U.S. Department of Transportation

National Highway Traffic Safety Administration


Preliminary Regulatory Evaluation

# Impacts on Safety and Compliance Costs Involving Safety Standards, Labeling and Reporting for Replica Motor Vehicles

Office of Regulatory Analysis and Evaluation
National Center for Statistics and Analysis
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# Table of Contents

## EXECUTIVE SUMMARY

The National Traffic and Motor Vehicle Safety Act ("Safety Act") (49 U.S.C. Chapter 301, Motor Vehicle Safety (49 U.S.C. 30101 *et seq*.)) authorizes and directs the Secretary of Transportation to prescribe Federal motor vehicle safety standards (FMVSS) to reduce traffic accidents and deaths and injuries resulting therefrom.[1] Under § 30112(a) of the Safety Act, a person may not manufacture for sale, sell, offer for sale, introduce or deliver for introduction into interstate commerce, or import into the United States, any new motor vehicle or motor vehicle equipment unless the vehicle or equipment complies with all applicable FMVSS in effect on the date of manufacture.

On December 4, 2015, Congress enacted the FAST Act (Public Law 114-94). Section 24405 of the FAST Act amended § 30114 of the Safety Act by, among other things, adding a subsection (b)(1)(A) that directs NHTSA by delegation to "exempt from § 30112(a) of this title not more than 325 replica motor vehicles per year that are manufactured or imported by a low-volume manufacturer." NHTSA is proposing to adopt a regulation, 49 CFR Part 586, and amend others to implement the low-volume manufacturer replica vehicle program. The FAST Act contains specific procedural requirements for the registration of low-volume manufacturers, labeling of vehicles, reporting, and other matters related to the exemption program. To implement the program and the procedural mandates of the FAST Act, new Part 586 would set

[1] The Secretary of Transportation has delegated the responsibility to promulgate regulations under 49 U.S.C. Chapter 301, Motor Vehicle Safety (49 U.S.C. 30101 et seq.) to NHTSA. *See*, 49 CFR 1.95.

forth requirements for registration, labeling, providing consumer disclosures, submitting annual reports, and other requirements needed for the administration of the program.

While we believe that many, if not all, of the manufacturers affected by this proposal would be considered small businesses, this NPRM would not have a significant negative economic impact on them. The rulemaking would not result in net financial costs, but would instead provide significant cost savings for the affected manufacturers.

NHTSA has prepared this preliminary regulatory evaluation to analyze the benefits and costs of implementing the replica provision as proposed in the Notice of Proposed Rulemaking (NPRM). NHTSA calculated the benefits of this proposed rule by analyzing the savings that would be realized by low-volume manufacturers when producing replica vehicles that would not be required to meet all the Federal regulations and FMVSS applicable to new motor vehicles.

The proposal would enable a new market for replica vehicles for which compliance with FMVSS is either prohibitively expensive or impossible – generating production cost savings and benefits in the form of new consumer surplus. The rule would also reduce the costs of innovation and create new economic opportunities for small manufacturers and their current and prospective employees. The costs of the rule include incremental reductions in safety and fuel economy, as well as increased paperwork costs for replica manufacturers.

NHTSA was unable to quantify and monetize some of the categories of impacts mentioned above due to data unavailability and/or uncertainty (e.g., incremental consumer surplus and innovation). That said, NHTSA expects the impacts of the rule to be small because the FAST Act limits the output of manufacturers producing replica vehicles under this proposed rule to 325 replica vehicles per year. The table below provides a summary of the various benefits and costs that may accrue from this rule, as well as the various factors that define the

range of possible outcomes. This range illustrates the uncertainty inherent in predicting the outcome from establishing an entirely new market opportunity.

**Table E-1: Ranges of Outcomes for Benefit and Cost Categories**

**Benefits**

| Element | Low Case | High Case |
|---|---|---|
| Incremental consumer surplus | **Not estimated:** Incremental consumer Surplus would be low if substitutes such as luxury sports cars and kit cars are viable alternatives for consumers. | **Not estimated**: If replicas manufactured under the rule differ greatly in price and/or transaction cost from luxury sports cars and kit cars - thus behave more like a unique product- incremental consumer surplus could be high. |
| Mitigated compliance costs | **Estimated:** Captures the cost of installing required safety technologies on an average modern car. | **Not Estimated:** Would consider the avoided costs of forcing required safety technologies into older vehicle designs. |
| Innovation | **Not Estimated:** The proposed rule is primarily used to replicate old technology. | **Not Estimated:** Manufacturers producing under the proposed rule seek to incorporate some newer technologies into replica vehicles. Could lead to innovation to make technology fit into older designs. (e.g., miniaturization). |
| Incremental employment impacts | **Not Estimated:** Job losses from contractors and small businesses that assemble kit cars are around or equal to the job gains for small replica manufacturers | **Not Estimated:** If kit car production remains relatively stable and replica car production increases significantly (consistent with case where replicas are a new and separate product category), employment effects would be greater. |

**Costs**

| Element | Low Case | High Case |
|---|---|---|
| Incremental fatalities, injuries and property damage | **Estimated**: Fatalities would be lower if: voluntary compliance with safety standards is high; production of replicas is on the low end; and VMT by replicas is also low. **Not Estimated**: Fatalities will be lower if replicas primarily function as a substitute for kit cars. | **Estimated**: Fatalities would be higher if: voluntary compliance is low; production is high; and if VMT is high. **Not Estimated**: Fatalities would be higher if replicas function as a new market that attracts new consumers - implying substitution from more compliant vehicles - or, if replica vehicle drivers choose to increase their VMT specifically to enjoy the replica vehicle, rather than as a substitute for mileage driven in substitute vehicles |
| Incremental fuel use | **Not Estimated:** Reflects low VMT. | **Not Estimated:** Reflects high VMT. |
| Reporting costs | **Estimated:** Reflects low bound of production. | **Estimated:** Reflects high bound of production. |

NHTSA was able to calculate preliminary estimates of some benefits and costs for different compliance scenarios using a variety of logical assumptions. NHTSA calculated the impact of the proposed rule on costs by analyzing cost savings arising from relaxing compliance with FMVSS and bumper standards, and reducing paperwork burden associated with reporting and labeling requirements. The primary cost impact of the proposed rule would be decreased production costs (i.e., vehicle component cost savings) through relaxed compliance with FMVSS and bumper standards. NHTSA estimates that the total discounted (three-percent discount rate) impact on costs for each replica vehicle exempted under this proposed rule would be between -$2,189 and -$811 for passenger vehicles, and between -$1,909 and -$649 for light trucks and vans (LTVs, consisting of trucks, MPVs, and buses with a GVWR of 4,536 kilograms (kg) (10,000 pounds (lbs.) or less); the corresponding estimates at a seven-percent discount rate are between -$2,148 and -$796 for replica cars, and between -$1,873 and -$636 for LTVs. NHTSA does not anticipate the production of any other types of replica vehicles (i.e., motorcycles, trailers, low-speed vehicles, medium- and heavy-duty trucks, and buses) under the proposed rule. The ranges of estimates reflect uncertainty in: (1) the extent to which replica vehicle manufacturers would comply voluntarily with FMVSS affected by the proposed rule; (2) the volume of replica vehicles manufactured each year; and (3) annual travel demand (vehicle-miles of travel, VMT) for replica vehicles. As noted in Table E-1, these estimates reflect average costs of these technologies in existing production vehicles, but do not necessarily reflect what the costs would be to install these technologies in replica vehicles. We request comment on this approach to representing the range of estimated impacts under uncertainty.

Estimates of per-vehicle impacts that would be observed for other replica vehicle types are presented in Appendix A, for cases where sufficient information was available.

NHTSA calculated the impact of the proposed rule on benefits by analyzing the change in safety costs related to increased fatalities, injuries and property costs due to relaxing compliance with FMVSS and bumper standards. The primary impact on benefits of this proposed rule would be an expected increase in fatalities and injuries for drivers and occupants in both replica vehicles and some portion of their crash partners due to relaxing FMVSS requirements. The total estimated discounted (three-percent discount rate), per-vehicle change in benefits of this proposal are between -$8,448.82 and -$1,067.88 for replica cars and between -$9,514.04 and -$744.25 for replica LTVs (between $6,313.68 and -$793.56 for replica cars and between -$7,039.07 and -$547.65 for replica LTVs at a seven-percent discount rate). Per-vehicle benefit and cost impacts are presented by vehicle type and discount rate in E-2 below:

**Table E-2: Summary of Benefit and Cost Impacts (per Vehicle, 2017 Dollars)**

| Impact | Passenger Cars | LTVs |
|---|---|---|
| Benefits – 3% Discount Rate | -$8,449 to -$1,068 | -$9,514 to -$744 |
| Benefits – 7% Discount Rate | -$6,314 to -$794 | -$7,039 to -$548 |
| Costs – 3% Discount Rate | -$2,209 to -$821 | -$1,929 to -$659 |
| Costs – 7% Discount Rate | -$2,168 to -$806 | -$1,893 to -$646 |

As noted in Table E-1, these results could vary further depending on: the makeup of the baseline vehicle fleet that replica vehicles replace; and the extent to which replica vehicles increase exposure due to added vehicle miles travelled (VMT) or change driving behavior due to the characteristics of the vehicles' performance.

For this analysis, NHTSA assumed that 40 low-volume manufacturers will produce between 4,000 and 8,000 replica vehicles (on average 100-200 per manufacturer) annually. This assumption was based on: (1) a projection of California replica vehicle sales provided by the

California Air Resources Board, along with state-level vehicle registration data[2]; and (2) available information on firms that produce, or are interested in producing, replica vehicles consistent with those affected by the proposed rulemaking. Among replica vehicles sold, NHTSA assumes that 90% will be passenger cars and 10% will be trucks under 4,536 kilograms (10,000 pounds). Based on these assumptions, NHTSA estimates that involvement in the proposed Part 586 exemption program would save low-volume manufacturers of replica passenger cars and LTVs between $3.4 million and $17.2 million at a three-percent discount rate (between $3.3 million and $16.8 million at a 7% discount rate) annually, resulting from the elimination of the requirement to certify compliance of their vehicles with the vehicle FMVSS, fuel economy standards, bumper standards, and labeling requirements. NHTSA estimates that annual impact on benefits associated with the proposed rule would be between -$68.4 million and -$4.1 million at a 3% discount (between -$51.1 million and -$3.1 million at a 7% discount rate) annually, resulting from incremental property damage, injury, and fatality costs.

It is important to note that the estimates of benefit impacts in this analysis are not appropriate for use as a retrospective analysis of the safety standards affected by the proposed rule. Rather, the benefit impact estimates are strictly conditional on the assumptions regarding VMT for replica vehicles.

[2] The California Air Resources Board provided a projection of 400-500 replica vehicles sold in California each year under the proposed rule. NHTSA divided the midpoint of the range (450 vehicles per year) by the share of Californian vehicle registrations within total national vehicle registrations as reported by IHS Automotive in the National Vehicle Population Profile (approximately 11 percent) to identify an estimate of annual national replica vehicle production.

# I. INTRODUCTION

The purpose of this report is to present the potential benefits and costs of exempting replica vehicles manufactured by low-volume manufacturers from NHTSA's regulations and vehicle standards. The information offered here pertains to the impacts of exempting replica vehicles on the small-volume manufacturers who produce the vehicles (benefits derived from foregone compliance costs) and the impact on fatalities, injuries, and property damage.

Until the FAST Act, low-volume manufacturers of replica vehicles were subject to virtually the same Vehicle Safety Act requirements as the largest manufacturers when producing their new motor vehicles. Occasionally, small manufacturers are given more time to comply with new FMVSS requirements, such as by having longer phase-in timelines to comply with a new requirement, and can also petition for exemptions from certain FMVSS for limited periods of time on certain specific grounds.[3] However, notwithstanding the flexibility regarding compliance dates and limited-period exemptions, until the FAST Act, low-volume manufacturers of replica vehicles had the same responsibilities as larger manufacturers to certify their vehicles as complying with all FMVSS applying to the vehicle that were in effect on the day of manufacture of the vehicle. These FMVSS comprise standards applying to "equipment" and standards applying to the "vehicle" as a unit.

The FAST Act allows low-volume manufacturers of replica vehicles registered in the proposed exemption program to be exempted from meeting the "vehicle" FMVSS formally

[3] 49 CFR Part 555.

applying to the vehicles, along with fuel economy standards, bumper standards, and labeling requirements. Manufacturers that are not low-volume do not qualify to participate in this exemption program. Larger manufacturers and small manufacturers of vehicles that do not qualify as replicas must still ensure their vehicles meet all FMVSS applying to the vehicle on the date of manufacture, including the current "vehicle" FMVSS.

## A. Background

The National Traffic and Motor Vehicle Safety Act ("Safety Act") (49 U.S.C. Chapter 301, Motor Vehicle Safety (49 U.S.C. 30101 *et seq*.)) authorizes and directs the Secretary of Transportation to prescribe Federal motor vehicle safety standards (FMVSS) to reduce traffic accidents and deaths and injuries resulting therefrom.[4] Under § 30112(a) of the Safety Act, a person may not manufacture for sale, sell, offer for sale, introduce or deliver for introduction into interstate commerce, or import into the United States, any new motor vehicle or motor vehicle equipment unless the vehicle or equipment complies with all applicable FMVSS in effect on the date of manufacture.

Pursuant to the Safety Act, NHTSA has issued FMVSS to protect the public against unreasonable risk of crashes occurring because of the design, construction, or performance of a vehicle and against unreasonable risk of death or injury in a crash. Some of the FMVSS are "vehicle" standards that apply only to new completed vehicles as a unit and not to aftermarket components, some are "equipment" standards that apply to original and aftermarket items of

[4] The Secretary of Transportation has delegated the responsibility to promulgate regulations under 49 U.S.C. Chapter 301, Motor Vehicle Safety (49 U.S.C. 30101 et seq.) to NHTSA. *See*, 49 CFR 1.95.

equipment, and a few are both a vehicle and an equipment standard. Section 30115 of the Safety Act requires that the manufacturer or distributor of a motor vehicle or motor vehicle equipment subject to the FMVSS certify at delivery that the vehicle or equipment complies with all applicable FMVSS.

The Safety Act provides limited authority to the Secretary of Transportation to exempt motor vehicles from § 30112(a). Section 30113 authorizes the Secretary to exempt motor vehicles from an FMVSS or bumper standard on a temporary basis and under tightly defined circumstances. Section 30114 sets forth "special exemptions" for motor vehicles and motor vehicle equipment from § 30112(a). Until the Fixing America's Surface Transportation Act (FAST Act), exemptions under §30114 were limited to those necessary for research, investigations, demonstrations, training, competitive racing events, show, or display.

On December 4, 2015, the FAST Act (Public Law 114-94) was enacted. Section 24405 of the FAST Act amended § 30114 of the Safety Act by, among other things, adding a subsection (b)(1)(A) that directs NHTSA by delegation to "exempt from § 30112(a) of this title not more than 325 replica motor vehicles per year that are manufactured or imported by a low-volume manufacturer." Section 30114(b)(1)(B) states that the agency shall limit this exemption to motor vehicle (vehicle) standards that apply to motor vehicles[5] and explicitly states that the exemption does not apply to FMVSS applicable to motor vehicle equipment (equipment) standards.[6]

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[5] Without the FAST Act exemption, new replica vehicles are required to meet all FMVSS for the replica's vehicle type as of the date of manufacture of the replica. E.g., a replica manufactured on January 1, 2019 resembling a 1973 passenger car is required to meet all the FMVSSs for passenger cars in effect on January 1, 2019.

[6] Using the above example, the FAST Act exempts the vehicle from meeting the FMVSS in effect on January 1, 2019 applying to passenger cars that are "vehicle" standards, such as the standards for advanced frontal air bags, side impact head protection, ejection mitigation, roof crush resistance, fuel system crash integrity, and electronic stability control. Under the FAST Act, the replica would still have to meet the "equipment" standards in effect on the equipment's date of manufacture, such as those for lamps, glazing materials, and tires.

Section 24405 of the FAST Act also exempts replica motor vehicles from 49 U.S.C. 32304, 32502, and 32902 and from Section 3 of the Automobile Information Disclosure Act (15 U.S.C. 1232). That is, replica motor vehicles would be exempt from passenger motor vehicle country-of-origin labeling requirements, bumper standards, average fuel economy standards, and vehicle labeling and safety rating disclosure requirements.

Under the delegation in 49 CFR 1.95 and pursuant to § 24405 of the FAST Act, NHTSA is proposing to adopt a regulation, 49 CFR Part 586, and amend others to implement the low-volume manufacturer replica vehicle program. The FAST Act contains specific procedural requirements for the registration of low-volume manufacturers, labeling of vehicles, reporting, and other matters related to the exemption program. To implement the program and the procedural mandates of the FAST Act, new Part 586 would set forth requirements for registration, labeling, providing consumer disclosures, submitting annual reports, and other requirements needed for the administration of the program. This NPRM also proposes changes to Part 565 to require manufacturers to encode specific information into the VIN of each replica, and to Parts 566 and 567 for manufacturer identification and vehicle certification, respectively.

### B. Market Analysis

The replica vehicle program is expected to reduce manufacturing costs and pave the way for a new, niche-market, automotive industry. Because this rule will allow the development of a new industry, it is difficult to estimate how many entities will be impacted. While NHTSA cannot with certainty estimate the number of manufacturers that will participate in the exemption program or the number of replica vehicles that will be produced annually, NHTSA has some information that informs plausible production assumptions. NHTSA assumes, based on

information from the California Air Resource Board, interest in the program, and information about the kit car industry, that annual production of replica vehicles could be between 4,000 and 8,000 vehicles per year.

NHTSA's lower-bound annual production estimate is informed by a staff report from the State of California Air Resource Board (CARB) that estimates that between 400 and 500 specially produced motor vehicles[7] will be registered in California annually. The California Air Resource Board has authority to regulate emissions for replica vehicles sold in California.[8] Based on CARB's estimate and the percent of all vehicle registrations in the U.S. that are in California, an estimated 4,000 replica vehicles will be manufactured annually.[9]

NHTSA's upper-bound annual production estimate is based on communication with prospective replica manufacturers and information about the kit car industry. Currently, the demand for replica vehicles is primarily met by consumers purchasing "kit cars"[10] and building their own. There appear to be a few reasons replica vehicles are often built from kits instead of

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[7] The definition for specially produced motor vehicle at 42 U.S.C. 7525(a)(5)(H)(i) is the same as the definition of replica motor vehicle at 49 U.S.C. 30114(b)(7)(B) except that specially produced motor vehicles are limited to light-duty vehicles and light duty-trucks.

[8] In addition to directing NHTSA to exempt a limited number of replica motor vehicles from NHTSA's safety standards, Section 24405 of the FAST Act also allows for less stringent emission standards for replica vehicles. The California Air Resource Board is authorized to promulgate regulations for engines that are permitted to be installed in replica vehicles.

[9] The California Air Resources Board provided a projection of 400-500 replica vehicles sold in California each year under the proposed rule. NHTSA divided the midpoint of the range (450 vehicles per year) by the share of Californian vehicle registrations within total national vehicle registrations as reported by IHS Automotive in the National Vehicle Population Profile (approximately 11 percent) to identify an estimate of annual national replica vehicle production.

[10] Kit car manufacturers sell car components for self-assembly by consumers and are typically not manufacturers of motor vehicles for purposes of complying with the FMVSS. A "kit car" is an assemblage of motor vehicle, either in assembled or unassembled form that cannot form a motor vehicle. The kits often lack engines and transmissions and may be designed to replace the body of a donor vehicle.

sold as complete vehicles. First, the costs associated with ensuring compliance with NHTSA's safety standards both at the design and testing phase and during production can be substantial and the demand for replica vehicles may not be large enough to justify expending resources to develop vehicles that both accurately replicate well-known classic cars and meet current standards. Second, NHTSA's standards may preclude or inhibit the accurate replication of exterior features. And third, car enthusiasts who wish to own a replica vehicle may prefer to build it themselves.

Kit car manufacturers have expressed considerable interest in the replica vehicle program, indicating that they see unmet consumer demand for replica vehicles. As explained in this analysis, NHTSA expects this rule to result in substantial cost savings for manufacturers who participate in the program. As a result, reproduction of classic cars will become more financially viable and businesses will enter the market. NHTSA expects that many replica vehicle manufacturers will come from the kit car industry.[11] The kit car industry is already in the business of replicating the exterior of well-known classic vehicle and would be well-positioned to transition into manufacturing complete replica vehicles.

Information about the kit car industry provides NHTSA with a starting point for estimating the size the replica vehicle program. According to one website, there are 54 kit car manufacturers in the US and according to a sister website, there are 141 in the UK.[12] While

[11] There are other entities, such as DeLorean, that are interested in producing replica vehicles that do not manufacturer kit cars.

[12] See http://www kitcarusa.com/kit_cars_manu_list.php and http://www.madabout-kitcars.com/kitcar/kit_cars_manu_list.php. Last accessed November 6, 2018.

NHTSA estimates that the majority of replica vehicles will be built in the US,[13] looking at other, more developed, low-volume manufacturing industries abroad may provide an indication of the growth potential. Based on the size of the kit car industry and the number of entities that have expressed interest in the program, NHTSA estimates that there will be 40 entities manufacturing exempt replica vehicles annually.

To estimate production levels, NHTSA at the most likely consumers of replica vehicles. NHTSA believes the most likely consumers of replica vehicles are people who would purchase kit cars, but lack the technical knowledge to complete the vehicle themselves. One indicator of the size of the market would be the number of kit cars that are purchased and never completed. NHTSA does not have sufficient information to represent the size of the U.S. kit car industry[14]. To help inform the scope of replica vehicle production under the proposed rule, NHTSA looked to information on the UK kit car industry. There are approximately 3,500 kit cars sold in the UK annually and there are approximately 1,000 fewer kit cars completed and registered in the UK than there are kits sold.[15] Assuming that most kit cars include vehicle bodies that replicate classic cars and considering that the US's population is approximately five times as large as UK's, it is plausible that there could be demand for 5,000 replica vehicles a year. Further, there are likely people who would like to own a replica vehicle and recognize that they lack the ability to

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[13] This assumption is based on the percent of all passenger cars sold in the US but are manufactured outside the US. Between January and August 2018, 76.1% of vehicles sold in the U.S. were produced domestically and 23.9% were imported. "U.S. light-vehicle sales by nameplate, August & 8 months." Automotive News. September 10, 2018, pp. 56-7.

[14]There are only an estimated 800 kit cars sold in the U.S. annually according to a press release by Congressman Markwayne Mullin (Mullin, Green Support U.S. Manufacturing and Skilled Labor with Automotive Bill (June 11, 2015), https://mullin.house.gov/news/documentsingle.aspx?DocumentID=63. Last accessed November 6, 2018.)

[15] This is based on an estimate that there are 2,500 kit cars completed and registered in the UK annually. Raven, Christopher and Pinch, Steven (2003) The British kit car industry: understanding a 'world of production'. European Urban and Regional Studies, 10 (4), 343-354.

complete a kit car. These potential consumers are not represented in the difference between the number of kit cars purchased and the number completed. To account for this additional demand, NHTSA estimates that it is plausible that annual sales may be as high as 8,000 vehicles per year.

NHTSA requests comment on the assumption that there will be approximately 40 manufacturers producing between 4,000 and 8,000 exempt replica vehicles annually.

### C. Effects on Low-Volume Replica Vehicle Manufacturers

The Small Business Administration's regulations at 13 CFR Part 121 define a small business, in part, as a business entity "which operates primarily within the United States." (13 CFR 121.105(a).)

This proposed rule would directly impact low-volume manufacturers that choose to produce replica vehicles. While we believe that many, if not all, of the manufacturers affected by this proposal would be considered small businesses, this NPRM would not have a significant negative economic impact on them. The rulemaking would not result in net financial costs, but would instead provide significant cost savings for the affected manufacturers.

Until the FAST Act, low-volume manufacturers of replica vehicles were subject to virtually the same Vehicle Safety Act requirements as the largest manufacturers when producing their new motor vehicles. Occasionally, small manufacturers are given more time to comply with new FMVSS requirements, such as by having longer phase-in timelines to comply with a new requirement, and can also petition for exemptions from certain FMVSS for limited periods of

time on specified bases.[16] However, notwithstanding the flexibility regarding compliance dates and limited-period exemptions, until the FAST Act, low-volume manufacturers of replica vehicles had the same responsibilities as larger manufacturers to certify their vehicles as complying with all applicable FMVSS that were in effect on the day of manufacture of the vehicle.

The central effects of the FAST Act on low-volume manufacturers of replica vehicles registered in the proposed exemption program are exemptions from meeting the "vehicle" FMVSS and bumper standards applying to the vehicles, along with fuel economy standards, and labeling requirements. Each of these effects would be beneficial for low-volume replica vehicle manufacturers, by reducing barriers to market entry through lower production costs.

[16] Pursuant to 49 CFR Part 555, a manufacturer may petition for a temporary exemption on the bases of substantial economic hardship, making easier the development or field evaluation of new motor vehicle safety or impact protection, or low-emission vehicle features, or that compliance with a standard would prevent it from selling a vehicle with an overall level of safety or impact protection at least equal to that of non-exempted vehicles.

# II. COST IMPACTS

## A. Overview of Methods

This section discusses the methods used to calculate cost impacts associated with the rulemaking, including cost savings due to relaxing compliance with: FMVSS; bumper standards; and reporting and labeling requirements in areas within the scope of the proposed rule (e.g., fuel economy standards). The detailed calculations of these estimates are provided in Appendix A.

### A.1. Affected Vehicles and Standards

The unit of analysis is the component of each year's new vehicle fleet that would be comprised of replica passenger cars and replica LTVs[17] (trucks, MPVs,[18] and buses with a GVWR of 4,536 kilograms (10,000 pounds or less)). NHTSA does not anticipate the production of any other types of replica vehicles (i.e., motorcycles, trailers, low-speed vehicles[19], medium- and heavy-duty trucks, and buses) under the proposed rule; we request comment on this assumption. Estimates of per-vehicle impacts that would be observed for other replica vehicle types are presented in Appendix A, for cases where sufficient information was available.

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[17] LTVs consist of trucks of 10,000 pounds gross vehicle weight or less; pickups, vans, minivans, truck-based station wagons, and sport utility vehicles (SUVs). See: https://icsw nhtsa.gov/cars/problems/studies/LTV/.

[18] The term multipurpose passenger vehicle (MPV) encompasses vehicles that may be referred to as SUVs, crossovers, minivans, and full-size vans. However, not all SUVs, crossovers, minivans or full-size van are MPVs. NHTSA defines an MPV as "a motor vehicle with motive power, except a low-speed vehicle or trailer, designed to carry 10 persons or less which is constructed either on a truck chassis or with special features for occasional off-road operation."

[19] Low-speed vehicles are four-wheeled vehicles with a GVWR of less than 1,361 kilograms (3,000 pounds) and a top speed of between 20 and 25 miles per hour.

In this analysis, we assume that 40 manufacturers would each produce a combination of replica passenger cars and replica LTVs totaling 100-200 vehicles per year (4,000-8,000 vehicles per year across all manufacturers). This assumption was informed by: (1) a projection of California replica vehicle sales by the California Air Resources Board, along with state-level vehicle registration data[20]; and (2) available anecdotal information on firms that produce, or are interested in producing, replica vehicles consistent with those affected by the proposed rulemaking; we request comments on this assumption.

For passenger cars and LTVs, replica vehicles would be exempt from complying with the following FMVSS:

[20] The California Air Resources Board provided a projection of 400-500 replica vehicles sold in California each year under the proposed rule. NHTSA divided the midpoint of the range (450 vehicles per year) by the share of Californian vehicle registrations within total national vehicle registrations as reported by IHS Automotive in the National Vehicle Population Profile (approximately 11 percent) to identify an estimate of annual national replica vehicle production.

**Table 1: FMVSS for Cars and LTVs Included in the Analysis of Production Cost Savings**

| FMVSS No. | Safety Feature | FMVSS Effective Date |
|---|---|---|
| 101 | Controls and displays | 1/1/1968 |
| 102 | Transmission and starter interlock | 1/1/1968 |
| 103 | Windshield defrosting/defogging | 1/1/1968 |
| 104 | Windshield wipers | 1/1/1968 for cars, 1/1/1969 for LTVs |
| 105A | Dual master cylinders | 1/1/1968 for cars, 9/1/1983 for LTVs |
| 105B | Front disc brakes | 1/1/1976 for cars, 9/1/1981 for LTVs |
| 106 | Brake hoses | 1/1/1968 |
| 108 | Side-marker/center-high-mounted stop lamps | 1/1/1968-1/1/1969 |
| 111 | Rear visibility | 1/1/1968; 5/2018 for backup cameras |
| 113 | Hood latch system | 1/1/1969 |
| 114 | Theft and rollaway prevention | 1/1/1970 |
| 118 | Power windows | 1/1/1969 |
| 124 | Accelerator controls | 9/1/1973 |
| 126 | Electronic stability control systems | 2009-2012 |
| 135 | Brake systems | 9/1/2000 for cars, 9/1/2002 for LTVs |
| 138 | Tire pressure monitoring systems | 2006-2008 |
| 201 | Instrument panel improvements | 1/1/1968 for cars, 9/1/1981 for LTVs |
| 201B | Head impact upgrade (padding) | 1999-2003 |
| 202 | Head restraints | 1/1/1969 for cars, 9/1/1991 for LTVs |
| 203/204 | Energy-absorbing steering assemblies | 1/1/1968 |
| 205 | Glazing materials | 1/1/1968 |
| 206 | Improved door locks | 1/1/1968 |
| 207 | Door locks/sliding doors on LTVs | 1/1/1968 for cars, 1/1/1972 for LTVs |
| 208 | Lap belts | 1/1/1968 for cars, 7/1/1971 for LTVs |
| 208F | Three-point belts for outboard front seat occupants | 9/1/1973 for cars, 9/1/1976 for LTVs |
| 208G | Three-point belts for outboard rear seat occupants | 12/11/1989 for cars, 9/1/1991 for LTVs |
| 208H | Automatic two-point seat belts | 1986-1989 for cars only |
| 208I | Frontal air bags | 1987-1990 for cars, 1994-1997 for LTVs |
| 212 | Adhesive windshield bonding | 1/1/1970 for cars, 9/1/1978 for LTVs |
| 214A | Side door beams | 1/1/1973 for cars, 9/1/1993 for LTVs |
| 214B | TTI(d) reduction in two- and four-door cars | 1994-1997 |
| 214C | Curtain and side air bags | 2011-2015 |
| 216 | Roof crush resistance | 9/1/1973 for cars, 9/1/1993 for LTVs |
| 226 | Ejection mitigation | 2014-2017 |
| 301 | Fuel system integrity | 2006-2009 |
| 302 | Flammability of materials | 9/1/1972 |
| 401 | Interior trunk release | 9/1/2001 |

There is considerable uncertainty in the degree of regulatory relief replica vehicle manufacturers would incorporate into the vehicle manufacturing process under the proposed rule. That is, although the proposed rule would relax compliance requirements with all FMVSS and bumper standards, at least some replica vehicle manufacturers may comply voluntarily with at least some FMVSS and bumper standards. At a minimum, NHTSA expects replica vehicle manufacturers to provide three-point seat belts voluntarily. Every state except for New Hampshire mandates seat belts in all new passenger cars and LTVs; NHTSA believes it would be unrealistic to expect replica vehicle manufacturers to attempt to sell replica vehicles that would require retrofit seat belts in 49 states. In this analysis, NHTSA investigates the implications of state-level seat belt requirements by presenting benefit and cost impacts under a baseline in which all replica vehicle manufacturers provide three-point seat belts voluntarily (referred to as the *Voluntary Seat Belts* scenario).

However, NHTSA believes it is realistic to expect at least some replica vehicle manufacturers to avoid complying voluntarily with standards that would impair the resemblance of replica vehicles to the corresponding original vehicles. In this analysis, NHTSA investigates the implications of appearance constraints by presenting benefit and cost impacts under a baseline in which all replica vehicle manufacturers comply with all relevant standards except for those assumed to have the strongest effect on vehicle appearance: all air bags (affecting the appearance of steering wheels, dashboards, and the lining of the interior), roof crush resistance (affecting the appearance of pillars), and bumper standards. This scenario is referred to as the *Appearance Constraint* scenario).

We present estimates under the *Voluntary Seat Belts* and *Appearance Constraint* scenarios as upper and lower bounds, respectively, of the scope of impacts that would likely be observed under the proposed rule; we request comment on this assumption.

NHTSA acknowledges that the cost savings associated with relaxing safety compliance for replica vehicle manufacturers could feasibly be larger than those for large manufacturers, because smaller manufacturers would not be able to exploit economies of scale or produce their own compliant components in at least some cases. In turn, observed cost savings could be different to those estimated in this analysis even after controlling for all other factors. However, in the absence of information on variability in the costs safety technologies across current and potential vehicle manufacturers, NHTSA assumes in this analysis that the estimated cost savings are representative for replica vehicles. We request comment on this assumption.

For reference, we also present per-vehicle estimates under a baseline in which replica vehicle manufacturers relax compliance with all standards affected by the proposed rule (referred to as the *Full Exemption* scenario). However, NHTSA does not expect this scenario to be a realistic outcome under the proposed rule, due to both State laws requiring seat belt use and possible litigation concerns.

## A.2. Cost Impact Estimation Technique

Per-vehicle cost impacts are represented as the mitigated costs of complying with FMVSS, bumper standards, and reporting and labeling requirements. Estimated per-vehicle cost impacts do not include mitigated compliance test costs, because there are no such costs observed

under the status quo (i.e., compliance test costs are prohibitively high, and thus there are no compliant replica vehicles produced under the status quo).

The mitigated costs (or cost savings) are assumed to yield benefits that accrue fully to manufacturers (via producer surplus, as the difference between sales price and cost of production grows) and replica vehicle purchasers (via consumer surplus, as the difference between willingness-to-pay and sales price grows), consistent with economic theory. The estimated cost savings represent an incomplete share of the total incremental consumer and producer surplus under the proposed rule. That is, the development of a new replica vehicle industry is expected to generate incremental consumer and producer surplus due not only to the cost-saving effects of reducing safety compliance costs, but also due to broader effects from opening access to a new replica vehicle market. However, NHTSA does not have sufficient information on demand and supply for replica vehicles and their substitutes to estimate incremental consumer and producer surplus beyond the cost savings estimated in this section. Thus, the cost savings identified in this section serve as a partial measure of incremental consumer and producer surplus. The unquantifiable component of incremental consumer and producer surplus is recognized in Section III.E. We make no further assumptions on how the cost savings are allocated among producers and consumers; rather, we assume that each dollar saved in the production process yields a benefit of one dollar across producers and consumers.

Cost impact estimates for individual vehicles are multiplied by the number of vehicles assumed to be produced per year to generate estimates of total annual cost impacts for each vehicle category. The estimated cost impacts are assumed to occur at the time of vehicle manufacture (i.e., cost savings are realized when the vehicle is built).

Thus, the estimated discounted and undiscounted cost impacts are nearly equivalent for the year of manufacture: The discounted cost impacts for a given year of manufacture are equal to 98.5 percent and 96.7 percent of the undiscounted cost impacts at three-percent and seven-percent discount rates, respectively, based on a discount factor equal to $1/(1+r)^{t-0.5}$, where *r* equals the discount rate and *t* equals the year (and where the year is equal to one for the year of manufacture and sale). This specification accounts for an assumption that vehicles would be manufactured at a uniform rate throughout a given year (and thus the midpoint of the year, *t-0.5*, is the expected time that a given vehicle would be produced). A detailed discussion of the methods and calculations of potential cost impacts is presented in Appendix A.

## B. Total Cost Impacts

Total potential cost impacts are presented in Tables 2-6 below. These tables were derived in Appendix A, and readers are referred to Appendix A for details on the methods and assumptions used to calculate these results.

### B.1. Passenger Cars – Total Per-Vehicle Cost Impacts

The estimated undiscounted per-vehicle cost impacts for replica passenger cars presented in this section are itemized in Table 2:

**Table 2: Total Undiscounted Cost Impact – Replica Passenger Cars (2017 Dollars, per Vehicle)**

| Scenario | Passenger Cars Produced per Year | FMVSS Cost Impact | Bumper Standard Cost Impact | Reporting and Labeling Cost Impact | Total Cost Impact |
|---|---|---|---|---|---|
| Appearance Constraint | 3,600 | -$662.97 | -$134.14 | -$72.58 | -$869.69 |
| Appearance Constraint | 7,200 | -$662.97 | -$134.14 | -$36.29 | -$833.40 |
| Voluntary Seat Belts | 3,600 | -$2,035.06 | -$134.14 | -$72.58 | -$2,241.78 |
| Voluntary Seat Belts | 7,200 | -$2,035.06 | -$134.14 | -$36.29 | -$2,205.49 |
| Full Exemption | 3,600 | -$2,229.87 | -$134.14 | -$72.58 | -$2,436.59 |
| Full Exemption | 7,200 | -$2,229.87 | -$134.14 | -$36.29 | -$2,400.30 |

Total undiscounted per-vehicle cost impacts for replica passenger cars are estimated to be between -$2,242 and -$833 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. Applying discount factors to the total undiscounted per-vehicle benefits (which are assumed to accrue during the year of vehicle manufacture) yields estimates of total discounted benefits:

**Table 3: Total Discounted Cost Impacts – Replica Passenger Cars (2017 Dollars, per Vehicle)**

| Scenario | Passenger Cars Produced per Year | Total Cost Impact (3% Discount Rate) | Total Cost Impact (7% Discount Rate) |
|---|---|---|---|
| Appearance Constraint | 3,600 | -$857.46 | -$841.97 |
| Appearance Constraint | 7,200 | -$821.17 | -$805.68 |
| Voluntary Seat Belts | 3,600 | -$2,209.42 | -$2,168.42 |
| Voluntary Seat Belts | 7,200 | -$2,173.13 | -$2,132.13 |
| Full Exemption | 3,600 | -$2,401.37 | -$2,356.75 |
| Full Exemption | 7,200 | -$2,365.09 | -$2,320.46 |

At a three-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$2,209 and -$821 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. At a seven-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$2,168 and -$806 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily.

B.2. LTVs – Total Per-Vehicle Cost Impacts

The estimated undiscounted per-vehicle cost impacts for replica LTVs presented in this section are itemized in Table 4:

**Table 4: Total Undiscounted Cost Impacts – Replica LTVs (2017 Dollars, per Vehicle)**

| Scenario | Replica LTVs Produced per Year | FMVSS Cost Impact | Reporting and Labeling Cost Impact | Total Cost Impact |
|---|---|---|---|---|
| Appearance Constraint | 400 | -$632.45 | -$72.58 | -$705.03 |
| Appearance Constraint | 800 | -$632.45 | -$36.29 | -$668.74 |
| Voluntary Seat Belts | 400 | -$1,884.95 | -$72.58 | -$1,957.53 |
| Voluntary Seat Belts | 800 | -$1,884.95 | -$36.29 | -$1,921.24 |
| Full Exemption | 400 | -$2,099.24 | -$72.58 | -$2,171.82 |
| Full Exemption | 800 | -$2,099.24 | -$36.29 | -$2,135.53 |

Total undiscounted per-vehicle cost impacts for replica LTVs are estimated to be between -$1,958 and -$669 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. Applying discount factors to the total undiscounted per-vehicle cost

impact (which is assumed to accrue during the year of vehicle manufacture) yields estimates of total discounted per-vehicle cost impacts:

**Table 5: Total Discounted Cost Impacts – Replica LTVs (2017 Dollars, per Vehicle)**

| Scenario | Replica LTVs Produced per Year | Total Cost Impact (3% Discount Rate) | Total Cost Impact (7% Discount Rate) |
|---|---|---|---|
| Appearance Constraint | 400 | -$695.22 | -$682.79 |
| Appearance Constraint | 800 | -$658.93 | -$646.50 |
| Voluntary Seat Belts | 400 | -$1,929.34 | -$1,893.62 |
| Voluntary Seat Belts | 800 | -$1,893.06 | -$1,857.33 |
| Full Exemption | 400 | -$2,140.49 | -$2,100.78 |
| Full Exemption | 800 | -$2,104.20 | -$2,064.49 |

At a three-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$1,929 and -$659 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. At a seven-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$1,893 and -$646 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily.

B.3. Passenger Cars and LTVs Combined – Total Annual Cost Impact

The total discounted annual cost impact for replica vehicles is identified by multiplying the total discounted cost impact per vehicle by the number of vehicles that would be affected by the rulemaking each year. In this analysis, we assume that, each year, 40 manufacturers would produce a combination of 100-200 replica cars and LTVs combined per manufacturer, with passenger cars and LTVs comprising 90 percent and 10 percent of the total volume of replica

vehicles produced, respectively. Thus, we assume that 3,600-7,200 replica cars and 400-800 replica LTVs (and no other replica vehicles) would be produced each year. In turn, our estimate of total annual cost impact is equal to 3,600-7,200 multiplied by our estimate of total cost impact per replica passenger car, plus 400-800 multiplied by our estimate of total cost impact per replica LTV:

**Table 6: Total Annual Cost Impact**
**(Millions of 2017 Dollars)**

| Scenario | Annual Replica Vehicle Production | Undiscounted | 3% Discount Rate | 7% Discount Rate |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | -$3.4 | -$3.4 | -$3.3 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | -$6.5 | -$6.4 | -$6.3 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | -$8.9 | -$8.7 | -$8.6 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | -$17.4 | -$17.2 | -$16.8 |

The total annual undiscounted cost impact for replica vehicles is estimated to be between -$17.4 million and -$3.4 million when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. The total annual discounted cost impacts for replica vehicles are estimated to be between -$17.2 million and -$3.4 million at a three-percent discount rate when seat belts are provided voluntarily, and between -$16.8 million and -$3.3 million at a seven-percent discount rate when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily.

# III. BENEFIT IMPACTS

## A. Overview of Methods

This section itemizes the methods used to calculate impacts on benefits associated with the proposed rulemaking, which are estimated to include: impacts on safety arising from relaxing compliance with FMVSS, and impacts on property damage costs arising from relaxing compliance with bumper standards. NHTSA recognizes that incremental producer and consumer surplus under the proposed rule would likely exceed the magnitude of the production cost savings estimated in the preceding section. That is, the development of a new replica vehicle industry is expected to generate incremental consumer and producer surplus due not only to the cost-saving effects of reducing safety compliance costs, but also due to broader effects from opening access to a new replica vehicle market. The remainder of incremental producer and consumer surplus not identified in the preceding section also represents a benefit to producers and consumers.

However, NHTSA does not have sufficient information available on the demand and supply of replica vehicles and their substitutes to estimate the components of incremental producer and consumer surplus that are nor captured within the estimates of production cost savings. Rather, NHTSA specifies the unmeasured component of producer and consumer surplus as an unquantified benefit impact in this section. We request comment and information to enable the complete estimation of incremental producer and consumer surplus.

A.1. Affected Vehicles and Standards

The unit of analysis is the component of each year's new vehicle fleet that would be comprised of replica passenger cars and replica LTVs. The set of candidate replica vehicles includes all vehicles based on model years originally manufactured at least 25 years prior. In this analysis, we assume that 40 manufacturers would each produce a combination of replica passenger cars and replica LTVs totaling 100-200 vehicles per year (4,000-8,000 vehicles per year across all manufacturers), and that no other replica vehicles would be produced.

For passenger cars and LTVs, replica vehicles would be exempt from complying with the following FMVSS:

**Table 7: Exempted FMVSS Replica Cars and LTVs under the Proposed Rule**

| FMVSS No. | Safety Feature | FMVSS Effective Date |
|---|---|---|
| 101 | Controls and displays | 1/1/1968 |
| 102 | Transmission and starter interlock | 1/1/1968 |
| 103 | Windshield defrosting/defogging | 1/1/1968 |
| 104 | Windshield wipers | 1/1/1968 for cars, 1/1/1969 for LTVs |
| 105A | Dual master cylinders | 1/1/1968 for cars, 9/1/1983 for LTVs |
| 105B | Front disc brakes | 1/1/1976 for cars, 9/1/1981 for LTVs |
| 106 | Brake hoses | 1/1/1968 |
| 108 | Side-marker/center-high-mounted stop lamps | 1/1/1968-1/1/1969 |
| 111 | Rear visibility | 1/1/1968; 5/2018 for backup cameras |
| 113 | Hood latch system | 1/1/1969 |
| 114 | Theft and rollaway prevention | 1/1/1970 |
| 118 | Power windows | 1/1/1969 |
| 124 | Accelerator controls | 9/1/1973 |
| 126 | Electronic stability control systems | 2009-2012 |
| 135 | Brake systems | 9/1/2000 for cars, 9/1/2002 for LTVs |
| 138 | Tire pressure monitoring systems | 2006-2008 |
| 201 | Instrument panel improvements | 1/1/1968 for cars, 9/1/1981 for LTVs |
| 201B | Head impact upgrade (padding) | 1999-2003 |
| 202 | Head restraints | 1/1/1969 for cars, 9/1/1991 for LTVs |
| 203/204 | Energy-absorbing steering assemblies | 1/1/1968 |
| 205 | Glazing materials | 1/1/1968 |
| 206 | Improved door locks | 1/1/1968 |
| 207 | Door locks/sliding doors on LTVs | 1/1/1968 for cars, 1/1/1972 for LTVs |
| 208 | Lap belts | 1/1/1968 for cars, 7/1/1971 for LTVs |
| 208F | Three-point belts for outboard front seat occupants | 9/1/1973 for cars, 9/1/1976 for LTVs |
| 208G | Three-point belts for outboard rear seat occupants | 12/11/1989 for cars, 9/1/1991 for LTVs |
| 208H | Automatic two-point seat belts | 1986-1989 for cars only |
| 208I | Frontal air bags | 1987-1990 for cars, 1994-1997 for LTVs |
| 212 | Adhesive windshield bonding | 1/1/1970 for cars, 9/1/1978 for LTVs |
| 214A | Side door beams | 1/1/1973 for cars, 9/1/1993 for LTVs |
| 214B | TTI(d) reduction in two- and four-door cars | 1994-1997 |
| 214C | Curtain and side air bags | 2011-2015 |
| 216 | Roof crush resistance | 9/1/1973 for cars, 9/1/1993 for LTVs |
| 226 | Ejection mitigation | 2014-2017 |
| 301 | Fuel system integrity | 2006-2009 |
| 302 | Flammability of materials | 9/1/1972 |
| 401 | Interior trunk release | 9/1/2001 |

There is considerable uncertainty in the degree of regulatory relief replica vehicle manufacturers would incorporate into the vehicle manufacturing process under the proposed rule. That is, although the proposed rule would relax compliance requirements with all FMVSS and bumper standards, at least some replica vehicle manufacturers may comply voluntarily with at least some FMVSS and bumper standards. At a minimum, NHTSA expects replica vehicle manufacturers to provide three-point seat belts voluntarily. Every state except for New Hampshire mandates seat belts in all new passenger cars and LTVs; NHTSA believes it would be unrealistic to expect replica vehicle manufacturers to attempt to sell replica vehicles that would require retrofit seat belts in 49 states. In this analysis, NHTSA investigates the implications of state-level seat belt requirements by presenting benefit and cost impacts under a baseline in which all replica vehicle manufacturers provide three-point seat belts voluntarily (referred to as the *Voluntary Seat Belts* scenario).

However, NHTSA believes it is realistic to expect at least some replica vehicle manufacturers to avoid complying voluntarily with standards that would impair the resemblance of replica vehicles to the corresponding original vehicles. In this analysis, NHTSA investigates the implications of appearance constraints by presenting benefit and cost impacts under a baseline in which all replica vehicle manufacturers comply with all relevant standards except for those assumed to have the strongest effect on vehicle appearance: all air bags (affecting the appearance of steering wheels, dashboards, and the lining of the interior), roof crush resistance (affecting the appearance of pillars), and bumper standards. This scenario is referred to as the *Appearance Constraint* scenario).

We present estimates under the *Voluntary Seat Belts* and *Appearance Constraint* scenarios as upper and lower bounds, respectively, of the scope of impacts that would be

observed under the proposed rule; we request comment on this assumption. NHTSA acknowledges that the safety technologies provided by replica vehicle manufacturers could feasibly be less effective than those provided by large manufacturers. In turn, observed safety impacts could be different to those estimated in this analysis even after controlling for all other factors. However, in the absence of information on variability in the effectiveness of safety technologies across current and potential vehicle manufacturers, NHTSA assumes in this analysis that the estimated effectiveness of safety technologies for existing manufacturers is representative of the corresponding effectiveness in replica vehicles. We request comment on this assumption.

For reference, we also present per-vehicle estimates under a baseline in which replica vehicle manufacturers relax compliance with all standards affected by the proposed rule (referred to as the *Full Exemption* scenario). However, NHTSA does not expect this scenario to be a realistic outcome under the proposed rule, due to both State laws requiring seat belt use and possible litigation concerns.

A.2. Benefit Impact Estimation Technique

Per-vehicle benefit impacts are represented as the: (1) impacts on safety arising from relaxing compliance with FMVSS; and (2) impacts on property damage arising from relaxing compliance with bumper standards. Impacts on safety are modeled as the monetized value of the change (increase) in fatalities and injuries that are projected to occur under the proposed rule due to relaxing FMVSS compliance; these impacts are assumed to be borne by replica vehicle occupants and other travelers (i.e., people either traveling in replica vehicles, or those interacting with replica vehicles). Extant NHTSA analysis is used to estimate changes in fatality risk per

mile when relaxing FMVSS compliance; changes in per-mile risk are multiplied by estimates of total miles traveled per vehicle to yield estimates of changes in total risk per vehicle.

Impacts on property damage are modeled as: (1) the property damage costs represented within the estimates of comprehensive fatality and injury costs; and (2) the monetized value of the increase in property damage that is projected to occur under the proposed rule due to relaxing bumper standard compliance. Property damage impacts are assumed to be borne by replica vehicle owners and insurers.

Monetized safety impact estimates for individual vehicles are multiplied by the number of replica vehicles assumed to be produced per year to generate monetized estimates of total annual safety impacts. The estimated impacts for each vehicle are assumed to occur at a constant rate for each year across a 30-year vehicle lifetime, based on the 30-year passenger vehicle lifetime represented within the CAFE Model. The 30-year lifetime represents a period over which: (a) replica vehicles would be driven at assumed annual rates (i.e., the vehicles would be used rather than having been scrapped or otherwise taken out of service at that point); and (b) assumed per-mile fatality and injury risk are representative (i.e., beyond 30 years, structural changes in the vehicle fleet may change safety risk considerably). We request comment on this assumption.

The discounted costs for a given year that a replica vehicle is driven are equal to $1/(1+r)^{t-0.5}$, where *r* equals the discount rate (either three percent or seven percent) and *t* equals the year (and where the year is equal to one for the year of manufacture and sale). This specification accounts for an assumption that vehicles would be manufactured and driven at uniform rates throughout a given year (and thus the midpoint of the year is the expected time that a given vehicle would be produced and begin to be driven).

Details of these calculations are presented in Appendix A of this analysis.

### B. Total Quantifiable Benefit Impacts

Total discounted quantifiable benefit impacts for each vehicle type derived from Appendix A are presented in the tables below.

B.1. Passenger Cars – Total Quantifiable Benefit Impacts

The estimated discounted quantifiable per-vehicle benefit impacts for replica passenger cars presented in Appendix A are itemized in Table 8 and Table 9. Increases in monetized safety and property damage impacts represent negative benefit impacts:

**Table 8: Total Discounted Quantifiable Benefit Impacts – Replica Passenger Cars (2017 Dollars, per Vehicle, 3% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Property Damage Benefit Impact | Total Benefit Impact |
|---|---|---|---|---|
| Appearance Constraint | Low | -$995.87 | -$72.01 | -$1,067.88 |
| Appearance Constraint | High | -$2,309.91 | -$168.75 | -$2,478.66 |
| Voluntary Seat Belts | Low | -$3,544.28 | -$72.01 | -$3,616.29 |
| Voluntary Seat Belts | High | -$8,280.08 | -$168.75 | -$8,448.82 |
| Full Exemption | Low | -$6,226.36 | -$72.01 | -$6,298.37 |
| Full Exemption | High | -$14,563.36 | -$168.75 | -$14,732.11 |

**Table 9: Total Discounted Quantifiable Benefit Impacts – Replica Passenger Cars (2017 Dollars, per Vehicle, 7% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Property Damage Benefit Impact | Total Benefit Impact |
|---|---|---|---|---|
| Appearance Constraint | Low | -$741.80 | -$51.76 | -$793.56 |
| Appearance Constraint | High | -$1,723.86 | -$121.29 | -$1,845.14 |
| Voluntary Seat Belts | Low | -$2,649.24 | -$51.76 | -$2,701.00 |
| Voluntary Seat Belts | High | -$6,192.40 | -$121.29 | -$6,313.68 |
| Full Exemption | Low | -$4,656.71 | -$51.76 | -$4,708.47 |
| Full Exemption | High | -$10,895.29 | -$121.29 | -$11,016.58 |

At a three-percent discount rate, total discounted quantifiable per-vehicle benefit impacts for replica passenger cars are estimated to be between -$8,449 and -$1,068 under the two baselines. At a seven-percent discount rate, total discounted quantifiable per-vehicle benefit impacts for replica passenger cars are estimated to be between -$6,314 and -$794 under the two baselines.

B.2. LTVs – Total Quantifiable Benefit Impacts

The estimated discounted quantifiable per-vehicle benefit impacts for replica LTVs presented in Appendix A are itemized in Table 10 and Table 11. Increases in monetized safety impacts represent negative benefit impacts:

**Table 10: Total Discounted Quantifiable Benefit Impacts – Replica LTVs (2017 Dollars, per Vehicle, 3% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Total Benefit Impact |
|---|---|---|---|
| Appearance Constraint | Low | $744.25 | $744.25 |
| Appearance Constraint | High | $1,786.06 | $1,786.06 |
| Voluntary Seat Belts | Low | $3,920.64 | $3,920.64 |
| Voluntary Seat Belts | High | $9,514.04 | $9,514.04 |
| Full Exemption | Low | $7,696.43 | $7,696.43 |
| Full Exemption | High | $18,700.31 | $18,700.31 |

**Table 11: Total Discounted Quantifiable Benefit Impacts – Replica LTVs (2017 Dollars, per Vehicle, 7% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Total Benefit Impact |
|---|---|---|---|
| Appearance Constraint | Low | $547.65 | $547.65 |
| Appearance Constraint | High | $1,317.49 | $1,317.49 |
| Voluntary Seat Belts | Low | $2,899.36 | $2,899.36 |
| Voluntary Seat Belts | High | $7,039.07 | $7,039.07 |
| Full Exemption | Low | $5,694.84 | $5,694.84 |
| Full Exemption | High | $13,840.33 | $13,840.33 |

At a three-percent discount rate, total quantifiable discounted per-vehicle benefit impacts for replica LTVs are estimated to be between -$9,514 and -$744 under the two baselines. At a

seven-percent discount rate, total discounted quantifiable per-vehicle benefit impacts for replica passenger cars are estimated to be between -$7,039 and -$548 under the two baselines.

B.3. Passenger Cars and LTVs Combined – Total Quantifiable Benefit Impacts

Total discounted quantifiable annual benefit impacts for replica vehicles derived from Appendix A presented below in Tables 12-14. As discussed in Appendix A, these represent an assumed 3600-7200 replica cars and 400-800 replica LTVs produced annually.

**Table 12: Total Annual Discounted Quantifiable Benefit Impacts (Millions of 2017 Dollars, Upper Bound, when 3,600-7,200 Replica Cars and 400-800 Replica LTVs Are Produced across 40 Manufacturers)**

| Scenario | Annual Production | VMT | Total Benefit Impact (3% Discount Rate) | Total Benefit Impact (7% Discount Rate) |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | -$4.1 | -$3.1 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | -$9.6 | -$7.2 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | -$8.3 | -$6.2 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | -$19.3 | -$14.3 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | -$14.6 | -$10.9 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | -$34.2 | -$25.5 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | -$29.2 | -$21.8 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | -$68.4 | -$51.1 |

At a three-percent discount rate, total annual quantifiable benefit impacts are estimated to be between -$68.4 million and -$4.1 million under the two baselines. At a seven-percent discount rate, total annual quantifiable benefit impacts are estimated to be between -$51.1 million and -$3.1 million under the two baselines.

Consistent with the calculation of total annual benefit impacts, total annual incremental fatalities and fatality equivalents are estimated as the discounted sum of annual incremental fatalities and fatality equivalents per vehicle multiplied by the number of vehicles produced per year:

**Table 13: Total Annual Discounted Incremental Fatalities (Millions of 2017 Dollars, Upper Bound, when 3,600-7,200 Replica Cars and 400-800 Replica LTVs Are Produced across 40 Manufacturers, 3% Discount Rate)**

| Scenario | Annual Production | VMT | Incremental Fatalities | Incremental Fatality Equivalents |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | 0.15 | 0.39 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | 0.36 | 0.91 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | 0.31 | 0.78 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | 0.72 | 1.82 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | 0.57 | 1.44 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | 1.34 | 3.39 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | 1.14 | 2.89 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | 2.67 | 6.77 |

**Table 14: Total Annual Discounted Incremental Fatalities (Millions of 2017 Dollars, Upper Bound, when 3,600-7,200 Replica Cars and 400-800 Replica LTVs Are Produced across 40 Manufacturers, 7% Discount Rate)**

| Scenario | Annual Production | VMT | Incremental Fatalities | Incremental Fatality Equivalents |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | 0.11 | 0.29 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | 0.27 | 0.68 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | 0.23 | 0.58 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | 0.54 | 1.36 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | 0.43 | 1.08 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | 1.00 | 2.53 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | 0.85 | 2.15 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | 2.00 | 5.06 |

At a three-percent discount rate, total annual incremental fatality equivalents are estimated to be between 0.39 and 6.77 under the two baselines (0.15 to 2.67 fatalities). At a seven-percent discount rate, total annual incremental fatality equivalents are estimated to be between 0.29 and 5.06 under the two baselines (0.11 to 2.00 fatalities).

## C. Unquantified Benefit Impacts

C.1. Incremental Consumer Surplus

The proposed rule is expected to enable the development of the market for replica vehicles by reducing barriers to entry for replica vehicle manufacturers. By making replica vehicles available, the proposed rule would generate at least some measure of consumer and producer surplus in addition to the impacts described in this analysis. That is, the development of a new replica vehicle industry is expected to generate incremental consumer and producer surplus due not only to the cost-saving effects of reducing safety compliance costs, but also due to broader effects from opening access to a new replica vehicle market. NHTSA does not have sufficient information available regarding the demand for, and potential supply of, replica vehicles and their substitutes to quantify the incremental consumer and producer surplus that would arise under the proposed rule.

Thus, the share of incremental consumer and producer surplus not comprised of the cost savings identified in the preceding section is an unquantified benefit. Although it is unquantified, we believe it is an important consideration because the added risks associated with driving replica vehicles would be implicitly voluntarily accepted by purchasers of these vehicles. This implies that, depending on the portion of safety costs that represent externalities, societal benefits may actually exceed the costs of added safety risk from driving vehicles with less safety equipment. We request comment and information on the demand and supply of replica vehicles and their substitutes.

C.2. Innovation

The proposed rule implements a statutory mandate that removes certain regulatory constraints for small volume manufacturers. As required by the statute implemented in this rule, certain vehicles sold by small volume manufacturers would not be subject to fuel economy standards under the CAFE program or certain FMVSS as long as replica vehicles meet the requirements, such as appearance of a vehicle manufactured at least 25 years prior.

By creating a market for a new class of vehicles, the proposed rule would enable new opportunities for innovation that could enable the inclusion of safety technologies that are not required by FMVSS for replica vehicles. The scenarios examined in this preliminary analysis assume manufacturers would produce vehicles without safety standards that would interfere with the original vehicle designs. These include technologies such as air bags, stronger bumpers, improved roof crush, and other standards that would compromise the original vehicle designs that they are trying to replicate.

Potentially, manufacturers might find innovative ways to incorporate some of these standards into the replica designs. To the extent that this occurs, the estimates provided in this analysis might overstate both cost savings and safety impacts from this rule. To the extent that innovation modifies the design and price of replica vehicles, this will influence the consumer surplus experienced by replica vehicle buyers, which, as noted above, we are currently unable to measure. However, it is also possible that innovation could have broader applications that affect the larger OEM markets.

Prior studies have concluded that deregulation can stimulate innovation[21]. Removing regulatory constraints would allow manufacturers some opportunity to design innovations within the definitions of the rule. For example, an innovation might include provision of safety features that meet the objective of the FMVSS while not succeeding in strict compliance with the FMVSS or successful demonstration of test standards performance. Additional innovations might include systems of manufacture, digital features that could not be provided with technologies available to original vehicles now eligible to be replicated, engine configuration and performance, or materials used in certain aspects of manufacture.

Some studies have concluded that regulatory flexibility helps to promote innovation, and that less prescriptive economic regulations allowed market innovation to increase markedly[22]. Reduction of economic regulatory constraints among airlines in the 1970s are associated with subsequent price decreases and expanded services[23]. In the healthcare sector, the relationship between regulation and innovation is recognized in the development of medical devices[24]. Removal of tax and other restrictions on home and small brewers at both the federal and state levels is widely recognized as a necessary precursor to the dramatic expansion of the craft brew industry in the United States[25].

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[21] See, for example, https://www.oecd.org/sti/inno/2102514.pdf

[22] See, for examples from multiple industries, https://www.itif.org/files/2011-impact-regulation-innovation.pdf

[23] https://www.mercatus.org/publication/unleashing-innovation-deregulation-air-cargo-transportation

[24] https://www.nejm.org/doi/full/10.1056/NEJMp1109094

[25] https://www.theatlantic.com/business/archive/2018/01/craft-beer-industry/550850/

Some authors find that certain regulations stimulate innovation, and hence a reduction of regulation might be found to provide negative innovation benefits. Certain innovations might be needed for compliance with social regulations, for example, or public confidence in product safety might be strengthened by safety regulations[26].

While it is not possible to predict what innovations in the design, manufacture or performance of replica vehicles might result from a lessening of constraints as outlined in the proposed rule, it is reasonable to anticipate qualitatively that some innovation may be a benefit resulting from the final rule. We request comments on the impact on innovation that could result from enabling the production of replica cars.

C.3. Employment Impacts

The production of replica vehicles will result in the creation of employment opportunities to design, manufacture, assemble, and market these vehicles, as well as the need for administrative and management capabilities. The extent of these jobs will be a function of the number of vehicles sold annually, as well as the operational and production requirements within each business that chooses to market these vehicles. Potentially offsetting a portion of these jobs might be job losses in businesses that currently assemble and sell parts for existing kit cars. This would be a function of the extent to which replica vehicles become replacements for kit car

[26] See, for example, http://www.innovation-policy.org.uk/share/02_The%20Impact%20of%20Regulation%20on%20Innovation.pdf

sales. NHTSA requests comments on the scope of potential market sales for replica vehicles, and the extent to which these sales may come from existing demand for kit cars.

C.4. Fuel Consumption Impacts

The FMVSS have resulted in motor vehicles becoming safer, but heavier. Relaxing FMVSS compliance requirements would thus result in vehicles that are lighter than fully-compliant alternatives. In turn, these lighter vehicles would consume less fuel for a given volume of travel than fully-compliant alternatives.

The specific effect of the proposed rule on fuel consumption is less clear, however, due to uncertainty in the mass and fuel economy of both replica vehicles and their substitutes. We have not calculated fuel consumption impacts within quantified cost impacts due to this uncertainty. To gain an understanding of the potential scope of fuel consumption impacts, we applied a formula linking changes in vehicle mass to changes in fuel consumption to the VMT schedules considered in this analysis, conditional on assumptions regarding vehicle mass and fuel economy. The formula is:

$$\textit{Change in fuel economy} = (\textit{Change in vehicle mass})^{0.8} \times \textit{Baseline fuel economy}$$

In the following example we assume that: (1) all replica vehicle VMT displace VMT in a relatively lightweight (sporty) vehicle of equivalent mass (3,000 pounds) and fuel economy (20 miles per gallon); (2) per Simons (2017), the mitigated vehicle mass associated with relaxing compliance with the FMVSS in passenger cars is approximately 170 pounds; (3) replica vehicles

incorporate half of the potential weight reduction feasible under the proposed rule (85 pounds); and (4) fuel has a constant cost of $2.50 per gallon in 2017 dollars.

Under these assumptions, the above formula yields estimated per-vehicle lifetime fuel consumption savings of between 33 and 78 gallons per replica vehicle, with a corresponding undiscounted per-vehicle fuel cost savings of between $83 and $194 per vehicle ($64-$149 per vehicle at a three-percent discount rate, and $41-$96 at a seven-percent discount rate). Applying the per-vehicle estimates to assumed annual production of 4,000-8,000 vehicles yields total annual fuel consumption savings of between 133,000 and 622,000 gallons, with a corresponding undiscounted total fuel cost savings of between $332,000 and $1.6 million ($254,000-$1.2 million at a three-percent discount rate, and $164,000-$769,000 at a seven-percent discount rate).

We request comment on assumptions regarding the effects of mass reduction associated with foregone FMVSS compliance on replica vehicle fuel consumption and fuel costs.

# IV. COST-EFFECTIVENESS AND NET BENEFITS

## A. Cost-Effectiveness

Cost-effectiveness represents a measure of the average monetary cost (or cost savings) per unit of change. In conventional safety regulatory analyses, cost-effectiveness would measure the average estimated change in total costs per unit improvement in safety (e.g., cost per life saved). In cases such as this analysis, evaluating *relaxing* safety standards, cost-effectiveness can be measured in terms of average cost savings per incremental fatality (or per incremental fatality equivalent, including injury).

In conventional safety regulatory analyses, a policy alternative can be considered cost effective if the estimated cost per unit increase is less than an appropriate benchmark. For example, a proposed safety standard could be considered cost effective if the average cost per life saved equivalent (i.e., combining lives saved and injuries avoided, weighted by the relative values of injuries to fatalities) under the proposed standard were less than the value of a statistical life. That is, the proposed standard would yield safety benefits at a lower cost than the benchmark value for those benefits. In this analysis, the proposed rule can be considered cost effective if the estimated cost savings per unit increase are *greater* than an appropriate benchmark. Thus, the proposed rule would be cost effective if the estimated average cost savings per incremental fatality equivalent are greater than the comprehensive economic cost of a fatality.

A.1. Passenger Cars – Cost-Effectiveness

At a three-percent discount rate, the safety cost analysis estimated between 0.00004 and 0.00033 incremental fatality per replica passenger car under the two baselines (between 0.00003 and 0.00025 at a seven-percent discount rate). Accounting for the estimate of 1.53 equivalent incremental fatalities across non-fatal injury categories, the proposed rule is estimated to result in between 0.00010 and 0.00083 incremental fatality per replica passenger car at a three-percent discount rate under the two baselines (between 0.00007 and 0.00062 at a seven-percent discount rate).

The benefits analysis estimated total per-vehicle cost savings of between $821.17 and $2,209.42 at a three-percent discount rate under the two baselines (between $805.68 and $2,168.42 at a seven-percent discount rate).

Estimates of cost-effectiveness for replica passenger cars are identified here by dividing the estimates of *net* cost savings per vehicle (i.e., net of incremental property damage costs) by the estimates of incremental fatality equivalents per vehicle:

**Table 15: Cost-Effectiveness Estimates – Replica Passenger Cars (3% Discount Rate)**

| Scenario | Annual Production | VMT | Cost Impact per Vehicle | Safety Effect per Vehicle (Fatality Equivalents) | Cost-Effectiveness (Mil. $ per Fatality Equivalent) |
|---|---|---|---|---|---|
| Appearance Constraint | 3,600 | Low Case | -$785.45 | 0.00010 | $7.8 |
| Appearance Constraint | 3,600 | High Case | -$688.72 | 0.00023 | $4.2 |
| Appearance Constraint | 7,200 | Low Case | -$749.16 | 0.00010 | $7.4 |
| Appearance Constraint | 7,200 | High Case | -$652.43 | 0.00023 | $3.9 |
| Voluntary Seat Belts | 3,600 | Low Case | -$2,137.41 | 0.00036 | $6.0 |
| Voluntary Seat Belts | 3,600 | High Case | -$2,040.68 | 0.00083 | $2.4 |
| Voluntary Seat Belts | 7,200 | Low Case | -$2,101.12 | 0.00036 | $5.9 |
| Voluntary Seat Belts | 7,200 | High Case | -$2,004.39 | 0.00083 | $2.4 |

**Table 16: Cost-Effectiveness Estimates – Replica Passenger Cars (7% Discount Rate)**

| Scenario | Annual Production | VMT | Cost Impact per Vehicle | Safety Effect per Vehicle (Fatality Equivalents) | Cost-Effectiveness (Mil. $ per Fatality Equivalent) |
|---|---|---|---|---|---|
| Appearance Constraint | 3,600 | Low Case | -$790.21 | 0.00007 | $10.6 |
| Appearance Constraint | 3,600 | High Case | -$720.68 | 0.00017 | $4.2 |
| Appearance Constraint | 7,200 | Low Case | -$753.92 | 0.00007 | $10.1 |
| Appearance Constraint | 7,200 | High Case | -$684.39 | 0.00017 | $3.9 |
| Voluntary Seat Belts | 3,600 | Low Case | -$2,116.66 | 0.00027 | $7.9 |
| Voluntary Seat Belts | 3,600 | High Case | -$2,047.13 | 0.00062 | $3.3 |
| Voluntary Seat Belts | 7,200 | Low Case | -$2,080.37 | 0.00027 | $7.8 |
| Voluntary Seat Belts | 7,200 | High Case | -$2,010.84 | 0.00062 | $3.2 |

Under both discount rates, only two of the cost-effectiveness measures exceed the comprehensive cost of a fatality ($9.9 million in 2017 dollars) – the measures for the *Appearance Constraint* scenario with the lower VMT assumption ($10.1 million to $10.6 million at a seven-percent discount rate depending upon the level of annual production, exceeding the comprehensive cost of a fatality by between $0.2 million and $0.7 million). Thus, the cost-effectiveness analysis indicates that the proposed rule would not be cost effective unless: (1) the proposed rule has a small effect on the composition of replica vehicles; (2) travel demand for replica vehicles is low; and (3) a seven-percent discount rate is used to discount safety impacts. Variations in cost-effectiveness across discount rates reflect differences in timing between safety impacts (accrued at a constant rate over the lifetime of the vehicle) and lower manufacturing

costs (accrued at the time of manufacture). It is important to note that the estimates of cost-effectiveness in this analysis are not appropriate for use as a retrospective analysis of the safety standards affected by the proposed rule. Rather, the cost-effectiveness estimates are strictly conditional on the assumptions regarding VMT for replica vehicles.

A.2. LTVs – Cost-Effectiveness

At a three-percent discount rate, the safety cost analysis estimated between 0.00002 and 0.00038 incremental fatality per replica LTVs under the two baselines (between 0.00006 and 0.00028 at a seven-percent discount rate). Accounting for the estimate of 1.53 equivalent incremental fatalities across non-fatal injury categories, the proposed rule is estimated to result in between 0.00008 and 0.00096 incremental fatality per replica LTV at a three-percent discount rate under the two baselines (between 0.00006 and 0.00071 at a seven-percent discount rate).

The benefits analysis estimated total per-vehicle cost savings of between $658.93 and $1,929.34 at a three-percent discount rate under the two baselines (between $646.50 and $1,893.62 at a seven-percent discount rate).

Estimates of cost-effectiveness for replica passenger cars are identified here by dividing the estimates of *net* cost savings per vehicle (i.e., net of incremental property damage costs) by the estimates of incremental fatality equivalents per vehicle:

**Table 17: Cost-Effectiveness Estimates – Replica LTVs (3% Discount Rate)**

| Scenario | Annual Production | VMT | Cost Impact per Vehicle | Safety Effect per Vehicle (Fatality Equivalents) | Cost-Effectiveness (Mil. $ per Fatality Equivalent) |
|---|---|---|---|---|---|
| Appearance Constraint | 400 | Low Case | -$695.22 | 0.00008 | $9.3 |
| Appearance Constraint | 400 | High Case | -$695.22 | 0.00018 | $3.9 |
| Appearance Constraint | 800 | Low Case | -$658.93 | 0.00008 | $8.8 |
| Appearance Constraint | 800 | High Case | -$658.93 | 0.00018 | $3.7 |
| Voluntary Seat Belts | 400 | Low Case | -$1,929.34 | 0.00040 | $4.9 |
| Voluntary Seat Belts | 400 | High Case | -$1,929.34 | 0.00096 | $2.0 |
| Voluntary Seat Belts | 800 | Low Case | -$1,893.05 | 0.00040 | $4.8 |
| Voluntary Seat Belts | 800 | High Case | -$1,893.05 | 0.00096 | $2.0 |

**Table 18: Cost-Effectiveness Estimates – Replica LTVs (7% Discount Rate)**

| Scenario | Annual Production | VMT | Cost Impact per Vehicle | Safety Effect per Vehicle (Fatality Equivalents) | Cost-Effectiveness (Mil. $ per Fatality Equivalent) |
|---|---|---|---|---|---|
| Appearance Constraint | 400 | Low Case | -$682.79 | 0.00006 | $12.4 |
| Appearance Constraint | 400 | High Case | -$682.79 | 0.00013 | $5.1 |
| Appearance Constraint | 800 | Low Case | -$646.50 | 0.00006 | $11.7 |
| Appearance Constraint | 800 | High Case | -$646.50 | 0.00013 | $4.9 |
| Voluntary Seat Belts | 400 | Low Case | -$1,893.62 | 0.00029 | $6.5 |
| Voluntary Seat Belts | 400 | High Case | -$1,893.62 | 0.00071 | $2.7 |
| Voluntary Seat Belts | 800 | Low Case | -$1,857.33 | 0.00029 | $6.4 |
| Voluntary Seat Belts | 800 | High Case | -$1,857.33 | 0.00071 | $2.6 |

Under both discount rates, only two of the cost-effectiveness measures exceeds the comprehensive cost of a fatality ($9.9 million in 2017 dollars) – the measures for the *Appearance Constraint* scenario with the lower VMT assumption ($11.7 million to $12.4 million at a seven-percent discount rate depending upon the level of annual production). Thus, the cost-effectiveness analysis indicates that the proposed rule would not be cost effective unless: (1) the proposed rule has a small effect on the composition of replica vehicles; (2) travel demand for replica vehicles is low; and (3) a seven-percent discount rate is used to discount safety impacts. It is important to note that the estimates of cost-effectiveness in this analysis are not appropriate for use as a retrospective analysis of the safety standards affected by the proposed rule. Rather,

the cost-effectiveness estimates are strictly conditional on the assumptions regarding VMT for replica vehicles.

A.3. Passenger Cars and LTVs Combined – Cost-Effectiveness

NHTSA assumes that, under the proposed rule, 40 replica vehicle manufacturers each would produce 100-200 replica passenger cars and LTVs combined per year.

NHTSA assumes further that 90 percent of replica light-duty vehicles produced under the proposed rule will be passenger cars, while 10 percent will be LTVs. By combining the above cost-effectiveness estimates for passenger cars and LTVs with the assumptions on annual vehicle production, we obtain the following estimates of overall cost-effectiveness:

**Table 19: Cost-Effectiveness Estimates – Annual Sales Mix of 90% Passenger Cars and 10% LTVs (3% Discount Rate)**

| Scenario | Annual Production | VMT | Cost Impact per Vehicle | Safety Effect per Vehicle (Fatality Equivalents) | Cost-Effectiveness (Mil. $ per Fatality Equivalent) |
|---|---|---|---|---|---|
| Appearance Constraint | 4,000 | Low Case | -$776.43 | 0.00010 | $8.0 |
| Appearance Constraint | 4,000 | High Case | -$689.37 | 0.00023 | $3.1 |
| Appearance Constraint | 8,000 | Low Case | -$740.14 | 0.00010 | $7.6 |
| Appearance Constraint | 8,000 | High Case | -$653.08 | 0.00023 | $2.9 |
| Voluntary Seat Belts | 4,000 | Low Case | -$2,116.61 | 0.00036 | $5.9 |
| Voluntary Seat Belts | 4,000 | High Case | -$2,029.54 | 0.00085 | $2.4 |
| Voluntary Seat Belts | 8,000 | Low Case | -$2,080.32 | 0.00036 | $5.8 |
| Voluntary Seat Belts | 8,000 | High Case | -$1,993.25 | 0.00085 | $2.4 |

**Table 20: Cost-Effectiveness Estimates – Annual Sales Mix of 90% Passenger Cars and 10% LTVs (7% Discount Rate)**

| Scenario | Annual Production | VMT | Cost Impact per Vehicle | Safety Effect per Vehicle (Fatality Equivalents) | Cost-Effectiveness (Mil. $ per Fatality Equivalent) |
|---|---|---|---|---|---|
| Appearance Constraint | 4,000 | Low Case | -$779.47 | 0.00007 | $10.8 |
| Appearance Constraint | 4,000 | High Case | -$716.89 | 0.00017 | $4.3 |
| Appearance Constraint | 8,000 | Low Case | -$743.18 | 0.00007 | $10.3 |
| Appearance Constraint | 8,000 | High Case | -$680.60 | 0.00017 | $4.0 |
| Voluntary Seat Belts | 4,000 | Low Case | -$2,094.35 | 0.00027 | $7.8 |
| Voluntary Seat Belts | 4,000 | High Case | -$2,031.78 | 0.00063 | $3.2 |
| Voluntary Seat Belts | 8,000 | Low Case | -$2,058.06 | 0.00027 | $7.7 |
| Voluntary Seat Belts | 8,000 | High Case | -$1,995.49 | 0.00063 | $3.2 |

NHTSA estimates cost-effectiveness for replica passenger cars and LTVs would be between $2.4 million and $8.0 million saved per incremental fatality equivalent at a three-percent discount rate, and between $3.2 million and $10.8 million saved per fatality equivalent at a seven-percent discount rate. Consistent with the analysis of passenger cars and LTVs independently, the only scenario in which the proposed rule is estimated to be cost-effective is when: (1) the proposed rule has a small effect on the composition of replica vehicles; (2) travel demand for replica vehicles is low; and (3) a seven-percent discount rate is used to discount safety impacts.

## B. Net Benefits

Net benefits represent the difference between total benefits and total costs. In regulatory analysis, net benefits is used as an absolute measure of how much better off society would be (in dollar terms) if a policy alternative were enacted; a positive value for net benefits indicates that society would be better off under the policy alternative, and a negative value indicates that society would be worse off.

In cases such as this analysis, evaluating *relaxing* safety standards, net benefits of the proposed rule would be positive if the cost savings associated with relaxing standards are larger than the social costs of incremental fatalities, injuries, and property damage. That is, positive net benefits would confirm that the proposed rule is expected to generate production cost savings that exceed the expected safety costs. Conversely, negative net benefits indicate that the social costs associated with relaxing standards are larger than the corresponding production cost savings.

Estimates of discounted net benefits per year affected by the proposed rule are found by subtracting the estimated total cost impacts from the estimated total benefit impacts[27]:

[27] Benefit impacts and net benefits do not include unquantified incremental consumer surplus and incremental producer surplus.

**Table 21: Total Annual Discounted Net Benefits**
**(Millions of 2017 Dollars, 3% Discount Rate)**

| Scenario | Annual Production | VMT | Total Benefit Impact | Total Cost Impact | Net Benefits |
|---|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | -$4.1 | -$3.4 | -$0.8 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | -$9.6 | -$3.4 | -$6.3 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | -$8.3 | -$6.4 | -$1.8 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | -$19.3 | -$6.4 | -$12.8 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | -$14.6 | -$8.7 | -$5.9 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | -$34.2 | -$8.7 | -$25.5 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | -$29.2 | -$17.2 | -$12.0 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | -$68.4 | -$17.2 | -$51.3 |

**Table 22: Total Annual Discounted Net Benefits (Millions of 2017 Dollars, 7% Discount Rate)**

| Scenario | Annual Production | VMT | Total Benefit Impact | Total Cost Impact | Net Benefits |
|---|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | -$3.1 | -$3.3 | $0.2 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | -$7.2 | -$3.3 | -$3.9 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | -$6.2 | -$6.3 | $0.2 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | -$14.3 | -$6.3 | -$8.0 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | -$10.9 | -$8.6 | -$2.3 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | -$25.5 | -$8.6 | -$17.0 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | -$21.8 | -$16.8 | -$4.9 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | -$51.1 | -$16.8 | -$34.3 |

Consistent with the cost-effectiveness analysis, the estimated net benefits for replica passenger cars under the proposed rule are negative in all cases except in the *Appearance Constraint* scenario under the low VMT assumption at a seven-percent discount rate, in which case net benefits are positive but very close to zero ($0.2 million). At a three-percent discount rate, net benefits are negative but near zero (-$1.8 million to -$0.8 million) in the *Appearance Constraint* scenario under the low VMT assumption. Net benefits are negative in the *Voluntary Seat Belts* scenario under the high VMT assumption at both discount rates (-$51.3 million to -$2.3 million). These results indicate that the proposed rule is expected to: (1) generate safety costs exceeding the corresponding production cost savings across most combinations of key assumptions in the analysis; and (2) generate safety costs similar in magnitude to the corresponding production cost savings under the most conservative assumptions in the analysis.

Variations in net benefits across discount rates reflect differences in timing between benefit impacts (accrued at a constant rate over the lifetime of the vehicle) and cost impacts (accrued at the time of manufacture). It is important to note that the estimates of net benefits are not appropriate for use as a retrospective analysis of the safety standards affected by the proposed rule. Rather, the net benefits estimates are strictly conditional on the assumptions regarding VMT for replica vehicles.

## V. UNFUNDED MANDATES REFORM ACT

The Unfunded Mandates Reform Act of 1995 (Public Law 104-4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditures by States, local or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually (adjusted annually for inflation with base year of 1995). Adjusting this amount by the implicit gross domestic product price deflator for 2017 results in an equivalent threshold of $150 million in 2017 dollars (107.948/71.868 = 1.50). The assessment may be included in conjunction with other assessments, as it is here.

The proposed rule on replica vehicles is not likely to result in expenditures by State, local or tribal governments of more than $150 million annually. The estimated annual change in discounted societal benefits is between -$68.4 million and -$4.1 million at a three-percent discount rate (between -$51.1 million and -$3.1 million at a seven-percent discount rate).

# Appendix A. Calculation of Costs and Benefits

## Appendix A.1. Calculation of Potential Impacts on Costs

Appendix A.1.a. Passenger Cars – FMVSS Requirements

Simons (2017)[28] provides estimates of the set of identifiable incremental vehicle production costs associated with FMVSS relevant to passenger cars in this rulemaking. Simons' analysis is based on cost teardown studies for MY 1968 through 2012 vehicles. All estimates presented here were converted from 2012 dollars to 2017 dollars using the Bureau of Economic Analysis' GDP Price Deflator[29]:

[28] Simons, J. F. (2017). *Cost and Weight Added by the Federal Motor Vehicle Safety Standards for Model Years 1968-2012 in Passenger Cars And LTVs*. Report No. DOT HS 823 354. National Highway Traffic Safety Administration, Washington, DC. (November)

[29] https://fred.stlouisfed.org/series/GDPDEF, calculated using the annual values for 2012 and 2017 reported in Simons (2017).

**Table 23: Incremental FMVSS Compliance Unit Costs for Passenger Cars (2017 Dollars)**

| FMVSS No. | Incremental Cost |
|---|---|
| 101 – Controls and Displays | $0.00^ |
| 102 – Transmission and Starter Interlock | $0.00^ |
| 103 – Windshield Defrosting/Defogging | $0.00 |
| 104 – Windshield Wiping/Washing | $0.00 |
| 105/135 – Brake Systems | $44.29 |
| 106 – Brake Hoses | $0.00^ |
| 108 – Lamps and Reflective Disks | $45.06 |
| 111 – Rear Visibility | $29.35 |
| 113 – Hood Latch Systems | $0.00 |
| 114 – Theft Protection/Rollaway Prevention | $0.00^ |
| 118 – Power Window Systems | $0.93 |
| 124 – Accelerator Control Systems | $0.52 |
| 126 – Electronic Stability Control (with Anti-Lock Brakes) | $528.50 |
| 138 – Tire Pressure Monitoring Systems | $178.78 |
| 201 – Instrument Panel Improvements | $4.43 |
| 201B – Head Impact Upgrade | $12.59 |
| 202 – Head Restraints | $96.39 |
| 203/4 – Steering Control Assemblies | $26.25 |
| 205 – Glazing Materials | $0.00 |
| 206 – Improved Door Locks | $0.00^ |
| 207 – Door Locks/Sliding Doors | $2.54 |
| 208 – Seat Belts | $194.81 |
| 208I – Frontal Air Bags | $363.76 |
| 212 – Adhesive Windshield Bonding | $0.00 |
| 214 – Side Impact Protection | $191.96 |
| 214 – Side Air Bags/Window Curtains | $291.85 |
| 216 – Roof Crush Resistance | $7.36 |
| 226 – Ejection Mitigation | $4.23 |
| 301 – Fuel System Integrity | $50.93 |
| 302 – Flammability of Materials | $0.00^ |
| 401 – Interior Trunk Release | $1.96 |
| **TOTAL** | **$2,076.50** |
| **TOTAL (Not Including Seat Belts)** | **$1,881.69** |
| **TOTAL (Air Bags and Roof Crush Resistance Only)** | **$662.97** |

*^-No cost study was conducted, but available information supports an estimate of no cost impact.*

The recent addition of backup cameras to FMVSS No. 111 is not represented within Simons (2017). The final regulatory impact analysis for the addition of backup cameras to FMVSS No. 111[30] estimates that the average per-vehicle installation cost for backup cameras is between $132 and $142 in 2010 dollars. Taking the midpoint of the estimate and converting to 2017 dollars, we estimate a $153.37 cost savings associated with forgone installation of backup cameras in replica passenger cars. Simons does not include cost estimates associated with the quiet car rule; however, for this analysis we assume that no replica passenger cars would be hybrid or all-electric vehicles subject to the quiet car rule.

Altogether, relaxing FMVSS compliance requirements for passenger cars would result in an estimated savings for replica passenger cars of: $2,035.06 when seat belts are provided voluntarily ($1,881.69 + $153.37); $662.97 when relaxing compliance only with air bags and roof crush resistance; and $2,229.87 ($2,076.50 + $153.37) when relaxing all FMVSS compliance.

Appendix A.1.b. LTVs – FMVSS Compliance

Simons (2017)[31] provides estimates of the set of identifiable incremental vehicle production costs associated with FMVSS relevant to LTVs in this rulemaking. Simons' analysis

[30] NHTSA (2014). *Backover Crash Avoidance Technologies: FMVSS No. 111*. National Highway Transportation Safety Administration, Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis. March.

[31] Simons, J. F. (2017). *Cost and Weight Added by the Federal Motor Vehicle Safety Standards for Model Years 1968-2012 in Passenger Cars And LTVs*. Report No. DOT HS 823 354. National Highway Traffic Safety Administration, Washington, DC. (November)

is based on cost teardown studies for MY 1968 through 2012 vehicles. All estimates presented here were converted from 2012 dollars to 2017 dollars using the implicit GDP deflator[32]:

**Table 24: Incremental FMVSS Compliance Unit Costs for LTVs (2017 Dollars)**

| FMVSS No. | Incremental Cost |
|---|---|
| 101 – Controls and Displays | $0.00^ |
| 102 – Transmission and Starter Interlock | $0.00^ |
| 103 – Windshield Defrosting/Defogging | $0.00 |
| 104 – Windshield Wiping/Washing | $0.00 |
| 105/135 – Brake Systems | $44.77 |
| 106 – Brake Hoses | $0.00^ |
| 108 – Lamps and Reflective Disks | $45.06 |
| 111 – Rear Visibility | $41.59 |
| 113 – Hood Latch Systems | $0.00 |
| 114 – Theft Protection/Rollaway Prevention | $0.00^ |
| 118 – Power Window Systems | $0.87 |
| 124 – Accelerator Control Systems | $0.52 |
| 126 – Electronic Stability Control (with Anti-Lock Brakes) | $528.50 |
| 138 – Tire Pressure Monitoring Systems | $178.78 |
| 201 – Instrument Panel Improvements | $20.36 |
| 201B – Head Impact Upgrade | $12.59 |
| 202 – Head Restraints | $104.48 |
| 203/4 – Steering Control Assemblies | $26.25 |
| 205 – Glazing Materials | $0.00 |
| 206 – Door Locks | $1.28 |
| 207 – Door Locks/Sliding Doors | $0.00 |
| 208 – Seat Belts | $214.30 |
| 208I – Frontal Air Bags | $363.76 |
| 212 – Adhesive Windshield Bonding | $0.00 |
| 214 – Side Impact Protection | $18.06 |
| 214 – Side Air Bags/Window Curtains | $268.68 |
| 226 – Ejection Mitigation | $27.34 |
| 301 – Fuel System Integrity | $48.66 |
| 302 – Flammability of Materials | $0.00^ |
| **TOTAL** | **$1,945.87** |
| **TOTAL (Not Including Seat Belts)** | **$1,731.58** |
| **TOTAL (Air Bags Only)** | **$632.45** |

*^-No cost study was conducted, but available information supports an estimate of no cost impact.*

[32] https://fred.stlouisfed.org/series/GDPDEF, calculated using the annual values for 2012 and 2017 reported in Simons (2017).

The recent addition of backup cameras to FMVSS No. 111 is not represented within Simons (2017). The final regulatory impact analysis for the addition of backup cameras to FMVSS No. 111 estimates that the average per-vehicle installation cost for backup cameras is between $132 and $142 in 2010 dollars. Taking the midpoint of the estimate and converting to 2017 dollars, we estimate a $153.37 cost savings associated with forgoing installation of backup cameras in replica passenger cars. Simons does not include cost estimates associated with the quiet car rule; however, for this analysis we assume that no replica LTVs would be hybrid or all-electric vehicles subject to the quiet car rule.

Altogether, relaxing FMVSS compliance requirements for LTVs would result in an estimated savings for replica LTVs of: $1,884.95 when seat belts are provided voluntarily ($1,731.58 + $153.37); $632.45 when relaxing compliance only with air bags and roof crush resistance; and $2,099.24 ($1,945.87 + $153.37) when relaxing all FMVSS compliance.

Appendix A.1.c. Passenger Cars– Bumper Standards

The proposed rule would relax the requirement to meet the bumper protective criteria specified in 49 CFR Part 581 for replica passenger cars. The most recent available NHTSA analysis comparing bumper costs and benefits with and without compliance to bumper standards is the 1982 final regulatory impact analysis for the Part 581 bumper standard[33]. The 1982 analysis estimates that compliance with Part 581 increases vehicle production costs by between

[33] NHTSA (1982). *Final Regulatory Impact Analysis: Part 581 Bumper Standard*. Office of Program and Rulemaking Analysis, Plans and Programs. (May)

$39 and $76 in 1981 dollars. For this analysis, NHTSA applies the midpoint of the 1982 estimate ($57.50 in 1981 dollars) and converts the value to 2017 dollars using the GDP Price Deflator, yielding an estimate of the cost savings from relaxing compliance with bumper standards equal to $134.14[34].

Appendix A.1.d. LTVs – Bumper Standards

LTVs are not governed by the bumper standards affected by the rulemaking. Thus, NHTSA estimates that the rulemaking would have no effect on bumper standard compliance costs for manufacturers of replica LTVs.

Appendix A.1.e. Production Cost Savings – Reporting and Labeling Cost Savings

The FAST Act provision for the production of replica vehicles exempts replica manufacturers from complying with certain reporting and labeling costs. Specifically, section 24405 of the FAST Act exempts replica motor vehicles from 49 U.S.C. 32304 and 32902 and from section 3 of the Automobile Information Disclosure Act (15 U.S.C. 1232). That is, replica motor vehicles will be exempt from passenger motor vehicle country of origin labeling requirements, average fuel economy standards, and vehicle labeling and safety rating disclosure requirements on the Monroney label. Also, because replica vehicles are exempt from the FMVSS, the manufacturers of the replica vehicles are exempt from the requirement to provide certain information in the owner's manuals.

[34] It is likely that current compliance costs are lower than the estimated costs from the 1982 analysis due to learning and re-design effects. However, in the absence of information on these factors, NHTSA chose to apply the estimate from the 1982 analysis.

The following is an analysis of the decrease in reporting and labeling costs associated with exemptions for replica vehicles. The analysis is broken down by NHTSA regulation.

*Appendix A.1.e.i. Parts 531 and 533 - Corporate Average Fuel Economy*

Under the rulemaking, replica passenger car and LTV manufacturers would be exempt from CAFE standards (49 CFR Parts 525-538). This exemption is complicated to quantify for several reasons. Although new subsection (b)(4) added to 49 USC 30114 by Sec. 24405(a) (2) of the FAST Act specifies that replica motor vehicles shall be exempt from the CAFE standards, Sec. 24405(b) of the FAST Act specifies that replica vehicles must comply with requirements issued by the Environmental Protection Agency (EPA) regarding the engine that may be installed. Presumably, those regulations will at least partially move the replica motor vehicle's performance toward what the CAFE standards would otherwise have required. Determining what additional actions might be required for a particular vehicle would be complicated to calculate prior to knowing the final EPA regulations.

As low-volume manufacturers, manufacturers have the option of petitioning for exemptions to complying with CAFE standards under the status quo (Parts 525.6 and 525.7). The proposed rule would eliminate the need to petition for exemptions, and thus would provide cost savings associated with preparing petitions; no technology or fuel consumption impacts are associated with Parts 525.6 and 525.7 under the proposed rule, because the proposed rule does not change the scope of relief from CAFE compliance. NHTSA estimates that, for each low-volume manufacturer of passenger cars and LTVs, the process of petitioning for an exemption under Parts 525.6 and 525.7 involves: 40 engineer labor hours (at an hourly wage of $47.71, for a total wage cost of $1,908.40); eight manager labor hours (at an hourly wage of $53.92, for a

total wage cost of $431.36); 40 legal labor hours (at an hourly wage of $67.25, for a total wage cost of $2,690.00); and one clerical labor hour (at an hourly and total wage cost of $17.91).

Altogether, the total estimated wage cost per replica passenger car and LTV manufacturer to petition for an exemption under Parts 525.6 and 525.7 is $5,047.67. The Bureau of Labor Statistics estimates that wages represent 70.1 percent of total compensation to private workers, on average[35]. NHTSA estimates that the total labor cost per replica passenger car and LTV manufacturer to petition for an exemption under Parts 525.6 and 525.7 is $7,200.67 ($5,047.67 / 0.701 = $7,201.10). Thus, NHTSA estimates that the proposed rule would generate cost savings of $7,201.10 per replica car and LTV manufacturer, by mitigating the need to petition for exemptions ($288,043.94 across all manufacturers at an assumed volume of 40 manufacturers per year, or approximately $36 per vehicle when producing 200 vehicles per year).

However, NHTSA assumes no direct effect of the proposed rule on CAFE compliance technology costs (e.g., drivetrain technologies) due to the presence of alternative mechanisms for obtaining exemptions from CAFE compliance under the status quo. Thus, NHTSA estimates that the rulemaking would have no effect on CAFE compliance technology costs for manufacturers of replica passenger cars and LTVs. NHTSA also estimates that the rulemaking would have no effect on the requirement for manufacturers to submit reports regarding their efforts to improve automotive fuel economy in 49 CFR Part 537 unless the manufacturer also produces non-exempt vehicles. As there are no low-volume manufacturers currently submitting reports under Part 537, NHTSA estimates that no replica manufacturers, which by their definition manufacturer no more than 5,000 vehicles worldwide

[35] Bureau of Labor Statistics (2019). *Employer Costs for Employee Compensation – March 2019*. https://www.bls.gov/news.release/ecec.t04 htm, last accessed July 10, 2019.

annually, would be subject to the reporting requirements under Part 537 even if they had not received an exemption to manufacturer replica vehicles. Therefore, the cost savings associated with exempting replica vehicles from Part 537 are limited to the paperwork cost replica manufacturers would forego by not having to submit an exemption request under Part 531 and Part 533.

*Appendix A.1.e.ii. NCAP & Automobile Information Disclosure Act Compliance Cost Savings*

The FAST Act exempts replica vehicles from the Automobile Information Disclosure Act (15 U.S.C. 1231-1233), which applies to vehicle manufacturers that sell motor vehicles in the United States with a Gross Vehicle Weight Rating of 10,000 pounds or less. The Automobile Information Disclosure Act (15 U.S.C. 1231-1233), also called the "Monroney Act," after its sponsor, Senator Monroney of Oklahoma, requires all new light vehicles to have a window sticker affixed that shows, among other things: vehicle make, vehicle model, vehicle identification number, the final assembly point, the name and location of the dealer to whom the vehicle is to be delivered, the manufacturer's suggested retail price (MSRP) of the base vehicle, the MSRP of the optional equipment installed on a particular vehicle, the transportation chargers for delivery of the vehicle from the manufacturer to the dealer, and the total MSRP of all of the above. The window label must also include the safety ratings assigned by NHTSA under its New Car Assessment Program (NCAP), or a statement that the vehicle was not assigned safety ratings under NCAP.

Due to the small size of the manufacturers that will qualify to manufacture replica vehicles, NHTSA estimates that the exemption from the Automobile Information Disclosure Act will save replica manufacturers $1 per vehicle in printing costs and $1.64 for the cost of labor to affix each sticker. These cost saving estimates are based on what the estimates for the costs

NHTSA expects replica vehicles to incur when printing and affixing temporary labels, which are provided below.

*Appendix A.1.e.iii. Owner's Manual Cost Savings*

The following FMVSS include requirements to provide information in owner's manuals which impose burdens on manufacturers: FMVSS Nos. 108, 110, 202a, 208, 210, and 226. As replica vehicles would be exempt from these standards, the manufacturers would not be required to provide information in owner's manuals. NHTSA estimates a burden reduction of 457.5 hours, at a cost of $20 per hour, yielding a total cost savings of $11,000 annually for replica manufacturers based on NHTSA's most recent estimates, as itemized below.[36]

NHTSA estimates the following burden for review time and time to prepare any technical changes for per manual per model line. NHTSA estimates that it takes 4 hours to include headlamp aiming instructions in the owner's manual. However, FMVSS No. 108 permits manufacturer a choice in placing headlamp aiming instruction in the owner's manual or on a label affixed to the vehicle. About half of the on-vehicle aim applications are estimated to use labels, with the remainder using information in the owner's manual to convey the necessary information. Therefore, NHTSA estimates a total burden of 60 hours (4 hours × 50 models × .5 = 100 hours) reduced under the proposed rule, for a total annual cost savings of $2,000 (100 hours per year x $20 per hour).

[36] OMB Control No. 2127-0541. For additional information, see the 60-day notice at 79 FR 75859, the 30-day notice 80 FR 22261, and supporting statements at https://www.reginfo.gov/public/do/PRAViewICR?ref_nbr=201504-2127-001.

NHTSA estimates that it takes vehicle manufacturers 1.5 hours per vehicle model line to assemble all the tire related information to include in the owner's manual, and that manufacturers perform a review of this information each model year as tire sizes and rim designations may change. Therefore, NHTSA estimates a total burden hour reduction of 75 hours (1.5 hours × 50 models = 75 hours), for a total annual cost savings of $1,500 (75 hours per year x $20 per hour).

NHTSA estimates that 25% of all owner's manuals need to be updated annually to satisfy the requirements in FMVSS No. 202a which require that the owner's manual for each vehicle must include an accurate description of the vehicle's head restraint system in an easily understandable format and provide additional information. For each manual that is updated, NHTSA estimates that it takes 5 hours. Therefore, NHTSA estimates that replica manufacturers will experience a burden reduction of 62.5 hours (0.25 x 50 models x 5 hours per model) for not having to meet the owner's manual requirements in FMVSS No. 202a, yielding an estimated annual cost savings of $1,250 (62.5 hours per year x $20 per hour).

FMVSS No. 208 requires that certain safety features (e.g., air bags, the care and maintenance of air bag systems) be explained to the owner by means of the owner's manual. NHTSA estimates that about 25% of the owner's manuals need major revision each year. The estimated burden to produce the required text and information is based on technical writing to consolidate the required new facts and/or information into text suitable for publication in the owner's manual. Since a great deal of the background information dealing with air bags is likely already available from the manufacturers engineering staff, it is estimated that no more than 16 hours of effort should be needed to compile the new text material. Therefore, NHTSA estimates a burden reduction of 240 hours for replica vehicles not having to comply with the information

requirements of FMVSS No. 208 (50 models per year × .25 × 16 hours = 200 hours per year), yielding an annual cost savings of $4,000 per year (200 hours per year x $20 per hour).

FMVSS No. 210 requires that the owner's manual for vehicles with a gross vehicle weight rating of 10,000 pounds or less manufactured after September 1, 1987 shall include: A section explaining that child restraints are designed to be secured by means of the vehicle seat belts, and that children could be endangered in a crash if their child restraints are not properly secured in the vehicle and, in a vehicle with rear designated seating positions, a statement alerting vehicle owners that children are always safer in the rear seat. It is estimated that manufacturers would need no more than an hour to review the owner's manual for each of the models to verify that the content is current and correct, and to add engineering corrections to bring the information current, as required. NHTSA also estimates that 25% of all owner's manuals will be updated each year. Therefore, NHTSA estimates a burden reduction of 12.5 hours annually for all replica manufacturers (50 models per year × .25 × 1 hour per model = 12.5 hours per year), yielding an annual cost savings of $250 (12.5 hours per year x $20 per hour).

NHTSA estimates that 25% of owner's manuals will need revision to comply with the owner's manual requirements in FMVSS No. 226 and estimates that it will take manufacturers 8 hours to make those revisions. Therefore, NHTSA estimates a burden reduction of 100 hours for replica manufacturers (50 models per year × .25 × 8 hours per model = 100 hours per year), yielding an annual cost savings of $2,000 (100 hours per year x $20 per hour).

Altogether, the estimated owner's manual information collection cost savings to replica vehicle manufacturers under the proposed rule total $11,000 per year:

**Table 25: Annual Owner's Manual Information Collection Cost Savings under the Proposed Rule (2017 Dollars)**

| Safety Standard | Annual Cost Savings |
|---|---|
| FMVSS No. 108 | $2,000 |
| FMVSS No. 110 | $1,500 |
| FMVSS No. 112 | $1,250 |
| FMVSS No. 208 | $4,000 |
| FMVSS No. 210 | $250 |
| FMVSS No. 226 | $2,000 |
| **Total** | **$11,000** |

In addition to the costs savings associated with not having to compile information for owner's manuals, replica manufacturers will also experience cost savings from not having to incur printing costs. NHTSA estimates that it only costs manufacturers, on average, about $.50 for each owner's manual.[37] However, because replica manufacturers are smaller and therefore, unable to take advantage of economies of scale, the costs associated with printing owner's manuals would likely be higher than the average. NHTSA estimates that any cost savings a replica vehicle manufacturer would experience from not printing owner's manuals would be offset by the requirement to provide customer disclosures, which is discussed below.

[37] The estimate is provided in the supporting statements NHTSA submitted to OMB in 2015 in support of the renewal of NHTSA's Information Collection titled "Consolidated Owner's Manual Requirements for Motor Vehicles and Motor Vehicle Equipment." NHTSA estimated costs as $8,198,948 for 16,500,000 vehicles, or approximately $.50 per vehicle. The supporting statements can be accessed at https://www.reginfo.gov/public/do/PRAViewDocument?ref_nbr=201504-2127-001.

*Appendix A.1.e.iv. New Reporting Costs*

Under the proposed rule, each manufacturer must register with NHTSA and submit one summary report annually. NHTSA estimates that it will take 10 hours to complete an initial registration submission. NHTSA estimates that the wage cost for compiling and submitting the required information to be $33.98 per hour, based on the Bureau of Labor Statistics' mean hourly wage estimate for technical writers in the motor vehicle manufacturing industry[38], for a total wage cost of $339.8 per registration (10 hours × $33.98 per hour = $339.80); NHTSA also assumes that, on average, 10 manufacturers will complete initial registration submissions each year. NHTSA requests comment on these assumptions. Based on these assumptions, the estimated annual initial registration wage cost is $3,398.00 ($339.80 per registration x 10 registrations per year). The Bureau of Labor Statistics estimates that wages represent 70.1 percent of total compensation to private workers, on average[39]. Thus, the total estimated annual initial registration labor cost is $4,847.36 ($3,398 / 0.701 = $4,847.36).

NHTSA assumes that each annual report would take two hours to produce, at a wage cost of $33.98 per hour, based on the Bureau of Labor Statistics' mean hourly wage estimate for technical writers in the motor vehicle manufacturing industry, for a total wage cost of $67.96 per report ($33.98 per hour x 2 hours per report = $67.96 per report). Dividing the wage cost by the factor of 0.701 that was applied above yields a total labor cost of $96.95 per report ($67.96 / 0.701 = $96.95). The assumptions of hourly burden and cost per hour are based on NHTSA's best estimate; we request comment on these assumptions. At an assumed 40 affected replica

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[38] Bureau of Labor Statistics (2019). *Occupational Employment and Wages, May 2018*. https://www.bls.gov/oes/current/oes273042.htm, last accessed July 9, 2019.
[39] Bureau of Labor Statistics (2019). *Employer Costs for Employee Compensation – March 2019*. https://www.bls.gov/news.release/ecec.t04 htm, last accessed July 10, 2019.

vehicle manufacturers per year, total annual costs of providing annual reports are estimated to be $3,877.89 ($96.95 per report x 40 reports per year = $3,877.89 per year).

Altogether, new annual reporting costs are estimated to be $8,725.25 ($4,847.36 + $3,877.89 = $8,725.25).

*Appendix A.1.e.v. New Labeling Costs and Costs to Provide Customer Disclosures*

Manufacturers of replica vehicles would also be required to affix temporary labels on the dashboard or steering wheel hub of each exempted vehicle alerting passengers that the vehicle does not comply with all FMVSS and directing them to consult their customer disclosure for more information on the standards from which the vehicle is exempt. NHTSA assumes that it will take each manufacturer two hours to design and format the temporary labels, at a labor cost of $33.98 per hour, based on the Bureau of Labor Statistics' mean hourly wage estimate for technical writers in the motor vehicle manufacturing industry[40]; we request comment on these assumptions. The estimated wage cost to each manufacturer is $67.96 (2 hours x $33.98 per hour), or $2,718.40 for 40 manufacturers. The Bureau of Labor Statistics estimates that wages represent 70.1 percent of total compensation to private workers, on average[41]. Thus, the total estimated annual label design and formatting labor cost is $3,877.89 ($2,718.40 / 0.701 = $3,877.89). However, NHTSA assumes that this cost is offset by equivalent foregone costs under NCAP and the Automobile Information Disclosure Act (i.e., designing and producing Monroney labels).

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[40] Bureau of Labor Statistics (2019). *Occupational Employment and Wages, May 2018*. https://www.bls.gov/oes/current/oes273042.htm, last accessed July 9, 2019.
[41] Bureau of Labor Statistics (2019). *Employer Costs for Employee Compensation – March 2019*. https://www.bls.gov/news.release/ecec.t04 htm, last accessed July 10, 2019.

NHTSA assumes the cost to print or purchase printed labels for each replica vehicle to be $1 per vehicle; we request comment on this assumption. This cost is much higher than what NHTSA estimates for the total cost to provide certification labels.[42] However, as the temporary replica vehicle warning label is much larger than the other labels and each replica manufacturer is a much smaller than the average vehicle manufacturer, the cost of each label will likely be much higher than labels found on conforming vehicle. NHTSA assumes that it will take approximately 3 minutes to label each vehicle. This is much longer than the estimated 18 seconds to label an average vehicle with a Part 567 certification label.[43] However, because replica vehicle manufacturers are expected to be much smaller than the average vehicle manufacturer, NHTSA assumes that replica vehicle manufacturers will not be able to label each vehicle as quickly; we request comment on this assumption. The wage costs associated with affixing each temporary label to the steering hub are estimated to be $1.15, based on the Bureau of Labor Statistics' mean hourly wage estimate for motor vehicle assemblers and fabricators ($22.95 per hour x 3/60 hours per label = $1.15 per label)[44]. The Bureau of Labor Statistics estimates that wages represent 70.1 percent of total compensation to private workers, on average[45]. Thus, the total estimated per-vehicle labeling labor cost is $1.64 ($1.15 / 0.701 = $1.64). However, NHTSA assumes that this cost is offset by equivalent foregone costs under NCAP and the Automobile Information Disclosure Act (i.e., affixing Monroney labels).

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[42] NHTSA estimates that the cost of Part 567 certification labels is approximately $.10 per label.

[43] 83 FR 8732, February 28, 2018.
[44] Bureau of Labor Statistics (2019). *Occupational Employment and Wages, May 2018*.https://www.bls.gov/oes/current/oes512098, last accessed July 11, 2019.
[45] Bureau of Labor Statistics (2019). *Employer Costs for Employee Compensation – March 2019*. https://www.bls.gov/news.release/ecec.t04 htm, last accessed July 10, 2019.

The FAST Act provides an option, under § 30114(b)(3)(B) for the agency to require low-volume manufacturers to deliver written notice of the exemption to the dealer and the first purchaser of the motor vehicle, if the first purchaser is not an individual that purchases the motor vehicle for resale. As NHTSA is requiring replica manufacturers to provide written disclosures to first purchasers, NHTSA assumes that any cost savings for not being required to provide information in owner's manuals would be offset by the cost to provide customer disclosures. Because replica manufacturers are smaller and, therefore, unable to take advantage of economies of scale, NHTSA estimates that the cost a replica manufacturer would incur if they were required to provide the owner's manuals would be higher than the cost to print customer disclosures.

Overall, although there are *different* labeling costs under the proposed rule, NHTSA assumes that these costs are offset by equivalent cost savings under NCAP and the Automobile Information Disclosure Act. We request comment on this assumption.

*Appendix A.1.e.vi. Unchanged Costs*

In addition to the new reporting and labeling requirements, replica vehicle manufacturers must continue to comply with other NHTSA reporting and labeling requirements including, but not limited to, the requirement to submit manufacturer identification information (Part 566) and VIN-deciphering information (Part 565); the requirement to retain records needed for proper investigation of possible defects related to motor vehicle safety and instances of nonconformity to motor vehicle safety standards (Part 576); the requirement to compile and maintain information about first purchasers; and the requirement that foreign manufacturers to designate a permanent resident of the United States as its agent upon whom service of notices and processes may be made. NHTSA is proposing minor changes to both Part 566 and 565 with respect to

replica vehicle manufacturers, but NHTSA estimates that those changes will not increase costs to replica vehicle manufacturers associated with those changes.

The FAST Act exempts replica motor vehicles from 49 U.S. 32304 which contains the provisions from the American Automobile Labeling Act (AALA) that require all new passenger motor vehicles to bear labels providing information about domestic and foreign content of their equipment. 49 CFR Part 583 establishes requirements for the disclosure of information relating to the countries of origin of the equipment of new passenger motor vehicles. However, manufacturers that produce fewer than 1,000 motor vehicles per model year are exempted.[46] NHTSA assumes that most replica manufacturers will manufacturer fewer than 1,000 vehicles per year and would have been exempt from the requirements of Part 583. Therefore, NHTSA assumes that replica manufacturers will not experience any cost savings as a result of the FAST Act's exemption for replica vehicles from the requirements in 49 U.S.C. 32304.

*Appendix A.1.e.vii. Net Impacts*

The estimated net impact on annual reporting costs under the proposed rule is identified by summing the individual estimated (non-zero) impacts presented in this subsection, as presented in Table 26:

[46] 49 CFR 583.5 (g).

**Table 26: Net Annual Impact on Reporting and Labeling Costs under the Proposed Rule – Replica Cars and LTVs (2017 Dollars)**

| Cost Element | Change in Costs |
|---|---|
| New Reports and Registrations | $8,725.25 |
| CAFE | -$288,043.94 |
| Owner's Manuals | -$11,000.00 |
| **Net Annual Cost Impact** | **-$290,318.69** |

Altogether, the proposed rule is estimated to decrease replica car and LTV manufacturers' reporting and labeling costs by $290,318.69 per year. The decrease in costs is driven predominantly by the reduction in CAFE exemption costs (-$288,043.94). At three- and seven-percent discount rates, the estimated discounted net annual cost impacts are -$286,059.51 and -$280,661.67, respectively.

Per-vehicle cost impacts are identified by dividing the annual cost impacts by the assumed number of vehicles produced per year (4,000-8,000). Thus, the estimated undiscounted cost impacts per vehicle are between -$72.58 and -$36.29; the estimated discounted cost impacts per vehicle are between -$71.51 and -$35.76 at a three-percent discount rate, and between -$70.17 and -$35.08 at a seven-percent discount rate.

Appendix A.1.f. Budgetary, Legal, and Policy Costs

The proposed rule would not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Appendix A.1.g. Total Cost Impacts

Total undiscounted per-vehicle cost impacts for each vehicle type are calculated by summing cost impact estimates from sections B through D above. The estimated cost impacts are the estimated cost savings due to: relaxing compliance with FMVSS standards and bumper standards; and relaxing reporting and labeling requirements. Total discounted cost impacts for each vehicle type are identified by multiplying undiscounted cost impacts (which are assumed to accrue in the year of manufacture) by a discount factor equal to 98.5 percent and 96.7 percent of the undiscounted cost impacts at three-percent and seven-percent discount rates, respectively. Total annual cost impacts are identified by applying the per-vehicle cost impact estimates across all vehicles assumed to be produced each year.

*Appendix A.1.g.i. Passenger Cars – Total Per-Vehicle Cost Impacts*

The estimated undiscounted per-vehicle cost impacts for replica passenger cars presented in this section are itemized in Table 27:

**Table 27: Total Undiscounted Cost Impact – Replica Passenger Cars (2017 Dollars, per Vehicle)**

| Scenario | Passenger Cars Produced per Year | FMVSS Cost Impact | Bumper Standard Cost Impact | Reporting and Labeling Cost Impact | Total Cost Impact |
|---|---|---|---|---|---|
| Appearance Constraint | 3,600 | -$662.97 | -$134.14 | -$72.58 | -$869.69 |
| Appearance Constraint | 7,200 | -$662.97 | -$134.14 | -$36.29 | -$833.40 |
| Voluntary Seat Belts | 3,600 | -$2,035.06 | -$134.14 | -$72.58 | -$2,241.78 |
| Voluntary Seat Belts | 7,200 | -$2,035.06 | -$134.14 | -$36.29 | -$2,205.49 |
| Full Exemption | 3,600 | -$2,229.87 | -$134.14 | -$72.58 | -$2,436.59 |
| Full Exemption | 7,200 | -$2,229.87 | -$134.14 | -$36.29 | -$2,400.30 |

Total undiscounted per-vehicle cost impacts for replica passenger cars are estimated to be between -$2,242 and -$833 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. Applying discount factors to the total undiscounted per-vehicle benefits (which are assumed to accrue during the year of vehicle manufacture) yields estimates of total discounted benefits:

**Table 28: Total Discounted Cost Impacts – Replica Passenger Cars (2017 Dollars, per Vehicle)**

| Scenario | Passenger Cars Produced per Year | Total Cost Impact (3% Discount Rate) | Total Cost Impact (7% Discount Rate) |
|---|---|---|---|
| Appearance Constraint | 3,600 | -$857.46 | -$841.97 |
| Appearance Constraint | 7,200 | -$821.17 | -$805.68 |
| Voluntary Seat Belts | 3,600 | -$2,209.42 | -$2,168.42 |
| Voluntary Seat Belts | 7,200 | -$2,173.13 | -$2,132.13 |
| Full Exemption | 3,600 | -$2,401.37 | -$2,356.75 |
| Full Exemption | 7,200 | -$2,365.09 | -$2,320.46 |

At a three-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$2,209 and -$821 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. At a seven-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$2,168 and -$806 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily.

*Appendix A.1.g.ii. LTVs – Total Per-Vehicle Cost Impacts*

The estimated undiscounted per-vehicle cost impacts for replica LTVs presented in this section are itemized in Table 29:

**Table 29: Total Undiscounted Cost Impacts – Replica LTVs (2017 Dollars, per Vehicle)**

| Scenario | Replica LTVs Produced per Year | FMVSS Cost Impact | Reporting and Labeling Cost Impact | Total Cost Impact |
|---|---|---|---|---|
| Appearance Constraint | 400 | -$632.45 | -$72.58 | -$705.03 |
| Appearance Constraint | 800 | -$632.45 | -$36.29 | -$668.74 |
| Voluntary Seat Belts | 400 | -$1,884.95 | -$72.58 | -$1,957.53 |
| Voluntary Seat Belts | 800 | -$1,884.95 | -$36.29 | -$1,921.24 |
| Full Exemption | 400 | -$2,099.24 | -$72.58 | -$2,171.82 |
| Full Exemption | 800 | -$2,099.24 | -$36.29 | -$2,135.53 |

Total undiscounted per-vehicle cost impacts for replica LTVs are estimated to be between -$1,957 and -$669 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. Applying discount factors to the total undiscounted per-vehicle cost

impact (which is assumed to accrue during the year of vehicle manufacture) yields estimates of total discounted per-vehicle cost impacts:

**Table 30: Total Discounted Cost Impacts – Replica LTVs (2017 Dollars, per Vehicle)**

| Scenario | Replica LTVs Produced per Year | Total Cost Impact (3% Discount Rate) | Total Cost Impact (7% Discount Rate) |
|---|---|---|---|
| Appearance Constraint | 400 | -$695.22 | -$682.79 |
| Appearance Constraint | 800 | -$658.93 | -$646.50 |
| Voluntary Seat Belts | 400 | -$1,929.34 | -$1,893.62 |
| Voluntary Seat Belts | 800 | -$1,893.06 | -$1,857.33 |
| Full Exemption | 400 | -$2,140.49 | -$2,100.78 |
| Full Exemption | 800 | -$2,104.20 | -$2,064.49 |

At a three-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$1,929 and -$659 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. At a seven-percent discount rate, the total per-vehicle cost impact for replica passenger cars is estimated to be between -$1,894 and -$646 when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily.

*Appendix A.1.g.iii. Passenger Cars and LTVs Combined – Total Annual Cost Impact*

The total discounted annual cost impact for replica vehicles is identified by multiplying the total discounted cost impact per vehicle by the number of vehicles that would be affected by the rulemaking each year. In this analysis, we assume that, each year, 40 manufacturers would produce a combination of 100-200 replica cars and LTVs combined per manufacturer, with passenger cars and LTVs comprising 90 percent and 10 percent of the total volume of replica

vehicles produced, respectively. Thus, we assume that 3,600-7,200 replica cars and 400-800 replica LTVs (and no other replica vehicles) would be produced each year. In turn, our estimate of total annual cost impact is equal to 3,600-7,200 multiplied by our estimate of total cost impact per replica passenger car, plus 400-800 multiplied by our estimate of total cost impact per replica LTV:

**Table 31: Total Annual Cost Impact**
**(Millions of 2017 Dollars)**

| Scenario | Annual Replica Vehicle Production | Undiscounted | 3% Discount Rate | 7% Discount Rate |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | -$3.4 | -$3.4 | -$3.3 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | -$6.5 | -$6.4 | -$6.3 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | -$8.9 | -$8.7 | -$8.6 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | -$17.4 | -$17.2 | -$16.8 |

The total annual undiscounted cost impact for replica vehicles is estimated to be between -$17.4 million and -$3.4 million when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily. The total annual discounted cost impacts for replica vehicles are estimated to be between -$17.2 million and -$3.4 million at a three-percent discount rate when seat belts are provided voluntarily, and between -$16.8 million and -$3.3 million at a seven-percent discount rate when replica vehicle manufacturers provide at least some FMVSS-compliant technologies voluntarily.

## Appendix A.2. Calculation of Potential Impacts on Safety

A central impact of relaxing FMVSS requirements for replica vehicles would be an expected increase in fatalities and injuries for drivers and occupants in both replica vehicles and

their crash partners under the rule.[47] Fatalities and injuries would be expected to increase because FMVSS have had a measurable negative effect on fatality and injury rates (e.g., lives saved due to the presence of seat belts, air bags, improved brakes, and improved seating and steering materials); by relaxing FMVSS requirements, fatality and injury rates per VMT for replica cars would thus be higher than in the absence of the rule.

The analytical approach used to estimate safety impacts incorporates evidence on the effectiveness of FMVSS in reducing fatalities to estimate the incremental fatality and injury costs that would be incurred if FMVSS were relaxed for replica vehicles. Kahane (2015) presents a detailed statistical analysis of the incremental safety impacts of FMVSS for passenger cars and LTVs, represented in terms of absolute and relative reductions in fatalities and injuries.[48] For the safety impact analysis, NHTSA developed an approach to incorporate key estimates from Kahane (2015) within the analysis of safety costs associated with relaxing FMVSS compliance for replica vehicles.

Appendix A.2.a. Passenger Cars – Safety Impacts

For the ensuing analysis, we focus on the safety impacts of relaxing FMVSS compliance for replica cars. The first step in estimating safety impacts is to calculate the total potential

[47] Although we expect an increase in fatalities and injuries for drivers and occupants in both replica vehicles and their crash partners, due to limited data, this study examines only the impacts on replica vehicle occupants. The available data report net safety effects for all drivers and occupants, with separate estimates for cars and LTVs. We assume that the safety effects reported for one vehicle class apply to replica vehicles of the same class; most of the estimated lives saved in the data are associated with FMVSS that would affect drivers and occupants of a focal vehicle rather than crash partners.

[48] Kahane, C. J. (2015, January). *Lives saved by vehicle safety technologies and associated Federal Motor Vehicle Safety Standards, 1960 to 2012 – Passenger cars and LTVs – With reviews of 26 FMVSS and the effectiveness of their associated safety technologies in reducing fatalities, injuries, and crashes.* (Report No. DOT HS 812 069). Washington, DC: National Highway Traffic Safety Administration.

fatalities that would have occurred without the relevant subset of FMVSS based on values reported in Kahane (2015), leading to a percentage estimate of the incremental fatality risk relative to a baseline with all FMVSS.

Kahane (2015) reports the following estimates of lives saved by vehicle technologies in 2012, as summarized in Table 32, which serve as the relevant FMVSS to evaluate within the analysis of safety impacts:

**Table 32: Car Occupant Lives Saved by Vehicle Technologies in 2012† (from Kahane, 2015)**

| FMVSS No. | Car Occupant Lives Saved |
|---|---|
| 105 – Dual Master Cylinders and Front Disc Brakes | 217 |
| 126 – Electronic Stability Control | 500 |
| 201 – Instrument Panel Improvements | 431 |
| 201B – Head Impact Upgrade | 347 |
| 203/204 – Energy-Absorbing Steering Assemblies | 1,323 |
| 206 – Door Locks | 486 |
| 208 – Seat Belts | 7,169 |
| 208I – Frontal Air Bags | 1,738 |
| 212 – Windshield Bonding | 177 |
| 214A – Side Door Beams | 359 |
| 214B – Side Impact Protection | 565 |
| 214C – Side Air Bags | 272 |
| 216 – Roof Crush Resistance | 122 |
| 226 – Rollover Curtains | 3 |
| 301 – Fuel System Integrity | 5 |
| TOTAL | 13,714 |

*†- The 2012 fleet contains vehicles that are not compliant with some or all FMVSS.*

The values in **Error! Reference source not found.** reflect estimated lives saved by the FMVSS evaluated in this section on vehicles in the fleet, with the exception of backup cameras, which are discussed later in this section. Because the on-road fleet contains vehicles that are not

compliant with some or all FMVSS, the estimates of lives saved are not sufficient to estimate the difference in fatality risk in fully-FMVSS-compliant vehicles relative to non-compliant vehicles (i.e., non-compliant vehicles in the fleet obscure the effects of compliant vehicles). Maintaining assumptions of linearity in Kahane (2015) (e.g., FMVSS No. *X* reduces fatality risk in a vehicle by *y* percent, independently of all other effects), we can divide the estimates of lives saved from **Error! Reference source not found.** by the penetration rate of each FMVSS in the latest observed model year (2012) in Kahane (2015) to estimate lives saved under a vehicle fleet consisting only of fully-FMVSS-compliant vehicles:

**Table 33: Lives Saved by Vehicle Technologies in 2012 if All Cars Complied with All Applicable FMVSS (from Kahane, 2015)**

| FMVSS No. | Car Occupant Lives Saved with 2012 compliance rate | Car Occupant Lives Saved if fully compliant |
|---|---|---|
| 105 – Dual Master Cylinders and Front Disc Brakes | 217 | 217 |
| 126 – Electronic Stability Control | 500 | 2,455 |
| 201 – Instrument Panel Improvements | 431 | 431 |
| 201B – Head Impact Upgrade | 347 | 545 |
| 203/204 – Energy-Absorbing Steering Assemblies | 1,323 | 1,324 |
| 206 – Door Locks | 486 | 486 |
| 208 – Seat Belts | 7,169 | 7,225 |
| 208I – Frontal Air Bags | 1,738 | 1,828 |
| 212 – Windshield Bonding | 177 | 177 |
| 214A – Side Door Beams | 359 | 360 |
| 214B – Side Impact Protection | 565 | 647 |
| 214C – Side Air Bags | 272 | 654 |
| 216 – Roof Crush Resistance | 122 | 122 |
| 226 – Rollover Curtains | 3 | 201 |
| 301 – Fuel System Integrity | 5 | 22 |
| TOTAL \| Difference from Table Above | 13,714 | **16,694** \| 2,980 (21.7%) |

After adjusting for technology penetration rates, adding the full suite of FMVSS to cars is estimated to have been capable of saving 16,694 lives in 2012 (an increase of 2,980, or 21.7 percent relative to the unadjusted value). In addition, Kahane (2015) estimates a total of 25,967 car occupant fatalities if there were no FMVSS. In other words, with the 16,406 lives saved when cars are in full compliance with the applicable FMVSS, we would see 9,273 fatalities (25,967 – 16,694 = 9,273). Among the 9,273 fatalities, 303 fatalities would be mitigated independently of the proposed rule, because they are associated with FMVSS that govern equipment (i.e., child safety seats, conspicuity tape). Thus, the baseline level of car occupant fatalities associated with full compliance with FMVSS is 9,273 less 303, or 8,970.

Estimates of the relative increase in fatality risk from relaxing all FMVSS requirements for replica vehicles are found by dividing the estimated number of fatalities in 2012 with relaxed FMVSS compliance (25,967 less 303, or 25,664) by estimated fatalities in 2012 if all vehicles were FMVSS compliant (8,970) and subtracting 1.00. The estimate of 2012 fatalities with relaxed FMVSS compliance is equal to Kahane's (2015) estimate of fatalities without the relevant FMVSS, less Kahane's estimated lives saved for FMVSS not affected by the proposed rule (i.e., child safety seats, conspicuity tape) (303). The estimate of 2012 fatalities if all cars were FMVSS compliant equals the estimate of 2012 fatalities without FMVSS, less the estimated lives saved under a full-FMVSS fleet). Corresponding estimates for NHTSA's two baselines are found in the same manner, with adjustments for lives saved among the FMVSS with which replica vehicle manufacturers are assumed to comply voluntarily:

**Table 34: FMVSS Safety Measures and Percentage Estimates of Incremental Fatality Risk Relative to a Baseline with Full FMVSS Compliance (from Kahane, 2015 and Independent Calculations)**

| | **Voluntary Seat Belts** | **Appearance Constraint** | **Full Exemption** |
|---|---|---|---|
| Estimated Fatalities in 2012 If All Cars Were Fully Compliant with FMVSS *(1)* | 8,970 (= 9,273 - 303) | 8,970 (= 9,273 - 303) | 8,970 (= 9,273 - 303) |
| Estimated Fatalities in 2012 without Applicable Vehicle Technologies in Table 33**Error! Reference source not found.** in 2012 *(2) = (1), plus Incremental Lives Saved from* ***Error! Reference source not found.*** | 18,439 (= 8,970 + 9,469) | 11,573 (= 8,970 + 2,603) | 25,664 (= 8,970 + 16,694) |
| **Relative Increase in Fatalities without Vehicle Technologies in Table 33** Error! Reference source not found.**in 2012** *(3) =[(2)/(1) – 1.00]* | **105.6%** [= (18,439/8,970) – 1.00] | **29.0%** [= (11,573/8,970) – 1.00] | **186.1%** [= (25,664/8,970) – 1.00] |

The vehicle technologies considered in this analysis are associated with strong safety effects. For the baselines in the analysis, the number of fatalities without the applicable vehicle technologies is estimated to be between 29 percent and 106 percent higher (for the *Appearance Constraint* and *Voluntary Seat Belts* scenarios, respectively) than if the 2012 car fleet included only fully-FMVSS-compliant vehicles (11,573 fatalities and 18,439 fatalities, respectively, versus 9,273 fatalities).

An analysis of the results in Kahane (2015) reveals that MY 2012 cars that are fully compliant with FMVSS would have a baseline fatality risk of 0.60 fatalities per 100 million VMT (an overall fatality rate of 0.80 fatalities per 100 million VMT, multiplied by the ratio of fatalities under a fully FMVSS-compliant fleet to observed fatalities in 2012 as reported by Kahane, 8,970/11,949). Future trends in fatality rates are difficult to project with certainty. For simplicity, in this analysis we assume a constant baseline fatality rate of 0.60 per 100 million VMT for fully-FMVSS-compliant cars.

Following from Table 34, NHTSA's baseline estimate is that replica cars would have the following incremental fatality rates across scenarios (i.e., relative to fully-FMVSS-compliant vehicles, found by taking the difference between estimated fatality rates and the baseline):

**Table 35: Incremental Replica Car Fatality Rates Relative to a Baseline with Full FMVSS Compliance (from Kahane, 2015 and Independent Calculations, Fatalities per 100 Million VMT)**

| | **Voluntary Seat Belts** | **Appearance Constraint** | **Full Exemption** |
|---|---|---|---|
| Baseline Fatality Rate *(1)* | 0.60 | 0.60 | 0.60 |
| Fatality Rate under Proposed Rule *(2)* | 1.23 | 0.77 | 1.72 |
| **Incremental Fatality Rate [=*(2)* – *(1)*]** | **0.63** | **0.17** | **1.12** |

That is, NHTSA estimates that exempting replica cars from current FMVSS would increase the fatality rate for occupants of the replicas by between 0.17 and 0.63 fatalities per 100 million VMT across the two baselines.

The next step in the analysis is to multiply the estimated incremental fatality rates by an estimate of VMT per replica vehicle per year. We have anecdotal information that indicates many replica cars would be sport cars (e.g., Shelby American 427 Cobra) that are not suitable for driving in hazardous weather conditions. Initially, NHTSA considered using the assumption that annual VMT for replica vehicles would be approximately two-sevenths of average VMT as reported in *Highway Statistics 2015*[49] (the factor of 2:7 represents casual weekend driving versus

[49] Federal Highway Administration (2017). *Highway Statistics 2015*. Table VM-1. Office of Highway Policy Information, January.

daily commuting). For replica cars and LTVs, the applicable average VMT value is for light-duty vehicles with short wheelbases in 2015, or 11,327 miles per year. However, NHTSA believes this estimate would be too high because NHTSA assumes that most purchasers of replica vehicles will buy the vehicle for collections or recreational driving and will not use it for everyday commuting or errands. NHTSA believes the annual VMT for motorcycles better estimate for vehicles driven primarily for leisure because most motorcycles owners do not consider their motorcycle to be their principal transportation vehicle. The average VMT for motorcycles, as reported in *Highway Statistics 2015*, is 2,280 miles per year.

For this analysis, we consider two alternative assumptions for annual replica car VMT. In the first case, we assume that VMT for replica vehicles in Year 1 of driving is equal to the above average annual VMT for motorcyclists (2,280 miles per year), with annual VMT declining over 30 years at the same rate as in the passenger car VMT schedule in the most recent CAFE analysis. Under this assumption, VMT declines to 1,061 in Year 10, and to 497 by Year 30, with an overall annual average VMT of 973. In the second case, we assume that annual VMT *averages* 2,280 across 30 years, by scaling the VMT schedule in the first case by 2,280/973). The two alternative replica vehicle VMT schedules follow. We request comment on these assumptions:

**Table 36: Replica Passenger Car VMT Schedules**

| Year | VMT – Proportional to CAFE (Low Case) | VMT – Annual Average = 2,280 (High Case) |
|---|---|---|
| 1 | 2280 | 5341 |
| 2 | 1967 | 4609 |
| 3 | 1951 | 4571 |
| 4 | 1908 | 4469 |
| 5 | 1866 | 4372 |
| 6 | 1810 | 4239 |
| 7 | 1652 | 3870 |
| 8 | 1469 | 3441 |
| 9 | 1271 | 2977 |
| 10 | 1062 | 2487 |
| 11 | 888 | 2079 |
| 12 | 745 | 1746 |
| 13 | 695 | 1629 |
| 14 | 658 | 1542 |
| 15 | 652 | 1527 |
| 16 | 635 | 1487 |
| 17 | 621 | 1454 |
| 18 | 608 | 1425 |
| 19 | 595 | 1394 |
| 20 | 582 | 1364 |
| 21 | 570 | 1336 |
| 22 | 560 | 1311 |
| 23 | 549 | 1286 |
| 24 | 538 | 1261 |
| 25 | 529 | 1239 |
| 26 | 519 | 1216 |
| 27 | 513 | 1201 |
| 28 | 507 | 1187 |
| 29 | 501 | 1174 |
| 30 | 497 | 1163 |

Table 37 presents estimates of incremental fatalities that would be attributable to forgoing compliance with the applicable FMVSS for replica cars. The incremental fatality impacts are monetized by multiplying the incremental fatalities per vehicle by NHTSA's estimate of the

comprehensive cost of fatalities (approximately $9.9 million in 2017 dollars) and applying discount factors to each year across vehicle lifetimes; the calculation of the comprehensive cost of fatalities in presented in Appendix C:

**Table 37: Lifetime Per-Vehicle Incremental Fatalities and Fatality Cost Impact Due to Forgoing Compliance with FMVSS in Replica Cars (Not Including TPMS and Backup Cameras)**

| Scenario | VMT Case | Incremental Fatalities per Vehicle (3% Discount Rate) | Incremental Fatalities per Vehicle (7% Discount Rate) | Fatality Cost Impact per Vehicle (2017 dollars, 3% Discount Rate) | Fatality Cost Impact per Vehicle (2017 dollars, 7% Discount Rate) |
|---|---|---|---|---|---|
| Appearance Constraint | Low | 0.00004 | 0.00003 | $381.59 | $285.61 |
| Appearance Constraint | High | 0.00009 | 0.00007 | $893.94 | $669.09 |
| Voluntary Seat Belts | Low | 0.00014 | 0.00010 | $1,387.90 | $1,038.81 |
| Voluntary Seat Belts | High | 0.00033 | 0.00025 | $3,251.42 | $2,433.61 |
| Full Exemption | Low | 0.00025 | 0.00018 | $2,446.98 | $1,831.51 |
| Full Exemption | High | 0.00058 | 0.00043 | $5,732.54 | $4,290.67 |

At a three-percent discount rate, fatality costs per vehicle are estimated to increase by between $382 and $3,251 for replica cars over a 30-year vehicle lifetime across the two baselines (an increase of between $286 and $2,434 at a seven-percent discount rate). Injury cost impacts are relatively uncertain for at least two reasons. Not only is it difficult to quantify effects on injury rates for some FMVSS, but it is also difficult to identify disaggregated effects of FMVSS by injury severity. For this analysis, we assume that FMVSS affect non-fatal injury classifications (MAIS 0 through MAIS 5) proportionally to the corresponding effect on fatalities.

This assumption is based primarily on a judgment that: (1) the reduction in the risk of experiencing a crash due to FMVSS would equally mitigate all levels of injury severity, not just fatalities; and (2) the reduction in the severity of a crash due to FMVSS would reduce the per-mile rates of injury risk across all MAIS categories by substantially similar levels. We believe this is a reasonable assumption because any given reduction in crash frequency or crash severity associated with FMVSS could reasonably affect all injury categories linearly.

Under an assumption of equivalent (relative) incremental effects on fatalities and injuries, it is feasible to incorporate an estimate of incremental MAIS 0 through MAIS 5 injury cost impacts through a simple scaling factor applied to estimated incremental fatality costs. Blincoe et al. (2015) report that fatal injuries comprise 39.5 percent of total comprehensive costs due to injury.[50] Thus, under an assumption that the FMVSS considered in this analysis affect non-fatal injuries proportionally to their impact on fatalities, then total injury and fatality costs would be approximately 2.53 (1/0.395) times the value of fatalities alone (i.e., the value of injuries, separate from fatalities, is 1.53 times the value of fatalities).

The estimated value of 1.53 fatality equivalent of injury per estimated fatality can be applied as a scaling factor directly to the estimated non-discounted fatality costs per vehicle to generate estimates of total safety (fatality plus injury) costs before accounting for TPMS and backup cameras:

[50] Blincoe, L.J., Miller, T.R., Zaloshnja, E., & Lawrence, B.A. (2015). *The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised).* National Highway Traffic Safety Administration, Report No, DOT HS 812 013, Washington, DC.

**Table 38: Total Lifetime Safety Cost Impacts per Vehicle (Incremental Non-Discounted Fatality and Injury Cost) Due to Forgoing Compliance with FMVSS in Replica Cars (Not Including TPMS and Backup Cameras)**

| Scenario | VMT Case | Injury Cost Impact per Vehicle (2017 dollars, 3% Discount Rate) | Injury Cost Impact per Vehicle (2017 dollars, 7% Discount Rate) | Total Safety Cost Impact per Vehicle (2017 dollars, 3% Discount Rate) | Total Safety Cost Impact per Vehicle (2017 dollars, 7% Discount Rate) |
|---|---|---|---|---|---|
| Appearance Constraint | Low | $584.76 | $437.78 | $966.34 | $723.29 |
| Appearance Constraint | High | $1,369.91 | $1,025.35 | $2,263.85 | $1,694.44 |
| Voluntary Seat Belts | Low | $2,126.87 | $1,591.91 | $3,514.76 | $2,630.72 |
| Voluntary Seat Belts | High | $4,982.60 | $3,729.36 | $8,234.02 | $6,162.98 |
| Full Exemption | Low | $3,749.85 | $2,806.68 | $6,196.83 | $4,638.19 |
| Full Exemption | High | $8,784.76 | $6,575.20 | $14,517.30 | $10,865.87 |

At a three-percent discount rate, total lifetime per-vehicle safety costs are estimated to be between $966 and $8,234 under the two baselines (between $723 and $6,163 at a seven-percent discount rate), before accounting for TPMS and backup cameras. No post-hoc studies are available to quantify the safety impacts of TPMS, but the preliminary determination[51] estimated that fatality rates would be approximately 0.37 percent higher without fleet-wide TPMS (based on an annual reduction of 124 fatalities relative to 33,243 vehicle occupant fatalities in 2001). Under this proposal, the incremental safety impacts of TPMS are estimated to be equal to the all-FMVSS fatality rate multiplied by both 0.37 percent and annual VMT. Thus, total incremental safety cost impacts associated with exempting replica vehicles from TPMS compliance are equal to:

[51] NHTSA (2000). *Federal Motor Vehicle Safety Standards: Tire Pressure Monitoring Systems; Controls and Displays*. https://www nhtsa.gov/sites/nhtsa.dot.gov/files/tpmsfinalrule.pdf.

**Table 39: Total Discounted Safety Cost Impacts (Incremental Non-Discounted Fatality and Injury Cost) per Vehicle Due to Forgoing Compliance with TPMS in Replica Cars, 30-Year Vehicle Lifetime**

| VMT | Discounted TPMS Safety Cost Impact (3% Discount Rate, 2017 dollars) | Discounted TPMS Safety Cost Impact (7% Discount Rate, 2017 dollars) |
|---|---|---|
| Low Case | $12.32 | $8.12 |
| High Case | $28.86 | $19.02 |

The final regulatory impact analysis (FRIA) for backup cameras within FMVSS No. 111[52] estimates the cost per effective life saved for backup cameras is $15.9 million in 2010 dollars at a three-percent discount rate, and $26.3 million in 2010 dollars at a seven-percent discount rate. The value of a statistical life used within the FRIA was $8.86 million (in 2010 dollars); thus, the estimates of cost per effective life saved for backup cameras indicate that the estimated safety benefits of backup cameras are only 56 percent as large as installation costs at a three-percent discount rate (34 percent at a seven-percent discount rate). Multiplying this estimate by the estimated installation cost ($153.37 in 2017 dollars) yields estimates of backup camera safety benefits (for average vehicles, in 2017 dollars) of $85.46 at a three-percent discount rate, and $51.67 at a seven-percent discount rate.

To identify our final estimate of the safety cost impact of relaxing backup camera requirements for replica cars, we multiply the estimates of backup camera safety benefits in average vehicles by the ratio of replica vehicle annual VMT to average vehicle VMT

[52] NHTSA (2014). *Backover Crash Avoidance Technologies: FMVSS No. 111*. National Highway Traffic Safety Administration, Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis. March.

(2,280/11,327)[53], yielding estimates of $17.20 at a three-percent discount rate and $10.40 at a seven-percent discount rate. **Error! Reference source not found.** Table 40 summarizes the total discounted estimated safety cost impacts associated with relaxing compliance with FMVSS, including TPMS and backup cameras:

**Table 40: Total Discounted Safety Cost Impacts (Incremental Non-Discounted Fatality and Injury Cost) per Vehicle Due to Forgoing Compliance with FMVSS in Replica Cars, 30-Year Vehicle Lifetime, Accounting for TPMS and Backup Cameras**

| Scenario | VMT Case | 3% Discount Rate | 7% Discount Rate |
|---|---|---|---|
| Appearance Constraint | Low | $995.87 | $741.80 |
| Appearance Constraint | High | $2,309.91 | $1,723.86 |
| Voluntary Seat Belts | Low | $3,544.28 | $2,649.24 |
| Voluntary Seat Belts | High | $8,280.08 | $6,192.40 |
| Full Exemption | Low | $6,226.36 | $4,656.71 |
| Full Exemption | High | $14,563.36 | $10,895.29 |

At a three-percent discount rate, the total per-vehicle safety cost impacts for replica cars associated with the proposed rule are estimated to be between $996 and $8,280 under the two baselines. At a seven-percent discount rate, the total per-vehicle safety cost impacts for replica cars associated with the proposed rule are estimated to be between $742 and $6,192 under the two baselines.

[53] Federal Highway Administration (2017). *Highway Statistics 2015*. Table VM-1. Office of Highway Policy Information, January.

Appendix A.2.b. LTVs – Safety Cost Impacts

For the ensuing analysis we focus on the safety impacts of relaxing FMVSS compliance for replica LTVs. The first step in estimating safety impacts is to calculate the total potential fatalities that would have occurred without the relevant subset of FMVSS based on values reported in Kahane (2015), leading to a percentage estimate of the incremental fatality risk relative to a baseline with all FMVSS.

Kahane (2015) reports the following estimates of lives saved by vehicle technologies in 2012, as summarized in Table 41, which serve as the relevant FMVSS to evaluate within the analysis of safety impacts:

**Table 41: LTV Occupant Lives Saved by Vehicle Technologies in 2012 (from Kahane, 2015 and Independent Calculations)†**

| FMVSS No. | LTV Occupant Lives Saved |
|---|---|
| 105 – Dual Master Cylinders and Front Disc Brakes | 201 |
| 126 – Electronic Stability Control | 824 |
| 201 – Instrument Panel Improvements | 304 |
| 201B – Head Impact Upgrade | 269 |
| 203/204 – Energy-Absorbing Steering Assemblies | 1,084 |
| 206 – Door Locks | 641 |
| 208 – Seat Belts | 8,316 |
| 208I – Frontal Air Bags | 1,193 |
| 212 – Windshield Bonding | 95 |
| 214 – Side Impact Protection | 315 |
| 216 – Roof Crush Resistance | 0 |
| 226 – Rollover Curtains | 41 |
| 301 – Fuel System Integrity | 4 |
| TOTAL | 13,287 |

*†- The 2012 fleet contains vehicles that are not compliant with some or all FMVSS.*

The values in Table 41 reflect estimated lives saved due to the effects of the FMVSS evaluated in this section on vehicles in the fleet (with the exception of TPMS and backup cameras, discussed later in this section). Because the fleet contains vehicles that are not compliant with some or all FMVSS, the estimates of lives saved are not sufficient to estimate the difference in fatality risk in fully-FMVSS-compliant vehicles relative to non-compliant vehicles (i.e., non-compliant vehicles in the fleet obscure the effects of compliant vehicles). Maintaining assumptions of linearity in Kahane (2015) (e.g., FMVSS No. *X* reduces fatality risk in a vehicle by *y* percent, independently of all other effects), we can divide the estimates of lives saved from Table 41 by the penetration rate of each FMVSS in the latest observed model year (2012) in Kahane (2015) to estimate lives saved under a vehicle fleet consisting only of fully-FMVSS-compliant vehicles:

**Table 42: LTV Occupant Lives Saved by Vehicle Technologies in 2012 if All Vehicles Complied with All Applicable FMVSS (from Kahane, 2015)**

| FMVSS No. | LTV Occupant Lives Saved with 2012 Compliance Rate | LTV Occupant Lives Saved |
|---|---|---|
| 105 – Dual Master Cylinders/Front Disc Brakes | 201 | 201 |
| 126 – Electronic Stability Control | 824 | 3,667 |
| 201 – Instrument Panel Improvements | 304 | 304 |
| 201B – Head Impact Upgrade | 269 | 444 |
| 203/204 – Energy-Absorbing Steering Assemblies | 1,084 | 1,087 |
| 206 – Door Locks | 641 | 646 |
| 208 – Seat Belts | 8,316 | 8,321 |
| 208I – Frontal Air Bags | 1,193 | 1,311 |
| 212 – Windshield Bonding | 95 | 96 |
| 214 – Side Impact Protection | 315 | 525 |
| 216 – Roof Crush Resistance | 0 | 0 |
| 226 – Rollover Curtains | 41 | 274 |
| 301 – Fuel System Integrity | 4 | 19 |
| TOTAL \| Difference from Table above | 13,287 | 16,897 \| 3,610 (27.2%) |

After adjusting for technology penetration rates, adding the full suite of FMVSS to LTVs is estimated to have been capable of saving 16,897 lives in 2012 (an increase of 3,610, or 27.2 percent relative to the unadjusted value). In addition, Kahane (2015) estimates a total of 23,247 LTV occupant fatalities in 2012. In other words, with the 16,897 lives saved when LTVs are in full compliance with the applicable FMVSS, we would see 6,350 fatalities (23,247 – 16,897 = 6,350). Among the 6,350 fatalities, 215 fatalities would be mitigated independently of the proposed rule, because they are associated with FMVSS that govern equipment (i.e., child safety seats, conspicuity tape). Thus, the baseline level of LTV occupant fatalities associated with full compliance with FMVSS is 6,350 less 215, or 6,135.

Estimates of the relative increase in fatality risk from relaxing FMVSS requirements for replica LTVs are found by dividing the estimated number of fatalities in 2012 with relaxed FMVSS compliance (23,247 less 215, or 23,032) by estimated fatalities in 2012 if all vehicles were FMVSS compliant (6,135) and subtracting by 1.00. The estimate of 2012 fatalities with relaxed FMVSS compliance is equal to Kahane's (2015) estimate of fatalities without the relevant FMVSS, less Kahane's estimated lives saved for FMVSS not affected by the proposed rule (i.e., child safety seats, conspicuity tape) (215). The estimate of 2012 fatalities if all LTVs were FMVSS compliant equals the estimate of 2012 fatalities without FMVSS, less the estimated lives saved under a full-FMVSS fleet from Table 42). Corresponding estimates for NHTSA's two baselines are found in the same manner, with adjustments for lives saved among the FMVSS with which replica vehicle manufacturers are assumed to comply voluntarily:

**Table 43: FMVSS Safety Measures and Percentage Estimates of Incremental Fatality Risk Relative to a Baseline with Full FMVSS Compliance for LTVs (from Kahane, 2015 and Independent Calculations)**

| | **Appearance Constraint** | **Voluntary Seat Belts** | **Full Exemption** |
|---|---|---|---|
| Estimated Fatalities in 2012 If All LTVs Were Fully Compliant with FMVSS *(1)* | 6,135 (= 6,350 – 215) | 6,135 (= 6,350 – 215) | 6,135 (= 6,350 – 215) |
| Estimated Fatalities in 2012 without Applicable Vehicle Technologies in Table 42**Error! Reference source not found.** in 2012 *(2) = (1), plus Incremental Lives Saved from* ***Error! Reference source not found.*** | 7,712 (= 6,135 + 1,577) | 14,711 (= 6,135 + 8,576) | 23,032 (= 6,135 + 16,897) |
| **Relative Increase in Fatalities without Vehicle Technologies in Table 42 in 2012** *(3) =[(2)/(1) – 1.00]* | **25.7%** [= (7,712/6,350) – 1.00] | **139.8%** [= (14,711/6,135) – 1.00] | **275.4%** [= (23,032/6,135) – 1.00] |

Table 43 confirms that the vehicle technologies considered in this analysis are associated with strong safety effects. For the baselines in the analysis, the number of fatalities without the applicable vehicle technologies is estimated to be between 26 percent and 140 percent higher (for the *Appearance Constraint* and *Voluntary Seat Belts* scenarios, respectively) than if the 2012 LTV fleet included only fully-FMVSS-compliant vehicles (7,712 fatalities and 14,711 fatalities, respectively, versus 6,135 fatalities).

An analysis of the results in Kahane (2015) reveals that MY 2012 LTVs that are fully compliant with FMVSS would have a baseline fatality risk of 0.53 fatalities per 100 million VMT (an overall fatality rate of 0.84 fatalities per 100 million VMT, multiplied by the ratio of fatalities under a fully FMVSS-compliant fleet to observed fatalities, 6,135/9,747). Future trends

in fatality rates are difficult to project with certainty. For simplicity, in this analysis we assume a constant baseline fatality rate of 0.53 per 100 million VMT for fully-FMVSS-compliant LTVs.

Following from Table 43, NHTSA's baseline estimate is that replica LTVs would have the following incremental fatality rates (i.e., relative to fully-FMVSS-compliant vehicles, found by taking the difference between estimated fatality rates and the baseline):

**Table 44: Incremental Replica LTV Fatality Rates Relative to a Baseline with Full FMVSS Compliance for LTVs (from Kahane, 2015 and Independent Calculations, Fatalities per 100 Million VMT)**

| | **Appearance Constraint** | **Voluntary Seat Belts** | **Full Exemption** |
|---|---|---|---|
| Baseline Fatality Rate *(1)* | 0.53 | 0.53 | 0.53 |
| Fatality Rate under Proposed Rule *(2)* | 0.66 | 1.27 | 1.98 |
| **Incremental Fatality Rate [=*(2)* – *(1)*]** | **0.14** | **0.74** | **1.46** |

NHTSA estimates that exempting replica LTVs from current FMVSS would increase the fatality rate for occupants of the replicas by between 0.14 and 0.74 fatalities per 100 million VMT under the two baselines.

The next step in the analysis is to multiply the estimated incremental fatality rate by an estimate of VMT per replica vehicle per year. For this analysis, we consider two alternative assumptions for annual replica LTV VMT. In the first case, as with replica passenger cars, we assume that VMT for replica vehicles in Year 1 of driving is equal to the average annual VMT for motorcyclists as reported in *Highway Statistics 2015*,[54] 2,280 miles per year, with annual

[54] Federal Highway Administration (2017). *Highway Statistics 2015*. Table VM-1. Office of Highway Policy Information, January.

VMT declining over 30 years at the same rate as in the pickup truck VMT schedule in the most recent CAFE analysis. Under this assumption, VMT declines to 895 in Year 10, and to 560 by Year 30, with an overall annual average VMT of 937. In the second case, we assume that annual VMT *averages* 2,280 across 30 years, by scaling the VMT schedule in the first case by 2,280/937). The two alternative replica LTV VMT schedules follow. We request comment on these assumptions:

**Table 45: Replica LTV VMT Schedules**

| Year | VMT – Proportional to CAFE (Low Case) | VMT –Annual Average = 2,280 (High Case) |
|---|---|---|
| 1 | 2280 | 5547 |
| 2 | 1927 | 4688 |
| 3 | 1868 | 4545 |
| 4 | 1781 | 4334 |
| 5 | 1659 | 4037 |
| 6 | 1516 | 3688 |
| 7 | 1361 | 3312 |
| 8 | 1194 | 2904 |
| 9 | 1037 | 2522 |
| 10 | 895 | 2178 |
| 11 | 772 | 1879 |
| 12 | 771 | 1876 |
| 13 | 734 | 1785 |
| 14 | 705 | 1716 |
| 15 | 689 | 1677 |
| 16 | 672 | 1634 |
| 17 | 654 | 1590 |
| 18 | 642 | 1561 |
| 19 | 628 | 1527 |
| 20 | 614 | 1493 |
| 21 | 599 | 1458 |
| 22 | 593 | 1444 |
| 23 | 581 | 1414 |
| 24 | 578 | 1406 |
| 25 | 573 | 1395 |
| 26 | 561 | 1365 |

| | | |
|---|---|---|
| 27 | 554 | 1348 |
| 28 | 554 | 1347 |
| 29 | 562 | 1367 |
| 30 | 560 | 1363 |

Table 46 presents estimates of incremental fatalities that would be attributable to forgoing compliance with the applicable FMVSS for replica LTVs. The incremental fatality impacts are monetized by multiplying the incremental fatalities per vehicle by NHTSA's estimate of the comprehensive cost of fatalities (approximately $9.9 million in 2017 dollars) and applying discount factors to each year across vehicle lifetimes; the calculation of the comprehensive cost of fatalities in presented in Appendix B:

**Table 46: Lifetime Per-Vehicle Incremental Fatalities and Fatality Cost Impact Due to Forgoing Compliance with FMVSS in Replica LTVs (Not Including TPMS and Backup Cameras)**

| Scenario | VMT Case | Incremental Fatalities per Vehicle (3% Discount Rate) | Incremental Fatalities per Vehicle (7% Discount Rate) | Fatality Cost Impact per Vehicle (2017 dollars, 3% Discount Rate) | Fatality Cost Impact per Vehicle (2017 dollars, 7% Discount Rate) |
|---|---|---|---|---|---|
| Appearance Constraint | Low | 0.00003 | 0.00002 | $282.47 | $209.13 |
| Appearance Constraint | High | 0.00007 | 0.00005 | $687.24 | $508.81 |
| Voluntary Seat Belts | Low | 0.00015 | 0.00011 | $1,536.75 | $1,137.77 |
| Voluntary Seat Belts | High | 0.00038 | 0.00028 | $3,738.84 | $2,768.13 |
| Full Exemption | Low | 0.00030 | 0.00023 | $3,027.72 | $2,241.64 |
| Full Exemption | High | 0.00074 | 0.00055 | $7,366.28 | $5,453.78 |

At a three-percent discount rate, fatality costs per vehicle are estimated to increase by between $282 and $3,739 for replica LTVs over a 30-year vehicle lifetime across the two baselines (an increase of between $209 and $2,768 at a seven-percent discount rate).

Injury cost impacts are relatively uncertain for at least two reasons. Not only is it difficult to quantify effects on injury rates for some FMVSS, but it is also difficult to identify disaggregated effects of FMVSS by injury severity. For this analysis, we assume that FMVSS affect non-fatal injury classifications (MAIS 0 through MAIS 5) proportionally to the corresponding effect on fatalities. This assumption is based primarily on a judgment that: (1) the reduction in the risk of experiencing a crash due to FMVSS would equally mitigate all levels of injury severity, not just fatalities; and (2) the reduction in the severity of a crash due to FMVSS would reduce the per-mile rates of injury risk across all MAIS categories by substantially similar levels. We believe this is a reasonable assumption because: any given reduction in crash frequency or crash severity associated with FMVSS could reasonably affect all injury categories linearly.

Under an assumption of equivalent (relative) incremental effects on fatalities and injuries, it is feasible to incorporate an estimate of incremental MAIS 0 through MAIS 5 injury cost impacts through a simple scaling factor applied to estimated incremental fatality costs. Blincoe et al.[55] (2015) report that fatal injuries comprise 39.5 percent of total comprehensive costs due to injury. Thus, under an assumption that the FMVSS considered in this analysis affect non-fatal injuries proportionally to their impact on fatalities, then total injury and fatality cost impacts

[55] Blincoe, L.J., Miller, T.R., Zaloshnja, E., & Lawrence, B.A. (2015). *The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised).* National Highway Traffic Safety Administration, Report No, DOT HS 812 013, Washington, DC.

would be approximately 2.53 (1/0.395) times the value of fatalities alone (i.e., the value of injuries, separate from fatalities, is 1.53 times the value of fatalities).

The estimated value of 1.53 fatality equivalent of injury per estimated fatality can be applied as a scaling factor directly to the estimated non-discounted fatality costs per vehicle to generate estimates of total safety (fatality plus injury) costs before accounting for TPMS and backup cameras:

**Table 47: Total Lifetime Safety Cost Impacts per Vehicle (Incremental Non-Discounted Fatality and Injury Cost) Due to Forgoing Compliance with FMVSS in Replica LTVs (Not Including TPMS and Backup Cameras, 2017 Dollars)**

| Scenario | VMT Case | Injury Cost Impact (3% Discount Rate) | Injury Cost Impact (7% Discount Rate) | Total Safety Cost Impact (3% Discount Rate) | Total Safety Cost Impact (7% Discount Rate) |
|---|---|---|---|---|---|
| Appearance Constraint | Low | $432.87 | $320.49 | $715.35 | $529.652 |
| Appearance Constraint | High | $1,053.15 | $779.73 | $1,740.40 | $1,288.54 |
| Voluntary Seat Belts | Low | $2,354.98 | $1,743.56 | $3,891.74 | $2,881.33 |
| Voluntary Seat Belts | High | $5,729.54 | $4,241.99 | $9,468.37 | $7,010.12 |
| Full Exemption | Low | $4,639.80 | $3,435.18 | $7,667.52 | $5,676.82 |
| Full Exemption | High | $11,288.37 | $8,357.59 | $18,654.65 | $13,811.37 |

At a three-percent discount rate, total lifetime per-vehicle safety costs are estimated to be between $715 and $9,468 under the two baselines (between $530 and $7,010 at a seven-percent discount rate), before accounting for TPMS and backup cameras. No post-hoc studies are available to quantify the safety impacts of TPMS, but the preliminary determination[56] estimated

[56] NHTSA (2000). *Federal Motor Vehicle Safety Standards: Tire Pressure Monitoring Systems; Controls and Displays*. https://www nhtsa.gov/sites/nhtsa.dot.gov/files/tpmsfinalrule.pdf.

that fatality rates would be approximately 0.37 percent higher without fleet-wide TPMS (based on an annual reduction of 124 fatalities relative to 33,243 vehicle occupant fatalities in 2001). Under this proposal, the incremental safety impacts of TPMS are estimated to be equal to the all-FMVSS fatality rate multiplied by both 0.37 percent and annual VMT. Thus, total incremental safety cost impacts associated with exempting replica vehicles from TPMS compliance are equal to:

**Table 48: Total Discounted Safety Cost Impacts (Incremental Non-Discounted Fatality and Injury Cost) per Vehicle Due to Forgoing Compliance with TPMS in Replica Cars, 30-Year Vehicle Lifetime**

| VMT | Discounted TPMS Safety Cost Impact (3% Discount Rate, 2017 dollars) | Discounted TPMS Safety Cost Impact (7% Discount Rate, 2017 dollars) |
|---|---|---|
| Low Case | $11.70 | $7.63 |
| High Case | $28.47 | $18.56 |

The final regulatory impact analysis (FRIA) for backup cameras within FMVSS No. 111[57] estimates the cost per effective life saved for backup cameras is $15.9 million in 2010 dollars at a three-percent discount rate, and $26.3 million in 2010 dollars at a seven-percent discount rate. The value of a statistical life used within the FRIA was $8.86 million (in 2010 dollars); thus, the estimates of cost per effective life saved for backup cameras indicate that the estimated safety benefits of backup cameras are only 56 percent as large as installation costs at a three-percent discount rate (34 percent at a seven-percent discount rate). Multiplying this estimate by the estimated installation cost ($153.37 in 2017 dollars) yields estimates of backup

[57] NHTSA (2014). *Backover Crash Avoidance Technologies: FMVSS No. 111*. National Highway Traffic Safety Administration, Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis. March.

camera safety benefits (for average vehicles, in 2017 dollars) of $85.46 at a three-percent discount rate, and $51.67 at a seven-percent discount rate.

To identify our final estimate of the safety cost impacts of relaxing backup camera requirements for replica LTVs, we multiply the estimates of backup camera safety benefits in average vehicles by the ratio of replica vehicle annual VMT to average vehicle VMT (2,280/11,327[58]), yielding estimates of $17.20 at a three-percent discount rate and $10.40 at a seven-percent discount rate. **Error! Reference source not found.** Table 49 summarizes the total discounted estimated safety cost impacts associated with relaxing compliance with FMVSS, including TPMS and backup cameras:

**Table 49: Total Discounted Safety Cost Impacts (Incremental Non-Discounted Fatality and Injury Cost) per Vehicle Due to Forgoing Compliance with FMVSS in Replica LTVs, 30-Year Vehicle Lifetime, Accounting for TPMS and Backup Cameras**

| Scenario | VMT Case | 3% Discount Rate | 7% Discount Rate |
|---|---|---|---|
| Appearance Constraint | Low | $744.25 | $547.65 |
| Appearance Constraint | High | $1,786.06 | $1,317.49 |
| Voluntary Seat Belts | Low | $3,920.64 | $2,899.36 |
| Voluntary Seat Belts | High | $9,514.04 | $7,039.07 |
| Full Exemption | Low | $7,696.43 | $5,694.84 |
| Full Exemption | High | $18,700.31 | $13,840.33 |

At a three-percent discount rate, the total per-vehicle safety cost impacts for replica LTVs associated with the proposed rule are estimated to be between $744 and $9,514 under the two

[58] Federal Highway Administration (2017). *Highway Statistics 2015*. Table VM-1. Office of Highway Policy Information, January.

baselines. At a seven-percent discount rate, the total per-vehicle safety cost impacts for replica cars associated with the proposed rule are estimated to be between $548 and $7,039 under the two baselines.

Appendix A.2.c. Passenger Cars – Bumper Standards

The proposed rule is estimated to generate incremental property damage in addition to the estimated fatality and injury cost impacts above. 49 CFR Part 581 establishes bumper standards that yield estimated property damage savings of between $137 and $285 (in 1981 dollars) at a ten-percent discount rate. Taking the midpoint of the range and converting to 2017 dollars using the Implicit GDP Price Deflator yields an estimate of $492.23 in 2017 dollars. Under this proposal, the property damage savings would be foregone. Because at least some older passenger cars and trucks have bumpers that meet or exceed current bumper standards, estimates of the impacts of relaxing compliance with the standard represent upper-bound estimates.

NHTSA estimates that replica vehicles' discounted exposure (at a three-percent discount rate) to property damage risk through relaxing bumper standards would be equal to the ratio of NHTSA's estimate of VMT to FHWA's estimate of annual VMT for the average vehicle (11,327 miles per year), thus the effective discounted impact of relaxing the bumper standard for replica vehicles is equal to either (973/11,327) or (2,280/11,327) multiplied by $492.23, or increases in property damage costs of $42.28 (for the low VMT case) and $99.08 (for the high VMT case) at a ten-percent discount rate. NHTSA scaled the estimate at a ten-percent discount rate consistent with estimates of values across 30-year horizons with three-percent, seven-percent and ten-percent discount rates to identify incremental property damage costs associated with relaxing compliance with the bumper standard: $72.01 (low VMT) and $168.75 (high VMT) at a three-

percent discount rate, and $51.76 (low VMT) and $121.29 (high VMT) at a seven-percent discount rate.

**Table 50: Total Discounted Property Damage Cost Impacts Due to Forgoing Bumper Standards in Replica Cars (2017 Dollars)**

| VMT | 3% Discount Rate | 7% Discount Rate |
|---|---|---|
| Low Case | $72.01 | $51.76 |
| High Case | $168.75 | $121.29 |

Appendix A.2.d. LTVs – Bumper Standards

The bumper standards evaluated above only apply to passenger cars. Thus, NHTSA estimates no impact related to relaxing compliance with bumper standards for replicas of LTVs.

Appendix A.2.e. Total Benefit Impacts

Total discounted benefit impacts for each vehicle type are calculated by summing the discounted benefit impact estimates presented above. The estimated total benefit impacts are comprised of the estimated injury, fatality and property damage impacts due to relaxing compliance with FMVSS standards and bumper standards. To identify total annual benefit impacts, the per-vehicle impacts must be multiplied by the estimated number of vehicles affected per year.

*Appendix A.2.e.i. Passenger Cars – Total Benefit Impacts*

The estimated discounted per-vehicle benefit impacts for replica passenger cars presented in this section are itemized in Table 51 and Table 52. Increases in monetized safety and property damage impacts represent negative benefit impacts:

**Table 51: Total Discounted Benefit Impacts – Replica Passenger Cars (2017 Dollars, per Vehicle, 3% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Property Damage Benefit Impact | Total Benefit Impact |
|---|---|---|---|---|
| Appearance Constraint | Low | -$995.87 | -$72.01 | -$1,067.88 |
| Appearance Constraint | High | -$2,309.91 | -$168.75 | -$2,478.66 |
| Voluntary Seat Belts | Low | -$3,544.28 | -$72.01 | -$3,616.29 |
| Voluntary Seat Belts | High | -$8,280.08 | -$168.75 | -$8,448.82 |
| Full Exemption | Low | -$6,226.36 | -$72.01 | -$6,298.37 |
| Full Exemption | High | -$14,563.36 | -$168.75 | -$14,732.11 |

**Table 52: Total Discounted Benefit Impacts – Replica Passenger Cars (2017 Dollars, per Vehicle, 7% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Property Damage Benefit Impact | Total Benefit Impact |
|---|---|---|---|---|
| Appearance Constraint | Low | -$741.80 | -$51.76 | -$793.56 |
| Appearance Constraint | High | -$1,723.86 | -$121.29 | -$1,845.14 |
| Voluntary Seat Belts | Low | -$2,649.24 | -$51.76 | -$2,701.00 |
| Voluntary Seat Belts | High | -$6,192.40 | -$121.29 | -$6,313.68 |
| Full Exemption | Low | -$4,656.71 | -$51.76 | -$4,708.47 |
| Full Exemption | High | -$10,895.29 | -$121.29 | -$11,016.58 |

At a three-percent discount rate, total discounted per-vehicle benefit impacts for replica passenger cars are estimated to be between -$8,449 and -$1,068 under the two baselines. At a

seven-percent discount rate, total discounted per-vehicle benefit impacts for replica passenger cars are estimated to be between -$6,314 and -$794 under the two baselines.

*Appendix A.2.e.ii. LTVs – Total Benefit Impacts*

The estimated discounted per-vehicle benefit impacts for replica LTVs presented in this section are itemized in Table 53 and Table 54. Increases in monetized safety impacts represent negative benefit impacts:

**Table 53: Total Discounted Benefit Impacts – Replica LTVs (2017 Dollars, per Vehicle, 3% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Total Benefit Impact |
|---|---|---|---|
| Appearance Constraint | Low | $744.25 | $744.25 |
| Appearance Constraint | High | $1,786.06 | $1,786.06 |
| Voluntary Seat Belts | Low | $3,920.64 | $3,920.64 |
| Voluntary Seat Belts | High | $9,514.04 | $9,514.04 |
| Full Exemption | Low | $7,696.43 | $7,696.43 |
| Full Exemption | High | $18,700.31 | $18,700.31 |

**Table 54: Total Discounted Benefit Impacts – Replica LTVs (2017 Dollars, per Vehicle, 7% Discount Rate)**

| Scenario | VMT | Fatality and Injury Benefit Impact | Total Benefit Impact |
|---|---|---|---|
| Appearance Constraint | Low | $547.65 | $547.65 |
| Appearance Constraint | High | $1,317.49 | $1,317.49 |
| Voluntary Seat Belts | Low | $2,899.36 | $2,899.36 |
| Voluntary Seat Belts | High | $7,039.07 | $7,039.07 |
| Full Exemption | Low | $5,694.84 | $5,694.84 |
| Full Exemption | High | $13,840.33 | $13,840.33 |

At a three-percent discount rate, total discounted per-vehicle benefit impacts for replica LTVs are estimated to be between -$9,514 and -$744 under the two baselines. At a seven-percent discount rate, total discounted per-vehicle benefit impacts for replica passenger cars are estimated to be between -$7,039 and -$548 under the two baselines.

*Appendix A.2.e.iii. Passenger Cars and LTVs Combined – Total Benefit Impacts*

Total discounted annual benefit impacts for replica vehicles are identified by multiplying total discounted per-vehicle benefit impacts by the number of vehicles that would be affected by the rulemaking each year. In this analysis, we assume that, each year, 40 manufacturers would produce a combination of 100-200 replica cars and LTVs combined per manufacturer, with passenger cars and LTVs comprising 90 percent and 10 percent of the total volume of replica vehicles produced, respectively. Thus, we assume that 3,600-7,200 replica cars and 400-800 replica LTVs (and no other replica vehicles) would be produced each year. In turn, our estimates of total annual benefit impact are equal to 3,600-7,200 multiplied by our estimates of total benefit impact per replica passenger car, plus 400-800 multiplied by our estimates of total benefit impacts per replica LTV:

**Table 55: Total Annual Discounted Benefit Impacts (Millions of 2017 Dollars, Upper Bound, when 3,600-7,200 Replica Cars and 400-800 Replica LTVs Are Produced across 40 Manufacturers)**

| Scenario | Annual Production | VMT | Total Benefit Impact (3% Discount Rate) | Total Benefit Impact (7% Discount Rate) |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | -$4.1 | -$3.1 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | -$9.6 | -$7.2 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | -$8.3 | -$6.2 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | -$19.3 | -$14.3 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | -$14.6 | -$10.9 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | -$34.2 | -$25.5 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | -$29.2 | -$21.8 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | -$68.4 | -$51.1 |

At a three-percent discount rate, total annual benefit impacts are estimated to be between -$68.4 million and -$4.1 million under the two baselines. At a seven-percent discount rate, total annual benefit impacts are estimated to be between -$51.1 million and -$3.1 million under the two baselines.

Consistent with the calculation of total annual benefit impacts, total annual incremental fatalities and fatality equivalents are estimated as the discounted sum of annual incremental fatalities and fatality equivalents per vehicle multiplied by the number of vehicles produced per year:

**Table 56: Total Annual Discounted Incremental Fatalities (Millions of 2017 Dollars, Upper Bound, when 3,600-7,200 Replica Cars and 400-800 Replica LTVs Are Produced across 40 Manufacturers, 3% Discount Rate)**

| Scenario | Annual Production | VMT | Incremental Fatalities | Incremental Fatality Equivalents |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | 0.15 | 0.39 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | 0.36 | 0.91 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | 0.31 | 0.78 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | 0.72 | 1.82 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | 0.57 | 1.44 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | 1.34 | 3.39 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | 1.14 | 2.89 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | 2.67 | 6.77 |

**Table 57: Total Annual Discounted Incremental Fatalities (Millions of 2017 Dollars, Upper Bound, when 3,600-7,200 Replica Cars and 400-800 Replica LTVs Are Produced across 40 Manufacturers, 7% Discount Rate)**

| Scenario | Annual Production | VMT | Incremental Fatalities | Incremental Fatality Equivalents |
|---|---|---|---|---|
| Appearance Constraint | 3,600 Cars, 400 LTVs | Low Case | 0.11 | 0.29 |
| Appearance Constraint | 3,600 Cars, 400 LTVs | High Case | 0.27 | 0.68 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | Low Case | 0.23 | 0.58 |
| Appearance Constraint | 7,200 Cars, 800 LTVs | High Case | 0.54 | 1.36 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | Low Case | 0.43 | 1.08 |
| Voluntary Seat Belts | 3,600 Cars, 400 LTVs | High Case | 1.00 | 2.53 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | Low Case | 0.85 | 2.15 |
| Voluntary Seat Belts | 7,200 Cars, 800 LTVs | High Case | 2.00 | 5.06 |

At a three-percent discount rate, total annual incremental fatality equivalents are estimated to be between 0.39 and 6.77 under the two baselines (0.15 to 2.67 fatalities). At a seven-percent discount rate, total annual incremental fatality equivalents are estimated to be between 0.29 and 5.06 under the two baselines (0.11 to 2.00 fatalities).

# APPENDIX B. COST AND BENEFIT ESTIMATES FOR ADDITIONAL VEHICLE TYPES

## Appendix B.1. Background

A central assumption within the analysis is that no replica vehicles would be produced among the other vehicle types affected by the proposed rule (i.e., motorcycles, medium- and heavy-duty trucks, buses, LSVs, and trailers). In this appendix, we present the per-vehicle cost impacts and benefit impacts that were identifiable for these vehicle types.

The relevant FMVSS that apply to replica motorcycles are FMVSS Nos. 105, 108, 110, 111, 122, 123, and 135. FMVSS Nos. 105, 122 and 135 establish requirements for motorcycle brake systems and tests thereof. FMVSS No. 108 establishes requirements for external lighting. FMVSS No. 110 includes requirements that motorcycle tires must satisfy. FMVSS No. 111 establishes requirements for rear visibility. FMVSS No. 123 establishes requirements for the location, function, labeling and lighting of motorcycle controls and displays, and the form and location of footrests and stands.

The relevant FMVSS that apply to replica LSVs are FMVSS Nos. 111 and 500. FMVSS No. 111 includes the requirement for backup cameras. FMVSS No. 500 established safety standards for low-speed vehicles (four-wheeled vehicles, with a GVWR of less than 1,361 kilograms (3,000 pounds) and top speeds between 20 and 25 miles per hour). The standard governs lighting (headlights, turn signals, and tail/brake lights), conspicuity (reflex reflectors), internal and external mirrors, parking brakes, seat belts, and glazing materials.

The relevant FMVSS that apply to trailers are FMVSS Nos. 120, 121 and 224. FMVSS No. 121 establishes performance requirements for vehicles equipped with air brake systems, including trailers. Revisions to the standard have added mandatory anti-lock brakes (ABS).

FMVSS No. 224 requires certain trailers and semitrailers to be equipped with rear impact guards to protect occupants of other vehicles from effects of rear impacts with trailers.

**Appendix B.2. Motorcycles – Production Cost Savings and Total Cost Impacts**

FMVSS Nos. 122 and 123 are vehicle-specific standards that apply to motorcycles only; FMVSS Nos. 105, 108, 110, 111, and 135 also apply to motorcycles under this proposed rule. FMVSS No. 122 establishes requirements for motorcycle brake systems and tests thereof. A 1979 review of FMVSS No. 122 compliance costs[59] concluded that by the time FMVSS No. 122 was established, motorcycle manufacturers were already compliant with the standard. Thus, NHTSA assumes that there would be no effect on manufacturing costs or safety for replica motorcycles if FMVSS No. 122 were relaxed. This is not intended as evidence that FMVSS No. 122 does not offer benefits; not only could removing the standard lead to the production of future motorcycles that are more dangerous, but the standard also streamlines the enforcement of compliance with brake standards.

FMVSS No. 123 establishes requirements for the location, function, labeling and lighting of motorcycle controls and displays, and the form and location of footrests and stands. NHTSA was unable to identify cost or safety studies associated with FMVSS No. 123 when the agency established the requirements. In the absence of observed cost and safety estimates, NHTSA is unable to generate an estimate of the benefits and costs associated with relaxing compliance with FMVSS No. 123.

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[59] Harvey, M.R., Lesczhik, J.A., and McLean, R.F. (1979). *Cost Evaluation for Nine Federal Motor Vehicle Standards, Volume III: FMVSS 122*, De Lorean Motor Company, Troy, MI, DOT Final Report No. DOT HS 805 317. (November).

However, at least some components of replicas of motorcycles governed by FMVSS No. 123 are likely to be: (1) compliant with the standard (e.g., clutches located on the left handlebar and activated by squeezing); (2) functionally equivalent and identifiable directly or through documentation (e.g., horn on the right handlebar rather than the left handlebar); or (3) of minimal impact (e.g., tachometer that does not label units).

For FMVSS Nos. 105/135 and 111, we assume that the cost of complying with the standards is equivalent for motorcycles and passenger cars. Thus, the estimated cost impact associated with relaxing compliance with FMVSS Nos. 105, 111 (not including backup cameras, which does not apply to motorcycles), and 135 is -$44.93 plus -$29.27, or -$74.20 per vehicle. For FMVSS No. 108 (brake systems), we assume that compliance costs for motorcycles are half as high as for passenger cars (because motorcycles have half as many brakes). Thus, the estimated cost impact associated with relaxing compliance with FMVSS No. 108 for motorcycles is -$22.09 per vehicle.

FMVSS No. 110 includes requirements that motorcycle tires must satisfy. For this analysis, we assume that that the existence of FMVSS No. 110 has resulted in manufacturers producing motorcycle tires that are compliant with FMVSS No. 110 by default, and hence there would be no cost savings to replica motorcycle manufacturers when acquiring non-compliant tires as an alternative. Thus, we assume no cost savings associated with relaxing compliance with FMVSS No. 110 for replica motorcycle manufacturers; we request comment on this assumption.

Altogether, the estimated cost impact for motorcycles is -$96.29 per vehicle. Applying discount factors yields estimates of discounted total cost impacts equal to -$94.88 and -$93.09 per motorcycle at a three-percent- and seven-percent discount rate, respectively.

**Appendix B.3. Trailers – Production Cost Savings**

FMVSS No. 108 establishes requirements regarding vehicle visibility and illumination, including trailers. NHTSA identified no information on the effects of FMVSS No. 108 on trailer costs. However, Simons (2017) reported no change in light-duty vehicle costs due to FMVSS No. 108 (i.e., manufacturing practices when the standard was introduced were sufficient to meet the standard); for this analysis, NHTSA assumes that, consistent with light-duty vehicles, there was no incremental effect of FMVSS No. 108 on trailer costs, with the exception of conspicuity tape, which is a unique requirement for trailers. A NHTSA web search for conspicuity tape prices at major vendors indicated a range of between $50 and $200 per 150-foot roll of conspicuity tape certified to DOT standards. For this analysis, we assume a cost of $100 to equip a replica trailer with conspicuity tape that is compliant with FMVSS No. 108 (taking the midpoint of the range revealed in the web search and then reducing the price by 20 percent to account for returns to scale); we request comment on this assumption. Thus, the estimated cost impact of relaxing compliance with FMVSS No. 108 is -$100 per trailer.

FMVSS No. 120 includes requirements that trailer tires must satisfy. For this analysis, we assume that that the existence of FMVSS No. 120 has resulted in manufacturers producing trailer tires that are compliant with FMVSS No. 120 by default, and hence there would be no cost savings to replica trailer manufacturers when acquiring non-compliant tires as an alternative. Thus, we assume no cost savings associated with relaxing compliance with FMVSS No. 120 for replica trailer manufacturers; we request comment on this assumption.

FMVSS No. 121 establishes standards for vehicles equipped with air brake systems, including trailers. Revisions to the standard have added mandatory anti-lock brakes (ABS).

However, Tarbet[60] (2004) notes that manufacturers had already offered trailers with ABS in advance of the standard; hence, relaxing compliance with FMVSS No. 121 under the proposed rule would not necessarily involve the omission of ABS (i.e., replica trailers would have the same ABS that the original trailers had). Simons (2017) reports a representative compliance cost for FMVSS No. 121 (without ABS) of $119.49 in 2012 dollars, or $128.63 in 2017 dollars. Thus, the estimated cost impact of relaxing compliance with FMVSS No. 121 is -$128.63 per trailer.

FMVSS No. 224 establishes standards related to protecting occupants of other vehicles from effects of rear impacts with trailers. The final rule for FMVSS No. 224[61] provides an estimate of compliance costs (in 1996 dollars) of $200 for energy-absorbing bumper guards. Applying the Implicit GDP Price Deflator yields a compliance cost estimate of $295.26 in 2017 dollars. Thus, the estimated cost impact of relaxing compliance with FMVSS No. 224 is -$295.26 per trailer.

Altogether, the upper-bound estimated cost impact associated with relaxing FMVSS compliance for trailers is -$523.89.[62]

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[60] Tarbet, M.J. (2004). *Cost and Weight Added by the Federal Motor Vehicle Safety Standards for Model Years 1968-2001 in Passenger Cars and Light Trucks*. Report No. DOT HS 809 834. National Highway Traffic Safety Administration, Washington, DC.

[61] *Federal Register, Vol. 61, No. 16, pp. 2004-2036.*

[62] Not all trailers are required to have conspicuity tape, rear impact guards, or ABS.

**Appendix B.4. Trailers – Fuel Consumption Savings**

The final rule for FMVSS No. 224[63] provides an estimate of $23.05 in in additional fuel costs due to increased vehicle weight (in 1996 dollars) associated with the standard, which requires that most new trailers with a GVWR greater than 4,536 kilograms (10,000 pounds) be equipped with rear impact guards designed to reduce injuries and fatalities resulting from collisions of light-duty vehicles into the rear ends of heavy trailers. Applying the Implicit GDP Price Deflator yields an estimate of $34.03 in 2017 dollars. Relaxing compliance with standard is thus estimated to yield a cost impact of -$34.03 per trailer in benefits to purchasers of replica trailers, due to decreased fuel consumption when relaxing compliance with the standard.

**Appendix B.5. Trailers – Total Cost Impacts**

The undiscounted per-vehicle cost impacts identified in this analysis for replica trailers include cost impacts accruing to manufacturers (production cost savings) and purchasers (fuel consumption savings) due to relaxing FMVSS compliance, totaling -$557.92 per trailer. Applying discount factors yields estimates of discounted total cost impacts equal to -$549.73 and -$539.36 per trailer at a three-percent- and seven-percent discount rate, respectively.

**Appendix B.6. Low-Speed Vehicles – Production Cost Savings and Total Cost Impacts**

FMVSS No. 500 established safety standards for low-speed vehicles (four-wheeled vehicles, with a GVWR of less than 1,361 kilograms (3,000 pounds) and top speeds between 20 and 25 miles per hour). The standards govern lighting (headlights, turn signals, and tail/brake

[63] Federal Register, Vol. 61, No. 16, pp. 2004-2036.

lights), conspicuity (reflex reflectors), internal and external mirrors, parking brakes, seat belts, and glazing materials. The analysis in the final rule for FMVSS No. 500[64] indicates that vehicles that fall within the range of top speed subject to FMVSS No. 500 generally have much of the equipment required to be compliant. Thus, NHTSA assumes that seat belt, backup camera, and quiet car rule costs are likely to be the primary drivers of compliance cost savings under the proposed rule.

For seat belts, we carry forward our estimate of seat belt cost impact for passenger cars, -$194.27. For backup cameras, we also apply our estimate for passenger cars, -$153.37. Although we estimate no quiet car rule compliance cost savings for other vehicle types, some LSVs that would be produced under the proposed rule are electric and thus would need to be compliant with the quiet car rule under the status quo. For this analysis, we assume an upper-bound cost impact for relaxing quiet car rule compliance for LSVs equal to the average estimated compliance costs reported in the final quiet car rule[65], -$74.15 per vehicle (in 2013 dollars).

Altogether, the estimated cost impact for forgoing FMVSS compliance in LSVs is -$421.79. Applying discount factors yields estimates of discounted total cost impacts equal to -$415.60 and -$407.76 per LSV at a three-percent- and seven-percent discount rate, respectively.

**Appendix B.7. Trailers – Safety Impact**

Kahane (2015) reports that conspicuity tape (part of the scope of FMVSS No. 108) is estimated to have had a significant effect on fatalities. Kahane estimates that 161 fatalities were

[64] https://one.nhtsa.gov/cars/rules/rulings/lsv/lsv html

[65] NHTSA (2016). *Federal Motor Vehicle Standards: Minimum Sound Requirements for Hybrid and Electric Vehicles*. https://www nhtsa.gov/staticfiles/rulemaking/pdf/QuietCar_FinalRule_11142016.pdf.

avoided in 2012 due to the use of conspicuity tape. Applying the same process used in the analysis of injuries involving passenger cars and LTVs, we estimate the value of mitigated injuries due to the use of conspicuity tape as equal to 1.53 times the value of mitigated fatalities (at a comprehensive cost of $9.9 million per fatality):

**Table B-1: Estimated Value of Mitigated Fatalities and Injuries Due to the Use of Conspicuity Tape in 2012 (2017 Dollars)**

| Vehicle Type | Value of Mitigated Fatalities | Value of Mitigated Injuries | Total Value of Mitigated Fatalities and Injuries |
|---|---|---|---|
| Trailers | $16.0 billion | $24.5 billion | $40.5 billion |

The estimated mitigated fatalities due to the use of conspicuity tape represent a mitigated fatality cost of $16.0 billion in 2012; the corresponding estimate of mitigated injury costs is $24.5 billion, yielding a total mitigated safety cost of $40.5 billion.

To identify an estimate of per-vehicle mitigated safety costs, it is necessary to estimate the number of registered trailers. FMCSA[66] reports that: (1) there were approximately 2.47 million registered combination trucks in 2012 (i.e., truck tractors pulling at least one trailer); and (2) out of all large trucks involved in fatal crashes, 61 percent were combination trucks carrying one trailer, 3 percent were combination trucks carrying two trailers, and less than 0.1 percent were combination trucks carrying three trailers. Based on this information, we estimate that the number of registered trailers in 2012 is equal to 2.47 million multiplied by ((61 + (3x2)) / 61), with the latter term representing an adjustment factor to account for the three percent of

[66] https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Large-Truck-Bus-Crash-Facts-2012.pdf.

combination trucks carrying two trailers. Thus, the resulting estimate of registered trailers in 2012 is approximately 2.7 million.

Dividing the estimate of the total value of mitigated fatalities and injuries in 2012 ($40.5 billion) by the estimated number of registered trailers in 2012 (2.7 million) yields an estimate of per-vehicle safety impact associated with conspicuity tape requirements for replica trailers, equal to $1,492.76. Thus, the per-vehicle safety impact associated with relaxing conspicuity tape requirements is estimated to be -$1,492.76 per trailer.

# APPENDIX C. COMPREHENSIVE COSTS OF FATALITIES AND INJURIES

The comprehensive value of societal impacts from fatalities and injuries includes a variety of cost components. Table C-1 summarizes the cost components and corresponding unit costs in 2017 dollars. As shown, the cost components included medical, EMS, market productivity, household productivity, insurance administration, workplace, legal, congestion, travel delay, and the nontangible value of physical pain and loss of quality of life (i.e., quality adjusted life years, QALYs). The unit costs were revised from those published in the agency's 2015 report (Blincoe, 2015 et al.).[67] Blincoe et al. reported unit costs in 2010 dollars. To convert them to 2017 economics, the analysis derived adjustment factors from two types of economic index for adjustment factors: two series of non-seasonally-adjusted Consumer Price Index (CPI) and the Employment Cost Index (ECI).[68] CPI series that were used for deriving adjustment factors include CUUR0000SA0 (All Items, Urban Consumers, U.S. All City Average) and CUUR0000SAM2 (Medical Care Services, Urban Consumers, U.S. All City Average). The ECI used is the series CIU1010000000000I (Total Compensation, Civilian workers, All Industries and Occupations). Each adjustment factor is the ratio of the index value in 2017 to that in 2010. Table C-2 lists the adjustment factors and the indexes they used.

Note that instead of using a direct adjustment, the value of QALY was derived based on the formula shown in the last row of Table C-2 adjusting the value of statistical life (VSL) to

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[67] Blincoe, L., Miller, T., Zalloshnja, E., Lawrence, B., The economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised), DOT HS 812 013 National Center for Statistics and Analysis, Washington, D.C., May 2015.

[68] Published by the Bureau of Economic Analysis within the Bureau of Labor Statistics as of April 30, 2018.

reflect after-tax wages and household productivity. This is an accounting mechanism that prevents double-counting of these factors, which are hypothetically considered to be inherently included in VSL estimates. The current established DOT VSL is $9.6 million (in 2015 dollars) which was based on the most current 2016 DOT Guidance on VSL (DOT, 2016).

**Table C-1: Comprehensive Unit Costs (2017 Dollars)**

| Components | PDO | MAIS0 | MAIS1 | MAIS2 | MAIS3 | MAIS4 | MAIS5 | Fatal |
|---|---|---|---|---|---|---|---|---|
| Medical | $0 | $0 | $3,448 | $14,110 | $59,900 | $167,943 | $473,424 | $13,943 |
| EMS | $66 | $43 | $123 | $248 | $468 | $942 | $961 | $1,014 |
| Market Prod. | $0 | $0 | $3,200 | $22,727 | $75,533 | $165,318 | $396,351 | $1,095,650 |
| Household Prod. | $70 | $53 | $1,012 | $8,342 | $26,636 | $44,073 | $112,008 | $340,354 |
| Ins. Adm. | $215 | $161 | $3,707 | $5,237 | $17,277 | $31,728 | $81,518 | $31,834 |
| Workplace | $73 | $54 | $400 | $3,104 | $6,781 | $7,468 | $13,021 | $13,833 |
| Legal | $0 | $0 | $1,329 | $3,767 | $13,940 | $29,975 | $92,966 | $119,693 |
| *Congestion* | $2,470 | $1,662 | $1,674 | $1,702 | $1,749 | $1,774 | $1,795 | $6,715 |
| *Property Damage* | $4,045 | $3,026 | $8,946 | $9,565 | $18,014 | $18,353 | $16,963 | $12,602 |
| QALYs | $0 | $0 | $24,880 | $389,791 | $870,811 | $2,206,053 | $4,918,006 | $8,293,434 |
| **Total** | $6,939 | $4,999 | $48,719 | $458,593 | $1,091,109 | $2,673,627 | $6,107,013 | $9,929,072 |

**Table C-2: Adjustment Factors**

| Cost Components | Area (Index Type) | Adjustment Factor |
|---|---|---|
| Medical | Medical Care Service (Consumer Price Index) | 1.232 |
| EMS | All Items (Consumer Price Index) | 1.124 |
| Market Productivity | Total Employee Compensation (Employment Cost Index) | 1.174 |
| Household Productivity | Total Employee Compensation (Employment Cost Index) | 1.174 |
| Insurance Administration | All Items (Consumer Price Index) | 1.124 |
| Workplace | Total Employee Compensation (Employment Cost Index) | 1.174 |
| Legal | All Items (Consumer Price Index) | 1.124 |
| *Congestion* | Total Employee Compensation (Employment Cost Index) | 1.174 |
| *Property Damage* | All Items (Consumer Price Index) | 1.124 |
| | | |
| QALYs | Total Employee Compensation (Employment Cost Index) | VSL - 0.881862*Market Productivity – Household Productivity |