Hampton Roads District Dynamic Message Sign (DMS) Regional Improvement Study

April 2026

Perry Xu

Simran Arora

Jacobs

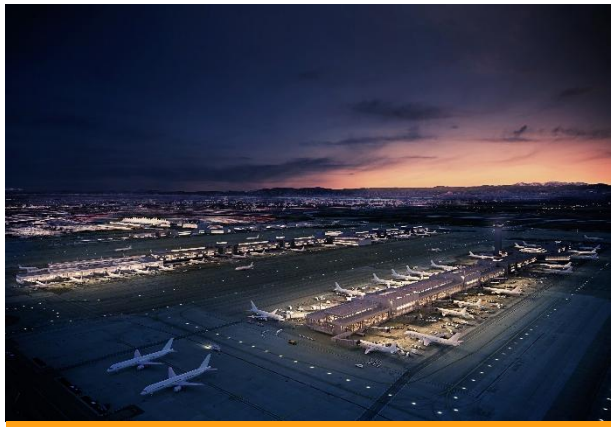
Challenging today.
Reinventing tomorrow.

Presenters

Perry Xu, P.E.
Traffic / ITS
Perry.Xu@jacobs.com

Simran Arora, AICP
Transportation Planning/Data Science
Simran.Arora@jacobs.com

Jacobs - Advanced Mobility



Aviation

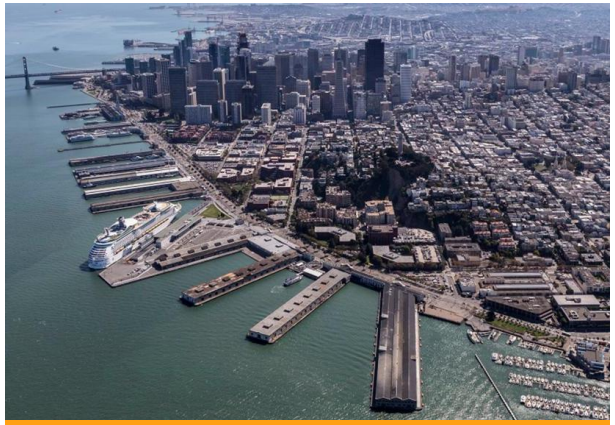
Advanced Mobility

Highway Design

Transportation Planning

Bridges

Rail & Transit



Ports & Maritime

Tunnel & Ground Engineering

Where are we located?

Mid-Atlantic Region

40+
COUNTRIES

400
OFFICES

55K+
TALENT FORCE

$22.5B
BILLION IN BACKLOG

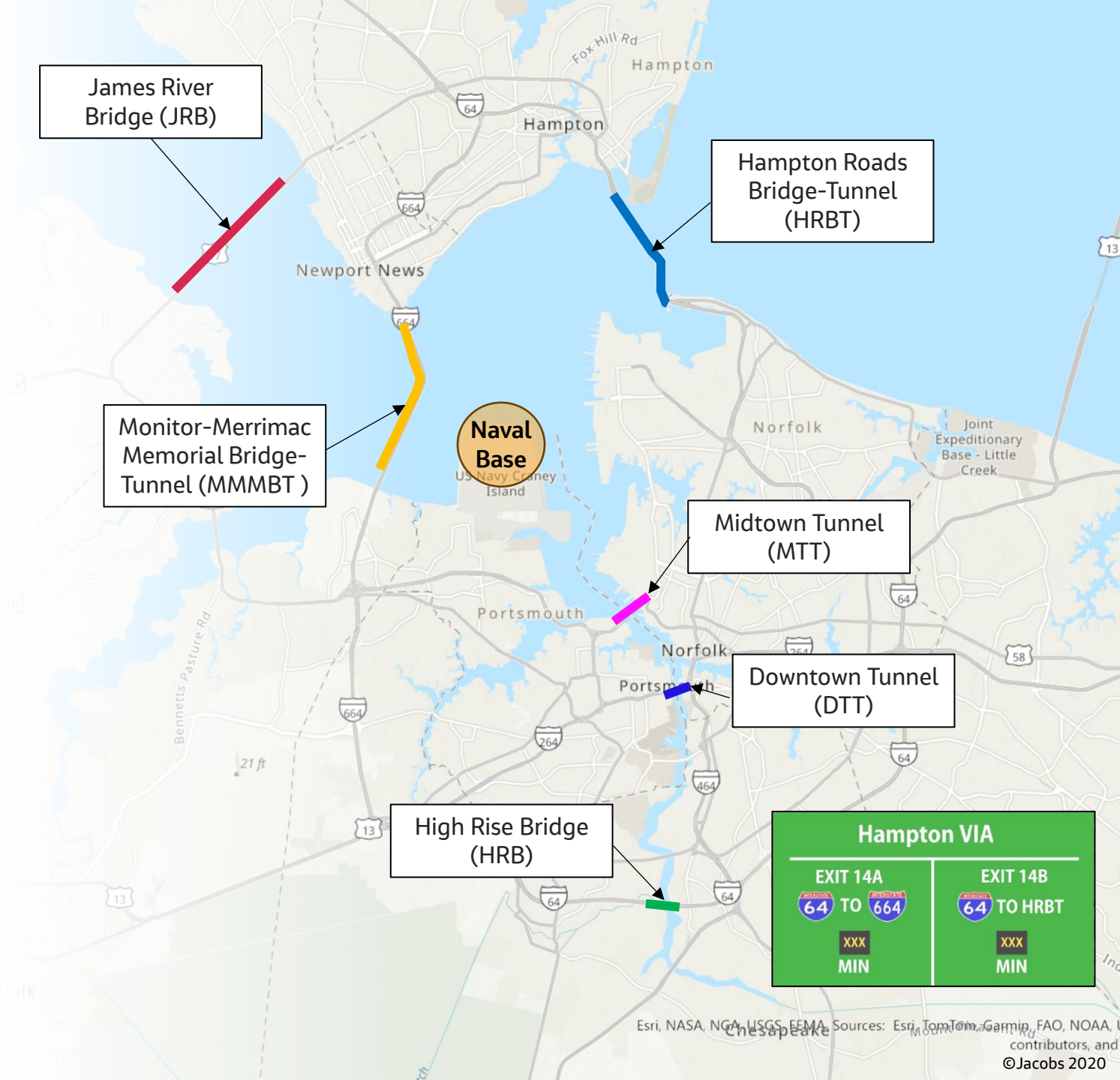
$2.5B
BILLION IN CLIENT SAVINGS

$13B
ANNUAL REVENUE

Project Background
Why this study is needed

- Extensive interstate network and the new 45-mile Hampton Roads Express Lanes (HREL) network
- Rapid expansion of over 300 DMS across isolated projects and lack of network-level coordination and optimization
- Changing seasonal traffic patterns due to HREL and key major water crossings/tourist attractions
- Aging infrastructure, with some over 20 years old

Result: Redundant signs, inefficient messaging, and outdated coverage

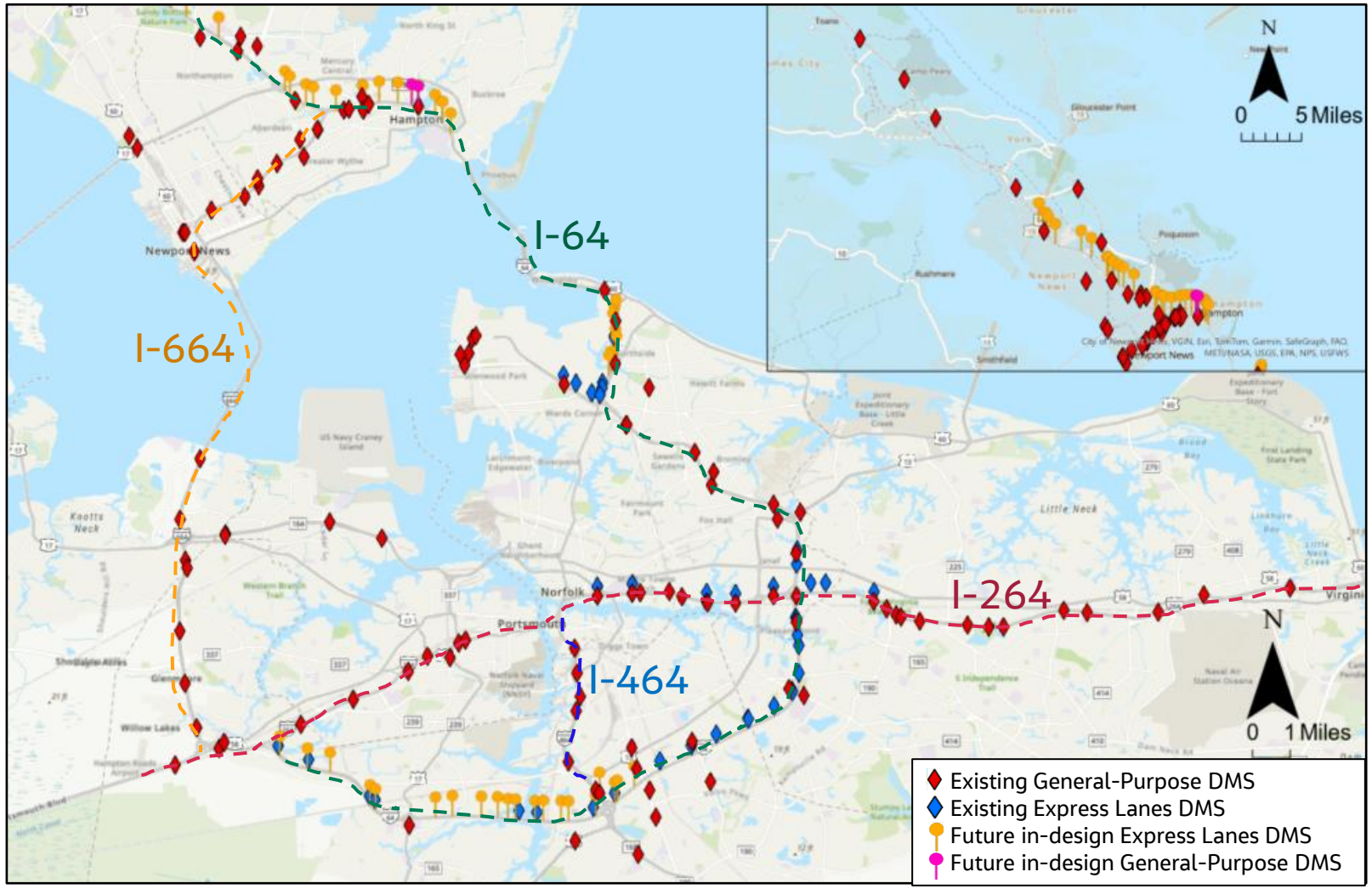


Project Background
Dynamic Message Signs (DMS)

- DDMS: Dedicated Dynamic Message Signs
  - These provide real-time traffic information for specific lanes/purposes
- GPDMS: General Purpose DMS
  - Travel Times
  - Traffic Incidents
  - Lane Closures
    - Movable bridge
    - Crucial as most tunnels are two-lanes
  - Emergency Messages, Events, etc
- HOV lanes or Express lanes DMS
    - Tolling info

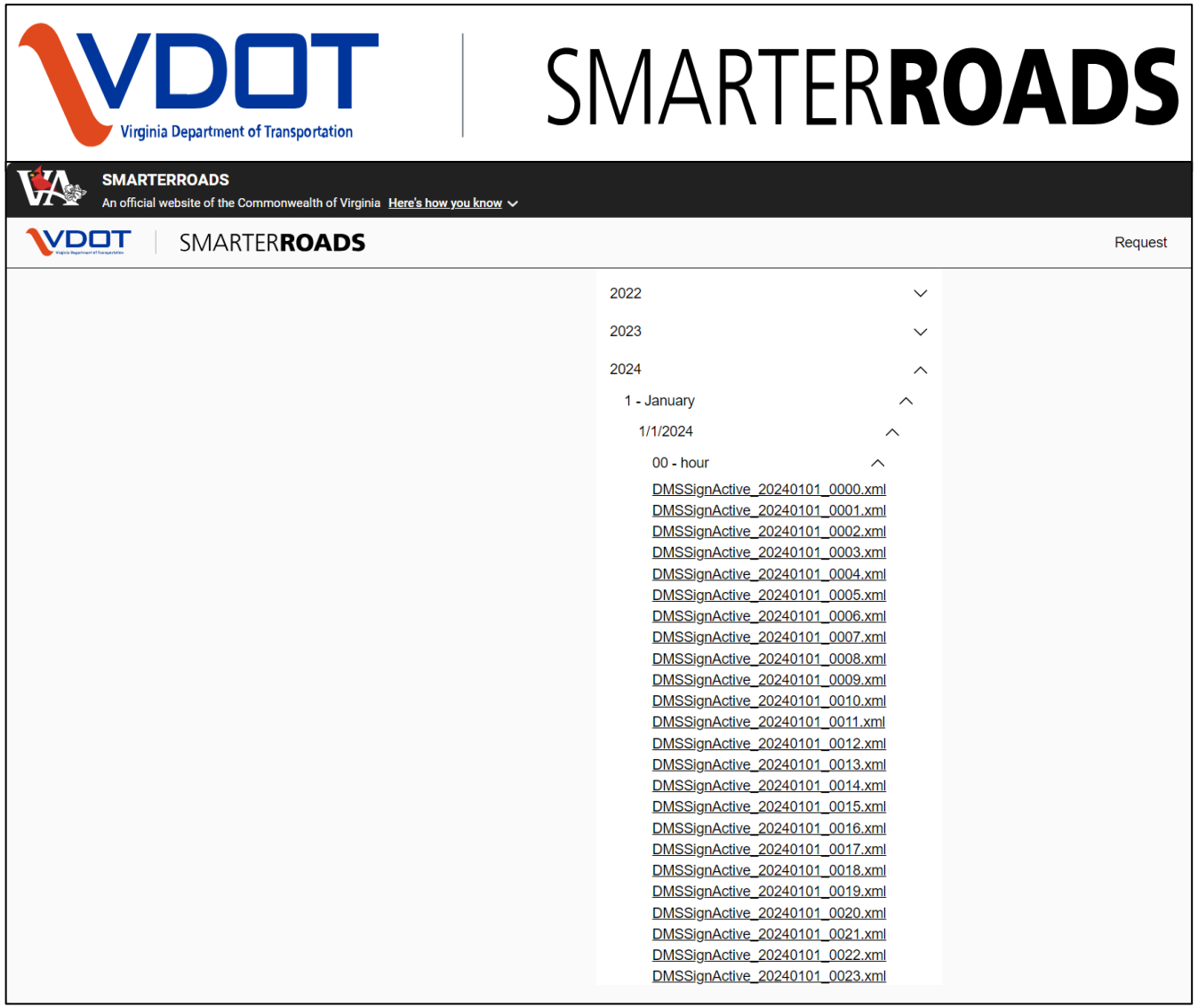
Project Background
Study DMS Network Scope

- Total **198 Existing DMS signs** in the district, with **165 General-purpose DMS**. **60 Proposed DMS** from HREL Project
- Duplication, redundancy and obsolete DMS issues were identified **mostly along I-264** and other major arterials
- Total **25 GP DMS** are identified and proposed to be removed or modified



Data and Analytics Approach

- **SmarterROADS - VDOT open data portal**
  - Processed millions of DMS message records on minute-level
  - Developed Python-based data pipeline for cleaning and analysis
- **StreetLight Traffic Data**
  - Integrated StreetLight traffic data for travel pattern/OD
- **HREL DB and all other related PS&E**
  - All future toll and GP DMS
- **511 VDOT**
  - Real-time Sign data
- **VDOT Maintenance Data log**
  - Installation Date and Structure evaluation
- **HMMS(Highway Maintenance Management System)**
  - maintenance and inspection data for supporting structures



DMS Evaluation Criteria

➢**Redundancy & Spacing**

Proximity of Signs with Similar Functions

➢**Asset Condition & Lifecycle**

Installation Age & Structure Condition

➢**Operational Performance**

Uptime/Online Minutes

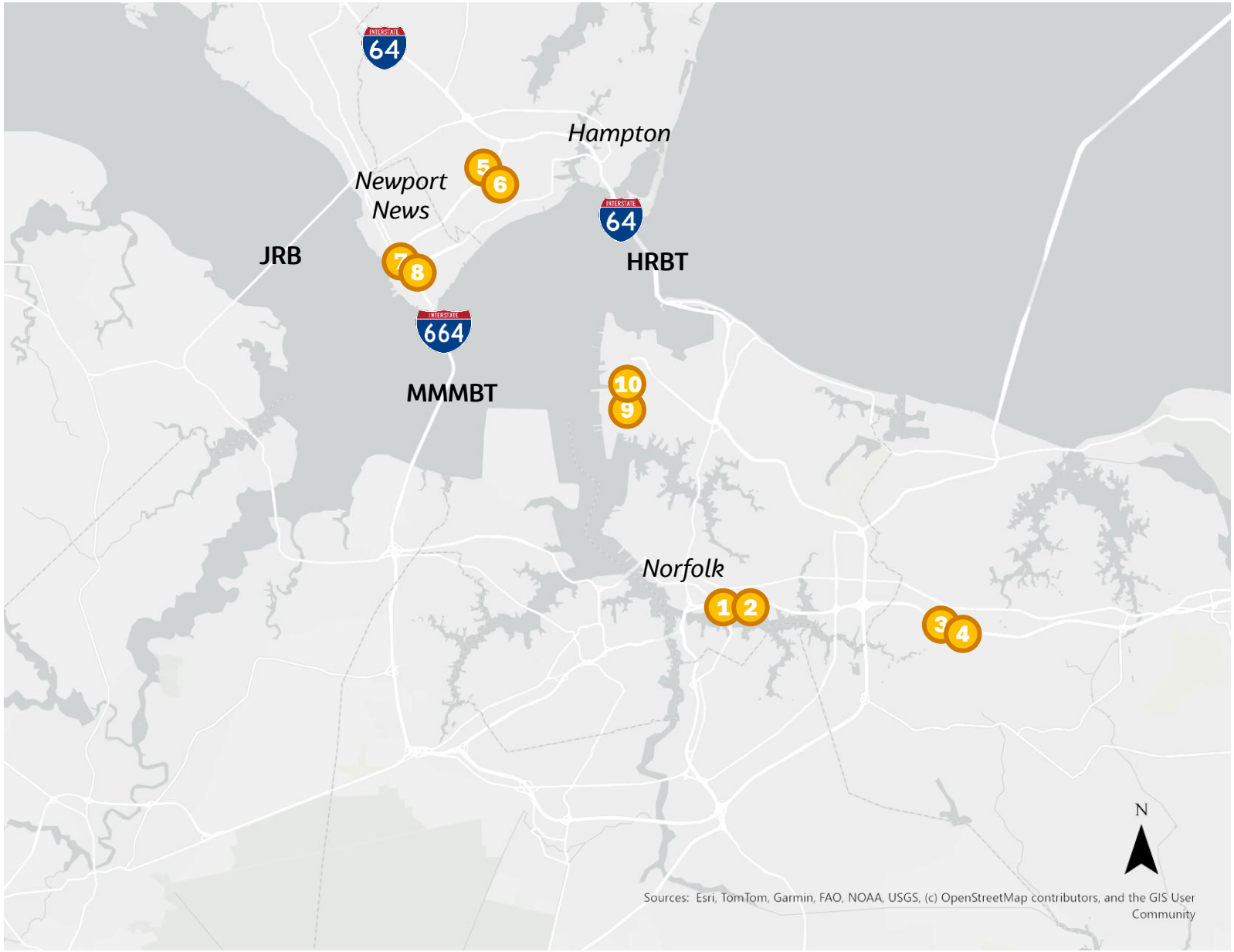
➢**Traffic Flow Pattern**

Alignment with Traffic Patterns and Demand

DMS Evaluation Criteria

DMS Locations and Analysis Types

- **1. I-264W MM9.6** vs **2. I-264W MM9.4**
  - Analysis by density
- **3. I-264W MM15.5** vs **4. I-264W MM16.9**
  - Analysis by Corridor
- **5. City Rt. 7059S MM 1.8** vs **6. City Rt. 7059N MM 1.2**
  - Analysis by installation year & traffic pattern
- **7. US-60E MM266.9** vs **8. City Rt. 7002E MM0.23**
  - Analysis by installation year & traffic pattern
- **9. USN-1** vs **10. USN-2**
  - Analysis by operational performance



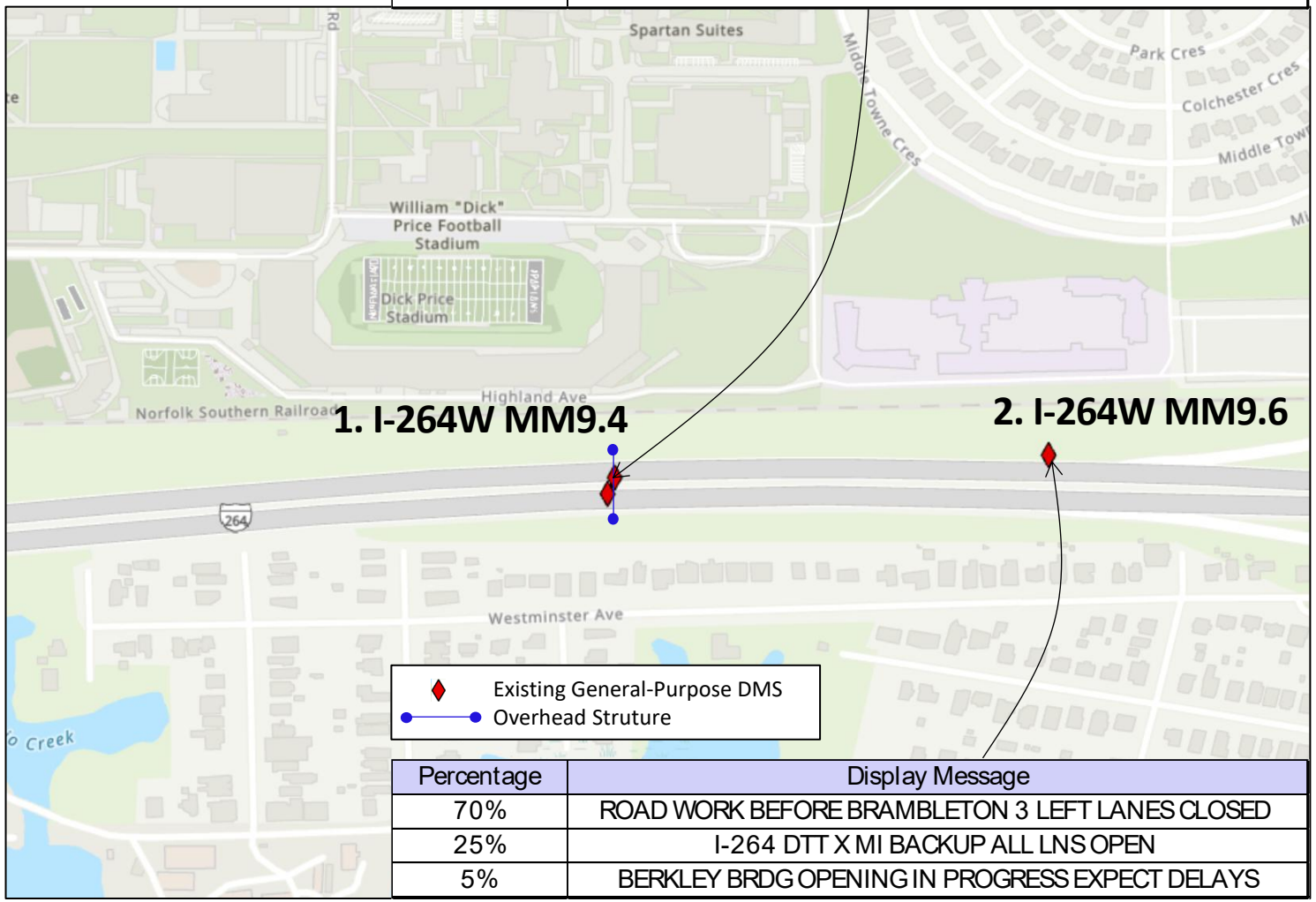
Representative DMS Analysis
Analysis by Density

- I-264W MM9.6 vs I-264W MM9.4
  - Displays the same message 90% of time
  - 850 feet away
  - Both were installed in 2013
  - Butterfly vs Overhead
  - 4 lanes segment

➢ **Recommendation**

- **Redundant coverage with no additional operational value and remove I-264W MM9.6 Butterfly DMS**

Percentage	Display Message
70%	ROAD WORK BEFORE BRAMBLETON 3 LEFT LANES CLOSED
25%	I-264 DTT X MI BACKUP ALL LNS OPEN
5%	BERKLEY BRDG OPENING IN PROGRESS EXPECT DELAYS



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70%	ROAD WORK BEFORE BRAMBLETON 3 LEFT LANES CLOSED
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5%	BERKLEY BRDG OPENING IN PROGRESS EXPECT DELAYS

Representative DMS Analysis

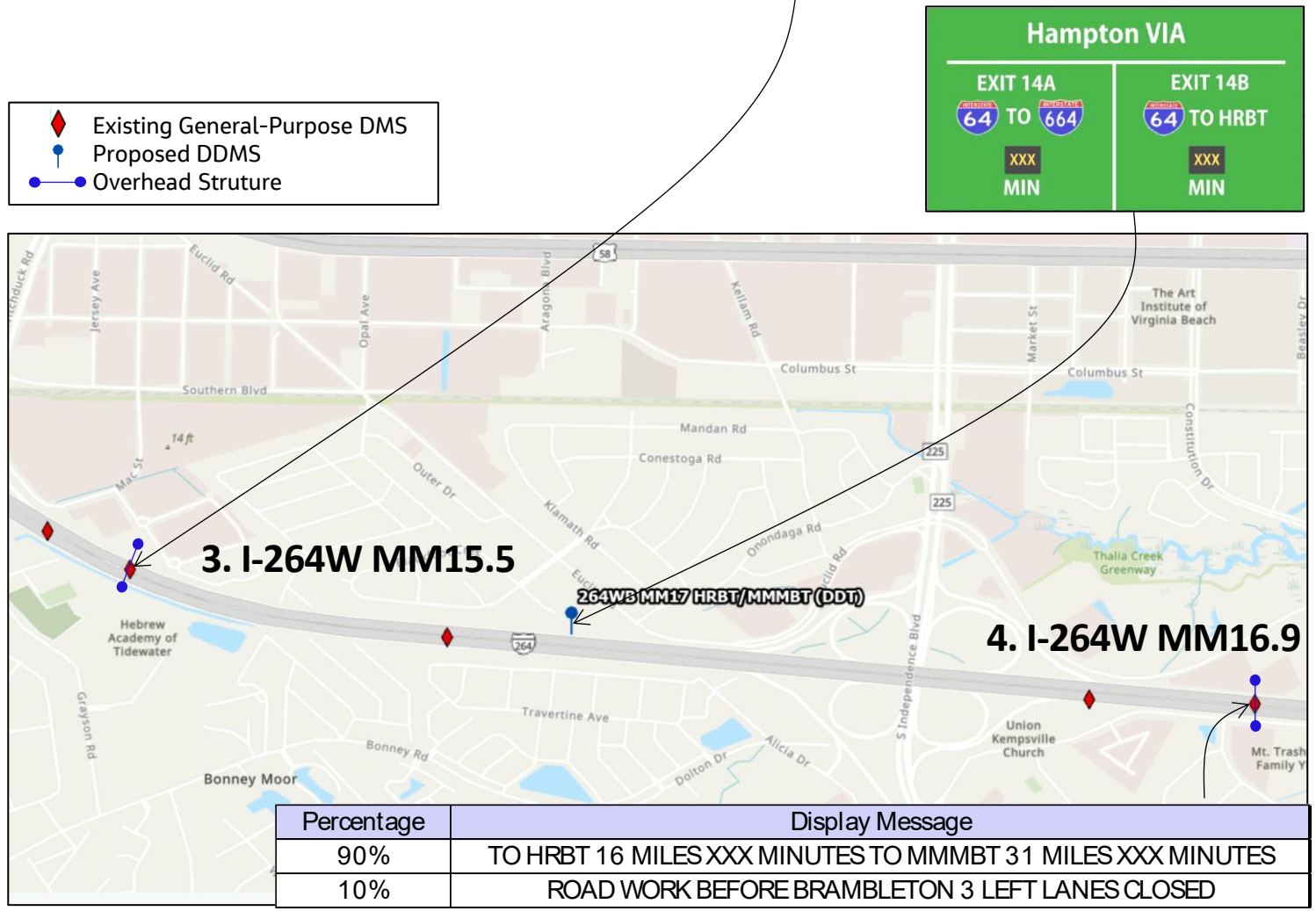
Analysis by Corridor

- I-264W MM15.5 vs I-264W MM16.9
  - Displays the same TT message 90% of time
  - 1 mile apart
  - **A proposed DDMS I-264W at MM16 will be used for TT**

➢ **Recommendation**

- **Remove I-264W MM16.9 to free up the downstream DMS with future DDMS**

Percentage	Display Message
90%	TO HRBT 16 MILES XXX MINUTES TO MMMBT 31 MILES XXX MINUTES
10%	BERKLEY BRDG SCHEDULED OPENING 2:30



Percentage	Display Message
90%	TO HRBT 16 MILES XXX MINUTES TO MMMBT 31 MILES XXX MINUTES
10%	ROAD WORK BEFORE BRAMBLETON 3 LEFT LANES CLOSED

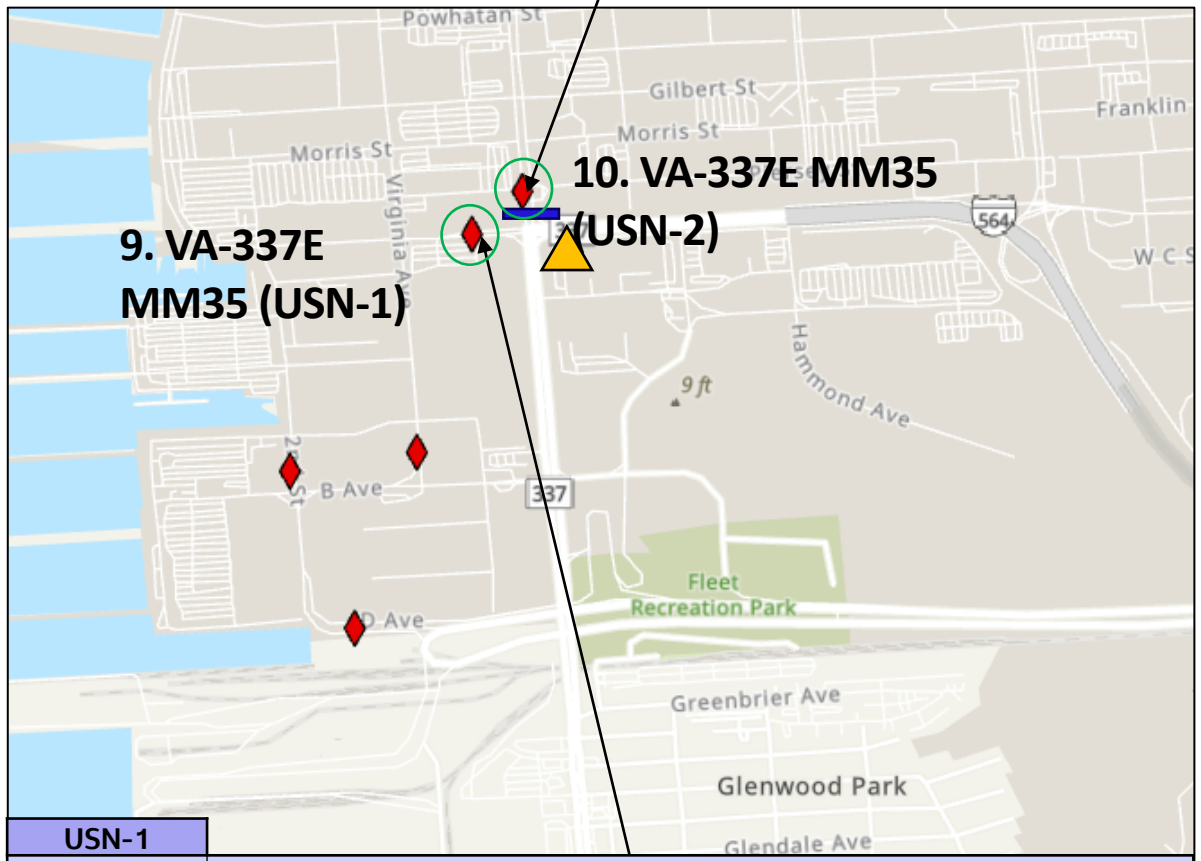
Representative DMS Analysis
Analysis by Performance

- USN-1 vs USN-2
  - USN-1 is **off most of time, <10min within one week**
  - 0.1 mile apart
  - Displays the same message
  - Both were installed in **1998**

➢ **Recommendation**

- **Combine and Relocate to nearby Naval Base gate**

USN-2	
Percentage	Display Message
70%	TO HRBT 9 MILES XXX MINUTES TO MMMBT 38 MILES XXX MINUTES
30%	ROAD WORK MESSAGE AND LANES COLSURE

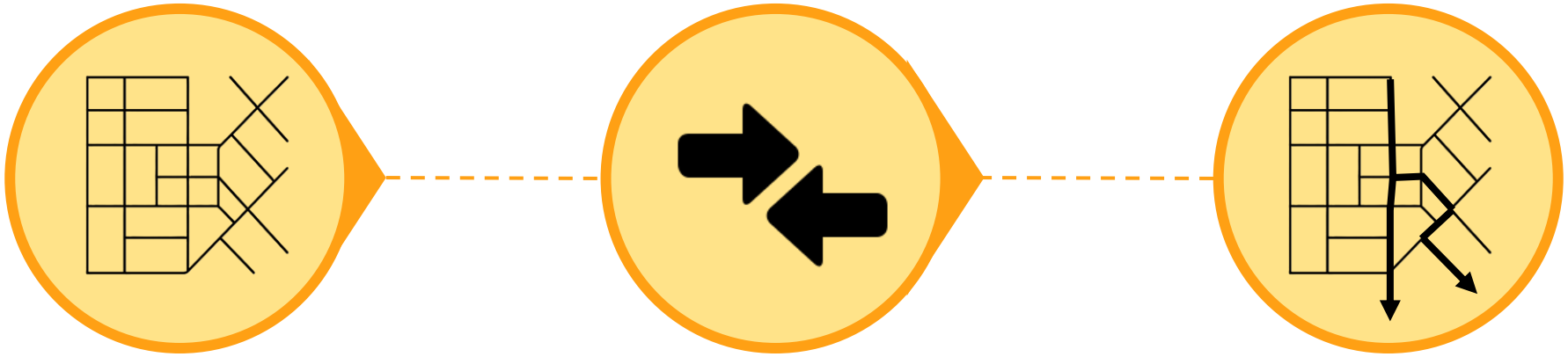


USN-1	
Percentage	Display Message
100%	TO HRBT 10 MILES XXX MINUTES TO MMMBT 38 MILES XXX MINUTES

Gate

Proposed new sign location

Traffic Flow Pattern Methodology



Identify Regional Traffic Patterns

Jacobs | STREETLIGHT DATA

Validate DMS Relevance against Traffic Demand

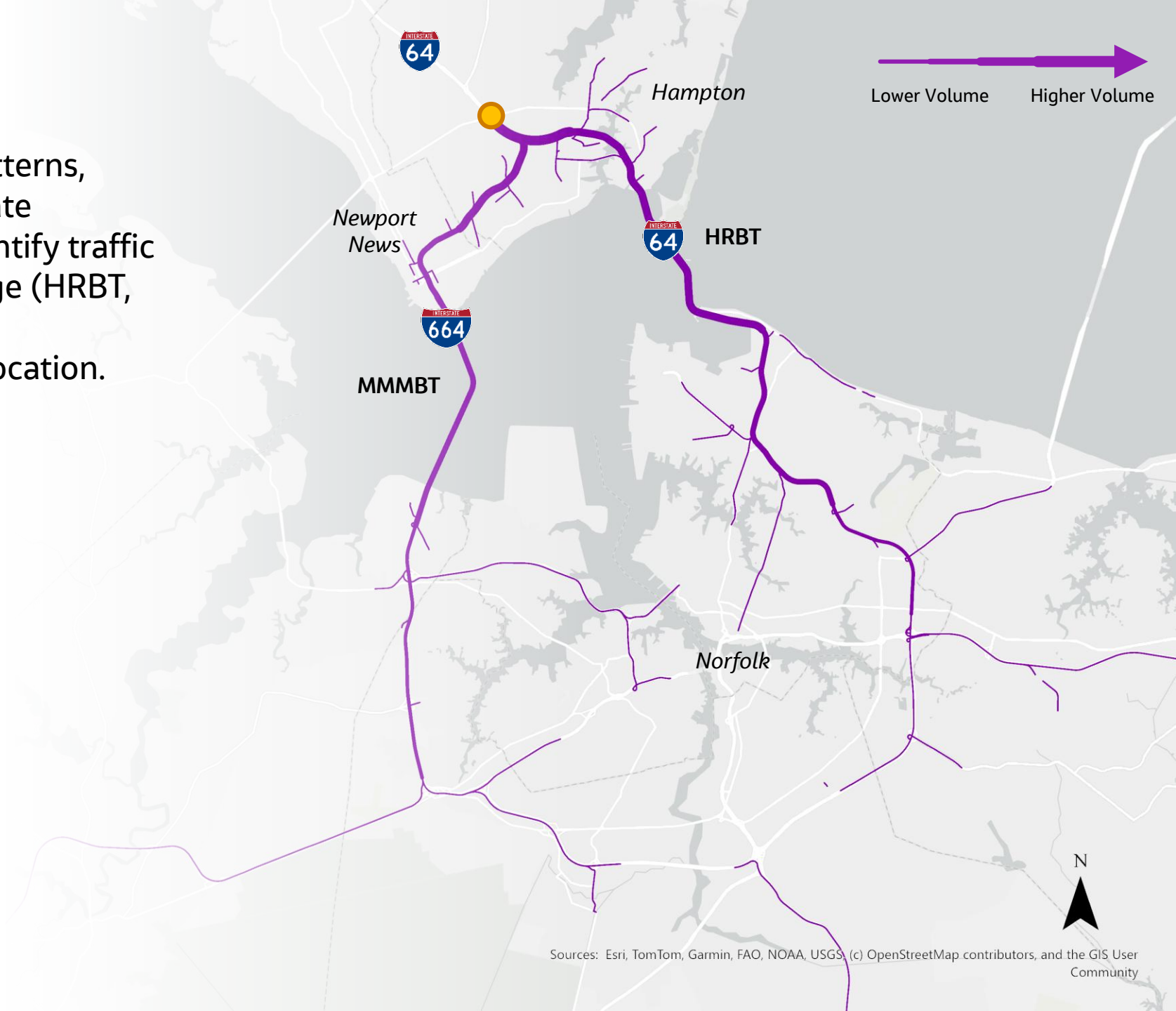
Evaluate Route Utilization (HRBT vs MMMBT vs JRB)

Traffic Flow Pattern

To better understand traffic flow patterns, **StreetLight Data** was used to evaluate regional travel movements and quantify traffic volumes passing through each bridge (HRBT, MMMBT, and JRB) and through the surrounding network at each DMS location.

StreetLight Metrics include:

- **Regional Traffic Patterns**
- **Traffic Patterns between Origins and Destinations**
- Traffic volume, speeds and travel time
- AADT
- Pedestrian, bike, and transit data



Representative DMS Analysis

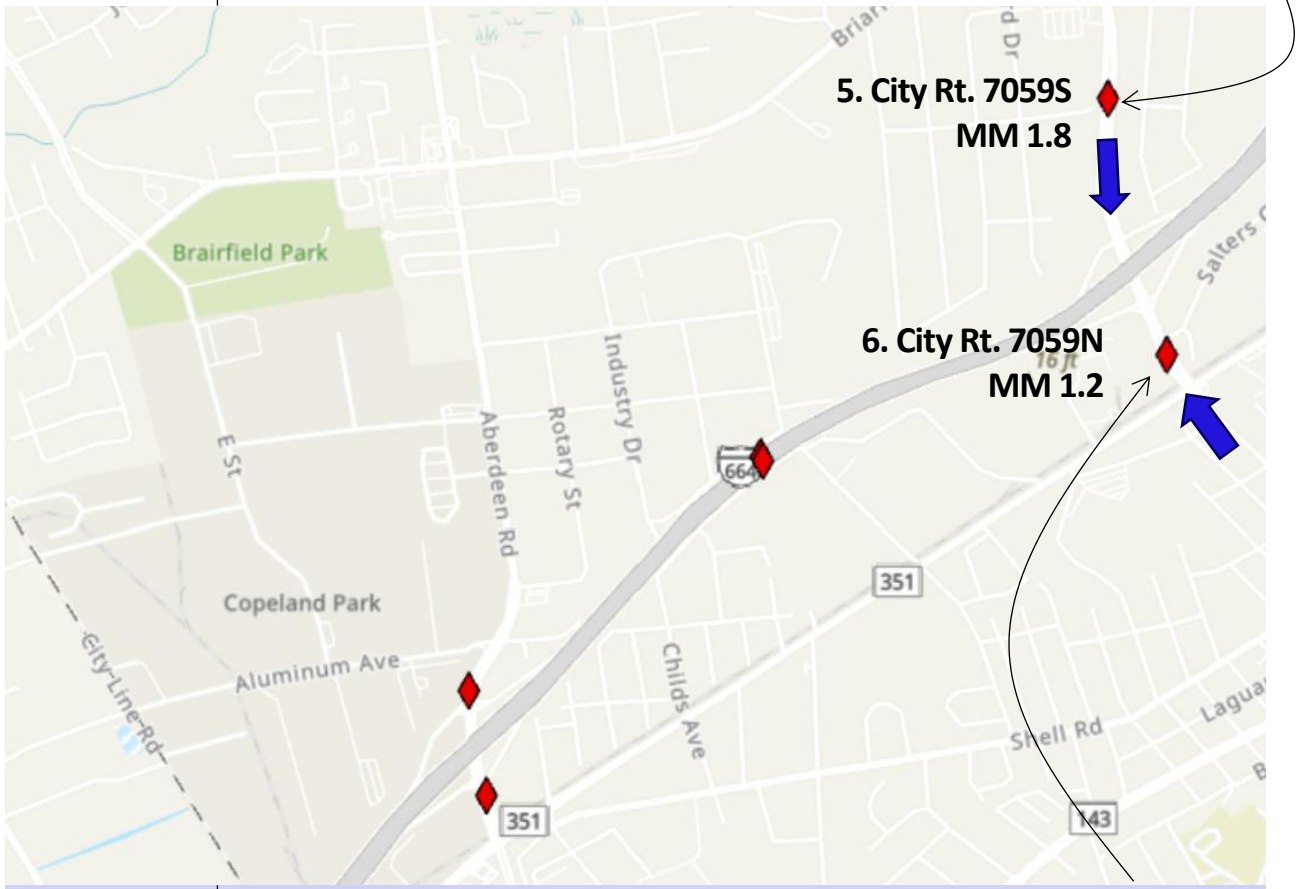
Analysis by **Installation Year** & **Traffic Pattern**

- **City Rt. 7059S MM 1.8** vs **City Rt. 7059N MM 1.2**
  - Display Travel Time message to **HRBT and MMMBT for 60% of time**
  - **Installed in 1998.** Both butterfly structured

1. City Rt. 7059S MM 1.8 (southbound)

2. City Rt. 7059N MM 1.2 (northbound)

Percentage	Display Message
60%	TO HRBT 8 MILES XXX MINUTES TO MMMBT 7 MILES XXX MINUTES
35%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED



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35%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED

Representative DMS Analysis

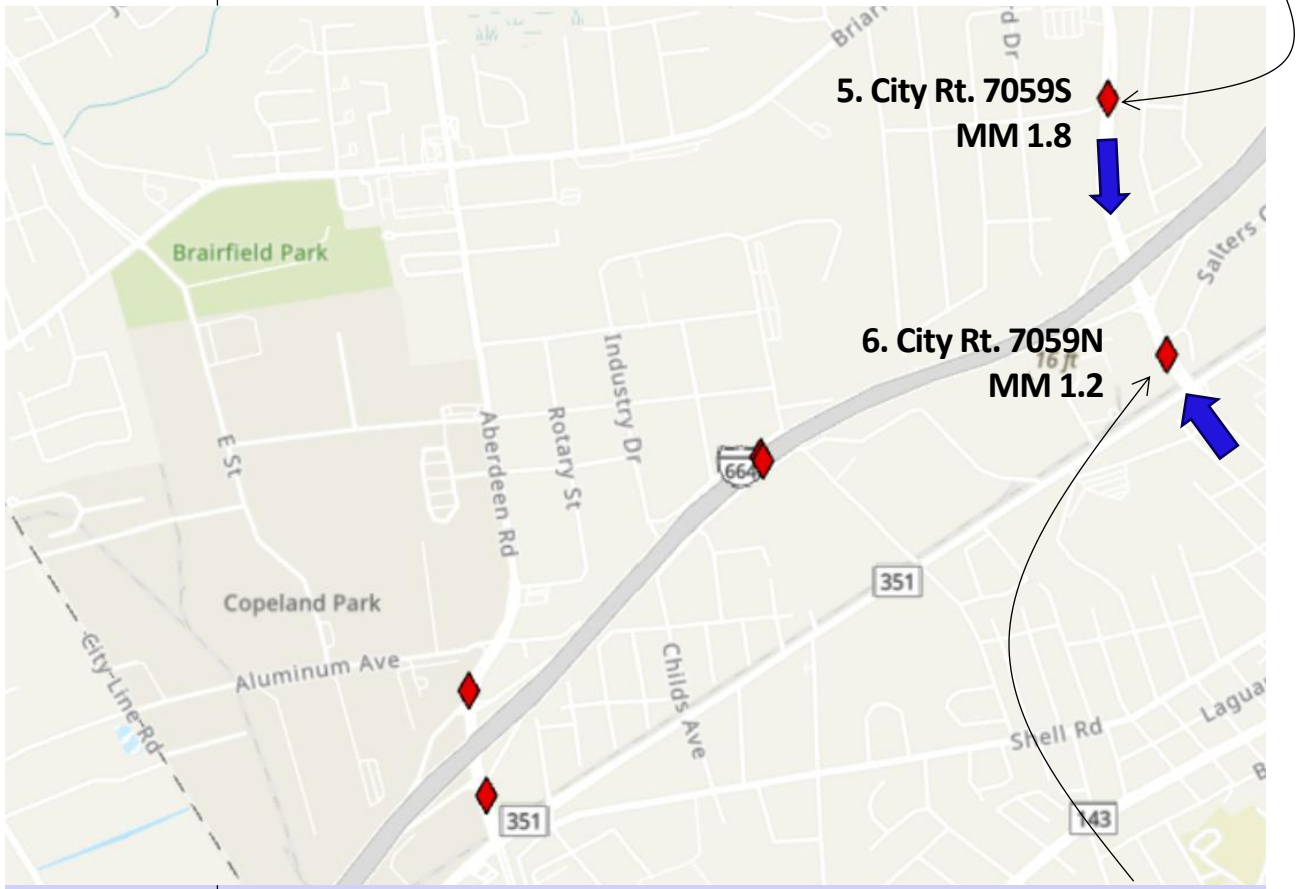
Analysis by **Installation Year** & **Traffic Pattern**

- **City Rt. 7059S MM 1.8** vs **City Rt. 7059N MM 1.2**
  - **Traffic Pattern:** Less than 300 trips daily to HRBT
  - **Recommendation:** **Propose to replace**

STREETLIGHT DATA	Total		HRBT		MMMBT	
	SB	NB	SB	NB	SB	NB
Daily, Weekday	4,500	8,800	100	260	570	700
Weekday AM (5 hr)	820	2,200	30	70	130	230
Weekday PM (5 hr)	1,300	2,200	15	20	120	100
Daily, Weekend	4,600	8,200	140	300	900	790

StreetLight Data, May – September, 2024

Percentage	Display Message
60%	TO HRBT 8 MILES XXX MINUTES TO MMMBT 7 MILES XXX MINUTES
35%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED



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60%	TO HRBT 8 MILES XXX MINUTES TO MMMBT 7 MILES XXX MINUTES
35%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED

Representative DMS Analysis

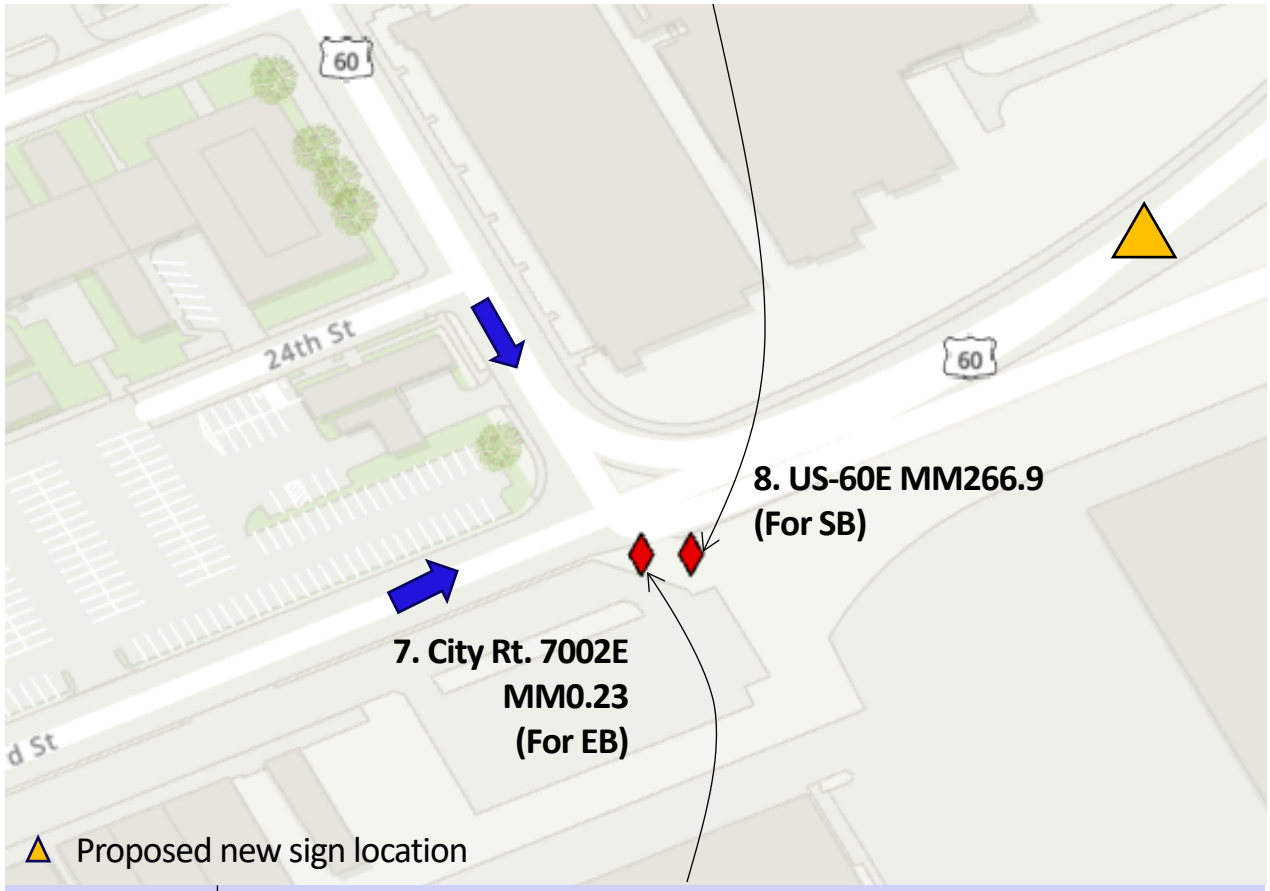
Analysis by **Installation Year** & **Traffic Pattern**

- **US-60E MM266.9** vs **City Rt. 7002E MM0.23**
  - Displays the same message **90% of time**
  - **Back-to back placement**
  - **Both were installed in 1998**

7. City Rt. 7002EMM0.23 (For EB)

8. US-60E MM266.9 (For SB)

Percentage	Display Message
65%	TO HRBT 11 MILES XXX MINUTES TO MMMBT 4 MILES XXX MINUTES
30%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED



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60%	TO HRBT 8 MILES XXX MINUTES TO MMMBT 7 MILES XXX MINUTES
35%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED

Representative DMS Analysis

Analysis by **Installation Year** & **Traffic Pattern**

- **US-60E MM266.9** vs **City Rt. 7002E MM0.23**

➢ Recommendation ▲

- Remove both signs
- Proposed a new DMS on the existing US-60 on-Ramp overhead structure

STREETLIGHT DATA	Total		HRBT		MMMBT		JRB	
	SB	EB	SB	EB	SB	EB	SB	EB
Daily, Weekday	9,100	800	500	200	3,100	200	60	60
Weekday AM (5 hr)	3,100	150	90	40	600	40	<10	<10
Weekday PM (5 hr)	1,800	170	100	40	960	40	20	30
Daily, Weekend	4,600	320	270	90	2,200	80	30	20

StreetLight Data, May – September, 2024

Percentage	Display Message
65%	TO HRBT 11 MILES XXX MINUTES TO MMMBT 4 MILES XXX MINUTES
30%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED

Percentage	Display Message
60%	TO HRBT 8 MILES XXX MINUTES TO MMMBT 7 MILES XXX MINUTES
35%	ROAD WORK MESSAGE AND LANES COLSURE
5%	INCIDENT MESSAGE AND LANES BLOCKED

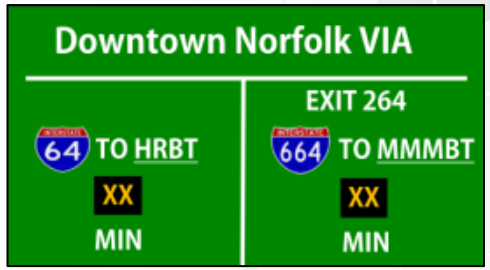
DDMS Face Conceptual Plan – StreetLight O-D Analysis

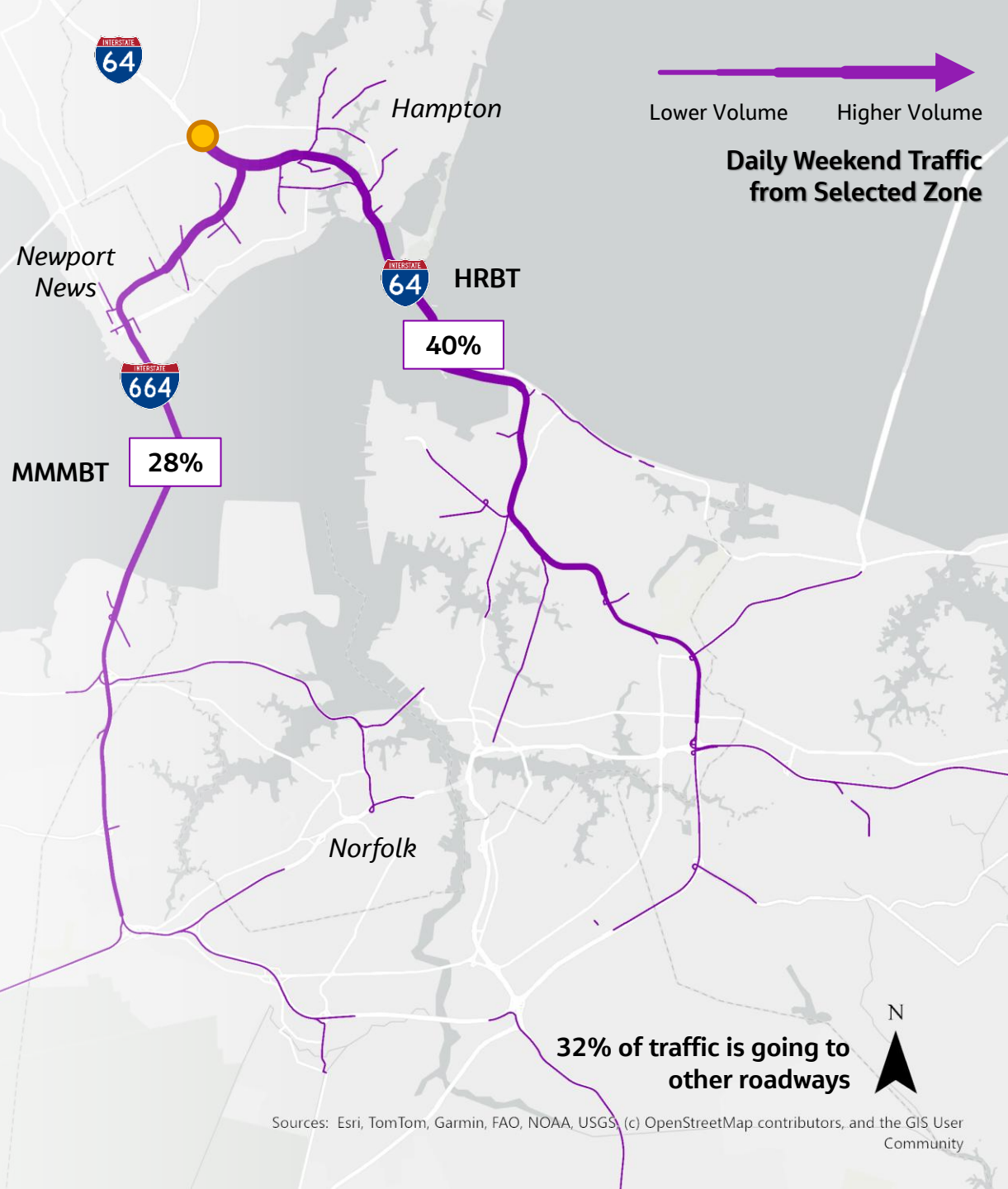
I-64 EB MM263.2

- Utilization at HRBT and MMMBT supports proposed sign location
- Sign Location: No Major Constructability Issues

STREETLIGHT DATA	Total	HRBT	MMMBT
Daily, Weekday	71,000	24,500	17,500
Weekday AM (3 hr)	14,000	4,500	3,500
Weekday PM (5 hr)	22,500	7,500	6,000
Daily, Weekend	64,500	25,500	18,000

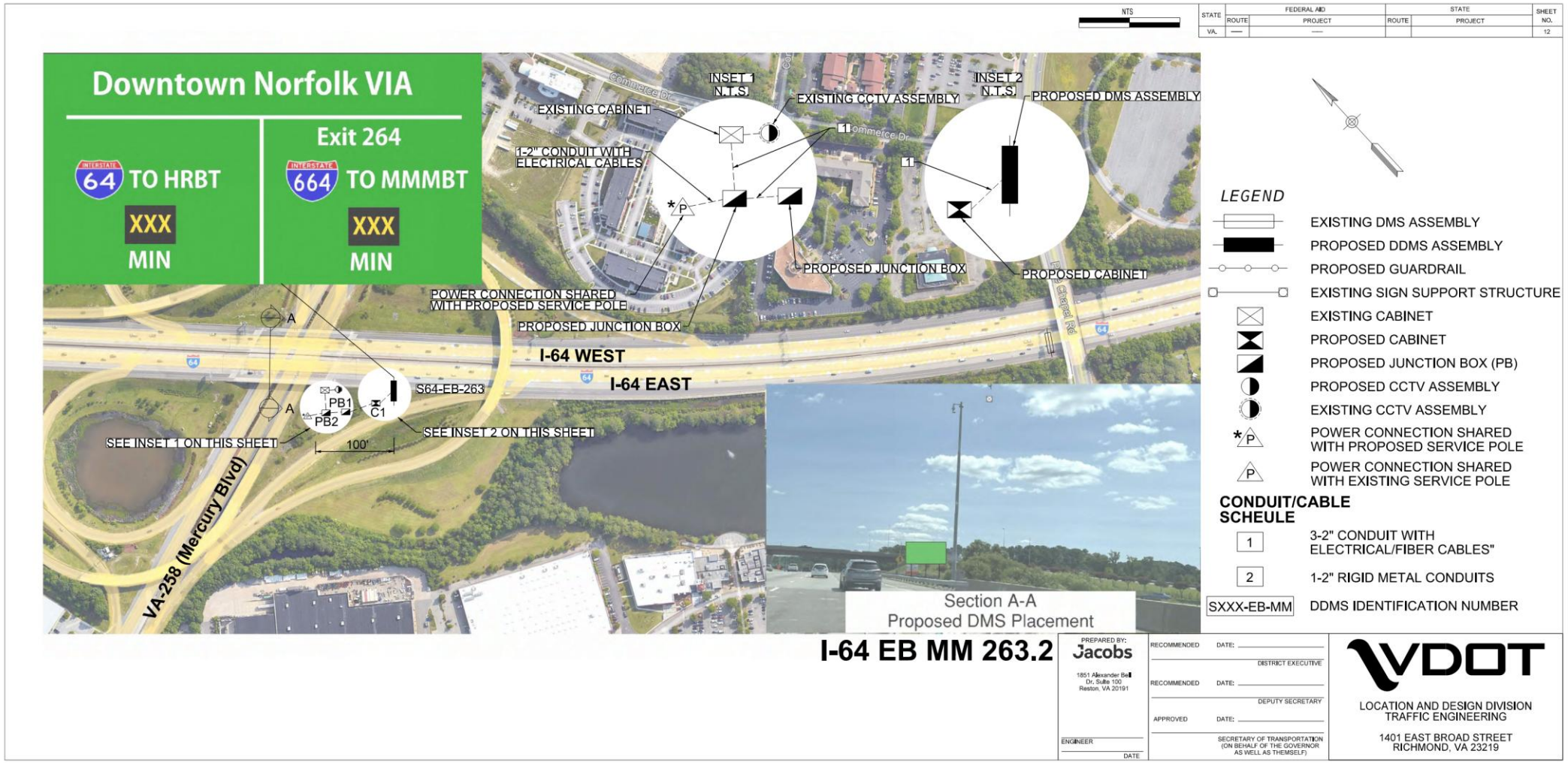
2023 March and April Streetlight Data





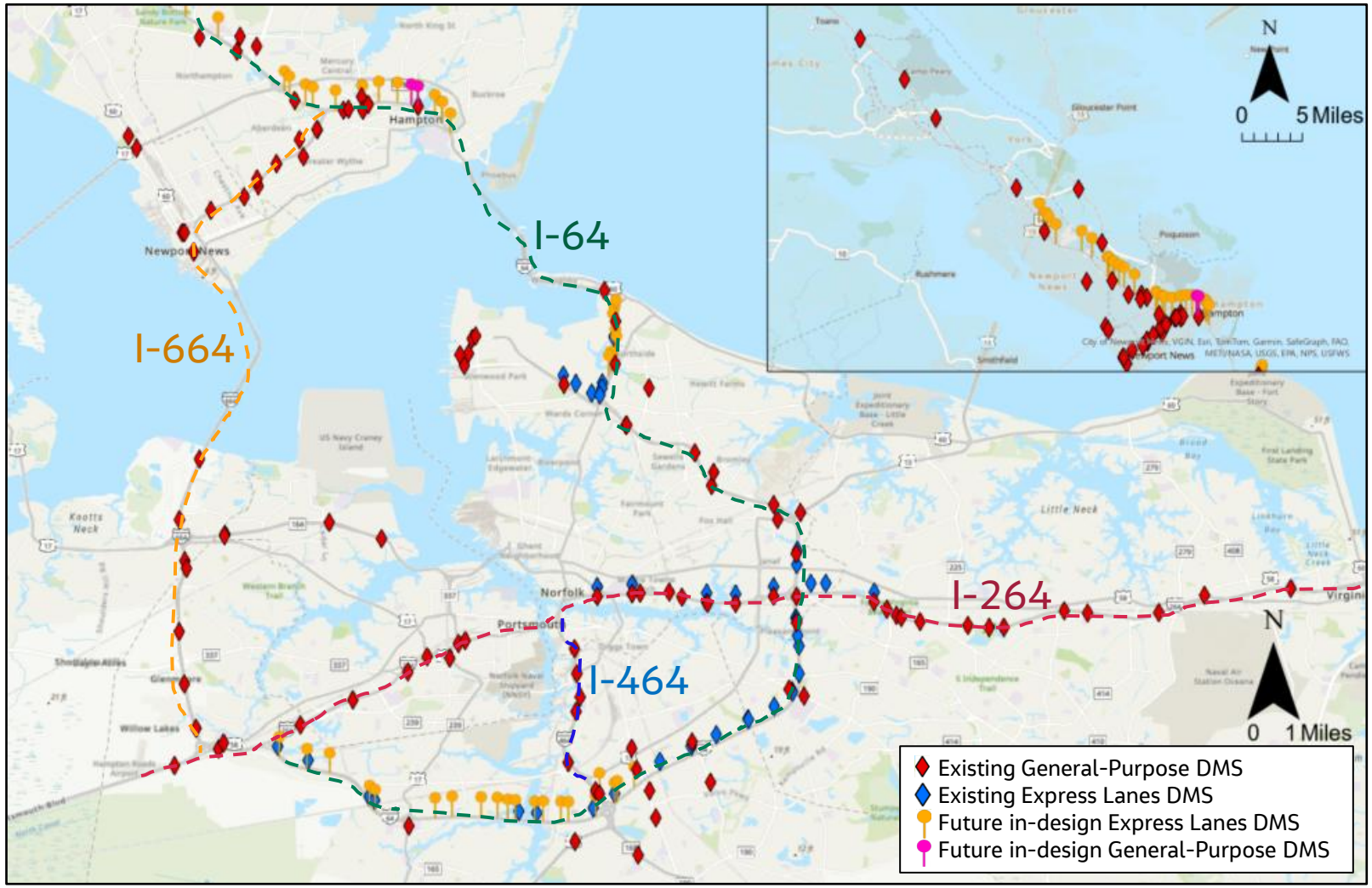
DDMS Conceptual Plan

I-64 EB MM 263.2



Analysis Final Finding

- Identified 25 redundant/obsolete DMS.
- Optimized 17 new DDMS sign Design
- Potential $1 million O&M annually.
- Improved network-level messaging efficiency at TMC.



Next Steps and Future Plans

- Development of Design Plans
  - Create site-specific designs for DMS removal, relocation, or modification
  - Ensure alignment with VDOT's infrastructure goals
- Repurposing and Optimization of Freed-Up DMS
  - Address high-crash areas
  - Enhance network coverage
  - Adapt to changing traffic patterns
- Review of Existing ATMS Capacity
  - Evaluate and upgrade ATMS for emerging technologies
  - Prepare for machine learning and connected vehicle infrastructure
- Enhancing Maintenance Efficiency
  - Streamline the DMS network
  - Improve ATMS to reduce maintenance burden
  - Effectively allocate resources as ITS installations increase.

Thank you
Q & A

Contact

Perry Xu, PE: Perry.Xu@Jacobs.com

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