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Modeling Impacts of Major Roadway Incidents

Case Study of Interstate 10 in Houston, TX

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Meeting Agenda

1 | Overview

2 | Incident Scenarios Development

3 | Traffic Simulation Modeling Summary and Performance Measures

4 | Select Scenarios Analysis and Results

5 | Conclusions

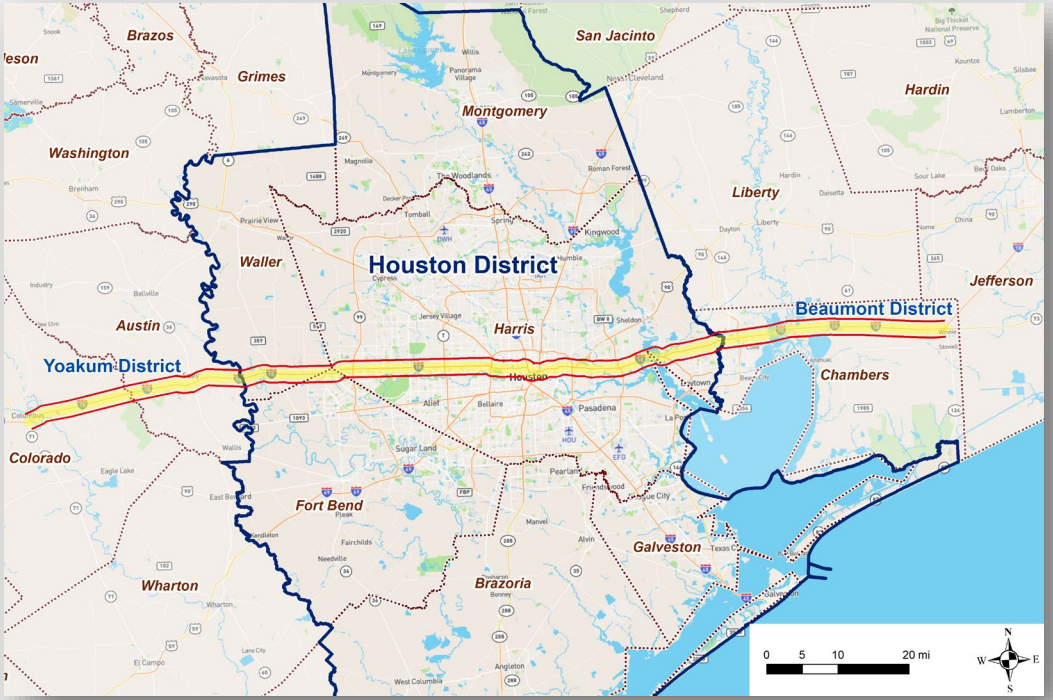
Overview

Background and Needs

- Houston's freeways and supporting facilities experience:
  - Significant congestion
  - Frequent and numerous (un)planned events, causing severe travel time impacts
- Impact evaluation is key!
  - Understanding impacts to travelers and the regional network
- Traffic simulation modeling needs:
  - Helps benchmark traffic patterns
  - Help identify network bottlenecks
  - Identify traffic diversions
  - Help build roadway system resiliency
  - Proactive planning!

Study Area

- IH 10 Feasibility Corridor
- Approximately 132 miles
- Limits:
  - West: SH 71 near Columbus, TX
  - East: SH 73 near Winnie, TX
- TxDOT Districts: Houston, Yoakum, and Beaumont
- Counties: Colorado, Austin, Waller, Fort Bend, Harris, Chambers



Traffic Simulation Modeling Approach

- Regional Travel Demand Model (TDM)
  - TDM converted to Mesoscopic Dynamic Traffic Assignment (DTA) Model (DynusT)
- Mesoscopic (DTA) Model
  - Calibrated eight-county 2019 model and updated network to develop 2023 base year model
  - Baseline No Build scenario defined as 2023 model
- Incident DTA run types:
  - **Short-term scenarios** - One-shot run
    - with varying driver behaviors (e.g., historical, en-route)
  - **Long-term scenarios** - Dynamic User Equilibrium (DUE) run

Scenarios Development

Scenarios Development

Identify/define incident scenarios (and characteristics) to be modeled?

- Incident types?
- Where are incidents located?
- What directions are impacted?
- How often does a location experience incidents?
- How long do those incidents last?

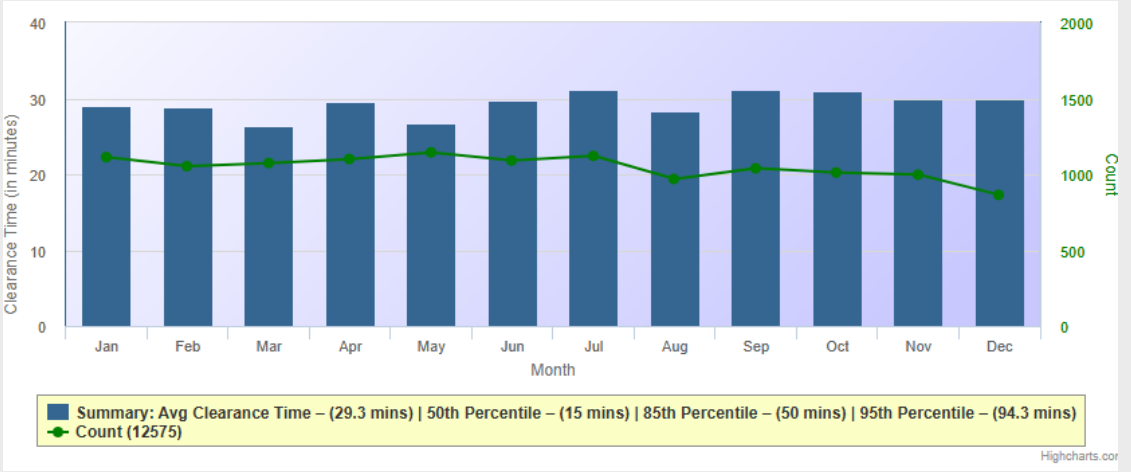
Top 20 Incident Prone Locations

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

Data Source: Houston Transtar (2022)

Incident Clearance Times

- I-10 Katy 2025 stats:
  - Average incident clearance times = **29 min**
  - 95th percentile = **94 min**



Data Source: Houston Transtar (2025)

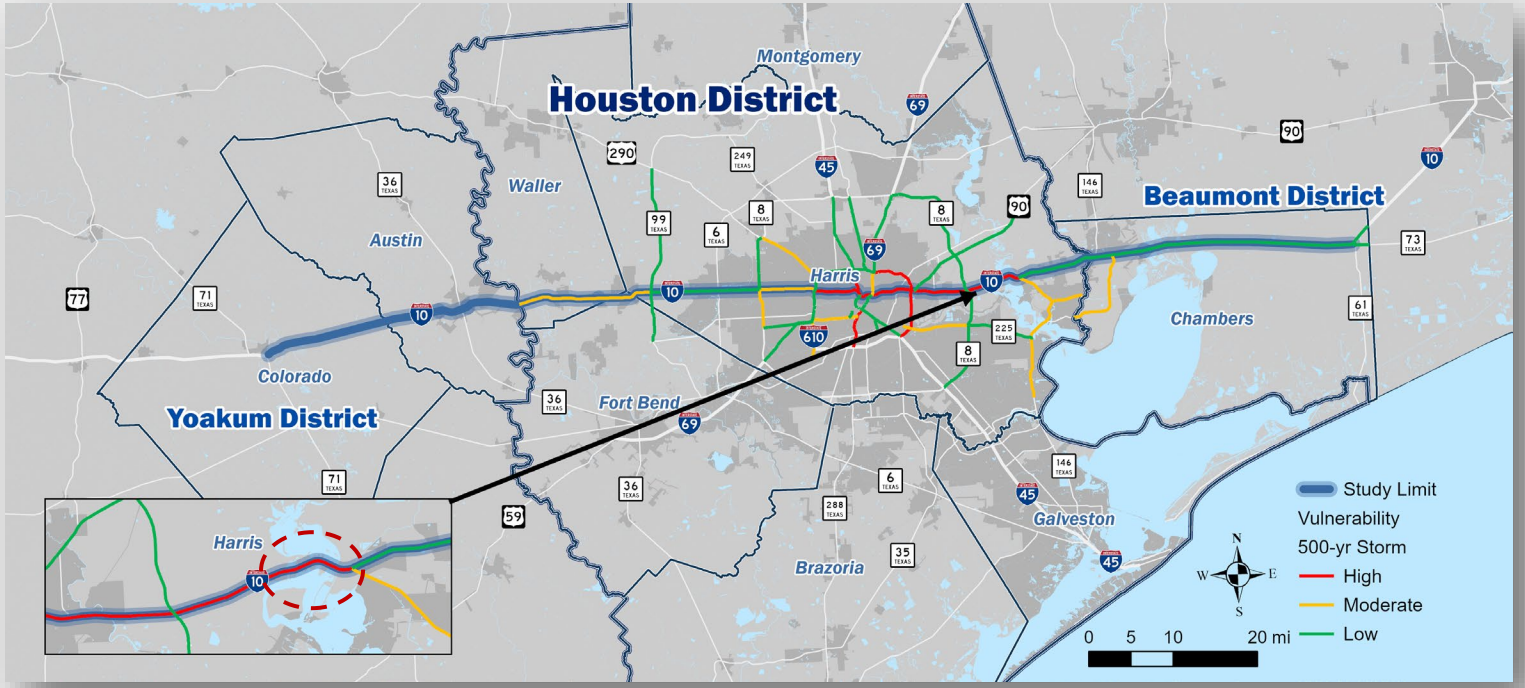
Incidents With 6+ Hour Clearance Times (Examples)

Location	Incident Description	Lanes affected	Clearance Time
IH-10 Katy - Park Ten, WB	Heavy Truck, Accident, Hazmat Spill	4 Mainlanes, 1 Shoulder Lane	9 hours 56 mins
IH-10 Katy - IH-45 Gulf/Hogan St, EB	Heavy Truck, Accident, Hazmat Spill	5 Mainlanes, 2 Shoulder Lanes	8 hours 22 mins
IH-10 East - Waco St, EB	Accident, Vehicle Fire	4 Mainlanes, 2 Shoulder Lanes	7 hours 22 mins
IH-10 Katy - Park Ten, WB	Accident	5 Mainlanes, 2 Shoulder Lanes	6 hours 44 mins
IH-10 - FM-1463, WB	Heavy Truck, Accident, Hazmat Spill, Vehicle Fire	3 Mainlanes, 2 Shoulder Lanes	6 hours 29 mins
IH-10 Katy - Houston Ave, EB	Heavy Truck, Accident, Lost Load	3 Mainlanes, 1 Shoulder Lane	6 hours 9 mins
IH-10 Katy - Houston Ave, EB	Heavy Truck	4 Mainlanes	6 hours 8 mins
IH-10 Katy - Houston Ave, EB	Heavy Truck, Accident	3 Mainlanes, 1 Shoulder Lane	6 hours 4 mins

Data Source: Houston Transtar (2025)

500-Year Storm Vulnerability

- San Jacinto River bridge vulnerable to climate hazards



Data Source: H-GAC Regional Resilience Tool, 2024

Defined Scenarios

- Seven different closure scenarios of varying locations, severities, and durations

Defined Scenarios (cont.)

Short-term Impacts – unplanned event

Scenario	Lane Closures	Direction	Closure Duration	I-10 Cross Street
1	3 of 5 Lanes	WB	P.M. Peak (3 p.m. – 7 p.m.)	Barker Cypress
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
4	12 of 12 Lanes	Both	All Day (12 a.m. - 12 a.m.)	Kirkwood

Long-term Impacts – "planned" event

Scenario	Event	Closure Details
5	Bridge Strike, Bridge Replacement	**Complete closure** of bridge over San Jacinto River
6	Major Construction	**Lane closures** to 8 lanes on I-10 inside BW 8 **Speed reductions** to 50 mph
7	Severe Flooding	**Complete closure** of I-10 inside the I-610 Loop

Modeling Results and Performance Measures

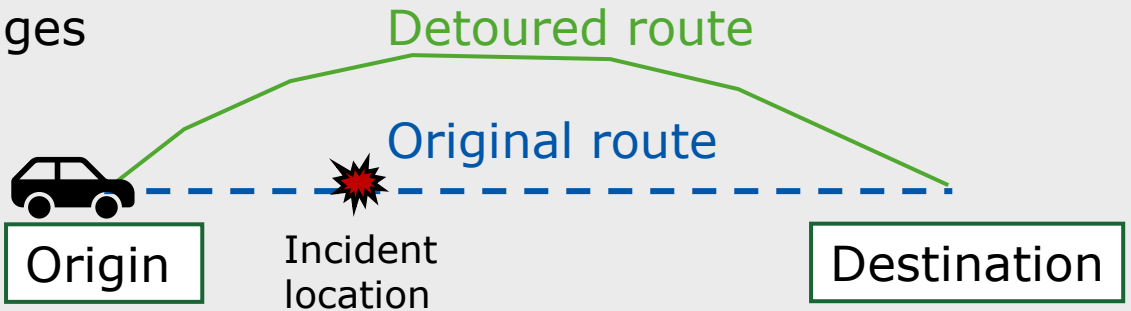
Base Year 2023 Model Summary (Region)

Time Period	Vehicle Type	Total Number o Vehicles	VHT	VMT	Avg Trip Time (min)	Avg Trip Lengt (mi)	Avg vehicle Dela (min)
Daily	Passenger Car	19,986,290	5,329,895	187,126,321	16.0	9.4	4.8
Daily	Truck	337,450	279,076	13,091,504	49.6	38.8	9.9
Daily	**Total Vehicles**	**20,323,740**	**5,608,971**	**200,217,825**	**16.6**	**9.9**	**4.9**
AM Peak	Passenger Car	3,538,391	1,064,946	37,266,875	18.1	10.5	5.0
AM Peak	Truck	41,951	38,816	1,827,912	55.5	43.6	8.2
AM Peak	Total Vehicles	3,580,342	1,103,762	39,094,787	18.5	10.9	5.0
PM Peak	Passenger Car	6,753,923	2,160,285	67,111,036	19.2	9.9	6.7
PM Peak	Truck	107,683	109,204	4,598,529	60.8	42.7	14.2
PM Peak	Total Vehicles	6,861,606	2,269,489	71,709,565	19.8	10.5	6.8

Note: Summary results are based on DUE run (15 iterations) with simulation run time of 3.5 days, RGAP = 0.7%, Incomplete Trips = 0

Performance Measures

- Baseline scenario versus incident scenarios comparisons
  - Trips Affected: travel time changes of at least ±5 minutes
  - Travel time changes
  - Speed changes
  - Economic cost changes

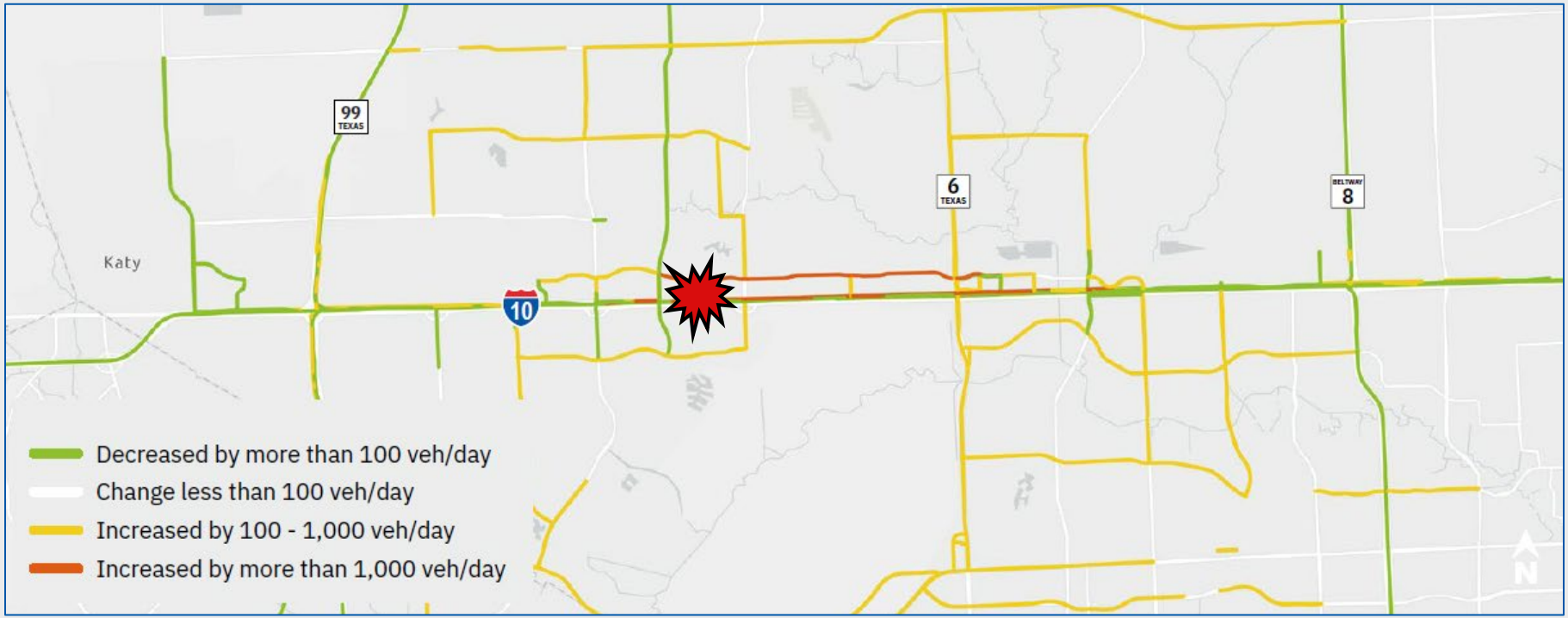


Select Scenarios
Analysis and Results

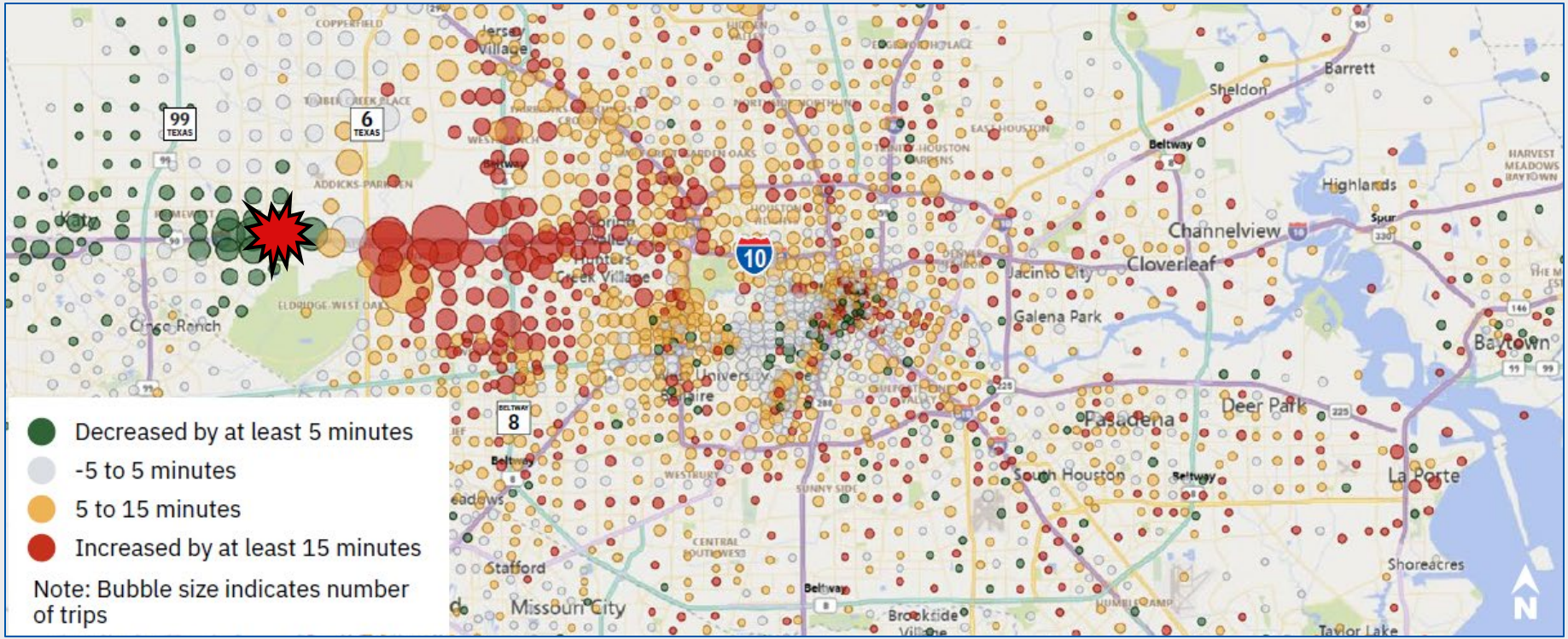
Scenario 1 – Short-Term Partial Closure, Westbound

# Lanes	5 Lanes
Closure	3 Lanes
Direction	WB
Time Period	PM Peak Period
Duration	3-7 PM

Scenario 1 – Traffic Volumes

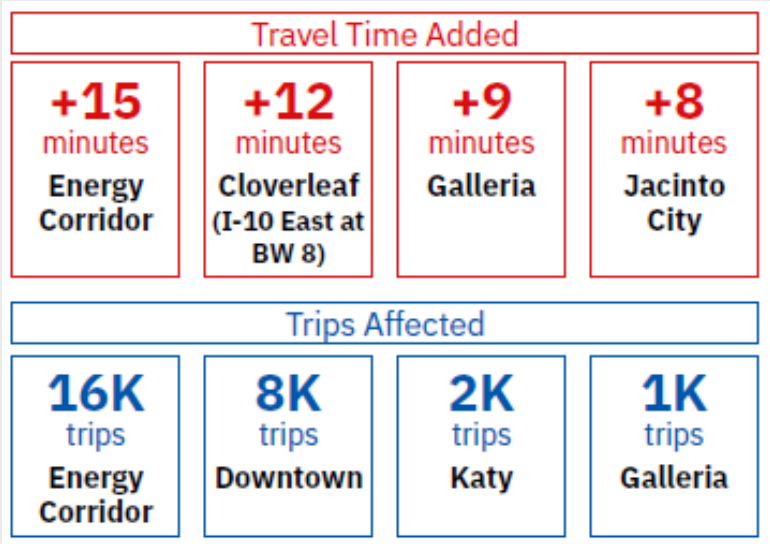


Scenario 1 – Traffic Impacts - Trip Origins



Scenario 1 – Modeling Results

Vehicles	Origin and Destination	Travel Time Change (min)	Trips Affected (#)	Economic Cost ($)	
				Total	Per Trip
All Vehicles	All (OD)	+9	119,057	$505K	$4
	Energy Corridor (O)	+15	16,248	$113K	$7
Freight Only	All (OD)	+27	2,091	$60K	$29
	Brookshire (D)	+39	24	$1K	$43

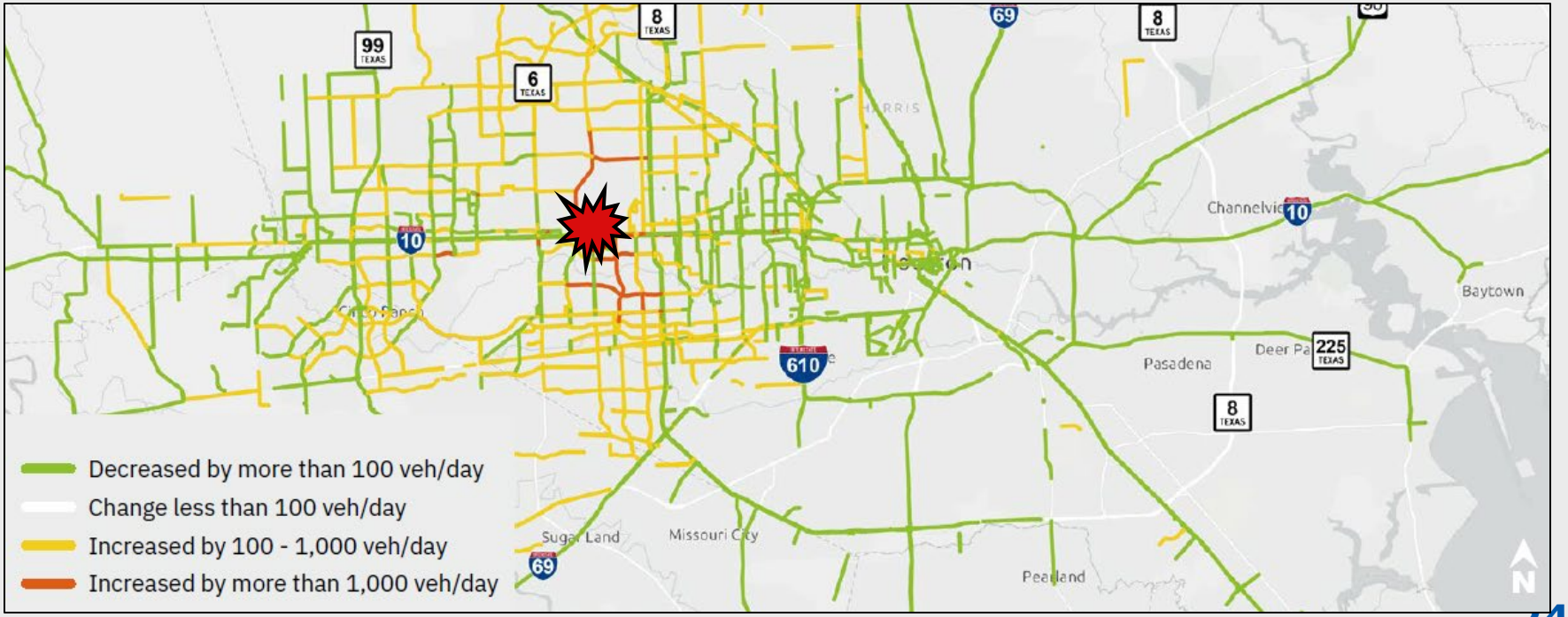


Note: Above are modeling results for the PM peak period (3-7 PM)

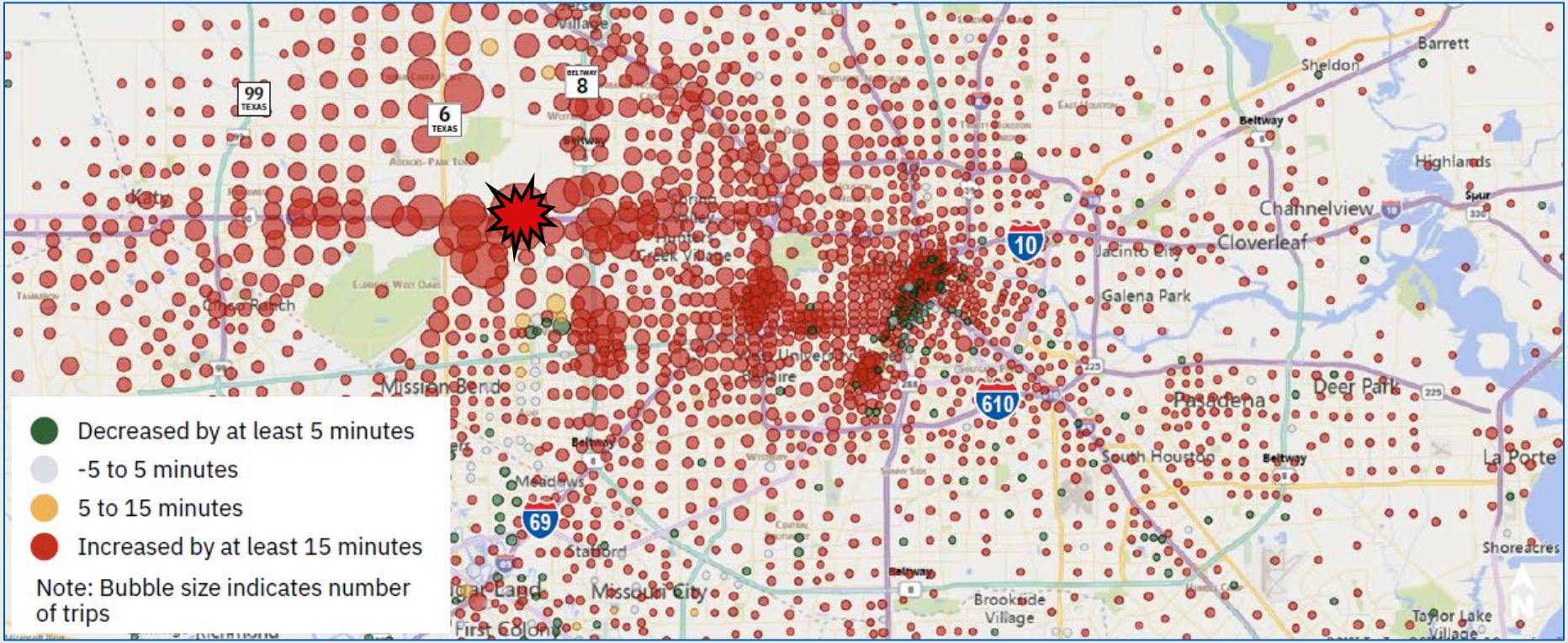
Scenario 4 – Short-Term Full Closure, Both Directions

# Lanes	12 Lanes
Closure	Full
Direction	EB/WB
Time Period	All Day
Duration	12-12 AM

Scenario 4 – Traffic Volumes

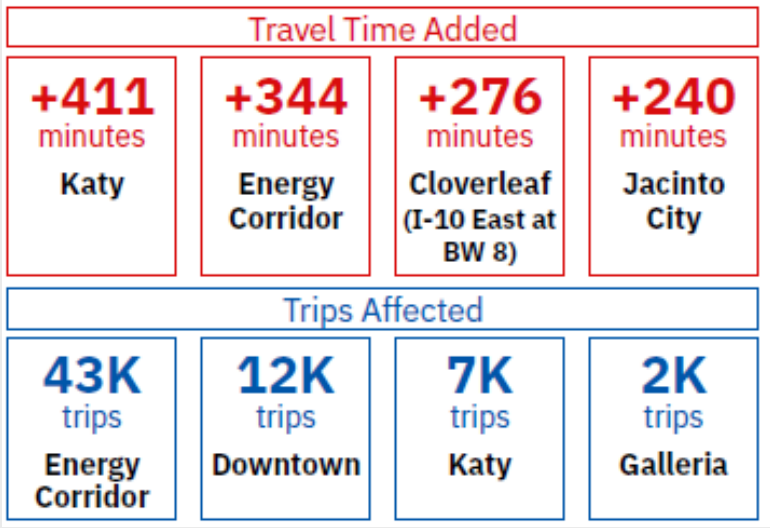


Scenario 4 – Traffic Impacts - Trip Origins



Scenario 4 – Modeling Results

Vehicles	Origin and Destination	Travel Time Change (min)	Trips Affected (#)	Economic Cost ($)	
				Total	Per Trip
All Vehicles	All (OD)	+210	344,531	$35.9M	$104
	Katy (O)	+411	6,890	$1.3M	$188
Freight Only	All (OD)	+526	7,940	$4.5M	$563
	Brookshire (O)	+891	41	$39K	$954

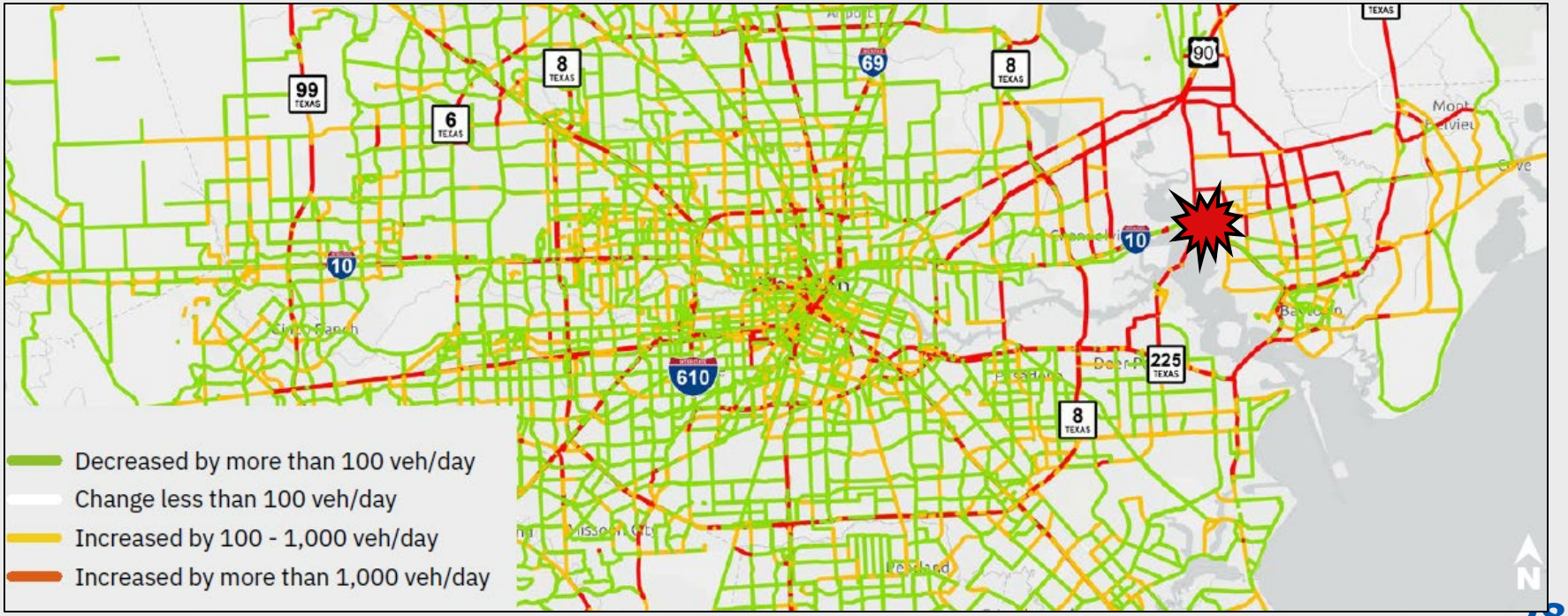


Note: Above are modeling results for the PM peak period (3-7 PM)

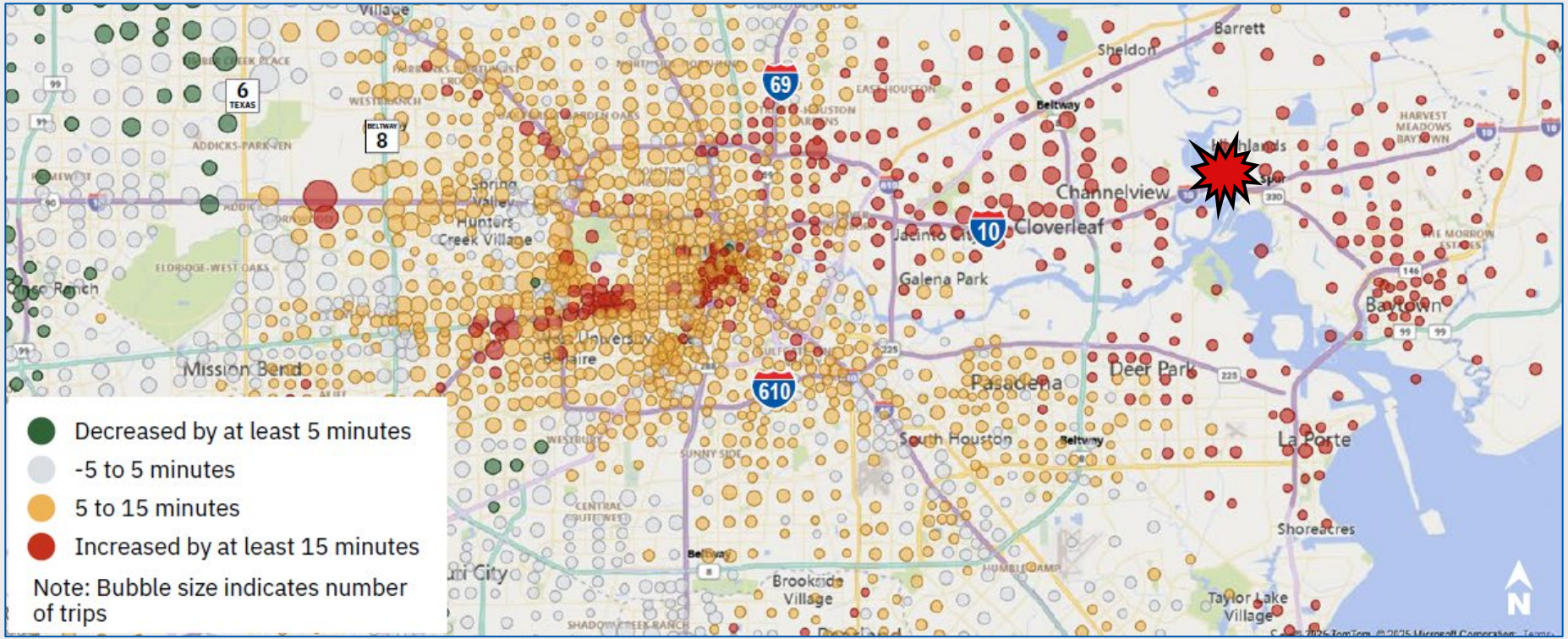
Scenario 5 – Long-term Full Bridge Closure, Both Directions

# Lanes	6 Lanes
Closure	Full
Direction	EB/WB
Duration	Long Term

Scenario 5 – Traffic Volumes



Scenario 5 – Traffic Impacts - Trip Destinations



Scenario 5 – Modeling Results

Vehicles	Origin and Destination	Travel Time Change (min)	Trips Affected (#)	Economic Cost ($)	
				Total	Per Trip
All Vehicles	All	+12	1.3M	$8.6M	$7
	Baytown (D)	+347	10,985	$2.0M	$182
Freight Only	All	+54	32,698	$1.9M	$58
	Baytown (D)	+366	293	$116K	$395
	Houston Ship Channel Industrial Corridor (O)	+107	234	$27K	$115

Travel Time Added

+347 minutes	+76 minutes	+23 minutes	+12 minutes
Baytown	Cloverleaf (I-10 East at BW 8)	Jacinto City	Downtown

Trips Affected

32K trips	30K trips	13K trips	11K trips
Energy Corridor	Downtown	Katy	Baytown

Note: Above are modeling results for the PM peak period (3-7 PM)

Conclusions

- **Proactive planning is essential!**
  - Frequently occurring short-term closures (Scenarios 1 to 3) caused localized congestion.
  - Full day complete closure (Scenario 4), resulted in the highest average added travel time.
  - In long-term scenarios like Scenario 6, travelers adapted their behavior, but regional impacts, especially near Downtown, remained substantial.
  - Scenarios 4-7 are rare, but given their extreme impacts, TxDOT needs to plan for these cases too.
- **Accessibility and Reliability in key areas should be maintained**
  - Downtown Houston and the Energy Corridor consistently emerged as the most impacted activity centers in terms of both disrupted trips and economic losses.
    - Longer-term closures, intensified these effects.
  - When I-10 within BW 8 or the I-610 Loop was affected, the most significant economic and mobility impacts were concentrated in and around Downtown Houston.
    - These patterns underscore Downtown's pivotal role in the Houston transportation system

Q & A