

# Advancing Freight Fluidity Performance Measures Workshop

Next Steps Implementing Freight Fluidity:  
How, **What, Where, When**

Freight Fluidity Scale of Analysis

Bill Eisele and Juan Villa

Texas A&M Transportation Institute



# Presentation Outline

- Research Questions
- Freight Fluidity Defined
- Freight Box Concept
- Analyses Scales
- Considerations and Next Steps

# Research Questions

- At what scale or geography can freight fluidity be applied?
- What are the options for analyzing corridors and gateways versus analyzing particular supply chains?
- What factors should be considered in determining level of analysis?

# Freight Fluidity Defined

*“Freight Fluidity” focuses on transportation supply chain performance measurement (SCPM) - that is, the measurement of the travel time, travel-time reliability and cost of moving freight shipments from end-to-end of a supply chain.*

Working definition developed by background paper authors

# Freight Fluidity Defined

*‘Freight Fluidity’ is a broad term referring to the characteristics of multi-modal supply chains and associated freight networks in a geographic area of interest, where any number of specific modal data elements and performance measures are used to describe the performance (including costs and resiliency) and quantity of freight moved (including commodity value) to inform decision-making.*

Adapted from Maryland State Highway Administration Freight Fluidity Efforts

# Components of Fluidity: *Mind Your Freight Ps and Qs!*

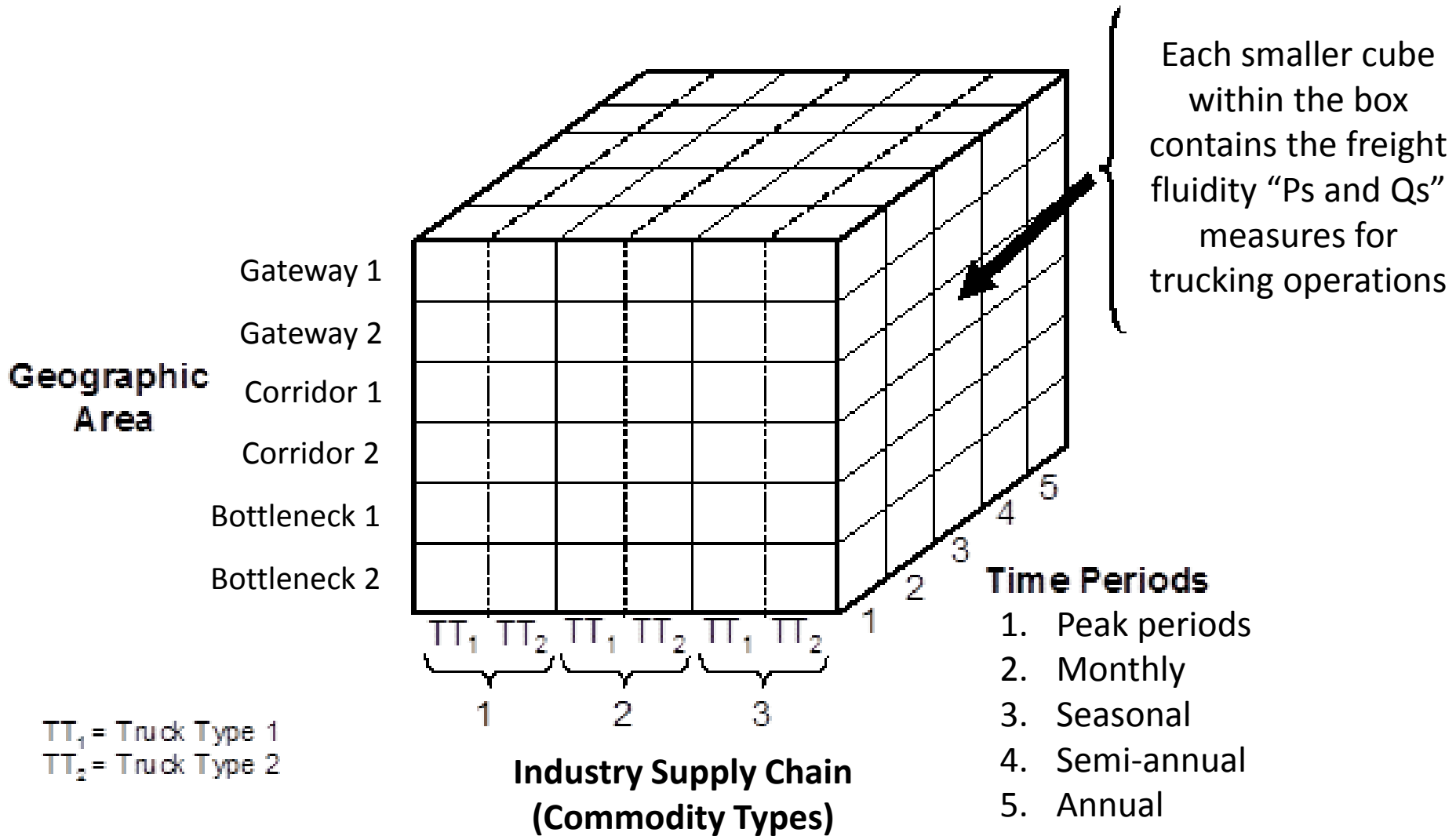
Components	Description	Selected Suggested Measures/Considerations <sup>1</sup>
<b>Performance (“Ps”)</b>	<p>How well are the links/nodes and network operating?</p> <p>Where are there bottlenecks in the supply chain or freight network?</p>	<ul style="list-style-type: none"> <li>● Mobility (e.g., total delay, delay per mile, travel time index)</li> <li>● Reliability (e.g., planning time index)</li> <li>● Costs<sup>2</sup> (associated with delay, unreliability, wasted fuel)</li> </ul>
	<p>How well do supply chains and the system (infrastructure, users, agencies) react to disruptions (i.e., how resilient is the system)?</p>	<p>Resiliency<sup>3</sup> (or risk) has 4 aspects:</p> <ul style="list-style-type: none"> <li>● Robustness (ability to withstand disruption, measured in time)</li> <li>● Rapidity (time to respond and recover)</li> <li>● Redundancy (alternate route [capacity] availability/access within a certain travel time)</li> <li>● Resourcefulness (ability and time to mobilize needed resources)</li> </ul>
<b>Quantity (“Qs”)</b>	<p>How much freight is moved (and where)?</p>	<ul style="list-style-type: none"> <li>● Volume (e.g., # of trucks, railcars, twenty-foot equivalent units [TEUs])</li> <li>● Weight (e.g., pounds, tonnage)</li> <li>● Value<sup>2</sup></li> </ul> <p><i>Footnotes described in more detail in background paper</i></p>

# Key Aspects of Freight Fluidity Definition

Freight Fluidity Definition Phrase	Scoping Questions for Analyst to Ask
"...multi-modal..."	What freight modes are included?
"...geographic area of interest..."	What is the geographic scale?
"...specific modal data elements..."	What are types of data elements going into the analysis?
"...network performance..."	What network performance measures are needed? How well are the links/nodes and network operating? Where are the bottlenecks in the system?
"...quantity of freight moved..."	How much (volume, weight, value) freight is moved (and where)?
"...resiliency..."	How well does the system react to disruptions?
"...to inform decision-making."	What decisions do you plan to make with the freight fluidity network characteristics? What is appropriate study scale, measures and study scope to ensure you can impact these decisions with the results?

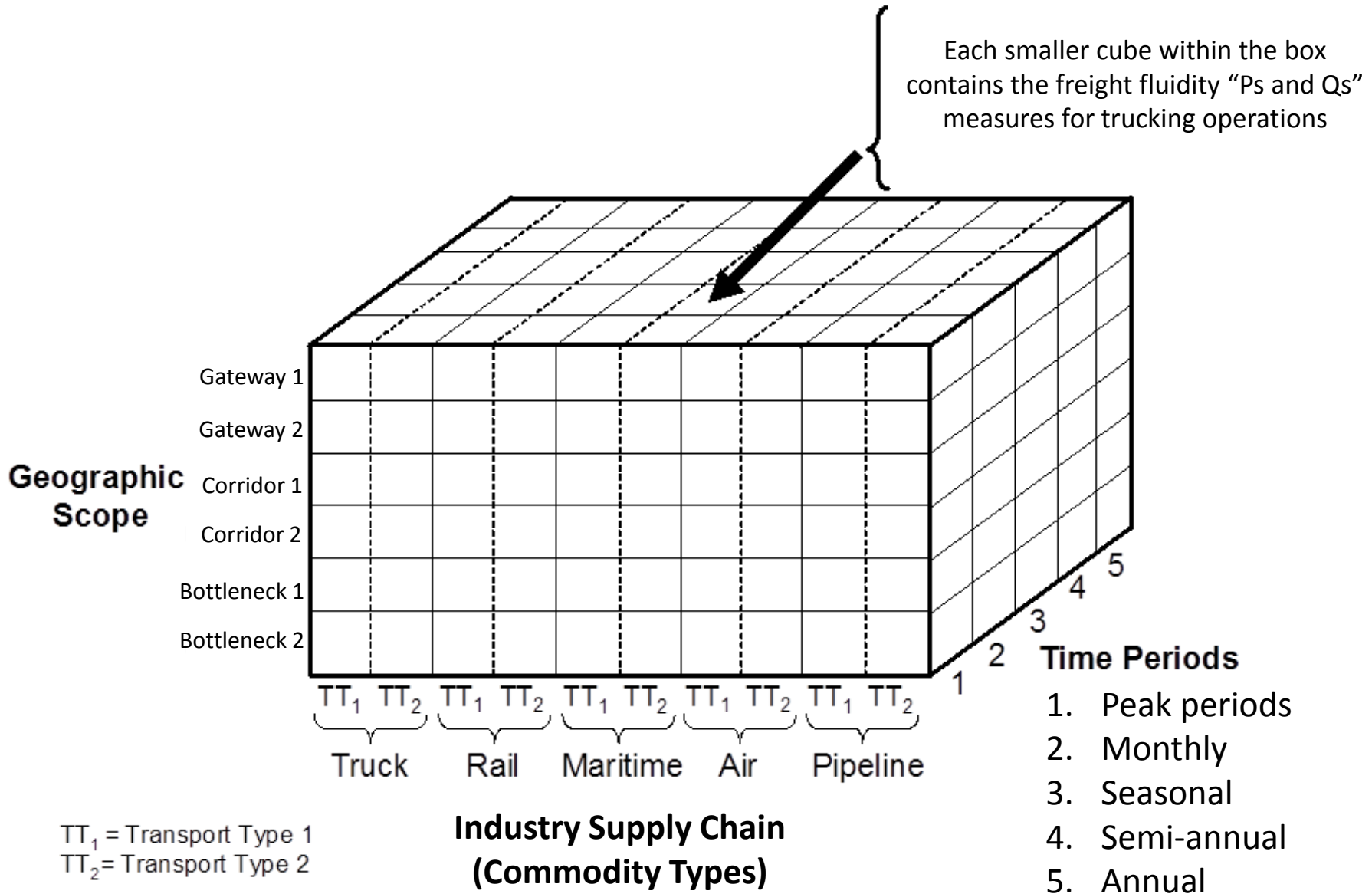
*Scale – spatial and temporal is critical everywhere.*

# Freight Box Concept (Trucks)





# Freight Box Concept (Varied Supply Chain Modes)



# Jurisdictions and Typical Uses with Associated Analyses Scales

Agency Jurisdiction (Examples)	Typical Geographic Analysis Scale	Typical Temporal Analysis Scale	Frequency of Analysis Updates	Example Use Case Question(s)
International (World Bank, Private Corporations)	Megaregion to global	Monthly, seasonal, annual	Seasonal, Annual	How is the global supply chain operating? How is the country's overall logistics operating? Are my client's suppliers receiving goods in a timely manner?
Federal (FHWA, Chamber of Commerce)	National Highway System (NHS) – national; Global; Borders (gateways), interconnectors	Annual	Annual	Where are there bottlenecks in NHS continuity and/or connectivity? Where are delays in imports/ exports?

*Note: shading indicates the possible geographic scale range of a beta (initial) freight fluidity measurement system*

# Jurisdictions and Typical Uses with Associated Analyses Scales

Agency Jurisdiction (Examples)	Typical Geographic Analysis Scale	Typical Temporal Analysis Scale	Frequency of Analysis Updates	Example Use Case Question(s)
Megaregion (MPO, COG, Chamber of Commerce)	Regional or even global	Seasonal, Annual	Seasonal, Annual	How does my region compete in comparison to peers/competitive regions?
State (DOT)	Interstate and regional	Peak periods, monthly, annual	Monthly, annual	How are corridors on the state freight plan operating?  How well are border crossings and ports operating?
Local (MPO, city, county, Chamber of Commerce)	Urban area and/or specific roadways	Peak periods,	Seasonal, annual	Where are specific freight bottlenecks on Main Street?

*Note: shading indicates the possible geographic scale range of a beta (initial) freight fluidity measurement system*

# Takeaways - Jurisdiction and Users

- Geographic scale is broad
- Two temporal “scales” to consider
  - Temporal scale of analysis
  - How often analyses updated
- Supply chain analysis scale, includes
  - Links: segments of road, rail, etc.
  - Nodes: transload locations, gateways
- Focus beta fluidity tool on geographic “biggest bang for the buck” (shaded in prior table)

# Considerations and Next Steps

# Geographic Scale

- Very broad
  - International to local main street
- Any discussion about geographic scale is inherently tied to the transport application
- Decision is a function of the final use of the indicator

# Options for Analyzing Corridors vs. Specific Supply Chains

- Analysis should not be Supply Chain OR Corridor, but Supply Chain AND Corridor – Systems approach
- Freight box concept useful to communicate/visualize spatial and temporal aspects of fluidity analysis
- Suggested supply chain measures introduced (and illustrated in freight box)
- “Cubes” of actual and targets can be compared for improvement analysis

# Options for Analyzing Corridors vs. Specific Supply Chains (cont.)

- Supply chain is critical analysis unit (to move from facility-based to trip based analysis)
- Freight box is scalable (spatially & temporally)
- Freight fluidity tool should likewise be flexible/expandable geographically and temporally
- Systems approach is important to capture performance of all supply chains and modes



# Additional Factors to Consider in Determining Level of Analysis

- Definition proposed and components of definition are linked to scale of analysis
- Both spatial/temporal scale important and defined based upon use
- Must also consider how often user will want to update results

# Additional Factors to Consider in Determining Level of Analysis (cont.)

- Freight fluidity estimating over all geographic and temporal scales is generally feasible, limited largely only by data limitations
- Need fluidity tool to focus initially on the areas of highest interest
- Tool must be created with spatial/temporal flexibility (and expandability) to handle the more common uses initially with an eye toward future expansion as it becomes clearer how industry will use the tool

# Thanks Very Much!

Bill Eisele

[bill-eisele@tamu.edu](mailto:bill-eisele@tamu.edu)

979 845 8550

Juan C. Villa

[j-villa@tamu.edu](mailto:j-villa@tamu.edu)

979-862-3382