Texas A&M Transportation Institute

Improving Freight Investment Decision-making with Big Data and Effective Communication Techniques

Bill Eisele, Ph.D., P.E., PMP
Senior Research Engineer & Mobility Division Head
Texas A&M Transportation Institute

May 5, 2022
Freight Mobility Research Institute (FMRI)
Boca Raton, Florida

Our Conversation Today

- A brief TTI Introduction
- The typical freight data
- Selected projects and visualizations
- Freight challenges (and opportunities)
- Some final thoughts
- Discussion

Texas A&M Transportation Institute

Vision

TTI leads in the creation of knowledge that transforms transportation for the benefit of society.

Mission

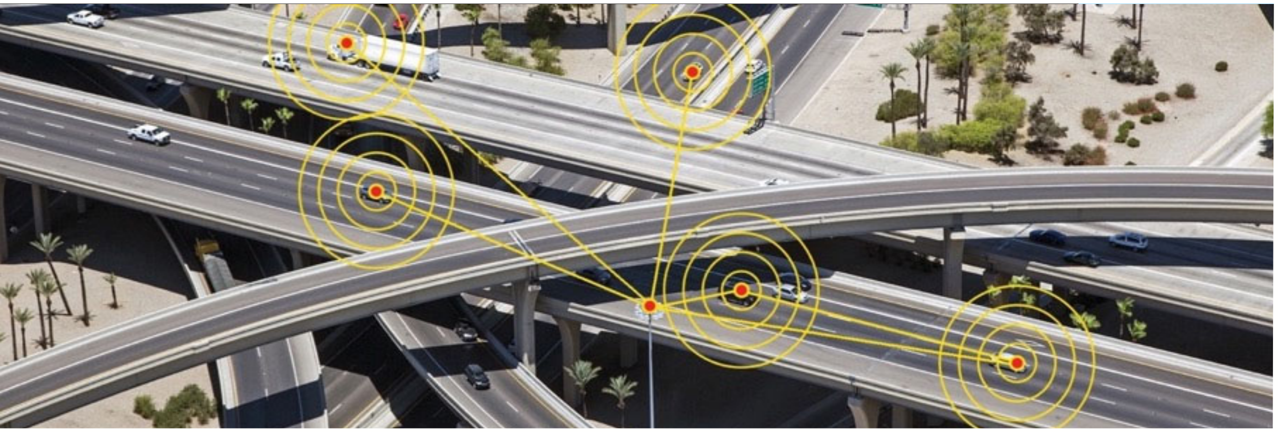
TTI delivers practical, innovative and sustainable solutions to improve the movement of people, data, and goods through research, education, and technology transfer.

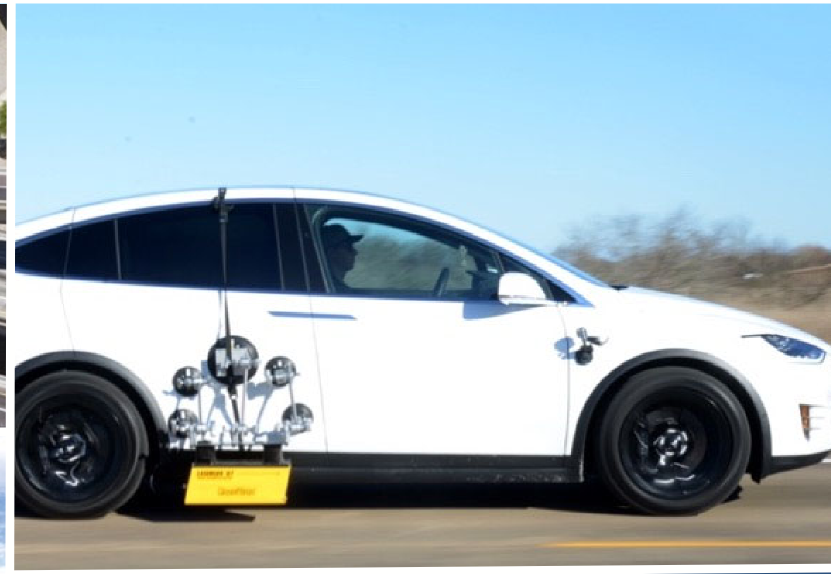
Legacy

Established 1950

State Agency

Early Focus: *roadside safety, pavements, bridges*





Current Research Emphases

Technology

CAV

Mobility

Human Behavior

Our Research Portfolio

- Mobility
- Human Interaction
- Economics
- Connected Transportation
- Infrastructure
- Safety
- Workforce Development
- Planning and Operations
- Policy
- Freight
- Environment
- Security

Key Messages

I want you to…

- …keep in mind why informed system performance is important – decision-making, accountability, transparency, and *"it's the right thing to do."*
- …understand that data are available (and constantly improving) to help tell the story of person and goods movement (and related investment needs) across modes.
- …understand that supply chain data are the "Holy Grail" of freight data to inform modal data integration.
- …know that there are many on-going successful national, state and local mobility analyses activities and visualizations (several examples are provided) from which we can build for improved decision-making.

Texas A&M Transportation Institute

Why Care about Freight Transportation?

- It's only important if you eat….
- ….or buy anything
- The backbone of our economy (supply chains, logistics systems)
- All modes are critical to freight transportation
  - Trucks (big and small), rail, air, ports (ships), bikes, robots, etc.
- Explosion in e-commerce
- And so much more….

Texas A&M Transportation Institute

Fixing the Problem Starts with Understanding It
Understanding System Performance to Improve Planning and Investment Decisions

With improved understanding, we can…

- …identify when, where, and how people and goods are moving
- …identify congested locations & bottlenecks in the system
- …inform policy, program, and project prioritization/selection
- …identify impacts of situations & solutions
- …inform performance management (system monitoring)
- …*and because it's the right thing to do!*
  - Accountability and transparency

Texas A&M Transportation Institute

The (Freight) Data

- **Travel Time & Travel Time Reliability ("Easiest")**
  Highway monitoring systems; National Performance Management Research Dataset; company/vendor probe datasets; Automatic Identification System (AIS)
- **Cost (using value of time, cost of unreliability) ("Moderately Easy")**
  Business-to-business information; survey input; industry input/trends; Consumer Price Index
- **Volume of goods ("More Difficult")**
  Commodity Flow Survey; Freight Analysis Framework; Economic Census; Highway Performance Monitoring System; Lloyd's Register; industry input

Texas A&M Transportation Institute

The (Freight) Data (cont.)

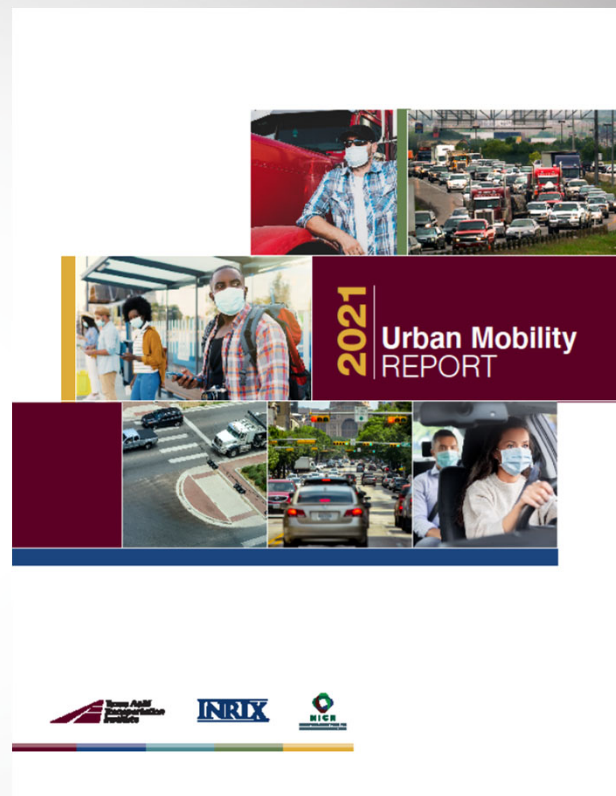
- **Origin-Destination Data ("Getting Easier")**
  Travel surveys; vendor datasets (QA/QC); Electronic Logging Devices (ELDs)
- **Supply Chain End-to-End Data (across modes) ("Difficult")**
  The "Holy Grail"; business-to-business information; supply chain survey input; industry input

Evolving technologies (AV/CV, robots, drones, etc.) will provide future data sources…

Texas A&M Transportation Institute

2021 Urban Mobility Report

- Evaluates mobility conditions in urban areas
- Freeway and principal arterial street networks
- 101 urban areas from 1982 to 2020
- 393 <mostly smaller> urban areas from 2014 to 2020
- Uses a suite of performance measures



Texas A&M Transportation Institute

https://mobility.tamu.edu/umr

National Congestion Statistics

- Annual 2020 congestion costs and travel delays <u>were half</u> the 2019 levels

Measure	2019	2020
Annual Delay Per Auto Commuter (hours)	54	27
Wasted Fuel Per Auto Commuter (Gallons)	22	11
Congestion Cost Per Auto Commuter (in 2020$)	$1,170	$605

https://mobility.tamu.edu/umr

Texas A&M Transportation Institute

National Congestion Statistics

Measure	2019	2020
Hours of Extra Travel Time (Billions)	8.7	4.3
Gallons of Fuel Wasted (Billions)	3.5	1.7
Cost to Society (Billions)	$190	$101
Truck Congestion Cost (Billions)	$20	$11
Tons of Extra CO2 Due to Congestion (Million)	36	18

- Total congestion delay was similar to 1997

https://mobility.tamu.edu/umr

Texas A&M Transportation Institute

Selected Florida Congestion Statistics

Urban Area	Delay per Auto Commuter 2020, 2019	Cost per Auto Commuter 2020, 2019
Miami, FL	**27 (42),** 74 (10)	**$608 (35),** $1,606 (11)
Orlando, FL	**22,** 61	**$471,** $1,261
Jacksonville, FL	**21,** 53	**$448,** $1,089
Tampa-St. Petersburg, FL	**18,** 53	**$401,** $1,125
Cape Coral, FL	**15,** 45	**$337,** $938
Sarasota-Bradenton, FL	**12,** 35	**$247,** $695

***Bold** = 2020 values*

Texas A&M Transportation Institute

https://mobility.tamu.edu/umr

Miami Visualization

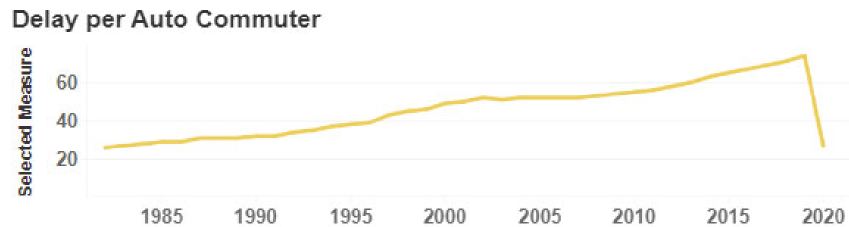
URBAN MOBILITY REPORT 2021

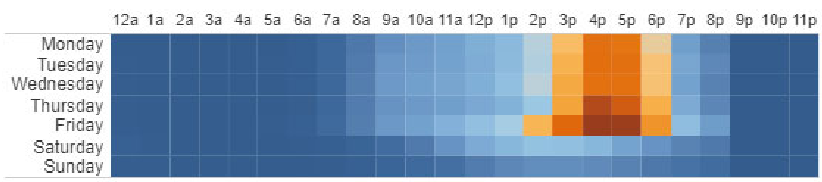
Miami, FL

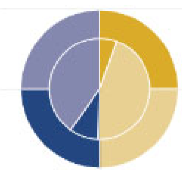
Year: 2020

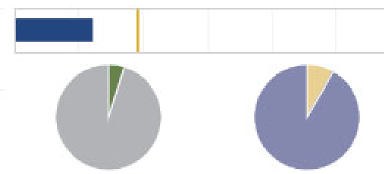
Miami's 2020 delay is **37%** of 2019 delay levels.

Measure: Delay per Auto Commuter









2020 Congestion

Total Annual Delay:	112,879K Hours	Planning Time Index (PTI):	
Delay Rank:	7	PTI Rank:*	
Annual Delay/Commuter:	27 Hours	Travel Time Index (TTI):	1.11
Delay/Commuter Rank:	45	TTI Rank:	34
Congested Weekday			

Economic

Annual Congestion Cost:	$2,491M
Annual Congestion Cost Rank:	8
Congestion Cost/Commuter:	$608
Congestion Cost/Commuter	39

Cost Components

Value of Time:	$20.17/Hour
Commercial Value of	$55.24/Hour
Avg State Gasoline Cost:	$2.26/Gallon
Avg State Diesel Cost:	$2.71/Gallon

Truck-Based

Annual Truck Delay:	3,956K Truck Hours	Wasted Truck Fuel:	6,429K Gallons
Truck Delay Rank:	11	Wasted Truck Fuel Rank:	11
Annual Congestion Cost	$209M	Excess CO2 from Trucks:	70K Tons
Congestion Cost (Trucks) Rank:	11	Excess CO2 from Trucks Rank:*	12

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

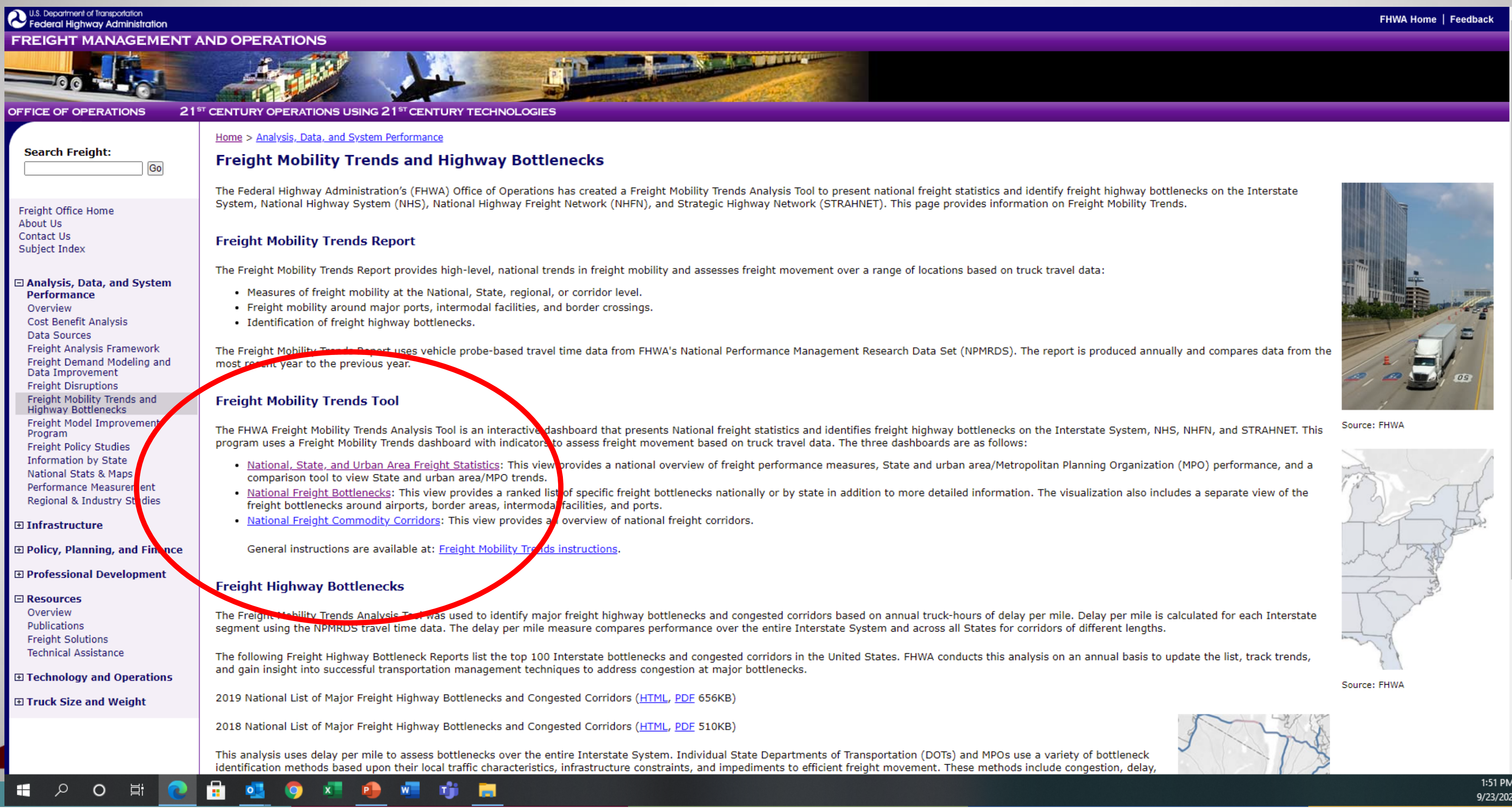
Environmental

Excess Fuel Consumed:	44,167K Gallons
Excess Fuel Consumed Rank:	8
Wasted Fuel/Commuter:	13 Gallons
Wasted Fuel/Commuter Rank:	29
Excess CO2 from Congestion:	440K Tons
Excess CO2 from Congestion	8

Texas A&M Transportation Institute

FHWA Freight Mobility Trends (FMT) Tool

https://ops.fhwa.dot.gov/freight/freight_analysis/mobility_trends/index.htm



U.S. Department of Transportation
Federal Highway Administration

FHWA Home | Feedback

FREIGHT MANAGEMENT AND OPERATIONS

OFFICE OF OPERATIONS 21ST CENTURY OPERATIONS USING 21ST CENTURY TECHNOLOGIES

Search Freight: Go

Freight Office Home
About Us
Contact Us
Subject Index

⊟ **Analysis, Data, and System Performance**
Overview
Cost Benefit Analysis
Data Sources
Freight Analysis Framework
Freight Demand Modeling and Data Improvement
Freight Disruptions
Freight Mobility Trends and Highway Bottlenecks
Freight Model Improvement Program
Freight Policy Studies
Information by State
National Stats & Maps
Performance Measurement
Regional & Industry Studies

⊞ **Infrastructure**

⊞ **Policy, Planning, and Finance**

⊞ **Professional Development**

⊟ **Resources**
Overview
Publications
Freight Solutions
Technical Assistance

⊞ **Technology and Operations**

⊞ **Truck Size and Weight**

Home > Analysis, Data, and System Performance

Freight Mobility Trends and Highway Bottlenecks

The Federal Highway Administration's (FHWA) Office of Operations has created a Freight Mobility Trends Analysis Tool to present national freight statistics and identify freight highway bottlenecks on the Interstate System, National Highway System (NHS), National Highway Freight Network (NHFN), and Strategic Highway Network (STRAHNET). This page provides information on Freight Mobility Trends.

Freight Mobility Trends Report

The Freight Mobility Trends Report provides high-level, national trends in freight mobility and assesses freight movement over a range of locations based on truck travel data:

- Measures of freight mobility at the National, State, regional, or corridor level.
- Freight mobility around major ports, intermodal facilities, and border crossings.
- Identification of freight highway bottlenecks.

The Freight Mobility Trends Report uses vehicle probe-based travel time data from FHWA's National Performance Management Research Data Set (NPMRDS). The report is produced annually and compares data from the most recent year to the previous year.

Source: FHWA

Freight Mobility Trends Tool

The FHWA Freight Mobility Trends Analysis Tool is an interactive dashboard that presents National freight statistics and identifies freight highway bottlenecks on the Interstate System, NHS, NHFN, and STRAHNET. This program uses a Freight Mobility Trends dashboard with indicators to assess freight movement based on truck travel data. The three dashboards are as follows:

- National, State, and Urban Area Freight Statistics: This view provides a national overview of freight performance measures, State and urban area/Metropolitan Planning Organization (MPO) performance, and a comparison tool to view State and urban area/MPO trends.
- National Freight Bottlenecks: This view provides a ranked list of specific freight bottlenecks nationally or by state in addition to more detailed information. The visualization also includes a separate view of the freight bottlenecks around airports, border areas, intermodal facilities, and ports.
- National Freight Commodity Corridors: This view provides an overview of national freight corridors.

General instructions are available at: Freight Mobility Trends instructions.

Source: FHWA

Freight Highway Bottlenecks

The Freight Mobility Trends Analysis Tool was used to identify major freight highway bottlenecks and congested corridors based on annual truck-hours of delay per mile. Delay per mile is calculated for each Interstate segment using the NPMRDS travel time data. The delay per mile measure compares performance over the entire Interstate System and across all States for corridors of different lengths.

The following Freight Highway Bottleneck Reports list the top 100 Interstate bottlenecks and congested corridors in the United States. FHWA conducts this analysis on an annual basis to update the list, track trends, and gain insight into successful transportation management techniques to address congestion at major bottlenecks.

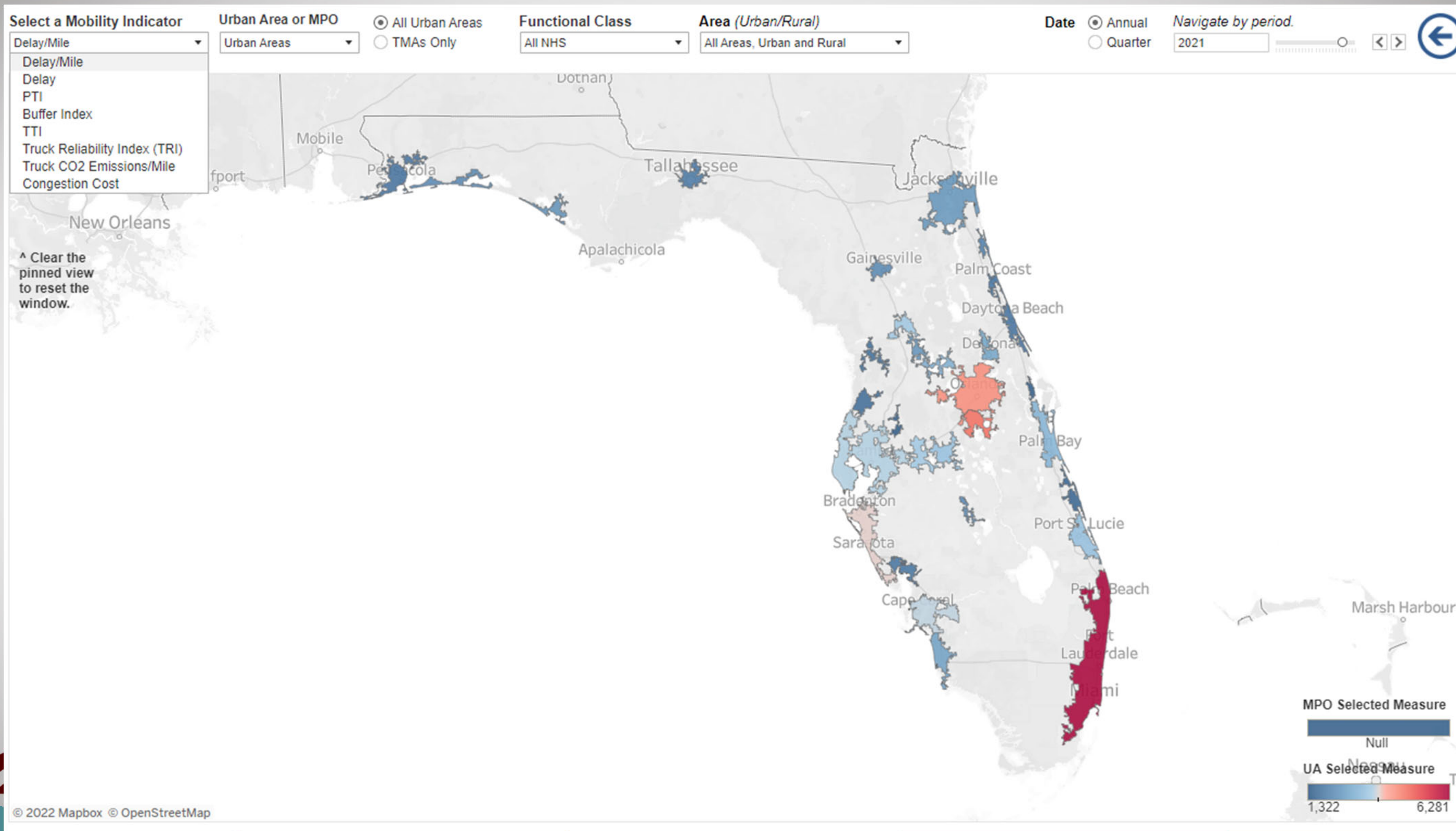
2019 National List of Major Freight Highway Bottlenecks and Congested Corridors (HTML, PDF 656KB)

2018 National List of Major Freight Highway Bottlenecks and Congested Corridors (HTML, PDF 510KB)

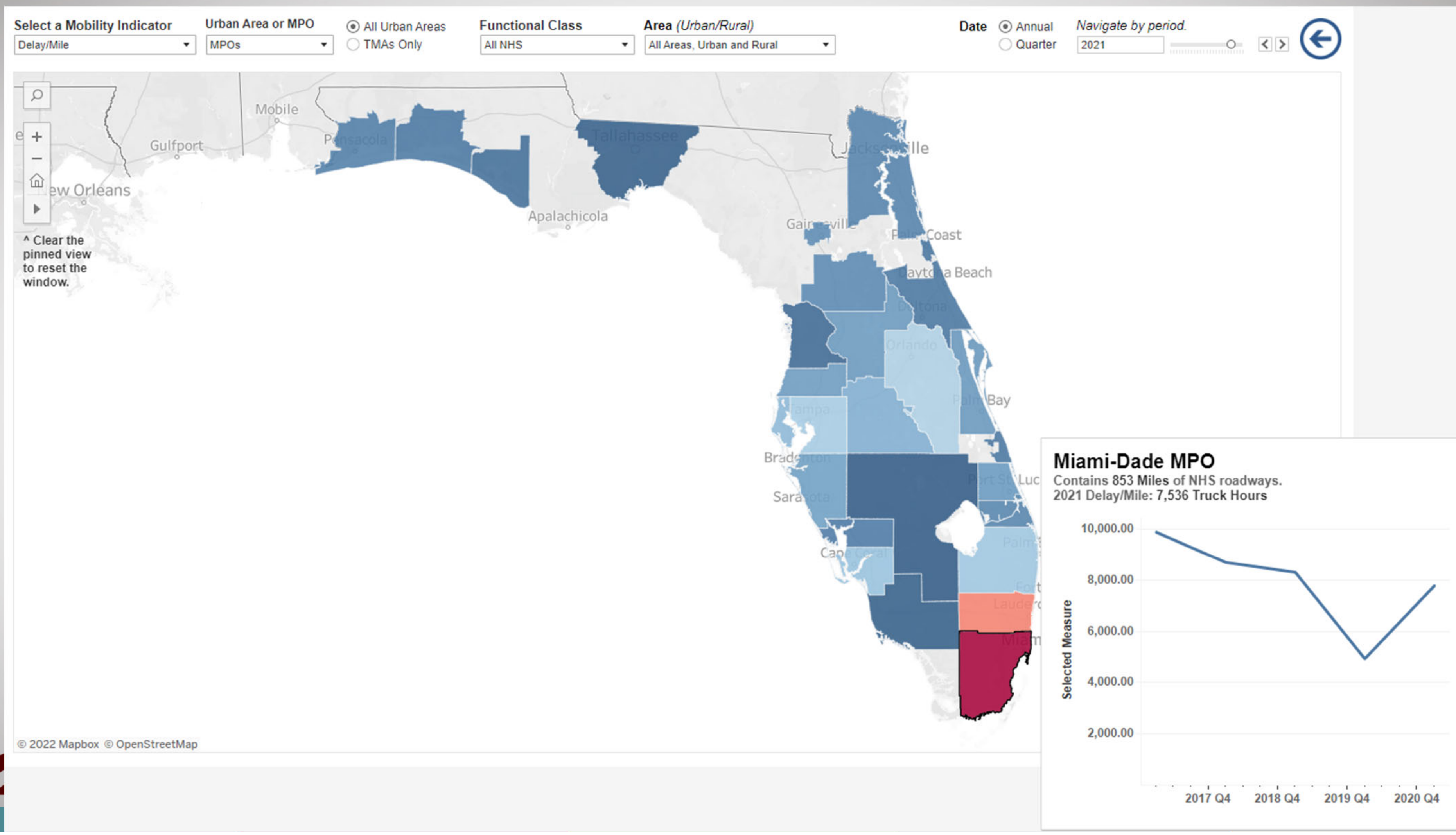
This analysis uses delay per mile to assess bottlenecks over the entire Interstate System. Individual State Departments of Transportation (DOTs) and MPOs use a variety of bottleneck identification methods based upon their local traffic characteristics, infrastructure constraints, and impediments to efficient freight movement. These methods include congestion, delay,

1:51 PM
9/23/2021

FHWA Freight Mobility Trends (FMT) Tool



FHWA Freight Mobility Trends (FMT) Tool



U.S. Department of Transportation
Federal Highway Administration

Florida

Date: (•) Annual ( ) Quarter
Navigate by period. 2021
(•) Urban Areas ( ) MPOs
Area *(Urban/Rural)*: All Areas, Urban and Rural
Functional Class: Interstates

Select a Mobility Indicator: Delay/Mile
And How Many to Rank? 1,000
At What Time of Day? All
Primary Highway Freight System? Not Filtered
- Not Filtered
- Primary Highway Freight System
- Other Interstates Not PHFS
- PHFS and Other Interstates
- Not on the NHFN

Strategic Highway Network? Not Filtered
Direction: (All)

^ Clear the pinned view to reset the window.

MPO Selected Measure
Null

UA Selected Measure
131 20,318

Color legend minimums are NOT negative.
Color gradient will change based on the measure.

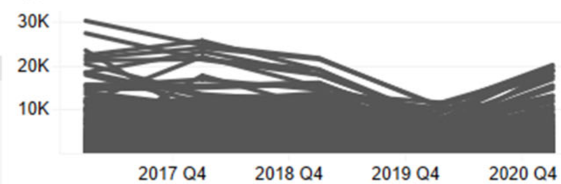
© 2022 Mapbox © OpenStreetMap

Top 300 Freight Bottlenecks based on Delay/Mile in Florida

Hover or click the table to see the segment. Click again to clear.

Rank	Urban Area	Road	Length (Miles)	AADT (Trucks)	Delay (Hours)	Delay/ Mile	PTI (95th %)	BI	TTI	TRI	CO2/ Mile	Cong. Cost	FAF Value
1	[Not in an UA]	I-4	19.7	7,877	399,216	20,318	2.36	51.8%	1.35	1.15	33 mt	$22.1M	$14.6B
2	Miami, FL	I-95	10.6	9,453	210,557	19,823	2.07	62.2%	1.25	1.43	44 mt	$11.6M	$22.6B
3	Tampa, FL	I-4	5.8	6,875	110,354	19,103	2.32	61.2%	1.36	1.32	29 mt	$6.1M	$16.6B
4	Miami, FL	I-95	7.7	4,816	147,218	19,018	3.90	146.0%	1.58	2.00	20 mt	$8.1M	$11.4B
5	Miami, FL	I-95	1.3	10,397	24,976	19,010	1.96	55.4%	1.26	1.51	43 mt	$1.4M	$24.6B

Road: (All)



FHWA Freight Mobility Trends (FMT) Tool

U.S. Department of Transportation
Federal Highway Administration

Select Port Area Roadway Statistics *(Comparison Not Advised.)*

Name	Delay (Hours)	Delay/ Mile	PTI (95th %)	BI	TTI	TRI
Honolulu Harbor	616,735	6,489	2.43	70.0%	1.37	1.40
Illinois International Port District	297,356	5,690	1.91	53.1%	1.22	1.37
Port of Baltimore	858,195	4,100	1.59	29.4%	1.19	1.18

Date: Annual (selected) / Quarter
Navigate by period. 2021

Special Area: Port

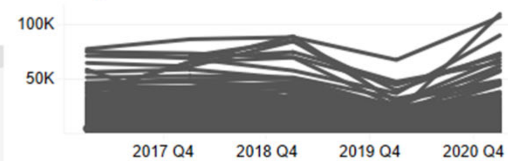
Select a Mobility Indicator: Delay/Mile
And How Many to Rank?: 1,000
At What Time of Day?: All
Functional Class: Interstates
Direction: (All)

Click a facility to see how its corridors performed.

Top 336 Freight Bottlenecks around Port Areas based on Delay/Mile

Rank	Urban Area	Road	Length (Miles)	AADT (Trucks)	Delay (Hours)	Delay/ Mile	PTI (95th %)	BI	TTI	TRI	CO2/ Mile	Cong. Cost	FAF Value
1	Cincinnati, OH	I-71/I-75	1.3	10,612	144,090	109,555	5.44	130.6%	2.25	1.30	48 mt	$8.0M	$29.6B
2	New York, NY	I-278	8.0	7,417	857,443	106,846	6.29	162.0%	2.35	1.47	52 mt	$47.4M	$43.0B
3	Baton Rouge, LA	I-10	2.2	11,189	193,737	90,002	6.43	257.5%	1.80	2.54	53 mt	$10.7M	$17.8B
4	Houston, TX	I-45	1.6	7,917	119,867	73,569	4.73	131.5%	2.02	1.63	45 mt	$6.6M	$23.3B
5	New York, NY	I-278	7.7	7,503	550,785	71,310	4.36	120.2%	1.90	1.78	48 mt	$30.4M	$43.3B

Segment Trend *(Hover or click a road in the table)*



Texas Department of Transportation
100 Most Congested Roads

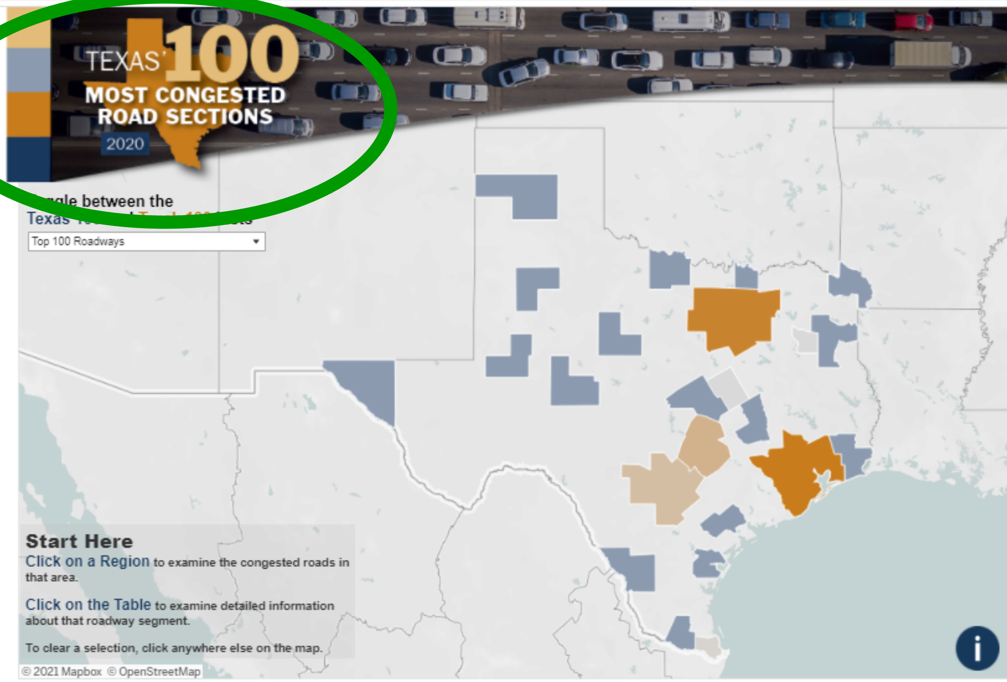
Rank	Rank Truck	Roadway	From	To	County	Annual Hrs of Delay per Mile	Annual Hrs of Truck Delay per Mile	TCI	PTI	CSI	Annual Congestion Cost (M)	Annual Truck Congestion Cost (M)
1	2	IH 610	IH 10 / US 90	US 59 / IH 69	Harris	1,112,917	68,89[illegible]	2.45	3.89	3.25	$90.63	$20.99
2	1	IH 35	US 290 N	SH71	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

Texas A&M Transportation Institute

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

Texas Department of Transportation

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



Distance

Miles Covered	9,946 Miles
Segments	1,860 Segments

Traffic Delay

Delay	528,476,928 Hours
Wasted Fuel	196,448,185 Gallons
Congestion Cost	$11,509,432,063

Truck Delay

Truck Delay	26,781,934 Hours
Truck Wasted Fuel	44,552,582 Gallons
Truck Cong. Cost	$1,546,997,366

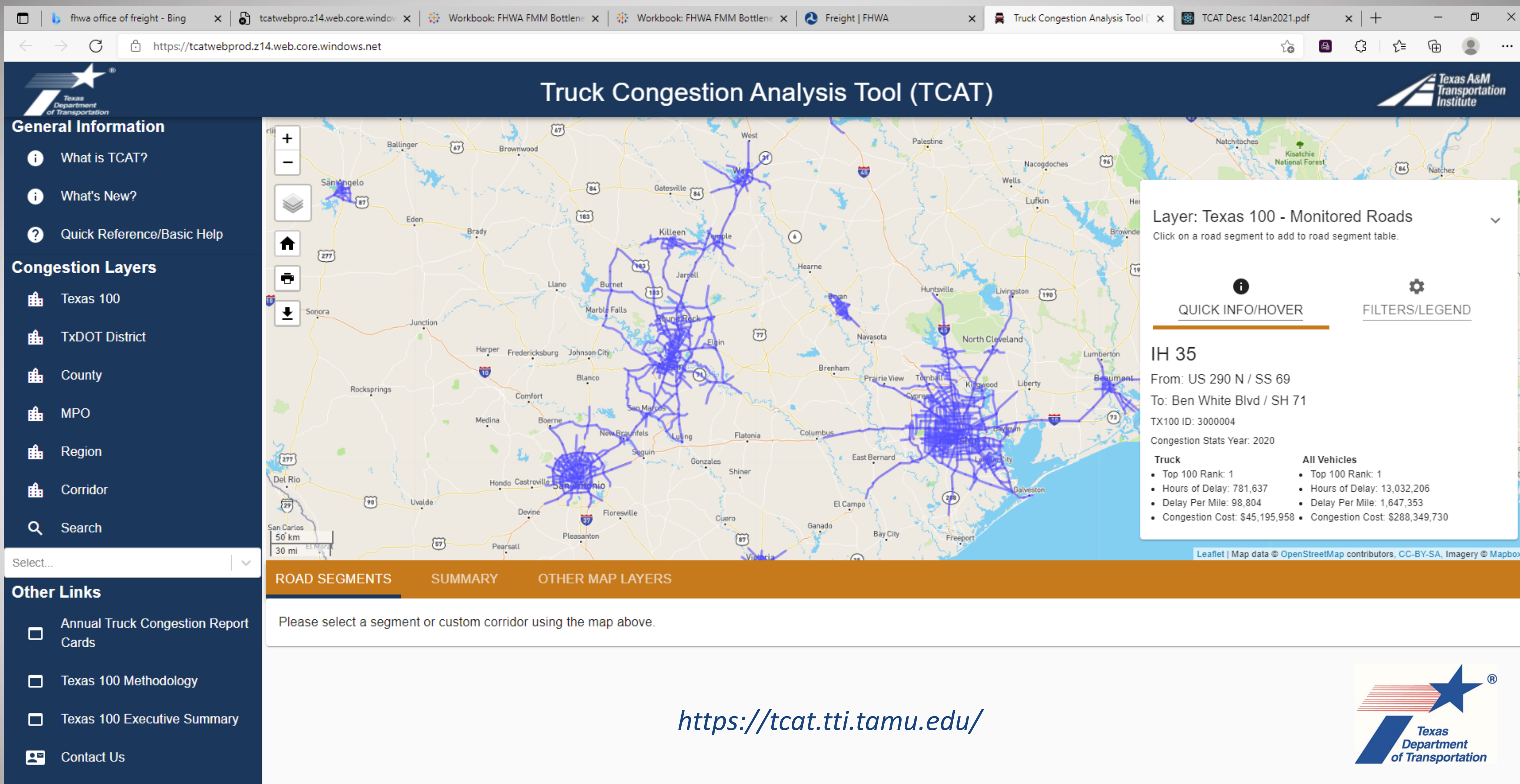
Truck Impact

- 5.1% of Total Delay
- 22.7% of Wasted Fuel
- 13.4% of Congestion Costs

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

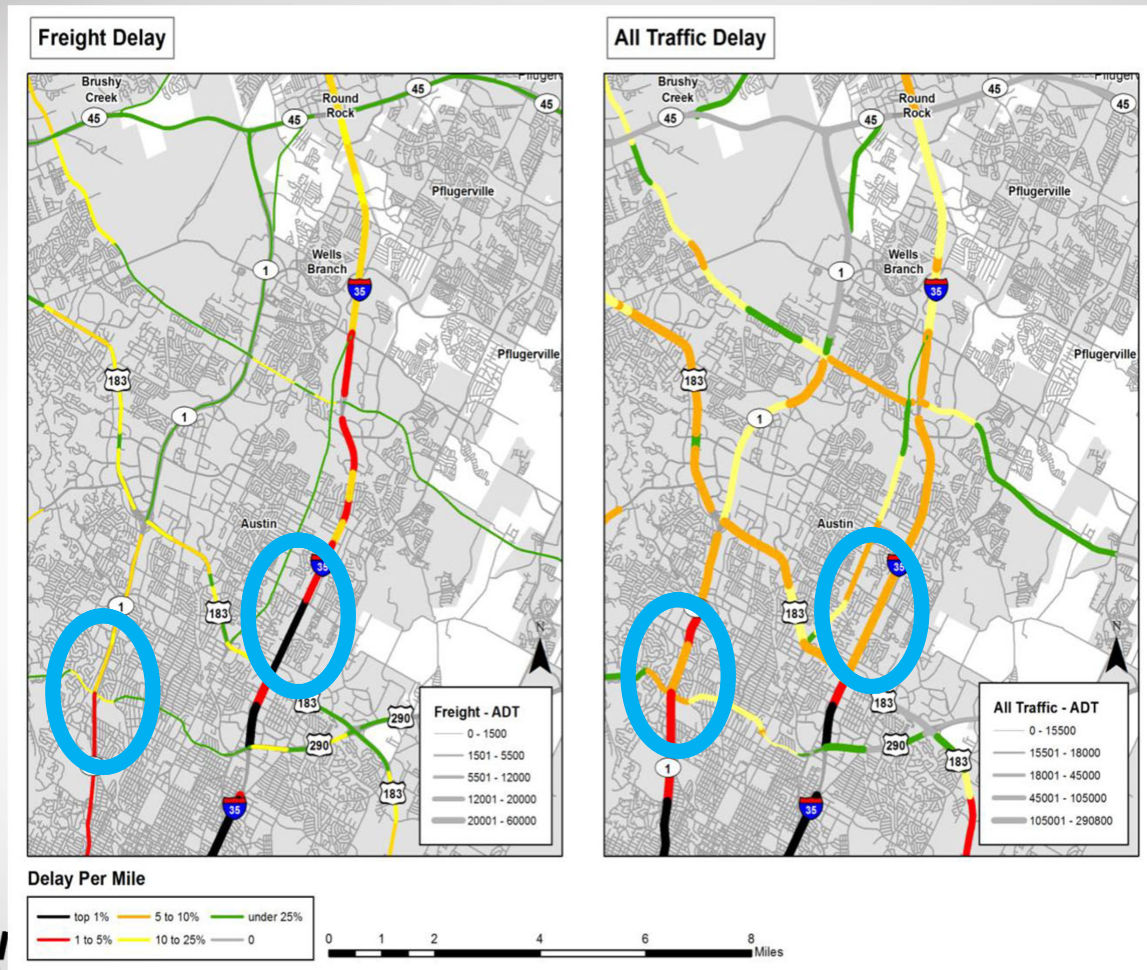
Texas Department of Transportation



https://tcat.tti.tamu.edu/

Texas Department of Transportation

Truck Delay in Austin, Texas

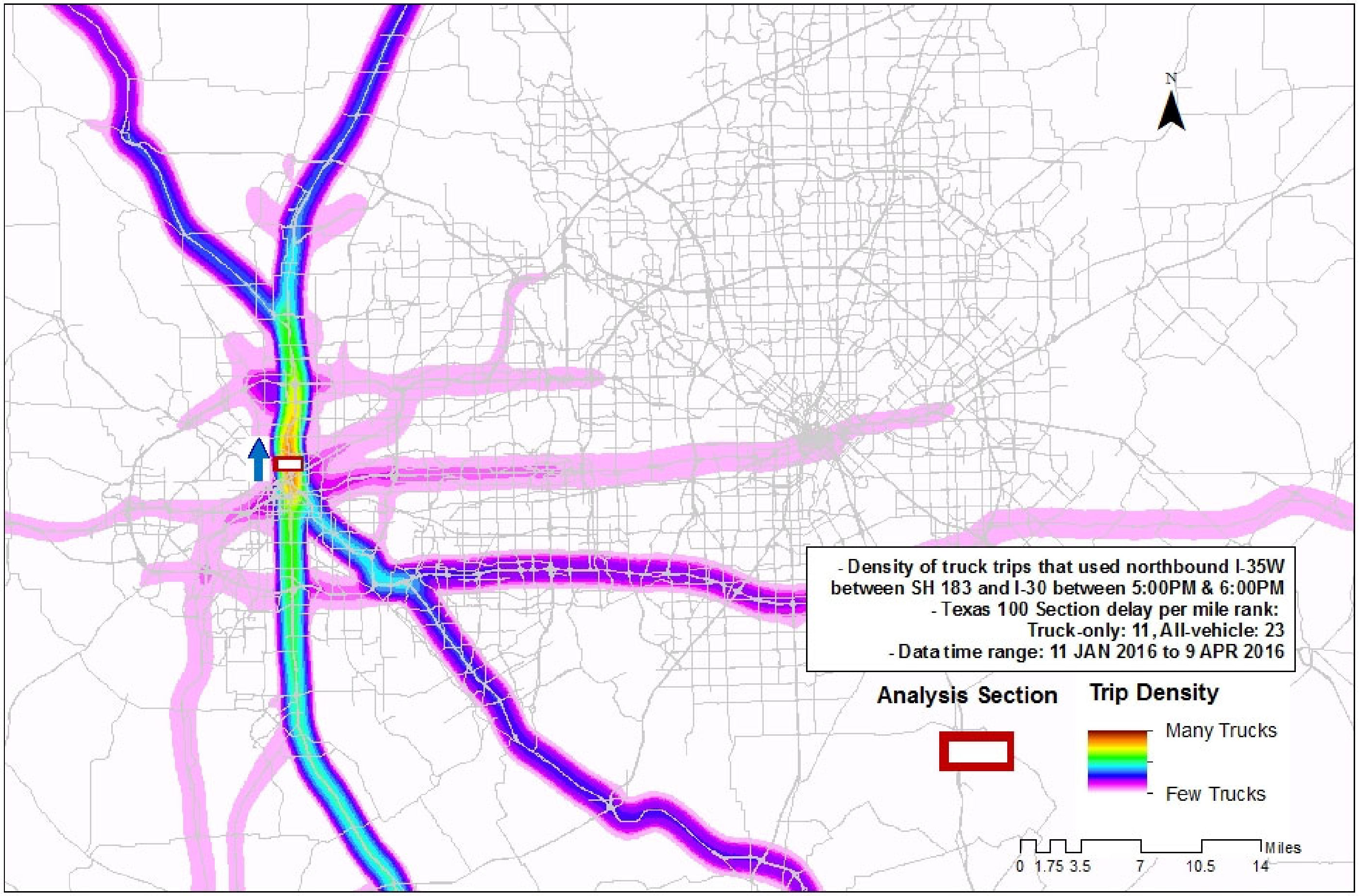


Texas A&M Transportation Institute

Texas Department of Transportation

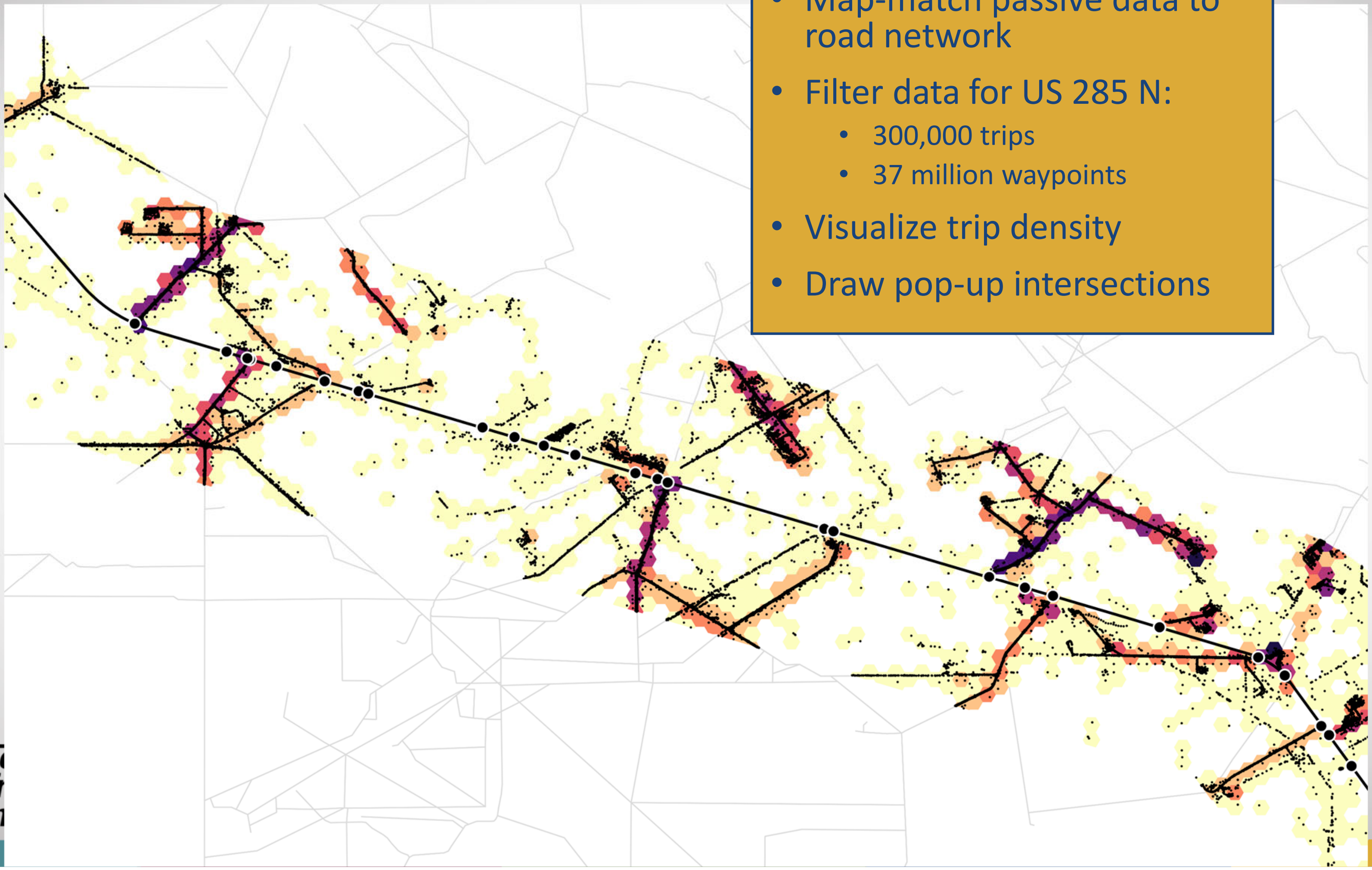
Select Link Analysis - Heat Maps

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



*35W selected area coordinate (-97.323 32.78 ;-97.316 32.77)

Unique Waypoint Data Application



Identifying Pop-up Intersections

- Map-match passive data to road network
- Filter data for US 285 N:
  - 300,000 trips
  - 37 million waypoints
- Visualize trip density
- Draw pop-up intersections

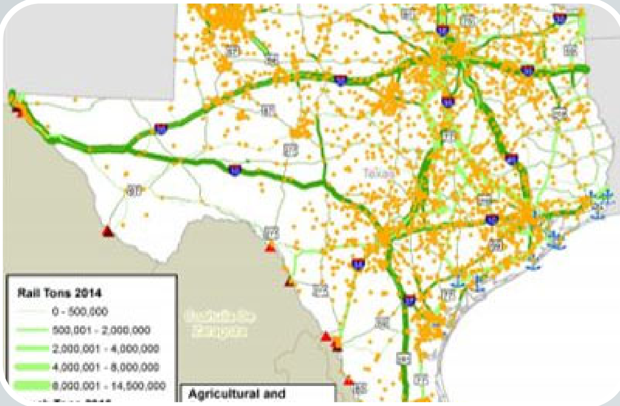
The Concept of "Freight Fluidity"

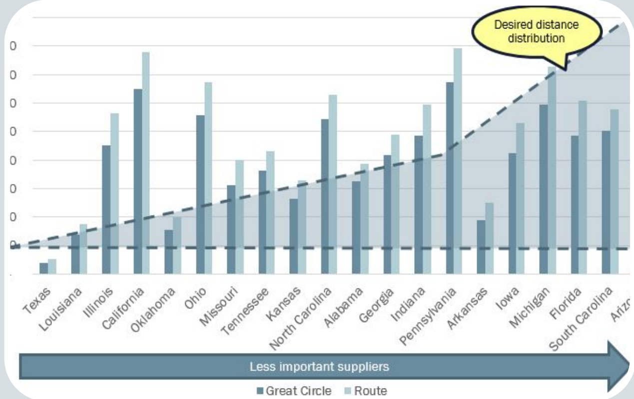
Freight Fluidity is the performance of the trips for goods moving in your state or region

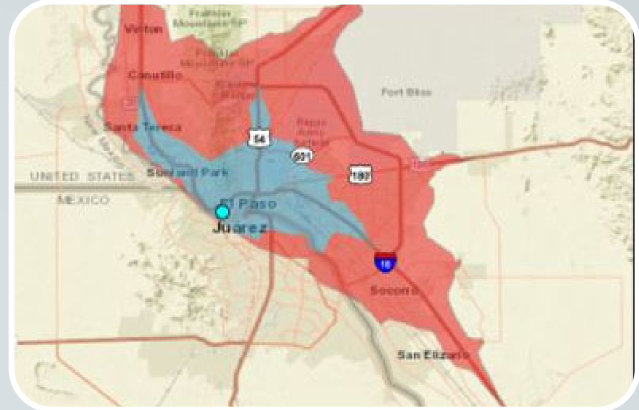
- Awareness of **goods moving in the region**
- Understanding of **current economic conditions and supply chain opportunities**
- Use of awareness and economic/supply chain intel to identify **key trip routes for freight**
- Assessment of **freight mobility and bottlenecks along these trip routes**

Texas A&M Transportation Institute

Guidebook Provides 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

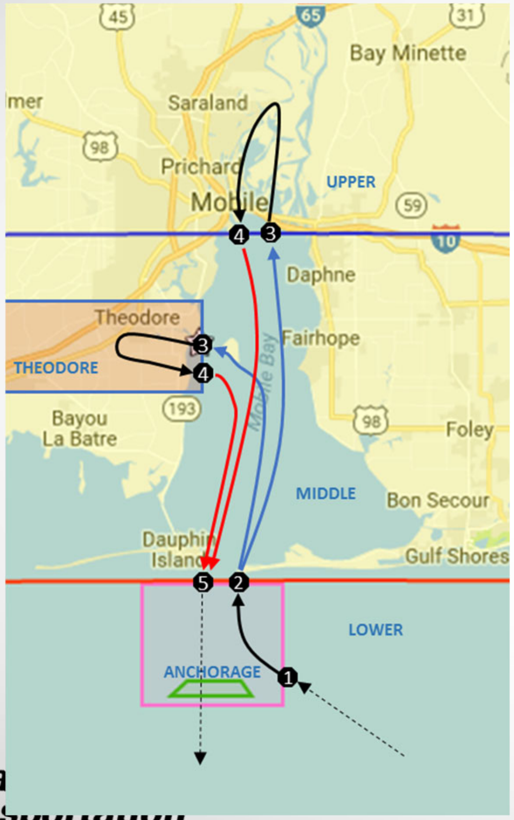
- In-Depth, Location-Specific Information using NPMRDS

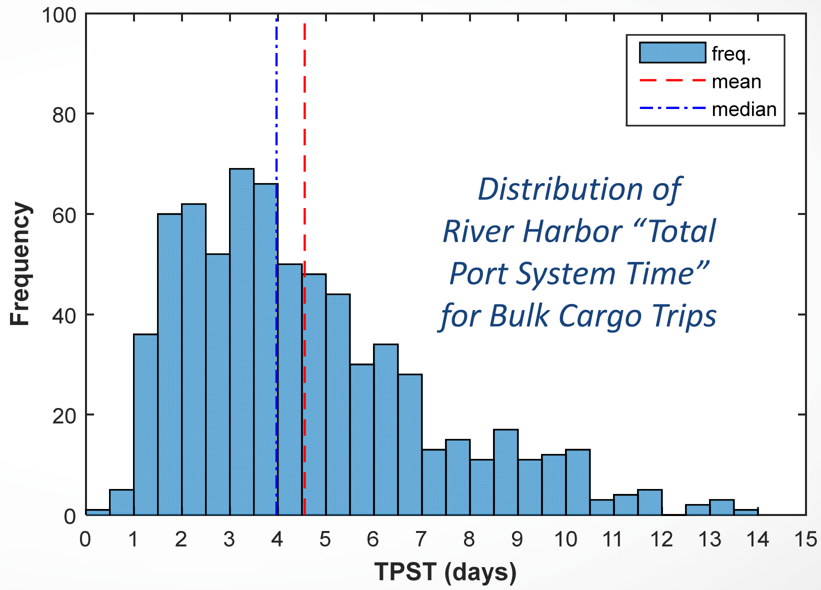
- Multimodal: Port and Border Crossing Analysis

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

<table>
<tr><th rowspan="6" colspan="2">What Resources Are Available for Understanding Freight Fluidity?</th><th colspan="10">What Questions Are You Trying to Answer?</th></tr>
<tr><th>What Key Goods or Freight Move in Texas?</th><th>Page</th><th>Where Are The Economic Relations and Opportunities?</th><th>Page</th><th>How Well Does Texas’s System Perform for Freight?</th><th>Page</th><th>What Can We Understand about Multimodal Connections and Impacts?</th><th>Page</th><th>Where Can I Get Information in a Hurry?</th><th>Page</th></tr>
<tr><td>Freight Fluidity in Detail</td><td>9</td><td rowspan="4">Economic Analysis of Trading Partners and Opportunities</td><td rowspan="4">12</td><td>Framework Development</td><td>22</td><td>Port</td><td>27</td><td>Texas 100</td><td>31</td></tr>
<tr><td>Texas Freight Mobility Plan</td><td>10</td><td>Bottlenecks</td><td>23</td><td>Border</td><td>28</td><td>COMPAT/TCAT</td><td>32</td></tr>
<tr><td>Regional or Local Plans</td><td>11</td><td>Performance Measurement/ Visualization</td><td>24</td><td rowspan="2">Next Steps</td><td rowspan="2">34</td><td rowspan="2">FHWA Freight Mobility Trends</td><td rowspan="2">33</td></tr>
<tr><td>Freight Analysis Framework</td><td>12</td><td>Multimodal Trip Connections</td><td>26</td></tr>
<tr><td rowspan="4">Who Is the User?</td><td>Leadership/ Decision Maker</td><td colspan="2">Main User</td><td colspan="2">Main User</td><td colspan="2">Main User</td><td colspan="2">Secondary User</td><td colspan="2">Secondary User</td></tr>
<tr><td>Planner/ Policy Analyst</td><td colspan="2">Main User</td><td colspan="2">Main User</td><td colspan="2">Main User</td><td colspan="2">Main User</td><td colspan="2">Main User</td></tr>
<tr><td>Operator</td><td colspan="2">Secondary User</td><td colspan="2">Secondary User</td><td colspan="2">Main User</td><td colspan="2">Main User</td><td colspan="2">Main User</td></tr>
<tr><td>Industry Partners</td><td colspan="2">Main User</td><td colspan="2">Secondary User</td><td colspan="2">Main User</td><td colspan="2">Secondary User</td><td colspan="2">Secondary User</td></tr>
</table>

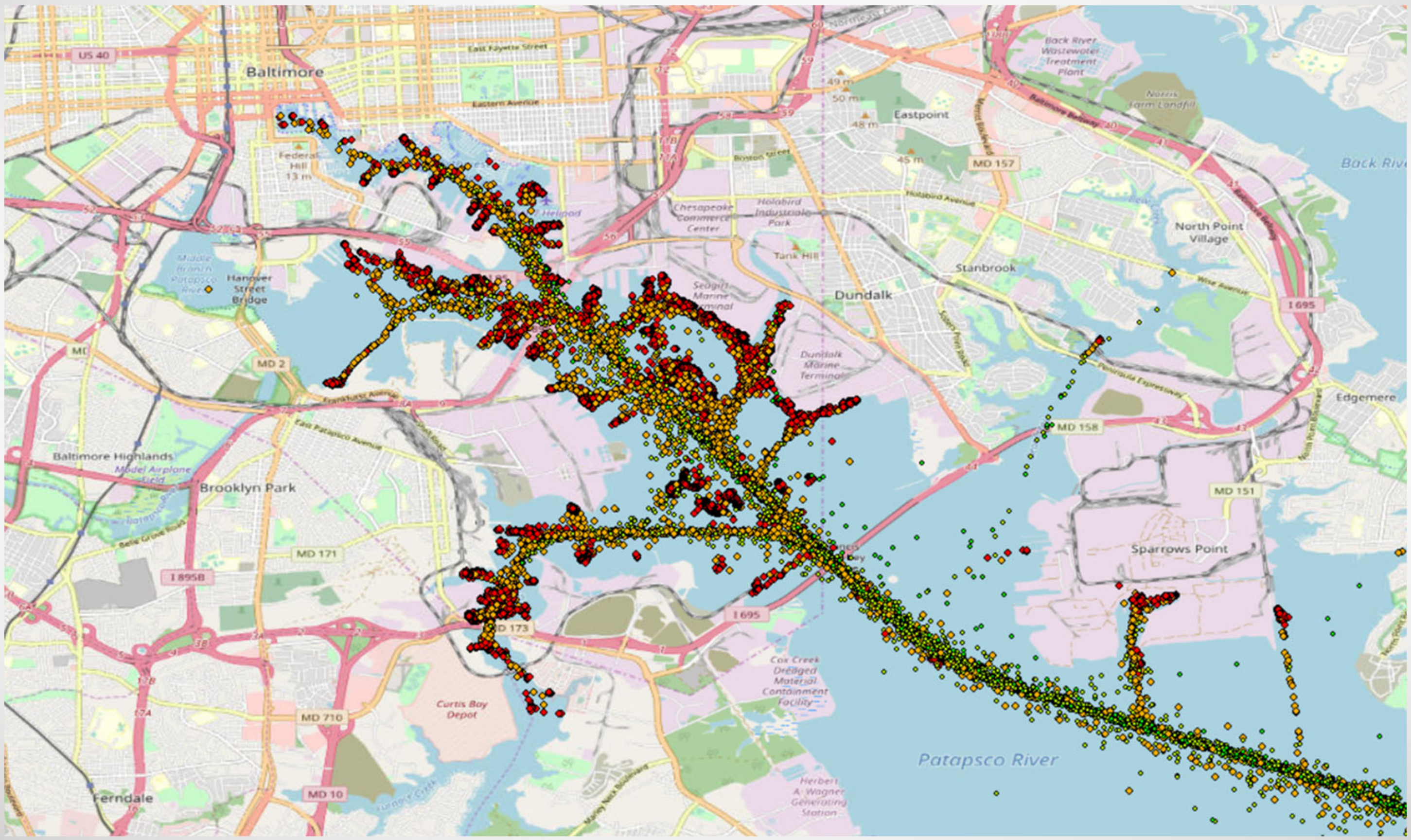
Developing and Implementing a Freight Fluidity Management Framework for U.S. Ports (U.S. Army Corps of Engineers)



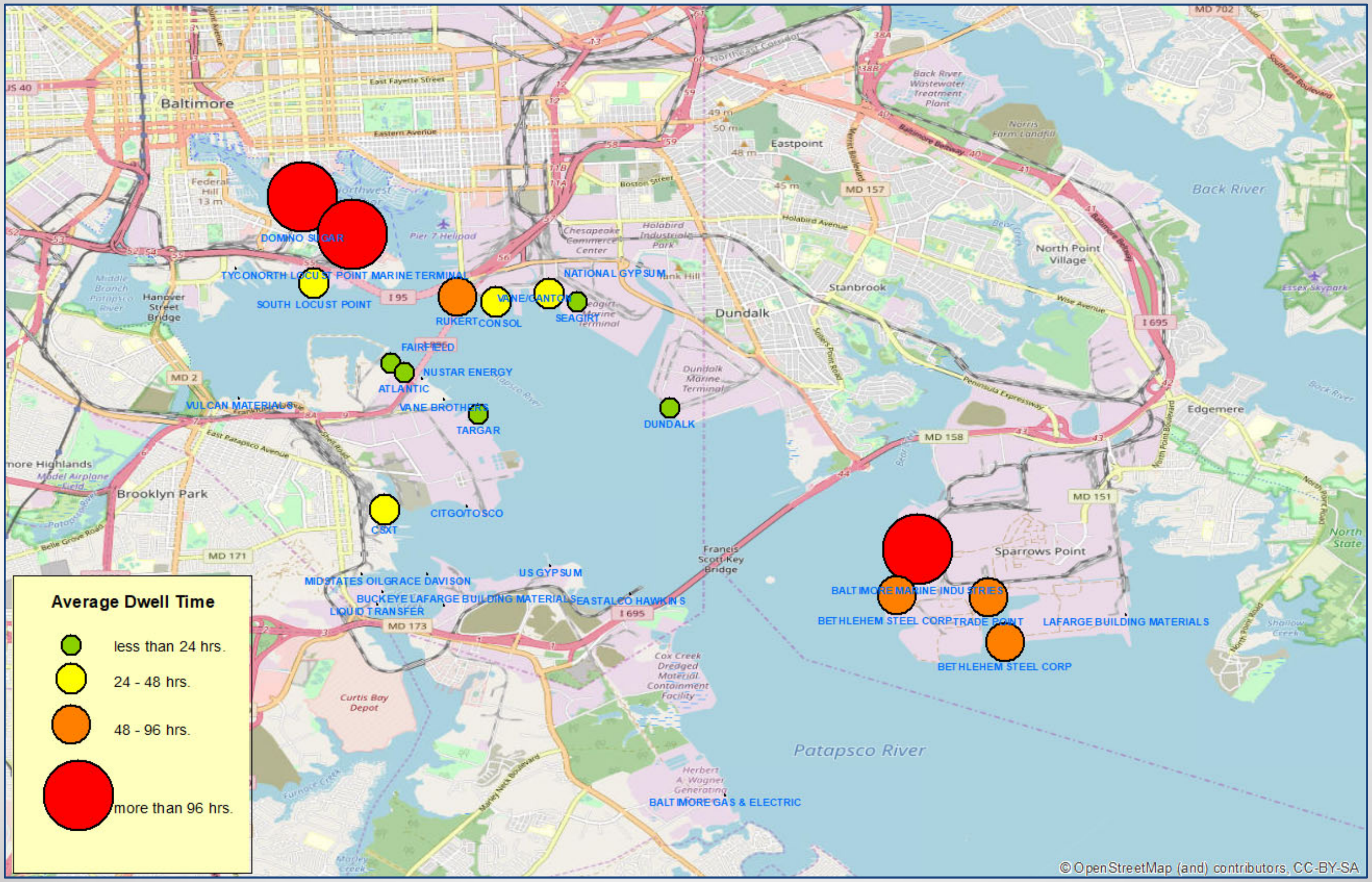


Port of Mobile, Alabama

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)

Texas A&M Transportation Institute

Understanding the 'why' (of what is happening): Implications of Urgent Deliveries

- Strain on supply chains and logistics
- Strain on the multi-modal transportation system (world-wide)
- Bottlenecks in the system

- Need for transportation <u>projects</u>, <u>programs</u> and <u>policies</u> to mitigate the impacts

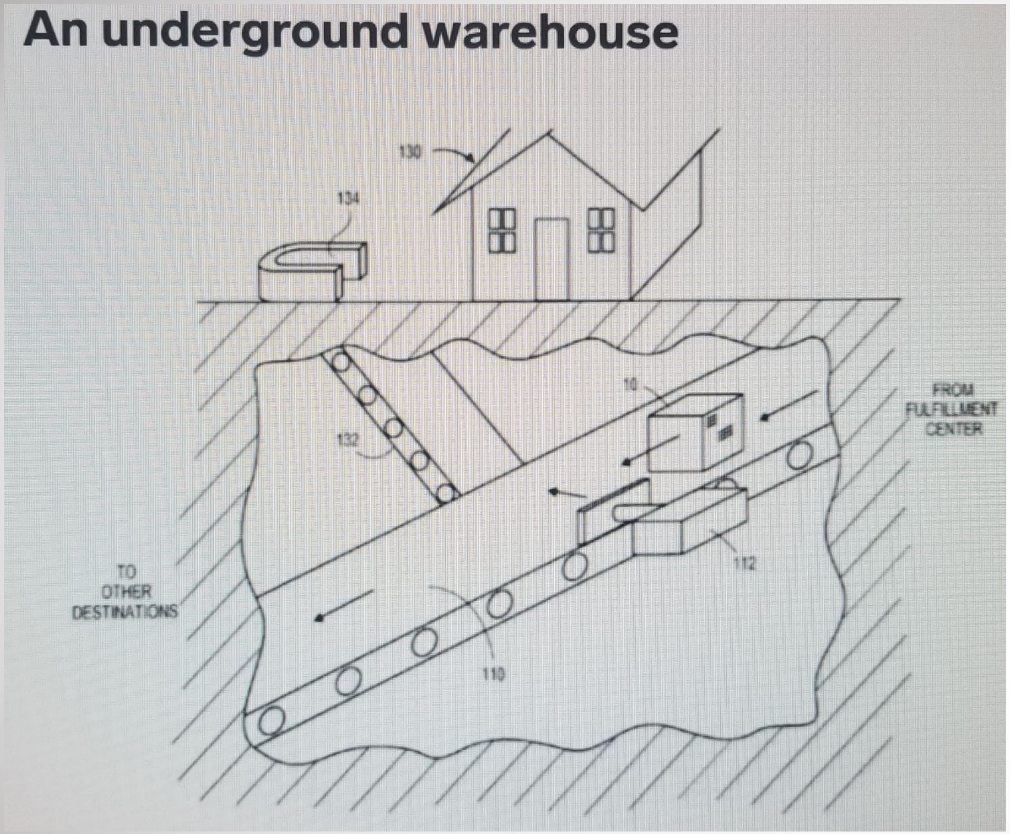
Texas A&M Transportation Institute

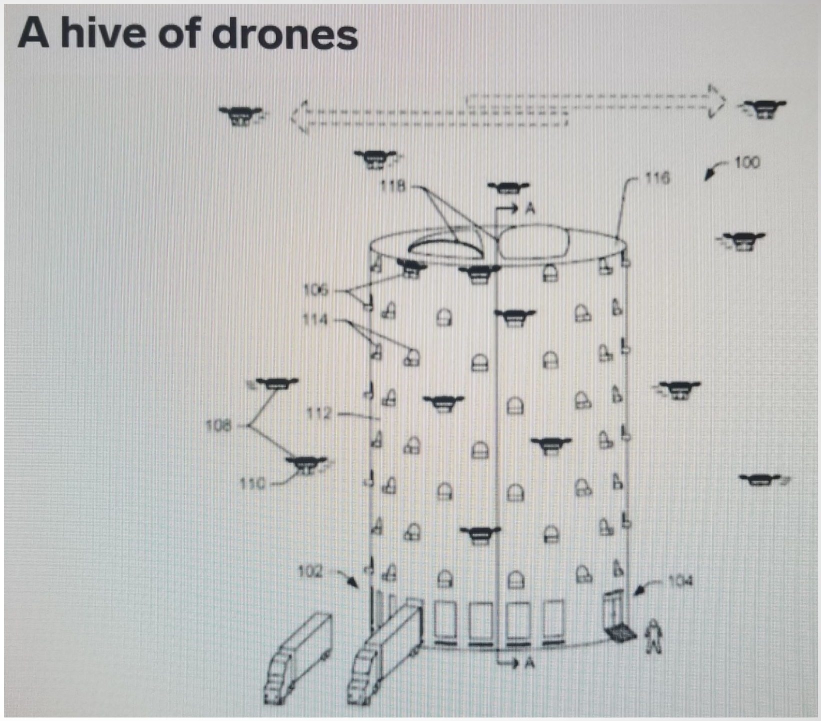
Private-sector Demands/Solutions

- Carriers (and shippers) must make their delivery windows!
- "Next-day delivery" or "same day delivery" means must get product closer to customers before you click "add to cart" and "purchase now"
  - Warehouse and/or distribution centers closer to customers
- More trucks to "make their turns"
- Access to the curb

Texas A&M Transportation Institute

Amazon Patents – a glimpse into the future?



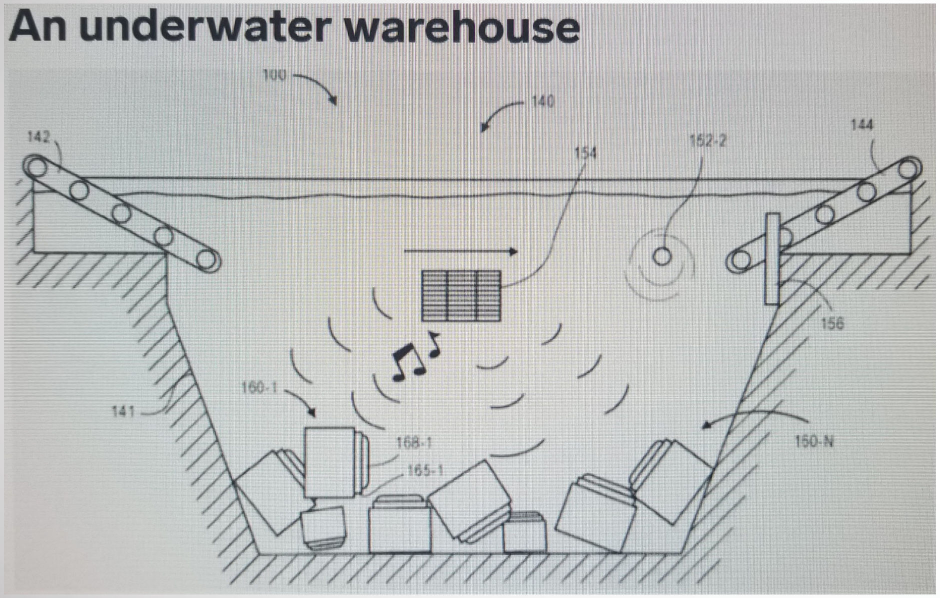


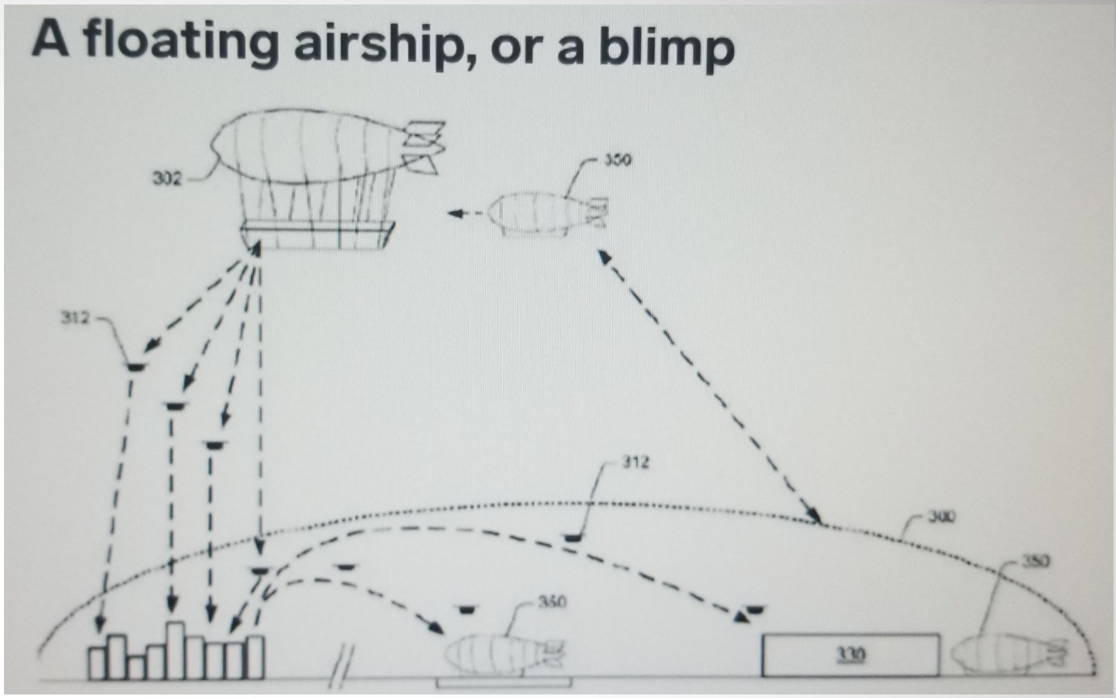
"Multi-level fulfillment center for unmanned aerial vehicles"

Texas A&M Transportation Institute

Source: www.businessinsider.com

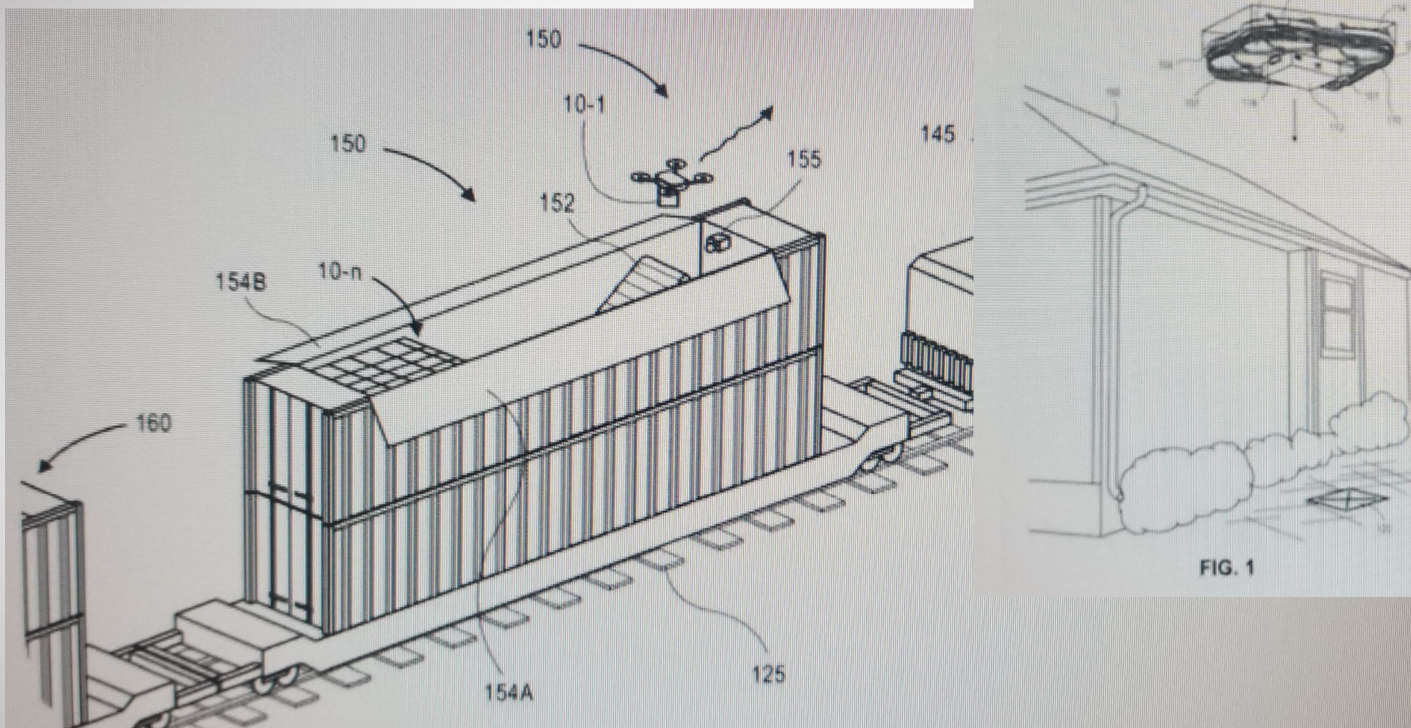
Amazon Patents – a glimpse into the future?

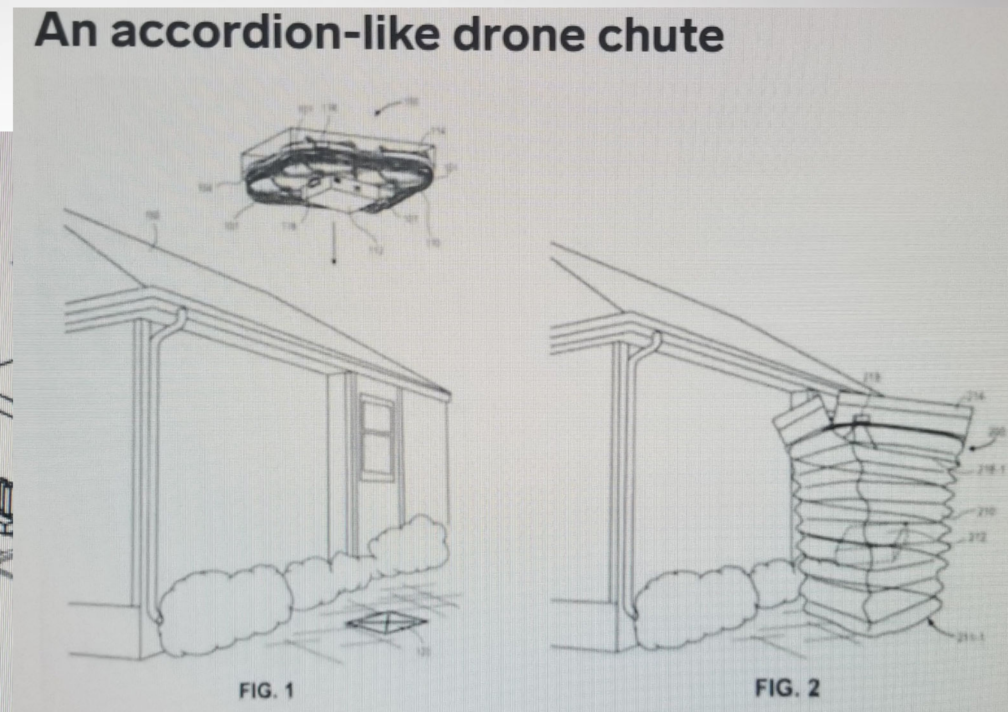




Source: www.businessinsider.com

Amazon Patents – a glimpse into the future?





Texas A&M Transportation Institute

Source: www.businessinsider.com

Technological Solutions are ~~Coming~~ Here

- Delivery robots
- Autonomous vehicles – beginning in the freight delivery, long-haul being tested (showing promise)
- “Space-age” deliveries

- What about technology xx?...

- …if it reliably and safely helps the private-sector hit delivery windows, it will be in the running.

- How do we plan transportation systems for this? (land use, city planning implications)
- How do we successfully engage the private sector for data sharing opportunities?

Texas A&M Transportation Institute

Some (More) Final Thoughts

- Data considerations
  - What do you really need and how often?
  - Data governance
  - Public-private partnerships
  - Non-disclosure Agreements (NDAs) (with vendor data)

- Needed human resources
  - Data scientists!!
  - Understanding of transportation systems (typical data ranges)
  - GIS, analytics within GIS
  - Bright students & young professionals!

- Visualization / Communication
  - Begin with the end in mind (what questions are you trying to answer)
  - Simple visualizations can often get it done (vs. more complex analytics)
  - Tie decision-informing results to economics (dollars, benefit/costs)

Contact Info & Selected Resources

Bill Eisele, Ph.D., P.E., b-eisele@tti.tamu.edu, 979-317-2461

(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"*

Texas A&M Transportation Institute