Modeling the Traffic Impacts of Transit Facilities using Dynamic Traffic Assignment

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Outline

- Introduction and Motivation
- Proposed Urban Rail System
- Dynamic Traffic Assignment Implementation
- Results
- Conclusion

Introduction

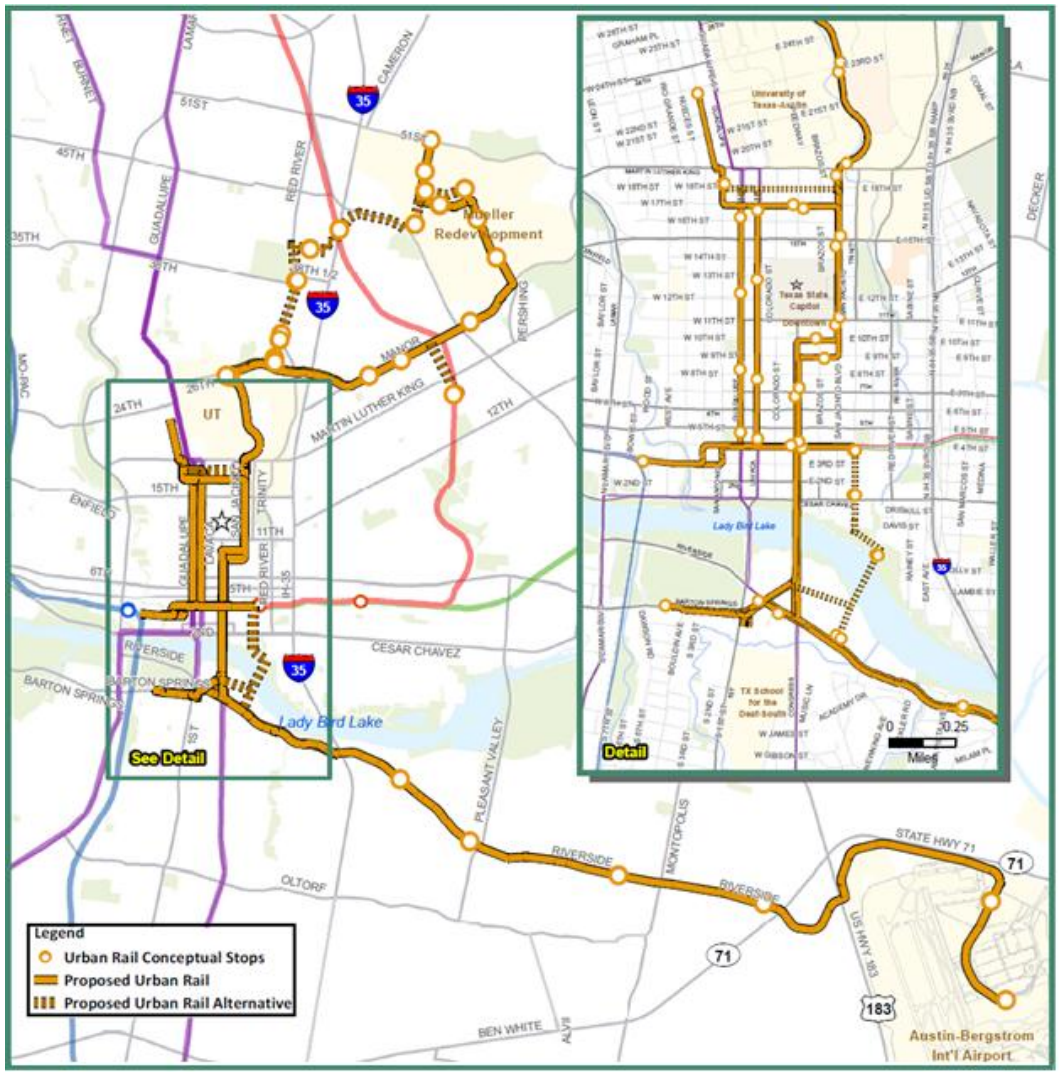
- Implementation of new or expansion of existing transit systems can significantly impact traveler behavior
- Agencies have used several methods to estimate traffic impacts: corridor-specific analysis and regional planning
- Corridor-specific analysis
  - Microsimulation to quantify vehicular delay
  - Route choice is non-existent or greatly simplified
- Regional planning
  - Captures changes in vehicular use through mode choice and traffic assigment
  - Not detailed enough to directly model transit impedances during the traffic assignment process

Motivation and Purpose

- Dynamic traffic assignment (DTA) provides a connection between the two methods
  - Models route choice behavior using realistic, detailed inputs at a fine time scale across a large spatial area

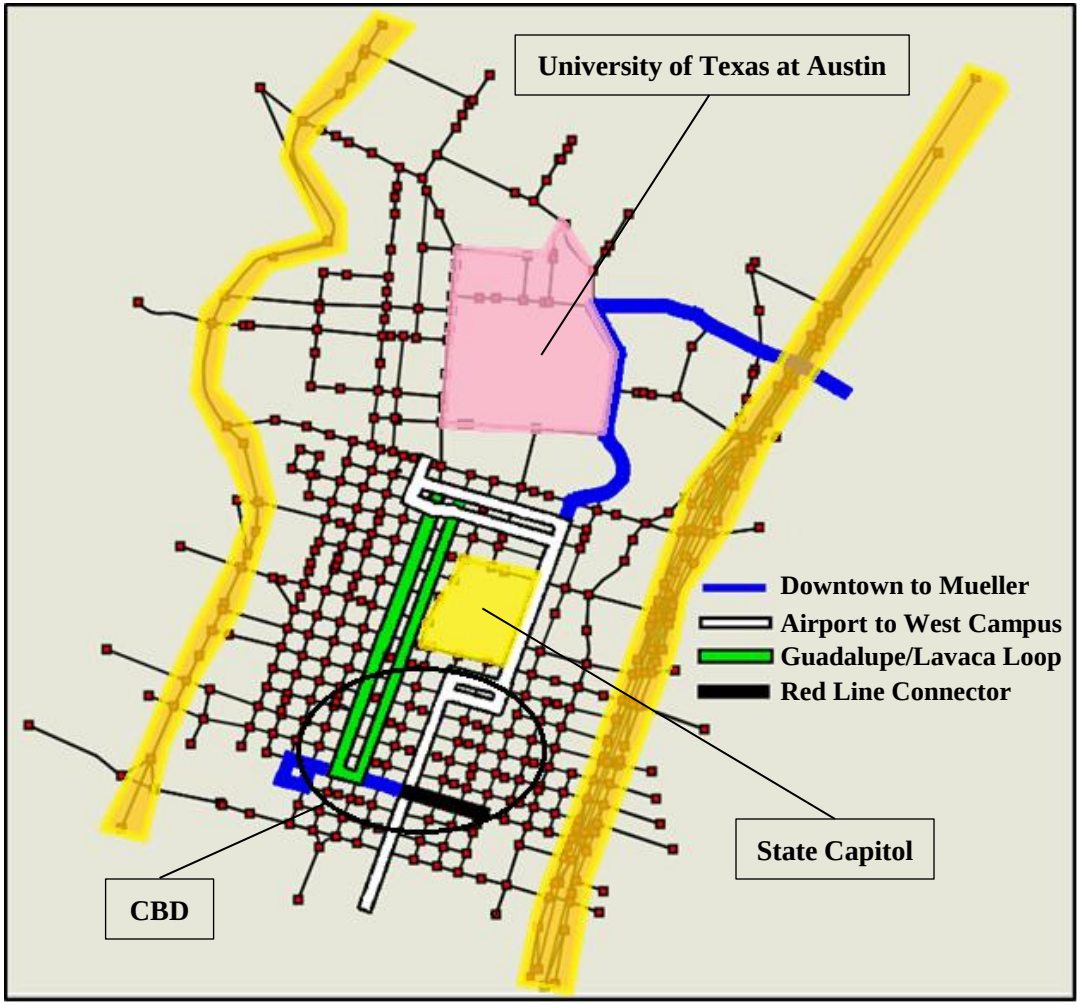
- This study demonstrates the benefits and capabilities of DTA when analyzing traffic impacts caused by transit facilities
  - Proposed urban rail through downtown Austin, Texas used as a case study

Proposed Urban Rail System



- Connects the three major employers of Austin: University of Texas at Austin, the State of Texas, and the CBD
- Majority of rail has dedicated guideway
- Three major geometric changes:
  - Guadalupe/Lavaca Corridor - one lane converted into a shared rail and BRT lane.
  - San Antonio Street - one lane converted into dedicated rail ROW.
  - 4th Street - one lane added in westbound direction.

Base Case Network and Routes



- Base Case Network
  - 1,253 links
  - 456 nodes
  - 86 centroids
  - 2,542 origin-destination pairs
- Routes
  - 10 minute headways
  - 5 minute headways at overlapping routes

Dynamic Traffic Assignment Implementation

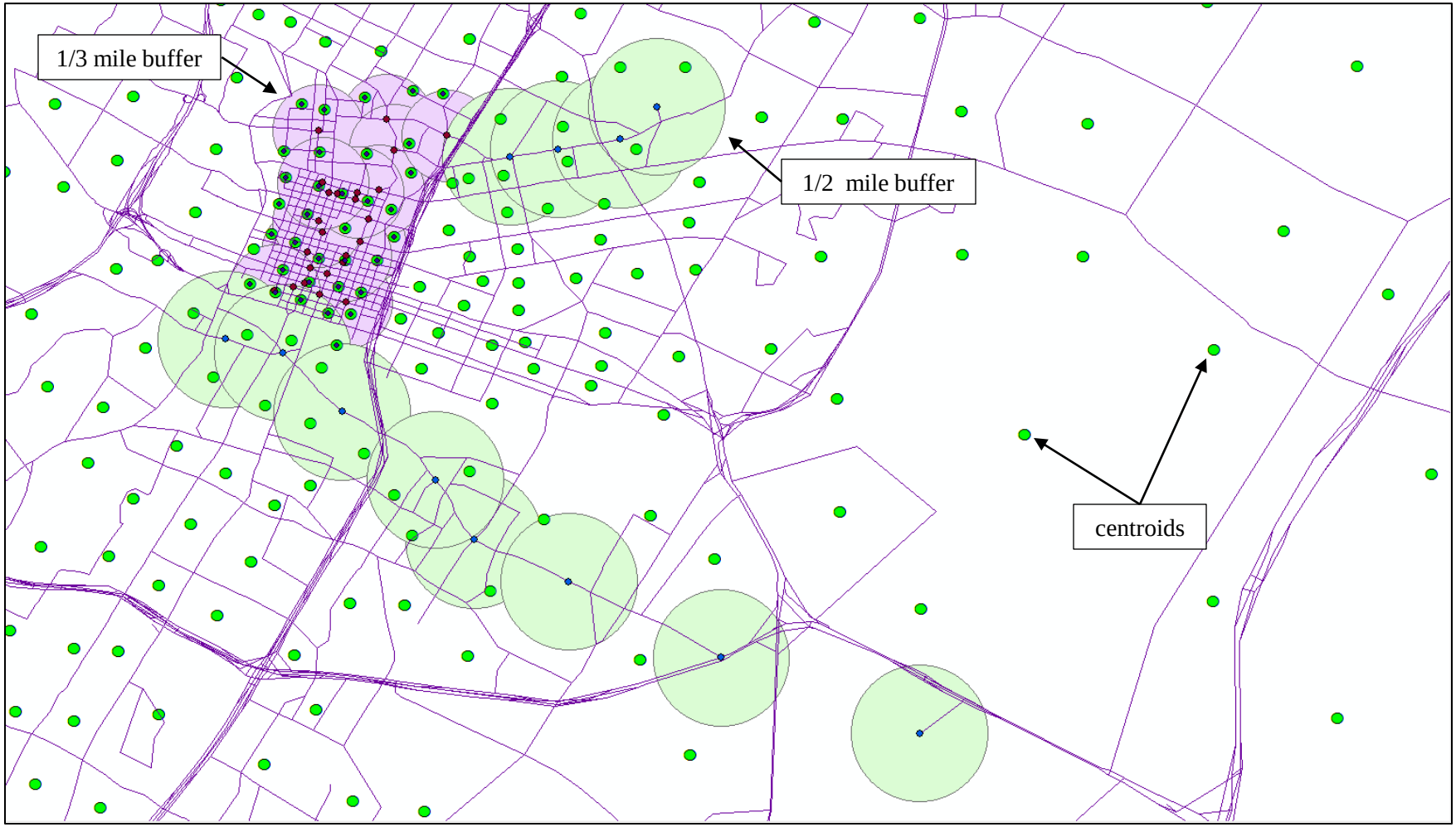
- Inputs necessary for DTA:
  - Network with known link capacities, jam densities, and free-flow speeds
  - Traffic signal timings and transit schedules
  - Origin-destination matrix for each assignment period

- Analysis used simulation-based DTA software
  - Cell transmission model to simulate flow
  - Method of successive averages as convergence method
  - Convergence measured through the *cost gap percentage* – percent increase of travel time an average user feels over the shortest path travel time
  - Simulation period from 7:00 AM to 9:00 AM

Scenarios

- Five scenarios were modeled:
  - Base Case Scenario – no rail implementation
  - Worst Case Scenario – rail implementation, but no auto users switch mode
  - 4% Scenario – 4% of drivers switch to the rail service, where service is available
  - 8% Scenario
  - 16% Scenario

Determination of Availability

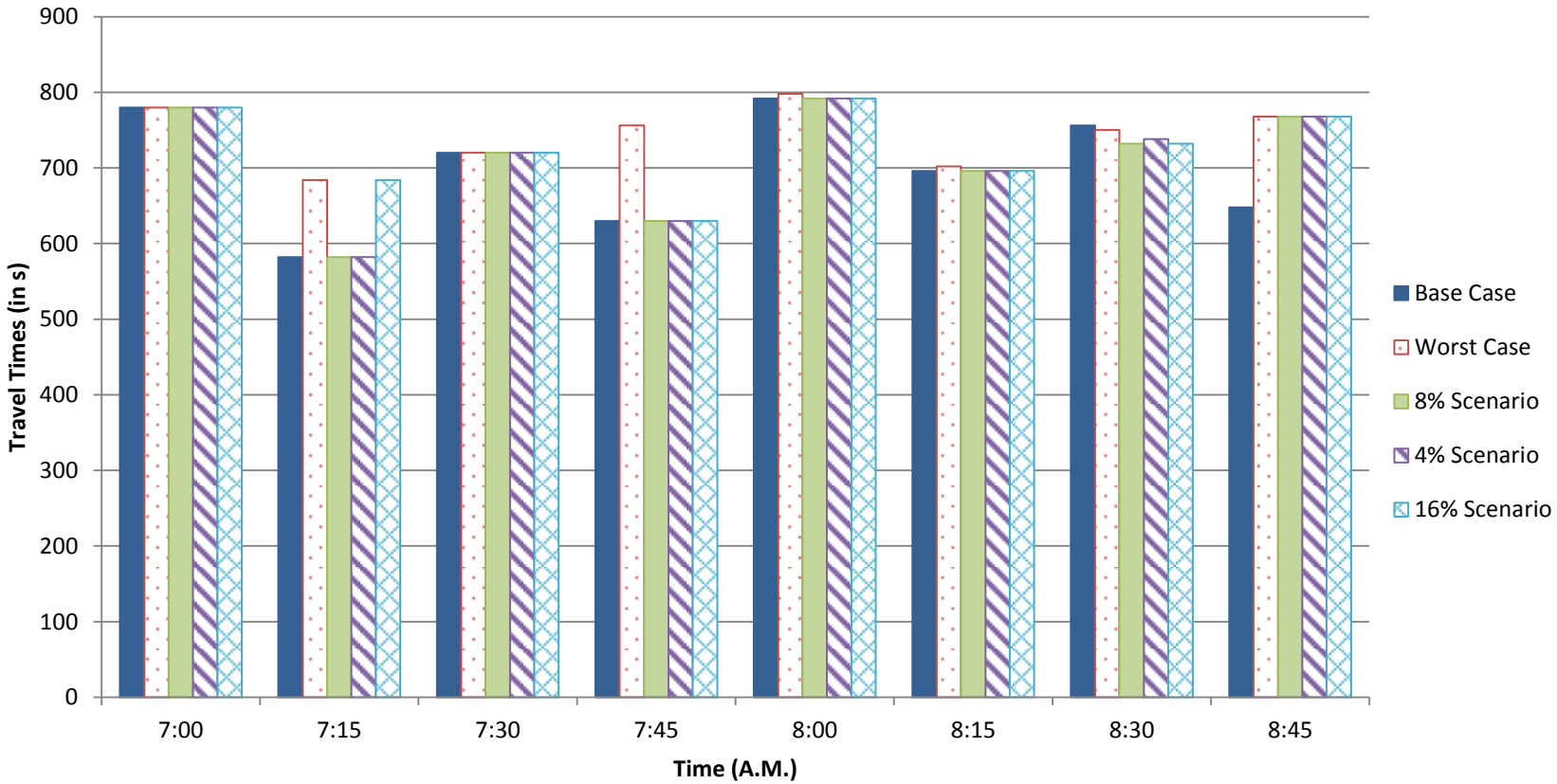


Results – East-West Corridor Travel Times

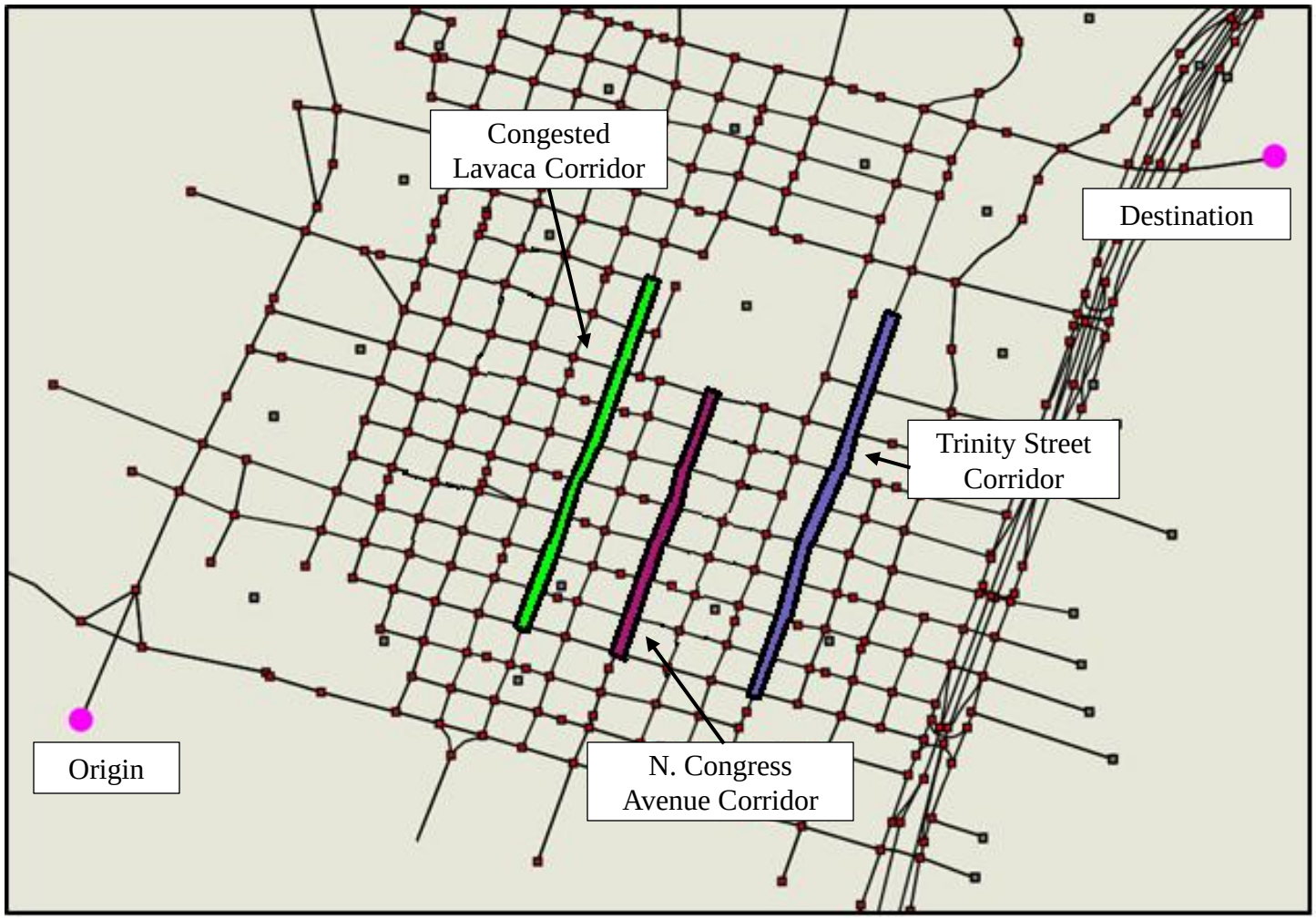
	Average Travel Time on Corridor (min)				
Corridor	**Base Case**	**Worst Case**	**4% Scenario**	**8% Scenario**	**16% Scenario**
Cesar Chavez EB	6.45	6.03	6.44	5.93	6.05
Cesar Chavez WB	7.81	7.77	7.77	7.98	7.28
5th Street	5.82	5.67	5.78	5.57	5.54
6th Street	6.44	6.44	6.44	6.64	6.65
8th Street WB	3.36	3.34	3.49	3.48	3.28
7th Street EB	3.78	3.80	3.79	3.79	3.76
9th Street EB	2.99	2.81	2.98	2.81	2.98
10th Street WB	3.45	3.64	3.49	3.46	3.46
11th Street EB	5.83	5.56	5.50	5.04	5.39
11th Street WB	4.88	5.05	5.19	5.00	4.84
12th Street EB	3.64	3.30	3.23	3.54	3.14
12th Street WB	2.88	2.84	2.87	2.86	2.84
15th Street WB	6.00	6.16	6.35	5.96	5.98
15th Street EB	11.40	8.86	17.21	6.41	6.34
M.L.K. Boulevard WB	4.21	4.34	4.19	4.30	3.99
M.L.K. Boulevard EB	3.60	3.50	3.56	3.60	3.61

- Most east/west streets have roughly the same travel time across all scenarios

Results – Guadalupe/Lavaca Loop Travel Time



Congested Lavaca Corridor



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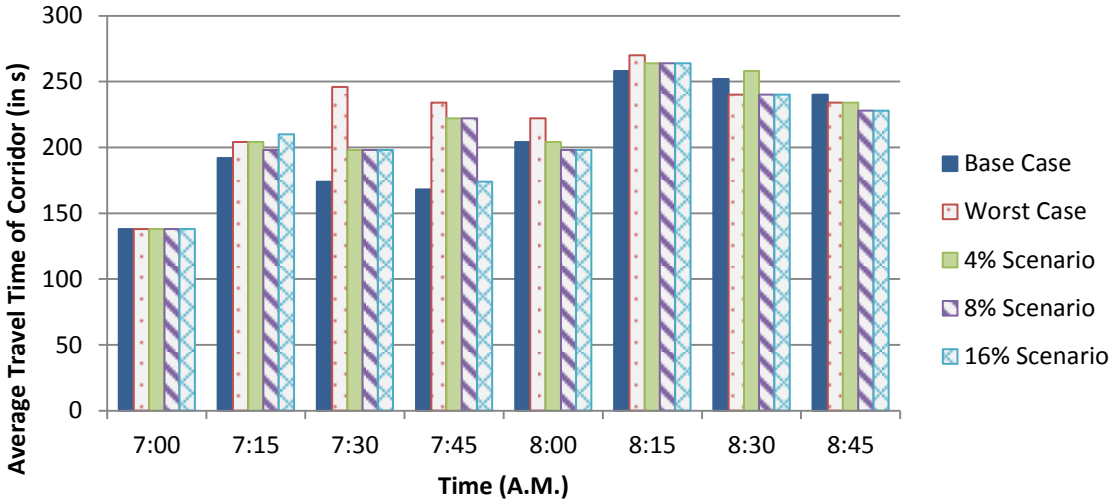
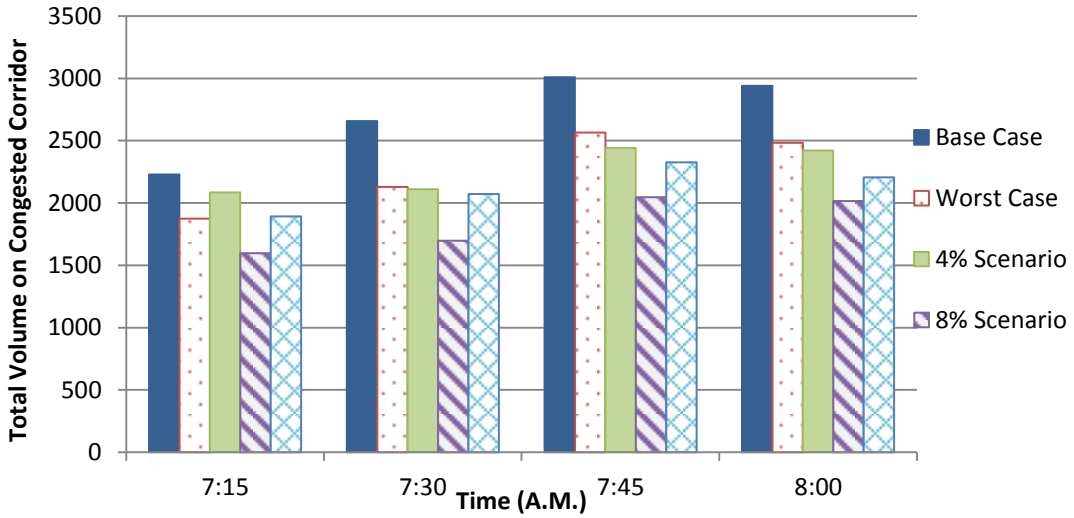
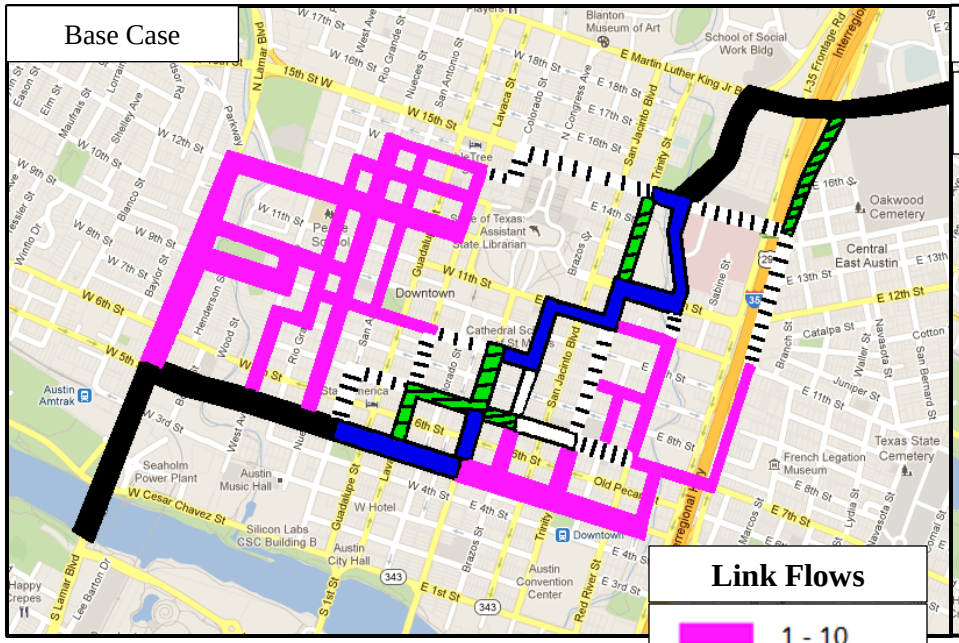


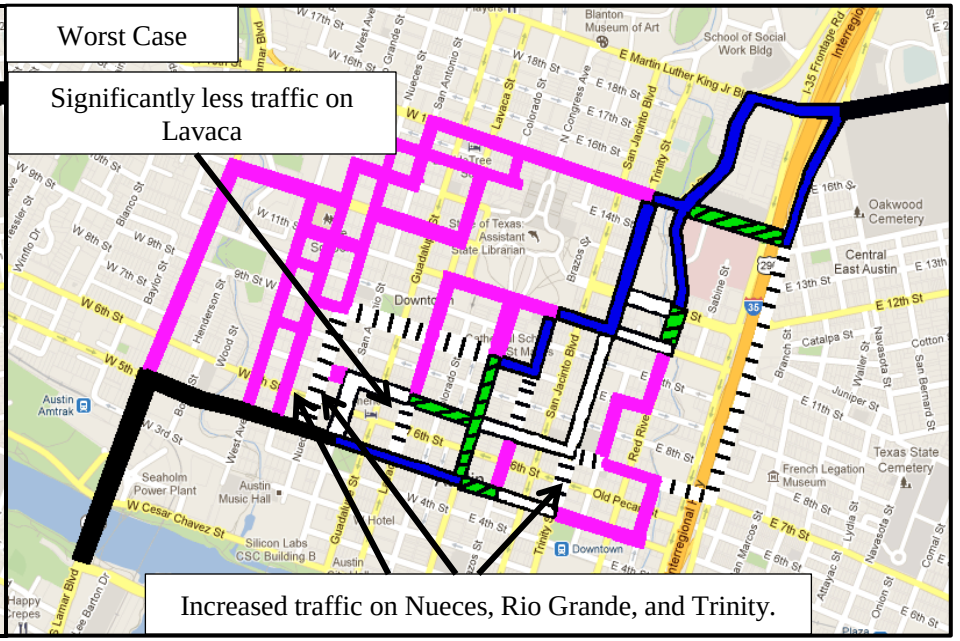


Results – Base Case vs. Worst Case Travel Patterns

Base Case



Worst Case



Significantly less traffic on Lavaca

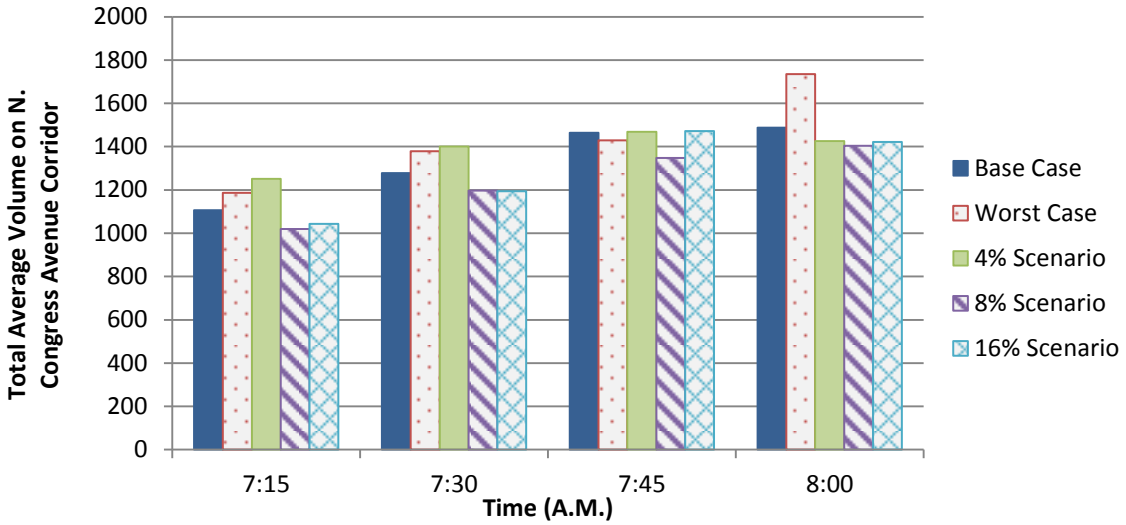
Increased traffic on Nueces, Rio Grande, and Trinity.

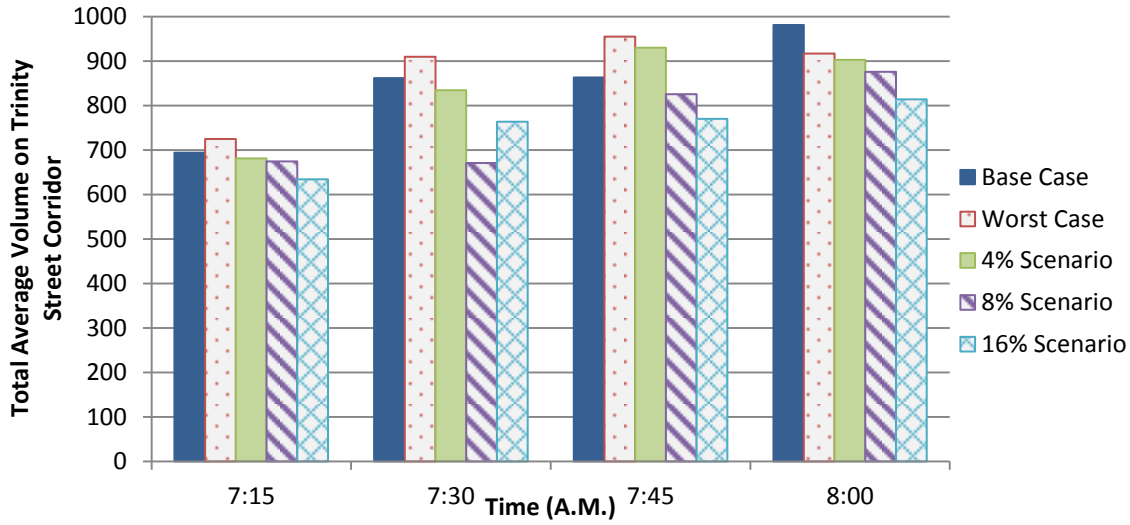
Link Flows

- 1 - 10
- 10 - 20
- 20 - 30
- 30 - 50
- 50 - 100
- 100 - 150

If not specified, link flows are zero

Results – Volume on Parallel Corridors





Conclusion

- The urban rail system had limited impact on the overall transportation system
  - Network exhibited minimal congestion where geometric changes occurred
- At the few congested locations, travel patterns do change
  - If low ridership occurs, traffic will switch to parallel roadways
- Integration of DTA into the design of transit systems provides limitless possibilities and the potential for more efficient systems

Thank You

Questions??