Applying Mesoscopic Model to Assess the Potential Impact of Closing a Key Freeway Segment Due to Flooding

What happens **NEXT** is happening **NOW**.

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9/15/2025

CDM Smith

Project Description
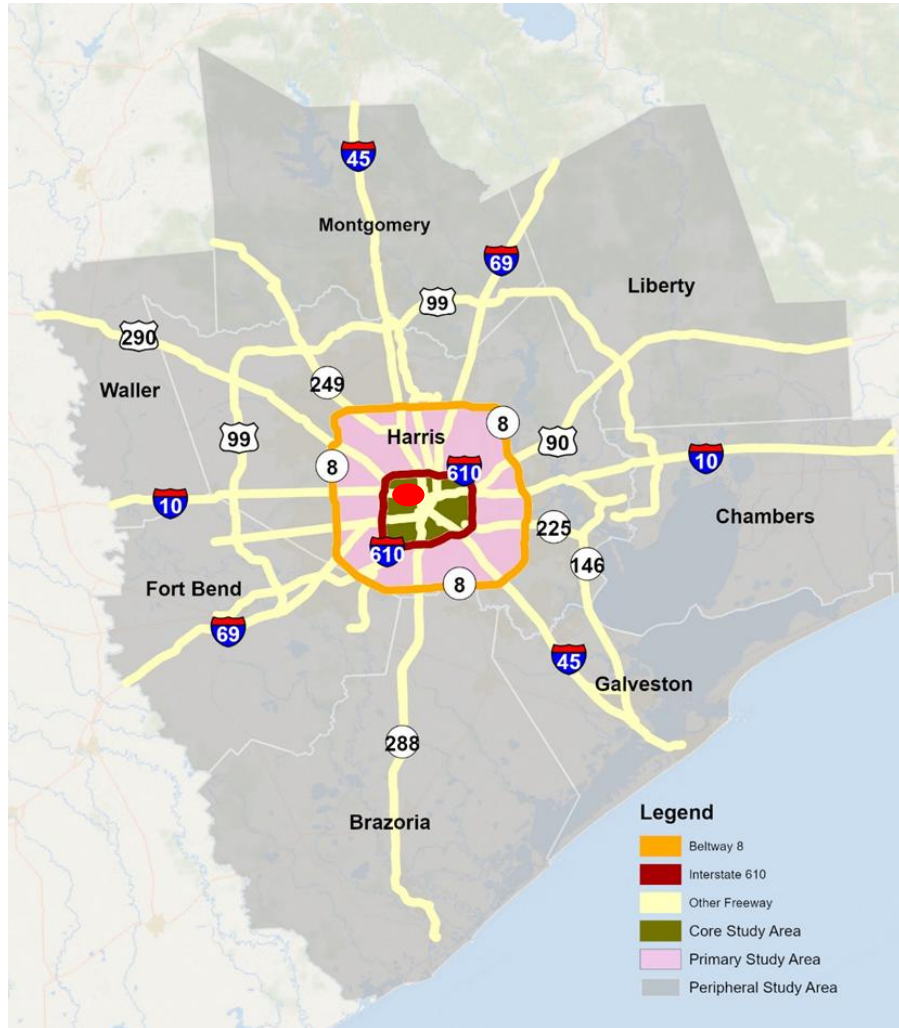
Project Locations

- 1.8 miles of I-10 next to White Oak Bayou

- Frequently flooded. Within 100-year flood plain.

- 177,000 ADT in 2023

- TxDOT plans to evaluate this segment above flood plain.

- Apply regional DTA model to demonstrate operation delay without elevation.
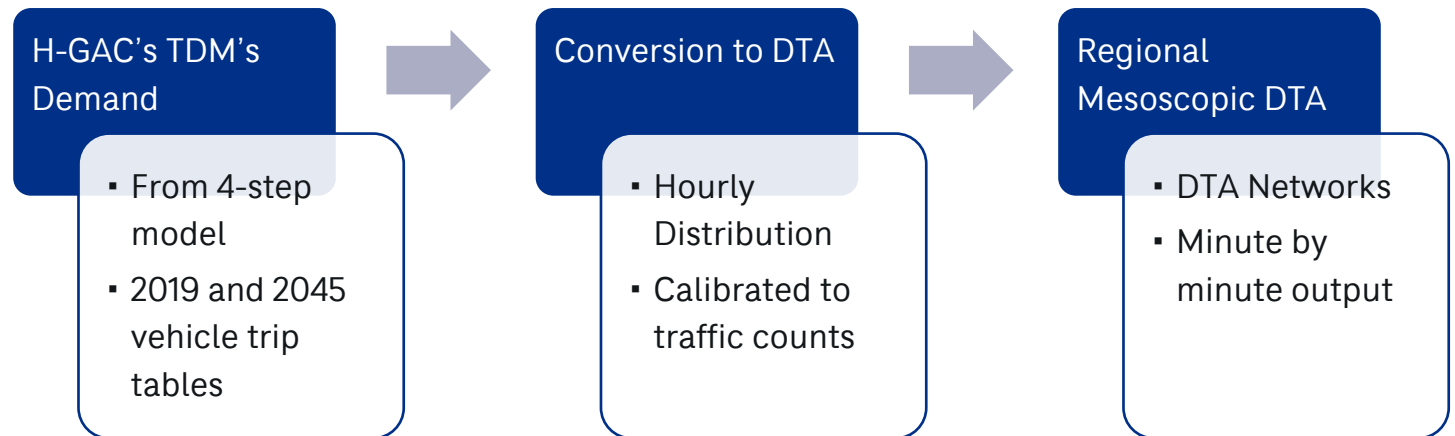
  - Flooding and repair construction

Why Dynamic Traffic Assignment ?

- Dynamic traffic assignment

  - Simulate real-time traffic condition (speed, density, queuing)

  - Route-choice based on temporal travel time

- Advantage:

  - Evaluate traffic operation

  - Route-change due to incident

Project Area

- Model cover 8-county area

- Urban Core area are inside BW 8 (pink color)

- Demands from H-GAC's TDM and calibrated to 2019 regional counts

- 2019 and 2045 models

H-GAC's TDM's Demand		Conversion to DTA		Regional Mesoscopic DTA
▪ From 4-step model ▪ 2019 and 2045 vehicle trip tables	→	▪ Hourly Distribution ▪ Calibrated to traffic counts	→	▪ DTA Networks ▪ Minute by minute output

Project Background

Scenarios

- Evaluate long-term impact on 2045 model

- Five scenarios ran

Normal Day	
Incident Day- Partial Closure	**Construction – Partial Closure**
Incident Day – Full Closure	**Construction – Full Closure**

- Severity of closure
  - Partial closure: half of the lanes still passable
  - Full closure: all lanes impassible

- Duration
  - Incident Day: on the day of flooding
  - Construction: on re-construction after the flooding (to repair flooding damage)

- Construction partial closure is planned for current I-10 elevation.

- Other scenarios could be avoided with I-10 elevation.

Driver Behavior Assumptions

- Flooding occurs between 2pm to 9pm

- Where drivers adjust routes?

  - At few designated location ranging from 10 miles to last exit before flooded segment

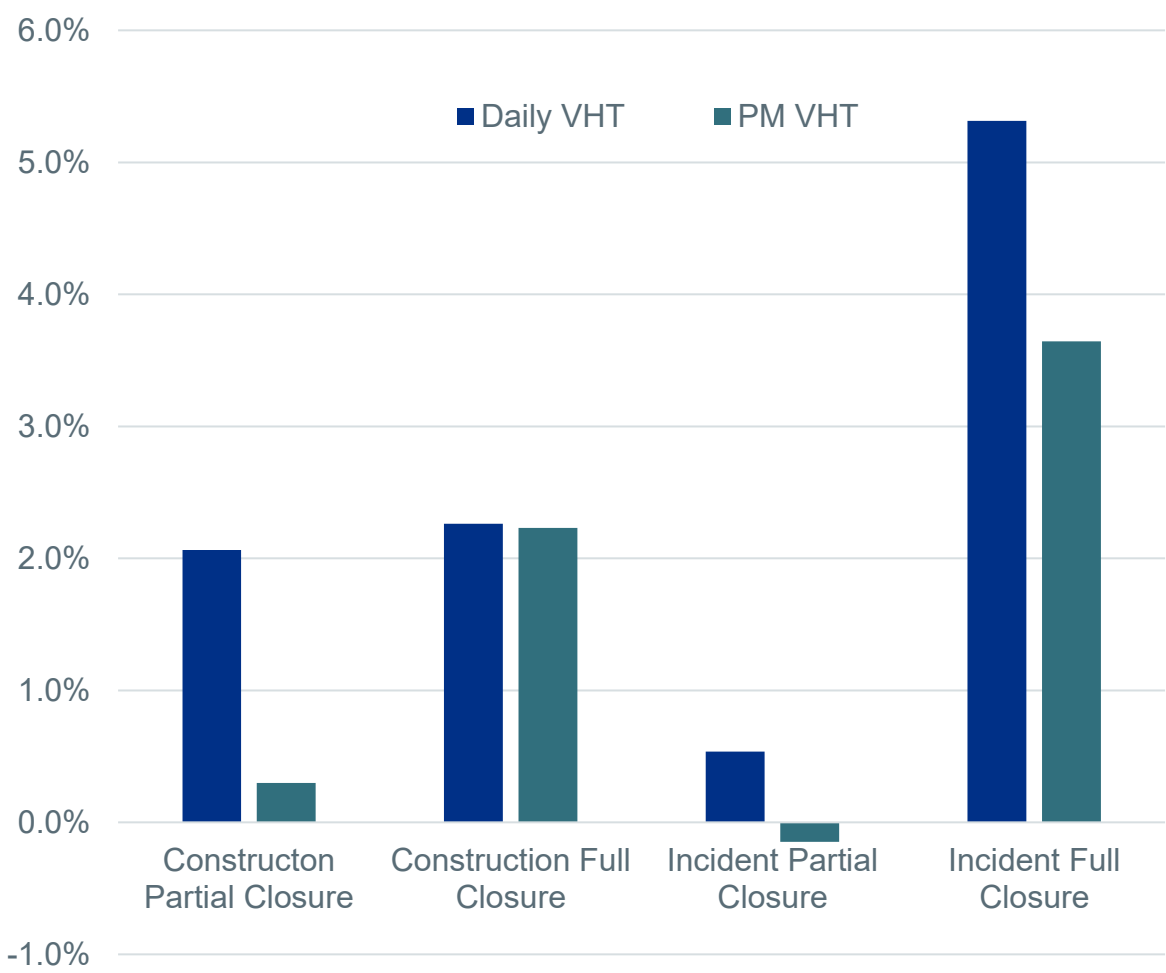 - Closer to flooded segment, more drivers change routes

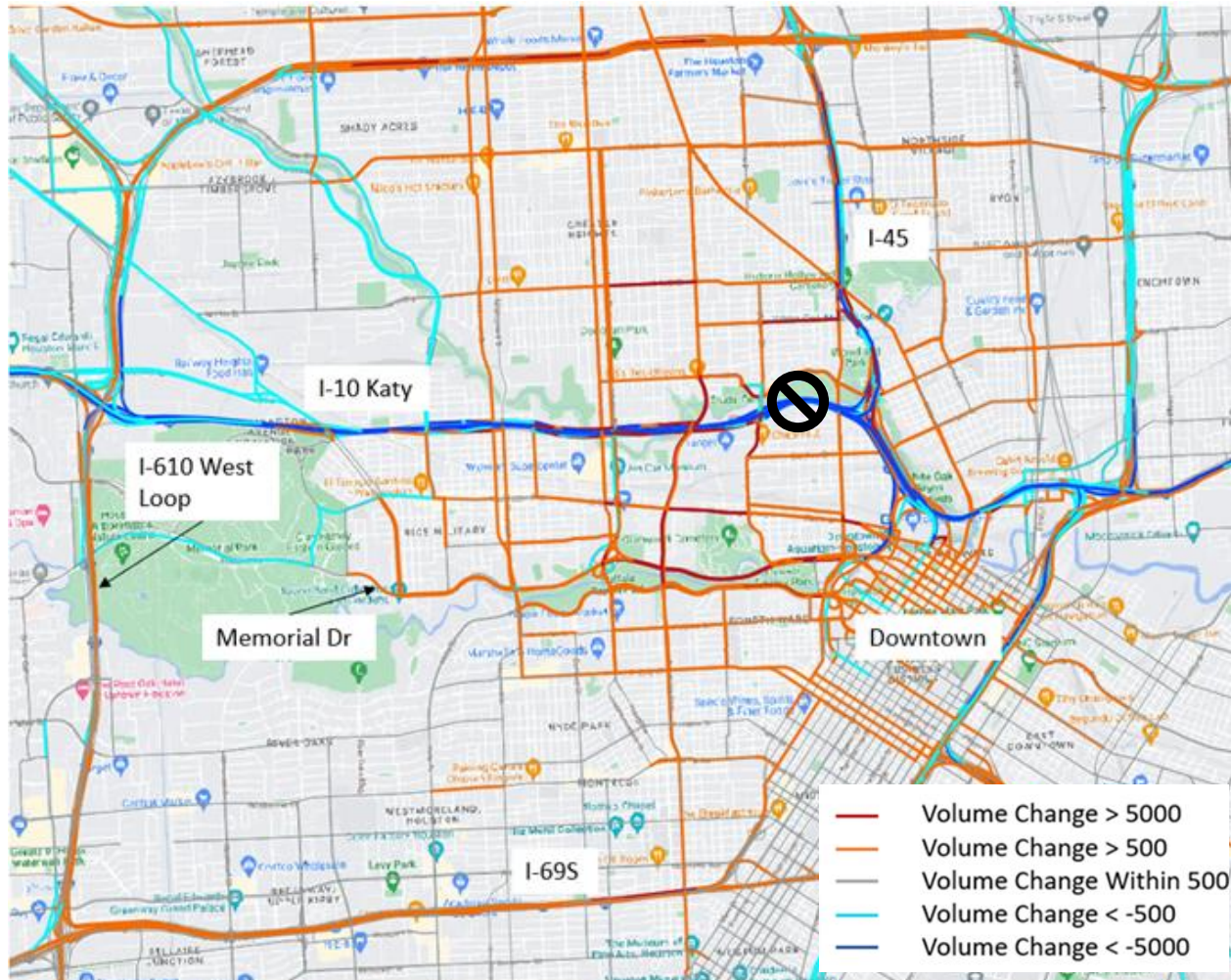| Incident Day	Repair Construction
Historical class: stick to normal day travel routes in partial closure scenarios. Forced to change route in full closure scenarios	All user-equilibrium class: ■ construction over a year ■ all drivers find fastest routes under "new-normal" construction condition
En-route class: update their routes to current information during trip	
Pre-Trip class: re-plan their routes with current information when they start	

Noticeable Model Results

Regional Impact

- Insignificant impact on daily VMT (less than 0.25%)

- Increase daily VHT from 0.5% to 5%

- I-10 partial closure has less impact on PM VHT

Where Traffic Diverge

Traffic diversion on Incident Day Full Closure Scenario

I-45

I-10 Katy

I-610 West Loop

Memorial Dr

Downtown

I-69S

Volume Change > 5000
Volume Change > 500
Volume Change Within 500
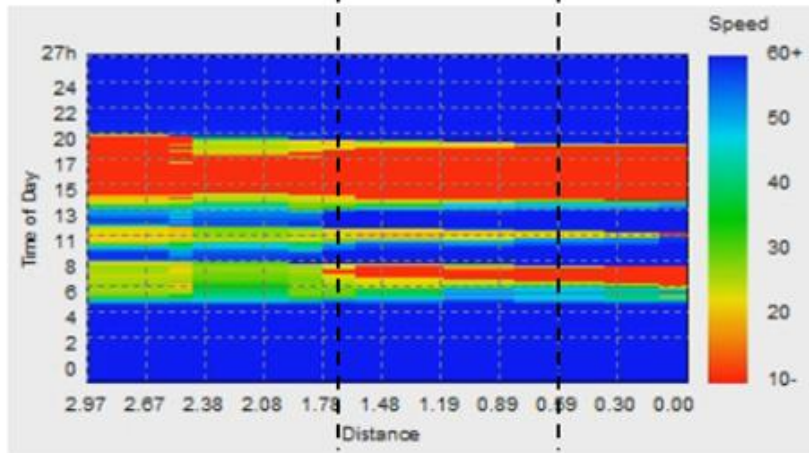Volume Change < -500
Volume Change < -5000

- Traffic detour to parallel east-west freeway routes (I-610 North Loop, I-69), and local streets (Memorial, etc)

- Change in I-10 access/egress pattern
  - Less traffic on downtown's freeway to I-10
  - I-610 West Loop and local NS arterials are used for detour access/egress

- Traffic diversion is more prominent in full closure scenarios.

- In construction scenarios, diverted traffic is more concentrated a few efficient detour routes.
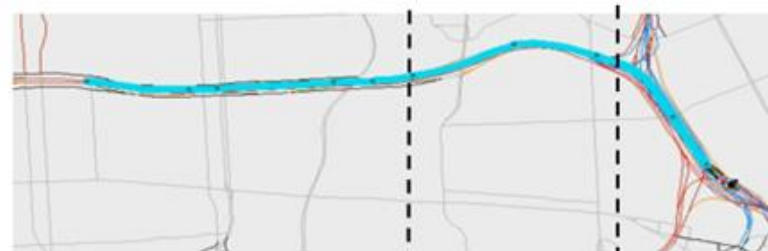
I-10 on Partial Closure Scenarios

- Partial closure is metering traffic on I-10 corridor.

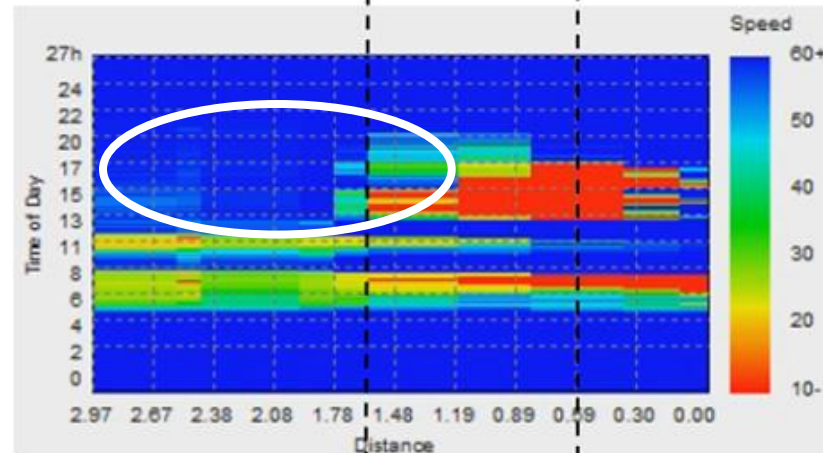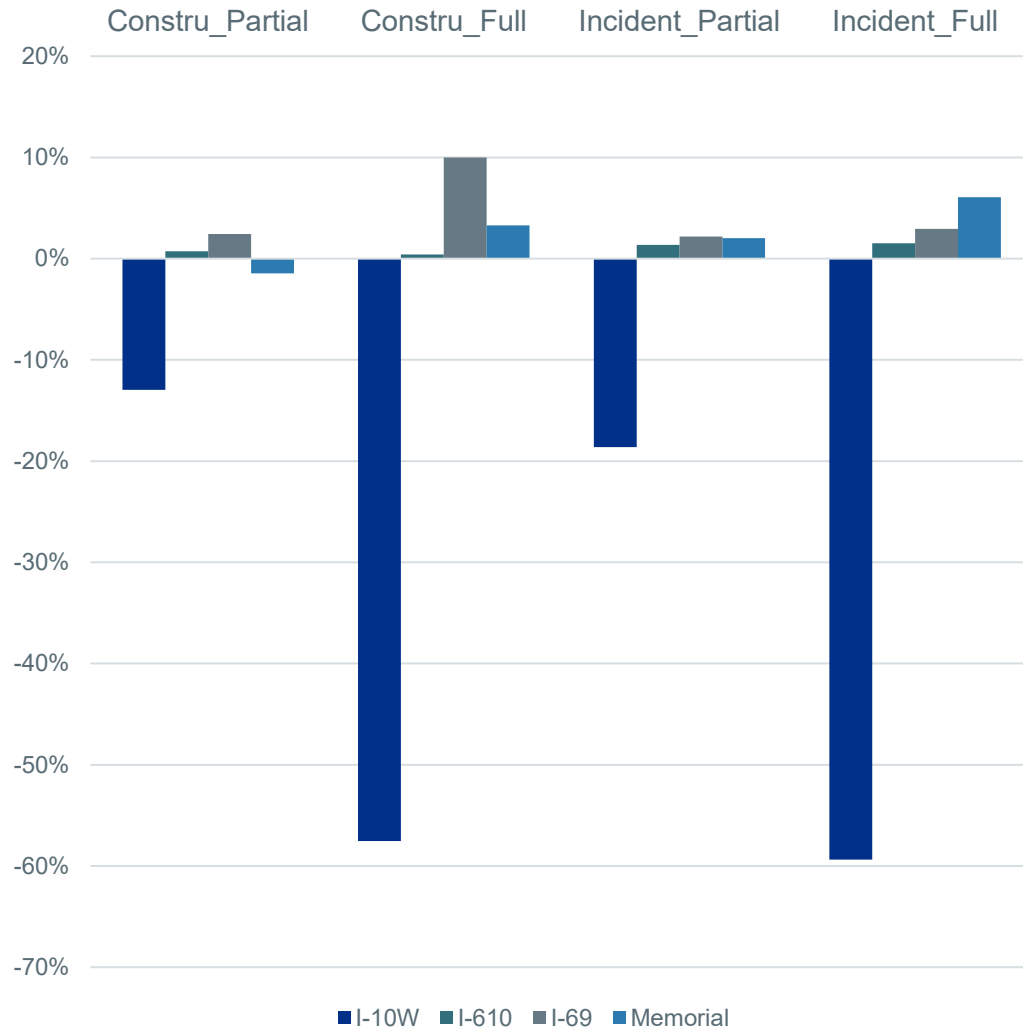- WB: less traffic, faster speed downstream of closed segment
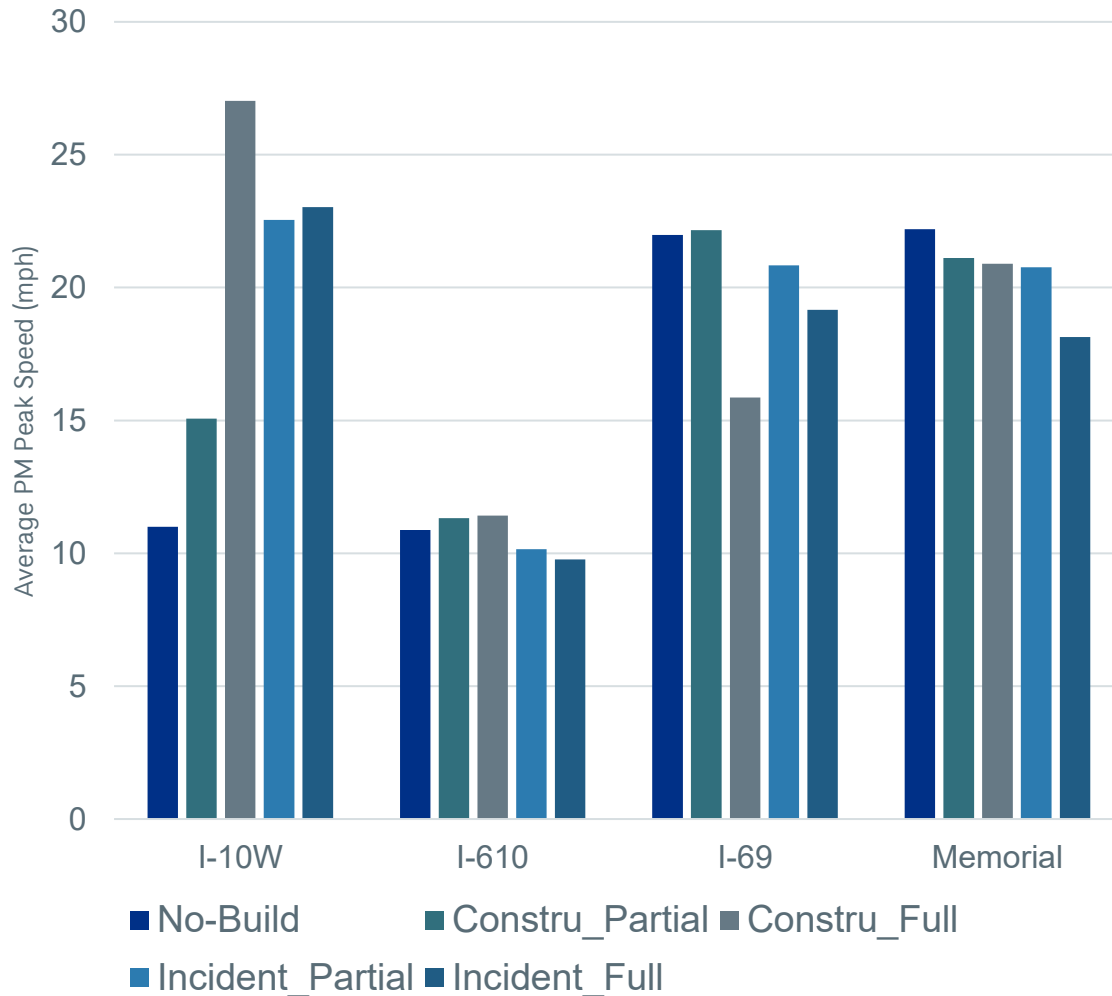

RevNB45

Incident Partial Closure

PM VMT Change of Major Detour Corridor (on a weekday)

- **Partial closure is least impactful.**
  - I-10 corridor retains more than 80% VMT in partial closures scenarios.
  - I-10 loses almost 60% VMT in full closure scenarios.
- **Diversion is spread out.**
  - I-69 is the #1 detour route, especially on construction scenarios.
  - Local arterial (Memorial) gets more traffic on incident scenarios.
  - Most VMT detour occurs outside the major routes identified here.

PM Speed on Parallel Routes

- I-10 speed increased due to metering.
- Less than 2mph speed change on other corridors for partial closures scenarios
- Because I-69 is faster, it has more "cushion" to absolve detour than I-610 in full closure scenarios.

Summary of Model Results

- Elevation of I-10 will prevent higher negative impact of full closure on flooding day and subsequent re-construction.

  - More than 80% of I-10 VMT will divert to other routes under full closure.

  - Local residents suffer the cost of traffic detour – more than 50% of diversion spreads to local streets.

  - Higher regional VHT

- Under partial closure scenarios, average I-10 corridor speed is faster.

  - But not improving daily VHT

- DTA could simulate the different operation behaviours on incident day and on construction scenarios.

Speed Comparison with current White Oak Reconstruction
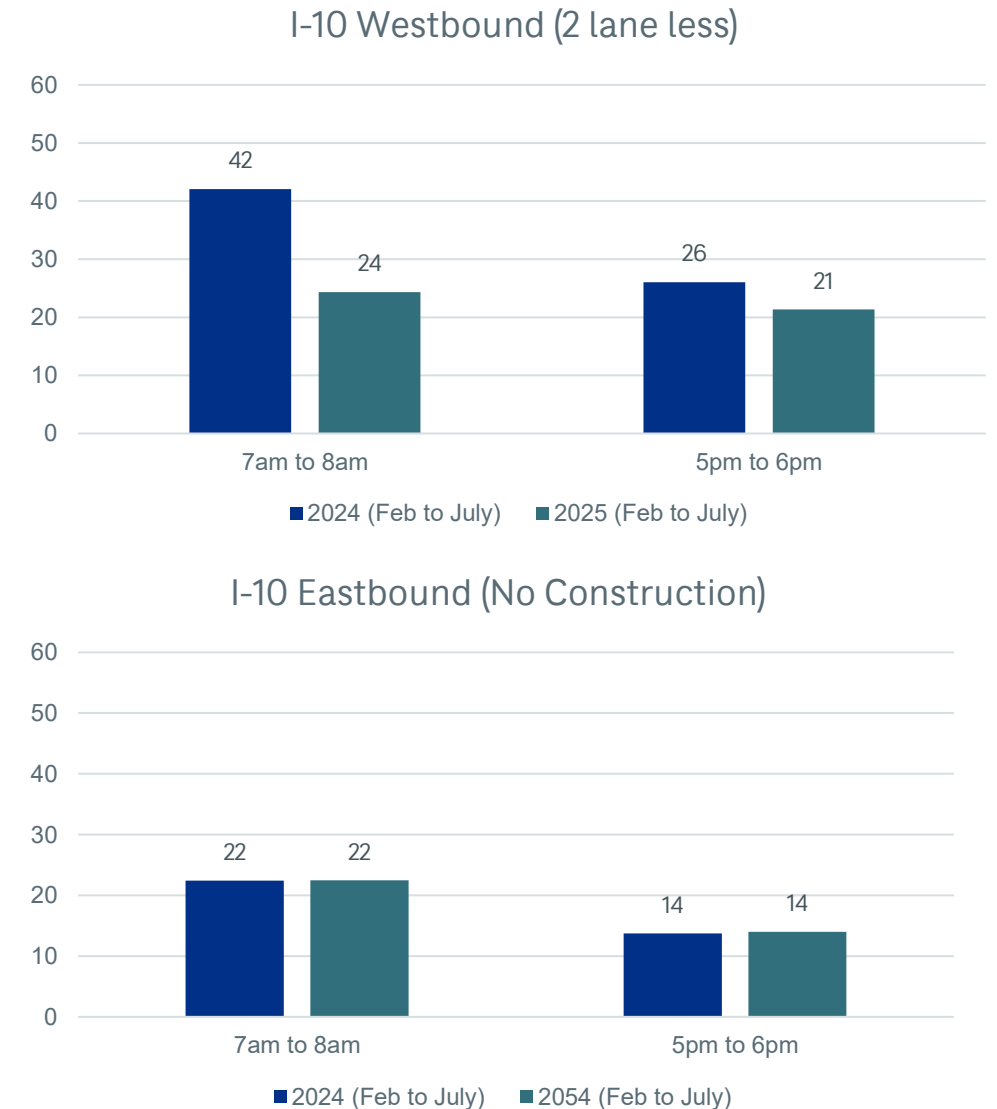
Current Construction

- I-10 White Oak re-construction began on Jan 18, 2025

- Current Phrase:

  - 2 WB lane closed (4 to 2 lanes).

  - WB ramps at Taylor Street closed

  - No construction on eastbound

- INRIX speed available

Image from Google Earth 8/2025

Speed at Construction Spot

- Construction closure at WB only

- Lower WB peak hour speed at spot with closure

- Same EB peak hour speed without lane closure

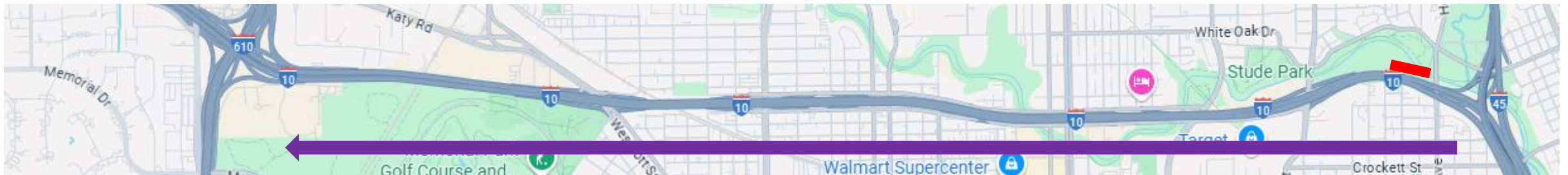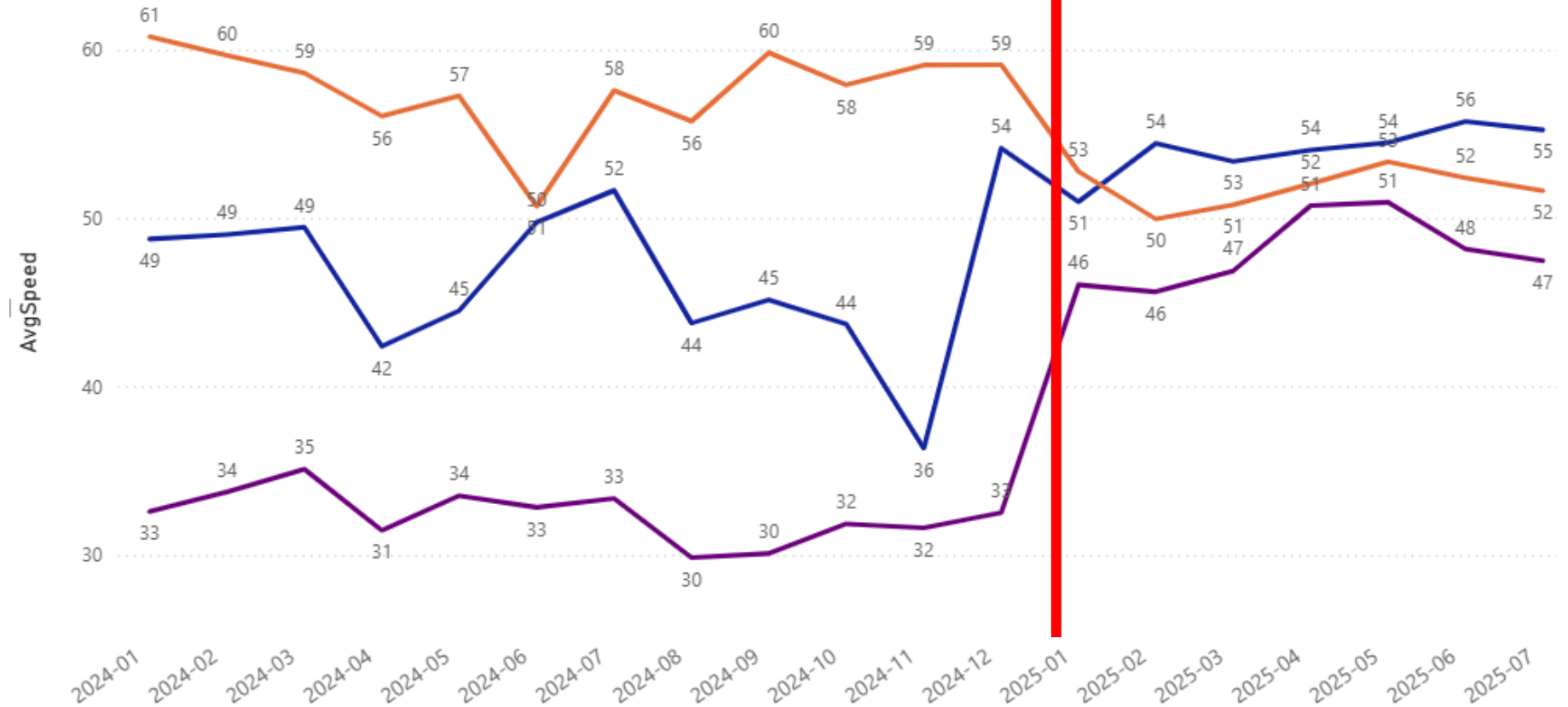- Speed: every non-holiday Tuesday to Thursday from February to July

I-10 Westbound (2 lane less)

	7am to 8am	5pm to 6pm
2024 (Feb to July)	42	26
2025 (Feb to July)	24	21

I-10 Eastbound (No Construction)

	7am to 8am	5pm to 6pm
2024 (Feb to July)	22	14
2054 (Feb to July)	22	14

Observed Speed on I-10 Corridor (Westbound)

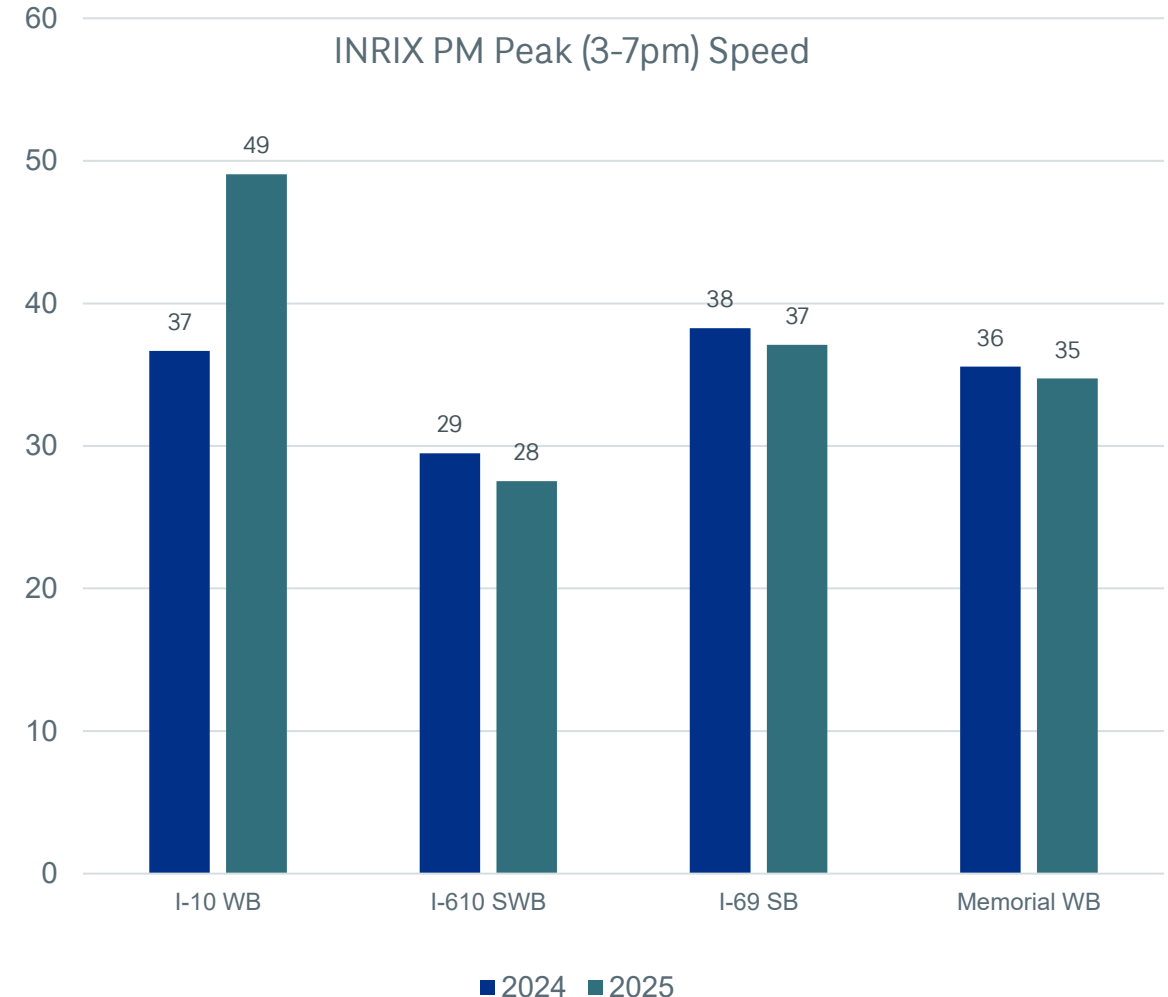- I-10 WB peak hour speed improves with partial lane closure

Hour ● 7 ● 12 ● 17

Construction began

Compare with DTA Model

- INRIX confirms model's forecast.
  - higher I-10 speed with partial closure
  - Speed on parallel corridors are similar with partial closure.
- Observed 2024/25 speed is higher than model's 2045 speed.
- Model forecast accuracy could be improved with more in-depth study.

INRIX PM Peak (3-7pm) Speed

	I-10 WB	I-610 SWB	I-69 SB	Memorial WB
2024	37	29	38	36
2025	49	28	37	35

■ 2024 ■ 2025

Thank you!

What happens NEXT is happening NOW.

Let's shape your NOW together.

Thank you to
Brenda Bustillos
Liza Amar

Vassilis Papayannoulis
Sherry Chen

Sadia Sharmin
James Wilson-Schutter

CDM Smith