Port of Houston, Gulf shipping)
- **Use available resources** (available visualization/other tools) to identify travel times, performance for the truck route.
- **Use truck volumes** to see changes along the route
- Match with multimodal mobility data if available (e.g., ship call, available Marine data, https://cirp.usace.army.mil/products/aisap.php, some ADS-B air cargo data available.)
- Sophisticated analytics can involve crowdsourced probe data for specific detail.
- Continue Involvement! MPO Discussions, DOT, State and local representatives





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Matrix for Using the Freight Fluidity Guidebook – *What Questions are You Trying to Answer?*

		What Questions Are You Trying to Answer?									
		What Key Goods or Freight Move in Texas?	**Page**	**Where Are The Economic Relations and Opportunities?**	**Page**	**How Well Does Texas's System Perform for Freight?**	**Page**	**What Can We Understand about Multimodal Connections and Impacts?**	**Page**	**Where Can I Get Information in a Hurry?**	**Page**
What Resources Are Available for Understanding Freight Fluidity?		Freight Fluidity in Detail	9	Economic Analysis of Trading Partners and Opportunities	12	Framework Development	22	Port	27	Texas 100	31
		Texas Freight Mobility Plan	10			Bottlenecks	23	Border	28	COMPAT/TCAT	32
		Regional or Local Plans	11			Performance Measurement/ Visualization	24	Next Steps	34	FHWA Freight Mobility Trends	33
		Freight Analysis Framework	12			Multimodal Trip Connections	26				
Who Is the User?	**Leadership/ Decision Maker**	Main User		Main User		Main User		Secondary User		Secondary User	
	Planner/ Policy Analyst	Main User		Main User		Main User		Main User		Main User	
	Operator	Secondary User		Secondary User		Main User		Main User		Main User	
	Industry Partners	Main User		Secondary User		Main User		Secondary User		Secondary User	

Sample Bottlenecks Insights (to inform Freight Fluidity)

Urban Mobility Report for Houston, 4th in the nation for truck congestion in very large urban areas. New York, Los Angeles, and Chicago are highest. Dallas ranks #6.

https://mobility.tamu.edu/umr/

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URBAN MOBILITY REPORT 2021

Houston, TX

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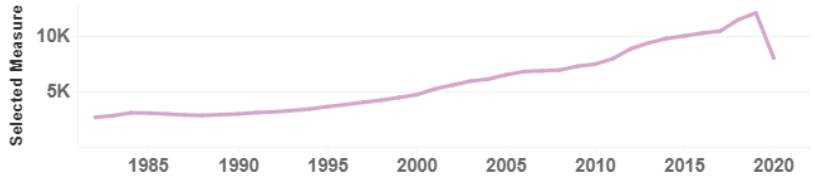
Year: 2020

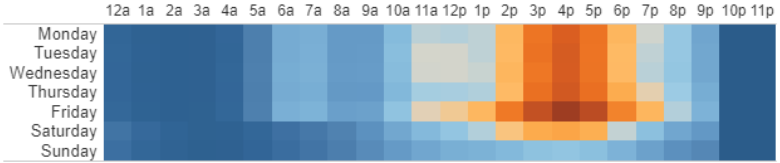
Houston's 2020 delay is **64%** of 2019 delay levels.

Measure: Annual Truck Delay

Annual Truck Delay

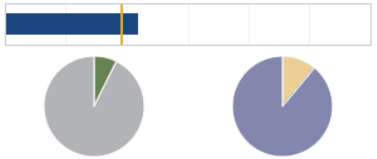


What Time Did Congestion Happen in 2020?



Delay Split

Cost Comparisons



2020 Congestion

Total Annual Delay:	169,765K Hours	Planning Time Index (PTI):	
Delay Rank:	4	PTI Rank:*	
Annual Delay/Commuter:	49 Hours	Travel Time Index (TTI):	1.15
Delay/Commuter Rank:	3	TTI Rank:	6
Congested Weekday			

Economic

Annual Congestion Cost:	$3,795M
Annual Congestion Cost Rank:	4
Congestion Cost/Commuter:	$1,097
Congestion Cost/Commuter	5

Cost Components

Value of Time:	$20.17/Hour
Commercial Value of	$55.24/Hour
Avg State Gasoline Cost:	$2.05/Gallon
Avg State Diesel Cost:	$2.51/Gallon

Truck-Based

Annual Truck Delay:	7,950K Truck Hours	Wasted Truck Fuel:	14,010K Gallons
Truck Delay Rank:	4	Wasted Truck Fuel Rank:	4
Annual Congestion Cost	$420M	Excess CO2 from Trucks:	194K Tons
Congestion Cost (Trucks) Rank:	4	Excess CO2 from Trucks Rank:*	4

Environmental

Excess Fuel Consumed:	68,295K Gallons
Excess Fuel Consumed Rank:	4
Wasted Fuel/Commuter:	21 Gallons
Wasted Fuel/Commuter Rank:	2
Excess CO2 from Congestion:	681K Tons
Excess CO2 from Congestion	4

*Rank based on 101 legacy urban areas rather than all 494 urban areas.

Texas Department of Transportation
100 Most Congested Roads

Rank	Rank Truck	Roadway	From	To	County	Annual Hrs of Delay per Mile	Annual Hrs of Truck Delay per Mile	TTI	PTI	CSI	Annual Congestion Cost (M)	Annual Truck Congestion Cost (M)
1	2	IH 610	IH 10 / US 90	US 59 / IH 69	Harris	1,112,917	68,89	2.45	3.89	3.25	$90.63	$20.99
2	1	IH 35	US 290 N	SH71	Travis	1,085,136	108,645	2.71	4.73	3.54	$215.22	$72.33
3	3	US 59	IH 610	SH 288	Harris	870,291	51,604	2.12	3.36	2.17	$105.83	$23.64
4	44	Woodall Rodgers Fwy	US 75	N Beckley Ave	Dallas	748,546	14,976	2.03	3.06	2.31	$21.31	$1.81
5	5	IH 10 / US 90	N Eldridge Pkwy	Sam Houston Tollway W	Harris	659,959	48,855	1.95	3.33	2.30	$50.23	$13.43
6	9	IH 45	Sam Houston Tollway N	IH 610	Harris	656,582	39,713	1.69	2.33	2.01	$135.37	$31.08
7	4	IH 635	IH 35E / US 77	US 75	Dallas	584,661	49,538	1.86	2.58	2.34	$112.58	$33.59
8	14	IH 35E / US 77	SH 183	IH 30	Dallas	555,861	32,302	1.72	2.62	2.14	$67.3	$14.81

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https://mobility.tamu.edu/texas-most-congested-roadways/

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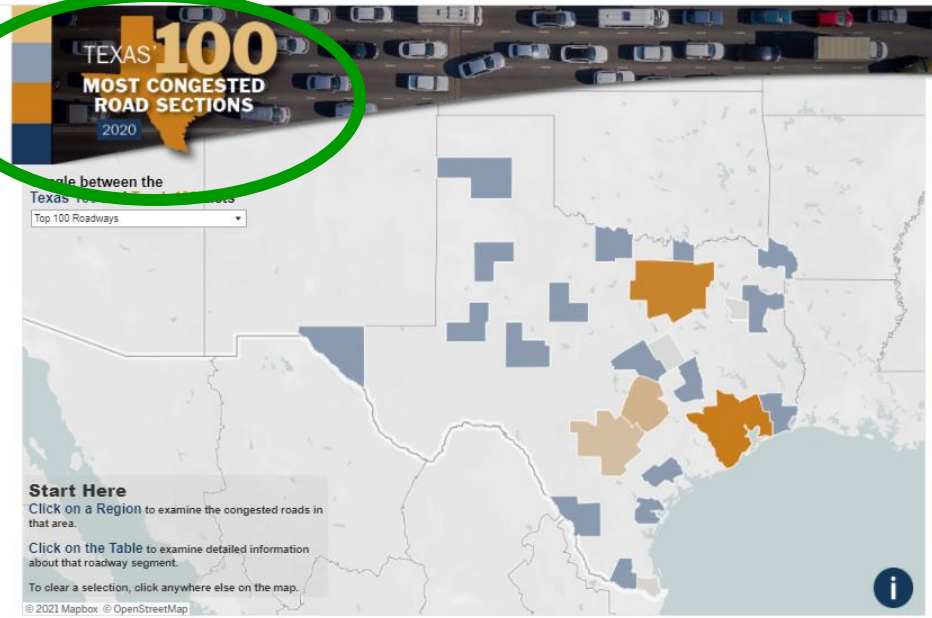
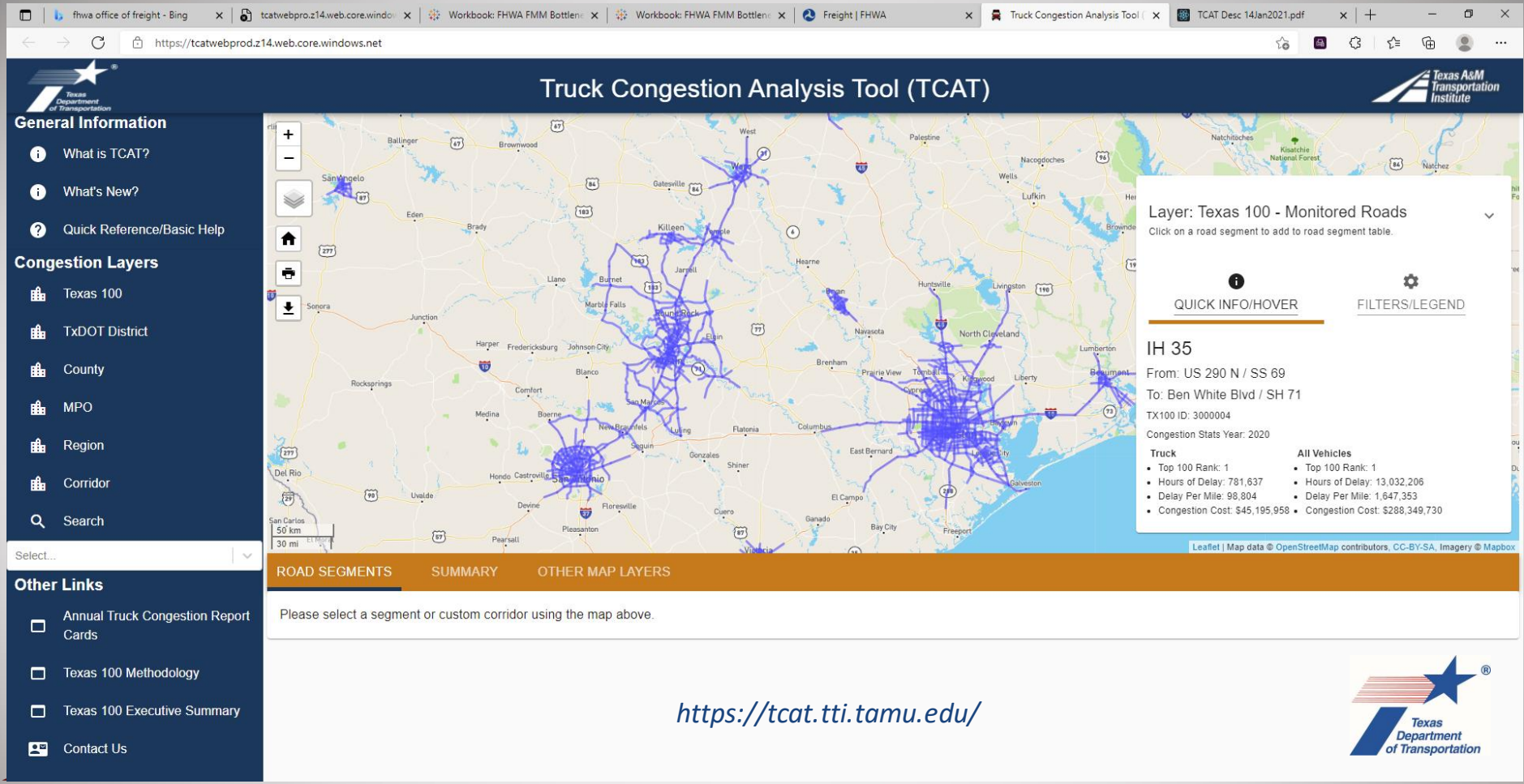


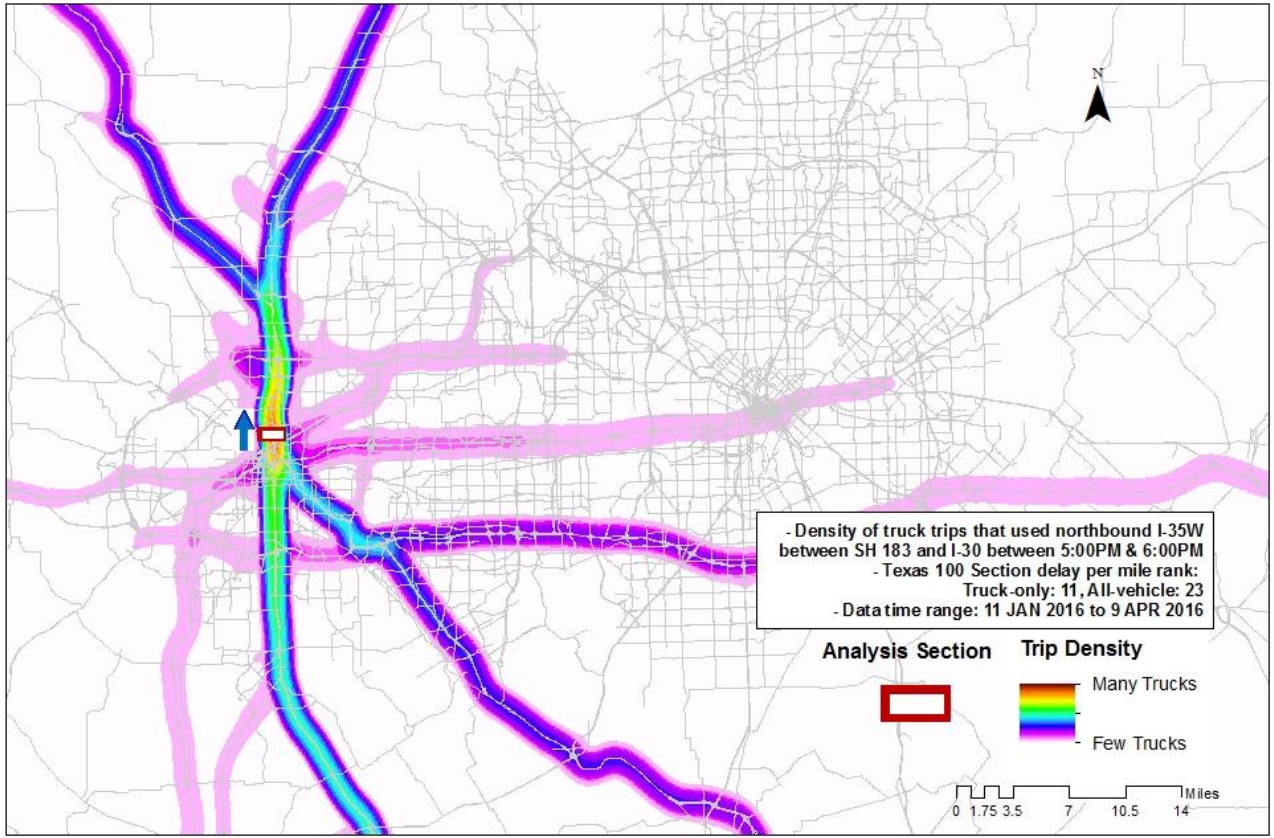
The Most Congested Roadways in Texas

Rank	Road Name	From	To	Truck Rank	Delay/Mile	TCI	PTI (95th %)	Annual Congestion Cost
1	IH 35	US 290 N / SS 69	Ben White Blvd / SH 71	1	1,647,353	2.88	5.14	$288,349,730
2	W Loop Fwy / IH 610	Katy Fwy / IH 10 / US 90	Southwest Fwy / US 59 / IH 69	3	1,628,226	2.48	3.74	$124,306,026
3	Southwest Fwy / IH 69 / US 59	W Loop Fwy / IH 610	South Fwy / SH 288	10	1,212,072	2.13	3.32	$138,668,566
4	Woodall Rodgers Fwy / SS 366	US 75	N Beckley Ave	51	1,101,570	2.17	3.02	$32,244,105
5	Eastex Fwy / IH 69 / US 59	SH 288	IH 10	2	1,003,970	2.54	3.99	$67,464,382
6	N Loop W Fwy / IH 610	North Fwy / IH 45	Katy Fwy / IH 10 / US 90	6	856,232	2.24	3.24	$117,193,926
7	Gulf Fwy / IH 45	IH 10 / US 90	S Loop E Fwy / IH 610	5	841,919	1.84	2.52	$147,204,103
8	Stemmons Fwy / IH 35E / US 77	John W. Carpenter / SH 183	Tom Landry Fwy / IH 30	7	762,476	1.78	2.58	$91,478,884
9	US 75	Lyndon B. Johnson Fwy / IH 635	Woodall Rodgers Fwy / SS 366	35	728,986	1.89	2.67	$137,657,190
10	IH 10 / US 90	North Fwy / IH 45	Eastex Fwy / US 59	4	709,397	2.12	2.95	$25,556,267
11	Katy Fwy / IH 10 / US 90	W Loop N Fwy / IH 610	North Fwy / IH 45	13	686,642	1.86	2.53	$84,468,539
12	IH 35	Ben White Blvd / SH 71	Slaughter Ln	11	624,012	1.77	2.74	$54,507,889
13	South Fwy / SH 288	Gulf Fwy / IH 45	S Loop W Fwy / IH 610	16	570,702	1.80	2.79	$59,663,362
14	Katy Fwy / IH 10 / US 90	N Eldridge Pkwy	Sam Houston Tollway W / SL 8	14	560,394	1.66	2.67	$39,665,051
15	North Fwy / IH 45	Sam Houston Tollway N	N Loop Fwy / IH 610	18	556,129	1.50	1.94	$110,223,734
16	North Fwy / IH 35W / US 287	SH 183	IH 30	8	545,796	1.83	2.56	$41,930,045
17	North Fwy / IH 45	N Loop Fwy / IH 610	IH 10 / US 90	28	530,579	1.68	2.58	$35,069,655
18	Lyndon B. Johnson Fwy / IH 635	Stemmons Fwy / IH 35E / US 77	US 75	27	525,050	1.61	1.94	$88,543,351


Truck Congestion Analysis Tool (TCAT)
https://tcatwebprod.z14.web.core.windows.net
General Information
What is TCAT?
What's New?
Quick Reference/Basic Help
Congestion Layers
Texas 100
TxDOT District
County
MPO
Region
Corridor
Search
Select...
Other Links
Annual Truck Congestion Report Cards
Texas 100 Methodology
Texas 100 Executive Summary
Contact Us
Layer: Texas 100 - Monitored Roads
Click on a road segment to add to road segment table.
QUICK INFO/HOVER
FILTERS/LEGEND
IH 35
From: US 290 N / SS 69
To: Ben White Blvd / SH 71
TX100 ID: 3000004
Congestion Stats Year: 2020
Truck
Top 100 Rank: 1
Hours of Delay: 781,637
Delay Per Mile: 98,804
Congestion Cost: $45,195,958
All Vehicles
Top 100 Rank: 1
Hours of Delay: 13,032,206
Delay Per Mile: 1,647,353
Congestion Cost: $288,349,730
ROAD SEGMENTS
SUMMARY
OTHER MAP LAYERS
Please select a segment or custom corridor using the map above.
https://tcat.tti.tamu.edu/

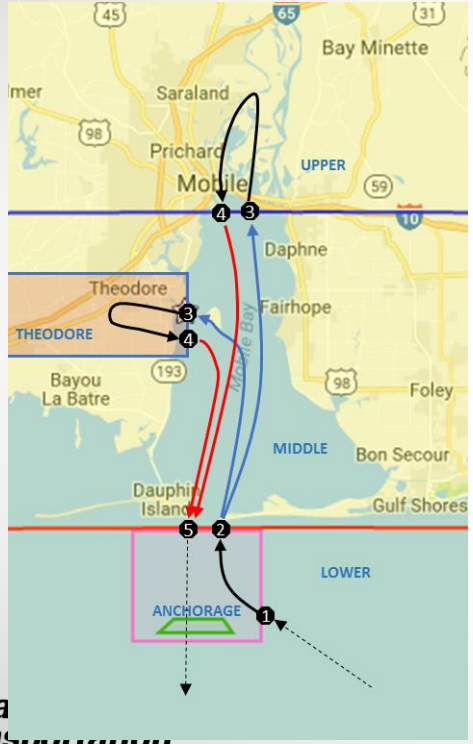
Select Link Analysis - Heat Maps

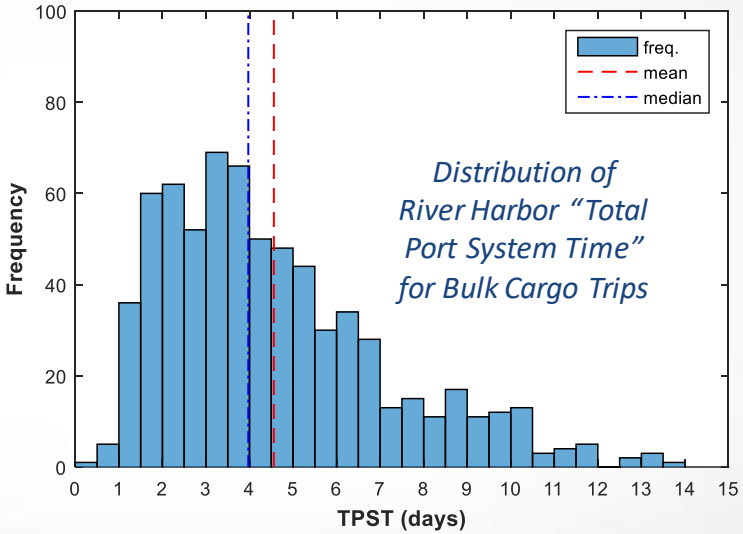
Truck Trip Patterns (for All Trucks Using I-35W Northbound in Downtown Fort Worth)



Sample Multi-modal Opportunities (to inform Freight Fluidity)

Developing and Implementing a Freight Fluidity Management Framework for U.S. Ports (U.S. Army Corps of Engineers)





Port of Mobile, Alabama

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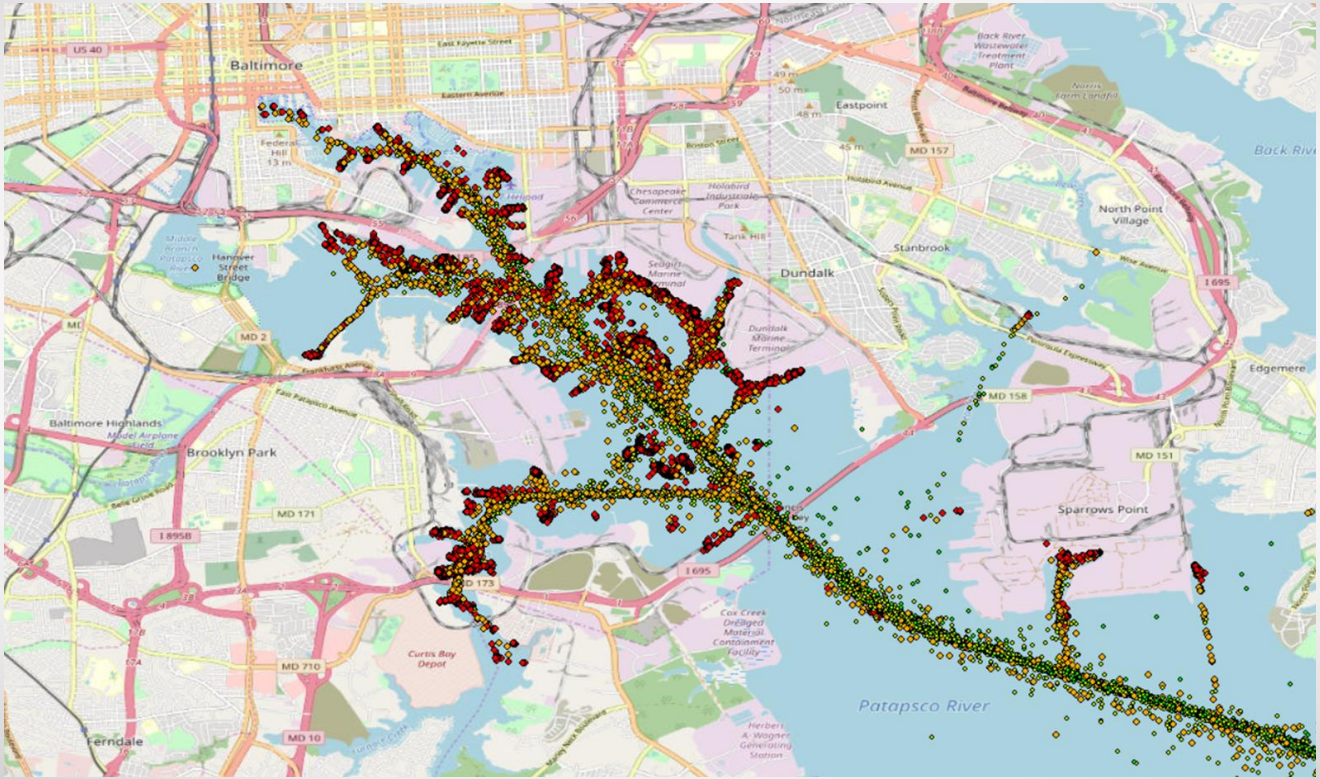
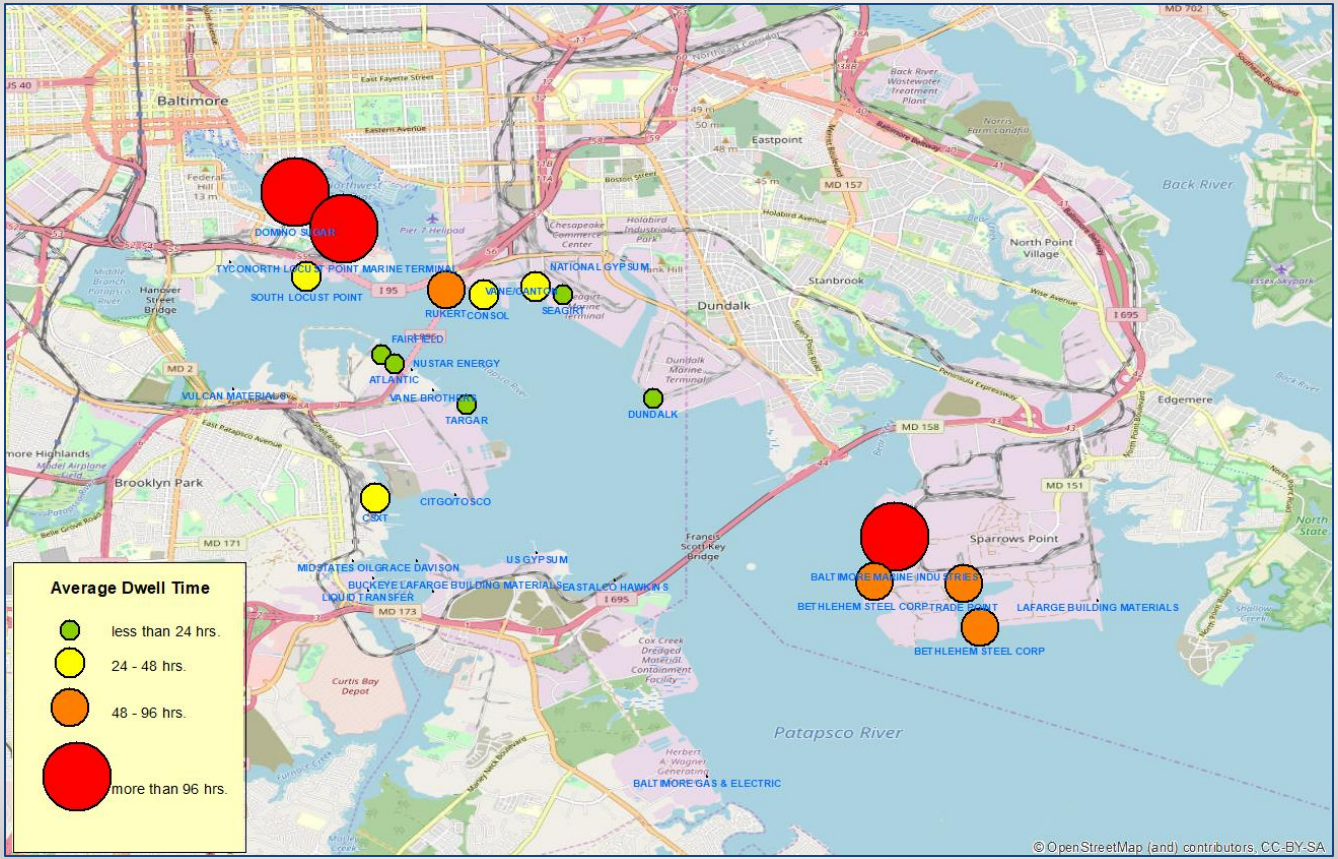
AIS Plot of All Vessels *(Port of Baltimore)*



Dwell Time at Terminal Areas *(Port of Baltimore)*



Port Fluidity Analysis

- Practical Interpretation of Results (Port of Brownsville, Texas):
  - The coefficients represent unitary increments of traffic per roadway and direction by a unit of change in sea import or export flows.
  - Example:
    - Model 1 B2out (SH 48 Outbound), a unit of sea cargo (e.g., one ton) arriving at the Port of Brownsville, is expected to be associated with an increase of outgoing traffic (from the port) in SH 48 (B2) in the same week ("lag0" model) by 0.095%, and by 0.070% two weeks before ("lag2" model) vessel arrival.

- ***For a single vessel visit carrying 1,000 TEUS, this translates into 15 more trucks per week in the same week, and 11 more trucks per week two weeks before going out of the port on SH 48.***

	Model 1 (Imports)
SH 48 Outound (B2Out)	Import_lag0 (0.0009541) Import_lag2 (0.0007017)

	Model 1 (Imports)
SH 48 Outound (B2Out)	Same week (+15 trucks) 2 weeks prior (+11 trucks)

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Contact Info & Selected Resources

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(find me on LinkedIn)

Texas A&M Transportation Institute Mobility Division

http://mobility.tamu.edu

- TTI 2021 *Urban Mobility Report*, https://mobility.tamu.edu/umr/
- Transportation Research Board, Urban Freight Transportation Committee
  - http://urbanfreight.tti.tamu.edu
  - *"Urban Freight Transportation Committee Centennial Paper: Embracing the Future with Insights from the Past"*

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