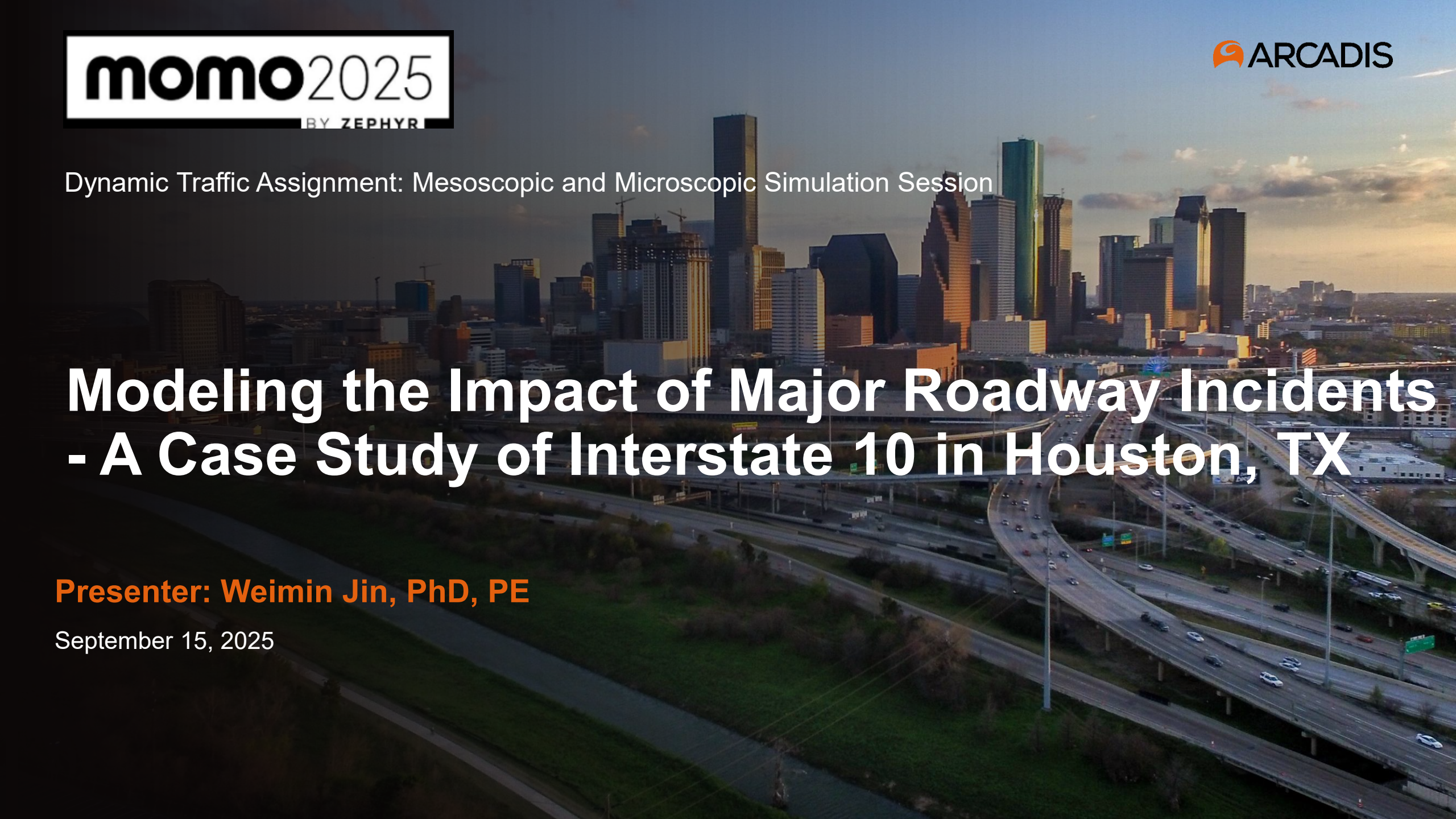
momo2025 BY ZEPHYR

ARCADIS

Dynamic Traffic Assignment: Mesoscopic and Microscopic Simulation Session



Modeling the Impact of Major Roadway Incidents - A Case Study of Interstate 10 in Houston, TX

Presenter: Weimin Jin, PhD, PE

September 15, 2025

Agenda

01 Overview

02 Modeling and Performance Measures

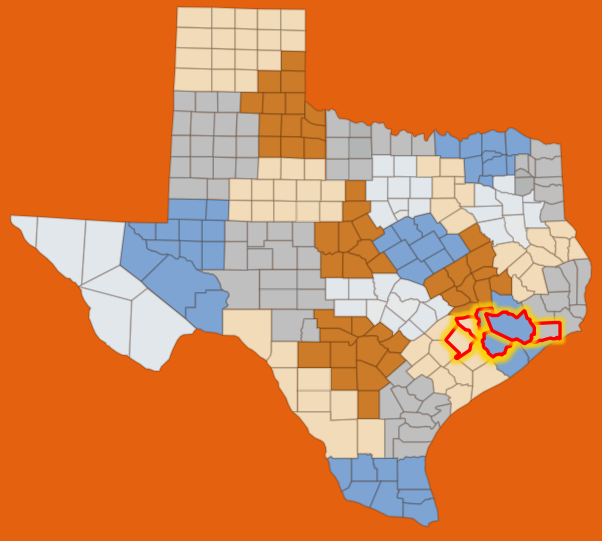
03 Representative Scenarios Analysis and Results

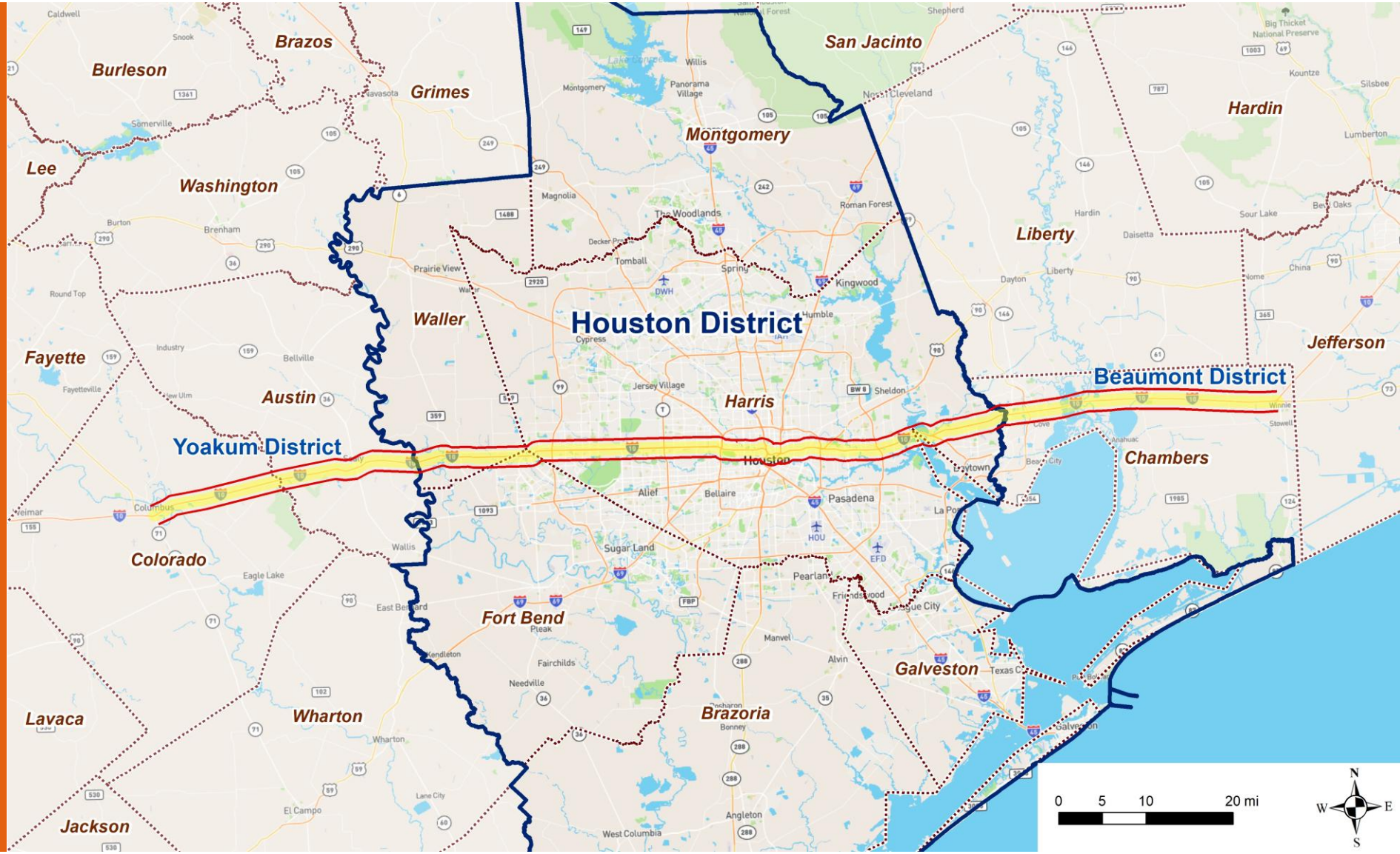
Overview

Study Area

IH 10 from SH 71 to SH 73

- Approximately **132 miles**
- West limit: SH 71 near Columbus, TX
- East limit: SH 73 near Winnie, TX
- **Three TxDOT Districts: Houston, Yoakum and Beaumont**
- Six Counties: Colorado, Austin, Waller, Fort Bend, Harris, Chambers





Background and Needs

- Major incidents – planned (construction) and unplanned (accidents, flooding) – cause severe travel time impacts.
- Impact evaluation is key to understanding short- and long-term effects on travelers and the regional network.
- Modeling & Evaluation identify bottlenecks, guide diversions, and strengthen system resilience.

Modeling and Performance Measures

Scenario Development

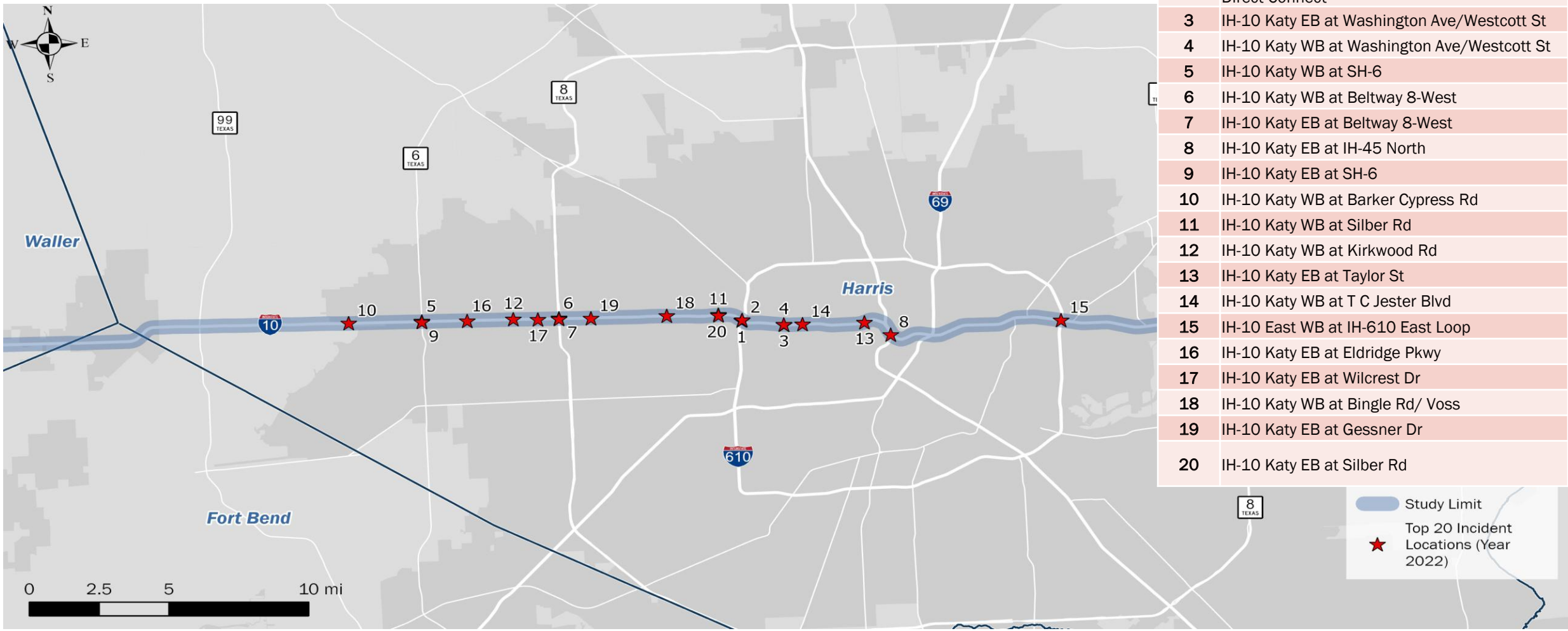
When developing the scenarios to be tested on the Mesoscopic DTA tool, two questions need to be answered

1. Where are those incident locations?
2. How long do those incidents last?

Needs to understand the historical incidents data

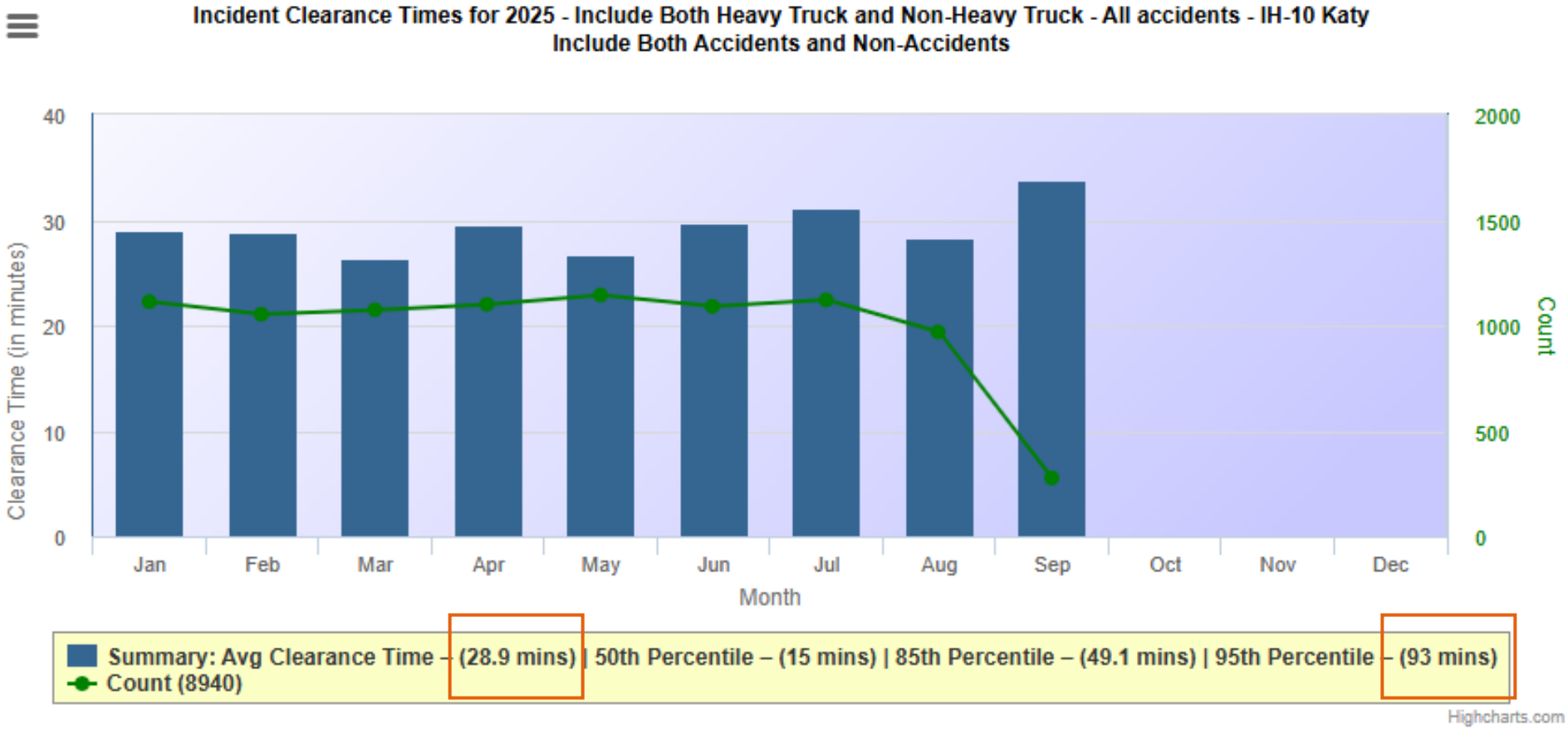
Top 20 Incident - Prone Locations (2022)

Ranking	Location
1	IH-10 Katy EB at IH-610 West Loop/ US 290 Direct Connect
2	IH-10 Katy WB at IH-610 West Loop/ US 290 Direct Connect
3	IH-10 Katy EB at Washington Ave/Westcott St
4	IH-10 Katy WB at Washington Ave/Westcott St
5	IH-10 Katy WB at SH-6
6	IH-10 Katy WB at Beltway 8-West
7	IH-10 Katy EB at Beltway 8-West
8	IH-10 Katy EB at IH-45 North
9	IH-10 Katy EB at SH-6
10	IH-10 Katy WB at Barker Cypress Rd
11	IH-10 Katy WB at Silber Rd
12	IH-10 Katy WB at Kirkwood Rd
13	IH-10 Katy EB at Taylor St
14	IH-10 Katy WB at T C Jester Blvd
15	IH-10 East WB at IH-610 East Loop
16	IH-10 Katy EB at Eldridge Pkwy
17	IH-10 Katy EB at Wilcrest Dr
18	IH-10 Katy WB at Bingle Rd/ Voss
19	IH-10 Katy EB at Gessner Dr
20	IH-10 Katy EB at Silber Rd



Incidents Clearance Time (2025)

In 2025, avg incident clearance times is 29 min and 95th percentile is 93 min on I-10 Katy.



Source: Houston Transtar

Incidents With Long Clearance Times (2025)

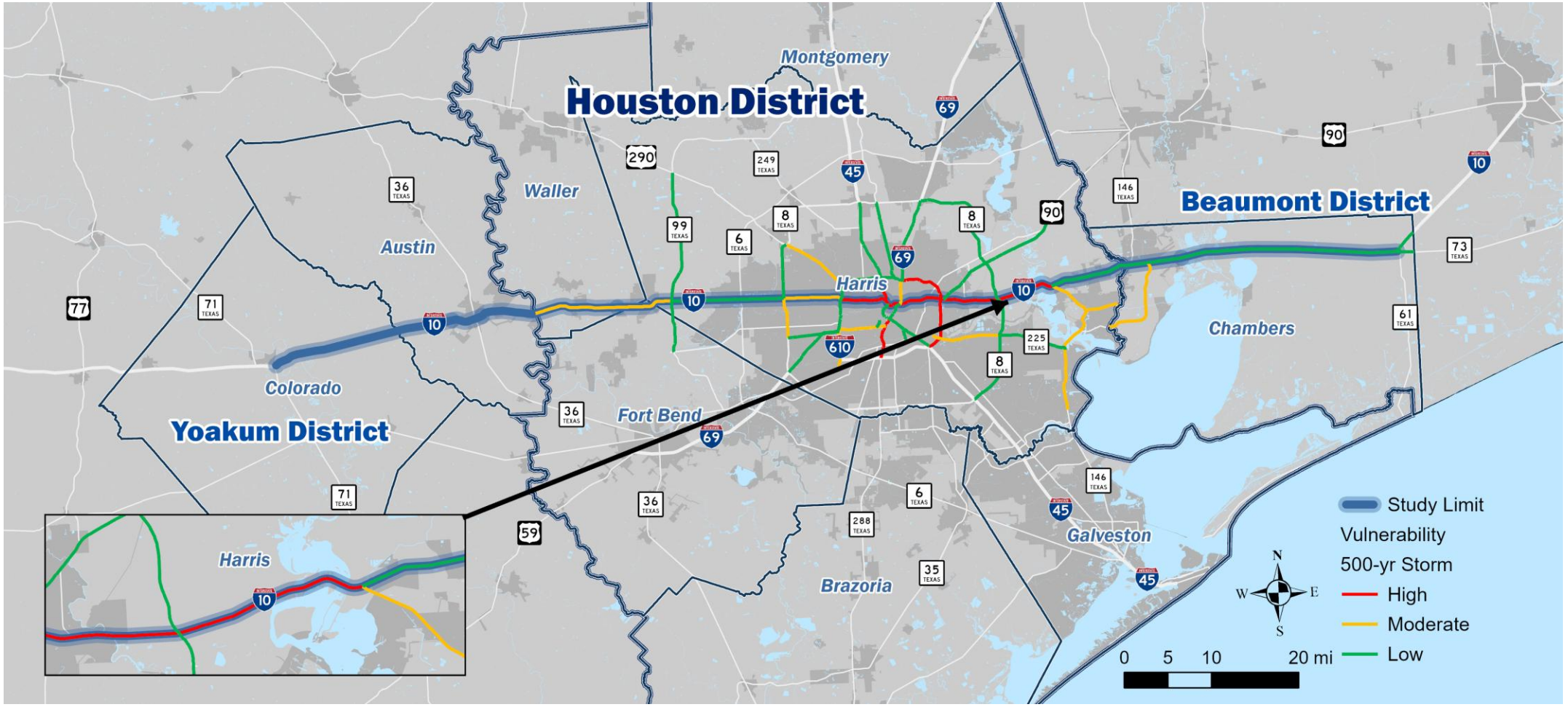
Historical Incidents show some incidents have over 6-hour clearance time and multiple mainline closure on I-10

TxDOT Incident ID	Location	Time Entered	Accident Collision	Incident Description	Lanes Affected	Clearance Time Mins
1598963	IH-10 Katy Westbound At Park Ten	6/13/2025 11:00:14 AM	Major Accident/Collision	Heavy Truck,Accident,Hazmat Spill	4 Mainlanes,1 Shoulder Lanes	9 hours 56 mins
1652318	IH-10 Katy Eastbound At IH-45 Gulf/ Hogan St	9/6/2025 6:45:40 PM	Major Accident/Collision	Heavy Truck,Accident,Hazmat Spill	5 Mainlanes,2 Shoulder Lanes	8 hours 22 mins
1561943	IH-10 East Eastbound At Waco St	5/26/2025 9:24:05 PM	Fatality Accident/Collision	Accident,Vehicle Fire	4 Mainlanes,2 Shoulder Lanes	7 hours 22 mins
1482832	IH-10 Katy Westbound At Park Ten	2/18/2025 12:19:38 AM	Fatality Accident/Collision	Accident	5 Mainlanes,2 Shoulder Lanes	6 hours 44 mins
1487569	IH-10 Westbound At FM-1463	3/1/2025 3:33:16 AM	Major Accident/Collision	Heavy Truck,Accident,Hazmat Spill,Vehicle Fire	3 Mainlanes,2 Shoulder Lanes	6 hours 29 mins
1514164	IH-10 Katy Eastbound At Houston Ave	5/6/2025 9:18:28 PM	Major Accident/Collision	Heavy Truck,Accident,Lost Load	3 Mainlanes,1 Shoulder Lanes	6 hours 9 mins
1562731	IH-10 Katy Eastbound At Houston Ave	5/28/2025 3:57:05 PM	None	Heavy Truck	4 Mainlanes	6 hours 8 mins
1651305	IH-10 Katy Eastbound At Houston Ave	9/4/2025 10:02:30 AM	Major Accident/Collision	Heavy Truck,Accident	3 Mainlanes,1 Shoulder Lanes	6 hours 4 mins

Source: Houston Transtar

Vulnerability to a 500-Year Storm

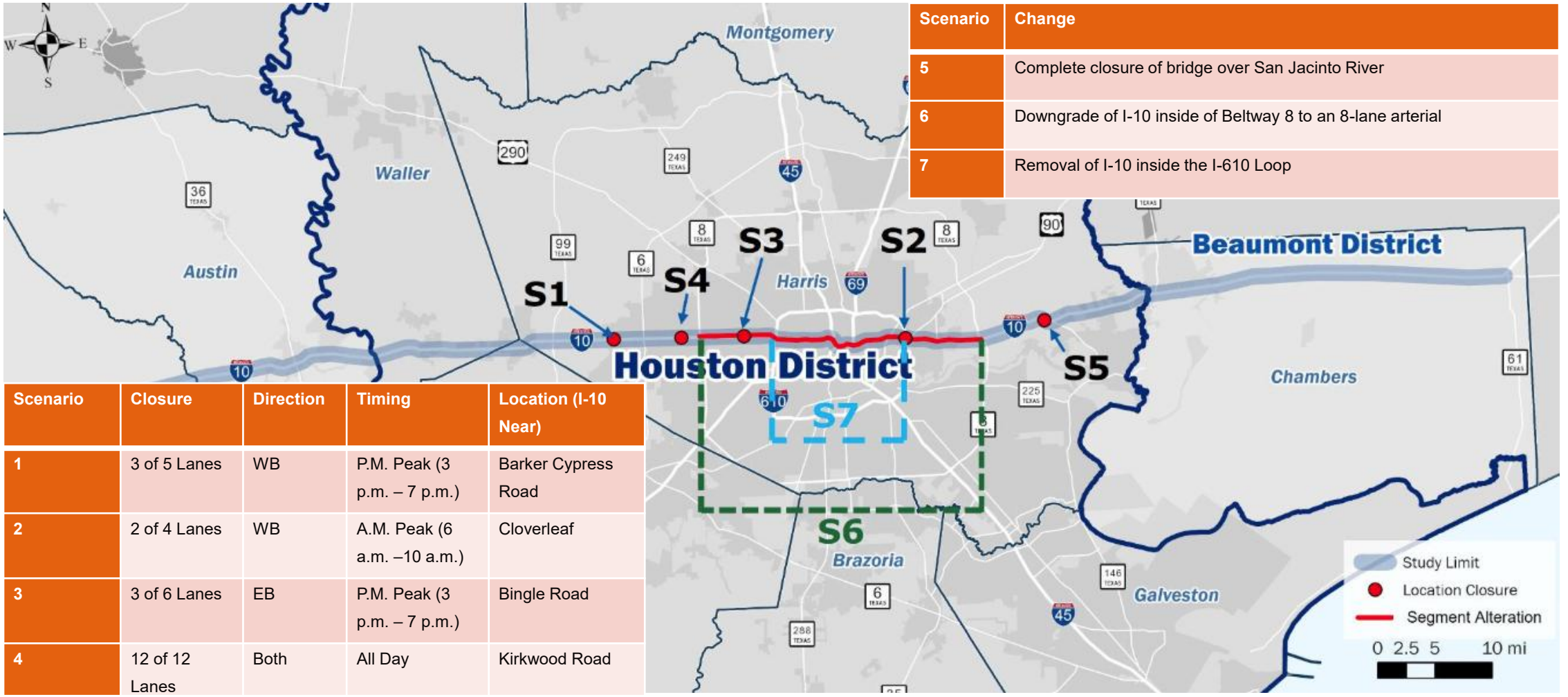
Bridge over San Jacinto River Vulnerable to Climate Hazard



Scenario Locations

Tested seven different closure scenarios of varying locations, severities, and durations.

Scenario	Change
5	Complete closure of bridge over San Jacinto River
6	Downgrade of I-10 inside of Beltway 8 to an 8-lane arterial
7	Removal of I-10 inside the I-610 Loop



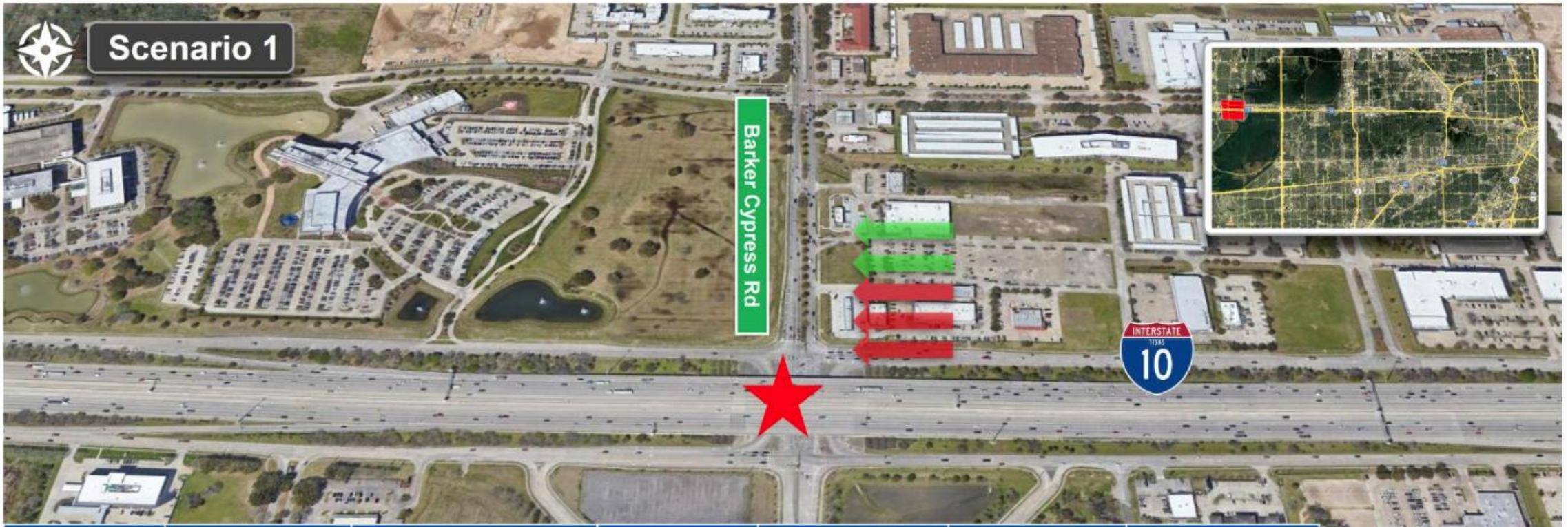
Scenario	Closure	Direction	Timing	Location (I-10 Near)
1	3 of 5 Lanes	WB	P.M. Peak (3 p.m. – 7 p.m.)	Barker Cypress Road
2	2 of 4 Lanes	WB	A.M. Peak (6 a.m. –10 a.m.)	Cloverleaf
3	3 of 6 Lanes	EB	P.M. Peak (3 p.m. – 7 p.m.)	Bingle Road
4	12 of 12 Lanes	Both	All Day	Kirkwood Road

Modeling and Performance Measures

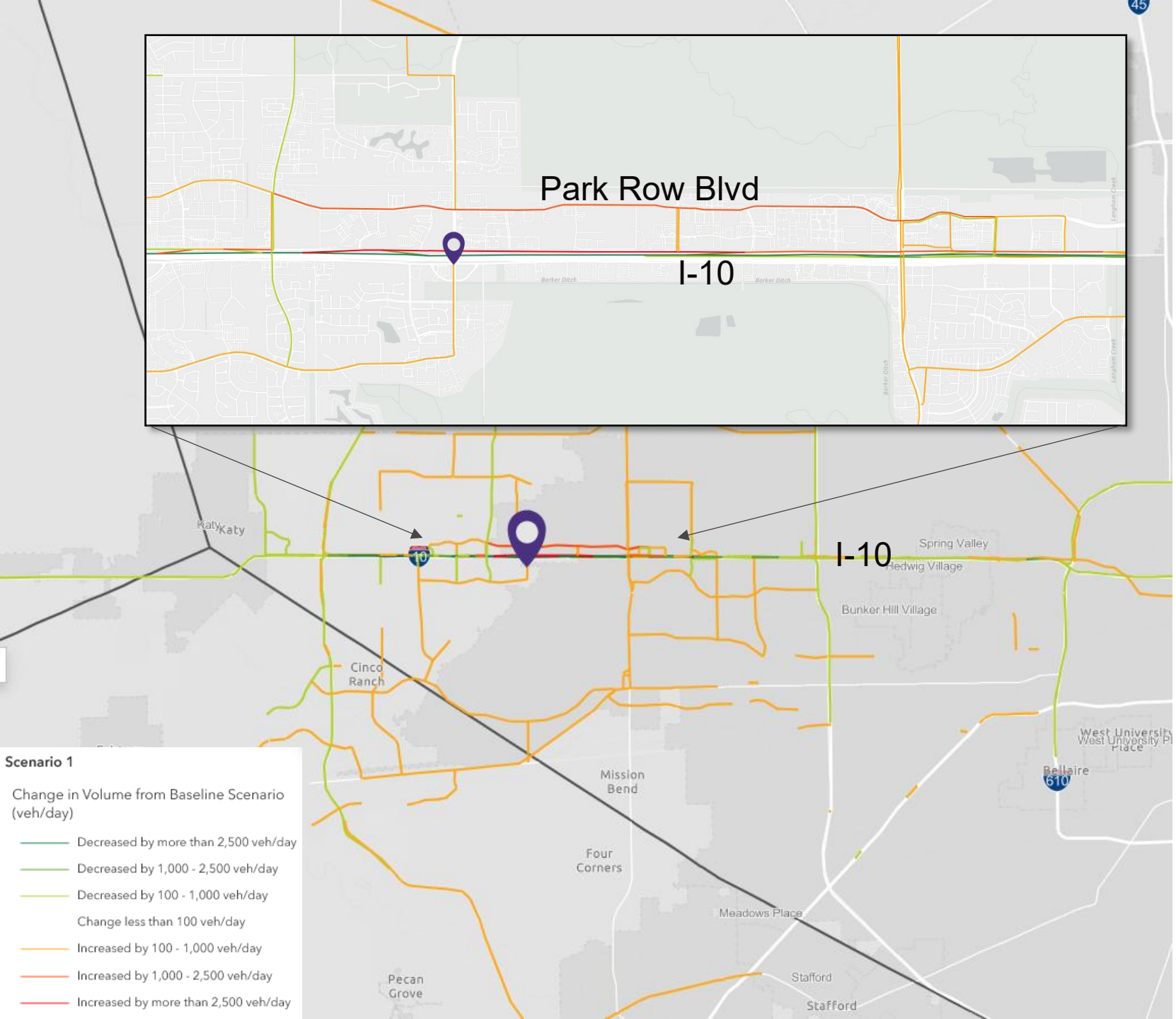
- Meso-DTA modeling tool – DynusT
- DTA Method
  - **One-shot run with varying driver behaviors** (historical, en-route) for scenarios S1-S4 to model **short-term** impacts of incidents on I-10 and the region
  - **Dynamic User Equilibrium (DUE)** run for scenarios S5-S7 to model **long-term** impacts of incidents on I-10 and the region
- Performance Measures
  - Trips affected, travel time change, speed change, and economic cost
  - Changes in travel time, speed, and economic cost for vehicle trips originating from or destined to activity centers and freight centers.

Representative Scenarios Analysis and Results

Scenario 1 (S1) – Short-Term WB Partial Closure



#Lanes	Closure	% Capacity Reduction	Direction	Duration	Start Time	End Time
5 Lanes	WB 3 Lanes	60% for WB	WB	PM Peak	15:00	19:00



ARCADIS

Key Takeaways on Volume Shift:

- Main impact at the WB frontage road, used as detour, traffic increased by more than 2,500 veh/day.
- Park Row Blvd. see an increase in traffic, possible rerouting and volumes are >1,000 veh/day
- Traffic increased in the surrounding arterials by fewer than 1,000 veh/day
- Traffic decreased at I-10 WB downstream of incident, gradually increased further west

Scenario 1 - All Vehicle Results for 4-hour PM

Trips Affected

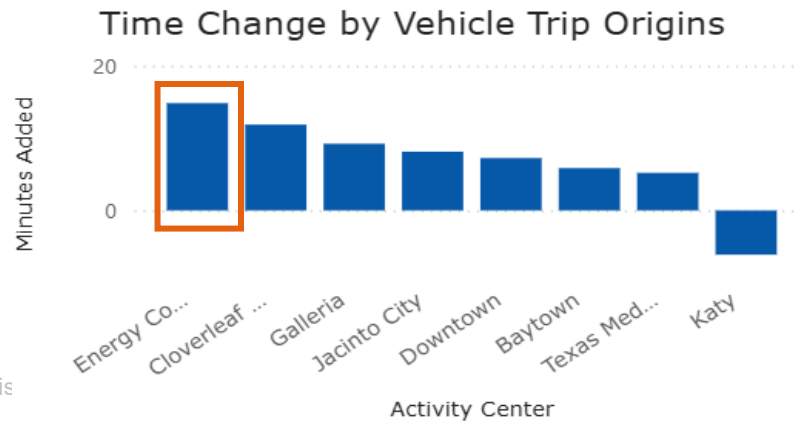
- All vehicles: 119,057
- Energy Corridor (Top Origin): 16,248

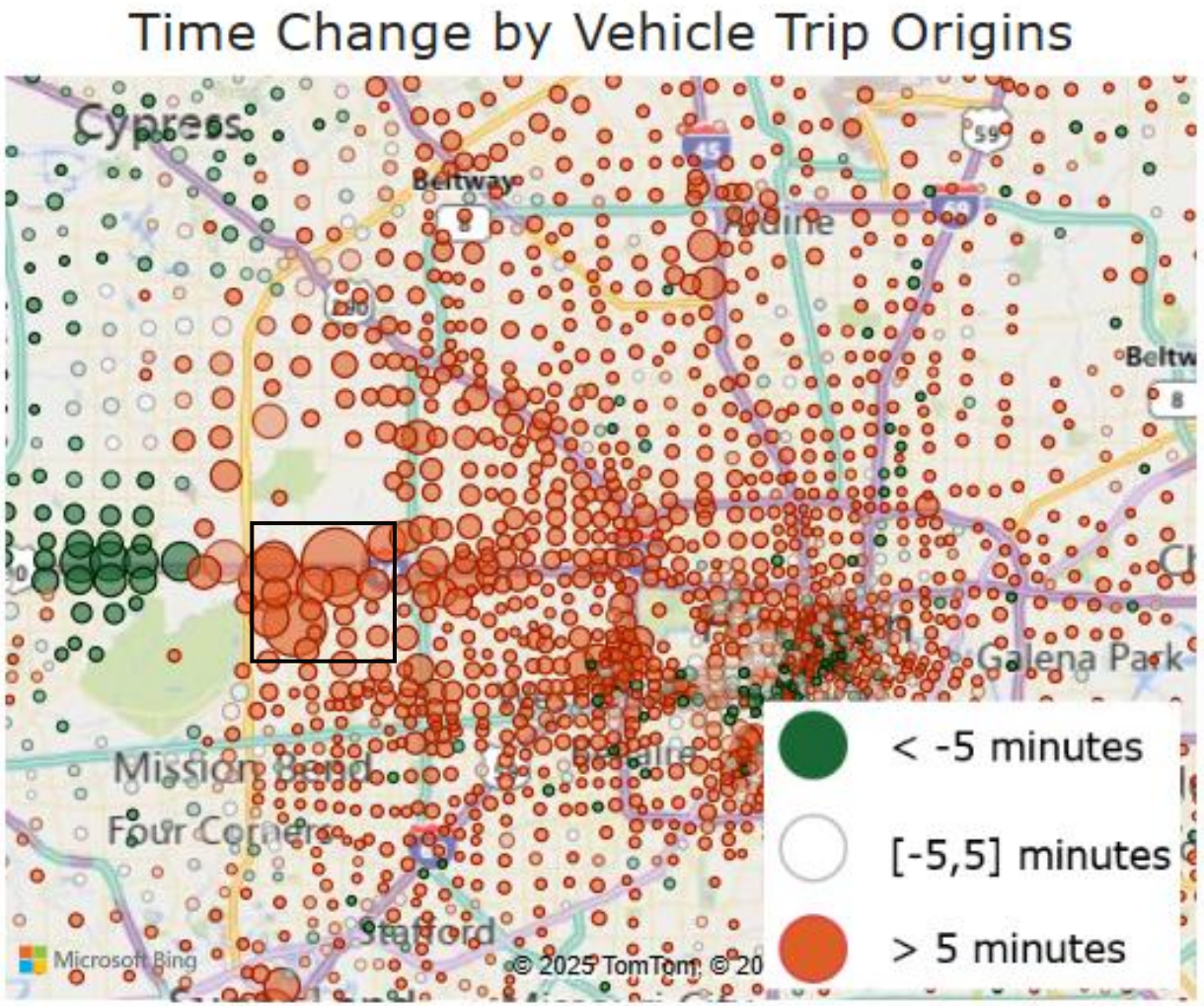
Travel Time/Speed Change

- All vehicles: +9 min (-0.7 mph)
- Energy Corridor (Top Origin): +15 (-2.4 mph)

Economic Cost Change

- All vehicles: +$505,176 (+$4.2/trip)
- Energy Corridor (Top Origin): +$113,175 (+$7.0/trip)

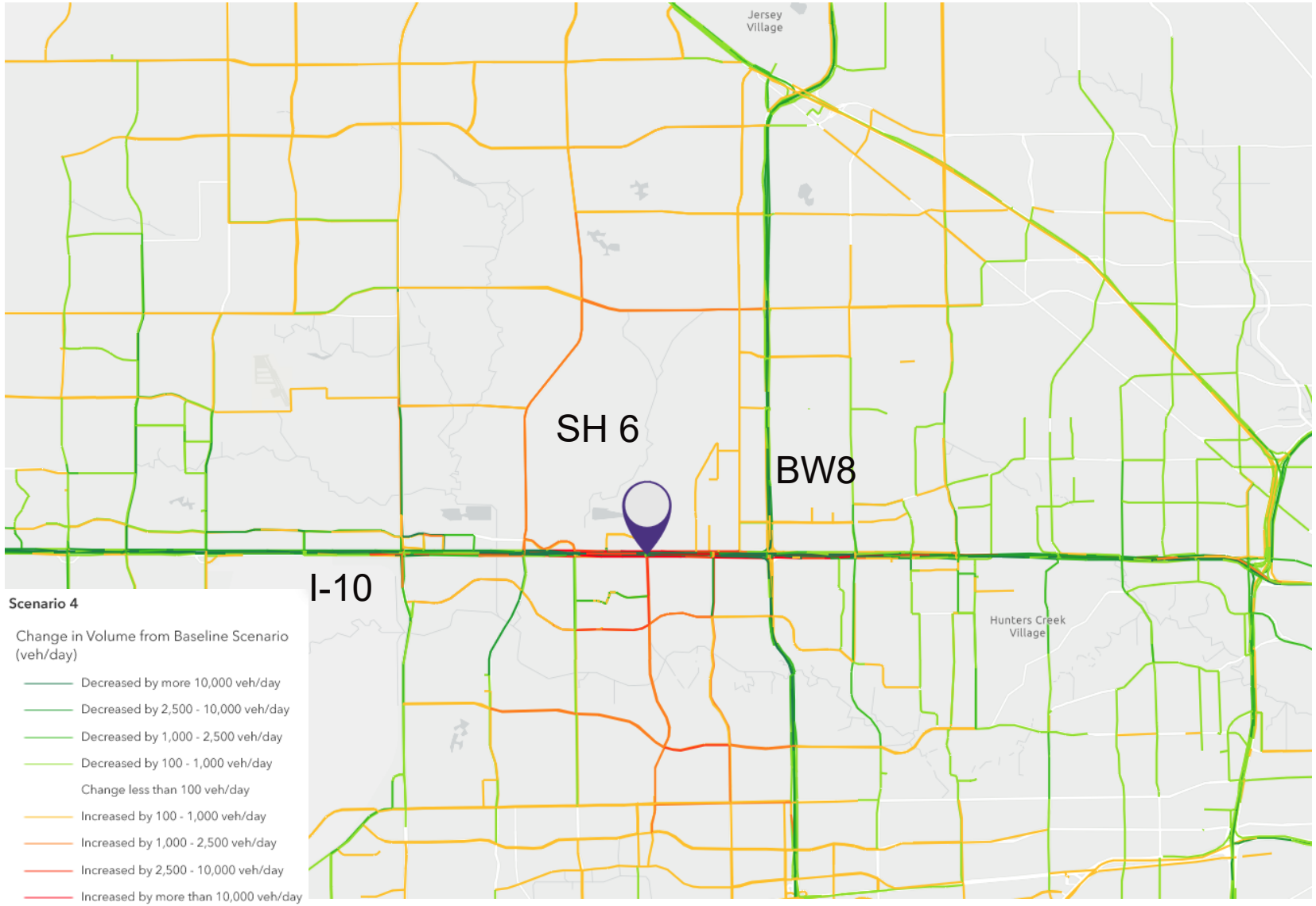




Scenario 4 (S4) – Full Day Closure on Both Directions

#Lanes	Closure	% Capacity Reduction	Direction	Duration	Start Time	End Time
12 Lanes	Full	100%	EB/WB	All Day	00:00	23:59

Scenario 4 – Volume Shift



Key Takeaways on Volume Shift:

- Traffic on I-10 decreased east/west of the incident as far as study area terminus
- Between SH 6 and BW 8 there is an increased in traffic on frontage roads and arterials by fewer than 1,000 veh/day
- Other main facilities see a vehicle throughput reduction including, BW 8, I-45 SB, I-610

Scenario 4 - All Vehicle Results for 4-hour PM

Trips Affected

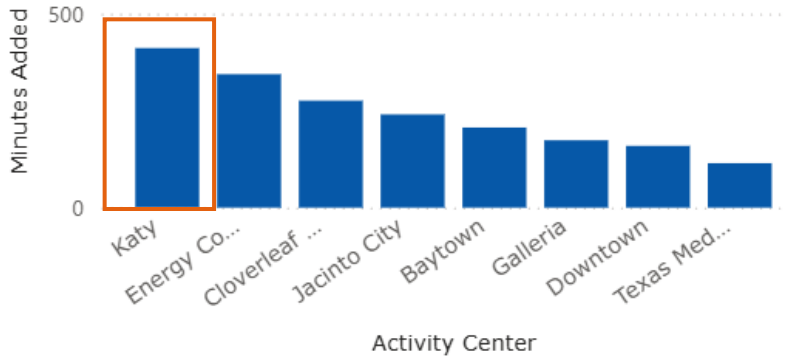
- All vehicles: 344,531
- Katy (Top Origin): 6,890

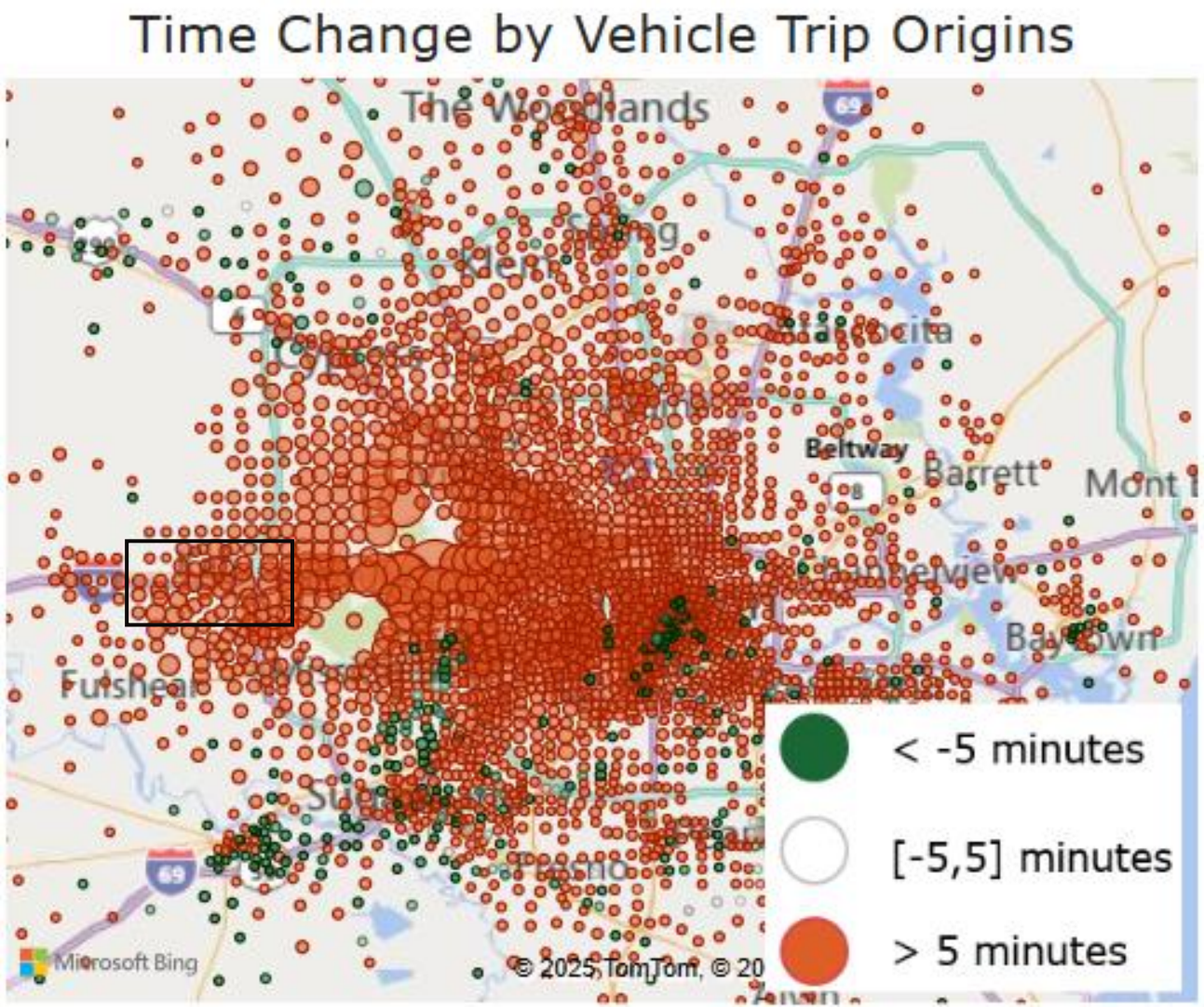
Travel Time/Speed Change

- All vehicles: +210 min (-2.4 mph)
- Katy (Top Origin): +411 min (-8.6 mph)

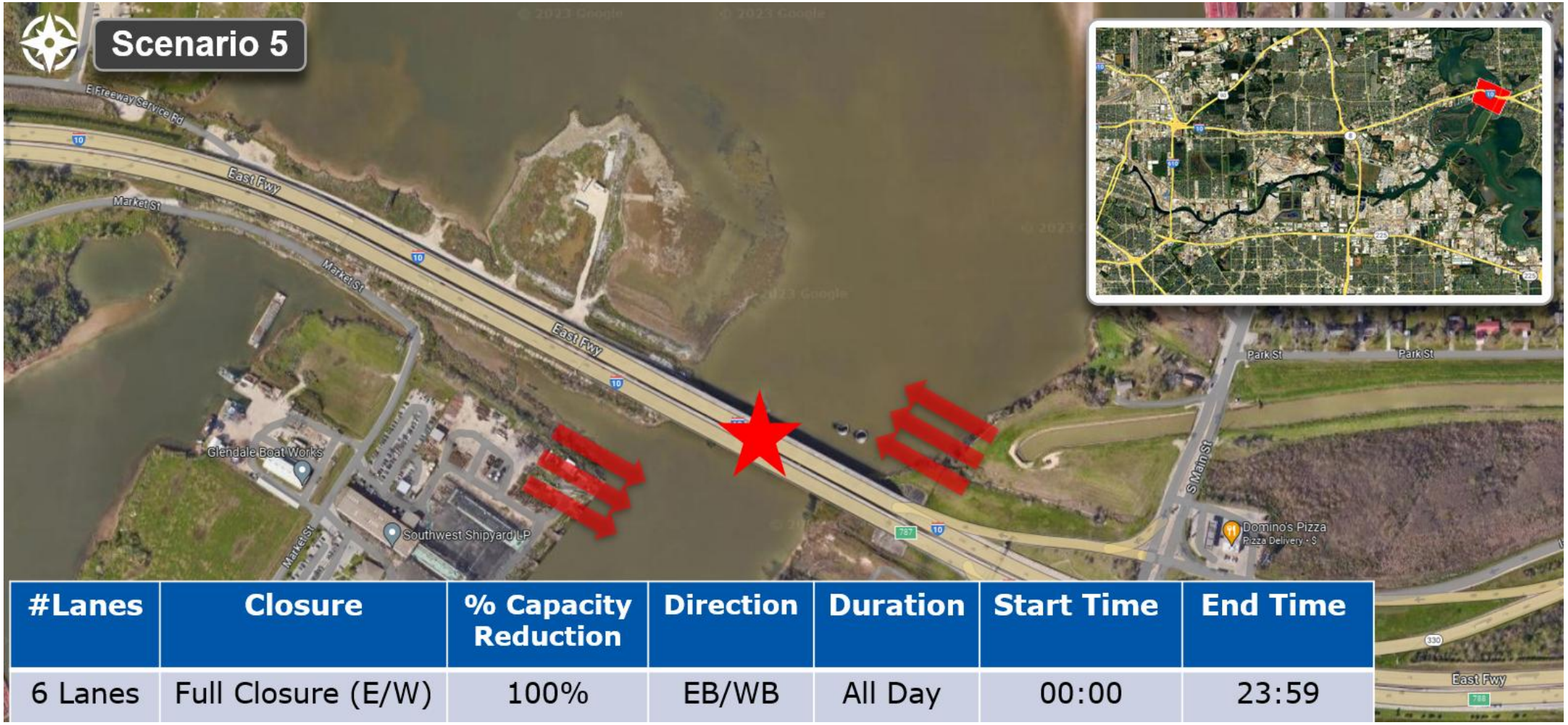
Economic Cost Change

- All vehicles: +$35.9M (+$104/trip)
- Katy (Top Origin): +$1.3M (+$188/trip)



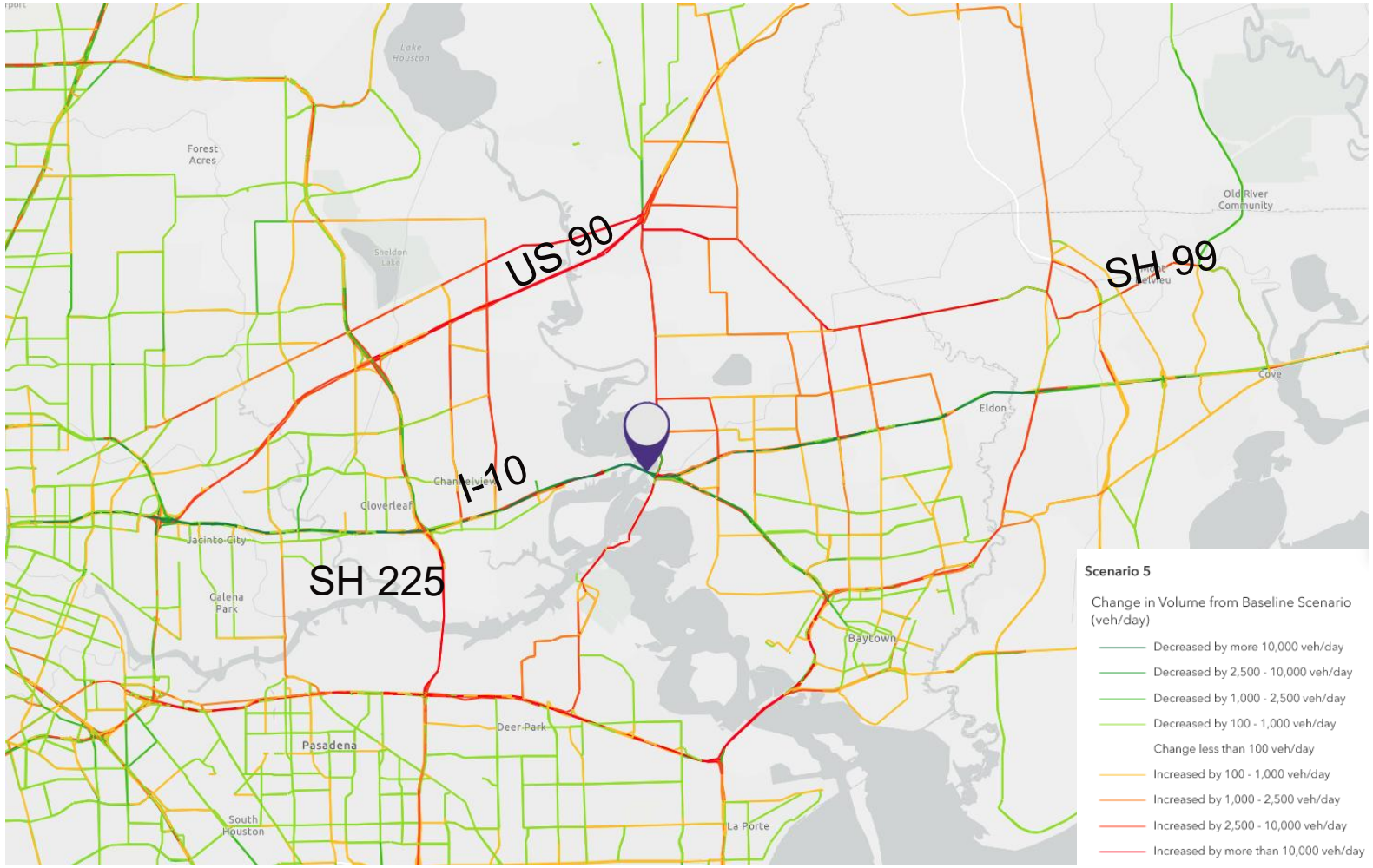


Scenario 5 (S5) – Long-Term Full Closure of Bridge over San Jacinto River



#Lanes	Closure	% Capacity Reduction	Direction	Duration	Start Time	End Time
6 Lanes	Full Closure (E/W)	100%	EB/WB	All Day	00:00	23:59

Scenario 5 – Volume Shift



Key Takeaways on Volume Shift:

- Traffic on I-10 East decrease considerably between I-610 and SH 99
- Several facilities including US 90 and SH 225, experience an increase in daily volume as these facilities serve as rerouting alternative for daily commuters

Scenario 5 - All Vehicle Results for 4-hour PM

Trips Affected

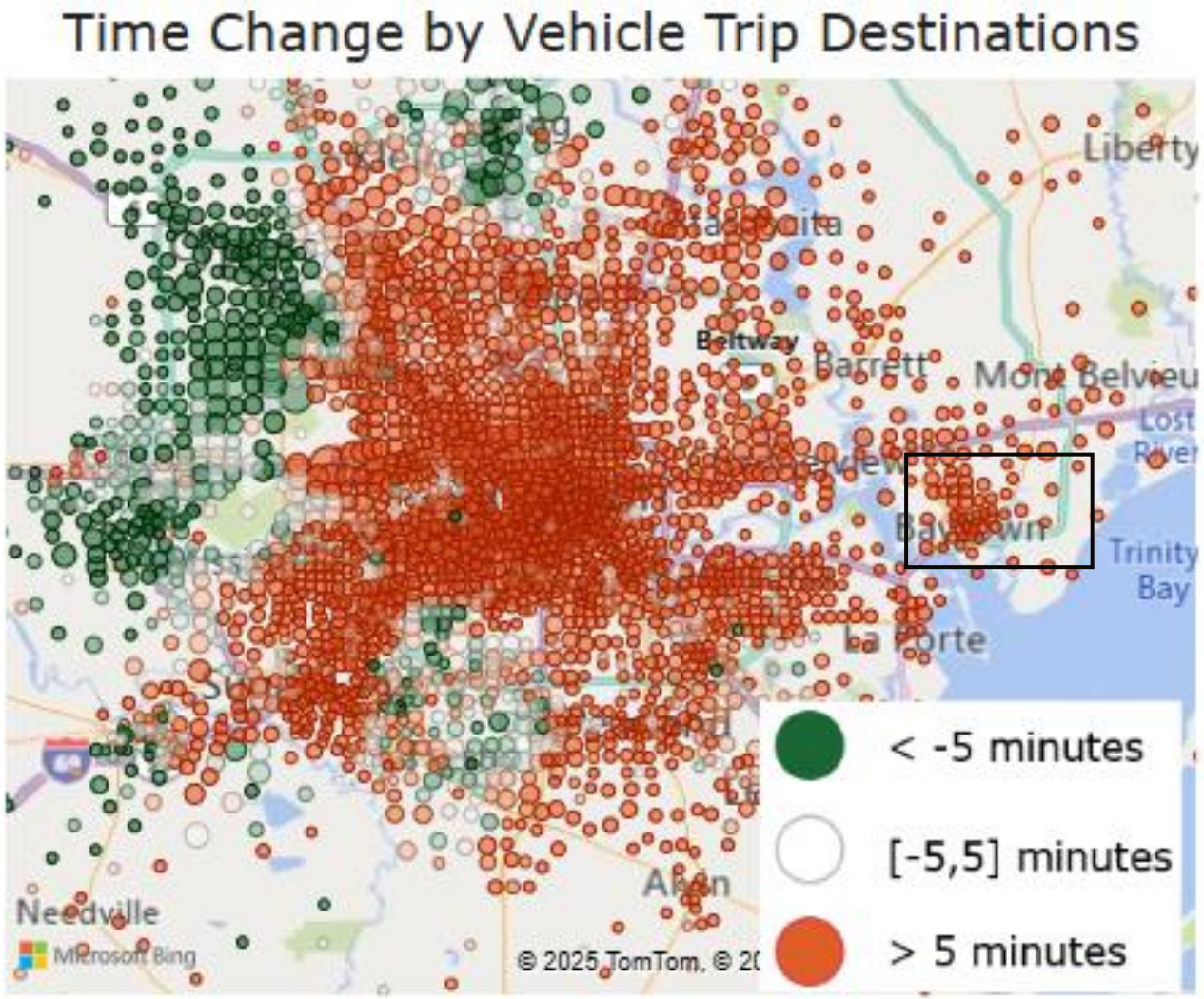
- All vehicles: 1.3M
- Baytown (Top Destination): 10,985

Travel Time/Speed Change

- All vehicles: +12 min (-1.3 mph)
- Baytown (Top Destination): +347 min (-29.2 mph)

Economic Cost Change

- All vehicles: +$8.6M (+$6.6/trip)
- Baytown (Top Destination): +$2.0M (+$182.2/trip)



Project Team

Arcadis: Koushik Arunachalam, Otto Clemente, Shashank Shekhar, Fernando Cordero, Haggai Davis, Fengjiao Zou, Mostafa Jafarzadehfadaki

TxDOT: Brenda Bustillos, David Gao