Measuring Supply Chain Performance: Fluidity Metrics and Bottlenecks

Findings from I-95 Corridor Coalition Freight Fluidity Measures Pilot Project

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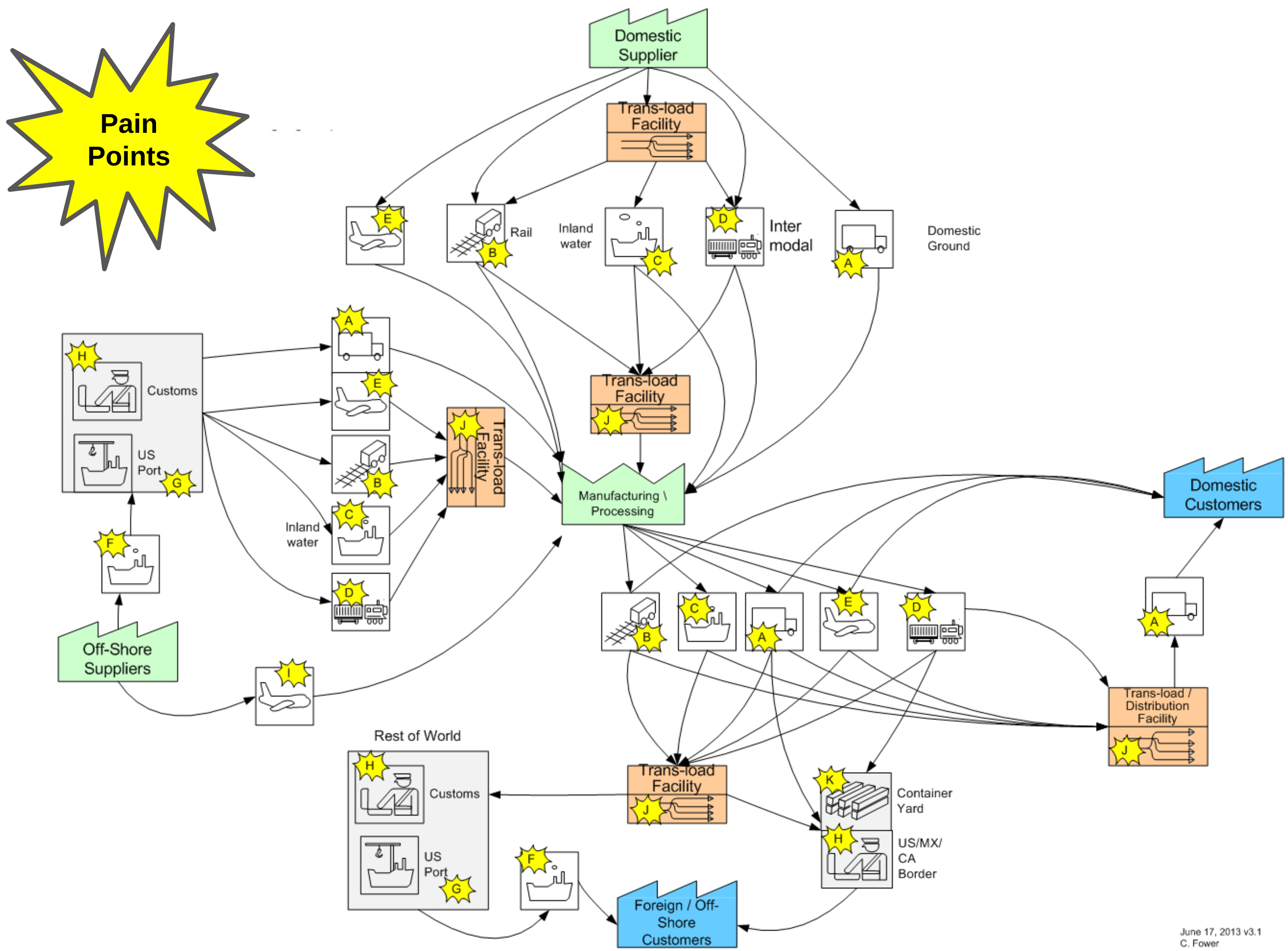
Project

- **Objective**
  - Demonstrate and improve the measurement of freight transportation performance using a supply chain perspective
  - ➡ ***End to end*** conception of performance and measurement, across modes and stages
- **5 Supply Chain Case Studies**
  - Retail, Automotive, Food, Electronics, Export Grain
- **Case Study Sponsors**
  - I-95 Corridor Coalition, Intermodal Committee
  - FHWA, Office of Freight Management
  - U.S. Department of Commerce, Advisory Committee on Supply Chain Competitiveness

Supply Chain Schematic

Performance Bottlenecks Linked to Stage Transfers



Points of Vulnerability

Performance Bottlenecks are Public-Private: “Joint” Pain

A = Domestic Ground Transportation

- Driver shortages
- HOS restrictions limiting productivity
- Fuel volatility
- Disparate State TL weight restrictions limit asset utilization
- Significant urban congestion
- Chicago, NY, LA, Atlanta
- Lack of a single communication portal on traffic and road conditions

B = Domestic Rail

- Speed & in-transit delays
- Limited effective short haul lines
- Insufficient rail sidings
- Too few transload hubs
- Limited infrastructure in key hubs
- South East, Dakotas
- Limited visibility for in-transit products

C = Inland Water Transport

- Failing Lock systems
- Dredging needs for key freight conduits
- Limited intermodal transfer infrastructure
- Limited asset availability
- Limited interconnectivity to major ground transportation hubs

D = Intermodal

- Weight restrictions limit asset utilization
- Rail speed
- Lack of robust transloading infrastructure make modal selecting a non option for many shippers
- Limited capacity of drivers and equipment

E = Domestic Air

- Kaizen A
- Kaizen B

F = Global Ocean

- Limited ice rated vessels for cold weather ports
- Volatile bunker fuel costs
- Limited pre-clearance processes delay unload and transfer times
- Worker shortage

G =US Ports

- Limited infrastructure at some ports restrict vessel & cargo types
- Labor disputes impede flow and cause unscheduled delays
- Difficulty managing seasonal spikes
- Significant congestion at major ports with little or no visibility to bottlenecks
- Systems and infrastructure limitations impede efficiency, resulting in unloading delays
- Facility and infrastructure improvements needed to capitalize on Panama Canal expansion to pull freight out of Central American ports
- Lack of common performance metrics to forecast choke points for effective redirection of cargo

H = US Customs & Border Crossing

- Lack of systems integration cause clearance delays and status updates
- Lack of expediant issue escalation and resolution process
- Limited physical infrastructure to accommodate volumes
- Detroit, Port Huron, MI, El Paso, TX, Buffalo
- Current infrastructure has difficulty processing oversized cargo
- Short and unpredictable hours of operations
- Lack of carrier interchange agreements cause significant delays in trailer exchanges into and out of Mexico and Canada
- No preferred shipper status to expedite the flow of high volume O/D pairs
- Lack of inter-agency integration increases processing times for: Duty drawbacks, FTZ approvals, shipment in bond

I = International Air

- Limited transload and logistics parks / infrastructure reduces mode selection and increases costs
- Weak workforce training contributing to worker skill set gaps
- Limited FTZ and Bonded Facility zones
- No streamlined FTZ and Bond processes

J = Transload Facilities

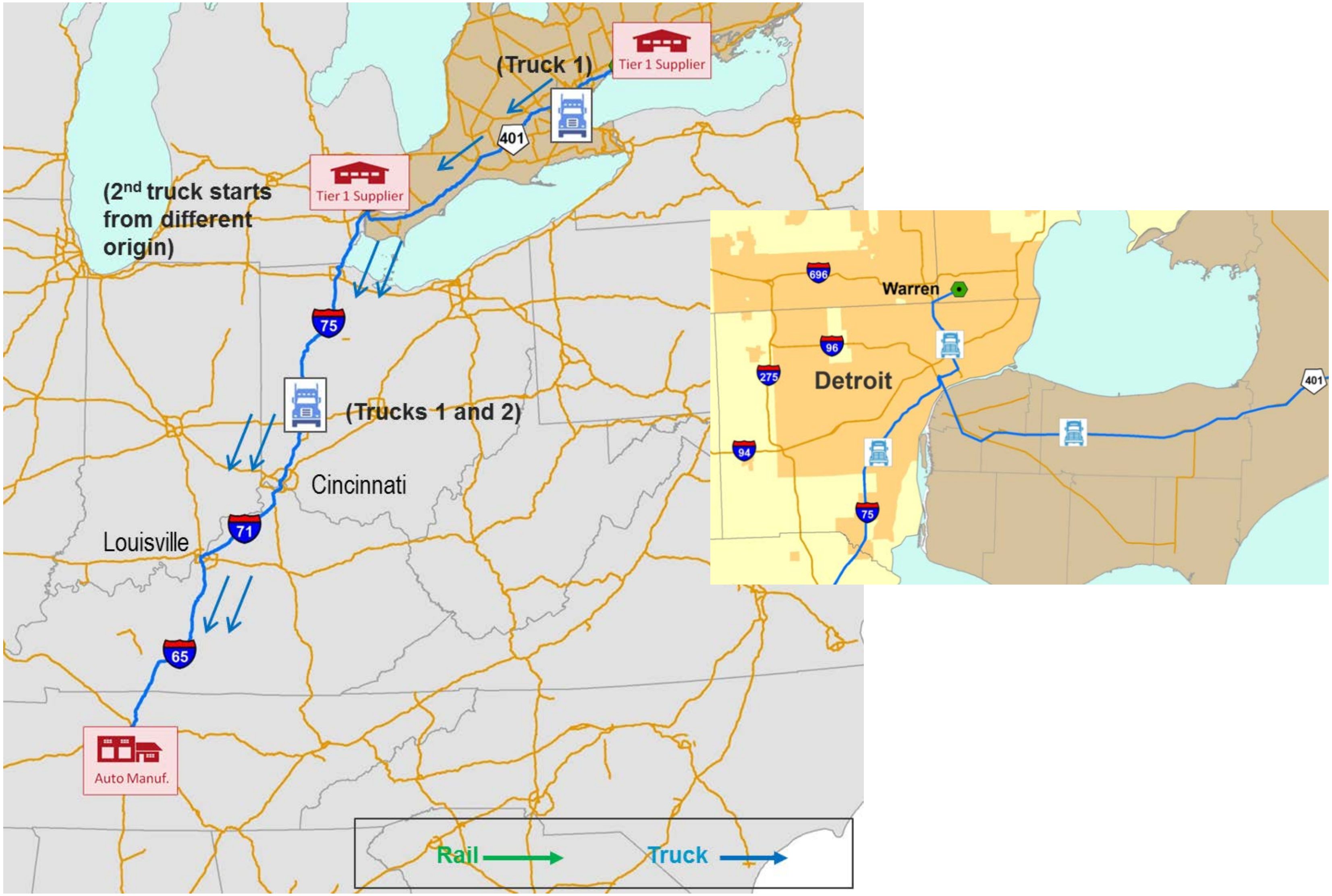
- Limited transload and logistics parks / infrastructure reduces mode selection and increases costs
- Weak workforce training contributing to worker skill set gaps
- Limited FTZ and Bonded Facility zones
- No streamlined FTZ and Bond processes

Performance Measures and Metrics

Market-Driven Factors

Measure	Metric
Transit time	Travel time in days (or hours)
Reliability	95% travel time in days (or hours)
Cost	Dollars
Safety	Fatality and injury rate
Risk	Disruption *(storms, labor, infrastructure failure, political forces…)*
	Capacity expansion delays *(physical, regulatory limitations and delays…)*

Automotive Supply Chain/TL *(General Motors)*



Automotive Supply Chain Measures/TL

Links and Nodes	Data Sources
Parts Supplier Plant, Warren, Michigan	
Truckload move (through)	ATRI, Chainalytics
General Motors Plant, Spring Hill, TN	

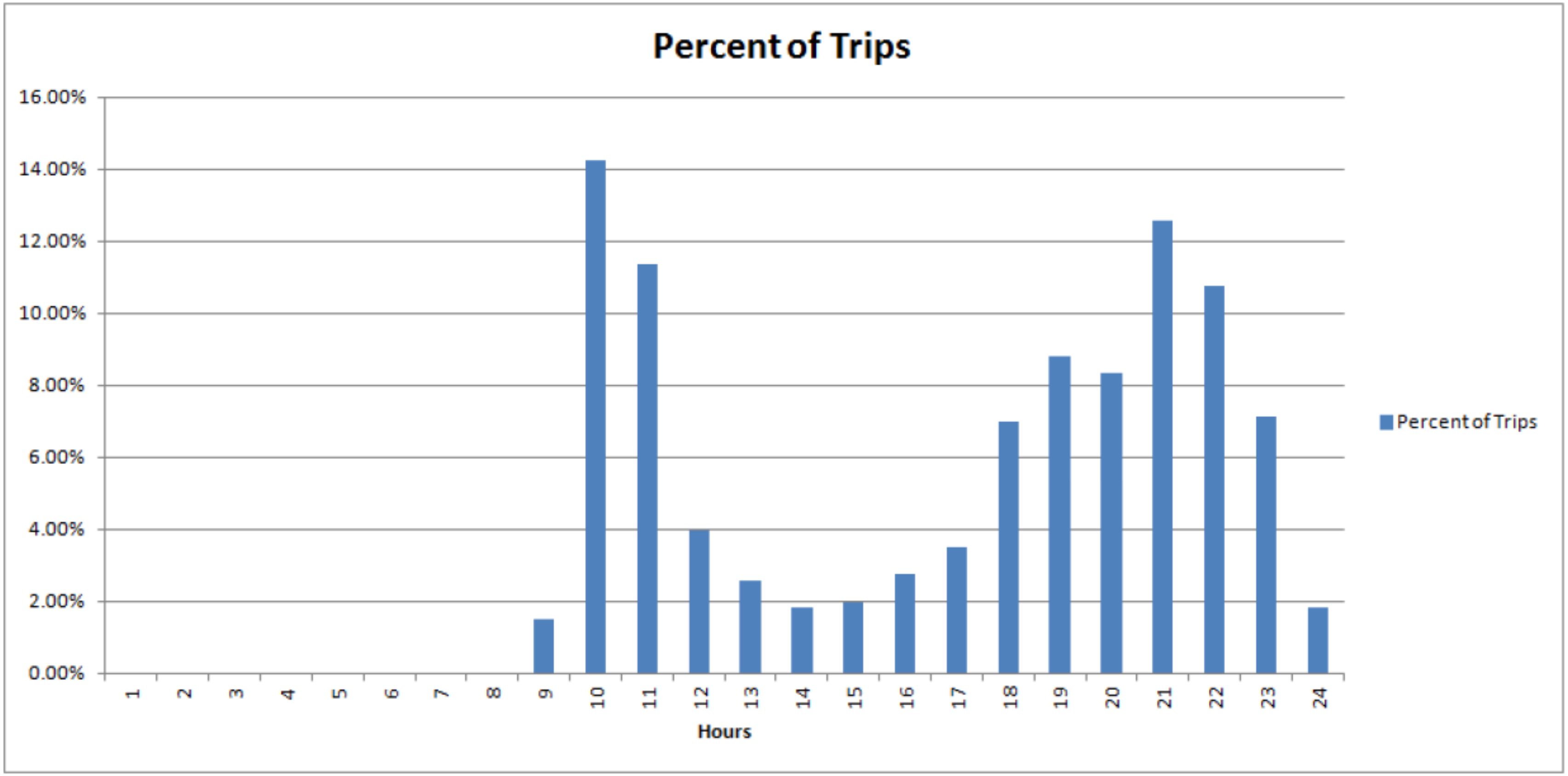
Links and Nodes	Data Sources
Parts Supplier Plant, Chatham, Ontario	
Truckload move	ATRI, Chainalytics
International border crossing	⬇
Truckload move	ATRI, Chainalytics
General Motors Assembly Plant, Spring Hill, TN	

Automotive Supply Chain Performance/TL

Links and Nodes	Transit Time/Dwell Time (Hours)	Reliability (95% travel time)	***Cost*** (2014 $'s)
Parts Supplier Plant, Chatham, Ontario			
Truckload move	*1.5*	*3.0*	*$1,052*
International border crossing	⬇	⬇	
Truckload move	*18.4*	*23.2*	
General Motors Assembly Plant, Spring Hill, TN			
Totals	**19.9**	**26.2**	**$1,052**

I-95 CORRIDOR COALITION

Hours of Service Effect (499 Miles)



➡Bi-Modal Distribution in No-Tolerance Environment

Types of Performance Risk

Disruption Risks

❶ *System interruptions* stem from such causes as natural disasters, infrastructure failure, and labor actions

- Infrequent but serious, and facing "new normal"

❷ *Acceleration* is risk that conditions <u>may rapidly</u> grow much worse

- Phase transition/state change in traffic flow, or energy supply loss

❸ *Deterioration* is risk that conditions <u>gradually</u> grow worse

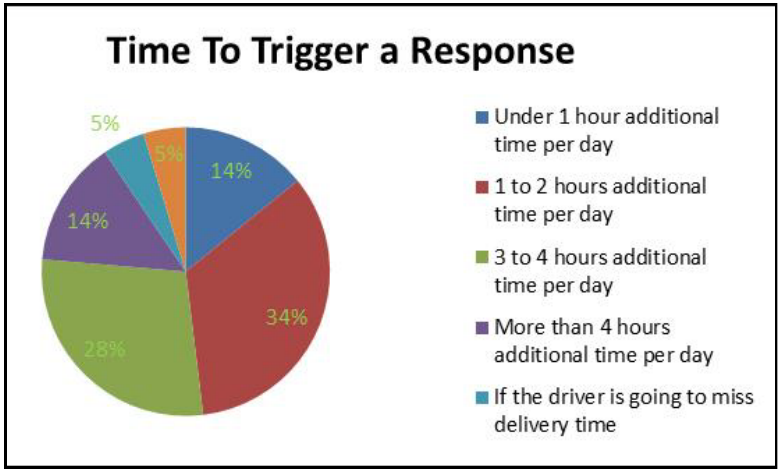
Planning Risks

❹ *Institutional* risks are uncertainties in implementation of improvements

❺ *Process* risks are immediate challenges to daily logistics planning

Risk Management

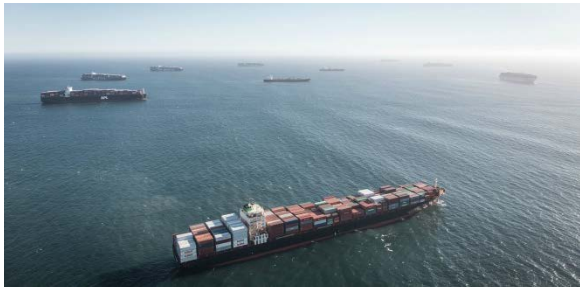
- **Long term disruption risks mainly handled in supplier/plant location decisions**
  - Chronic short term = long term
- **Process risks actively managed**
  - Weather, customs, work zones, other local conditions
  - 2-3 day horizon
  - Premium on information and time to adjust
  - Adjustments: ship early, expedite, reroute
  - Performance tracking by route, TOD, carrier
  - ➡ Buffering built in
- **Sensitive process: 2-hour trigger**



Source: NCHRP 8-99

Considerations for Discussion

- **We can measure supply chain fluidity**
  - End-to-end, across modes, stages and jurisdictions
  - In critical dimensions, for critical sectors of the economy
- **Bottlenecks are performance vulnerabilities**
  - Pain points, not just capacity pinch points
  - Key focus: stage transfer process and conditions
  - Public-private problem
  - Time series improves diagnostics



- **Vulnerabilities intertwined with risk management**
  - Unsolved process and conditions failures are buffered
  - Buffering reduces productivity, increases structural cost
  - Long term consequence: businesses move or fail

Thank You!

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