# TSM&O CONSORTIUM MEETING SUMMARY

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| **Meeting Date**: | March 9, 2017 (Thursday) | **Time**: 10:00 AM – 12:00 PM |
| **Subject:** | TSM&O Consortium Meeting | |
| **Meeting Location:** | FDOT's Orlando Office<br>133 S. Semoran Blvd., Orlando, FL 32807<br>Lake Apopka B Conference Room | |

## I. OVERVIEW

The purpose of this recurring meeting is to provide an opportunity for District Five FDOT staff and regional agency partners to collaborate on the state of the TSM&O Program in District Five and ongoing efforts.

A flyer for the upcoming FHWA Workshop, "Applying Archived Operations Data in Transportation Planning," was made available for Consortium stakeholders. FHWA requests that all those interested in attending RSVP by Friday, March 17th.

## II. DISTRICT FIVE TSM&O IMPLEMENTATION PLAN UPDATE

David Williams (VHB) presented slides to update consortium members on the status of the District 5 TSM&O Implementation Plan.

- Purpose of the Implementation Plan
  - Create the framework for the D5 TSM&O Program
  - Serve as a living document that is revisited as milestones are reached, etc.
  - D5-specific document
  - Reliant on stakeholder buy-in
  - Not project-specific; not just an ITS program
  - Provide a basis and process for the Department to advance its TSM&O program even in the event of complete staff turnover.
- Status of the Implementation Plan
  - Creating Task Action Matrices for all 6 dimensions:
    - Business Process - TSM&O Funding sources
    - Organization & Workforce – Staffing & Organization Charts
      - Work with local agencies to identify staffing needs
      - How many people are involved in TSM&O?
      - Where do those people fit?
      - What is a good organization and staffing model to work with?
      - Where does each position fit in the organization, who do they work with?
      - What kind of supervision do they have?
      - District 5 is looking to provide options. Optimal organization will depend upon how many staff you have working directly for the organization and how many work for the private sector. There is not a one-size-fits-all

solution. District 5 is putting together sample contracts, which will make it easier for the program to be built at the local level.

- Culture – Education and Outreach Materials
  - Creating display materials to educate people about technologies and approaches to the planning process.
  - TSM&O is not about just serving the demand, but managing traffic and developing the community you want to have. Provide materials so that you can take them to your organization and use them.
  - Move TSM&O concepts from traffic ops to the entire organization. Build into how the organization functions.
- Systems & Technology - Commonalities between ITS master plans
- Collaboration – Local sharing/communication processes
- Performance Measures - Standardized evaluation metrics
  - Working into dashboard system to be able to evaluate corridor needs on-the-fly

- Visit www.CFLSmartRoads.com/tsmo.html for the draft Implementation Plan
- Anticipate a draft will be available by May Consortium

- Implementing the Program
  - District Five: TSM&O Implementation Plan
    - Identify an implementation plan that promotes program maturity and sets the foundation for an effective TSM&O practice in District 5
  - Central Office: Implementing TSM&O Processes into FDOT Processes
    - UNF Study that will provide recommendations on how to incorporate TSM&O in each stage of project development
    - Reviewed FDOT guiding documents for TSM&O language.
    - Hopes to recommend TSM&O language for each of these documents.
    - Anticipates a draft report this Fall 2017
  - Central Office: Blueprint to Incorporate TSM&O in Corridor Planning
    - Focuses on identifying specific TSM&O strategies that can be incorporated into a corridor study
    - Draft issued in September 2016, awaiting final document
    - Identified a gap in planning for TSM&O in the 5- to 20-year horizon
      - Long range corridor plans may not be incorporating TSM&O strategies
    - Situations where the Blueprint can be applied:
      - TSM&O Strategies in the 5- to 20-year timeframe
      - Incorporation of TSM&O strategies in long-term corridor plans
      - Identification of strategies for inclusion in PD&E
    - Steps to apply the Blueprint to a corridor study:
      - Data collection
      - Define study area and time frames
      - Stakeholder outreach
      - TSM&O Matrix
        - List of TSM&O strategies with descriptions, requirements, interdependencies, where/when it is best to deploy, issues that the strategy addresses or mitigates, and the benefits the strategy provides (mobility, safety, environment)
      - Analyze and refine strategies

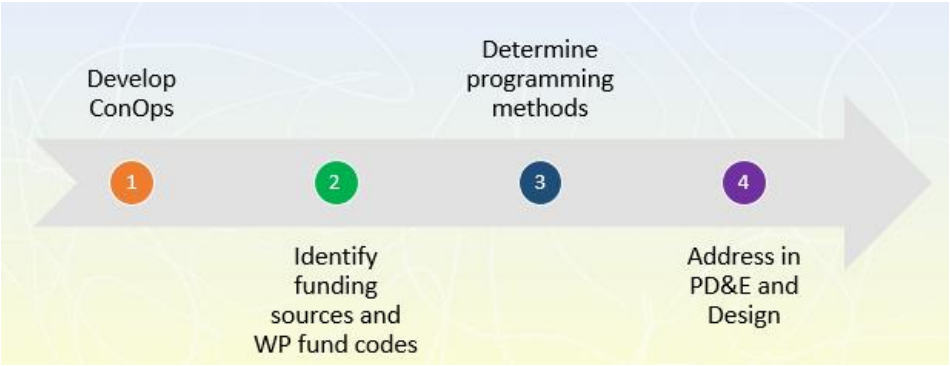
- Develop tiers for segments of the corridor based on priority need.
- Develop TSM&O packages for each tier.

**Table 3-5 Illustrative Example of a Congestion Mitigation Package**

| Strategy | Potential Benefits |
|---|---|
| Hard Shoulder Running | Provides additional capacity with limited additional right of way and construction |
| Dynamic Pricing | Provides a more reliable choice for having free flow conditions |
| Dynamic Speed Limits | Smoothing flow of traffic based on real-time conditions helps minimize speed differences and avoid stop-and-go situations. |
| Dynamic Rerouting | Changes destination signing during periods when one facility is congested and parallel facility or facilities are not, to optimize system performance |
| Integrated Corridor Management | Incorporates Dynamic Rerouting as well as active management of facilities to optimize traffic flow in a corridor |
| Express Lanes | Lane use is controlled by access, vehicle eligibility, and price |
| Reversible Lane | Reversible lane on roadways with high directional flow increases capacity. |
| Enhanced Traveler Information | Provides estimated travel time information (tailored to user where possible) to allow users to make better decisions |
| Connected Vehicles V2I | CV technology may in the future change the delivery method of information from infrastructure-based technologies (DMS) to in-vehicle messaging. CV may allow messages more specifically tailored to the motorist. |

- Use the Tool for Operations Benefit/Cost Analysis (TOPS-BC) developed by FHWA.

- Develop recommendations
- Document in Planning-level ConOps
  - Introduction
  - Study area and planning horizon
  - Summary of long-term corridor improvements
  - Summary of current and projected operating conditions
  - Analysis of TSM&O Strategies – TOPS-BC findings
  - Further Analyses
  - Recommendations on application of strategies




- DISCUSSION / Q&A:
  - Question: What is the scope of the corridor? District-wide?
    - Jeremy: This approach was originally developed based on a 5-mile corridor. The 5-mile designation was developed for freeway sections, but is moving over to arterial. The 5-mile designation is arbitrary at this point. TSM&O work that has traditionally been done by the traffic office will be broader and handled by all units.

- Jeremy's elaboration on status of the IP:
  - Working on establishing what funding types are eligible for each purpose. Working on determining how we establish a prioritization process; identifying the appropriate steps in FDOT.
    - Goal is report to CO: this is how we prioritize projects at the district level, and how we recommend the process should work statewide.
  - Corridor Studies – TOPS-BC takes the analyses we have traditionally done and incorporates them into a BCA process that allows us to make high-level decisions. TOPS-BC is an estimation tool; we still need to bring in experts at the right time in the process.
- Question: What is going on with changes in procurement and JPAs?
  - Jeremy: Historically, how the JPAs have been set up within FDOT District Five is not up to traditional FHWA standards for federal funds. FDOT is not given a lot of choice in how they administer federal funds. JPAs are not allowed except under niche circumstances.
  - Follow-up question: Lately a lot of us have been provided FDOT funds to buy equipment and we are installing it. How can we continue to do things like that under the forthcoming new procurement guidance?
    - Jeremy: FDOT is considering solutions. There may be the ability to maintain push-button maintenance and construction contracts at the district level. That would provide flexibility like JPAs, but FDOT would hold the contract. District 5 is looking for solutions to restore procurement mechanisms but also comply with federal rules.
  - Follow-up question: Will signal maintenance contracts have to be federalized in the new agreement?
    - Followed up at the end of the meeting: signal maintenance contracts will not need to be federalized.
- Question: Is there the opportunity to buy from state contract?
  - Jeremy: Will follow up.

## III. EXPRESS BUS – PERFORMANCE MEASURES, DISTRICT 4 AND DISTRICT 6

David Williams presented on Express Bus and Performance Measures for Bus Routes in Districts 4 and 6.

- 95 Express Program – District 4 and District 6
  - Low-cost alternative to capacity projects on I-95
    - Converted old high-occupancy vehicle (HOV) lanes to express lanes
      - HOV lanes no longer provided reliable travel
    - HOV/carpool vehicles exempt from tolls
    - Only 2-axle vehicles allowed in express lanes
    - Dynamic tolling
      - System-wide increased use of express lanes = increase in tolling charges
      - System-wide decreased use of express lanes = decrease in tolling charges
      - Dynamic message signs display current toll; once the driver enters an express lane, their maximum toll is locked in at that price (decrease in tolls will also be passed along).
    - Transit, technology, travel demand management

  - Original 7-mile project (District 6) along I-95 was extended into Broward County (District 4), covering ~21 miles
  - Goals
    - Decrease overall congestion on I-95; provide safe and predictable trips; maintain free flow of traffic in express lanes (45 mph); increase person throughput
- 95 Express Bus
  - Started with 3 routes, expanded to 10 after impressive ridership numbers
    - 8 routes on I-95, 2 routes on I-595
  - Average commuter roundtrip: 52 miles
  - Current average daily ridership: 4,765
  - Total vehicle miles saved: 240,000+ miles/day
  - Increased person throughput by 25% on express lanes during PM peak hours
  - Capital costs: $650,000 per bus; used existing park-and-ride lots (key component)
  - Operation and Maintenance (O&M) Costs: $4.55 million/year for 6 routes
- 95 Express Bus - Lessons Learned
  - Understand the market:
    - Early planning with transit provider;
    - Determine market potential using Origin/Destination (O/D) surveys and travel demand models;
    - Attract choice riders;
    - Provide park-and-ride connectivity; and
    - Allow for expansion opportunities
- 95 Express Bus – Performance Measures
  - Primary: peak load factor, passengers per trip, farebox recovery, operating cost per passenger trip
  - Supplemental: Reportable incidents per 100,000 revenue miles, revenue vehicle system failures per 100,000 revenue miles, service- related complaints, on-time performance
  - Created composite score normalized to 1.0 value. Gave each bus route 12-18 months to mature. Identify how each route is doing based on composite score, among other factors. When in Watch or Fail categories, determine how the routes can improve.
    - Restructure service, realign route, add stops, take away stops, marketing, etc.
    - Termination of the route is a last resort
  - District 4 and Broward County Transit developed the performance measures as part of the JPA. Currently, they are having some trouble with reporting. They are in the process of developing more standardized reporting methodology for quarterly reports.
    - District 4 explained further that instituting performance measures in the middle of the program, rather than from the start, has made the reporting difficult.
      - Implementing performance measure reporting and methodology from the beginning of the process will make things much smoother.
- DISCUSSION / Q&A:
  - Question: How are the routes modified?
    - Increasing frequency, merging routes, marketing opportunities, coordinating with park and ride, etc.
    - Jeremy: I-95 Express program is one of the most successful in the country. Excess revenue from these tolls were pulled into funding the express bus. They used performance measures to determine which routes should and should not be funded. Park-and-Rides contributed to the success of the express bus service.

        - Jeremy: Current discussion in Florida Legislature about modifying state rule/law to require bus trips to be free on express lanes.
            - The Rules that are under consideration to be changed include:
                - 14-100.003
                - 14-100.004
                - 14-100.005
                - 14-100.006
                - https://www.flrules.org/Gateway/View_notice.asp?id=18490254
    - Question: For I-4 express lanes, will we be looking at express bus in the future?
        - Jeremy: If state legislature decides that all express bus trips will be free, then our express lanes become eligible for bus trips.
        - Follow-up question: Has this bill been vetted through elected officials locally?
            - Express bus would be competing with SunRail; that might concern the local municipalities that will be managing SunRail after 2021.

## IV. DANGEROUS BY DESIGN (2016), PEDESTRIAN SAFETY[1]

David Williams presented slides on the Dangerous by Design 2016 report, developed by Smart Growth America, National Complete Streets Coalition, and other partners.

- Pedestrian Danger Index (PDI), examines the metropolitan areas to determine those that are most dangerous for pedestrians. Standardized value accounts for pedestrian fatalities, population for each MSA, and pedestrian commuters.
- Report looks at 104 MSAs and assigns index values. The report also looks at vulnerable populations by race, income, and age.
- Florida has the highest Pedestrian Danger Index, and is home to eight of the ten most dangerous MSAs nationwide by this measure
- The 2016 edition has implemented tracking percent change from previous edition (2014). Orlando-Kissimmee PDI has decreased by 4%; PDI for Florida has increased by 5%.
- Study recommends focus on Complete Streets policy and design elements.
- DISCUSSION / Q&A:
    - Question: Is this study biased?
        - Discussion about the methodology only taking commuting trips into account
        - Study can be used to make the case to get projects done that support pedestrian safety
        - The study is primarily focused on working trips as identified through the ACS 5-year estimate data. However, it did use non-work journeys to determine a national PDI for each racial and ethnic, as well as age group. Due to data limitations, this adjusted PDI may be less reliable.

[1] Smart Growth America et al (2017). Dangerous by Design 2016. Obtained at https://smartgrowthamerica.org/resources/dangerous-by-design-2016/.

## V. SUMTER COUNTY ATMS PROJECT UPDATE

Mark Van Hala introduced Brian Kanely who presented an update on the Sumter County Advanced Traffic Management System (ATMS).

- Status:
  - The planning phase is 99% complete:
    - In the final stages, receiving comments.
    - Anticipate completion by end of March 2017.
  - Goal is to start Phase 1 Engineering Design in FY 2018.
  - Goal is to start Phase 1 construction in FY 2019.
- Regional goals established for Sumter County ATMS:
  - Work with Lake and Marion to improve traffic operations on US 27/US 441 within the three counties.
  - Work with FDOT to efficiently manage detoured traffic from I-75 and/or the FL Turnpike when a major incident occurs on either freeway.
  - Work with adjacent counties on regional issues, including hurricane evacuation.
  - Marion County has ATMS up and running; Lake County slightly behind Sumter County. Soon all 3 counties will have ATMS, working together to coordinate.
- Phase Details
  - Phase 1 will include the signals on two major roadways in the Villages (C-466 and C-466A), and construction of the Traffic Management Center (TMC) at the PW Building in Bushnell.
  - Phase 2 will include the I-75 interchanges with signals, the US 27/441 corridor, the SR 44 corridor, the CR 48 corridor and the connection to the FDOT District 5 Regional TMC via the existing fiber optic cable along I-75.
  - Phase 3 will include the remaining signals in the County.
  - ATMS will use primarily fiber optic cable and some wireless technology.
- Cost estimates:
  - ATMS Engineering Design & Construction: Total project cost estimated to be $13,350,000
    - Phase 1: $750,000, 6% of total project cost
    - Phase 2: $2,400,000, 18% of total project cost
    - Phase 3: $10,200,000, 76% of total project cost due to large amount of fiber needed to provide second fiber link between the TMC and Wildwood/Villages and connect isolated signals to the TMC.
- Technical Challenges
  - Primary technical challenge is the ATMS communications system/network.
  - Secondary technical challenge is to provide wireless technology for signals in rural areas.
- Funding
  - Project will be funded through FDOT and Sumter County.
  - Sumter County is working with the Metropolitan Planning Organization (MPO) on funding.
- DISCUSSION / Q&A
  - Question: Was the planning initiative started by Sumter County or the MPO?
    - County Public Works
  - Question: How does Sumter County work with I-75 FRAME?
    - Jeremy: Different applications set up as part of FRAME. Most run locally. Traffic Advisory Messages take info from local system. Later implements will build on it.
      - Will become more of an Integrated Corridor Management effort. Share video, data, access to systems. FDOT will be able to see what is going on with the system. Restructuring agreement to be more comprehensive.

- Question: Does the project identify O&M costs and using in-house staff or contractors?
  - Initially through in-house, Phase 1 minimal. Train in-house staff to operate.
  - Phase II – county needs to determine how they'll set it up. O&M is contract staff right now. County system only 211 people, mostly public works and fire.

## VI. COMPARISON OF REGIONAL ITS MASTER PLANS

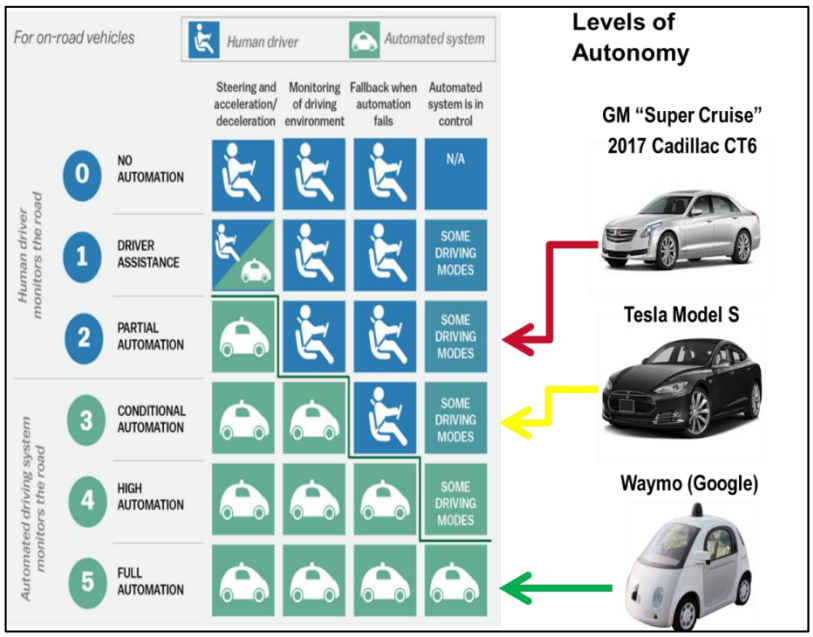
Joe Perri presented slides comparing Regional ITS Master Plans.

- Anticipated schedule for ITS Master Plans was discussed
- Potential Items for Incorporation into ITS Master Plans
  - Proposed Projects
  - Estimates calculated for projects
    - Estimates developed for the various phases of the projects
    - Identify future O&M costs – project by project and system-wide. Identify years of future O&M costs based on deployment schedules.
  - Participating agencies and their requirements
  - Proposed Technologies
    - Automated/Connected Vehicle, networking. Stay compliant with regional architecture.
  - Year(s) targeted for implementation
  - O&M funding approach
    - During master planning stage, funding sources should be identified so the agency can plan for any potential shortfalls.
  - Prioritization Process used
    - Varies across agencies, but should be documented in the plan.
  - Staffing needs
  - Multi-Modal projects
  - Security Standards
    - Physical and network security
  - Data management standards
    - How to store, archive, and share data
- DISCUSSION / Q&A
  - Question: Is that item list everything that should be included in an ITS master plan?
    - Jeremy: No. It is not necessarily better if you have all of the categories. Create your ITS Master Plan based on the needs of your agency; there is not a right or wrong answer for how everything exactly fits. This is a list of items that were identified in one or more of the ITS Master Plans that were reviewed.
  - Question: Where is the District Five ITS Master Plan in comparison to the others?
    - The table was updated to include the status of the District Five ITS Master Plan for each of the items above

## VII. TRANSPORTATION AND FUTURE TECHNOLOGIES

Jeremy Dilmore discussed slides concerning Automated / Connected Vehicles (AV/CV) and other innovations in the transportation industry, as presented during a recent MetroPlan Orlando meeting.

- HDR Presentation – Status of AV/CV
  - Differences between connected and autonomous vehicles.
  - Truck Platooning
    - Studies by State to remove following distance requirement to allow platooning.
  - Legislative Action – Florida has most permissive AV/CV laws. The state may adjust car following distance laws. A car must have a licensed driver for the vehicle somewhere in the world, and an insurance policy covering at least $5 million.
  - Levels of Autonomy for AV
    - Level 3 is considered by several manufacturers to be the "danger zone," due to the conditional automation involved within this level
      - There is enough automation to allow the driver to remove eyes from the road, but the driver may be required to suddenly take over driving from the automated system, leading to dangerous situations and potential lawsuits
      - Most manufacturers will not develop automated vehicles in this level, either manufacturing vehicles that operate in Levels 0-2, or Levels 4-5




  - Literature projections – penetration rate for autonomous vehicles. 2040 before high saturation. Threshold of 50% or more is when industry leaders expect to see the benefits: fitting more cars on the roadway, less pavement, shorter headways, fewer crashes, etc.
    - Aggressive projections
  - Benefits of CV – safety.
    - Forward collision warning,
    - Emergency electronic brake,
    - Do not pass warning,

        - Eco-traffic signal timing,
        - Curve speed warning,
        - Stop gap assistance,
        - Pedestrian in signalized intersection, and
        - Eco-traffic signal timing.
    - "Killer Apps" for AV/CV have already been developed. Once the hardware hits the street, applications will already be available.
    - Map indicates substantial AV/CV efforts across the state of Florida, including the Central Florida Automated Vehicle Proving Grounds Partnership
- HDR Presentation – Future Proofing
    - Communication Structure
        - Dedicated Short Range Communications (DSRC) vs 5G (Connected Car)
    - Visual Localization (on vehicle)
        - LiDAR vs. Visual (Optical Camera)
    - Fundamentals for developing CV infrastructure – Access to power, communications backhaul, mounting locations and space in NEMA enclosures.
    - Data and Processing – Data storage – Cloud is important, but it can't store everything.
        - Uploading ALL data collected from CV to the Cloud would require too much bandwidth
        - FDOT will have a report on data storage investment needs
    - AV assistance – A foot or two matters in lane-keeping assistance.
        - Reference markers. What should those reference markers look like? Visual or reflective? Lasers or optical? Should they be more plentiful in a rural setting?
        - What happens when there is no lane marking? Dirt roads?
    - Pavement and Design Considerations
        - Once you put the reference markers out, they'll be so precise that the wheel paths will go over the same pavement again and again, and this ruts the pavement. May need to change pavement design standards. *Changing pavement design is expensive*.
            - Different manufacturer technologies may result in slightly different measurement schemes, which in turn could lead to slightly different tire locations; this is still unclear
    - Recognition systems – standardization of signage
        - How does AV/CV function with a crossing guard holding a STOP sign?
    - Future Proofing Takeaways
        - Infrastructure will continue to lag behind vehicle technology, but it is not all or nothing; use the best information, make good decisions, and don't wait for everything to be here.
- HDR Presentation – TransFuture
    - Dealing with uncertainty, planning for multiple futures.
    - Scenario planning: look at impacts of each and the probability of our needs in a future year. Quantify uncertainty. Make decisions based on risk – overbuild and underbuild.
    - Emerging Trends – Millennial travel behavior
        - Active transport, less VMT, flexible work parameters, fewer driver's licenses
    - Emerging Trends – AV/CV
        - Reduction in crashes, increased roadway capacity, fuel efficiency, platooning, etc.
    - Other examples of emerging trends include telecommuting, ridesharing, automation, and smart cities

- City of Orlando Presentation – Central Florida Automated Vehicle Proving Grounds Partnership
    - Areas of focus
        - 4 modes of travel – automobiles, freight, transit, bike/ped
            - Interaction between those modes
        - Safety
        - Full range of automation
            - Development of sensors, human factors, policy, alternative fuels
    - The Partnership was chosen based on breadth of focus – all modes, all stages of development.
    - Anticipated Benefits
        - Earn & Retain "Smart City" branding
        - USDOT Designation/Certification Agreement and funding opportunities
        - Coordinated Research
        - Safer and more livable communities
        - Allows partners to independently pursue other opportunities
    - SunTrax
        - 5-mile track for AV/CV testing
        - Construction begins Summer 2017
        - Intended to simulate an urban setting
    - Current Status
        - Unofficial designation since mid-January 2017.
        - Initial Team Meeting – early February 2017. USDOT Convening of 10 winning teams.
    - Next steps
        - Developing MOUs. Process for adding others to the team in once MOUs developed.
        - Process for engagement, procurement, protocols.
- Question: Heard there would be an unmanned ITS RC on I-4 to mimic the behavior of an AV to monitor spacing.
    - Jeremy: Put in hands of Public Private Partnership (P3) concessionaire, have not heard anything about it. Will follow up.

THE CENTRAL FLORIDA AUTOMATED VEHICLE PROVING GROUNDS PARTNERSHIP


## VIII. CURRENT INITIATIVES UPDATE

Jeremy provided an update of current projects and activities taking place within District Five.

- UF Big Data Research Project
    - Pedestrian Crash Research
        - A number of questions regarding pedestrian crashes were given to UF for the project to answer
        - Number 1 correlation with pedestrian crashes – education level.
        - Other correlations: Day/night, population, age, ethnicity, distance to red light cameras, bus usage.
        - Used GIS tools and regression analysis.
    - Road Rangers
        - Roadway clearance time vs. incident clearance time. Incident Duration map. Lane blocking duration. Duration of incidents on I-4, where Road Ranger service is available, are lower than I-95 where there are not. Road Ranger response times.
            - Analysis Method – Tableau
                - Allows for quick adjustments to what data is needed
    - SunRail Sentiment analysis
        - Social Media – Twitter, filtering, analysis – positive vs. negative, sentence structure
        - Feeds in real time – positive and negative sentiments
            - Issues –
                - Sample size is 3 stations
                - Other people may be posting but analysis used 3 APIs, biased samples. Check for spatial, temporal biases in social media data. Report available on District 5 SharePoint, available to be sent out if requested.

        - Filtering software still struggles with sarcasm and figures of speech taken from social media
    - Going forward:
        1. FDOT asks questions
        2. Universities have direct access to data
        3. FDOT develops a team of experts
        4. Experts guide development (correlation does not equal causation)
        5. Universities run data analysis system; present results
        - If members have questions, FDOT has funding for UF and UCF to do these types of projects. Do you think this is sustainable? Reasonable?
    - Jeremy requested that any public agency with questions that could potentially be answered through Big Data should direct those questions to him, so that he can forward them onto the universities to be analyzed further
- Active Projects
    - ReIP
        - Discussion of more Closed-Circuit Television (CCTV) integration
        - Multicast vs. Unicast
            - Multicast supports a much larger number of connections.
    - I-75
        - Several segments complete
    - Active Arterial Management – automated data collection
        - Phase 1 – Complete
        - Phase 2 – Finalizing
        - Phase 3 – Award in progress
    - TSP
        - Phase 1 – Complete.
            - Still some integration issues; timing being worked on
            - Construction done but integration continues.
        - Phase 2 – In construction
        - Phase 3 – Study Design next fiscal year; Design Build.
    - Intersection Movement Counts
        - 10 intersections deployed; working on accuracy issues.
    - AAMO
        - Diversion Route Timings under development
    - Active Arterial Management (AAM) Dashboard
        - Sprint 2 complete – working wireframe
    - Planning Dashboard – make data available.
        - Environment created
        - Test API working
        - Adding data – scheduled in August
    - University of Florida Big Data Research Project
    - Loop vs. Signal Performance Measures data comparison
        - Reduce cost and provide more ubiquitous data through application of production factors
        - Ways to correlate data.
    - Regional Traffic Management Center (RTMC)
        - Clearing and grubbing final grading
        - Awarded

- Event Management
  - To advertise; added sign removal (additional CO funds)
- Bridge Security
  - Advertising
- Adaptive Ramp Metering
  - Had stakeholder meeting; gathering lessons learned; helping develop statewide ramp metering guidebook.
  - Apply bounds to ramp metering metrics so you don't close off arterials
    - Want to do ramp metering, but not at the expense of the arterial system.

- Future Work
  - Shortlisted
    - TSM&O Continuing Services – In Selection (Retiming work)
    - Route and Mode Choice
      - Take transit, vehicular information to support single dataset that can be queried to determine optimal choice.
  - Advertised
    - TMC Operations (Freeway and Arterial)
    - Integrated Corridor Management System (ICMS)
  - Advertising Soon
    - I-75 FRAME
    - PedSafe, Greenway, and SunStore,
    - SR 434 Connected Vehicle
    - I-75/I-95 Ramp Metering Study
    - ITS software (Road Ranger, AVL, iVDS, MIMS, etc.) – selecting by July
    - SR 40 Design-Build-Operate-Maintain (DBOM)
  - Update on software availability
    - Inter-agency Video Distribution System (iVDS) ready to go
    - New FDOT Domain is up and running
      - Involved in Sunguide 6.2 upgrade
      - Adding Dynamic Message Signs (DMS), CCTV, and Bluetooth devices to current software
        - Next up MIMS update – maintenance and inventory management software.
        - Next up Activu update –
          - SunGuide – Use this function to send over to EOC, sheriffs, etc. to connect and update so they look at the right camera at the right time
          - Followed by Domain connections
  - Grant Opportunities
    - FASTLANE – no updates
    - Accessible Transportation Technology Research Initiative (ATTRI) – open and available
    - Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) – waiting to hit
  - FDOT Central Office Strategic Plan
    - Policy Focused
      - FDOT Workforce Evaluation

- Project Recommendations
- Performance Measure Driven
- Integration of TSM&O into other units in FDOT

- TSM&O Implementation Plan
  - Looking to clarify funding process
  - Staffing and organization

## IX. UPDATING CAPABILITY MATURITY FRAMEWORK – ONE MINUTE ASSESSMENT

Jeremy requested that all Consortium members please complete a one-minute CMF assessment of the region as a whole, for each of the six dimensions. A second assessment for each Consortium members' respective public agency was also requested.

- https://ops.fhwa.dot.gov/tsmoframeworktool/tool/traffic_mgmt/
- What level do you think we are at? Are we making progress?
- Email Jeremy the final score

## X. ATTACHMENTS

- A – Sign in sheets
- B – FHWA Workshop Handout
- C – Presentation Slides
- D – Meeting agenda

END OF SUMMARY

*This summary was prepared by Kayla Costello and 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 kcostello@vhb.com so they can be finalized for the files.*

# TSM&O Consortium Meeting
# March 9, 2017

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# TSM&O Consortium Meeting
# March 9, 2017

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# TSM&O Consortium Meeting
# March 9, 2017

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# TSM&O Consortium Meeting
# March 9, 2017

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Winter/Spring 2017

U.S. Department of Transportation
Federal Highway Administration

reliability efficiency choices

**WORKSHOP DATE & TIME:**
**March 27, 2017**
**9:00 AM – 4:00 PM**

**LOCATION:**
**Florida Department of Transportation District 5**
**Orlando Urban Office**
**133 South Semoran Blvd.**
**Lake Apopka Conf. Room**
**Orlando, FL 32807**

### How can Archived Operations Data help Transportation Planners?

It allows agencies to harness archived day-to-day transportation data and use it to make more informed decisions, track the impacts of those decisions, and manage their investments to achieve their performance objectives.

For more information on the workshop contact:

**Mr. Wayne Berman**
**FHWA Office of Operations**
**wayne.berman@dot.gov**
**202-366-4069**

# Applying Archived Operations Data in Transportation Planning

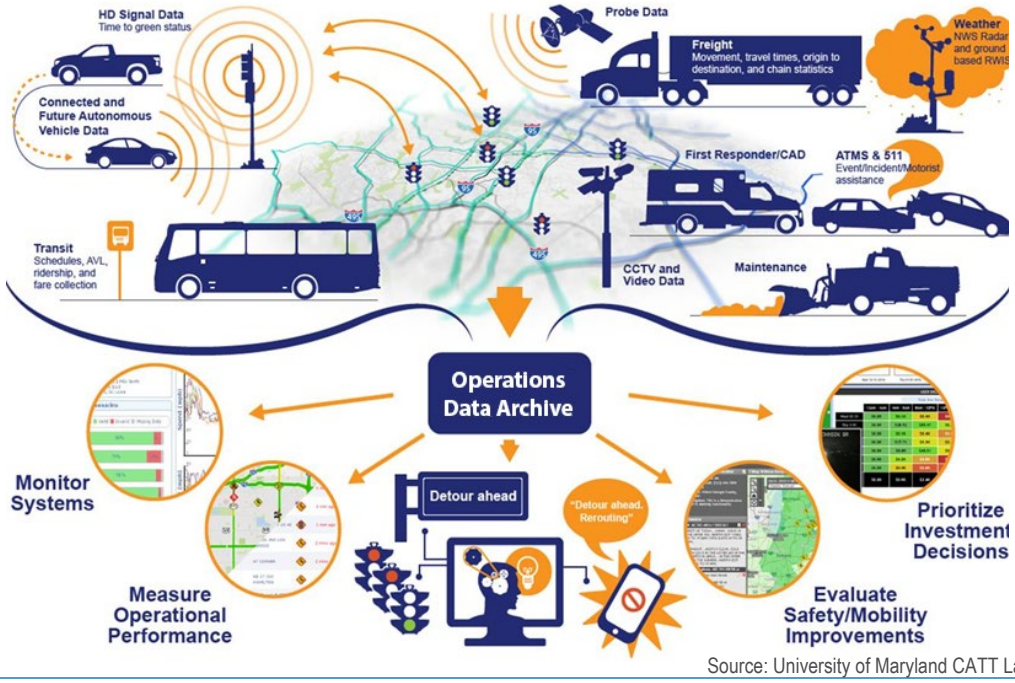
## A Workshop

Every day there are billions of pieces of data collected on the functioning of the transportation system – highways, transit, freight, arterials, road weather, incidents, video, signals, etc. This workshop emphasizes the importance and benefit of capturing and storing this data and archiving it for future. In doing so, agencies can obtain a more complete picture of system performance and conduct more sophisticated modeling. Archived operations data can also open up new types of analyses to support the planning process. The goal of the workshop is to:

- Assist transportation planners & operations partners to take advantage of the opportunities to advance planning and programming through archived operations data.
- Raise awareness of the opportunities and provide "how-to" guidance.
- Help overcome the barriers to obtaining and using data.

This one-day workshop will walk participants through how to:

- Meet a range of planning needs with archived operations data,
- Conquer the challenges of using archived operations data,
- Archived operations data that planners need, and
- Identify the planning opportunities that are now accessible due to archived operations data.




Source: University of Maryland CATT Lab


## What is Archived Operations Data?

Archived operations data is the collection and storage of transportation related data. It can include traffic, transit, bike, pedestrian, construction, and weather information that is usually collected in real-time by intelligent transportation system (ITS) infrastructure, such as in pavement inductive loop detectors, radar detectors, remote traffic microwave sensors (RTMS), Bluetooth, and E-ZPass or other unique identifier tag readers. It also includes incident or event information entered into electronic logs by transportation or public safety personnel.

**U.S. Department of Transportation Planning for Operations Resources at:**

http://www.ops.fhwa.dot.gov/plan4ops/index.htm

## Who Should Attend?

Transportation planners, operators, metropolitan planning organizations, State DOTs, local governments, and other participants involved in planning. The workshop is designed for agencies that are interested in getting the most out of their data.

## Workshop Agenda

| |
|---|
| Welcome and Introductions |
| Module I: Introduction to Use of Archived Operations Data for Planning<br>• Understanding archived operations data<br>• Benefits of archived operations data for planning<br>• Archived operations data types<br>• Discussion and examples of use |
| Local Presentation on Update on Archived Data Available in Florida DOT District 5 |
| Module 2: Applications of Archived Operations Data in Planning<br>• Reporting performance measures<br>• Visualization with existing performance measures tools<br>• Evaluating performance trends for target setting |
| *Lunch Break* |
| Module 2: Applications of Archived Operations Data in Planning (continued)<br>• Data for analytical tools<br>• Project identification and confirmation<br>• Before and after studies |
| Module 3: Moving Forward with Archived Operations Data – Challenges/Solutions<br>• Obtaining the data<br>• Getting past institutional challenges<br>• Procuring 3rd party data<br>• Data management |
| Summary Discussion |

***Please RSVP by Friday, March 17, 2017 to:***

Jackie Clark, Leidos
Jacquelyn.B.Clark@leidos.com
Phone: (703) 318-4753

U.S. Department of Transportation
Federal Highway Administration

# Welcome to the TSM&O Consortium Meeting

## March 9, 2017

Transportation Systems Management & Operations

# Meeting Agenda

1. Introduction
2. D5 TSM&O Implementation Plan
3. Express Bus and Performance Measures
4. Dangerous by Design
5. Sumter County ATMS Update
6. Comparison of Regional ITS Master Plans
7. Transportation and Future Technologies
8. FDOT Current Projects Overview
9. Updating CMF – One Minute Assessment

# TSM&O Implementation Plan Update

- Purpose of the Implementation Plan
- Status of the Implementation Plan
- Review of other TSM&O Implementation Projects

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# Purpose of the Implementation Plan

The TSM&O Implementation Plan **IS**:

- Program framework
- A living document
- Inclusive of all 6 CMF Dimensions
- D5 Specific
- Dependent on **Stakeholder Buy-In**

The TSM&O Implementation Plan **IS NOT**:

- Project Specific
- Only applicable to some functional units
- An ITS program
- One size fits all

# Status of the Implementation Plan

- Task Action Matrices for all six dimensions
- Business Process – TSM&O Funding sources
- Org & Workforce – Staffing and Organization Charts
- Culture – Education and Outreach Materials
- Systems & Technology – Commonalities between ITS Master Plans
- Collaboration – Local sharing / communication processes
- Performance Measures – Standardized evaluation metrics

Please visit **CFLSmartRoads.com/tsmo.html** for the draft Implementation Plan

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# Implementing the TSM&O Program

**D5** • TSM&O Implementation Plan
- Establish a foundation for effective TSM&O practices in District 5

**CO** • Implementing TSM&O Processes into FDOT Processes
- How to incorporate TSM&O into project development at FDOT

**CO** • Incorporating TSM&O in Corridor Studies: A Blueprint
- Specific TSM&O strategies for corridors

# Implementing TSM&O into FDOT Processes

- UNF reviewed FDOT guiding documents for TSM&O language
  - **PD&E Manual**
  - **Florida Green Book**
  - **ETDM Planning & Programming Manual**
  - **Plans Preparation Manual**
  - **Practical Design Handbook**
  - **CADD Manual**
  - **Project Management Book**
  - **Florida Intersection Design Guide (FIDG)**
  - **Traffic Engineering Manual**
  - **Florida's ITS Integration Guidebook**
  - **Work Program Instructions**

# Incorporating TSM&O in Corridor Studies: A Blueprint

- Identified a gap in planning for TSM&O in the 5-20 year horizon
  - Long range corridor plans may not be incorporating TSM&O strategies
- Situations where the Blueprint can be applied:
  - TSM&O Strategies in 5-20 year timeframe
  - Incorporation of TSM&O strategies in long-term corridor plans
  - Identification of strategies for inclusion in PD&E


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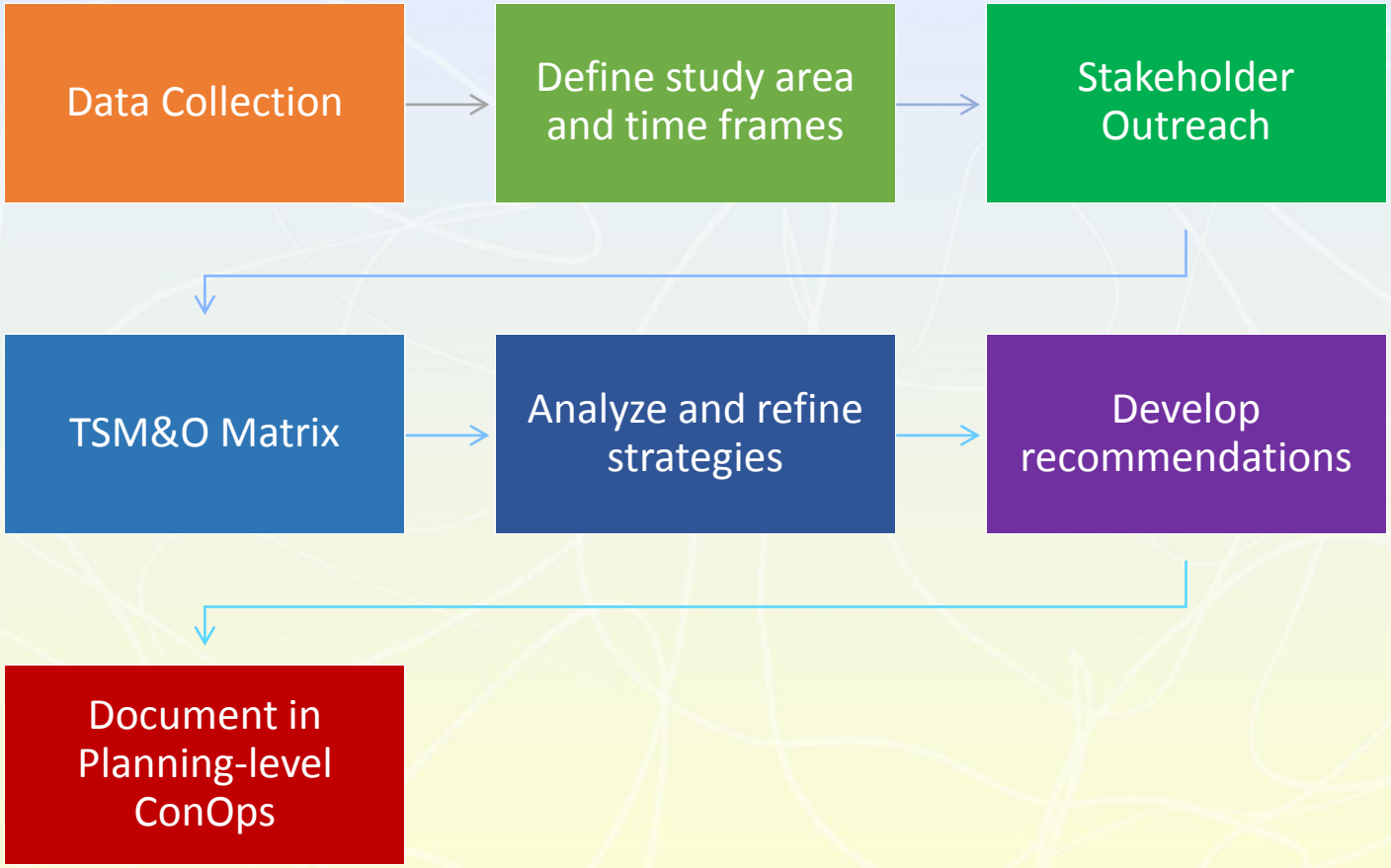
# Incorporating TSM&O in Corridor Studies: A Blueprint

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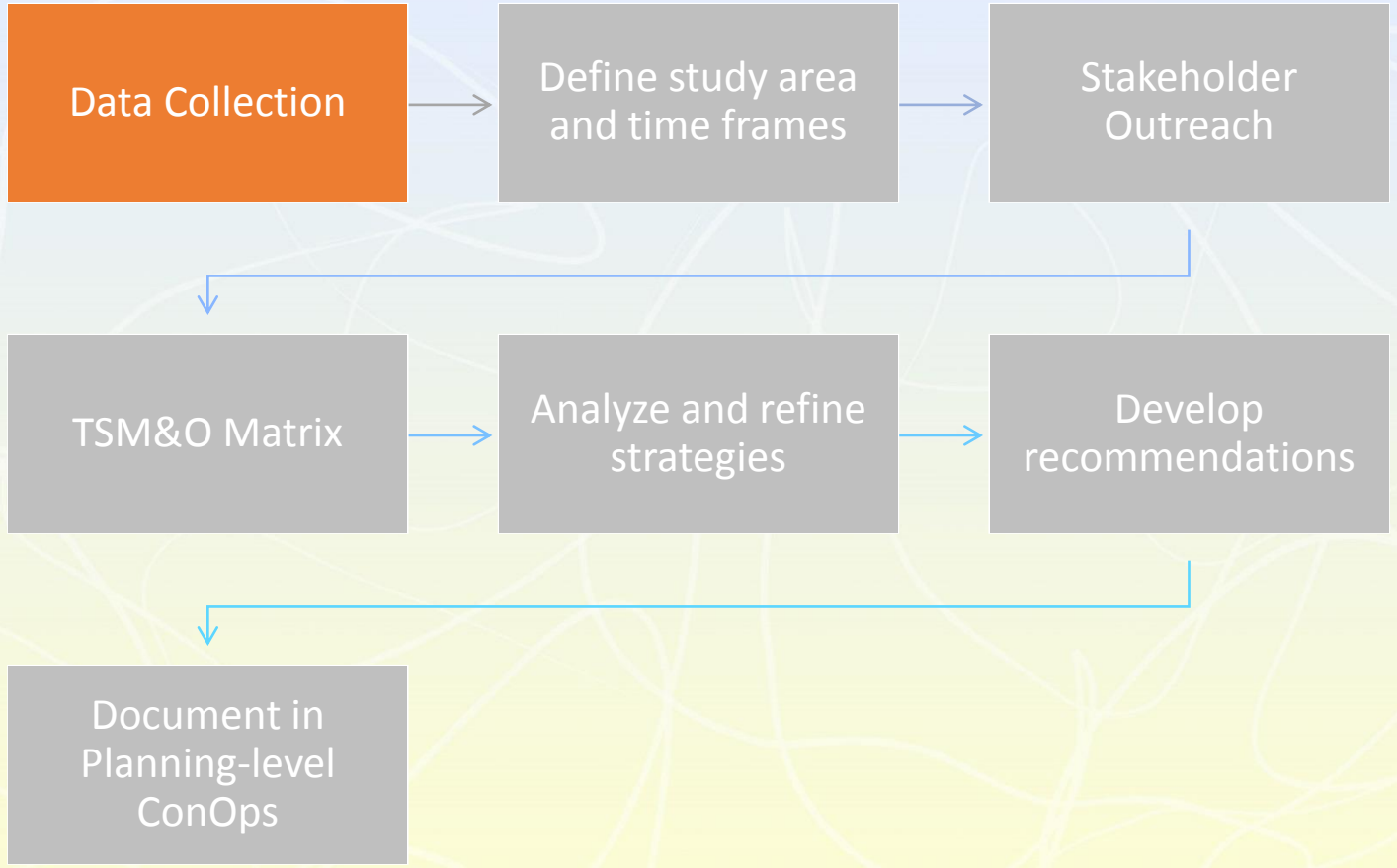
# Incorporating TSM&O in Corridor Studies: A Blueprint

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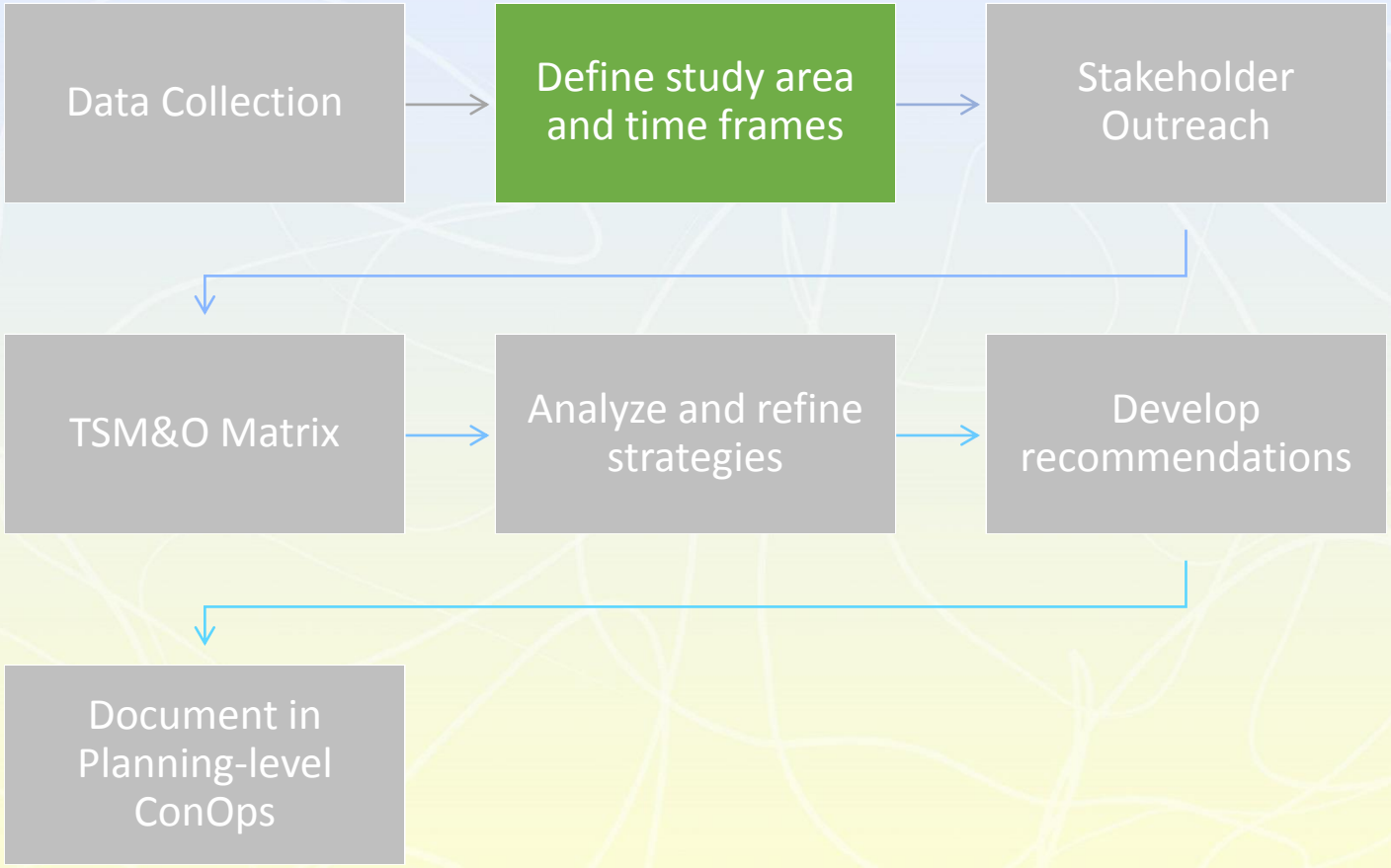
# Incorporating TSM&O in Corridor Studies: A Blueprint

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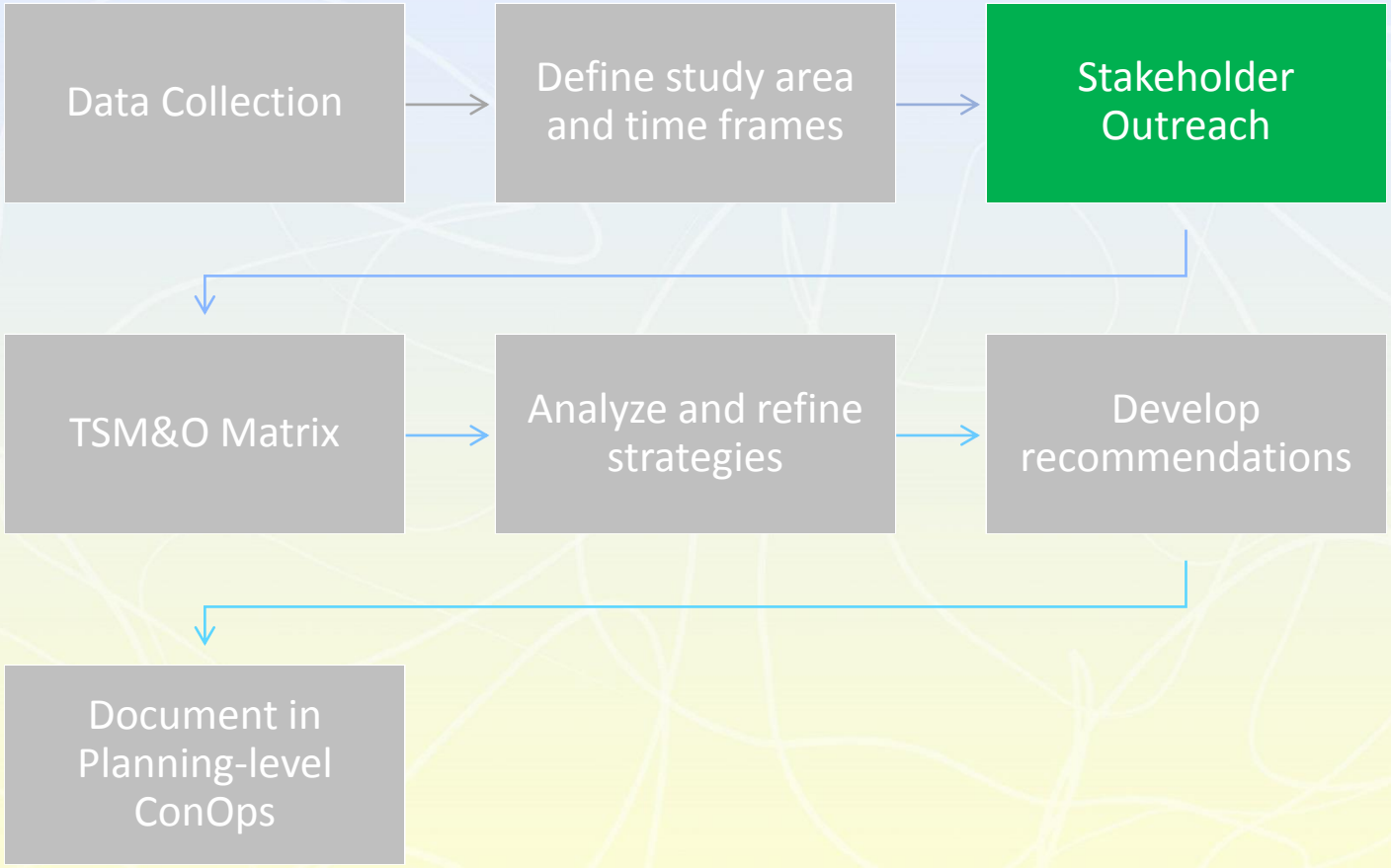
# Incorporating TSM&O in Corridor Studies: A Blueprint

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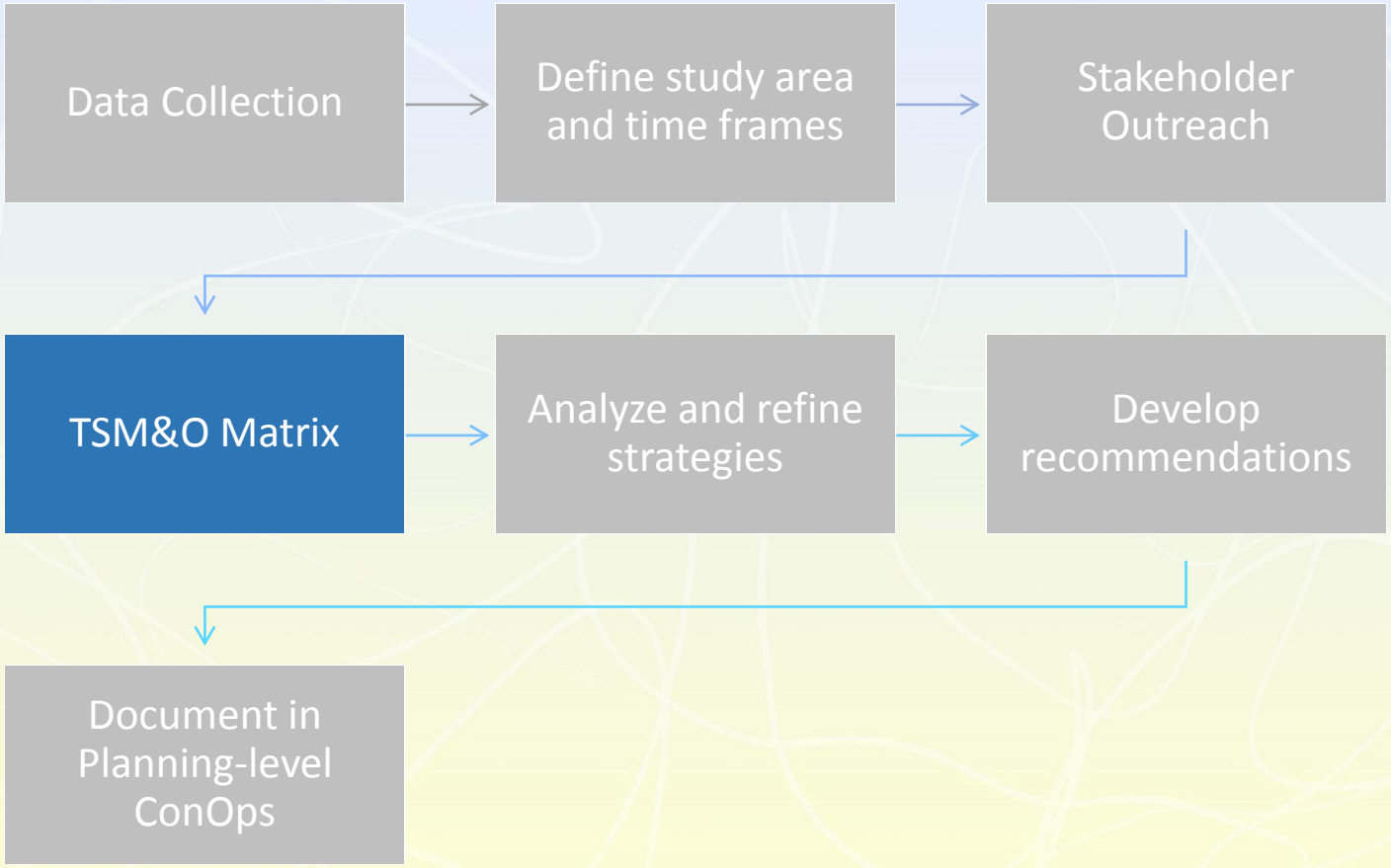
# Incorporating TSM&O in Corridor Studies: A Blueprint

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# Incorporating TSM&O in Corridor Studies: A Blueprint

- TSM&O Matrix is a list of TSM&O strategies with the following information:
  - Description of strategy
  - Requirements that need to be in place
  - Interdependencies
  - Where/When is it best to deploy
  - Issues this strategy addresses or mitigates
  - Benefits strategy provides (Mobility, Safety, Environment)

**Table 3-3 Matrix of Freeway TSM&O Strategies**

| Strategy | Description | Requirements | Interdependencies | Where/When to Deploy | Needs/Issues Addresses | (P=Primary Benefit, S=Secondary Benefit) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Mobility | Safety | Environment |
| Hard Shoulder Running/ Dynamic Priced Shoulder Lane (DPShL)<br>- Bus-Only<br>- General Purpose<br>- Dynamically Priced | This strategy, which has also been called temporary shoulder use, allows drivers to use the shoulder as a travel lane(s) based on congestion levels during peak periods and in response to incidents or other conditions as warranted during nonpeak periods. This strategy may also be used as a managed lane (e.g., opening the shoulder as temporary bus-only lane). This strategy can include tolling with dynamic pricing where traffic is managed in real time and the toll is adjusted to maintain a threshold speed. | Adequate shoulder width, adequate pavement thickness, enforcement, method to maintain minimum speed or level of service, refuge areas if segment is long (more than five miles). Adequate sight distances, intensive enforcement if tolled or only open to specific vehicle categories. Management of lane through interchanges. Also can include Lane-Specific Electronic Toll Collection. Dynamic pricing requires tolling infrastructure, detection and monitoring, communications and power, TMC, and software. | Need tolling technology, CCTV for monitoring, and Dynamic Message Signs (DMS) for information dissemination. This strategy is frequently implemented in conjunction with DSpL and DLA. Maximize benefits with queue warning, junction control, dynamic re-routing, ramp metering, traveler information, and incident response. | Long-term work zones. Roadways at capacity without ability to expand. High recurrent V/C where there is adequate shoulder width or ability to widen, shoulder pavement is adequate or can be hardened, segment length is long enough, and safety concerns can be addressed. | Travel time reliability, relief of capacity or safety deficiency and bottlenecks. Where traffic volumes often approach capacity or persist for long durations. Many applications are peak period only. | P | | S |
| Adaptive Ramp Metering (ARM) | Use of traffic signal(s) on ramps to dynamically control the rate vehicles enter a highway facility. ARM uses traffic responsive or adaptive algorithms (as opposed to local traffic responsive or fixed- time rates) that can optimize either local or systemwide conditions. This, in essence, smooths the flow of traffic onto the mainline, allowing efficient use of existing highway capacity and reducing congestion due to bottlenecks. | Adequate ramp geometrics including storage and merge length. Requires detection and monitoring, communications and power, TMC, and software. | Maximize with queue warning and traveler information. Typically supports Integrated Corridor Management (ICM) | Where: collision problems extend along throughout a corridor (not at isolated locations); multiple bottlenecks on the highway are observed; optimization of highway throughput requires coordinated rates for several ramp meters; non-recurring congestion problems need to be addressed; and flexibility is needed to more quickly address changing conditions over time. | Where traffic volumes often approach capacity or persist for long durations. Bottlenecks, especially lane reductions, weaving and merging areas at ramps, and other geometric bottlenecks, with backups into arterial intersections. | P | P | S |
| Lane Control Signals (LCS)/Dynamic Lane Assignment (DLA) | This strategy, also known as dynamic lane use control, involves dynamically closing or opening of individual traffic lanes as warranted and providing advance warning of the closure(s), typically through dynamic lane control signs, to convey to motorists the status of the lanes or safely merge traffic into adjoining lanes. | Integration with Traffic Management Center (TMC) software/system; fiber and power backbone; available space to install a dynamic message sign (DMS) and supporting infrastructure, and detection and monitoring. | DLA is often installed in conjunction with dynamic speed limits and also supports the DPShL and DJC strategies. | Where there is a high proportion of rear-end and/or side-swipe crashes. Roadway geometrics issues that cause recurring congestion (e.g., horizontal and vertical curves, ramp bottlenecks, other substandard geometric designs). During long-term work zones. | Long-term work zones. Lane drops in congested areas. | S | S | |
| Dynamic Speed Limits (DSpL)/Speed Harmonization | This strategy, which has also been called variable speed limit (VSL), adjusts speed limit displays based on real-time traffic, roadway, and/or weather conditions. DSpL can either be enforceable (regulatory) speed limits or recommended speed advisories, and they can be applied to an entire roadway segment or individual lanes. This "smoothing" process helps minimize the differences between the lowest and highest vehicle speeds, to slow traffic to a sustainable uniform speed approaching and through a congested area. | One lane control display should be visible at all times for maximum effectiveness, enforcement, driver education. Speed measurement and adjustment of algorithms as needed to optimize flow and safety. Requires detection and monitoring, communications and power, TMC, and software. | Traveler information and queue warning for maximizing effectiveness. Hard shoulder running is often also used in conjunction with dynamic speed limits. | Level of Service (LOS) E or F for minimum 3 hours during the peak hour and for 7 hours per day. Typical peak-hour volume exceeds 1,100 vehicles per hour (vph) per lane; the facility has a history of reduced speeds of 40 mph or less for a least 1 hour on typical days (55 mph posted speed). Where there is a high proportion of rear-end and/or side-swipe crashes, and secondary crashes. During long- term work zones. | Locations where there is an increased incidence of rear-end, lane change, or secondary crashes that occur near a specific location on the highway. Along roadway segments that experience frequent adverse weather (e.g., fog, wind, etc.). Applied in Work Zones. | S | P | P |
| Dynamic Junction Control (DJC) | Dynamically allocates lane access on mainline and ramp lanes in interchange areas where high traffic volumes are present, and the relative demand on the mainline and ramps change throughout the day. For off- ramp locations, this may consist of assigning lanes dynamically either for through movements, shared through-exit movements, or exit-only. For on-ramp locations, this may involve a dynamic lane reduction on the mainline upstream of a high-volume entrance ramp. | Junction control is only advantageous at on-ramps when the mainline has spare capacity (giving priority to a higher merge volume). Similarly, junction control at an off-ramp is only desirable if an exit ramp has available width to accommodate an additional exit lane (giving priority to a higher exiting volume and/or downstream merging volume). Requires detection and monitoring, communications and power, TMC, and software. | Dynamic re-routing may also be employed with junction control to help manage traffic in a variety of contexts. Maximize with speed harmonization, hard shoulder running, dynamic re-routing, ramp metering, traveler information, and incident response. | Interchanges that experience significant recurrent congestion, where there are large variations in mainline and ramp volumes, and where mainline or shoulder lanes can be borrowed to accommodate traffic. | Locations where there are large numbers of side-swipe or rear-end collisions at or immediately downstream of entrance ramps during certain times of day. Bottlenecks, especially lane reductions, weaving and merging areas at ramps, and other geometric bottlenecks. | P | S | |

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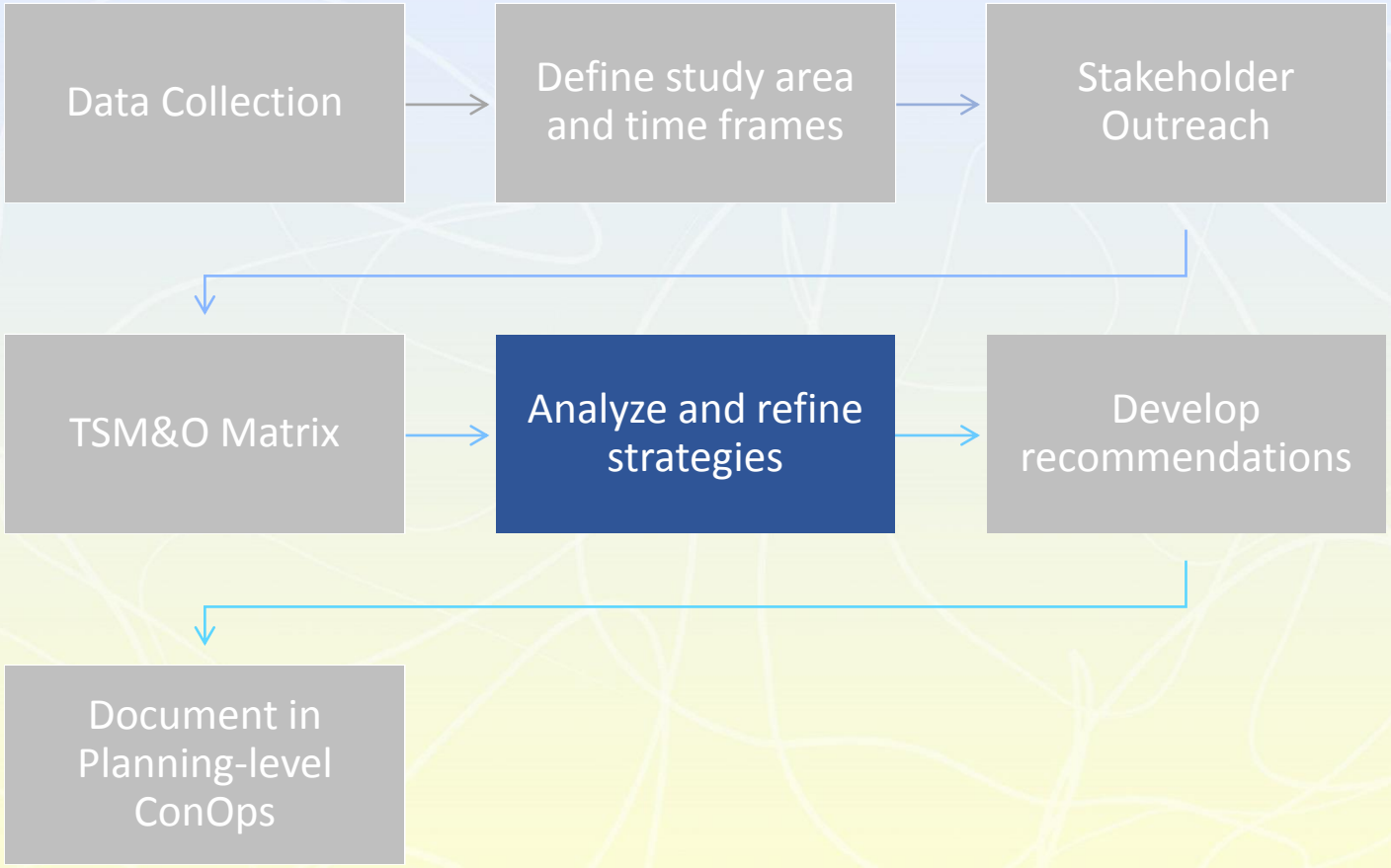
# Incorporating TSM&O in Corridor Studies: A Blueprint

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# Incorporating TSM&O in Corridor Studies: A Blueprint

- Analyze and Refine Strategies
  - Develop tiers for segments of the corridor based on priority need
  - Develop TSM&O packages for each tier


**Table 3-5 Illustrative Example of a Congestion Mitigation Package**

| Strategy | Potential Benefits |
|---|---|
| Hard Shoulder Running | Provides additional capacity with limited additional right of way and construction |
| Dynamic Pricing | Provides a more reliable choice for having free flow conditions |
| Dynamic Speed Limits | Smoothing flow of traffic based on real-time conditions helps minimize speed differences and avoid stop-and-go situations. |
| Dynamic Rerouting | Changes destination signing during periods when one facility is congested and parallel facility or facilities are not, to optimize system performance |
| Integrated Corridor Management | Incorporates Dynamic Rerouting as well as active management of facilities to optimize traffic flow in a corridor |
| Express Lanes | Lane use is controlled by access, vehicle eligibility, and price |
| Reversible Lane | Reversible lane on roadways with high directional flow increases capacity. |
| Enhanced Traveler Information | Provides estimated travel time information (tailored to user where possible) to allow users to make better decisions |
| Connected Vehicles V2I | CV technology may in the future change the delivery method of information from infrastructure-based technologies (DMS) to in-vehicle messaging. CV may allow messages more specifically tailored to the motorist. |

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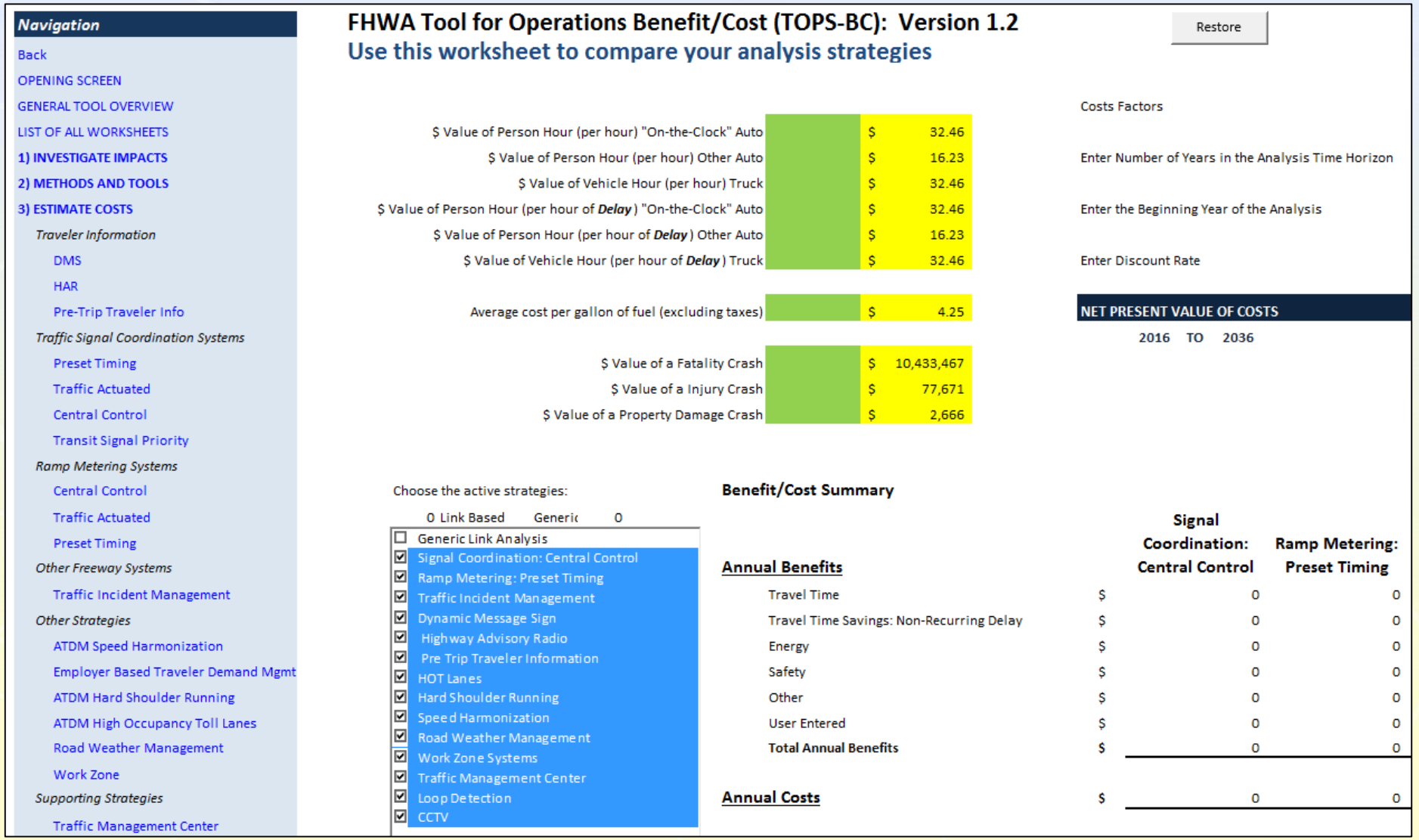
# Incorporating TSM&O in Corridor Studies: A Blueprint

- Analyze and Refine Strategies
  - Analyze TSM&O packages using the Tool for Operations Benefit/Cost Analysis (**TOPS-BC**) developed by FHWA



**Navigation**

Back
OPENING SCREEN
GENERAL TOOL OVERVIEW
LIST OF ALL WORKSHEETS
**1) INVESTIGATE IMPACTS**
**2) METHODS AND TOOLS**
**3) ESTIMATE COSTS**
*Traveler Information*
DMS
HAR
Pre-Trip Traveler Info
*Traffic Signal Coordination Systems*
Preset Timing
Traffic Actuated
Central Control
Transit Signal Priority
*Ramp Metering Systems*
Central Control
Traffic Actuated
Preset Timing
*Other Freeway Systems*
Traffic Incident Management
*Other Strategies*
ATDM Speed Harmonization
Employer Based Traveler Demand Mgmt
ATDM Hard Shoulder Running
ATDM High Occupancy Toll Lanes
Road Weather Management
Work Zone
*Supporting Strategies*
Traffic Management Center

**FHWA Tool for Operations Benefit/Cost (TOPS-BC): Version 1.2**

**Use this worksheet to compare your analysis strategies**

Restore

| | | |
|---|---|---|
| $ Value of Person Hour (per hour) "On-the-Clock" Auto | $ | 32.46 |
| $ Value of Person Hour (per hour) Other Auto | $ | 16.23 |
| $ Value of Vehicle Hour (per hour) Truck | $ | 32.46 |
| $ Value of Person Hour (per hour of ***Delay***) "On-the-Clock" Auto | $ | 32.46 |
| $ Value of Person Hour (per hour of ***Delay***) Other Auto | $ | 16.23 |
| $ Value of Vehicle Hour (per hour of ***Delay***) Truck | $ | 32.46 |
| Average cost per gallon of fuel (excluding taxes) | $ | 4.25 |
| $ Value of a Fatality Crash | $ | 10,433,467 |
| $ Value of a Injury Crash | $ | 77,671 |
| $ Value of a Property Damage Crash | $ | 2,666 |

Costs Factors

Enter Number of Years in the Analysis Time Horizon

Enter the Beginning Year of the Analysis

Enter Discount Rate

**NET PRESENT VALUE OF COSTS**

2016 TO 2036

Choose the active strategies:

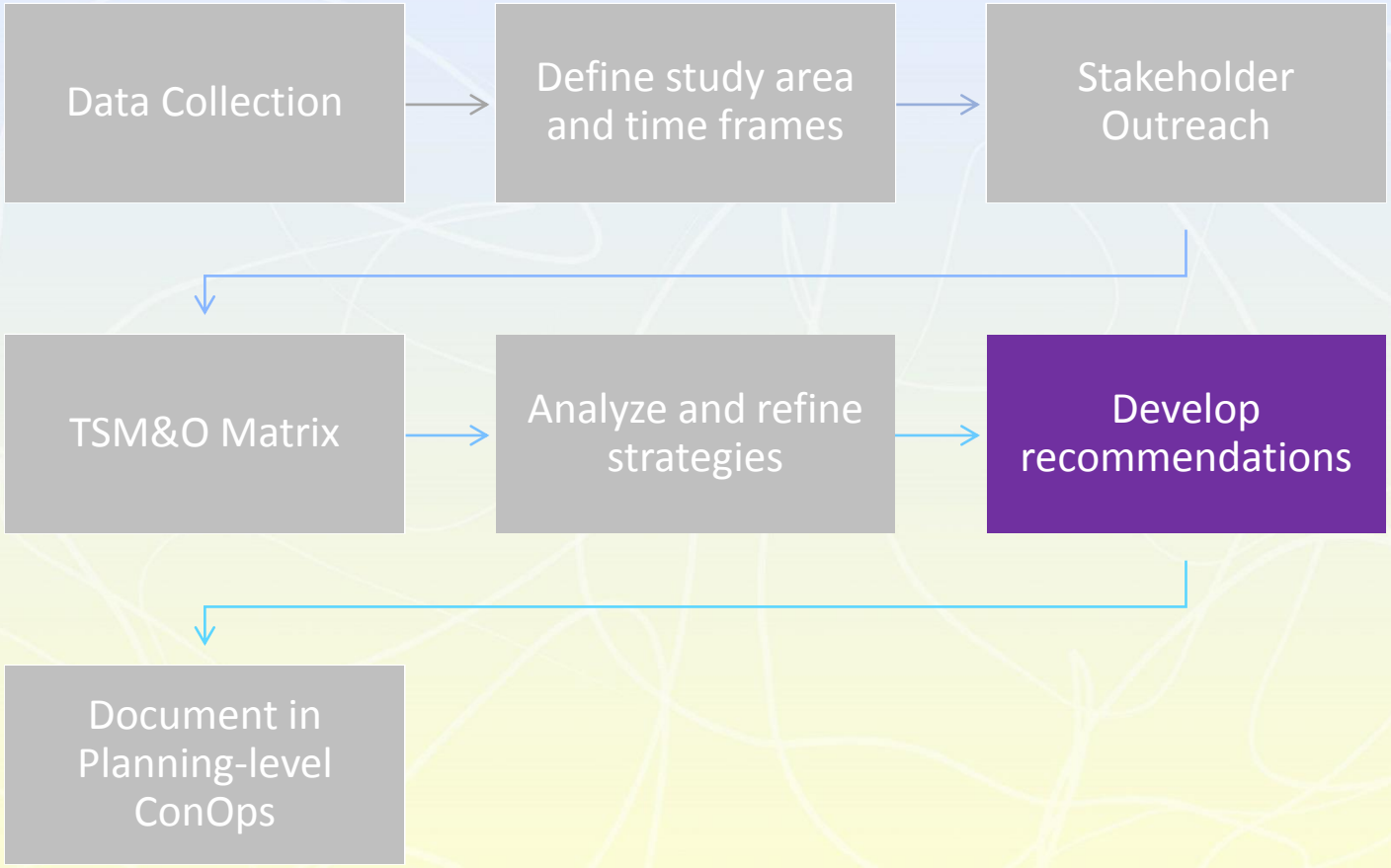
0 Link Based Generic 0

- ☐ Generic Link Analysis
- ☑ Signal Coordination: Central Control
- ☑ Ramp Metering: Preset Timing
- ☑ Traffic Incident Management
- ☑ Dynamic Message Sign
- ☑ Highway Advisory Radio
- ☑ Pre Trip Traveler Information
- ☑ HOT Lanes
- ☑ Hard Shoulder Running
- ☑ Speed Harmonization
- ☑ Road Weather Management
- ☑ Work Zone Systems
- ☑ Traffic Management Center
- ☑ Loop Detection
- ☑ CCTV

**Benefit/Cost Summary**

| | | Signal Coordination: Central Control | Ramp Metering: Preset Timing |
|---|---|---|---|
| **Annual Benefits** | | | |
| Travel Time | $ | 0 | 0 |
| Travel Time Savings: Non-Recurring Delay | $ | 0 | 0 |
| Energy | $ | 0 | 0 |
| Safety | $ | 0 | 0 |
| Other | $ | 0 | 0 |
| User Entered | $ | 0 | 0 |
| **Total Annual Benefits** | $ | 0 | 0 |
| **Annual Costs** | $ | 0 | 0 |

# Incorporating TSM&O in Corridor Studies: A Blueprint

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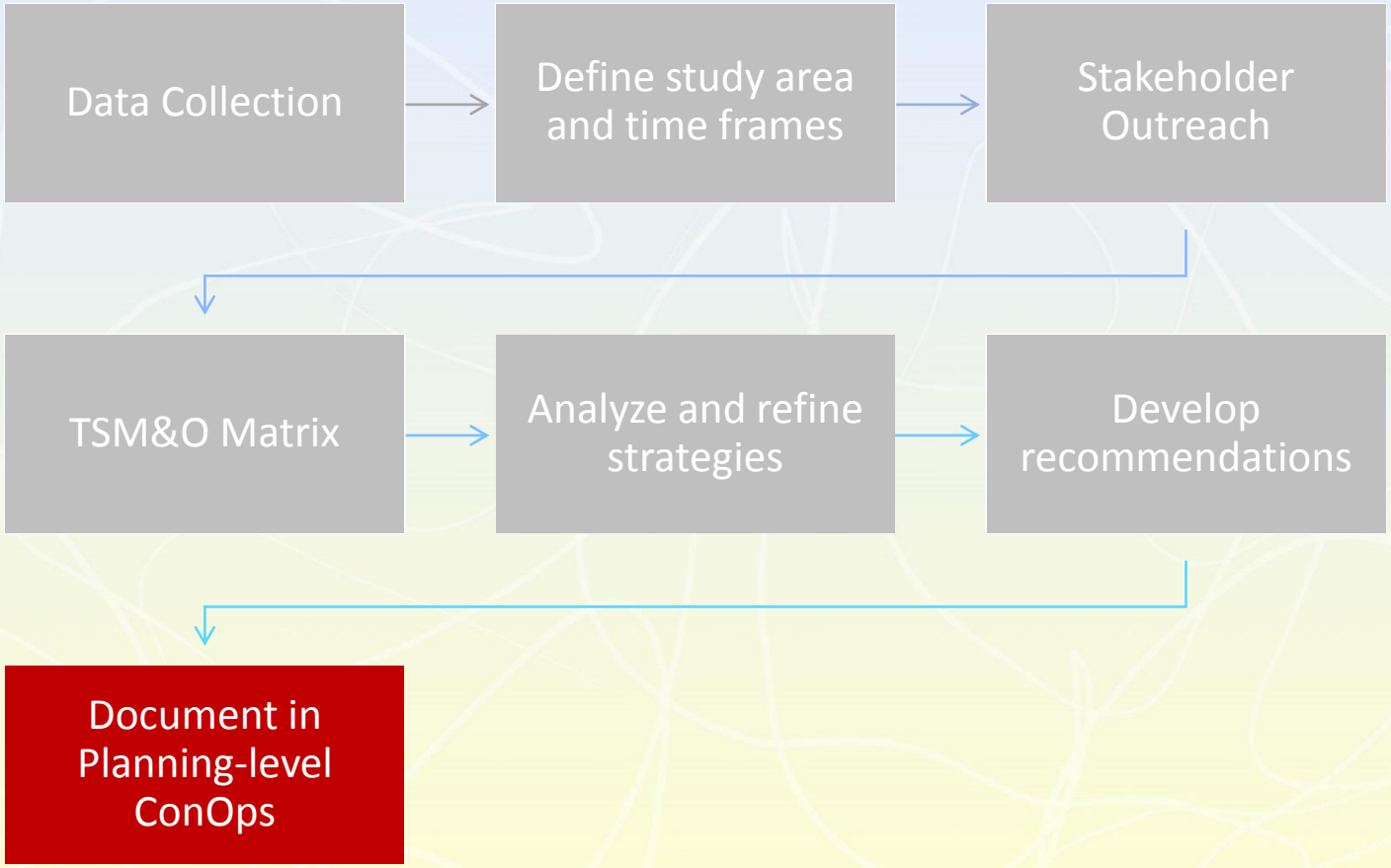


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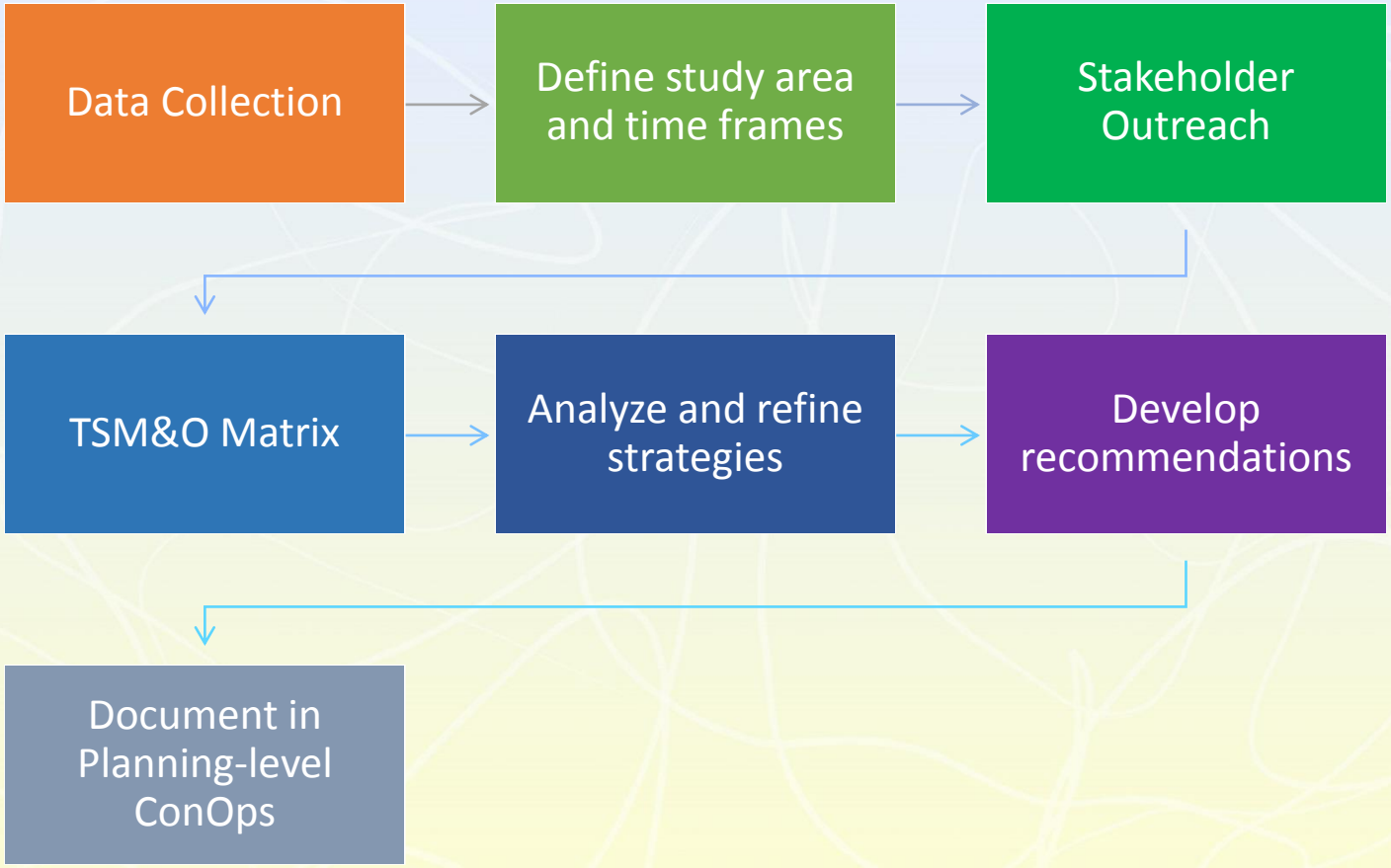
# Incorporating TSM&O in Corridor Studies: A Blueprint

- Document findings and recommendations in Planning-Level Concept of Operations
  - Introduction
  - Study area and planning horizon
  - Summary of long-term corridor improvements
  - Summary of current and projected operating conditions
  - Analysis of TSM&O Strategies – TOPS-BC findings
  - Further Analyses
  - Recommendations on application of strategies

# Incorporating TSM&O in Corridor Studies: A Blueprint

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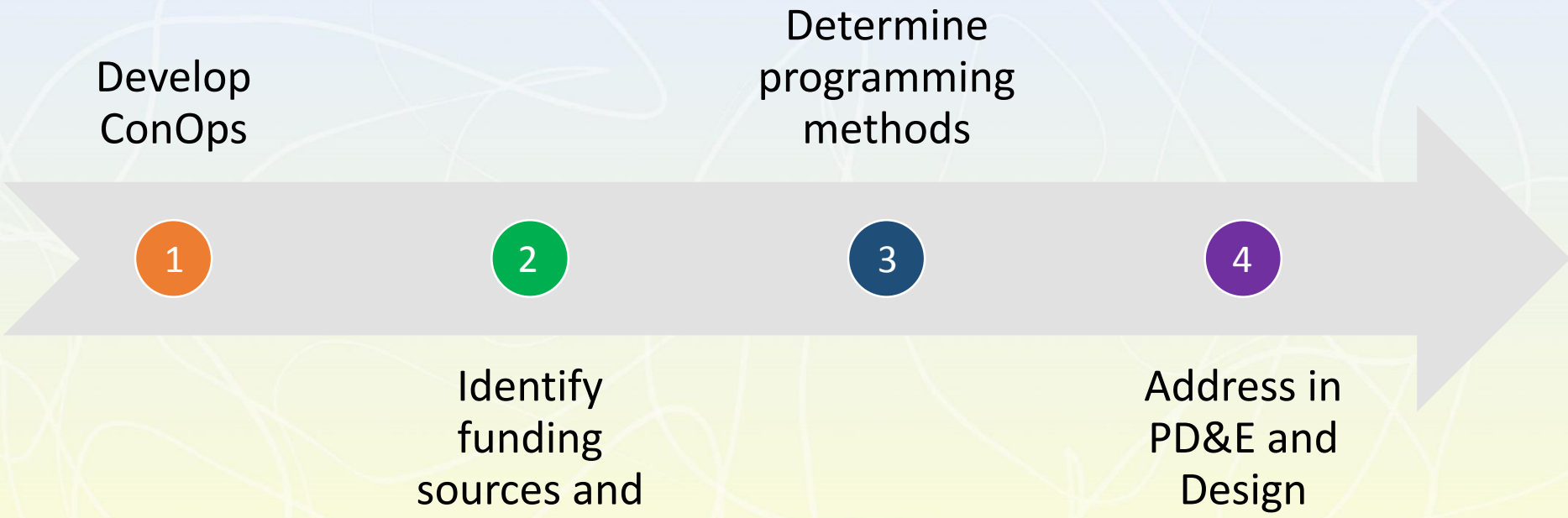


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# Questions?

# Express Bus and Performance Measures for Bus Routes

David Williams, VHB

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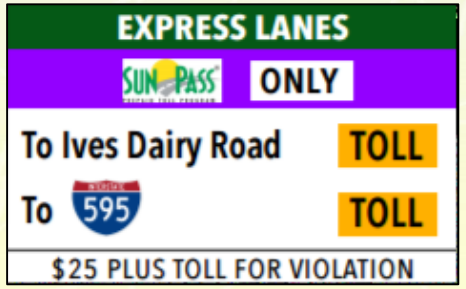
# 95 Express Program – D4 and D6

- Low-cost alternative to capacity projects on I-95
  - Dynamic Tolling
  - Transit
  - Technology
  - Travel Demand Management

95 EXPRESS

- Original 7-mile project (D6) along I-95 was extended into Broward County (D4), covering ~21 miles
- FY 2015-16: 22,007,739 vehicle trips in express lanes*
- **Goals**
  - **Decrease overall congestion on I-95**
  - **Provide safe, predictable trip**
  - **Maintain free flow of traffic in express lanes (45MPH)**
  - **Increase person throughput**




*95 Express Annual Operations Report: FY 2015-2016.

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# 95 Express Bus – D4 and D6

- 8 Express Bus Routes on I-95
- 2 Express Bus Routes on I-595
- Average Commuter Roundtrip: 52 miles
- Current Average Daily Ridership: 4,765
- Total Vehicle Miles Saved: 240,000+ miles per day
- Person Throughput - ⬆ **25%** on Express Lanes during PM Peak Hour due to express buses**
  - Average Vehicle Occupancy = 1.31 ➡ 1.70

95 EXPRESS


*FDOT District 4 (2016). Regional Express Bus Initiative. PPT.
**I-95 Monitoring Report (2014).

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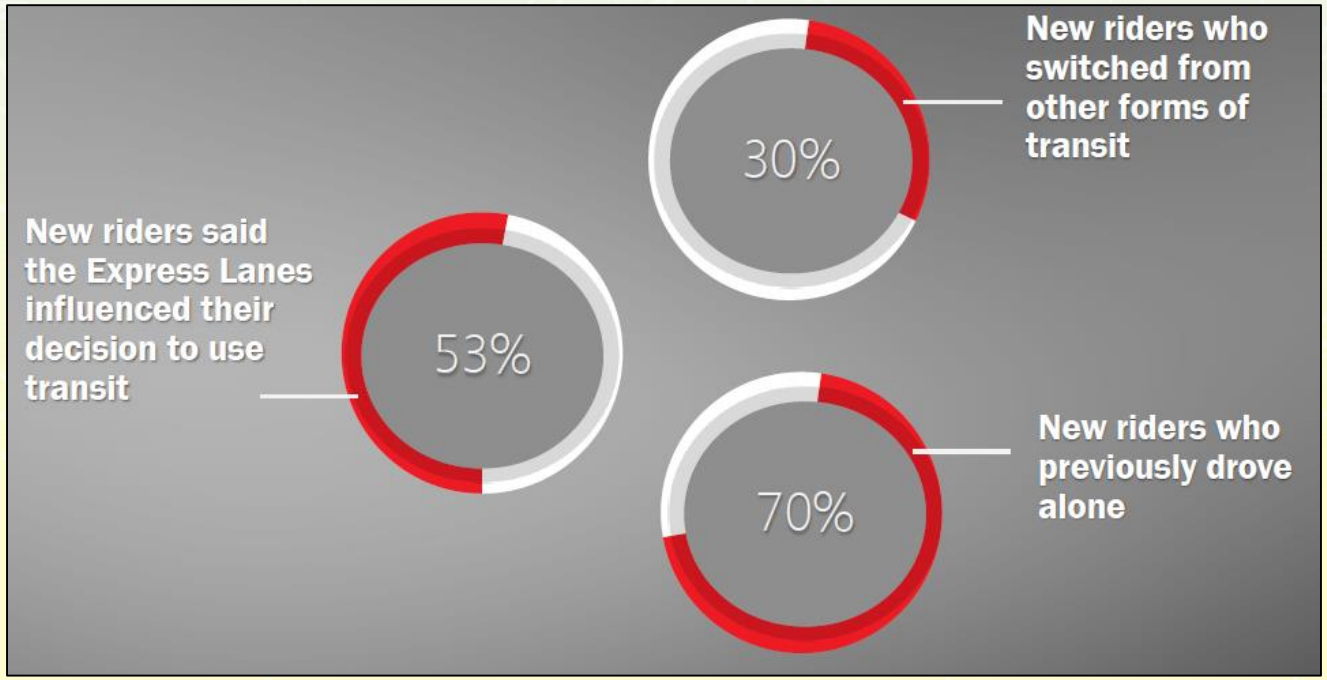
# 95 Express Bus – Lessons Learned

- Understand the Market:
  - Early planning with transit provider
  - Determine **market potential** using O/D surveys and travel demand models
  - **Attract choice riders**
  - Provide **park-and-ride connectivity**
  - Allow for expansion opportunities



# 95 Express Bus – Performance Measures

- Industry-standard performance measures for express bus service were identified
  - (P) Peak Load Factor
  - (P) Passengers per trip
  - (P) Farebox recovery
  - (P) Operating cost per passenger trip
  - (S) Reportable incidents per 100,000 revenue miles
  - (S) Revenue vehicle system failures per 100,000 revenue miles
  - (S) Service-related complaints
  - (S) On-time performance

# 95 Express Bus – Performance Measures

- **Peak Load Factor** – ratio of vehicle capacity to passenger capacity by route
  - Used to assess how many passengers can be carried during peak hour of service
- **Passengers per trip** – total passengers per revenue trip
  - Used to determine how effective the service is in capturing trips
- **Farebox Recovery** – ratio of operating expenses to fare revenue generated per route
  - Used to assess how efficient the service is in generating revenue in relation to total operating expense of the service

# 95 Express Bus – Performance Measures

- (P) **Operating costs per passenger trip** – ratio of total operating cost per passenger trip
  - Used to determine how well the Agency is controlling the resources expended for carrying each passenger

- (S) **Reportable incidents per 100,000 revenue miles** – amount of revenue service provided between reportable incidents
  - Used to provide a measurement of safety for a given route

# 95 Express Bus – Performance Measures

- **Revenue vehicle system failures per 100,000 revenue miles** – amount of revenue service provided between vehicle system failures (i.e. mechanical breakdowns)
  - Used to provide a measurement of reliability for the service on a given route
- **Service-related complaint** – complaints per route
  - Used to determine service quality
- **On-time performance** – measures the schedule reliability of each route within a set threshold
  - Used to determine if schedules need to be adjusted

95 EXPRESS

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# 95 Express Bus – PM Methodology

- Determine the average system-wide performance (Express bus only) as a baseline
- Measure individual routes against the baseline
- Evaluation will pull primary performance measures into a single composite score
  - Secondary measures will be assessed separately

# 95 Express Bus – PM Methodology

- **Composite Score Methodology**
  1) Calculate system-wide average of each quantitative performance measure
  2) Calculate performance measure for each route relative to the performance measure category
  3) All measures will be normalized to a value of 1.0 using the corresponding system-wide average, producing indices for each measure for each route
  4) Each performance measure index score by route will be summed and then divided by the total number of performance measures to obtain the composite score for each route

$$\frac{\text{Index for Peak Load Factor} + \text{Index for Passengers per Trip} + \text{Index for Farebox Recovery} + \text{Index for Operating Cost per Passenger Trip}}{4}$$

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# 95 Express Bus – Performance Measures

| Category | Express Service Composite Score | Modification/Enhancement Action Recommendations |
|---|---|---|
| Exceed | > 1.25 of score average | Routes that have very high performance may benefit from a review to identify additional needs. Actions considered include service/schedule change, increased frequency, or creation of new route. |
| Pass | .75 to 1.25 of score average | Routes that have average to high performance require no active monitoring from the Agency. |
| Watch | .50 to .75 of score average | Routes that have below average performance require remedial monitoring and review to determine segments or service scheduling that may be unproductive. Actions considered may include restructuring of service, schedule and/or route adjustments, merging of routes, marketing, and park-and-ride coordination. |
| Fail | < .50 of score average | Routes that are candidates for elimination. Discontinuing a route indicates that all actions have been implemented and the route was unable to obtain acceptable levels of service utilization. |

# 95 Express Bus – PM Methodology

- District 4 and Broward County Transit (BCT) developed Performance Measures as part of their JPA

- District 4 has indicated there have been some reporting issues with the measures

- Currently working with BCT to develop a standardized reporting methodology on a quarterly basis

# Questions?

# Dangerous by Design 2016

David Williams, VHB

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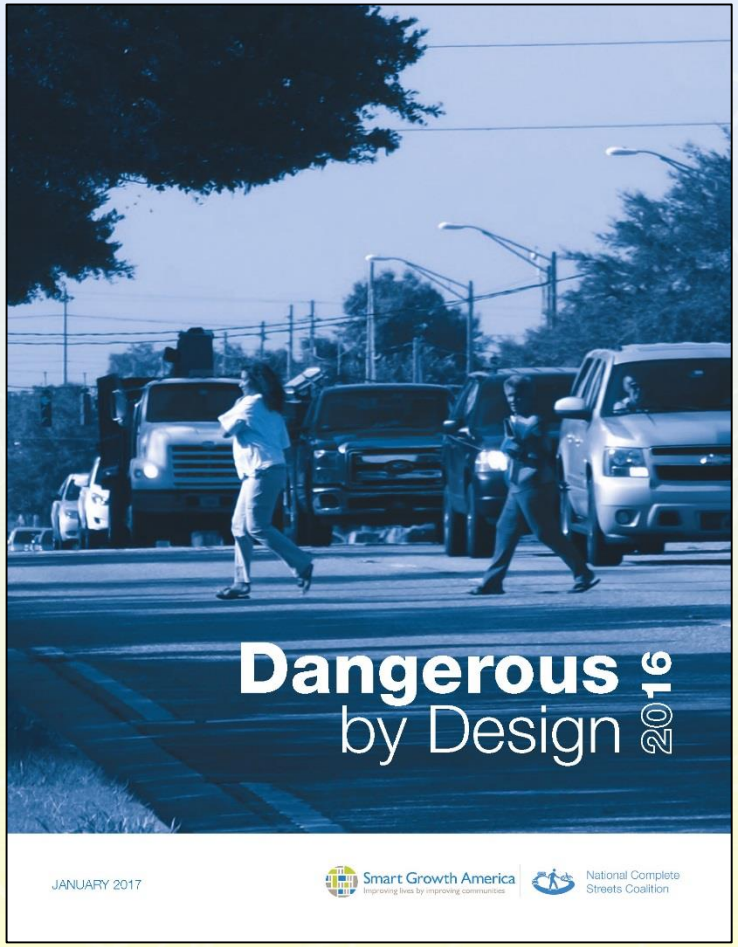
# Dangerous by Design 2016 (4th Edition)

- Utilizes the "Pedestrian Danger Index"
- Examines the metropolitan areas to determine those that are most dangerous for pedestrians
  - Also looks at race, income, and age
- This edition is the first to rank states by their danger to pedestrians
- Developed by Smart Growth America, National Complete Streets Coalition, and other partners

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# Pedestrian Danger Index

- A standardized value analyzing 104 MSAs, accounting for:
  - pedestrian fatalities,*
  - population for each MSA measured, and
  - pedestrian commuters**

$$\frac{\text{Average annual pedestrian fatalities (2009-2014) / total population (2014)} \times 100{,}000}{\text{Percentage of commuters who walk to work}}$$

*National Highway Traffic Safety Administration (2009-2014). "Fatality Analysis Reporting System (FARS) Encyclopedia."

**American Community Survey (2009-2014) Five Year Estimates.

# Pedestrian Danger Index
# 10 Most Dangerous Metropolitan Areas

| RANK | Metropolitan Statistical Area | 2016 PDI |
|---|---|---|
| **1** | **Cape Coral – Fort Myers, FL** | **283.1** |
| **2** | **Palm Bay – Melbourne – Titusville, FL** | **235.2** |
| **3** | **Orlando – Kissimmee – Sanford, FL** | **234.7** |
| **4** | **Jacksonville, FL** | **228.7** |
| **5** | **Deltona – Daytona Beach – Ormond Beach, FL** | **228.2** |
| **6** | **Lakeland – Winter Haven, FL** | **200.6** |
| **7** | **Tampa – St. Petersburg – Clearwater, FL** | **192.0** |
| 8 | Jackson, MS | 189.6 |
| 9 | Memphis, TN-MS-AR | 153.3 |
| **10** | **North Port – Sarasota – Bradenton, FL** | **148.2** |

**Florida is home to eight of the ten most dangerous MSAs nationwide**

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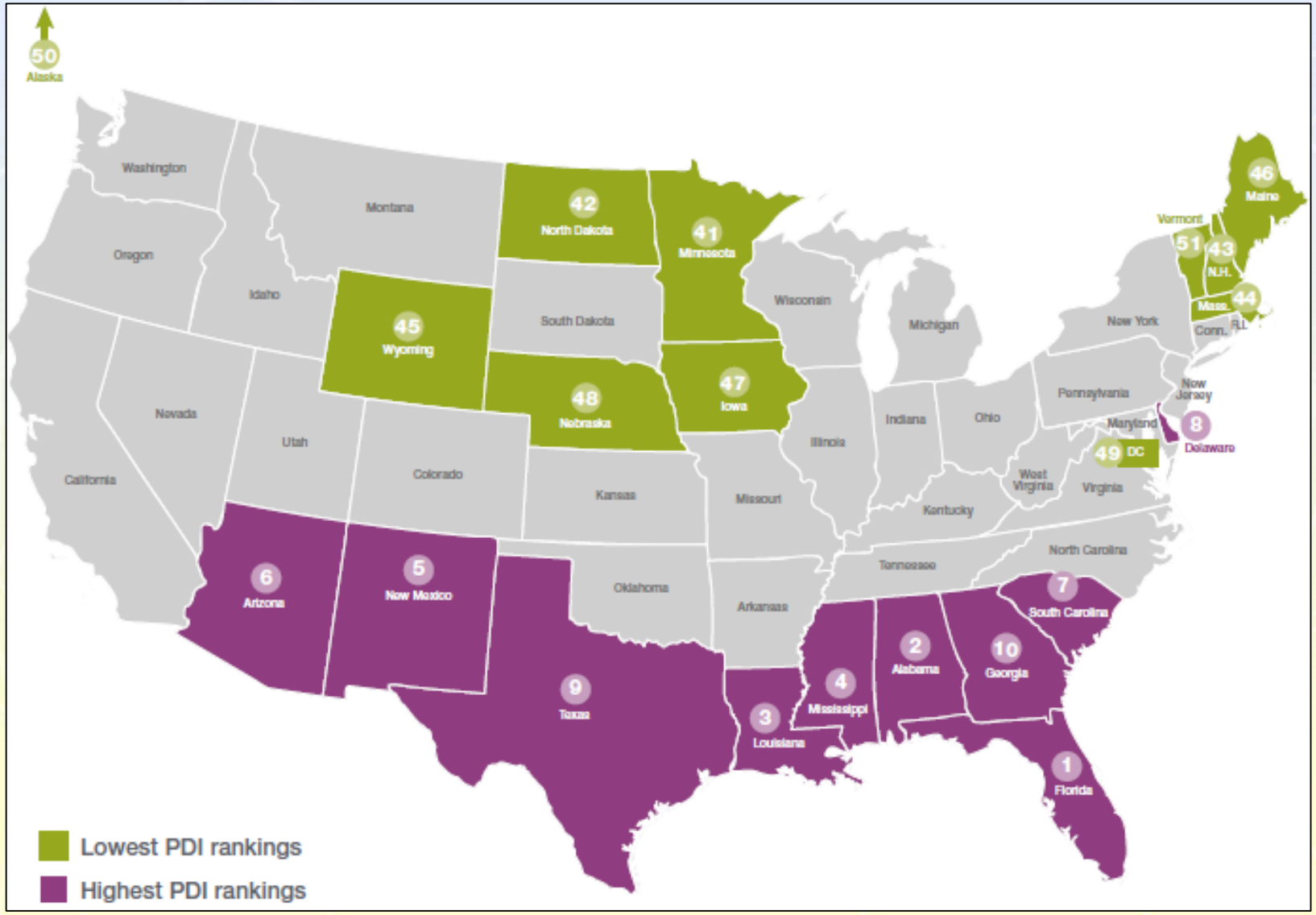
# Pedestrian Danger Index
# Other Notable Metropolitan Areas

| RANK | Metropolitan Statistical Area | 2016 PDI |
|---|---|---|
| 25 | Dallas – Ft. Worth – Arlington, TX | 110.4 |
| 26 | Atlanta – Sandy Springs – Roswell, GA | 107.2 |
| 51 | Los Angeles – Long Beach – Anaheim, CA | 69.8 |
| **N/A** | **MSA National Average** | **53.8** |
| 69 | Washington – Arlington – Alexandria, DC-VA-MD-WV | 43.5 |
| 80 | Chicago – Naperville – Elgin, IL-IN-WI | 34.2 |
| 85 | San Francisco – Oakland – Hayward, CA | 31.4 |
| 86 | Portland – Vancouver – Hillsboro, OR-WA | 31.3 |
| 95 | New York – Newark – Jersey City, NY-NJ-PA | 27.0 |
| 101 | Boston – Cambridge – Newton, MA-NH | 18.0 |

# Pedestrian Danger Index State Rankings



# Pedestrian Danger Index
# Percent Change from 2014 to 2016*

- **PDI for the Orlando – Kissimmee – Sanford MSA decreased by 4%**
- PDI for Miami – Ft. Lauderdale – West Palm Beach MSA did not change
- **PDI for the Jacksonville MSA increased by 25%**
- **PDI for the Tampa – St. Petersburg – Clearwater MSA increased by 1%**
- **The PDI for Florida increased by 5%**

The 4th edition introduced 53 additional MSAs to the study; percent change data is unavailable for these news MSAs

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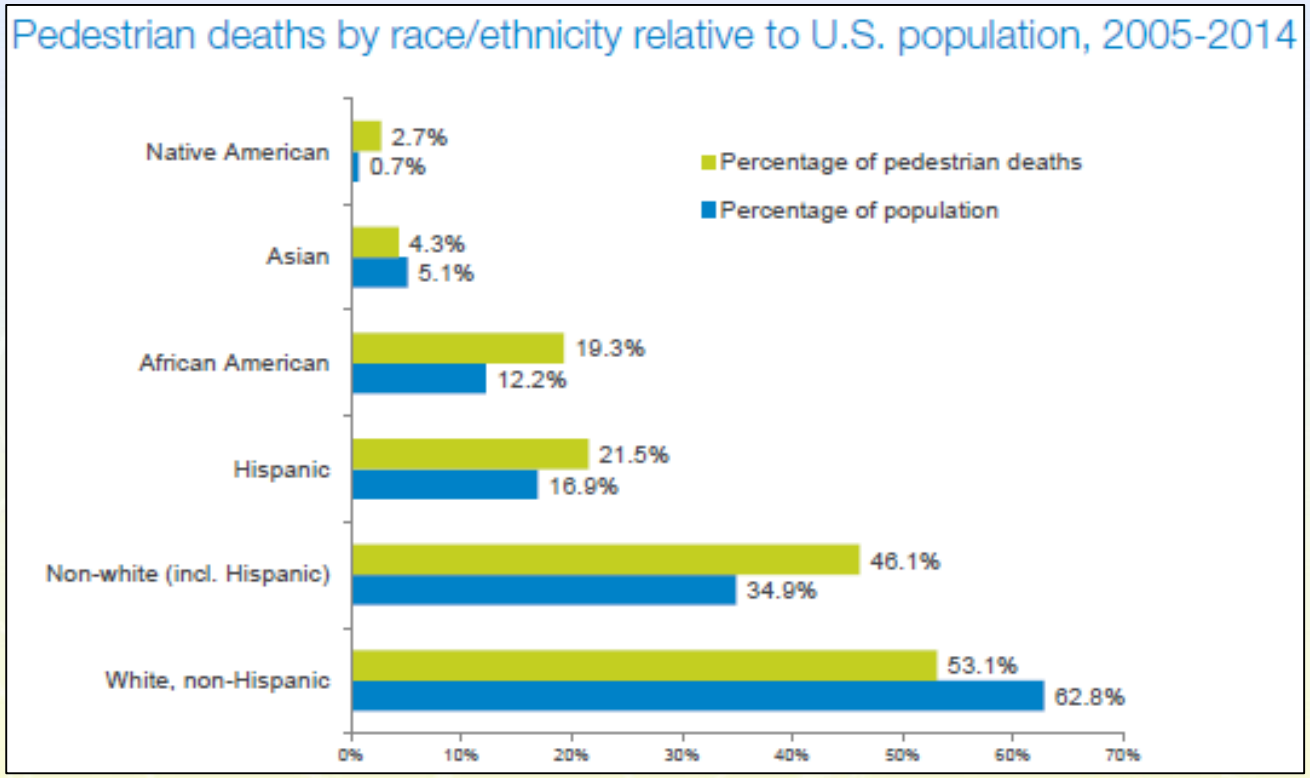
# Pedestrian Danger Index
# Vulnerable Populations

- **Minority groups** are disproportionately susceptible to being struck and killed by a vehicle
  - The study controlled for the relative amounts of walking among these populations
- **Adults 65 and older** are also more susceptible to being struck and killed by a vehicle
- **Median household income and PDI** are negatively correlated
- **Rate of uninsured people** is strongly correlated to PDI

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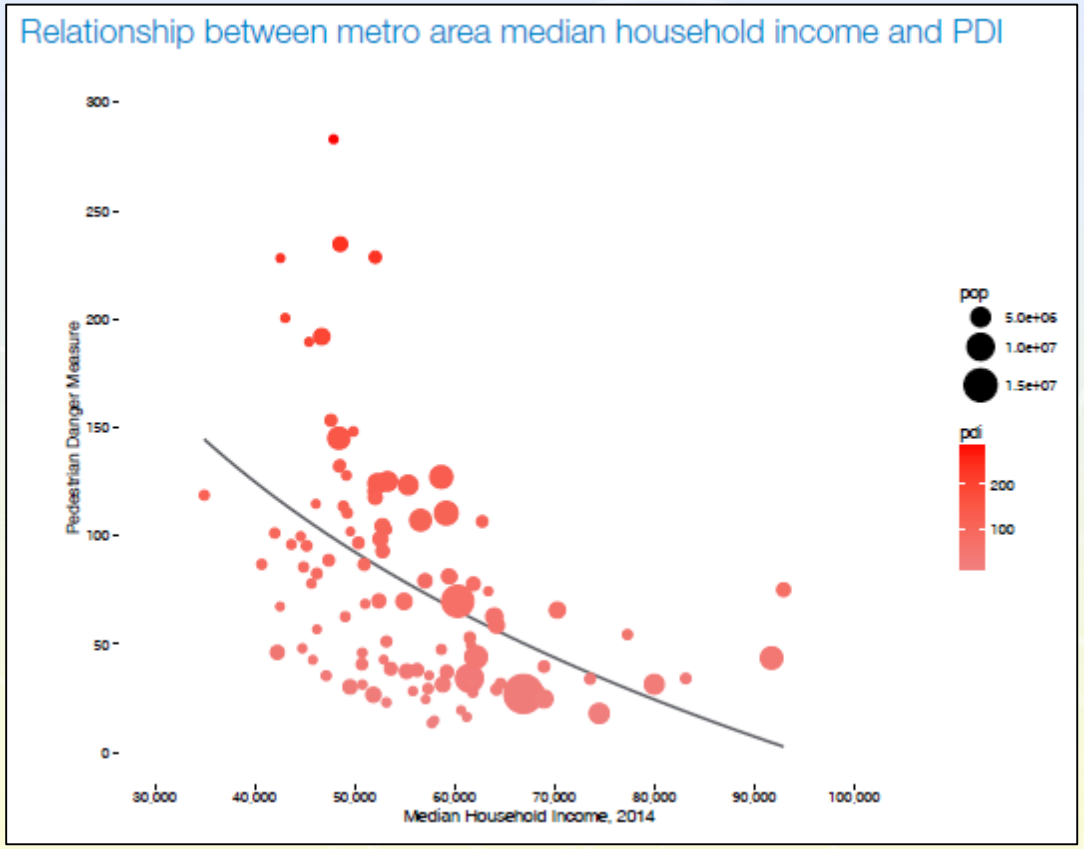
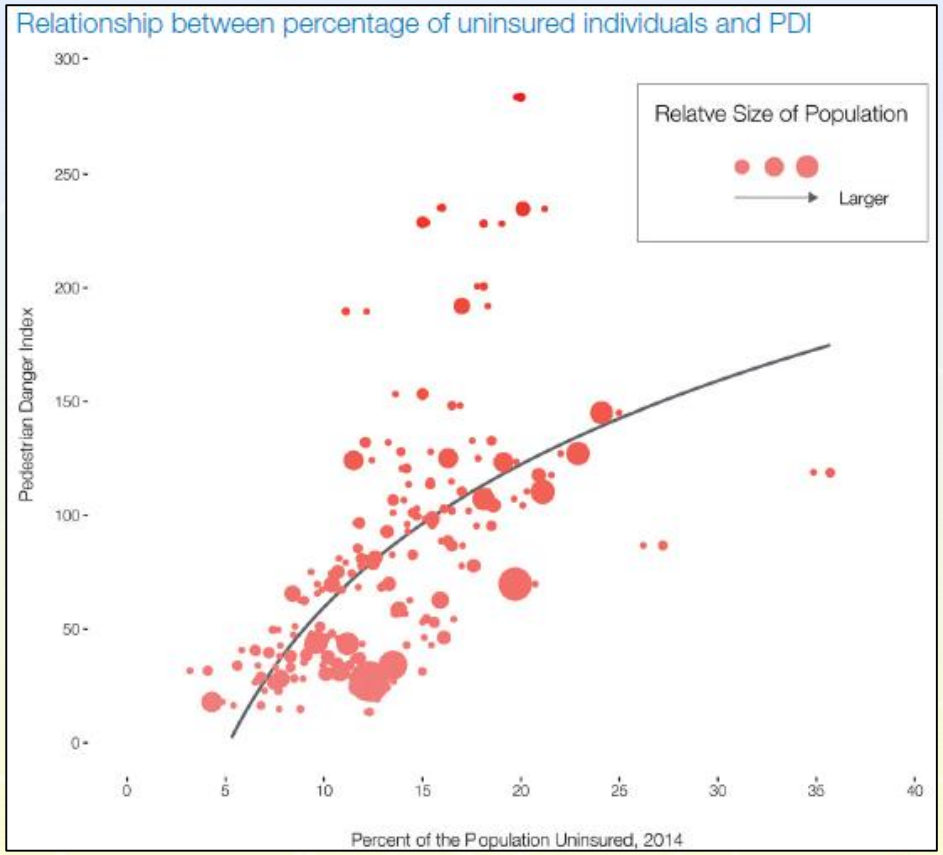
# Pedestrian Danger Index
# Vulnerable Populations

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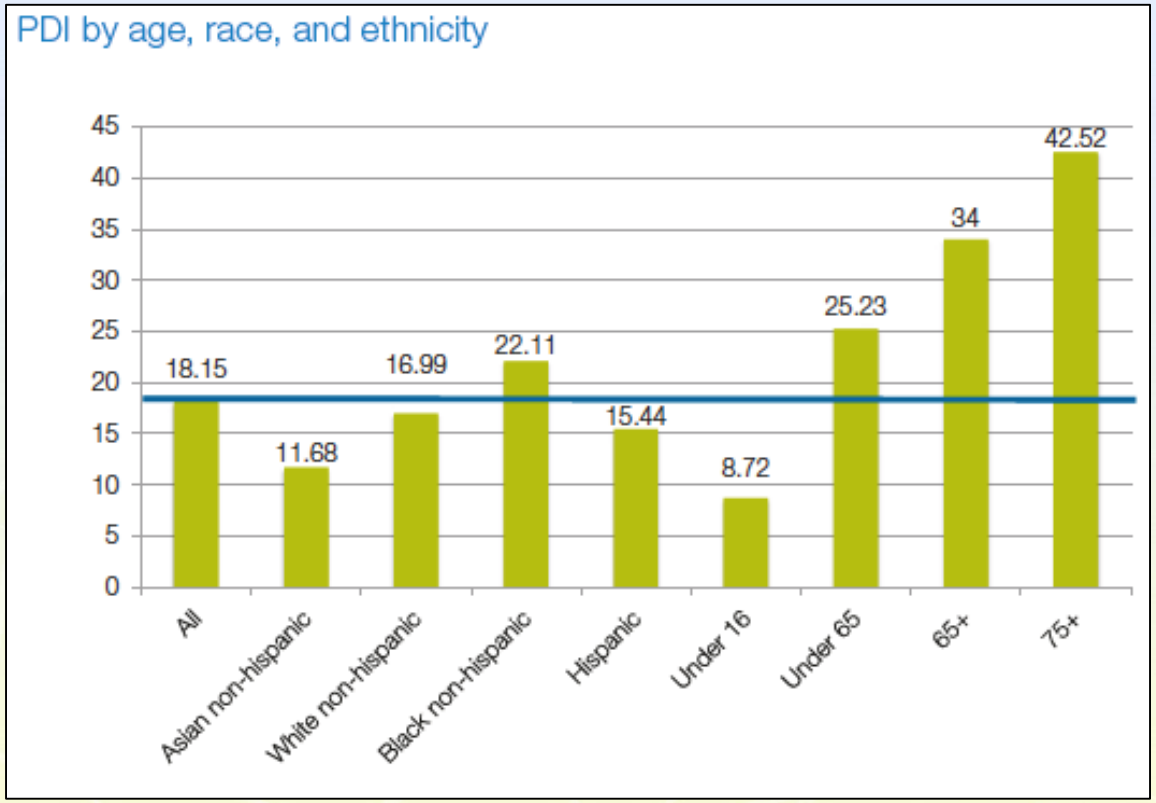
# Adjusted Pedestrian Danger Index* Vulnerable Populations

- Adjusted PDI is highest for those over 75 years old
  - While this group walks the least of all population groups, they are also struck and killed more than the other groups examined




*Adjusted PDI accounts for non-working trips, using more complete data provided by the CDC for fatality rates from 2009 to 2014

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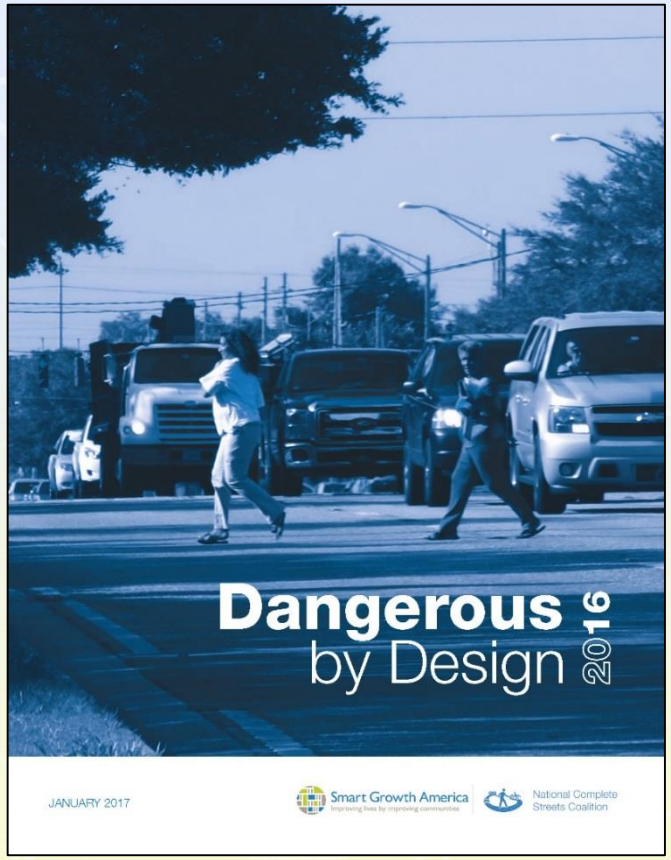
# Study Findings

- The State of Florida includes **8 of the 10 worst MSAs** regarding Pedestrian Danger Index; **Florida ranks worst in PDI for fourth consecutive time**
- There is a negative correlation between income and PDI
- Nationally, **non-white** and **older population groups** are overrepresented in pedestrian fatalities

**In 2014, 46.2 million people in the US were 65 and older. By 2060, the Department of Health projects 98 million people will be 65**

# Study Recommendations

- Approximately 1,200 communities nationwide have adopted Complete Streets policies
  - Must now implement these policies, which requires institutional and policy support from state DOTs
- Eighteen states have adopted Complete Streets policies (incl. Florida)
  - Must now implement their policies by addressing institutional, policy, and culture barriers to making streets safer
- **Shift the historical focus of the transportation planning process from vehicles to all users**

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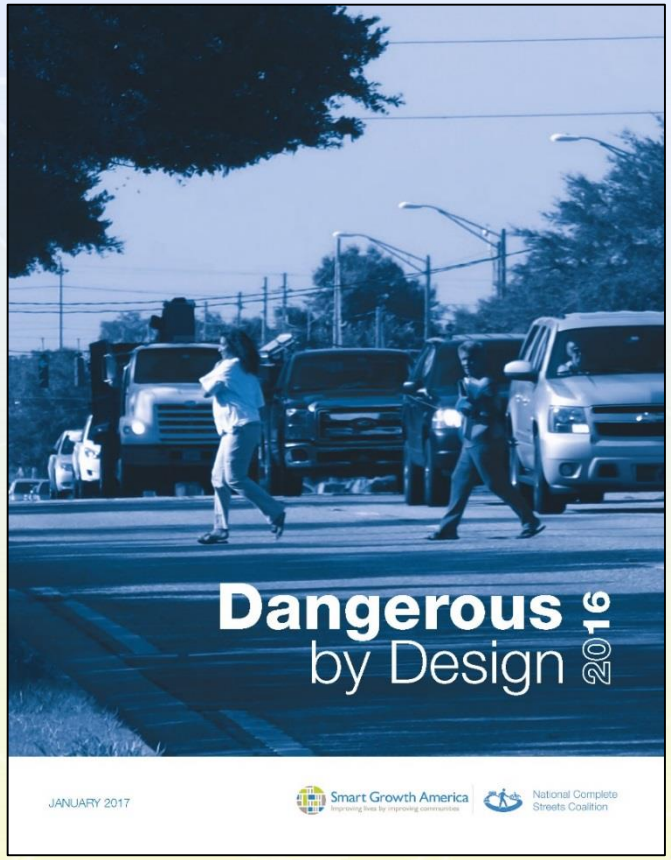
# Study Recommendations

- Incorporate Complete Streets approach:
  - Pedestrians separate from vehicles
  - Traffic speeds low
  - Sidewalks/curb ramps accessible to people with disabilities
  - Clarify where each roadway user should be expected to travel
- Incorporate Complete Streets design elements:
  - Wide sidewalks
  - Curb Extensions
  - Refuge islands
  - Pedestrian countdown signals
  - Leading pedestrian interval signal timing
  - Midblock crossings
  - Narrow travel lanes
  - Planting street trees
  - Restrict right turns on red lights
  - Compact intersections
  - Smaller curb radii
  - Back-in angled parking

# Study Recommendations

- Expand programs which focus on ending all traffic deaths, such as *Vision Zero* or *Toward Zero Deaths*
- Coordinate with emergency responders and medical staff
- Ensure highway interchanges within communities provide safe access for pedestrians and bicyclists
- Utilize funding opportunities provided by FAST Act and the TIGER Grant Program to implement initiatives



# Questions?

# Sumter County ATMS Update

Brian Kanely,  Volkert, Inc.

FDOT

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# Sumter County Advanced Traffic Management System

Sumter County Public Works Division, Bushnell, FL

Mark D. Van Hala, PE, Assistant Public Works Director and County Engineer

# Sumter County Advanced Traffic Management System

- The planning phase of the project has been completed.
- The implementation will consist of three phases, each with an engineering design and construction component.
- Goal is to start Phase 1 Engineering Design in FY 18.
- Goal is to start Phase 1 Construction in FY 19.

# Sumter County Advanced Traffic Management System

- The regional goals established for the Sumter County ATMS are:
  - Work with Lake and Marion Counties to improve traffic operations on US 27/441 in the three County area.
  - Work with FDOT and regional public safety agencies to efficiently manage the detoured traffic from I-75 and/or the FL Turnpike when a major incident occurs on either freeway.
  - Work with FDOT on TSM&O initiatives as opportunities arise.

# Sumter County Advanced Traffic Management System

- Phase 1 will include the signals on two major roadways in the Villages (C-466 and C-466A) and construction of the Traffic Management Center (TMC) at the PW Building in Bushnell.
- Phase 2 will include the I-75 interchanges with signals, the US 27/441 corridor, the SR 44 corridor, the CR 48 corridor and the connection to the FDOT District 5 Regional TMC via the existing fiber optic cable along I-75.
- Phase 3 will include the remaining signals in the County.
- ATMS will use primarily fiber optic cable and some wireless technology.

# Sumter County Advanced Traffic Management System

- ATMS Engineering Design & Construction Costs (total project cost is estimated to be $13,350,000).
  - Phase 1: $750,000; 6% of total project cost (fiber optic cable related costs are 50% of the Phase 1 construction cost).
  - Phase 2: $2,400,000; 18% of total project cost (fiber optic cable related costs are 54% of the Phase 2 construction cost).
  - Phase 3: $10,200,000; 76% of total project cost (fiber optic cable related costs are 51% of the Phase 3 construction cost). Phase 3 would be broken into sub-phases.

# Sumter County Advanced Traffic Management System

- ATMS Engineering Design & Construction Costs (continued)
  - Total ATMS Costs = $13,350,000.
  - Phase 3 costs are 76% of total project cost due to large amount of fiber needed to provide second fiber link between the TMC and Wildwood/Villages and connect isolated signals to the TMC.
  - Using new/future wireless technology has potential to substantially lower the Phase 3 cost.

# Sumter County Advanced Traffic Management System

- Primary technical challenge is the ATMS communications system/network.
  - The majority of signals are in the Villages & Wildwood.
  - The TMC is in Bushnell, 15 – 20 miles away.
  - Challenge is to provide county owned fiber optic cable between the TMC and the Villages/Wildwood.
- Secondary technical challenge is to provide wireless technology for signals in the outlying rural areas of the County.

# Sumter County Advanced Traffic Management System

- Primary non-technical challenge is funding.
- Project will be funded through FDOT and Sumter County.
- Securing a steady flow of funding to complete all three phases of the project will be challenging. New/future wireless technology could substantially lower costs.
- Sumter County is working with the MPO on funding.

# Sumter County Advanced Traffic Management System

- Questions/Comments?

- Contact person:
  - Brian Kanely, P.E.
  - Senior Traffic Engineer, Volkert, Inc.
  - brian.kanely@volkert.com
  - Office: 352-240-7459
  - Cell: 352-262-3580

# Comparison of Regional ITS Master Plans

Joe Perri, VHB

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# Schedule for ITS Master Plans

- **MetroPlan Orlando ITS Master Plan**
  - In latter stages of; Master Plan anticipated for completion in May 2017
- **Space Coast TPO ITS Master Plan**
  - Completed 2015
- **Lake County ITS Master Plan**
  - In development; Master Plan anticipated for completion end of 2017
- **Sumter County ITS Master Plan**
  - Anticipated completion March 2017
- **River to Sea TPO ITS Master Plan**
  - Phase 1 completed in 2016; Phase 2 will continue through FY 2017/18
- **Ocala/Marion TPO**
  - To Be Determined

# Potential Items for Incorporation in ITS Master Plans

- Projects proposed
- Estimates calculated for projects
  - Estimates developed for the various phases of the projects
  - Identify future O&M costs
- Include participating agencies requirements
- Include recommended technologies
- Identify years targeted for implementation
- O&M funding approach
- Prioritization process used
- Identification of staffing needs
- Multi-Modal projects
- Security Standards
- Identify data management standards

# Potential Items for Incorporation Into ITS Master Plans

| Items included in one or more ITS Master Plan(s) | District Five | MetroPlan Orlando | Lake County | Sumter County | River2Sea TPO | Space Coast TPO | Ocala / Marion TPO |
|---|---|---|---|---|---|---|---|
| **Projects Proposed?** | No | Still in development | Yes | Yes | Still in development | Yes | TBD |
| **Estimates calculated for projects?** | No | Still in development | Yes | Yes | Still in development | Yes | TBD |
| **Multi-phase estimates?** | No | No | Yes | Yes | Still in development | Yes. Planning-level estimates | TBD |
| **Agencies Covered?** | Yes | List of agencies | List of agencies | List of agencies | List of agencies | List of agencies | TBD |
| **Technology Suggested** | Yes | Identifies strategies, not technology. | Yes, specific technologies. Not specific vendors. | Yes, specific technologies. Not specific vendors. | Still in development | Yes, specific technologies. Not specific vendors. | TBD |
| **Year Targeted?** | No | Five-year horizon: 2017-2021 | Short- & mid-term. Fully deployed within 5-10 years. | Phase 1 CST by FY 2019. | Still in development | 10-yr horizon (2025), 5-yr updates | TBD |
| **O&M Funding Approach?** | Yes | Reliant on SU funds in several categories | No specified approach. Options discussed. | No | Still in development | Set aside funds; any leftover SU funding available as well | TBD |
| **Prioritization Process Used?** | No | Scoring based on 8 criteria | Scoring system used | No | Still in development | 2013 SOS Scoring modified for ITS | TBD |
| **Staffing Identified?** | Yes | Staffing identified. Needs not identified. | Yes | Utilize existing County Staff. Future needs not identified. | Still in development | Yes. Staffing is major need moving forward | TBD |
| **Multi-modal Projects Identified?** | Yes | Yes. Still in development. | Yes | No | Still in development | Strategies discussed. No specific projects. | TBD |
| **Security Standards Identified?** | Yes | No. | Not yet. To be consistent w/region. | No | Yes | Discussed, but not identified. | TBD |
| **Data Management Standard Identified?** | Yes | No.<br>Data-sharing: Yes. | Preliminary. To be consistent w/region. | No | Objective to develop data warehouse | No. Update will likely consider this further. | TBD |

# Questions?

# Transportation and Future Technologies

Jeremy Dilmore, District Five ITS

FDOT

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# Automated and Connected Vehicle Presentations MetroPlan

Roy Santanu

Ben Pierce

Charles Ramdatt

Presented by:

Jeremy Dilmore

# Summary of Presentations

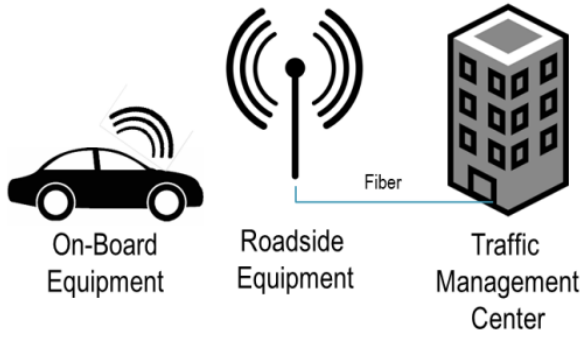
- HDR Status of Connected/Autonomous Vehicle
- HDR Presentation on TransFuture
- HDR Presentation on Future Proofing
- City of Orlando Presentation on Smart Cities

# Status of Connected and Autonomous Vehicle

# Connected Vehicles vs. Autonomous Vehicles

## Connected Vehicles

- Vehicle-to-Vehicle; Vehicle-to-Infrastructure communications system
- 5.9 GHz Wireless Radio
- Safety and mobility applications embedded in Wireless Radio




## Autonomous Vehicles

- Contain numerous on-board sensors (Lidar, GPS, Radar, Ultrasonic, Camera's, etc.)
- Divided into 6 levels of automation by SAE
- Can operate without assistance from infrastructure
- Heavily promoted by Automotive Industry

# Autonomous Vehicles


**Autonomous Vehicle Deployments**

- Uber (Pittsburgh, Nevada, others)
- Lyft in 2017


**Autonomous Micro-Shuttles**

- Pilot deployments throughout the US
- Smart City Deployment

**Truck Platooning**

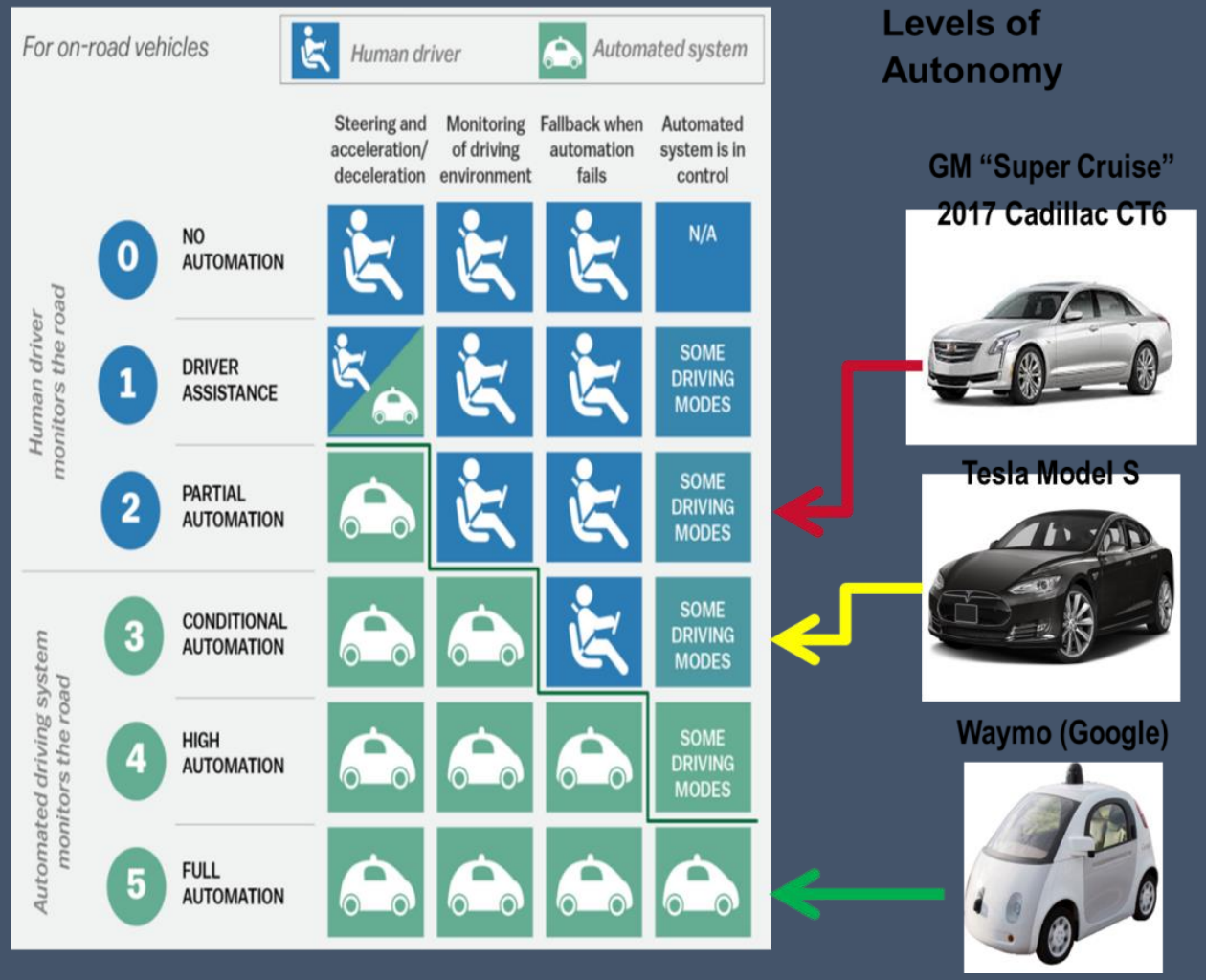
- European Trial Completed
- Pilot tests (runs) in States

**Production Vehicles**

- Tesla Model S

# State of the Practice for Autonomous Vehicles

- Technology progression over past 10 years suggests:
  - Following Moore's Law
- 10-year traditional vehicle development lifecycle
  - Announcements suggest we are close to mid-way in the lifecycle
    - **Ford** – Autonomous Vehicle Fleets by 2021
    - **Volkswagen** expects first self-driving cars on the market by 2019
    - **BMW** to launch autonomous iNext in 2021
    - **GM:** Autonomous cars could be deployed by 2020 or sooner
    - **Toyota:** First autonomous Toyota to be available in 2020
    - **Audi** A8 capable of fully autonomous driving in 2017
    - http://www.driverless-future.com/?page_id=384



# Legislative Actions by States

- Federal Automated Vehicles Policy

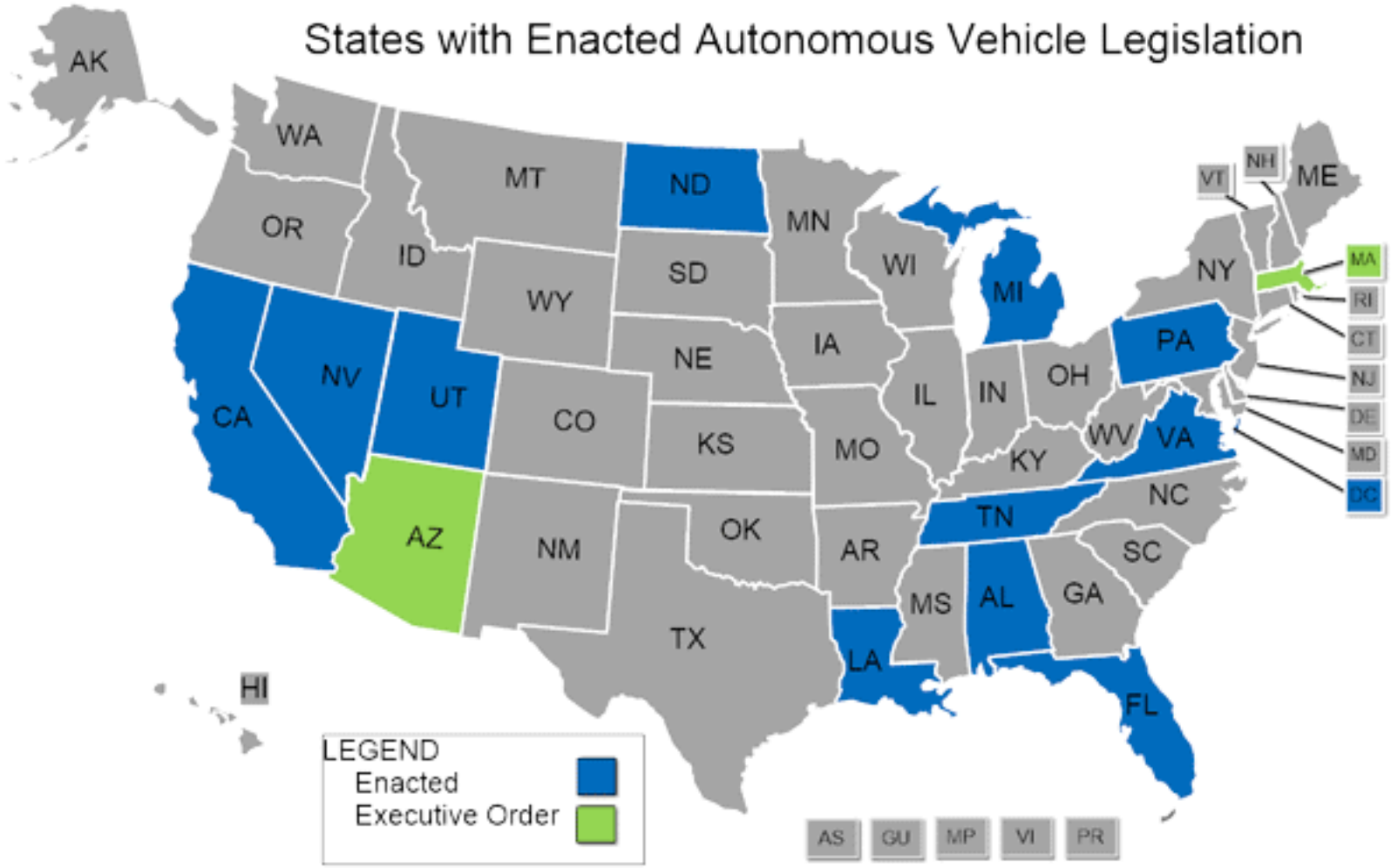
**Most Aggressive**

- Florida
- Michigan
- Nevada

**Most Conservative**

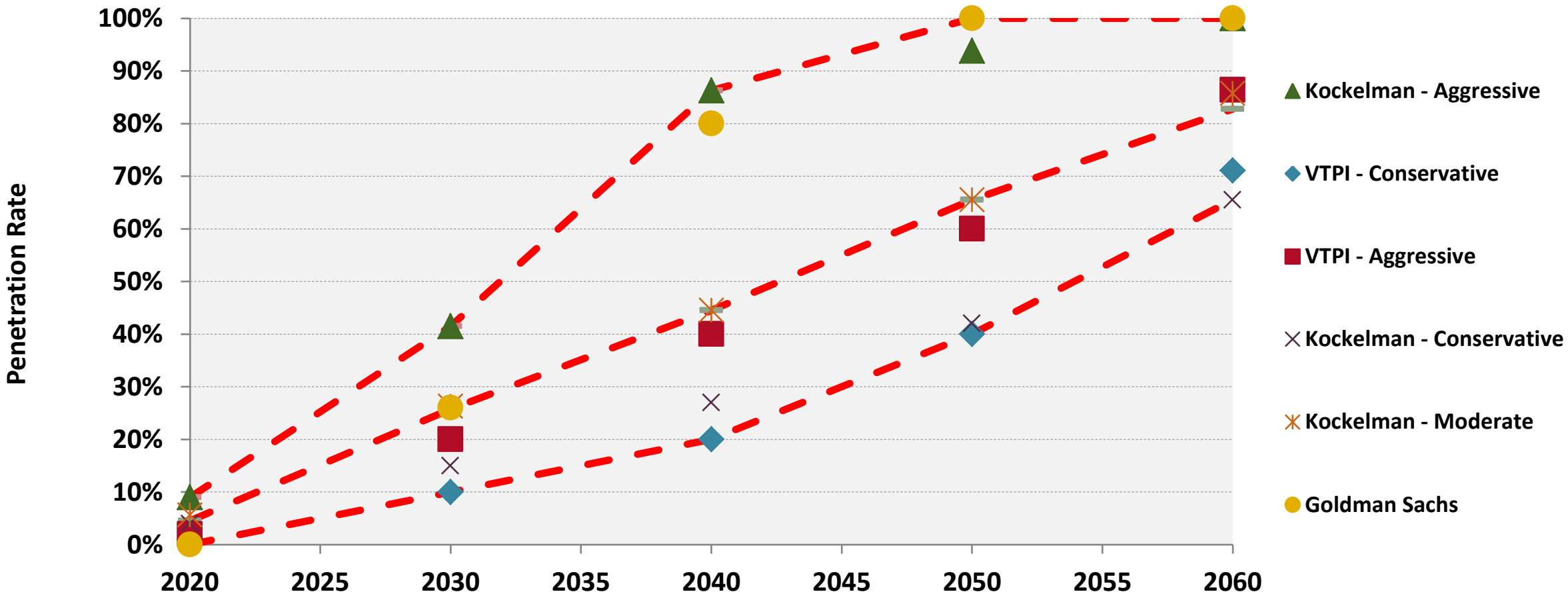
- California

**Policy/Guidelines Approach**



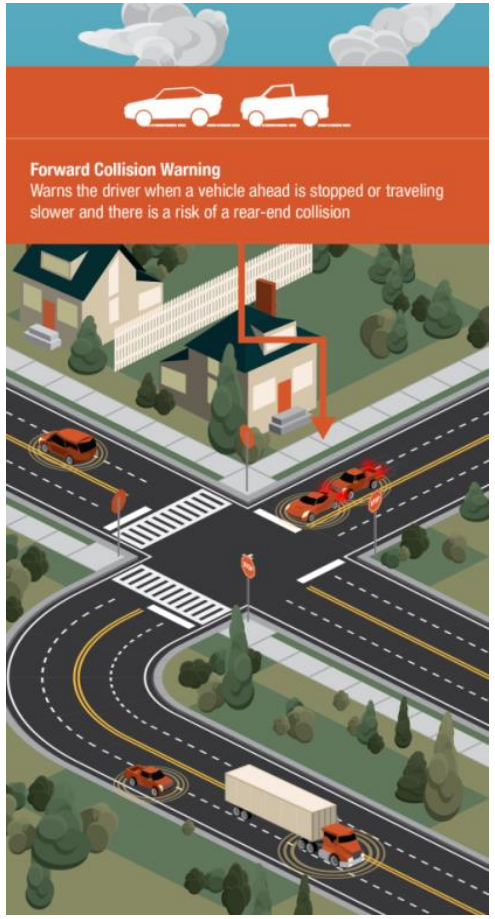
# Autonomous Vehicles – Literature Projections

Passenger Vehicle Fleet Adoption of Level 3 or above: 10% to 40% by 2030

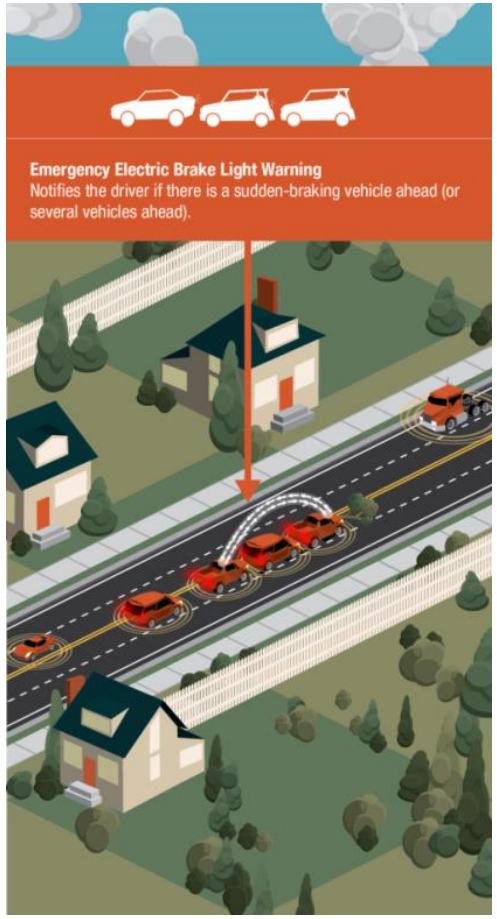


# Benefits of Connected Vehicle Technology: Safety Benefits

**Forward Collision Warning**




**Emergency Electronic Brake**



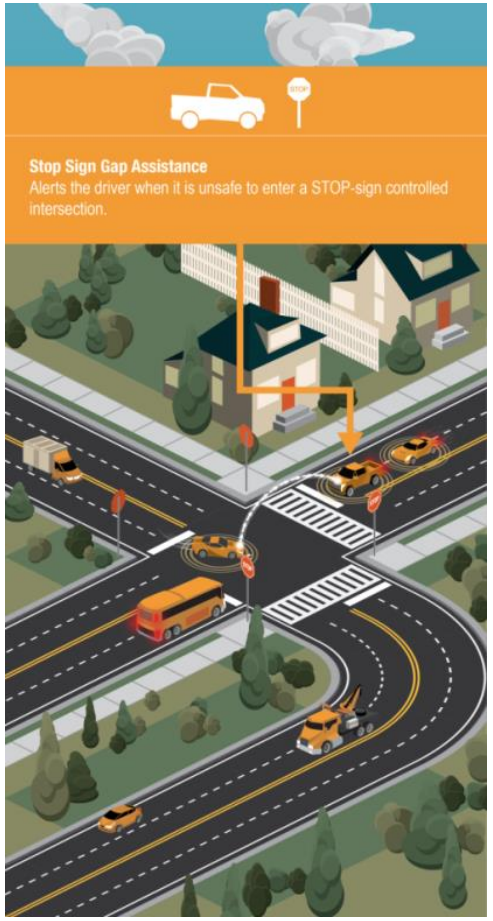

**Do Not Pass Warning**


**Lane Change Blind Spot Warning**

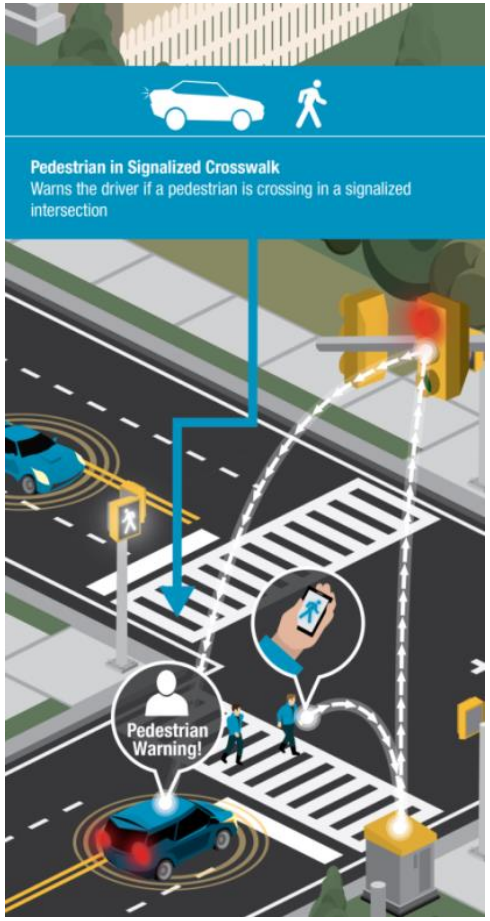
# Benefits of Connected Vehicle Technology: Benefits (cont.)

**Curve Speed Warning**

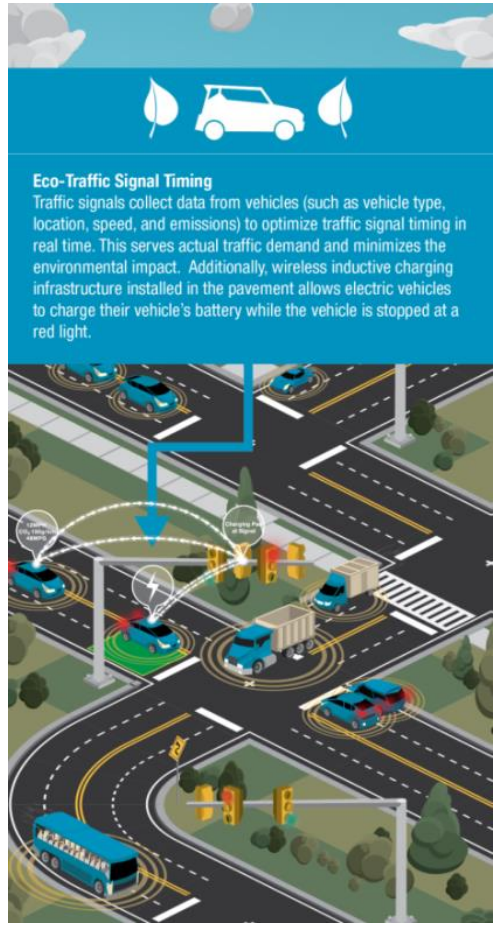

**Stop Gap Assistance**




**Ped. in Signalized Intersection**




**Eco-Traffic Signal Timing**



# “Killer Apps” for Connected and Autonomous Vehicles

## V2I Safety

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

## V2V Safety

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

## Agency Data

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

## Environment

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

## Road Weather

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

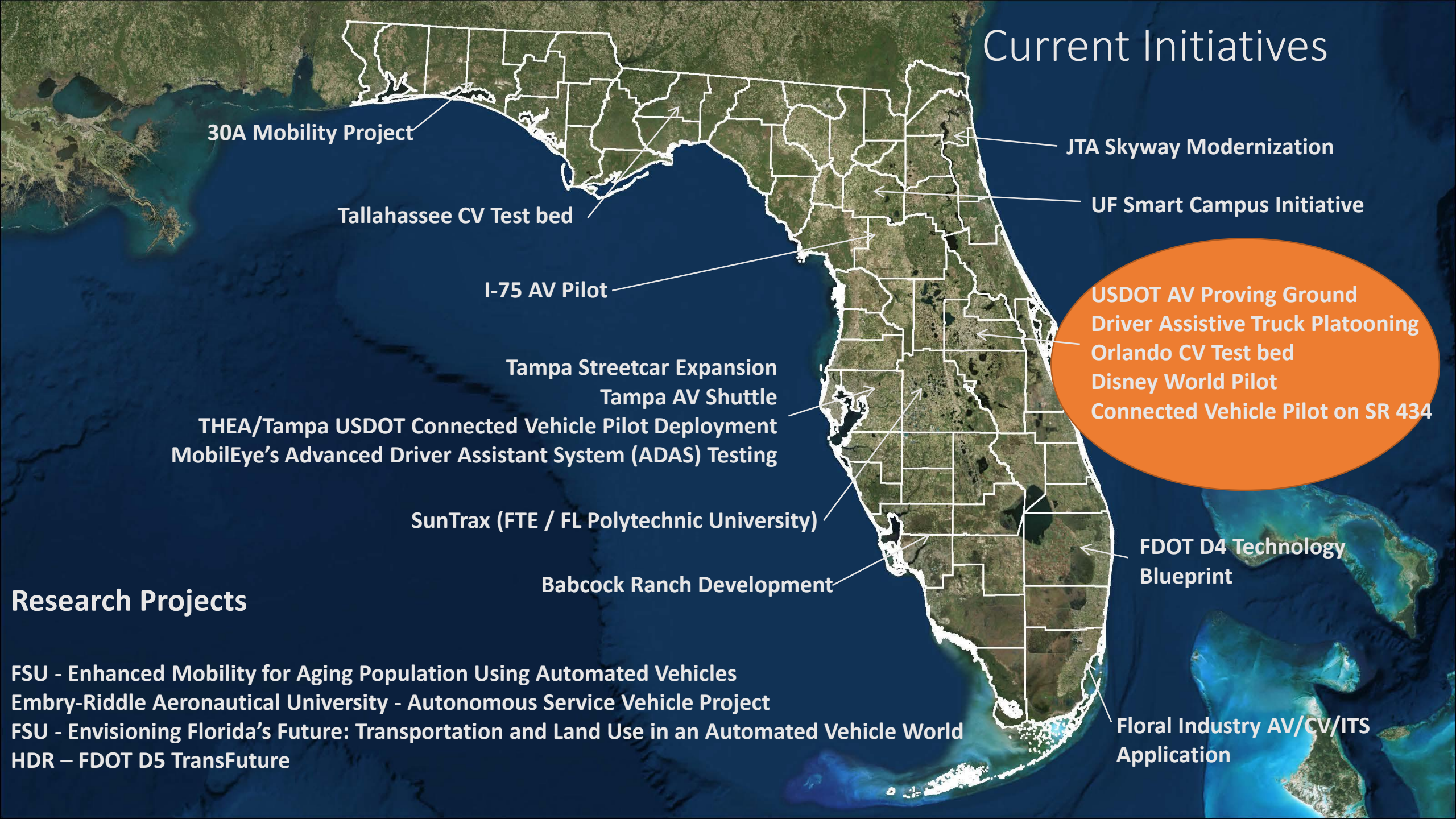
## Mobility

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

## Smart Roadside

- Wireless Inspection
- Smart Truck Parking

# Current Initiatives




## Research Projects

FSU - Enhanced Mobility for Aging Population Using Automated Vehicles
Embry-Riddle Aeronautical University - Autonomous Service Vehicle Project
FSU - Envisioning Florida's Future: Transportation and Land Use in an Automated Vehicle World
HDR – FDOT D5 TransFuture

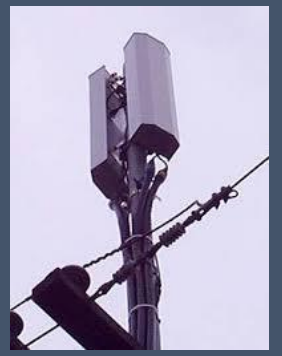
# Future Proofing for Transportation Technology

# Dedicated Short Range Communications (Connected Vehicle)

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

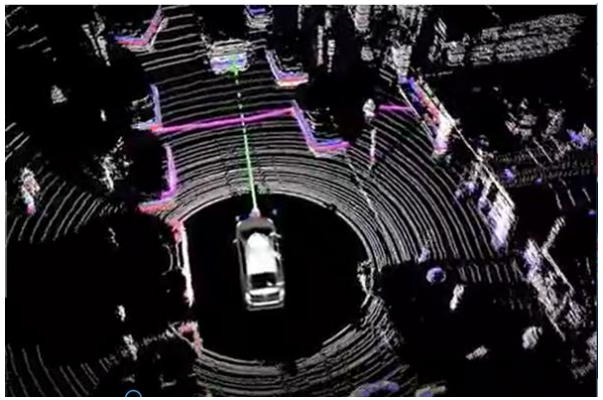
## 5G Cellular (Connected Car)

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



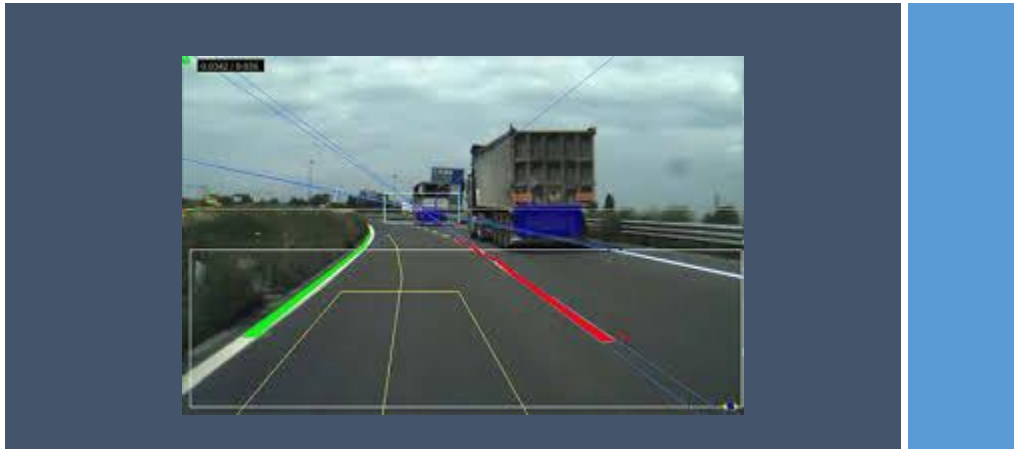
# LIDAR

- Pro's:
  - Good signal in many conditions
  - Richness of information
  - Ability to detect small and irregular objects
  - Day/night does not matter
- Con's
  - Expensive
  - Bulky – "hard" to mount ergonomically
  - Limited suppliers



## Visual (Optical Camera)

- Pro's:
  - Relatively inexpensive
  - "Easy" to connect, mount, and replace
  - Many, many providers
  - Already found in automobiles (i.e., "standard" equipment")
- Con's
  - Can be "fooled" like human eye
  - Adversely impacted by weather
  - Latency in image processing

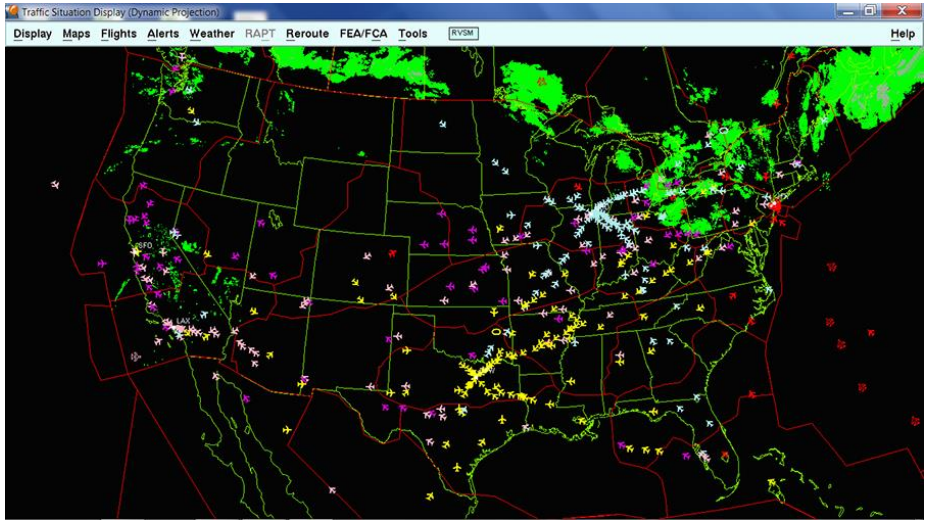


# Fundamentals

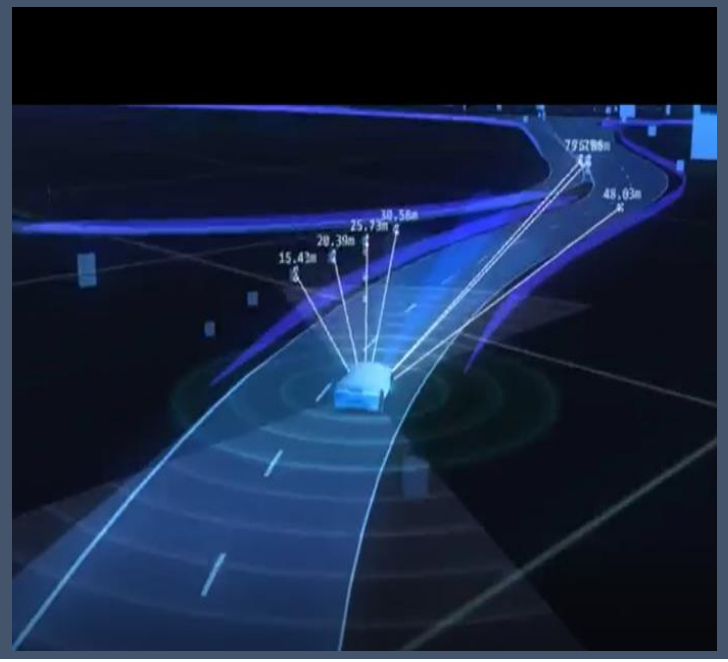
- Access to power
  - 110V
  - Power-over-Ethernet
- Communications backhaul
  - Fiber
  - Copper Wire
  - Millimeter Wave or other “fast” wireless
- Mounting locations and space in NEMA Enclosures

# Data and Processing


- Data Storage
  - To  Cloud or not to Cloud
  - Security and privacy
- Data Processing
  - Use of data
    - Daily operations:
      - Decision support system
      - Real-time data processing
    - Long-term planning
      - Data mining/spectral analysis
- Availability of data
    - Revenue model
    - Open sharing



# Autonomous Vehicle Assistance




- Lane Keeping Assistance
  - Visual reference markers for optically based AVs
  - Radar/Lidar friendly reference markers
  - Reflective lane markings
  - Position correction broadcasts (Assisted GPS Correction Factors)
  - Map updates
- Warning Systems
  - Radio transmissions for roadway guidance and wayfinding
  - Roadway configuration/warning

# Pavement and Design Considerations

- Roadway Configurations
  - Exclusive AV lanes
  - Modular Lanes/Dynamic Restriping
  - Curve/Turning radius and banking
  - Access and Egress  from dedicated lanes

- Pavement Considerations
  - Full-depth hard shoulder
  - Less wheel-load distribution
    - More wear and tear on vehicle tire tracks
    - Denser concrete

# Policies and Procedures

- Construction
  - Pavement markings during construction
  - Wayfinding with smart traffic cones
  - Timing for restriping
- Traffic Control
  - Incident management
- Identifying Vehicles in Autonomous Mode
- Licensing
- Traffic Routing and Operations
  - HOT Lanes or Personal Freight?
  - Mixed Use Vehicles (Passenger, Transit, Freight)
  - Where and When for AV?


# Future Proofing Takeaways

- We are still learning what needs to be done for future-proofing
- Future-Proofing crosses all aspects of transportation
- Infrastructure will continue to lag vehicle technology – BUT

**It is not "ALL or NOTHING!"**

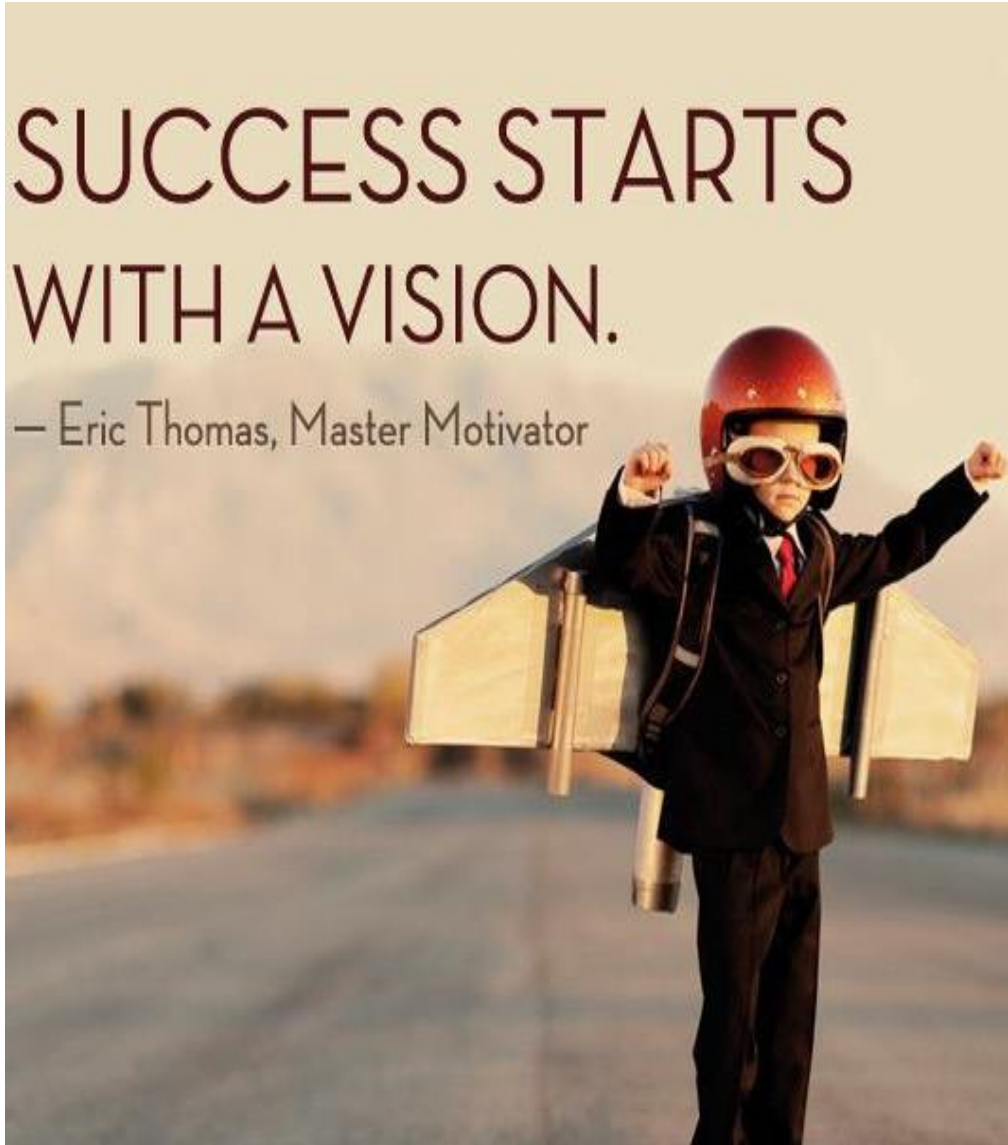
# Summary

- Fiber Infrastructure
  - We are doing very well in this area
- Cloud Computing and Storage
  - We are looking at feasibility of this
  - Understand our roles during events
- Use of reflectors
  - No progress on this front that I am aware of
- Pavement Designs
  - Discuss concerns with over investment here
- MOT Standards
  - Point of consideration

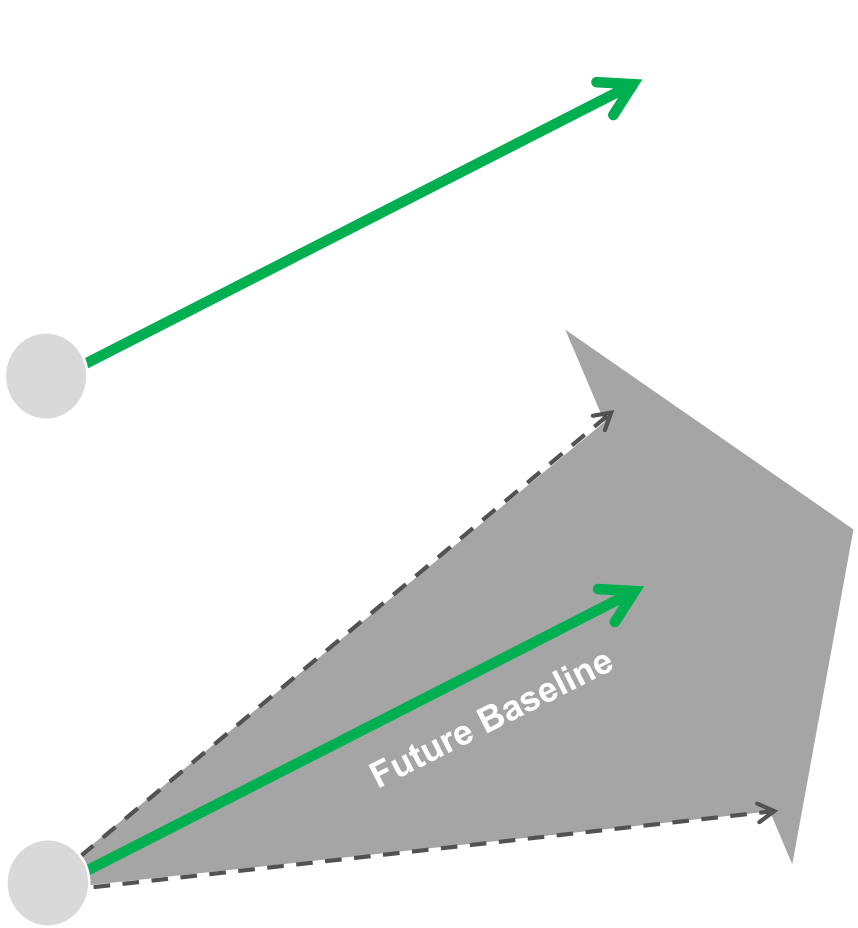
# TransFuture

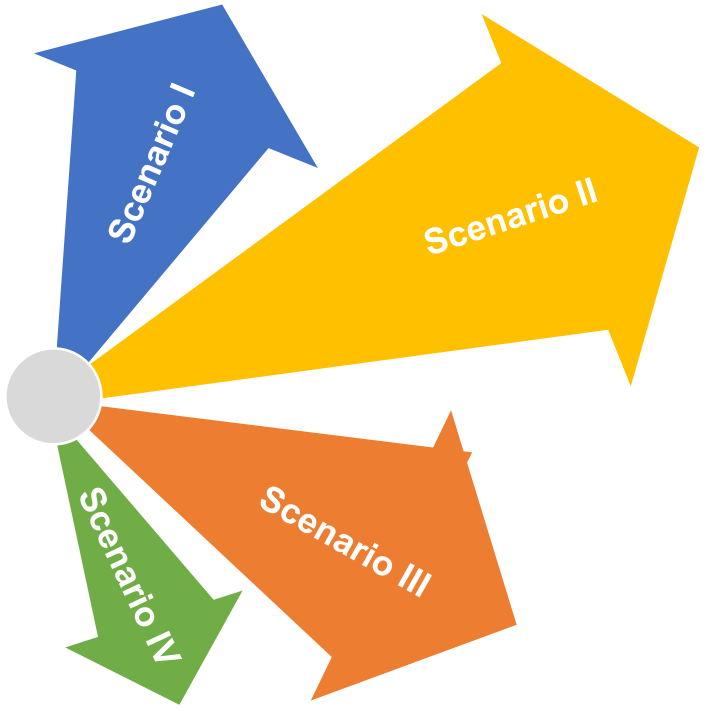
# Motivation

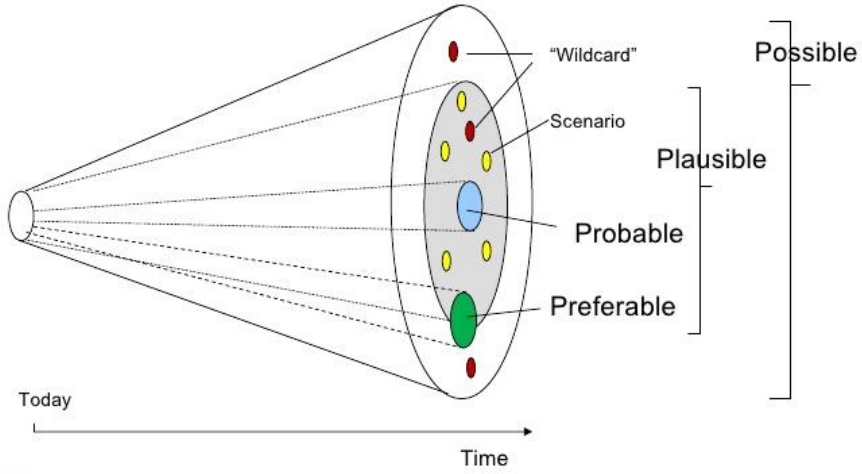
- On the verge of a paradigm shift
  - Technological advancements
  - Emerging societal trends
- Transportation transformation
- Traditional planning tools are falling short of answering policy questions of tomorrow – inherent design based on historical trends



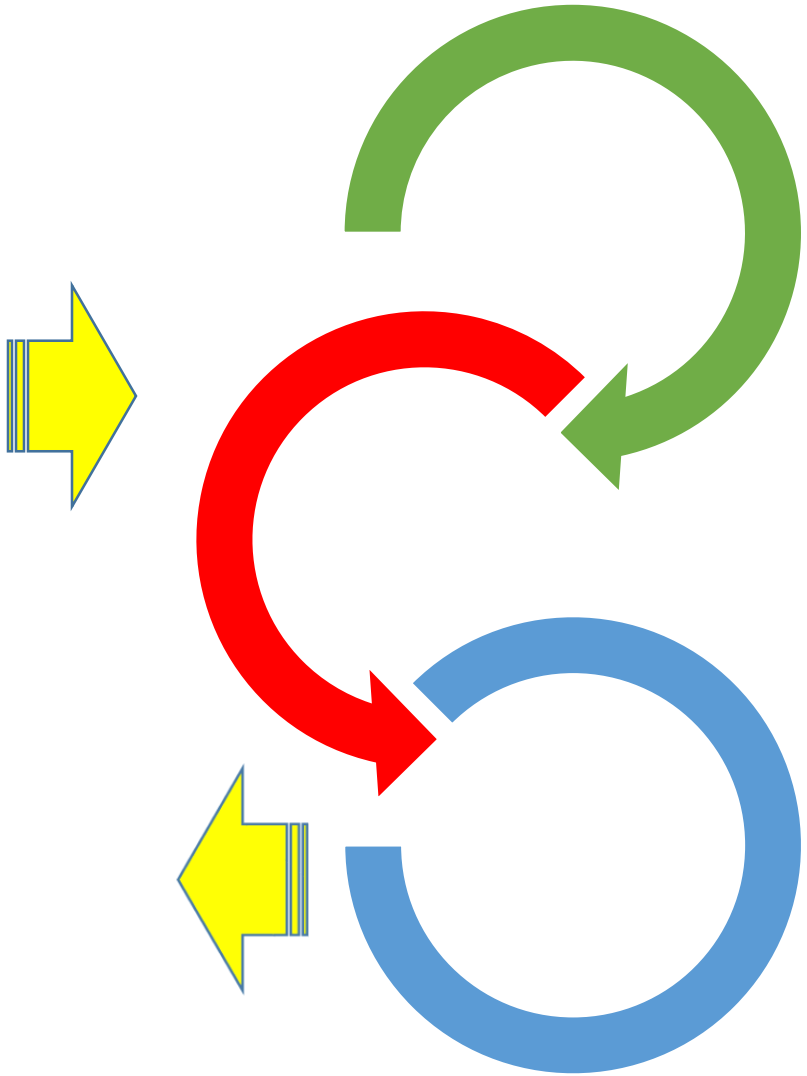
# Planning for Multiple Futures

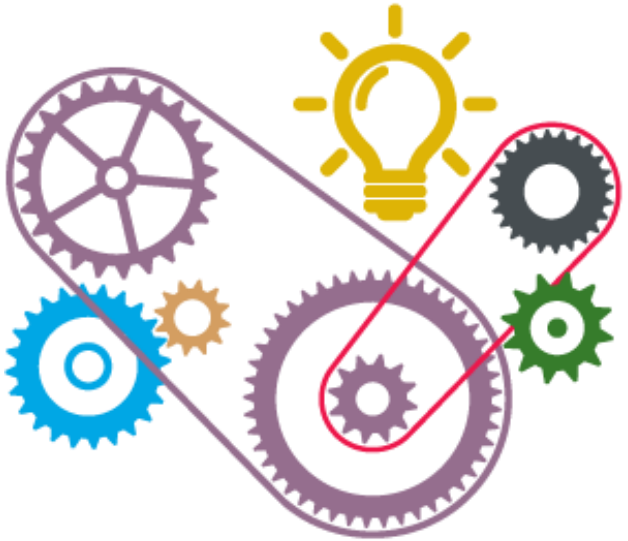


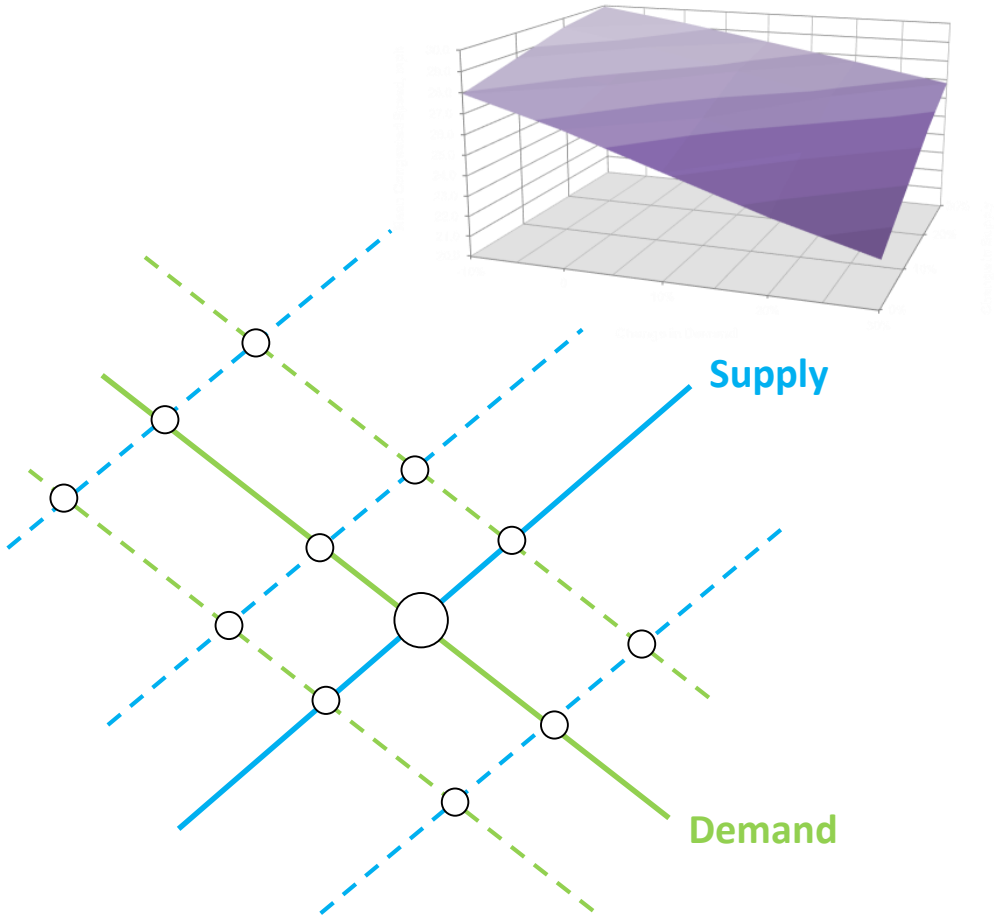



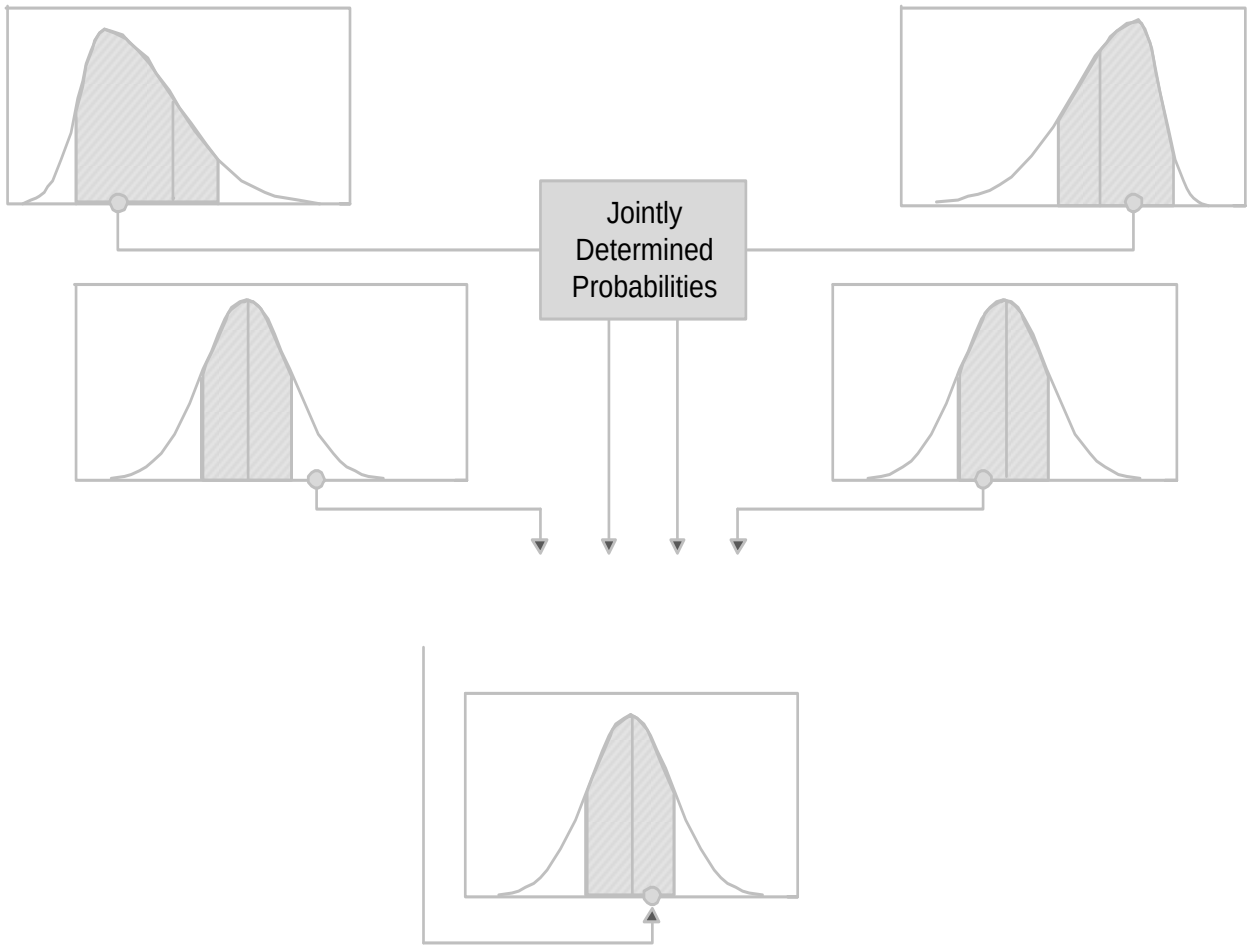
# Conceptual Framework





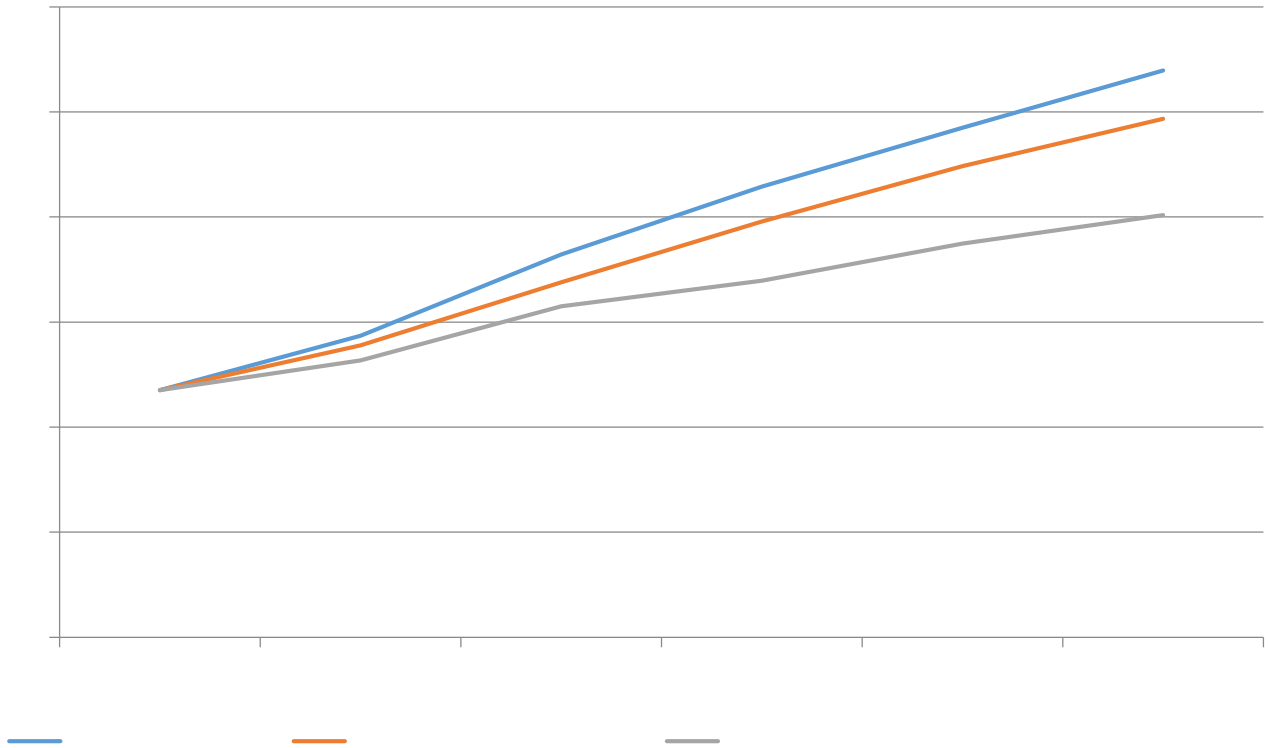
# Conceptual Framework



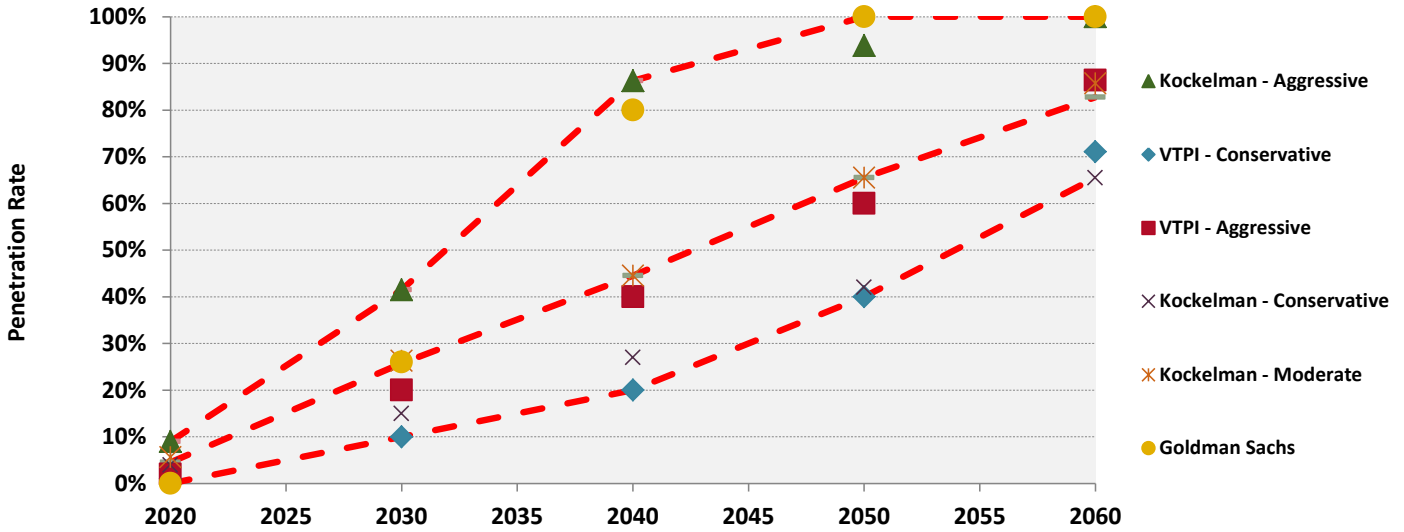



# Emerging Trends

- Millennial Travel Behavior
  - Active transport, less VMT, flexible work parameters



# Emerging Trends

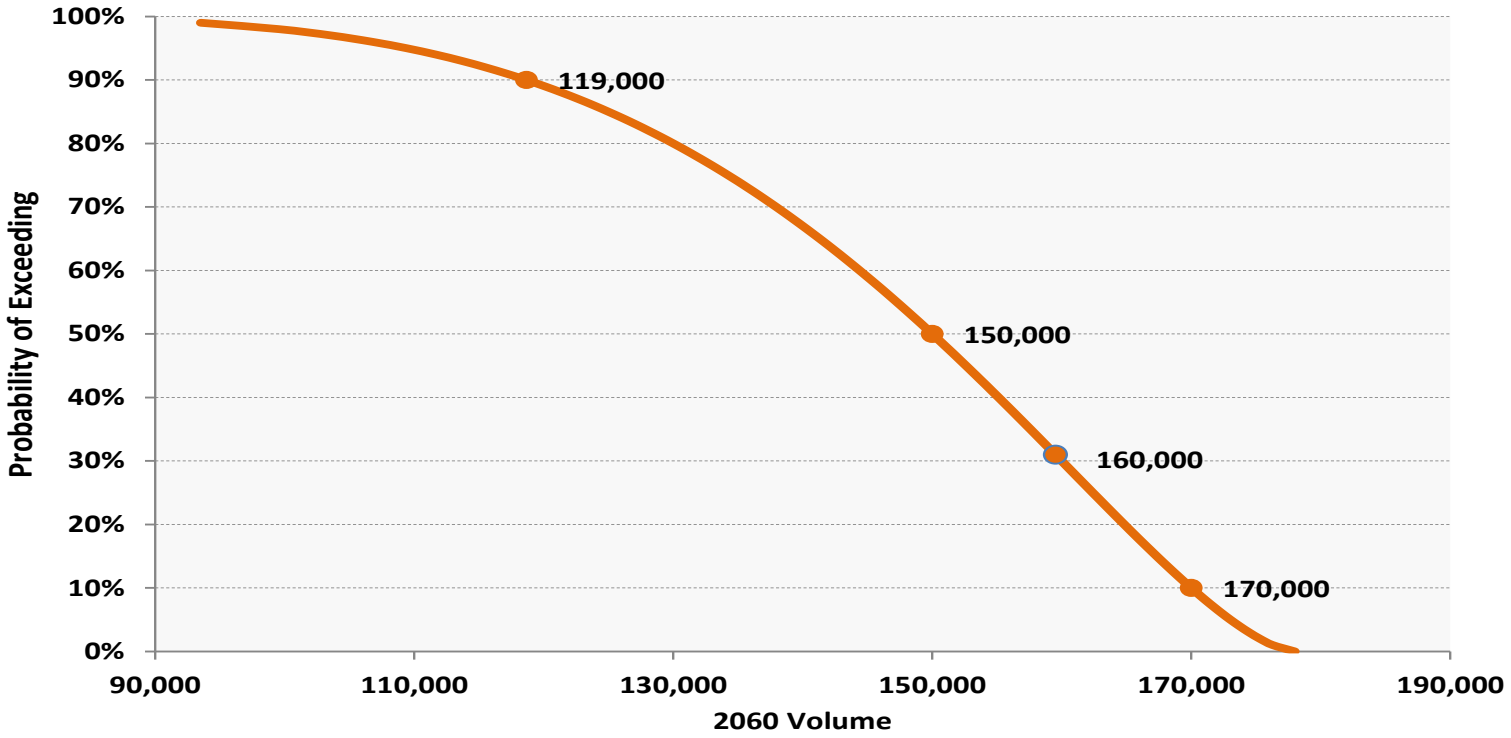



- Automated Vehicles
  - 90% reduction in crashes
  - Capacity could increase as much as five-fold
  - Platooning: fuel efficiency
  - Vehicle and infrastructure design

# Sample of Other Trends

- Telecommuting
- Ridesharing
- Automation
- Smart Cities

# Hypothetical Corridor Analysis



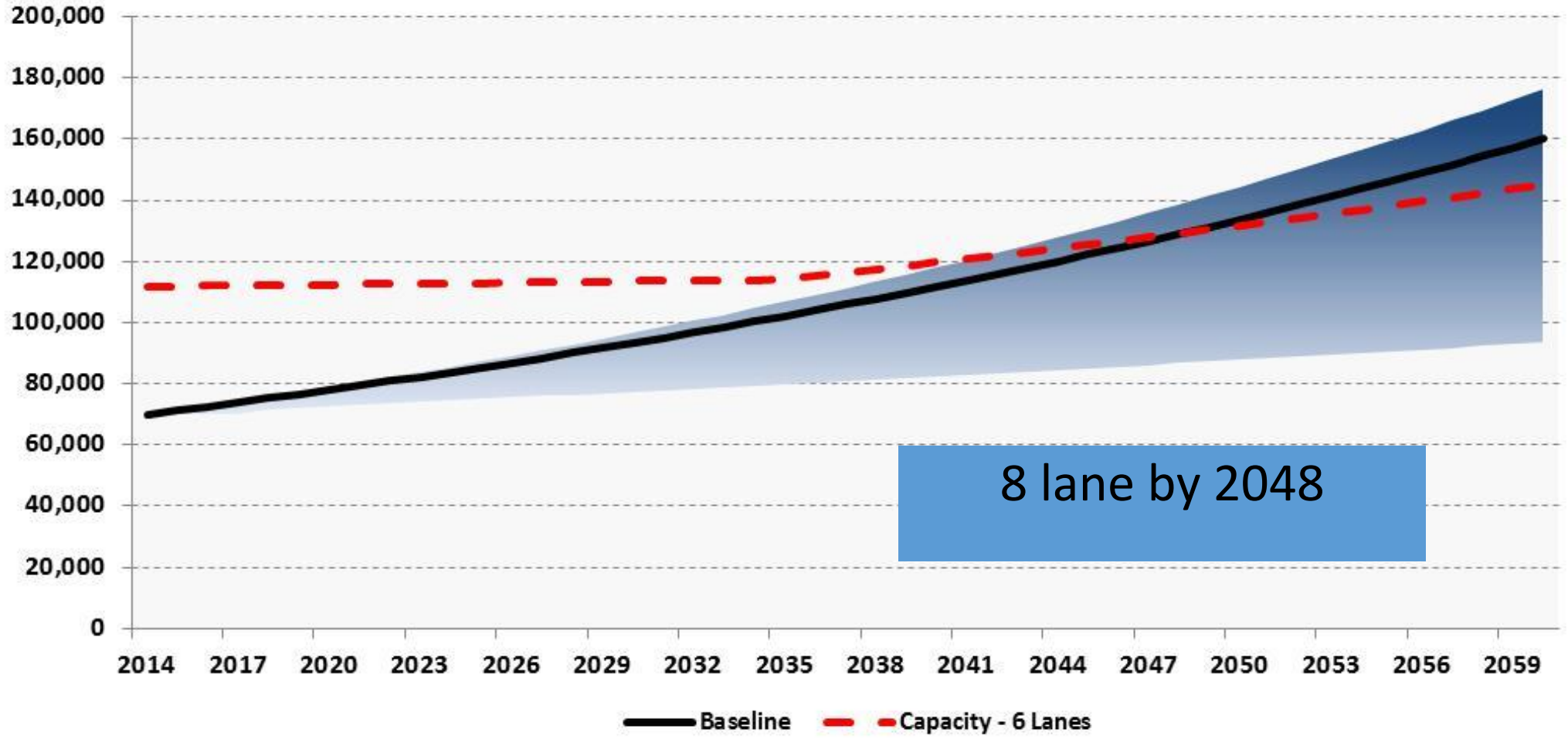

2060 capacity thresholds (@ 50% AV market penetration)

6 lanes = 145,000

8 lanes = 190,000

10 lanes = 240,000

# Hypothetical Corridor Analysis



# Central Florida Automated Vehicle Proving Grounds Partnership

**Overview by**

**Charles A. Ramdatt, P.E., PTOE, AICP**

**for**

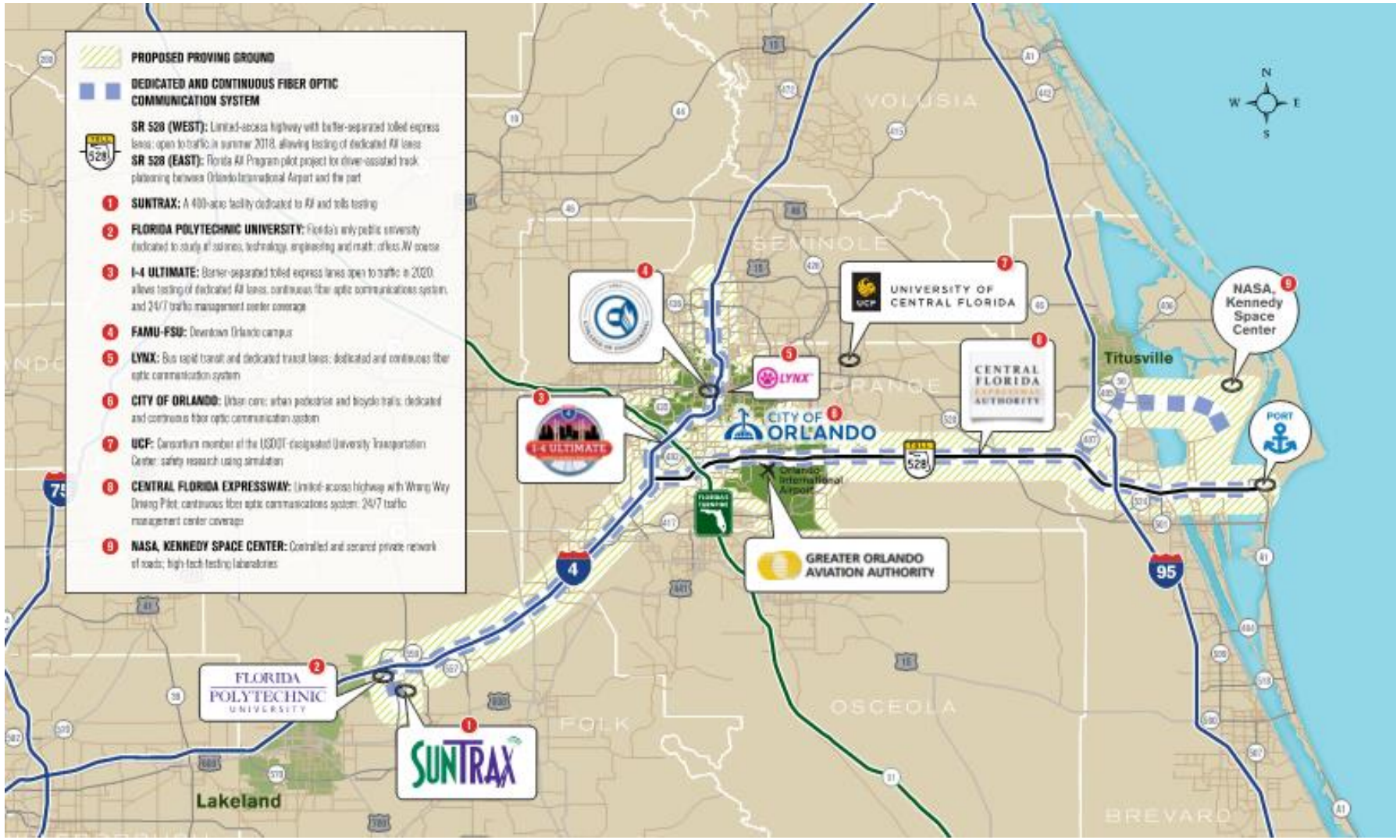
**MetroPlan Orlando**

**February - March 2017**

# Areas of Focus

- **Four Modes of Travel**
  - **Automobiles**
  - **Freight**
  - **Transit**
  - **Bike-Ped**
- **Interaction of Modes**
- **Safety**
- **Full Range of Automation**
  - **Vehicles**
  - **Roadside Equipment**
  - **Sensors**
  - **Human Factors**
  - **Alternate Fuels**
    - **Fueling/Charging Facilities**
    - **Fueling/Charging Types**

# Map of Primary Partner & Facility Locations



# Team

- **City of Orlando**
- **University of Central Florida**
- **Florida Polytechnic University**
- **FAMU-FSU College of Engineering**
- **Florida Turnpike Enterprise**
- **Central Florida Expressway**
- **Florida Department of Transportation Districts 1 & 5**
- **Lynx**
- **NASA – Kennedy Space Center**

# Approach

- **UCF & FPU**
  - **Research, Simulation & Emulation**
- **FAMU & FSU**
  - **Review of Work Performed by Primary University Partners**
  - **Allow for Minority Institutions' Participation & Mentoring**
- **FTE & FPU**
  - **Development of Test Track**
  - **Closed Environment Testing**
- **NASA-KSC**
  - **Testing of sensors for extreme environments**
  - **Closed Environment Testing**
- **CFX & FDOT**
  - **Freight Vehicle, Infrastructure & Sensor Testing in More Open Environments**
- **City of Orlando, UCF & Lynx**
  - **Automobile, Freight, Transit & Bike-Ped Vehicle, Infrastructure & Sensor Testing in Open Environments**
- **UCF School of Public Administration, FAMU & FSU Law Schools**
  - **Public Engagement**
  - **Policy Development**
  - **Legislative Coordination**

# Why?

- **City of Orlando's Executive Leadership Direction**
  - **Use Affordable & Emerging Technologies on a Continuing Basis to be -**
    - ***A Great Place to Visit, Live, Work, Play, Raise a Family, Ensure Good Environmental Stewardship, Attract the Creative Class and Promote Economic Development***
- **Response to USDOT Solicitation**
  - **Fall 2016**
  - **Numerous Concerns & Needs**
    - **Safety**
    - **Closed Environment Testing**
    - **Gradual Transition to Open Environment Testing**
    - **Research**
    - **Knowledge Sharing**

# Anticipated Benefits

- **Earn & Retain “Smart City” Branding**
- **US DOT Designation/Certification Agreement & Funding Opportunities**
- **Coordinated Research**
- **Safer & More Livable Communities**
- **Independent Pursuit of Other Opportunities**
  - **University Research**
  - **Independent engaging of auto-makers, OEMS & interest groups**
  - **Promoting and branding of work by subsets of the partnership**
  - **Engaging & utilization of Central Florida tech companies & talent**
  - **Economic Development**
  - **Attracting the “Creative Class”**
  - **Facilitating a culture of continuing innovation, review and R&D**

# Current Status

- **Unofficial designation since mid-January 2017**
- **Initial Team Meeting – early February 2017**
- **US DOT Convening of 10 winning teams – February 27 & 28, 2017**
- **Sharing of details & opportunities with local governments & other local interest groups**

# Next Steps

- **Development of Partnership MOU**
- **Development of process for engaging**
  - **Auto-makers**
  - **OEMs**
  - **Local Tech Community**
- **Dealing with the full range of procurement issues**
  - **Harmonizing among partners**
  - **Advocating for local, state and federal law/rule changes**
  - **Facilitating un-invited/un-solicited suggestions for innovation**
- **Development of protocols for media engagement as well as requests for, and releasing of, information**
- **Spring-boarding to other innovative ideas that can improve access, mobility & quality of life in Greater Orlando**

# Recognition

- **Beyond Traffic 2045**
- **US DOT Smart City Challenge**
- **MetroLab Network**
- **Smart City Council**

# Questions & Comments, Please

# Current Initiatives

Jeremy Dilmore, District Five ITS

# TSM&O Consortium Meeting

**January 2017**

# Overview

- Bid Data Project UF
- Active Work
- Future Work
- Update Software Availability
- Grant Opportunities Update
- TSMO Implementation Plan Update

# Pedestrian Crash

- Eric Hill MetroPlan Orlando
- Chad Lingenfelter D-5 Traffic Operations
- David Henderson Bicycle Pedestrian Administrator – Miami-Dade MPO
- Mark Horowitz Complete Streets Program Manager, Highway Construction and Engineering Division, Broward County
- Mighk Wilson Smart Growth Planner – MetroPlan Orlando

# Questions

- Are pedestrian crashes near transit stops more severe?
- Are pedestrian crashes in areas of recreational walking (defined using strava) less severe?
- Are pedestrian crashes in mixed-land use locations more severe?
- Are pedestrian crashes in low-income / minority neighborhoods more severe?
- Are pedestrian crashes in roadways with “curb median with lawn” more severe (mid-block crossing problem)?
- Are pedestrian crashes in roadways without sidewalks more severe?

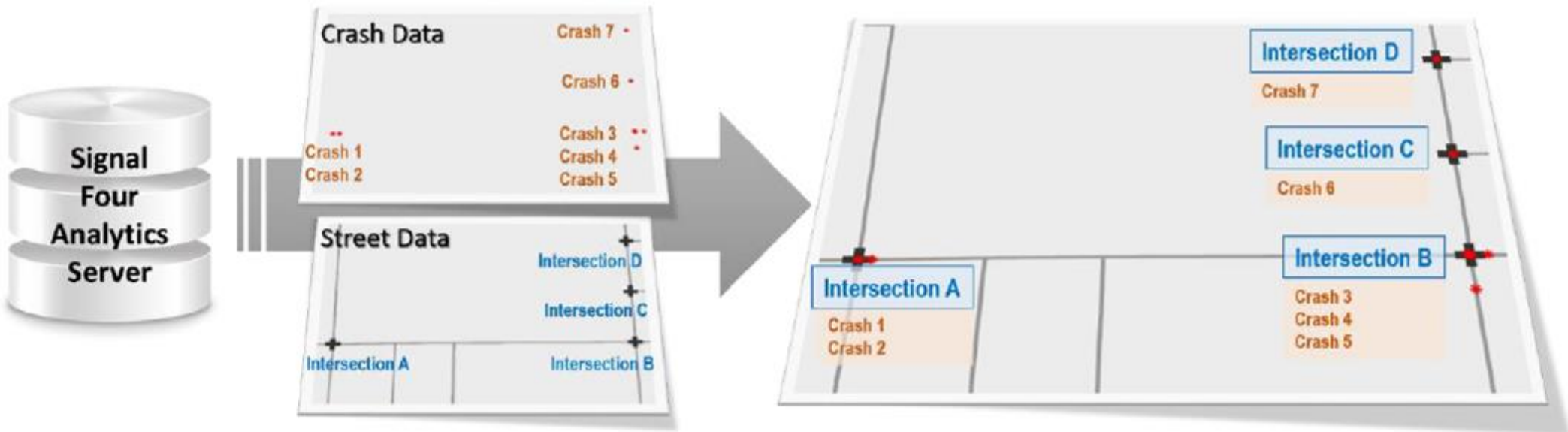
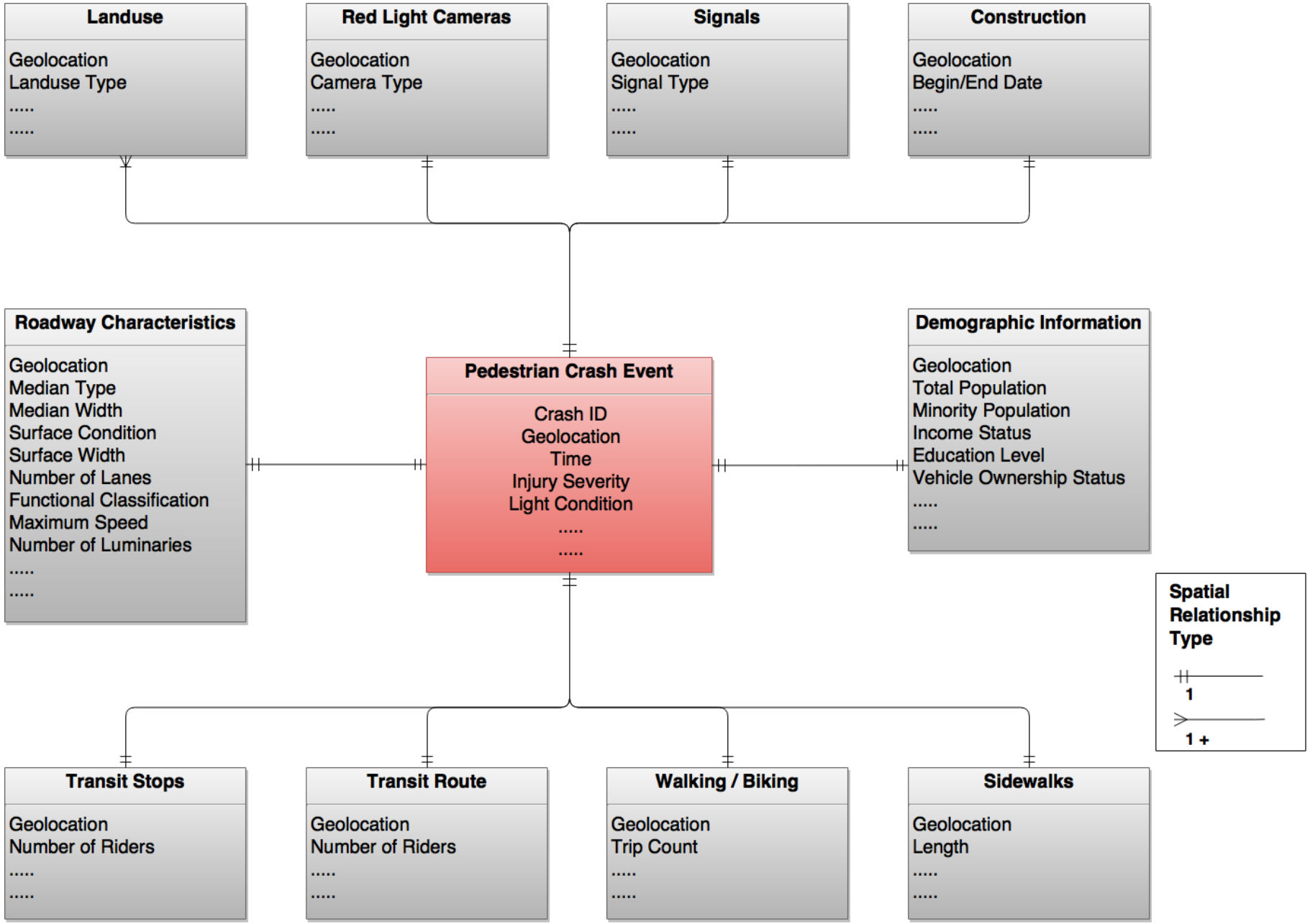



Figure 4. Conceptual process of association intersections with crash data


Landuse
Geolocation
Landuse Type
.....
.....
Red Light Cameras
Geolocation
Camera Type
.....
.....
Signals
Geolocation
Signal Type
.....
.....
Construction
Geolocation
Begin/End Date
.....
.....
Roadway Characteristics
Geolocation
Median Type
Median Width
Surface Condition
Surface Width
Number of Lanes
Functional Classification
Maximum Speed
Number of Luminaries
.....
.....
Pedestrian Crash Event
Crash ID
Geolocation
Time
Injury Severity
Light Condition
.....
.....
Demographic Information
Geolocation
Total Population
Minority Population
Income Status
Education Level
Vehicle Ownership Status
.....
.....
Spatial Relationship Type
1
1 +
Transit Stops
Geolocation
Number of Riders
.....
.....
Transit Route
Geolocation
Number of Riders
.....
.....
Walking / Biking
Geolocation
Trip Count
.....
.....
Sidewalks
Geolocation
Length
.....
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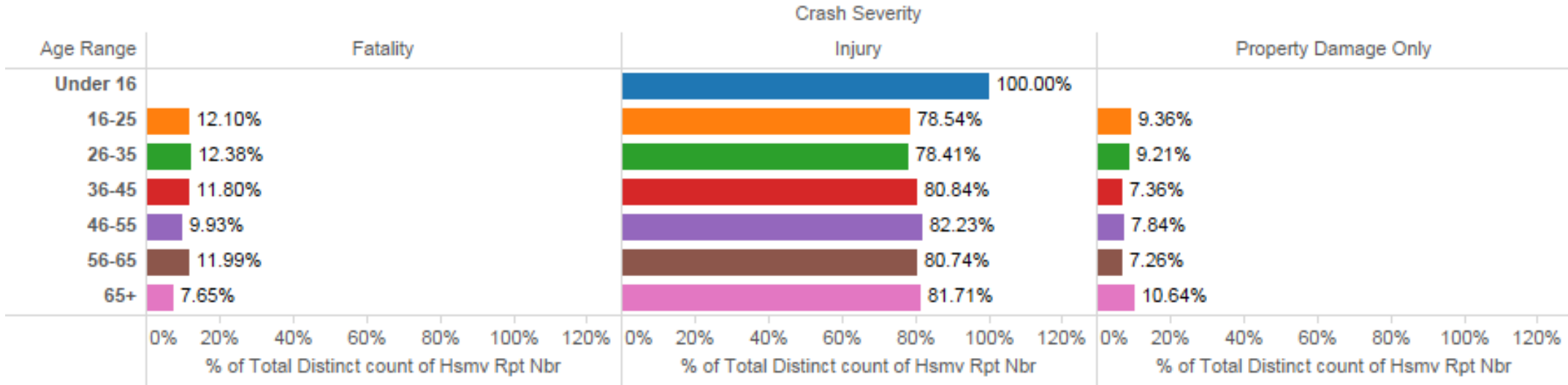
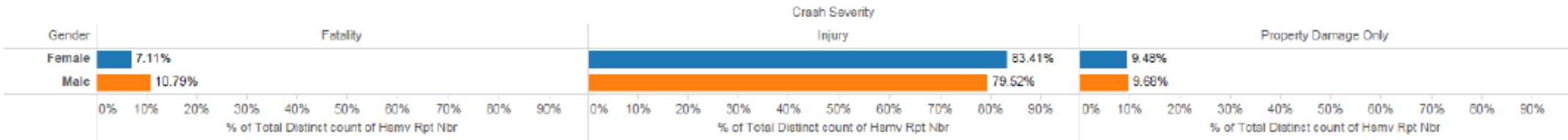



Crash Severity

| Gender | Fatality | Injury | Property Damage Only |
|---|---|---|---|
| Female | 7.11% | 83.41% | 9.48% |
| Male | 10.79% | 79.52% | 9.68% |



# Top Factors

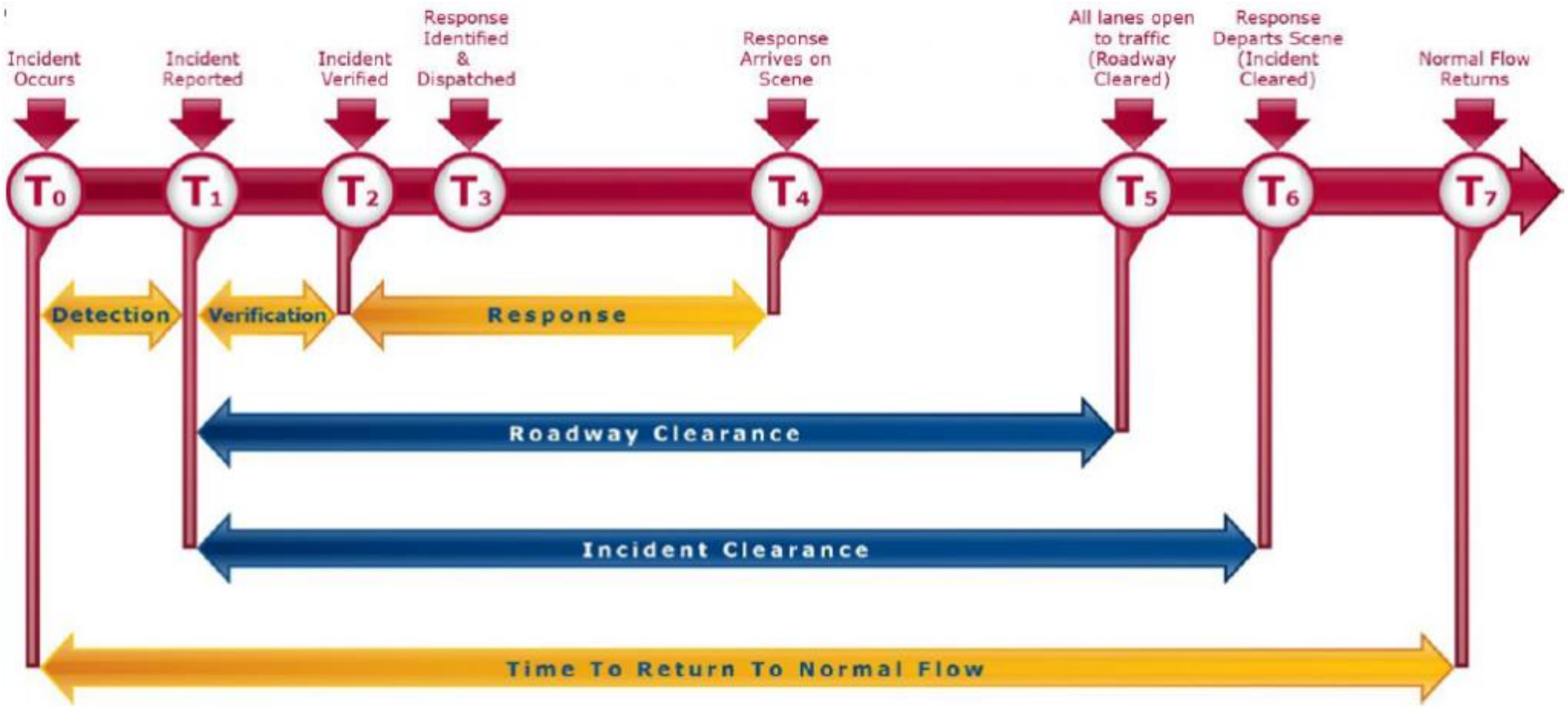
- Education Level
- Day time
- Population
- Age
- Ethnicity
- Distance to Red Light Running Cameras
- Bus Usage

| Variable | Gain |
|---|---|
| PercentBachelorsAndHigher | 211.65 |
| LightConditionDayLight | 190.4057 |
| TotalPopulation | 178.1093 |
| PopulationMedianAge | 172.7907 |
| PercentAfricanAmerican | 152.4922 |
| DistanceToRedLightCameras | 150.6849 |
| TotalOnAndOffAtTheNearestStop | 143.5178 |
| DistanceToNearestTransitStop | 141.7115 |
| Vacant | 141.376 |
| PercentWhite | 140.2894 |
| LightConditionDarkLighted | 138.2507 |
| TransportationWalk | 134.6569 |
| PercentWithDisability | 126.9994 |
| WorkedAtHome | 125.8058 |
| DistanceToNearestTransitRoute | 111.9195 |
| MedianValueHousingUnits | 106.7628 |
| MedianHouseholdIncome | 99.89326 |
| HouseholdsPublicAssistanceIncome | 89.33759 |
| TransportationOther | 85.8138 |
| PercentHispanic | 69.11561 |
| OccupiedHousingWithNoVehicle | 59.22816 |
| PercentMultiRace | 58.6117 |
| TransportationPublic | 53.48923 |
| PercentOtherRace | 53.12206 |
| DistanceToNearestSignalizedIntersection | 46.28277 |
| LightConditionNotLighted | 44.59914 |
| TransportationBike | 42.21838 |
| PercentAmerican | 36.06061 |
| OffsetDistance | 31.4055 |
| PercentAsian | 30.60968 |
| TransportationMotorVehicle | 24.29574 |
| FourWayIntersection | 20.14128 |
| LanduseResidential | 15.2142 |
| AlcoholRelated | 3.358084 |
| SchoolBusRelated | 1.213607 |

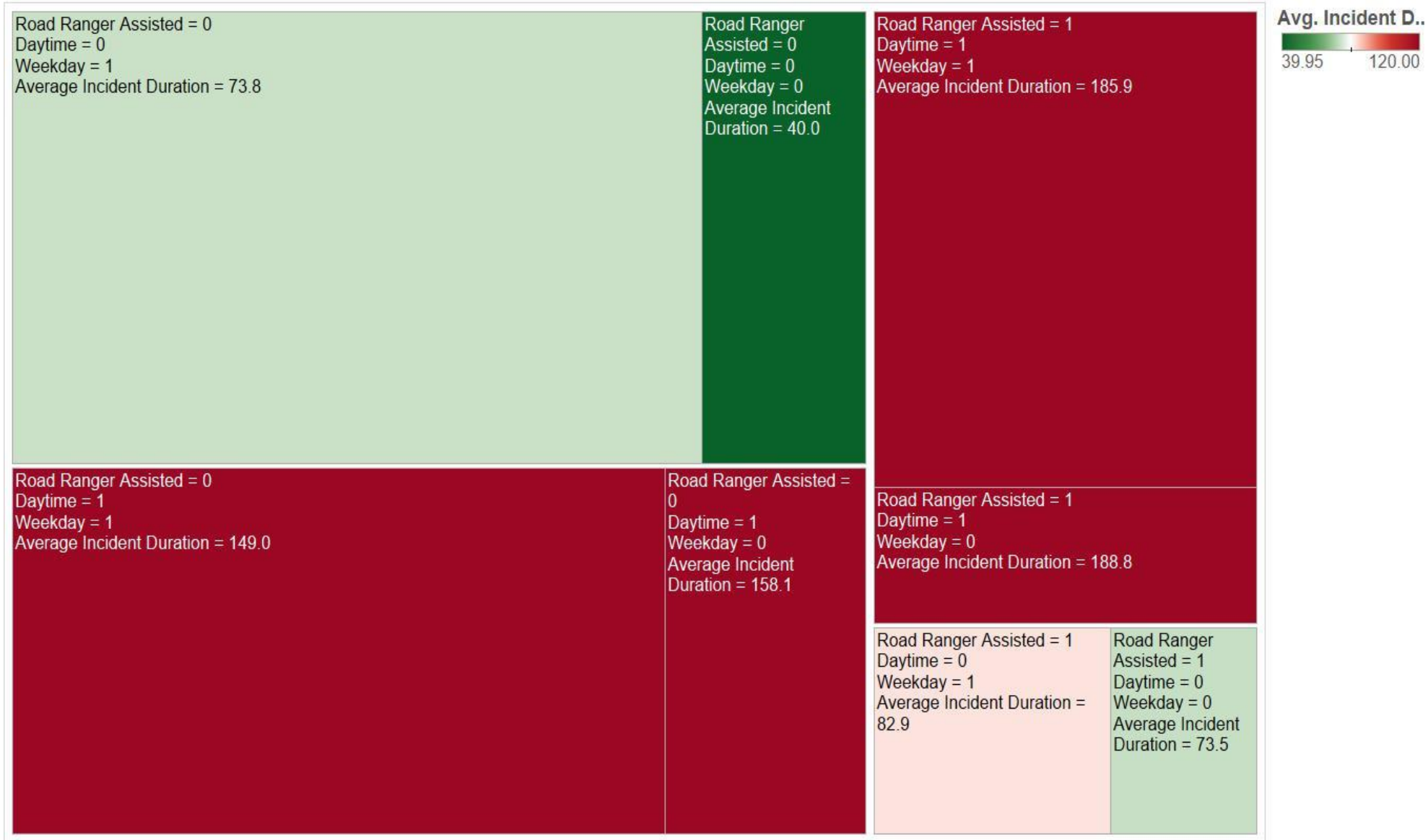
# Data Analysis

- GIS Tools
- Regression Analysis

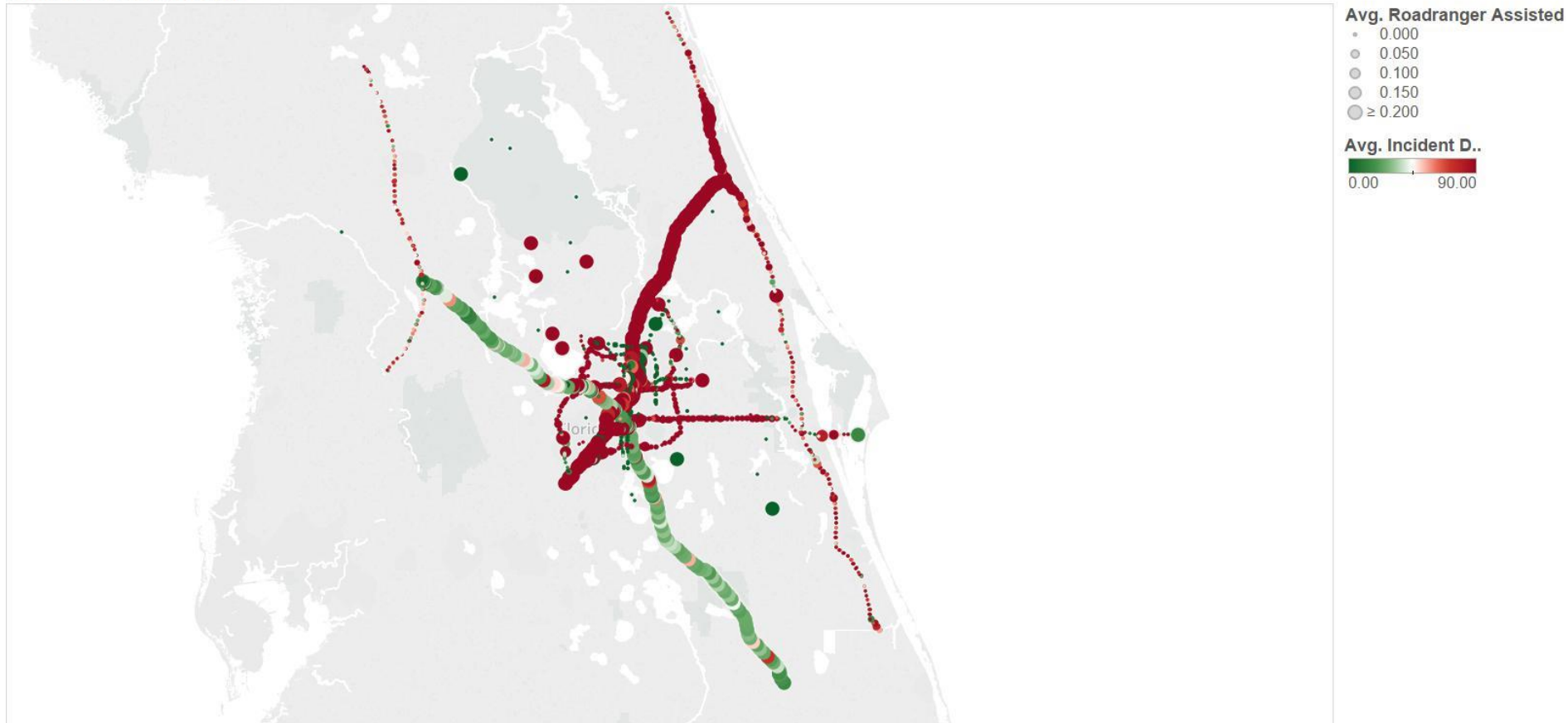
# Road Rangers



## Incident Duration Treemap

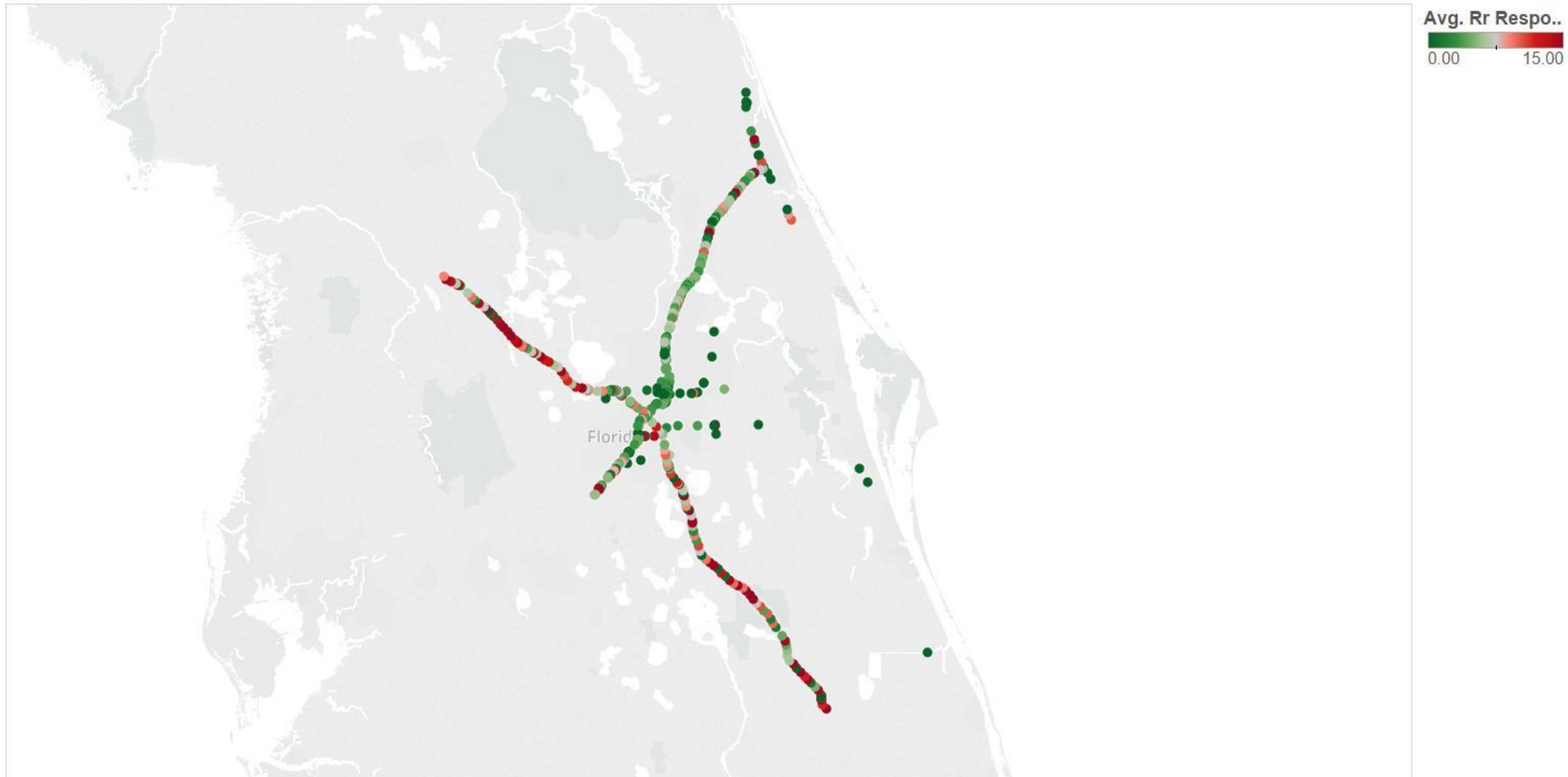


## Incident Duration Map

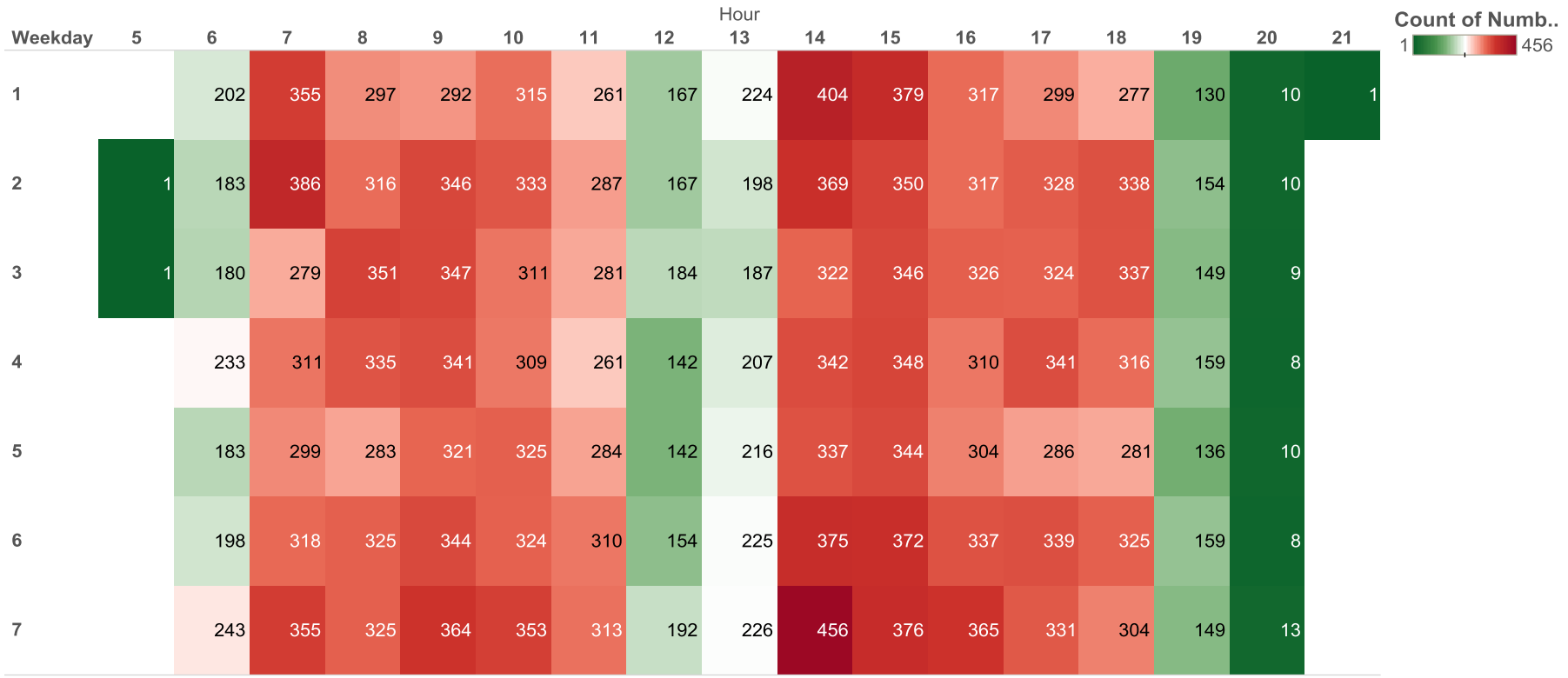


## Lane Blocking Duration Map

## RR Response MAP



## Time Distribution Incident



# Analysis Methodology

- Tableau

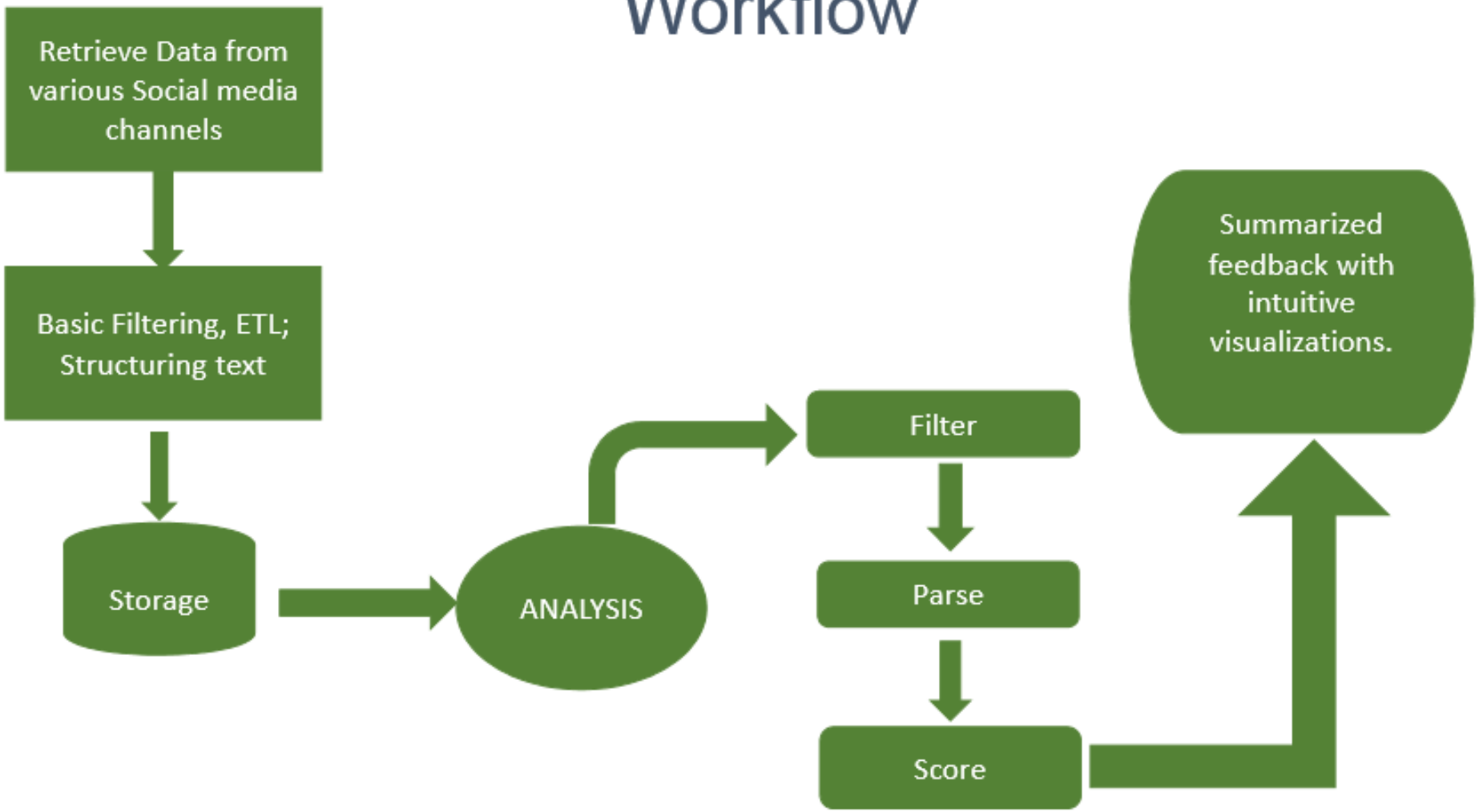
# Sunrail Sentiment Analysis

Positive

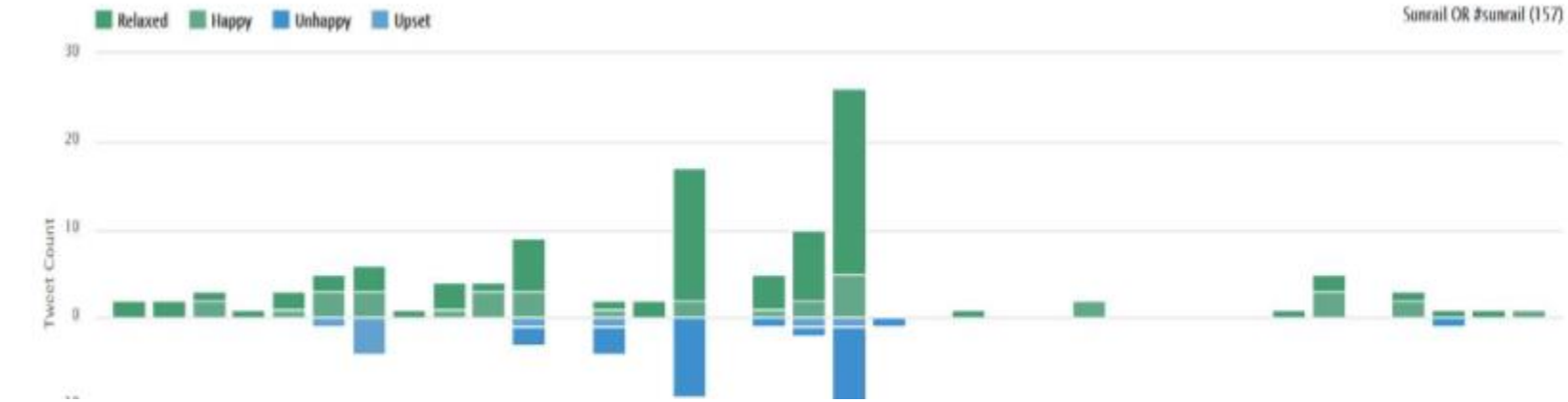
Neutral

Negative

# Workflow


Retrieve Data from various Social media channels
Basic Filtering, ETL; Structuring text
Storage
ANALYSIS
Filter
Parse
Score
Summarized feedback with intuitive visualizations.

# TimeLine


Relaxed
Happy
Unhappy
Upset
Sunrail OR #sunrail (157)
30
20
10
0
Tweet Count
12:00pm
Jun 28
12:00pm
Jun 29


pleasant
high confidence
unpleasant
low confidence
Map
Ocala
Daytona Beach
New Smyrna Beach
The Villages
Crystal River
Leesburg
Orlando
Titusville
Spring Hill
Kissimmee
Melbourne
Clearwater
Tampa
Largo
St. Petersburg
Lakeland
Winter Haven
Palm Bay

# Analysis Method

- Data collection from social media
- Sentiment analysis methodology

| Tweet | Rating |
| --- | --- |
| spoiled local. taking the Sunrail is such a treat! | Very Positive |
| If you are going to the vigil tonight the Sunrail will be running a late train. #Orla | Neutral |
| Messages of love & support @RideSunRail #SunRail @ChurchStOrlando #OrlandoUnited #WeAreOrlando #OrlandoStrong | Positive |
| Want to skip traffic for the game? #Sunrail has extended hours today just for you. #alocalthing #churchstreetstop https://t.co/aXMU145UTV/ | Positive |
| #SunRail is excited to announce extended service for the COPA games. #RideSunRail to tonight's match! https://t.co/QI9WarJmHP/ | Positive |
| #GOCAN "Sunrail has not been a success. We need to lead in the future [with light rail.]" - Alexander Duncan https://t.co/vGs8YmWIbW | Negative |
| Omg finally made it!Isunrail had mechanical issues! OMG WORKFLOW (at @mco in Orlando FL) https://t.co/ScOFHCum7p https://t.co/rWwjn7Vy9d | Negative |

# Next Steps

- Impact of Projects
  - How is land value impacted by transportation projects
  - Location extent of the impact
  - How long is the improvement
  - How long does it take to impact to be felt
  - How is land value impacted during construction versus after construction
  - How does construction duration impact land value
  - How does it impact different land uses (before and after construction)
  - Does it have a bigger effect on large versus small properties
  - How is the cost of construction per mile or total cost impact
  - How does right-of-way cost tie to land value impacts
  - Is there correlation between improvement in mobility and improvement land value
    - Overlay map of projects onto land value growth, or population growth

# Process

- We ask questions
- We discuss available data
- We develop a team of experts
- Experts guide development
- UF runs the system

# Going Forward

- We (Operators, MPO) asks questions
- Universities (UCF & UF) have direct access to data
- We (Operators, MPO) develops a team of experts
- Experts guide development
- Universities (UCF & UF) runs the data analysis system
- Universities (UCF & UF) present results

# Lessons Learned

- We don’t need to be experts in data mining
  - Those are available to us
- We need to organize our data, make it more available
  - Interest in looking at agency data and organizing it
  - Planning Dashboard
- We do need to ask questions
- They will ask questions based on our questions
- Results may vary…
  - Need different data
  - Here is the response

# Questions?

- Do you have questions you want answered?
  - We have some funding with UF and UCF for this
- Do you think this is sustainable?

# TSM&O Consortium Meeting

**January 2017**

# Active Projects

- ReIP
  - Complete – City of Orlando, Orange, Seminole County
  - In Progress – Brevard, Volusia, Osceola, Lake, Marion
  - Discussion more CCTV integration
- I-75
  - Polk County to CR 470 – Complete
  - CR 470 to Turnpike – Under Construction
  - Turnpike – Under Construction
  - Turnpike to US 27 – Complete
  - US 27 to Alachua County – Complete

# Active Projects

- AAM
  - Phase 1 - Complete
  - Phase 2 – Finalizing
  - Phase 3 – Award in progress
- TSP
  - Phase 1 – Complete
  - Phase 2 – In Construction
  - Phase 3 – Study Design next fiscal year, Design Build
- IMC
  - 10 intersection deployed; working on accuracy issues

# Active Projects

- AAMO
  - Diversion Route Timings under development
- AAM Dashboard
  - Sprint 2 complete – working wireframe
- Planning Dashboard
  - Environment created
  - Test API Working
  - Adding Data
- UF Big Data Work
- Loop vs SPM data comparison

# Active Projects

- RTMC
  - Clearing and Grubbing final grading
  - Awarded
- Event Management
  - To advertise; added sign removal
- Bridge Security
  - Advertising
- Adaptive Ramp Metering
  - Had stakeholder meeting; gathering lessons learned; helping develop statewide ramp metering guidebook

# Future Work

- Shortlisted
  - TSM&O Continuing Services – In selection
    - HDR
    - Metric
    - Arcadis
    - Atkins
  - Route and Mode Choice
    - RSG
    - Kapsch
    - Atkins

# Future Work

- Advertised
  - TMC Operations (Freeway and Arterial)
  - ICMS
- Advertise Soon
  - I-75 FRAME
  - PedSafe, Greenway, and SunStore
  - SR 434 Connected Vehicle
  - I-75/I-95 Ramp Metering Study
  - ITS Software (Road Ranger, AVL, iVDS, MIMS, etc.)
  - SR 40 DBOM

# Update on Software Availability

- iVDS ready to go
- New FDOT Domain is up and running
  - Involved Sunguide 6.2 Upgrade
  - Adding DMS, CCTV, and Bluetooth Devices to current software
    - Next Up MIMS Update
    - Next Up Activu Update
      - Followed by Domain Connections

# Grant Opportunities

- FASTLANE
  - No Update on this
- ATTRI
  - Open and available
- ATCMTD
  - Waiting for this to hit

# FDOT CO Strategic Plan

- Policy Focused
  - FDOT Workforce Evaluation
  - Project Recommendations
    - Operations and Maintenance Funding
    - Active Arterial Management
    - Integrated Corridor Management
    - Adaptive Signal Control/Sign Performance Metrics
    - Connected Vehicle
  - Performance Measure Driven
  - Integration for TSM&O into other units in FDOT

# TSM&O Implementation Plan

- Looking to Clarify Funding Process
- Staffing and Organization

# Updating Capability Maturity Framework One Minute Assessment

FDOT

Transportation Systems Management & Operations

https://ops.fhwa.dot.gov/tsmoframeworktool/tool/traffic_mgmt/

# TSM&O Consortium Meeting

**MEETING AGENDA**
D5 Urban Office
133 S. Semoran Blvd.
Orlando, FL
Lake Apopka B Conference Room

*March 9, 2017; 10:00 AM-12:00 PM*

1) WELCOME
2) FDOT D5 TSM&O IMPLEMENTATION PLAN UPDATE
   - David Williams, VHB
3) EXPRESS BUS – PERFORMANCE MEASURES, DISTRICT 4 AND DISTRICT 6
   - David Williams, VHB
4) DANGEROUS BY DESIGN (2016), PEDESTRIAN SAFETY
   - David Williams, VHB
5) SUMTER COUNTY ATMS PROJECT UPDATE
   - Brian Kanely, Volkert
6) COMPARISON OF REGIONAL ITS MASTER PLANS
   - Joe Perri, VHB
7) TRANSPORTATION AND FUTURE TECHNOLOGIES
   - Jeremy Dilmore, D5 ITS
8) CURRENT INITIATIVES UPDATE
   - Jeremy Dilmore, D5 ITS
9) UPDATING CAPABILITY MATURITY FRAMEWORK – ONE MINUTE ASSESSMENT

   https://ops.fhwa.dot.gov/tsmoframeworktool/tool/traffic_mgmt/