CENTRAL FLORIDA TSM&O CONSORTIUM MEETING SUMMARY

Meeting Date:	May 27, 2021 (Thursday)	**Time**: 10:00 AM – 12:00 PM
Subject:	TSM&O Consortium Meeting	
Meeting Location:	Teleconference	

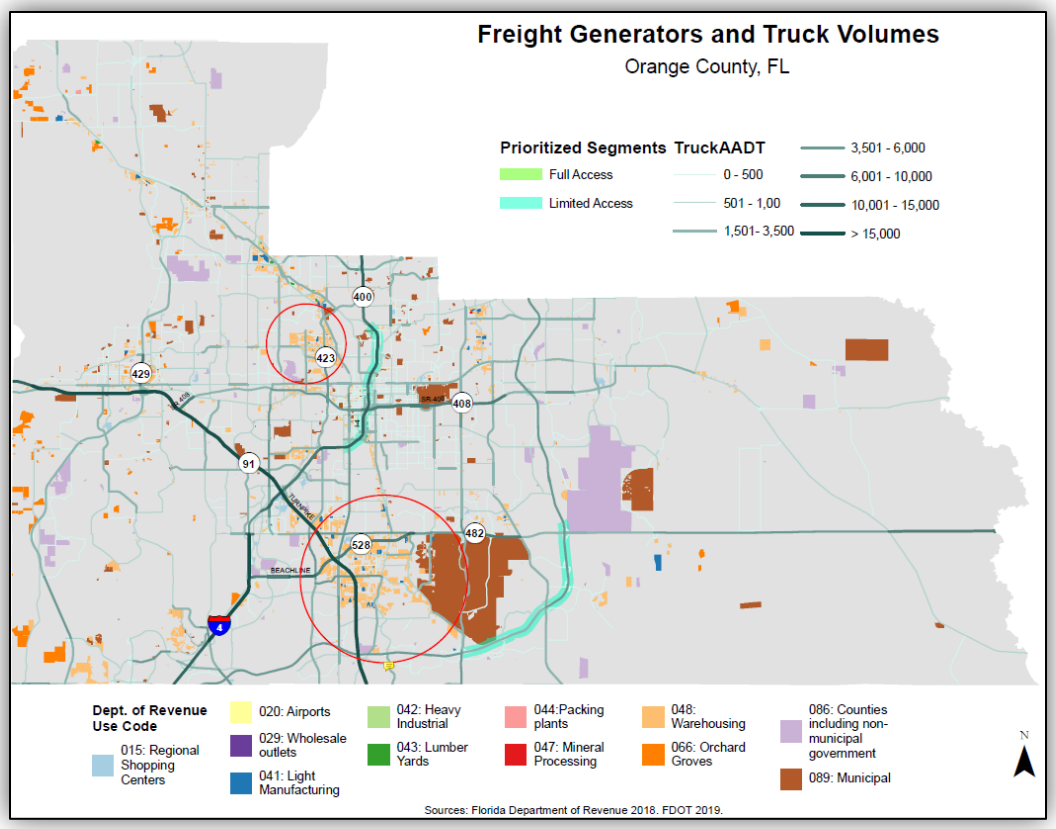
I. OVERVIEW

The purpose of this recurring meeting is to provide an opportunity for District Five FDOT staff and local/regional agency partners to collaborate on the state of the TSM&O Program and ongoing efforts in Central Florida. Jeremy Dilmore gave a short introduction and outlined the meeting agenda.

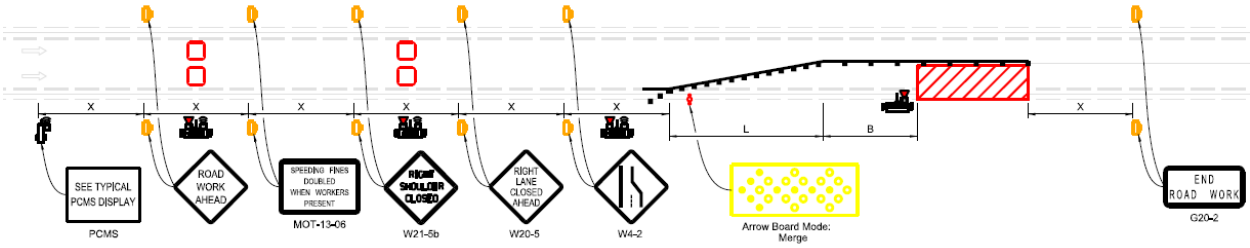
II. FREIGHT STUDIES FOR IMPROVED MOBILITY AND SAFETY

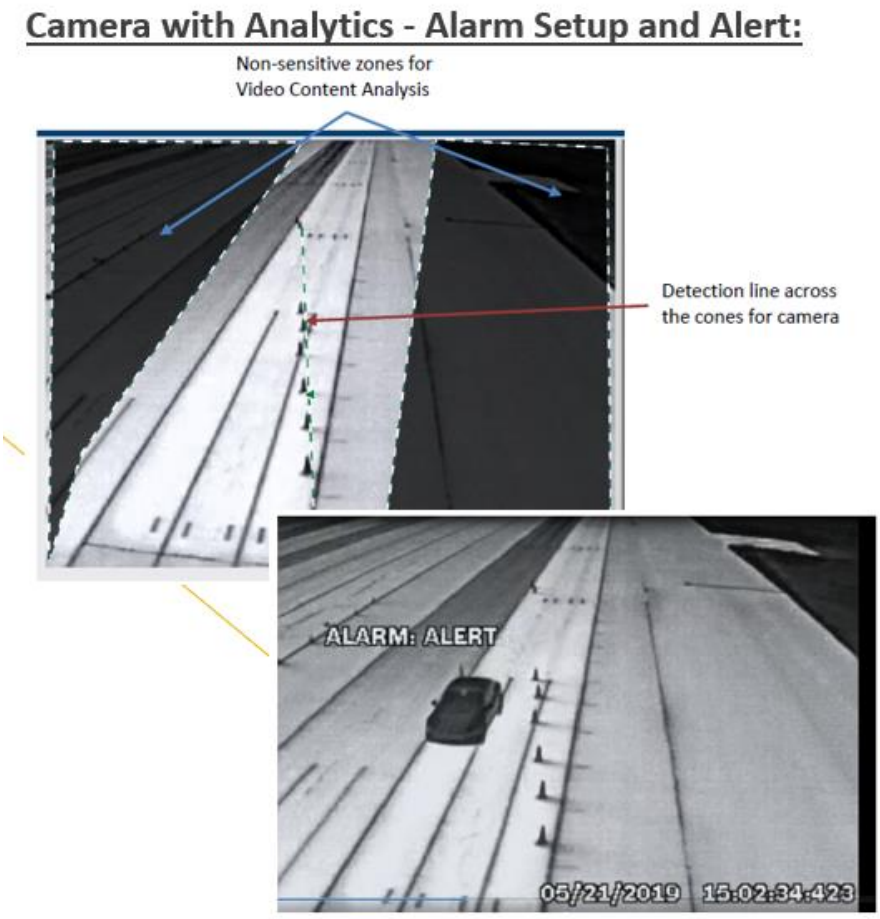
Aung Thurain presented on the Freight Studies for Improved Mobility and Safety project. The purpose of the presentation was to share the methodology for identifying needs and opportunities, obtain input to confirm areas of need, share preliminary strategies and deployment locations, and obtain input on concerns, enhancements, and agency roles.

- Goals & Objectives – Improve Safety & Efficiency of freight movement through identification of TSM&O strategies and technology
- Project Status
    - Analysis of Concepts – completed
    - Next Steps
        - Benefit/Cost Analysis, Final Recommendations, Concept Plans
- Methodology for freight analysis and recommendations
    - Literature review;
    - Focus on SIS corridors;
    - Roadways with high truck percentages/volumes;
    - Roadways with high truck-related crash rates; and
    - District-specific needs.
- Freight Priority System (FSP) – extends green phase on major roadways for trucks in the "dilemma zone" traveling at speeds that would not allow them to slow down in time for the red phase. This system would prevent vehicles on signalized cross streets from entering the highway when a high-speed truck is approaching, potentially avoiding deadly conflicts. An FSP system is most effective where trucks have a sufficient stretch of roadway to pick up speed, or where trucks are merging onto a highway from a high-speed facility.



- Identification of Candidate Roadways for FSP
  - Truck volume – 5,000+ Truck AADT
  - Corridor length – 2+ miles
  - Signalized Intersections – 6+ signals
  - Connection to limited access facility
  - Presence of truck traffic generators
  - Existing signal / ITS assets – ATC controller, Bluetooth, CCTV, ADMS
- FSP Candidate Roadways include:
  - John Young Pkwy
  - Mercy Dr
  - Silver Star Rd
  - Sand Lake Rd
  - Landstreet Rd
  - Orange Ave
  - Boggy Creek Rd
  - Tradeport Dr
  - Taft Vineland Rd
  - S Orange Blossom Trl
- Queue Warning System recommended for I-75 in Sumter/Marion Counties
- Ramp meter Bypass recommended for I-4 at John Young Pkwy and at Orange Blossom Trl
- Truck Preemption System – extends green phase to trucks approaching a ramp meter location
- Smart Work Zone Applications
- Video Analytics can identify a Work Zone boundary using physical barriers (e.g., traffic cones)
  - when a vehicle is detected bypassing this boundary, an alert/alarm can be sent to construction workers in the work zone





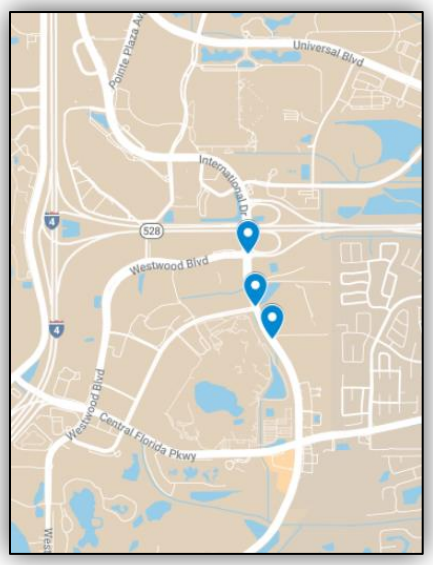
Discussion:

- Q: Cade Braud – Is there a hierarchy of call priorities (e.g., transit vs freight)?
  - A: Jeremy – We haven't gotten to the point of prioritizing; this would be something we look at in a design phase

III. PARTNER UPDATE – ORANGE COUNTY

Hazem El Assar presented on Orange County's various TSM&O projects.

- Intelight Signal Controller Replacement
  - countywide replacement controllers expected to be complete by Summer 2021
- ATMS Phase 4
  - 77% complete
  - expected complete in September 2021
- Hazard Mitigation Grant Program
  - switching spanwire intersections to mast arm
- Traffic Signal Cabinet Upgrade
  - hoping to implement ATC controllers as part of the project
  - consultant selection expected in June 2021
- Sand Lake Road InSync Adaptive Signal Control (ASCT)
  - 12 intersections
  - will bring total InSync intersections to 94
- International Drive – *MaxAdapt* ASCT Pilot
  - Six-lane section; 45mph speed limit
  - 0.60-mile in length
  - Summary of ATSPM data collection findings:
    - Travel time decreased for nearly all study periods
      - 49.7% in NB travel time
      - 11.8% in SB travel time
    - MaxAdapt was able to reduce total cycle throughout many time periods while still benefiting from increased *Arrival on Green* and *Platoon Ratios*
  - Did not include Approach Delay
  - Some tweaks are still needed, given the system was calibrated before Sea World was at capacity and Aquatica was reopened
  - Recommendations derived from MaxAdapt Pilot Study:
    - Consider expanding ASCT to include more I-Drive intersections
    - Continue to calibrate existing intersections to account for return of normal traffic
    - Consider deployment along other corridors with unpredictable traffic conditions
    - Upgrade existing signal detection system to provide ATSPM and IMC data



Discussion:

- Q: Jeremy – Were you able to perform a Before/After Study?
  - A: No, because the systems were constantly running.

Comparison with Existing Systems

Criteria	SCOOT	InSync	MaxAdapt
Timing optimization location	Central server	Cabinet processor	Controller module
Communication dependency	High	Low	Low
Controller compatibility	Siemens	Any	Intelight
Optimization objective	Min stops/delay	Min stops/delay	ATSPM based
Detection	Loops only	Proprietary	Any ATSPM detection
TSP/CV Interface	Questionable	Complex	Integrated
Pedestrian/Preemption transitions	Slow	Quick	Quick
Split/Cycle/Offset optimization	Yes	Partial	Yes
Phasing Sequence	Fixed	Flexible	Flexible
User friendliness	Complex	Moderate	Simple
Additional Maintenance	Comm + Detection	Comm + Detection + Processor	Comm + Detection
ATSPM Data	Need ATC controller	Need radar detection	Integrated

IV. PARTNER UPDATE – SEMINOLE COUNTY

Charles Wetzel briefly discussed Seminole County's efforts relating to vehicle detection, and where they see the direction of this technology in the future.

- Seminole County is in the middle of a large DMS upgrade
  - FDOT is completing 21 locations
  - County will wrap up the remaining locations
- Seminole County is also looking at a large RSU project, including Emergency Vehicle Preemption
- Detection
  - 387 of 400+ intersections are on loops (preferred detection method)
    - most video-only locations are where loops can't be implemented (e.g., bridges)
  - only issues identified with loops is construction zones where lanes are being shifted
    - usually don't see any issues when ATMS reports are collected
    - loops are cheap and dependable
- 104 ASCT locations

Discussion:

- Q: Steven Bostel – Have you seen a lot of communications from OBUs with the RSUs?
  - A: Charles – haven't seen much yet
- Q: Tushar Patel – The RSUs in Lake Mary were DSRC; are you changing to CV2X?
  - A: Charles – Yes.
- Q: Cade Braud – How do you handle loop replacements?
  - A: Charles – The County has three contractors to replace loops

        - The County is also very aggressive with resurfacing, which limits pavement problems. The standard RRR cycle is 7-8 years.
- Q: Are bike lane detection systems in place?
    - A: Not currently.

V. PARTNER UPDATE – BREVARD COUNTY

Rich Ataman provided a brief introduction on Brevard County's TSM&O Program, particularly in its workforce training efforts. A full-length presentation is anticipated for the next TSM&O Consortium.

- PedSafe Deployment
    - 43 intersections using GridSmart cameras
    - in the final round of repairs
- SR 3 ITS Upgrade
    - encompasses 16 intersections
    - GridSmart and loops installed at all intersections
- Brevard County Traffic Operations Day-to-Day Business
    - County is 72 miles long
    - 351 traffic signals; 130 school flashers; 100+ RRFBs
        - 220 signals on ATMS.now
    - 70+ miles of fiber
    - Use video/loops for detection
- I-WORK – real-time work management system for maintenance
    - managed by Rich and lead technician
    - looking to add all assets to system
    - will be a map-based system
- Training
    - developed an approach for signal technicians
    - all technicians conduct basic maintenance
    - advanced technicians conduct detection-related maintenance

VI. PARTNER UPDATE – SPACE COAST TPO

Steven Bostel presented on Space Coast TPO's update to the ITS Master Plan.

- Original ITS Master Plan completed in 2015
- found that the priority scoring from the 2015 ITS Master Plan did not really matter
    - focused more on "Tiering"
- O&M funding tied to each project is a major priority
- Evaluation Criteria for Projects
    - Safety – much closer look at safety in the 2021 ITS Master Plan
    - Congestion Management
    - Economic Significance
    - System Reliability
    - System Performance

  - Resiliency
- Focused on vulnerable roadway users
- Developed different "kits" or bundles of strategies for Intersection Safety Deployment
  - Kit A – Vehicle, Unsignalized intersection
    - Vehicle detection for side street with actuated flashing beacon on mainline
    - high-visibility LED highlighted signs
    - CV technology
    - Perform Intersection Control Evaluation (ICE) analysis
    - Signalize intersection (if warranted)
  - Kit B – Vehicle, Signalized Intersection
    - Signal retiming/phase modification
    - ASCT
    - Advanced (Dilemma) Zone Detection
    - CV Technology (SPaT, Red-Light Violation Warning)
    - Flashing beacon located upstream of intersection
    - Red light enforcement
  - Kit C – Bicycle
    - Signal retiming/phase modification
    - Blankout signs (YIELD TO BICYCLE)
    - Bicycle detection
    - Advanced Motorist Warning System
    - CV technology
    - Adaptive lighting
    - High-emphasis bicycle pavement markings
    - Continuous bicycle routes

  - Kit D – Pedestrian
    - Signal retiming/phase modification
    - Pass Pedestrian Detection
    - Blankout signs (YIELD TO PED)
    - Lighted crosswalks
    - Adaptive lighting
    - Accessible Pedestrian Detection System
    - CV technology (Pedestrian in X-Walk)
    - Traffic Calming
- Exploring additional Event Management tools
- Examining Parking Management as well
- One recommendation is establishing a Brevard-centric consortium for coordination efforts
  - Steven will lead the establishment of this local consortium
- Expected to be adopted in Summer 2021
- Steven played a short video that described the current, upcoming, and future ITS technologies within Brevard County
  - Intelligent Transportation Systems: At A Glance - YouTube

VII. LOCAL AGENCY PARTNER UPDATE – LYNX

Doug Jamison presented on LYNX's *AV Services Project*.

- Intent of the study was to develop a ConOps and a draft scope for deployment of AVs at LYNX
  - Provide details on the anticipated scope and vision for longer term incorporation of AVs at LYNX
  - Better understand how AVs would be required to operate to meet the needs of LYNX and its customers
  - Help LYNX and partners understand physical and data infrastructure currently available, and any anticipated gaps
- Project Structure

- User Survey Results
  - Opportunities
    - More flexible transit
    - Better mobility
    - Lower environmental impact
    - More efficient transit

        - Less congestion
    - Barriers
        - Driver assistance getting in and out of vehicle
        - Security
        - Wayfinding
        - Driver assistance getting secure on the vehicle
        - Untested technology
    - 90% of respondents thought LYMMO would be the best fit for AV service
    - 60% of respondents thought ACCESS LYNX would not be a good fit for AV service
- Operating Options
    - Small AV Shuttle
        - Technology available
        - Operational issues
            - charging
            - maintenance
            - speed differential with other vehicles
            - limited capacity
    - Retrofitted Existing Vehicle
        - Technology a few years away
        - Fewer operational issues
        - Lower lifecycle costs

- Comparison of AV Pilot Costs

AV Pilot Option	Current LYMMO Orange Line Annual Operating Costs	One-Year AV Pilot Operating Cost	Total LYMMO Orange Line Operating Cost for One-Year Pilot Period	% Increase
1. Interspersing 3 shuttles	$1,666,327	$ 1,291,408	$ 2,957,735	78%
2. Adding 1 shuttle		$ 543,942	$ 2,210,269	33%
Adding 3 shuttles		$ 1,631,827	$ 3,298,154	98%
3. Retrofitting 1 bus		$ 756,900	$ 2,423,227	45%

- Next Steps
    - Future AV direction at LYNX will need to involve funding partnerships
    - Development and release of a pilot RFP will be subject to:
        - identification and availability of dedicated funding
        - AV technology advancements
    - AV Pilot Deployment (TBD)

VIII. HIGHWAY RAIL NOTIFICATION & ARTERIAL APPROACH CLEARANCE

The Project Team, including Carlo Adair (HNTB), Scott Zornek (HNTB), and Melissa Gross (InNovo Partners), discussed the Highway Rail Notification & Arterial Approach Clearance project within the District.

- Project Update
  - currently in Phase III
    - Stakeholder Coordination
    - Develop Implementation Plan
    - Develop Systems Engineering Documentation
- Regional Priority Crossings

	MPO / TPO	Group 1	Group 2	Group 3	Total Study
LS	Lake – Sumter MPO	0	1	0	1
OM	Ocala Marion MPO	0	0	3	3
SC	Space Coast TPO	4	0	0	4
RS	River to Sea TPO	3	5	1	9
MP	MetroPlan Orlando	21	3	6	30

- Group 1 Findings
  - Short-term – signing and pavement marking enhancements
  - Mid-term – interconnected preemption
  - Long-term – AI and Machine Learning
- Anticipated application of short-, mid-, and long-term across all 900+ crossings
  - Short-term solutions = 93% of all crossings
  - Mid-term solutions = 12% of all crossings
  - Long-term solutions = 100% of all crossings
- Total implementation
  - Estimated Cost = $22.4 million
  - Estimated Benefit = $29.0 million

Mitigation Option	Frequency
Integrated Alert System	28
Enhanced Emergency Notification System at Grade Crossings	28
AI & Machine Learning	28
Pedestrian Pavement Markings	19
Continuous white striping across the grade crossing.	11
Traditional Do Not Stop On Tracks Signage.	11
LED Do Not Stop On Tracks signage.	10
Use of RPMs in conjunction with white striping.	9
Use of Delineators in conjunction with white striping.	8
Dynamic Envelope	8
Remove or replace confusing directional pavement markings or signage near the crossing.	6
Work with locals to have sidewalk constructed along the roadway on either side of the crossing and construct pedestrian crossing and install ped gates.	6
Continuous yellow center striping across the grade crossing.	5
Refresh pavement markings including stop bar, lane striping, and painted crossbuck.	5
Install a presignal upstream of the crossing that works in conjunction with the downstream intersection signal.	5
Install a presignal upstream of the crossing that works in conjunction with queue cutter sensor downstream of the crossing.	5
Construct pedestrian crossing and install ped gates.	4
Use of RPMs in conjunction with yellow striping.	3
Use of Delineators in conjunction with yellow striping.	3
Install and Interconnect Preemption with nearby traffic signal.	3
Install Ped gates.	3
Install directional signage or barrier to lead pedestrians to nearby intersection or crosswalk.	3
Improved lighting (LED) and more fixtures at intersection.	2
Redesign downstream intersection to allow continuous flow of vehicles.	2
Adaptive Traffic Signal Interface	2
Right in Right out configuration.	2
Install delineators in the center of the roadway to prevent left turns.	2
Signage prohibiting specific turn movements.	2
Straight only pavement markings.	2
Move stop bar closer to the crossing .	2
Install advanced pedestrian crosswalk signage with push button LED flashers.	2
Improved lighting (LED) and more fixtures at intersection.	2
LED Escape Lane signage or blank-out	1
Dynamic Sensor for exit gates.	1
Close or reconfigure driveway or side street.	1
Resurface.	1
Install pedestrian crosswalk outside of the crossing gates across the roadway.	1
Install "Stop Here" signage.	1
Move obstruction or redesign pedestrian facilities.	1
Bevel the difference in elevation or reconstruct.	1
Escape Lanes	0
Intelligent Grade Crossing System	0
Add low (not in sight line for intersection) fencing or guardrail between sidewalks and roadway lanes to channelize pedestrians and keep them from jaywalking.	0

IX. NEXT MEETING

- August 5, 2021

X. ATTACHMENTS

- A – Presentation Slides
- B – Meeting agenda

END OF SUMMARY

This summary was prepared by David Williams and is provided as a summary (not verbatim) for use by the Consortium Members. The comments do not reflect FDOT's concurrence. Please review and send comments via e-mail to dwilliams@vhb.com so the meeting summary can be finalized.

Welcome to the TSM&O Consortium Meeting

May 27, 2021

Transportation Systems Management & Operations

FDOT TSM&O
Transportation Systems Management & Operations

Central Florida TSM&O Consortium

Meeting Agenda

1. Welcome
2. Freight Studies for Improved Mobility and Safety
3. Local Agency Updates
    - Orange County
    - Seminole County
    - Brevard County
    - Space Coast TPO
    - LYNX
4. TSM&O Workforce Guidebook (NCHRP 20-07)
5. Highway Rail Notification & Arterial Approach Clearance Project
6. Current Initiatives

Freight Studies for Improved Mobility & Safety

TSM&O Consortium Meeting
May 2021

Partners

FDOT TSM&O

Consortium
(MPOs, Cities, Counties, Transit)

FDOT DISTRICT 5
(TSM&O, Freight)
PM: Noemi Rodriguez

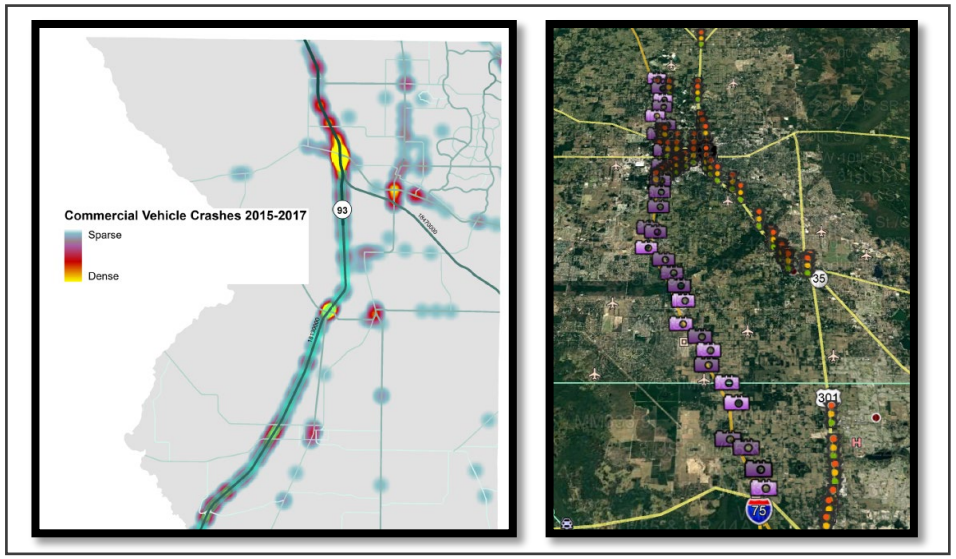
Consultant Team
RK&K, Gannett Fleming

Goals & Objectives

- Improve Safety & Efficiency of freight movement through identification of TSM&O strategies & technology

Project Status

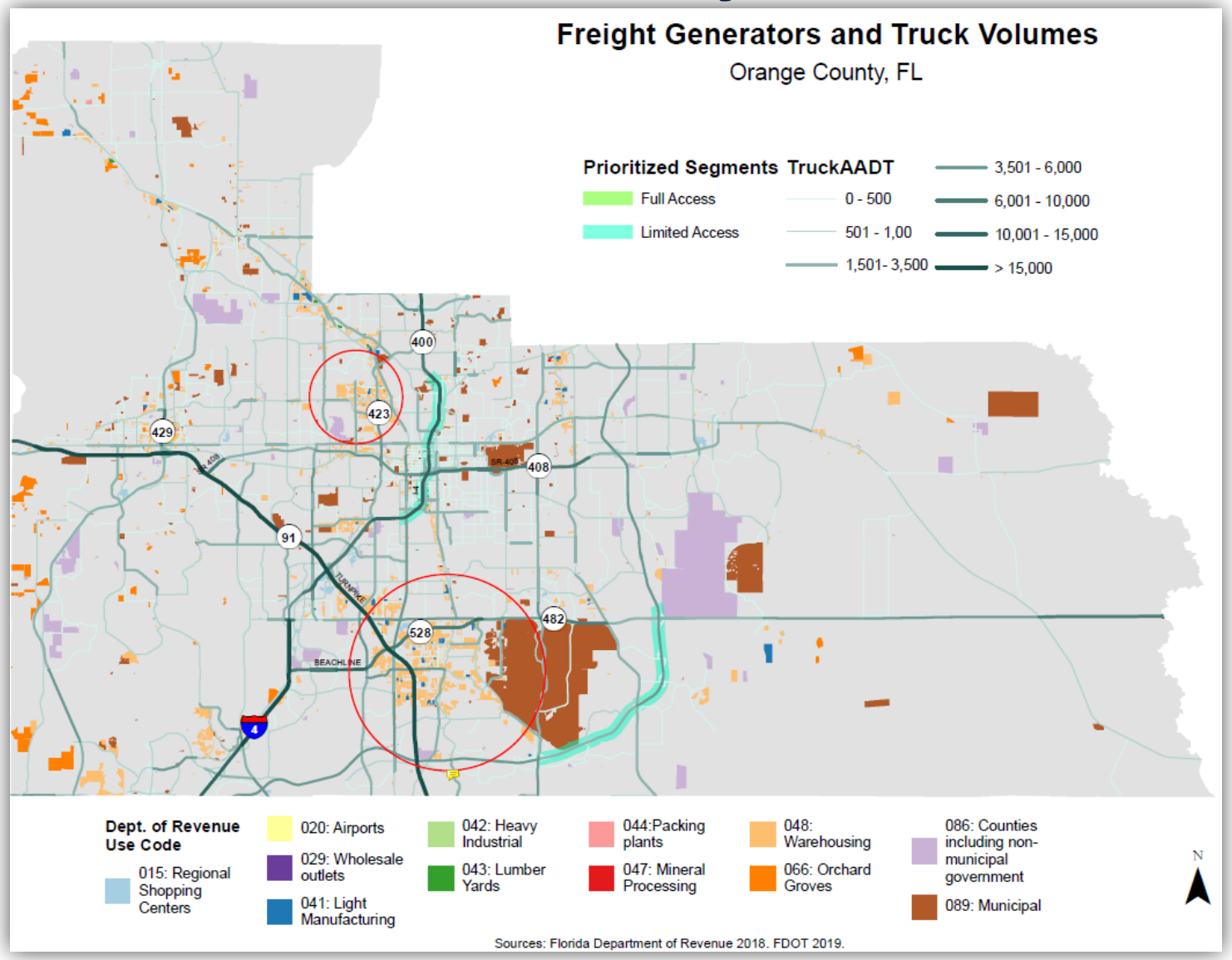
1) Stakeholder Involvement Plan
2) Literature Review
3) Data Collection
4) FLFAC Meeting
5) Identify Needs & Opportunities
6) Analysis of Concepts
7) B/C Analysis
8) Final Recommendations
9) Concept Plans



Presentation Objectives:

- ❑ Share methodology for identifying needs & opportunities
- ❑ Obtain input to confirm areas of needs
- ❑ Share preliminary strategies developed and deployment locations
- ❑ Obtain input on concerns, enhancements and agency roles

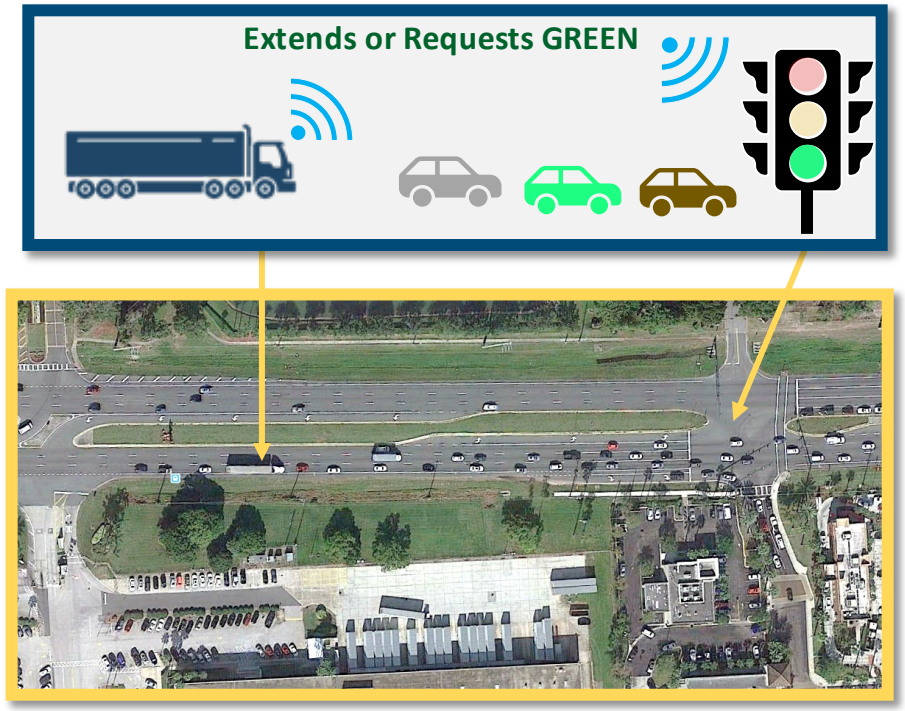
Identified Locations with Freight Movement & Safety Issues



Methodology

- Literature review of nationwide freight TSM&O efforts
- Major SIS corridors within D5
- Roadways segments with highest truck percent and/or volumes, serving freight-oriented land use areas in D5
- Roadway segments with the highest truck related crash rates on roadways identified above
- District specific needs and initiatives

Freight Signal Priority (FSP)



Vehicle Detection Evaluation

Evaluation Criteria	Dispatch Software	C2C connection	OBU/RSU	RFID	Radar/Video detection w/ Classifier	In Roadway (traffic loops)
Stakeholder coordination effort	High	High	High	Moderate	Low	Low
Detection coverage (as % of trucks)	Limited/Enrolled Fleets Only	Limited/Enrolled Fleets Only	Limited/Enrolled Fleets Only	Moderate-High	High	High
Detection accuracy (%)	up to 100%	---	---	100% (stores truck type data)	>90%	90%
Detection speed range (xx mph to xx mph) for classification	Allows detection at any speed	Allows detection at any speed	Allows detection at any speed	0 to 125 mph (could be higher)	18 to 112 mph	>25MPH
Differentiate truck vehicle class or axel	Yes	Limited/Enrolled Fleets Only	Limited/Enrolled Fleets Only	Yes	Yes	Yes
Communication Latency	<100 miliseconds (4G LTE Cellular)	Instantaneous*	<15 milliseconds (DSRC)	Instantaneous*	Instantaneous*	Instantaneous*
Truck operator installation cost	Low	Low	Moderate	Low	None	None
FDOT installation cost	Low (software)	Moderate	Moderate	Moderate-High	Moderate	Moderate
Software development cost	Included with installation Cost	---	Included with installation Cost	Included with installation Cost	Included with installation Cost	N/A

FSP Corridor Selection

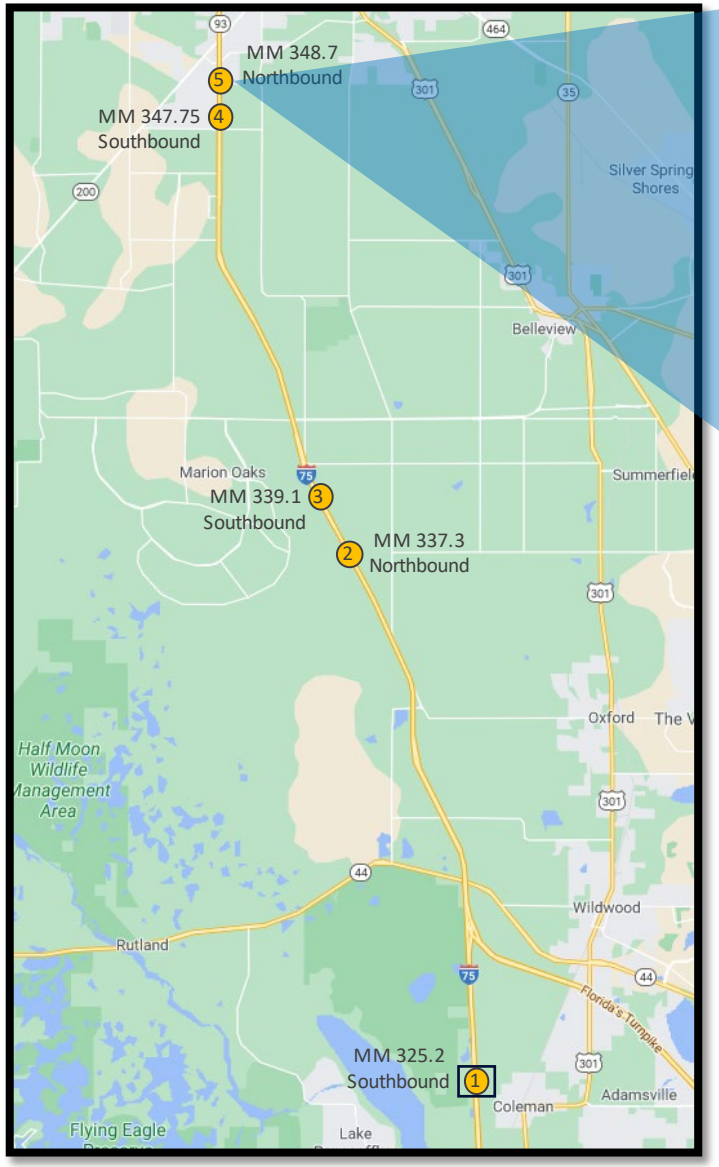
- ☑ Truck volume & percentage: 5000+ Truck AADT
- ☑ Corridor length: 2+ miles
- ☑ Signalized intersections: 6+
- ☑ Connection to limited access facility
- ☑ Presence of truck traffic generating businesses on/in vicinity of corridor
- ☑ Existing signal/ITS assets – ATC controller, Bluetooth, CCTV, arterial DMS

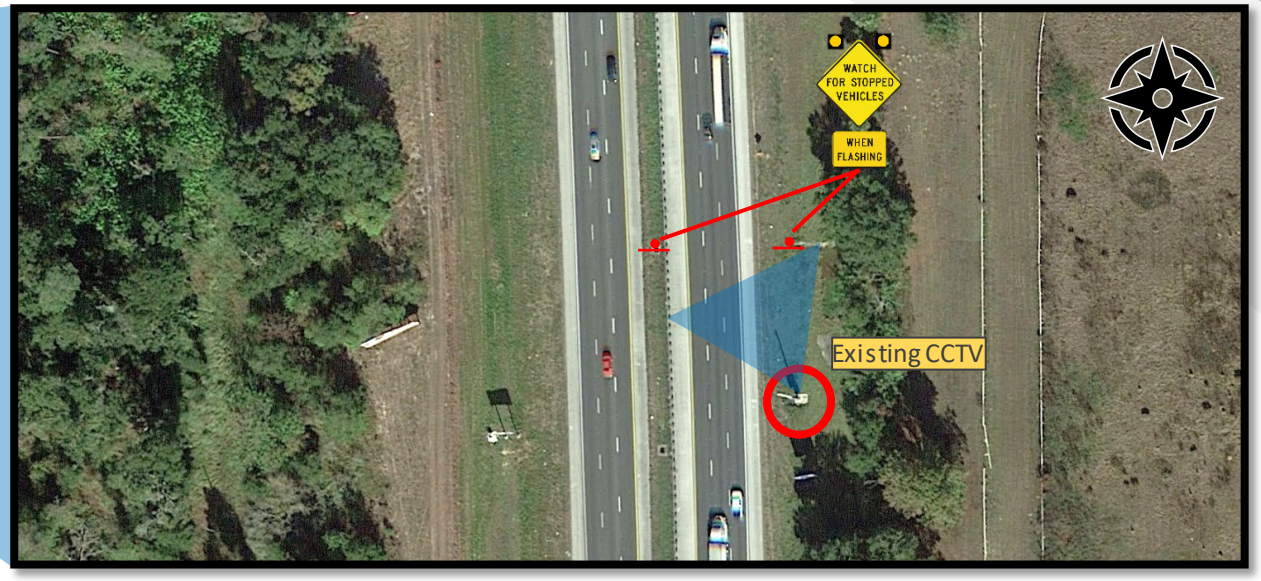
ORANGE COUNTY
SR-423/N John Young Pkwy
Mercy Drive
Silver Star Road/SR-416
Sand Lake Road/SR-482
E Landstreet Rd
Orange Avenue
Boggy Creek Road
Tradeport Drive
Taft Vineland Road
S Orange Blossom/US-442

Conditional Priority

Condition	Concept	Pros	Cons
Time-of-day (TOD) restrictions ✓	FSP operation is restricted to off-peak and nighttime hours	• Does not affect coordinated timings during peak periods • Trucks prioritized during times of excess capacity	• May not account for non-traditional side-street peaks
GREEN extension only & no side-street phase truncation ✓	Extends GREEN phase for trucks in dilemma zone, adjust signal timings to "gap out" minor side street GREEN phases quicker	• Easy to implement • Minimizes side-street delays and queueing	• Does not shorten delays for trucks in queue on SLR
Minimum truck volume requirement	FSP operation active during times of highest truck volumes	• Efficient use of cycle length • Limits FSP calls to times when truck volumes are highest	• Variation in truck demand from historical patterns • Inconsistent FSP activation
No side-street phase truncation at major streets (e.g. SR-408 ramps, Colonial, Princeton)	GREEN extension at all intersections, phase truncation active at minor intersections only	• Minimizes side-street delays and queueing • Major cross-street operation and coordination are preserved	• Inconsistent FSP activation
No side-street RED truncation when side-street queues, saturation or demand high	Real-time traffic responsive side-street phase truncation operation	• Maximizes efficiency of system • Minimizes side-street delays and queueing	• May require new equipment installation programming and TMC management
Limits on FSP activations per hour and/or minimum time between activations ✓	Priority requests are subject to a variable per hour limit based on TOD and/or a minimum time between activations	• Minimizes affect on coordinated timings during daytime hours	• Will require retiming and compatibility with existing controllers

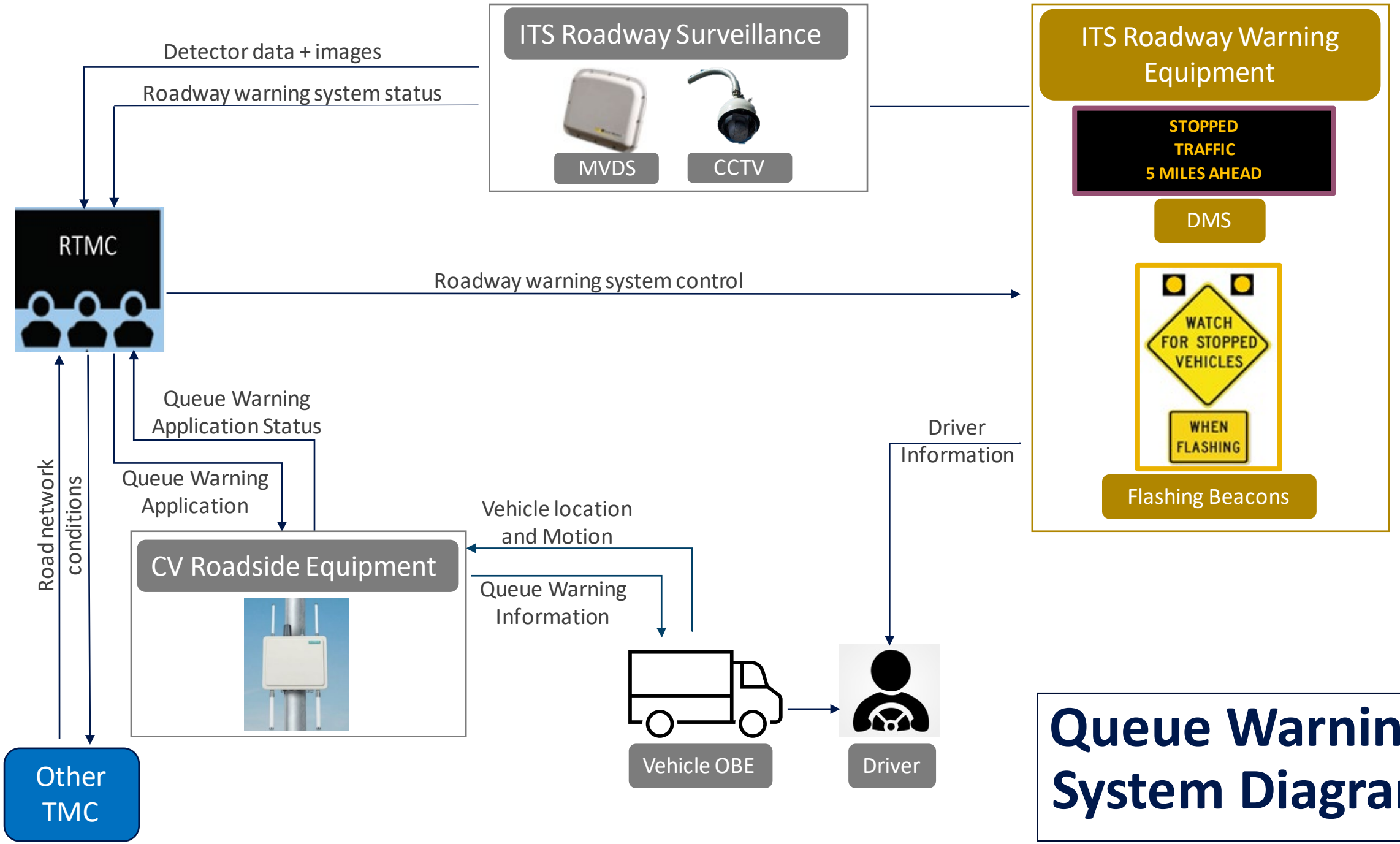
Queue Warning – I-75 Sumter/Marion



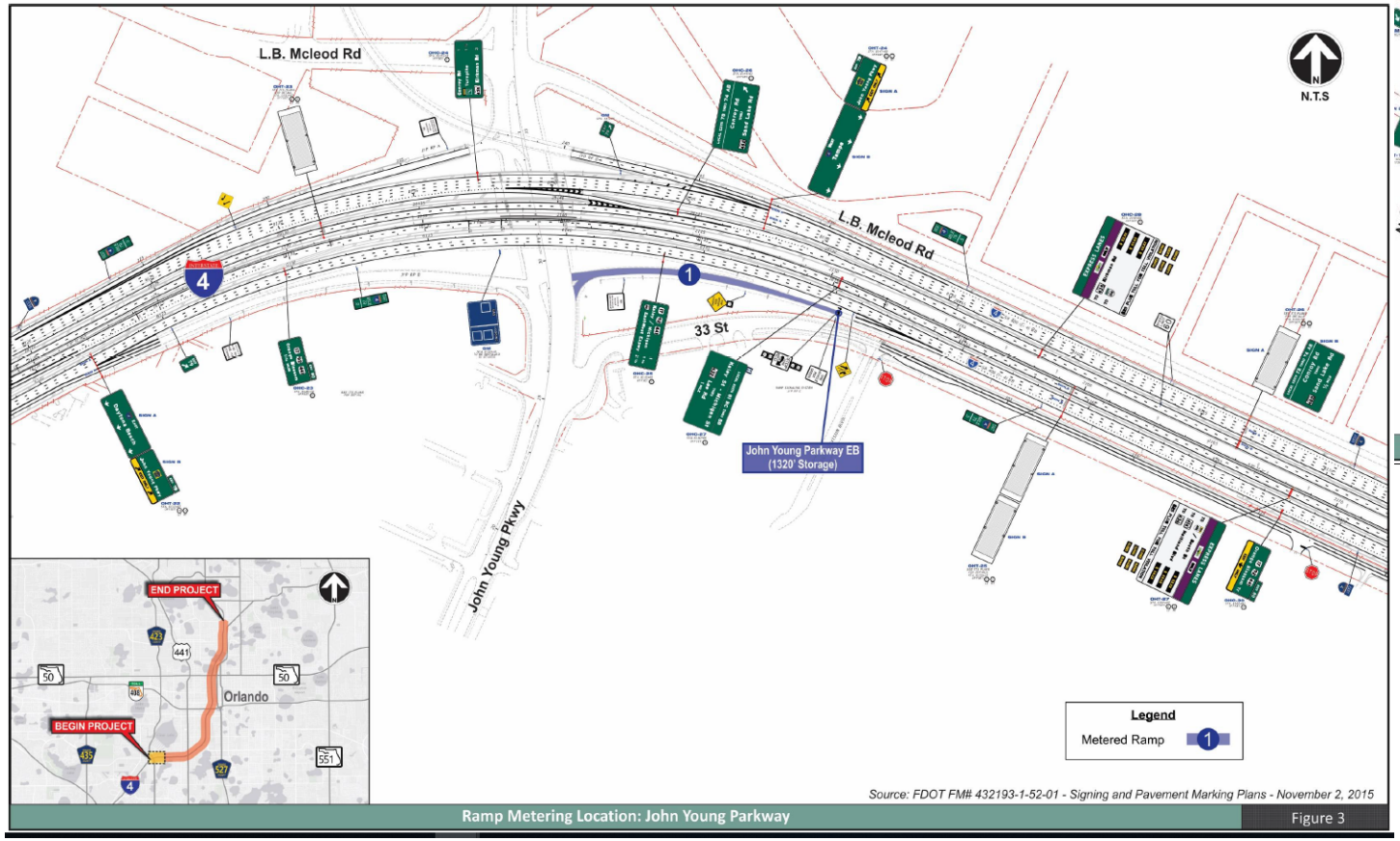


Sign & ITS Device	Direction, Side	Location	Connectivity Needs
 NEW Static Signs w/ Embedded LED Beacons	I-75 NB, LT/RT	MM 337.3 MM 348.7	• Fiber from nearest ITS vault/CCTV location • Power from nearest ITS vault/CCTV location
	I-75 SB, LT/RT	MM 325.2 MM 339.1 MM 347.75	

Queue Warning: System Diagram

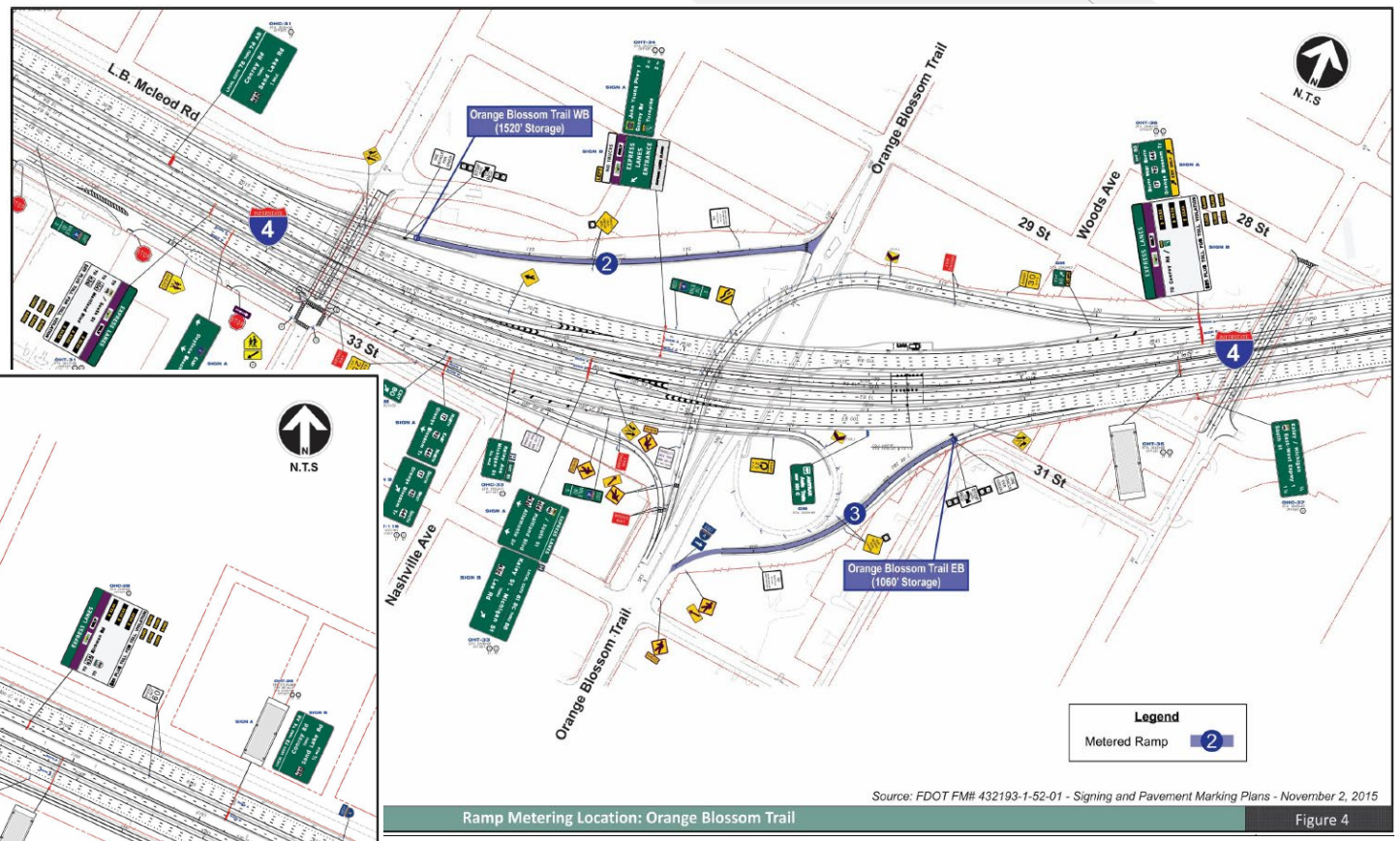


Ramp Meter Bypass @JPY & @OBT



Source: FDOT FM# 432193-1-52-01 - Signing and Pavement Marking Plans - November 2, 2015

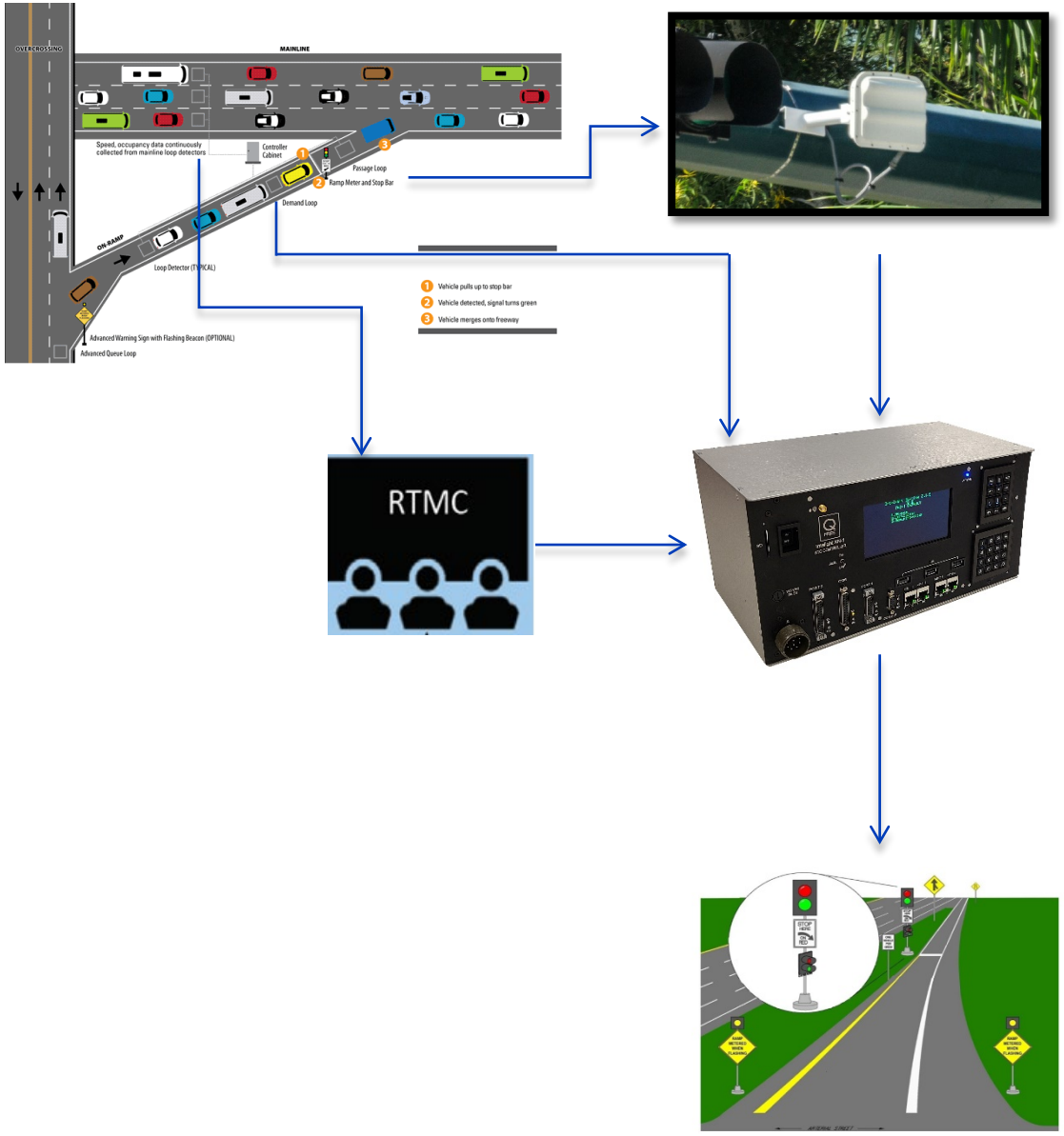
Ramp Metering Location: John Young Parkway — Figure 3



Source: FDOT FM# 432193-1-52-01 - Signing and Pavement Marking Plans - November 2, 2015

Ramp Metering Location: Orange Blossom Trail — Figure 4

Truck Preemption System Components



Radar/Microwave Detector

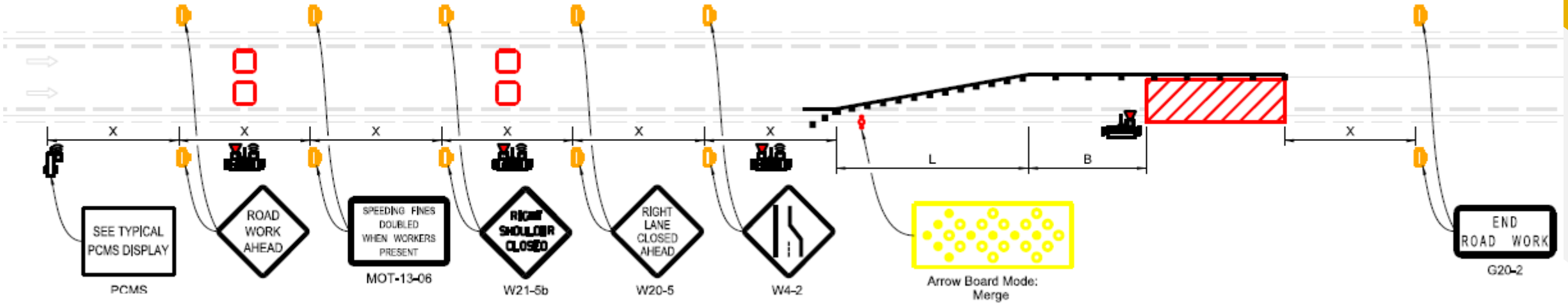
- ❑ Recognizes & tracks high-profile vehicles
- ❑ Extends GREEN to allow trucks & buses to clear STOPBAR
- ❑ Places call to controller when truck within 300’ of STOPBAR

ATC Controller

- ❑ Receives input from ramp loop detectors provides signal indication
- ❑ Receives input from radar detector to override ramp signal operation
- ❑ Receives input from mainline loops or system
  - ❑ Ramp metering rates
  - ❑ Ramp metering control or limits

Smart Work Zone Applications:

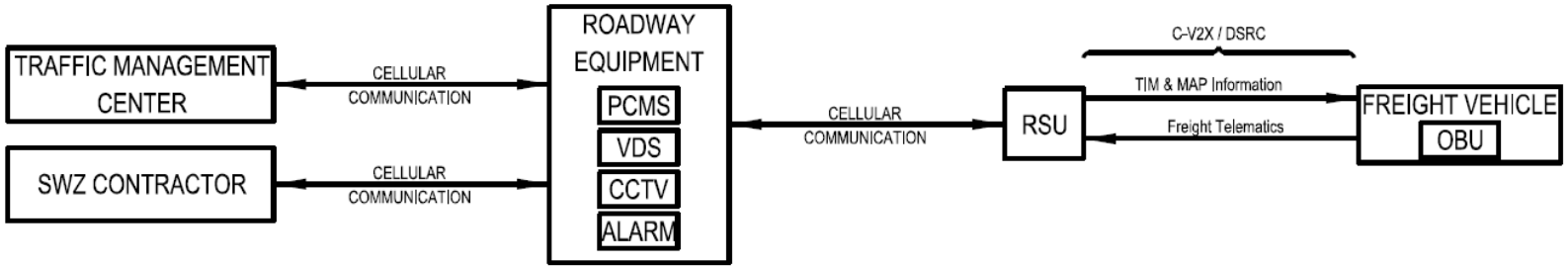
Work Zone Intrusion Alert



SYMBOLS:

- Work Area
- Channelizing Device (See Index 102-600)
- Work Zone Sign
- Lane Identification and Direction of Traffic
- Arrow Board
- Portable Changeable Message Sign (PCMS)
- Vehicle Detection System (VDS)
- CCTV Camera w/ Analytics
- Alarm System (Siren or Horn)
- VDS Detection Zone
- Connected Vehicle Roadside Unit (RSU)
- Temporary Mounting Pole
- SWZ Integrator Trailer

SYSTEM DIAGRAM:



TYPICAL PCMS DISPLAY:

With speed reduction:

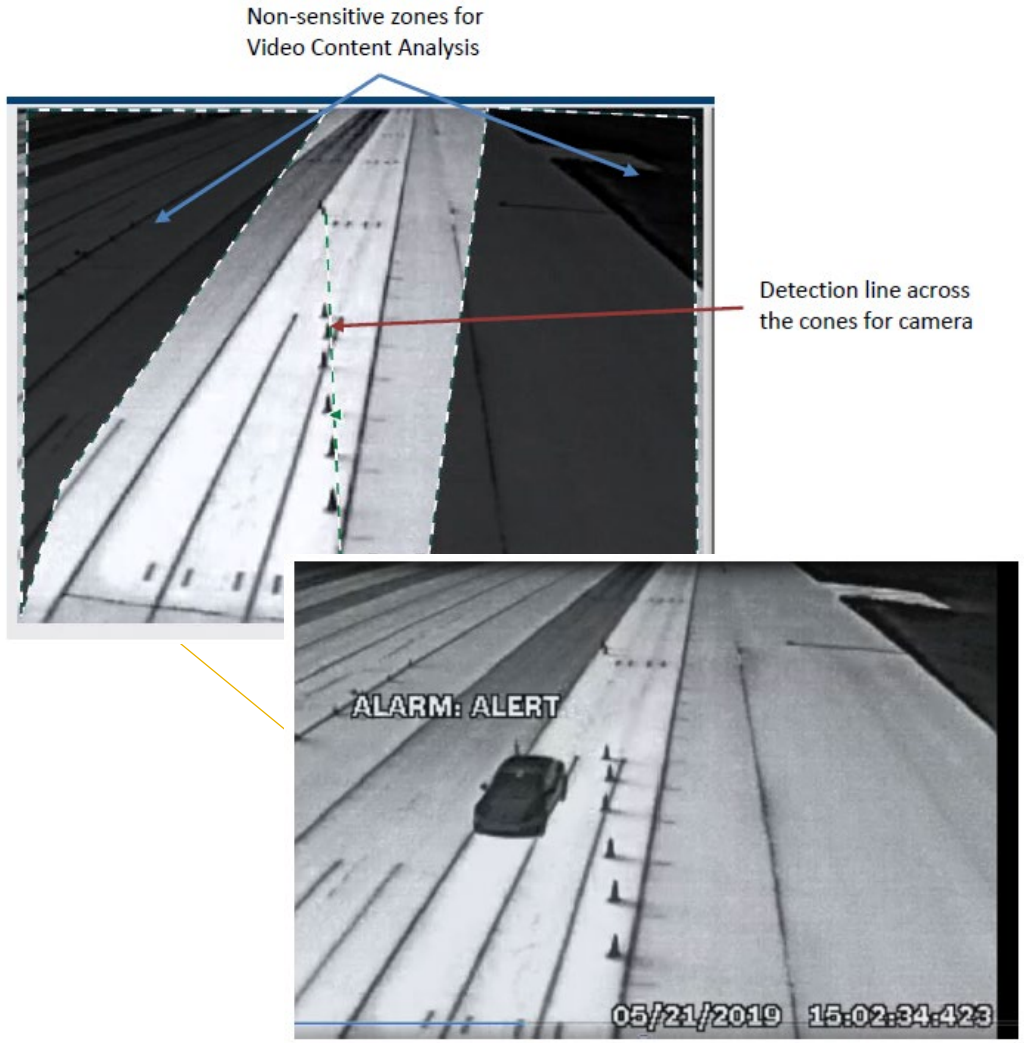
Message 1: WORKERS PRESENT AHEAD
Message 2: SPEED REDUCED NEXT XXMI

Without speed reduction:

Message 1: WORKERS PRESENT AHEAD
Message 2: NEXT XX MILES

Vehicle Intrusion:
Video Analytics

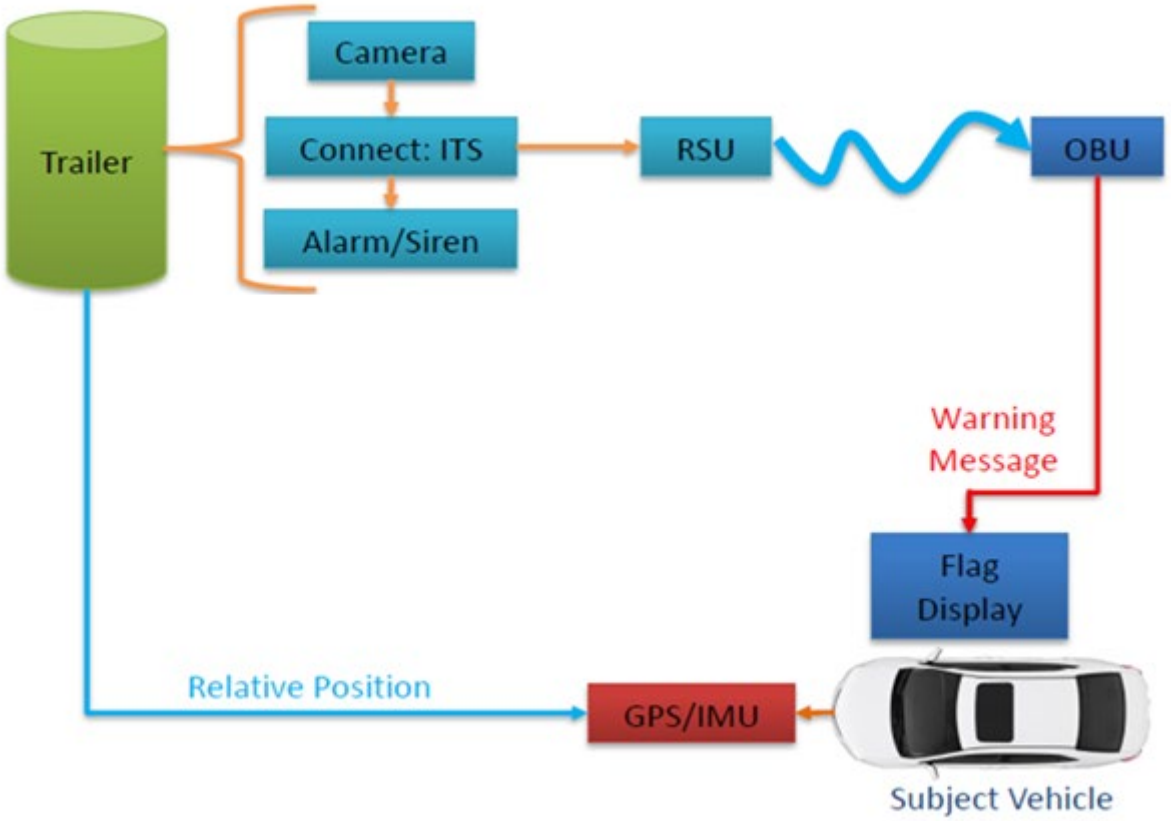
Camera with Analytics - Alarm Setup and Alert:



Average delays for each alert type:

Speed (mph)	DSRC	Camera	Audible
35	0.211 s	0.611 s	0.749 s
45	0.326 s	0.687 s	0.832 s
55	0.518 s	0.668 s	0.817 s
65	0.566 s	0.756 s	0.948 s
75	0.483 s	0.712 s	0.896 s
Average Delay Before Alert	0.421 s	0.687 s	0.848 s

Vehicle Intrusion:
System Components Diagram



Solar Integrator Trailer

Edge Computing Device

Questions?

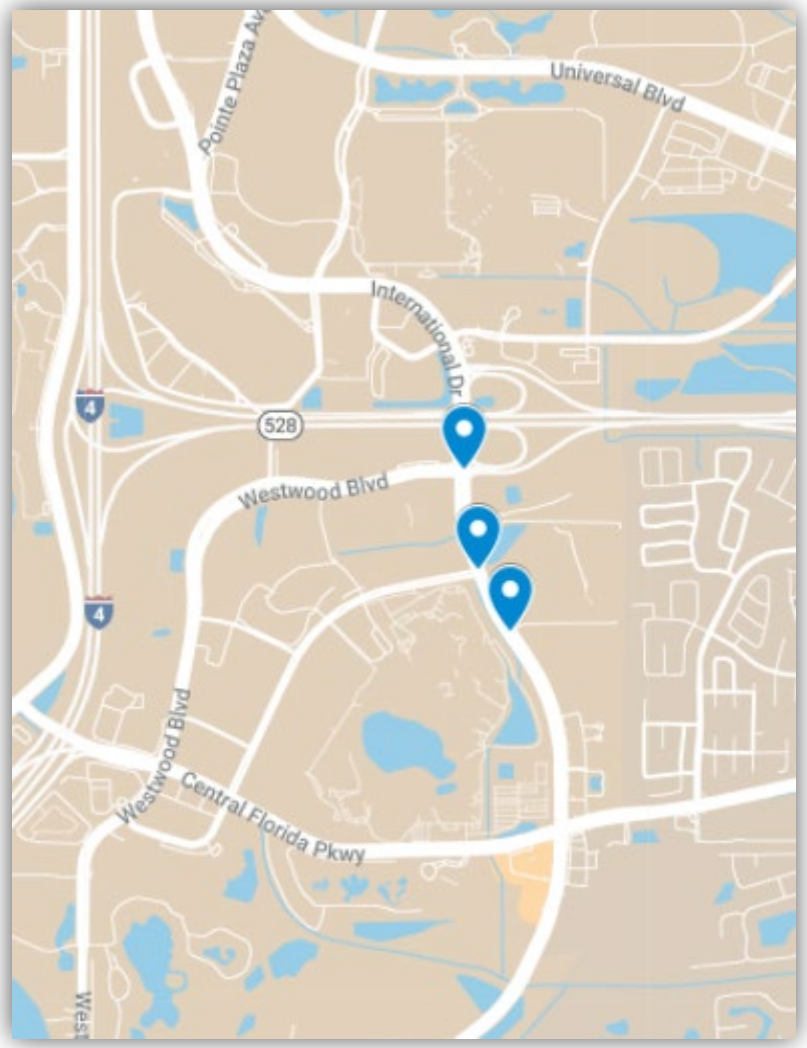
Email: athurain@rkk.com
FDOT: noemi.rodriguezbonilla@dot.state.fl.us

Orange County TSM&O Project Status

- Intelight Signal Controller Replacement
- ATMS Phase 4
- Hazard Mitigation Grant Program
- Traffic Signal Cabinet Upgrade
- Sand Lake Rd InSync Adaptive Signal Control
- International Dr MaxAdapt Adaptive Signal Control Pilot

Pilot Project Overview

- 3/5 mile in length
- Six lane section with 45 mph speed limit
- Three intersections including International Dr at:
  - Westwood Blvd/SR 528 EB Ramps
  - Sea Harbor Dr
  - Aquatica



Data Collected

Travel Time and Speed Study by Ultra Engineering:

- Data was collected with in-car GPS device
- Three runs in both north and south directions during time of days
- Weekend before study conducted Saturday, April 24; after study on Saturday May 8
- Weekday before study conducted Wednesday, April 28, after study on Wednesday, May 5
- Weekend runs were conducted mid-day / lunch time, afternoon 5pm, and evening 9pm
- Weekday runs were conducted mid-morning, mid-day lunch time, afternoon 5pm
- Selected dates without large convention center events.

Data Collected

Automated Traffic Signal Performance Measures:

- Data was collected automatically by the ATC traffic controller
    - Weekend before study conducted Saturday, April 24; after study on Saturday May 1
    - Weekday before study conducted Wednesday, April 28, after study on Wednesday, May 5
- Corridor was fitted with lane-by-lane presence detection and arterial lane-by-lane advanced detection
- Used Purdue Coordination Diagram
    - Arrival on Green (AoG)
    - Platoon Ratio (PR = AoG / % green of cycle)
- Approach Delay (arterial only), calculates:
    - Average Delay per Vehicle
    - Total Delay

Equipment

Traffic Controller: Intelight NEMA ATC Controller

- Communicating with Orange County Central System, Intelight MaxView
- Uses decentralized algorithm, corridor can operate on its own without a central system using peer to peer
- Requires activation of the MaxAdapt module in the local controller software, MaxTime
- Requires main line advanced detection
- Intersections use loop detection, supplemented by video detection

Results Summary

- Travel time decreased for nearly all study periods
    - 49.7% improvement in northbound travel time
    - 11.8% improvement in southbound travel time
- MaxAdapt was able to reduce total cycle throughout many time periods while still benefiting from increased AoG and Platoon Ratios
- This study did not include side street Approach Delay. Considering the cycle length was reduced, it is likely side street Approach Delay also decreased.
- The system was calibrated in November of 2020 before Sea World was at capacity and Aquatica was reopened. The system could likely see further improvements if recalibrated to cover current traffic characteristics and pedestrian actuations.

ATSPM Results

- Arrival on Green (AoG) and Platoon Ratio (PR) improvements are positive. More arrivals on green is good.
- Approach Delay (AD) and Total Delay (TD) improvements are negative. This is because less delay is good.
- These results are averages from the various times of day ATSPM data was collected.
- SB approach at SR 528 and NB approach at Aquatica are not included since those arrivals are random from other intersections not running MaxAdapt.

ATSPM Results								
	Weekday							
	NB				SB			
	AoG	PR	AD	TD	AoG	PR	AD	TD
SR528	31.39%	40.44%	-41.63%	-39.44%	N/A	N/A	N/A	N/A
Sea Harbor	21.00%	27.52%	-34.02%	-34.41%	0.31%	5.64%	-16.39%	-11.59%
Aquatica	N/A	N/A	N/A	N/A	34.61%	36.00%	-66.67%	78.24%
	Weekend							
	NB				SB			
	AoG	PR	AD	TD	AoG	PR	AD	TD
SR528	32.24%	37.38%	-17.42%	-18.15%	N/A	N/A	N/A	N/A
Sea Harbor	52.35%	35.52%	-27.19%	-27.27%	13.94%	0.11%	-17.22%	-13.69%
Aquatica	N/A	N/A	N/A	N/A	11.35%	0.28%	-39.88%	-41.20%

Recommendations

Based upon the favorable results of the study:

- Consider expanding the ASCT to include more International Drive intersections
- Continue to calibrate the existing intersections to account for return of normal traffic conditions
- Consider deployment along other corridors with unpredictable traffic conditions
- Upgrade existing signal detection systems to provide ATSPM and IMC data

Comparison with Existing Systems

Criteria	SCOOT	InSync	MaxAdapt
Timing optimization location	Central server	Cabinet processor	Controller module
Communication dependency	High	Low	Low
Controller compatibility	Siemens	Any	Intelight
Optimization objective	Min stops/delay	Min stops/delay	ATSPM based
Detection	Loops only	Proprietary	Any ATSPM detection
TSP/CV Interface	Questionable	Complex	Integrated
Pedestrian/Preemption transitions	Slow	Quick	Quick
Split/Cycle/Offset optimization	Yes	Partial	Yes
Phasing Sequence	Fixed	Flexible	Flexible
User friendliness	Complex	Moderate	Simple
Additional Maintenance	Comm + Detection	Comm + Detection + Processor	Comm + Detection
ATSPM Data	Need ATC controller	Need radar detection	Integrated

Seminole County Update

Charles Wetzel, Seminole County Traffic Engineering

Brevard County Update

Richard Ataman, Brevard County Traffic Operations

May 27, 2021

TSMO Consortium

Purpose

- Original Plan Complete in 2015
- New tech
- New projects
- Priority actions
- Next steps

Evaluation Criteria

Safety
(LRTP Goal 1)

Congestion Management
(LRTP Goal 1,4)

Economic Significance
(LRTP Goal 2,3)

System Reliability
(LRTP Goal 3)

System Performance
(LRTP Goal 3)

Resiliency
(LRTP Goal 2)

Evaluation example

Space Coast TPO ITS Master Plan Proposed Project List

							HIN 2+ Networks=Green (3) HIN 1 Network=Yellow (2) HIN 0 Networks=Red (1)	V/C > .85 = Green (3) V/C > .75 = Yellow (2) V/C < .75 = Red (1)	Direct Connect = Green (3) Indirect = Yellow (2) No connection = Red (1)	Improved Time = Green (3) Improved Consistency = Yellow (2) Neither = Red (1)	+Monitoring = Green (3) Some monitoring = Yellow (2) None = Red (1)	Redundancy = Green (3) On Evac Route = Yellow (2) Neither = Red (1)	
							SAFETY LRTP Goal 1	CONGESTION MANAGEMENT LRTP Goal 1, 4	ECONOMIC SIGNIFICANCE LRTP Goal 2, 3	SYSTEM RELIABILITY LRTP Goal 3	SYSTEM PERFORMANCE LRTP Goal 3	RESILIENCY LRTP Goal 4	Project Cost
Project Number	Project Type	Jurisdiction	Maintaining Agency	Corridor	Start	End	Level project may impact corridor identifed in VZ HIN	Targets high congested corridors	Provides improved access to high tourism/high employment zones	Improves travel time reliability	Improves ability to monitor performance of system	Promotes redundancy/sustainability of infrastrucute to withstand shocks/stressors	High, Med, Low
101	ATMS	Cape Canaveral Cocoa Beach FDOT	County/Cocoa Beach	SR A1A	Minutemen Causeway	SR 401							
102	ATMS	Cocoa Beach County FDOT	County/Cocoa Beach	SR 520	Milford Point	SR A1A							
103	ATMS	Cocoa/County	County/Cocoa	SR 501 (Clearlake Rd)	SR 520 (King St)	Industry Rd							
104	ATMS	Titusville	Titusville	SR 50	South Street	US 1 (Washington Ave)							
105	ATMS	Titusville / County	Titusville/County	US 1	Camp Rd	SR 406 (Garden St)							

Prioritization Criteria

Timing	Cost	Operations and Maintenance
0-5	<$4.0M = low	0-40 units, handled by existing staff
5-10	$4.0M to $7.0M = medium	41-160 units, may necessitate hiring of staff (1-2 technicians)
10+	>$7M = high	161+ (2-3 technicians)

Tiering

"ATMS" to establish redundant, robust network (US 1, SR A1A, intercoastal bridges) – 0 to 5 years

"ATMS" Tier A

- Project No. 101
- Project No. 102
- Project No. 105
- Project No. 106
- Project No. 107
- Project No. 109
- Project No. 113
- Project No. 114
- Project No. 115
- Project No. 191 ("ATMS Evac B")

"ATMS" on connecting arterial roadways, expand network – 5 to 10 years

"ATMS" Tier B

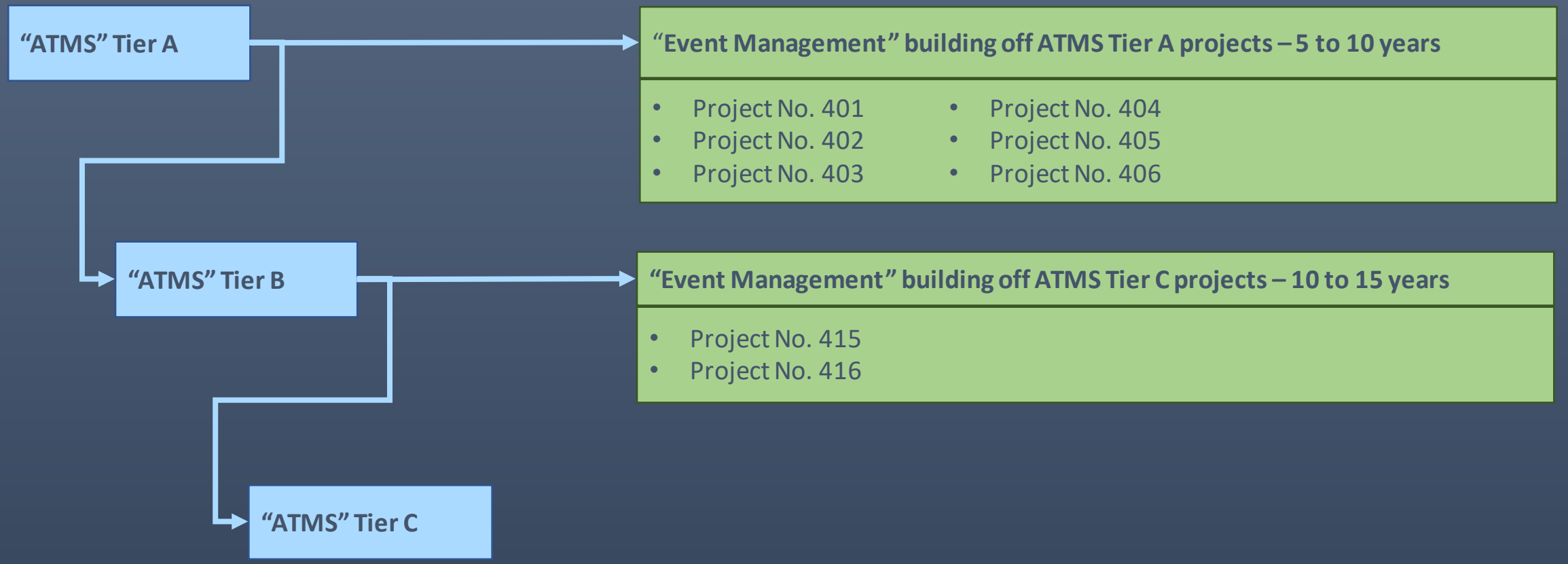
- Project No. 103
- Project No. 104
- Project No. 108
- Project No. 110
- Project No. 112
- Project No. 116
- Project No. 117
- Project No. 118
- Project No. 119
- Project No. 120
- Project No. 121
- Project No. 122
- Project No. 191 ("ATMS" Evac A)
- Project No. 193 ("ATMS" Evac C)
- Project No. 194 ("ATMS" Evac D)
- Project No. 195 ("ATMS Evac E)

"ATMS" build out of southern Brevard Co., future scaling – 10 to 15 years

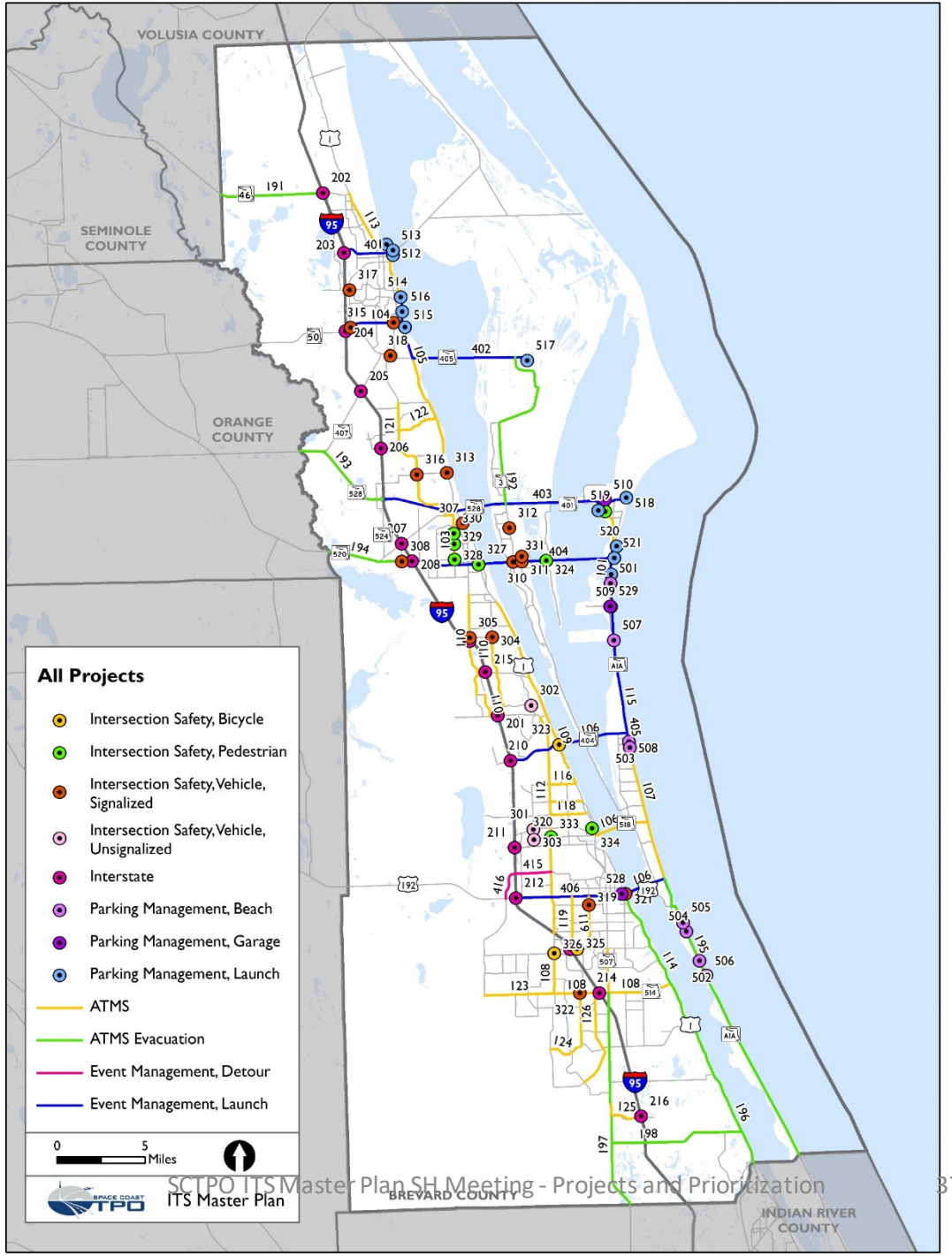
"ATMS" Tier C

- Project No. 123
- Project No. 124
- Project No. 125
- Project No. 126
- Project No, 196 ("ATMS" Evac F)
- Project No. 197 ("ATMS" Evac G)
- Project No. 198 ("ATMS" Evac H)

Tiering


"ATMS" Tier A
"ATMS" Tier B
"ATMS" Tier C
"Event Management" building off ATMS Tier A projects – 5 to 10 years
Project No. 401
Project No. 402
Project No. 403
Project No. 404
Project No. 405
Project No. 406
"Event Management" building off ATMS Tier C projects – 10 to 15 years
Project No. 415
Project No. 416

Projects


VOLUSIA COUNTY
SEMINOLE COUNTY
ORANGE COUNTY
BREVARD COUNTY
INDIAN RIVER COUNTY
All Projects
Intersection Safety, Bicycle
Intersection Safety, Pedestrian
Intersection Safety, Vehicle, Signalized
Intersection Safety, Vehicle, Unsignalized
Interstate
Parking Management, Beach
Parking Management, Garage
Parking Management, Launch
ATMS
ATMS Evacuation
Event Management, Detour
Event Management, Launch
0
5
Miles
ITS Master Plan

INTERSECTION SAFETY

- “INTERSECTION SAFETY” projects can deploy various technologies at specific locations to mitigate high vehicle, pedestrian, and bicycle crash rates. For example, unsignalized and signalized intersections as well as railroad and trail crossings
- Deployed technologies include, but are not limited to…
  - Blankout Signs (e.g., “Yield to Pedestrians”)
  - Passive Pedestrian Detection (PPD)
  - Bicycle Detection
  - Connected Vehicle (CV) Applications
  - Pedestrian Warning Systems (e.g., in-road lighting, RRFB, HAWK)
  - Network Communications (e.g., fiber optics, wireless)
  - Controller Installations / Modifications
  - Smart / Adaptive Lighting
  - Adaptive Signal Control Technology
  - Advanced Motorist Warning Systems

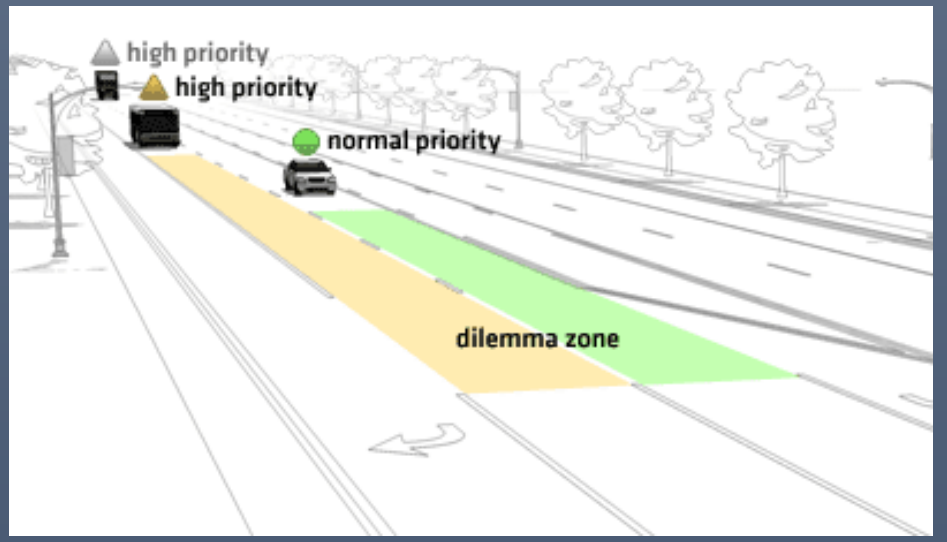
Kit "A" – Vehicle, Unsignalized Intersection

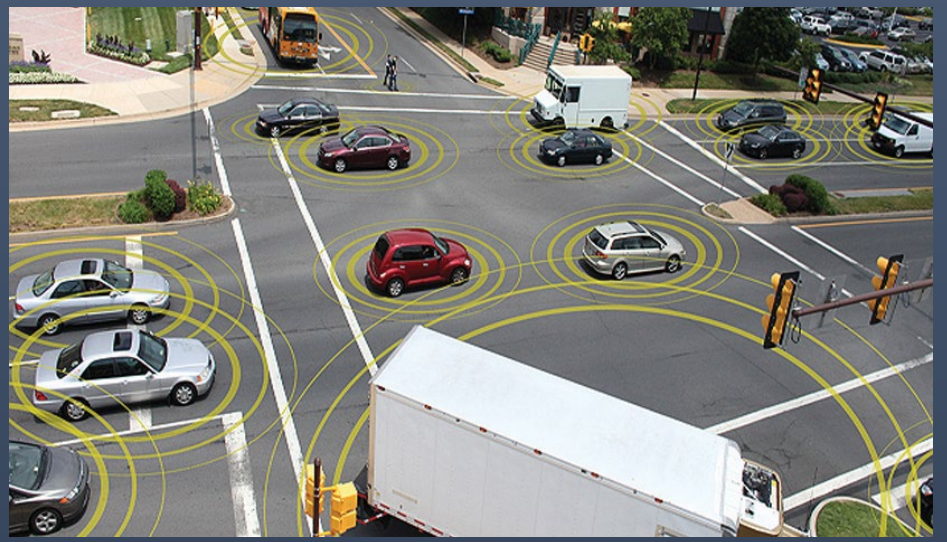
Potential strategies include…

- Vehicle detection on minor street w/ actuated flashing beacon for mainline and minor street motorists
- High-visibility LED highlighted signs
- Connected Vehicle technology (e.g., TIMs)
- Perform Intersection Control Evaluation (ICE)
  - Traffic calming
  - Roadway geometrics modifications
  - Roundabout
- Signalize the intersection (if warranted)

INTERSECTION SAFETY

- Kit “B” – Vehicle, Signalized Intersection
- Potential strategies include…
- Signal Retiming / Phase Modifications (e.g., protected vs. permissive, split phase)
- Adaptive Signal Control Technology (corridor based)
- Advanced (“Dilemma”) Zone Detection
- Connected Vehicle technology (e.g., SPAT, Red-Light Violation Warning)
- Flashing Beacon located upstream of intersection (e.g., actuated by red phase)
- Red Light Enforcement
  - Tattletale light
  - Red Light Violation Cameras (by local law enforcement)

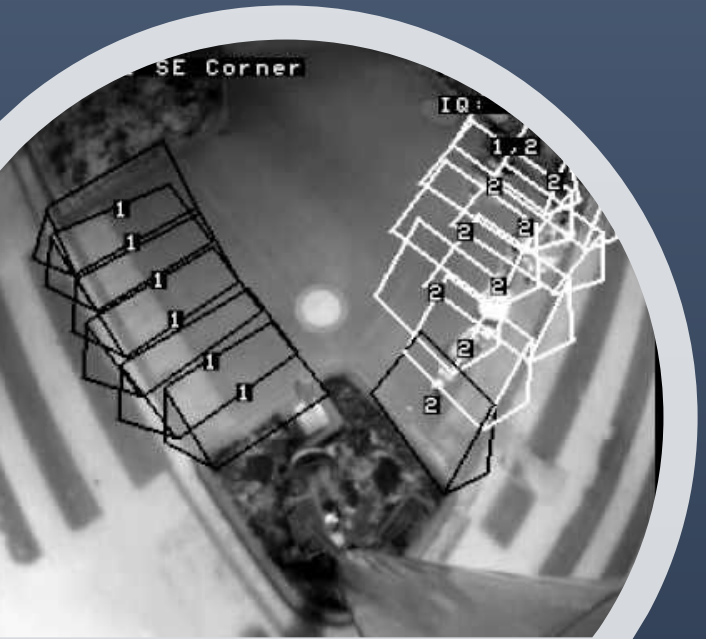




INTERSECTION SAFETY

Kit “C” – Bicycle

- Potential strategies include…
  - Signal Retiming / Phase Modifications
  - Blankout Signs (e.g., “YIELD TO BICYCLE”)
  - Bicycle-specific Detection
  - Advanced Motorists Warning System
  - Connected Vehicle technologies (e.g., TIMs)
  - Adaptive Lighting Systems
  - High-emphasis bicycle lane pavement markings
  - Continuous bicycle routes (end-to-end)



INTERSECTION SAFETY

Kit "D" – Pedestrian

- Potential strategies include…
  - Signal Retiming / Phase Modifications (e.g., leading pedestrian interval)
  - Passive Pedestrian Detection (PPD)
  - Blankout Signs (e.g., "YIELD TO PEDESTRIAN")
  - Lighted Crosswalks
  - Adaptive Lighting Systems
  - Accessible Pedestrian Detection Systems
  - Connected Vehicle technologies (e.g., Pedestrian in X-Walk)
  - Traffic Calming (e.g., raised crosswalks, pedestrian refuge)

EVENT MANAGEMENT

- “EVENT MANAGEMENT” projects can deploy various technologies along corridors with high traffic volumes due to special events; focus on providing origin-destination way finding and traffic monitoring
- Deployed technologies include, but are not limited to…
  - Communications (e.g., fiber optics, wireless, cellular)
  - CCTV Cameras
  - Vehicle Detection Systems (e.g., Bluetooth readers, MVDS)
  - Dynamic Message Signs
  - Programmable Blankout Signs (new)

Initiatives

A. Strengthen ITS planning and Integration into the Regional Planning Process
   Needs to be considered in all projects and modes

B. Advance County-wide Coordination
   Event Management, First Responders, cities, between maintaining agencies

C. Strengthen/Improve Event Management (evacuation, launch)
   Increased Space Launches and Regional Events draw large crowds

D. Funding for Maintenance and Operations
   More equipment means more maintenance and higher costs.

E. Update/Establish Policies

Next Steps

- Finalize plan (document review)
- Prepare for Board adoption
- Launch the Local Consortium
- Create Public Awareness

LYNX AV Services Project

Stakeholder Summary Draft

May 27, 2021

wsp

LYNX®

CITY OF ORLANDO

metroplan orlando
A REGIONAL TRANSPORTATION PARTNERSHIP

Introduction

LYNX, the City of Orlando, and MetroPlan Orlando have partnered on an automated vehicle (AV) Concept of Operations Study to examine the potential deployment of AVs in existing or future LYNX transit services.

Intent of the Study

The intent of the study was to develop a Concept of Operations and a draft scope for deployment of AVs at LYNX in order to:

- Provide details on the anticipated scope and vision for longer term incorporation of AVs at LYNX
- Better understand how AVs would be required to operate to meet the needs of LYNX and its customers
- Help LYNX and its partners understand physical and data infrastructure currently available and any anticipated gaps

Any future demonstration will be subject to funding identification and availability

Project Structure

Various memos folded into eventual Concept of Operations and Scope for Demonstration documents

Stakeholder coordination, update meetings, and deliverable review were conducted throughout

User Survey Results – AV Opportunities and Barriers

Opportunities

In order of selection frequency

1. More flexible transit
2. Better mobility for people who can't drive
3. Lower environmental impact
4. More efficient transit
5. Less congestion

Barriers

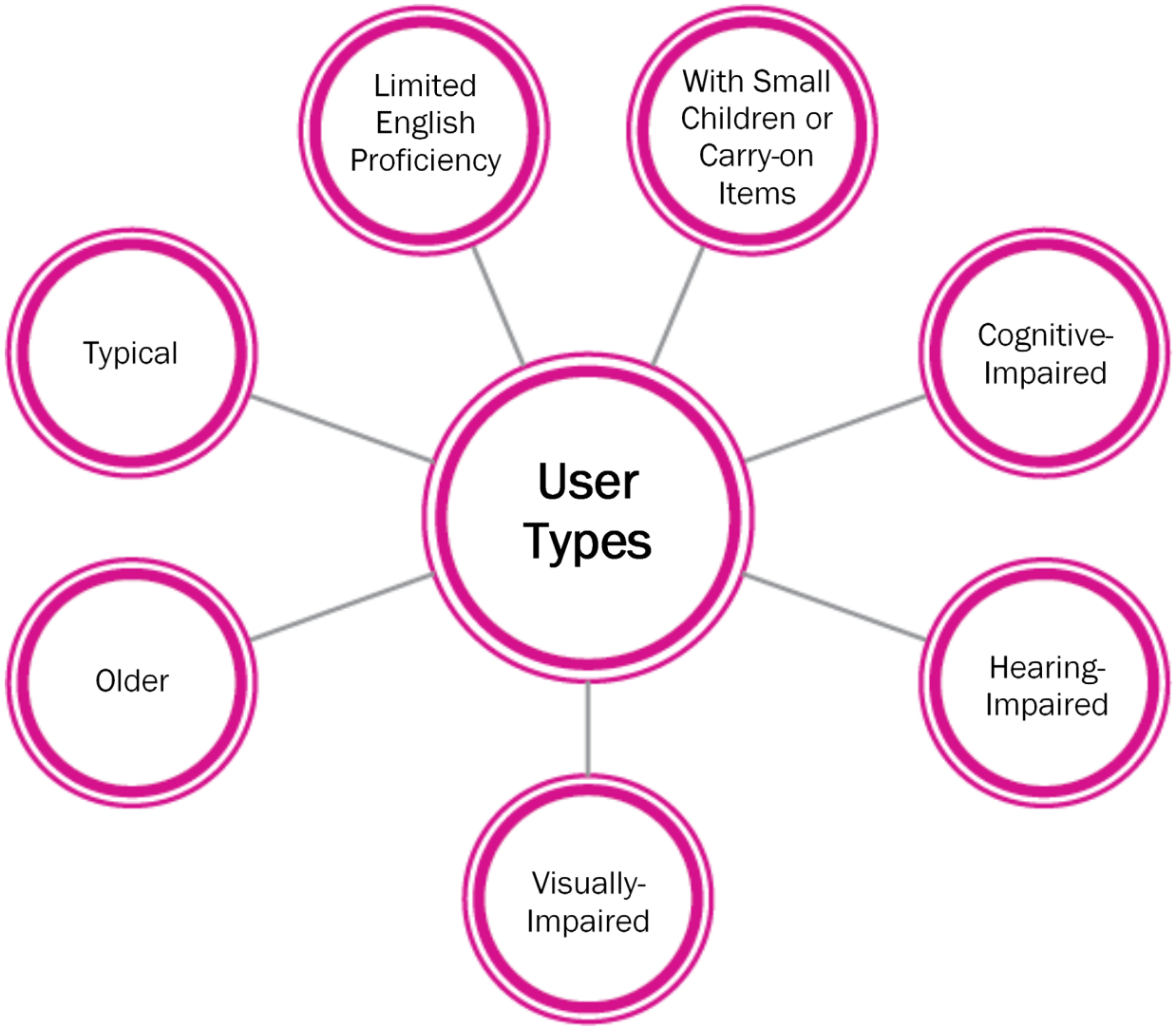
In order of selection frequency

1. Driver assistance getting in and out of the vehicle
2. Security
3. Wayfinding
4. Driver assistance getting secure on the vehicle
5. Untested technology

User Survey Results – Applicable Types of Service

- 90% of respondents thought that LYMMO would be the best fit for service by automated vehicles
  - *Followed by Disney Direct at 50% and NeighborLink at 40%*
- 60% thought that ACCESS LYNX would never be a good fit for service by automated vehicles
  - *No other responses had over 20%*
- 70% responded that they agreed with the statement "Overall, the use of automated vehicles in public transportation will help people like me."

User Types


User Types
Limited English Proficiency
With Small Children or Carry-on Items
Typical
Cognitive-Impaired
Older
Hearing-Impaired
Visually-Impaired

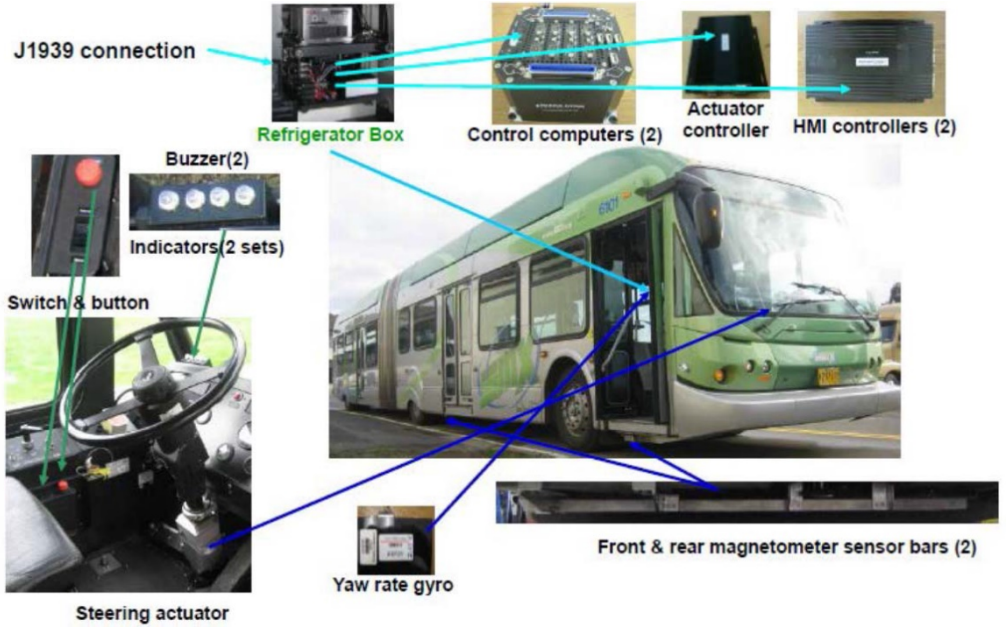
Operating Options

Small AV Shuttle

- Technology available
- Operational issues
  - *Charging, maintenance, speed differential with other vehicles, limited capacity*

Retrofitted Existing Vehicle

- Technology a few years away
- Fewer operational issues
- Lower lifecycle costs



Potential AV Pilot Project – LYMMO Orange Line

- Exclusive lanes
- Limited interactions with other traffic
- Transit signal priority at signalized intersections
- Nearby charging infrastructure

Comparison of AV Pilot Costs

AV Pilot Option	Current LYMMO Orange Line Annual Operating Costs	One-Year AV Pilot Operating Cost	Total LYMMO Orange Line Operating Cost for One-Year Pilot Period	% Increase
1. Interspersing 3 shuttles	$1,666,327	$ 1,291,408	$ 2,957,735	78%
2. Adding 1 shuttle		$ 543,942	$ 2,210,269	33%
Adding 3 shuttles		$ 1,631,827	$ 3,298,154	98%
3. Retrofitting 1 bus		$ 756,900	$ 2,423,227	45%

A pilot retrofitting one 35-foot bus with AV features would result in relatively low deployment cost from an operations perspective and limited operational impacts to other LYMMO buses, while maintaining passenger capacity

Potential AV Pilot Benefits

- Engagement and education
- Testing and evaluation
- Increased safety and efficiency
- Economic development opportunities
- Lower operating costs

LYNX's goal is to provide transit services – AVs could make sense if they provide the same or better service to all passengers than other alternatives

Potential Broader Application

- In the future, AVs could be integrated into the LYNX fleet for different services, pending the level of AV development over time

- This includes:
  - *Circulators*
  - *NeighborLink*
  - *Line haul services*

Financial Analysis – Next Steps

Federal

- **Federal Grants.** Consider applying for several federal discretionary grant opportunities, including the USDOT BUILD, FTA Integrated Mobility Innovation (IMI), and Accelerating Innovation Mobility (AIM) grant programs
- **Federal Formula Funds.** Consider pursuing federal flex funds such as Congestion Mitigation and Air Quality (CMAQ), Surface Transportation (STP), Transportation Management Area (TMA), and Transportation Alternatives funds through MetroPlan Orlando
- **Emerging Federal Opportunities.** Monitor potential new or retooled programs that could arise from a new infrastructure package currently being advanced by Congress or through the surface transportation reauthorization bill in 2021

State

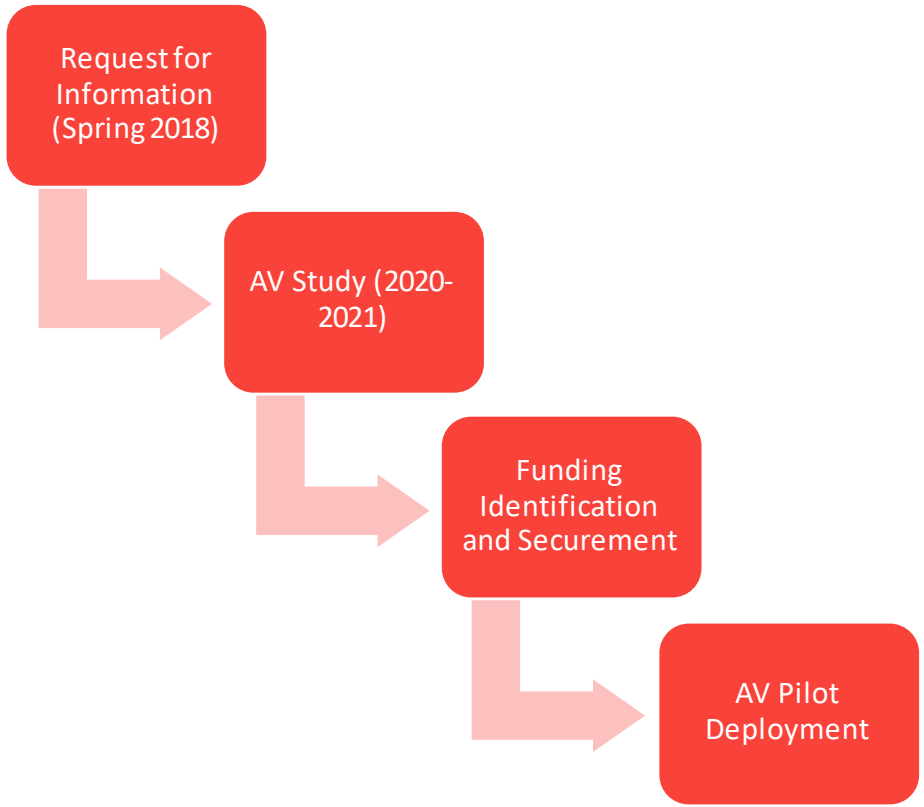
- **FDOT Partnership.** Consider securing a partnership with FDOT for use of state funds for the AV pilot, to match federal grants, and/or to use toll revenue credits to meet federal share requirements

Project-Specific

- **Private Involvement.** Identify opportunities to involve the private sector in contributing land, vehicles, or cash to support an AV pilot project

Conclusions and Next Steps

- Future AV direction at LYNX will need to involve funding partnerships
  - *LYNX provides the services requested by funding partners*
- Development and release of a pilot RFP will be subject to:
  - *Identification and availability of dedicated funding*
  - *AV technology advancements*



Thank you!

Any questions?

Highway Rail Notification & Arterial Approach Clearance

TSM&O Consortium Meeting

May 27, 2021

FDOT D5

Presenters

Jeremy Dilmore, PE

R. "Carlo" Adair, PE

Melissa Gross, PE

Agenda

- Project Update
- Stakeholder Feedback
- Implementation Plan - Short-, Mid-, and Long-Term Strategies
- Concept Plans
- Next Steps
- Feedback!

Project Overview

RECALL - Purpose and Need

FDOT District 5 encompasses over 900 railroad crossings throughout its jurisdiction.

Purpose:

- Engage Stakeholders
- Evaluate improvement scenarios for Safety (Vision Zero)
- ***Implementation Plan*** including a prioritized list of District crossings
  - Regionally accepted site solutions,
  - Concept plans advancement,
  - Regional "Typicals" for industry use
  - Implementation strategy

Project Update

Summary thus far

Evaluation Factors (Phase I):

- Empirical Data
- Historical Records
- Human Behavior
- Physical Conditions
- Probability and Statistics
- Engineering Judgement

Evaluation Factors (Phase II):

- Existing Conditions Verification
- Regional Impacts
- Future Development
- Planning and Coordination
- **Stakeholder Feedback**

Evaluation Factors (Phase III):

- Probability and Statistics
- Benefit Cost Analysis
- Define Short-, Mid-, and Long-Term Solutions
- Planning and Coordination
- **Stakeholder Feedback**

Phase I

- Data Collection
- Rail Crossing Prioritization
- Stakeholder Involvement Plan
- Literature Review
- Stakeholder Coordination
- Completion Date 03/02/2021

Phase II

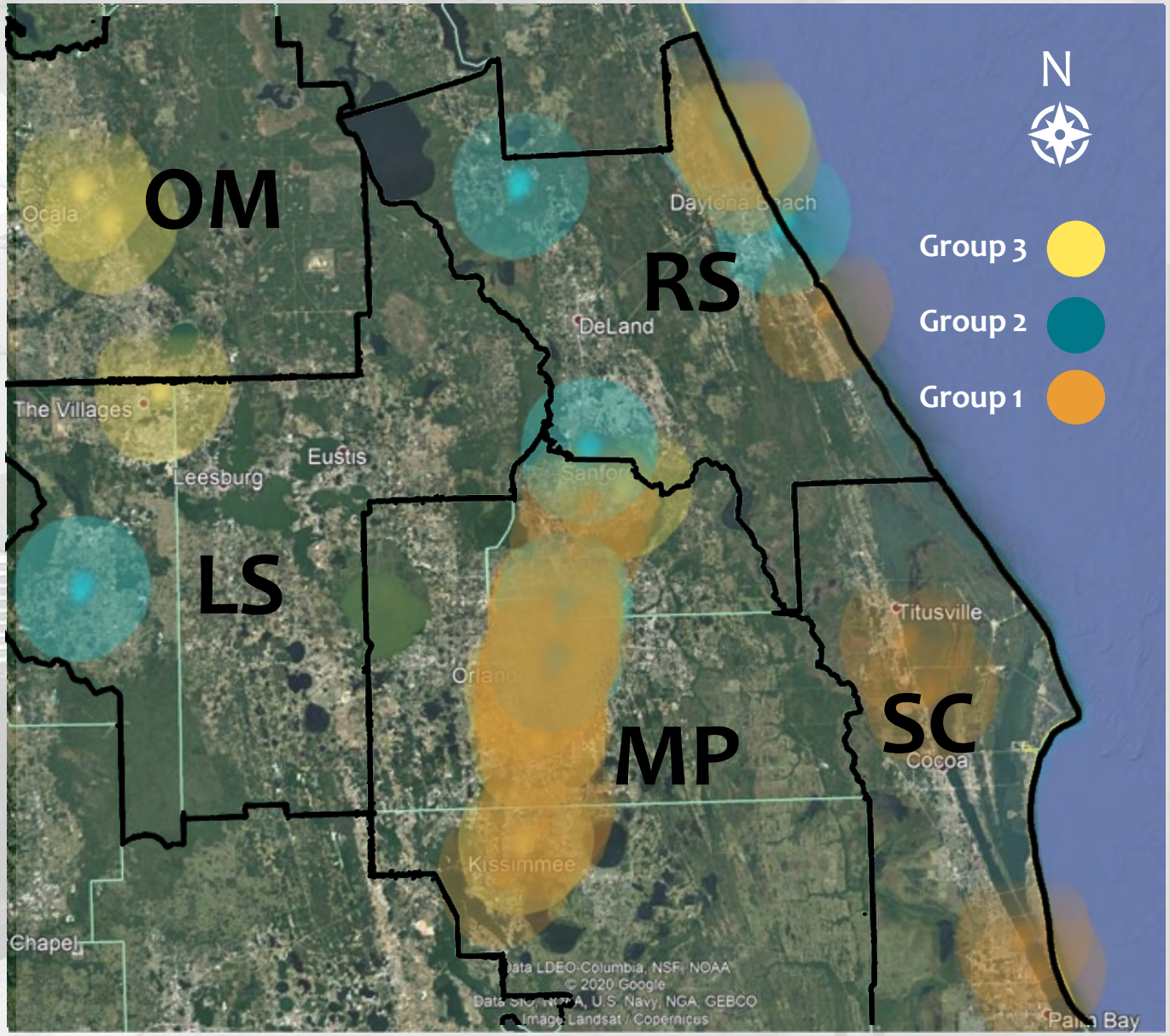
- Refine Rail Crossing Prioritization List
- Evaluation of Prioritized Crossing Locations
- Recommend Solutions
- Stakeholder Coordination
- Nearing Completion

Phase III

- Refine Recommended Solutions
- Develop Concept Level Plans
- Stakeholder Coordination
- Develop Implementation Plan
- Develop SE Documentation

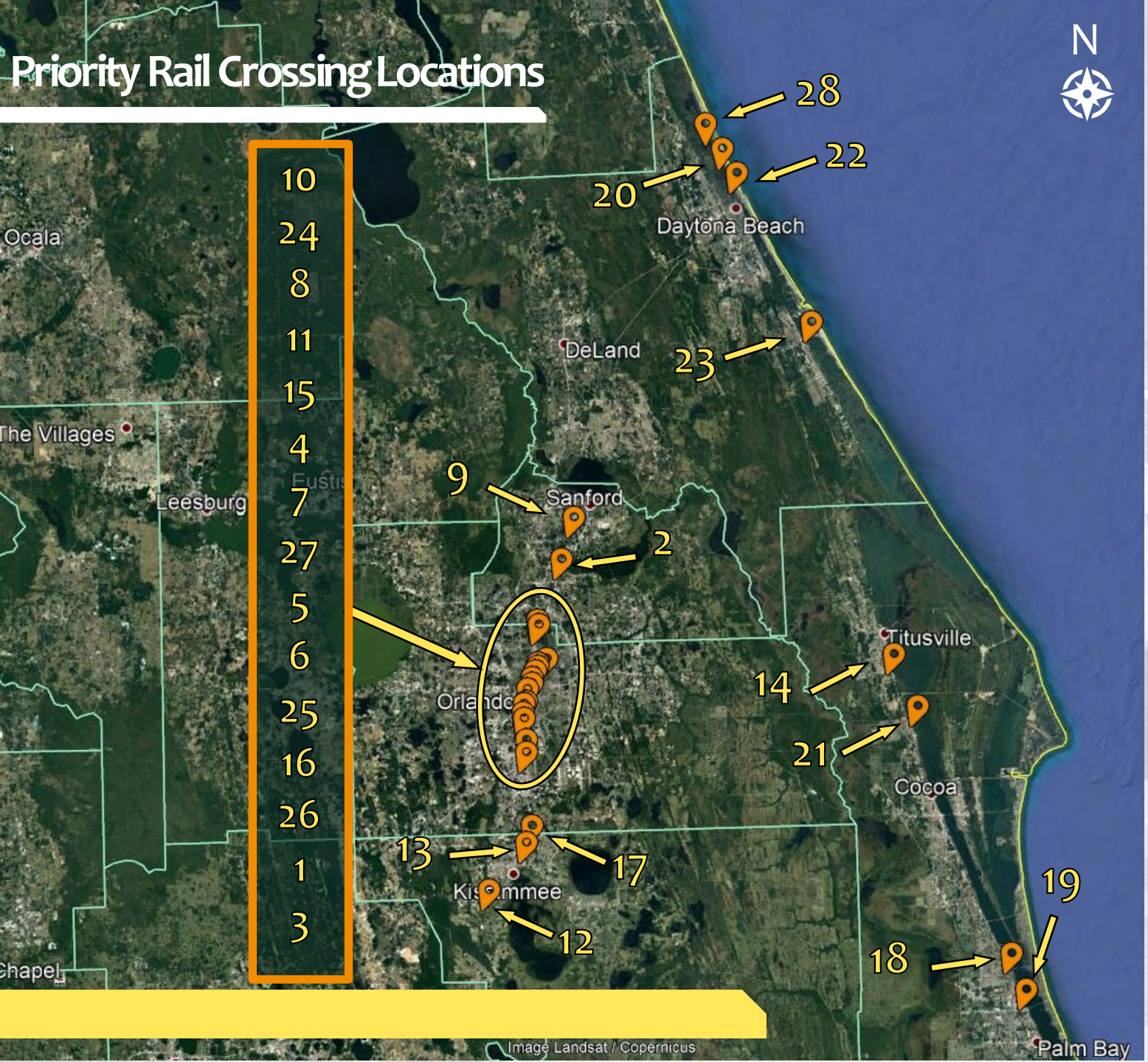
Regional Priority Crossings

	MPO / TPO	Group 1	Group 2	Group 3	Total Study
LS	Lake – Sumter MPO	0	1	0	1
OM	Ocala Marion MPO	0	0	3	3
SC	Space Coast TPO	4	0	0	4
RS	River to Sea TPO	3	5	1	9
MP	MetroPlan Orlando	21	3	6	30



FDOT D5

Priority Rail Crossing Locations



	CROSSING NAME	RAIL OWNER
1	E LANCASTER RD	CFRC/SUNRAIL
2	CR-427 / N R. REAGAN BLVD	CFRC/SUNRAIL
3	CR-528 / E LANDSTREET RD	CFRC/SUNRAIL
4	SR-527 / N MAGNOLIA AVE	CFRC/SUNRAIL
5	W PINE ST	CFRC/SUNRAIL
6	W SOUTH ST	CFRC/SUNRAIL
7	US-17/92 / W COLONIAL DR	CFRC/SUNRAIL
8	SR-426/527 / FAIRBANKS AVE	CFRC/SUNRAIL
9	CR-4220 / W LAKE MARY BLVD	CFRC/SUNRAIL
10	E HORATIO AVE	CFRC/SUNRAIL
11	US-17/92 / S ORLANDO AVE	CFRC/SUNRAIL
12	S POINCIANA BLVD	CFRC/SUNRAIL
13	US-192/441 / VINE ST	FEC
14	SR-50 / CHENEY HWY	CFRC/SUNRAIL
15	VIRGINIA DR	CFRC/SUNRAIL
16	W MICHIGAN ST	CFRC/SUNRAIL
17	E CARROLL ST	FEC
18	SR-518 / W EAU GALLIE BLVD	FEC
19	E HIBISCUS BLVD	FEC
20	CR-4019 / LPGA BLVD	CFRC/SUNRAIL
21	FAY BLVD	FEC
22	CR-4040 / FAIRVIEW AVE	FEC
23	WASHINGTON ST	FEC
24	E PACKWOOD AVE	CFRC/SUNRAIL
25	W GORE ST	CFRC/SUNRAIL
26	W KALEY ST	CFRC/SUNRAIL
27	W JEFFERSON ST	CFRC/SUNRAIL
28	HAND AVE	FEC

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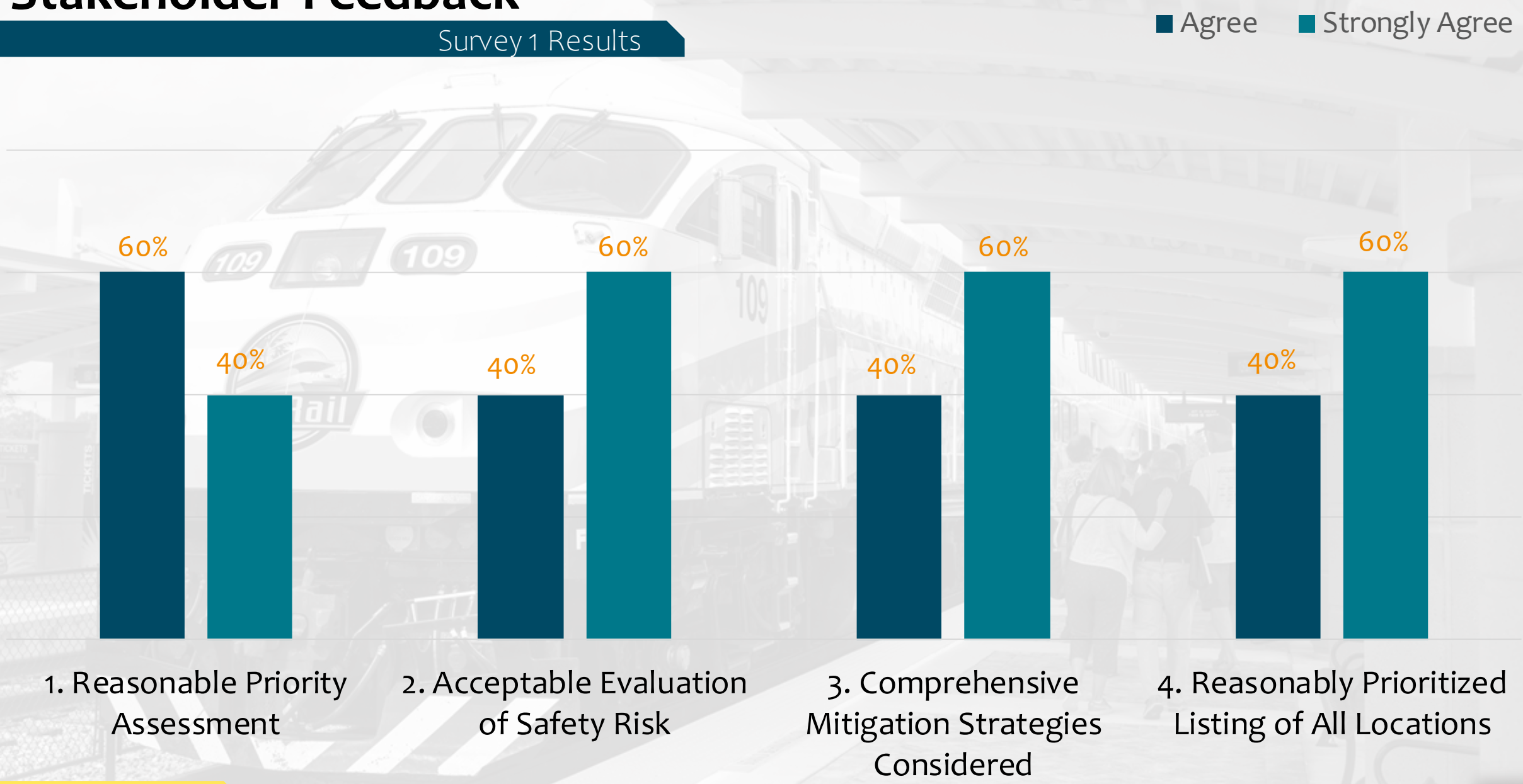
Stakeholder Feedback

Survey 1 Results



Stakeholder Feedback

Survey 1 Results

5. Are there any additional safety factors you recommend as part of this safety evaluation process presented at the TSM&O Consortium Meeting?

Comment: "Just to take into account any future improvements to the roadways/intersections with crossings and probably consider closing the crossing if it's dangerous or can be relocated to a better location."

6. Considering local jurisdictional preferences, are there any additional mitigation strategies you would like to see considered for further evaluation? If yes, please identify them in your response.

Comments: "Not at this time."

7. Are there any proposed mitigation strategies that should be removed from consideration based on local jurisdictional preferences? If yes, please identify them in your response.

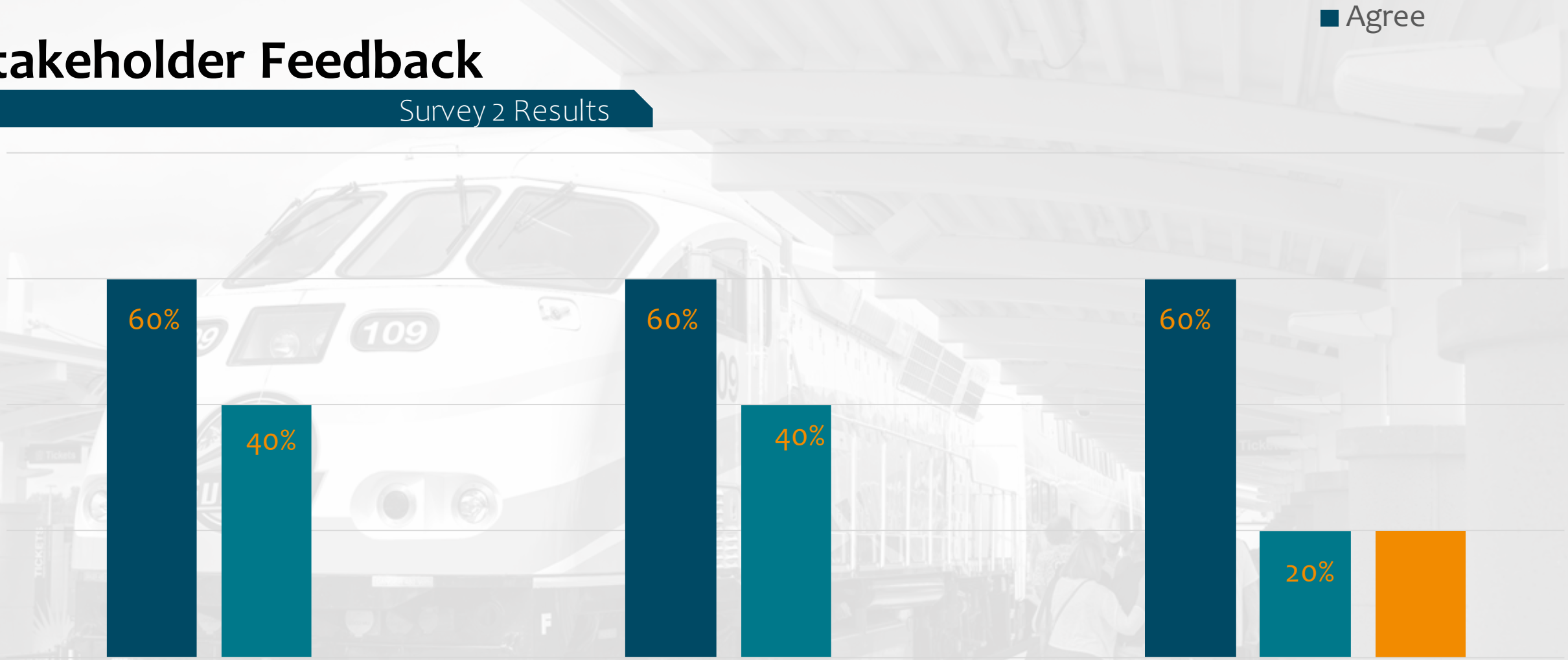
Comments: "No."

8. Are there any specific concerns or insights regarding identified rail crossing locations within your jurisdiction that you would like to have considered in addition to the safety assessment presented at the TSM&O Consortium Meeting?

Comments: "Gatlin/Holden Avenue intersection with Orange Ave. There might be a long-term improvement to realign Holden with Gatlin. So, whether we need to keep both locations or close one and add a new one needs to be studied."

Stakeholder Feedback

Survey 2 Results



Stakeholder Feedback

Survey 2 Results

4. Are there any additional rail crossings that you would like to further discuss? If so, please elaborate.

Comment: "It has recently been brought to my attention that there have been two incidents at crossing 622352Y, Aquatic Drive at US 441 in Orlando."

5. Are there any additional risks that you thought were not identified in the study? If so, please provide your feedback.

Comments: "None."

6. Are there any proposed mitigation strategies that should be removed from consideration based on local jurisdictional preferences? If yes, please identify them in your response.

Comments: "None." and "I am not 100% sure about #RRX type of phone system. I feel like the protocol should be to call 911 if stuck on a crossing and 911 should reach out to rail company. Although I am not sure if they are equipped to do this or not…. I do think it would be good to make the rail crossing ID number larger regardless of who needs to know it."

7. Considering local jurisdictional preferences, are there any additional mitigation strategies you would like to see proposed? If yes, please identify them in your response.

Comments: "None."

Stakeholder Feedback

Survey 2 Results

4. Are there any additional comments that you would like to share?

Comment: "I think this study/tech memo is a great start in identifying locations that are antiquated and need good improvements to promote safety for all users."

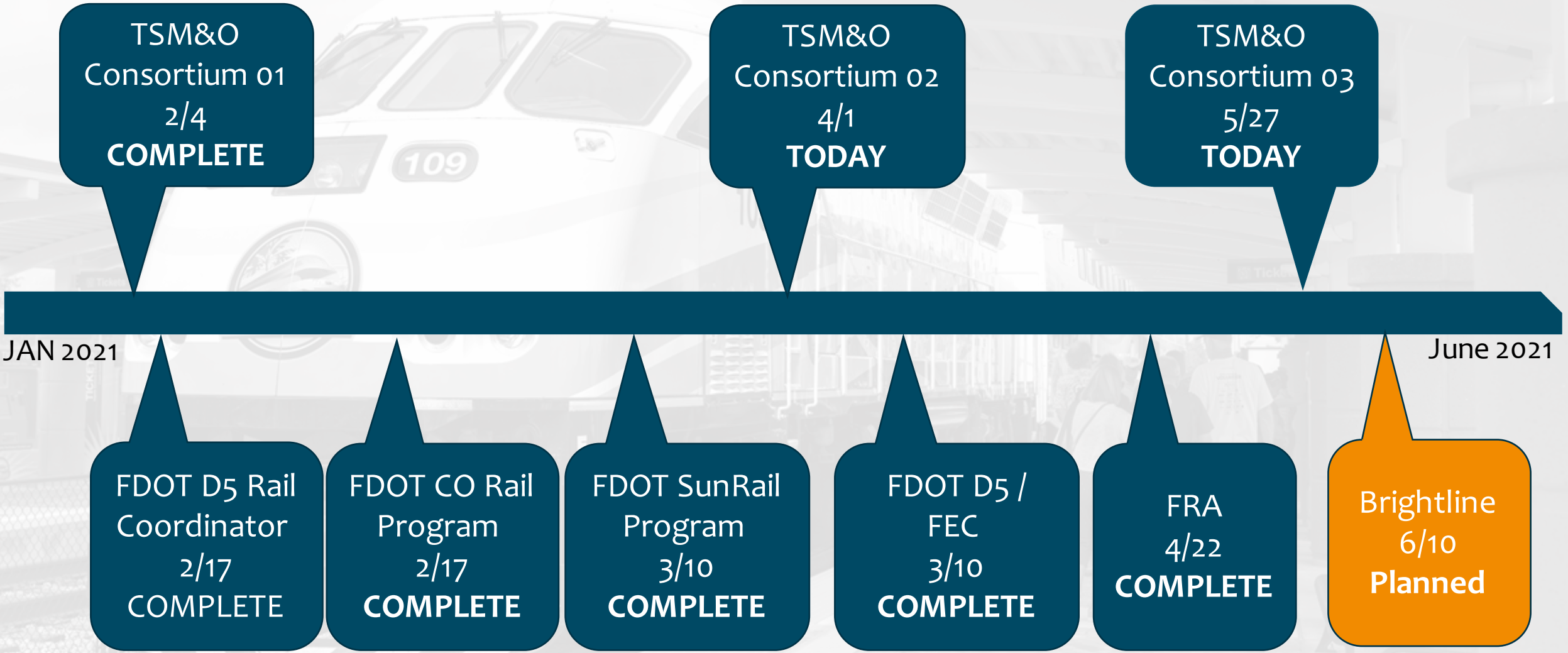
"My overall comment for our area is knowing what improvements Brightline is doing and that they incorporate any strategies that you have identified."

"I agree that RR X-ings require attention, particularly based on the historical crash data. But how will you determine how far down the list you'll go to program funding, before you allocate funds to other needed safety improvements?"

"The study based on current detection technology is a step in the right direction. We need to consider additional rail and roadway video detection that can provide heat maps of near misses and other important data. This data can be used to provide predictive analytics, by machine learning dynamically linking all ITS safety countermeasures to provide intelligent decision support, thereby reducing the probability of crashes at rail crossings and adhering to best safety practices and Vision Zero principals."

Stakeholder Feedback

Timeline of engagements



Field Review Analysis - Findings

Of the 28 Group 1 locations:

- Short-Term Solution - Signing and Pavement Marking Enhancements (26 locations)
- Mid-Term Solution – Interconnected Preemption (3 locations)
- Long-Term Solution – Artificial Intelligence & Machine Learning (28 locations)

From these applied concept/quantity relationships, we find:

- Short-Term Solutions = 93% (~840 crossings)
- Mid-Term Solutions = 12% (~96 crossings)
- Long-Term Solutions = 100% (~905 crossings)

Mitigation Strategies

Mitigation Option	Frequency
Integrated Alert System	28
Enhanced Emergency Notification System at Grade Crossings	28
AI & Machine Learning	28
Pedestrian Pavement Markings	19
Continuous white striping across the grade crossing.	11
Traditional Do Not Stop On Tracks Signage.	11
LED Do Not Stop On Tracks signage.	10
Use of RPMs in conjunction with white striping.	9
Use of Delineators in conjunction with white striping.	8
Dynamic Envelope	8
Remove or replace confusing directional pavement markings or signage near the crossing.	6
Work with locals to have sidewalk constructed along the roadway on either side of the crossing and construct pedestrian crossing and install ped gates.	6
Continuous yellow center striping across the grade crossing.	5
Refresh pavement markings including stop bar, lane striping, and painted crossbuck.	5
Install a presignal upstream of the crossing that works in conjunction with the downstream intersection signal.	5
Install a presignal upstream of the crossing that works in conjunction with queue cutter sensor downstream of the crossing.	5
Construct pedestrian crossing and install ped gates.	4
Use of RPMs in conjunction with yellow striping.	3
Use of Delineators in conjunction with yellow striping.	3
Install and Interconnect Preemption with nearby traffic signal.	3
Install Ped gates.	3
Install directional signage or barrier to lead pedestrians to nearby intersection or crosswalk.	3
Improved lighting (LED) and more fixtures at intersection.	2
Redesign downstream intersection to allow continuous flow of vehicles.	2
Adaptive Traffic Signal Interface	2
Right in Right out configuration.	2
Install delineators in the center of the roadway to prevent left turns.	2
Signage prohibiting specific turn movements.	2
Straight only pavement markings.	2
Move stop bar closer to the crossing .	2
Install advanced pedestrian crosswalk signage with push button LED flashers.	2
Improved lighting (LED) and more fixtures at intersection.	2
LED Escape Lane signage or blank-out	1
Dynamic Sensor for exit gates.	1
Close or reconfigure driveway or side street.	1
Resurface.	1
Install pedestrian crosswalk outside of the crossing gates across the roadway.	1
Install "Stop Here" signage.	1
Move obstruction or redesign pedestrian facilities.	1
Bevel the difference in elevation or reconstruct.	1
Escape Lanes	0
Intelligent Grade Crossing System	0
Add low (not in sight line for intersection) fencing or guardrail between sidewalks and roadway lanes to channelize pedestrians and keep them from jaywalking.	0

Mitigation Strategies (Benefits)

Mitigation Option	Legend Number	E LANCASTER RD	CR-427 / N R. REAGAN BLVD	CR-528 / E LANDSTREET RD	SR-527 / N MAGNOLIA AVE	W PINE ST	W SOUTH ST	US-17/92 / W COLONIAL DR	SR-426/527 / FAIRBANKS AVE	CR-4220 / W LAKE MARY BLVD	E HORATIO AVE	US-17/92 / S ORLANDO AVE	S POINCIANA BLVD	US-192/441 / VINE ST	VIRGINIA DR	W MICHIGAN ST	E CARROLL ST	E PACKWOOD AVE	W GORE ST	W KALEY ST	W JEFFERSON ST	HAND AVE	CR 4109/LPGA BLVD	CR 4040/FAIRVIEW AVE	WASHINGTON ST	SR 50/CHENEY HWY	FAY BLVD	SR 518/W EAU GALLIE BLVD	E HIBISCUS BLVD
Signing and Pavement Marking Enhancements	1	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Integrated Alert System	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enhanced ENS	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Improved Roadway Lighting	4		✓	✓						✓	✓	✓	✓				✓				✓								
AI & Machine Learning	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Interconnect Preemption	6		✓								✓														✓				
Presignal/ Queue Cutter Signal	7	✓	✓						✓	✓	✓		✓	✓	✓	✓													
LED R8-8 Sign	8		✓		✓		✓	✓			✓	✓						✓					✓		✓	✓			
Escape Lane	9		✓						✓			✓																	
Adaptive Traffic Signal Interface	10		✓		✓																								
Roadway Geometry Reconfiguration	11	✓										✓							✓	✓									
Resurfacing	12															✓													
Dynamic Sensor for exit Gates	13	✓				✓				✓	✓				✓				✓		✓								
Pedestrian Crossing Enhancements	14		✓	✓	✓	✓	✓		✓						✓		✓		✓	✓		✓	✓	✓					✓
Pedestrian Crossing Marking	15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Costs

Crash Severity	Comprehe
Fatal (K)	$10,670,000
Severe Injury (A)	$872,612
Moderate Injury (B)	$174,018
Minor Injury (C)	$106,215
Property Damage Only (O)	$7,700

Note:

(1) Sou
(CA
12/2

Crossing Name	on severity of crash/fatality) Benefits "B"	Implementation Cost	(Benefit/Implementation Cost)
R 4220/W Lake Mary Blvd Near misses and 1 grade crossing collision	$38,500	$362,925	0.11
R 427/ N Ronald Reagan Blvd) near misses, 4 Vehicle Collisions (Non-fatal) and 1 grade cossing ollision	$780,772	$698,695	1.12
. Horatio Ave near miss and 3 grade crossing collisions	$30,800	$439,826	0.07
. Packwood Ave near misses and 2 grade crossing collisions		42,169	0.16
R-426/527/ Fairbanks Ave vehicle collision (non fatal			2.93
S-17/			1.22
			0.07
			1.09

Signing & Pavement Mitigation Method Cost Estimate

PAY ITEM	DESCRIPTION	Units	Qnty.	Unit Cost	Cost	
630 2 12	CONDUIT, F&I, DIRECTIONAL BORE	100	LF	$23.90		
700 11391	ELECTRONIC DISPLAY SIGN, FURNISH & INSTALL OVERHEAD MOUNTAC POWERED, BLANK OUT SIGN, UP TO 12 SF	1	AS	$5,854.16		
700 1 11	SINGLE POST SIGN, F&I GROUND MOUNT, UP TO 12 SF	4	AS	$351.71	$	1,406.84
705 11 3	DELINEATOR, FLEXIBLE HIGH VISIBILITY MEDIAN	40	EA	$172.64	$	6,905.60
710 90	PAINTED PAVEMENT MARKINGS, FINAL SURFACE	1	LS	$8,000.00	$	8,000.00
639 2 1	ELECTRICAL SERVICE WIRE, F&I	100	LF	$6.39		
639 3 12	ELECTRICAL SERVICE DISCONNECT, F&I	1	EA	$2,285.00		
641 2 12	PRESTRESSED CONCRETE POLE, F&I, TYPE P-II SERVICE POLE	1	EA	$1,656.74		
				SUBTOTAL	$	16,312.44
				MAINTENANCE OF TRAFFIC (10%)	$	1,631.24
				MOBILIZATION (10%)	$	1,794.37
				CONTINGENCY (10%)	$	1,973.81
				DESIGN (15%)	$	2,446.87
				MAINTAINANCE (3% Annually)	$	2,598.15
				TOTAL	$	26,756.87

Values based on statewide averages available from: https://www.fdot.gov/programmanagement/Estimates/HistoricalCostInformation/HistoricalCost.shtm

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Benefit-Cost Ratios (BCRs)

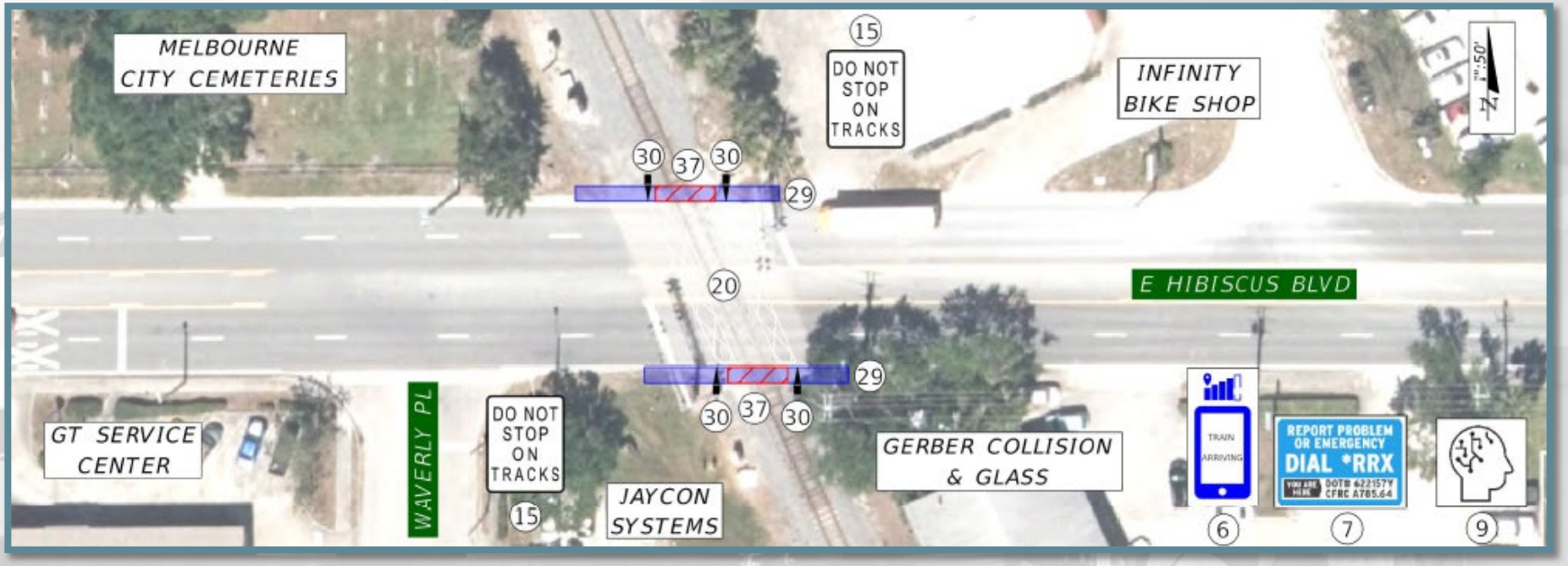
					Sample Conditions				Systemwide Conditions			
Mitigation Method	Concept Legend	Implementation (Short - , Mid - , Long -)	Crash Reduction (Minor, Medium, Major)	Implementation Cost (individual location)	Number of Applicable Locations	Implementation Cost	Benefit	Benefit Cost Ratio (Benefit/Implementation Cost)	Number of Applicable Locations (Systemwide)	Total Implementation Cost	Total Benefit	Delta (+ Savings, - Loss) possible reduced collisions over 5-yr
Signing and Pavement Marking Enhancements	1	Short	Minor, Near Miss, Property Damage Only	$ 26,757	26	$ 695,682	$ 916,300	1.32	840	$ 22,475,880	$ 29,603,538	$ 7,127,658
Integrated Alert System	2	Long	Major, Near Miss, Property Damage, and vehicular collisions (non fatal and fatal)	$ 5,525	28	$ 154,700	$ 8,603,892	55.62	305	$ 5,000,125	$ 278,030,081	$ 273,083,956
Enhanced ENS	3	Long	Medium, Near Miss, Property Damage, and vehicular collisions (non fatal)	$ 2,762	28	$ 77,336	$ 7,656,732	99.01	305	$ 69,383,080	$ 247,478,456	$ 177,483,376
Improved Roadway Lighting	4	Long	Medium, Near Miss, Property Damage, and vehicular collisions (non fatal)	$ 71,695	8	$ 573,560	$ 3,656,300	6.38	258	$ 18,497,310	$ 117,935,025	$ 99,437,715
AI & Machine	5	Long	Major, Near Miss, Property Damage, and vehicular collisions (non	$ 5,525	28	$ 5,525	$ 42,355,115	7666.28	305	$ 5,000,000	$1,368,377,808	$1,363,377,808
Adaptive Traffic Signal Interface	10	Mid	Major, Near Miss, Property Damage, and vehicular collisions (non fatal and fatal)	$ 107,643	2	$ 215,286	$ 1,464,526	6.80	64	$ 6,889,536	$ 46,864,832	$ 39,975,296
Roadway Geometry Reconfiguration	11	Short	Medium, Near Miss, Property Damage, and vehicular collisions (non fatal)	$ 25,698	4	$ 102,792	$ 1,198,108	11.66	123	$ 3,315,042	$ 38,638,983	$ 35,323,941
Resurfacing	12	Long	Minor, Near Miss, Property Damage Only	$ 12,146	1	$ 12,146	$ 30,800	2.54	32	$ 388,672	$ 985,600	$ 596,928
Dynamic Sensor for exit Gates	13	Mid	Major, Near Miss, Property Damage, and vehicular collisions (non fatal and fatal)	$ 67,587	7	$ 473,109	$ 2,183,698	4.62	226	$ 15,274,662	$ 70,502,250	$ 55,227,588
Pedestrian Crossing Enhancements	14	Long	Major, Pedestrian Collisions (non fatal and fatal)	$ 192,050	14	$ 2,688,700	$ 24,830,448	9.24	452	$ 86,806,600	$ 801,668,750	$ 714,862,150
Pedestrian Crossing Marking	15	Long	Medium, Pedestrian Collisions (non fatal)	$ 8,000	28	$ 224,000	$ 4,363,060	19.48	226	$ 1,808,000	$ 35,216,127	$ 33,408,127

					Sample Conditions				Systemwide Conditions			
Mitigation Method	Concept Legend	Implementation (Short - , Mid - , Long -)	Crash Reduction (Minor, Medium, Major)	Implementation Cost (individual location)	Number of Applicable Locations	Implementation Cost	Benefit	Benefit Cost Ratio (Benefit/Implementation Cost)	Number of Applicable Locations (Systemwide)	Total Implementation Cost	Total Benefit	Delta (+ Savings, - Loss) possible reduced collisions over 5-yr
Signing and Pavement Marking Enhancements	1	Short	Minor, Near Miss, Property Damage Only	$ 26,757	26	$ 695,682	$ 916,300	1.32	840	$ 22,475,880	$ 29,603,538	$ 7,127,658

East Hibiscus Blvd

Concept Plan

Benefit Cost Ratio: ~1.5



Proposed Improvements:

① White/Yellow Striping, RPMS, & Delineators

⑥ Integrated Alert System

⑦ Enhanced ENS

⑨ AI & Machine Learning

⑮ R8-8 Sign

⑳ Dynamic Envelope

㉙ Install Sidewalk

㉚ Pedestrian Crossing with Gates

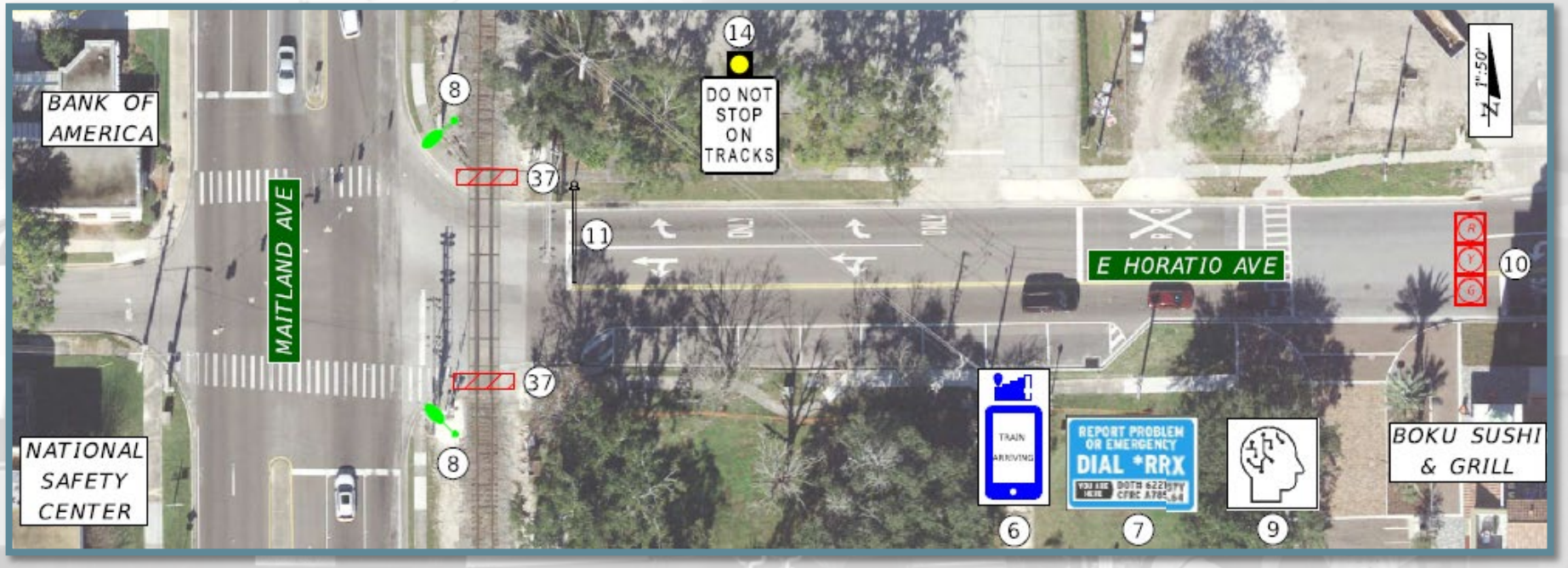
㊲ Colored Pedestrian Surface

Melbourne, FL.

East Horatio Ave

Concept Plan

Benefit Cost Ratio: 0.7



Proposed Improvements:

⑥ Integrated Alert System

⑦ Enhanced ENS

⑧ LED or Additional Lighting

⑨ AI & Machine Learning

⑩ Interconnect Preemption with Maitland Ave

⑪ Presignal for Intersection with Maitland Ave

⑫ Queue Cutter and Presignal

⑭ LED R8-8

㊲ Colored Pedestrian Surface

Maitland, FL.

FDOT D5

East Packwood Ave

Concept Plan

Benefit Cost Ratio: 0.16

Proposed Improvements:

⑥ Integrated Alert System

⑦ Enhanced ENS

⑨ AI & Machine Learning

⑬ Right Turn Movement Merge

⑭ LED R8-8

㊲ Colored Pedestrian Surface

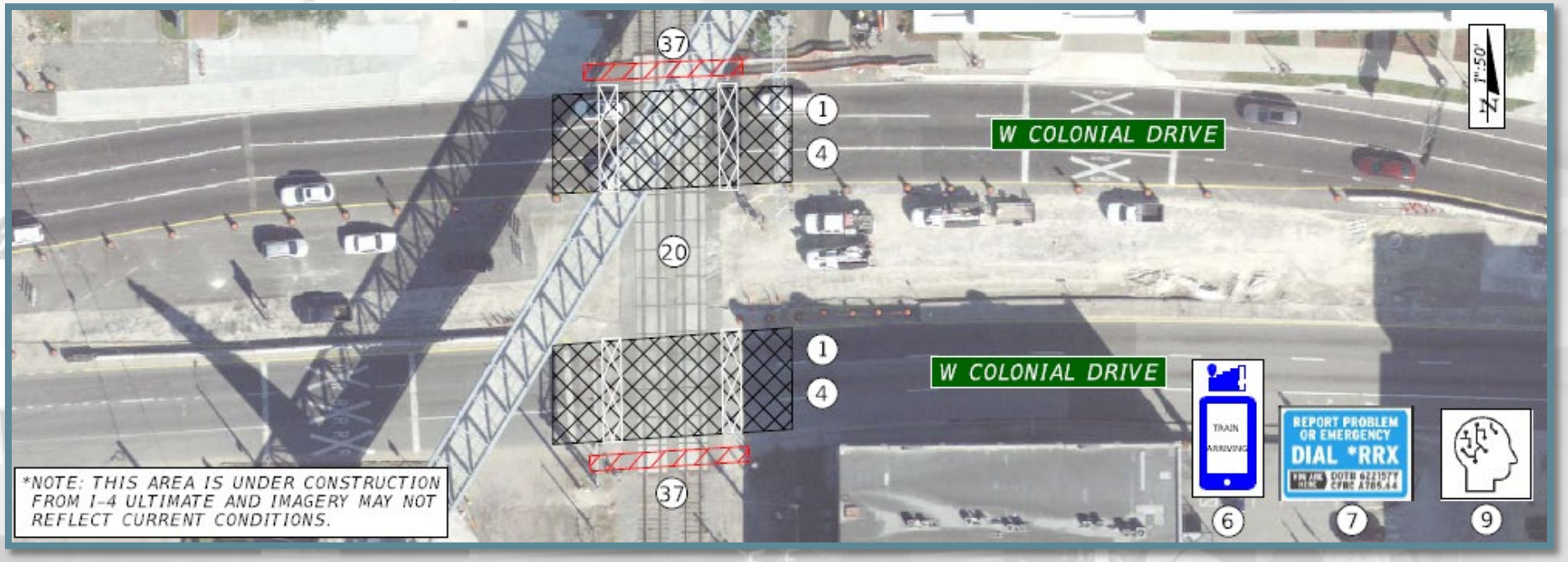
Maitland, FL.

FDOT D5

West Colonial Dr

Concept Plan

Benefit Cost Ratio: 6.46



Proposed Improvements:

- (1) White Striping, RPMS, & Delineators
- (3) Center of Roadway Delineators
- (4) Remove Confusing Signage & Pavement Markings
- (6) Integrated Alert System
- (7) Enhanced ENS
- (8) LED or Additional Lighting
- (9) AI & Machine Learning
- (37) Colored Pedestrian Surface

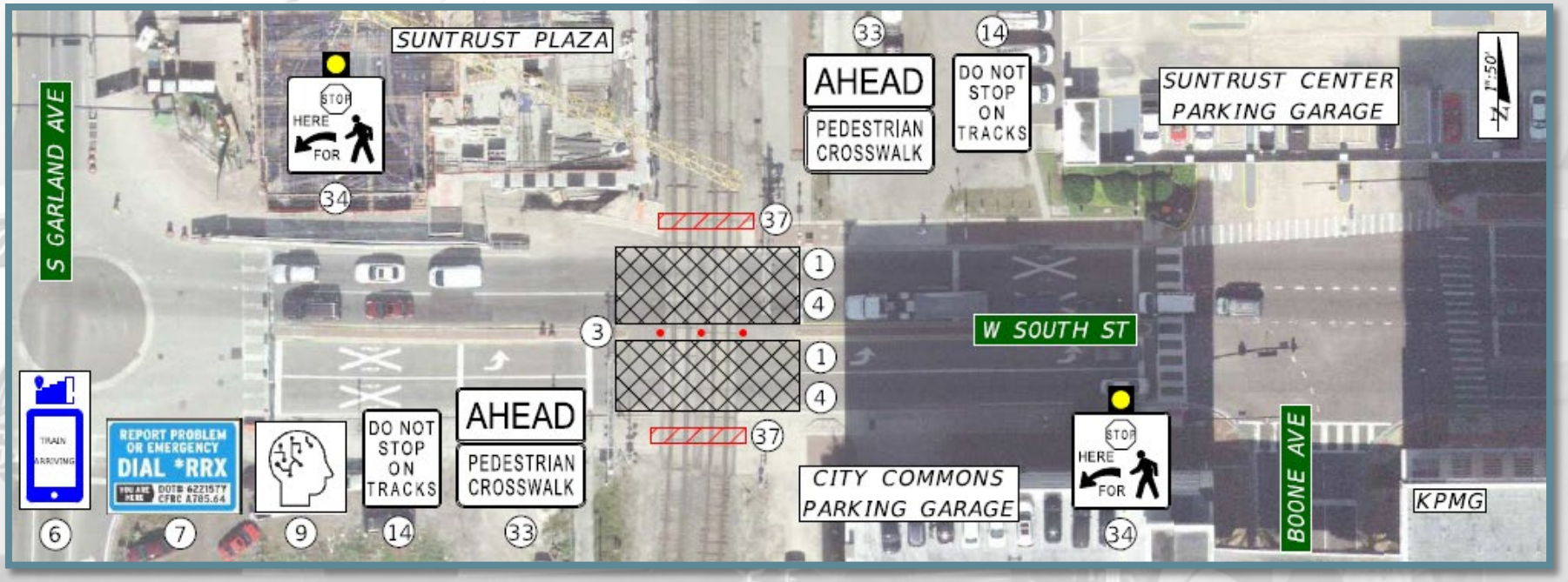
Orlando, FL.

FDOT D5

South Street

Concept Plan

Benefit Cost Ratio: 3.39



Proposed Improvements:

1. White Striping, RPMS, & Delineators
3. Center of Roadway Delineators
4. Remove Confusing Signage & Pavement Markings
6. Integrated Alert System
7. Enhanced ENS
9. AI & Machine Learning
14. LED R8-8
33. Pedestrian Channelization
34. Mid-Block Pedestrian Assembly with Flashers
37. Colored Pedestrian Surface

Orlando, FL.

FDOT D5

Your input is valuable!!!

Final Steps

- Stakeholder Questionnaire
- Feedback by **June 24th**

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Study Project Manager
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Phase I

- Data Collection
- Rail Crossing Prioritization
- Stakeholder Involvement Plan
- Literature Review
- Stakeholder Coordination
- Date 03/02/2021

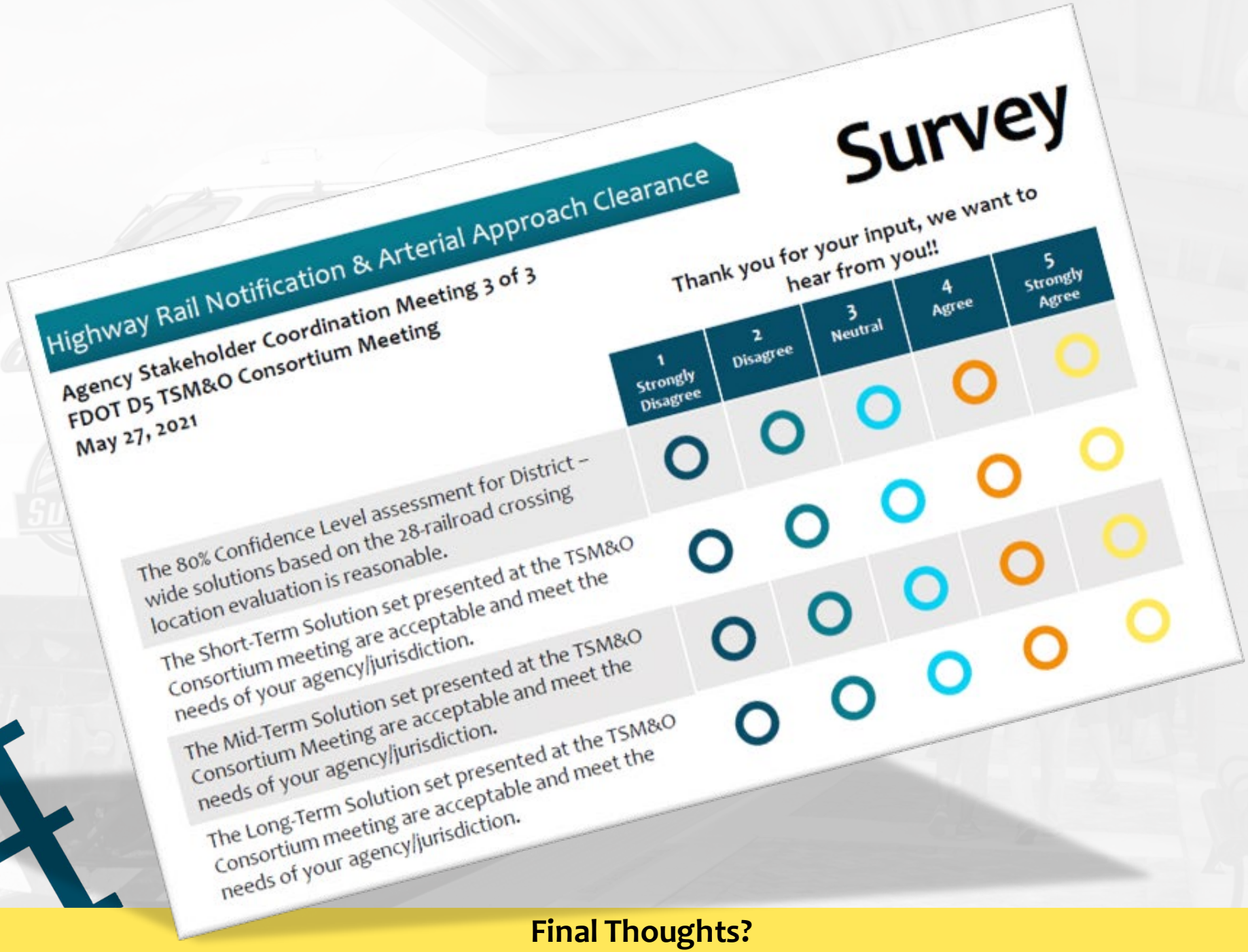
Phase II

- Refine Rail Crossing Prioritization List
- Evaluation of Prioritized Crossing Locations
- Recommend Solutions
- Stakeholder Coordination
- Nearing Completion

Phase III

- Refine Recommended Solutions
- Develop Regional "Typicals"
- **Final Stakeholder Coordination**
- **Develop Implementation Plan**
- **Develop SE Documentation**

Thank You!



Final Thoughts?

Current Initiatives

Jeremy Dilmore, District Five TSM&O

THANK YOU!

Next Consortium – July 15, 2021