CPCS

Analysis of Freight Transport Strategies and Methodologies

Florida Model Task Force Meeting

Florida Department of Transportation
RFP-DOT-16/17-9005-JP
Project BE277

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Solutions for growing economies

Presentation Map

Project Objectives and Overview

Summary of Key Questions and Task Outcomes

Recommended Strategies and Implementation Approaches

- Last-Mile Flow Maps
- Bottlenecks Analysis
- Travel Time Reliability

Summary of Benefits and Project Closeout Steps

The “Last Mile” of Freight

The “last mile” denotes the link in a (transportation) network that connects an end-user to a major freight corridor or a transportation hub

- For this study, includes access to terminals / DCs
- Historical public sector focus on longer hauls, corridors
- Better macro-level data and understanding of freight
- Localized and disaggregated data collection, storage is expensive
- Commercial sensitivity and proprietary nature of private transactions
- Obstacles to data sharing and acquisition

Freight decision-making is often blind to last mile activity, highlighting the need for more realistic data, models and strategies

FDOT D4 Last Mile Freight Issues Synthesis

- **Facility Access:** Routing from key corridors, ingress / egress
- **Queuing**: ramps, intersections, restricted turning areas
- **Signal Timing:** enhancing operations to allow smoother and efficient flow of trucks through arteries
- **Truck Parking**: limited current parking, potential available lots, matching demand
- **Rail Crossings:** truck delays, interactions, route choices
- **Freight Affinity:** some cities want to retain freight activity, others have moratoria

How to make access more efficient, reduce miles and circuity?

Where do the data suggest that there are hotspots and bottlenecks?

How to dynamically optimize intersections based on freight traffic?

How to sense and influence truck parking in real-time?

How to predict traffic and enhance truck/rail crossings?

What are the specific community concerns, calibrated to freight activity?

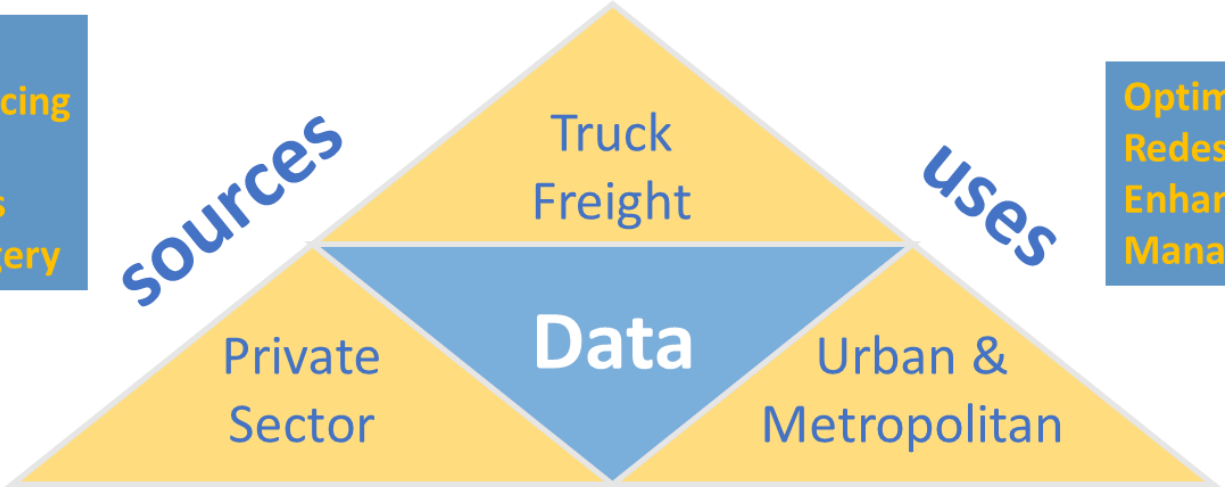
How to improve overall observability of regional and local freight traffic in D4?

Context for New Strategies and Methodologies

A deep understanding of the sources, analysis, and uses of new freight data is the common thread to making sure that freight continues to move efficiently – especially in the last mile

sources

- Smart cities
- Crowd-sourcing
- Fleets
- V2X sensors
- Digital imagery



uses

- Optimize capacity
- Redesign supply chains
- Enhance planning
- Manage demand

analysis

- Monitor land-use patterns
- Observe e-commerce trends

CPCS Solutions for growing economies

Source: CPCS Analysis

Primary Objective

To identify strategies, methodologies and other solutions…

…applied to **existing and future** freight-related transport analyses and investment decisions…

…compensate for lack of private sector data through support tools…

…highlight the **impact, effectiveness, time investment, and degree of difficulty** for implementation

Secondary Objective

To provide guidance on how to…

1. **Integrate recommendations** on strategies, methodologies and solutions into existing decision support tools;

2. **Identify data and information** required to support the project recommendations; and

3. **Analyze** generated outputs for scenario planning

Task Overview and Project Progress

Project Tasks	Project Deliverables
Task 0: Project Inception	• Project Kick-off Teleconference • Work Plan (revised per FDOT comments
Task 1: Current Strategy, Methodology, and Solution Review	• Technical Memorandum 1: Best Practices for Assessing Last Mile Freight Movements
Task 2: Identify Support Tools for Further Analysis	• Technical Memorandum 2: Key Considerations, Findings, and Recommended Processes
Task 3: Detailed Recommendations for Tool Modification	• Technical Memorandum 3: Recommendations and Implementation Steps
Task 4: Draft Final Report and Closeout Teleconference	• Draft Final Report • Project Closeout Teleconference and PPT
Task 5: Final Report	• Final Report • Presentation to Florida Model Task Force

Legend

Core Research Phases

Deliverables

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Project Key Questions and Task Outcomes

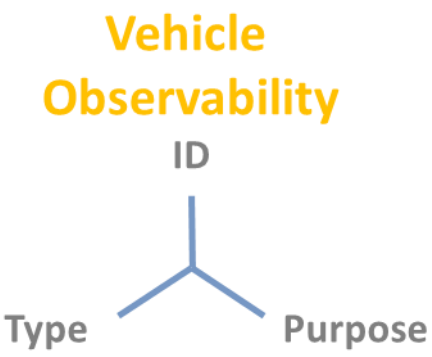
- What are the current public sector best practices related to analyzing, identifying, and quantifying freight movements?

→ **Task 1: Current Strategy, Methodology and Solution Review**

In Task 1, we synthesized best practices into a framework for last mile freight "observability" – the ability to understand how, when, where and which types of trucks are moving goods.

Last Mile "Observability" Best Practices Framework

- **Observability**
  - Vehicle ID – unique vehicles?
  - Vehicle Type – classification?
  - Vehicle Trip Purpose (or commodity)?



- **Access**
  - Unrestricted data acquisition?
  - Public inference of private activity?

- **Insight**
  - Procure insight or data?
  - Minimize costs of data acquisition, storage, and licensing?
  - Focus on efficiency of decision analysis?

Source: CPCS

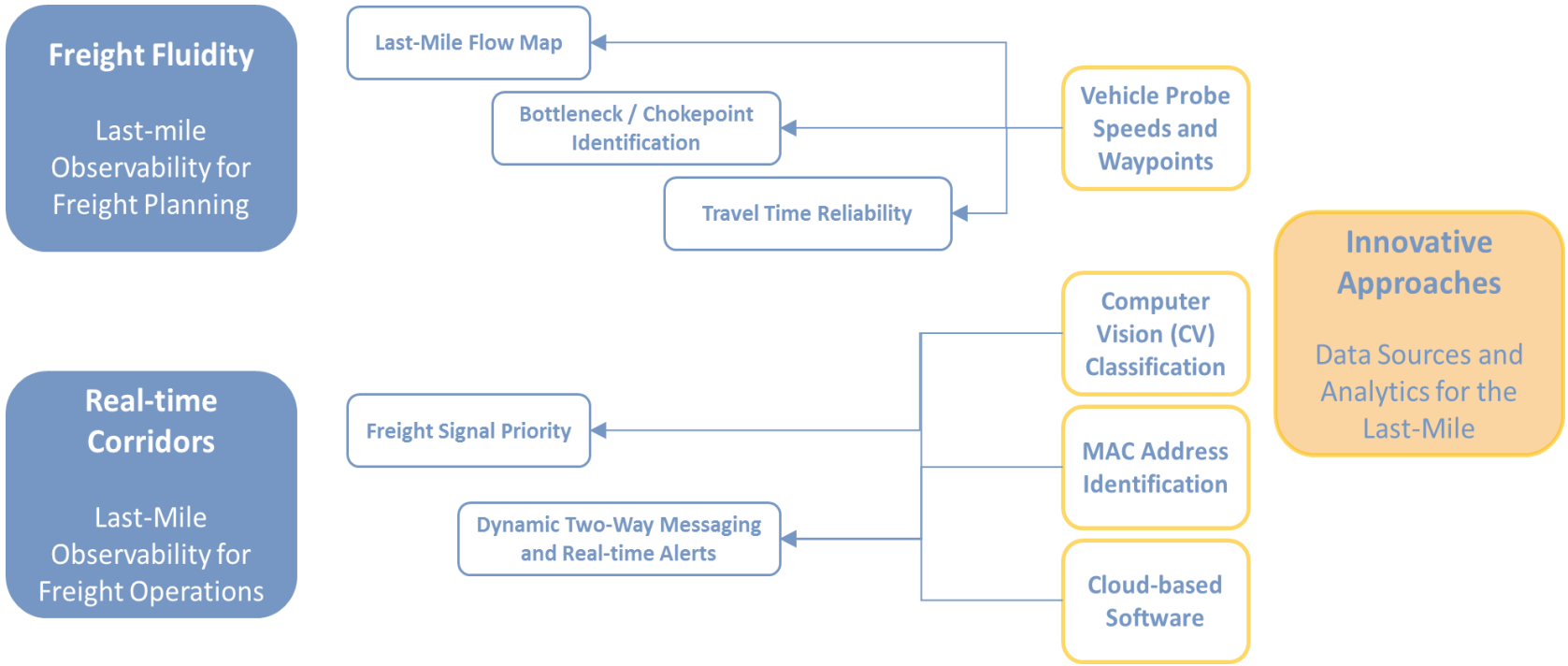
Project Key Questions and Task Outcomes

- What are the current public sector best practices related to analyzing, identifying, and quantifying freight movements? → **Task 1: Current Strategy, Methodology and Solution Review**
- What are the most promising investment decision support tools and methodologies for further analysis? → **Task 2: Identify Opportunities and Support Tool(s) for Further Analysis**

In Task 2, we identified the most promising applications in two opportunity areas: Freight Fluidity and Real-Time Corridors

Observability "over time" and "in time"

- **Freight Fluidity**: Planning applications for observability over time
- **Real-time Corridors**: Operations applications for observability in time



Source: CPCS

Freight Fluidity

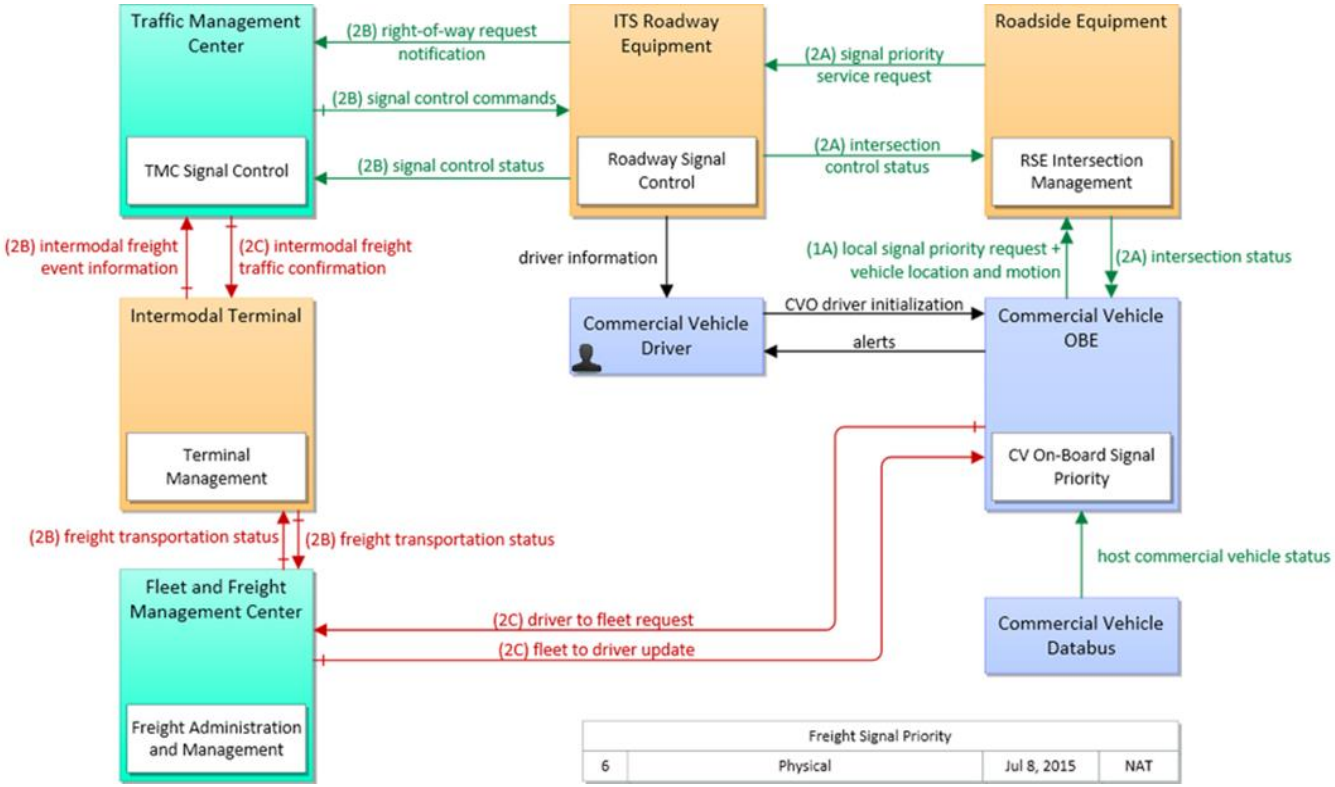
- Broad concept, many different definitions and approaches
- Addresses the efficiency with which goods move from one end of the supply chain to the other
- Connects the discussions of transportation and economic development
- Performance measures identify where bottlenecks or other inefficiencies, negative impacts arise
- Techniques involve fusing a variety of traditional and new data sources

Freight fluidity applications provide decision support for and feedback to long-term planning and project prioritization

Real-Time Corridors

- Focuses on real-time, dynamic management of critical corridors and arteries
- Often interacts with traffic systems management functions
- Leverages existing ITS infrastructure, but also pre-supposes new investments in V2X capabilities

Real-Time Corridors applications improve efficiency and capacity utilization in the near-term



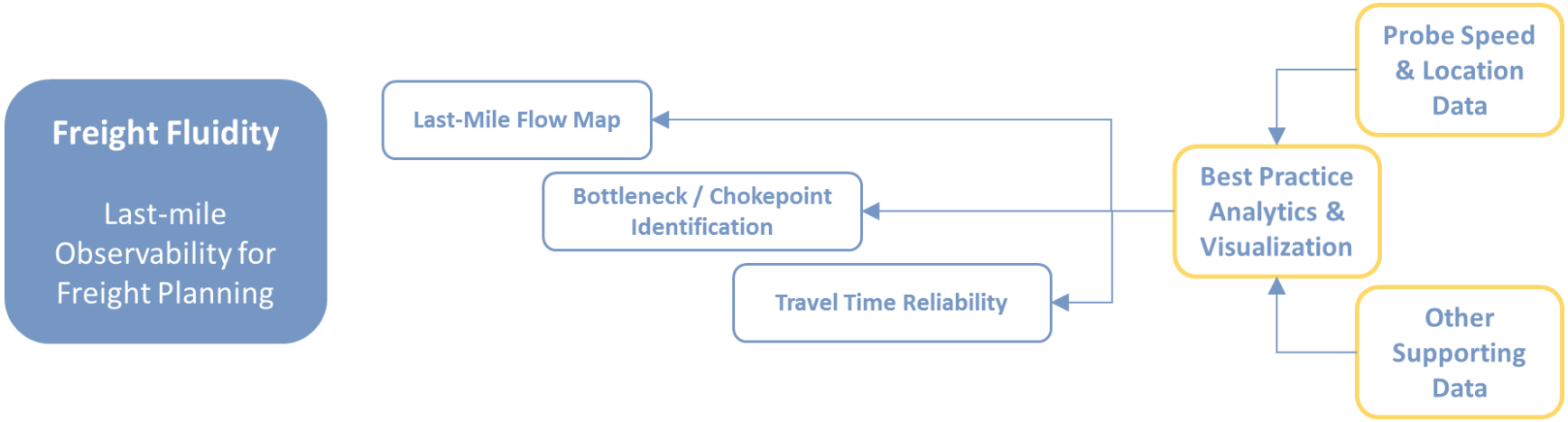
Source: FHWA

Project Key Questions and Task Outcomes

- What are the current public sector best practices related to analyzing, identifying, and quantifying freight movements? → **Task 1: Current Strategy, Methodology and Solution Review**
- What are the most promising investment decision support tools and methodologies for further analysis? → **Task 2: Identify Opportunities and Support Tool(s) for Further Analysis**
- What are the detailed modifications to the existing support tools or new approaches that will allow for more accurate freight planning? → **Task 3: Develop Detailed Recommendations for Tool Modification**

In Task 3, we focused on the Freight Fluidity opportunity area and identified detailed modifications to decision support tools and methodologies, and implementation steps for integrating recommended updates.

D4 focus on Freight Fluidity



Source: CPCS

FDOT and District 4 determined that the three Freight Fluidity applications previously identified are most promising for further analysis

Presentation Map

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Recommended Strategies and Implementation Approaches

- Last-Mile Flow Maps
- Bottlenecks Analysis
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Summary of Benefits and Project Closeout Steps

Three Related Strategies

Fully leverage location-enabled mobile data sources, specifically GPS data, in conjunction with existing data sets and methods

Recommendation 1: Understand Truck Flows

Use GPS waypoint data in conjunction with current data repositories to develop a finer-grained understanding of how trucks traverse the last mile network

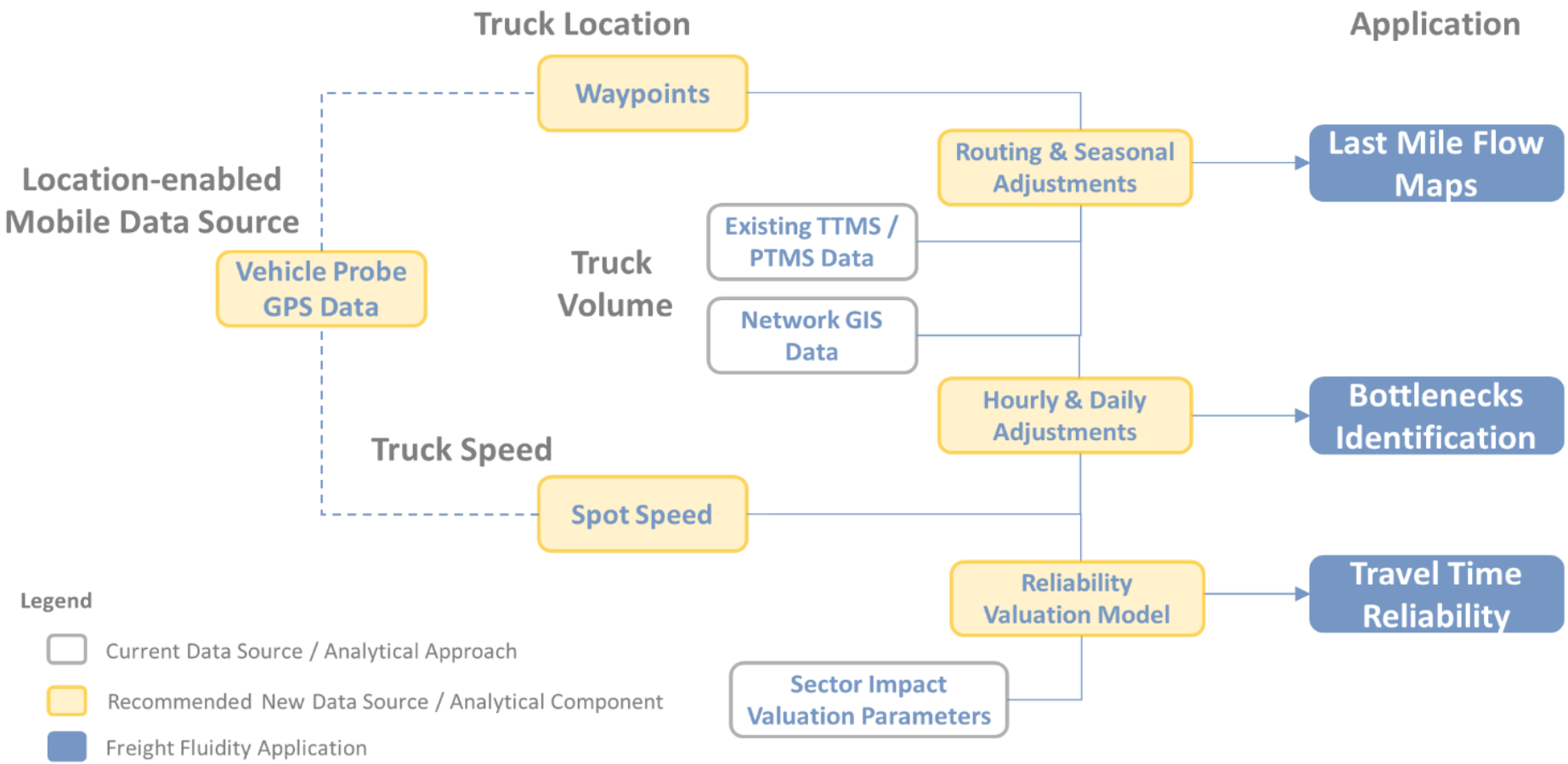
Recommendation 2: Identify Bottlenecks

Use GPS spot speeds along with estimated truck volumes to identify and precisely locate truck bottlenecks

Recommendation 3: Determine Value of Reliability

Use GPS spot speeds, truck volumes, freight facility information, and sector-specific valuation data to assess the value of improving travel time reliability in certain corridors

Recommended Implementation Approach



Source: CPCS

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Last-Mile Flow Maps

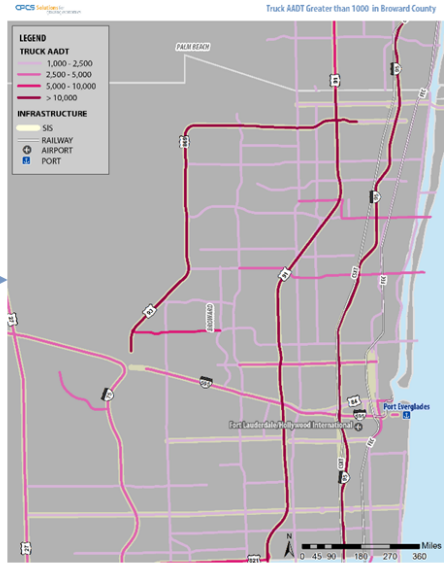
1. Identify network of interest → District 4 Last Mile Network
2. Select time horizon → Representative Weeks in a Year
3. Acquire data → GPS Waypoint Observations
4. Conflate to network and transform → FDOT LRS+RCI Enhanced Maps
5. Visualize for decision-making → Static or Interactive Maps

Truck GPS Waypoint Data

Existing TTMS / PTMS Data

Network GIS Data

Routing & Seasonal Adjustments

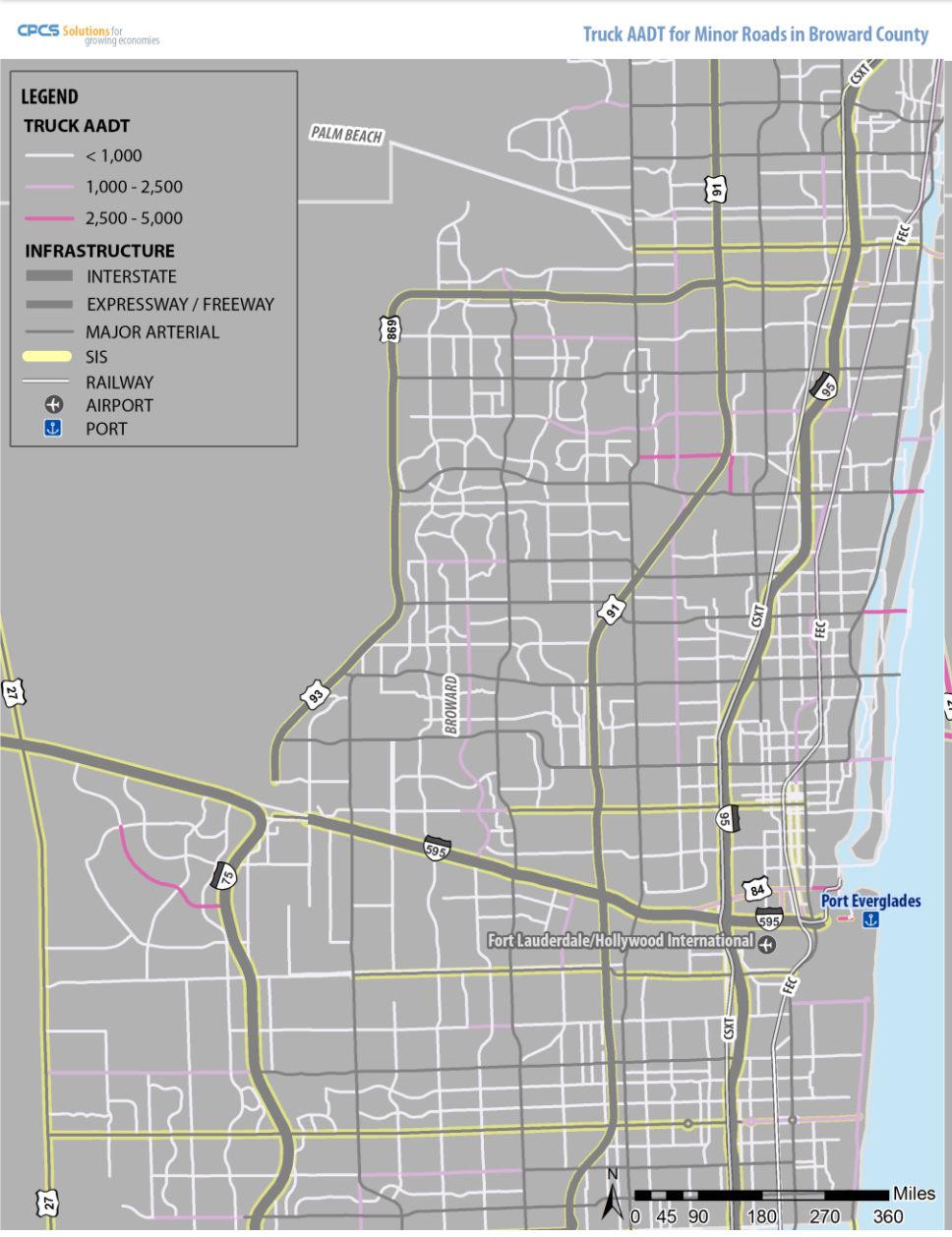


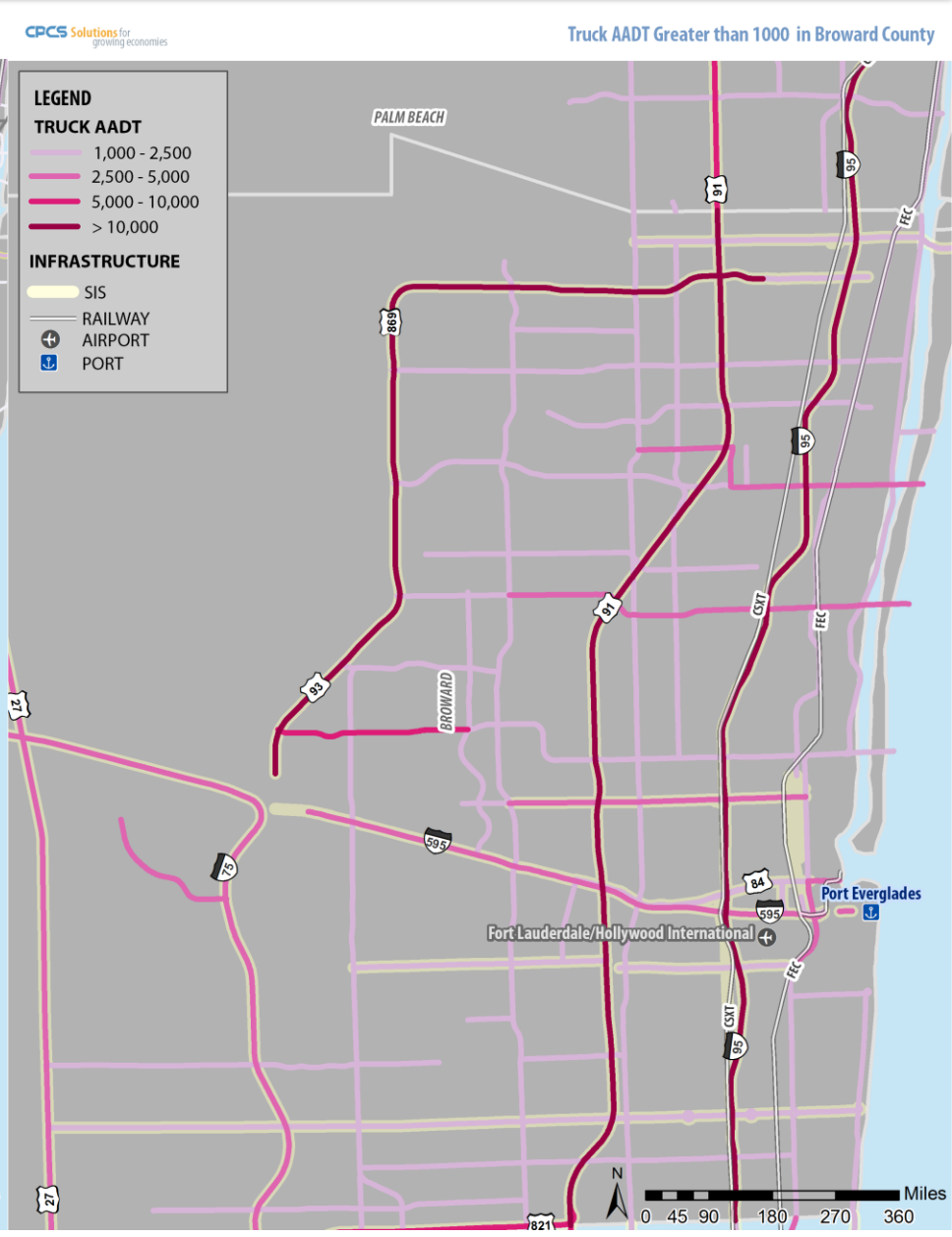
Legend

- Current Data Source / Analytical Approach
- Recommended New Data Source
- Implementation Step

Source: CPCS

Flow Map Examples





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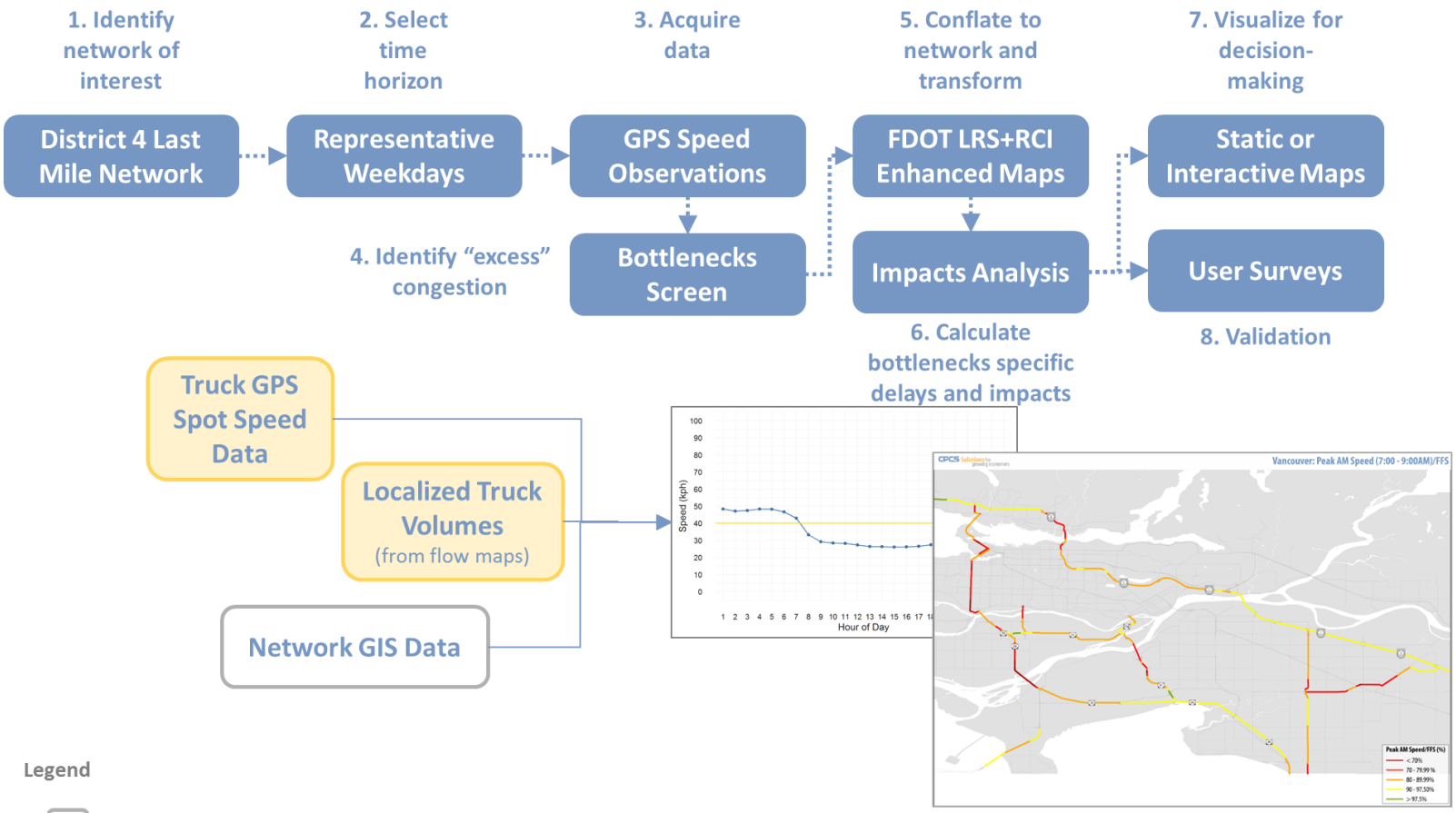
Recommended Strategies and Implementation Approaches

- Last-Mile Flow Maps
- **Bottlenecks Analysis**
- Travel Time Reliability

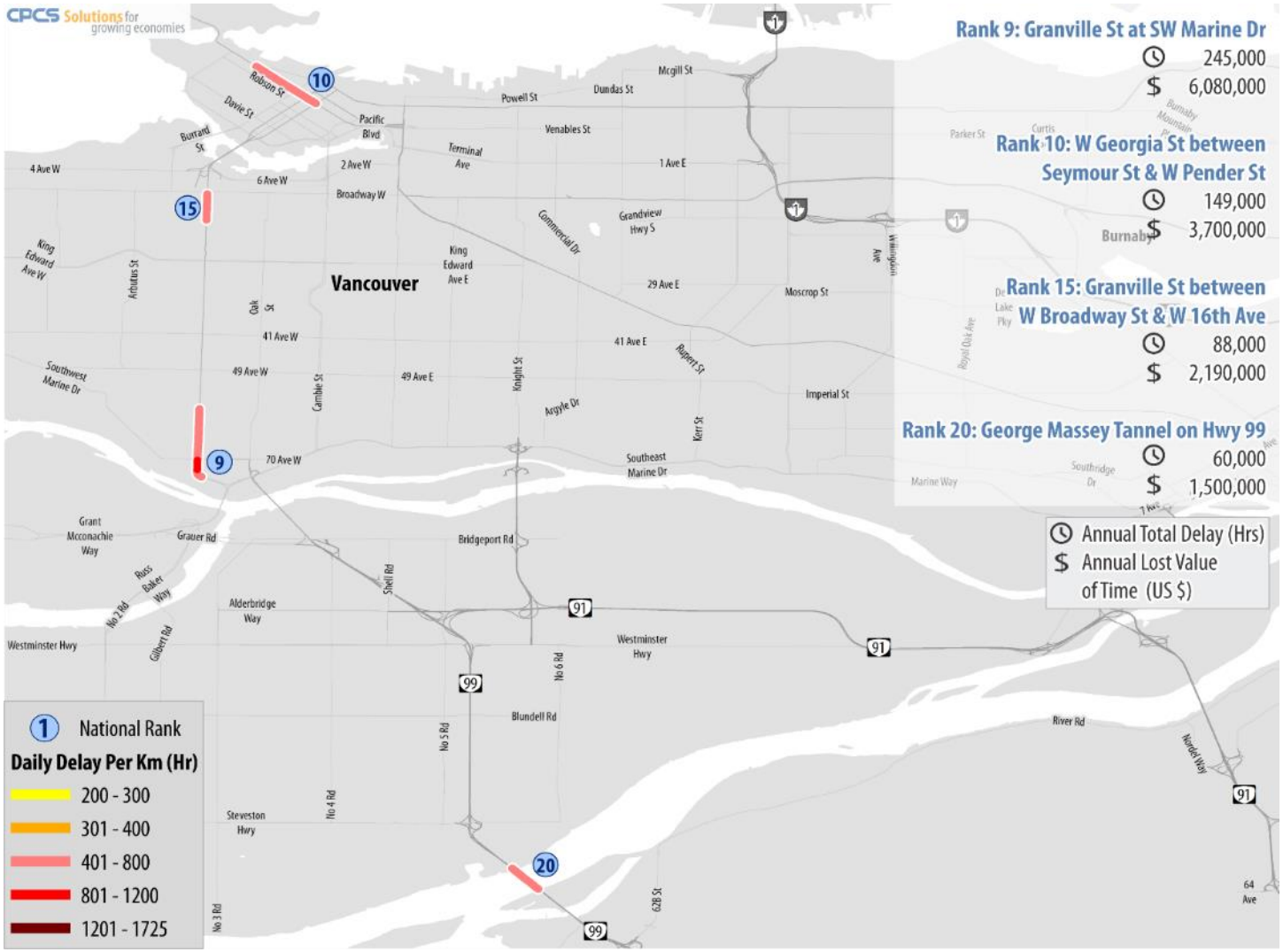
Summary of Benefits and Next Steps

Bottlenecks Analysis



Source: CPCS

Bottleneck Visualization Example



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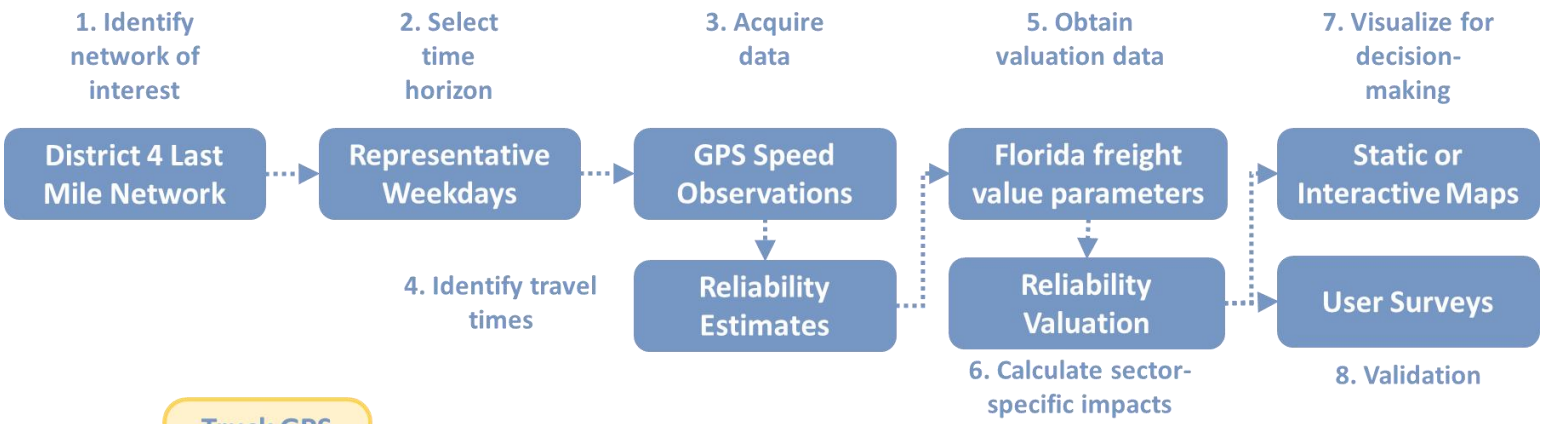
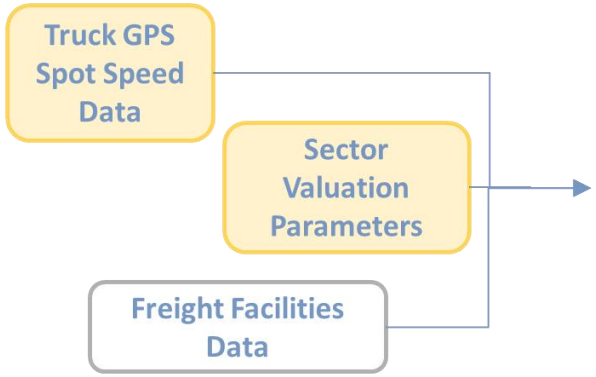
- **Travel Time Reliability**

Summary of Benefits and Project Closeout Steps

Travel Time Reliability Valuation





Medium trip distance, medium value (average buffer, medium time value cargo)

Without mitigation - comparator case				With buffering			
95th percentile travel time above median travel time	95th pct. Buffer index value	95th pctl. hours above median	expected value of unreliability cost per trip without mitigation (per loaded trip)	expected value of unreliability - cost per loaded trip with buffer mitigation	implied residual economic cost per loaded trip	expected reliability cost per expected delay hour	RELIABILITY RATIO - expected cost per delay hour as pct of direct hourly transport cost
1.1	0.1	1	$ 23.95	$ 67.59	$ 43.64	$ 140.92	220.2%
1.2	0.2	2	$ 59.51	$ 135.45	$ 75.94	$ 142.63	222.9%
1.3	0.3	3	$ 101.50	$ 204.30	$ 102.80	$ 144.62	226.0%
1.4	0.4	4	$ 138.99	$ 272.99	$ 134.00	$ 146.26	228.5%
1.5	0.5	5	$ 172.07	$ 341.64	$ 169.57	$ 147.53	230.5%
1.6	0.6	6	$ 202.03	$ 409.99	$ 207.96	$ 148.57	232.1%
1.7	0.7	7	$ 229.86	$ 478.08	$ 248.22	$ 149.43	233.5%
1.8	0.8	8	$ 256.17	$ 545.95	$ 289.78	$ 150.19	234.7%
1.9	0.9	9	$ 281.39	$ 613.64	$ 332.25	$ 150.86	235.7%
2	1	10	$ 305.77	$ 681.18	$ 375.41	$ 151.47	237.0%

Trip Parameters	
trip length	500 miles
avg. speed	50 mph
buffer for mitigation	94th pctl.
dock penalty above buffer	$ 250.00
cargo supply chain cost per hour	$ 35.00
dock delivery window for penalty excursion	2 hours

Legend

- Current Data Source / Analytical Approach
- Recommended New Data Source
- Implementation Step

Reliability Trade-off Curve Example

Medium trip distance, medium value (average buffer, medium time value cargo)							
Without mitigation - comparator case				With buffering			
95th percentile travel time above median travel time	95th pct. Buffer index value	95th pctl. hours above median	expected value of unreliability cost per trip without mitigation (per loaded trip)	expected value of unreliability - cost per loaded trip with buffer mitigation	implied residual economic cost per loaded trip	expected reliability cost per expected delay hour	RELIABILITY RATIO - expected cost per delay hour as pct of direct hourly transport cost
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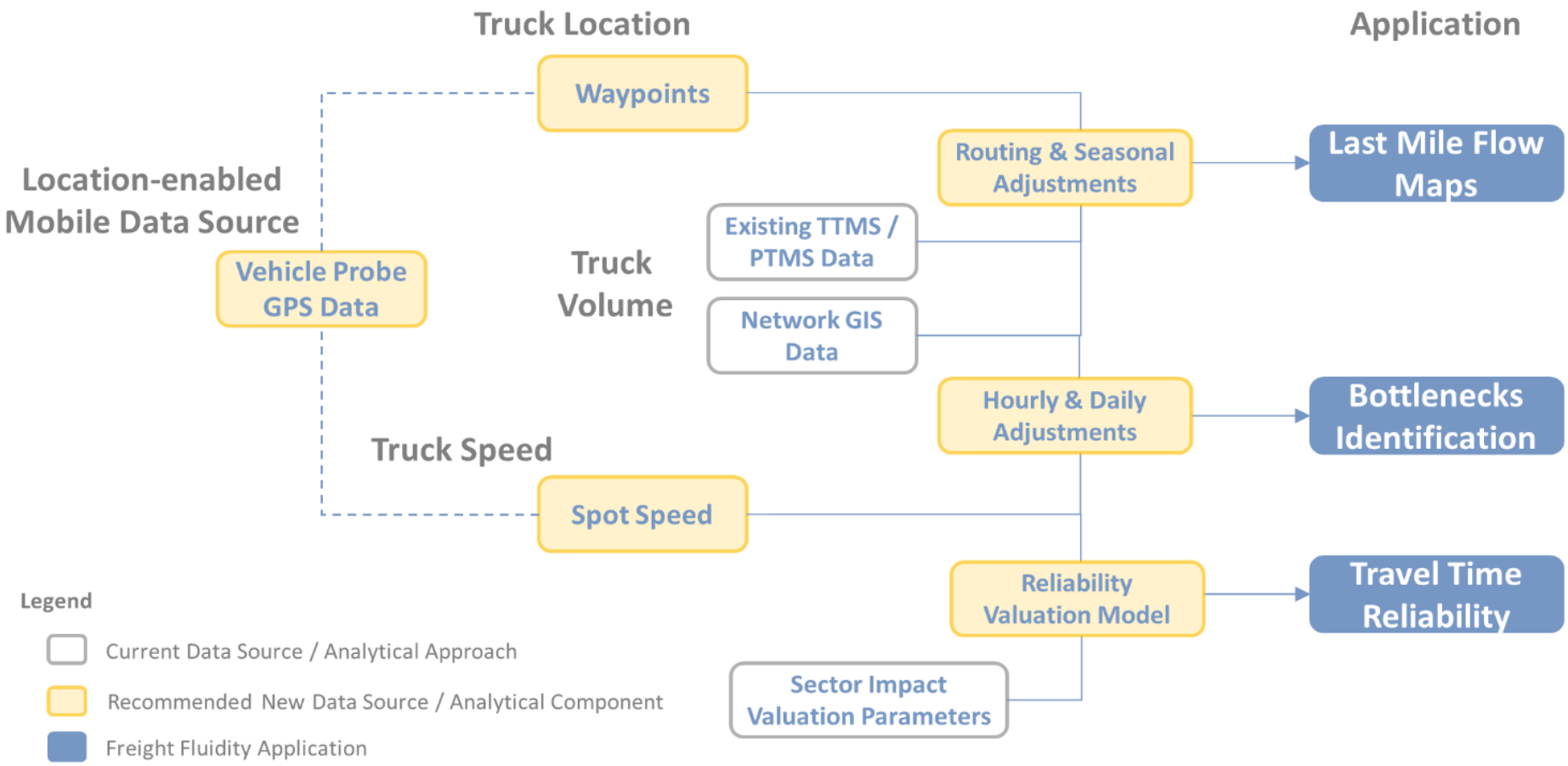
Trip Parameters	
trip length	500 miles
avg. speed	50 mph
buffer for mitigation	94th pctl.
dock penalty above buffer	$ 250.00
cargo supply chain cost per hour	$ 35.00
dock delivery window for penalty incursion	2 hours

Source: NCHRP 824

CPCS

Recap: Implementation Approach



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Last-Mile Flow Maps

Bottlenecks Analysis

Travel Time Reliability

Summary of Benefits and Project Closeout Steps

Summary: Benefits of Recommended Strategies and Methods

- **Better visibility** into and beyond the "last-mile" in urban areas
- **Improved planning / programming** of projects and policies to improve local truck operations (e.g. improved transportation / land use coordination)
- **Ability to influence**, and maybe shape demand for freight in terms of delivery timings, vehicle types
- **Scalable** to other FDOT Districts and transportation agencies
- **Collaborative relationships** with freight system actors, strategic partners and vendors
- **Increased efficiency and value capture** from data sources in the overall system

Project Closeout Steps

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Deliverables