Impacts to Traffic Safety and Mobility of Changes in Speed Limits for Indiana Freeways

CENTER FOR ROAD SAFETY

Raul A. Pineda, **Andrew P. Tarko (Principal Investigator)**
Lyles School of Civil Engineering
Purdue University

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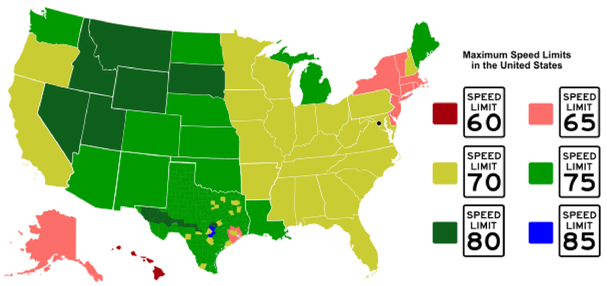
1. Background and Justification

Concern about the severe impact of trucks during collisions with other vehicles led to implementation of Differential Speed Limits (DSL) on Indiana rural freeways. Some experts doubt that this solution is indeed beneficial to safety.

There is a recent trend in neighboring states to replace the differential speed limits with a uniform speed limit (Ohio) or to increase the speed limit in rural freeways (Wisconsin).

The question to be addressed in this study is: Should Indiana follow other states and revert to a single speed limit on its freeways or not?



Source: *CrossCountryRoads.com* (2017)

State	Rural Trucks	Rural Non-Trucks	Urban Freeways
Indiana	65	70	55-65
Michigan	65	70-75	55-70
Ohio	70	70	50-65
Illinois	70	70	45-70
Kentucky	70	70	55-65
Wisconsin	70	70	55-65

2. Research Objectives

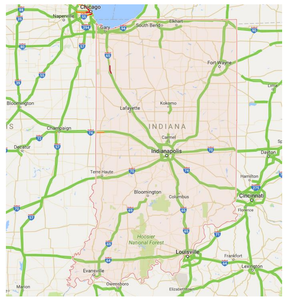
- Determine if the differential speed limits on rural freeways indeed increase the difference between the truck and non-truck speeds.
- Estimate the safety and mobility effect of removing the differential speed limits on rural freeways.
- Estimate the safety and mobility effect of raising the speed limits on urban freeways from 55 mph to 60 or 65 mph.

4. Literature Review

MOBILITY EFFECTS

- Increase in the speed limit increases in the average speed and the speed of drivers who violated the old speed limit.
- Drivers tend to "go with the flow" rather than to follow the posted speed limit.
- Change in the average speed is lower than the change in the posted speed limit.
- Some research found no difference in speed distribution under uniform and differential speed limits.
- The difference between average speeds of trucks and non-trucks is greater than the posted speed difference.
- Speed limiters for trucks reduce the average speed of trucks regardless of the speed limit.
- 21% of surveyed Indiana drivers believe that driving 5 mph over posted speed limit is safe, 44% said 10 mph, and 35% said 20 mph.

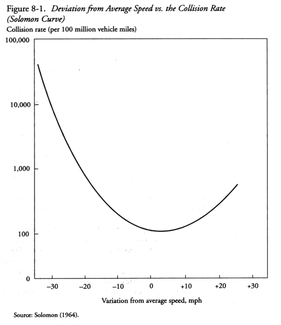
Source: *CrossCountryRoads.com* (2017)

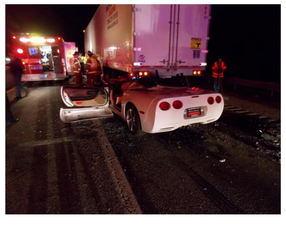


Source: *Map data* (2017) Google – Live Traffic

SAFETY EFFECTS

- Speed plays a significant role in crash risk and severity.
- Speed above or below the average speed of the flow increases the risk of crash.
- Increases in speed limits are related to increase in fatality rates.
- Higher truck speed limits are associated with the increase in fatality rate.
- The 2008 Indiana study did not confirm a significant increase in severity of accidents on interstates after the increase in the speed limit.
- Differential speed limits have two opposite effects: they slow trucks down but they increase the speed variation.
- Although differential speed limits may increase rear-end crashes, they may also reduce other types of crashes.
- Joint application of differential speed limits and truck lane restrictions is beneficial.
- Differential speed limits used around ramp intersections increase unsafe interactions between trucks and non-trucks.
- Some study results are inconclusive or contradictory.

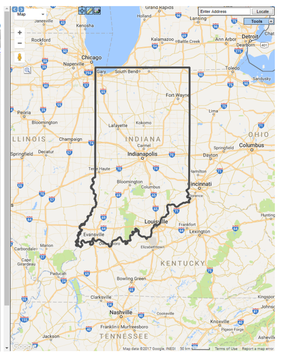




Source: *Indiana State Police* (2013) – Rear-end crash

5. Data

1. Traffic: hourly counts, speeds by vehicle type, and vehicle classification from permanent and short-term stations in Indiana, Illinois, Ohio, Michigan, Kentucky, and Wisconsin.
2. Roadway characteristics: number of lanes, lane width, shoulder width, median width, grade, terrain type, speed limit, etc. from Highway Performance Monitoring System.
3. Crashes frequency and crash severity taking into account type of vehicle involved in crashes and crash type from states crash records



Source: *Ms2soft - IN Traffic Count Database System* (2017)

6. Future Work

- Perform data analysis and estimate the speed and crash models for Midwest interstates based on the collected data and information.
- Estimate the state-wide mobility and safety effects of hypothetical speed limit changes on Indiana interstates.

7. References

1. Aarts, L., & van Schagen, I. (2006). Driving speed and the risk of road crashes: A review. *Accident Analysis & Prevention*, 215-224.
2. Elvik, R. (2013). A re-parametrization of the Power Model of the relationship between the speed of traffic and the number of accidents and accident victims. *Accident Analysis & Prevention*, 854-860.
3. Farmer, C. M. (2016). *Relationship of Traffic Fatality rates to Maximum State Speed Limits.* Arlington: Insurance Institute for Highway Safety (IIHS).
4. Federal Highway Administration. (2004). *The Safety Impacts of Differential Speed Limits on Rural Interstate Highways.* McLean: U.S. Department of Transportation.
5. Garber, N. J., Miller, J. S., Sun, X., & Yuan, B. (2006). Safety Impacts of Differential Speed Limits for Trucks and Passenger Cars on Rural Interstate Highways: A Modified Empirical Bayes Approach. *Journal of Transportation Engineering ASCE*, 19-29.
6. Ghods, A. H., Saccomanno, F., & Guido, G. (2012). Effect of Car/Truck Differential Speed Limits on Two-Lane Highways Safety Operation unig Microscopic Simulation. *Procedia*, 834-841.
7. Johnson, S. L., & Pawar, N. (2007). Analysis of Heavy Truck and Automobile Speed Distributions for Uniform and Differential Speed Limit Configurations on Rural Interstate Highways. *Transportation Research Board Annual Meeting*, 07-2949.
8. Mannering, F. (2009). An empirical analysis of driver perceptions of the relationship between speed limits and safety. *Transportation Research Part F*, 99-106.
9. Malyshkina, N. V., & Mannering, F. (2008). Effect of Increases in Speed Limits on Severities of Injuries in Accidents. *Transportation Research Record*, 122-127.
10. McCarthy, P. (2001). Effect of speed limits on speed distributions and highway safety: a survey of recent literature. *Transport Reviews*, 31-50.
11. Medina, A. M., & Tarko, A. P. (2006). Modeling the Endogenous Relationship between Driver Behavior and Highway Safety. *85th Annual Meeting of the Transportation Research Board.* Washington D.C.: TRB.
12. Neeley, G. W., & Richardson, L. E. (2009). The Effect of State Regulations on Truck-Crash Fatalities. *American Journal of Public Health*, 408-415.
13. Parker, M. J. (1997). *Effects of raising and lowering speed limits on selected roadway sections.* McLean, Virginia: FHWA.