TSM&O CONSORTIUM MEETING SUMMARY

Meeting Date:	November 15, 2018 (Thursday)	**Time**: 10:00 AM – 12:00 PM
Subject:	TSM&O Consortium Meeting	
Meeting Location:	Central Florida Expressway Authority 4974 Orl Tower Rd Orlando, FL 32807 CFX Boardroom	

I. OVERVIEW

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

II. CFMPOA REGIONAL PRIORITIES AND PROCESS - UPDATE

David Williams gave a brief update on bringing TSMO Priorities into the CFMPOA process.

- As Eric Hill discussed at the last Consortium, there are SIS, Trail and Transit project categories for the CFMPOA Regional Prioritized Projects List
- We are seeking to add a fourth project type: TSM&O
- Eric Hill drafted new language to be included
- A Future Projects section is being added; will establish how FDOT staff will incorporate this process into their funding opportunities
- Eric Hill spearheading the next steps
- There is now a task force to develop methodology for bringing projects to the MPO Alliance, which consists of members from SCTPO, RTSTPO and MetroPlan Orlando, as well as Orange County
- Next MPO Alliance Meeting is January 11, 2019

III. GAINESVILLE "AUTOBUS"

Emmanuel Posadas from the City of Gainesville gave an overview of the City of Gainesville progress in establishing automated vehicle transit service. Mr. Posadas gave the presentation over the phone.

- A best practice is to have an integrated organization that can work together well when developing new projects
- Autobus is mobility as a service; Transdev is the service provider
    - That is helpful because it puts the operating costs and maintenance on the provider – so that the costs remain consistent for the City

- Has not yet launched yet because NHTSA has been slow to approve the use of the vehicles in Gainesville
    - NHTSA requires a formal review process for all internationally manufactured vehicles
- AV shuttle conceived in 2015/2016 – Collaboration between UF, City of Gainesville and FDOT Central Office
- FDOT is the funding arm for this program
- UF Research team is with Dr. Libby
- Need willingness from agencies to collaborate from the highest level
- Leading the effort are FDOT's Tom Byron and UF Vice President Charlie Lane
- Transdev is using Easymile to supply their vehicles, but the City of Gainesville does not have to interact directly with Easymile since they are contracting with Transdev
- David Williams: What will the phasing look like?
    - Phase I – Autobus will run for a couple thousand feet back and forth, beginning sometime in January depending on NHTSA reviewal
    - Phase II – Autobus will cross several signals; hopefully by Spring 2019
    - Phase III – Route will connect residential areas and Depot Park downtown, which is also Gainesville's transit hub
    - Eco-departure – Bus timing will be based on signal timing, etc.
    - Mixed-traffic deployment; will be on an open, public street
- Funding supporting programs through I-75 FRAME District 2 – FHWA AID program
- Have to approach many companies – if free or under $5,000 then - partner with connected signals, launch slim AI in December
- In terms of technology, the City is trying everything and seeing what sticks
- Gainesville ATSPM using Google Delivery IO interface
    - This is similar to what Seminole County is doing
- Failure is a part of any progression of learning and building a successful transportation system
- Q: What the insurance look like for your consultant?
    - We are using standard liability insurance that most public agencies use for consultant work (no added protections for AV component)
- Q: When is Phase II
    - That is dependent on NHTSA, but hopefully in early Spring
- Is the autobus a lease or a purchase?
    - It is leased as mobility as a service
        - The City leaves this to Transdev's discretion – the City just pays Transdev
    - Currently we will just be using one vehicle, but that will increase
- EasyMile has already deployed in Florida – with JTA and a private development in Naples

IV. MODELING AUTOMATED, CONNECTED, ELECTRIC AND SHARED VEHICLES IN CENTRAL FLORIDA

Jason Learned of District Five PLEMO gave a presentation on the future of mobility in Central Florida.

- Discussed a report that came from FDOT Central Office on Automated, Connected, Electric and Shared vehicles (ACES)
- Relatively newly published document so not everything in the document has been digested

- This document is a guide, not a set of instructions since there is a lot of gray area in this field
- Current model is the CFRPM, covering 11 counties, 10 full and 1 partial
- Updating this model as part of the 2045 LRTP
- 2015 base year and interim scenarios every 5 years
- Forecasts demand at link level – it is not operations based
- Validated for various metrics
- Not validated simply on traffic counts
- ACES – Automated, Connected, Electric and Shared Use vehicles
    - This is the first guidance for how to model
    - D1 Regional Model also has attempted to model this
    - It is believed that operations are affected more than demand
    - Expected that capacity of roadways will increase
    - Published in September 2018
- Statutory requirement for MPOs in Florida – as a stage for analyzing and implementation
- No uniform policy and no funding program
- Two different models as a test platform
    - CFRPM and Gainesville Model
- Methodology – FHWA developed potential scenarios
    - Slow Roll
    - Niche Service Growth
    - Ultimate Traveler Assist
    - Managed Automated Lane Network
    - Competing Fleets
    - Robo Transit
    - Uses standard capacity but there may be higher capacity
- Results
    - Some small changes to slowing traffic
- Next Steps
    - How do we implement this?
    - Is the methodology sound?
    - Are the results valid?
    - Are scenarios mutually exclusive?
        - Tested individually but these will not happen in a vacuum
    - Policy impacts?
    - Financial Impacts?
- Implementation Plan
    - FDOT will run the model for each scenario and deliver the results to the MPOs
    - Only applicable to the future scenarios of 2025 and up
    - Changes are applied regionally
    - Changes to the model
        - Modified roadway capacity
        - Changes in trip lengths
        - Changes in vehicle trips
    - MPOs will need to develop scenario plans

  - Need to analyze policy and financial implications of scenarios
  - Need to develop vision and plan for implementation in LRRTP
  - Not a one-size-fits-all application
- Looking Forward – 2050 LRTP
  - Travel demand models focused primarily on SOV automobiles
  - Develop new steps/modes in existing models?
  - Develop/Use separate models?
  - Need a regionwide consensus on implementation
- Q: How is modeling electric vehicles different from automated or connected vehicles?
  - I think that term is included here because electric vehicles will be used more often in the future

V. TAMPA BAY SMART CITIES ALLIANCE

David Williams gave a presentation on the Tampa Bay Smart Cities Alliance.

- Information on this alliance can be found at www.TBSmartcities.com
- Agreement does not include financial obligations; focused on improving collaboration between public and private entities
- CUTR, FDOT and City of Tampa are the 3 core team members
- Two "ideas to action" workshops have been held
- Signed a MOU between City of Tampa and USF
  - Entry into the MetroLab Network
  - Developed MOU over 2 years
- A region-wide collaboration towards a RFP response for a private AV mobility service (TNC) in the Tampa Bay Area
- How do we use technology and innovation to…
  - Improve Safety?
  - Make sure we are ready for the future?
- Top focus areas
  - Develop CAV
  - Centralized Data Management hub
  - Improve access to multimodal information
  - Reimagine infrastructure
    - One of 3 connected vehicle pilots in the country
    - ATMS – AMP and ICM
- Have had two workshops to date; the last was in July 2018

VI. BEHAVIOR CLUSTERING

Jeremy Dilmore discussed how District Five is working to introduce new data analytics, for the purpose of improving the usefulness of data that exists today.

- Trying to benchmark with other people in Florida and collaborate as much as possible with leaders in the state
- Often engage outside of our boundary, including UF I-Street Data Management & Analytics
- ATSPM Data – Traffic Signal enumerations

- Dive down into the metadata – trying to pull out meaningful data from the larger data set
- The data has traditionally been good with details, but hard to pinpoint problems on a regional scale
- Looking for intuitive ways to find problems
- Finding at how the roadway is over capacity, or possibly where it is allocated poorly
    - Helping to decide when widening vs. operational changes are appropriate
    - Categorize timing issues
- Helping to answer: how do the intersections look and perform together as a whole?
- Automatically grouping signals by behavior
    - Which signals should be coordinated, and which don't need to be
    - Using data to make decisions rather than historical assumptions – using data that is not apparent without good analysis
    - Often is coming up with a logical pattern
- Signal clustering
    - May change across days of the week – looking at developing the most efficient patterns
    - Breaking down to as small as 15-minute periods to develop patterns
    - Midday periods are typically different
    - Some weekend patterns looked similar to weekday patterns
    - Use this data to describe overall patterns
- Can show timing needs vs overcapacity
- Want to look in a measured way – picking the signals that most need retiming using a data-based approach instead of using intuition
- Comments: It is not just day-to-day but also time of day; this needs to be considered
    - We agree, and we are making sure to include this data, even timing plans for holidays or during specific events
- Comment: Something might look like a faulty detector, but in fact there was no traffic for two hours
    - We need people who understand how to manipulate data and people who understand how controllers work and make sure communication is good and data is correct
    - <u>We are not looking to do less signal retiming but just doing it more effectively</u>
        - Similar to prioritizing roadway improvements, we're trying to prioritize retiming

VII. NEAR-MISS COLLISION DETECTION

Jeremy Dilmore briefly discussed progress on near-miss collision detection.

- Working with UF and UCF
- Traffic safety data is difficult to work with because it needs to get certified, and that process is slow
- There are often not clear patterns because even a place that is genuinely dangerous may only produce a few crashes per year
- FDOT is looking at other metrics to determine safety of roadways other than just crashes
- Identify vehicles and chart their speed and find crashes and near misses
- Near misses happen on a much more frequent basis so it is much easier to find trends and call roadways unsafe
- Dr. Sayid at University of British Columbia – Could sell system but it took too much time to process; just wanted to process these safety metrics in real time
- Want to find safety hotspots
- Flew drone at UF – UCF hired doctoral student
- Instead of looking at five years of data, they can better determine the safety of the location after five days, oftentimes with no crashes actually occurring

  - This allows us to be nimbler and make places safer before there are deaths and injuries
- Process is: Object Detection → Object Tracking → Collision Detection → Collision Avoidance
- Created collisions in the virtual environment in order to train the algorithm
- YOLO Deep Learning Framework
  - YOLO = You only look once
- Teach it to detect cars before in can track the vehicles
- Processing performance is close to real time
- Will track the accuracy of the detection
- Teach the algorithm what a collision would look like in the simulation
- Q: I know Microsoft has been working with the City of Bellevue – have you reached out to them?
  - I haven't heard of that, we have talked with Detroit, but please let me know
    - [following the Consortium meeting, we were able to track down the *City of Bellevue Video Analytics Towards Vision Zero* project[1]; thanks to Hazem El-Asser and Alissa Torres for bringing it to our attention]
  - Have already worked with Myovision in Detroit – looking to see who in the industry is doing this
- Q: Have you talked with the state safety efforts and how this will correlate with their funding mechanisms? They are pushing other new ways of detecting crashes
  - Have not – Talk with Anthony Nosse in D5 or Joseph Santos in Central Office
- Q: Will you make us maintain drones? Or will we use Gridsmart?
  - The idea is to use the Gridsmart cameras –
    - We want to leverage investments we've already made to improve our data as much as possible
  - Trying to engage MVDS and Wavetronix – have been reluctant so we have been talking to Rhythm – as soon as they have a competitor they will move as well

VIII. CURRENT INITIATIVES

Jeremy Dilmore briefly discussed current initiatives around the District.

- Vehicular Mobility – getting ATSPM Advanced Loops from Purdue and IMC
- Loops give 99% accuracy as compared with current methods
- Gridsmart gives above 90% accuracy – Iteris is also approaching this accuracy
- How can we combine our accurate loop data and 90%-accurate TMC data to bring the accuracy above 90%?
- Scenario-based planning to inform infrastructure investments
  - 45% is reoccurring congestion and 55% is non-reoccurring congestion – how can we solve this 55%?
  - Don't have enough data to quantify non-reoccurring congestion
  - Central Office called looking for data to develop tool for PD&E process to see effective crashes and other data to identify non-reoccurring congestion and build more robust roadways (District Five has the most robust database)

- Incident Detection
  - UF and UCF Researching incident detection
  - How can we detect crashes with ATSPM data and respond to it quickly?

[1] https://transportation.bellevuewa.gov/safety-and-maintenance/traffic-safety/vision-zero/video_analytics

- Looking to reduce data collection
  - Better for safety
  - Will drastically reduce costs so that more money can be spent on retiming
- Advance Loops and Stopbar, but no IMC
  - How can we create synthetic turning movement counts using loops and TMCs from adjacent signals in order to find the implied TMC data?
- TMCs only measure what traffic got through not what traffic tried to get through –
  - Finding unmet demand is more difficult
  - Hard to detect how long the queue is
  - Find this with Bluetooth devices, HERE, WAZE and 3rd party data
  - ASU growing present day data to predict for the future and be used in demand models
  - Unmet demand can flow into ICMS and be exported into Synchro
  - Suggested timing, TOD, Signal Timing and infrastructure improvements
- Proposed infrastructure improvements – Density Functions and ICE/SPICE
  - Some intersections show high delay in a model, but it actually is not the case
  - Is there a better way to make sure we are making the right investments?
- Are there any more updates desired?
- Q: How is the iVEDS Project coming along
  - Central office is paying for DIVAS – took 13.5 months to get an internet connection
  - DIVAS is the same as iVEDS but it is on the Central Office server
  - Understanding how to set up cameras
  - Should go live in a couple weeks, still keeping iVEDS instance open but should have the DIVAS up and running at the new TMC and be able to use greater base of information
  - Will keep both up until we make sure everyone is comfortable with this
- Q: For iVEDS or DIVAS- would like to get cameras from CFX, what is the issue?
  - It comes from transcoding – would like not to reduce any data but get the full data over
  - Could fix this issue
  - MPEG4 is too big to send so we need an HD camera
- Q: So wrecking companies would have access to the DIVAS system?
  - Yes, everyone would have access
  - Currently there is a fee that people had to pay for it – trying to treat everyone the same
  - Concerned about bandwidth issues with free access

IX. NEXT MEETING – January 10, 2018 at Central Florida Expressway Authority

X. ATTACHMENTS

- A – Sign in sheets
- B – Presentation Slides
- C – Meeting agenda

END OF SUMMARY

This summary was prepared by Jordan Crandall 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 dwilliams@vhb.com *so they can be finalized for the files.*

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

TSM&O Consortium Relocation-VHB Meeting

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

NOVEMBER 2018

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

	Visitor's Name	Company Name	*Person Authorizing Access**	Time In	Time Out	Visitor Badge Number
11.15.2018	Deborah Snyder	Jumter County	M. Ilkey	955		1
11.14.2018	Chris Cairns	City of Orlando	M. Ilkey	955	11:29	48
11.14.2018	ALISSA TORRES	ORANGE COUNTY	M. Ilkey	957	11:28	120
11.14.2018	Hazem El Assar	Orange Co	M. Ilkey	9:57		6
11.14.2018	Colleen Nicoulin	R2CTPO	M. Ilkey	9:55		99
11.14.2018	Jorge Barrios	Kittelson	M. Ilkey	10:00		104
11.14.2018	MARK TOBIN	City of Orlando	M. Ilkey	10 00		110
11.14.2018	H. Walker	Jacobs/FTE	M. Ilkey	10 00		125
11.14.2018	Johnci Tanches	FDOT	M. Ilkey	10:00		123
11.14.2018	Benton Bonney	Orlando	M. Ilkey	10:00		67

TSM&O Consortium Relocation-VHB Meeting

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

NOVEMBER 2018

	Visitor's Name	Company Name	*Person Authorizing Access**	Time In	Time Out	Visitor Badge Number
11.15.2018	David Williams	VHB	M. Ilkey	9:10		70
11.14.2018	Jordan Crandall	VHB	M. Ilkey	9:10		42
11.14.2018	Jason Leamed	FDOT	M. Ilkey	9:35	11:00	91
11.14.2018	Neil Oteyza	Seminole County	M. Ilkey	9:44		65
11.14.2018	Ray Martin	FDOT	M. Ilkey	9:50		23
11.14.2018	BRIAN HUTT	LSMPO	M. Ilkey	9:50		41
11.14.2018	Jenni Lamb	City of Melbourne	M. Ilkey	9:52		36
11.14.2018	Pam Richmond	Apopka	M. Ilkey	9:56		27
11.14.2018	Ryan Cunningham	Kittelson	M. Ilkey	10:00		53
11.14.2018	Juan G. Caldera	City of Orlando	M. Ilkey	10:00		62.

TSM&O Consortium Relocation-VHB Meeting
CENTRAL FLORIDA EXPRESSWAY AUTHORITY
NOVEMBER 2018

	Visitor's Name	Company Name	*Person Authorizing Access**	Time In	Time Out	Visitor Badge Number
11.15.2018	Dova Jamison	LYNX	M. Ilkey	9:23a	11:28	114
11.14.2018	Alison Stoth	FDOT	M. Ilkey	9:35	11:00	8
11.14.2018	Brian Stanger	FDOT D5	M. Ilkey	9:36		108
11.14.2018	Steven Dosser	SETRC	M. Ilkey	9:45		341
11.14.2018	Charlie Wetzel	Seminole Co	M. Ilkey	945		55
11.14.2018	Jay Williams	FDOT	M. Ilkey	9:50		5
11.14.2018	Katie King	FDOT/MEI	M. Ilkey	9:50		113
11.14.2018	Melissa Gross	InNovo	M. Ilkey	9:50		2
11.14.2018	JAY DAVOLL	APOPKA	M. Ilkey	9:51	11:49	30
11.14.2018	Manny Rodriguez	ICM	M. Ilkey	9:51		118

TSM&O Consortium Relocation-VHB Meeting

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

NOVEMBER 2018

	Visitor's Name	Company Name	*Person Authorizing Access**	Time In	Time Out	Visitor Badge Number
11.15.2018	BOBBY MADDOX	VOLUSIA County	M. Ilkey	10:15	11:48	101
11.14.2018	RICH ADAMAN	BREVARD COUNTY	M. Ilkey	10:15	11:48	25
11.14.2018	[signature]	FDOT	M. Ilkey	10:40	11:48	13
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			
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11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			

TSM&O Consortium Relocation-VHB Meeting

CENTRAL FLORIDA EXPRESSWAY AUTHORITY

NOVEMBER 2018

	Visitor's Name	Company Name	*Person Authorizing Access**	Time In	Time Out	Visitor Badge Number
11.15.2018	Tushar	FDOT	M. Ilkey	10:00	11:56	14
11.14.2018	Darren Greer	CODB	M. Ilkey	10:00	11:56	37
11.14.2018	Aaron Zhan	WSP	M. Ilkey	10:15	11:45.	581
11.14.2018	Francis Franco	LSMPO	M. Ilkey	10:25	1148	124
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			
11.14.2018			M. Ilkey			

Welcome to the TSM&O Consortium Meeting

November 15, 2018

Transportation Systems Management & Operations

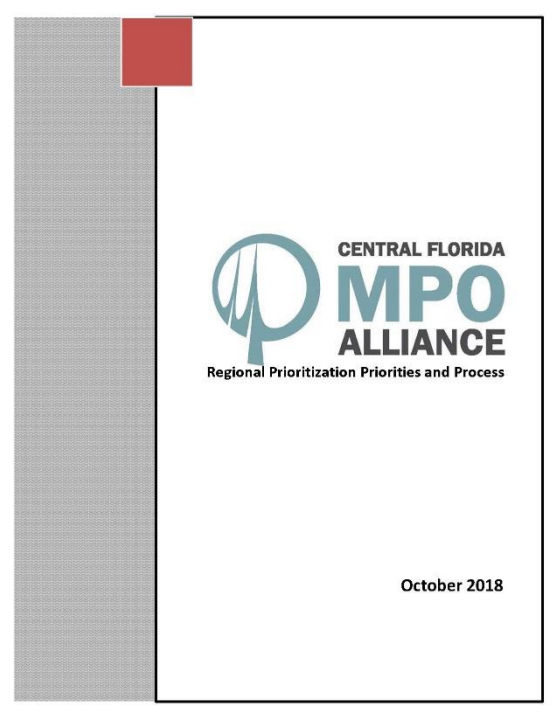
FDOT TSM&O Transportation Systems Management & Operations

Central Florida TSM&O Consortium

Meeting Agenda

1. Introduction
2. MPO Alliance Regional Priorities & Process – Update
3. Gainesville “Autobus” (formerly, *GAToRS*)
4. Modeling Automated, Connected, Electric & Shared Vehicles in Central Florida
5. Tampa Smart Cities Alliance
6. UF I-Street Data Management & Analytics
7. Collision Detection
8. Current Initiatives

MPO Alliance Regional Priorities and Process- Update



David Williams, VHB

FDOT TSM&O
Transportation Systems Management & Operations

Transportation Systems Management & Operations

CENTRAL FLORIDA TSM&O CONSORTIUM

CFMPOA Regional Priorities & Process – TSM&O Language

- "…the application of multimodal transportation strategies and technologies intended to maximize the efficiency, safety, and utility of the existing transportation network."
- "TSMO offers a cost-effective, efficient platform to significantly improve safety while at the same time enhancing the movement of people and goods, all with a positive impact on individual and national economic prosperity."
- "Adding a TSMO project list conveys a strong message to the FDOT on the important role that information and communication technologies will play in a 21st century transportation system."

CFMPOA Regional Priorities & Process – TSM&O Language

- “In the next year, CFMPOA members intend to work together, along with FDOT staff and the Consortium, to develop a program that will incorporate regional TSMO projects into the Regional List of Priority Projects. This will require defining a ‘regional’ project, establishing a process that incorporates independent M/TPO’s, and outlining funding opportunities.”

CFMPOA Regional Priorities & Process – Next Steps

- Task Force to develop methodology for bringing projects to MPO Alliance

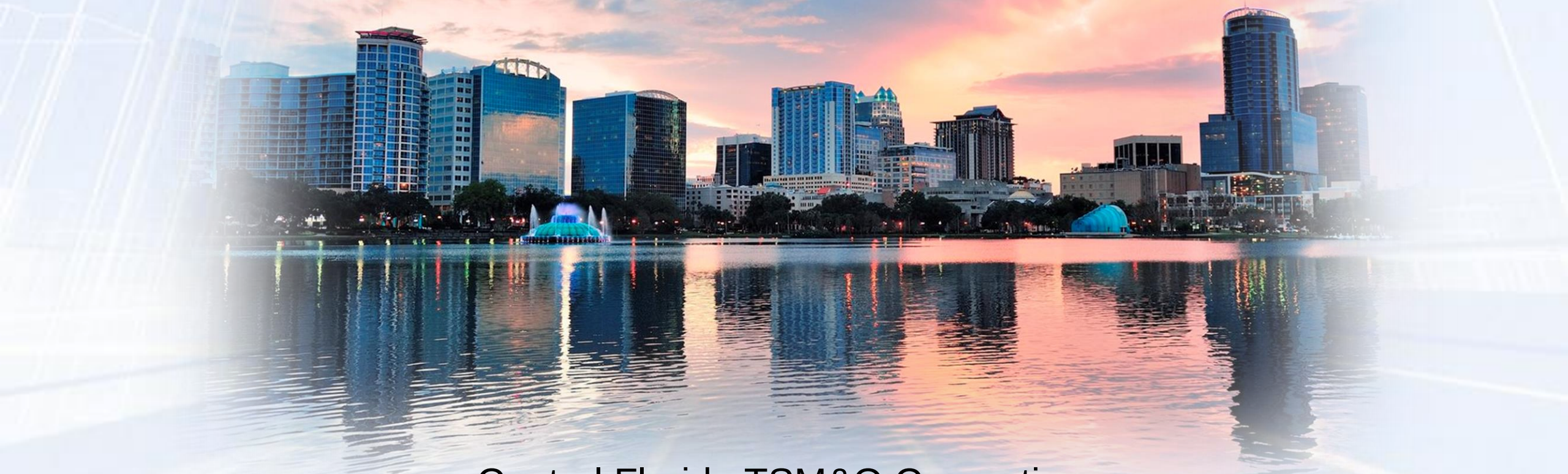
- Next MPO Alliance meeting – January 11, 2019

Gainesville's *Autobus*

Emmanuel Posadas, City of Gainesville

Gainesville *Autobus*

Modeling Automated, Connected, Electric & Shared Vehicles in Central Florida



Central Florida TSM&O Consortium

November 15, 2018

Central FL Regional Planning Model

- Also known as CFRPM
- Regional travel demand model
- 11 counties (10 full, 1 partial)
- Updating for 2045 Long Range Transportation Plan (LRTP)
- 2015 Base Year, interim scenarios every five (5) years
- Forecasts demand at link level – not operations-based
- Validated for various metrics

ACES

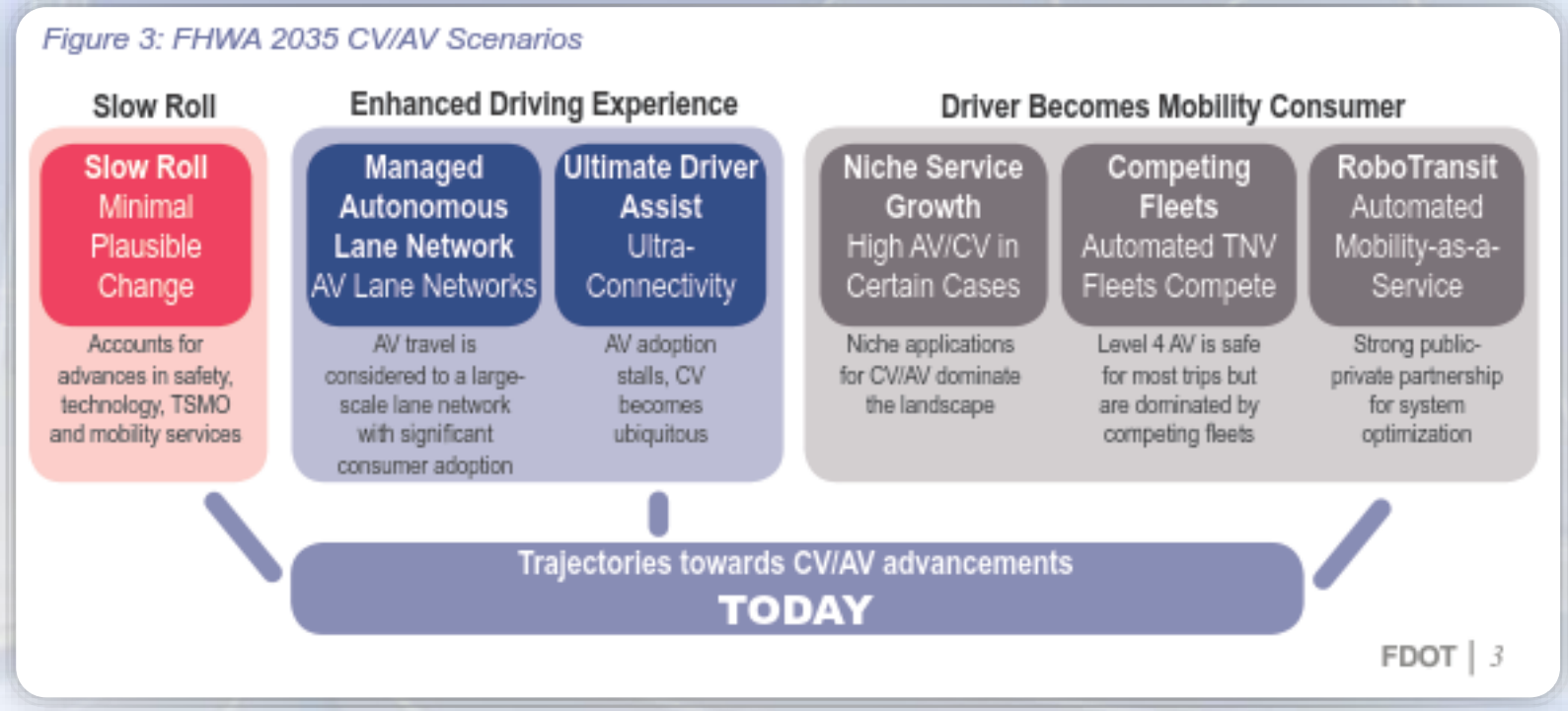
- Acronym for **A**utomated, **C**onnected, **E**lectric & **S**hared-Use Vehicles
- Until now, not much guidance for how to model
- Piecemeal efforts across state
  - D1 Regional Planning Model

Guidance for ACES

- Report published in September 2018
- Statutory requirement for MPOs in Florida
- At stage for analyzing and implementation
- No uniform policy, no funding program

Development of Guidance

- Federal Highway Administration (FHWA) developed potential scenarios
- FDOT incorporated scenarios into report



Development of Guidance

- Two models taken and modified as test platform for each scenario as test cases
  - CFRPM and Gainesville MPO
- Regionwide results presented

Methodology

	Model Network	Model - Trip Distribution	Model - Mode Choice
Slow Roll Minimum plausible change - Nothing beyond currently available technology and investments already in motion is adopted. (Baseline for comparison)	No changes	Decrease of 1 minute in Terminal Times in Central Business District and Fringe Areas. Increase of 2.5% in impedance Friction Factors for HBW to obtain longer trip lengths.	Auto Trip Table Factored by 2.5% to take into account non driving trips that are now using AV. Shift of 5% of transit trips to AV.
Niche Service Growth Innovation proliferates, but only in special purpose or "niche" AV zones, including retirement communities, campuses, transit corridors, urban cores, and ports.	Increase in AV Zone roadway Capacities in Area Types 10-29 for Facility Types 10-19 of 33% and Area Types 10-39 for Facility Types 20-29 of 15%.	Decrease of 2 minutes in Terminal Times in Central Business District and Fringe Areas. Increase of 2.5% in impedance Friction Factors for HBW to obtain longer trip lengths.	Auto Trip Table Factored by 2.5% to take into account non driving trips that are now using AV and by 5% in AV Zones.
Ultimate Traveler Assist CV technology progresses rapidly, but AV stagnates – 85% of vehicles have V2X capability by 2035 due to NHTSA mandate allowing DOTs to manage congestion aggressively.	Increase in Freeway & Arterial Capacities due to more efficient trip planning. Increased capacities in Area Types 10-59 for Facility Types 10-19 of 75% and Area Types 10-59 for Facility Types 20-39 of 35%.	Decrease of 1 minute in Terminal Times in Central Business District and Fringe Areas.	Auto Trip Table Factored by 2.5% to take into account non driving trips that are now using AV.
Managed Automated Lane Network Certain lanes become integrated with CV and AV – 50-60% of vehicles (75% of trucks) have automation capability for platooning in controlled settings.	Special AV Lanes. Increase in Freeway & Arterial Capacities. Use of HOV lanes for AV only on Freeways in CFRPM (not in GUATS). Increased capacities in Area Types 10-59 for Facility Types 10-19 of 75% and Area Types 10-39 for Facility Types 20-39 of 35%.	Decrease of 2 minutes in Terminal Times in Central Business District and Fringe Areas.	Trip Table Factored by 2.5% to take into account non driving trips that are now using AV and by 5% to take into account increases on AV lanes.
Competing Fleets Automated TNC-like services proliferate rapidly, but do not operate cooperatively. VMT doubles due to induced demand and empty vehicle repositioning.	Increase in Freeway Capacity in Area Types 10-59 for Facility Types 10-19 of 50%.	Decrease of 2 minutes in Terminal Times in Central Business District and Fringe Areas. Increase of 2.5% in impedance Friction Factors for HBW to obtain longer trip lengths.	Trip Table Factored by 2.5% to take into account non driving trips that are now using AV and by 7.5% in to take into account the AV Fleets.
Robo Transit On-demand shared services proliferate and integrate with other modes via cooperative data sharing, policies, and infrastructure.	Increase in Freeway & Arterial Capacities due to more efficient trip planning. Increased capacities in Area Types 10-59 for Facility Types 10-19 of 75% and Area Types 10-59 for Facility Types 20-39 of 35%.	Decrease of 2 minutes in Terminal Times in Central Business District and Fringe Areas. Increase of 5% in impedance Friction Factors for HBW to obtain longer trip lengths.	Trip Table Factored by 2.5% to take into account non driving trips that are now using AV and by 12.5% to take into account Robo Transit.

Results

	VMT (Millions)	VHT (Thousands)	Network Original Speed	Network Congested Speed
Cost Feasible	177.72	5,513.11	41.44	36.14
Slow Roll	188.62	6,465.28	41.44	35.45
Percent Change %	5.71	17.27	-	-1.91
Niche Service Growth	187.87	6,203.48	41.44	35.47
Percent Change %	5.71	12.52	-	-1.85
Ultimate Traveler Assist	189.07	5,707.27	41.44	37.58
Percent Change %	6.39	3.52	-	3.98
Managed Automated Lane Network	194.43	6,021.60	41.44	37.29
Percent Change %	9.40	9.22	-	3.18
Competing Fleets	198.01	7,100.14	41.44	35.20
Percent Change %	11.42	28.79	-	-2.60
Robo Transit	203.29	6,901.49	41.44	36.72
Percent Change %	14.39	25.18	-	1.60

Okay….Now What?

- How do we implement this?
- Is methodology sound?
- Are the results valid?
- Are scenarios mutually exclusive?
- Policy impacts?
- Financial impacts?

Implementation Plan

- FDOT will run the model for each scenario – deliver results to MPOs
- Only applicable to future scenarios – 2025 & up
- Changes applied regionally
- Changes to model
  - Modified roadway capacity
  - Changes trip lengths
  - Changes in vehicle trips

Implementation Plan

- MPOs will need to develop scenario plans
- Need to analyze policy and financial implications of scenarios
- Need to develop vision and plan for implementation in LRTP
- Not a one-size-fits-all application

Looking Forward – 2050 LRTP

- Travel demand models focused primarily on SOV automobile mode
- Develop new steps/modes in existing models?
- Develop/use separate models?
- Need for a regionwide consensus on implementation?

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ACES Report

http://www.fdot.gov/planning/policy/metrosupport/Resources/FDOT_MPOGuidebook_20181005.pdf

Tampa Bay Smart Cities Alliance

David Williams, VHB

Tampa Bay Smart Cities Alliance

- Effort by Tampa, FDOT, and USF to coordinate technology deployments in the region
  - Mobility and parking platforms
  - Smart water meters
  - CAV deployments
- No funding stipulations; primarily establishes a framework of coordination
- Includes private sector, such as developers, utilities, communications, and large local anchors

TAMPA BAY SMART CITIES ALLIANCE

Core Team

CUTR Center for Urban Transportation Research · FDOT · City of Tampa, Florida

Public

City of Tampa · Pinellas County · TBARTA · Tampa Bay Regional Planning Council · Port Tampa Bay · Pasco County Florida · PSTA · HART · Forward Pinellas · Expressway Authority · Hillsborough MPO Metropolitan Planning for Transportation · Hillsborough County Florida · St. Petersburg www.stpete.org

Private

tampaBAY partnership · TechData · Tampa Downtown Partnership · Florida Hospital · TECO Energy · verizon · Innovation Place · Westshore Alliance · SPP Strategic Property Partners · St. Pete Innovation District · METRO

Action Team: Data Platform

Action Team: Mobility as a Service (MaaS)

Action Team: Reimagining Infrastructure

Tampa Bay Smart Cities Alliance

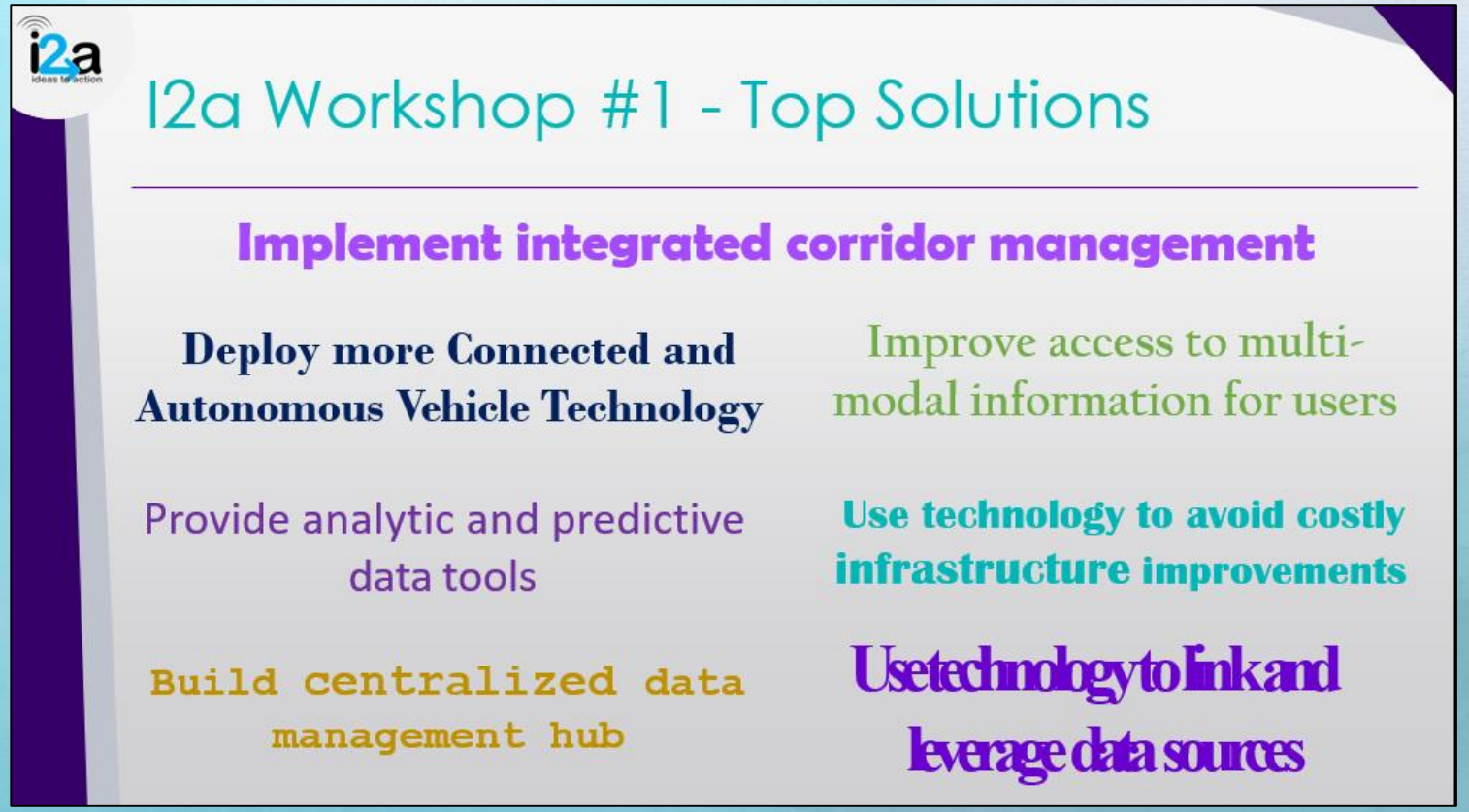
- Key Accomplishments to date
  - Conducted two **Ideas-to-Action** workshops
  - Smart Cities MOU signing between City of Tampa and USF
    - Entry into MetroLab Network
    - Developed MOU over two years
  - A region-wide collaboration towards a RFP response for a private AV mobility service (TNC) in Tampa Bay

Tampa Bay Smart Cities Alliance

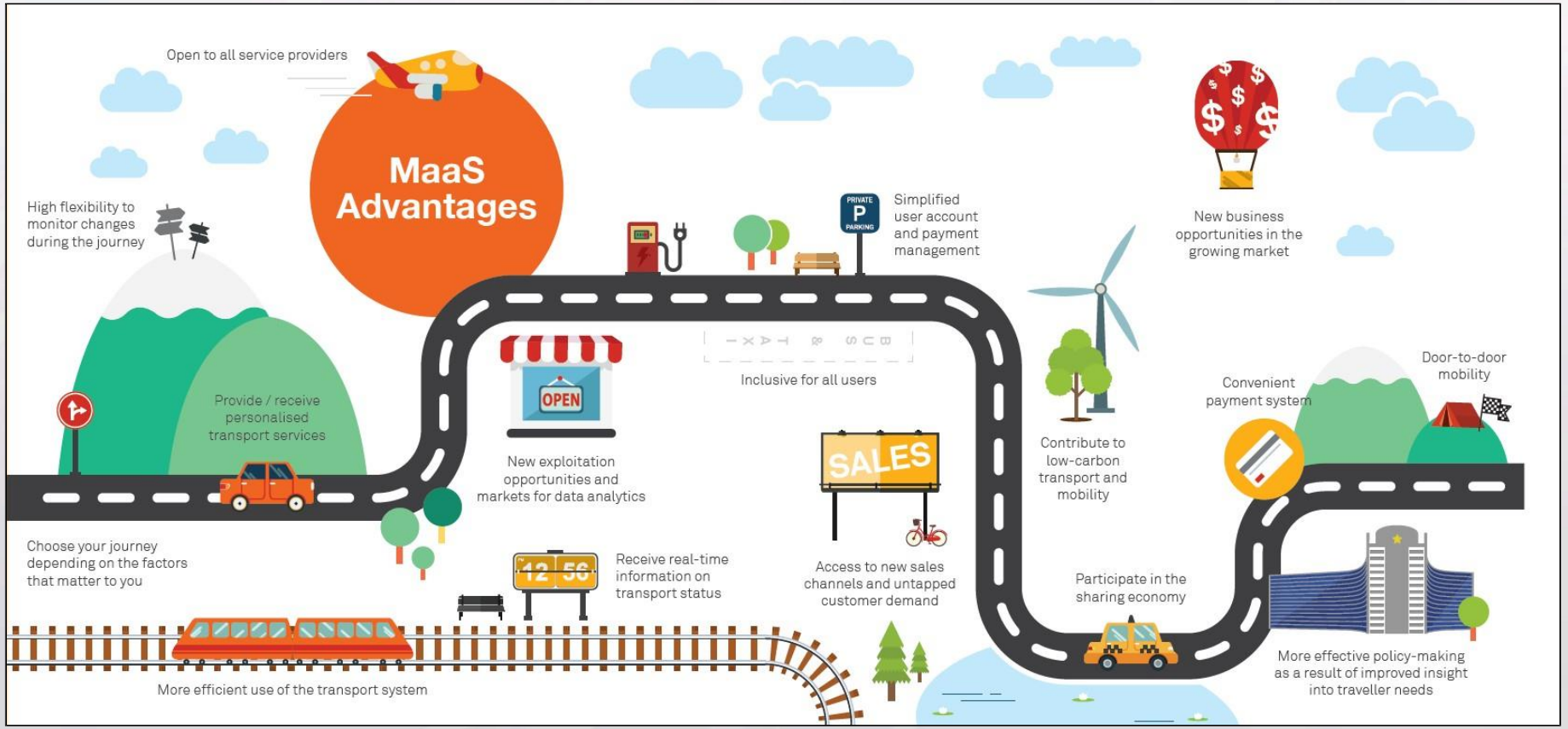
- How do we use technology and innovation to:
  - Improve **safety** of our limited access roadways?
  - Improve **safety** of our local streets and arterials?
  - Provide **multi-modal options** to the region?
  - Make sure our **infrastructure is ready** for the future?

Tampa Bay Smart Cities Alliance

- Top short-term and mid-term priorities in transportation / mobility
- Develop Implementation Strategy Actions

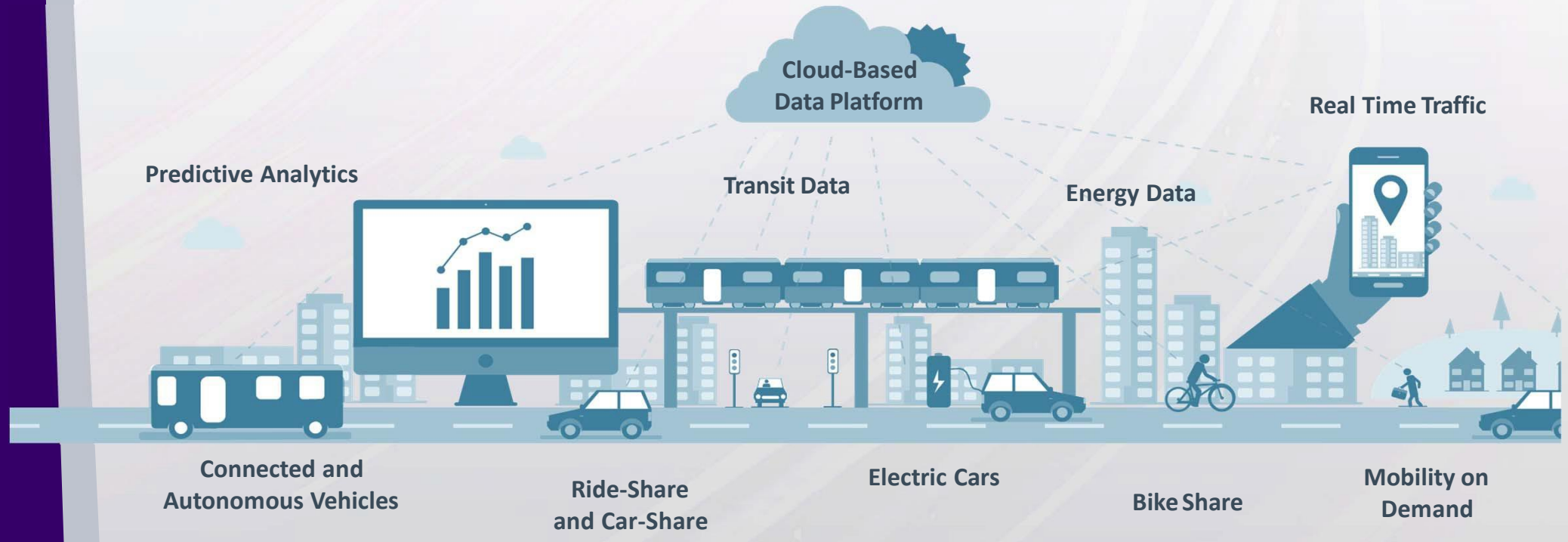


Mobility as a Service



Source: MaaS Alliance, 2018 (massalliance.eu)

Regional Data Platform



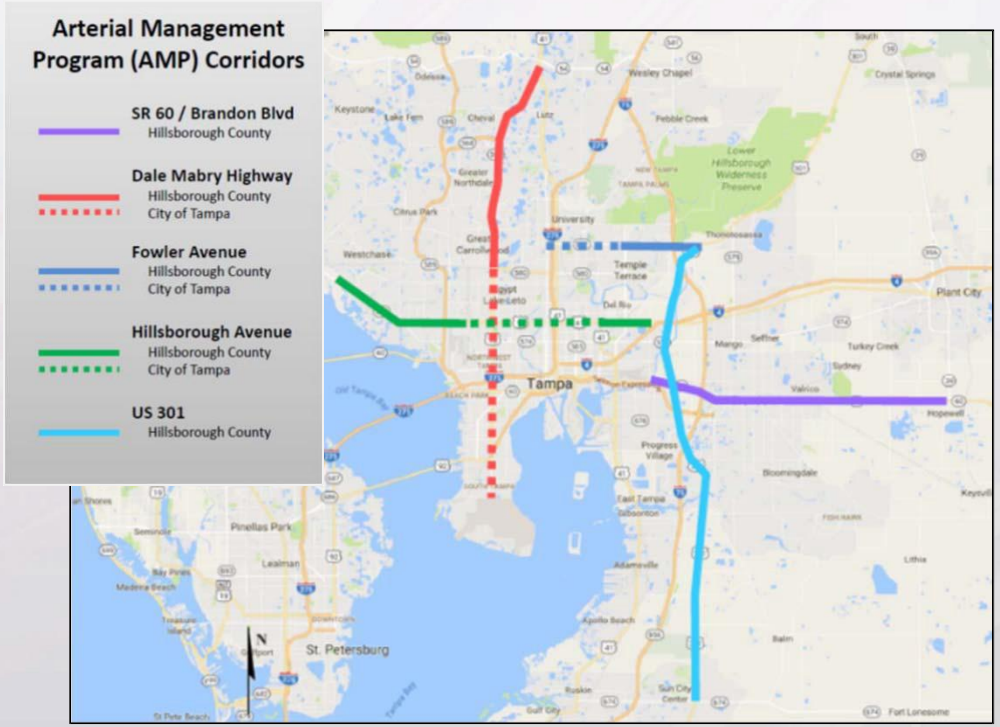
SHARED BY LOCAL AGENCIES THROUGHOUT THE REGION

Re-imagining Infrastructure

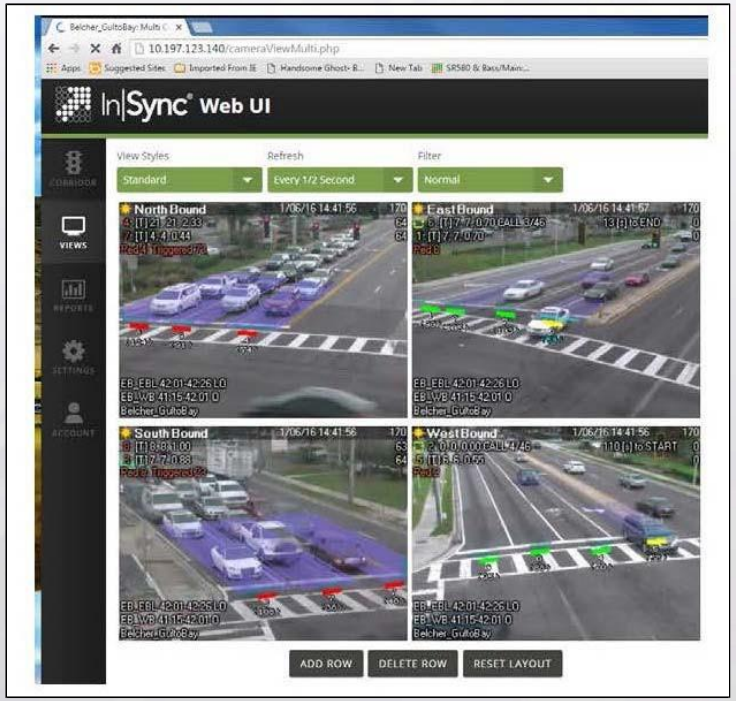
Connected and Autonomous Vehicles

Marion Transitway Autonomous Shuttle

Re-imagining Infrastructure



Arterial Management Program and Integrated Corridor Management



Active Traffic Management Systems

Questions?

UF I-Street
Data Management & Analytics

Dr. Sanjay Ranka

ATSPM Data

- High resolution (Deci-second) data for 329 Signalized Intersections from Seminole County, D5, Florida

- 3 key sets of files:
  - Raw Data Files
  - Data Logging Requirements File
  - ATSPM Additional Tables

	A	B	C	D
1	SignalID	Timestamp	EventCode	EventParam
2	1085	2017-01-05 00:00:00	136	0
3	1085	2017-01-05 00:00:00	140	0
4	1085	2017-01-05 00:00:00	142	0
5	1085	2017-01-05 00:00:00	143	0
6	1085	2017-01-05 00:00:00	144	0
7	1085	2017-01-05 00:00:00	145	0

- Raw Data Files
  - 22 comma-separated value files, between 10-17 GB each, contains the data recorded at Desi Second frequency. Each file contains about a week of raw data.
  - Has 4 columns: SignalID, Time of recording, EventCode: What event at the signal was captured & EventParam: What was the value of the event or attribute at that timestamp

ATSPM Data: Additional Tables

- Data Logging requirements Tables :
  - Event Code & parameter describe what each numeric value means.
- Intersection Metadata:
  - “Approaches” Sheet describes the various approaches per signal.
  - “Signals” sheet gives physical coordinates of the signal.
  - “Detectors” sheet describes individual detectors and which signals they are associated with.

Coord Pattern Change	Pattern # (0-255)	131	M	
Cycle Length Change	Pattern # (0-255)	132	M	
Offset Length Change	Pattern # (0-255)	133	M	
Split 1 Change	New Split Time in Seconds (0-255)	134	M	
Split 2 Change	New Split Time in Seconds (0-255)	135	M	
Split 3 Change	New Split Time in Seconds (0-255)	136	M	
Split 4 Change	New Split Time in Seconds (0-255)	137	M	
Split 5 Change	New Split Time in Seconds (0-255)	138	M	

	A	B	C	D	E	F	G	H
1	ApproachID	SignalID	DirectionTypeID	Description	MPH	ProtectedPhaseNumber	IsProtectedPhaseOverlap	PermissivePhaseNumber
2	8438	1005	1	Northbound	45	2	0	NULL
3	8439	1005	2	Southbound	45	6	0	NULL
4	8440	1015	1	Northbound	NULL	2	0	NULL
5	8441	1015	2	Southbound	NULL	6	0	NULL
6	8442	1020	1	Northbound	NULL	2	0	NULL
7	8443	1020	2	Southbound	NULL	6	0	NULL

ApproachRouteId	ApproachOrder	RouteDetailID	ApproachID
2	1	3	8800
2	2	4	8802
3	5	18	8712
3	3	20	8709
3	4	22	8710
3	2	24	8706
3	6	26	8714

Legend	
x	Enumeration CAPTURED - not present in all controllers' outputs.
x	Enumeration CAPTURED - present in all controllers' outputs.
x	Enumeration not CAPTURED.
Abbreviation	**Description**
M	Mandatory (Operation and command shall be implemented)
O	Optional (Operation and command may be implemented)
D	Deprecated

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	ID	DetectorID	DetChannel	DistanceFromStopBar	MinSpeedFilter	DateAdded	DateDisabled	LaneNumber	MovementTypeID	LaneTypeID	DecisionPoint	MovementDelay	ApproachID	DetectionHardwareID
2	12752	100504	4	330	NULL	05:02.0	NULL	1	1	1	0	0	8438	3
3	12753	100505	5	330	NULL	00:00.0	NULL	1	1	1	0	0	8438	3
4	12754	100510	10	330	NULL	00:00.0	NULL	1	1	1	0	0	8439	0

Application 1: Ranking & Classifying Traffic Intersections

ATSPM data from Seminole County:

1. Extract-Transform-Load: Downloaded the data, cleaned and reformatted it.
2. Identified Relevant MOEs, Computed MOEs cycle by cycle.
   - Platooning ratio:

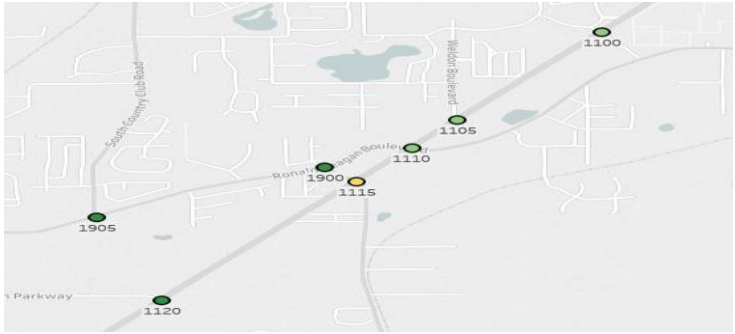
     The ratio of the number of vehicles arriving during the green time/phase to the proportion of the green interval of the total cycle.

Table 19:1: Relationship between Arrival Type and Platoon Ratio

Arrival type	Range of platoon ratio(R_p)	Default value(R_p)	Progression quality
1	≤ 0.50	0.333	Very poor
2	$> 0.50 - 0.85$	0.667	Unfavorable
3	$> 0.85 - 1.15$	1.000	Random arrivals
4	$> 1.15 - 1.50$	1.333	Favorable
5	$> 1.5 - 2.00$	1.667	Highly favorable
6	> 2	2.000	Exceptional

   - Arrivals on Green vs Arrivals on Red: Percentage AOG varies from .25 to .45
   - Split Status: Gap out/Max out/Force off
3. Rank Signals based on MOE's: Best or worse performing intersections.
4. Identify Signal behavior based on high resolution plot.
5. Automatic Classification of signals based on behavior.

Signal ID 1115
(Potentially Bad Detector, 1/5/16 to 8/5/16)



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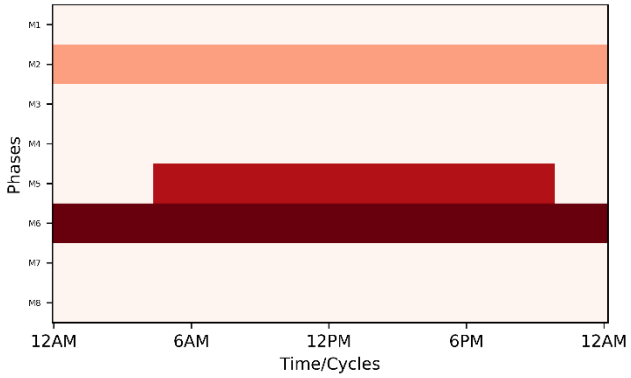

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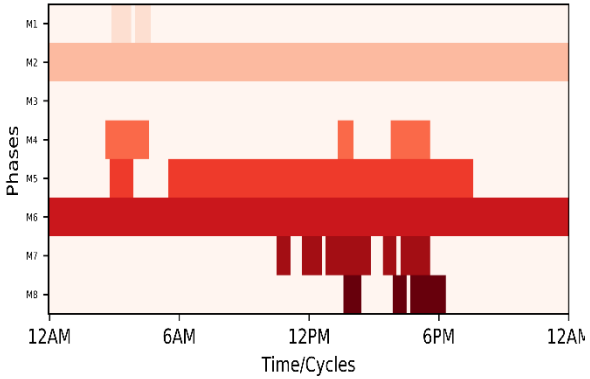

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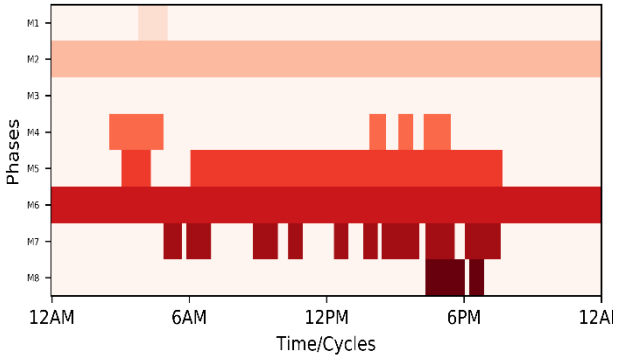

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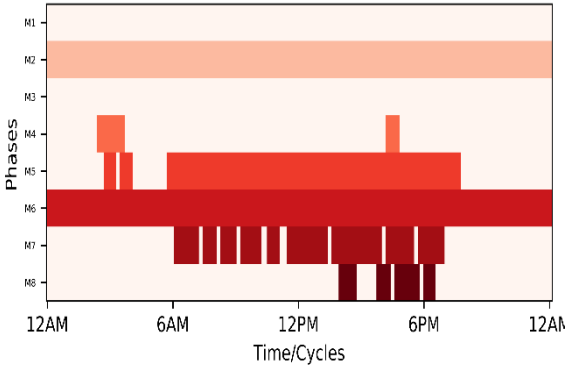

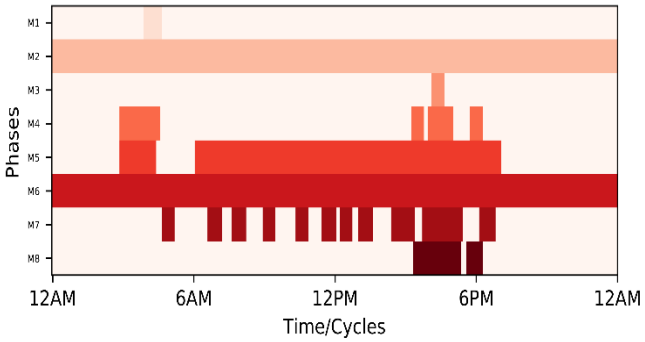

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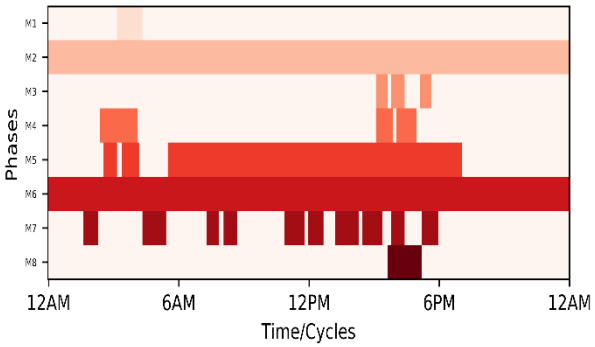

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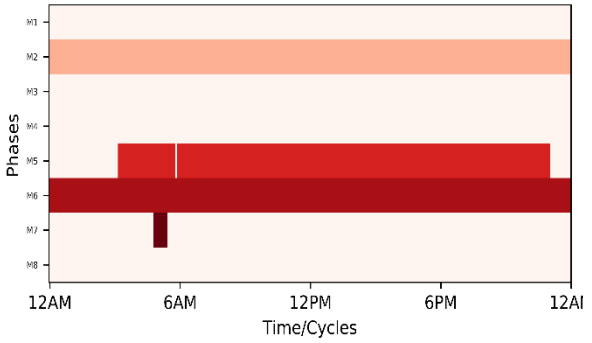

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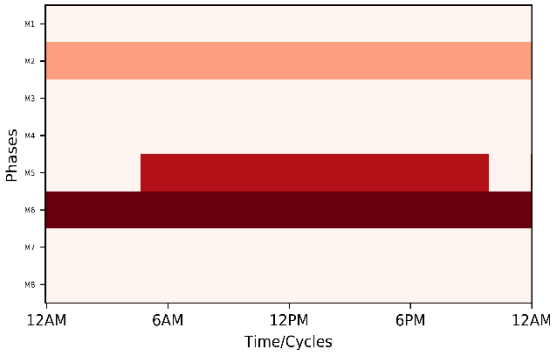
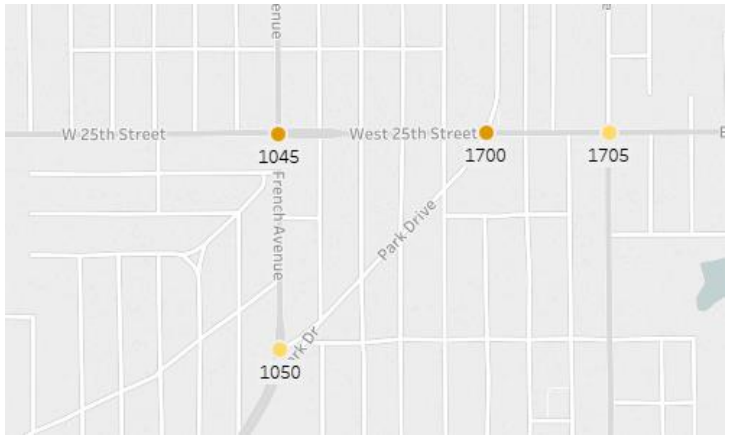


Sunday

Signal ID 1045
(Potential Overcapacity, 1/5/16 to 8/5/16)



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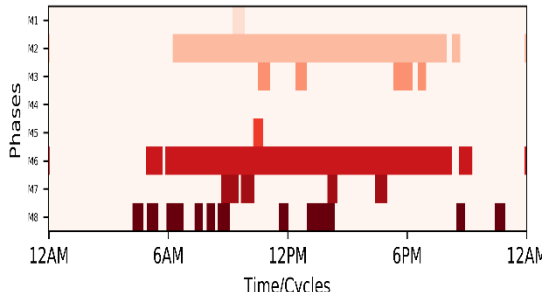

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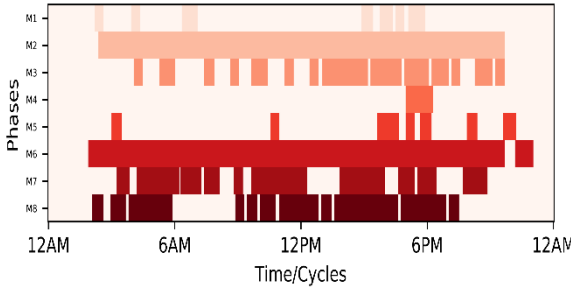

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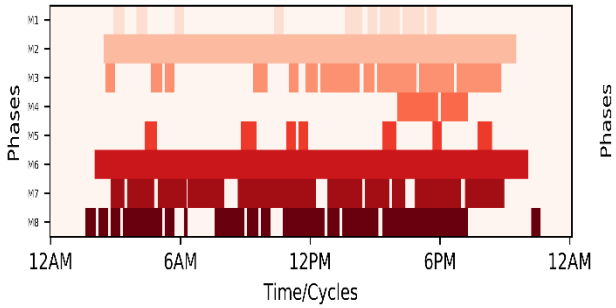

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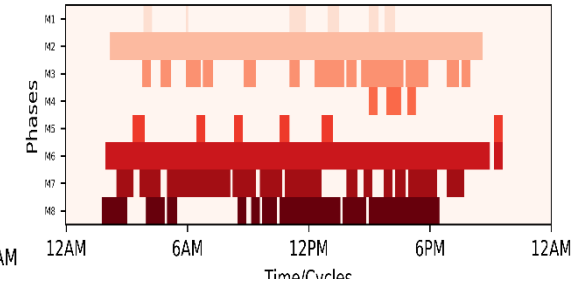

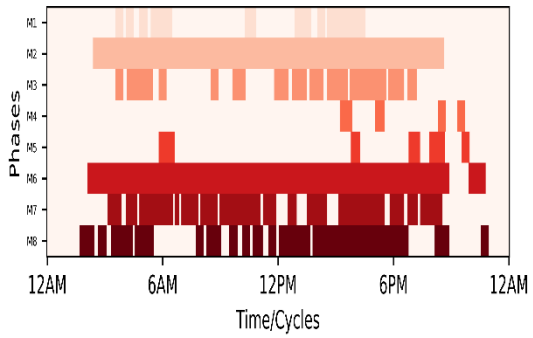

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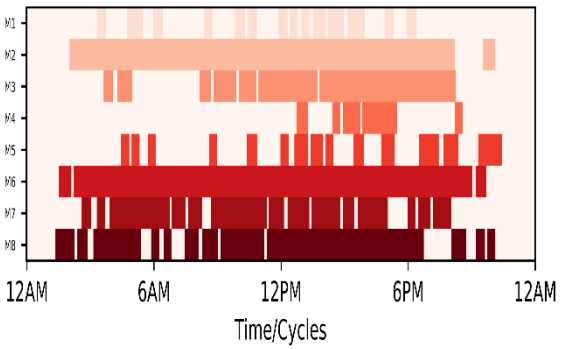

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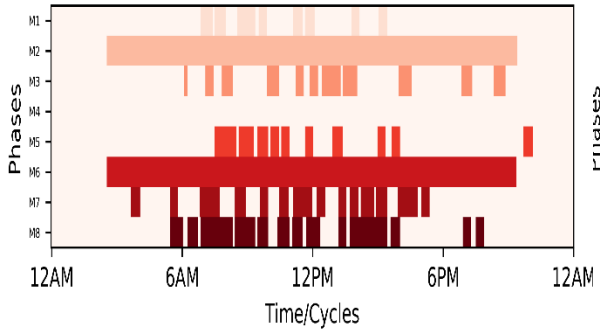

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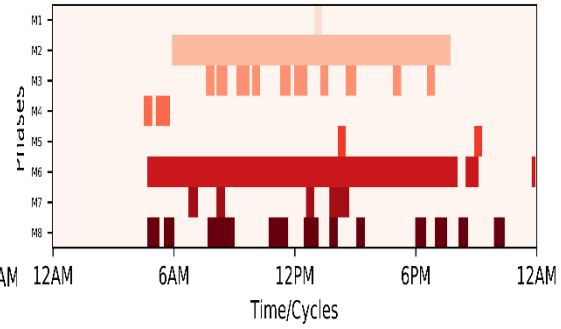
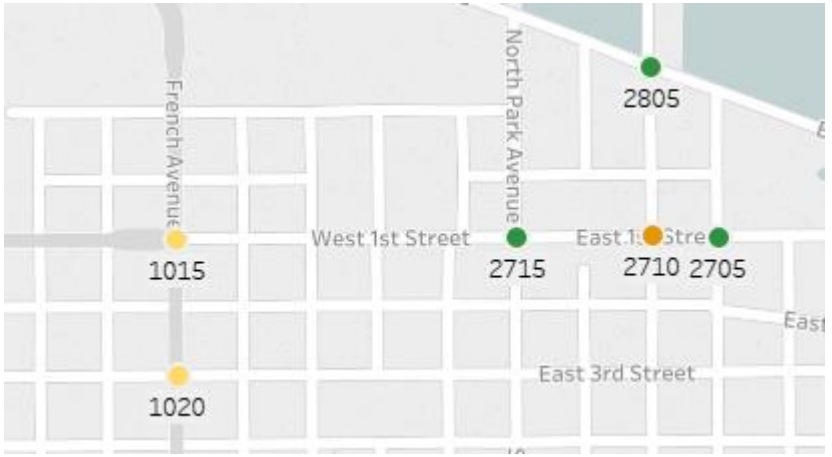


Sunday

Signal ID 1020
(Potential Timing Optimization, 1/5/16 to 8/5/16)



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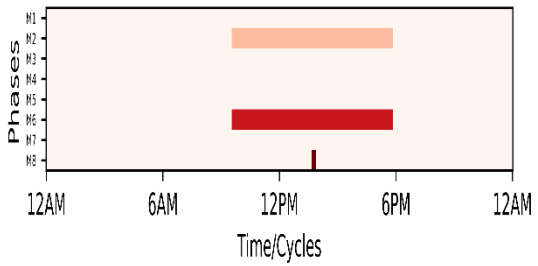

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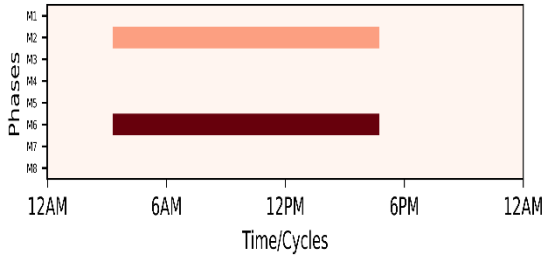

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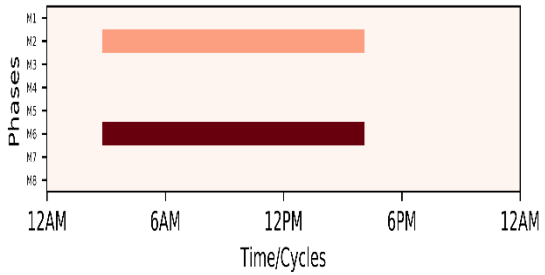

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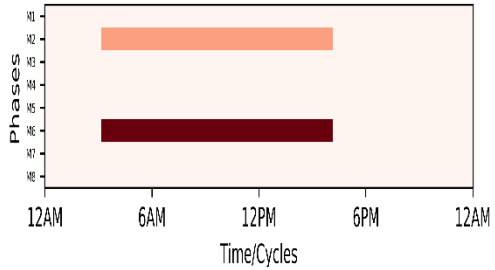

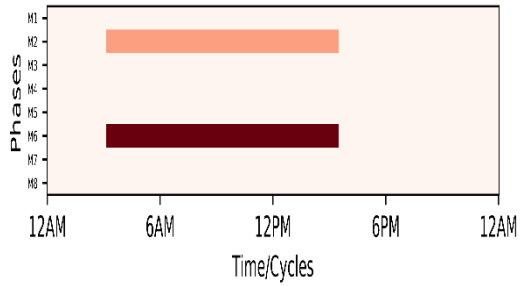

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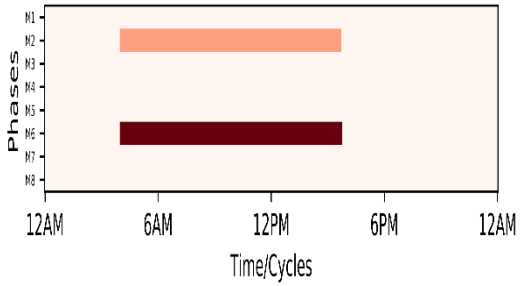

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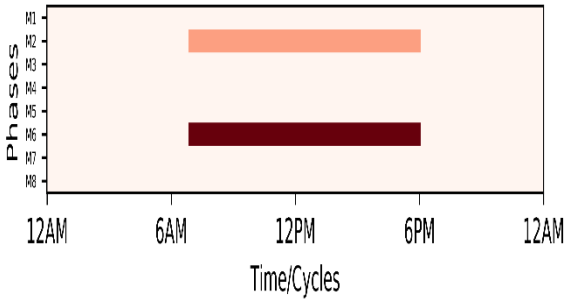

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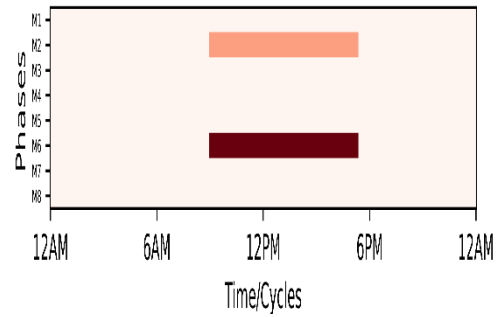
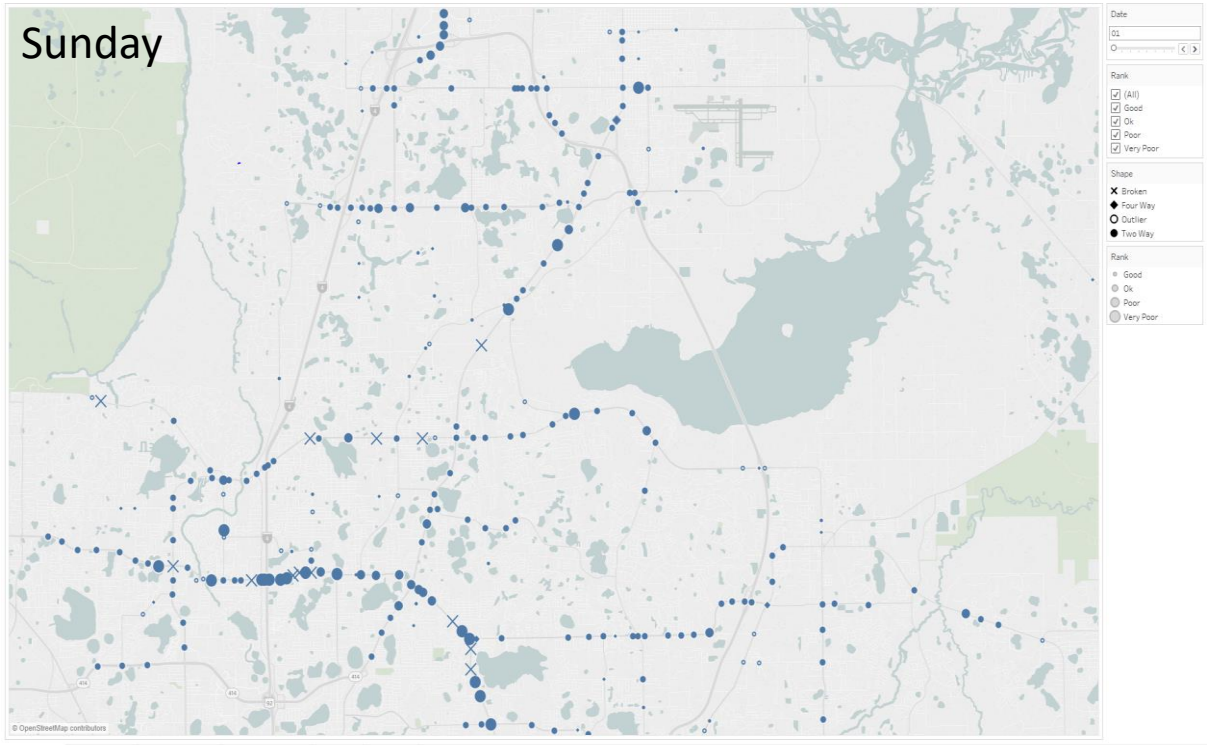


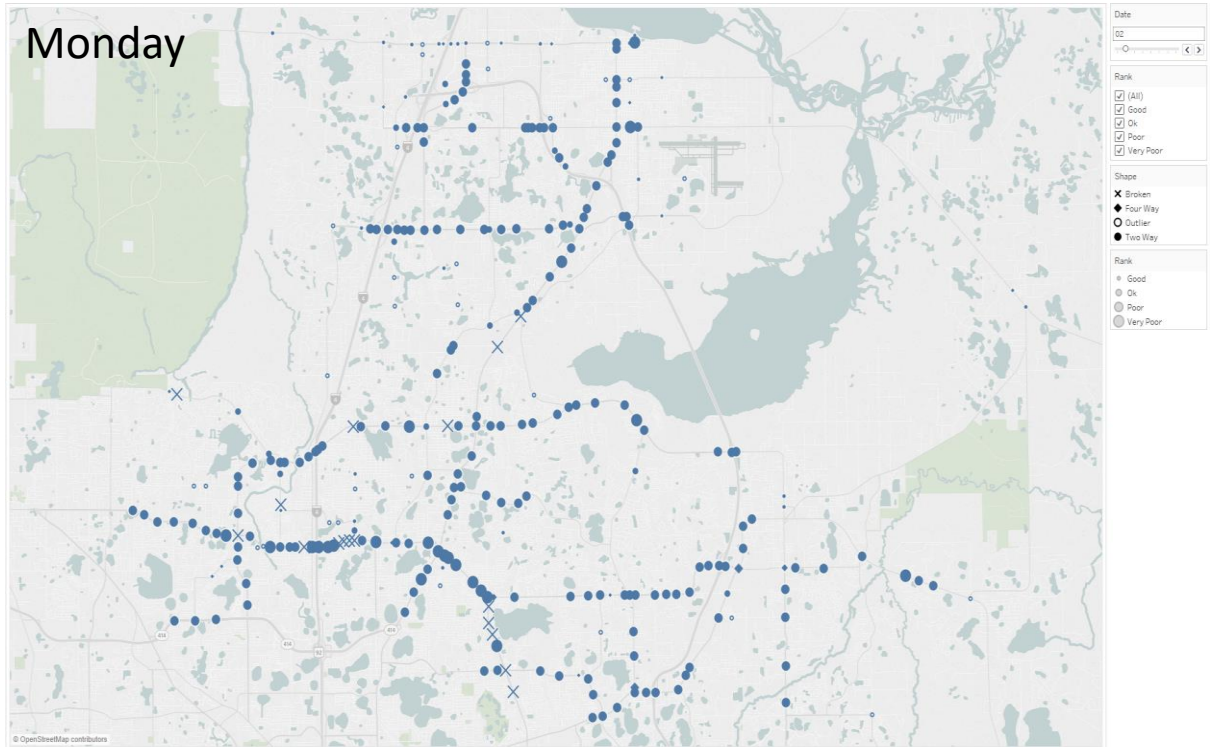
Sunday

Ranking Intersections on Behavior

Given a grid of signalized intersections:

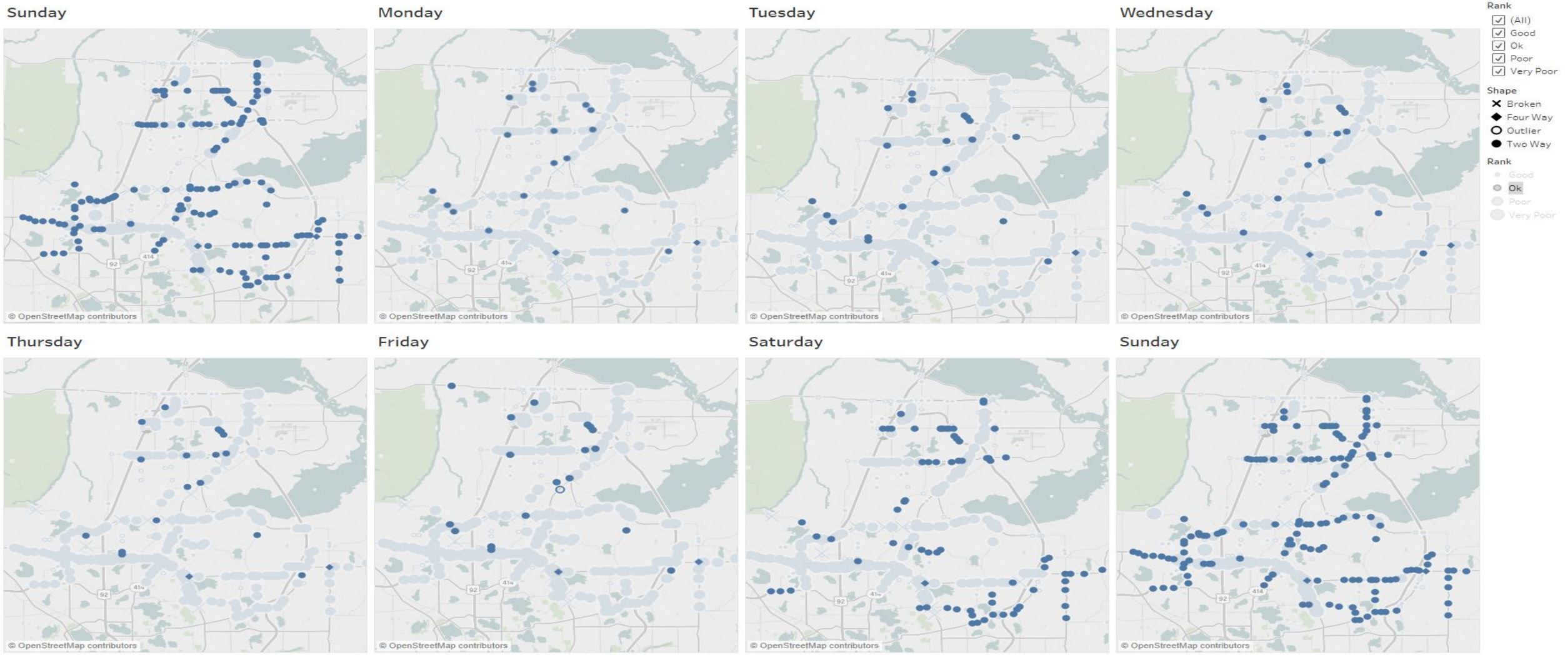
- Aim to identify most problematic intersections, eventually corridors.
- We look at a week worth of data from May 1st to May 8th 2016.
- A Dashboard which gives bird's eye view of people's experiences during the day.
- Based on a Singe MOE currently, we will incorporate all three in the future.





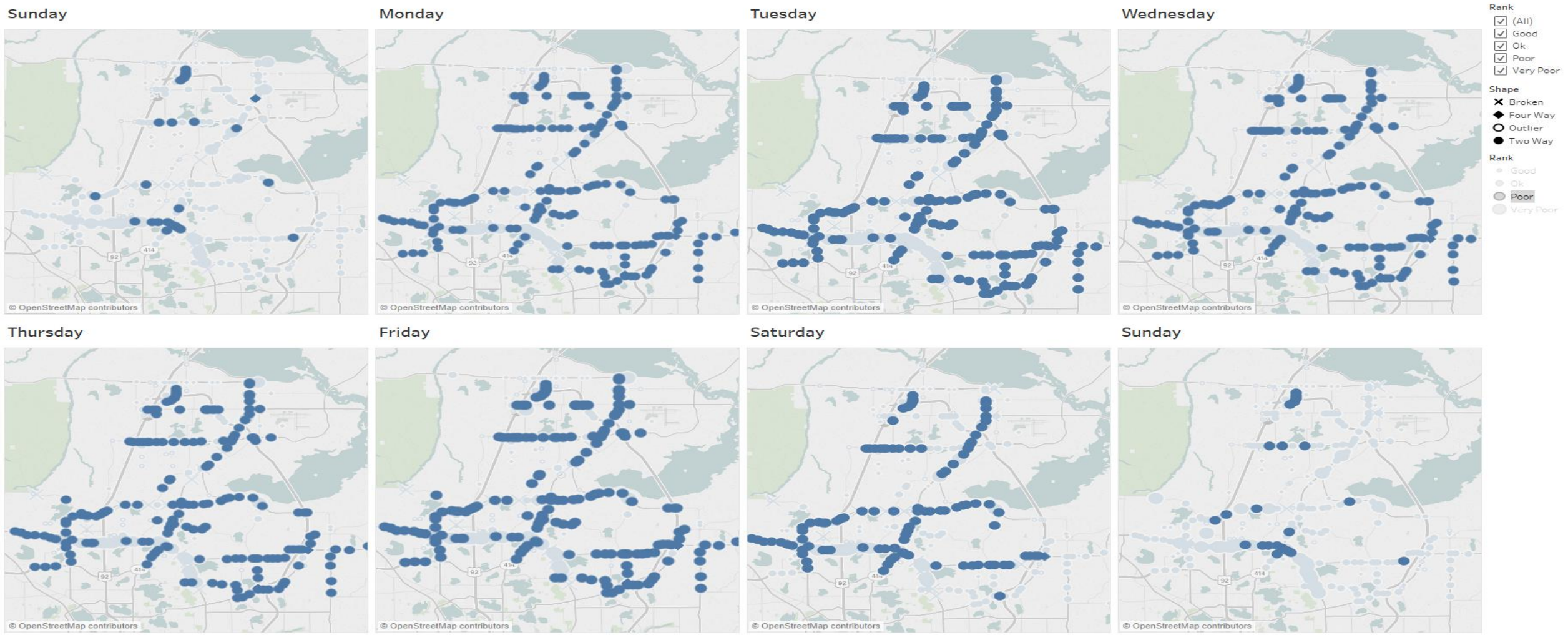
Signal Ranking

Week of 05/01 – 05/08, Signals rated Ok



Signal Ranking

Week of 05/01 – 05/08, Potentially Bad Intersections

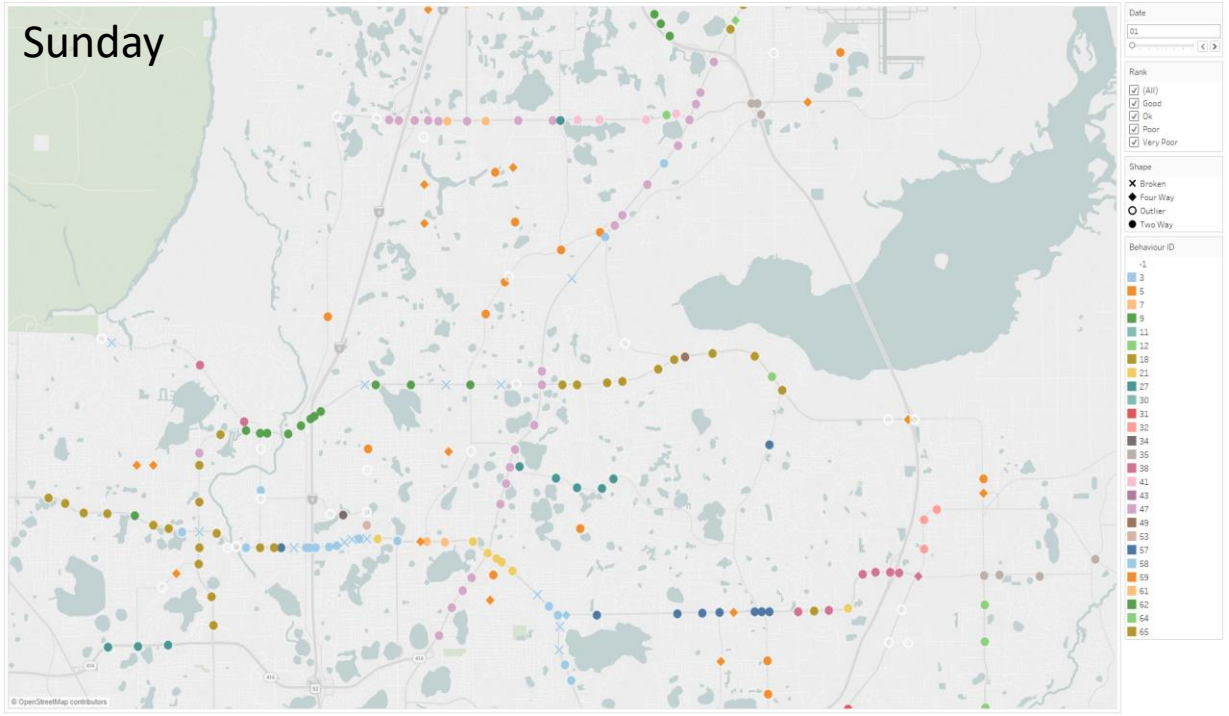


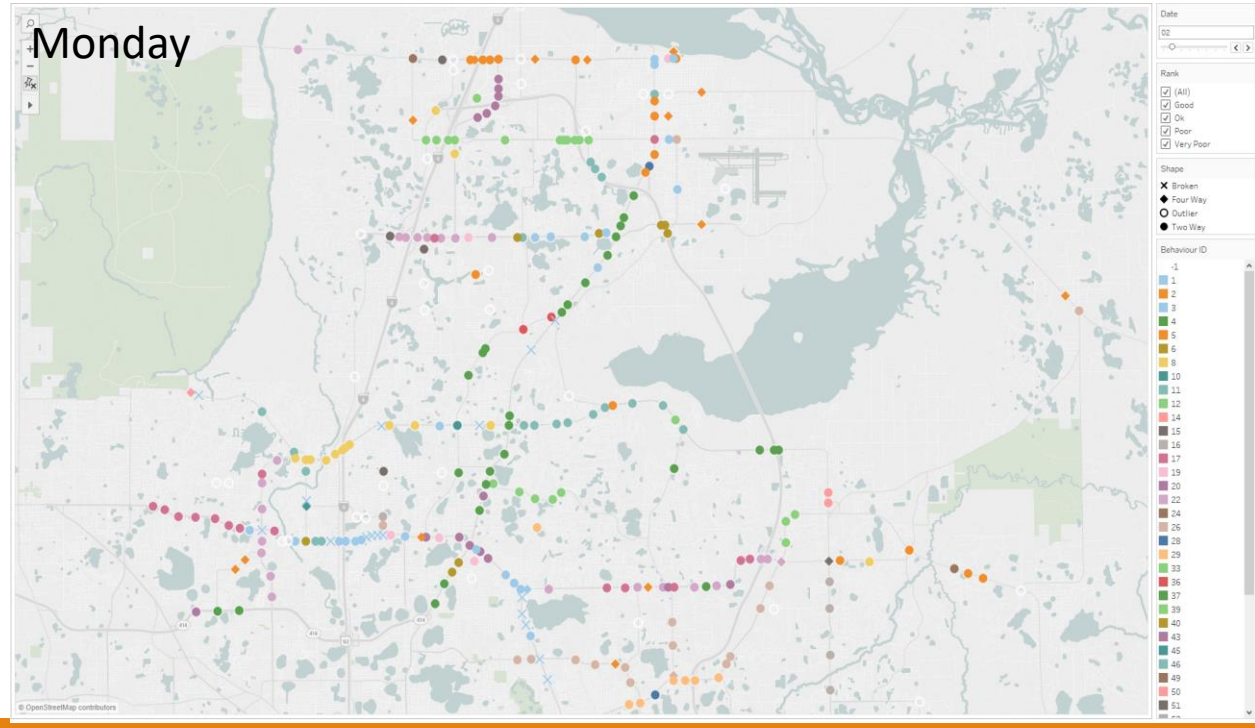
Classifying Signals on Behavior

Time of Day	Phase 2	Phase 6	Phase 4	Phase 8	Recommendation
8 AM – 12PM	<15 % Bad	>80% Bad	<15% Bad	<15 % Bad	Potential Timing Optimization
12 PM – 2PM	X	>70% Bad	>65% Bad	X	Potential Overcapacity
2PM – 4 PM	<15 % Bad	<15 % Bad	<15 % Bad	<15 % Bad	All Okay
4PM - 8 PM	>80% Bad	<15 % Bad	<15 % Bad	<15 % Bad	Potential Timing Optimization
8 PM – 8AM	<15 % Bad	<15 % Bad	<15 % Bad	<15 % Bad	All Okay

Automatically Grouping Signals by behavior

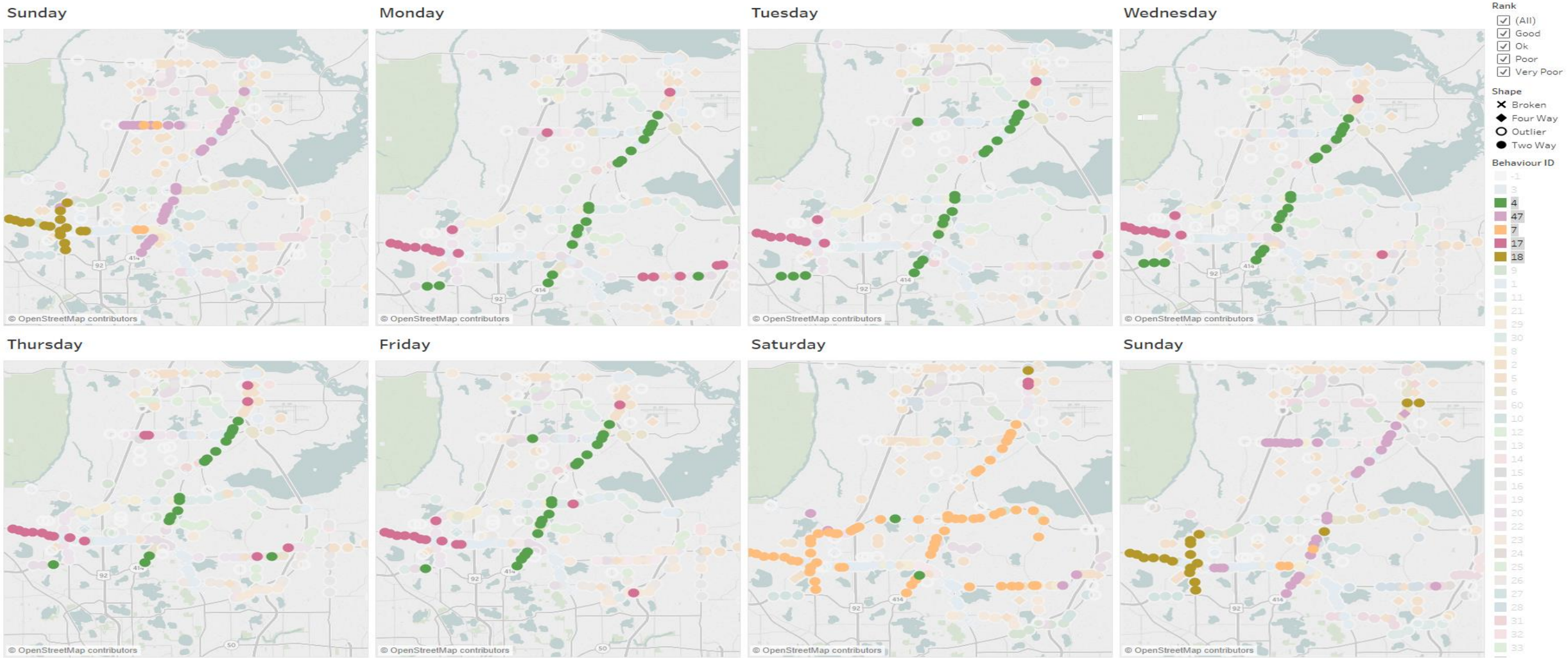
- We automatically group signals based on the plots shown above.
- Based on the plots that represent which represent signal behavior and compute the distance between the plot for each signal & direction.
- We store these distances in a matrix – the distance matrix.
- A quantitively representation of the distances between any two pairs of signals.
- We then put the pairs of signals which are similar in the same group or cluster.





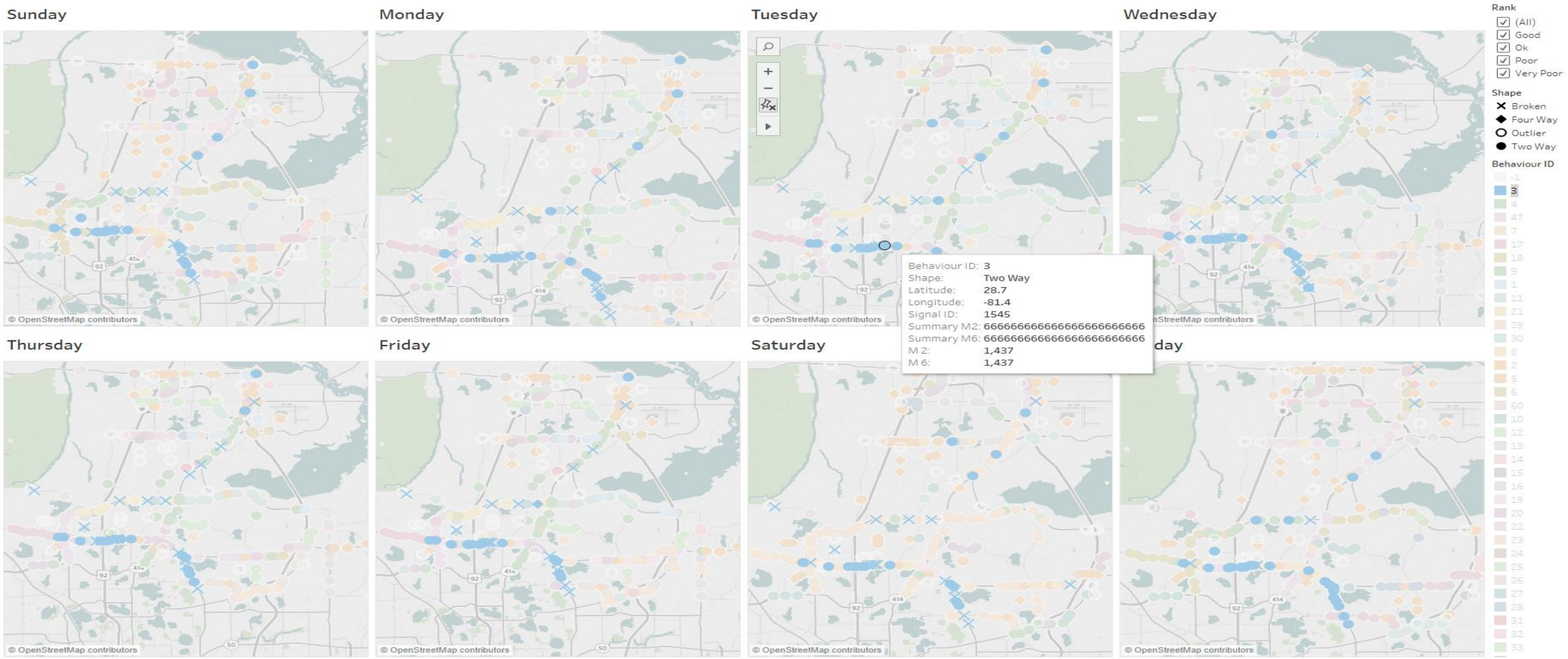
Signal Clustering

Week of 05/01 – 05/08/ in 2016



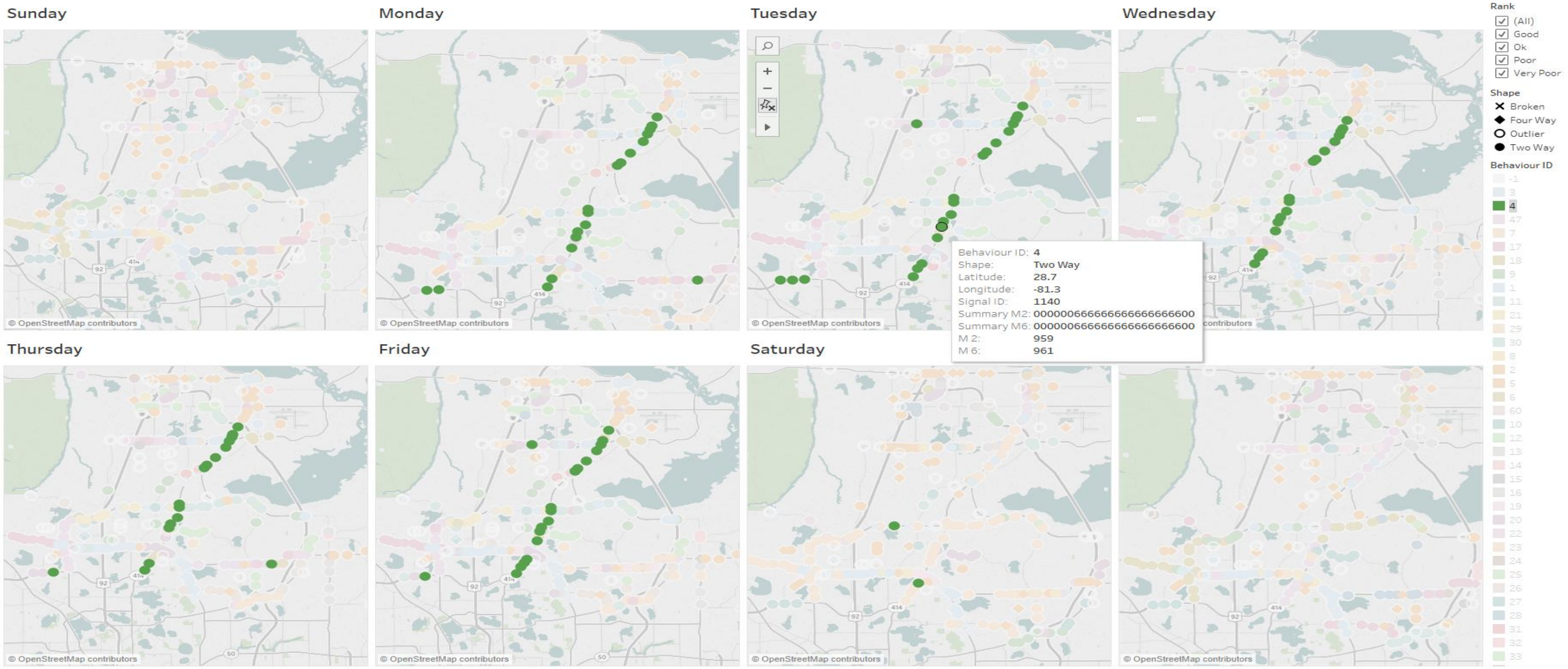
Signal Clustering

Group of Potentially Bad Intersections



Signal Clustering

Weekdays Group 1 – High traffic 7AM to 10PM

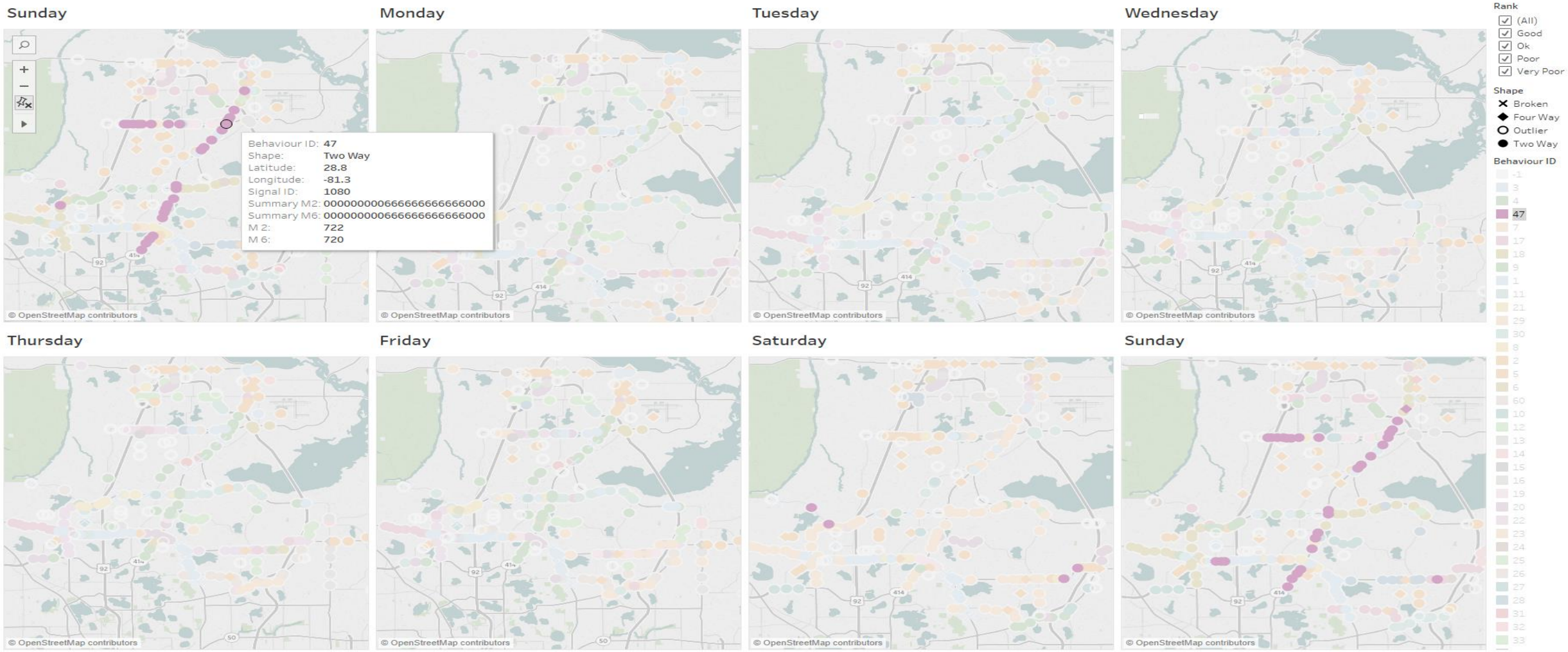


Signal Clustering

Weekdays Group 2 - High traffic 6AM to 9PM

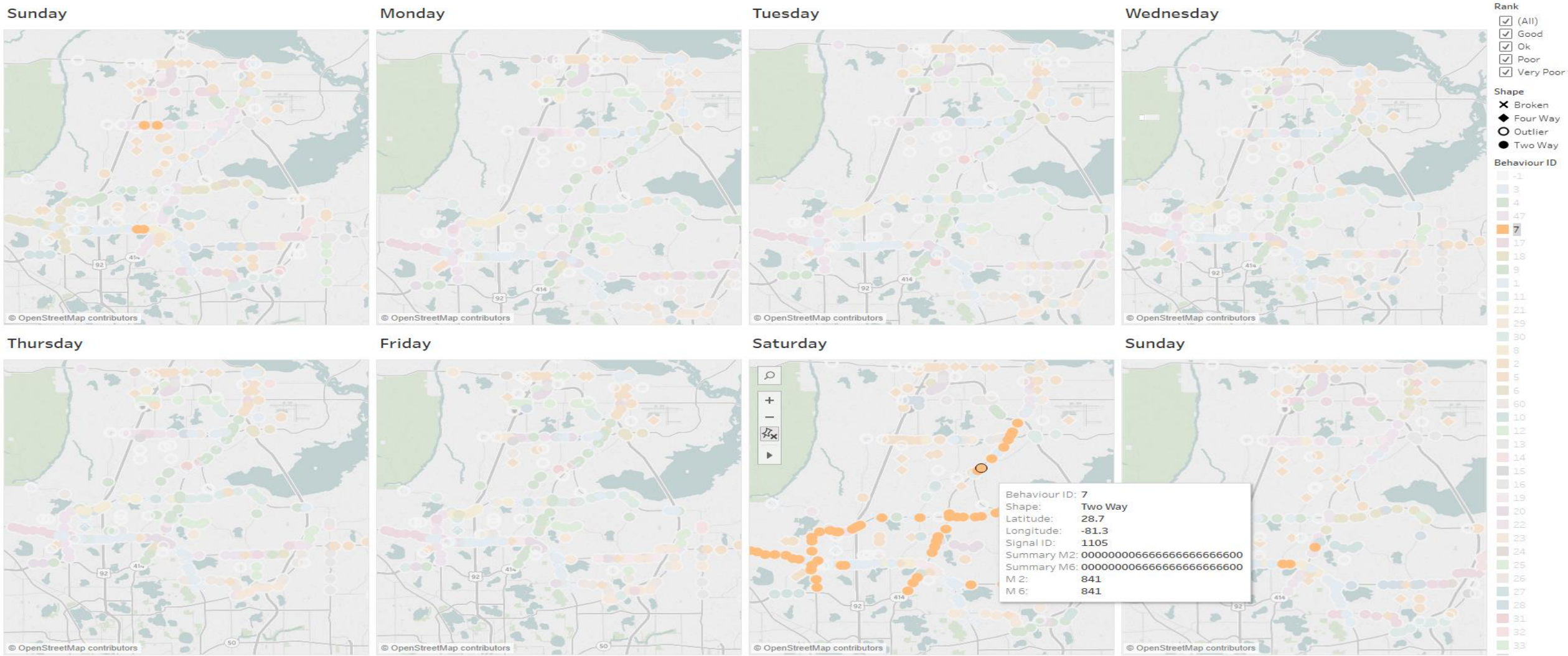
Signal Clustering

Sunday Group – 10AM to 9 PM



Signal Clustering

Saturday Group - 9 AM to 10 PM



Signal Clustering

Overall Picture: Potential to Aid New policy

Questions?

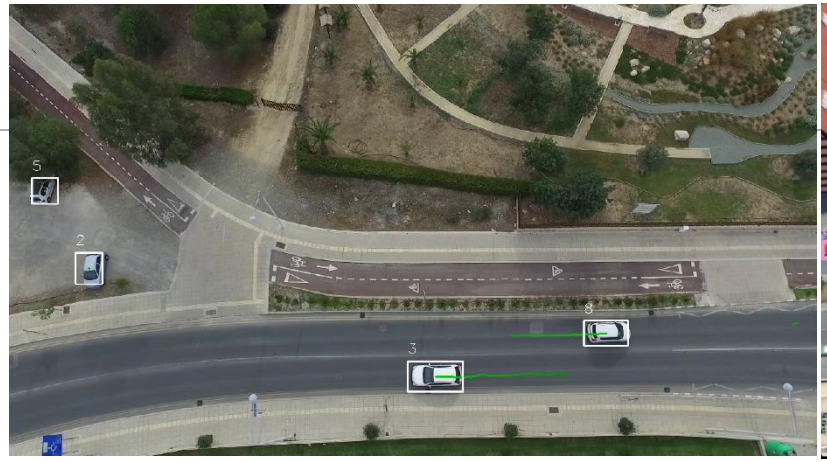
2. Detecting Near Collisions

Real-time Multi-Object Tracking and Road Traffic Safety Measurement (Detecting Near Collisions)

Object Detection → **Object Tracking** → **Collision Detection** → **Collision Avoidance**

- Fine-tune Detection CNN (YOLO) on Multi-Scale Drone/Satellite Videos/Images
- Implement Real-Time Tracker for vehicles based on DeepSort (Tracking by Detections with Kalman Filter)
- Learning likely collision scenario using CNNs
- Identify collision locations and associated objects
- Record incidents where objects come in close contact to each other or have to take evasive action to avoid collisions:

Annotation example



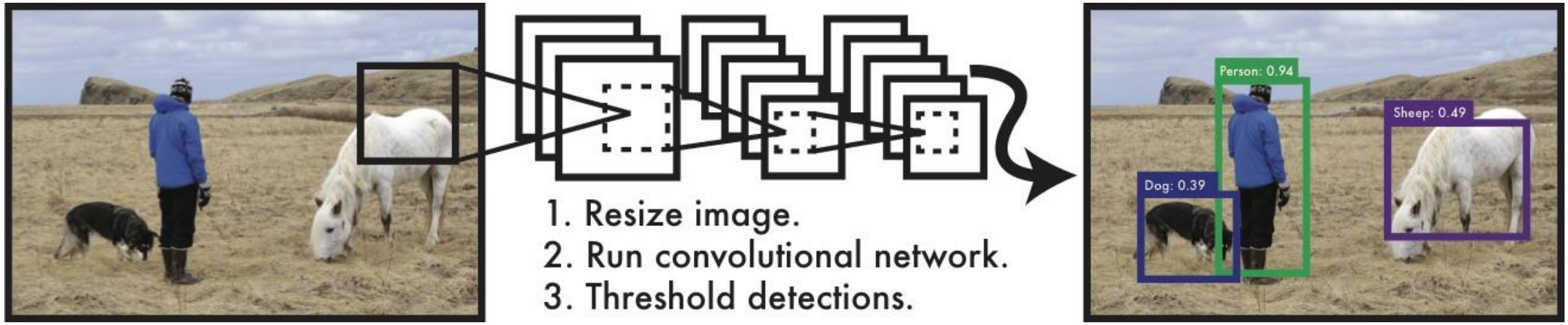
Tracking and trajectory example

Car Detection and Collision Detection

Detection and Tracking Approach

Object Detection: YOLO Deep Learning Framework

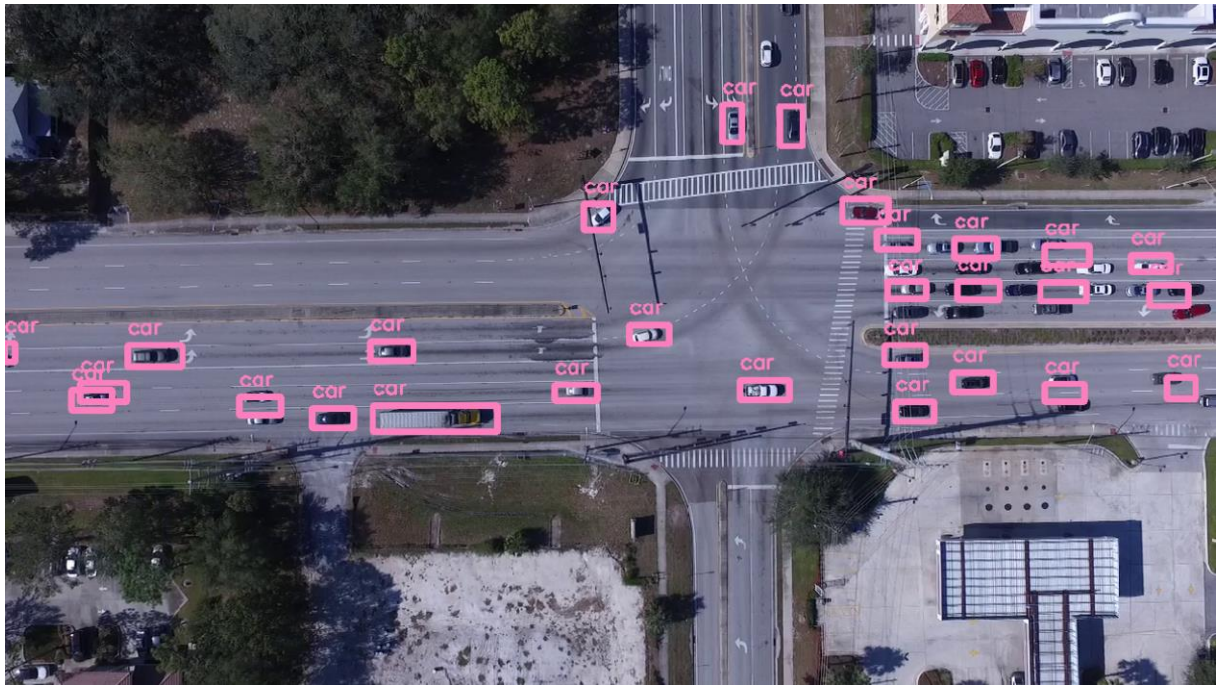
- With YOLO, you only look once at an image to perform detection
- Adapted Detection CNN (YOLO) on Multi-Scale Drone/Satellite Videos/Images



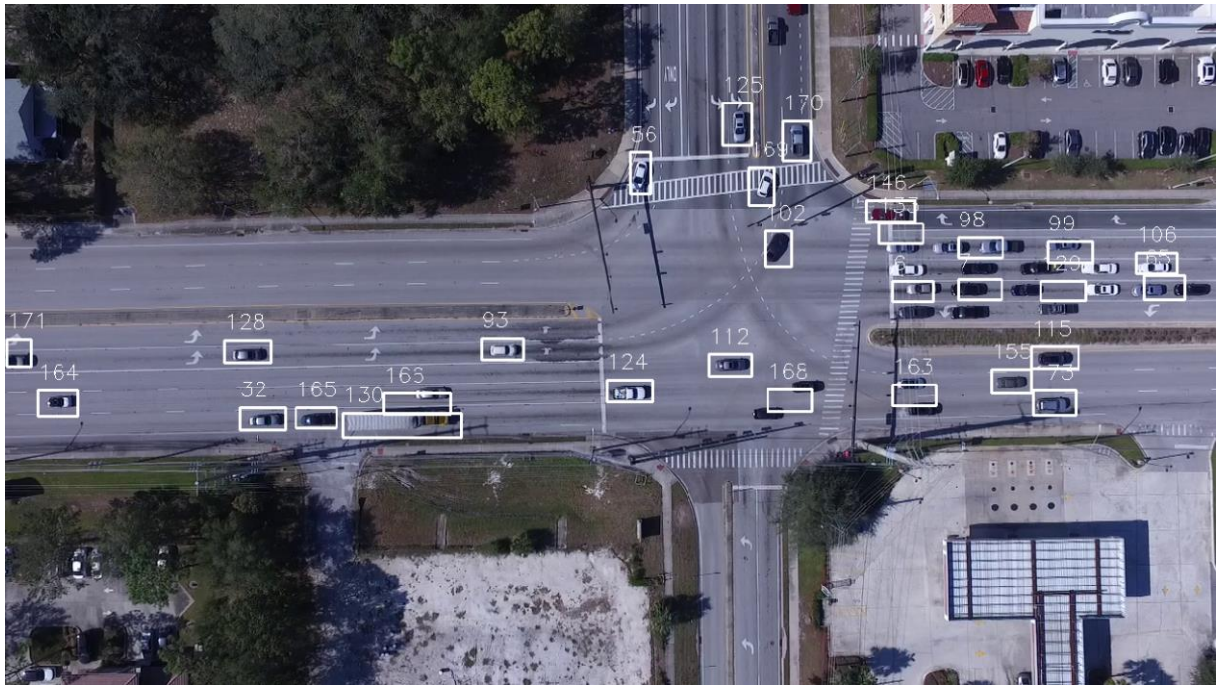
YOLO: You Only Look Once

Experimental Results on Video 1

Video 1: ‘400ft.mov’
Duration: 04:45 (24fps)
Resolution: 1280 x 720
Collision Scenario: None

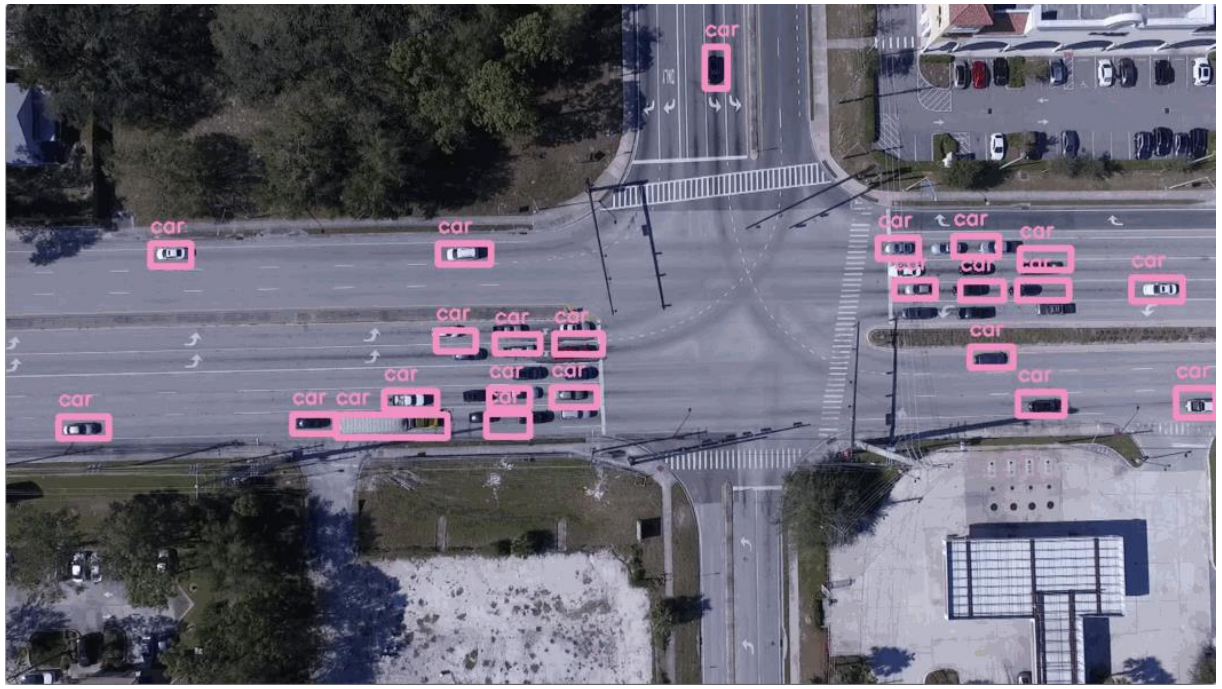


Car Detection Result



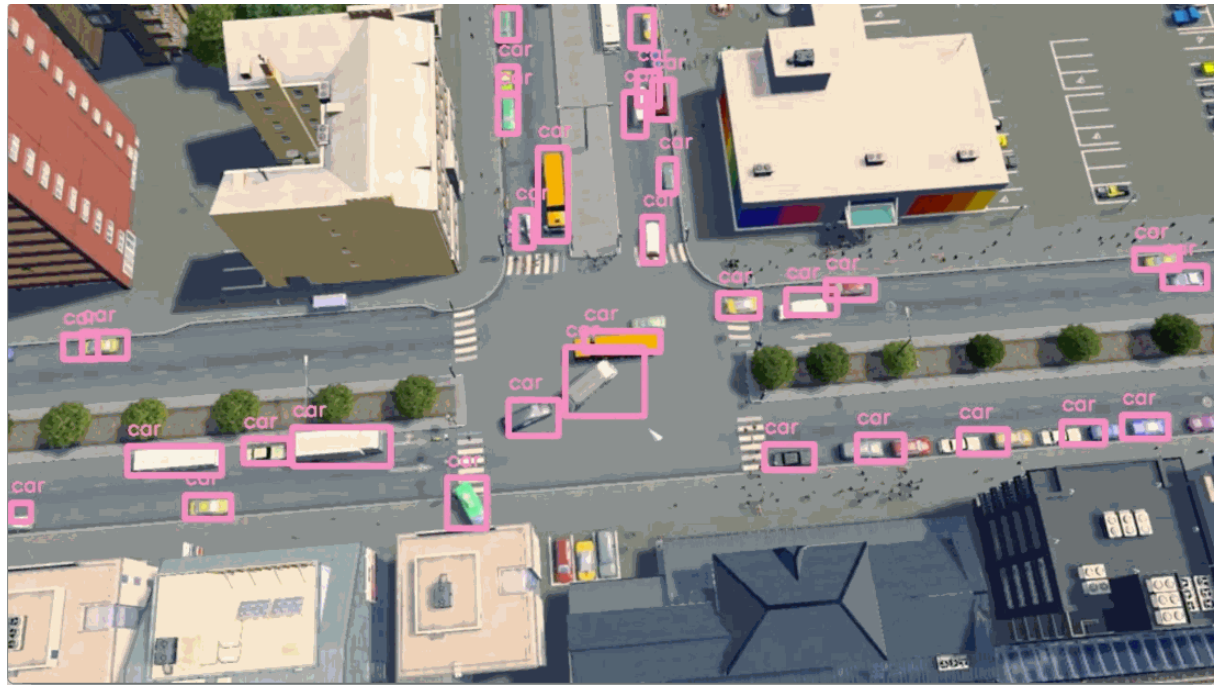
Car Tracking Result

Processing Performance is close to real time



Result on real video

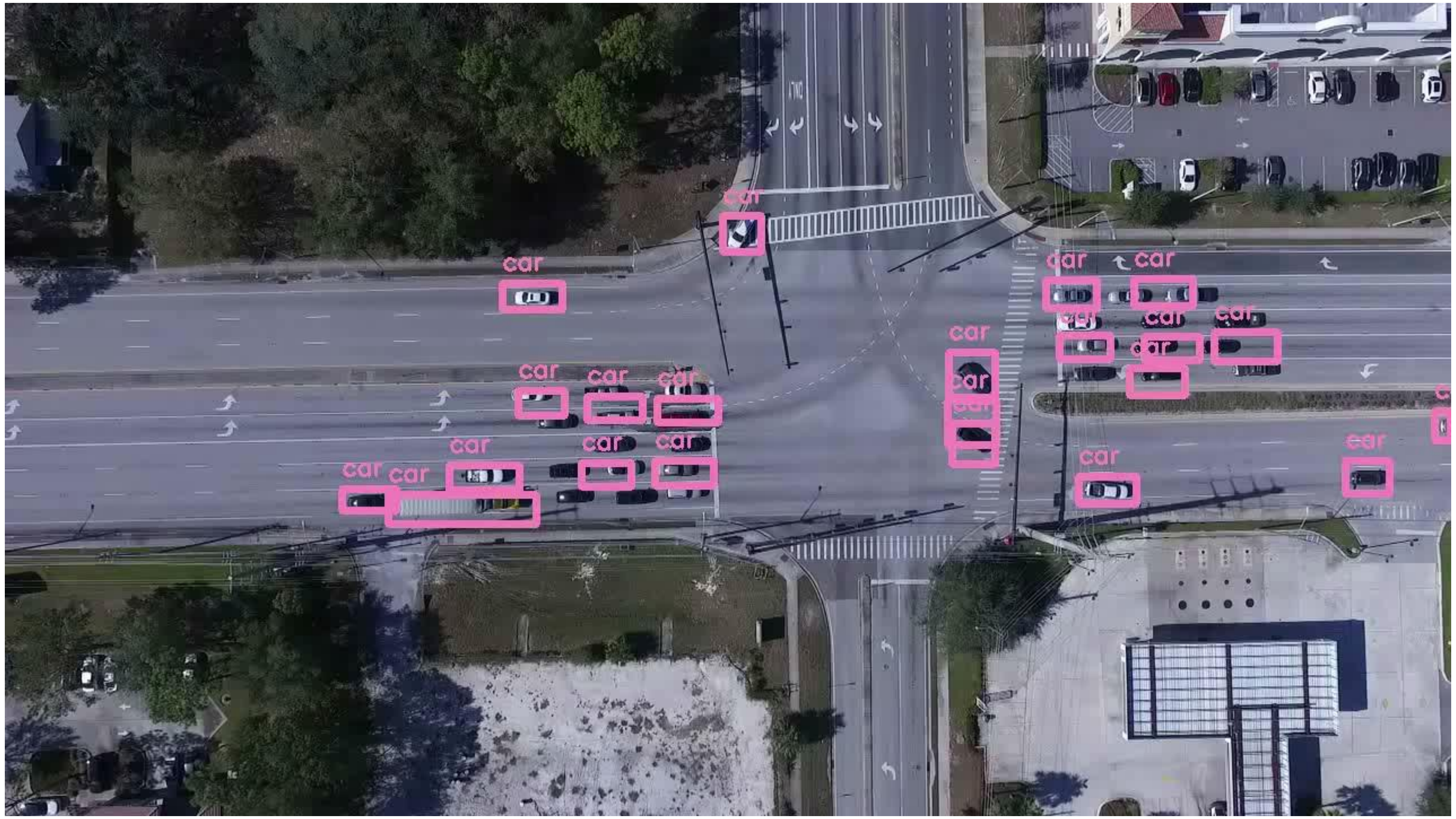
Video 1: ‘400ft.mov’
Duration: 04:45 (24fps)
Resolution: 1280 x 720
Collision Scenario: None



Result on video created by game simulation

Video 2: ‘Traffic_5.mp4’
Duration: 00:12 (25fps)
Resolution: 1280 x 720
Collision Scenario: ☑

Demo



Collision localization example on Video 2

Video 2: ‘Traffic_5.mp4’
Duration: 00:12 (25fps)
Resolution: 1280 x 720
Collision Scenario: ☑




Car Detection, Tracking and Collision Detection on Video 2

Video 2: ‘Traffic_5.mp4’
Duration: 00:12 (25fps)
Resolution: 1280 x 720
Collision Scenario: ☑

Video Frame

Result

Key Technologies

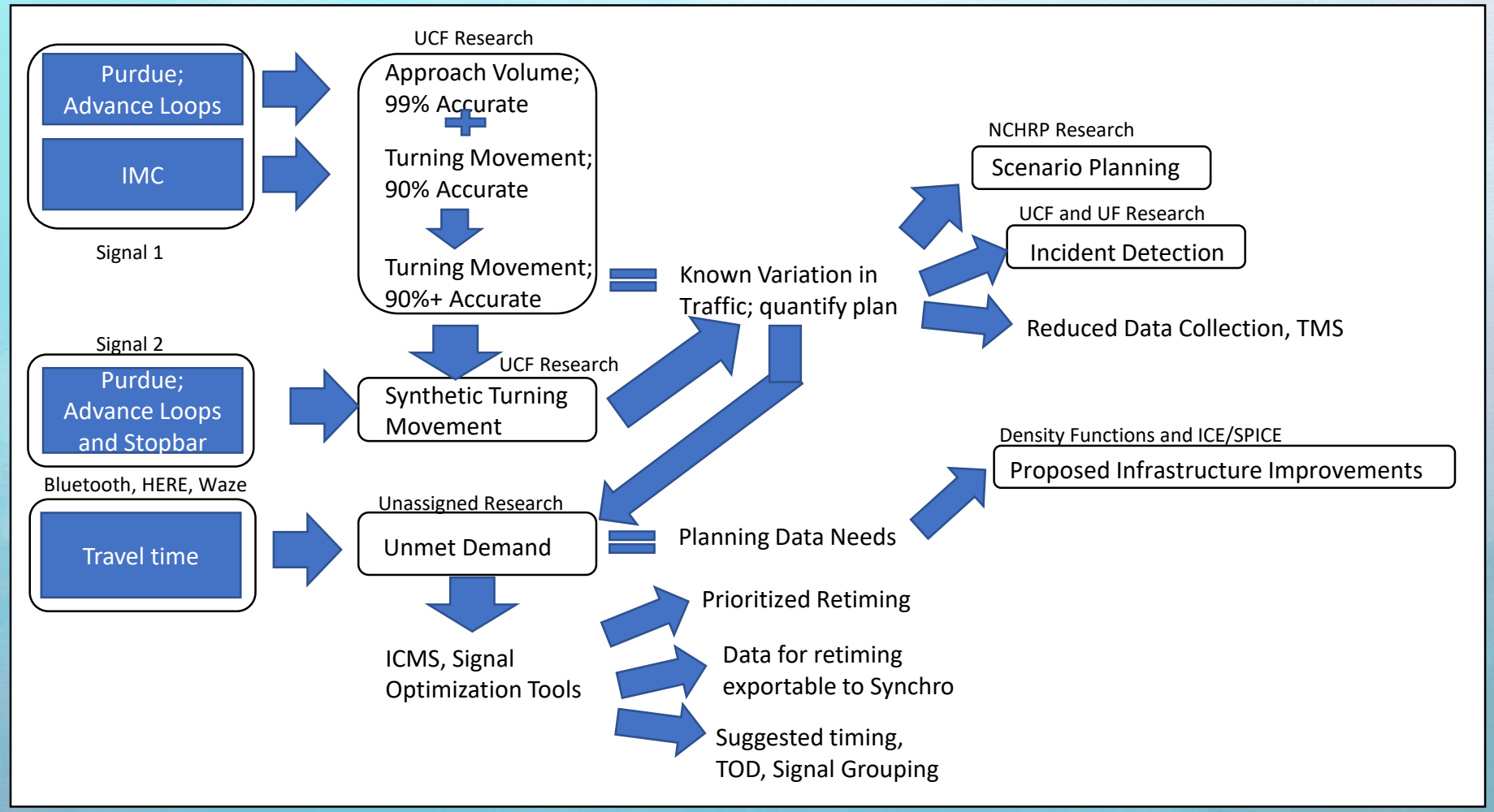
- Numpy: A python library for scientific computing, array processing & machine learning.
- Pandas: or the Python Data Analysis Library. Open Source.
- Dynamo dB: DynamoDB is a fully managed, NoSQL database service provided by Amazon AWS. It provides us Indexed storage.
- Tableau: It is a suite of software that allows users to explore and visualize their data.
- PyTorch: an open source machine learning library for Python. It provides a wide range of algorithms for deep learning, and uses the
- OpenCV: (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. The library is cross-platform and free for use under the open-source BSD license.
- CUDA: A parallel computing platform and application programming interface (API) model created by Nvidia.

Questions?

Current Initiatives

Jeremy Dilmore, FDOT District Five

Vehicular Mobility



THANK YOU!

Next Consortium – January 10, 2019

TSM&O Consortium Meeting

MEETING AGENDA

Central Florida Expressway Authority
4974 Orl Tower Rd
Orlando, FL 32807
CFX Boardroom

November 15, 2018; 10:00 AM-12:00 PM

1) WELCOME
2) CFMPOA REGIONAL PRIORITIES AND PROCESS – UPDATE
   - David Williams, VHB
3) GAINESVILLE "AUTOBUS"
   - Emmanuel Posadas, City of Gainesville
4) Modeling Automated, Connected, Electric & Shared Vehicles in Central Florida
   - Jason Learned, District Five PLEMO
5) TAMPA BAY SMART CITIES ALLIANCE
   - David Williams, VHB
6) BEHAVIOR CLUSTERING
   - Jeremy Dilmore, District Five TSM&O
7) NEAR-MISS COLLISION DETECTION
   - Jeremy Dilmore, District Five TSM&O
8) CURRENT INITIATIVES
   - Jeremy Dilmore, District Five TSM&O