Analysis of Freight Transport Strategies and Methodologies

Florida Model Task Force Meeting

Florida Department of Transportation
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Project BE277

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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?
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.

**Context for New Strategies and Methodologies**

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

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

**Data**
- Truck Freight
- Private Sector
- Urban & Metropolitan

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

Source: CPCS Analysis
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

Task 0: Project Inception

Task 1: Current Strategy, Methodology, and Solution Review

Task 2: Identify Support Tools for Further Analysis

Task 3: Detailed Recommendations for Tool Modification

Task 4: Draft Final Report and Closeout Teleconference

Task 5: Final Report

Project Deliverables

• Project Kick-off Teleconference
• Work Plan (revised per FDOT comments)

• Technical Memorandum 1: Best Practices for Assessing Last Mile Freight Movements

• Technical Memorandum 2: Key Considerations, Findings, and Recommended Processes

• Technical Memorandum 3: Recommendations and Implementation Steps

• Draft Final Report
• Project Closeout Teleconference and PPT

• Final Report
• Presentation to Florida Model Task Force

Legend

Core Research Phases  Deliverables
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
What are the current public sector best practices related to analyzing, identifying, and quantifying freight movements?

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?
Project Key Questions and Task Outcomes

- What are the current public sector best practices related to analyzing, identifying, and quantifying freight movements?
- What are the most promising investment decision support tools and methodologies 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

![Diagram showing concepts and relationships](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 presupposes 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?

- What are the most promising investment decision support tools and methodologies 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 1: Current Strategy, Methodology and Solution Review

Task 2: Identify Opportunities and Support Tool(s) for Further Analysis

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

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

Source: CPCS
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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

Location-enabled Mobile Data Source

- Vehicle Probe GPS Data

Truck Location
- Waypoints
- Existing TTMS / PTMS Data
- Network GIS Data
- Routing & Seasonal Adjustments

Application
- Last Mile Flow Maps
- Bottlenecks Identification
- Travel Time Reliability

Truck Volume
- Hourly & Daily Adjustments

Truck Speed
- Spot Speed

Legend
- Current Data Source / Analytical Approach
- Recommended New Data Source / Analytical Component
- Freight Fluidity Application

Source: CPCS
Presentation Map

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- Summary of Benefits and Project Closeout Steps
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

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

Source: CPCS
Flow Map Examples
Bottlenecks Analysis

1. Identify network of interest
   - District 4 Last Mile Network

2. Select time horizon
   - Representative Weekdays

3. Acquire data
   - GPS Speed Observations

4. Identify “excess” congestion
   - Bottlenecks Screen

5. Conflate to network and transform
   - FDOT LRS+RCI Enhanced Maps

6. Calculate bottlenecks specific delays and impacts
   - Impacts Analysis

7. Visualize for decision-making
   - Static or Interactive Maps

8. Validation
   - User Surveys

Legend

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

Source: CPCS
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
Travel Time Reliability Valuation

1. Identify network of interest
   - District 4 Last Mile Network

2. Select time horizon
   - Representative Weekdays

3. Acquire data
   - GPS Speed Observations

4. Identify travel times
   - Reliability Estimates

5. Obtain valuation data
   - Florida freight value parameters
   - Reliability Valuation

6. Calculate sector-specific impacts

7. Visualize for decision-making
   - Static or Interactive Maps
   - User Surveys

8. Validation

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)

<table>
<thead>
<tr>
<th>95th percentile travel time above median travel time</th>
<th>95th pct. Buffer index value</th>
<th>95th pct. hours above median</th>
<th>Without mitigation - comparator case</th>
<th>With buffering</th>
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### Trip Parameters
- **trip length**: 500 miles
- **avg. speed**: 50 mph
- **buffer for mitigation**: 94th pct.
- **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*
Recap: Implementation Approach

Location-enabled Mobile Data Source

- Vehicle Probe GPS Data

Truck Location
- Waypoints

- Existing TTMS / PTMS Data
- Network GIS Data

Routing & Seasonal Adjustments

Application
- Last Mile Flow Maps

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Truck Speed
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Reliability Valuation Model

Travel Time Reliability

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Source: CPCS
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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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**Legend**

- Core Research Phases
- Deliverables