**REPORT OF THE VIRGINIA
DEPARTMENT OF TRANSPORTATION**

Impact of Virginia Participation in a Federal Pilot Study of 91,000-Pound, Six-Axle Vehicles Utilizing the Interstate (Chapter 554, 2018)

**TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA**

SENATE DOCUMENT NO. 3

**COMMONWEALTH OF VIRGINIA
RICHMOND
2019**

Impact of Virginia Participation in a Federal Pilot Study of 91,000-Pound, Six-Axle Vehicles Utilizing the Interstate

Chapters 553 and 554 of the 2018 Acts of Assembly

Executive Summary

Chapters 553 (HB 1276) and 554 (SB 504) of the 2018 Acts of Assembly directed the Virginia Department of Transportation (VDOT) to convene a work group to identify the implications of the Commonwealth's participation in a federal data collection pilot program or project involving six-axle tractor truck semitrailer combinations weighing up to 91,000 pounds and utilizing interstate highways. The legislation required VDOT to consult relevant stakeholders and review the fee structure and axle spacing for qualifying tractor trucks, issues related to reasonable access from loading facilities onto a primary or secondary highway and interstate highways, the sufficiency of existing data in determining if certain routes and bridges should be excluded from the federal pilot program or project, and any other issues that VDOT deemed relevant or appropriate.

In response to this legislation, stakeholders were identified and three stakeholder meetings were held. Extensive literature was reviewed on the topic of increased weight limits on safety, mobility, infrastructure, mode shift, and enforcement/compliance. Although there are insufficient data available to fully quantify the impacts of 91,000-pound, six-axle vehicles, potential impacts are identified.

Potential Safety Impacts

The introduction of the heavier pilot vehicles poses a potential increase in the number of crashes and/or their severity in comparison to the 80,000-pound vehicles currently operating on interstate highways. Other studies have found increased crash rates but recognize that it is not possible to draw national conclusions due to a lack of relevant crash data. A related safety issue is the potential increase in damage to roadside safety hardware. Additionally, a possible increase in the number of safety violations, particularly regarding brakes on heavier vehicles, is a concern highlighted in earlier research.

Potential Operational Impacts

There is concern that the heavier pilot vehicles would further degrade the speed of the overall traffic stream on interstates, particularly on steep grades; pilot vehicles may operate at slower speeds than the current 80,000-pound vehicles, further reducing the speed of traffic. Additionally, the heavier pilot vehicles may be less capable than the 80,000-pound vehicles to accelerate at entrance ramps, degrading the flow of traffic within the vicinity of ramps. Operations off of the interstate are also a concern, particularly on more narrow roadways with less room within which to operate.

Potential Pavement Impacts

The impact on pavement condition of a 91,000-pound, 6-axle truck will depend on the axle spacing and configuration of the vehicle. Some configurations could result in decreased per-axle loads

that would result in little to no impact while other configurations could have more significant negative impacts. Shortening the service life of interstate and non-interstate routes included in a pilot could potentially increase maintenance costs substantially.

Potential Bridge Impacts

If a vehicle configuration is known, it is possible to evaluate each structure and determine its capacity to safely carry a specified load through a process referred to as "load rating." This analysis would identify any structures that are not capable of accommodating the pilot vehicle weight. In the case of the proposed pilot, the vehicle configuration is not known and, therefore, the load rating cannot be calculated.

In addition to the immediate issue of structural capacity, long-term deterioration is also a concern. Most size and weight studies in the literature reviewed anticipate an expected increase in deterioration rates for structures when subjected to increased frequency of heavier loads, leading to increased maintenance and replacement costs.

RECOMMENDATIONS

It is clear from the information gathered in this study, from both internal and external stakeholders as well as a review of existing literature, that there currently is insufficient data available to fully quantify the impacts of 91,000-pound, 6-axle combination vehicles on safety, operations, infrastructure condition, mode shift, or compliance and enforcement on Virginia's transportation system. A properly designed pilot focused on data collection could address these issues and provide an opportunity for meaningful evaluation of impacts attributable to the 91,000-pound, 6-axle vehicles; however, there are implications to pilot participation that must be considered.

- First, any meaningful pilot would have to be of sufficient duration to allow for adequate data collection as well as for some return on investment by carriers that upgrade their equipment.
- Safety must remain a primary consideration. Increases in crash rates among the heavier trucks could occur and, although a measureable decrease in safety would be a trigger for discontinuation of the pilot, any injuries or loss of life resulting from the pilot would be unacceptable.
- Enforcement of differing weight limits for participating and non-participating vehicles would place an additional burden on enforcement personnel.

There are uncertainties regarding the design and implementation of a federal pilot that make it difficult to evaluate potential pilot risks and benefits. Concerns about infrastructure damage, safety, and operational impacts resulting from these heavier loads remain a primary consideration. Accordingly, it is recommended that Virginia refrain from committing to a pilot at this time. In the event a federal pilot program is authorized, VDOT will review the parameters of the pilot and evaluate potential participation.

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INTRODUCTION

Original Legislation

During the 2018 session of the Virginia General Assembly, legislation was enacted (set out below) that requires VDOT to consider the implications of participation in a Federal Pilot program allowing tractor truck semitrailer combinations with a maximum weight of 91,000 pounds and six-axles to operate on interstate highways.

> *Be it enacted by the General Assembly of Virginia:*
>
> *1.§ 1. That the Department of Transportation (the Department) shall convene a work group to identify the implications of the Commonwealth's participation in a federal data collection pilot program or project involving six-axle tractor truck semitrailer combinations weighing up to 91,000 pounds and utilizing interstate highways. The Department shall consult relevant stakeholders and shall review (i) the fee structure for qualifying tractor trucks, (ii) the axle spacing for qualifying tractor trucks, (iii) issues related to reasonable access from loading facilities onto a primary or secondary highway and interstate highways, (iv) the sufficiency of existing data in determining if certain routes and bridges should be excluded from the federal pilot program or project, and (v) any other issues as deemed relevant or appropriate by the Department.*

This report summarizes the findings of VDOT's work group including stakeholder comments, VDOT assessments of data needs for pilot evaluation, and other factors that would influence the decision of whether to participate in a pilot or not. It is important to note that at the time of this work, no Federal Pilot program exists so details such as duration, vehicle configuration, data collection requirements, and funding source are not available. Based on input from internal and external stakeholders, this report identifies criteria that a pilot program would need to have in place in order for VDOT to consider participating in such a pilot program.

Previous Studies

Since the Federal government began regulating the size and weight limits allowed on the Interstate Highway System in 1956, additional research has been conducted to determine if these limits should be changed. The number and breadth of studies that have been published in this area are extensive. Outlined below is a brief summary of the U.S. Department of Transportation's *Comprehensive Truck Size and Weight Limits Study*, completed in 2015. This document is considered to be most pertinent to the review required by Chapters 553 and 554 of the 2018 Acts of Assembly.

Other studies examining the impacts of additional weight allowances for heavy vehicles/trucks have been performed in the past by both VDOT (and its research arm, the Virginia Transportation Research Council) and others. The key studies are mentioned herein, while additional detail concerning these studies is set forth in Appendix A.

Federal Comprehensive Truck Size and Weight Limits Study

The *Comprehensive Truck Size and Weight Limits Study* was performed by the Federal Highway Administration as required by the Moving Ahead for Progress in the 21st Century Transportation Authorization Act (MAP-21). The study resulted in numerous documents including a report to Congress and a related series of technical reports. In combination, these technical reports are considered to be the most recent and comprehensive research related to potential increased commercial truck weights.

The stated purpose of the study was to inform Congress of the potential implications of increasing the Federally-allowable size or weight of commercial vehicles, not to specifically advocate for new policies. The study included five core areas: safety, shift in mode of transportation by which goods are moved, pavement service life, bridge performance, and enforcement of vehicle size and weight limitations. Six different axle configurations (in addition to two control configurations) were evaluated as part of the study. Included in the evaluation was a tractor with a 53 foot semitrailer, the combination having a total of six axles and a gross vehicle weight (GVW) of 91,000 lb.

The authors of the study were able to utilize improved models, methods of analyses, and data sets that had never before been available. These improvements included the use of FHWA's Freight Analysis Framework to determine modal shift impacts, AASHTOWare Pavement ME Design to model the impacts to pavements, and AASHTOWare Bridge Rating (ABrR) for the structural analysis of bridges. Also unique to this study as compared to earlier size and weight studies was the use of the National Academies of Science (NAS) to provide objective peer review of the technical reports. Reviewers included subject matter experts from academia, and the public and private sectors.

The study was published in the form of a technical summary (Volume I), a series of five technical reports (Volume II), and a final report to Congress. Stakeholder comments on the study findings were obtained through a series of Web-based public meetings. A separate document was developed summarizing the findings of these meetings.

The study concluded that:

- Data and modeling capability limitations were too significant to allow for the estimation of the national impacts of the various scenarios examined
- A research program would have to be developed as a first step in determining the necessary models and data sets to make significant advancements in this area
- Additional study in this area would not result in more reliable findings at this time
- Limited information on size and weight did not allow for adequate analysis of crash and exposure data. At the time of the study, operating weights of trucks were not included in any state's crash data system. It was also noted that analytical tools are

needed to determine the impacts that trucks weighing more than 80,000 lb would have on longitudinal roadway barriers.

- A nationally accepted approach for calculating the effects of heavy vehicles on bridges and the resulting costs of repairing them does not exist. A methodology for estimating the damage resulting from different truck configurations and weights for concrete bridge decks is needed.
- In order to more accurately estimate the impacts of increased truck weights and varying axle configurations, improvements need to be made in AASHTOW are Pavement ME Design software, including the ability to calculate the impacts on the performance of composite (overlay) pavements.

Relevant/Key Legislative Studies/Responses Prepared by the Virginia Department of Transportation and Others in the Past Relating to Overweight or Heavy Vehicles.

Between 1991 and 2011, no fewer than nine studies related to increased truck weights and/or the allocation of pavement rehabilitation costs were undertaken by VDOT. Several of these studies were undertaken specifically to address permit fee structures and overweight vehicles. Increases in permit fees were recommended based on pavement deterioration estimates primarily derived from well-established engineering studies documenting the increased deterioration as a result of increased vehicle weight. This same deterioration information for bridges was not available.

Summaries of the VDOT studies as well as several national studies are included in Appendix A. Somewhat similar to the previously summarized *Comprehensive Truck Size and Weight Limits Study* (2015), insufficient data renders many of these research efforts inconclusive and points to the need to for federal pilot programs to fill some of these data gaps.

PURPOSE AND SCOPE

This study is conducted in response to Chapters 553 and 554 of the 2018 Virginia General Assembly (HB 1276 and SB 504, respectively). The chapter requires that VDOT convene a work group of stakeholders to identify the implications of participation in a potential federal pilot program involving six-axle tractor truck semitrailer combinations weighing up to 91,000 lb and utilizing interstate highways. Identification of those implications involved meeting with relevant stakeholders to obtain input, reviewing existing literature on safety, operational, and infrastructure impacts, determining the necessary criteria and conditions that would be required for participation, and identifying the required data to evaluate the pilot, should one be undertaken. This study does not attempt to fully quantify all impacts resulting from such potential pilot program (changes in traffic volumes, crashes, pavement conditions, etc.) but will identify the data that will be required to quantify those impacts.

APPROACH

Task 1: Internal Stakeholder Meetings

VDOT convened an internal working group to identify the data that would be needed to fully assess any pilot program that the Commonwealth chooses to participate in. Divisions represented included Governance and Legislative Affairs, Structure and Bridge, Maintenance, Traffic Engineering, Transportation and Mobility Planning, Location and Design, and the Transportation Research Council. Representatives from DMV, VSP, and the Port Authority were also contacted as part of the internal stakeholder meetings. Gaps in available data and data determined to be necessary to participate in the pilot were identified.

Task 2: External Stakeholder Meetings

Relevant stakeholders were invited to participate in a three separate meetings to provide input on their perceived impacts of a pilot study. Output from the Internal stakeholder group was shared with the External stakeholders at the second meeting and they were asked to review and provide comments on the draft report prior to the third meeting. A list of stakeholders is provided in Appendix B based on participation in any of the three meetings. External stakeholder meetings were announced on VDOT's website to encourage broader participation.

Task 3: Develop Report Documenting Feedback from all Stakeholder Meetings

A final report was developed summarizing the findings from previous truck weight studies done for Virginia and those of recent national significance, and considerations for pilot program design provided by both external and internal stakeholders**.**

FINDINGS AND DISCUSSION

The following sections summarize stakeholder comments, considerations for pilot design, issues related to data and evaluation of infrastructure impacts, and finally conclusions and recommendations.

Input from Industry Stakeholders

Comments were received from stakeholders expressing support and opposition. It is important to note that the majority of comments related to support of or opposition to a change in policy, not to the pros and cons of participation in a pilot. Comments are summarized below by whether they are "Supportive of" or "In Opposition to" with no comment given more weight than any other and no independent checking of facts. Comments are categorized by 1) impact to infrastructure, 2) impact on safety, 3) economic impacts, and 4) other impacts. All comments received from stakeholders may be accessed at http://www.vdot.virginia.gov/info/hb_1276_sb_504.asp.

Many of the comments received from stakeholders cited findings of the 2015 *Comprehensive Truck Size and Weight Study* produced by the Federal Highway Administration, referenced as CTSWS hereafter. The fact that both sides of the argument cite the same reference indicate several important considerations including 1) Facts can often be taken out of context to support an opinion; 2) There are likely both positive and negative impacts that would result from an increase in the allowable maximum load for tractor trailers; and 3) There is insufficient data to make definitive conclusions on any impact category (infrastructure, safety, economic, mode shift, etc.)

Comments in Support of a Change to Heavier Maximum Load Limits

Impacts to Infrastructure

- Referencing the CTSWS, 91,000 lbs on a 6-axle tractor trailer would result in a 2.4-4.2% reduction in the life-cycle cost of pavements due to the distribution of the weight

Impacts to Safety

- The additional axle provides a 1 ft. shorter stopping distance compared to current 80,000 lb, 5-axle loads.
- Current exemptions allow heavier trucks to operate off the interstate. Operation on the interstate would be safer.

Economic Impacts

- The additional loading will result in a 16% reduction in total miles driven for shippers that currently weight out before they box out.
- Again citing the CTSWS, an increase to 91,000 lb would result in an estimated $5.6 billion reduction in freight costs.

Other Impacts

- Fewer trucks will mean lower emissions.
- Virginia's participation in the pilot program will be useful in helping USDOT to collect data pertaining to loaded weights of trucks at the time of a crash, which is currently not collected.
- An increase to 91,000 lb is necessary for economic competitiveness.
- Existing overweight permitted loads (e.g. forest products) should be included in any pilot study in their current configuration (90,000 lb, 5-axle truck).

Comments in Opposition to a Change to Heavier Maximum Load Limits

Impacts to Infrastructure

- Transportation Research Board study found that increasing the weight of a heavy truck by only 10% increases bridge damage by 33%.
- Prior to a decision on pilot participation, VDOT should conduct an inventory of infrastructure assets and estimate the costs to improve any that lack the capacity to accommodate the additional loading.
- Allowing heavier trucks to travel on the interstates will also increase their travel on local roads which are more vulnerable than interstates in terms of negative infrastructure impacts.

Impacts to Safety

- The CTSWS found that trucks over 80,000 pounds have 18% higher brake violation rates and a separate study by IIHS found that trucks with out of service violations have 362% higher crash risk.
- CTSWS found a 47% higher crash rate in Washington State for 91,000-pound, 6-axle trucks
- Although the pilot is focused on interstate travel, reasonable access accommodations would result in significant travel on local roads where negative impacts on safety would be greater.
- Trucks at current GVW limits struggle to maintain speed up grades which forces other vehicles to reduce speed, sometime quickly, increasing crash risk.
- CTSWS cites a "profound lack of data" from which to draw any safety conclusions.
- Brakes, tires, and suspension are likely to wear out more quickly which could, in turn, lead to increased safety risks.
- The cost to society of crashes involving large trucks was estimated at $118 billion in 2015. Increasing the allowable load will only increase this cost.

Economic Impacts

- Heavier trucks will put Virginia's transportation balance at risk. Virginia currently has a strong and growing port and rail network including both Class 1 (defined by the Surface Transportation Board as having annual carrier operating revenues of at least $250 million in 1991 dollars) and short line railroads that along with the highway network provide a balanced network. Heavier allowable truck loads could divert freight from other modes disrupting this balance.
- An increase in weight limits from 80,000 pounds to 90,000 pounds would reduce rail traffic by 10-15%, impacting the short line railroads especially hard.

- There is no economic development benefit in participating in a pilot – that only comes with a policy change.
- The trucking industry would bear the burden of the capital expense to retrofit or replace trailers and tractors to legally operate under the higher weight limit without being able to recover these costs through rate increases.
- Operating costs for fleets will increase as well. The extra axle, whether or not the trailer is hauling the additional weight, will increase rolling resistance and result in fuel economy degradation of 0.5 miles per gallon, up to as much as 1.2 miles per gallon fully loaded.
- The additional axle, drums and brakes add approximately 3,000 pounds to the trailer's weight, decreasing the productivity gains suggested by those in favor of the higher weight limit.
- Any pilot program should include additional road and bridge funding.

Other Impacts

- No Federal pilot program exists today and the last several attempts to enact one have failed. Without an existing program, it is impossible to evaluate what participation would entail.
- Virginia would make a poor test case for a pilot of 91,000 lb, 6-axle trucks due to the existing congestion on interstates.
- CTSWS found that an increase in the legal load to 91,000 lb would result in a sharp decline in the freight shipped by rail. A Massachusetts Institute of Technology study found that benefits in terms of reduced trucks from heavier loads would be offset by rail diversion (10-15% reduction) and result in 6-12 million more truck trips or 3-5 million more truck miles traveled.
- Pilot participation would require neighboring states to participate as well. Lack of contiguous states would limit the opportunity for meaningful data collection required to evaluate pilot impacts.
- It is not VDOT's job to design a pilot and doing so could result in lobbyists saying that if it designed to our comments, VDOT would participate.
- Truck VMT has increased from 112,423 in 1982 to 287,895 in 2016. There is no evidence to suggest that increasing the allowable load limit will lead to a decrease in the number of trucks on the road.
- It is bad public policy to experiment with Virginia citizens.
- Rather than participating in a pilot, the focus should be on better data collection with existing heavier trucks including VMT and a uniform crash report form that would collect number of axles, truck weight, and road type at time of crash.

It is clear that there are strong arguments on both sides of this debate. Examples of benefits or advantages and corresponding disadvantages can be found throughout the lists above.

Considerations for Pilot Design

In the absence of a formally adopted Federal Pilot program, it is difficult to determine the appropriateness of Virginia's participation. In discussions with both internal and external stakeholders, a number of considerations were identified that Virginia could use to evaluate a pilot program, should one be enacted. Listing these considerations is not intended to indicate a willingness to participate should they all be addressed in a Federal pilot but rather are viewed as minimum threshold for participation.

Geographic Scope of Pilot

It has been well established that there is a lack of conclusive data upon which to draw meaningful conclusions regarding the impact of heavier vehicles. A well designed pilot could help to overcome that challenge but it would require data collection across both pilot and control corridors. It is always challenging to isolate the impacts of a single change in a system when other factors cannot be held constant. It is likely that traffic volumes, truck percentages, vehicle characteristics (across the vehicle fleet), and other factors would change throughout the pilot period making a direct before and after comparison difficult. Establishing both pilot and control corridors would provide a side by side comparison of impacts.

Axle Spacing

The draft language VDOT has seen concerning a federal pilot program did not specify details on the configuration of the proposed 6-axle tractor trailer combination. Since axle spacing has a significant impact on bridge loading and pavement deterioration, the configuration would weigh heavily in deliberations regarding participation. If the configuration was not specified at the Federal level as part of the pilot program, the impact of each configuration for every participating state (or neighboring states at a minimum) would have to be evaluated to determine the sufficiency of bridges in the pilot corridors to accommodate the heavier loads. This additional work would be time and cost prohibitive.

Contiguous States

Much of today's truck travel involves movement across state lines. Should any proposed Federal pilot be designed, consideration should be given to identifying multi-state freight corridors for inclusion in the pilot. Participation by an isolated state surrounded by states with lower maximum allowable loads could impact the number of trucks participating in the pilot and as a result, impact the data available for evaluation.

Relating to this consideration, research was undertaken to determine if other states have enacted legislation to facilitate participation in a Federal pilot, should one be developed. Three states appear to have some legislation relating to participation in pilots including Florida, Maine, and South Carolina. Only one of the three directly mentions overweight vehicles, however, the extent to which the legislation in these states would authorize participation in a pilot such as that contemplated under Chapters 553 and 554 is unclear. Excerpts from each is provided below.

> <u>Florida Statutes: Title XXVI, Chapter 339, Section 83</u>
> 339.83 Enrollment in federal pilot programs. – The Secretary of Transportation may enroll the State of Florida in any federal pilot program or project for the collection and study of data for the review of federal or state roadway safety, infrastructure sustainability, congestion mitigation, transportation system efficiency, autonomous vehicle technology, or capacity challenges.
>
> <u>Maine Revised Statutes: Title 29-A, Chapter 21, Section 2355-A</u>
> Six-axle truck weight pilot project. – Notwithstanding any other provision of this subchapter to the contrary, for as long as the provisions of 23 United States Code, Section 127 (a) (11) affording an exemption from the federal vehicle weight limitations for vehicles operating on all portions of the interstate system are in effect, a 6-axle combination vehicle consisting of a 3-axle truck tractor with a tri-axle semitrailer having a maximum gross vehicle weight of 100,000 pounds may be operated on any portion of the interstate system consistent with this subchapter as it applies to the Maine Turnpike.
>
> <u>South Carolina Code of Laws: Title 57, Chapter 3, Article 2, Section 57-3-110</u>
> Powers and duties of Department of Transportation.
> The Department of Transportation shall have the following duties and powers:
>
> …
>
> (5) initiate and conduct such programs and pilot projects to further research and development efforts, and to promote training of personnel in the fields of planning, construction, maintenance, and operations of the state highway system;
>
> …

Pilot Duration

The issue of how long a pilot should last is a complex one. There needs to be sufficient time to allow for adequate data collection as well as to allow trucking companies to recover the costs of retrofitting or replacing existing trailers. But, pilots that have durations that are too long run the risk of becoming permanent, despite any negative impacts that might be discovered through the course of the evaluation.

Requirements for Participants

To provide sufficient data for a robust evaluation, a proposed pilot may need to require participants to provide additional trip level information. For example, automated vehicle location (AVL) systems may need to be required on participating trucks to allow for the collection of vehicle-miles-traveled (VMT) data as well as exposure data for infrastructure elements. Vehicle weight at the time of a crash has been called out as an important but missing piece of data essential for safety evaluations. The ability to provide real-time vehicle weights would be critical.

Costs Incurred by State in Participation

Pilot programs are typically established to collect sufficient data to evaluate impacts prior to a decision on more wide-scale deployment. Later sections of this report will discuss what VDOT believes to be necessary data but it is important to note that the data would not come without cost. Given that this pilot would have nationwide implications, additional Federal funding should be made available to cover the costs that participating states would incur. If sufficient Federal funding is not made available, higher permit fees or other sources of funding for participation and data collection would need to be identified.

Quantitative Information Regarding Potential Pilot

The information provided by the internal stakeholders focused on the conditions that would have to be considered, the criteria that would have to be met, and the evaluation data that would have to be collected for Virginia to consider participation in a pilot program. This information, outlined below, is organized into five main areas: safety and operations, pavements, bridges, modal shift, and compliance and enforcement. Economic impacts are specifically not included in this report. Although it is anticipated that economic impacts, both positive and negative, are likely in the event of policy change allowing heavier trucks, impacts measured under a pilot scenario are unlikely to be reflective of a permanent change in policy.

Impacts to Interstate highways are the primary focus of the following sections. However, reasonable access to and from the Interstate must also be provided and will result in impacts to non-Interstate routes. Until pilot participants are identified along with their loading/unloading locations, the scope of impacts is unknown.

Safety & Operational Impacts

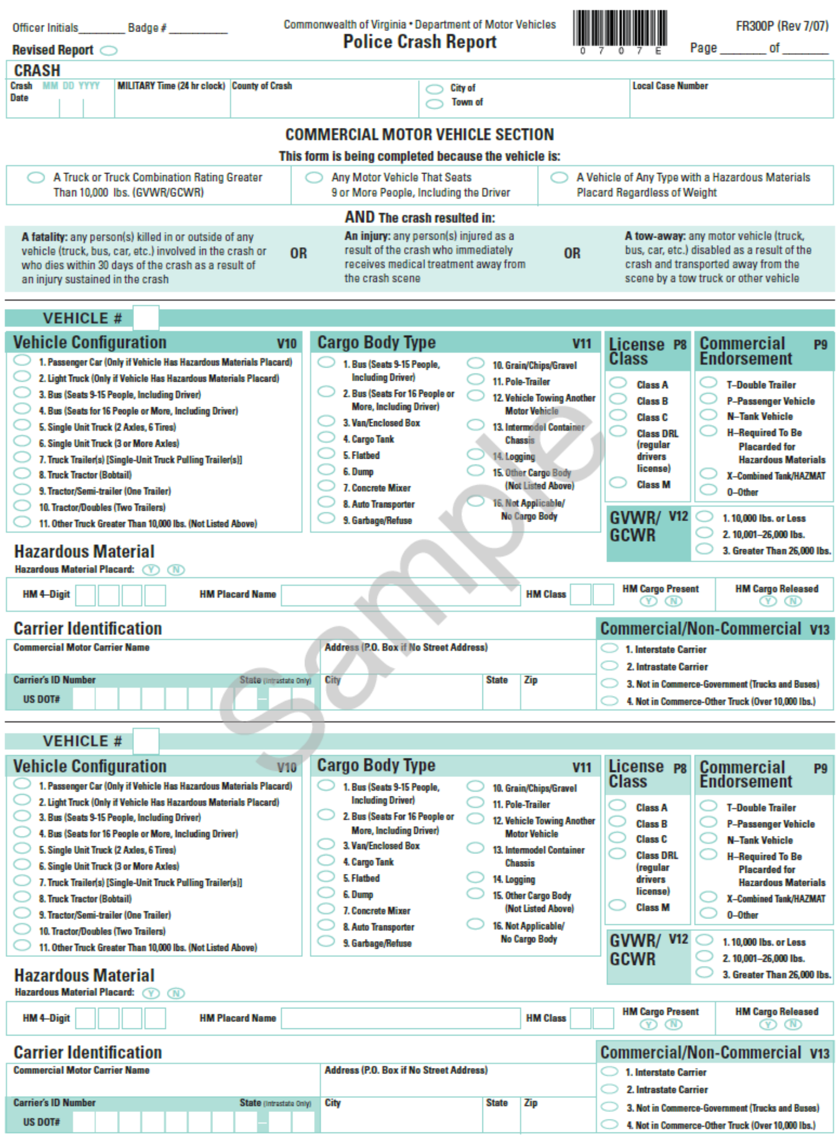
Virginia's participation in the proposed federal pilot would have potential safety and operational impacts pertaining to the heavier 91,000-pound vehicles on Virginia's Interstate highways versus the current 80,000-pound vehicles, the maximum weight of vehicles now allowed on interstates.

The potential impacts relate to (i) safety (ii) traffic data collection and (iii) operations.

Potential Safety Impacts

The introduction of the heavier pilot vehicles poses a potential increase in the number of crashes and/or their severity in comparison to the 80,000-pound vehicles operating on interstate highways. The *Comprehensive Truck Size and Weight Limits Study* (Federal Highway Administration, 2015) found that crash rates for the six-axle 91,000 truck configuration were significantly higher than the five-axle control truck rates but further stated it was not possible to draw national conclusions due to a lack of relevant crash data. The lack of relevant crash data underscores the need for further study to determine the potential safety impacts specific to Virginia's interstate highways.

In order to conduct a comparative crash analysis it is required that the pilot vehicles and the comparison 80,000-pound vehicles involved in a crash or incident must be identifiable by their weight and configuration. This requires modifying the "Commercial Vehicle" portion (see Figure 1) of Virginia's Crash Report form (used by law enforcement agencies statewide for reporting crashes) to add fields for indicating the vehicle configuration (e.g., 6-axle tractor-trailer, 5-axle tractor-trailer combination etc.) and the corresponding vehicle weight (e.g. 91,000 lbs., 80,000 lbs. etc.). Currently, that data is not included on the crash form.


Officer Initials_______ Badge # _________

Revised Report

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

07 07 E

FR300P (Rev 7/07)

Page _______ of _______

CRASH

Crash Date MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	City of / Town of	Local Case Number

COMMERCIAL MOTOR VEHICLE SECTION

This form is being completed because the vehicle is:

- A Truck or Truck Combination Rating Greater Than 10,000 lbs. (GVWR/GCWR)
- Any Motor Vehicle That Seats 9 or More People, Including the Driver
- A Vehicle of Any Type with a Hazardous Materials Placard Regardless of Weight

AND The crash resulted in:

A fatality: any person(s) killed in or outside of any vehicle (truck, bus, car, etc.) involved in the crash or who dies within 30 days of the crash as a result of an injury sustained in the crash **OR** **An injury:** any person(s) injured as a result of the crash who immediately receives medical treatment away from the crash scene **OR** **A tow-away:** any motor vehicle (truck, bus, car, etc.) disabled as a result of the crash and transported away from the scene by a tow truck or other vehicle

VEHICLE #

Vehicle Configuration V10

1. Passenger Car (Only if Vehicle Has Hazardous Materials Placard)
2. Light Truck (Only if Vehicle Has Hazardous Materials Placard)
3. Bus (Seats 9-15 People, Including Driver)
4. Bus (Seats for 16 People or More, Including Driver)
5. Single Unit Truck (2 Axles, 6 Tires)
6. Single Unit Truck (3 or More Axles)
7. Truck Trailer(s) [Single-Unit Truck Pulling Trailer(s)]
8. Truck Tractor (Bobtail)
9. Tractor/Semi-trailer (One Trailer)
10. Tractor/Doubles (Two Trailers)
11. Other Truck Greater Than 10,000 lbs. (Not Listed Above)

Cargo Body Type V11

1. Bus (Seats 9-15 People, Including Driver)
2. Bus (Seats For 16 People or More, Including Driver)
3. Van/Enclosed Box
4. Cargo Tank
5. Flatbed
6. Dump
7. Concrete Mixer
8. Auto Transporter
9. Garbage/Refuse
10. Grain/Chips/Gravel
11. Pole-Trailer
12. Vehicle Towing Another Motor Vehicle
13. Intermodel Container Chassis
14. Logging
15. Other Cargo Body (Not Listed Above)
16. Not Applicable/ No Cargo Body

License Class P8

Class A
Class B
Class C
Class DRL (regular drivers license)
Class M

Commercial Endorsement P9

T–Double Trailer
P–Passenger Vehicle
N–Tank Vehicle
H–Required To Be Placarded for Hazardous Materials
X–Combined Tank/HAZMAT
O–Other

GVWR/ GCWR V12

1. 10,000 lbs. or Less
2. 10,001–26,000 lbs.
3. Greater Than 26,000 lbs.

Hazardous Material

Hazardous Material Placard: Y N

HM 4–Digit | HM Placard Name | HM Class | HM Cargo Present Y N | HM Cargo Released Y N

Carrier Identification

Commercial Motor Carrier Name | Address (P.O. Box if No Street Address)

Carrier's ID Number | State (Intrastate Only) | City | State | Zip

US DOT#

Commercial/Non-Commercial V13

1. Interstate Carrier
2. Intrastate Carrier
3. Not in Commerce-Government (Trucks and Buses)
4. Not in Commerce-Other Truck (Over 10,000 lbs.)

Sample

VEHICLE #

Vehicle Configuration V10

1. Passenger Car (Only if Vehicle Has Hazardous Materials Placard)
2. Light Truck (Only if Vehicle Has Hazardous Materials Placard)
3. Bus (Seats 9-15 People, Including Driver)
4. Bus (Seats for 16 People or More, Including Driver)
5. Single Unit Truck (2 Axles, 6 Tires)
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8. Auto Transporter
9. Garbage/Refuse
10. Grain/Chips/Gravel
11. Pole-Trailer
12. Vehicle Towing Another Motor Vehicle
13. Intermodel Container Chassis
14. Logging
15. Other Cargo Body (Not Listed Above)
16. Not Applicable/ No Cargo Body

License Class P8

Class A
Class B
Class C
Class DRL (regular drivers license)
Class M

Commercial Endorsement P9

T–Double Trailer
P–Passenger Vehicle
N–Tank Vehicle
H–Required To Be Placarded for Hazardous Materials
X–Combined Tank/HAZMAT
O–Other

GVWR/ GCWR V12

1. 10,000 lbs. or Less
2. 10,001–26,000 lbs.
3. Greater Than 26,000 lbs.

Hazardous Material

Hazardous Material Placard: Y N

HM 4–Digit | HM Placard Name | HM Class | HM Cargo Present Y N | HM Cargo Released Y N

Carrier Identification

Commercial Motor Carrier Name | Address (P.O. Box if No Street Address)

Carrier's ID Number | State (Intrastate Only) | City | State | Zip

US DOT#

Commercial/Non-Commercial V13

1. Interstate Carrier
2. Intrastate Carrier
3. Not in Commerce-Government (Trucks and Buses)
4. Not in Commerce-Other Truck (Over 10,000 lbs.)

Figure 1. Virginia Police Crash Report -Commercial Vehicle Section

A related safety issue is the potential increase in damage to roadside safety hardware such as guardrail, median barriers, crash cushions, breakaway hardware on signs, etc. (See Figure 2) due to the heavier pilot vehicles involved in a crash, in comparison to the 80,000-pound vehicles and the associated increase in maintenance and repair costs. VDOT is responsible for installing and maintaining such roadside safety hardware as well as bearing the costs for those efforts. The *Comprehensive Truck Size and Weight Limits Study* (Federal Highway Administration, 2015) was inconclusive as to the impacts of the heavier vehicles due to a lack of available data which points to the need to conduct such a study in order to determine the potential impacts on Virginia's interstates.

Figure 2. Examples of Damage to Roadside Safety Hardware

In order to conduct the analysis of these impacts, further changes to Virginia's crash report may be desirable in order to document the appropriate crash sequence-of-events necessary to consider these potential impacts for both pilot vehicles and the 80,000-pound comparison vehicles.

Another safety-related consideration is the potential increase in the number of safety violations, particularly regarding brakes and assessment of any relationship to an increase in crashes by pilot vehicles in comparison to the 80,000-pound vehicles. The *Comprehensive Truck Size and Weight Limits Study* (Federal Highway Administration, 2015) indicated that vehicles operating at greater than 80,000 lbs. had a higher percentage (18%) of brake violations and a higher number of brake violations per inspection. Further study is desirable to determine if such an effect holds true on Virginia highways, the extent, and any relationship to increases in crashes by pilot vehicles in comparison to the 80,000-pound vehicles. Conducting this analysis would require correlating vehicle crash reports of pilot vehicles and the comparison 80,000-pound vehicles with their related safety violations maintained by DMV.

Evaluating the identified potential safety-related impacts would require an engineering study to examine the various issues and determine their relationship to any (i) increase in crashes or crash severity, (ii) related damage to roadside hardware, and (iii) increases in safety violations. Based on experience with similar safety studies, the cost to conduct an initial study (presume in year 3-5 of the pilot effort) is estimated to be approximately $45,000. The cost to conduct a further analysis to include additional years of crash history (presume at year 10 of the pilot effort) would be approximately $16,000, for a total cost over a 10-year period of approximately $61,000. (A similar study initiated by VDOT examined the safety impacts of the increased 70 mph speed limit on interstates on several variables such as vehicle speeds, total crashes, crash severity etc. as well as roadway improvements.)

Accomplishing these data collection changes would likewise involve efforts with potential costs on the part of the DMV, which maintains the crash reporting systems and related forms as well as the safety violation records for vehicles.

Traffic Data Collection

Evaluating the various potential impacts and benefits of the proposed 91,000 lb pilot vehicles would require considerable traffic data to quantify the location and extent of traffic for both the pilot vehicles as well as the current 80,000 lb vehicles in order to examine the relative impacts such as on interstate pavement structures and on bridges. This includes quantifying the Average Annual Daily Traffic (AADT) and Vehicle Miles of Travel (VMT) on interstate corridors in both directions of travel.

VDOT currently conducts and maintains widespread continuous traffic count coverage on interstates through its Continuous Count Sites (CCS) and Wavetronix sites (WTX) that could provide AADT and VMT data for the proposed pilot study with some limitations as follows:

1. There is very limited coverage for determining the weight of vehicles through Weigh-in-Motion (WIM) sites
2. Ability at present to fully utilize the DMV WIM site data due to the format of the data as it is presently collected (e.g., collected only for a single lane, etc.)
3. Only the CCS sites are capable of accurately distinguishing various types of vehicles across multiple lanes of travel, and therefore should be the primary data relied on for the pilot study.

The various CCS, WTX, and WIM traffic count sites and their locations are shown in Figure 3.

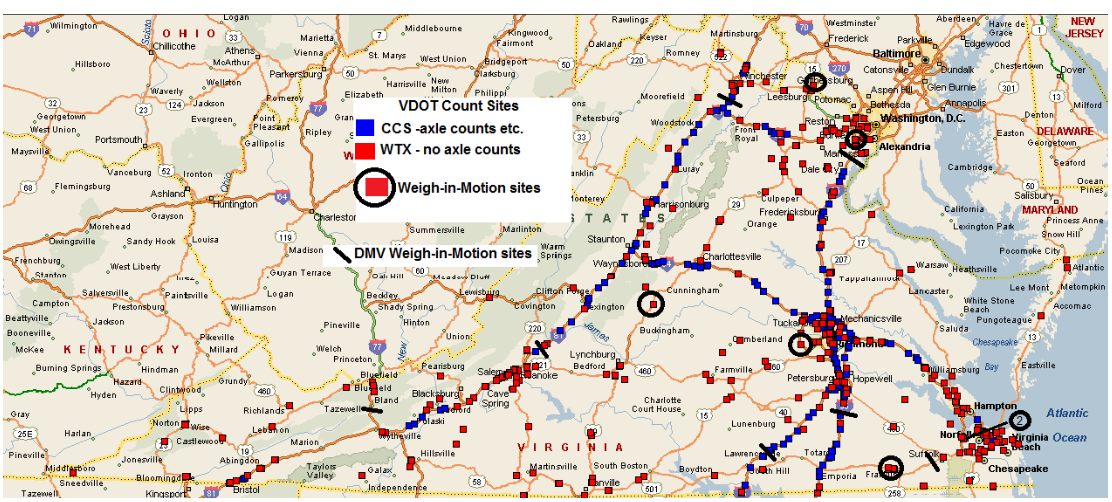

Figure 3. Locations of VDOT’s Continuous Count Sites, Wavetronix Sites, and Weigh-in-Motion Sites

While the current 80,000-pound, 5-axle vehicles are distinctly counted under Federal Highway's "Class 9" classification, it is anticipated the proposed 91,000-pound vehicles will have a similar configuration with a minimum of 6-axles and thus would be captured as "Class 10 vehicles" which includes all vehicles with 6 or more axles and prevents distinguishing them from other 6-axle (or more) vehicles. This includes the current 6-axle containerized cargo trucks that originate from a seaport.

Although in the future VDOT will be updating its CCS sites enabling them to distinguish between vehicles by number of axles within a particular count class (e.g., Class 9 and Class 10), most CCS sites do not currently have this capability. In summary, only the WIM stations could distinguish the pilot vehicles. Currently, there are no count stations that could distinguish the pilot vehicles from other 6-axle vehicles, but within the next few years, as the CCS sites are upgraded and replaced in the normal cycle, VDOT may have a significant number of stations that could discern and record the specific pilot vehicle.

Costs for Traffic Data Collection

To adequately quantify and fully distinguish the traffic of the pilot vehicles along a particular study corridor, two WIM stations would be necessary; one for vehicles entering the corridor at the southern/eastern end and one entering the corridor at the northern/western end. Additionally, one or more interim WIM stations (one in each travel direction) would be needed along the study corridor. The approximate costs for a single WIM station for a 10-year pilot study (which counts two lanes in a single travel direction) is $530,000 as detailed below. The cost for covering a full study corridor and a "control corridor" (where pilot vehicles are not allowed) are anticipated to require the following:

- Two WIM stations entering the corridor at the southernmost and northernmost locations
- Two interim WIM stations (one in each travel direction covering two travel lanes)
- An additional two WIM stations for a control corridor (one in each travel direction covering two travel lanes)

This results in a total of six WIM stations at an estimated price of $530,000 each (see Figure 4 below) for a total of $3,180,000. The actual cost may be more or less, depending on the final number of stations determined to be necessary, the availability of enhanced CCS sites, and the ability to better utilize WIM sites maintained by DMV in the future.

	Installation (5 year cycle) *	Operation ($650 per month)	Maintenance & Calibration	Inflation
	per lane/count site	per station/travel direction	per station/travel direction	per year
	$50,000	$650 per month	10 % of installation & operating cost	3% per year

* includes 50 man hours for site planning & design

example application: Locate site, Install, operate & maintain a single station in a single travel direction on a 2-lane section for 10-year period -Requires 1 station with 2 WIM count sites (1 site for each lane)

	10-year installation cost *= $50,000 per lane x 2 lanes + 50 man-hours cost ($7000) @ Year 1 + $50,000 per lane x 2 lanes x 1.03^5 @ Year 5	
A	$220,884	per station/travel direction
	* includes cost for 50 man hours per site for new site planning & design ($4,957)	
	10-year operation cost ** = ($650 per station/travel direction x 12 months + 40 man-hour cost per year) x 10 years x 1.03^10	
B	$158,125	per station/travel direction
	** includes cost for 40 man hours annually per site for data quality reviews ($3966)	
	10-year maintenance, inspection & calibration ($3,495 +$4,000 per lane, annually starting Year 2 incl. mobilization) cost = $7,495 per lane x 2 lanes per station/travel direction x 8 years x 1.03^10	
C	$151,911	per station/travel direction
	10-year total installation, operation and maintenance & calibration cost = A + B + C	
TOTAL A + B + C	$530,921	per station/travel direction for 10-year study period

Figure 4. Weigh-in-Motion Cost Estimate Worksheet

Potential Operational Impacts

There is concern that the heavier pilot vehicles would further degrade the speed of the overall traffic stream on interstates particularly on steep grades; pilot vehicles may operate at slower speeds than the current 80,000-pound vehicles, further reducing the speed of traffic. Additionally, the heavier pilot vehicles may be less capable than the 80,000-pound vehicles to accelerate at entrance ramps and decelerate to slower speeds when exiting the interstate, therefore further degrading the flow of traffic within the vicinity of ramps.

Vehicle probe data is commercially available (such as INRIX) to determine the traffic speed/flow, however that data does not provide data for specific lanes or vehicles. Therefore, evaluating these potential impacts requires utilizing and analyzing vehicle speeds via Automatic Vehicle Location (AVL) tracking devices on a sufficient number of pilot vehicles. AVL data provide time and location information that allows computation of the speeds of specific vehicles speeds in the traffic stream. Existing data sources (the National Performance Management Research Data Set provide truck speeds to compare pilot vehicle speeds with existing 80,000-pound trucks at desired locations such as on steep grades etc.

Based on detailed communications equipment costs for the Denver Regional Transportation District regional transit AVL/CAD system provided by the USDOT, the cost for the base and field communication hardware components of an AVL system are approximately $650,000 and $1,450,000 respectively. This presumes utilizing existing AVL tracking devices already installed on pilot and comparison vehicles. The cost to install AVL devices is approximately $3,500 per vehicle with the total dependent on how many vehicles would be necessary to monitor in order to fully evaluate and compare pilot versus 80,000 lb vehicle speeds. It is assumed that this cost would be incurred by the owners of the vehicles. The annual cost for maintaining all AVL equipment not in the vehicle is estimated at $175,000 and would be incurred by VDOT. For a 10-year study period that cost would be approximately $1,750,000.

The cost to conduct the operational analysis is an estimated $50,000 to evaluate initial years (e.g., years 2-3 of the study) and the cost to conduct an initial study (presumed in year 2-3 of the pilot effort) is approximately $50,000. The cost to conduct a further analysis to include additional years of speed data (presumed at year 10 of the pilot effort) is approximately $15,000 for a total cost over a ten-year period of $65,000.

Total Costs

The total estimated costs (rounded to the nearest $10,000) for evaluating the potential safety and operational impacts pertaining to the heavier 91,000-pound vehicles on Virginia's Interstate highways versus the current 80,000-pound vehicles is as follows:

Safety Study	$60,000
Traffic Data Collection	$3,190,000
Operational Impacts	$2,470,000
Total Approximate Costs	**$5,720,000**

Pavement Impacts

VDOT would need to collect additional data to determine pavement damage caused by the 6-axle 91,000-pound vehicles. The following high-level summary describes the types of pavement data and its associated collection costs. It should be noted that the costs mentioned below do not include staff time for additional data analysis and reporting.

Surface Distress Data

- Cracking (fatigue, longitudinal, transverse)
- Roughness (International Roughness Index, IRI)
- Rutting
- Faulting (for jointed concrete pavements only)

Surface distress data are a primary indicator of roadway condition and wear and tear of the road surface due to vehicle loads and/or environmental distress. Such data may also reveal sub-surface characteristics and deficiencies such as, lack of structure, drainage and materials related problems. VDOT currently collects surface distress data yearly for all interstate and primary roads maintained by VDOT. This data will be used to measure and summarize the condition of the road surface. VDOT already collects this data to effectively manage the yearly maintenance and operations program. Therefore, there would be no additional cost for this data collection to the pilot program.

Structural Condition Data

- Falling Weight Deflectometer (FWD)
- Ground Penetrating Radar (GPR)

As part of the pavement condition data gathering for the pilot program, VDOT would need to collect and monitor the structural strength of the pavement layers and the subgrade soil. Falling Weight Deflectometer (FWD) measures the structural condition of the pavement while Ground Penetrating Radar (GPR) is used to estimate pavement layer thickness and to determine the presence of moisture below the surface layers of pavement. Unlike the surface condition, structural condition of the pavement does not change frequently. Therefore, the structural condition data would need to be collected at three year intervals.

The cost of FWD data collection is approximately $350 per mile. Assuming that data would be collected on pilot and control corridors in each direction, there would be a total of 1,542 miles of data to collect. Therefore, the total approximate cost to collect FWD data collection each time is $540,000 (data would need to be collected every three years).

The cost of GPR data collection is approximately $80 per mile. Therefore, for the same routes, the total cost of GPR data collection each time is $130,000 (data would need to be collected every three years).

Weigh-in-Motion (WIM) Data

As outlined previously under the Traffic Data Collection section, WIM stations would need to be established along the pilot study corridor. The data from the WIM stations would be used to calculate information such as number of trucks and associated trips, total gross weight, weight per axle, axle configuration, etc. This data would be essential to identify the short and long term deterioration trend based on the actual weights carried by the pilot trucks and the number of trips they take.

The details and associated costs for establishing the required WIM stations are included previously under the Traffic Data Collection section of this report.

Structure and Bridge Impacts

If Virginia were to participate in a pilot to study 6-axle, 91,000-pound vehicles, the Structure and Bridge Division has identified four main concepts to evaluate:

1. Strength evaluation through analysis
2. Fatigue in steel members and serviceability in concrete members
3. The rate of change of deterioration
4. Maintenance impacts

It is noted that most size and weight studies in the literature reviewed anticipate an expected observed increase in deterioration rates for structures when subjected to increased frequency of heavier loads (FHWA, 2004; Transportation Research Board, 2002; U.S. Department of Transportation, 2015).

The major unknowns which will affect the design and structure of the study are:

- Sections of the Interstate System that would be corridors of study and control
- The configuration and expected loading of the 91,000-pound trucks
- The Average Daily Truck Traffic (ADTT) counts of the 91,000-pound trucks

Any proposal to increase the weight of the vehicle fleet that will use the Commonwealth's road and structure network must consider the relative ages and life expectations of the structures in the inventory (see Figure 5). As of the writing of this report, about 49% of the inventory has already exceeded its 50 year anticipated service life. In ten years, the percentage of the inventory that will have exceeded its expected 50-year design life will be 64%. The target design life for bridges was changed to 75 years with the publication of the 2nd Edition of the AASHTO LRFD Bridge Design Specifications in 1998.

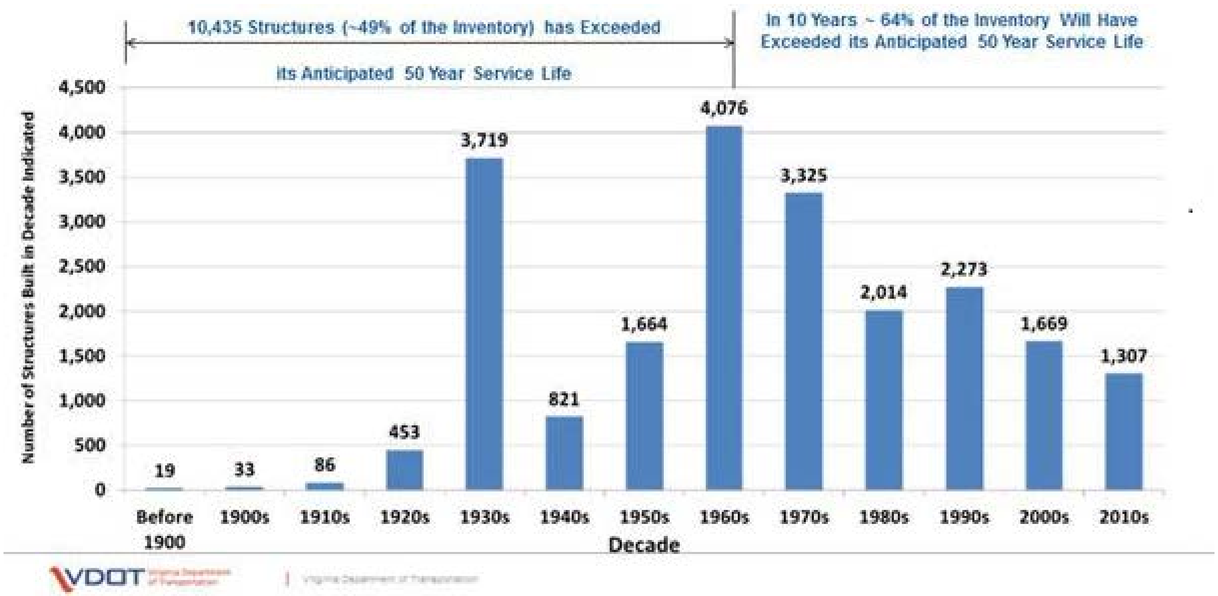

Figure 5. Number of VDOT Structures Built by Decade

Strength Evaluation through Analysis

Engineers are able to predict the expected response of a structure to a given loading. VDOT is required by FHWA to evaluate each structure and determine its capacity to safely carry all legal loads through a process referred to as load rating. VDOT currently load rates for two Virginia legal loads and four other federally required specialized hauling vehicles. The axle spacing and weight configurations for the two Virginia legal vehicles are shown in Figure 6 below:

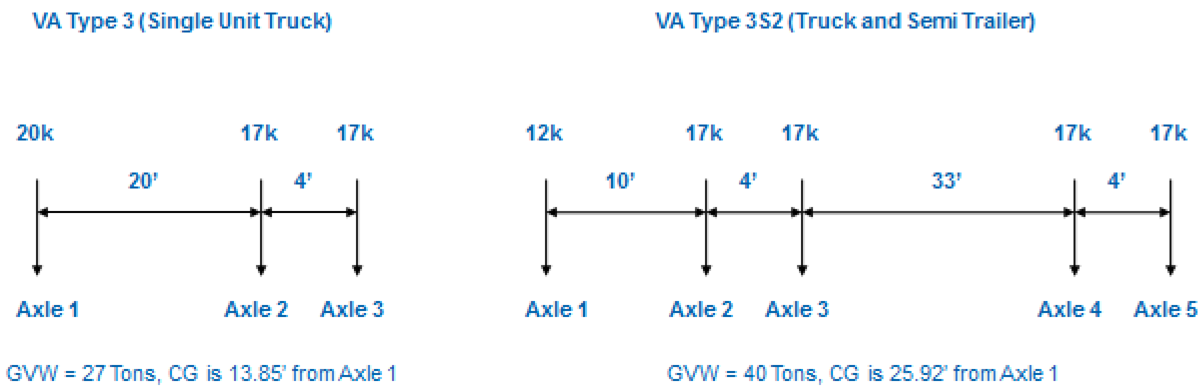

Figure 6. Axle Spacing and Weight Configurations for Virginia Legal Vehicles

VDOT has contacted various industry participants to obtain applicable configurations for vehicles. A response has been received from one industry participant thus far. Once more responses are received, engineers could develop a notional loading to use for a strength analysis that envelopes the effects of participating study vehicles. The concept of enveloping loads is shown in Figure 7.

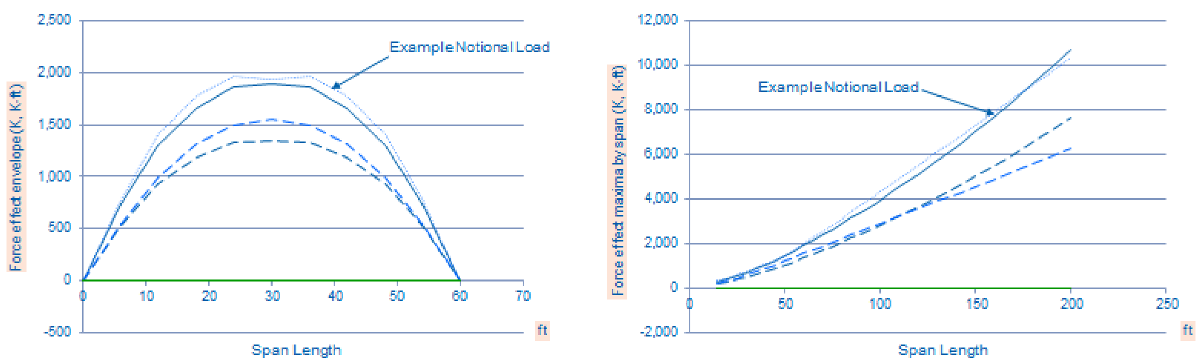

Figure 7. Example of Enveloping an Anticipated Load. Actual vehicle force effects should be less than the notational load.

After establishing the notional vehicle, and completing the required load ratings for the subject inventory, VDOT would select a statistical sample set of bridges in the participation and the control interstate corridors for further, more detailed evaluations over the duration of the pilot.

Fatigue (Steel) and Serviceability (Concrete) Considerations

The pilot would need to include analysis and physical inspection of details. Engineers would model the fatigue stresses in steel members and the serviceability limitations of concrete members. VDOT inspectors would conduct focused field evaluations on relevant details for structures of both material types including:

- Areas of controlling stresses
- Damaged areas
- Connections

VDOT would then determine if the data collected in the field could be correlated with results from the engineering analysis. This would enable validation of the analytical methodology with the field observations.

Rate of Change of Deterioration

Existing vehicle size and weight studies have consistently articulated the lack of robust data sets to accurately quantify the rate of deterioration change in the nation's bridge inventory. As part of VDOT's data collection efforts, changes in the rate of deterioration of structures in the participating and control corridors would be compared to determine if there is a statistically significant variance from the expected time-decay curve versus the adjusted time-decay curve. The primary area of focus for observations and data correlations would be deterioration of the bridge riding surfaces, or decks, and expansion joints since these members are in direct contact with the increased numbers of axles and wheel loadings. Other structural areas of focus would follow lines of live load distribution from the decks to the substructure foundation supports.

The methods of types of data that VDOT would need to collect would include:

- Expansion joints: VDOT may use scaled high resolution video and/or imaging techniques to measure the square footage of concrete deterioration of the expansion block out, or that portion of the concrete that is adjacent to the joint assembly.
- Decks: VDOT may use scaled high resolution video or imaging to measure linear feet of cracking. GPR, infrared thermography, and/or high resolution visual surveys may be used to measure square feet of delamination and/or spalling.

Other structural areas of detailed field inspection focus would include:

- Superstructure bearing assemblies: VDOT would monitor for changes in condition or movement beyond normal parameters
- Substructure bearing seats and anchorages: VDOT would monitor these for movement, cracking, and deterioration.

These areas of detailed inspection focus would supplement routine inspection practices which already capture overall structure and individual element conditions and associated member quantities. VDOT would deploy instrumentation to collect automated data to augment detailed field inspection data already collected. This effort may include mounting devices on superstructure and/or substructure members. The types of instruments used may include

- Strain Gauges
- Deflectometers

- Accelerometers

VDOT's engineers would study the results for correlation with the detailed field inspections and determine if mathematical modeling could be developed to better predict deterioration rates from associated loading.

Bridge conditions deteriorate slowly (see Figure 8). As such, changes to the predicted versus observed conditions of the structural members of the bridge may be minimal during the observation, or study duration, period. Instrumentation of selected bridges would improve understanding of load effects.

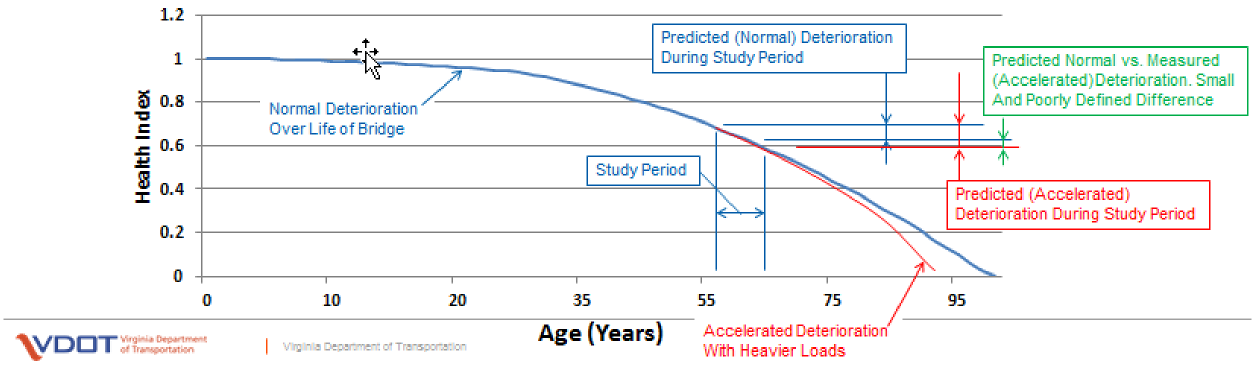

Figure 8. Typical Rates of Deterioration (Bridge Conditions Over Time)

Maintenance Impacts

VDOT anticipates two main drivers of the cost evaluation when comparing the results of the participation vs the control corridors:

1. Effects on concrete decks
   – Maintenance costs required to seal and patch decks
   – Maintenance costs of bridge deck expansion joints
   – The duration of anticipated service lives
2. Effects on superstructures (beams and girders)
   – Maintenance costs of girders for coating, repairs, or other tasks
   – The duration of anticipated service lives

It should be noted that major parts of the cost evaluation component outlined above that would need to be examined during the study period are separate and distinct from the costs of the structure evaluation prior to the study. These would include any strengthening efforts that may be required, all costs associated with instrumentation and the associated data collection, additional inspection costs to capture in-depth observations for components deemed critical for the study, and an increase in inspection frequency for the bridges selected for instrumentation. The maintenance costs detailed above are not included in the estimate below because they cannot be accurately forecasted at this time.

Study Costs to Structure and Bridge

The costs to the Structure and Bridge Division are broken down into two distinct time periods relative to the potential study:

The Study Preparation Costs (One-Time Costs)	
Instrumentation of selected bridges	$180,000
The Annual Study Costs (x 10 assuming 10-yr. study period)	
Inspection of 40 bridges ($480,000 x 10)	$4,800,000
In – Depth data for 24 bridges (GPR, Infrared, etc.) ($30,000 x 10)	$300,000
VDOT Analysis and reporting ($60,000 x 10)	$600,000
Total Approximate Costs	**$5,880,000**

It should be noted that these costs do not include the cost of load rating all bridges in the inventory at risk of having their capacity exceeded (as documented in the Fiscal Impact Statement for House Bill 214 and Senate Bill 73 in 2018) because it is assumed that the pilot configuration would be within the envelope of evaluated loads.

Mode Shift Impacts

Federal Analysis

The 2015 *Comprehensive Truck Size and Weight Limits Study* (U.S. Department of Transportation, 2015) includes a 250-page *Modal Shift Comparative Analysis Technical Report.* The premise of the analysis was that a change in weight limits on the Interstate System could affect the distribution of freight across modal options. Six weight policy options (scenarios) were evaluated to determine potential changes in the number of trips and miles traveled, quantity of freight shifted from truck and from rail, change in total logistics costs, and change in railroad contribution to freight movement. The results of that analysis determined that Scenario 2 (six axle, 91,000 pounds) would result in the shifting of approximately 2.31 million tons annually from rail to truck, nationwide.

Factors

The option to go from 80,000 to 91,000-lb loads could possibly make an impact on the competitive environment between truck and rail. However, the change would only occur if there is a significant cost savings or productivity boost on the motor carrier side. For many carriers, the productivity increases are offset by equipment investment, loss in gas mileage, and increases in maintenance cost. Based on that discussion, the question is how many will adopt the six-axle configuration in favor of the productivity increases or attracting customers from rail.

Freight productivity is tracked nationally and the data reveals an industry that is affected by many economic forces. Changes in consumer confidence, international economic fluctuations, the price of gas, and labor draw from other economic sectors are just a few significant influences. Tracking a pilot to determine its impact on the industry would also require a review of all these other factors to gauge the larger results and implications.

Multistate participation may also have an impact on how choices are made by shippers and carriers due to the long-haul nature of the freight service industry. The national pilot's success would depend largely on the participation of states along corridor lines. The more that participate, the more carriers would likely participate and the more clearly the data would reveal how well the industry would be served by larger trucks.

Data Sources

Traffic Counts. Several data sources would be required to track the different aspects of mode shift. Measuring the volume of five to six-axle truck configurations would primarily come from classification traffic counts from VDOT's Traffic Monitoring System continuous count sites. Traffic counts are converted to vehicle miles traveled.

Weigh in Motion. VDOT and DMV collect the weights of trucks as they pass on the highway in strategic locations. DMV's Weigh in Motion (WIM) sensors weigh trucks prior to passing the truck scales in several Interstate locations. The sensors are used to screen the trucks from going through the static scales. If the WIM detects a truck below a certain threshold, the truck would be allowed to pass the scale. This limits the number of trucks actually weighed manually. The data proceeding from the operation of WIM sensors is collected and saved. VDOT also has WIM sites for the purpose of monitoring truck weights in strategic corridors. However, the purpose is not for enforcement, as in the case of DMV.

Commodity Flow Data. Commodity Flow models include the *Freight Analysis Framework (FAF)* – from the Federal Highway Administration. FAF is a data source that reports commodity movement over the nation's highway system. It has limitations because it is not a trip-based origin-destination model, but a commodity origin-destination model; and it only reports to the state-level, not the county/city.

An alternative to FAF is Transearch, a commodity flow model by IHS Markit. Transearch is different in that it is a trip-based model that differentiates truck modes by type (i.e., truckload (TL), less-than-truckload (LTL), and Private). Transearch geography reports to the county or city. However, it is still a highly synthesized model—based on more than 90 federal and private data sources.

Both FAF and Transearch include a rail table, provided through an agreement with the Surface Transportation Board to use the Confidential Rail Waybill Sample. Both FAF and Transearch display the same type of information displayed in the truck tables.

FAF is provided by FHWA at no cost to the states every five years. Transearch is updated annually and comes at a considerable cost. However, the geographic and trip resolution offers considerable value for purposes such as VTrans, and other freight-related transportation studies. For any pilot, it would be important to have an annual update of this data to track intermodal rail activity.

Participant Registration/Questionnaire. Advancing a registration process for the Pilot by participating carriers would provide the opportunity to gather pertinent sample information. An application or questionnaire instrument could be used to identify the numbers of trucks being purchased; the commodities expected to be shipped; the volume of shipments; and the weights anticipated by each. Changes in rail intermodal contracts could also be captured.

Compliance and Enforcement Impacts

Currently, DMV issues about 3,800 container permits for vehicles that originate from the Port of Virginia to exceed the current 80,000-pound weight limit as well as for fluid milk trucks. These are blanket permits and DMV does collect information on the routes that are used by these overweight vehicles. The current permit fee is $250 per year with $10 staying with DMV to offset the costs of administering the permit program and the remaining funds being distributed through a lane mile allocation of the Highway Maintenance and Operations Fund. With respect to enforcing current weight limits (standard or permitted) DMV does have weigh-in-motion sensors (WIM) deployed at the larger weigh stations. The WIM data recorded 16,633 trucks that fit the Class 10 criteria (6 axles and weighing between 80,000 and 91,000 pounds); however, there is no way to tell how many of these include duplicate counts at successive weigh stations. The ability to determine how many vehicles are traveling specific sections of roadway that fit the Class 10 criteria would be critical for a meaningful pilot. Current data collection capabilities would not support an effective pilot evaluation or existing data reporting requirements.

Credentialing of participants in the pilot would be important as well. Currently, there are two types of credentials: a hard copy piece of paper and a sticker (that looks similar to a registration sticker). One option would be to issue a sticker for the 91,000-lb, 6-axle configuration that is very similar to the 5% overload sticker. From an enforcement perspective, these stickers make it readily apparent that the trucker has paid the fee which is helpful for enforcement personnel.

An additional consideration with respect to compliance and enforcement is the challenge of existing exemptions to the current 80,000-pound maximum weight limit. Any pilot evaluation will need to be able to distinguish between pilot vehicles and other permitted overweight loads, particularly if those loads are allowed to continue to operate on 5-axles. As has been noted throughout this report, the distribution of load can significantly impact the infrastructure response and it will be important to distinguish between heavier loads.

Total Cost of Data Collection

The total costs to VDOT to participate in the proposed pilot assuming a duration of 10 years is estimated to be approximately $13.6 million. It should be noted that this total is comprised primarily of the estimated costs (as previously described above) for the collection of data to determine the impacts on safety and operations, pavements, and bridges. There may be additional data required to determine the impacts in other areas that is not included in this estimate. Notably, costs to load rate bridges on both the interstates and arterial roadways, should the truck configuration selected for the pilot not be one VDOT has previously considered, are not included in this total. Costs to address increased maintenance or replacement needs or incident response are also not included.

RECOMMENDATIONS

It is clear from the information gathered in this study from internal and external stakeholders as well as a review of existing literature that there currently is insufficient data available to fully quantify the impacts of 91,000-pound, 6-axle combination vehicles on safety, operations, infrastructure condition, mode shift, or compliance and enforcement on Virginia's transportation system. Changes to both Federal and state-based size and weight limits over time have occurred with little to no evaluation of the impacts of the changes. There are, however, indications that the potential for negative impacts exist. Although the initial capacity of a bridge to carry the load of a heavier vehicle can be determined if the vehicle configuration is known, the long term impacts in terms of accelerated deterioration are not known and predictive models to estimate these impacts do not exist. Likewise, it cannot be stated that these heavier trucks will not have higher crash rates than their 80,000-pound counterparts. A properly designed pilot focused on data collection could address these issues and provide an opportunity for meaningful evaluation of impacts attributable to the 91,000-pound, 6-axle vehicles, however there are implications to pilot participation that must be considered.

- First, any meaningful pilot would have to have sufficient duration to allow for sufficient data collection as well as allow for some return on investment by carriers that upgrade their equipment. Increased deterioration is expected to occur on bridges on the pilot routes and additional maintenance costs are likely as a result. Because this deterioration might not be obvious immediately, significant damage could occur before it is detected.
- Safety must remain a primary consideration. Increases in crash rates among the heavier trucks could occur and although a decrease in safety would be a trigger for discontinuation of the pilot, any injuries or loss of life resulting from the pilot would be unacceptable.
- Enforcement of differing weight limits for participating and non-participating vehicles will place an additional burden on enforcement personnel. There could be a need for additional staff and equipment to address this need.

There are uncertainties regarding the design and implementation of a federal pilot that thus far does not exist that make it difficult to evaluate potential pilot risks and benefits. Concerns about infrastructure damage from these heavier loads remain a primary consideration. Accordingly it is recommended that Virginia refrain from committing to a pilot at this time. In the event a federal pilot program is authorized, VDOT will review the parameters of the pilot and evaluate potential participation.

Should a federal pilot program be enacted, the findings of this study indicate that the following factors should be included in the pilot's design.

1. ***The federal pilot program should include a robust evaluation framework.*** Several previous studies have concluded that there is insufficient data from which to draw meaningful conclusions regarding the impacts on safety, infrastructure condition, mode shift, or compliance and enforcement. Obtaining sufficient data would require that all participating states collect at least a minimum common set of data as discussed in earlier sections of this report.
2. ***The federal pilot program should establish an entity to collect and analyze data from the pilot program.*** Although data could and likely would be analyzed by participating states at a local level to determine local impacts, evaluation at an aggregate level would inform federal decision-making. An independent body responsible for the overall pilot data analysis would provide more legitimacy to the results.
3. ***The federal pilot program should specify a common vehicle configuration.*** Impacts of heavier vehicles would be highly dependent on the configuration of the vehicle. Previous studies have found that pavement impacts are directly influenced by axle loading and a common configuration would be necessary for bridge load rating analyses. Overall vehicle length can also influence operational characteristics such as turning radii.
4. ***The federal pilot program should identify new sources of funding to cover the costs incurred by participating states.*** It would be inappropriate to divert funds currently used for maintenance and operations to cover the costs of pilot program data collection, particularly when participation could result in increased maintenance needs. New funding or permit fees high enough to cover the costs of data collection as estimated in earlier sections of this report would be required.
5. ***The federal pilot program should include an early termination clause should negative impacts to safety or infrastructure condition be identified.*** It is clear that some impacts may not be identifiable in the near term. Bridge deterioration, for example, happens slowly and it would take years before differences between pilot corridors and control corridors could be detected, if they occurred. Other impacts may be seen much more quickly and participating states must have the opportunity to respond accordingly.
6. ***The federal pilot design should include multi-state freight corridors.*** Participation by non-contiguous states or inclusion of non-contiguous corridors would negatively impact the ability to collect data for evaluation.

REFERENCES

Carson, J.L. *Directory of Significant Truck Size and Weight Research, NCHRP 20-07, Task 303*. American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 2011.

Federal Highway Administration. *Comprehensive Truck Size and Weight Limits Study, Volume II – Technical Reports.* Washington, DC, 2015.

Federal Highway Administration. *Western Uniformity Scenario Analysis: A Regional Truck Size and Weight Scenario Requested by the Western Governors' Association*. Washington, DC, 2004.

Federal Highway Administration. *Comprehensive Truck Size and Weight Limits Study*: *Report to Congress*. Washington, DC, 2016.

Freeman, T.E., and Clark, T.M. *Performance of Pavements Subject to Higher Truck Weight Limits in Virginia*, Transportation Research Record 1806. Washington, D.C., 2002.

Transportation Research Board. *Regulation of Weights, Lengths, and Widths of Commercial Motor Vehicles: Special Report 267.* Washington, DC, 2002

Virginia Department of Motor Vehicles. *RD387 – Permit Equity Study: An Equitable Approach to Setting Permit Fees for Overweight Motor Vehicles*. Chapter 793 § 1, 2011. Richmond, 2011.

Virginia Department of Transportation. *Continuation of the Vehicle Cost Responsibility Study (SJR 238) to the Governor and the General Assembly of Virginia*. Richmond, 1992.

Virginia Department of Transportation. *Report of the Virginia Department of Transportation, Vehicle Cost Responsibility study (SJR 121) to the Governor and the General Assembly of Virginia*. Richmond, 1991.

Virginia Department of Transportation. *Weight Limits for Trucks Hauling Gravel, Sand, or Crushed Stone in Certain Southwest Virginia Counties. House Document No. 18*. Virginia General Assembly. Richmond, 2001.

Virginia Transportation Research Council. *A Review of the Current Overweight Permit Fee Structure in Virginia*. Response to Virginia General Assembly House Bill 1551. Charlottesville, 2008.

Virginia Transportation Research Council. *An Assessment of the Additional Highway Maintenance Costs Associated with Overweight Permits for Petroleum Tank Trucks Under Section 46.2-1144.1 of the Code of Virginia.* Response to Virginia General Assembly Senate Bill 1321. Charlottesville, 2007.

Virginia Transportation Research Council. *An Assessment of the Additional Highway Maintenance Costs Associated with Overweight Permits for Underground Pipe Cleaning, Hydroexcavating, and Water Blasting Equipment Under Section 46.2-1149.5 of the Code of Virginia*. Response to Virginia General Assembly House Bill 1645. Charlottesville, 2007.

Virginia Transportation Research Council. *Overweight Vehicles: Operation of Trucks Hauling Gravel, Sand, or Crushed Stone in the Coal Severance Tax Counties of Virginia*. Response to Virginia General Assembly House Bill 2917. Charlottesville, 2007.

APPENDIX A

Relevant/Key Legislative Studies/Responses Prepared by the Virginia Department of Transportation and Others in the Past Relating to Overweight or Heavy Vehicles.

Legislative Responses Prepared by the Virginia Department of Transportation

An Assessment of the Additional Highway Maintenance Costs Associated with Overweight Permits for Petroleum Tank Trucks Under Section 46.2-1144.1 of the Code of Virginia. Response to Virginia General Assembly Senate Bill 1321, Virginia Transportation Research Council, Charlottesville, 2007.

Senate Bill 1321 (SB 1321) of the 2007 Session of the Virginia General Assembly (Chapter 738 of the 2007 Acts of Assembly) which was codified as §46.2-1144.1, enables owners or operators of petroleum tank wagon trucks to apply for overweight permits from the Commissioner of the Virginia Department of Motor Vehicles. These vehicles are used to deliver petroleum products to homes or businesses with small tanks.

Prior to enactment of SB 1321, two-axle, six-tire tank wagons traveling without overweight permits were previously subject to limits under the *Code of Virginia* of no more than 20,000 pounds on a single axle and no more than 32,000 pounds of gross vehicle weight (GVW). Tank wagon owners who wished to transport a number of gallons of product that would result in the vehicle exceeding 32,000 pounds GVW could obtain a 5% overload permit for $200 (Virginia Department of Motor Vehicles [DMV], 2007). A 5% permit would allow a single-axle weight extension up to 21,000 pounds and a GVW of 33,000 pounds for a typical tank wagon with a 12,000-pound front steering axle.

For vehicles of this type now traveling (i.e., after SB 1321) with an overweight permit, § 46.2-1144.1 of the *Code* increases the allowable weight on an axle by 4,000 pounds to 24,000 pounds and the allowable GVW to 36,000 lb. Yet engineering research for the past 50 years has demonstrated that as axle loads increase, pavement damage increases exponentially.

The objective of this study was to quantify the additional maintenance costs associated with petroleum tank wagon trucks traveling with overweight permits issued under SB 1321.

The methodology included review of the Code of Virginia; stakeholder interviews; development of a pavement damage model based on equivalent single-axle loads (ESALs) of different vehicles; quantification of the unit cost per ESAL-mile on the Virginia highway system based on VDOT maintenance cost estimates; calculation of the additional maintenance costs associated with SB1321; and development of policy options to address the impacts of higher maintenance cost caused by SB1321.

The estimation of relative damage caused to Virginia roads by different vehicle classes was calculated by estimating typical ESALs for each vehicle class traveling on Virginia highways. ESAL values allow comparison across vehicle classes by converting damage from wheel loads of various magnitudes and repetitions to damage from a "standardized" load consisting of 18,000 pounds on a single axle, the most commonly used equivalent load in the U.S. and the basis of VDOT pavement design until recently. The output of an ESAL equation for a given axle weight and configuration is a load equivalency factor, i.e., a quantification of the relative damage caused by the axle as compared to an 18,000- pound, single axle (where ESAL = 1). ESAL equations employ assumed or actual values for the pavement metrics of structural number and "terminal" serviceability index (the point at which the pavement is considered to be at the end of its useful life) because the load equivalency factor of a given axle depends upon the type and structure of the pavement under evaluation for damage.

In conjunction with analogous and concurrent studies of sand and gravel trucks and hydroexcavating vehicles, the researchers determined that the overall maintenance cost. To summarize, the finding that each ESAL-mile of travel by overweight tank wagons in Virginia in 2007 caused $0.0366 in damage resulted from (1) assumed values to be used for structural numbers and terminal serviceability indexes for interstate, primary, and secondary system routes in Virginia, (2) average ESAL values calculated for each FHWA vehicle class based on weigh-in-motion data, and miles of travel for each vehicle examined, and (3) maintenance cost per ESAL-mile (i.e., exclusively load-related costs) of travel on Virginia highways.

The study concluded that:

- A number of no-cost exceptions to Virginia's size and weight limits for trucks are specified in the Code of Virginia.
- Prior to SB 1321, petroleum tank trucks could not operate at axle weights that were optimal from the business perspective of oil companies. At the higher weight, tank wagons are now able to make more deliveries to individual customers per trip.
- This study relates what engineers know about the effects of cumulative axle loads (in ESALs) on pavement life (it did not estimate effects on bridges) to VDOT's best available maintenance cost information based on the current condition of the state's roadways. Based on the methodology developed in this study, the estimated annual additional maintenance cost for a tank wagon operating with the heavier axle load ranges from $175 to $350, depending on annual mileage.
- Using this study's methodology for calculating the additional maintenance cost associated with a 4,000-pound axle weight increase for a tank wagon, it is unlikely that the annual additional maintenance cost for a tank wagon would equal $800—the temporary 1 year fee established in SB 1321.
- If the costs in the maintenance budget for a future fiscal year rose appreciably, the estimated cost per ESAL-mile of travel on the state's roadways could rise.
- The interviews conducted for this study indicate that oil company owners are willing to pay for the privilege of increasing the axle weights on their trucks. Even though businesses may be willing to pay for the additional maintenance damage that higher axle weights cause, there would be impacts on Virginia's motorists.

Policy options offered included the following:

- VDOT could draft proposed legislation establishing an annual overweight permit fee for tank wagons included under SB 1321 using the methodology developed in this study for calculating the additional maintenance costs attributable to the heavier axle loads. Fees collected could be dedicated to a fund for highway maintenance.

- VDOT could establish $800 as the permanent fee for each tank wagon whose owner wishes to carry 4,000 more pounds on the axle previously limited to 20,000 lb. This option would simply make the temporary fee that is being charged now the permanent fee. Although $800 is considerably higher than the additional maintenance cost for the 4,000-pound axle weight increase calculated in this study, this option is administratively simpler than the previously stated option.
- VDOT could draft proposed legislation allowing it to establish annual overweight permit fees using the methodology developed in this study not only for tank wagon trucks, but also for all vehicles that can currently obtain no-cost overweight permits or travel overweight without a permit, excluding coal haul trucks. Fees should be calculated using the methodology developed in this study for calculating the additional maintenance costs attributable to the heavier axle loads. Fees collected could be dedicated to a fund for highway maintenance.

An Assessment of the Additional Highway Maintenance Costs Associated with Overweight Permits for Underground Pipe Cleaning, Hydroexcavating, and Water Blasting Equipment Under Section 46.2-1149.5 of the Code of Virginia. Response to Virginia General Assembly House Bill 1645, Virginia Transportation Research Council, Charlottesville, 2007.

House Bill 1645 (HB 1645) of the 2007 Session of the Virginia General Assembly enables owners or operators of vehicles used for underground pipe cleaning, hydroexcavation, or water blasting to apply for overweight permits. These vehicles are used to transport water and debris, both of which are reducible loads and ordinarily subject to fees for overweight vehicles.

Three-axle single unit underground pipe cleaning or hydroexcavation trucks of this type traveling without overweight permits were previously subject to standard limits under the *Code of Virginia* of no more than 20,000 pounds on a single axle, no more than 34,000 pounds on a tandem axle, and no more than 54,000 pounds gross vehicle weight (GVW).

Two-axle single unit water blasting trucks of this type traveling without overweight permits were previously subject to limits of no more than 20,000 pounds per single axle and no more than 40,000 pounds GVW.

Prior to the enactment of HB 1645, owners and operators of such equipment who wished to transport loads that would result in the vehicle exceeding 54,000 pounds GVW could obtain 5% overload permits for $200 which allowed single-axle weights up to 21,000 pounds; a tandem axle weight of up to 35,700 pounds, and a GVW of up to 42,000 pounds (for two-axle trucks) or 56,700 pounds (for three-axle trucks).

For vehicles of this type now traveling with an overweight permit, § 46.2-1149.5 of the *Code of Virginia* increases the allowable weights on the tandem axle by 10,000 pounds to 44,000 pounds and the allowable GVW to 64,000 pounds. Weight on a single axle is still limited to 20,000 pounds.

From an engineering perspective, however, it is well established that a 44,000-pound tandem axle load on a typical interstate highway will cause 2.7 times more damage than a 34,000-pound tandem axle load for the types of vehicles included in HB 1645.

The objective of this study was to quantify the additional maintenance costs associated with overweight permits issued under pursuant to § 46.2-1149.5 as enacted by HB 1645. The methodology included review of legislative background; stakeholder interviews; development of a pavement damage model based on equivalent single-axle loads (ESALs) of different vehicles; quantification of the cost per ESAL-mile of travel on Virginia's highways using VDOT maintenance cost information; calculation of the annual additional maintenance costs associated with heavier axle loads for underground pipe cleaning, hydroexcavating, and water blasting vehicles authorized under HB 1645; and development of policy options to address the maintenance cost impacts of vehicles included under HB 1645 traveling with overweight permits authorized by HB 1645.

In conjunction with analogous and concurrent studies of sand and gravel trucks and petroleum tank wagon vehicles, the researchers determined that the overall maintenance cost per ESAL-mile of travel was $0.0366 in 2007 dollars. The finding that each ESAL-mile of travel by overweight vehicles in Virginia in 2007 caused $0.0366 in damage resulted from *critical* estimates of values to be used for structural number and terminal serviceability for interstate, primary, and secondary system routes in Virginia, average ESAL values for each FHWA vehicle class based on weigh-in-motion data, miles of travel for each vehicle examined, and maintenance cost per ESAL-mile (i.e., exclusively load-related costs) of travel on Virginia highways.

A second set of steps was taken for this specific legislative response: calculation of the additional ESALs allowed for the specific vehicles covered by the legislation, estimation of additional mileage incentivized by the legislation, and, finally, calculation of the additional maintenance cost resulting from heavier vehicles and different mileage corresponding to higher gross vehicle weights in FHWA data.

The study concluded that:

- A number of no-cost exceptions to Virginia's size and weight limits for trucks are specified in the *Code of Virginia*.
- The interviews conducted for this study indicated that the owners of underground pipe cleaning and hydroexcavation equipment believe their case is much like other cases in which no-cost exceptions to the *Code's* weight limits have been enacted.
- Prior to HB 1645, the weight limits for three-axle single unit trucks specified in the *Code* did not allow the operation of underground pipe cleaning and hydroexcavation equipment with full water and/or debris tanks.
- This study relates what engineers know about the effects of cumulative axle loads (in ESALs) on pavement life to VDOT's best available maintenance cost information based on the current condition of the state's roadways. Based on the methodology developed for this study, the estimated annual additional maintenance cost for a hydroexcavator operating with the heavier axle load ranges from $229 (VDOT bridge and pavement planning database mileage estimate) to $706 (FHWA mileage estimate). The estimated annual additional maintenance cost for a hydroexcavator operating with the heavier axle load ranges from $370 (Falcon mileage estimate) to $569 (FHWA mileage estimate).

- If the costs in a future fiscal year's maintenance budget were appreciably higher, the estimated cost per ESAL-mile of travel on the state's roadways could rise.
- Any statutory changes that allow an increase in the axle loads of trucks will lead to additional associated maintenance costs.
- A question for Virginia's policy makers to consider is whether companies should pay for the additional damage done to the state's highways as a result of their heavier trucks—as a cost of doing business more efficiently.

Policy options offered included the following:

- VDOT could draft proposed legislation establishing an annual overweight permit fee for vehicles included under HB 1645 using the method developed in this study for calculating the additional maintenance costs attributable to the heavier axle loads. Fees collected could be dedicated to a fund for highway maintenance.
- VDOT could draft legislation allowing it to establish annual overweight permit fees for all vehicles that can currently obtain no-cost overweight permits or travel overweight without a permit, excluding coal haul trucks. Fees should be calculated using the methodology developed in this study for calculating the increased maintenance costs attributable to the heavier axle loads. Fees collected could be dedicated to a fund for highway maintenance.
- VDOT could continue to make no-cost permits available to underground pipe cleaning, hydroexcavating, and water blasting equipment traveling with tandem axle weights higher than those HB 1645 allows.

Overweight Vehicles: Operation of Trucks Hauling Gravel, Sand, or Crushed Stone in the Coal Severance Tax Counties of Virginia. Response to Virginia General Assembly House Bill 2917, Virginia Transportation Research Council, Charlottesville, 2007.

Section 46.2-1143 of the *Code* authorizes coal haulers in such jurisdictions to transport loads in excess of the legal limits applicable elsewhere in the state and to travel up to 85 miles from a mine or other place of production to a preparation plant, loading dock, or railroad.

The provisions in § 46.2-1143 of the *Code* were first enacted in 1973 and have been amended several times since then. In 1999, § 46.2-1143 was amended to add "trucks hauling gravel, sand, or crushed stone no more than 50 miles from origin to destination" to the vehicles eligible to use these higher axle and gross weight limits, but only within the counties that impose the coal severance tax (hereinafter called "the coal severance counties"). At the time, the Virginia General Assembly established an expiration date of July 1, 2001, to allow for further study. The bill authorizing the amendment (House Bill [HB] 2209) directed VDOT to "monitor the operation of these vehicles and the effect of such operation on the condition of affected highways and report to the Governor and 2001 Regular Session of the General Assembly its findings and recommendations."

The findings of the study, reported in November 2000 (see Legislative Report, 2001), indicated that "[f]or each of the 18 sites monitored as part of this study, visible load-induced distress increased, wheel path rutting increased, and ride quality decreased from July 1999 through July

2000” (VDOT, 2001). However, the 2001 Virginia General Assembly extended the expiration date to July 1, 2002, and directed VDOT to continue its monitoring and to report its findings and recommendations to the 2002 General Assembly.

VDOT’s report to the 2002 General Assembly, dated November 2001, affirmed that the conditions reported in November 2000 had continued to deteriorate. In HB 1243, the 2002 General Assembly extended the sunset to July 1, 2007, and dropped the requirement that VDOT monitor, report findings, or recommend further action on this issue.

In HB 2917 (Chapter 523 of the 2007 Acts of Assembly), the 2007 Virginia General Assembly amended and reenacted § 46.2-1143 of the *Code*. The legislation extended the expiration date of provisions applicable to trucks hauling gravel, sand, and crushed stone from July 2007 to July 2009 and directed VDOT, in consultation with the Commonwealth Transportation Board, to recommend legislation regarding the operation of trucks hauling gravel, sand, and crushed stone under this section of the *Code*. The purpose of this study was to provide the background research necessary to fulfill the mandate of Virginia’s General Assembly.

The objectives of the study were to quantify the additional maintenance costs associated with the higher weight limits allowed under the legislation and to develop policy options to address the maintenance cost impacts of vehicles traveling with overweight permits.

In conjunction with analogous and concurrent studies of petroleum tank wagons and hydroexcavating vehicles, the researchers determined that the overall maintenance cost per ESAL-mile of travel was $0.0366 in 2007 dollars. The finding that each ESAL-mile of travel by overweight sand and gravel trucks in Virginia in 2007 caused $0.0366 in damage resulted from *critical* estimates of values to be used for structural number and terminal serviceability for interstate, primary, and secondary system routes in Virginia, average ESAL values for each FHWA vehicle class based on weigh-in-motion data, miles of travel for each vehicle examined, and maintenance cost per ESAL-mile (i.e., exclusively load-related costs) of travel on Virginia highways.

Estimation of the ESAL-mile unit cost figure allowed estimation of the annual additional maintenance costs caused by trucks hauling sand, gravel, and crushed stone of different possible configurations from three to six axles. Estimated maintenance costs depend upon both the increase in average ESALs attributable to a vehicle’s weight increase due to truck configuration and the annual mileage figure assumed for the truck configuration. It follows that each truck configuration, with different assumed annual mileage, imposed different levels of estimated damage cost on VDOT pavements.

The study concluded that:

- The initial legislation to include sand, gravel, and crushed stone as loads qualifying for higher gross and axle weight limits in the coal severance counties in 1999 was prompted by a desire to offer coal haulers alternate employment opportunities when coal production was low. It was also prompted by the rise of gas well drilling in the region and the need for crushed stone to stabilize the well sites and access roads to remote wells.

- The initial reason for subsection H of § 46.2-1143 of the *Code of Virginia*—to provide alternate employment for coal haulers during downturns in coal sales and hauling—is no longer valid.
- Gravel quarries and truck operators in the coal severance counties have modified their trucks to take advantage of the higher weight limits.
- Because the gas well and the coal mining operations at each site are different divisions of the same company, the severing of gas through wells is a business decision of the mining companies.
- The estimated annual additional maintenance costs attributable to damage caused by sand, gravel, and crushed stone haulers under the HB 2917 higher weight limits are sensitive to both the increase in average ESALs attributable to the weight increase and the mileage figure used.

Policy options developed in the study included:

- Allow the provision to expire.
- Extend the expiration date regarding the additional weight allowance.
- Charge haulers for incremental damage based on change in average ESALs.
- Charge all haulers of all overweight vehicles for incremental damage based on change in average ESALs.

A Review of the Current Overweight Permit Fee Structure in Virginia. Response to Virginia General Assembly House Bill 1551, Virginia Transportation Research Council, Charlottesville, 2008.

House Bill 1551 (HB 1551) (Chapter 864 of the 2008 Acts of Assembly) from the 2008 Session of the Virginia General Assembly directed the Virginia Department of Transportation (VDOT) to review the current permit fee structure applied to overweight vehicles operating on Virginia's highways. The review was to determine what, if any, additional fees should be associated with damage and added maintenance costs caused by such vehicles and what mechanism is best suited for the collection of such additional fees. HB1551 specified that VDOT's review was to be done in consultation with the Department of Motor Vehicles (DMV) and representatives of the industries that own and/or operate overload and overweight vehicles. Based on this review, the VDOT Commissioner was to recommend legislation on the fee structure for overweight vehicles to the Governor and the members of the Senate Finance and Transportation Committees and the House Appropriations and Transportation Committees by December 1, 2008.

The Virginia Transportation Research Council conducted a review of the current permit fee structure in place at the time of the study, applied to overweight vehicles traveling on state-maintained roads. VTRC developed a two-part fee calculation method based on the vehicle characteristics that cause pavement and bridge damage. The resulting fees are in proportion to the damage that overweight vehicles cause and are consistent with VDOT's pavement and bridge design practices. The fee calculation method allows policymakers to choose whether to impose fees for pavement damage, bridge damage, or both. The VTRC fee calculation method also allows policymakers to make choices that affect the amount of the resulting fees.

Although both pavements and bridges are susceptible to load-related damage, the mechanisms by which it occurs in each are different. As a result, VTRC developed separate methods for calculating permit fees for load-related pavement and bridge damage. Although pavement damage costs can be distributed across *all* vehicles, only *some* overweight trucks damage bridges. VTRC identified a way to calculate pavement damage fees on an equitable unit cost basis that is applicable to all heavy vehicles. This could not be done for bridges without the resulting fees being very high (since so few overweight trucks damage bridges). For that reason, VTRC developed a method for calculating bridge damage fees that achieves *relative* equity between the overweight vehicles that cause the damage. The bridge damage fee calculation method also affords an opportunity for policymakers to provide input. Though the report offers three policy options for consideration, the authors concede that this is an oversimplification due to the lack of data necessary to properly calculate damages.

Legislative Reports (DMV in collaboration with VDOT)

Virginia Department of Motor Vehicles. RD387 – Permit Equity Study: An Equitable Approach to Setting Permit Fees for Overweight Motor Vehicles. Chapter 793 § 1, 2011. December 2011.

This document reports the results of the study undertaken in 2011 in response to the enactment of Delegate Joe May's House Bill 2022, which called upon the Department of Motor Vehicles to:

> "develop a uniform system of permitting for overweight and oversize vehicles and a comprehensive, tiered schedule of fees for overweight vehicles, taking into consideration the Virginia Department of Transportation's research on the cost impact of damage to Virginia's highways from overweight vehicles, the administrative feasibility of such fee structure, and the impact of such fee structure on the Commonwealth's economic competitiveness."

Working in close consultation with the VDOT and the Virginia Port Authority (VPA), and with additional input from the Virginia State Police (VSP), the Virginia Economic Development Partnership, and more than 100 stakeholders from state and local government and from the private sector, DMV examined Virginia's current programs for issuing permits to overweight vehicles, compared these programs to those in other states, evaluated earlier studies regarding the damage overweight vehicles cause to transportation infrastructure, and developed a new schedule of overweight permit fees that recovers some of the cost of that damage, while preserving Virginia's competitive position as a business-friendly state.

Other VDOT Research

Weight Limits for Trucks Hauling Gravel, Sand, or Crushed Stone in Certain Southwest Virginia Counties. House Document No. 18. Virginia General Assembly, Richmond. Virginia Department of Transportation. 2001.

HB 2209 (Chapter 915 of the 1999 Acts of Assembly), enacted in the 1999 Session of the General Assembly, required that the Code of Virginia be amended and reenacted to extend the higher weight limits prescribed in subsection B of § 46.2-1143 to vehicles hauling sand, gravel, or crushed stone in the seven coal severance tax counties of Southwest Virginia. The bill required the Virginia

Department of Transportation (VDOT) to "monitor the operation of vehicles under this subsection and the effects of such operation on the condition of the affected highways." This document serves to fulfill the requirement to report these results and forms the basis for a recommendation to the Governor and the 2001 Regular Session of the General Assembly as to whether the bill's provisions should be allowed to expire on July 1, 2001, or to continue, either in their present form or some modified form.

The purpose of this study was to determine if vehicles operating under the higher allowable weight limit provisions cause pavements to deteriorate faster and, therefore, intensify maintenance and rehabilitation requirements than pavements bound by weight limits applicable elsewhere in the state.

The study had three limitations:

1. Because of varying interpretations of the provisions of HB 2209, it was impossible to locate a large number of representative control sites in Southwest Virginia. The reader is cautioned, therefore, that observations based on comparisons between severance tax and non-severance tax counties are not valid.
2. The 13 months available to monitor pavement performance was not enough time to allow the capture of data to determine whether there were significant differences in the rates of change among sites.
3. The tremendous number of variables that influence pavement performance and the vast resources and time required to answer questions related to truck-induced pavement damage would seem to speak against any extension of this study in an attempt to determine any peculiar effects higher-weight trucks may have in Southwest Virginia that they do not have elsewhere in the nation. The American Association of State Highway and Transportation Officials (AASHTO) has been leading a collaborative, comprehensive pavement research effort among all 50 states continuously for the past 40 years to determine the effects of higher-weight trucks. The outcome of AASHTO's study is clear: the damage caused by heavy vehicles increases exponentially with corresponding incremental increases in weight.

After the initial structural and functional conditions were documented at all study sites at the time HB 2209 went into effect (July 1999), the methodology consisted of monitoring the sites through documentation of the same condition indicators every 3 months throughout the 13-month study period. In addition, a detailed geotechnical (subsurface) investigation was conducted at each site in October 1999 to document pavement construction history and subgrade support conditions. To develop site-specific information about traffic volume and composition, a survey consisting of vehicle counts, classifications, and approximate measurements of weights using weigh-in-motion technology was performed in April and May 2000.

Results of the geotechnical investigation and traffic study were used in conjunction with pavement deflection test results to perform a detailed structural evaluation of all sites in accordance with the AASHTO pavement design and analysis procedure, which is widely used by U.S. state highway agencies.

Findings consisted of the following:

- The allotted 13 months was not sufficient to allow the capture of data to determine whether there were significant differences in the rates of change among sites. Therefore, observations that involved making comparisons between severance tax and non-severance tax (control) sites were inconclusive.
- For each of the 18 sites monitored as part of this study, visible load-induced distress increased, wheel path rutting increased, and ride quality decreased from July 1999 through July 2000.
- There were significant differences in the structural conditions of study sites.
- There was no consistent trend in structural deterioration for any site throughout the study period as determined by the pavement deflection analysis.
- Thirty-nine percent of the pavements investigated in this study were structurally inadequate to support traffic operating at weight limits allowed by HB 2209 for a sustained period of time.
- The cost of damage to primary and secondary roadway pavements within the seven severance tax counties caused by the net additional weight allowed by HB 2209 is estimated to be on the order of $28 million over a 12-year period. This estimate does not include costs associated with load-induced damage to bridges; motorist delays through work zones because of increased road and bridge repairs; safety and geometric roadway improvements; or loss of life and property resulting from the increased safety hazards of heavy trucks operating in mountainous terrain.
- The damaging effects on pavement performance of increasing vehicle weights are widely documented. The most comprehensive study of pavement performance under heavy vehicle loads, led by AASHTO, has been continuously underway since the 1950s.

Recommendations consisted of the following:

- In light of the structural evaluation and cost analysis performed for the 18 study sites and the literature review of pertinent studies, the provisions of HB 2209 pertaining to the authorization of additional weight limits for trucks hauling sand, gravel, or crushed stone should expire on July 1, 2001.
- Further, in the opinions of the principal investigators of this research and the members of the Coal Severance Tax Study Steering Committee, the outcome of continued monitoring of the sites studied herein would serve only to support the findings of the widely accepted AASHTO research effort, which are based on more than 40 years of continuous work conducted collaboratively by and for the 50 state highway agencies. It would seem that an attempt to replicate such a comprehensive and costly effort by continuing to monitor these Southwest Virginia sites would be redundant and is, therefore, not recommended.

Performance of Pavements Subject to Higher Truck Weight Limits in Virginia. T.E. Freeman and T.M. Clark, Transportation Research Record 1806. Washington, D.C., 2002.

The Virginia General Assembly mandated that VTRC conduct a study to determine if pavements in the state's southwest region have greater maintenance requirements due to that region's higher allowable weight limit provisions. Field surveys were carried out at 18 pavement locations that included both primary and secondary routes. Information captured for each of the locations included traffic classification weight surveys, subsurface conditions, and pavement structural evaluations. Based on the information collected, an estimate was made on the cost of damage that could be attributed solely to the net increase in allowable weight limits. The results were similar to those found in more comprehensive studies conducted for other highway agencies.

Findings consisted of the following:

- Relatively small increases in truck weight (resulting from House Bill 2209) resulted in significant increases in pavement damage.
- The cost estimate for structural damage to pavements resulting from the net weight increase in the seven counties affected was estimated at $28 million over 12 years.
- Cost estimates did not include other items such as bridge deterioration, roadway geometry improvements, or safety implications.

Report of the Virginia Department of Transportation, Vehicle Cost Responsibility study (SJR 121) to the Governor and the General Assembly of Virginia. Virginia Department of Transportation, Richmond, 1991.

Following the mandate set forth in SJR 121, the purpose of this study was to review the cost responsibility of the various vehicle classes (a total of nine) and provide the 1991 General Assembly with recommendations on the need to modify the revenue mix used at the time of the study. The two primary assumptions used throughout the effort were (1) the highway system should be user financed and (2) vehicles should be charged based on the costs they inflict.

General findings included the following:

- Only cars and personal use trucks are paying total fees proportionate to their cost responsibility; all other classes of vehicles are underpaying to varying degrees.
- The differences between revenue and cost responsibility increase as weights increase because responsibility increases geometrically with increased weight.
- Decisions regarding the need to modify the then existing tax structure were said to depend on the extent to which the sales tax was viewed as a mechanism by the General Assembly to offset discrepancies in user fee receipts for certain vehicle classes, since the contribution of the general sales tax to transportation financing could not be ignored.

Continuation of the Vehicle Cost Responsibility Study (SJR 238) to the Governor and the General Assembly of Virginia. Virginia Department of Transportation, Richmond, 1992.

A continuation of the study mandated by SJR 121, was undertaken to evaluate the use of deterioration methodology for the allocation of pavement rehabilitation costs and the resulting effects on the vehicle classification costs calculated in SJR 121, propose improvements in data collection to aid the next cost responsibility study, and to examine and determine the effects of tax equity proposals.

- The findings of the study confirmed the conclusions put forth in the previous study. From a cost occasioning perspective, passenger vehicles were found to overpay. The revenue-to-cost ratios found in the SJR 121 study were considered to still be representative.
- Pavement deterioration models that were deemed acceptable at that time, were not available for testing.
- It was recommended that a system-wide database of weigh-in-motion data be developed and used along with pavement performance data to allocate construction and rehabilitation costs in an equitable fashion among vehicle classes based on the consumption of pavement life.

Directory of Significant Truck Size and Weight Research, NCHRP 20-07, Task 303. J.L. Carson, Texas Transportation Institute. American Association of State Highway and Transportation Officials (AASHTO), 2011.

This research effort conducted as part of the National Cooperative Highway Research Program was performed to provide a summary of the noteworthy research pertaining to increasing the size and weight of large commercial trucks for the benefit of those influencing potential changes in current size and weight limits. Inclusion of information in this study was said to be based on when the research was conducted, scope, and expressed need. The information gathered takes the form of a directory, and as such, can be searched by specific subject area including infrastructure preservation, modal share, enforcement, highway safety, highway geometrics, industry costs, infrastructure financing, highway congestion, environment, and public opinion.

The majority of the research efforts included in this summary were conducted within 20 years of the publication date (since 1991) as it was presumed that more current research built on the findings of earlier work. General findings are provided for each of the primary sections including infrastructure preservation, modal share, enforcement, highway safety, highway geometrics, industry costs, infrastructure financing, highway congestion, environment, and public opinion. A select few of these findings are further described below.

- Roadway pavement deterioration is more closely related to axle weight that GVW. As such, increased weight limits and axle configurations that result in higher axle weights can result in significantly increased pavement costs.
- Higher GVW distributed over six axles instead of five axles can result in decreased pavement costs.
- Increases in truck size and weight are predicted to increase bridge related costs, though in some studies cost estimates may be higher than necessary because it is assumed bridges will be replaced rather than utilizing cost-effective alternatives.
- Unlike pavements, impacts to bridges are more sensitive to GVW than axle weight.

- Increased truck weight limits will result in increased truck transport due to lower costs. The extent of the shift from rail transport to truck transport will be dependent on the cost reduction.
- It is difficult to assess compliance with truck size and weight requirements due to inconsistent enforcement practices, but laws containing numerous exceptions result in reduced levels of enforcement.
- A lack of available crash and exposure data significantly reduce the value in comparing truck size and weight to highway safety levels.
- Trucks with higher GVW were associated with higher crash severities and lower crash rates.
- Though the magnitude will vary based on carrier type and commodities transported, increases in allowable truck size and weight limits will normally result in cost savings to industry.

Western Uniformity Scenario Analysis: A Regional Truck Size and Weight Scenario Requested by the Western Governors' Association, Federal Highway Administration. Washington, D.C., 2004.

This study was requested of the U.S. Department of Transportation by the Western Governors' Association and as a part of the scenarios being tested in the Comprehensive Truck Size and Weight Study. The scenario looked at the impacts of longer combination vehicles (LCV) which had configurations consisting of two 45 or 48 foot trailers with a maximum weight of up to 129,000 lb. The LCVs were assumed to be used in the states of Washington, Oregon, Nevada, Idaho, Utah, Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma. While it is understood that the findings of this particular study are not directly applicable to the single trailer, six axle configurations proposed, a limited number of the findings are assumed to be relevant.

General findings consisted of the following:

- Significant benefits, including reduced fuel consumption, are estimated to accrue to the shipper assuming the configurations tested.
- A small number of Western States collect fees that offset the increased infrastructure costs associated with LCV operations. Related to this, it the study recommended that financing plans be developed prior to allowing any changes to existing truck size and weight limits.
- Though safety was said to be the greatest issue of concern related to increased truck size and weight, there is not sufficient data currently available to adequately estimate crash rates or fatality numbers. Therefore it was suggested that a formal process for monitoring safety be put in place before allowing an increase in the use of LCVs tested in this scenario.

- U.S. DOT does not advocate state-specific exemptions from federal truck size and weight limits, as it increases the difficulty in both enforcing and complying with these limits and ultimately may decrease the chances of developing more comprehensive solutions.

Regulation of Weights, Lengths, and Widths of Commercial Motor Vehicles: Special Report 267. Transportation Research Board, Washington, D.C., 2002.

Special Report 267 was a result of the 1998 Transportation Equity Act for the 21st Century (TEA-21) as it directed the Secretary of Transportation to request the Transportation Research Board (TRB) study the weights, lengths, and widths of commercial vehicles and develop recommendations for any changes deemed appropriate. The committee that was tasked with this effort determined that there was insufficient information related to the costs, benefits, and impacts of size and weight of truck transportation. The study states that all previous studies have come to a similar conclusion. Many of the final conclusions provided in the report address how this lack of data should be addressed and are summarized below:

- There are significant opportunities for improving the efficiency of the highway system, and this includes allowing larger and heavier trucks to operate on this system.
- Previous studies have not produced acceptable estimates of bridge costs related to increased truck weights.
- Predicting the outcomes of regulatory changes cannot be done with a high degree of confidence.
- It is necessary to determine the safety consequences of potential changes in size and weight regulations, but additional monitoring and research that would be necessary to fully understand these consequences are not being conducted.
- Costs of monitoring compliance with regulations cannot be estimated because it is too inconsistent.

Recommendations consisted of the following:

- An independent public organization should be formed and charged with observing and evaluating commercial motor vehicle performance as well as the effects of size and weight regulations. The need for this organization is demonstrated by the fact that federal size and weight policy has been at a standstill for over 10 years even though there is significant dissatisfaction with the current regulations. Regulatory changes made in the past have been done without the benefit of objective analysis before or after the change has taken effect. Pilot studies would be overseen by this entity as would an ongoing program of monitoring and evaluation. Specific details regarding how the organization would be governed are included in the recommendation.

- The Secretary of Transportation should be authorized by Congress to allow pilot studies that would allow for temporary exemptions from current size and weight limits. These pilots would be recommended and carried out by the organization described in the previous recommendation.
- States should be allowed to participate in a federally-supervised permit program that would let trucks operate at weights above current regulations. Conditions under which these permits would be allowed are further described in the recommendation.
- Additional research is recommended on issues involving enforcement, air quality impacts, the relationship between truck performance and crashes, risk-based bridge costs, freight transportation market research, and new infrastructure development.

APPENDIX B

Listing of External Stakeholders

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