I-35 TOLLS TO DECREASE CONGESTION

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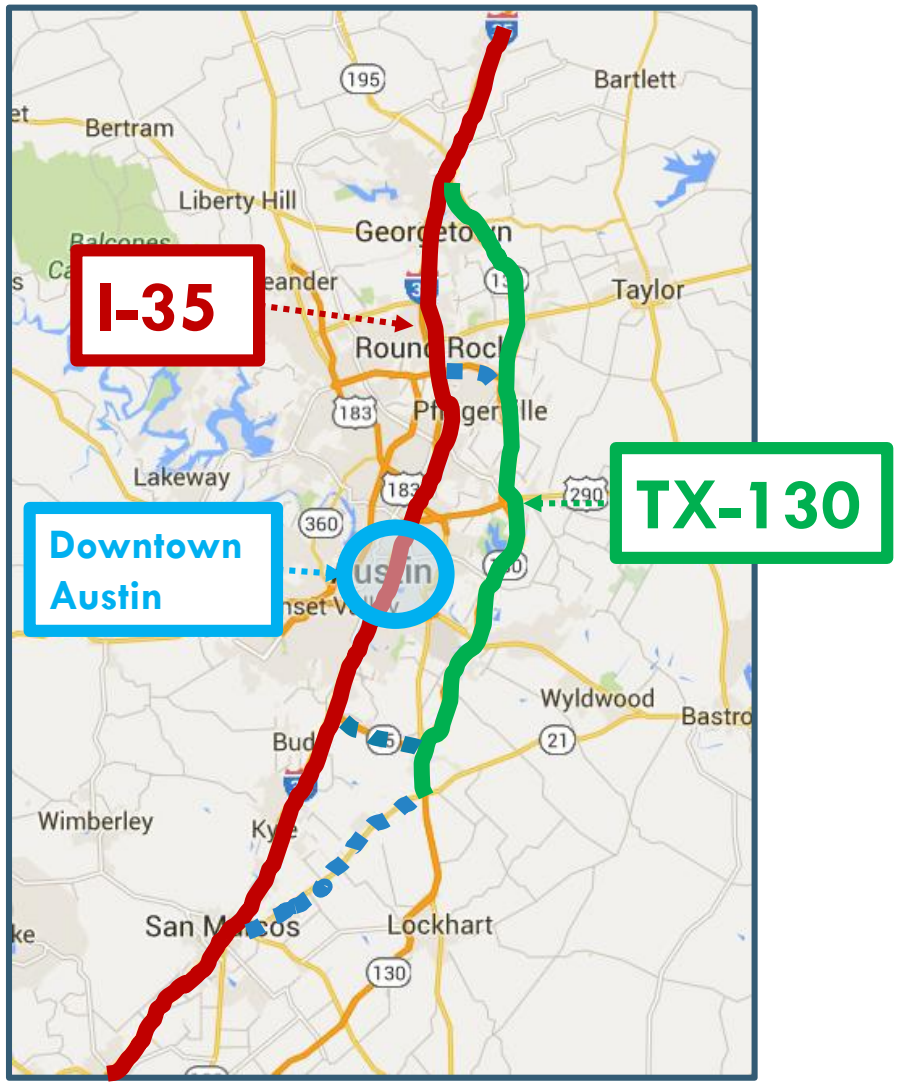
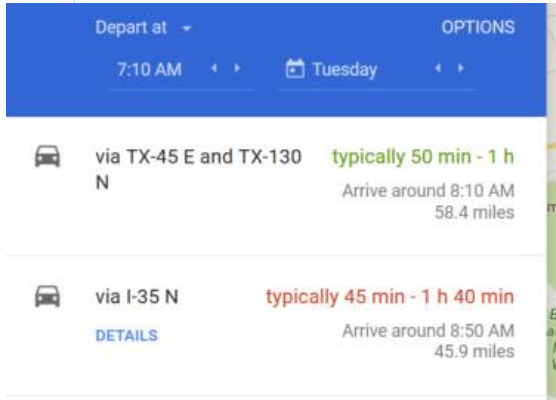
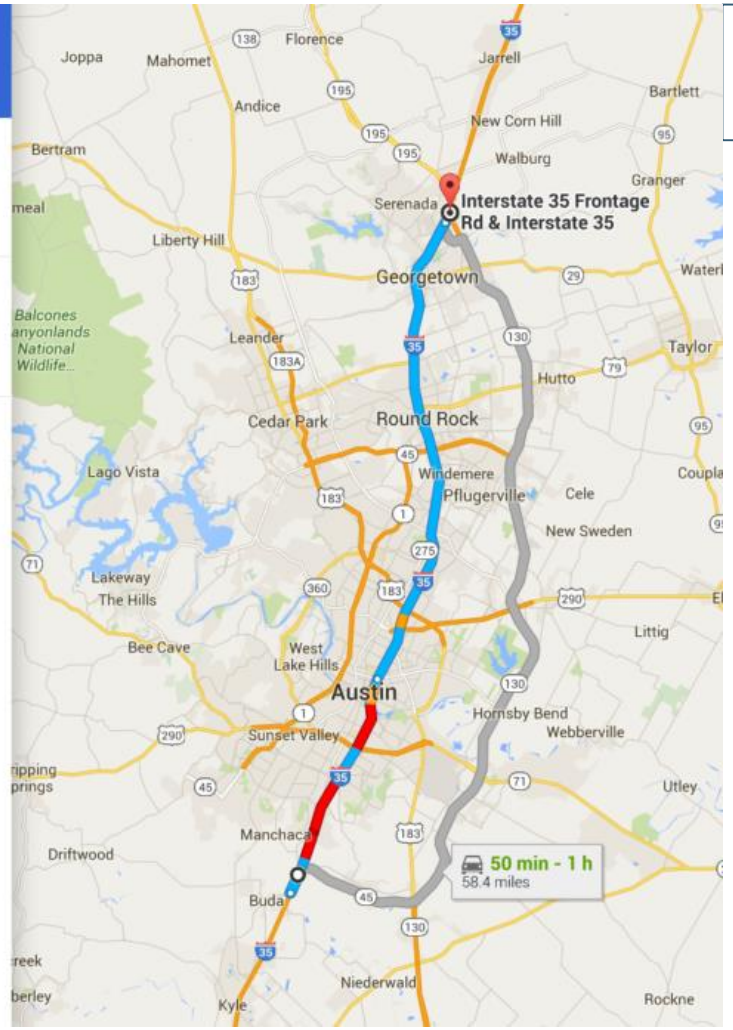
PURPOSE

- Analyze the impact a toll would have on I-35 to divert through-traffic around Austin on TX-130 rather than through Austin on I-35
  - Could tolling I-35 instead of TX-130 reduce total system travel time during peak morning traffic in Austin?
  - What toll on I-35 would be appropriate to compensate for lost toll revenue on TX-130?
  - What impact would the toll on I-35 have on traffic flows on I-35 and TX-130?

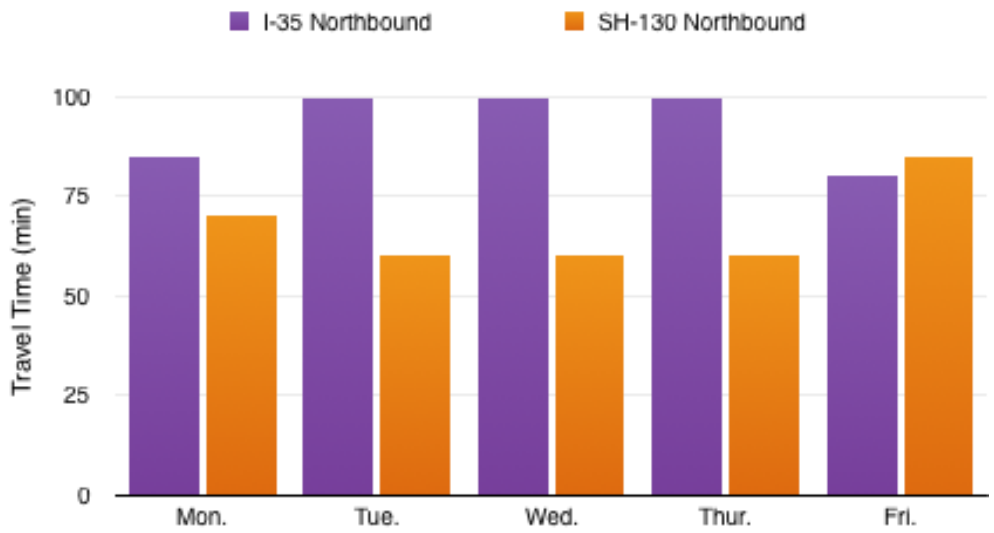


AUSTIN TRAVEL TIMES, FROM SOUTH TO NORTH



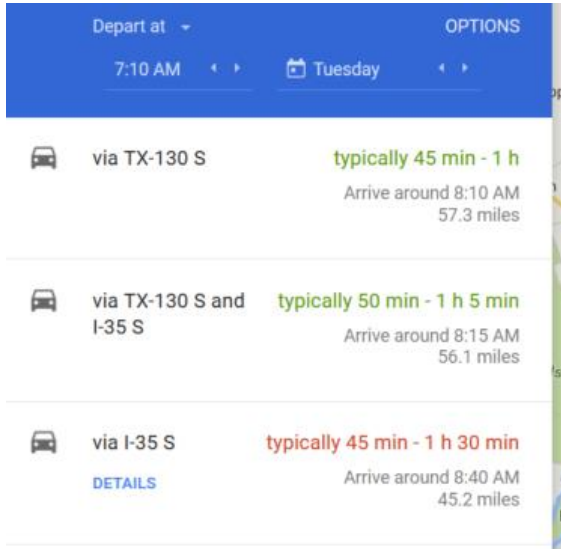


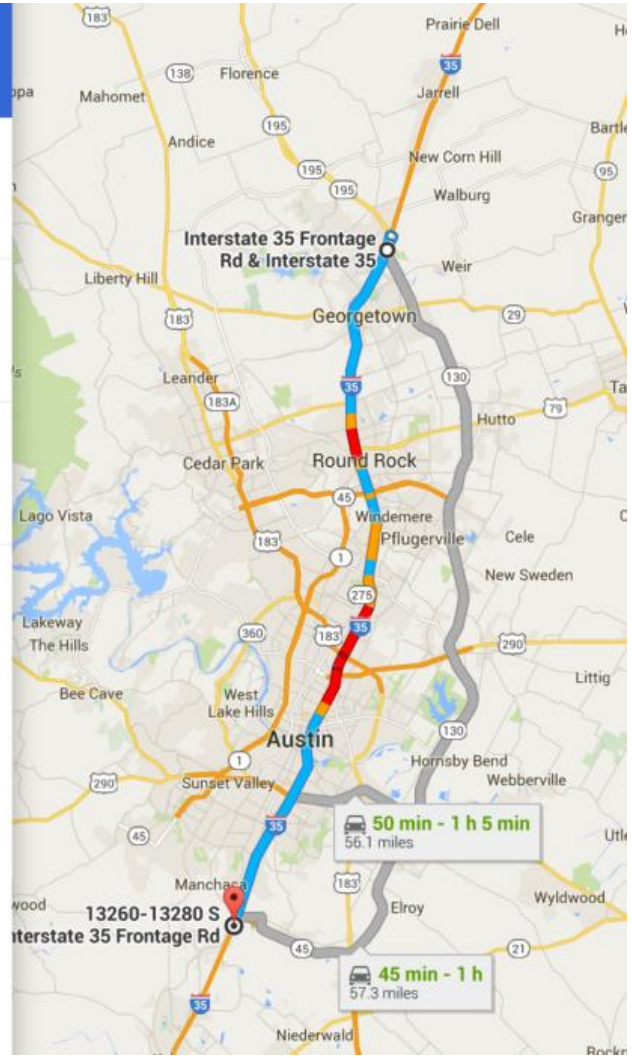
I-35 is a longer, less reliable route through the city during peak morning hours



Source: Google Maps

AUSTIN TRAVEL TIMES, FROM NORTH TO SOUTH





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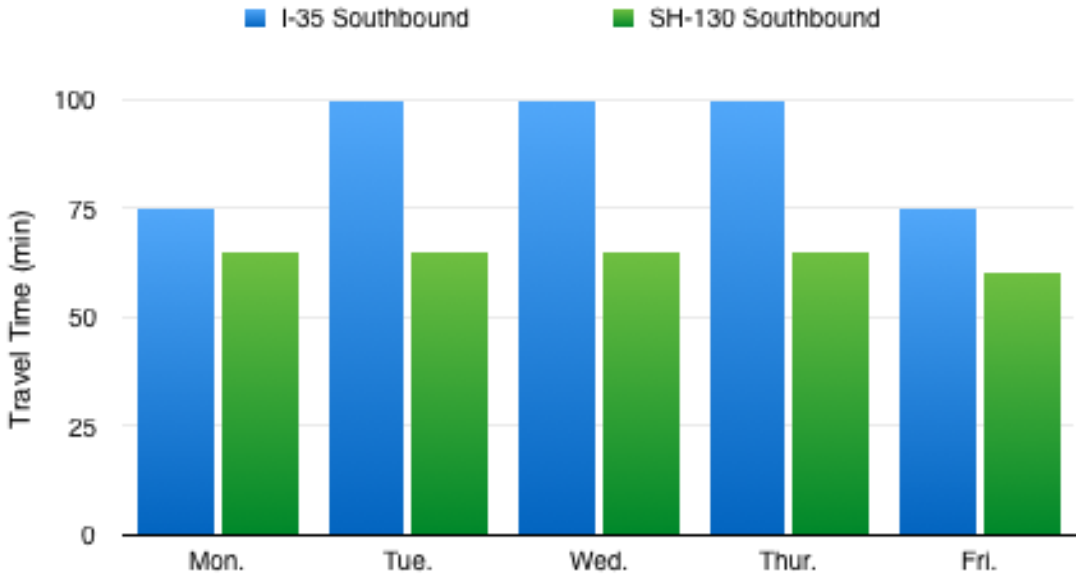
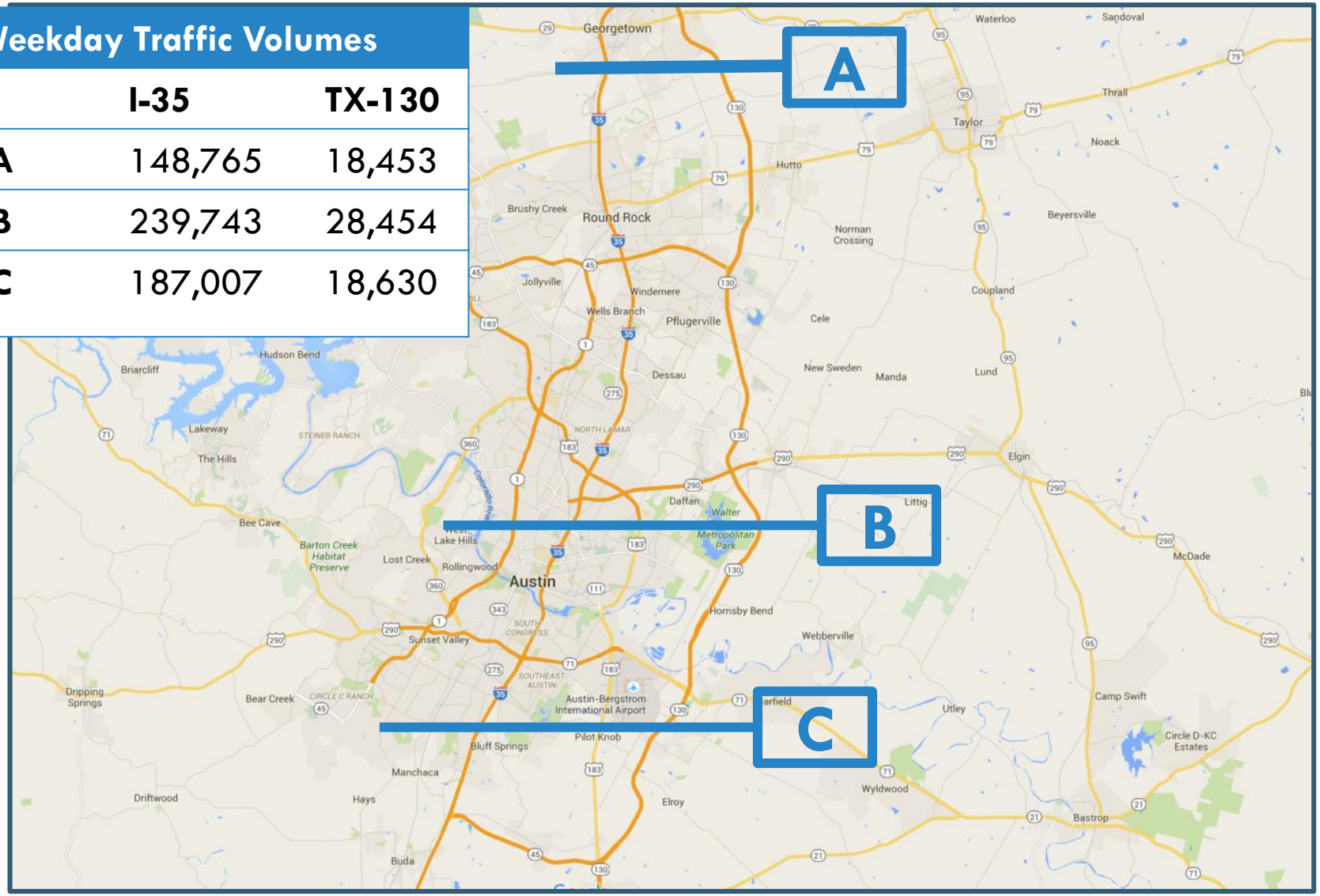


Source: Google Maps

TRAFFIC FLOWS ON I-35 ARE ~8X FLOWS ON TX-130

Weekday Traffic Volumes		
	I-35	TX-130
A	148,765	18,453
B	239,743	28,454
C	187,007	18,630

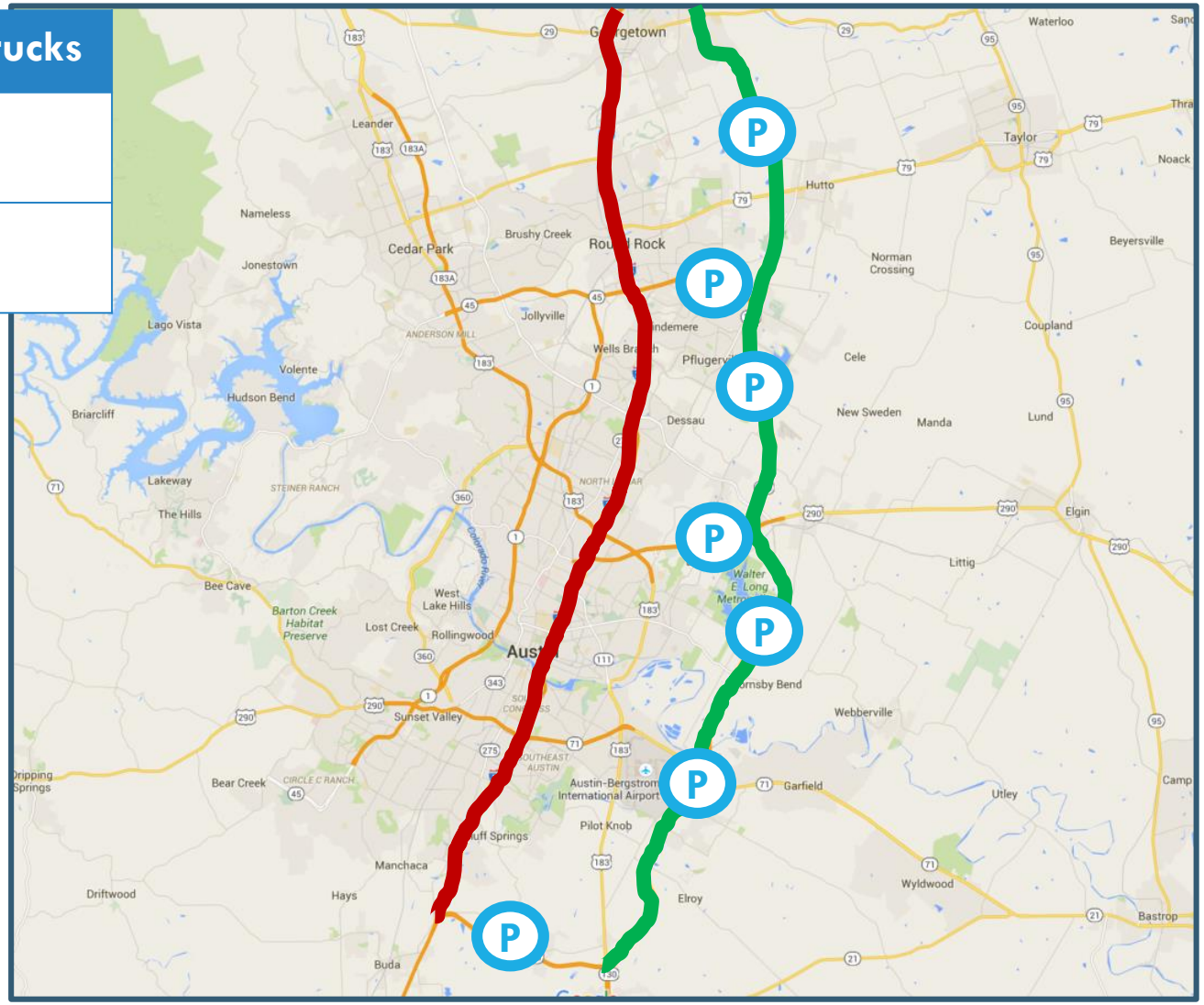


Source: TDOT Central Texas Turnpike System 2014 Traffic & Revenue Study

CURRENT TOLL CHARGES ON TX-130

Route	Cars	6-Axle Trucks
I-35 (across city, in RED)	$0.00	$0.00
TX-130 (around city, in GREEN)	$7.00	$21.00

- On Texas toll roads, vehicles pay a toll when they pass through a plaza and sometimes when they exit or enter the highway.
- Overall toll paid varies by distance traveled
  - Plaza tolls: $1.04 - $1.75 for cars
  - Exit / entrances: $0.47 - $0.75 for cars



ASSUMPTIONS

- Drivers value their time equally, at $10/hour
- Demand is constant
- Drivers behave rationally and select routes based solely on cost (in terms of time and tolls)
- Toll payment rate and car/truck ratio remains the same
- The time period for simulation is during peak hour

METHODOLOGY

1. Obtain and parse data
2. Linked highway nodes to real toll locations
3. Determined theoretical toll revenue
4. Toll I-35 links to match estimated TX-130 toll revenue
5. Algorithm B found user equilibrium with added tolls

DATA GATHERING

Data Needs:

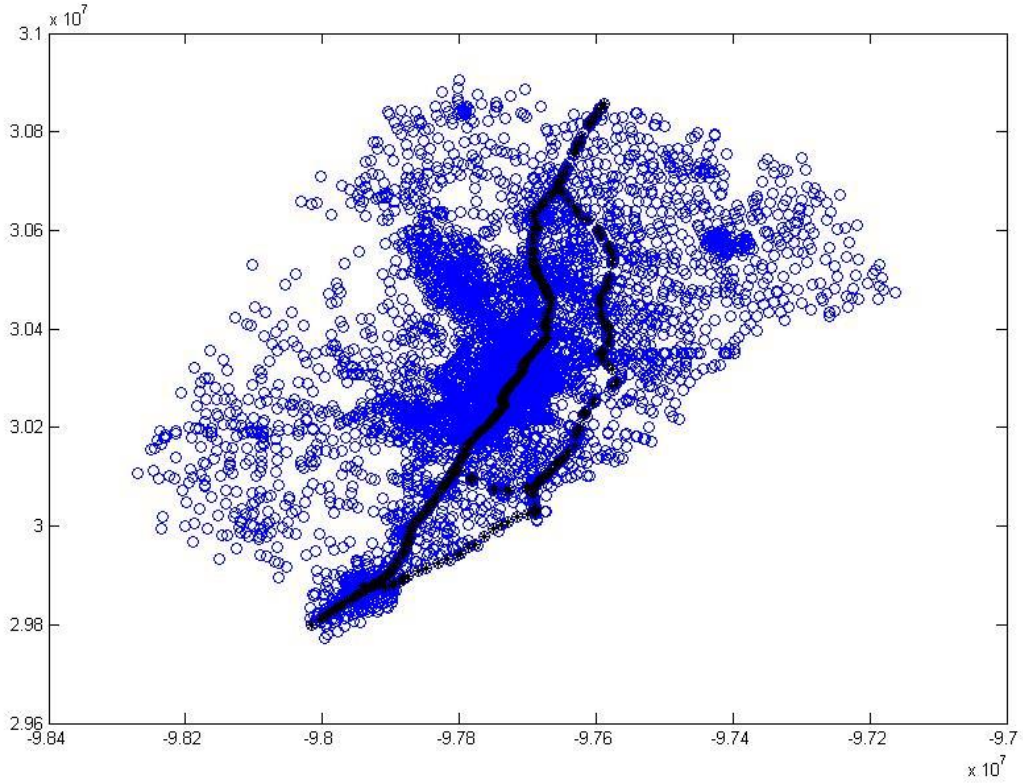
- I-35 and TX-130 nodes
- Links forming highways
- Austin network OD matrix
- Equilibrium flows
- Toll information
  - Locations
  - Rates
  - Total revenue

Sources:

- Austin network, nodes, trips, and flows files
- Texas Department of Transportation
- Toll calculator

PARSING NETWORK FILES

- Convert .txt files to graphical network
- Manually determine highway nodes
- Connect with highway links
- Compare to real-world intersections



TOLLING I-35

- MATLAB code adds toll to I-35 links
- Toll value hypothesized to match TX-130 revenue
- Trial and error
- Algorithm B used to determine equilibrium flows
- Output TSTT, SPTT, and flows saved
- Calculated metrics

TOLLING I-35

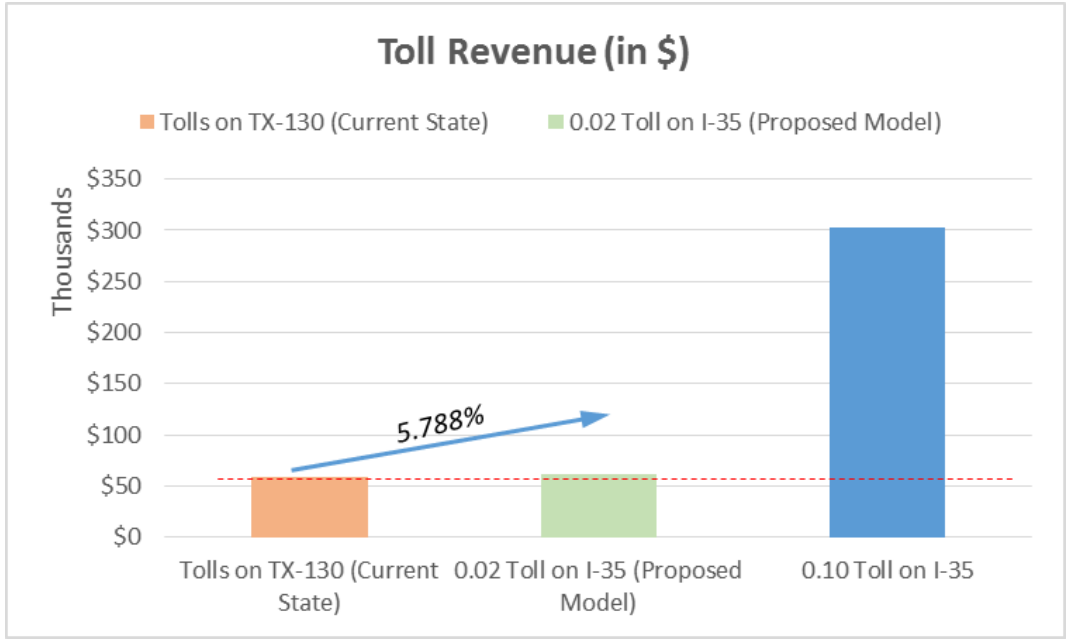
Algorithm B

- Dr. Boyles' code
- Modifications
  - Print flows to output file
  - Terminates after relative gap $< 10^{-6}$
  - Added toll factor to input files
    - Converts monetary toll to time units
    - Assumed $10 per hour value of time
- Trials ran
  - No added tolls
  - Tolls added to TX-130
  - Tolls on I-35 links

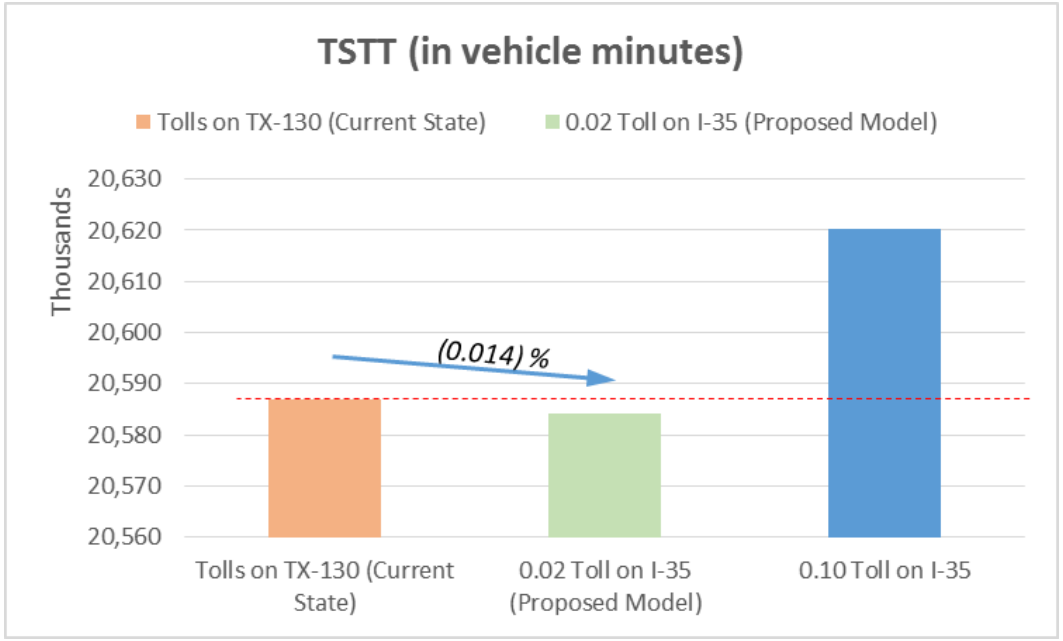
Metrics

- TSTT
- Toll revenue
- Total flow
- Ratio of flow on highways

RESULTS: TOLL REVENUE AND TSTT



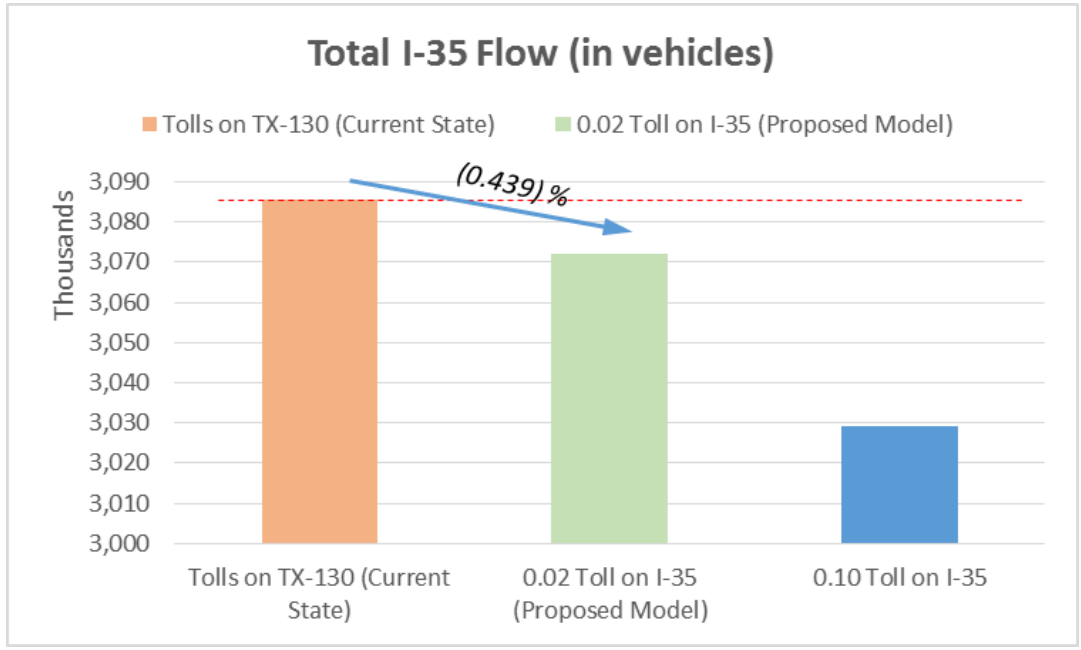
Toll revenue increases by ~6% on removing the tolls from TX-130 and imposing a $0.02 (per node) toll on I-35

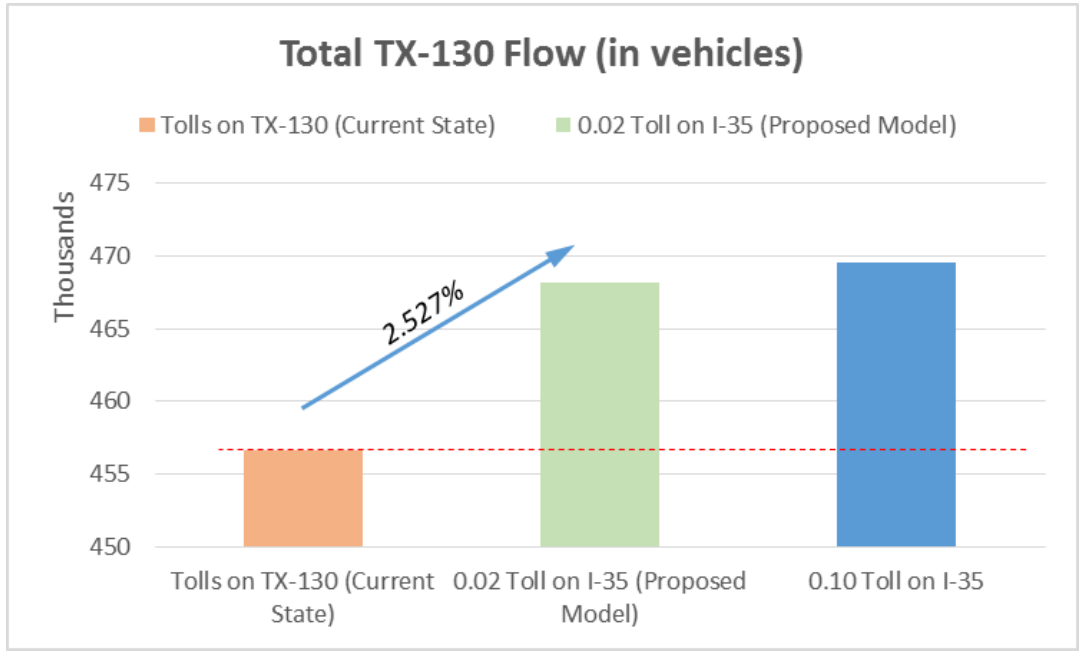


Total System Travel Time decreases by 0.014% on removing the tolls from TX-130 and imposing a $0.02 (per node) toll on I-35

Present toll of Tx-130: $7 maximum (from north to south or vice versa)
I-35 total length ~ 50 miles
Approximately 2 nodes per mile, total nodes ~ 100 nodes
So, maximum toll on I-35: 100*0.02 ~ $2 < TX-130 current maximum toll

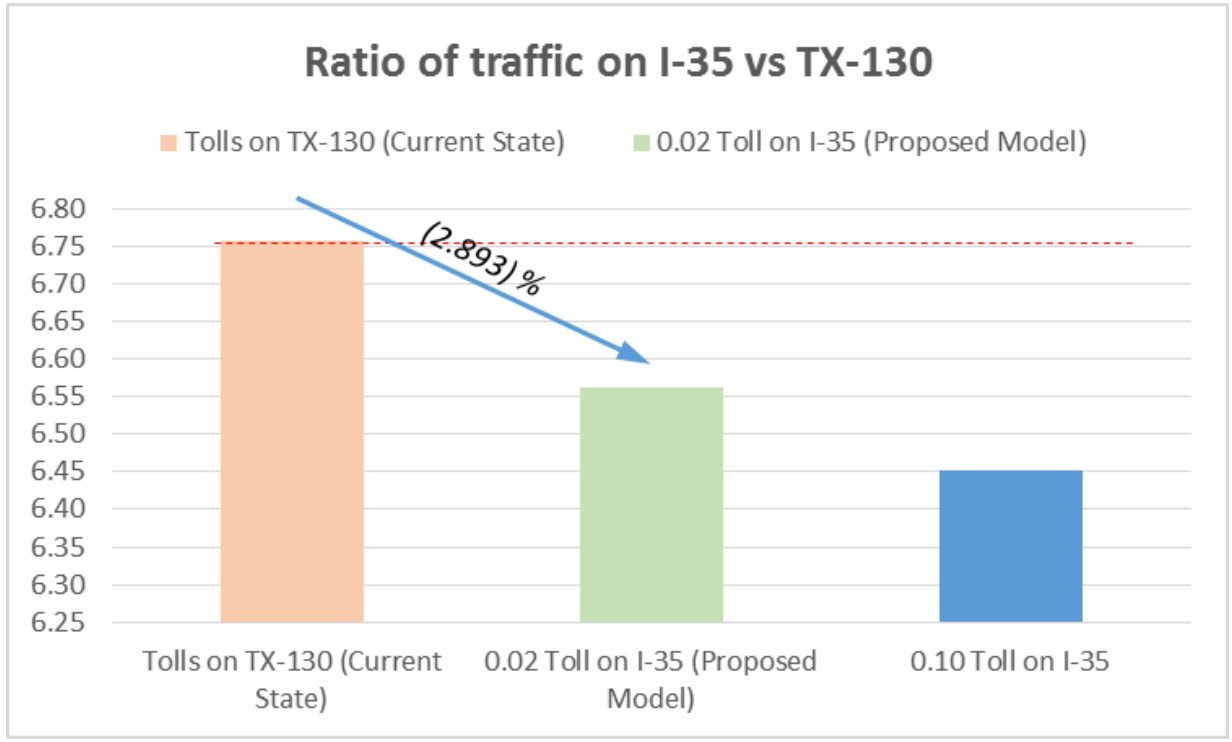
RESULTS: TRAFFIC FLOWS





Total flow on I-35 decreases by ~0.5% as people shift from tolled I-35 to un-tolled TX-130.
Similarly, total flow increases by ~3% on TX-130.

RESULTS: RATIO OF FLOW ON HIGHWAYS



Ratio of traffic on I-35 vs TX-130 decreases by ~3% after the proposed toll change

CONCLUSION

- Our Proposed model decreases TSTT by only 0.014% which is not significant to warrant an investment in changing the tolls
- Ratio of traffic on highways after the implementation of tolls on I-35 decreases by ~3%, thus indicating that the shift of tolls from TX-130 to I-35 could be a possible solution to decongestion of I-35 and better utilization of TX-130