# Congestion Prediction Using CV Data and Machine Learning –

## The Chesapeake Bay Bridge Queue Detection and Prediction Web Application


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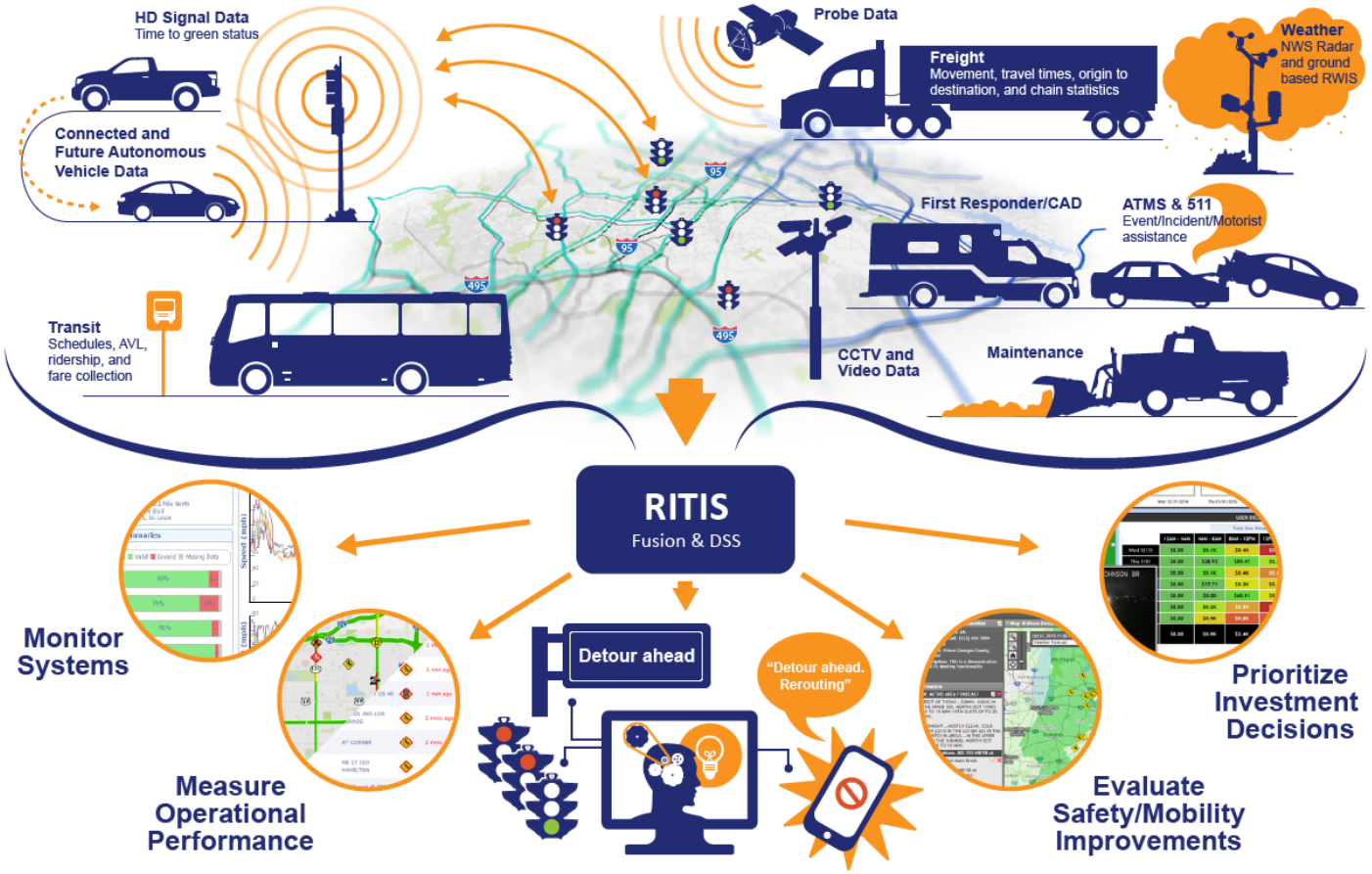
# Agenda

- Background
  - Time to reconfigure
- Web Application Overview
  - Operational view
  - Sensor interaction
  - Identification of Queues
  - Queue prediction
- Demonstration
- Q and A




https://ritis.org

# Chesapeake Bay Bridge

# William P. Lane Jr. Memorial Bay Bridge - Background

- Two spans of Bay Bridge (nominal conditions)
  - Northern span (3 lanes) carries WB traffic
  - Southern space (2 lanes) carries EB
  - Closing of ANY lane if a work zone in place
  - Contraflow supported by center 3 lanes
- Lane reconfigurations take up to 30 to 45 min., moving toward 15 min.
  - Lane configuration decision making typically 15 minutes
- Queues develop prior to reconfig during peak season
- **GOAL**: Identify upcoming congestion with sufficient notice to reconfigure the lanes before the congestion occurs

# Bay Bridge Queue Detection - Motivations

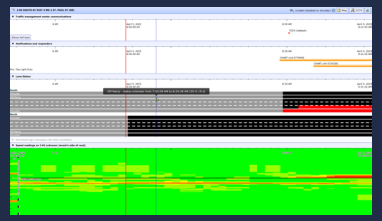
- Identify upcoming congestion with sufficient notice to reconfigure lanes prior to severe congestion
- MDTA engaged with the CATT Lab
  - Identify current queues
  - ***Predict*** future queues
- Optimizing capacity allocation on the bridge


From a manual ad-hoc decision process → To an automated data-driven system

# Bay Bridge Web App Functions

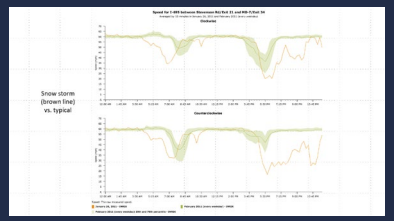
## Real Time Operational Insights and Queue Prediction

Event Identification

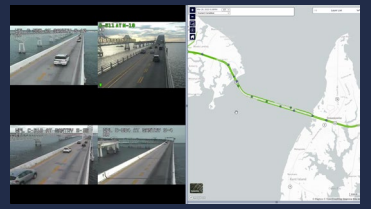


Situational Awareness

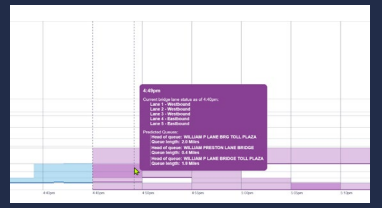
Volumes and Speeds




Cameras and Weather



Bottleneck/Queue Prediction



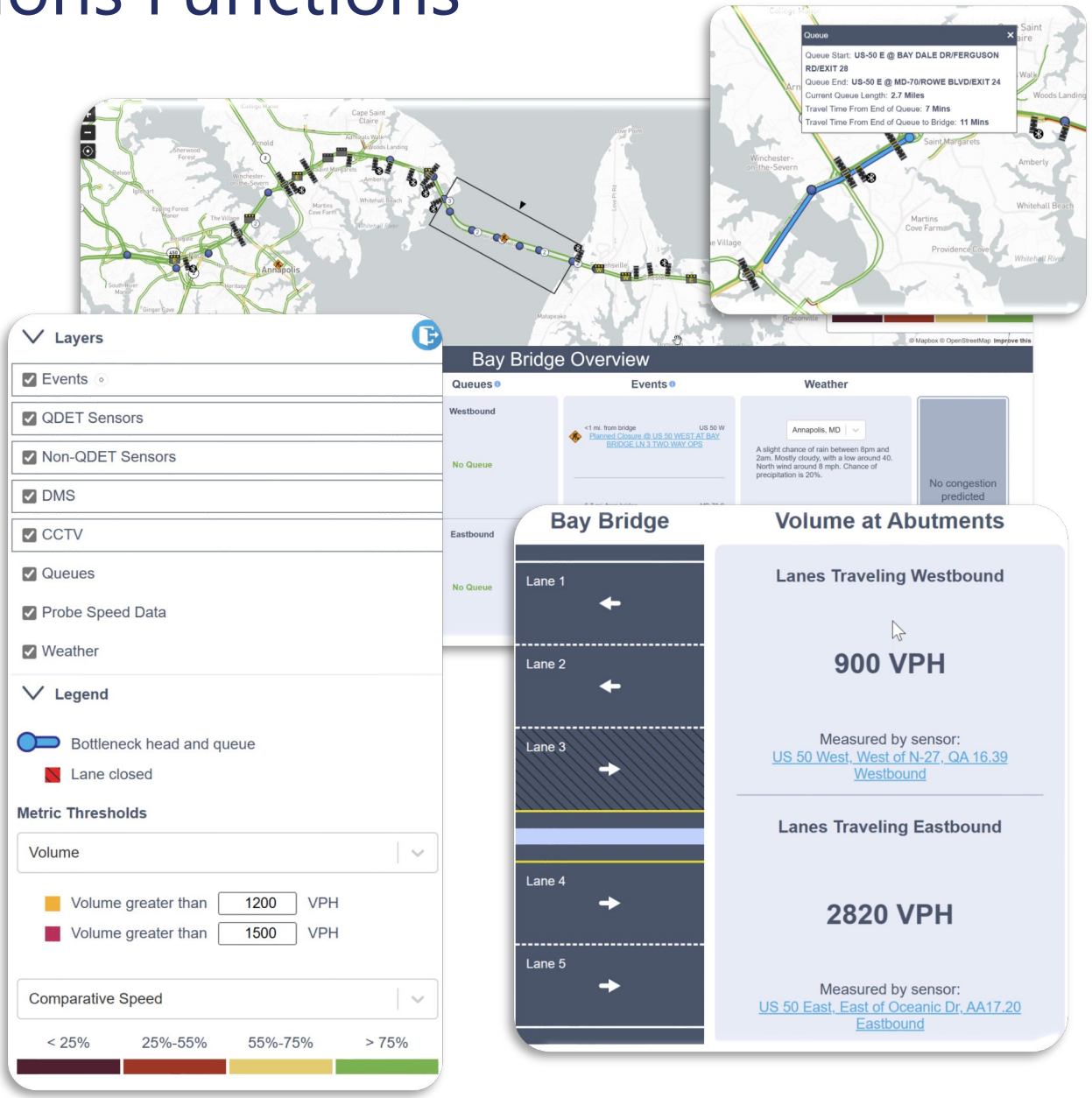
Queue Detection

# Bay Bridge Web App – Operations Functions

## Bay Bridge and Beyond

## Real-Time Situational Awareness

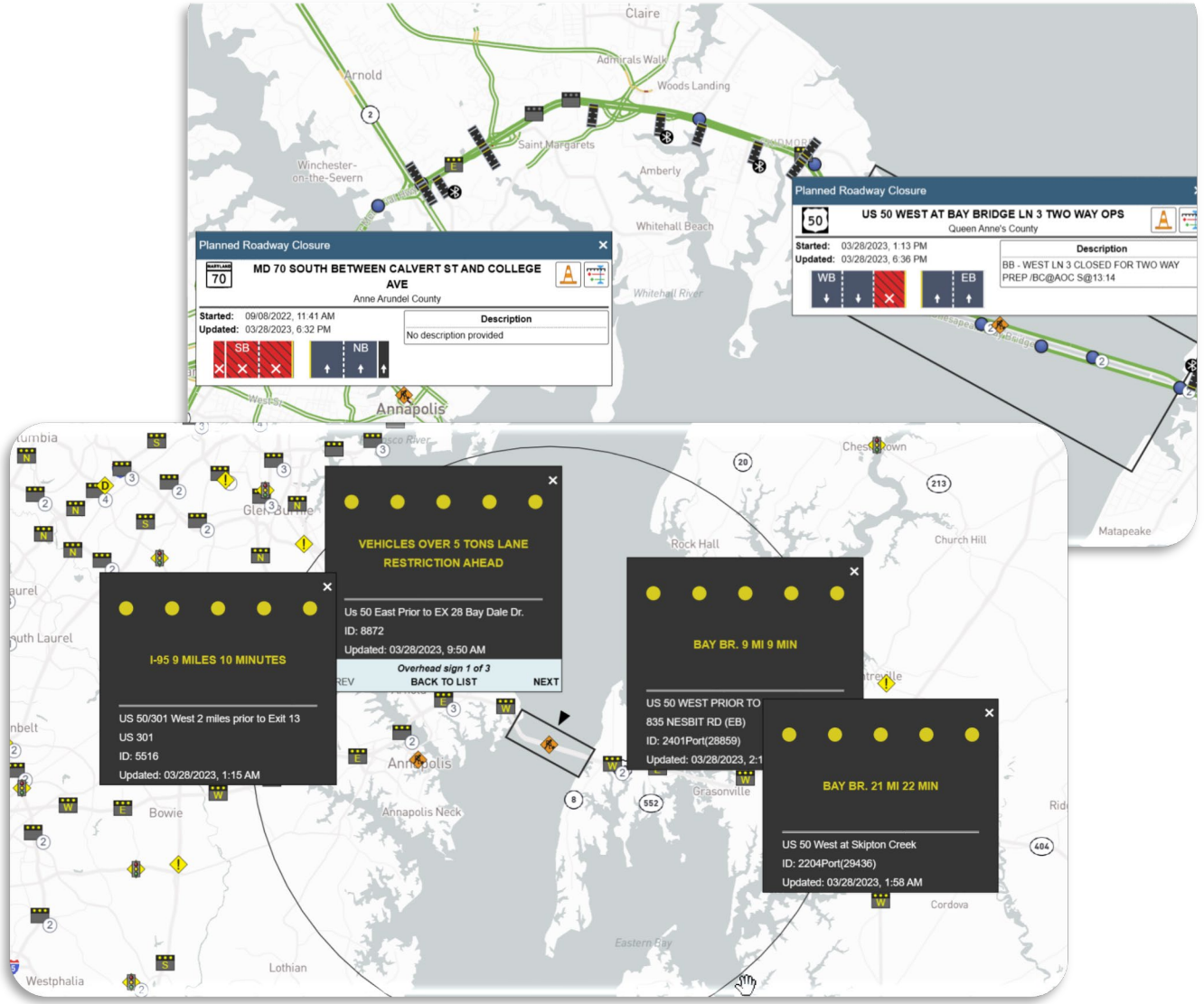
- Traffic
  - Speed/comparative speed/congestion/avg congestion
- Dynamic message signs, CCTV feeds
- Traffic events
- Traffic queues
- Real-time weather radar
- Volume and speed sensor insights with complementary roadway lane diagrams



# Bay Bridge Web App – Event Identification

## Event Integration

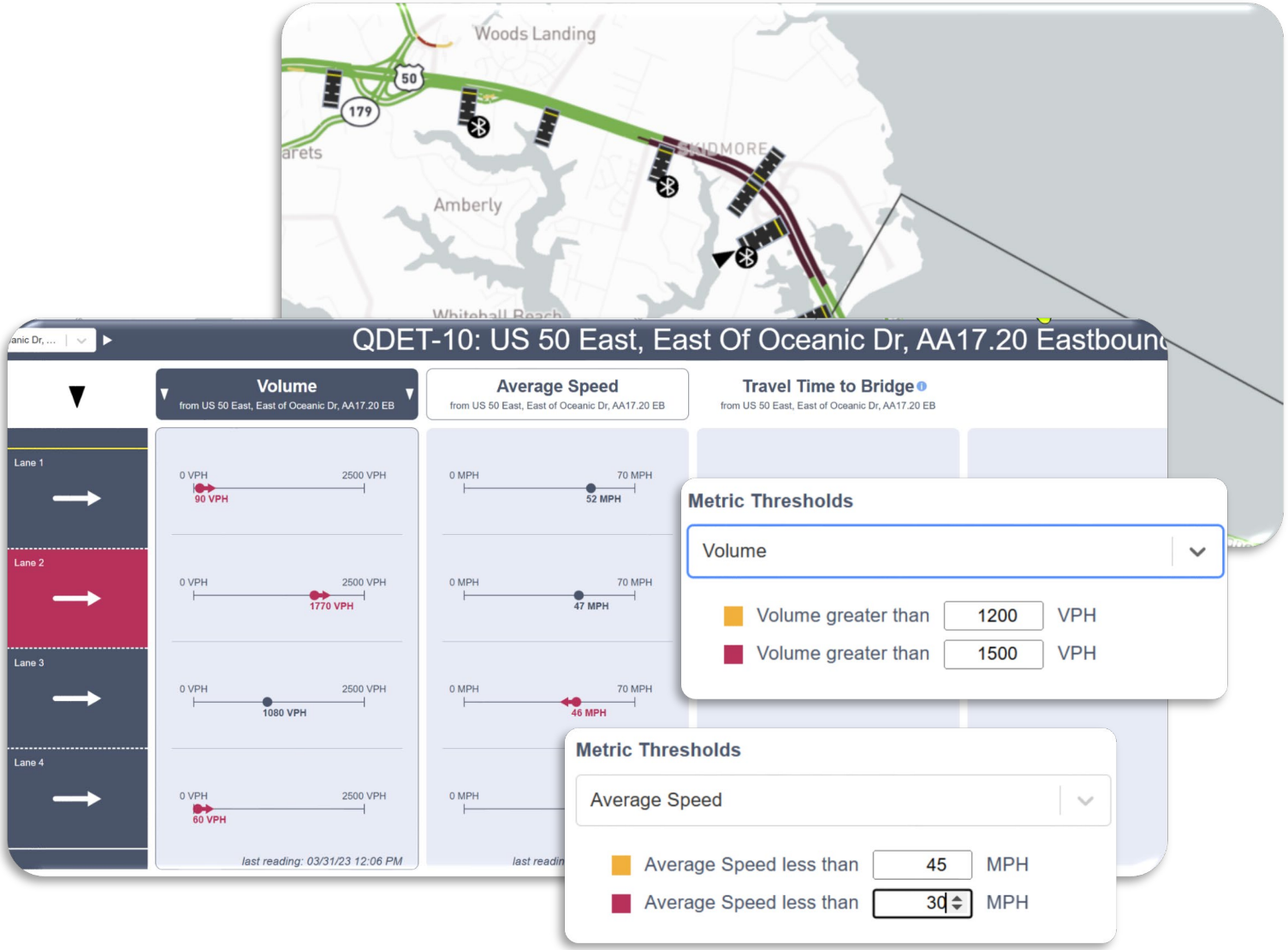
- Work zones
- Crashes
- Reported congestion
- Facility issues
- Roadway obstructions
- Dynamic message sign messaging
- The mapping of real-time weather alerts from the National Weather Service



# Bay Bridge Web App – Volume and Speed Insights

## Roadside Detector Volume and Speed

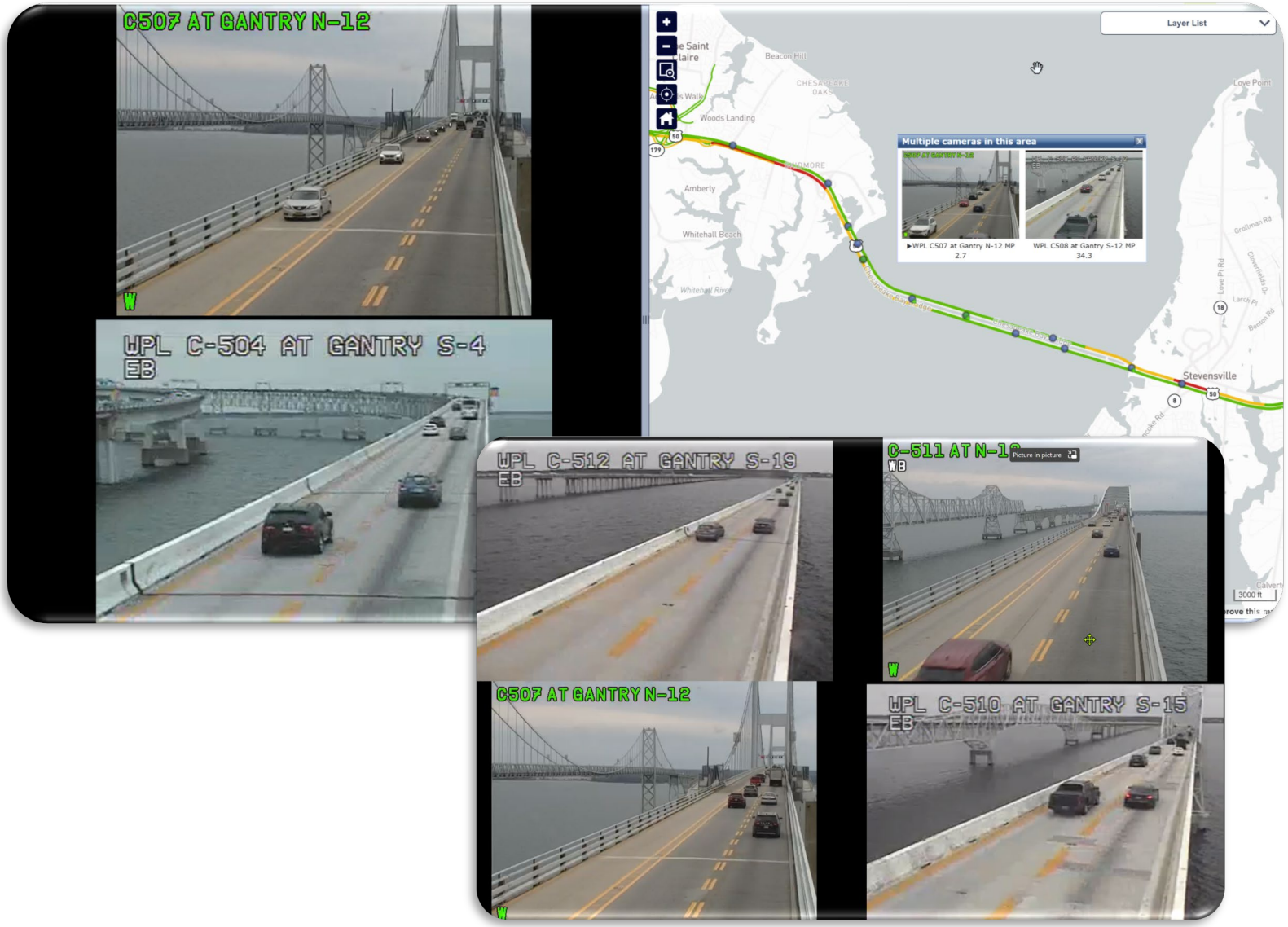
- Traditional radar sensors
- Bluetooth sensors with travel time integration
- Lane specific data visualizations for speed and volume
- Configurable speed and volume legend for lane color rendering



# Bay Bridge Web App – CCTV Integration

MDOT CCTV Video Feeds

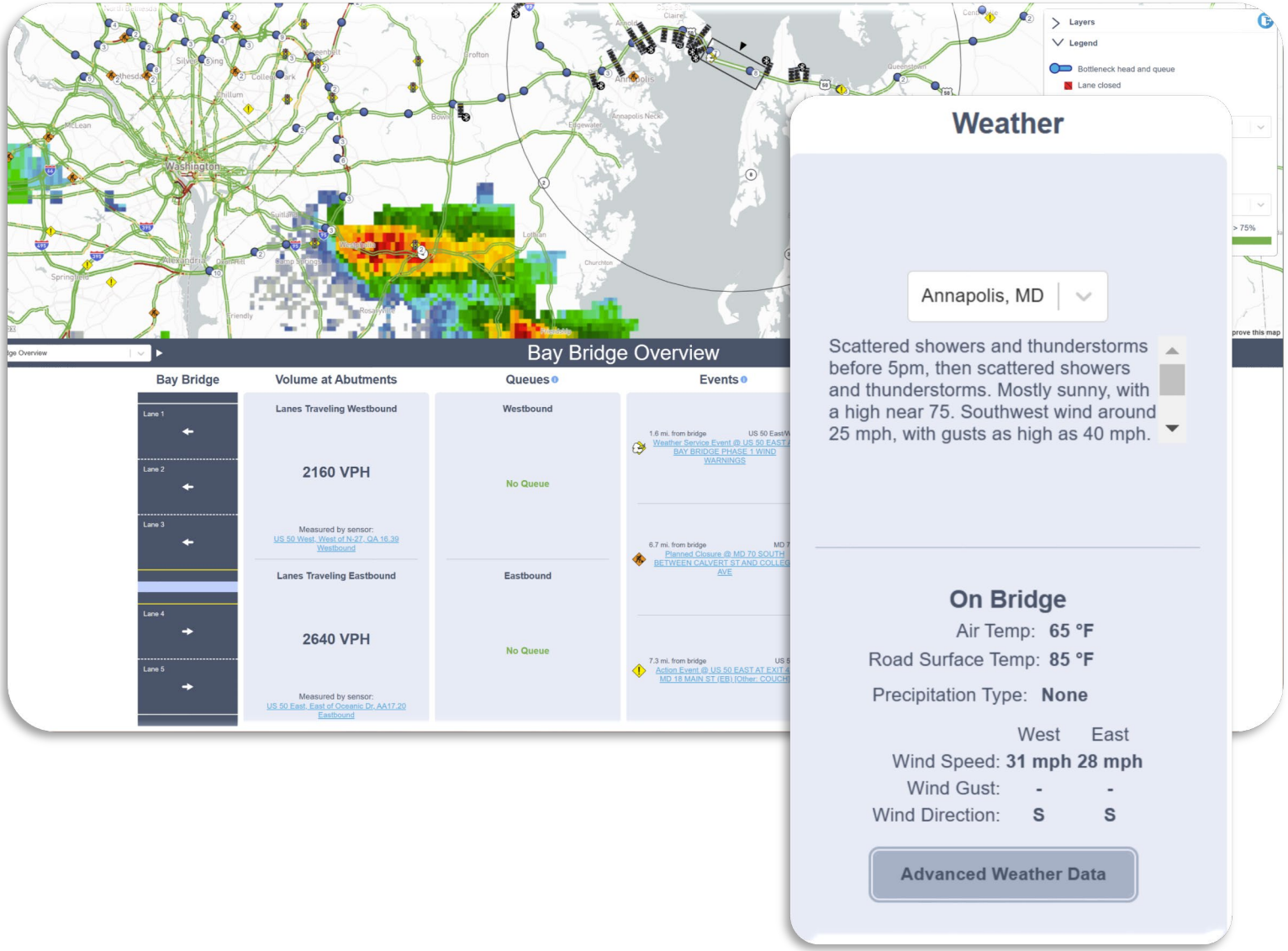
- Additional layer to map
- Accessed via RITIS integration today
- Configure your own video wall
- Supports multi-monitor ops center configurations



# Bay Bridge Web App – Weather

## Weather Layer Insights

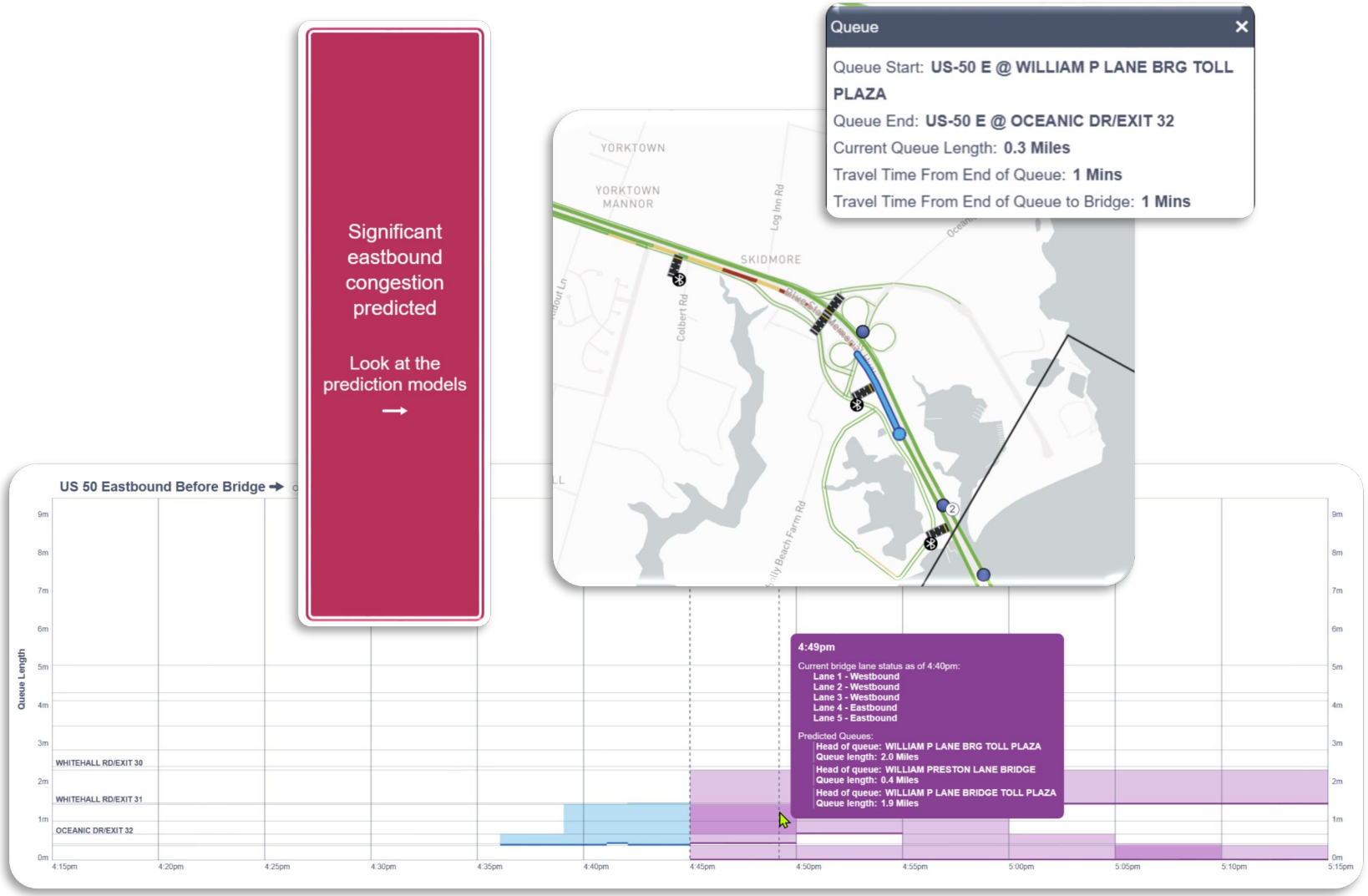
- NOAA near-term predictions
- FHWA RWIS sensors on the bridge
- Bridge wind speed
- Advanced Weather Data
  - shows the complete RWIS feed from the center of the bridge
- Weather radar



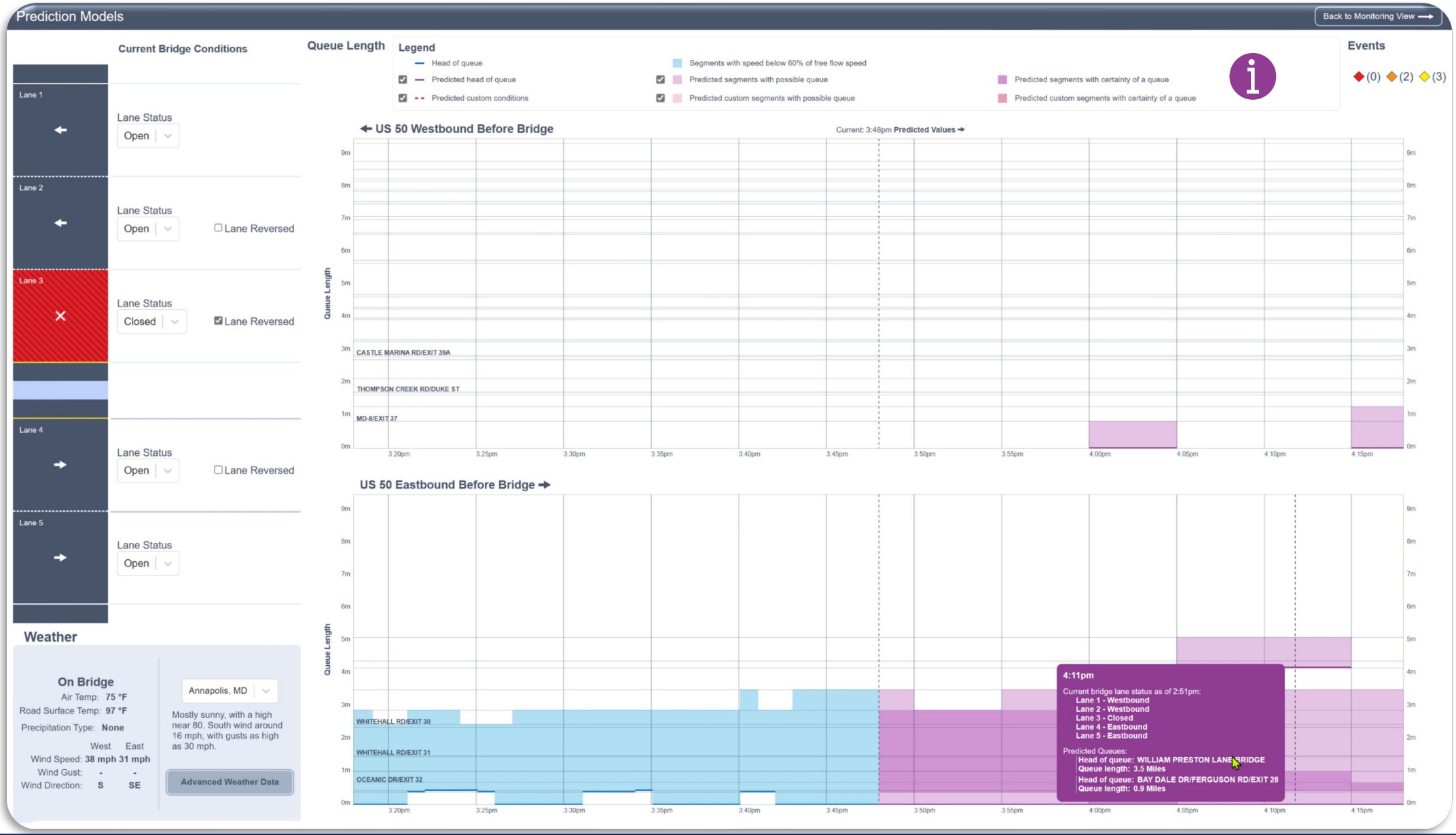
# Bay Bridge Web App – Queue Prediction View

## Queue Prediction

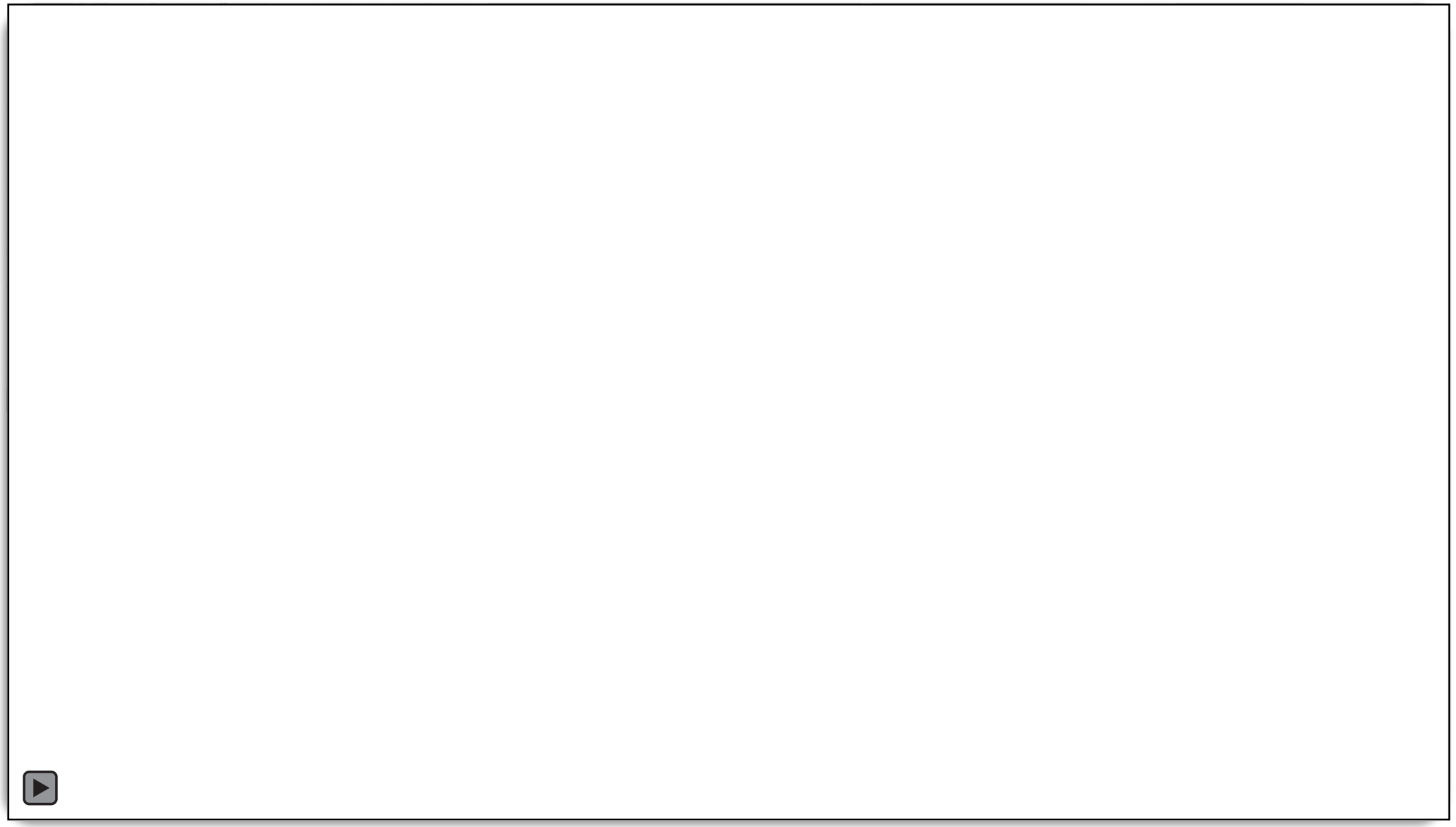
- Hypothetical lane configurations
  - Open/closed/reversed
- Current and Forecasted Queues
  - Up to 30-minute forecast
- Existing queues
- Forecasts with level of certainty



# Bay Bridge Web App – Queue Prediction View (detail)



# Bay Bridge Web App – Queue Prediction View (video demo)



# Q&A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# RITIS – Bay Bridge Web App Resources

- Bay Bridge Web App Video Tutorial
  - https://vimeo.com/803837172
- Copy of today's slide deck
  - Click here
- Personal demo of app

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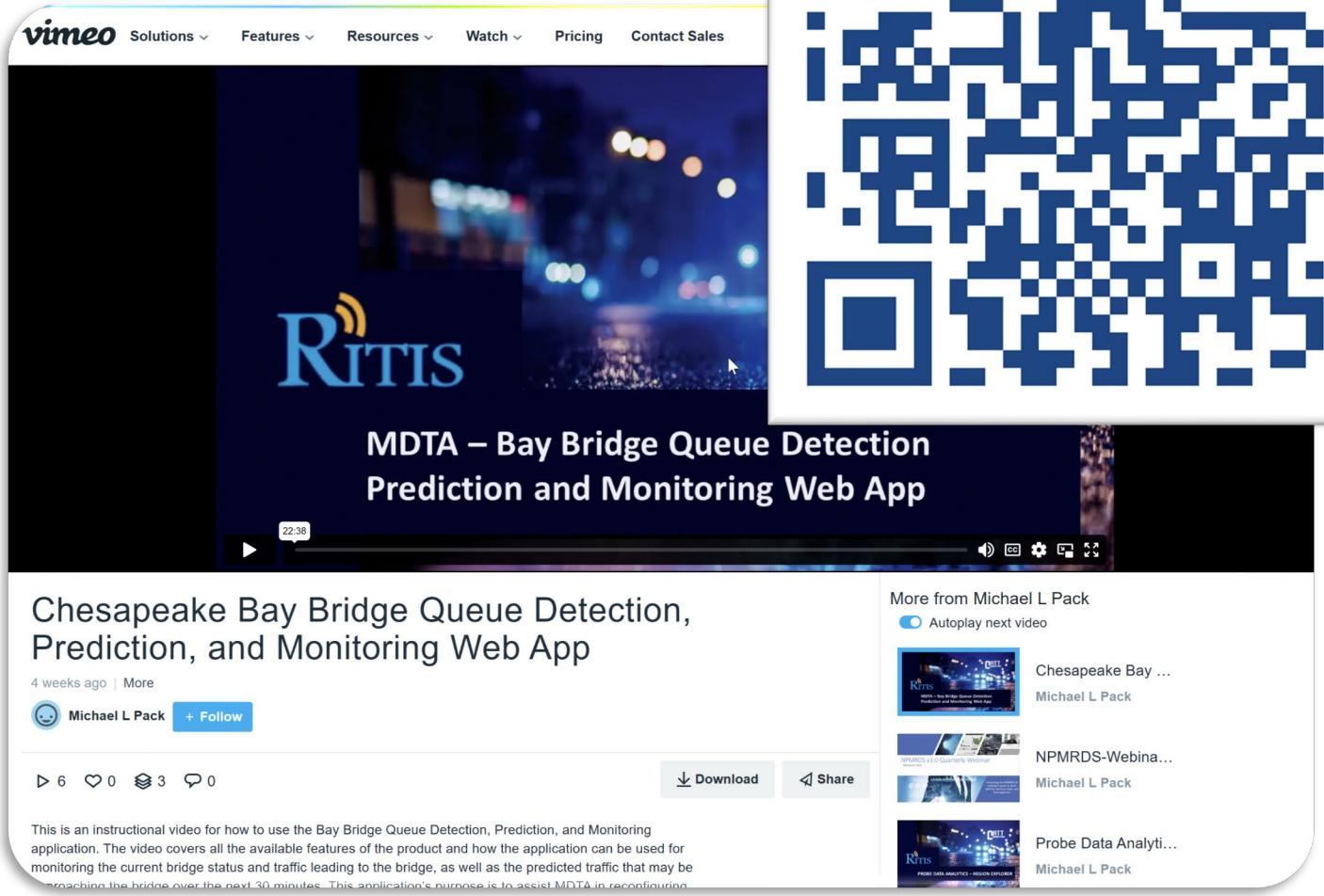

# Thanks!

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