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”
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
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
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
How will the Guidebook help?

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

**Economic Competitiveness**
- Enhance economic competitiveness, productivity, and development of the state

**Mobility and Reliability**
- Reduce congestion
- Improve efficiency and performance

**Multimodal Connectivity**
- Provide transportation choices
- Improve system connectivity for freight

**Customer Service**
- Incorporate citizen feedback
- Transparency in TxDOT communications
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
### What Resources Are Available for Understanding Freight Fluidity?

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<td>What Key Goods or Freight Move in Texas?</td>
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### Who Is the User?

<table>
<thead>
<tr>
<th>Leadership/Decision Maker</th>
<th>Main User</th>
<th>Main User</th>
<th>Main User</th>
<th>Secondary User</th>
<th>Secondary User</th>
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<tr>
<td>Planner/Policy Analyst</td>
<td>Main User</td>
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<tr>
<td>Operator</td>
<td>Secondary User</td>
<td>Secondary User</td>
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<tr>
<td>Industry Partners</td>
<td>Main User</td>
<td>Secondary User</td>
<td>Main User</td>
<td>Secondary User</td>
<td>Secondary User</td>
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</table>
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/
## Texas Department of Transportation
### 100 Most Congested Roads

<table>
<thead>
<tr>
<th>Rank</th>
<th>Rank Truck</th>
<th>Roadway</th>
<th>From</th>
<th>To</th>
<th>County</th>
<th>Annual Hrs of Delay per Mile</th>
<th>Annual Hrs of Truck Delay per Mile</th>
<th>TP</th>
<th>PTI</th>
<th>CSI</th>
<th>Annual Congestion Cost (M)</th>
<th>Annual Truck Congestion Cost (M)</th>
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<tr>
<td>1</td>
<td>2</td>
<td>IH 610</td>
<td>IH 10 / US 90</td>
<td>US 59 / IH 69</td>
<td>Harris</td>
<td>1,112,917</td>
<td>68,897</td>
<td>2.45</td>
<td>3.89</td>
<td>3.25</td>
<td>$90.63</td>
<td>$20.99</td>
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<tr>
<td>2</td>
<td>1</td>
<td>IH 35</td>
<td>US 290 N</td>
<td>SH 71</td>
<td>Travis</td>
<td>1,085,136</td>
<td>108,645</td>
<td>2.71</td>
<td>4.73</td>
<td>3.54</td>
<td>$215.22</td>
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<td>3</td>
<td>3</td>
<td>US 59</td>
<td>IH 610</td>
<td>SH 288</td>
<td>Harris</td>
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<td>51,604</td>
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<td>3.36</td>
<td>2.17</td>
<td>$105.83</td>
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<td>4</td>
<td>44</td>
<td>Woodall Rodgers Pkwy</td>
<td>US 75</td>
<td>N Beckley Ave</td>
<td>Dallas</td>
<td>748,546</td>
<td>14,976</td>
<td>2.03</td>
<td>3.06</td>
<td>2.31</td>
<td>$21.31</td>
<td>$1.81</td>
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<td>5</td>
<td>5</td>
<td>IH 10 / US 99</td>
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<td>Sam Houston Tollway W</td>
<td>Harris</td>
<td>659,959</td>
<td>48,865</td>
<td>1.95</td>
<td>3.33</td>
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<td>$50.23</td>
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<td>IH 45</td>
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<td>IH 610</td>
<td>Harris</td>
<td>656,582</td>
<td>39,713</td>
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<td>4</td>
<td>IH 635</td>
<td>IH 35 E / US 77</td>
<td>US 75</td>
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<td>584,661</td>
<td>49,538</td>
<td>1.86</td>
<td>2.58</td>
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<td>8</td>
<td>14</td>
<td>IH 35 E / US 77</td>
<td>SH 183</td>
<td>IH 30</td>
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<td>555,861</td>
<td>32,302</td>
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<td>2.62</td>
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<td>$67.3</td>
<td>$14.81</td>
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</table>
Truck Congestion Analysis Tool (TCAT)

Layer: Texas 100 - Monitored Roads
Click on a road segment to add to or remove from the list.

QUICK INFO/HOVER
FILTERS/LEGEND

IH 35
From: US 290 N / SS 69
To: Ben White Blvd / SH 71
TX100 ID: 3000004
Congestion Status: Year: 2020

- Top 100 Rank: 1
- Hours of Delay: 781,637
- Delay Per Mile: 90,894
- Congestion Cost: $49,195,950

- Top 100 Rank: 1
- Hours of Delay: 13,032,206
- Delay Per Mile: 1,647,353
- Congestion Cost: $288,349,730

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)

- Density of truck trips that used northbound I-35W between SH 193 and I-30 between 5:00PM & 6:00PM
- Texas 100 Section delay per mile rank:
  - Truck only: 11, All vehicle: 23
- Data time range: 11 JAN 2016 to 9 APR 2016

Analysis Section  Trip Density

- Many Trucks
- Few Trucks

0 1.75 3.5 7 10.5 14 Miles

*I-35W selected area coordinate: (-97.323 32.78, -97.318 32.77)*
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)
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.
Contact Info & Selected Resources

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• 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”