



**Regional Transportation Technical Advisory
Committee (RTTAC) Transportation Systems
Management & Operations (TSM&O)
Subcommittee**

Meeting Agenda

January 23, 2025 10:00 AM – 12:00 Noon

100 West Cypress Creek Road. 6th Floor, Suite 650,
Ft Lauderdale, FL 33309

10:00 AM	I. Call to Order / Introductions
10:10 AM	II. LRTP Updates • Miami Dade County TPO • Palm Beach TPA • Broward MPO
10:45 AM	III. FDOT District 4 Ramp Metering Alyssa Klein, FDOT District 4
11:30 AM	IV. Ramp Signals Discussion
11:40 AM	V. TRB Highlights
11:50 AM	VI. Upcoming Events: Florida Atlantic University Student Leadership Summit ITE Student Chapter January 31-February 1, 2025 Bike Immersion Ride Miami, FL February 5, 2025 Safe Streets Summit West Palm Beach, FL February 6-7, 2025
12:00 Noon	VII. Adjournment



**Regional Transportation Technical Advisory
Committee (RTTAC) Transportation Systems
Management & Operations (TSM&O)
Subcommittee**

Meeting Agenda

October 24, 2024 10:00 AM – 12:00 Noon

100 West Cypress Creek Road. 6th Floor, Suite 650,
Ft Lauderdale, FL 33309

10:00 AM	I. Call to Order / Introductions
10:10 AM	II. FDOT D4 TSM&O Master Plan Update Kent Walia, FDOT D4 Peter Haliburton, CTS Dr. Lissy La Paix, CTS
10:40 AM	III. Transportation Technology Tournament Dr. Mohammed Hadi, FIU Md Mahmud Hasan Mamun, FIU
11:10 AM	IV. Hurricane Recover Open Discussion
11:40 AM	V. Voting: ☐ TSM&O Subcommittee Schedule 2025 ☐ TSM&O Subcommittee Chair and Vice Chair Election
11:50 AM	VI. Upcoming Events: FDOT Transportation Symposium Orlando, FL November 7-8, 2024 ITE International 2025: Abstracts Due November 2024 Hyatt Regency Orlando, FL August 11-14, 2025 Bike Immersion Ride (Tentative) Miami, FL February 5, 2025 Safe Streets Summit West Palm Beach, FL February 6-7, 2025
12:00 Noon	VII. Adjournment



**Regional Transportation Technical Advisory
Committee (RTTAC) Transportation Systems
Management & Operations (TSM&O)
Subcommittee**

Meeting Minutes

October 24, 2024, 10:00 AM – 12:00 Noon

100 West Cypress Creek Road. 6th Floor, Suite 650,
Ft Lauderdale, FL 33309

Meeting attendees:

Hector DiDonato, Miami-Dade TPO
Brian Ruscher, Palm Beach TPA
Buffy Sanders, Broward MPO
Alexandra Lopez, FDOT D4 TSM&O
Francisco Morales, FDOT D4 PLEMO
Kent Walia, FDOT D4 PLEMO
Ana Calleja, FDOT D6 PLEMO
Sergio Bravo, FDOT D6 TSM&O
Javier Rodriguez, FDOT D6 TSM&O
Mohammed Hadi, FIU
Md Mahmud Hasan Mamum, FIU
Joseph Porges, Palm Tran
Girish Kumar, In-House D6 Traffic Ops
Peter Haliburton, CTS
Lissy La Paix, CTS
Catalina Echeverri, Gannett Fleming

Call to Order / Introductions

The meeting was called to order. All meeting attendees introduced themselves and the agencies they represent.

FDOT D4 TSM&O Master Plan Update

Kent Walia from FDOT D4 presented along with Peter Haliburton and Lissy La Paix from CTS the update to the D4 TSM&O Master Plan. The effort started in 2024. The team is setting up the base for congestion and the priorities for the next 5 years. The team is evaluating short, mid, and long term TSM&O strategies. See attachment at the end.

**Transportation Technology Tournament (TTT): Digital Twin for Connected
Safe and Reliable Travel in an Urban Network in the Presence of Work Zones
and Special Events**

Dr. Mohammed Hadi and Md Mahmud Hasan Mamum from FIU presented on their entry for the National Operations Center of Excellence (NOCoe) and the U.S. DOT ITS JPO's Professional Capacity Building (PCB) Program. The team traveled to the ITE International conference in Philadelphia to compete with other universities. This competition for students to work directly with public agencies to solve real-world transportation problems utilizing ITS and TSMO solutions. The sponsor for the FIU/FAU team was FDOT D4 TSM&O. See attachment at the end.

Hurricane Recovery Open Discussion

The participating agencies shared lessons learned on operations and emergency management from the 2024 hurricane season in the treasure coast, panhandle, and Tampa Bay area. Local examples include the recovery after hurricane Irma where the signal controller cabinets in City of Key West included raising the cabinet bases.

Voting

TSM&O Subcommittee Chair for the next 2 years will be Hector DiDonato from Miami Dade TPO and Brian Ruscher from Palm Beach TPA to serve as Vice Chair for 2 years.

The voting members also approved the TSM&O Subcommittee Schedule 2025 for last Thursday of January, April, July, and October. Calendar invites will be sent to meet in person at the Broward MPO on the following dates:

- January 23, 2025
- April 24, 2025
- July 24, 2025
- October 23, 2025

Upcoming Events

FDOT Transportation Symposium
<https://transportationsymposium.fdot.gov/>
Orlando, FL
November 7-8, 2024

ITE International 2025: Abstracts Due December 3, 2024
Hyatt Regency Orlando, FL
August 11-14, 2025

Safe Streets Summit
West Palm Beach, FL
February 6-7, 2025
<https://palmbeachtpa.org/sss2025/>

Bike Immersion Ride
Miami, FL
February 5, 2025

D4 TSM&O Master Plan Update

Presentation RTTAC TSM&O Subcommittee Meeting

October 24th, 2024



Agenda

- ◆ Introduction
- ◆ Existing Conditions
- ◆ Strategic Network
- ◆ Implementation Strategies
- ◆ Next Steps



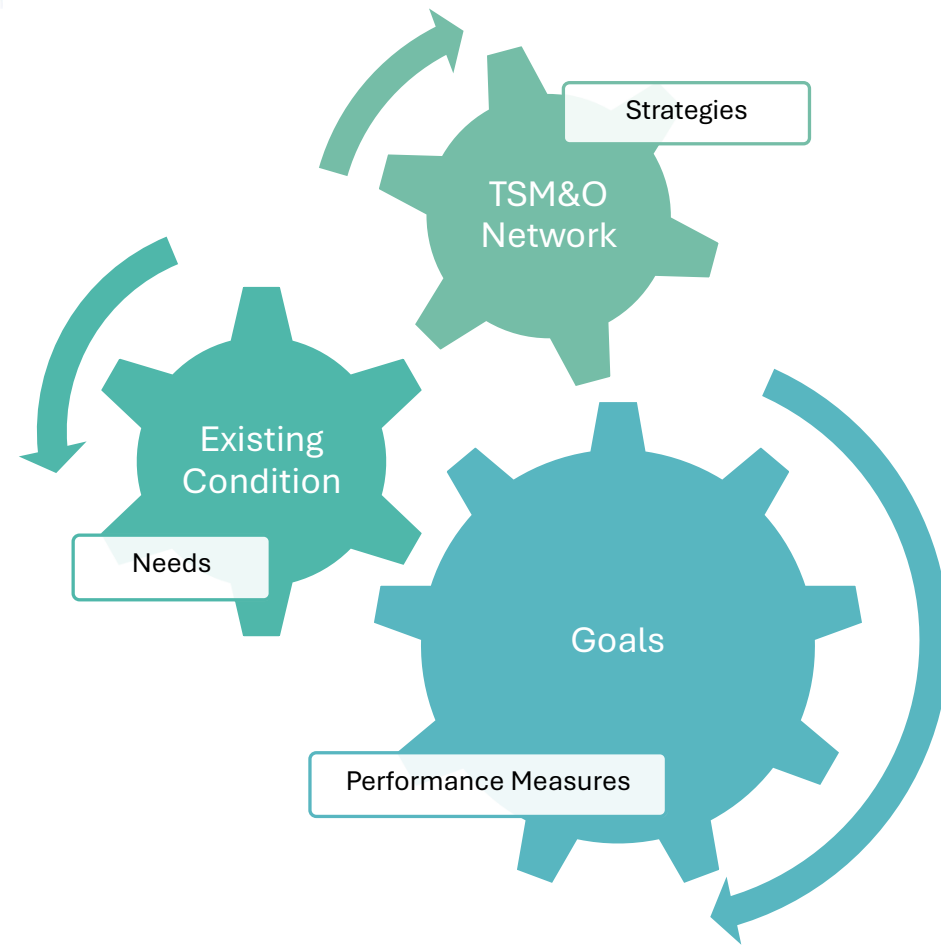
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What is TSM&O?

TSM&O strategies are used to manage the transportation system cohesively and improve mobility through integrated and innovative operations and management solutions that maximize existing capacity to eliminate the need to add capacity.

TSM&O Potential Benefits

- Decreased Travel Time and Delay
- Improved Reliability
- Reduction in Crashes
- Lower vehicle operating costs
- Improved collaboration
- Better agency efficiencies
- Lower implementation costs
- Faster implementation timelines



Intro

Existing
Conditions

Strategic
Network

Strategies

Next
Steps

4 Plan Update - Related Plans and Reports

TSM&O Strategic Plans

- FDOT Central Office TSM&O Strategic Plan 2017
- FDOT District 4 2023 TSM&O Strategic Business Plan 2020

D4 TSM&O Annual Report

- D4 2021 TSM&O Annual Report
- D4 2022 TSM&O Annual Report
- D4 2023 TSM&O Annual Report

Other Districts

- D1 TSM&O Master Plan
- D5 TSM&O Master Plan
- D6 TSM&O Master Plan 2023

Long Range Plans

- Indian River County MPO, 2020
- St. Lucie TPO, 2021
- Martin MPO, 2020
- Treasure Coast Transportation Council (TCTC) 2021
- Palm Beach TPA, 2019
- Broward MPO, 2019
- Southeast Florida Transportation Council (SEFTC)

Intro

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Outreach and Coordination

Stakeholders

- FDOT Central Office
- Turnpike Enterprise
- SEFTC TSM&O Subcommittee, TCTAC
- MPOs
- Counties, Cities
- Florida Trucking Association
- Freight Stakeholders
- FAU Freight Mobility Research Institute
- Transit Agencies

Areas Of Coordination

- Goals, outcomes, performance measures
- Network
- New corridors
- Strategies
- Programming and implementation
- Project Prioritization
- Funding
- Transit strategie

Intro

Existing
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Steps

6 Project Goals & Performance Measure



Safety

Enhance safety for all travelers

- Number of crashes per mile
- Severity of crashes: number of fatalities per mile
- Motorized and Non-motorized crashes
- (Number of) ITS deployment related to: e.g. V2P, Wrong Way Driving Warning



Mobility

Develop tailored mobility of people and goods

- % multimodal trips
- Bicycle/pedestrian integration
- First/last mile
- Truck Services
- Smart multimodal access



Reliability

Improve travel time reliability for motorists, transit users and freight

- V/C ratio, bottlenecks
- Job Accessibility, Dynamic accessibility - peak/off peak
- Travel Time Reliability (TTR)



Information

Boost traveler information resources

- ITS Deployment
 - Dynamic Message Signs (DMS):
 - Availability of DMS color messages.
 - DMS link to weather devices (RWIS)
- FL 511: (number of) incidents reported
- Communications with connected vehicles.



Resilience

Ensure TSM&O network resilience

Resilience to roadway events:

- Roadway clearance
- Number of road rangers
- Severe incident response vehicles
- Rapid incident scene clearance

Weather-related resilience:

- Monitor ITS deployment



Technology

Prepare network and system for emerging technologies

- Test beds, EV, CV
- Urban Air Mobility (UAM)
- Freight, e.g., Freight electrification and platooning

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Existing Conditions

Relation Goals Master Plan Update and
FDOT compass

Existing Conditions	Data availability	Related Goals
Roadway Network	✓	All
Crash Ratio	✓	Safety
Traffic Volumes & Capacity	✓	Mobility, Reliability
Signal Density	✓	Reliability
Bottlenecks	✓	Reliability
Transit Routes & Schedules	✓	Mobility
Truck volume (percentage)	✓	Mobility
Resilience	✓	Resilience
Fiber networks	✓	Information
Work zone management	✓	Reliability
Connected & autonomous vehicles	✓	Technology

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Existing Conditions

0-25%
Low Priority

25-50%
Medium/Low

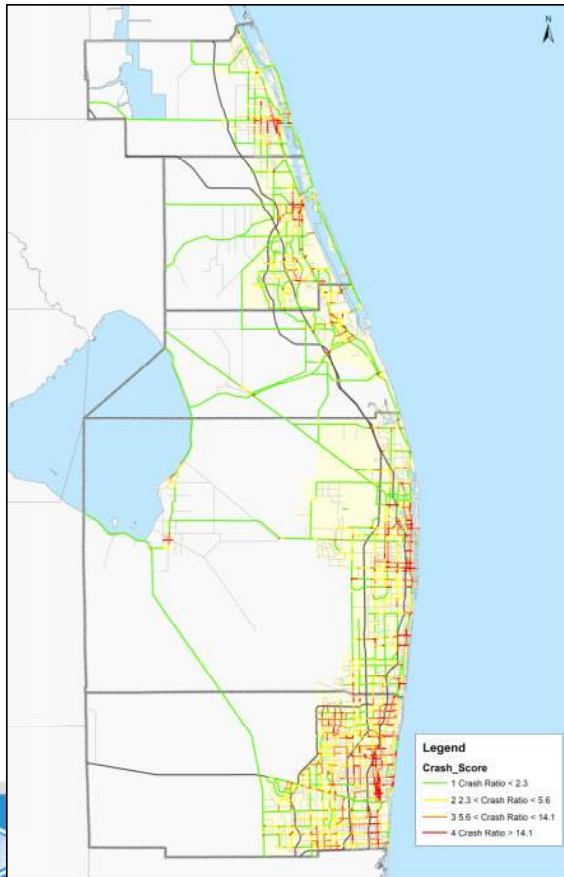
50-75%
Medium/High

75-100%
High Priority

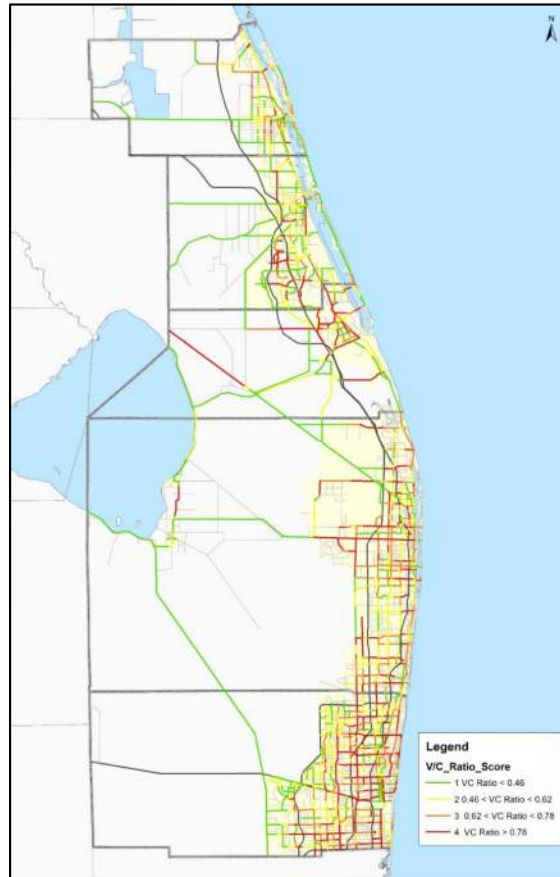
FDOT

TSM&O

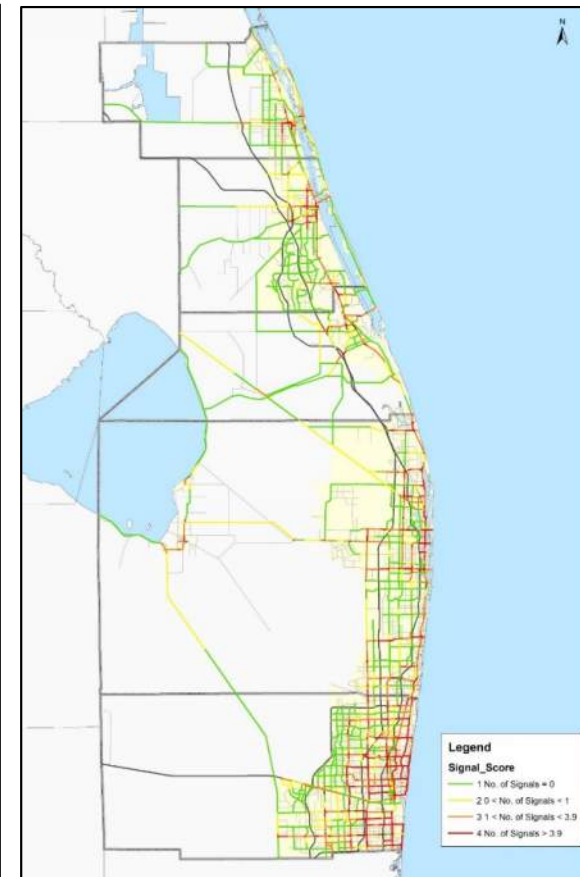
Crash Ratio



Traffic Volumes



Signal Density



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TSM&O Strategic Network

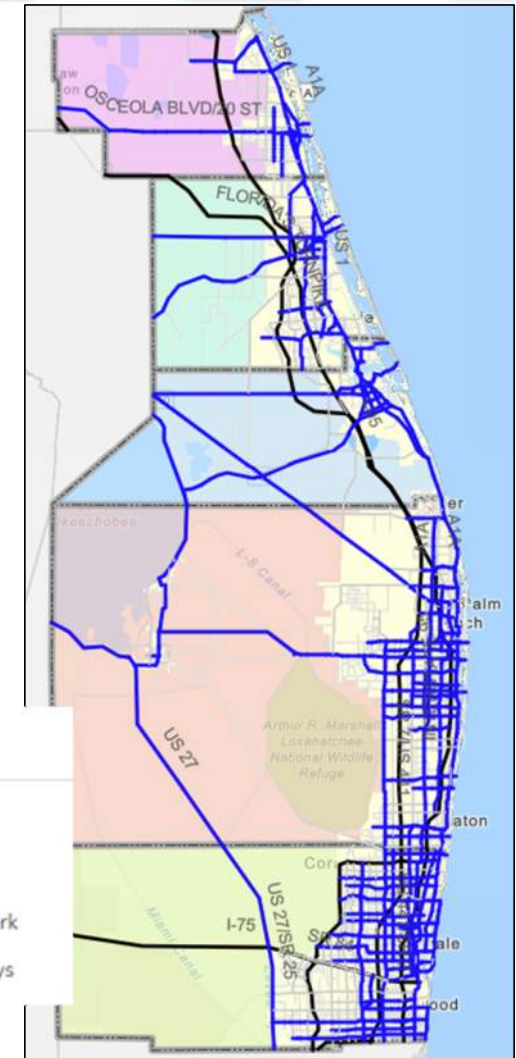
- Score each criterion in quartiles – i.e. 1-4
- Add scores for 7 criteria
- Composite score for all road segments
- Built 'corridors' from segments
- Strategic network = highest need corridors

Legend

D4_TSM&O_Network

TSMO_All_N

- TSM&O Network
- Other Roadways



Intro

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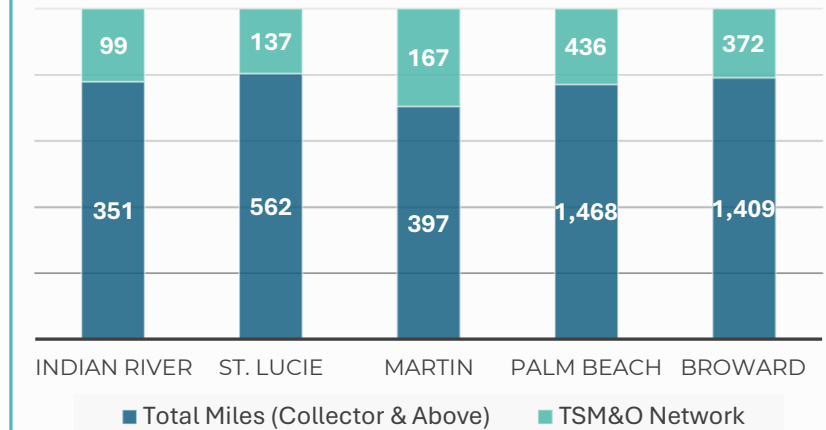
Next
Steps

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TSM&O Strategic Network

County	Total Miles (Collector & Above)	Freeway		Arterial		TSM&O Network	
		Miles	%	Miles	%	Miles	%
Indian River	351	29	8%	164	47%	99	28%
St. Lucie	562	62	11%	271	48%	137	24%
Martin	397	45	11%	215	54%	167	42%
Palm Beach	1,468	91	6%	595	41%	436	30%
Broward	1,409	140	10%	583	41%	372	26%
District 4	4,189	367	9%	1,828	44%	1,211	29%

District 4 Network


FDOT
TSM&O

11 TSM&O Strategies by Facility / Mode

All Facility Types

1. Traffic Management Centers; Active Traffic Management
2. Emergency Transportation Operations, Rerouting
3. Traffic Incident Management
4. Traveler Information/Dynamic Message Signs
5. Predictive Traveler Information
6. Integrated Corridor Management
7. Safety Service Patrols
8. Safety Programs
9. Surveillance/Detection
10. Special Event Management
11. Road Weather Information Systems
12. Connected & Automated Vehicles
13. Smart Corridor
14. Speed Warning and Enforcement
15. Roadway Closure Management
16. Flooded Road Management
17. Travel Demand Management
18. Parking Management Systems, Wayfinding

Freeway Management

19. Electronic Toll Systems
20. Express Lanes, High Occupancy Toll Facilities
21. Dynamic Lane Use Control
22. Adaptive Ramp Metering
23. Reversible Lanes
24. Variable Speed Limits
25. Hard Shoulder Running

Arterial Management

26. Traffic Signal Optimization/Retiming
27. Traffic Adaptive Signal Control
28. Intersection Safety Warning/Collision Avoidance

Work Zones

29. Smart Work Zones

Freight, Rail, Automated & Connected Vehicles

30. Grade Crossing Management
31. Truck Signal Priority
32. Truck Dynamic Rerouting
33. Truck Parking Availability System (TPAS)
34. Commercial Vehicle Information Systems
35. Connected Vehicle Applications – RSU, OBU

Transit and Multimodal

36. Pedestrian Crossing Detection
37. Rectangular Rapid Flashing Beacon (RRFB)
38. Pedestrian Safety Systems
39. Transfer Connection Protection
40. Adaptive & Intelligent Streetlights
41. Drawbridge management
42. Bicycle Alert System
43. Transit AVL & CAD [Automated Vehicle Locator & Computer aided Dispatch]
44. Transit Signal Priority
45. Bus Queue Jump
46. Bus Rapid Transit
47. Onboard Safety and Security Management
48. Dynamic Transit Fare Reduction

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Next Steps

Design Methodology of Implementation Strategies

Identify critical needs

Relate strategies to context class, goals and needs

Review relevance and effectiveness of strategies for segments/facilities with multiple needs

Regional ITS Architecture (RITSA) Updates

Develop and Prioritize Projects

Align groups of strategies to corridor segments by need

Present Recommendations and Obtain Input



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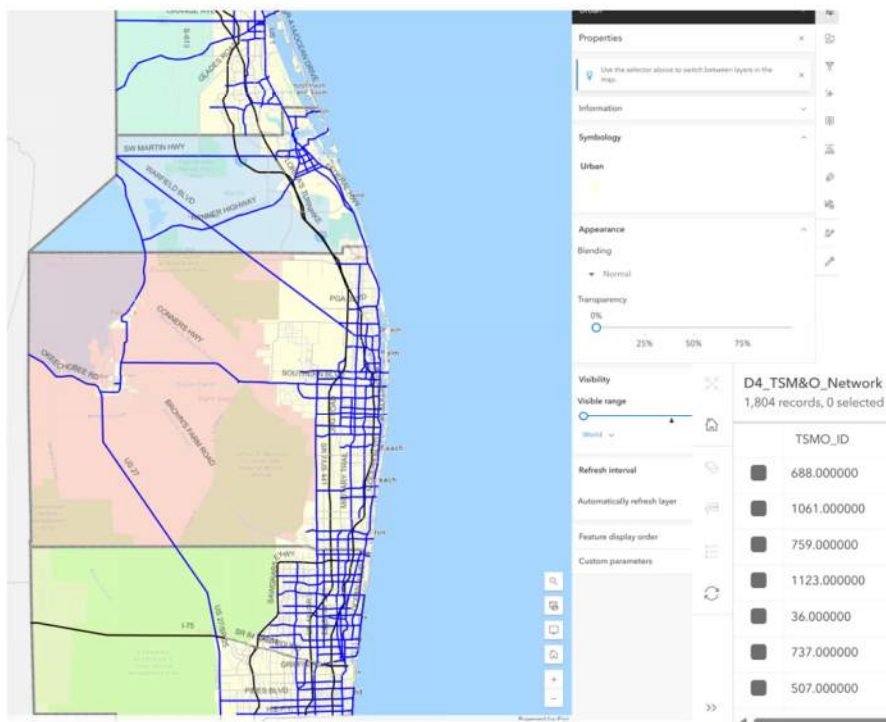


Questions?

- ◆ Kent Walia kent.walia@dot.state.fl.us
- ◆ Alexandra Lopez alexandra.lopez@dot.state.fl.us
- ◆ Nicholas Slupecki nicholas.slupecki@dot.state.fl.us
- ◆ Peter Haliburton phaliburton@ctseinc.com
- ◆ Lissy La Paix Puello llapaix@ctseinc.com

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GIS Viewer



PALM BEACH

Table Zoom to

FIPS_COU_1	99
WATER_1	0
OBJECTID_1	9513.000000
SHAPE_AR_1	5020382554.390000
FID_urba_1	59
OBJECTID_2	60
NAME_12	Miami
SHAPE_LE_1	534840.738030
SHAPE_AR_2	4096044029.610000
Shape_Area	1767137583.835938
Shape_Length	616292.687651

1 of 2

- <https://www.arcgis.com/home/item.html?id=2cd295db6f98451fa6f157fc2fc7e568>

Digital Twins For Traffic Management Systems, Vehicle Connectivity, And Automation

Mohammed Hadi, Ph.D., PE
Md Mahmud Hasan Mamun
Florida International University



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What is a Digital Twin

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- ▶ A virtual model of human, devices, products, systems, and/or processes
 - ▶ is dynamically updated with data from its physical twin
 - ▶ has a predictive capability (e.g., simulation and/or AI)
 - ▶ Informs decisions
 - ▶ Involves bi-directional interaction between the virtual and the physical environments



Digital Twin Components



- ▶ Physical object(s)
 - ▶ Real-world (e.g., sensors, CV equipment, drivers on the road)
 - ▶ Software-in-the-loop
 - ▶ Hardware-in-the-loop
 - ▶ Human-in-the-loop
- ▶ Virtual object(s)
 - ▶ Simulation including multiple simulation platforms and extension of simulation
 - ▶ AI for monitoring, diagnosis, prediction, and decision making
 - ▶ Other computational techniques depending on the use case
- ▶ Bi-directional information and data connections





Digital Twin Benefits



- ▶ Allows the identification of performance, errors, and issues prior to real-world occurrence
- ▶ Allows testing of devices, standards, and processes
- ▶ Provides predictive capabilities
- ▶ Provides assessment of current and past history
- ▶ Supports optimal resource utilization
- ▶ Can be used in workforce development/training
- ▶ Reduce cost of development and testing

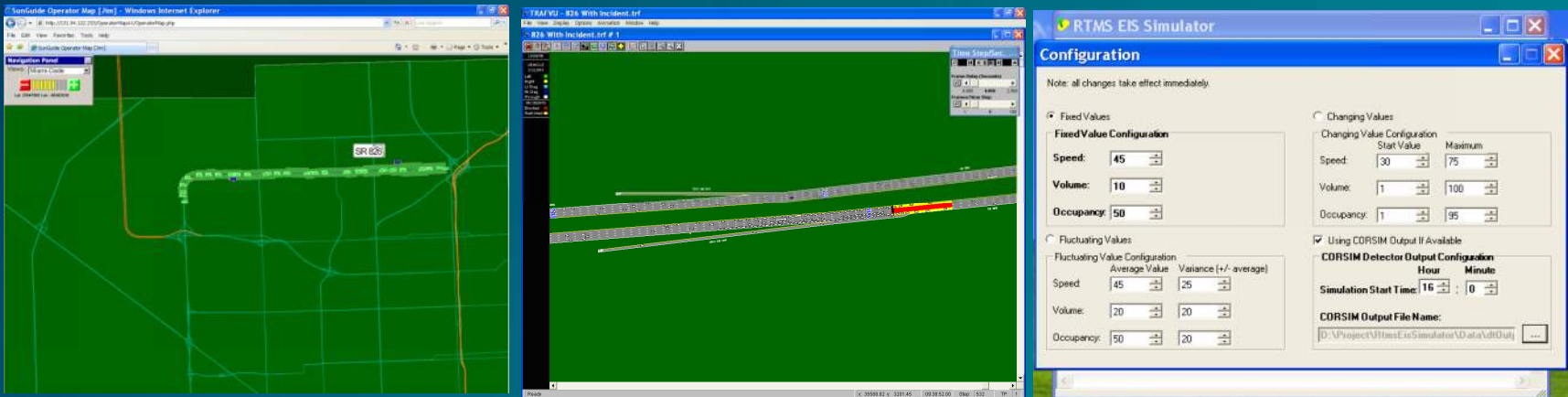


FIU Related Research



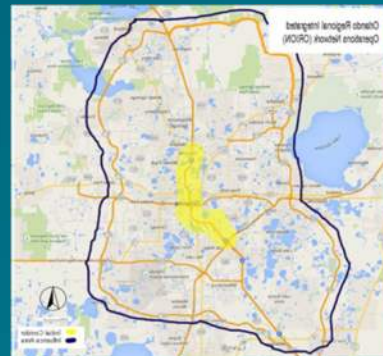
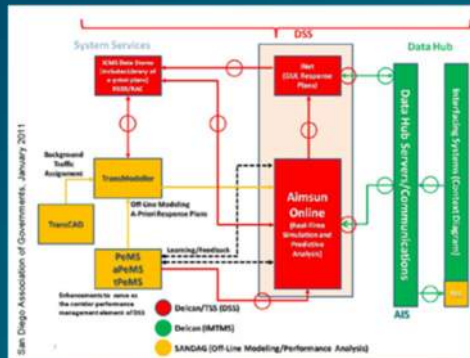
Traffic Management Simulation Development (SunSim)

- ▶ One of the early research on the subject (Research Center Project 2010-12)
- ▶ Data streams from the virtual detectors in CORSIM were converted to emulate microwave detector data in real-time operations
- ▶ Used for testing RTMS drivers, incident module in SunGuide, and the prediction of incident impacts.

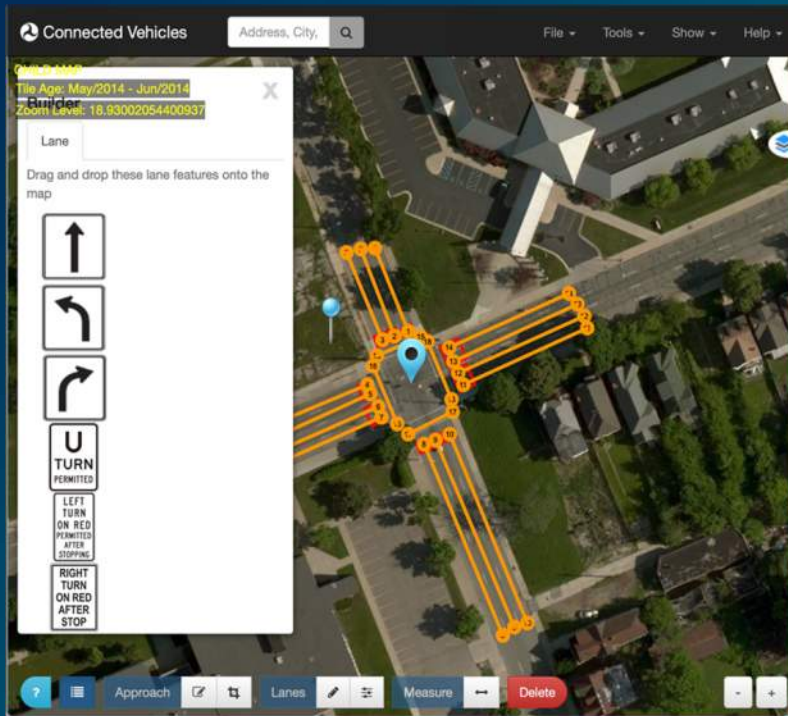


Review and Assessment of Traffic Management DSS and STP

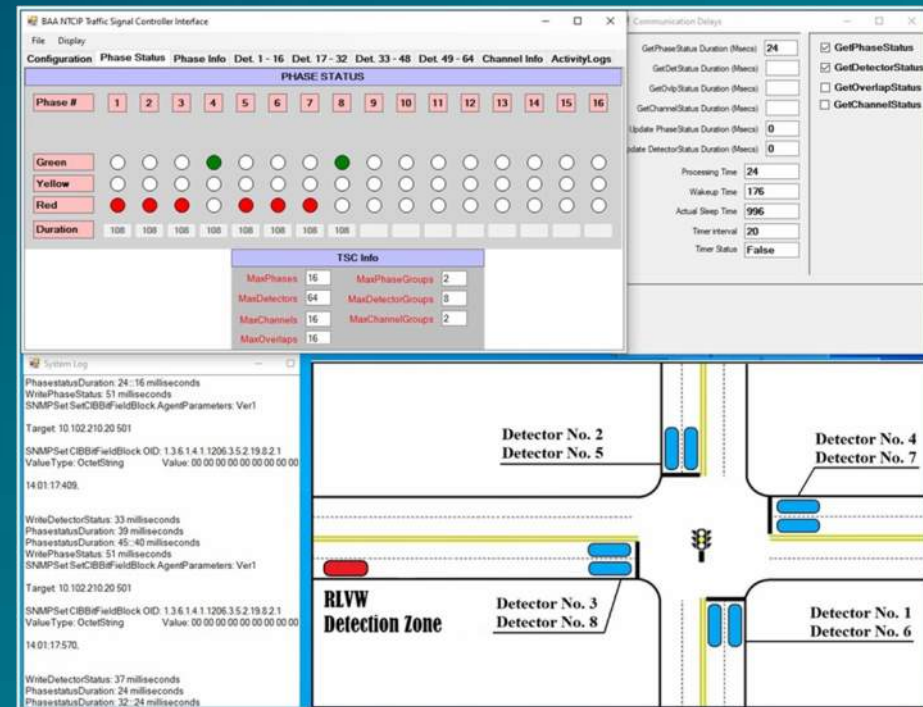
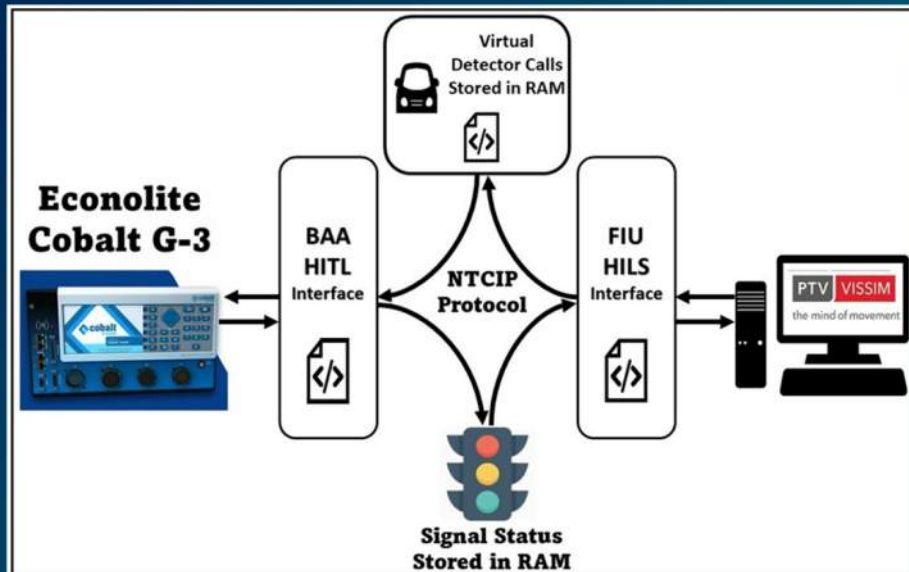
- ▶ FHWA and FDOT Projects
- ▶ Assess current state of practice, applicability, feasibility, and effectiveness of Decision Support Systems and Short-Term Prediction based on machine learning and simulation.
- ▶ Identify methods to support the decisions associated with ICM.
- ▶ Assess the capability needed to support ICM decisions



Hardware-In-the-Loop (HIL) Testing Environment

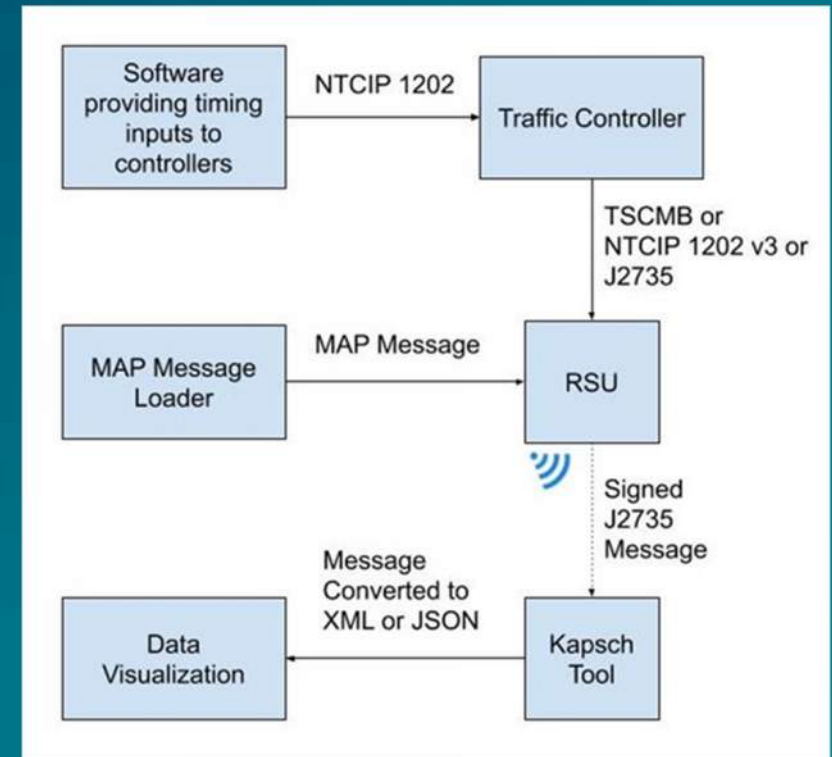


:::::HIL Simulation Data Flow and Interface :::::



Message-Level Application Requirements

- ▶ Three applications:
 - ▶ SPaT/MAP messages to support Red Light Violation Warning (LRVW)
 - ▶ Emergency Vehicle Preemption (EVP) using SRM/SSM messages, and
 - ▶ Work Zone Warning (WZW) and Reduced Speed Zone Warning And Lane Closure (RSZW/LC) using TIM messages
- ▶ Based on available national requirements



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Driving Simulator

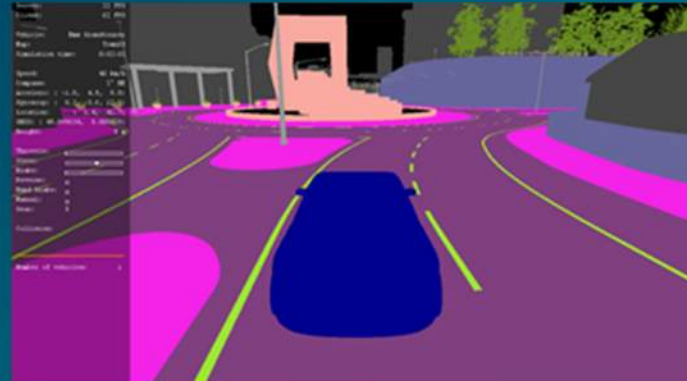
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Automated Vehicle Research

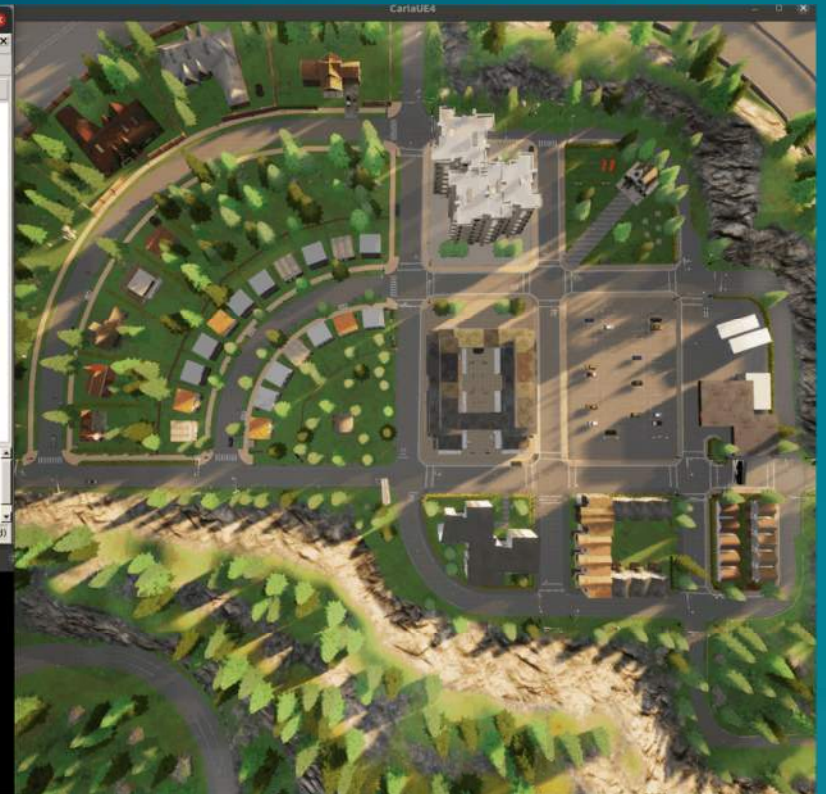
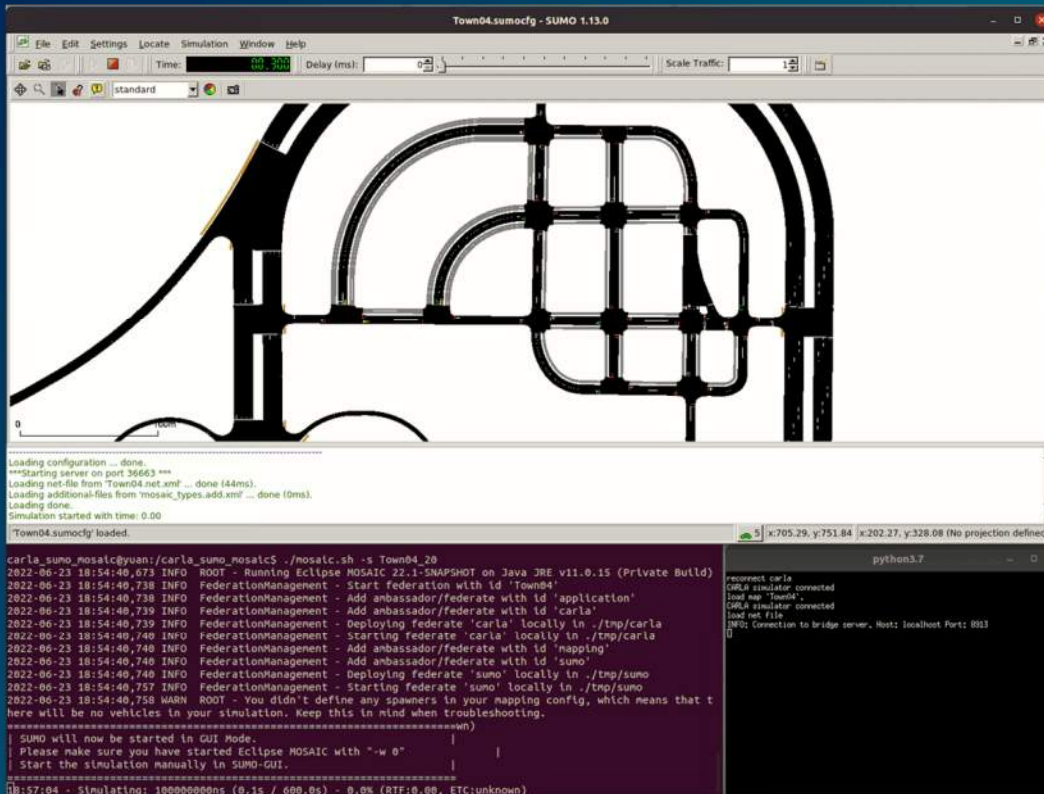
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Co-Simulation

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Digital Twin for Connected, Safe and Reliable Travel in an Urban Network in the Presence of Work Zones and Special Events

Presenters Md Mahmud Hasan Mamun, Jasmine Hadi, and Nattakarn Surangsirout

Advisor Dr. Mohammed Hadi, PE, Professor, Florida International University

In Collaboration Florida Department of Transportation District 4, and City of Fort Lauderdale, Florida



Source: DougBennett and meshaphoto from GettyImages



Team Members



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FDOT District 4



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Mariam De Celis

Engineering Tech
at Choice Engineering
Florida International University



Presentation Outline



01 Background

04 Implementation

02 Problem Statement

05 Potential Benefits

03 Proposed Solution

06 Next Steps

01 Background



Source: Kichigin from Canva.com

Background

- The City of Fort Lauderdale is one of the largest and most visited cities in South Florida with major events scheduled throughout the year.
 - The city is seeing major updates to its transportation system infrastructure with many work zones across the City.
- FDOT District 4 TSMO program has implemented incident management, ramp metering, managed lanes, and other advanced management strategies.
 - The City of Fort Lauderdale works with the FDOT on managing roadway construction and special events.

02 Problem Statement



Source: Liliia Bila from GettyImages.com

Problem Statement

Roadway
Construction
Activities



Special Events



Increased in

- Crashes
- Delays
- Vulnerable Road User Issue
- Unreliability
- Parking Issue

- **There is a need for a decision support system** at the FDOT District 4 traffic management center and the City of Fort Lauderdale, Florida **to ensure safe and efficient operations and work zone activities.**



Source: ivandesign from Canva.com



Source: RyanOverman from GettyImages.com

Example of Work Zone Impacts

- The Henry E. Kinney Tunnel in Fort Lauderdale, Florida.
- The construction started on September 7, 2021.
- The travel time and crash data were collected for a 1-mile segment on US-1 in the vicinity of the work zone.

HERE
Travel Time Data

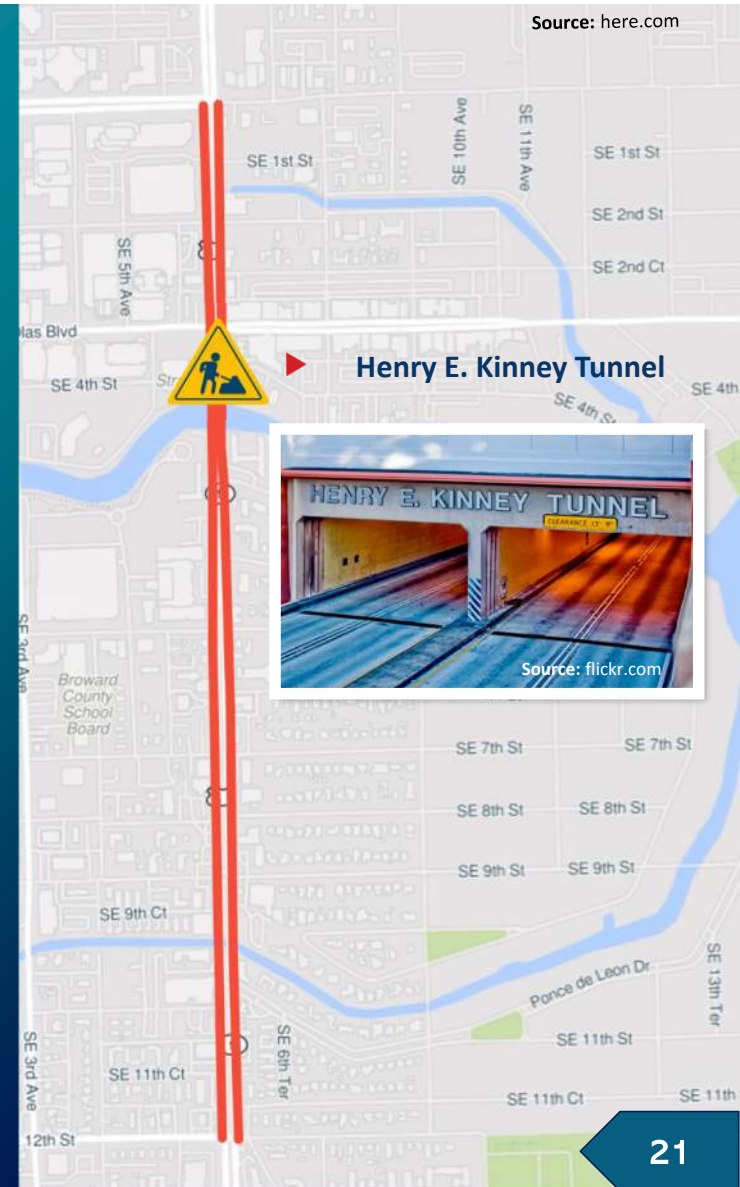


Source: here.com

Signal Four
Crash Data



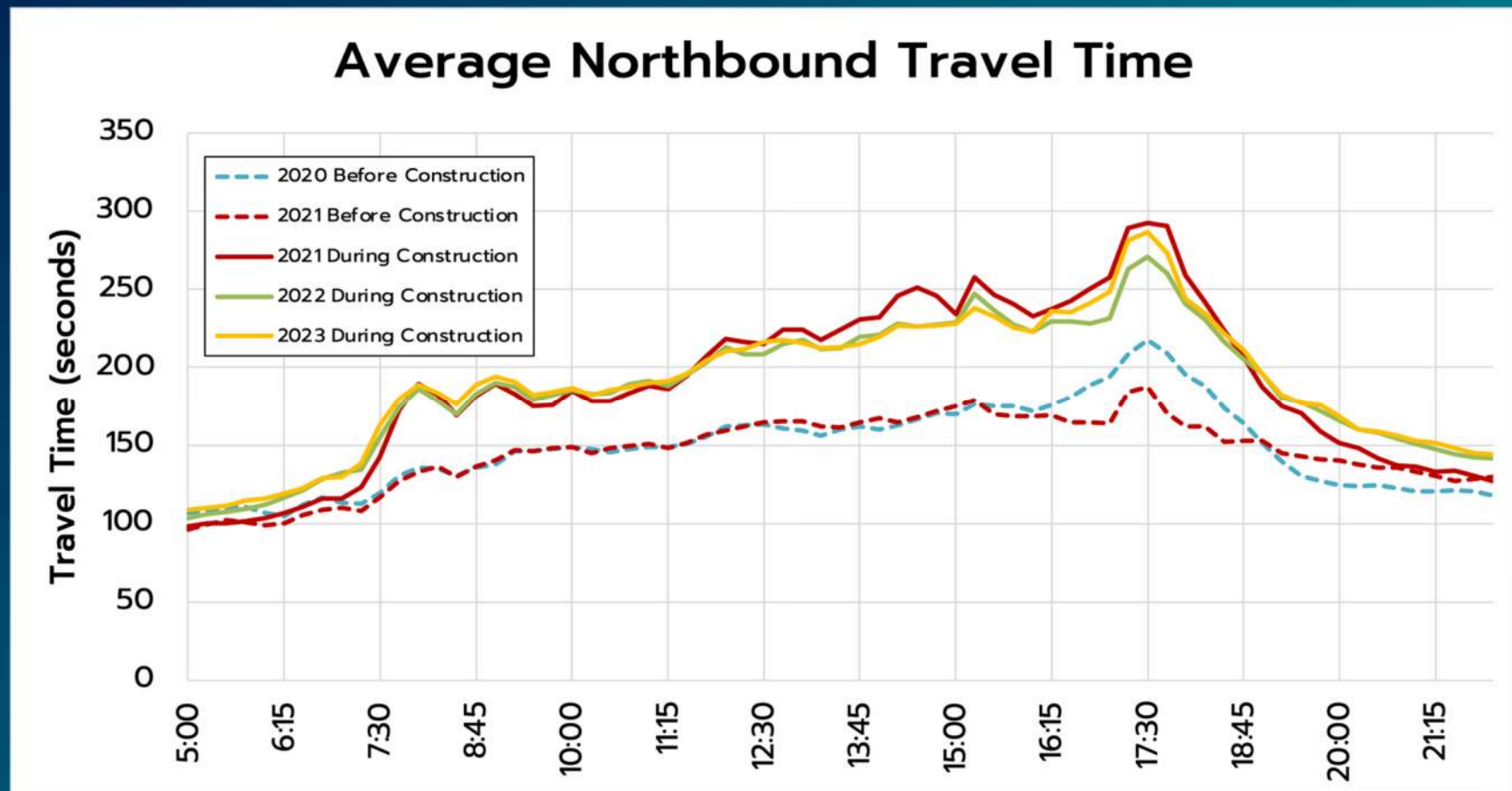
Source: signal4analytics.com



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Travel Time Impacts

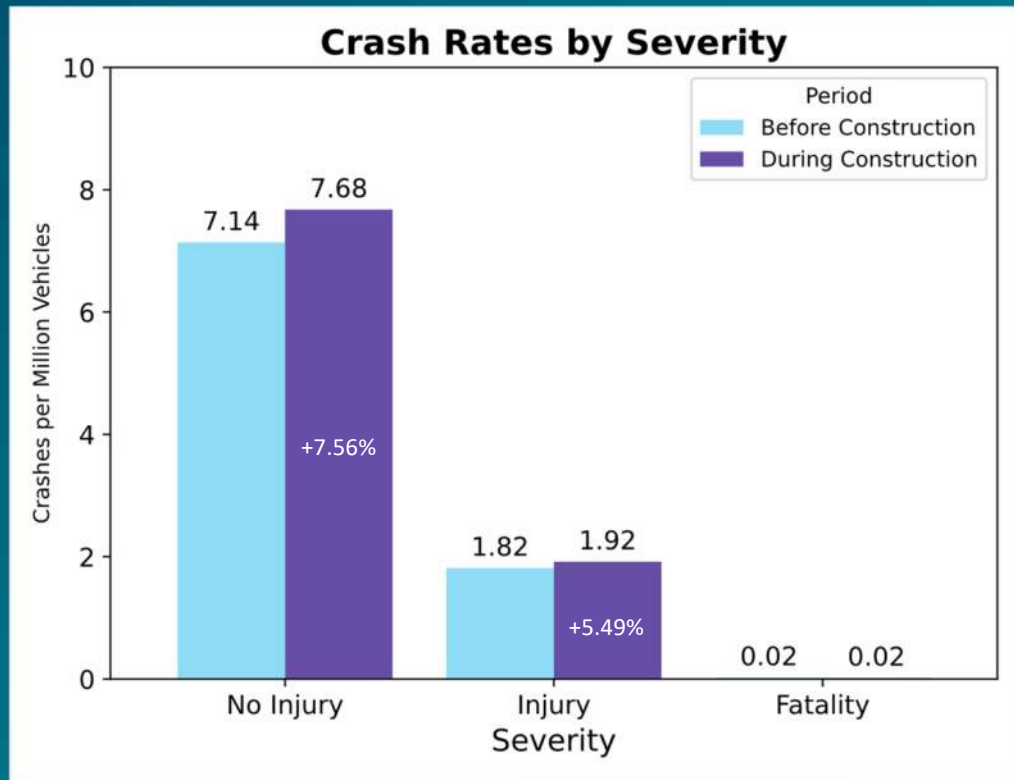
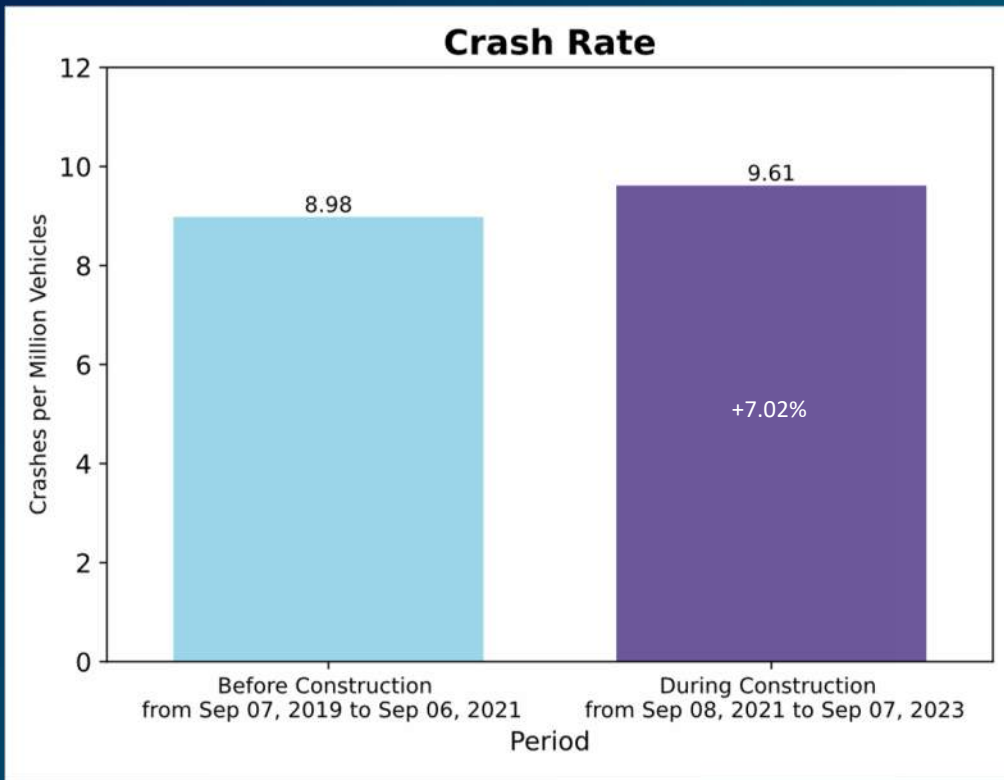
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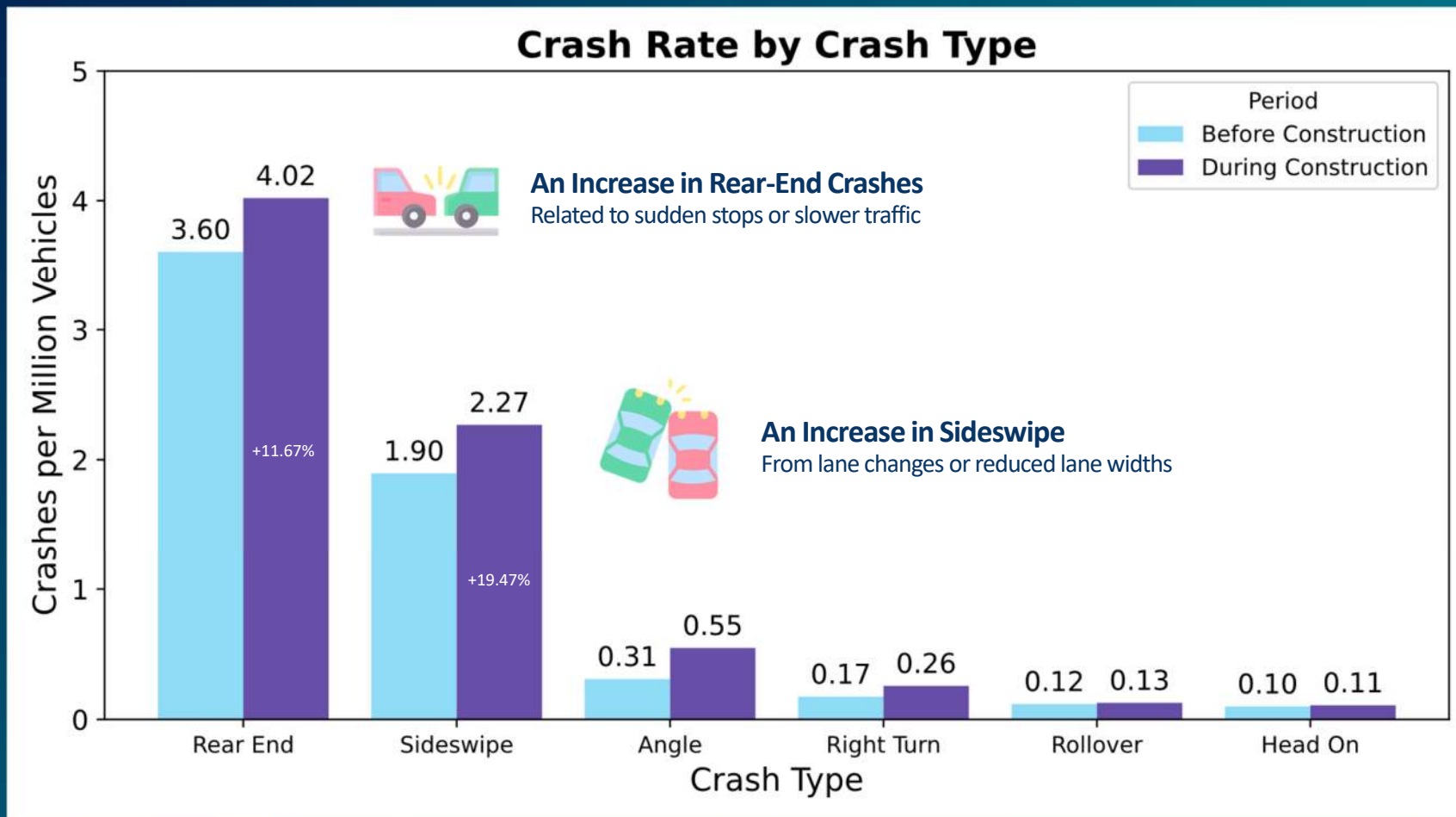
Example Safety Impacts

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Safety Impacts by Crash Type



03

Proposed Solution



Source: studioprofan from Canva.com

Digital Twin for Work Zone Connectivity and Management

Bi-directional Interaction and Data Exchange

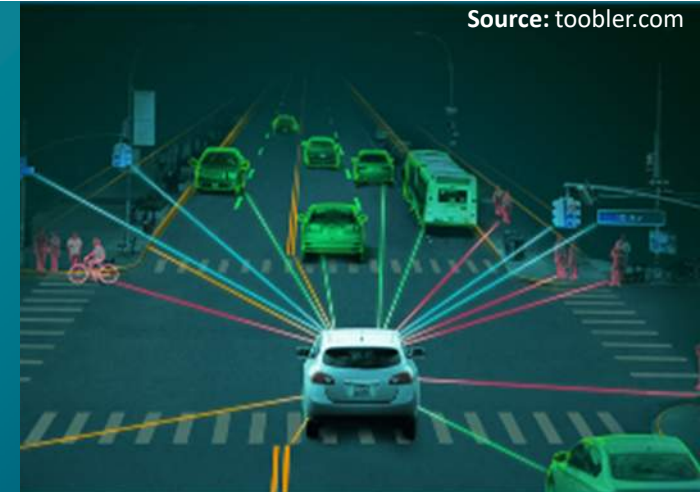
- Exchange data between the virtual and the physical components.

Predictive Capabilities Using Simulation and AI

- Leverages AI algorithms to analyze historical and real-time data and predict future scenarios.
- Utilizes co-simulation to forecast potential issues and outcomes for those predicted scenarios.

Decision Support System

- Informs decisions based on duplicating and recreating the actions and dynamic changes in simulation.



Source: toobler.com



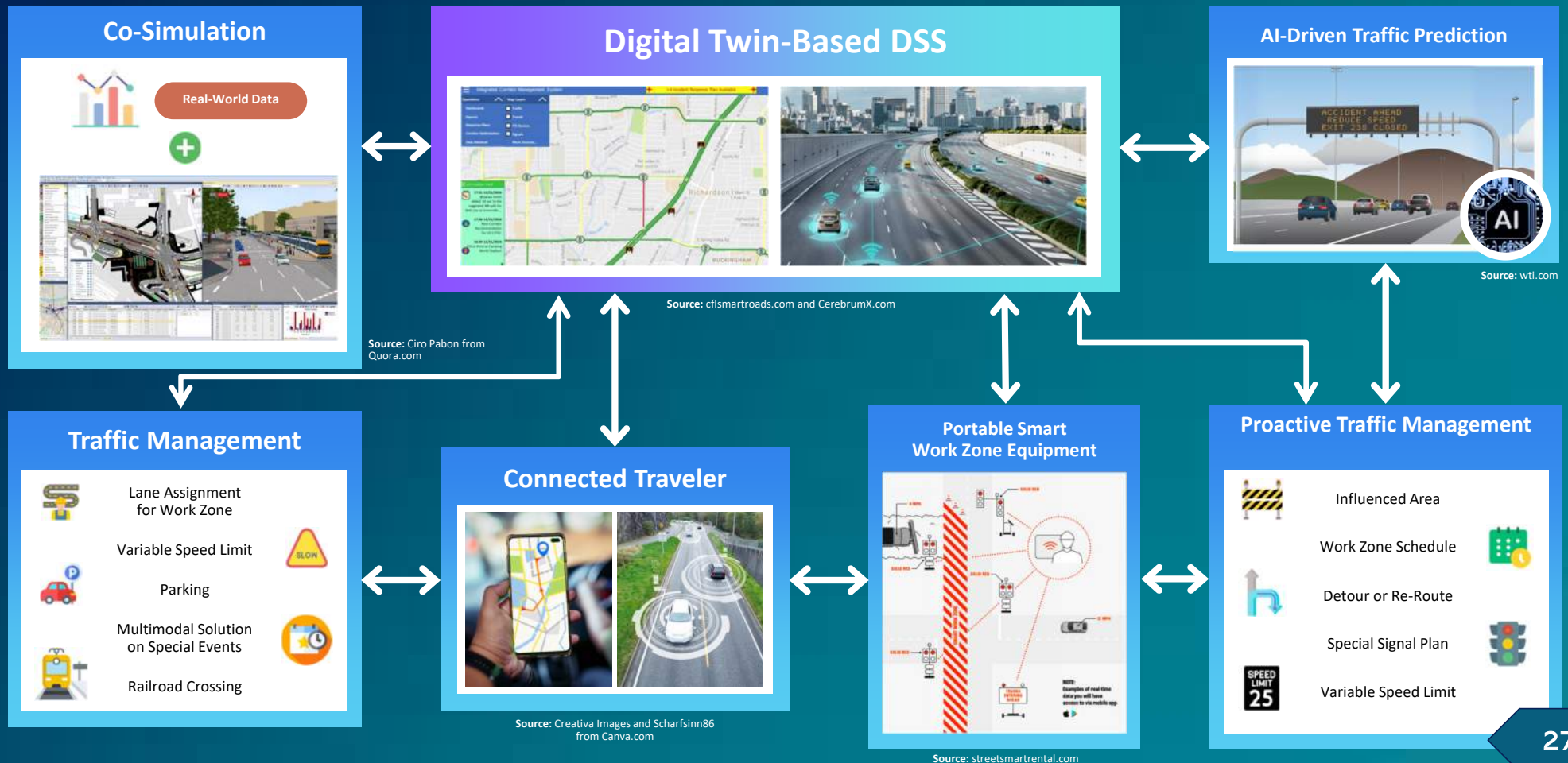
Source: L Yoon and Yi. (2022)



Source: Jasmine Hadi



Proposed Solution



04

Implementation



Source: ljubaphoto from GettyImages.com

ITS Service Package



Maintenance and Construction

- MC06: Work Zone Management
- MC07: Work Zone Safety Monitoring



Traveler Information and Personal Mobility

- TI01: Broadcast Traveler Information
- TI02: Personalized Traveler Information
- TI03: En-Route Guidance



Traffic Management

- TM01: Infrastructure-Based Traffic Surveillance
- TM02: Vehicle-Based Traffic Surveillance
- TM03: Traffic Signal Control
- TM06: Traffic Information Dissemination
- TM20: Variable Speed Limits
- TM21: Speed Harmonization



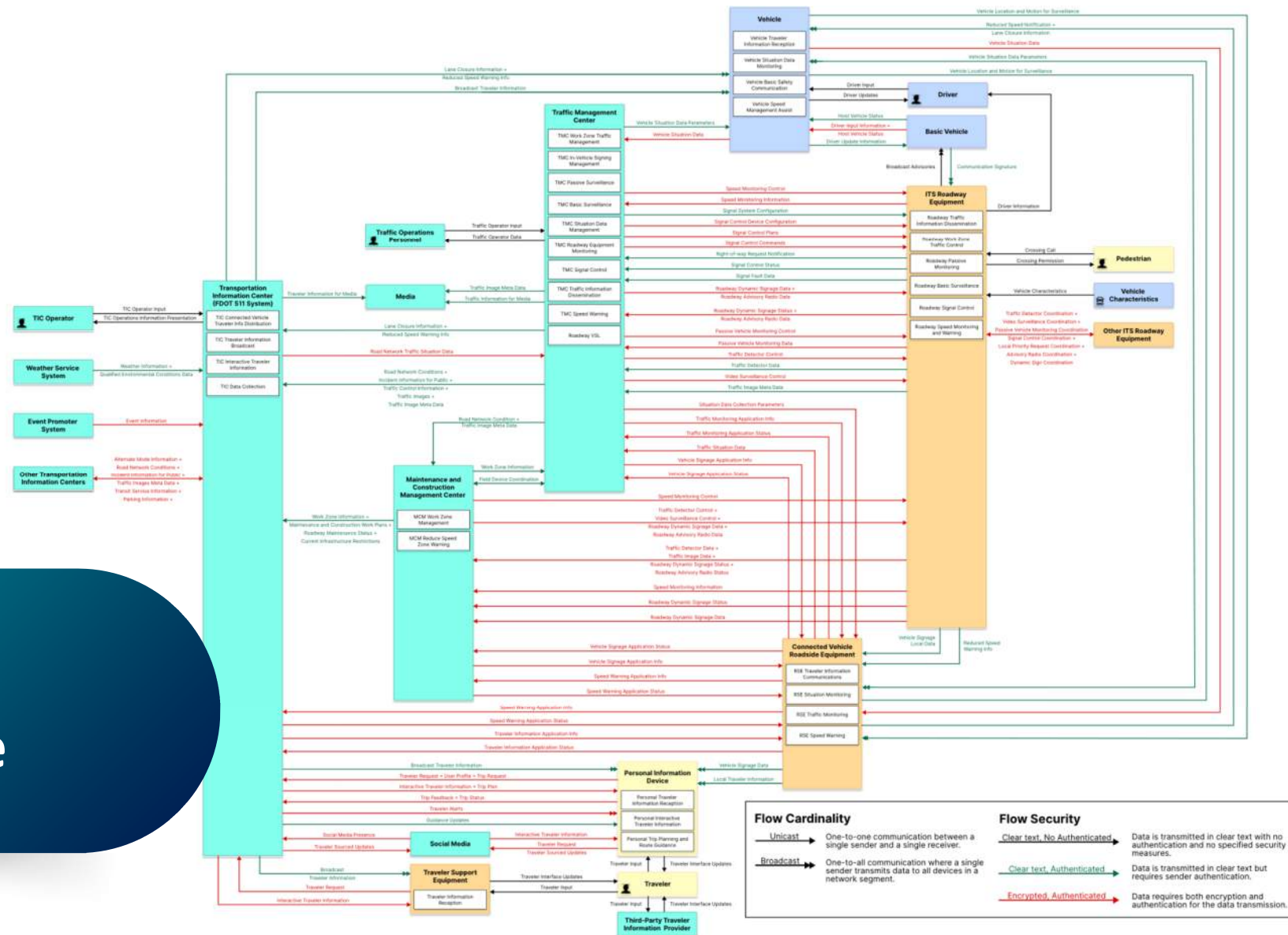
Vehicle Safety

- VS09: Reduced Speed Zone Warning or Lane Closure

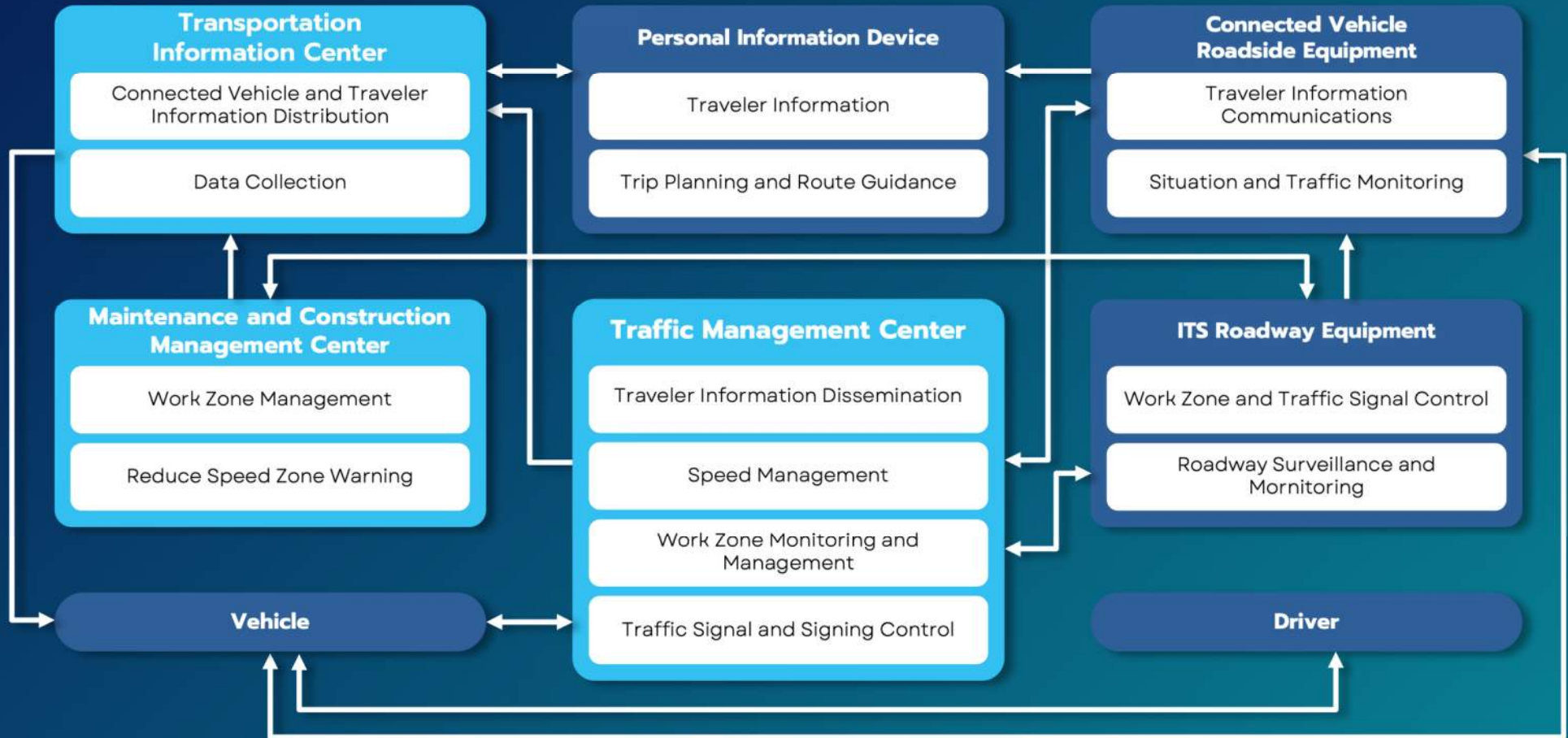


ITS Architecture

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Simplified ITS Architecture





Stakeholders



The City of Fort Lauderdale

Source: sketchify from Canva.com



FDOT District 4



Broward County



Traffic Management
Center Operators

Source: Mangostar Studio from Canva.com



Information Provider

Source: Sonny Sandra from IconbySonny and ivandesign from Canva



Other Regional Stakeholders

Cost Breakdown

Portable Equipment

Smart Work Zone Management
Special Event Management

\$700,000

Management Support System

Digital Twin Development

\$400,000

System Integration

\$100,000

Traveler Information System

Smartphone Application

\$100,000

Operation and Maintenance

\$130,000 (per year)

10% of the capital costs

Contingency

\$ XXXXXX

XX% of XXXXX



Source: wanco.com



Source: northamericatrafic.com



Source: coralsales.com

Implementation Timeline

Description	Duration	2024					2025								
		AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP
Developed Requirements, Specification, and Design	3 months														
Data Collection	2 months														
Data Preparation	2 months														
Smartphone Application Development	4 months														
Digital Twin & Decision Support System Development	6 months														
Portable Equipment Installation/Integration/Testing	4 months														
Verification, Validation, and Evaluation	3 months														

05

Potential Benefits



Source: Varel'ii Honcharuk from Canvas.com



Potential Benefits



Safety



Lower Crash Rates

Safe driving behavior was increased by **44%**

82% of drivers were able to react to slow or stopped traffic



Mobility

Congestion decreased by **30%**

Delays were reduced by up to **90%**



Improve Traffic Flow



Environmental

Proactive Traffic Management **Minimizes:**



Energy Consumption



Emissions



User

95% of drivers support using Smart Work Zone systems

Source:

The benefit database of the USDOT ITS Deployment Evaluation website

06

Next Steps



Source: Andrii Yalanskyl from GettyImages.com



Next Steps



1



System Design

Source: Milan_Jovic
from GettyImageSignatures.com

2



Pilot Deployments

Source: Jasmine Hadi

3



Outreach

Source: shironosov
from GettyImages.com

4



Evaluation

Source: BeeBright
from GettyImages.com



Thank You!



Source: honglouwawa from Getty ImagesSignature.com