Orlando, FL

November 7-8, 2024

2024 TRANSPORTATION SYMPOSIUM

Motorcycle Safety in Florida

James Landini, P.E.

FDOT – TSM&O Program Development Engineer

FDOT

Introduction

- **James Landini:**
- James.Landini@dot.state.fl.us
- TSM&O Program Development Engineer
- Motorcycle Safety Coalition member
- Motorcyclist since 1998

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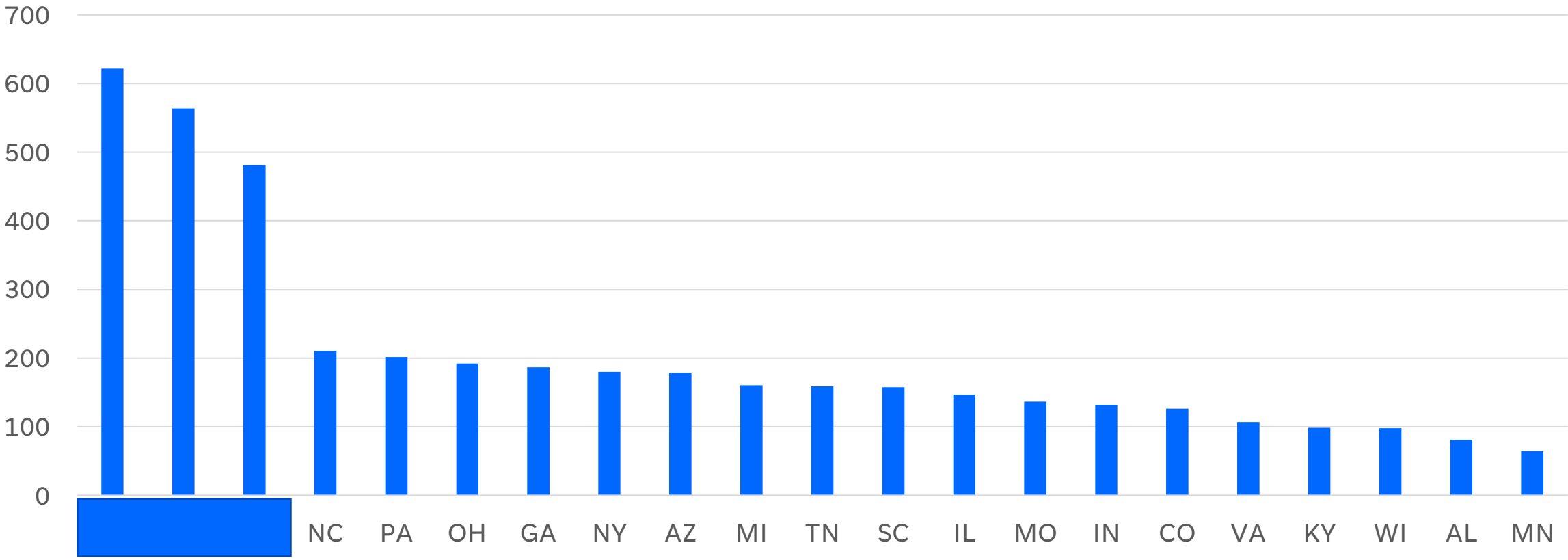
Florida Motorcycle Population

Image: Daytona Bike Week 2019

- The number of motorcyclists in Florida is growing. In 2022, Florida had:
  - 1.4 million motorcycle endorsements
  - Over 640,000 registered motorcycles
- Florida hosts several major motorcycle rallies that attract riders from all over the U.S.
  - Daytona Bike Week
  - Biketoberfest (Daytona)
  - Leesburg Bike Fest
  - Thunder Beach (Panama City Beach)

Annual Motorcyclist Fatalities by States (2018-2022 Avg.)



Source: https://cdan.dot.gov/STSI/stsi.htm#

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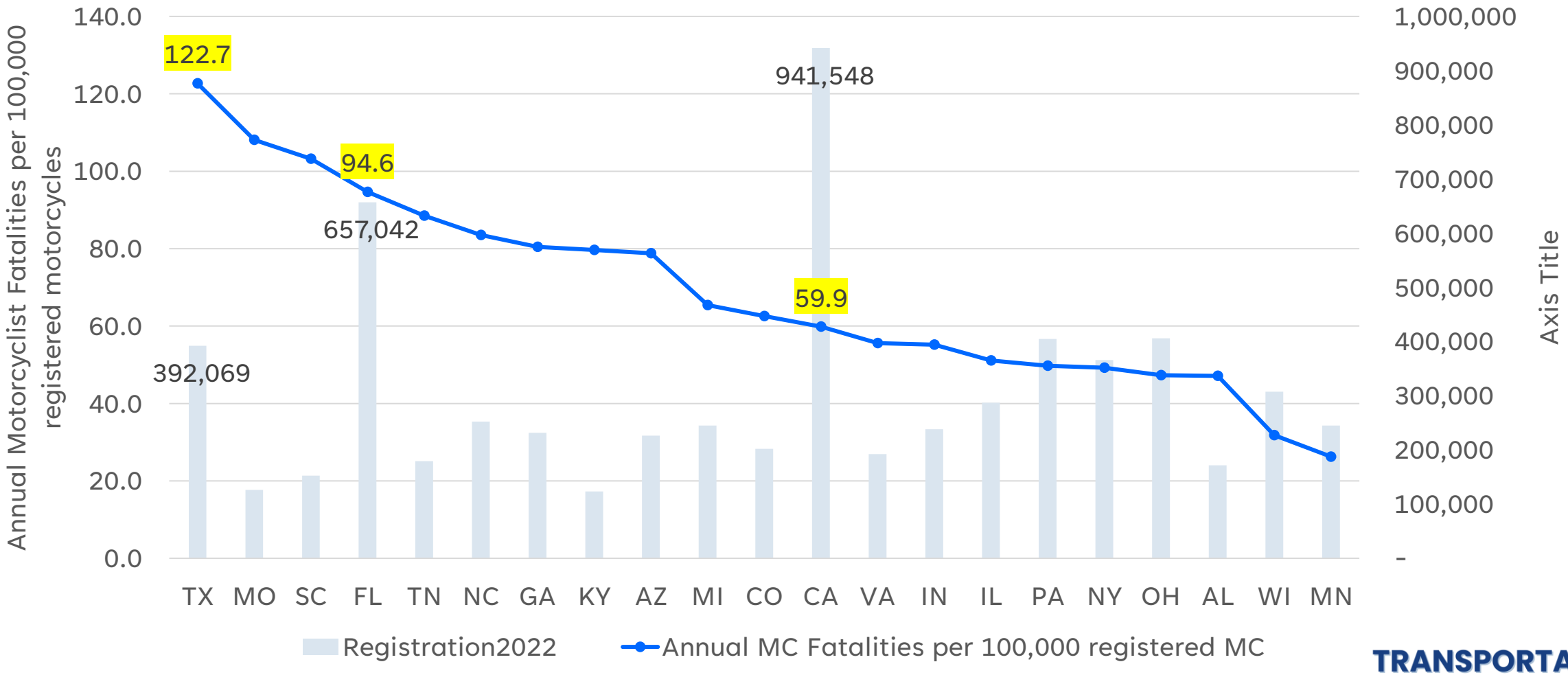
Motorcyclist Fatalities per 100,000 Registered Motorcycles by State



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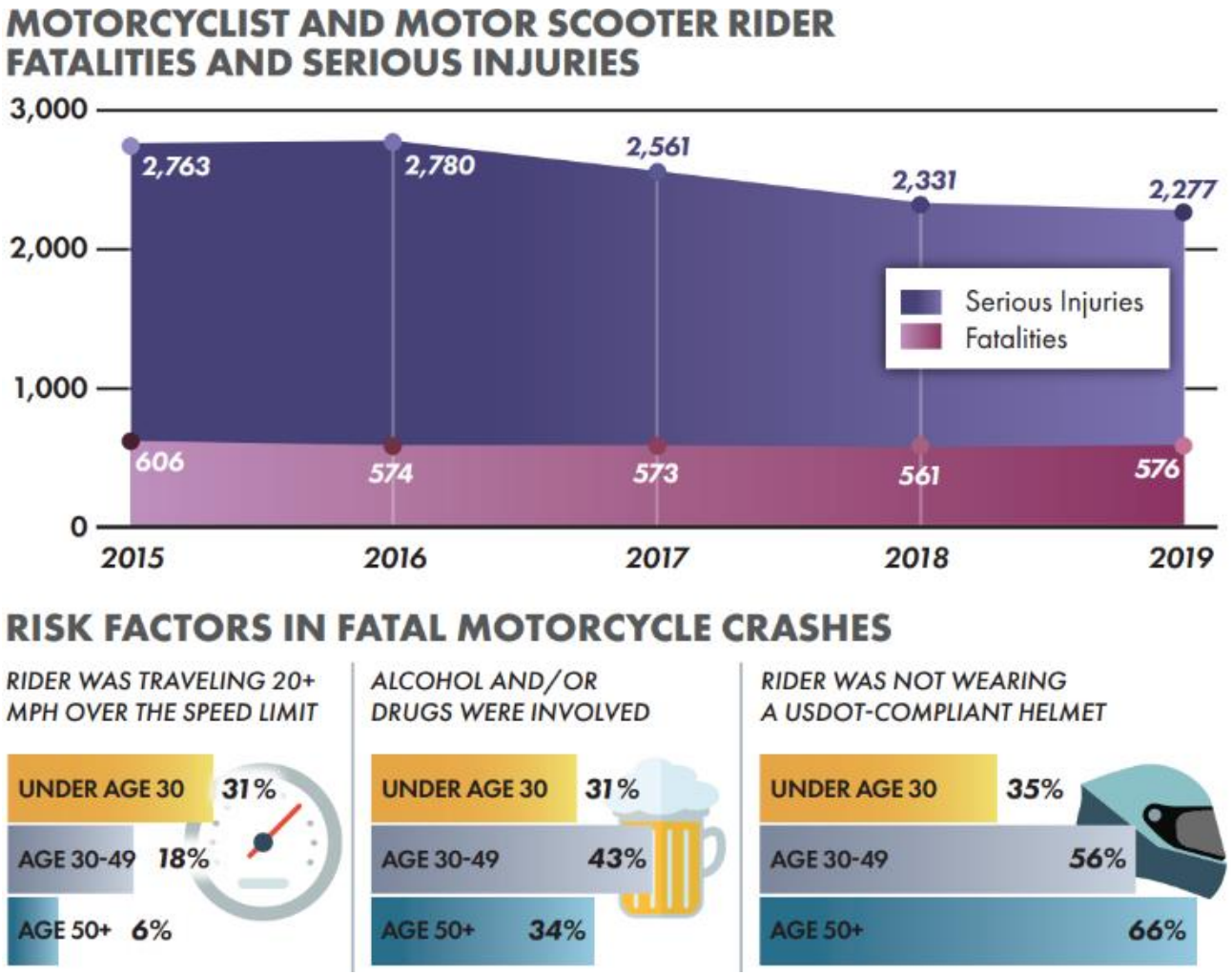
Motorcycle Crashes (Between 2015 and 2019)



- Motorcycles and motor scooters made up about **3%** of Florida's annual motor **vehicle registrations**.
- Motorcycles and motor scooters represented **19%** of the state's **annual traffic fatalities**.

Source: FDOT 2021 Strategic Highway Safety Plan

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Motorcycle Types

Cruisers mimic the style of American motorcycles from the 1930s and 1960s, such as Harley-Davidsons and Indians.

Scooters or motor scooters have a step-through frame and a platform for the rider's feet.

Sport/Supersport motorcycles are consumer versions of racing motorcycles. They are light weight and capable of high speeds.

Touring/ Sport Touring are large bikes with powerful engines, built for long-distance rides with room for passengers or luggage.

Off Road/ Dual Purpose are street-legal motorcycles that are designed for on and off-road use.

https://www.iihs.org/topics/motorcycles#motorcycle-types

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We can all help drive down fatalities

- Determine the safety issues within the roadway network
- Allows engineer to make evidence-based decision making
- Allows us to answer the question how can we bring down fatalities.
- **Caution: Correlation does not imply causation**

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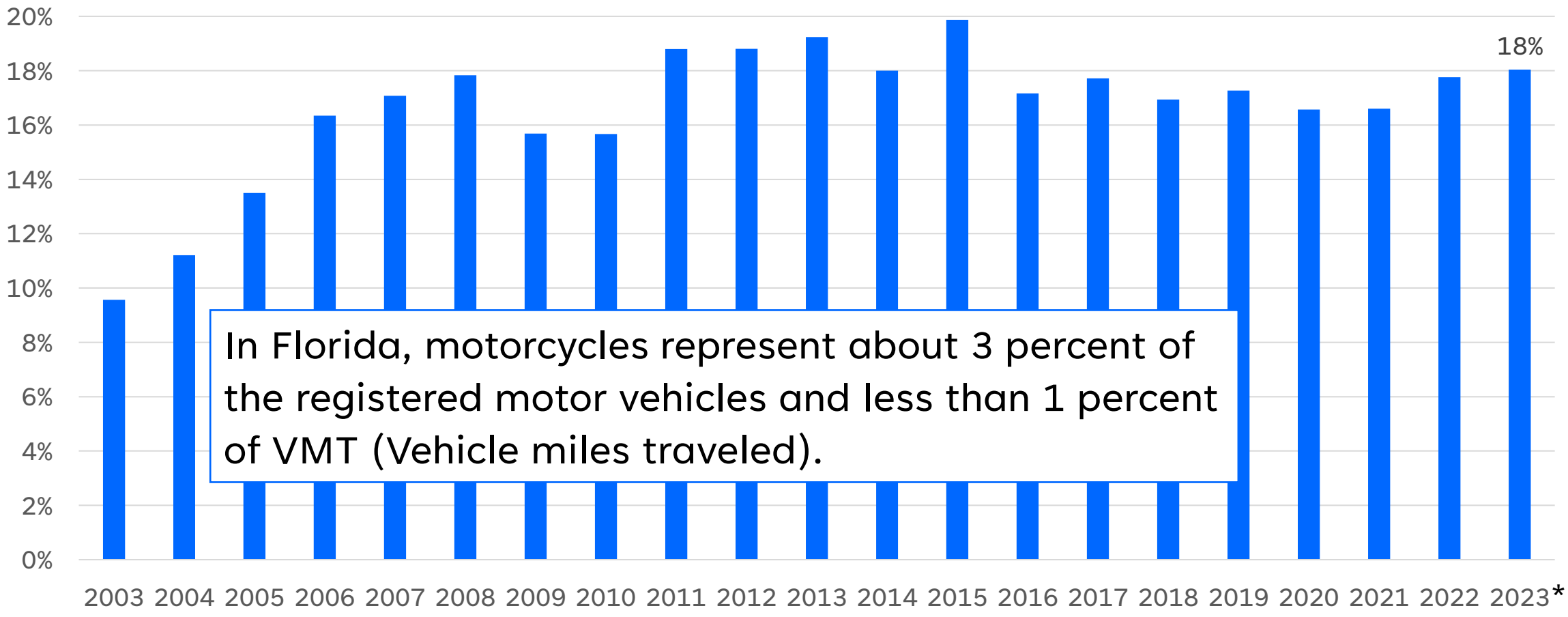
Proportion of MC Fatalities in Annual Traffic Fatalities in FL



In Florida, motorcycles represent about 3 percent of the registered motor vehicles and less than 1 percent of VMT (Vehicle miles traveled).

* Preliminary Data

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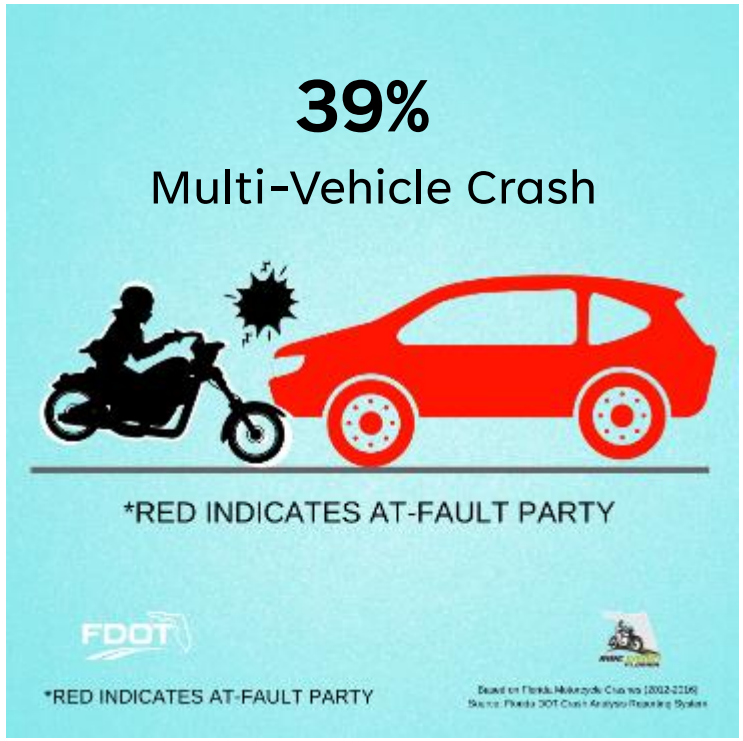
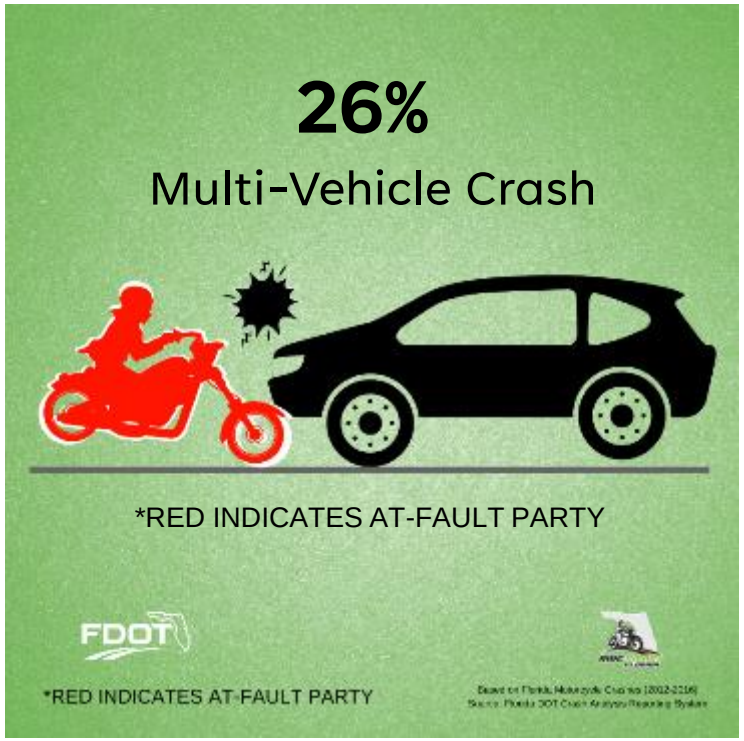
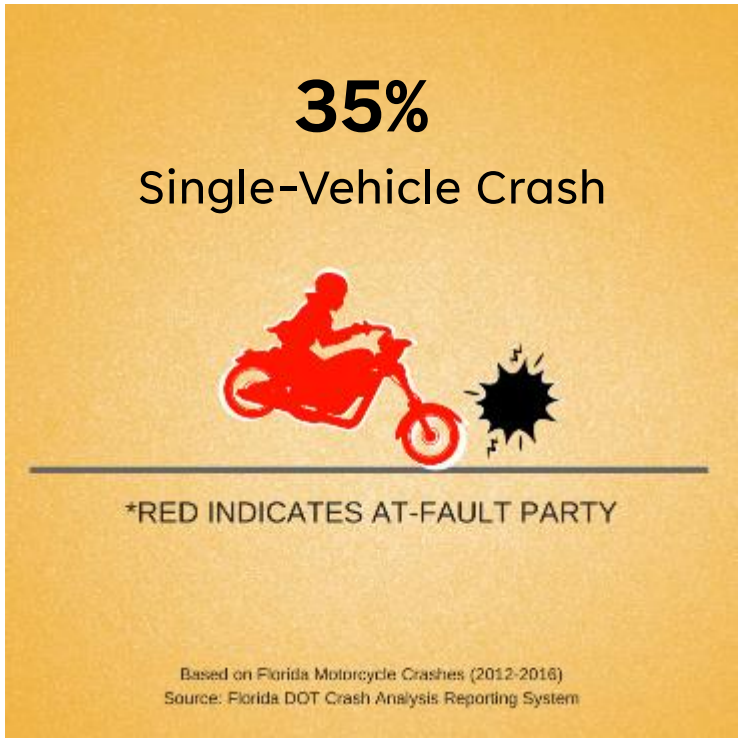
Motorcycle Crashes Breakdowns







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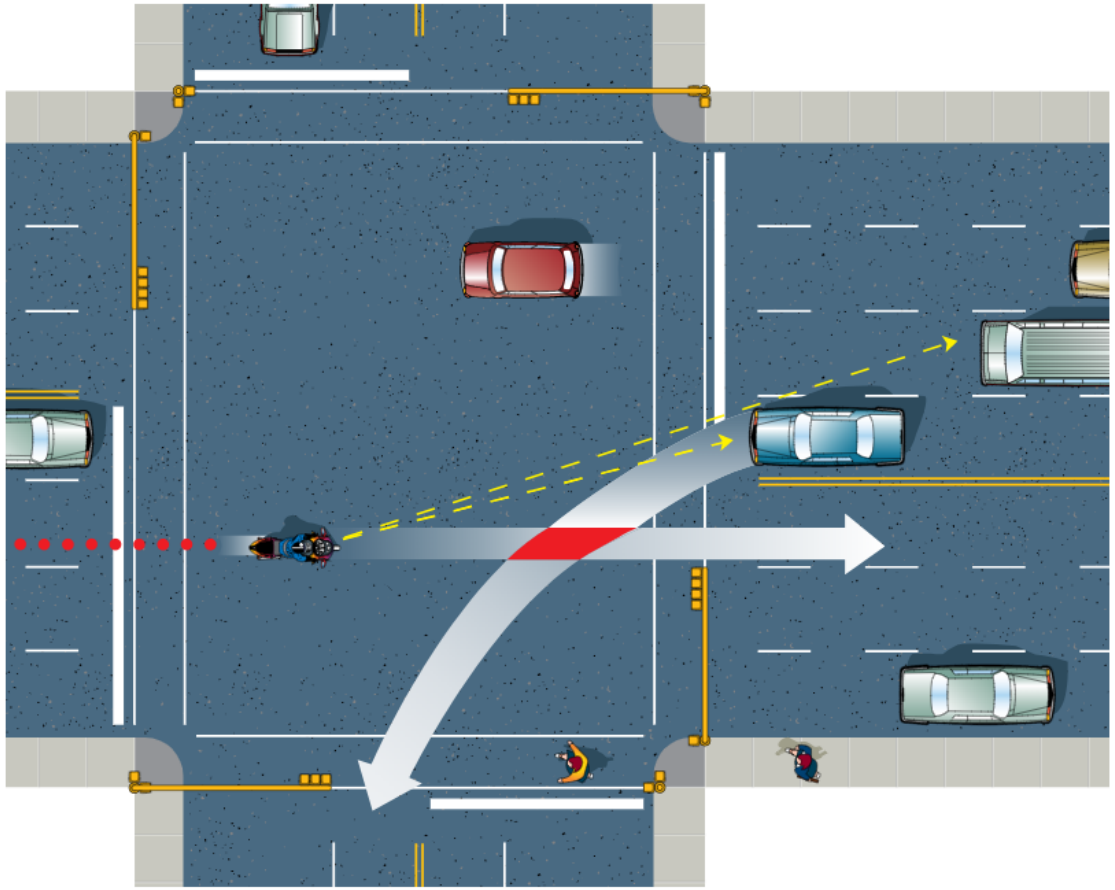
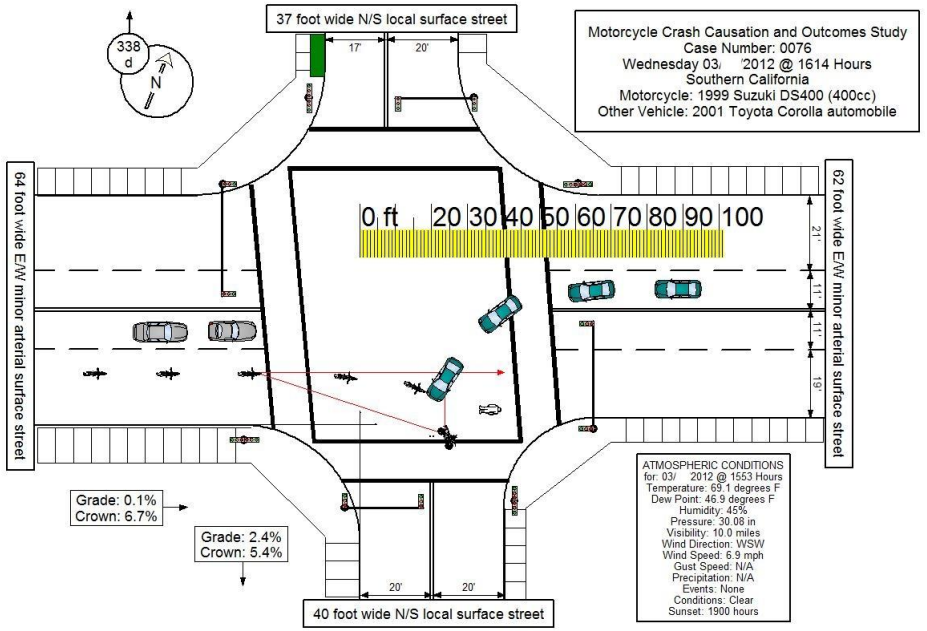
The most common cause of motorcycle/car collisions is the car turning left in front of the motorcycle





https://www.sgi.sk.ca/motorcycle/-/knowledge_base/motorcycle-handbook/left-turn-in-front-of-motorcycle

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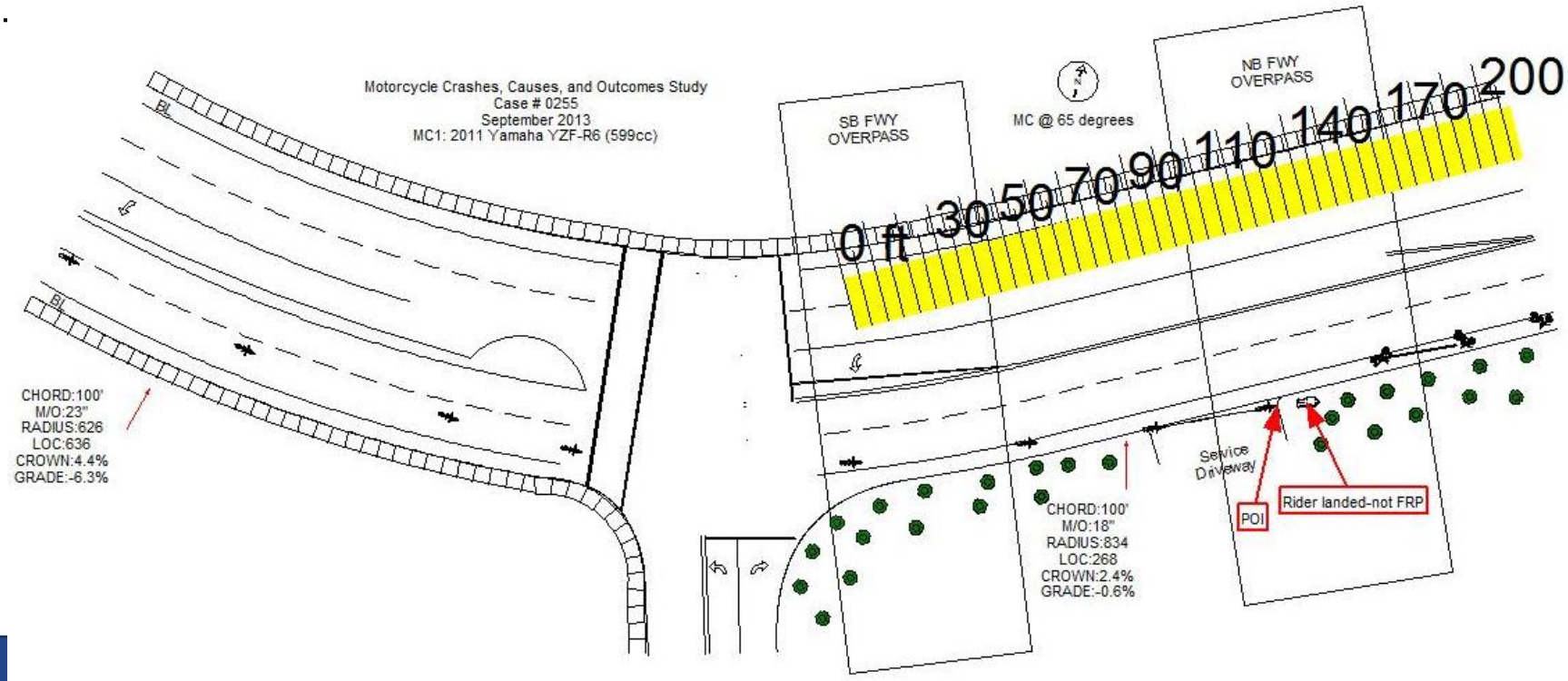
Single Vehicle Motorcycle Crashes

- About 1/3 of all fatal motorcycle crashes are single-vehicle motorcycle crashes
  - Of those, 63% of single-vehicle fatal motorcycle crashes are lane departure crashes
- In lane departure crashes, the severity of injury outcomes are highly correlated with



Florida Motorcycle Safety Coalition

- Assists the Florida Motorcycle Safety Program with implementing the Motorcycle Safety Strategic Plan (MSSP) goals and strategies.
- Uses data-driven research to develop, implement and evaluate counter measures
- The MSSP addresses:
  - road safety for Florida residents and visitors
  - strategic safety priorities for both public agencies and private organizations at state, regional, and local levels.
- **Ride Smart Florida** is the communication and outreach extension of the Florida Motorcycle Safety Coalition.

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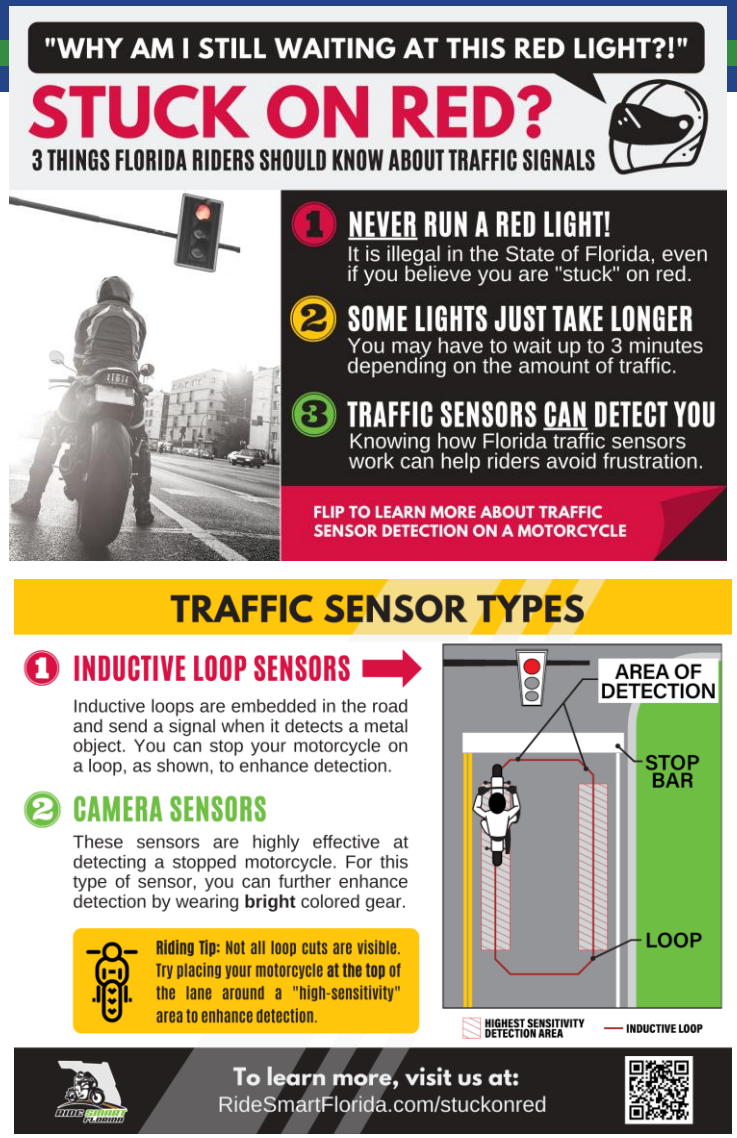
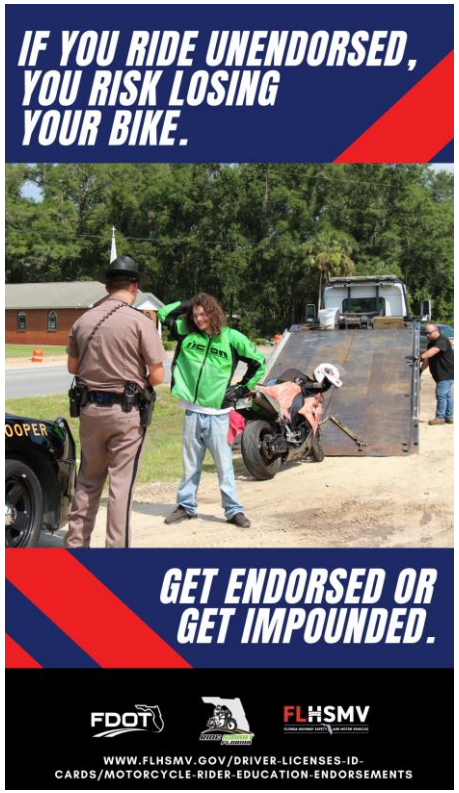
Safety Educational Material Development





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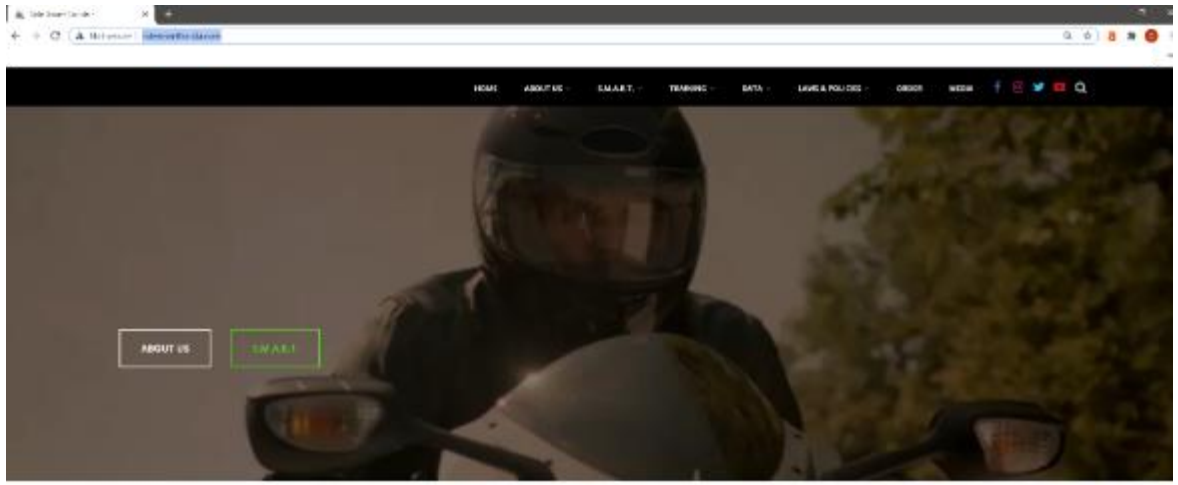
Ride Smart Florida Social Media and Website

https://www.facebook.com/RideSmartFL/



http://ridesmartflorida.com/

Coalition Engineering Countermeasures

Safe Roads – Ride Smart Florida

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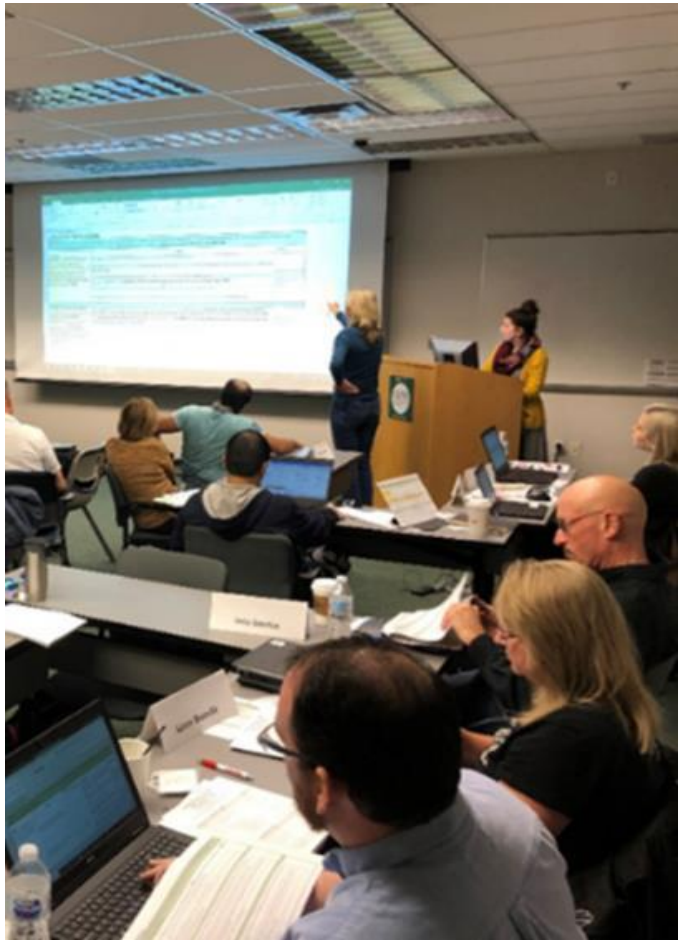
FL Motorcycle Safety Coalition



- Emphasis Areas Focus
  - Advocacy & Policy
  - Law Enforcement
  - Communications & Outreach
  - Rider Licensing & Training
  - Data & Analysis
  - **Roadway Engineering**
  - Trauma & Emergency Services

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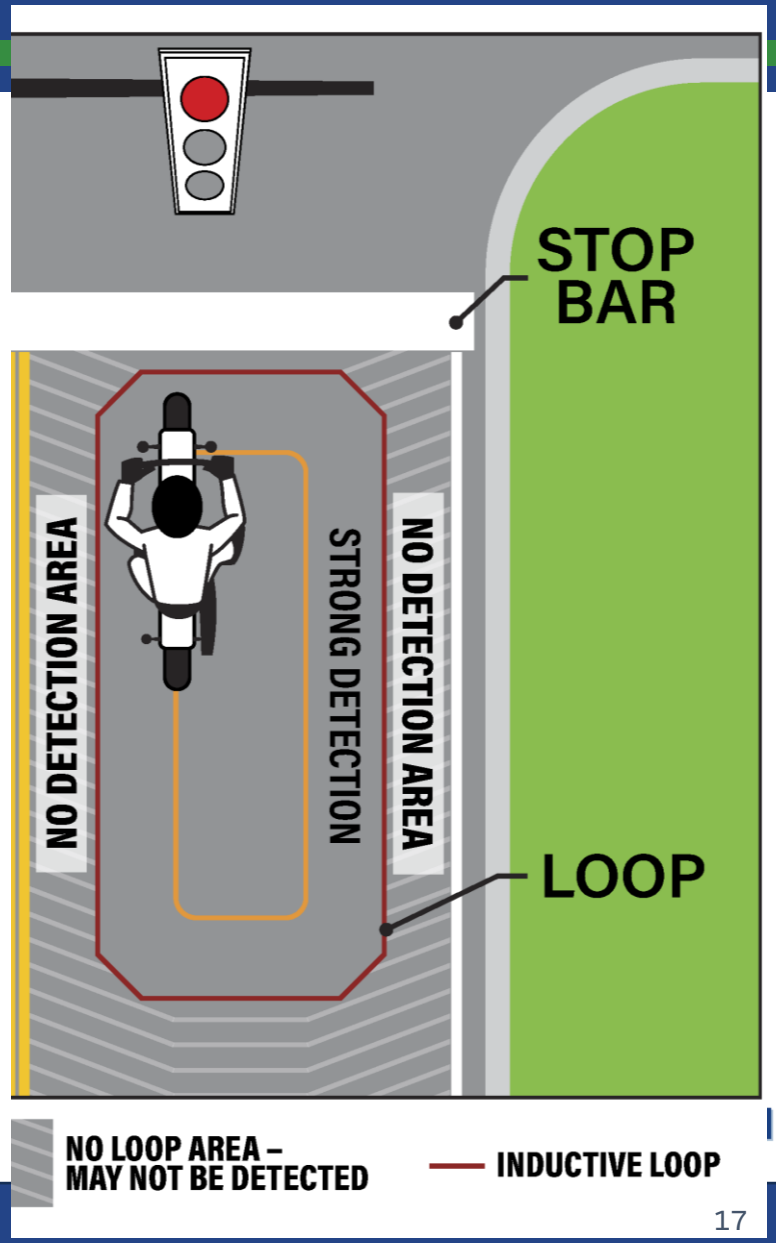
Traffic Engineering Signals: “Stuck on Red” Issue

- Coalition worked with FDOT engineers to address motorcyclist complaints of being “stuck” at sensor-based traffic signals
- FDOT conducted study that showed most motorcycles have enough metal to trigger FL traffic sensors
- Revealed proper placement of motorcycle on sensors can improve detection
- Developed educational post card for riders to understand traffic sensors



Traffic Engineering Signs: Dynamic Speed Feedback Signs (DSFS)

- Motorcycle crashes overrepresented on horizontal curves, especially rural two-lane roads.
- Traffic control strategies are not always motorcycle inclusive and/or affect motorcycles
- DSFS had delayed detection for motorcycles due to smaller target for detection
- Warning did not provide adequate reaction time
- Study (Wang, et al., 2018) found DSFS in “DYNAMIC” mode can effectively increase motorcyclist attention on curves and intention to reduce speed

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Roadway Design and Construction

- Maintenance of Traffic
- How different work zones affect the severity of motorcycle crashes?
  - Groove Pavement
  - Uneven Pavement
  - Edge Drops
  - MOT Signs
  - Others?

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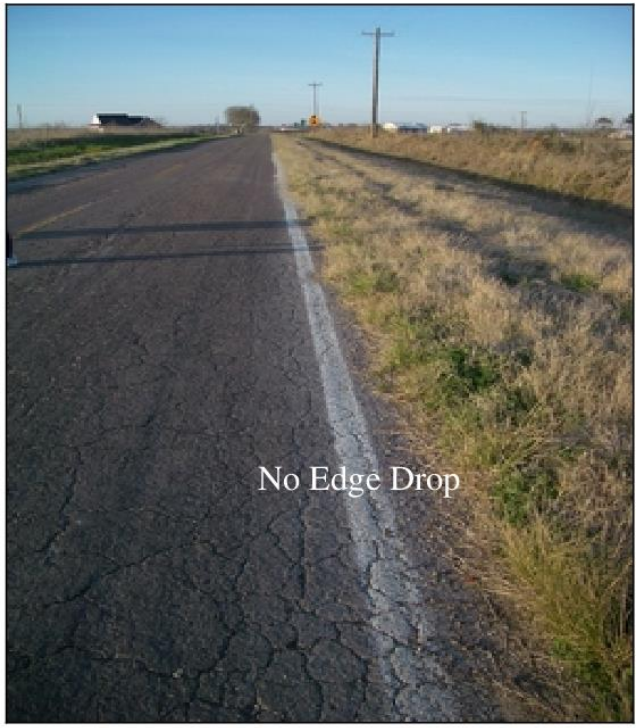
Edge drop can be dangerous to cars, but deadly to motorcycles



https://www.google.com/search?q=Edge+Drop+motorcycle+crash&rlz=1C1ONGR_enUS931US931&sxsrf=ALiCzsbevc6flVjRur9cjly4yPl2lh3pvg:1668085172270&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjzwJfB1aP7AhUFTTABHUpWAgIQ_AUoAnoECAEQBA&biw=1745&bih=852&dpr=1.1#imgrc=nvmBw3ItHkJyVM

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Maintenance

- Remove roadway debris
- Increase roadway maintenance awareness
- Educate the public

Curve Negotiation

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Guardrail Rub Rail

- Statistics show that the impact with a roadside safety barrier of a motorcyclist sliding on the pavement after an accident is potentially more dangerous than the accident itself.
- Roadside safety barriers are designed to contain errant vehicles and to reduce the severity of collisions.
- Rub Rail: FDOT Standard Plans Instructions Topic No. 625-010-003, Index 536-001 Guardrail, pay item 536-5-xxx

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Request: Florida's Highway Sign Library

FDOT Future potential sign

FDOT standard plans 102-600 sheet 4 of 11. The W8-15P placard shall be used in conjunction with the GROOVED PAVEMENT AHEAD sign

Sign# W8-15P

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Engineering Best Practices for Motorcyclist Safety

- **Barrier Design**
  - The purpose of roadside barrier systems is to reduce the severity of injuries and number of fatalities by controlling and mitigating crash forces.
- **Roadway Design**
  - Roadway geometry, pavement design, and pavement construction and maintenance practices are designed to construct and maintain roadway facilities that provide for motor vehicle travel.
- **Construction & Maintenance Practices**
  - Pothole maintenance, open milled road surfaces, raised manhole covers, steel plates, uneven pavement conditions, gravel or debris on roadway and traffic signal detection systems that do not detect a motorcycle are the specific risk each of them pose to motorcyclists.
- **Traffic Control**
  - Additional warning signs (i.e., "Motorcycles Use Extreme Caution") may need to be added to a plan to address specific work zone conditions when they exist.

Safety Message

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Contact Us

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Orlando, FL

November 7-8, 2024

2024 TRANSPORTATION SYMPOSIUM

Systems Engineering Analysis (SEA) Documentation Requirements

Jeremy Dilmore, P.E.

FDOT District Five – TSM&O Program Engineer

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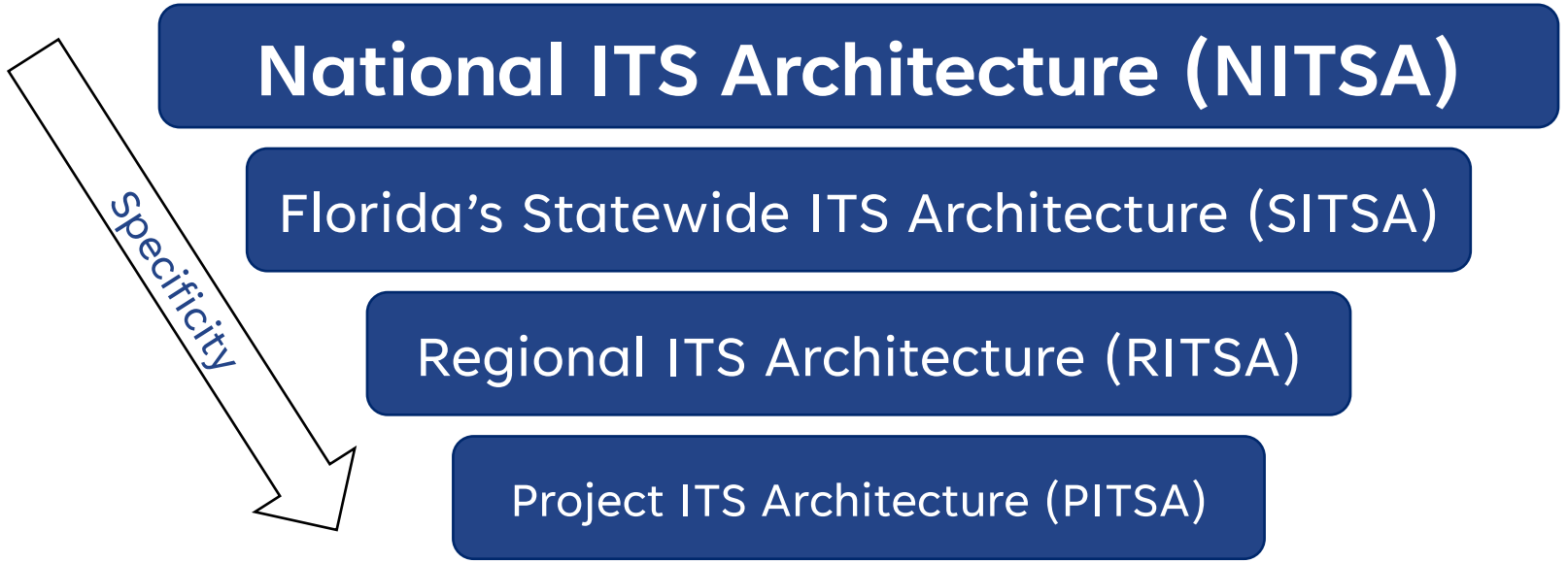
Systems Engineering – CFR Part 940

- **Title 23 Code of Federal Regulations (CFR) Part 940**
- *Systems Engineering (SE)* – structured process for arriving at a final design of a system
  - Emphasis on
    - User needs and required functionality
    - Documenting requirements
    - Design, implementation, and system validation
  - Benefits of SE approach
    - Reduced risk of schedule/cost overruns
    - Increased likelihood that project will meet users' needs
    - Improved stakeholder participation
    - More adaptable and resilient systems
    - Verified functionality and fewer defects
    - Better documentation
    - Higher level of reuse from one project to the next

Systems Engineering – CFR Part 940

- **Title 23 Code of Federal Regulations (CFR) Part 940**
- *Intelligent Transportation Systems (ITS) Architecture*
  - Common framework for ITS interoperability across local / physical architectures



Systems Engineering – CFR Part 940

- **Title 23 CFR Part 940.11 – Project Implementation**
  - All ITS projects funded with highway trust funds shall be based on a systems engineering analysis (SEA)
  - SEA shall include, at a minimum:
    - Identification of portions of the RITSA being implemented
    - Identification of participating agencies' roles and responsibilities
    - Requirements definitions
    - Analysis of alternative system configurations and technology options to meet requirements
    - Procurement options
    - Identification of applicable ITS standards/testing procedures
    - Procedures and resources necessary for operations and management of the system
  - If final design of ITS project is inconsistent with RITSA, then the RITSA shall be updated

Systems Engineering – CFR Part 940

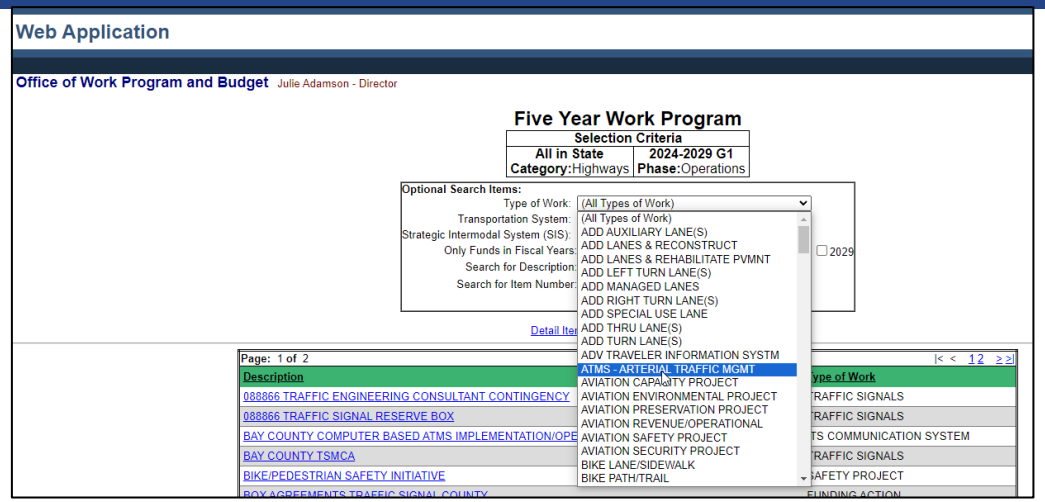
Some examples of ITS projects:

- **Traffic Signal Improvements (New, upgrades, etc.)**
  - FHWA considers traffic signals to be ITS projects
- Traffic Signal Priority (TSP)
- Emergency Vehicle Preemption (EVP)
- Wrong Way Driving (WWD) Detection System
- Dynamic Message Signs (DMS)
- Advanced Transportation Management System (ATMS)
- Smart Work Zone (SWZ)
- Connected Vehicle (CV) Infrastructure
- Computer Vision
- Pedestrian Detection Systems
- Fiber Communications

Helpful Tips

- You can identify ITS projects in the Work Program using Work Mix Codes or filtered by category on WP website
  - Traffic Signals: 0714 - 0717
  - ITS Projects: 0750 – 0761

  https://fdotewp1.dot.state.fl.us/fmsupportapps/workprogram/WorkProgram.aspx



- Reach out to your District's TSM&O Program for help
  - Confirmation of SEA documentation needs
  - Scoping and staff hours for SEA
  - Recent SEA samples
  - *ITS Change Request Form* questions and submittal

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FDOT ITS Architecture Resource

https://teo.fdot.gov/architecture/ or search keyword “FDOT ITS Architecture”

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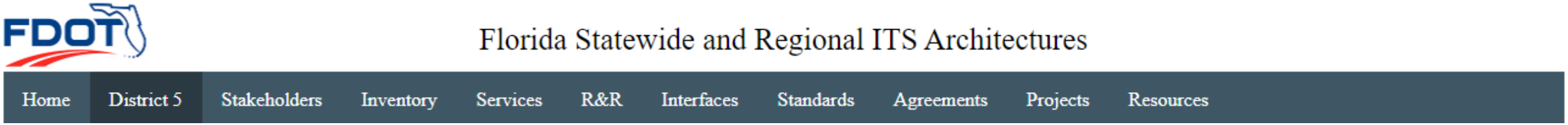

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FDOT Systems Engineering and ITS Architecture Procedure

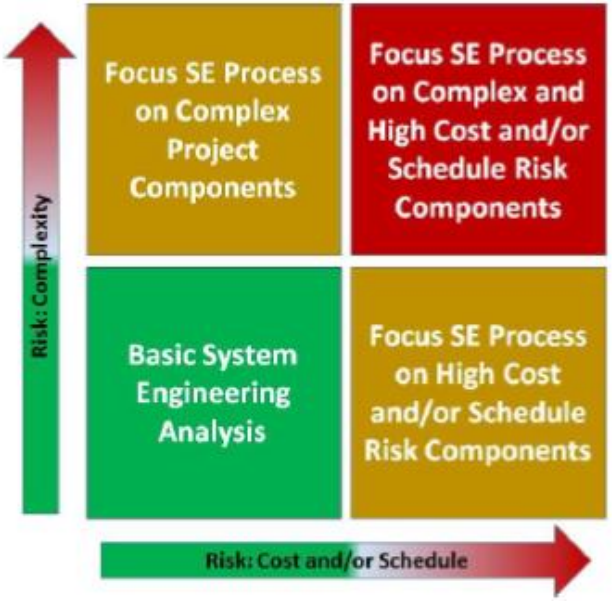
Florida Department of Transportation
Systems Engineering and Intelligent Transportation Systems (ITS) Architecture Procedure

750-040-003-d
April 19, 2023

FDOT TSM&O
Transportation Systems Management & Operations

Florida Department of Transportation
Traffic Engineering and Operations Office
Transportation Systems Management and Operations Section
605 Suwannee Street, M.S. 90
Tallahassee, Florida 32399-0450
850-410-5600

- Ensures compliance with 23 CFR Part 940
- Outlines SE project management methodology
- SEA should be conducted on a scale commensurate with project scope and complexity



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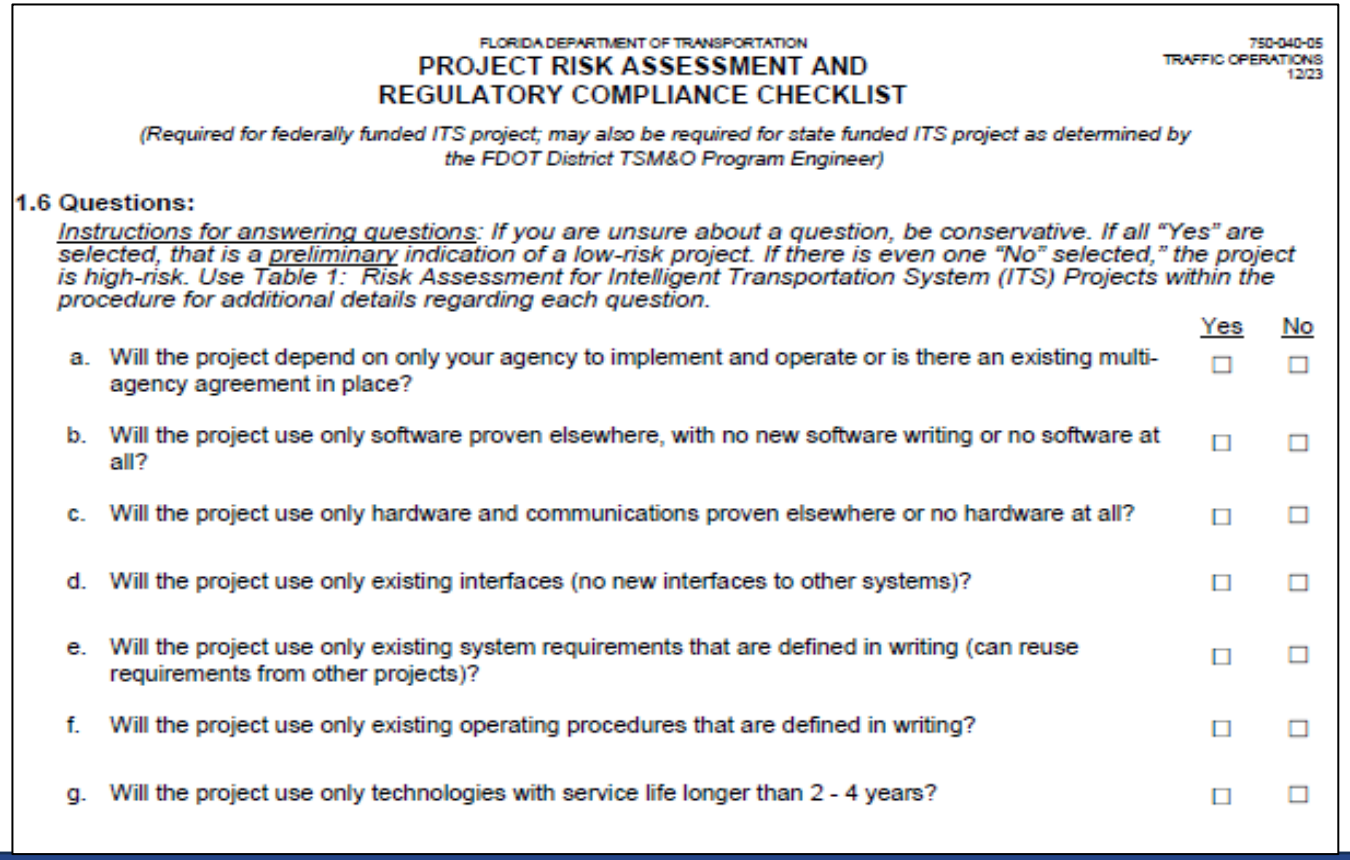
SEA Supporting Documentation Requirements

- Risk + Funding Type → SEA documentation requirements
- **Starting point**: *Risk Assessment and Regulatory Compliance Checklist (750-040-05)*



FLORIDA DEPARTMENT OF TRANSPORTATION

750-040-05
TRAFFIC OPERATIONS
12/23

PROJECT RISK ASSESSMENT AND REGULATORY COMPLIANCE CHECKLIST

(Required for federally funded ITS project; may also be required for state funded ITS project as determined by the FDOT District TSM&O Program Engineer)

1.6 Questions:

Instructions for answering questions: If you are unsure about a question, be conservative. If all "Yes" are selected, that is a preliminary indication of a low-risk project. If there is even one "No" selected," the project is high-risk. Use Table 1: Risk Assessment for Intelligent Transportation System (ITS) Projects within the procedure for additional details regarding each question.

		Yes	No
a.	Will the project depend on only your agency to implement and operate or is there an existing multi-agency agreement in place?	☐	☐
b.	Will the project use only software proven elsewhere, with no new software writing or no software at all?	☐	☐
c.	Will the project use only hardware and communications proven elsewhere or no hardware at all?	☐	☐
d.	Will the project use only existing interfaces (no new interfaces to other systems)?	☐	☐
e.	Will the project use only existing system requirements that are defined in writing (can reuse requirements from other projects)?	☐	☐
f.	Will the project use only existing operating procedures that are defined in writing?	☐	☐
g.	Will the project use only technologies with service life longer than 2 - 4 years?	☐	☐

- Required for all federally funded ITS projects (including all Traffic Signal improvements)
- Best practice for state-funded ITS projects

- All "**Yes**" responses→ likely low-risk
- Even one "**No**" response → high-risk

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Important Notes

- High-risk designation (and full SEA documentation) only applies the first time a type of project is conducted under the RITSA
  - New deployments of the same technology/system are likely low-risk*
    - *Risk Assessment and Regulatory Compliance Checklist* will satisfy SEA requirements

- Regular maintenance cycles are conducted to update ITS Architectures
  - FDOT ITS Architecture website may not reflect the most recent projects
  - Consult your District TSM&O group for any questions or clarifications

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*Assumes data flows, service packages, and stakeholders remain the same

SEA Supporting Documentation Requirements

- **High-risk federally funded ITS projects** shall produce the Systems Engineering Project Checklist (750-040-06) and, at a minimum, include the following SEA documentation:
  1. Project Systems Engineering Management Plan (PSEMP)
  2. Concept of Operations (ConOps)
  3. Analysis of Alternative System Configurations and Technology Options
  4. High-Level System Requirements
  5. Requirements Traceability Verification Matrix (RTVM)
  6. List of ITS Standards
  7. System Verification Plan
  8. System Validation Plan
  9. Operations and Management Plan
- **High-risk state-funded ITS projects** shall produce some/all of the SEA documentation above if required by the District TSM&O Program Engineer
  - Best practice is to treat state-funded projects as federally funded projects

SEA Supporting Documentation Requirements

FDOT

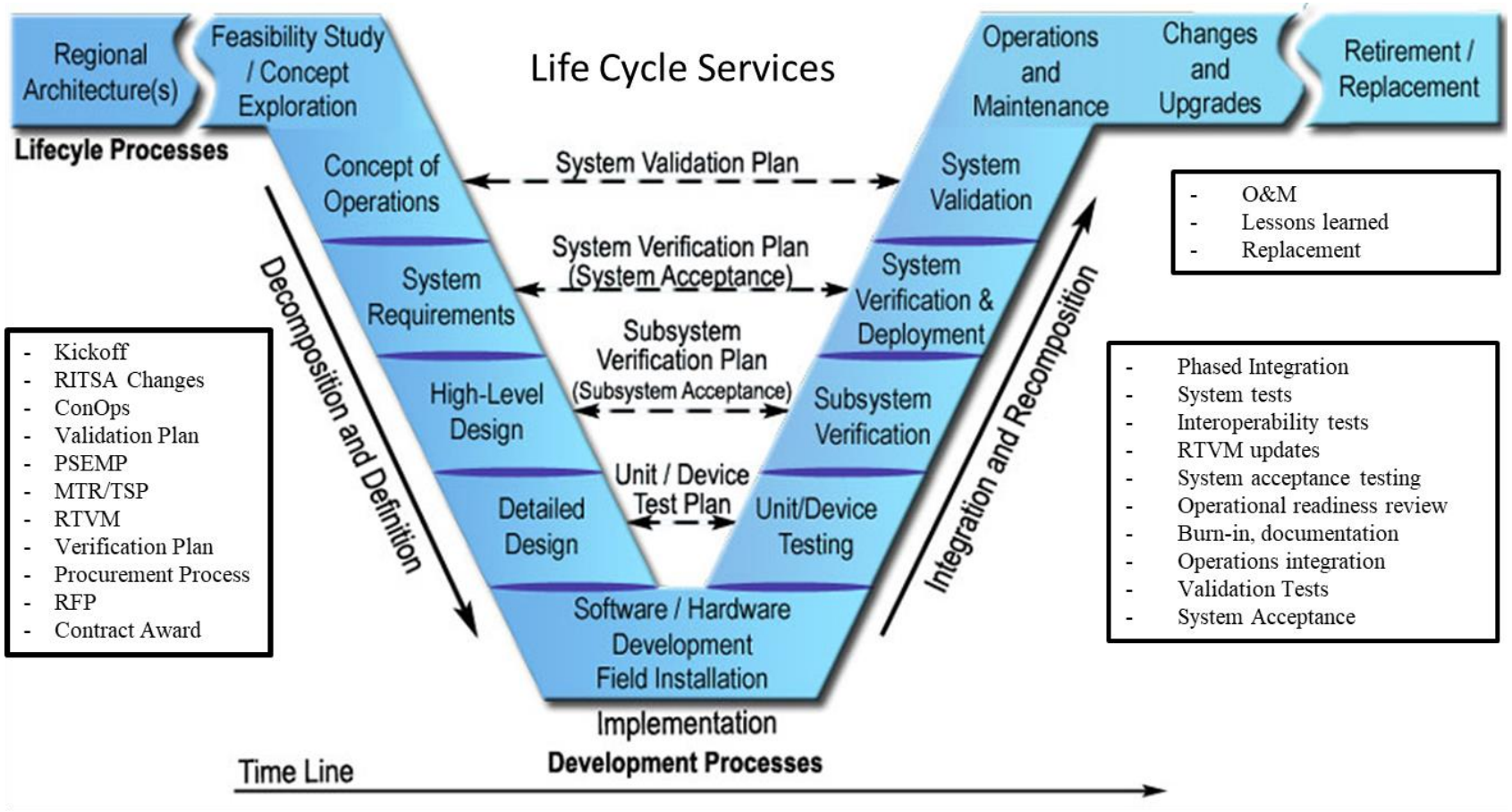
Following are links to the Systems Engineering template documents:

- Concept of Operations Template
- Configuration and Data Management Plan Template
- Hardware Development Plan Template
- Human Factors Engineering Project Plan Template
- Integrated Logistics Support Plan Template
- Operational Development Plan Template
- Program Management Plan Template
- Project Performance Management Plan Template
- Project Systems Engineering Management Plan Template
- Quality Management Plan Template
- Reliability and Maintainability Program Plan Template
- Requirements Traceability Verification Test Matrix (RTVM)
- Risk Management Plan Template
- Scope of Services Template
- Security Engineering Plan Template
- Software Development Plan Template
- Subcontract Management Plan Template
- System and Subsystem Requirements Template
- System Test Plan Template
- System Validation
- System Verification
- Test Procedures Template
- Test Report Template

All SEA document templates are available at https://www.fdot.gov/traffic/its/projects-deploy/semp.shtm

(Search keywords “FDOT Systems Engineering”)

Typical Systems Engineering Process



Concept of Operations (ConOps)

- **First building block for SEA Documentation**
- Current System and Constraints
- Project Objectives / Justification for changes
- Users and User needs (stakeholder engagement)
- Proposed System
  - Background, objectives, scope, constraints
- Assumptions/Constraints
- Risks
- Operational Scenarios
- Analysis of Proposed System
  - Alternatives, Cost, Schedule, Procurement
- Performance Measurement for System Validation

FDOT TSM&O
Transportation Systems Management & Operations

Form FM-SE-01

Concept of Operations (ConOps)
TEMPLATE

TEMPLATE Version: *2.0*

TEMPLATE Approval Date: *September 4, 2019*

Form FM-SE-01 Concept of Operations Template. Effective: 9/4/2019

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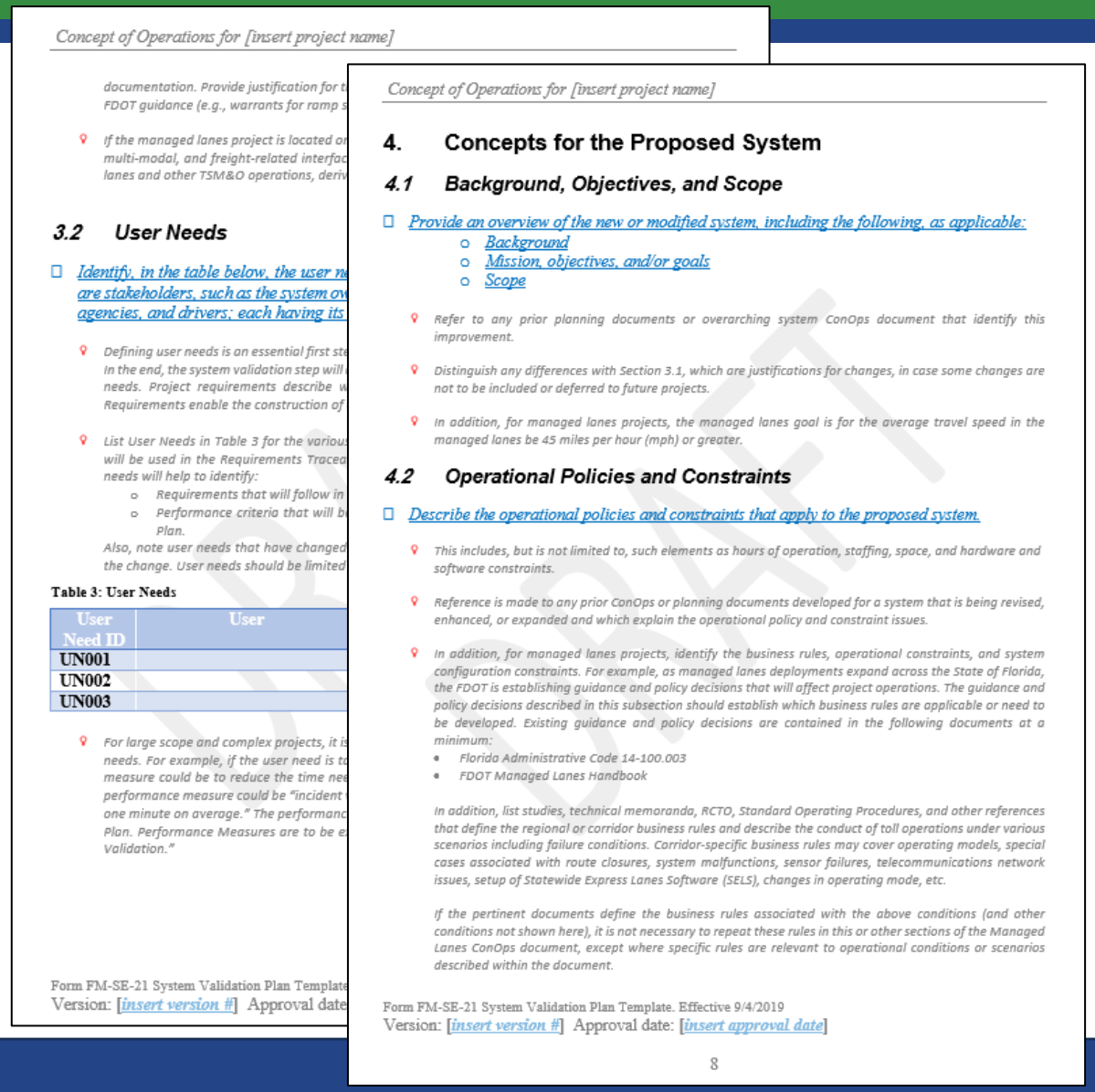
Concept of Operations (ConOps)



Concept of Operations for [insert project name]

documentation. Provide justification for t
FDOT guidance (e.g., warrants for ramp s

- If the managed lanes project is located o
multi-modal, and freight-related interfac
lanes and other TSM&O operations, deri

3.2 User Needs

- Identify, in the table below, the user n
are stakeholders, such as the system ow
agencies, and drivers; each having its

  - Defining user needs is an essential first ste
In the end, the system validation step will
needs. Project requirements describe w
Requirements enable the construction of

  - List User Needs in Table 3 for the various
will be used in the Requirements Tracea
needs will help to identify:
    - Requirements that will follow in
    - Performance criteria that will b
    Plan.

  Also, note user needs that have changed
the change. User needs should be limited

Table 3: User Needs

User Need ID	User
UN001	
UN002	
UN003	

  - For large scope and complex projects, it i
needs. For example, if the user need is t
measure could be to reduce the time nee
performance measure could be "incident
one minute on average." The performanc
Plan. Performance Measures are to be e
Validation."

Form FM-SE-21 System Validation Plan Templat
Version: [insert version #] Approval date

Concept of Operations for [insert project name]

4. Concepts for the Proposed System

4.1 Background, Objectives, and Scope

- Provide an overview of the new or modified system, including the following, as applicable:
  - Background
  - Mission, objectives, and/or goals
  - Scope

  - Refer to any prior planning documents or overarching system ConOps document that identify this improvement.

  - Distinguish any differences with Section 3.1, which are justifications for changes, in case some changes are not to be included or deferred to future projects.

  - In addition, for managed lanes projects, the managed lanes goal is for the average travel speed in the managed lanes be 45 miles per hour (mph) or greater.

4.2 Operational Policies and Constraints

- Describe the operational policies and constraints that apply to the proposed system.

  - This includes, but is not limited to, such elements as hours of operation, staffing, space, and hardware and software constraints.

  - Reference is made to any prior ConOps or planning documents developed for a system that is being revised, enhanced, or expanded and which explain the operational policy and constraint issues.

  - In addition, for managed lanes projects, identify the business rules, operational constraints, and system configuration constraints. For example, as managed lanes deployments expand across the State of Florida, the FDOT is establishing guidance and policy decisions that will affect project operations. The guidance and policy decisions described in this subsection should establish which business rules are applicable or need to be developed. Existing guidance and policy decisions are contained in the following documents at a minimum:
    - Florida Administrative Code 14-100.003
    - FDOT Managed Lanes Handbook

    In addition, list studies, technical memoranda, RCTO, Standard Operating Procedures, and other references that define the regional or corridor business rules and describe the conduct of toll operations under various scenarios including failure conditions. Corridor-specific business rules may cover operating models, special cases associated with route closures, system malfunctions, sensor failures, telecommunications network issues, setup of Statewide Express Lanes Software (SELS), changes in operating mode, etc.

    If the pertinent documents define the business rules associated with the above conditions (and other conditions not shown here), it is not necessary to repeat these rules in this or other sections of the Managed Lanes ConOps document, except where specific rules are relevant to operational conditions or scenarios described within the document.

Form FM-SE-21 System Validation Plan Template. Effective 9/4/2019
Version: [insert version #] Approval date: [insert approval date]

8

The ConOps Template gives instructions and explanations for each section and subsection

Project Systems Engineering Management Plan (PSEMP)

- **Controlling document for major ITS projects***
- Review of relevant ITS planning documents
- PITSA Development (ITS standards, Service Packages, etc.)
- High Level Functional Requirements
- Technology Assessment
- Requirements Traceability Verification Matrix (RTVM) and System Verification
- Risk Planning
- Project Management and Control
- System Testing, Integration, Verification, and Acceptance
- System Validation and Data Collection

FDOT TSM&O
Transportation Systems Management & Operations

Project Systems Engineering Management Plan (PSEMP)
TEMPLATE

TEMPLATE Version: ***2.0***

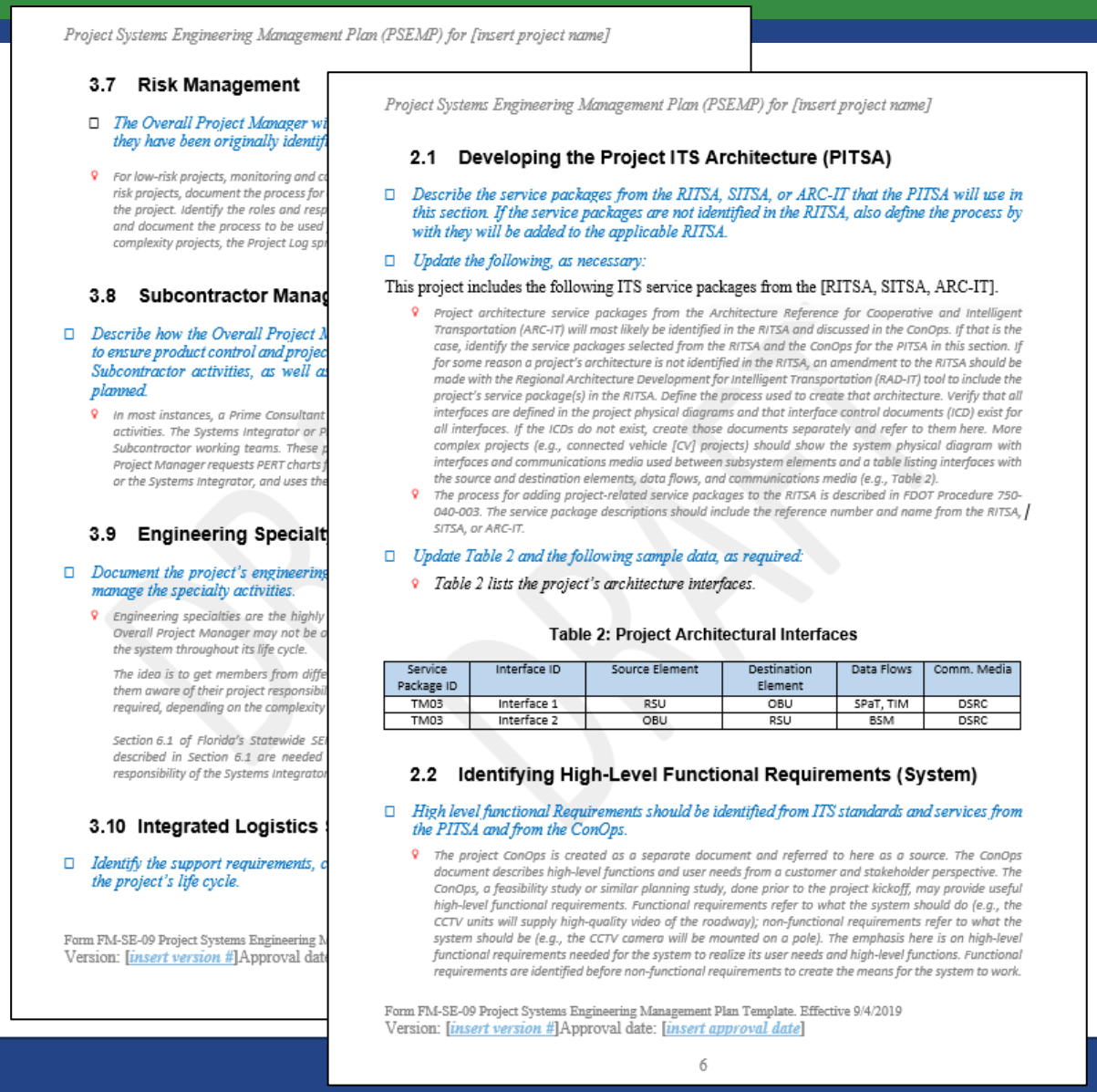
TEMPLATE Approval Date: ***September 4, 2019***

Form FM-SE-09 Project Systems Engineering Management Plan Template. Effective 9/4/2019

TRANSPORTATION SYMPOSIUM

*Most SEA documentation is written into PSEMP and/or included as attachments

Project Systems Engineering Management Plan (PSEMP)



Project Systems Engineering Management Plan (PSEMP) for [insert project name]

3.7 Risk Management

- ☐ *The Overall Project Manager wi they have been originally identif*
  - *For low-risk projects, monitoring and c risk projects, document the process for the project. Identify the roles and resp and document the process to be used complexity projects, the Project Log spr*

3.8 Subcontractor Manag

- ☐ *Describe how the Overall Project M to ensure product control and projec Subcontractor activities, as well a planned.*
  - *In most instances, a Prime Consultant activities. The Systems Integrator or P Subcontractor working teams. These p Project Manager requests PERT charts f or the Systems Integrator, and uses the*

3.9 Engineering Specialt

- ☐ *Document the project's engineering manage the specialty activities.*
  - *Engineering specialties are the highly Overall Project Manager may not be a the system throughout its life cycle.*

    The idea is to get members from diffe them aware of their project responsibil required, depending on the complexity

    Section 6.1 of Florida's Statewide SE described in Section 6.1 are needed responsibility of the Systems Integrator

3.10 Integrated Logistics

- ☐ *Identify the support requirements, c the project's life cycle.*

Form FM-SE-09 Project Systems Engineering M
Version: [*insert version #*]Approval dat

Project Systems Engineering Management Plan (PSEMP) for [insert project name]

2.1 Developing the Project ITS Architecture (PITSA)

- ☐ *Describe the service packages from the RITSA, SITSA, or ARC-IT that the PITSA will use in this section. If the service packages are not identified in the RITSA, also define the process by with they will be added to the applicable RITSA.*
- ☐ *Update the following, as necessary:*

This project includes the following ITS service packages from the [RITSA, SITSA, ARC-IT].

- *Project architecture service packages from the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) will most likely be identified in the RITSA and discussed in the ConOps. If that is the case, identify the service packages selected from the RITSA and the ConOps for the PITSA in this section. If for some reason a project's architecture is not identified in the RITSA, an amendment to the RITSA should be made with the Regional Architecture Development for Intelligent Transportation (RAD-IT) tool to include the project's service package(s) in the RITSA. Define the process used to create that architecture. Verify that all interfaces are defined in the project physical diagrams and that interface control documents (ICD) exist for all interfaces. If the ICDs do not exist, create those documents separately and refer to them here. More complex projects (e.g., connected vehicle [CV] projects) should show the system physical diagram with interfaces and communications media used between subsystem elements and a table listing interfaces with the source and destination elements, data flows, and communications media (e.g., Table 2).*
- *The process for adding project-related service packages to the RITSA is described in FDOT Procedure 750-040-003. The service package descriptions should include the reference number and name from the RITSA, / SITSA, or ARC-IT.*

- ☐ *Update Table 2 and the following sample data, as required:*
  - *Table 2 lists the project's architecture interfaces.*

Table 2: Project Architectural Interfaces

Service Package ID	Interface ID	Source Element	Destination Element	Data Flows	Comm. Media
TM03	Interface 1	RSU	OBU	SPaT, TIM	DSRC
TM03	Interface 2	OBU	RSU	BSM	DSRC

2.2 Identifying High-Level Functional Requirements (System)

- ☐ *High level functional Requirements should be identified from ITS standards and services from the PITSA and from the ConOps.*
  - *The project ConOps is created as a separate document and referred to here as a source. The ConOps document describes high-level functions and user needs from a customer and stakeholder perspective. The ConOps, a feasibility study or similar planning study, done prior to the project kickoff, may provide useful high-level functional requirements. Functional requirements refer to what the system should do (e.g., the CCTV units will supply high-quality video of the roadway); non-functional requirements refer to what the system should be (e.g., the CCTV camera will be mounted on a pole). The emphasis here is on high-level functional requirements needed for the system to realize its user needs and high-level functions. Functional requirements are identified before non-functional requirements to create the means for the system to work.*

Form FM-SE-09 Project Systems Engineering Management Plan Template. Effective 9/4/2019
Version: [*insert version #*]Approval date: [*insert approval date*]

6

The PSEMP Template gives instructions and explanations for each section and subsection

Requirements Traceability Verification Matrix (RTVM)

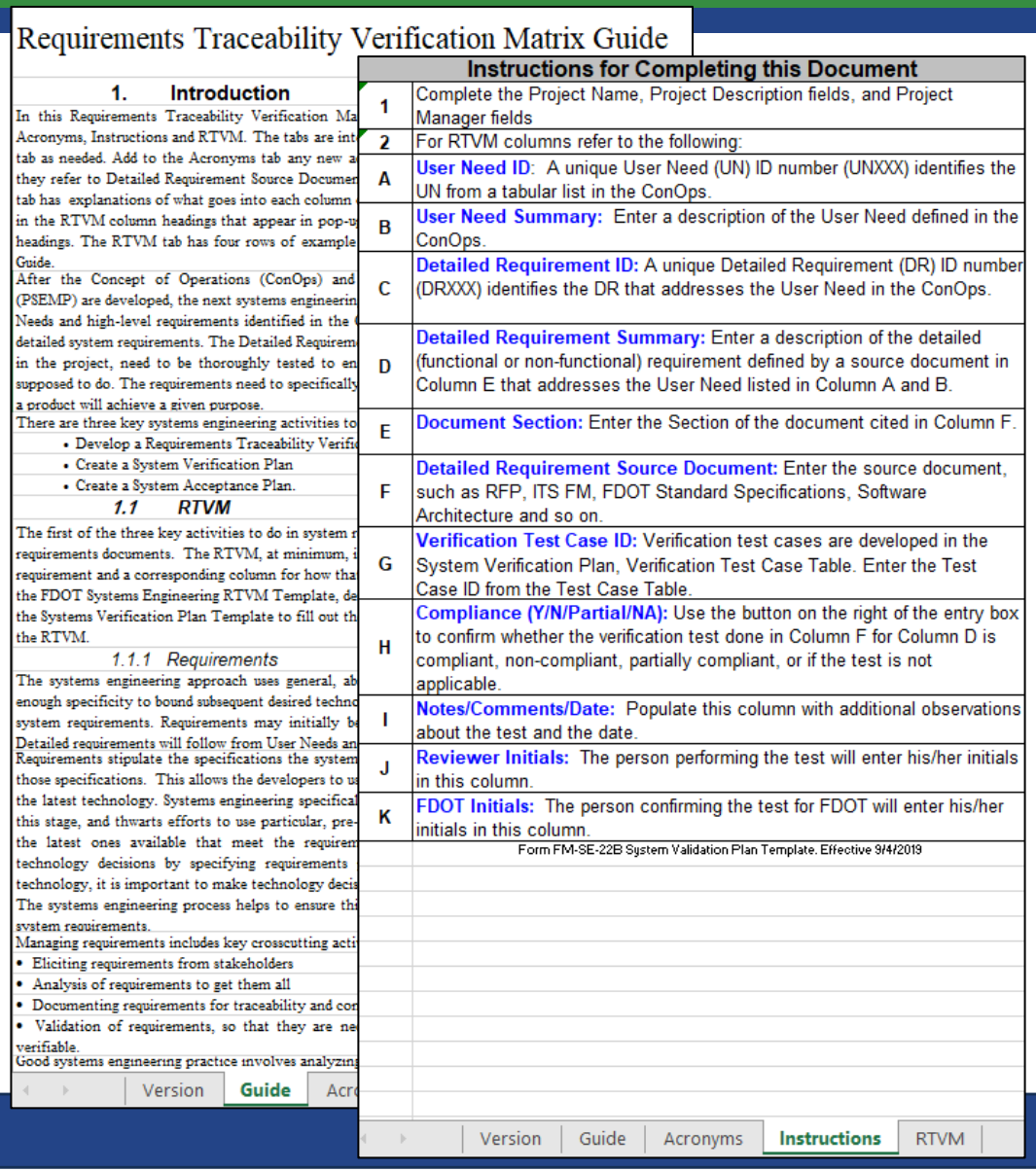
- User Need → System Requirement(s) to meet need → Test
  - Informed by content in ConOps, PSEMP, and System Verification Plan

REQUIREMENTS TRACEABILITY VERIFICATION MATRIX

Project Name:	< *required* >
Project Description:	< *required* >
Project Manager Name:	< *required* >
Agency/Firm:	< *optional*>

User Need ID	User Need Summary	Detailed Requirement ID	Detailed Requirement Summary	Document Section	DR Source Document	Verification Test Case ID	Compliance (Y/N/Partial/NA)	Notes/Comments/Date	Reviewer Initials	FDOT Initials
UN009	Continuous electrical power and communications	DR001	Install power service assembly	639-3	FDOT Standard Specs	TC015	Yes	APL PRODUCTS USED	JD	
UN019	Performance measures and system validation	DR002	Send traffic measures of effectiveness (MOEs) to Regional Traffic Management Center (RTMC) Master Server and save for MOE report	Q - Testing	RFP	TC007	Partially	APL PRODUCTS USED	JD	
UN002	Closed-circuit television (CCTV) system oversight of highway and interchanges	DR003	Furnish and install CCTV camera at locations shown in plans	682-1	FDOT Standard Specs	TC001	Yes	APL PRODUCTS USED	JD	
UN003	Microwave vehicle detection system (MVDS) system for real-time data	DR004	Furnish and install microwave vehicle detection system at locations shown in plans	660-2.2.1	FDOT Standard Specs	TC002	Yes	APL PRODUCTS USED	JD	
		DR005								
		DR006								

Requirements Traceability Verification Matrix (RTVM)



Requirements Traceability Verification Matrix Guide

1. Introduction

In this Requirements Traceability Verification Ma
Acronyms, Instructions and RTVM. The tabs are int
tab as needed. Add to the Acronyms tab any new a
they refer to Detailed Requirement Source Documer
tab has explanations of what goes into each column
in the RTVM column headings that appear in pop-u
headings. The RTVM tab has four rows of example
Guide.
After the Concept of Operations (ConOps) and
(PSEMP) are developed, the next systems engineerin
Needs and high-level requirements identified in the
detailed system requirements. The Detailed Requirem
in the project, need to be thoroughly tested to en
supposed to do. The requirements need to specifically
a product will achieve a given purpose.
There are three key systems engineering activities to

- Develop a Requirements Traceability Verifi
- Create a System Verification Plan
- Create a System Acceptance Plan.

1.1 RTVM

The first of the three key activities to do in system r
requirements documents. The RTVM, at minimum, i
requirement and a corresponding column for how tha
the FDOT Systems Engineering RTVM Template, de
the Systems Verification Plan Template to fill out th
the RTVM.

1.1.1 Requirements

The systems engineering approach uses general, ab
enough specificity to bound subsequent desired techno
system requirements. Requirements may initially b
Detailed requirements will follow from User Needs an
Requirements stipulate the specifications the system
those specifications. This allows the developers to us
the latest technology. Systems engineering specifica
this stage, and thwarts efforts to use particular, pre-
the latest ones available that meet the requirem
technology decisions by specifying requirements
technology, it is important to make technology decis
The systems engineering process helps to ensure thi
system requirements.
Managing requirements includes key crosscutting acti

- Eliciting requirements from stakeholders
- Analysis of requirements to get them all
- Documenting requirements for traceability and cor
- Validation of requirements, so that they are ne

verifiable.
Good systems engineering practice involves analyzing

Version | Guide | Acr

Instructions for Completing this Document

1	Complete the Project Name, Project Description fields, and Project Manager fields
2	For RTVM columns refer to the following:
A	**User Need ID**: A unique User Need (UN) ID number (UNXXX) identifies the UN from a tabular list in the ConOps.
B	**User Need Summary:** Enter a description of the User Need defined in the ConOps.
C	**Detailed Requirement ID:** A unique Detailed Requirement (DR) ID number (DRXXX) identifies the DR that addresses the User Need in the ConOps.
D	**Detailed Requirement Summary:** Enter a description of the detailed (functional or non-functional) requirement defined by a source document in Column E that addresses the User Need listed in Column A and B.
E	**Document Section:** Enter the Section of the document cited in Column F.
F	**Detailed Requirement Source Document:** Enter the source document, such as RFP, ITS FM, FDOT Standard Specifications, Software Architecture and so on.
G	**Verification Test Case ID:** Verification test cases are developed in the System Verification Plan, Verification Test Case Table. Enter the Test Case ID from the Test Case Table.
H	**Compliance (Y/N/Partial/NA):** Use the button on the right of the entry box to confirm whether the verification test done in Column F for Column D is compliant, non-compliant, partially compliant, or if the test is not applicable.
I	**Notes/Comments/Date:** Populate this column with additional observations about the test and the date.
J	**Reviewer Initials:** The person performing the test will enter his/her initials in this column.
K	**FDOT Initials:** The person confirming the test for FDOT will enter his/her initials in this column.

Form FM-SE-22B System Validation Plan Template. Effective 9/4/2019

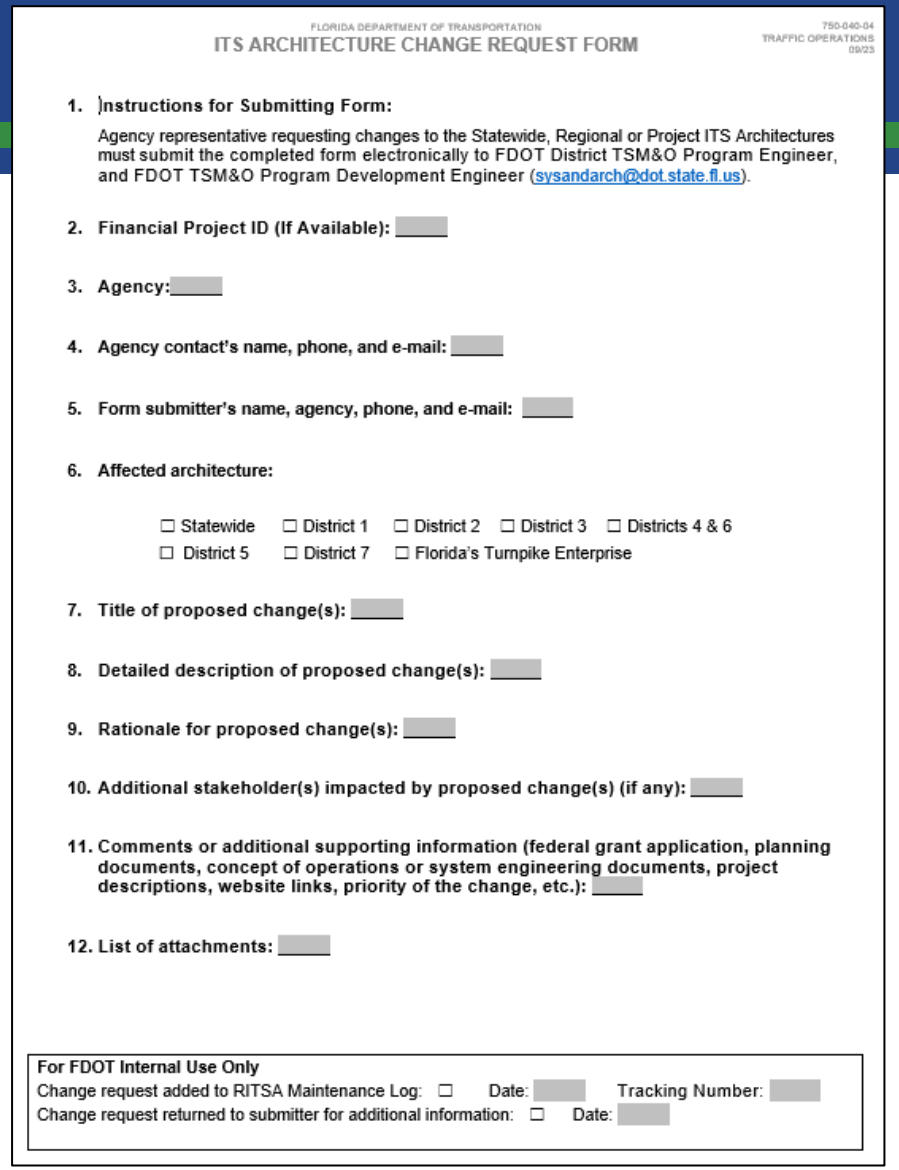
Version | Guide | Acronyms | Instructions | RTVM

The RTVM tabs give clear instructions and explanations for each column

RITSA Updates

- RITSAs are updated through regular maintenance cycles, covering:
  - New or modified Projects, Service Packages, Data Flows, etc.

- To update the RITSA, an *ITS Change Request Form* is required
  - May require supplemental documentation:
    - Interconnect / Data Flow diagrams
    - ConOps / PSEMP
    - Links to relevant materials
    - Grant Proposal (where applicable)



FLORIDA DEPARTMENT OF TRANSPORTATION
750-040-04
TRAFFIC OPERATIONS
09/23

ITS ARCHITECTURE CHANGE REQUEST FORM

1. **Instructions for Submitting Form:**
   Agency representative requesting changes to the Statewide, Regional or Project ITS Architectures must submit the completed form electronically to FDOT District TSM&O Program Engineer, and FDOT TSM&O Program Development Engineer (sysandarch@dot.state.fl.us).
2. **Financial Project ID (If Available):** _____
3. **Agency:** _____
4. **Agency contact's name, phone, and e-mail:** _____
5. **Form submitter's name, agency, phone, and e-mail:** _____
6. **Affected architecture:**
   ☐ Statewide ☐ District 1 ☐ District 2 ☐ District 3 ☐ Districts 4 & 6
   ☐ District 5 ☐ District 7 ☐ Florida's Turnpike Enterprise
7. **Title of proposed change(s):** _____
8. **Detailed description of proposed change(s):** _____
9. **Rationale for proposed change(s):** _____
10. **Additional stakeholder(s) impacted by proposed change(s) (if any):** _____
11. **Comments or additional supporting information (federal grant application, planning documents, concept of operations or system engineering documents, project descriptions, website links, priority of the change, etc.):** _____
12. **List of attachments:** _____

For FDOT Internal Use Only
Change request added to RITSA Maintenance Log: ☐ Date: _____ Tracking Number: _____
Change request returned to submitter for additional information: ☐ Date: _____

TRANSPORTATION SYMPOSIUM

Systems Engineering Analysis

- Technology is constantly evolving
  - New/Upgraded systems, platforms, hardware, communications

- Following a Systems Engineering approach leads to:
  - More thoughtful ITS project planning
  - Greater emphasis on stakeholder outreach
  - Increased TSM&O involvement in project development process
  - Improved risk identification, mitigation, and avoidance
  - Repeatability of ITS projects
  - Improved performance measurement
  - Improved system validation

Contact Us

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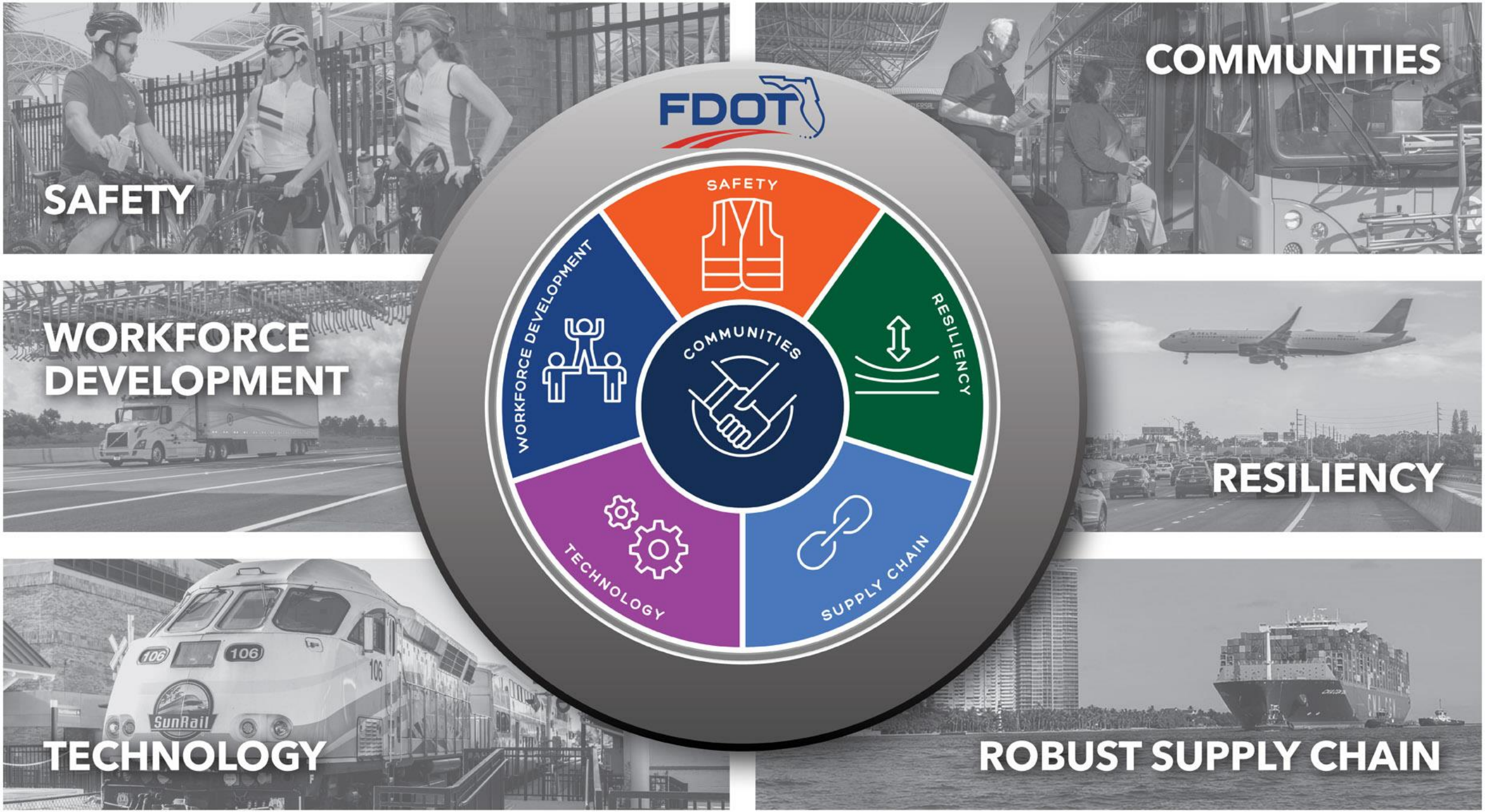
SAFETY
COMMUNITIES
WORKFORCE DEVELOPMENT
RESILIENCY
TECHNOLOGY
ROBUST SUPPLY CHAIN
FDOT
SAFETY
RESILIENCY
SUPPLY CHAIN
TECHNOLOGY
WORKFORCE DEVELOPMENT
COMMUNITIES