Louisiana Transportation Research Center

Technical Assistance Report 17-01-TA-SS

Literature Review of the Implications of Differential Speed Limit Implementation

by

Haggai Davis, III
Ravindra Gudishala
Kirk Zeringue
Chester Wilmot
Julius Codjoe
Matthew Roberts

LTRC

4101 Gourrier Avenue | Baton Rouge, Louisiana 70808
(225) 767-9131 | (225) 767-9108 fax | www.ltrc.lsu.edu

Literature Review of the Implications of Differential Speed Limit Implementation

by

Haggai Davis, III
Ravindra Gudishala
Kirk Zeringue
Chester Wilmot
Julius Codjoe
Matthew Roberts

Louisiana Transportation Research Center
4101 Gourrier Avenue
Baton Rouge, LA 70808

LTRC Project No. 17-01-TA-SS

conducted for

Louisiana Department of Transportation and Development
Louisiana Transportation Research Center

December 2017

EXECUTIVE SUMMARY

This report addresses the matter of differential and uniform speed limits and their application at the state level. It was prepared in response to a request in the 2017 session of the Louisiana House of Representatives where the Louisiana Department of Transportation and Development (DOTD) was asked to "study the safety and operational impacts of differential speed limits on interstate highways" (House Concurrent Resolution 112). Thus, the purpose of this study is to inform the Louisiana Legislature about the documented various benefits and costs of a differential speed limit for passenger cars versus larger vehicles specifically with regards to the topics of Safety, Mobility and Operations, Fuel Consumption and Emissions, and Truck Determination as outlined in HCR 112.

The majority of research into this topic has not been able to conclusively determine which speed limit system is safer, a uniform speed limit (USL) or a differential speed limit (DSL). There is uncertainty amongst the literature as to which is better, USL or DSL. The uncertainty is due to several factors that work against each other. Changes in observed speed are usually less than the changes in the posted speed, which dulls the impact of a DSL. If the posted speed limit is too low, many drivers will ignore it leading to low compliance rates. A slower speed reduces the severity of crashes; however, a greater speed variance increases the opportunity for crashes. Almost 75% of the nation's truck fleet cannot travel above a preset speed because they have speed limiters built in. In other countries, the limiter is mandatory, but no study has attempted to quantify the safety. In America, the current trend has states moving toward a USL. Passenger car drivers tend to prefer a DSL, but less strongly than truck drivers prefer a USL. The time and cost to fully implement a speed limit regime change can be substantial.

With the lack of strong evidence in the existing published research in either direction, this paper cannot conclude which method is better than the other. Further research (on a much larger scale than this literature review) would be necessary to conclude which speed limit arrangement is better.

ACKNOWLEDGMENTS

We would like to thank Dortha Cummins and Brian Wolshon, Ph.D., for their guidance and contributions to this project.

TABLE OF CONTENTS

INTRODUCTION

The National Highway Traffic Safety Administration (NHTSA) reported that 37,461 people died in 2016 on US roads, marking the second year in a row that the number has increased *[1]*. Many transportation-related agencies have adopted a "Vision Zero" or "Towards Zero Deaths" campaign aiming to eliminate the need for that statistic. Speed can often play a role in fatalities, so setting the proper speed limit for roadways is important in saving lives.

American speed limits have a complicated history over the past 50 years, which hinders researchers' ability to look at much longer stretches of data and draw conclusions about determining the best speed limit strategy. From 1973 to 1987, the maximum speed limit was 55 MPH. After that, Congress raised the allowable limit to 65 MPH. It was not until 1995 that states had full discretion over setting an appropriate limit. Some states raised the speed limit for all vehicles equally – a uniform speed limit (USL). Others raised speeds for trucks less than that of cars – a differential speed limit (DSL).

On the surface, the benefit of a DSL seems intuitive, lowering the speeds for big trucks would reduce the severity of accidents. However, it also has the effect of increasing total variance in speed which increases the number of accidents.

This report aims to explore the literature published about these issues and to inform decision makers about the factors to be weighed when considering DSL versus USL. It was prepared in response to a request in the 2017 session of the Louisiana House of Representatives where the Louisiana Department of Transportation and Development (DOTD) was asked to "study the safety and operational impacts of differential speed limits on interstate highways" (House Concurrent Resolution 112). Thus, the purpose of this study is to inform the Louisiana Legislature about the documented benefits and costs of a differential speed limit for passenger cars versus larger vehicles specifically with regards to the topics of Safety, Mobility and Operations, Fuel Consumption and Emissions, and Truck Determination as outlined in HCR 112.

OBJECTIVE

The objectives of this study were to determine whether uniform speed limits or differential speed limits are more beneficial to traffic safety, operations, mobility, energy conservation and environmental improvements in the state. The approach to achieve this objective was to conduct a literature review of scholarly articles published in peer reviewed journals and research articles produced by state agencies.

SCOPE

The scope of this study was limited to a literature review of differential speed limit research previously conducted by others in the United States, and to a limited extent, the international research community. No new research was conducted.

LITERATURE REVIEW

The literature reviewed in this report has been organized into four topic areas based on the needs listed by the resolution. The topic areas are Safety and Operation Impacts, Environmental and Energy Conservation Impacts, Governmental Implementation, and User Perspectives.

Safety and Operational Impacts

An important question to be addressed by this report is whether a DSL or USL is safer. Unfortunately, the concept of safety is already a complex issue and muddied even further by several opposing factors directly related to the DSL and factors independent of the posted speed.

Observed Speed and Variance

Posted speed and compliance are a good place to begin because they provide insight into the potential for unsafe conditions. When measuring drivers' speed through an area, the most common statistic used is the mean. The compliance rate is defined as the percentage of drivers traveling at or below the posted speed. Several studies have observed actual speeds and measured compliance rates with the posted speed across various DSLs and USLs. Two of these studies found that observed speed is largely unaffected by posted speed limits *[2] [3]*. However, several other studies found that the higher the posted speed, the faster drivers go *[4] [5] [6] [7]*. Since the increase in observed speed is less than the increase in posted speed, the compliance rate will rise as a result. The studies listed in Table 1 indicate this except for the study by Harkey in 1994 *[7]*.

Table 1
Summary of Compliance Rate Findings

Paper	Posted Car/Truck Speed (MPH)	Observed Car/Truck Speed (MPH)	Observed Car/Truck Differential (MPH)	Compliance (Cars/Trucks)
Harkey 1994	65/55	67.4/61.1	6.3	62%/51%
Johnson 2010	65/55	71.6/62.6	9.1	10%/2%
Johnson 2005	65/55	73.2/64.2	9	7%/0%
Harkey 1994	65/60	67.8/63.6	4.2	N/A
Johnson 2010	65/65	69.9/67.2	2.7	10%/41%

Harkey 1994	65/65	67.6/63.8	3.8	40%/73%
Johnson 2010	70/60	72.3/63.7	8.6	35%/14%
Johnson 2005	70/65	73.5/66.7	6.8	21.8%/32.5%
Johnson 2010	70/70	72.2/69.0	3.2	35%/67%
Johnson 2005	70/70	72.6/68.6	4	31.4%/69.6%
Johnson 2005	75/75	74.8/72.3	2.5	53%/73%

Speed variance, another important statistic, is a measure of how spread out from the mean speed vehicles are traveling. DSLs have the potential to create a larger variance forcing more car-truck interactions assuming at least partial truck compliance with the new limit *[2].* Speed variance contributes to the number of potential crashes because the greater the difference in speeds, the more cars will have to pass trucks or other cars to maintain their pace. The two studies that found the observed speed independent of the posted speed noticed no changes to the speed variance, but amongst the studies that found a correlation, the magnitude of the observed differential was related to the extent of the posted differential.

Traffic simulation models have been used to quantify the number of increased maneuvers related to DSL implementation. Assuming compliance and a 10 MPH DSL, trucks get passed by four times as many vehicles than if they were traveling at the mean speed *[5].* Appendix A has a condensed outline of findings from various studies.

Crash Rates and Severity

The number of crashes and their severity provide a direct measure of safety. Again, some studies found no significant evidence of USL or DSL leading to fewer total crashes or fatal crashes *[3], [7], [8].* However, other studies did find there was a slight decrease in the number of crashes under a DSL *[9], [10].* As with the speed and variance, many studies have found different results. One study found that as speeds increase, the total crash rates do not rise, but fatality rates do *[5].* In other words, people make the same number of driving mistakes, but the results of those mistakes are costlier. However, one study disagreed and found no changes in the severity of accidents when the posted speed limit was increased 5 MPH *[11].*

Another complication is that a DSL can alter the type of collisions. Some studies found no change in the type of crashes while other studies found that a DSL lowers every type except for car-into-truck rear-end crashes *[2]*, *[7]*.

A summary of the findings from various studies related to changes in crashes can be found in Appendix B. When considering the findings from those studies, it is important to note that, while some studies may have shown a decrease in fatal crashes during the period that DSL was implemented, those studies are also unable to attribute those decreases directly to DSL alone. The same is true for studies that show an increase in crashes. In other words, the studies don't take into account other factors that may have affected changes in crashes (i.e., increased speed enforcement, voluntary diversion, changes in vehicle miles travelled (VMT), truck lane restrictions, etc.) or are unable to isolate DSL as a main contributing factor. The studies that conclude a decrease in crashes due to a DSL also have difficulty removing the influence of external sources such as improvements in truck safety technologies *[13]*. Much like speed, there are a wide number of factors at play, which makes proving any one of them difficult. One study found that VMT played the largest role in predicting crashes *[14]*. Interestingly, VMT/capita is significantly, negatively associated with truck-crash fatalities *[15]*.

One issue that seems to arise from the findings in Appendix B is that as DSL is introduced on freeways, some trucks may choose to divert to other roads and thus reduce the number of trucks on freeways. This would then reduce the number of crashes on freeways with DSL, particularly truck-related crashes (and increase crashes/fatalities on other roads). The differences between the change in fatal crashes and the change in truck-related fatal crashes amongst the studies in Appendix B would suggest that this voluntary diversion is what is happening.

Travel Times

With the reduction in speed for trucks comes an increase in travel time. Changes in the speed limit often produce shifts in the measured speed less than the change in posted speed, so a 5 MPH posted reduction would be expected to reduce observed truck speeds 2-4 MPH *[6]*, *[12]*. A drop from 69 MPH to 66 MPH represents about a 5% slow down. This change means that trucks would either spend more time driving per day to cover the same distance or take additional days to complete their routes. Both cases represent an increased cost to the trucking industry.

Complications

The difference in conclusions is a repeating pattern in the literature. Some studies will find small, but meaningful results, while others do not. There are several issues that complicate the discussion and lead to the overall inconclusiveness of existing research:

- *The statistical nature of traffic safety research*. Accounting and controlling for every variable outside of the focus is virtually impossible. Engineering is only one of four factors (aka the 4 Es) that affect safety. The other three are education, enforcement, and emergency response *[16]*. Changes in any one can alter the number and severity of crashes, especially fatalities. There has yet to be a study that attempts to address all four Es at once. This is likely because of the incredible complexity and amount of data that would be needed to draw any conclusions.
- *Traffic safety research tends to be observational, not experimental.* It may not even be possible to undertake a study like the one mentioned in the previous bullet because traffic safety research tends to consist of observational studies, more so than experimental studies. Researchers have difficulty isolating desired variables because driving does not happen in a laboratory. Most of the literature consisted of analysis of large volumes of data collected either first hand or from various state agency reports.
- *No uniform definition of safety*. Safety is not uniformly defined as being related to the number of crashes. State DOTs look at many factors such as roadway geometry, environmental conditions, and/or driver behavior when assessing the qualitative safety performance of a road *[17]*. Safety is also not a static condition. Crashes are a probabilistic event and naturally fluctuate spatially and temporally even without significant changes to the base conditions. Researchers use statistical methods such as Empirical Bayes (EB) or a modified version to help reduce the fluctuations in the data *[2], [8], [9], [18], [19]*. EB models weigh and combine national and local averages to better interpret and predict crash numbers.
- *The existence of governors in truck engines*. Almost 75% of all trucks have a built-in governor that prevents trucks from going above a preset speed *[5]*. This mandated (by fleet owners) speed restriction makes it even harder to confidently discuss the impact that lowering (or raising) the posted speed limit will have on speed and variance if the governor-restricted speed is already lower than the previous posted speed.
- *Driver behavior adjustment period.* Part of the difficulty in obtaining consistent results stems from how drivers react with changes in speed limits. Often times, an adjustment period can last up to a year as people become more accustomed to the new legal limit *[13]*.
- *Enforcement rate.* An active and visible police presence can reduce mean speeds by

up to 10%, and 85th percentile speeds even further *[20], [21]*. However, enforcement practices and resources across jurisdictions differ making an active and visible police presence at all times and at all roadways segments impractical.

- *Variables contributing to travel speed.* There are many variables that influence speed and crashes and these variables are difficult to control for (e.g., weather, road conditions, visibility, lighting, traffic incidents, vehicle density, traffic volume, and road geometrics also influence speed, etc.) *[12], [18]*. With so many variables affecting travel speed, it is not easy to definitively state that a posted differential truck speed would meaningfully affect actual speed or crashes.

Wet Conditions

HCR 112 specifically mentioned a relationship of wet conditions, truck speed, and safety. Unfortunately, there has not been enough research conducted anywhere to meaningfully discuss the effects of increased truck speeds in wet conditions on splash rates or the spraying of significant amounts of water/mud that impacts a driver's ability to operate a vehicle safely.

Environmental & Energy Conservation Impacts

Fuel Efficiency

Like many of the facets of DSL, it is difficult to confidently state the effects on fuel consumption and the resulting emissions produced. Recent data suggests that some vehicles only lose .05 MPG/MPH above 60 MPH *[5]*. Different reports have projected different potential fuel consumption changes *[4]*. One study cited an inefficiency constant of 0.4 MPG/MPH, while another reported a 0.1 MPG/MPH drop for a 3 MPH increase *[5]*. Each case leads to a very different result when discussing the importance of consumption in total cost projections. Fuel economy has contributing factors other than speed such as driver behavior (i.e., acceleration rates, coasting, etc.), engine settings (i.e., gear ratios, size, horse power, tire pressure, etc.), and road quality. Additionally, the effects of traffic speed variation on fuel consumption are assumed to be negative; however, they have not been studied enough to be quantified precisely.

Researchers have attempted to estimate the effects on pollution to the state of Michigan caused by reducing the extent of the differential or eliminating their DSL. They found the expected increases that come with increased fuel consumption for most categories *[4]*. However, because of the number of differences between each case, the results are only vaguely generalizable to the idea that, in the narrow speed ranges being considered here, emissions are roughly proportional to fuel consumption.

Wear and Tear

Another important monetary aspect to consider is the changes to the deterioration rate of roads. A higher speed has been shown to have negligible impact on smooth pavement life expectancy, but an increase in speed variability would raise the rates of vehicle maneuvers, such as braking, accelerating, and changing lanes *[4]*.

Unfortunately, there is not much research into exactly how engines would respond over their life at 65 MPH vs. 70 MPH. However, the following conclusions were reached after researchers spoke with industry members familiar with each component of truck equipment. The trucks themselves would likely experience a greater cost due to the increased stress on the tires of approximately 0.04% *[4]*. However, most drivers said other factors like air pressure and proper tire selection are likely more important. There appears to be very little additional damage to the engine itself from the increased operating speed as there are no recommended adjustments to maintenance frequency and no adjustments to used vehicle price. Ultimately, the only changes to physical assets are minor, outweighed by more important factors, and are not expressly better or worse.

Government Implementation

United States

When investigating the implementation of DSL, it is useful to examine what other governing bodies have said on the topic and how they have acted. Since speed limit discretion was returned to the states with the repeal of the National Mandatory Speed Limit (NMSL) in 1995, less than one quarter of the states have attempted a DSL. Table 2 lists the states who have implemented a DSL within the period of 1994-2016. The table also shows the extent of the differential, when it was implemented, and the location.

Table 2
List of states that implemented DSLs

State	DSL Employed	Location	Car/Truck (MPH)
Arkansas	1996 - 2015	Rural freeways	70/65
California	2001 - present[1]	Rural freeways	70/55
Louisiana	2003 - present	Atchafalaya Basin Bridge	60/55
Idaho	1998 - present	Rural freeways	80[2]/70
Illinois	1987 - 2014	Rural freeways	70[3]/55
Indiana	1987 - present	Rural freeways	70/65[4]
Michigan	1995 - present	Rural freeways	70/60
Montana	1999 - present 1999 -2013	Rural freeways Rural 2-lane highways	75/65, 80/70 70/60
Ohio	1987 - 2009	Rural freeways	65/55
Oregon	2003 - present	Rural freeways	65/70[5]
Virginia	1987-1994	Rural freeways	65/55
Washington	1977 - present	Rural freeways	70/60

1. State of California (2001). Section 22406, (c), 2001.
2. Changed from 75 to 80 in 2014.
3. In 2014, max speed limit for cars was increased from 65 MPH to 70 MPH, however, speed limit for trucks stayed at 55 MPH even after a hard push from the trucking lobby to increase it to at least 60 MPH.
4. In 2005, truck speed limit was increased from 60 to 65 MPH, while other cars speed limit increased from 65 to 70 MPH.
5. In 2003, Oregon Legislature enacted revisions to the statutes governing maximum speed limits on interstate highways in Oregon (House Bill 2661). The legislature authorized a maximum posted speed of 70 MPH for passenger vehicles and 65 MPH for heavy commercial vehicles (trucks) on interstate highways.

Virginia, Ohio, Illinois, and Arkansas have returned to a USL. Indiana tried to remove it, but the bill did not make it out of the legislature. Oregon asked the Oregon DOT for an updated literature review of the differential speed data, and that report concluded there now exists limited evidence for improved safety due to differential speed limits *[12]*.

Arkansas is an interesting case to examine because even though the law was changed to a USL in 2015, as of the writing of this paper 2.5 years later, there are still “Truck Speed 65” signs up on various places on rural interstate routes in Arkansas. New and recently rehabilitated facilities have proper updated signage, but the state DOT is likely waiting until a larger total sign overhaul to make the change. If a state were to switch to a DSL, a new signing plan would have to be developed, the physical signs would have to be purchased, and workers would have to install them. Researchers estimated that it would cost the state of Michigan roughly $730/mile to put up new signs *[4]*.

Louisiana currently has a DSL on the Atchafalaya Basin Bridge. While previous studies have found slight improvements in safety of this stretch of I-10 since DSL implementation, they have not been able to conclusively tie the improvements to the DSL *[20], [23]*.

Figure 1 shows a graph of the rural interstate fatality rates in the US from 2004 to 2013 *[24]*. The graph compares the national average to the average of the states that had DSLs in place during the entire period. Therefore, Virginia and Ohio are excluded from the data set. Louisiana is also not included because it isn't a statewide implementation (isolated to just the Atchafalaya Basin Bridge on I-10). Complete data was not readily available for periods prior to 2004 and after 2013.

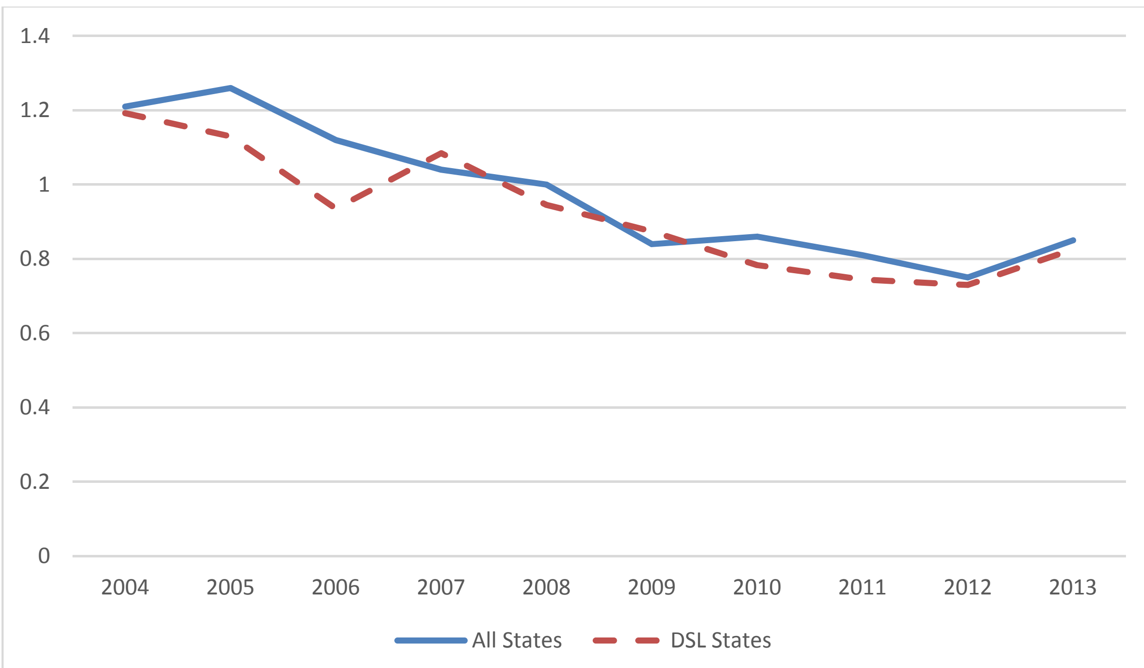

Figure 1
Rural interstate fatality rate (per 100 million VMT)

While no statistical analysis was conducted on the data, the graph does show that the trends among DSL states generally follow the overall national trend. If the DSL states had a consistently lower (or higher) fatality rate relative to the national rate, then it might indicate a relationship of DSL to fatality rate. In this case, the fatality rate is higher in some years and lower in other years. This suggests that there is no obvious relationship between fatality rates and DSL implementation which echoes the inconclusiveness of our previous discussion on crash rates and severity.

Vehicle Classification

When tasked with the issue of determining what defined a "truck," one report found that the weight of a vehicle did not significantly affect the fatality rate *[15]*. They examined various categories in the data and proposed several reasons related to complications and the non-uniformity of the data as to why they believed this potentially unexpected result to be true. Another explanation why this result contradicts intuition is the misconception that heavier vehicles have a longer stopping distance. Physics predicts and studies confirm that a fully loaded and unloaded truck will stop in roughly the same distance *[5]*. However, the maximum truck length was strongly correlated with an increased fatality rate *[15]*. Unfortunately, the study only gave a modeling parameter, which is not directly useful for setting a length to define a truck.

Facility Type

Implementation of DSL in the US has mainly been limited to rural freeways. However, Montana also previously implemented DSL on their two-lane state highways. One study advised against this because of the projected increased number of passing maneuvers this would result in without the necessary vision to complete the maneuvers *[25], [26]*. When Montana switched from a DSL to a USL they found a 48.6% drop in non-animal related crashes on major arterials. They currently have a uniform speed limit of 65 MPH on their two lane highways and a DSL on their rural freeways. These results point to freeways (like the interstate system) as being the only suitable place a DSL can be implemented. DSL may not work without lane restrictions for trucks citing an increase in variance leading to an increased crash risk *[23]*. However, truck lane restrictions and DSL are not necessarily linked since speed differentials are not significantly reduced from implementing truck lane restrictions.

International Experience in Implementing DSL

Most international countries have no research into a differential posted speed because they handle the issue of truck speed more directly *[27], [28], [29], [30], [31]*. Australia, the European Union, Malaysia, and Indonesia all require a device that prevents the truck from traveling above a certain preset speed. Australia has the highest allowable rate at 115 KM/H (72 MPH). The EU mandates 100 KM/H (62 MPH) for buses and 90 KM/H (56 MPH) for trucks. New studies from Malaysia and Indonesia both suggested trucks be limited to 70 KM/H (43 MPH).

From 1993 (the year after initial implementation of speed limiters) to 2005, heavy vehicle crashes fell by 26% in the United Kingdom *[28]*. Heavy vehicle crashes also decreased in Australia in the 10 years following their speed limiter legislation. However, several other improvements also were made such as improvement to infrastructure and advances in vehicle safety, and no study in the UK, the EU, or Australia has tried to determine what percentage of that drop is directly attributable to the limiters.

Each region sets a different weight for their definition of a truck. The EU uses 7.5 long tons (~16,500 lb.), Australia and Indonesia both use 12 tons, and Malaysia suggests 20 tons (44,000 lb.).

User Perspective

Unlike the uncertainty surrounding the objective aspects of a DSL, there is much more subjective clarity. Truck drivers are strongly opposed. They feel targeted by these restrictions and point out that trucks have uniformly higher compliance rates than passenger vehicles.

Truck drivers surveyed feared a resulting increase in vehicle interactions due to a DSL (especially near interchanges). Truckers agreed that a uniform speed limit of 70 MPH seemed best even if their vehicle was not subjected to a speed limiting device (governor) *[5], [22].* They also argued that an increased top speed would allow for shorter travel times potentially reducing the amount of driving done while fatigued. About 68% of truck drivers said that company speed policies affect driver retention. A company's speed policy often affects a driver's pay check *[5].* Since drivers are usually paid per mile, a higher speed means more money per hour.

As mentioned earlier, trucks move 2-4 MPH, roughly 5% of the mean speed of 69 MPH, slower for a 5 MPH DSL, which adds 20-25 minutes to a 10-hour trip *[6], [12].* A 10 MPH DSL would exacerbate the problem even further and increase the number of potentially dangerous hours truck drivers spend on the road.

From a general driving population point of view, users are split with USL being preferred 50.2% of the time and a DSL 44.5% *[25].* When broken down by vehicle type, some differences emerged. Passenger vehicle occupants preferred a DSL 56.8% while truck driver preferred a USL 68.7% *[25]*. Truck drivers believed a USL was safer, and they did so by a larger margin than passenger drivers believed a DSL was safer *[25].* Another study found similar results that passenger car drivers support a DSL and believe it is safer *[22].*

CONCLUSIONS

One of the main focuses of this literature review was to determine if safety benefits have been realized by implementing DSL in the past. Unfortunately, despite numerous studies by state, federal, and international organizations, the issue is still unresolved.

Traffic operations and safety issues are multivariate systems. Changing the posted speed limit can have competing impacts, if it has any impact at all. Most studies have not been able to conclusively say which speed limit arrangement is safer. Some studies suggest that a differential speed limit is slightly safer, others say it is slightly worse.

Trucks could experience slightly less wear at a lower speed, but the increased variance would be slightly worse for the pavement. Fuel consumption and emissions would slightly decrease from a DSL, but at a direct cost to the trucking industry. Whether or not a DSL leads to a net profit or loss depends heavily on the price of fuel, fuel consumption rates, the time value of the freight transported, and the labor rate of the truck drivers.

Many states are removing their DSL and reverting to a USL. Almost every other country bypasses the need for a DSL by simply having speed regulators built into the truck, but no study has been able to quantify how much safer trucking is as a result of the regulators.

Because an academic consensus has not been reached about many of the aspects related to differential speed limits, this report cannot definitively state that one method is better than the other in terms of safety and/or operations.

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

cm	centimeter(s)
DOT	Department of Transportation
DOTD	Louisiana Department of Transportation and Development
DSL	Differential Speed Limit
EB	Empirical Bayes
FHWA	Federal Highway Administration
ft.	foot (feet)
in.	inch(es)
Inc	Inconclusive
KM/H	Kilometers per Hour
LTRC	Louisiana Transportation Research Center
lb.	pound(s)
m	meter(s)
MPG	Miles Per Gallon
MPH	Miles Per Hour
NMSL	National Mandatory Speed Limit
NHTSA	National Highway Traffic Safety Administration
USL	Uniform Speed Limit
VMT	Vehicle Miles Traveled

REFERENCES

1. "USDOT Releases 2016 Fatal Traffic Crash Data." 6 Oct. 2017, 28. https://www.nhtsa.gov/press-releases/usdot-releases-2016-fatal-traffic-crash-data

2. Garber, N.J., and Gadiraju, R. "Effects of Truck Strategies on Traffic Flow and Safety on Multilane Highways." *Transportation Research Record 1256*, Transportation Research Board, National Research Council, Washington, D.C., 1991, pp. 49-55.

3. Yuan, B., and Garber, N. J. "Effects of Differential Speed Limits on Vehicle Speed and Crash Characteristics Using Hypothesis Tests." University of Virginia, Charlottesville, Mid-Atlantic Universities Transportation Center, Research and Special Programs Administration, 2002.

4. Savolainen, P., Gates, T., Hacker, E., Davis, A., Frazier, S., Russo, B., Rista,E., Parker, M., Mannering, F., and Schneider, W. "Evaluating the Impacts of Speed Limit Policy Alternatives." Wayne State University; Michigan Department of Transportation, 2014.

5. Johnson, S.L., and Pawar, N. "Cost/Benefit Evaluation of Large Truck-Automobile Speed Limit Differentials on Rural Interstate Highways." Mack-Blackwell Transportation Center; Research and Special Programs Administration, 2005.

6. Johnson, S.L., and Murray. D. "Empirical Analysis of Truck and Automobile Speeds on Rural Interstates: Impact of Posted Speed Limits." Transportation Research Board 89th Annual Meeting, Transportation Research Board, 2010.

7. Harkey, D. L., and Mera, R. "Safety Impacts of Different Speed Limits on Cars and Trucks." FHWA/RD-93-161. FHWA, U.S. Department of Transportation, 1994.

8. Garber, N. J.; Miller, J. S.; Sun, X.; and Yuan, B. "Safety Impacts of Differential Speed Limits for Trucks and Passenger Cars on Rural Interstate Highways: A Modified Empirical Bayes Approach." *Journal of Transportation Engineering*, Volume 132, Issue 1, 2006, pp. 19-29.

9. Elbassuoni, S.; Dixon, M.; and Abdel-Rahim, A. "Long-Term Impact of Differential Speed Limits on Rural Freeways in Idaho." Transportation Research Board 94th Annual Meeting, Transportation Research Board, 2015, 15p

10. Davis, A.; Hacker, E.; Savolainen, P.T.; and Gates, T.J. "Longitudinal Analysis of Rural Interstate Fatalities in Relation to Speed Limit Policies." Transportation Research Record: Journal of the Transportation Research Board, Issue 2514, 2015, pp 21–31

11. Malyshkina, N. V., and Mannering, F. "Effect of Increases in Speed Limits on

Severities of Injuries in Accidents." *Transportation Research Record 2083*, Transportation Research Board, National Research Council, Washington, D.C., 2008.

12. Monsere, C.; Kothuri, S.; and Razmpa, A. "Update to Issues Report for Interstate Speed Changes," June, 2017.

13. Dixon, M.P.; Abdel-Rahim, A.; and Elbassuoni, S. "Evaluation of the Impacts of Differential Speed Limits on Interstate Highways in Idaho." University of Idaho, Moscow; Idaho Transportation Department; Federal Highway Administration, 2012.

14. Garber, N. J.; Miller, J.S.; Sun, X.; and Yuan, B. "Safety Impacts of Differential Speed Limits for Trucks and Passenger Cars on Rural Interstate Highways: A Modified Empirical Bayes Approach." *Journal of Transportation Engineering*, Volume 132, Issue 1, 2006, pp 19-29.

15. Neeley, G.W., and Richardson, Jr., L.E. "The Effect of State Regulations on Truck-Crash Fatalities." *American Journal of Public Health*, Volume 99, Issue 3, 2009, pp 408-415.

16. *HSIP Glossary*. Highway Safety Improvement Program Manual - Safety | Federal Highway Administration, USDOT, 15 July 2011, safety.fhwa.dot.gov/hsip/resources/fhwasa09029/app_d.cfm.

17. *Highway Safety Analysis Toolbox*. LA DOTD, wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Highway_Safety/Pages/Highway_Safety_Analysis_Toolbox.aspx.

18. Srinivasan, R. "Safety Impacts of Differential and Uniform Car-Truck Speed Limits on Illinois and North Carolina Interstates." Transportation Research Board 85th Annual Meeting, Transportation Research Board, 2006.

19. Garber, N.J.; Miller, J.S.; Yuan, B.; and Sun, X. "Safety Effects of Differential Speed Limits on Rural Interstate Highways." FHWA-HRT-05-042, FHWA, U.S. Department of Transportation, 2005.

20. Radhakrishnan, M., and Wilmot, C.G. "Impact of Left Lane Truck Restriction Strategies on Multilane Highways in Louisiana—A Literature Review." Louisiana State University, Baton Rouge; Louisiana Transportation Research Center, 2009.

21. Johnson, S.L., and Pawar, N. "Analysis of Heavy-Truck and Automobile Speed Distributions for Uniform and Differential Speed Limit Configurations on Rural Interstate Highways." Transportation Research Board 86th Annual Meeting, Transportation Research Board, 2007.

22. Hu, W. and Mccartt, A.T. "Effects of Automated Speed Enforcement in Montgomery County, Maryland, on Vehicle Speeds, Public Opinion, and Crashes." *Traffic Injury Prevention,* vol. 17, no. sup1, Feb. 2016, pp. 53–58.

23. Ishak, S.; Wolshon, B.; Sun, X.; Korkut, M.; and Qi, Y. "Evaluation of the Traffic Safety Benefits of a Lower Speed Limit and Restriction of Trucks to Use of Right Lane Only on I-10 Over the Atchafalaya Basin." Louisiana State University, Baton Rouge; Louisiana Transportation Research Center; 2012.

24. *USDOT Roadway Safety Data Dashboard*. https://rspcb.safety.fhwa.dot.gov/Dashboard/Default.aspx

25. Gates, T.J.; Savolainen, P.T.; Russo, B.J.; Hamzeie, R.; Kay, J.J.; Frazier, S.; and Finkelman, J. "Safety and Operational Impacts of Differential Speed Limits on Two-Lane Rural Highways in Montana." Wayne State University; Montana Department of Transportation; Federal Highway Administration, 2016.

26. Ghods, A.H., and Saccomanno, F.F. "Safety and Traffic Implications of Differential Car and Truck Speed Controls for Two-Lane Highways." *Journal of Transportation Engineering*, Volume 142, Issue 11, 2016.

27. Barber, A. Department for Transportation, "Motor Vehicle Variation of Speed Limits in England and Wales," 2014.

28. Archer, J. ; Fotheringham, N.; Symmons, M.; and Corben, B. Transport Accident Comission, "The Impact of Lowered Speed Limits in Australia," 2008.

29. *Learning from Others : An International Study on Heavy Truck Speed Limiters*, Transport Canada, 2008.

30. Saifizul, A.A.; Yamanaka, H. and Karim, M.R. "Empirical Analysis of Gross Vehicle Weight and Free Flow Speed and Consideration on its Relation with Differential Speed Limit." *Accident Analysis and Prevention*. Elsevier Ltd, 43(3), 2011, pp. 1068–1073.

31. Pranoto, H. "Improving Road Safety of Tank Truck in Indonesia by Speed Limiter Installation." 2022, 2017, pp. 4–8.

APPENDIX A

List of Papers Reviewed

Author	Year	Preferred Option In Terms of:				
		Overall Opinion	**Speed and Variance**	**Crash Frequency**	**Crash Severity**	**Compliance**
Monsere, C.	2017	Slight DSL	Inc	Inc	Slight DSL	USL
Ghods, A.	2016	Inc	USL	DSL		
Gates, T.	2016	USL				
Elbassuoni, S.	2015	DSL	Mixed	DSL	DSL	DSL
Davis, A.	2015	Slight DSL		Slight DSL	DSL	
Savolianen, P.	2014	USL	USL	Inc	inc	USL
Barber, A.	2014	Inc				
Dixon, M.	2012	Strong DSL	DSL	DSL	DSL	
Johnson, S.	2010	Inc	Inc			USL
Neely, G.	2009	Inc		Inc	Inc	
Radhakrishnan, M.	2009	USL	USL			
Korkut, M.	2009	Inc				
Trans Canada	2008	Inc				
Archer, J.	2008	Inc		Inc	Inc	
Ishak, S.	2008	Slight USL				
Johnson, S.	2007	Inc	Slight USL			
Garber, N.	2006	Inc		Inc	Inc	
Novotny, N.	2005	Inc				
Garber, N.	2005	Inc	Inc	Inc	Inc	
Raghavan, S.	2005	Inc		Mixed	Mixed	
Johnson, S.	2005	Inc	Slight USL	Inc	Inc	USL
Yuan, B.	2002	Inc	Inc	Inc	Inc	
Harkey, D.	1994	Inc	Slight USL	Inc	Inc	USL

Inc – inconclusive

APPENDIX B

Summary of Findings

Study			Posted Speed Limit (MPH)		Changes in Total Crashes		
Reference	**Period**	**Scope**	**From**	**To**	**Fatal crashes**	**Truck-Related Fatal crashes**	**Frequency**
Davis et al.	1999-2011	US	USL*	DSL*	-3.3%	-24.6%	
Savolainen et al.	2004-2012	Michigan (Urban)	USL (55)	DSL (70/60)	-45%**		
		US	DSL* (65-70/60)	USL* (70)			Decreased
	1999-2011	US	USL*	DSL*		-20.5%	
Dixon et al.	1998-2011	Idaho	USL (75)	DSL (75/65)	-26%	-38%	
Korkut et al.	2004-2006	Louisiana	USL (60)	DSL (60/55)	-13%	-79%	
Gates et al.	2005-2014	Montana	DSL (70/60)	USL (65)			Non-SIG
Garber et al.	1991-2000	Idaho	USL	DSL			
		Virginia	DSL	USL	Non-SIG**		Increased

*Comparing Speed Limits (instead of change from/to)
** Crash rate (instead of frequency) *[12]*

APPENDIX C

House Concurrent Resolution 112

ENROLLED

2017 Regular Session

HOUSE CONCURRENT RESOLUTION NO. 112

BY REPRESENTATIVE STEVE CARTER

A CONCURRENT RESOLUTION

To urge and request the Department of Transportation and Development to study the safety and operational impacts of differential speed limits on interstate highways and to report the findings to the Senate and House committees on transportation, highways and public works and to the member of the House of Representatives representing House District Number 68 on or before January 1, 2018.

WHEREAS, school buses, truck-tractor, semi-trailers or any combination of these vehicles are the largest vehicles on the roadway and when these vehicles travel at increased speeds they can negatively impact driver behavior and increase traffic and fatalities; and

WHEREAS, large vehicles traveling at increased speeds in wet conditions can splash or spray significant amounts of water or mud thus impacting a driver's ability to operate a vehicle safely; and

WHEREAS, many truck drivers do not adjust to prevailing road conditions which can lead to more severe motor vehicle accidents, even if the frequency of crashes is unchanged or decreased; and

WHEREAS, reduced speed limits for large vehicles may afford drivers of those vehicles sufficient time to react when an emergency occurs on the road, which can result in a reduction in the frequency and severity of motor vehicle accidents; and

WHEREAS, a reduction in speed limits for large vehicles will positively impact fuel economy, and contribute to a decrease in fuel consumption and associated costs; and

WHEREAS, passing a large vehicle on the interstate requires other drivers to maintain a safe and steady speed and ensure there is adequate space between the two vehicles to safely pass; and

WHEREAS, reduced speed limits for larger vehicles will assist in vehicles passing efficiently and safely; and

WHEREAS, trucks and buses traveling at increased speeds have been a long standing safety concern given their larger blind spots and increased size which results in restricted maneuverability, longer stopping distances, and higher impact forces in a collision; and

WHEREAS, given the safety concerns associated with large vehicles many states have implemented differential speed limits where larger vehicles have a posted speed limit lower than passenger cars in lieu of uniform speed limits where the speed limits are the same for both passenger cars and larger vehicles; and

WHEREAS, at least seven states have implemented differential speed limits to enhance safety, including California, Idaho, Indiana, Michigan, Montana, Virginia, and Washington.

THEREFORE, BE IT RESOLVED that the Legislature of Louisiana does hereby urge and request the Department of Transportation and Development to study the safety and operational impacts of differential speed limits on interstate highways.

BE IT FURTHER RESOLVED that the study conducted by the Department of Transportation and Development shall include consideration and determination of the following:

(1) What impact and to what extent do uniform speed limits and differential speed limits have on traffic safety, specifically, the type and number of accidents, the type of vehicles involved in these accidents, the severity of the accidents, and driver behavior in the state of Louisiana?

(2) Whether safety and mobility will improve as a result of adopting differential speed limits on interstate highways across the state, considering traffic volume, variability in traffic speeds, crash history, and roadway geometry?

(3) Whether requiring school buses, truck-tractor, semi-trailers or any combination of these vehicles to travel at a speed not to exceed ten miles per hour below the posted speed limit will improve traffic conditions and safety on interstate highways of the state?

(4) Whether the gross weight of the motor vehicle should determine whether differential speed limits should apply?

(5) Whether differential speed limits will yield fuel and emissions savings resulting in energy conservation and environmental improvements in the state?

BE IT FURTHER RESOLVED that the Department of Transportation and Development shall submit a written report to the Senate and House committees on transportation, highways and public works and the member of the House of Representatives representing House District Number 68 detailing its findings regarding the safety and operational impacts of differential speed limits on or before January 1, 2018.

BE IT FURTHER RESOLVED that a suitable copy of this Resolution be transmitted to the secretary of the Department of Transportation and Development.

SPEAKER OF THE HOUSE OF REPRESENTATIVES

PRESIDENT OF THE SENATE