Data Initiatives Program

FDOT TSM&O

Transportation Systems Management & Operations

SUNGUIDE℠

Central Florida DOT
Regional Freeway ATMS

Multiple Local Agency
Traffic Signal ATMS systems

Jeremy Dilmore, PE
FDOT District 5
TSMO Engineer
Florida Department of Transportation

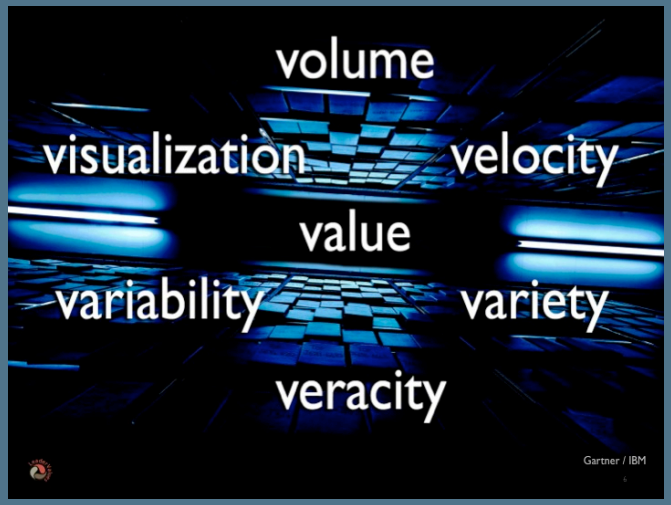
Clay Packard, PE
FDOT District 5
Consultant Project Manager
VHB

TSMO Data Initiatives Program

- Objectives:
  - Extract value from the Big Data sources available to us
  - Take Action! - Go beyond reporting
  - Automate Traffic Operations
- Key Strategies:
  - working with people,
  - make things consistent,
  - solve meaningful problems.
- Approach
  - Start small and build on knowns
  - focus on user needs serving us, other offices, other agencies – our clients
  - adhere to systems engineering process, ROADS program, USDOT guidance
  - leave behind a platform to grow and on which to incorporate additional technology

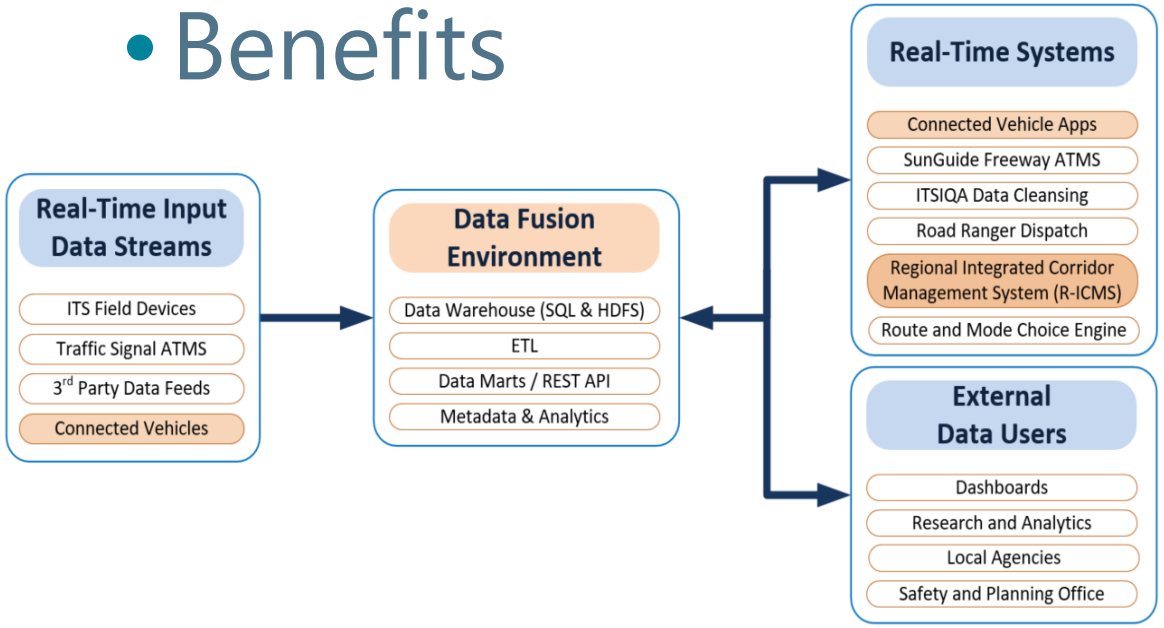
TSMO Data Initiatives Program

7 V's of Big Data



Each Project Contributes:

- Objectives
- Activities
- Outcomes
- Benefits



Our Journey Through Projects…

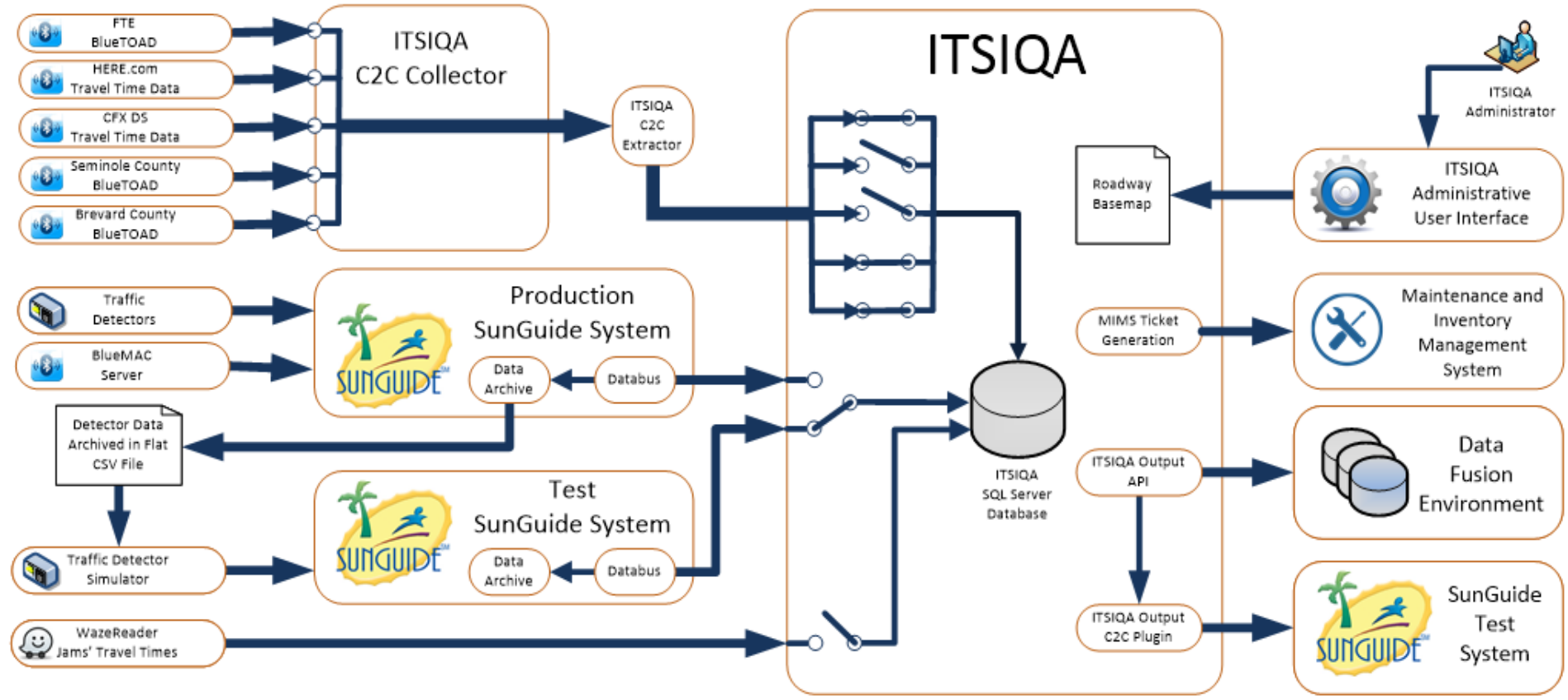
Big Data Analytics - UF

Value of Data

- How to use Big Data for Transportation?
- 5 Use Cases
- Subject Matter Experts
  - Identify problems
  - Ask relevant questions
  - Prioritize research
- Model and Visualize w/ multiple data sets
  - Geospatially joined
  - Aggregation strategies

ITS Input Quality Assurance - AECOM

- First Real-time operational system in the journey
- Connects data sources to apps

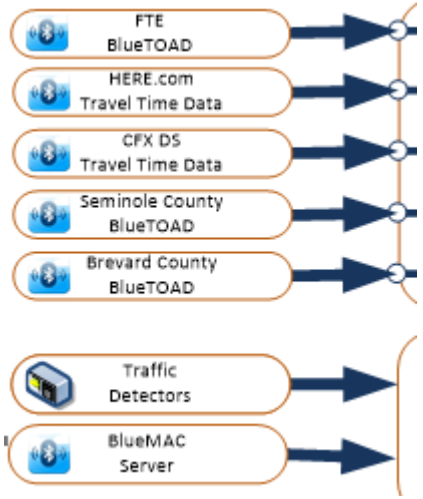


ITS Input Quality Assurance - AECOM

Velocity of Data

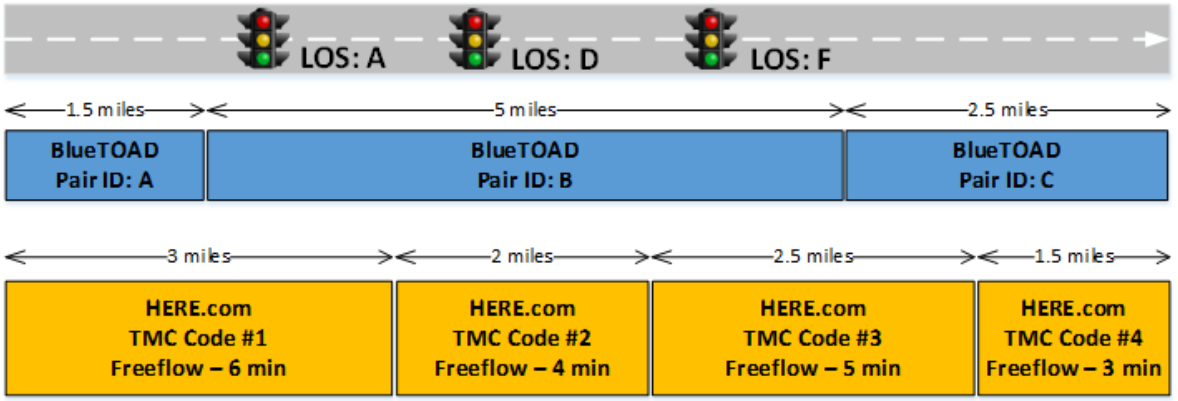
Veracity of Data

- Multiple data sources overlapping



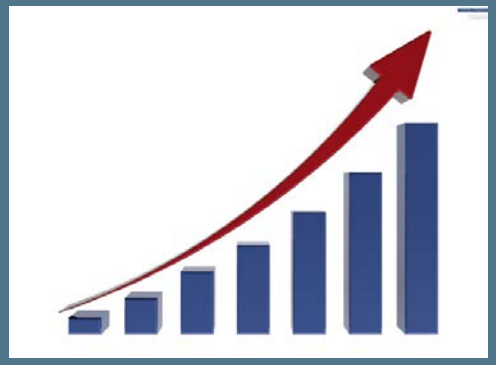
- Quality Control
- Filtering

- Spatial Normalization
- Temporal Normalization



Data Fusion Environment

Volume of Data



Variety of Data

- Collect once, Share often
  - Multiple Projects
  - Multiple Users
- Multiple Technologies

elastic

kafka

APACHE HBASE

cassandra

FLUME

HIVE

hadoop

confluent

APACHE STORM™

Distributed · Resilient · Real-time

MESOS

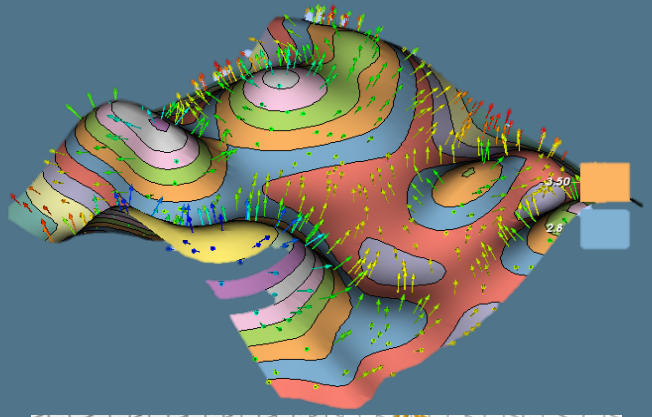
Spark

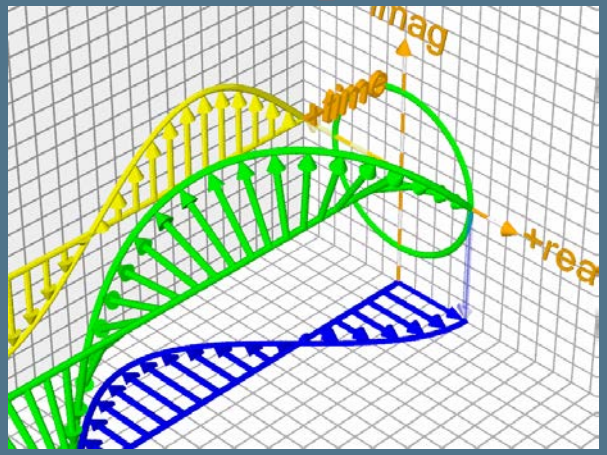
samza

Lightning-Fast Cluster Computing

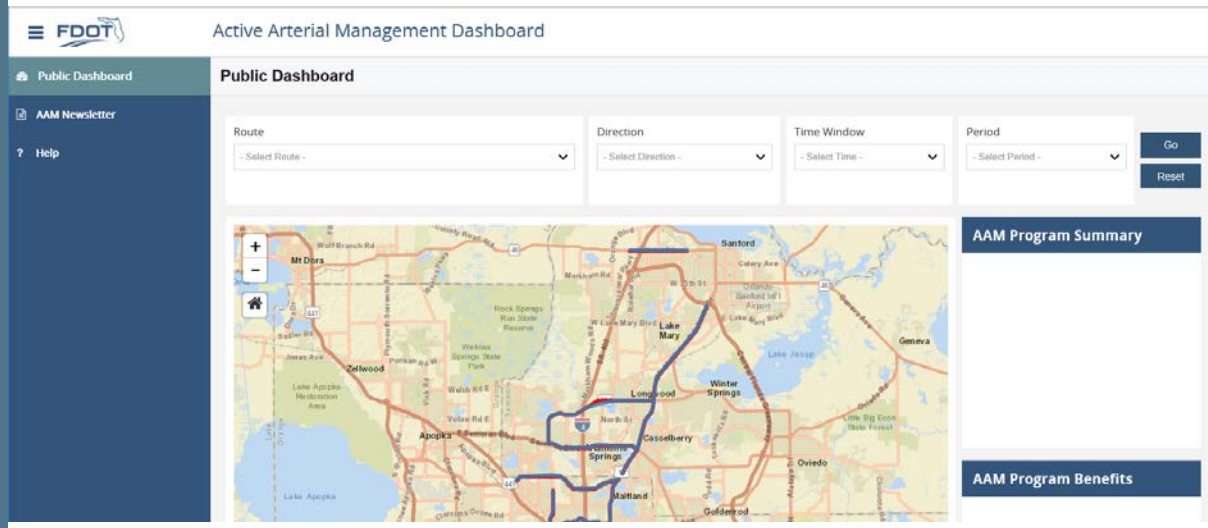
Dashboards Epic, VHB

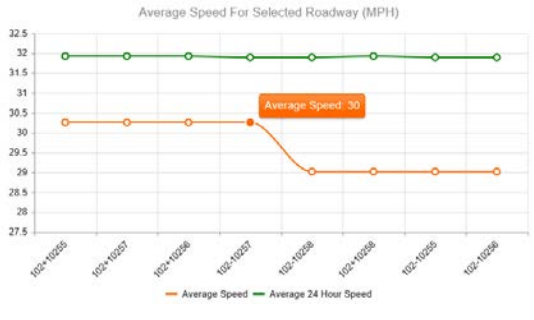
Visualization of Data

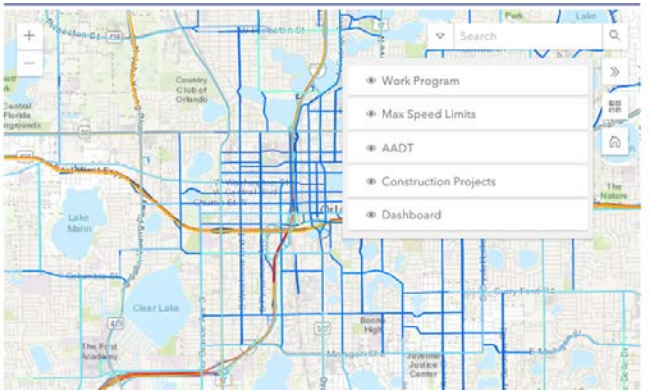




- Real-time Visualization
- Multiple dashboards for multiple users
- Internet Accessible

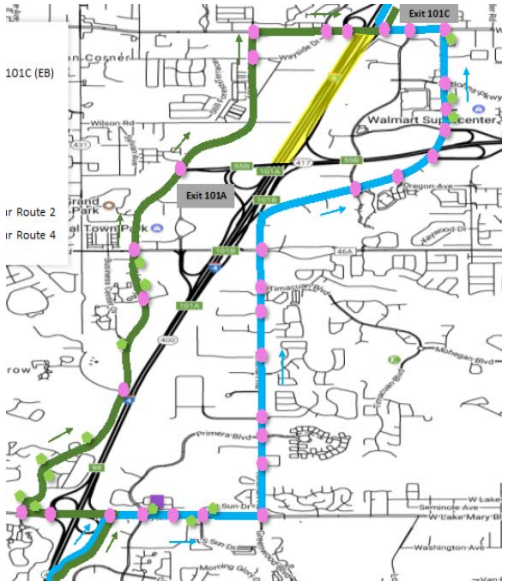






Regional Integrated Corridor Management System

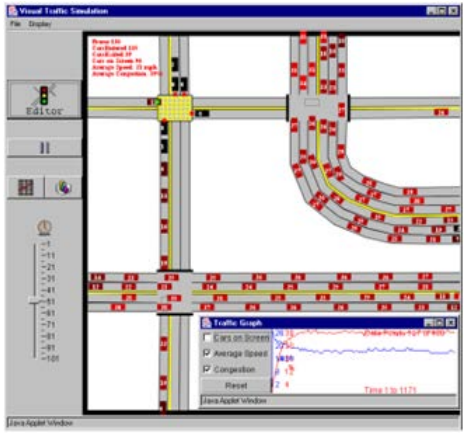
Incident Detection



Response Plan
w/ Diversion Route

Data Fusion Environment

Signal Timing
Plan Selection and
Optimization



Mesoscopic
Simulation for
Realtime 30 Minute
Forecasting

Non-Recurring Incident Detection & Response

- Design Time:
  - Repository of Response Plans having Diversion Routes
  - Rules engine mapping event attributes to response plans
- Run-Time:
  - Rules Engine Selects response plan for active incident
  - Mesoscopic simulation engine predicts measures of effectiveness 30 minutes into future
  - Operator and Agency Approval obtained prior to activation

Signal Optimization Tool

$$I_d = \sqrt{\sum_{i=0}^{n} \left(\frac{v_{i,j}}{c_i} - \frac{v_{i,k}}{c_i} \right)^2},$$

- Separate offline process
- Grouping and clustering time intervals
  - Based on similarities of traffic demand and capacity
  - Considers every approach in the intersection
- Highway Capacity Software used for recommended offsets and cycle lengths
- Traffic Engineer Role:
  - Review,
  - Make adjustments,
  - Request recalculate measures of effectiveness
  - Approve and Implement via local agency traffic signal ATMS

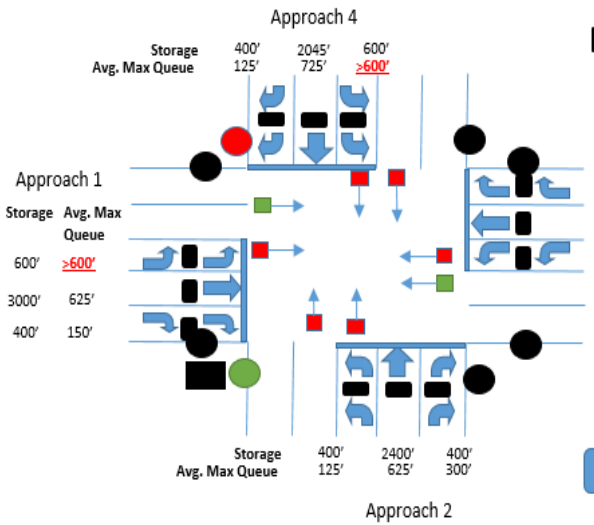
Intersection Signal Timing Recommendation

Integrated Corridor Management System

PLEASE RECALCULATE CORRIDOR

USER X

Intersection Recommendation - US 17-92 at Fairbanks – 24/7 all days from 11/1-1/19



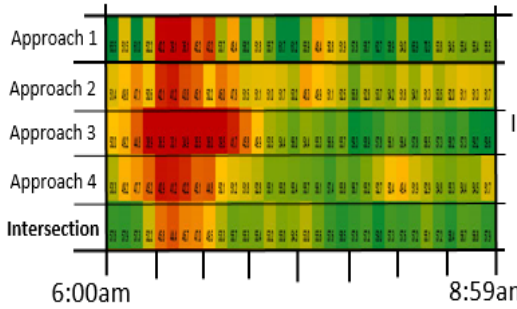
Day/Time Pattern: M-AM

MIMS

MAP

CAMERAS

Percent change in performance metric: FIT Improvement %



Comments

17:21 11/21/2016
@James Smith
Added 10 sec to the suggested offset for Aragon Ave....

New Recommended Timing Plans	Fit Improvement	Applicability
COIT ROAD @ BELT LINE:	*11%*	*100%*
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PLAN 8Y	9%	26%
PLAN 9A *Version history*	12%	40%

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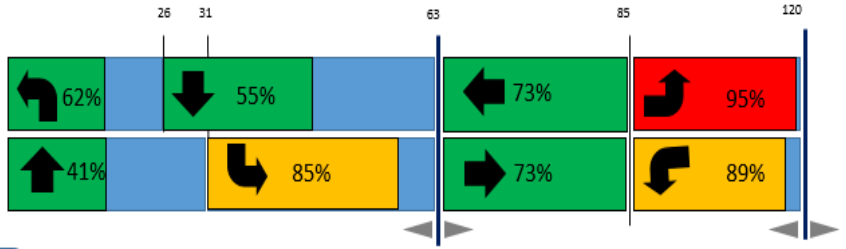
PLAN 6Y	9%	22%
PLAN 7A	7%	36%

Recommended Plan 9A (modified)



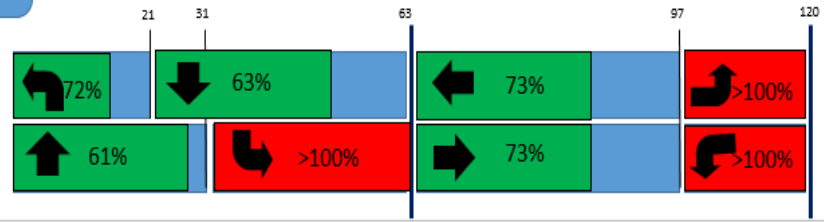
RECALCULATE PERFORMANCE

BACK

REVERT

SAVE

Existing Plan 6x



Stakeholder Coordination & Agency Approval

Central Florida CONSORTIUM

- System Concept and Design
- Response Plan Development
- Operations…

Integrated Corridor Management System — USER X

Limited Access Roadway Incident - Corridor Diversion Response Plan – Approval Status

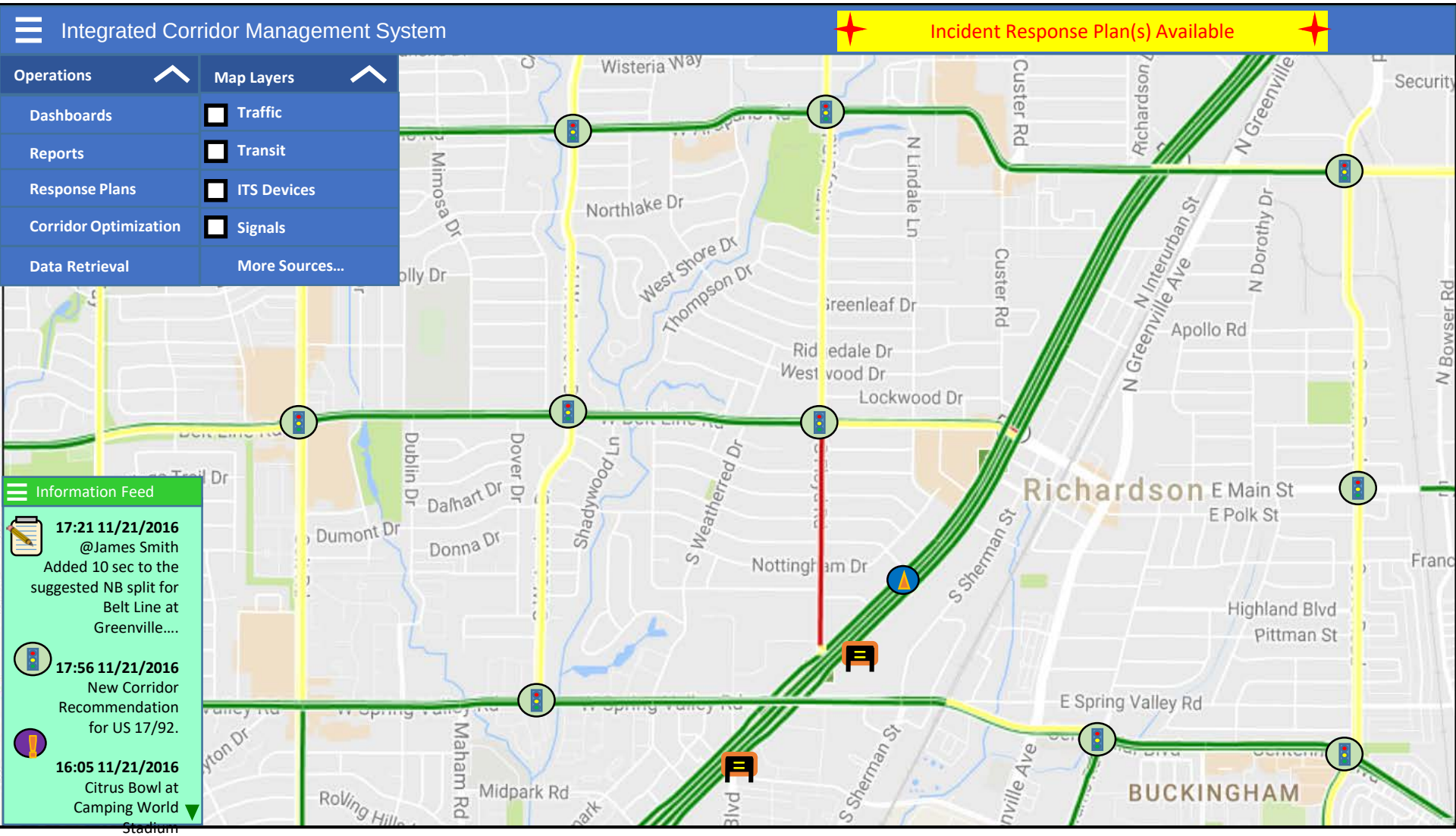
BACK

Agency	Time	Point of Contact	Items Pending Approval	Items Rejected	Items Approved
Seminole County	6:01PM	Darren Wilson 407-354-8746 Pete Varasquez 407-833-8577			Flush Plan Set 6x
FDOT	6:03 PM	Owen Kittleton 386-980-7122			DMS 75N248 DMS 75N245
Orange County		Tom Castanza 407-341-3411	Flush Plan Set 6x		
Orange County		Tom Castanza 407-341-3411	Flush Plan Set 8x		

Beyond R-ICMS

- Incorporate additional operational incident response treatments to the system
  - Ramp Metering
  - Hard shoulder running
  - Managed Lanes Pricing
  - Non-recurring congestion on the freeway treatments
- Artificial Intelligence
  - Response Plan Selection and Evaluation
  - Signal Timing Optimization
- Full Automation
- Monetize Information, Analytics and Insights
- Help other VHB offices Rinse and Repeat for their clients!

Let’s Talk!


Integrated Corridor Management System
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Richardson
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E Polk St
Highland Blvd
Pittman St
E Spring Valley Rd
BUCKINGHAM
Midpark Rd
Dumont Dr
Donna Dr
Dalhart Dr
Nottingham Dr
Custer Rd
N Lindale Ln
N Greenville Ave
N Interurban St
N Dorothy Dr
S Sherman St
S Weatherred Dr
Shadywood Ln
Dublin Dr
Dover Dr
Maham Rd
Mimosa Dr

Integrated Corridor Management System

USER X

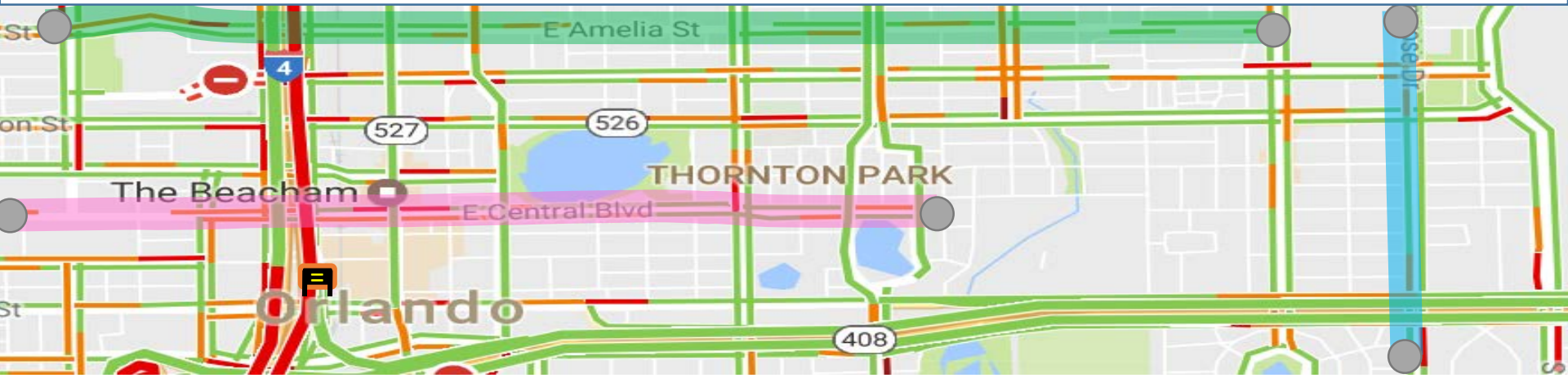
Corridor Optimization Strategy Recommendations

Corridor	Requested By	Analysis date/time pattern	Fit Improvement	Applicability	LOS	Delay	Agencies
E Amelia St	System (rejected)	24/7 all days from 11/1-1/19	5%	8%	B → A	7 min → 3.3 min	FDOT
E Central Blvd	System (modified)	4-7 PM weekdays from 11/1-1/19	9%	12%	C → B	9 min → 7.2 min	Seminole, Volusia
E Central Blvd	Engineer A	4-7 PM weekdays from 11/1-1/19	6%	14%	B—B	14 min → 13.2 min	City of Orlando, Orange County
Primrose Dr	Operator X	6-9 AM weekends from 11/1-1/19	7%	9%	A→A	4.4 min → 4.6 min	FDOT, City of Daytona

Request New Analysis

SHOW ALL CORRIDORS

GO TO CORRIDOR



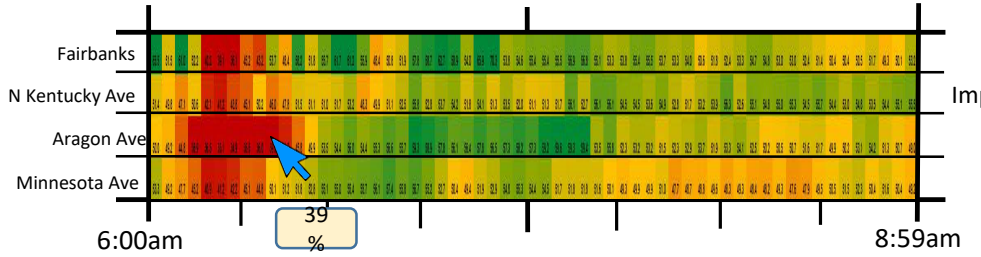
Integrated Corridor Management System

USER X

Corridor Recommendation – US 17-92 – by System – 24/7 all days from 11/1-1/19

Percent change in performance metric: *FIT Improvement %* ▼

Day/Time Pattern: M-AM ▼



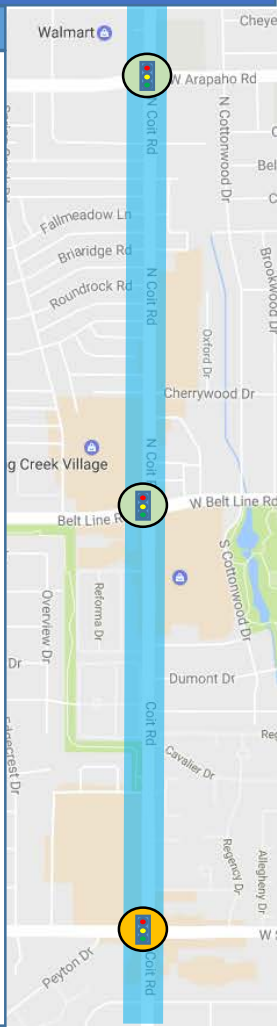
Legend:
Improvement
No Change
Worse

TOD Pattern Details

Time Window:
Monday 6:00AM-10:00

Plan Sets
- 7Y
- 8X

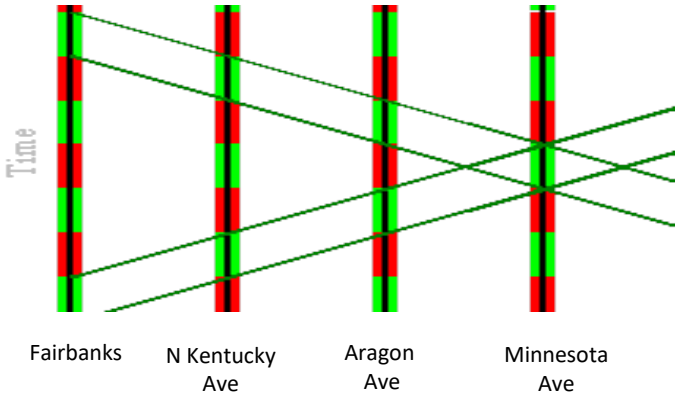
Intersection	Fit Improvement	Applicability	LOS AVG LOS WORST	Delay AVG (min) Delay WORST (min)	Agencies	Action
US 17-92 (Aggregated):	***9%***	***58%***	**B → A** **C → B**	**34.4 → 28.3** **44.4 → 38.3**	***(multiple)***	OFFSETS DETAILS
Fairbanks (Master)	7%	70%	C → B F → D	7 → 3.3 2 → 5.3	FDOT	DETAILS
N Kentucky Ave	11%	68%	B→ B B→ B	9 → 7.2 11 → 9.2	City of Orlando	DETAILS
Aragon Ave	8%	81%	A→A A→A	14 → 13.2 17 → 16.2	City of Orlando	DETAILS
Minnesota Ave	9%	45%	B→A C→B	4.4 → 4.6 4 → 6.6	Orange County	



Integrated Corridor Management System

USER X

Corridor Offset Recommendation – US 17-92 – 24/7 all days from 11/1-1/19



Corridor Timing Plan Set: Plan Set 8X

Plan Set 8X Details

Cycle Length: 120 Sec

Master Controller: Fairbanks

Active times:

- MTW 6:30AM – 9:30AM
- TF 6:00AM-9:00AM

Intersection	Offset (second)	Fit Improvement	Applicability	Agencies
Fairbanks (Master)	0	7%	70%	FDOT
N Kentucky Ave	10	11%	68%	City of Orlando
Aragon Ave	25	8%	81%	City of Orlando
Minnesota Ave	15	9%	45%	Orange County

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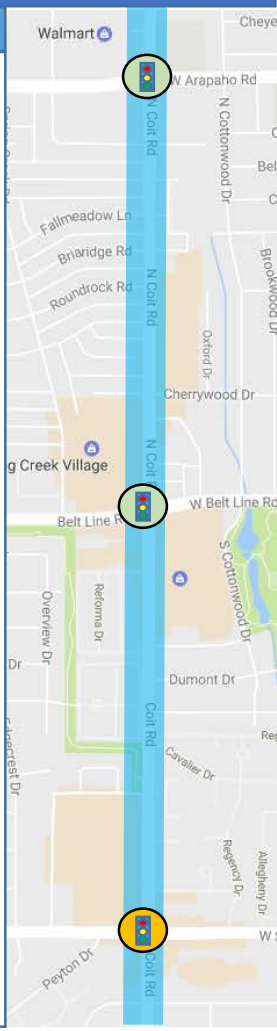

RECALCULATE PERFORMANCE METRICS | BACK | REVERT | SAVE

Integrated Corridor Management System

PLEASE RECALCULATE CORRIDOR

USER X

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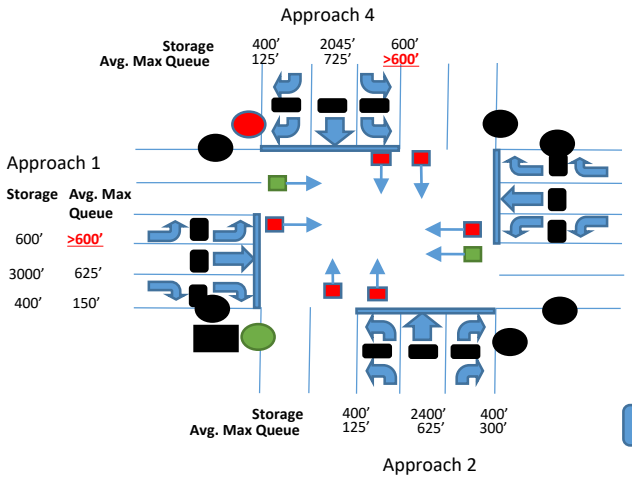

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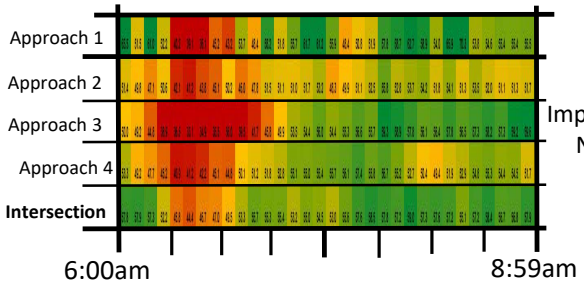
Percent change in performance metric: *FIT Improvement %*



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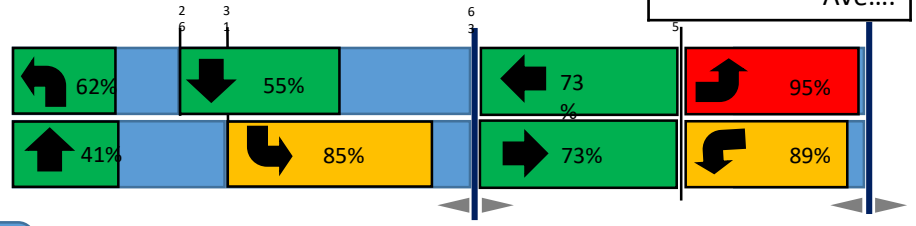

RECALCULATE PERFORMANCE

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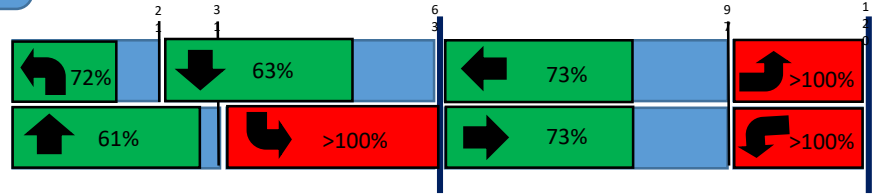

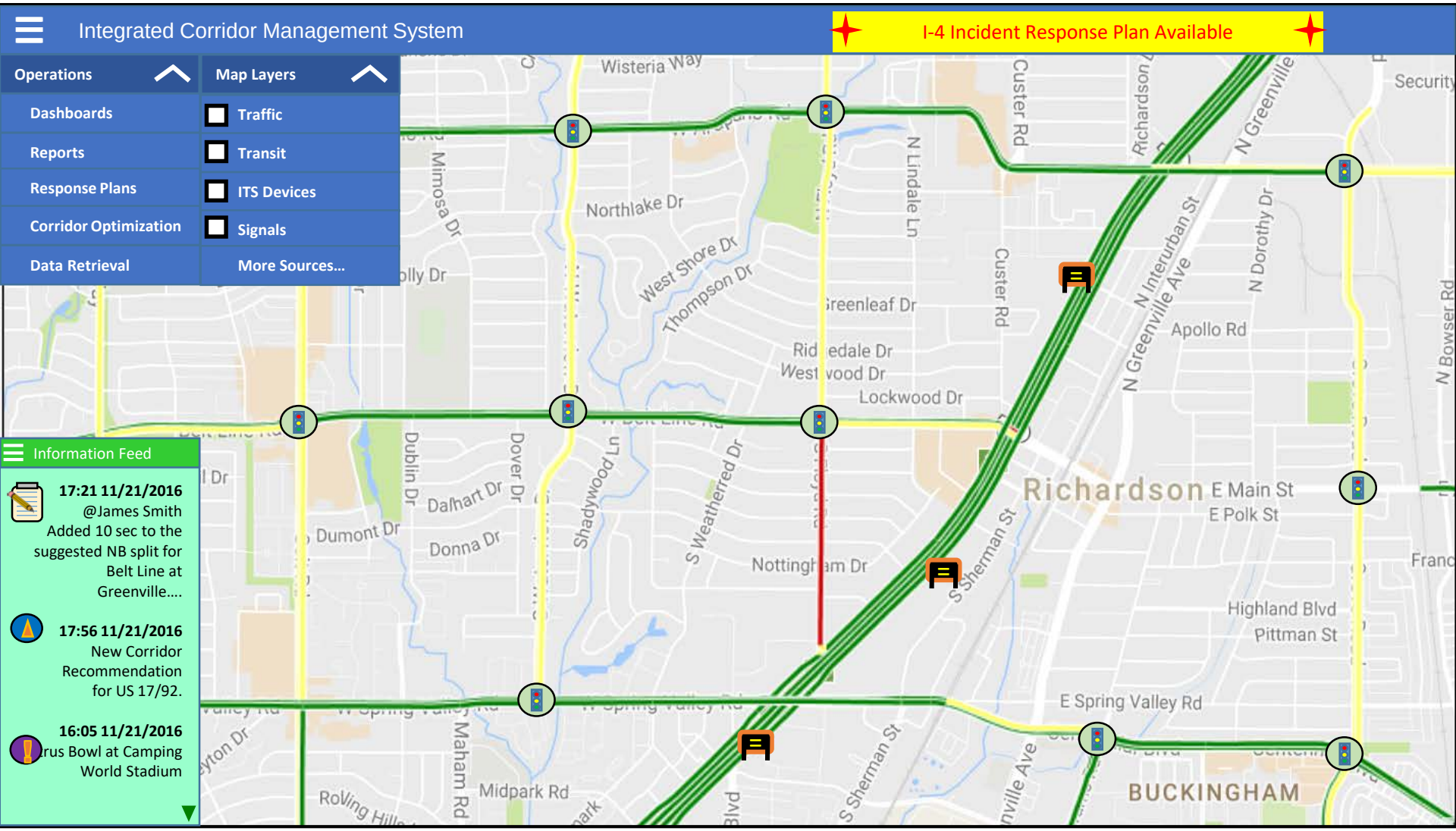
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Dublin Dr
Dover Dr
Dalhart Dr
Donna Dr
Dumont Dr
Shadywood Ln
S Weatherred Dr
Nottingham Dr
S Sherman St
Richardson
E Main St
E Polk St
Highland Blvd
Pittman St
E Spring Valley Rd
Maham Rd
Midpark Rd
Rolling Hills
BUCKINGHAM

Integrated Corridor Management System

USER X

Limited Access Roadway Incident - Corridor Diversion Response Plan

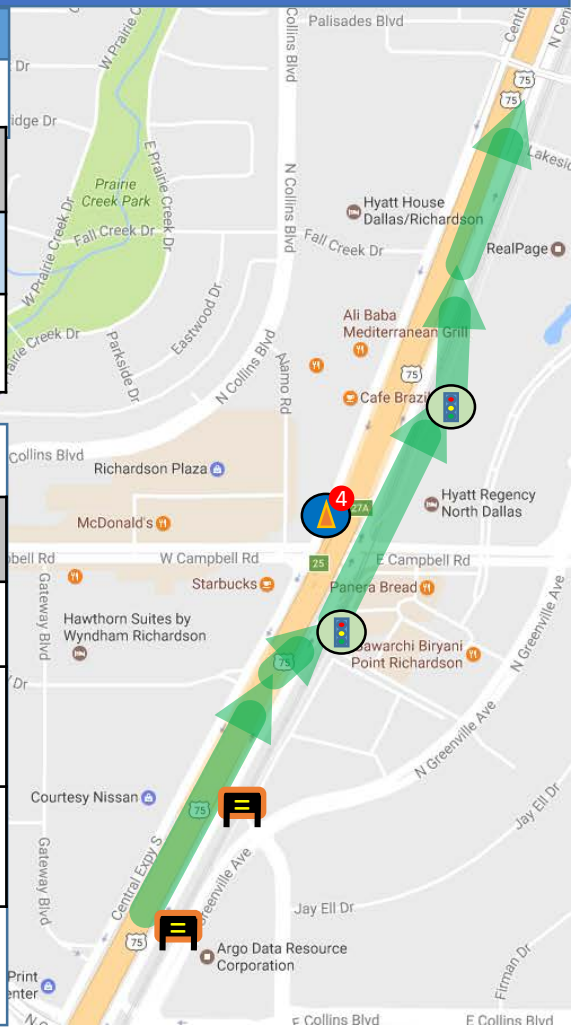
Incident on US-75 at Campbell Road – 17:21 11/21/2016 - 4 blocked lanes

Response Plan	MOE Improvement	TVT Improvement	Timing Plans Needed	Agencies
Diversion to frontage road	5%	4%	3	Seminole, Volusia
Diversion to US 17-92	4%	3.5%	8	FDOT, Seminole, Volusia

Incident on US-75 at Campbell Road – Diversion to Frontage road response plan

☑	Response Plan Item	Status	Item Detail	Agency
☑	*Flush Plan Set (3 signals)*	Ready	Flush Plan Set 6x	Seminole
☑	DMS 75N245	Active		FDOT
☑	DMS 75N248	Active		FDOT

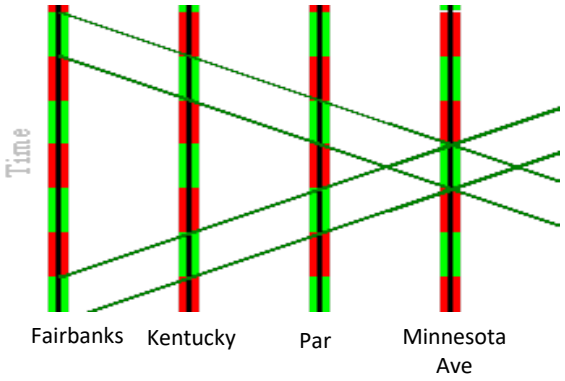
BACK | RESPONSE PLAN SCHEMATIC | APPROVAL STATUS | REJECT | APPROVE



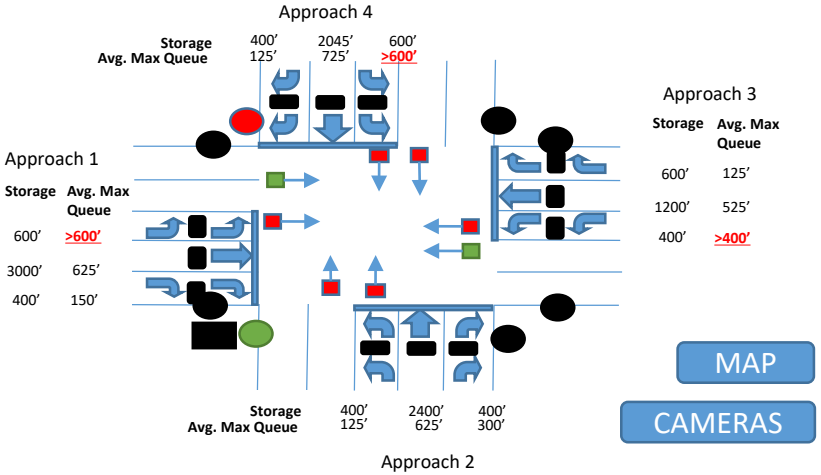
Corridor Diversion - Flush Plan Set Details – I-4 Frontage Rd near Fairbanks

BACK

Flush Plan Set 6x:
Cycle Length: 300 Sec
Master Controller: Fairbanks
Overall MOE
Improvement: 34%



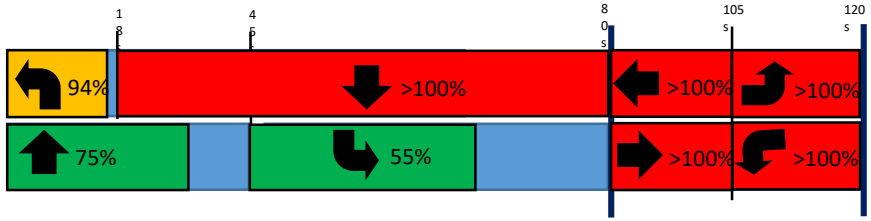
Intersection	Existing Cycle Length	Existing Offset	New Cycle Length	New Offset	MOE Improvement
Frontage and Fairbanks (master)	120	0	300	0	12%
Frontage and Kennedy	120	23	300	100	9%
Frontage and Par	120	53	300	80	12%
Frontage and Minnesota	120	53	300	80	12%



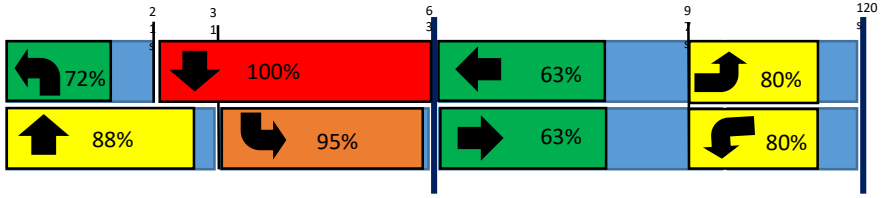
MAP

CAMERAS

Flush Plan 9A



Existing Plan 6x



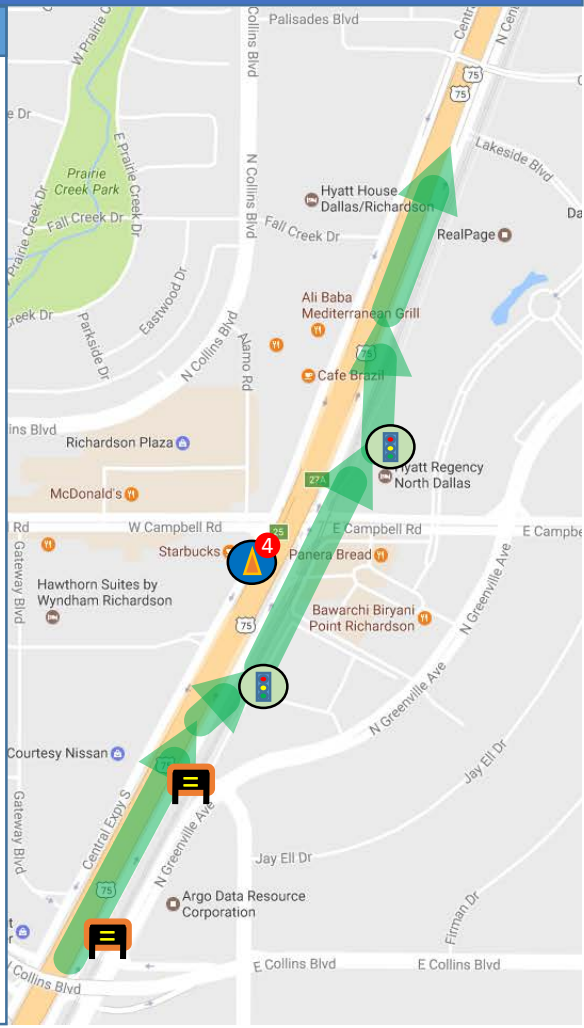
Integrated Corridor Management System

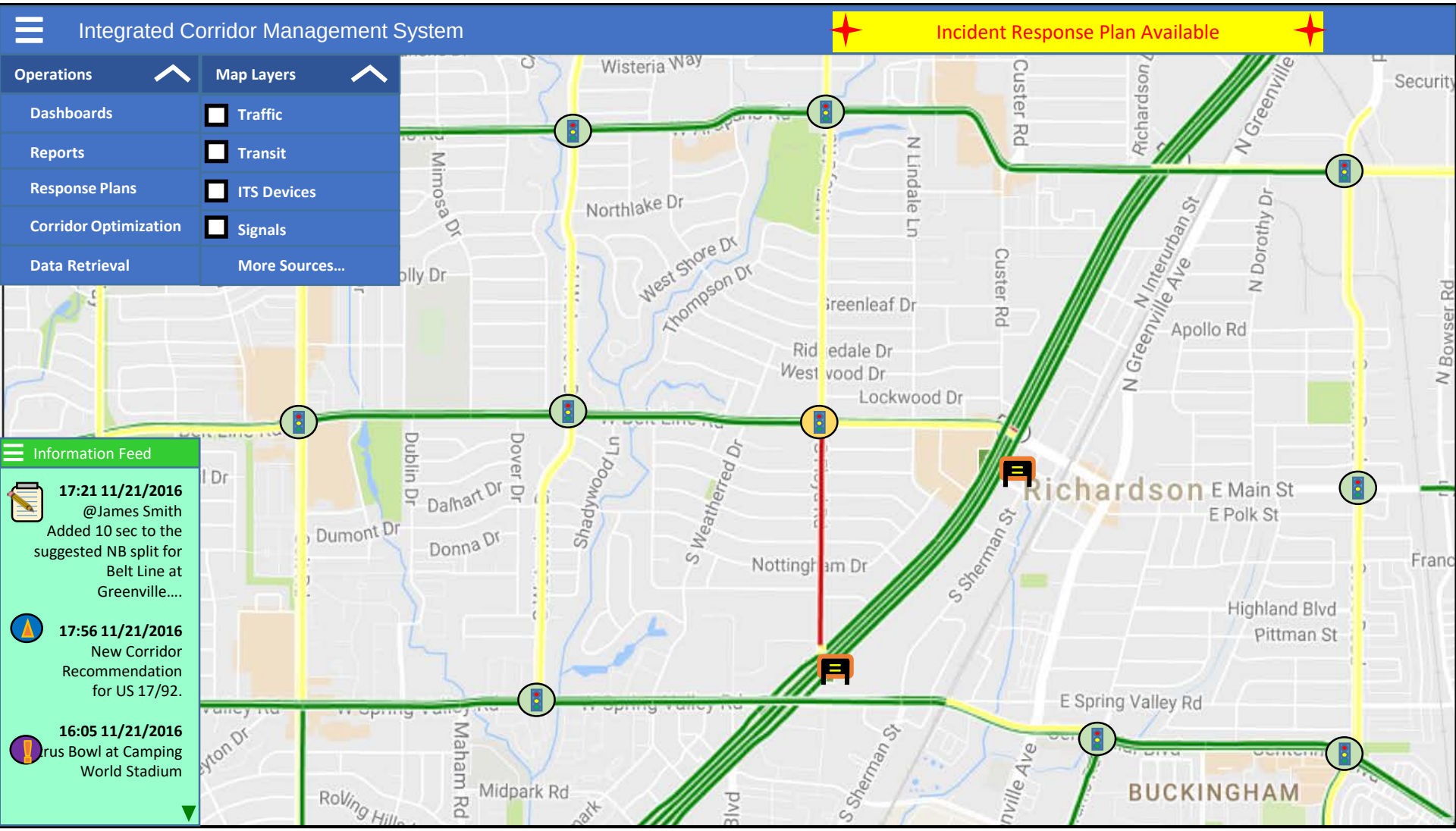
USER X

Limited Access Roadway Incident - Corridor Diversion Response Plan – Approval Status

BACK

Agency	Time	Point of Contact	Items Pending Approval	Items Rejected	Items Approved
Seminole County	6:01PM	Darren Wilson 407-354-8746 Pete Varasquez 407-833-8577			Flush Plan Set 6x
FDOT	6:03 PM	Owen Kittleton 386-980-7122			DMS 75N248 DMS 75N245
Orange County		Tom Castanza 407-341-3411	Flush Plan Set 6x		
Orange County		Tom Castanza 407-341-3411	Flush Plan Set 8x		




Integrated Corridor Management System
Incident Response Plan Available
Operations
Dashboards
Reports
Response Plans
Corridor Optimization
Data Retrieval
Map Layers
Traffic
Transit
ITS Devices
Signals
More Sources...
Information Feed
17:21 11/21/2016
@James Smith
Added 10 sec to the suggested NB split for Belt Line at Greenville....
17:56 11/21/2016
New Corridor Recommendation for US 17/92.
16:05 11/21/2016
rus Bowl at Camping World Stadium
Wisteria Way
Custer Rd
N Greenville
Security
Mimosa Dr
Northlake Dr
N Lindale Ln
West Shore Dr
Thompson Dr
N Interurban St
N Dorothy Dr
N Greenville Ave
N Bowser Rd
Greenleaf Dr
Apollo Rd
Lockwood Dr
Dublin Dr
Dover Dr
Dalhart Dr
Dumont Dr
Donna Dr
Shadywood Ln
S Weatherred Dr
Richardson
E Main St
E Polk St
S Sherman St
Highland Blvd
Pittman St
E Spring Valley Rd
Maham Rd
Midpark Rd
BUCKINGHAM

Integrated Corridor Management System

USER X

Arterial Roadway Incident Response Plan

Incident at US-92 and Par – *14:21 11/22/2016*
2 blocked lanes eastbound

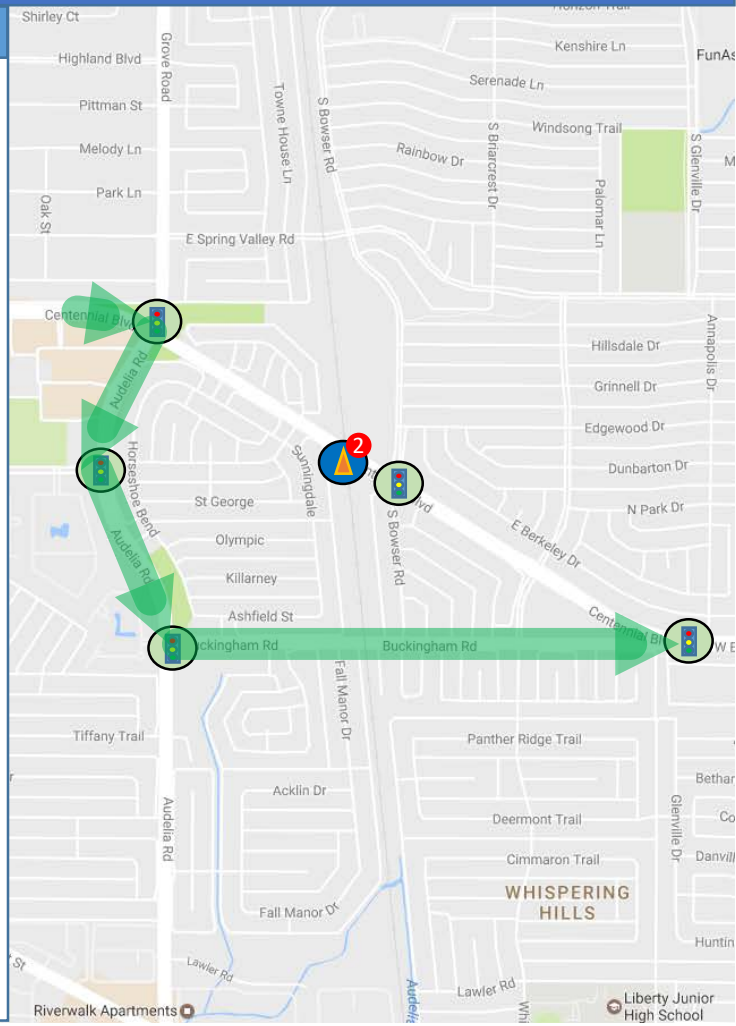
Response Plan	MOE Improvement	TVT Improvement	Timing Plans Needed	Agencies
Dynamic Plan Set 1	15%	17%	4	Seminole, Volusia
Dynamic Plan Set 2	9%	3.5%	8	Seminole, Volusia
Dynamic Plan Set 3	6%	4%	5	FDOT, Seminole, Volusia
Dynamic Plan Set 4	11%	10%	5	FDOT

BACK

APPROVAL STATUS

REJECT

APPROVE



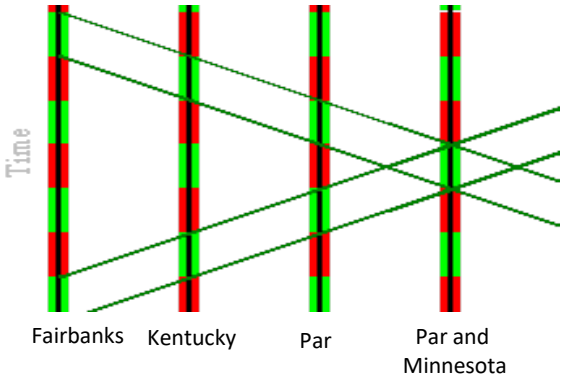
Corridor Diversion - Flush Plan Set Details – I-4 Frontage Rd near Fairbanks

BACK

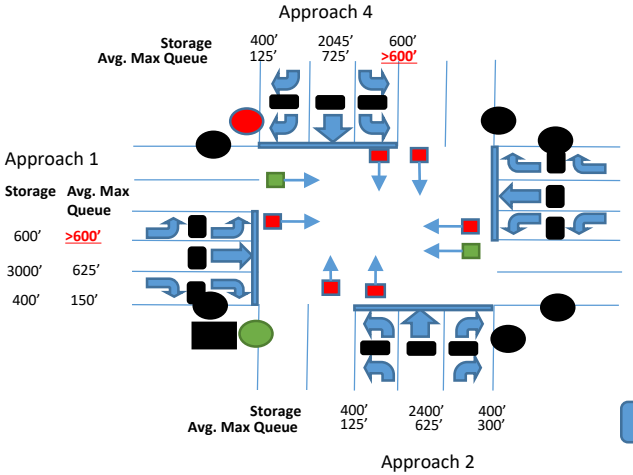
Dynamic Plan Set 1:
Cycle Length: 300 Sec
Master Controllers:

- Fairbanks
- Par and Minnesota

Overall MOE Improvement: 34%



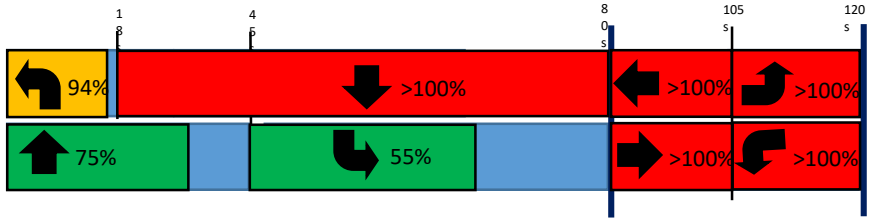
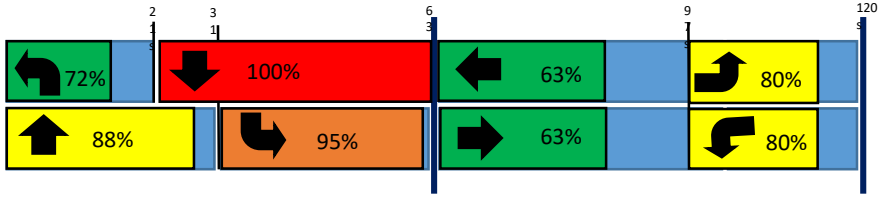
Intersection	Existing Cycle Length	Existing Offset	New Cycle Length	New Offset	MOE Improvement
Frontage and Fairbanks (master)	120	0	120	0	12%
Frontage and Kennedy	120	23	120	100	9%
Frontage and Par	120	53	120	80	12%
Par and Minnesota	160	11	160	11	12%



MAP

CAMERAS

Recommended Plan 9A



Existing Plan 6x