Path-based reliability using truck GPS data

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Motivation

- Truck travel speeds may be different
- Trucks restriction
- How do we model truck travel time and reliability during
  - recurring congestion
  - non-recurring congestion

Background on Study Area

- Study area is Shelby county
- FAF network
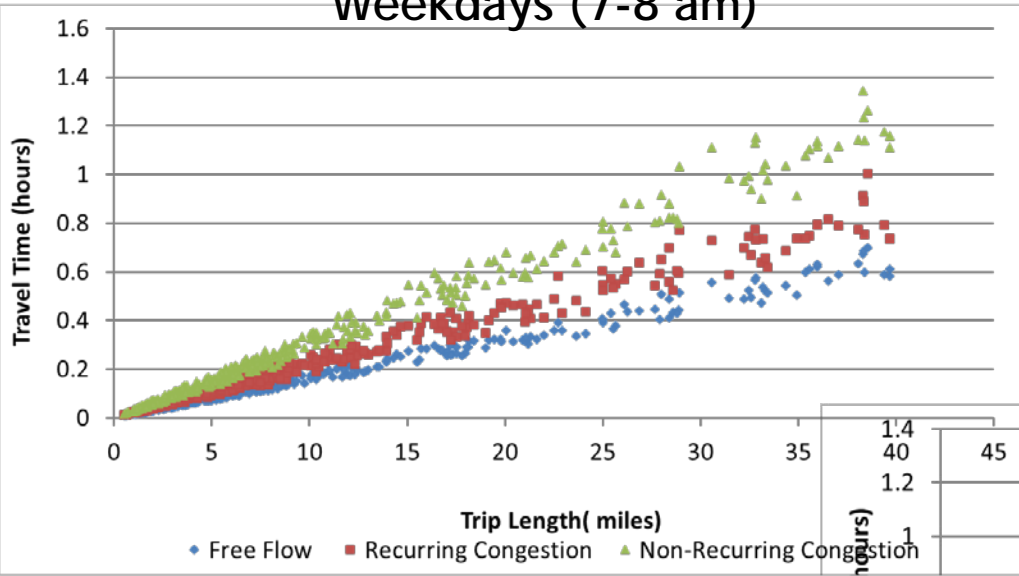- GPS truck data 2 weeks in April and June (2012, 2013)

Data Preparation

- Reasonable OD distance (~40 miles)
  - Large OD distance => negligible congestion marginal effects
- Shortest path (SP) based on off-peak travel time
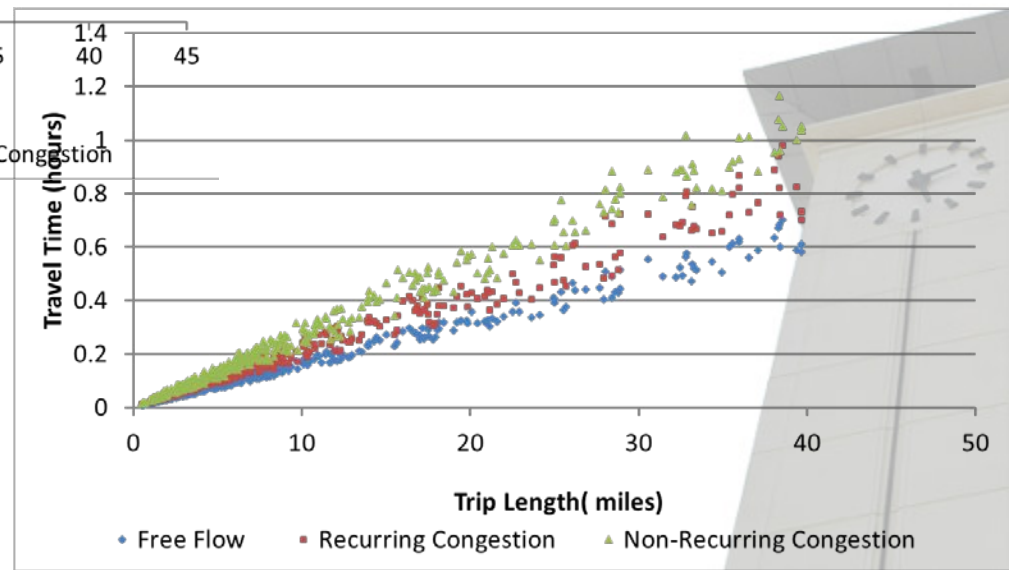- SP remains unchanged for the analysis

Travel Time (TT) vs. Trip Length (TL)
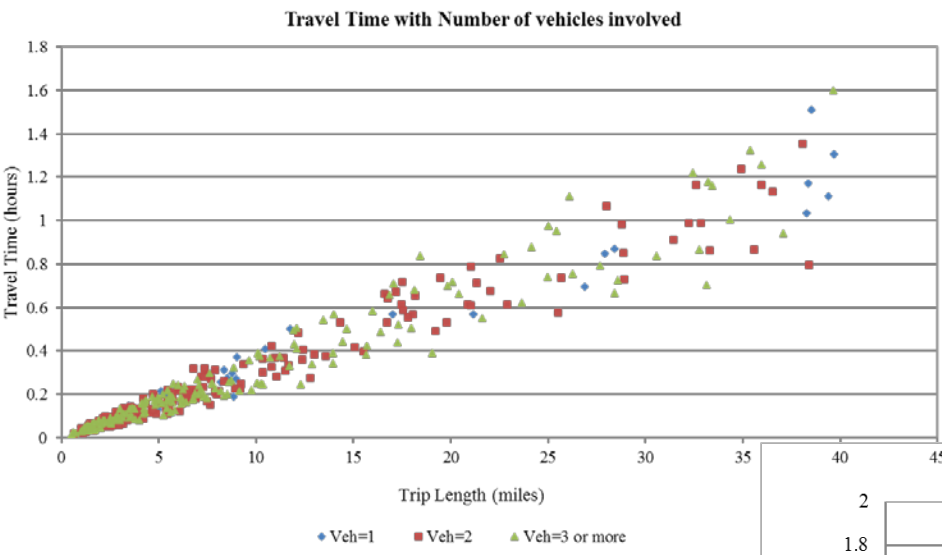

Weekdays (7-8 am)

Keeping TL constant:
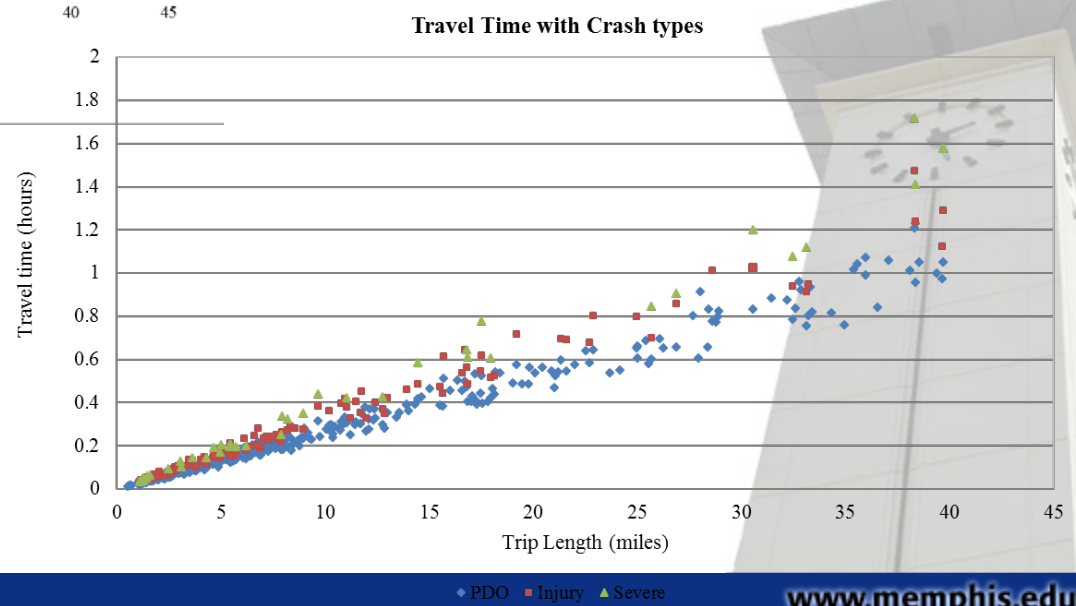Higher reliability in non-recurring congestion

Weekends (7-8am)
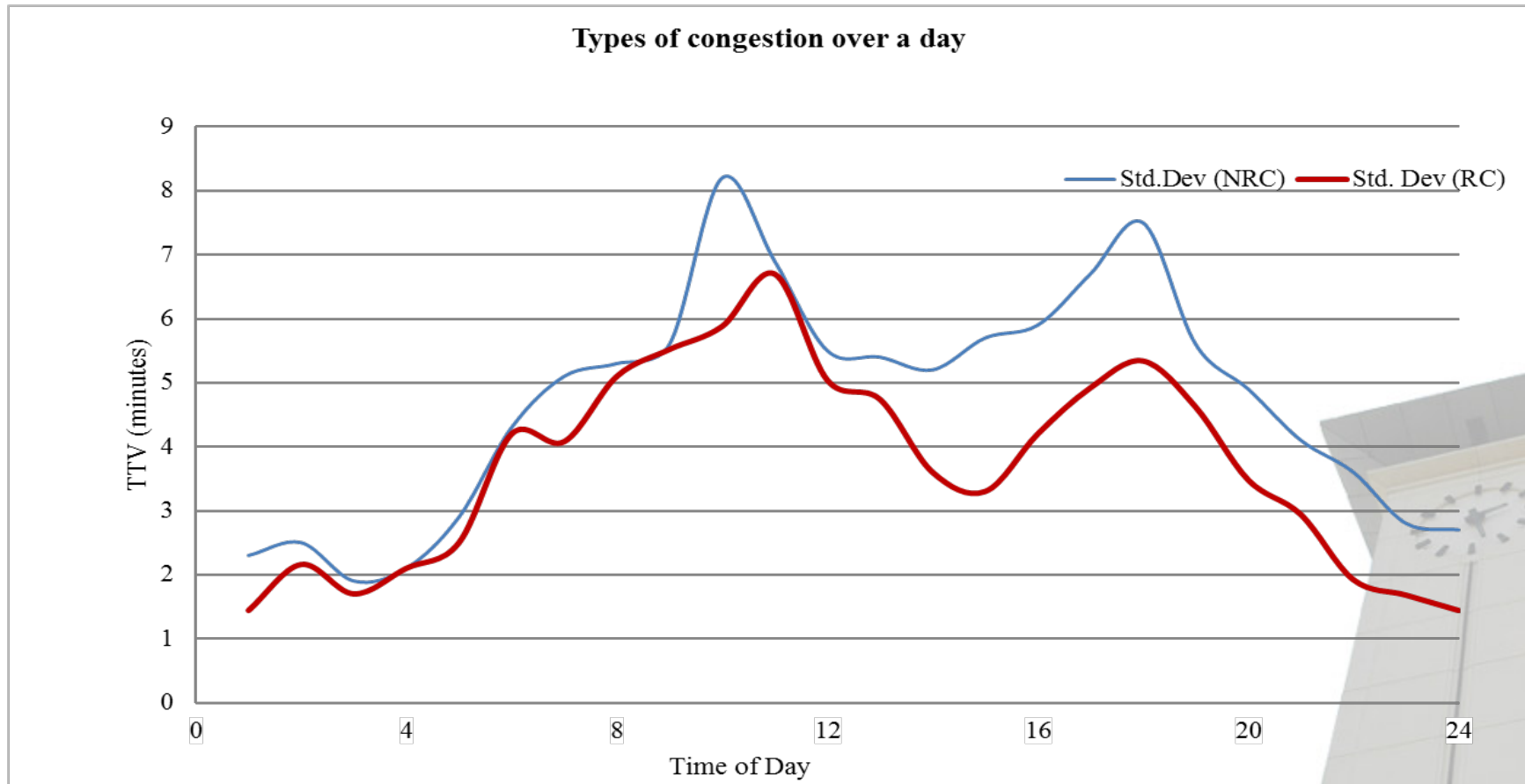
TT, TL, # of Vehicles, Crash Type

Travel Time with Number of vehicles involved

- Significant effects of a crash
- Effects depend on severity, # of vehicles, clearance time etc.
- All related to each other (e.g., clearance time higher for injury crashes)

Travel Time with Crash types

Travel Time Variation (TTV) over Time of Day with congestion types

Types of congestion over a day

- Significantly different between RC and NRC during peak hours
- Similar during 2am-6am

Effects of arterials

Effect of Arterial road on Travel Time Variation

$y = 37.01x^2 + 23.681x + 0.16$
$R^2 = 0.991$
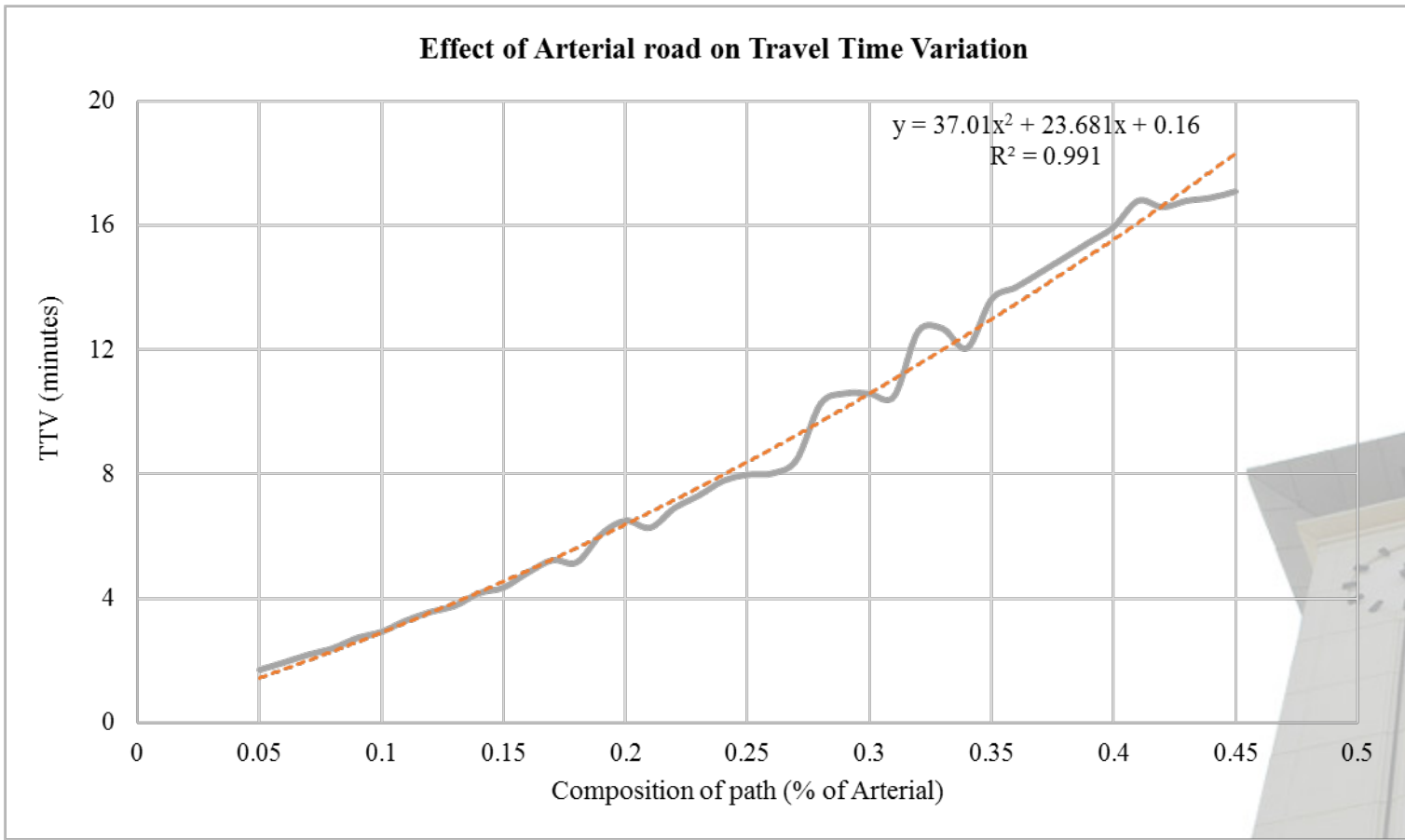
Results (Fixed Effect Panel Data Model)

Variables	Model 1 (Travel Time Variation)	Model 2 (Travel Time)
Roadway Characteristics		
Volume to Capacity Ratio (VCR) (%)		
AM Peak	0.287	–
PM Peak	0.523	–
Facility type: Arterial (%)	0.895	6.895
Area type: Rural (%)	-1.192	-4.192
Geometrics: 2 or more lanes	-0.225	
Crash Characteristics		
Number of vehicles involved in the crashes	3.348	23.489
Number of crashes occurred on the path	3.436	29.664
Crash Type		
Rear-end	2.893	12.893
Sideswipe	3.946	21.946
Angle	1.665	30.665

Variables	Model 1 (Travel Time Variation)	Model 2 (Travel Time)
Crash Severity		
Injury	1.985	21.985
Severe injury	4.817	34.817
Crash Type and Crash Severity (Interactive)		
Rear-end and Injury	3. 04	23.204
Roadway and Crash Characteristics		
Characteristics (Interactive)		
Rear-end and Arterial		14.012
Rear-end and Rural		13.347
Adjusted R2		0.418
Number of observations		

Compared to a PDO crash an injury crash will likely additional variation of 4.817 min.

Conclusion

- ## Critical factors
  - Functional class, facility type, crash type, severity, and # of vehicles involved

- ## Weekend travel time reliability is higher

- ## Usage
  - Path based reliability
  - Incident management
  - Routing
  - Reliability cost estimation
  - Travel demand models

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Thank you!

Contact Information

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