Houston…We have a problem

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Abstract:

Almost everybody at some point in their life has been stuck in traffic. No one enjoys it, but no one has a decent way to combat it. The French Federation of Mathematical Games and the Mathematical Modelling Company joined together to ask scholars around the world for what they believe to be possible solutions. The problem presented to us was the traffic in and around Houston, Texas on January 29th, 2018. We decided that a portion of Houston's northeast corner would be the trial region for the interventions proposed. Possible interventions considered include: adding more lanes to the current road ways, slightly changing the hours some companies start their shifts, and encouraging more people to take public transportation over their own vehicles.

Simplifying Assumptions:

- North East section of Houston was our main focus
- All cars are of same size—No semi trucks or commercial/public busses
- Constant Speed

Calculations:

- The provided flux values were compared to the flux calculated under ideal driving conditions
- Size of a car is 5 meters
- Maintained the speed limit without variance
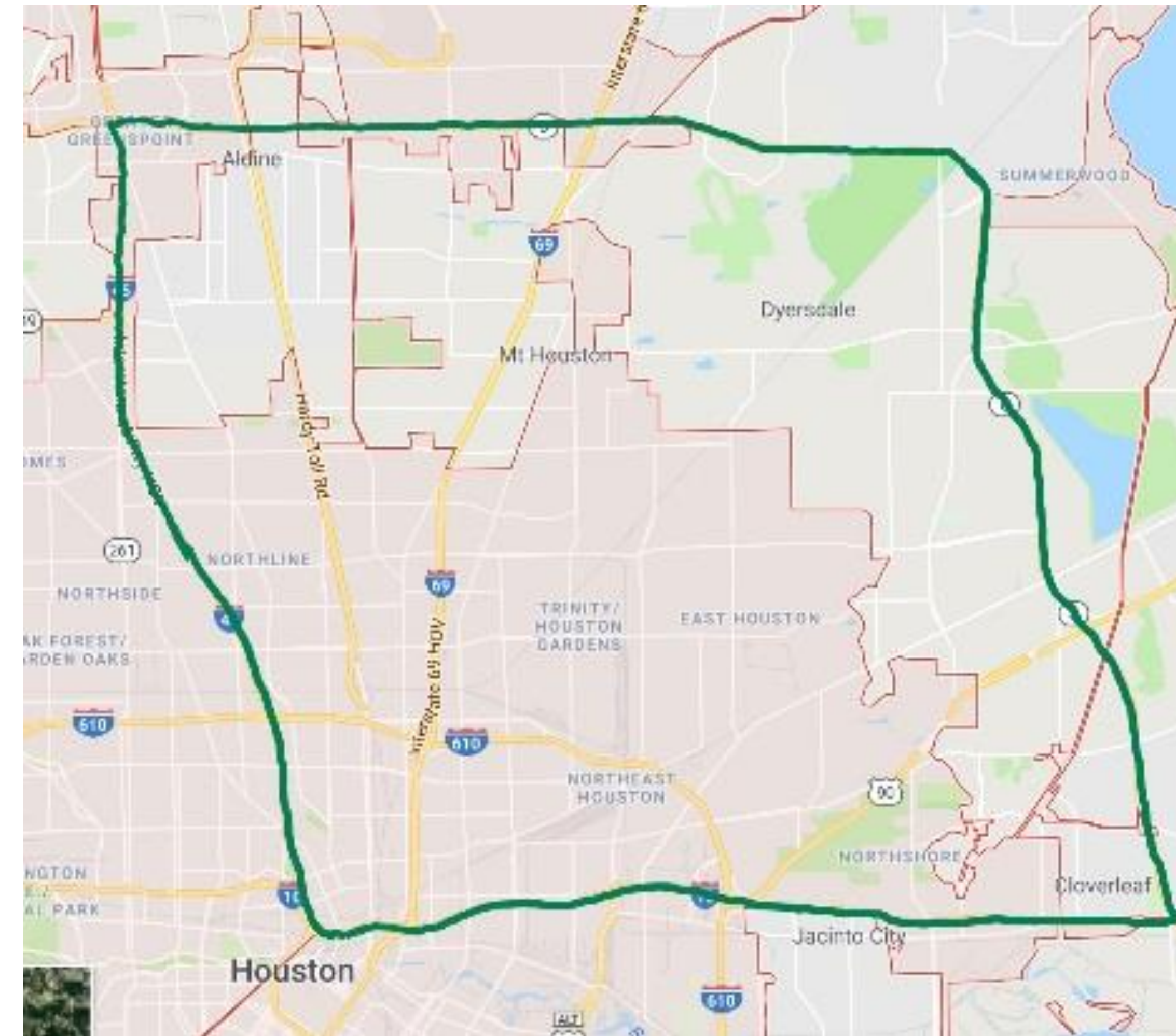- The safety distance is 5 meters for every 16 kilometers per hour

Figure 1: Section of Houston used in data calculations

$$Cars\ with\ Safety\ Distance: C$$

$$Speed\ in\ kilometers\ per\ hour: S$$

$$Number\ of\ Lanes: L$$

$$Flux: N$$

$$Flux\ for\ One\ Lane: N = C \times S$$

$$Flux\ for\ Variable\ Lanes: N = C \times S \times L$$

Vehicles per Intersection
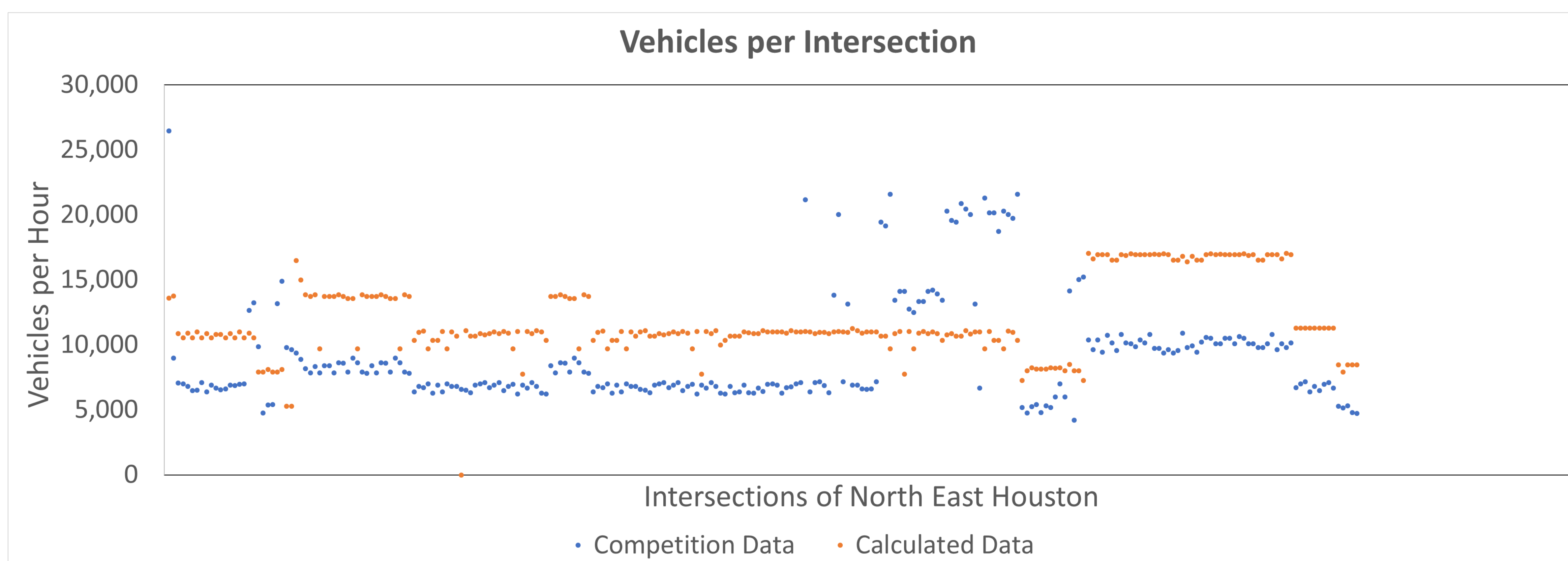
- Competition Data
- Calculated Data

Figure 2: This graph depicts the difference in the competition's data calculations compared to the data we had calculated.

Houston…We have a Solution

- Additional Lanes
  - Cost per kilometer: $1.9 million
  - Induced Demand
- Shifting the work day
  - Lessens flux per hour
  - Increases people on roads throughout day
- Encouraging Public Transportation
  - Consolidates vehicles
  - Maintaining and providing resources

Conclusion:

Overall, with the simplifications and assumptions we made, our data was not far off from the true data. If we included other variables into our calculations we would have less error, however, there would be no way to get the exact data that was taken on the day in question. Improving on the road ways to lessen the traffic fabricates a new set of problems and this includes: cost, locations, materials, and upkeep. The best option, we believe, would be to change the shift times so that the flux of cars would be decreased over the period of "rush hour." Without projecting this, we don't have a concrete resolution to what the outcomes would be. The proposed solutions all have different expectations, but we have to take into account what the public would appeal most to.

Not our exit

To build upon our research, the assumptions we started with could be altered. The alterations could be made to mimic a real-life scenario.
- Use all of Houston
- Include semi-trucks and commercial/public busses
- Account for variations in speed

References

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- Mathematical Modelling Company, Corp. (2018-2019)
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