Advanced Freight Mobility Solutions (AFMS)

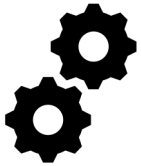
2018 Florida Automated Vehicles Summit

November 28, 2018

Agenda

1) Welcome
2) Background/ Project Goals
3) Technology Overview
    a) Freight Signal Priority
    b) Connected Vehicles
    c) Applications
4) Freight Operator Engagement
5) Next Steps






Advanced Freight Mobility Solutions (AFMS) Project Goals

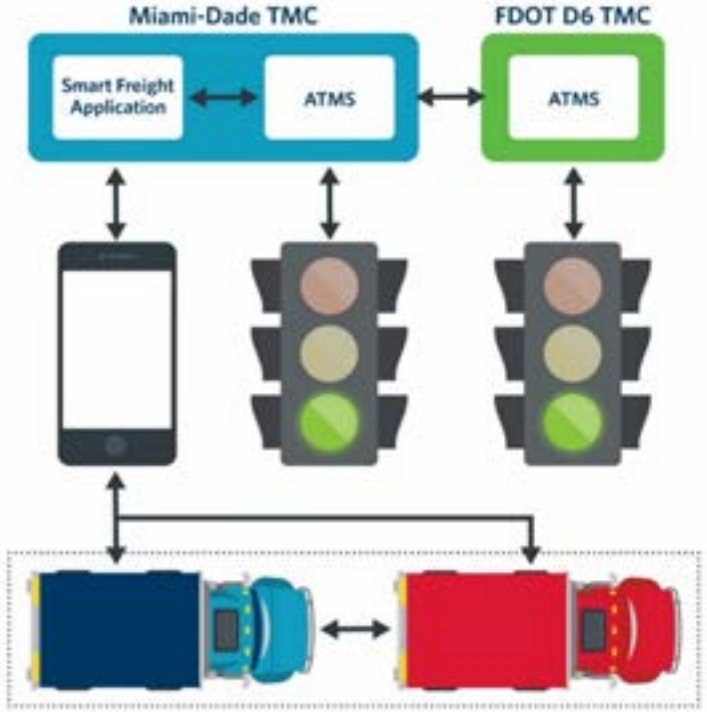
1) Reduce congestion in the project area and leading to the National Highway Freight Network (US 27)

2) Enhance economic competitiveness of the freight industry

3) Reduce environmental impact of freight shipping

4) Improve roadway safety

5) Leverage existing & planned assets



Freight Signal Priority – Initial Efforts (2015)

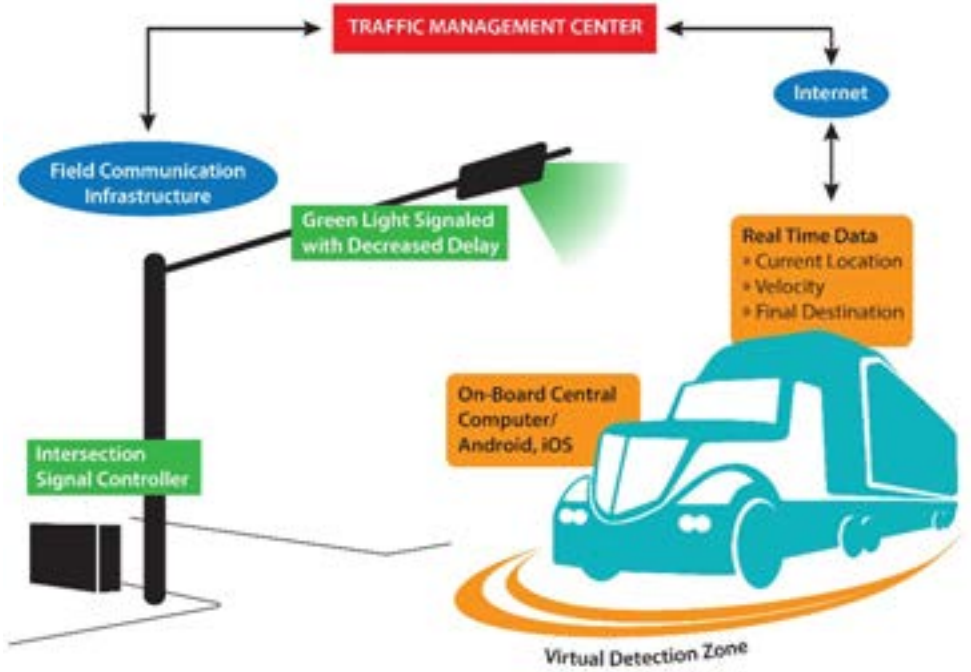
Connected Vehicle for Urban Freight Mobility in Miami-Dade County

3 Phase Approach

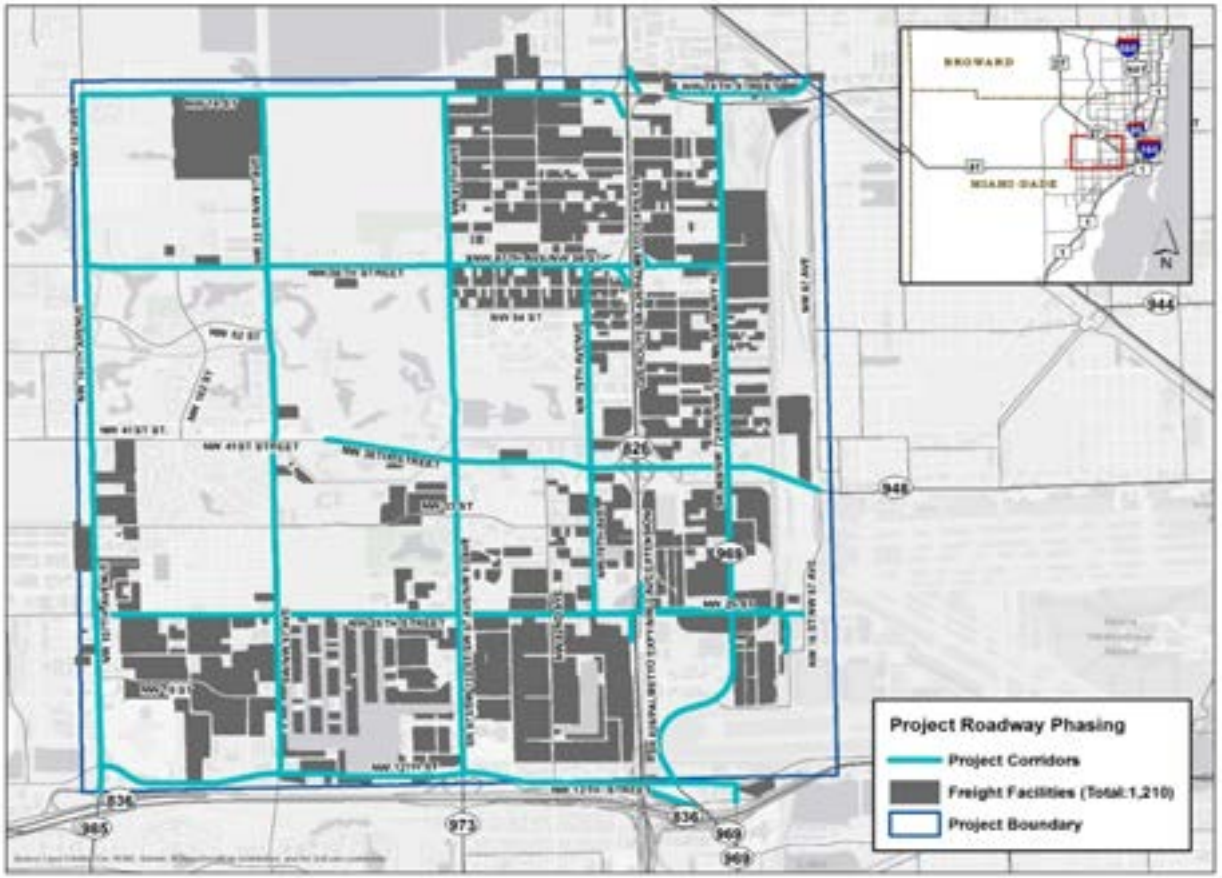
1) Measure existing operations

2) Stakeholder engagement & deploy CV technology

3) Prioritize trucks during non-peak hours to reduce truck travel times through multiple corridors

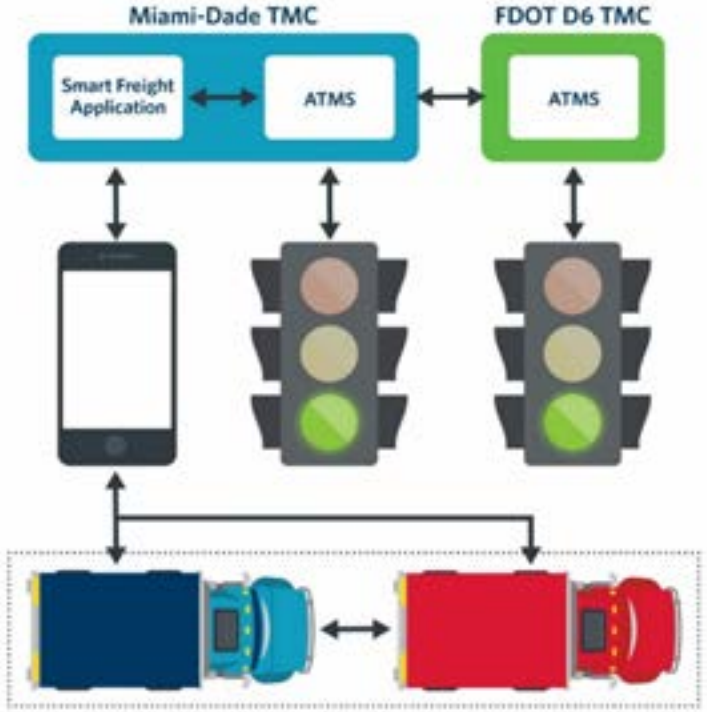


AFMS Project Area w/ Freight Facilities



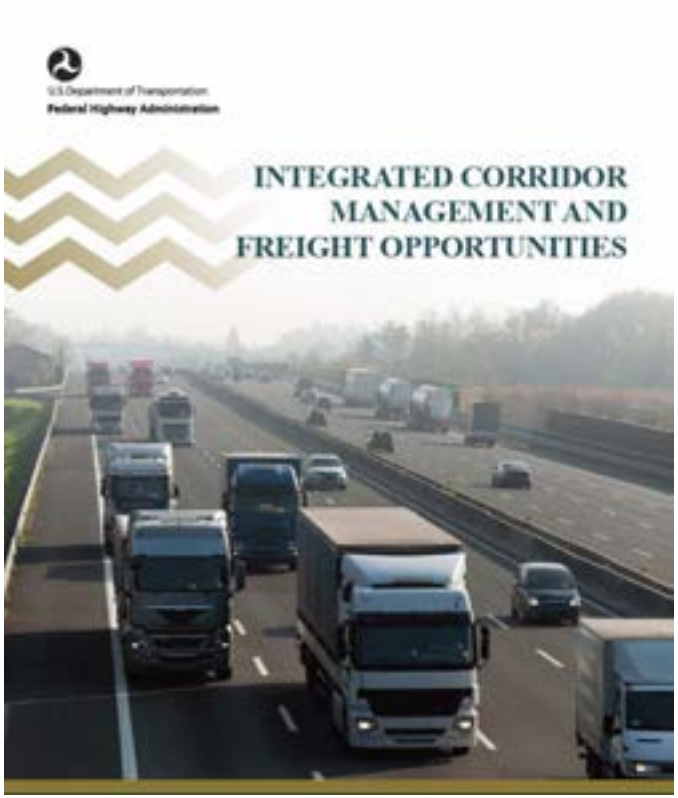
Technologies

1) Freight Signal Priority
2) Connected Vehicles
3) Applications
4) Truck “Platooning”



Freight Signal Priority

1) Integrated Corridor Management and Freight Opportunities (USDOT, 2015)
   a) On-time pick-ups and deliveries
   b) Improved travel reliability
   c) Reduced fuel consumption
   d) Reduced labor and vehicle maintenance costs
   e) Reduced crash involvement



https://ops.fhwa.dot.gov/publications/fhwahop15018/index.htm

Freight Signal Priority + Connected Vehicle

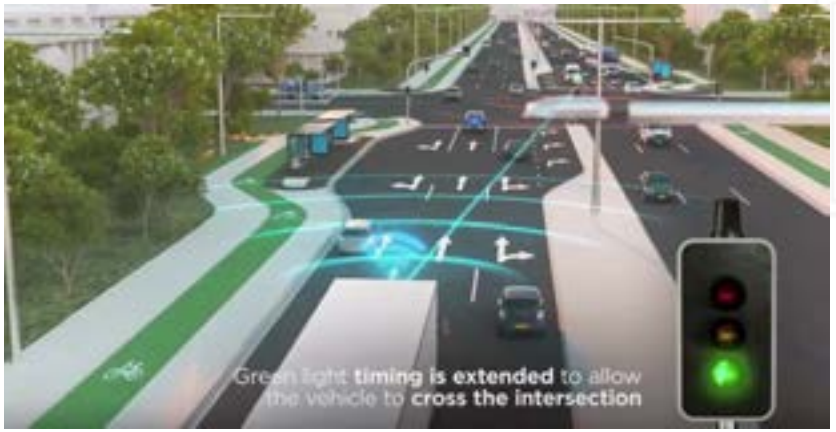
1) Relatively old concept, retooled by way of Connected Vehicle initiative (USDOT)

2) Eco-Freight Signal Priority
   a) Gives signal priority to freight vehicles approaching a signalized intersection
   b) Takes into consideration:
      i. Vehicle location (GPS)
      ii. Speed
      iii. Type
      iv. Weight
   c) Priority based on real-time traffic conditions and Signal Phase and Timing (SPaT)

esy of USDOT

Freight Signal Priority – Australia Trial

1) Connected Vehicle for Urban Freight Mobility is not yet realized in the US
2) Presents unique opportunity for 1st deployment in US
   a) Critical mass of freight vehicles
   b) Repetitive routes
   c) Time sensitive cargo
   d) Build upon recent CV successes
   e) Willing end-users (?)

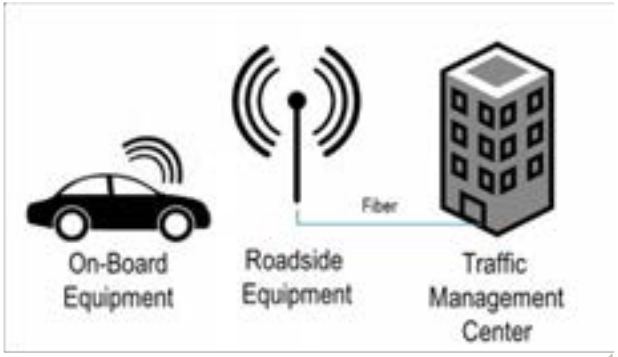


https://www.youtube.com/watch?v=y2UAZoaPSqg

Connected Vehicle - 101

Point-to-Point Wireless Communications

- Dedicated Short Range Communications (DSRC)
- V2V (Vehicle-to-Vehicle)
- V2I (Vehicle-to-Infrastructure)
- V2X (Vehicle-to-All)
- Low latency wireless (Milliseconds)
  - 5.9 GHz
  - 802.11p wireless router, IEEE1609.X



Connected Vehicle – Major System Components

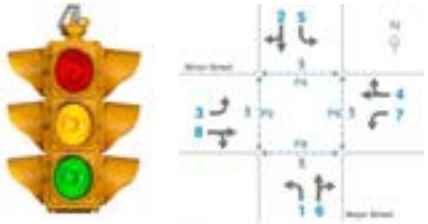
Dedicated Short Range Communications (DSRC)

- **Roadside Equipment (RSE or RSU)**
  - Costs would be roughly $3,000 to $5,000 per DSRC Radio + installation costs
  - Requires Power-Over-Ethernet (POE)
  - ~25 feet in air for best performance
  - Backhaul connectivity to Internet (cellular, copper, or fiber)
- **On-Board Equipment (OBE or OBU)**
  - Costs would be roughly $500 - $2,000 per unit – will be embedded in passenger vehicles by OEMs 2021 – 2023
- **Traffic Management Center (TMC)**
  - Need to send/receive messages from RSE
  - Monitor status of RSE equipment
  - Typically Web-Based Monitoring and Cloud-Based Data processing

Key Considerations - DSRC

- Generally Point-to-Point radio (line-of-sight) but some ability to “bend” around corners/objects
- 300 – 1,000 meter effective range
- No “handshake;” messages are “fire-and-forget”
- Antenna placement makes a big difference in performance
- Messages are ultra-low latency
  - ~2-3 milliseconds

SAE J2735 DSRC Message Set

Basic Safety Message 	**Traveler Information Message** 
Signal Phase and Timing 	**Roadside Alert** 

Connected Car - 101

Internet Connectivity

- Cellular Connectivity/WiFi Hotspot
- Infotainment Systems
- Smartphone Extension
- Telematics and Remote Access

Connected Vehicle (DSRC) vs Connected Car (cellular)

- Pro's:
  - Strong standards
  - Mandatory in passenger vehicles
  - Dedicated bandwidth
  - Low latency
- Con's
  - Limited range (point-to-point)
  - Not ubiquitous in all devices
  - Limited suppliers (currently)

- Pro's:
  - Will be ubiquitous
  - Large industry support
  - Encompasses mobile and many other devices
  - Further range/reach
- Con's
  - Can become bandwidth limited
  - No standards as of yet
  - Latency?

Connected Vehicle - Applications

Applications in Various States of Maturity

- Green highlighted have been prototyped and are being deployed
- Goal is to improve:
  - Safety
  - Mobility
  - Environment
  - Economic Development

V2I Safety

- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

Agency Data

- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

Environment

- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

Road Weather

- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

Mobility

- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging
- Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization

Smart Roadside

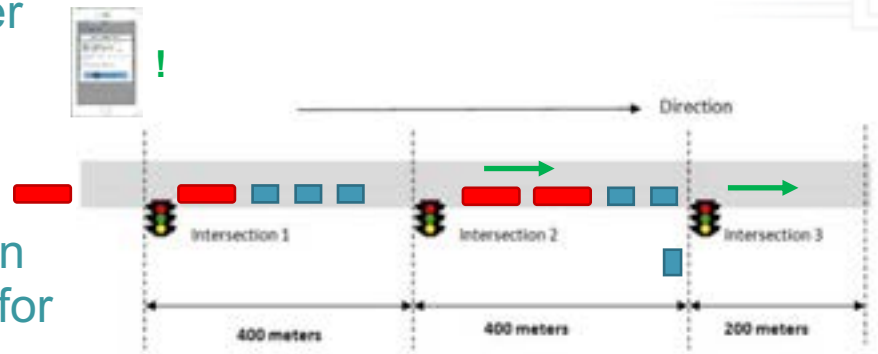
- Wireless Inspection
- Smart Truck Parking

Truck “Platooning”

- Not referring to Driver-Assistive Truck Platooning

- **Platoon**, as defined by FHWA (MUTCD):
  - A group of vehicles or pedestrians traveling together as a group, either voluntarily or involuntarily, because of traffic signal controls, geometrics or other factors

- For AFMS, 2+ CV-enabled trucks in close proximity (same traffic platoon) will trigger an ‘event’ for the SPaT to be adjusted to allow for optimized movement of said truck ‘platoon’



Stakeholder Engagement

1) Recruit freight fleet operators to install On-Board Units (OBUs) for Connected Vehicle (CV) freight signal priority

2) Why should they participate?

3) What is the cost to participate?

4) Data privacy

5) Plan to ensure driver utilization of technology

TPO
Miami-Dade Transportation Planning Organization

FTAC
Freight Transportation Advisory Committee

#MiamiSMARTPlan
Mobility Today & Tomorrow

Next Steps

- Execute MOU
- Stakeholder Engagement – private trucking firms, local businesses
- Kick-off project Q1 of 2019

Carlos A. Castro
Florida Department of Transportation
Modal Development Office
1000 NW 111th Avenue
Miami, Florida 33172
305-470-5238
carlos.castro@dot.state.fl.us

Rickey Fitzgerald
Manager, Freight & Multimodal Operations
Florida Department of Transportation
605 Suwannee Street, MS 25
Tallahassee, Florida 32399
850-414-4702
rickey.fitzgerald@dot.state.fl.us

Edward R. Hutchinson
Florida Department of Transportation
Office of Transportation Data and Analytics
605 Suwannee Street
Tallahassee, FL 32399
850-414-4910
ed.hutchinson@dot.state.fl.us