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Retrofit Assessment for Existing Motorcoach

A Report to Congress

Disclaimer

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EXECUTIVE SUMMARY

This report, *Retrofit Assessment for Existing Motorcoaches*, is submitted in response to Section 32703(e)(2) of the Moving Ahead for Progress in the 21st Century Act (MAP-21), enacted on July 6, 2012, and Conference Report Number 112-557, pages 414-416. MAP-21 requires the Secretary of Transportation to issue a report to Congress on the feasibility, costs, and benefits of retrofitting motorcoaches with lap/shoulder belts.

On November 25, 2013, NHTSA issued a final rule requiring lap/shoulder belts for each passenger seating position in all new over-the-road buses, and in new buses other than over-the road buses with gross vehicle weight ratings (GVWR) greater than 11,793 kg (26,000 lb), see 78 FR 70416. This rule also examined the feasibility of retrofitting existing motorcoaches with lap/shoulder belts, and determined that the cost and engineering expertise needed for a retrofitting operation would be beyond the means of bus owners (for-hire operators), many of which are small businesses. After considering the low likelihood that a retrofit requirement would be technically practicable at a reasonable cost, the cost impacts on small businesses, and the low benefits that would accrue from a retrofit requirement, NHTSA decided not to pursue a retrofit requirement for seat belts.

This report discusses the findings of the final rule, and in addition includes additional analysis of the retrofitting issue in light of the decision of the USDOT to increase its value of a statistical life, as well as the subsequent adoption of electronic stability control technology in new motorcoaches.

Among the findings of the final rule and this report are:

- The cost of retrofitting motorcoaches with lap/shoulder belts is expected to range from $14,650 to $40,000 per vehicle.
- Retrofitting would produce a significant burden on the small entities that would be responsible for accomplishing it.
- Safety benefits are a function of belt use rates. The final rule estimated that if 15 percent of motorcoach passengers wore belts, about 1.5 fatalities and 140 injuries would be prevented annually. If 83 percent of motorcoach passengers wore belts (the then current rate for passenger cars and light trucks), about 8 fatalities and 790 injuries would be prevented.
- Belt use rates for motorcoaches are much lower than for other passenger vehicles, typically under 10 percent even in countries where usage in passenger vehicles is 90 percent.

- Given low belt use rates, retrofitting was unlikely to produce substantial safety benefits.
- After adjusting for a higher value of statistical life and the installation of ESC in new motorcoaches, NHTSA finds that, due to the substantial impact on small entities, the phase-in of lap/shoulder belts on new motorcoaches, and low belt use rates, it would be impractical to require retrofitting on older vehicles.

I. Introduction

This report responds to requirements in the Moving Ahead for Progress in the 21st Century Act (MAP-21, P.L. 112-141) that requires the Secretary of Transportation to issue a report to Congress on retrofitting existing motorcoaches with safety improvements in order to improve motorcoach safety and prevent passenger ejections. MAP-21 also directs the Secretary to issue a rule requiring seat belts at each designated seating position in all new motorcoaches, and to consider requiring advanced glazing and other portal improvements to new motorcoaches. In addition, it requires the Secretary to issue a report to Congress on the feasibility of retrofitting these technologies to existing vehicles. On November 25, 2013, NHTSA issued a final rule requiring lap/shoulder belts for each passenger seating position in all new over-the-road buses, and in new buses other than over-the road buses with agross vehicle weight ratings (GVWR) greater than 11,793 kg (26,000 lb), see 78 FR 70416. This rule also examined the feasibility of retrofitting existing motorcoaches with lap/shoulder belts, and determined that the cost and engineering expertise needed for a retrofitting operation would be beyond the means of bus owners (for-hire operators), many of which are small businesses. After considering the low likelihood that a retrofit requirement would be technically practicable at a reasonable cost, the cost impacts on small businesses, and the low benefits that would accrue from a retrofit requirement NHTSA decided not to pursue a retrofit requirement for seat belts. This report addresses the findings of that study, and includes additional analysis that reflects subsequent changes in the Department's policy regarding the value of a statistical life (VSL) and the adoption of electronic stability control in the motorcoach fleet, both of which could hypothetically influence the Department's previous decision. This study does not address advanced glazing. The Department has not issued advanced glazing requirements for new vehicles, and thus has no basis for analyzing or requiring retrofitting of advanced glazing on older vehicles at this time.

II. Legislation

On July 6, 2012, the President signed into law a new two-year transportation reauthorization bill, the Moving Ahead for Progress in the 21st Century Act (MAP-21, P.L. 112-141). MAP-21 authorizes funds for Federally aided highways, highway safety programs, transit programs, and other purposes.

Section 32703(e)(2) of MAP-21, Retrofit Assessment for Existing Motorcoaches, states that:

> "(A) In general.--The Secretary may assess the feasibility, benefits, and costs with respect to the application of any requirement established under subsection (a) or (b)(2) to motorcoaches manufactured before the date on which the requirement applies to new motorcoaches under paragraph (1).
>
> (B) Report.--The Secretary shall submit a report on the assessment to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure and the Committee on Energy and Commerce of the House of Representatives not later than 2 years after the date of enactment of this Act."

Subsection (a) of Section 32703 directs that, not later than 1 year after the date of enactment of this act, the Secretary shall prescribe regulations requiring safety belts to be installed in motorcoaches at each designated seating position. Subsection (b)(2) of Section 32703 directs that the Secretary shall consider requiring advanced glazing standards for each motorcoach portal and shall consider other portal improvements to prevent partial and complete ejection of motorcoach passengers, including children. In prescribing such standards, the Secretary shall consider the impact of such standards on the use of motorcoach portals as a means of emergency egress.

III. Background

Millions of people are transported by commercial buses annually. These trips include both business and pleasure tours and are both intra- and inter-city. Older citizens and students account for the majority of occupants on these trips, approximately 54 percent. According to the Motorcoach Census 2008,[1] the motorcoach industry in the United States and Canada had approximately 3,400 carriers and 33,536 motorcoaches. Of this number, approximately 3,137 carriers and approximately 29,325 motorcoaches were based in the United States.[2]

In recent years, there have been several serious commercial bus crashes investigated by the National Transportation Safety Board (NTSB). In each crash there were at least three fatalities and six occupants

[1] Bourquin, P. (2008, December 8). Motorcoach census 2008, A benchmarking study of the size and activity of the motorcoach industry in the United States and Canada in 2007. Washington, DC: American Bus Association.
[2] Motorcoach, as used in the document, generally means an over-the-road bus.

with serious injuries. The causes of most of the crashes were attributed to driver error or poor maintenance of the bus. In many of these crashes, the NTSB determined that the risk of passenger fatalities or injuries would have been minimized if passengers had been properly restrained with lap/shoulder belts.

In July 2012, MAP-21 was enacted, providing funding and authorization to govern United States Federal surface transportation spending. Section 32703(a) of MAP-21 requires the Secretary of Transportation to prescribe regulations requiring safety belts to be installed in “motorcoaches” at each designated seating position. The act defines “motorcoach” to be an over-the-road bus, i.e., a bus characterized by an elevated passenger deck located over a baggage compartment. MAP-21 also defines “safety belt,” also commonly called a seat belt, as an occupant restraint system consisting of integrated lap/shoulder belts (§32702[12]). Section 32703(e)(2) of MAP-21 directs the Secretary to assess the feasibility, benefits, and costs with respect to retrofitting motorcoaches with safety belts, and to consider retrofitting anti-ejection safety countermeasures for motorcoaches.

IV. Retrofitting Safety Belts on Motorcoaches

Notice of Proposed Rulemaking

On August 18, 2010, the National Highway Traffic Safety Administration issued a Notice of Proposed Rulemaking (NPRM), titled "Federal motor vehicle safety standard (FMVSS) Motorcoach Definition; Occupant Crash Protection," see 75 FR 50958. In the NPRM, we asked for comments on the issue of retrofitting existing (used) buses with seat belts at passenger seating positions.[3] We did not include a retrofit proposal as part of the NPRM, but we wanted to know more about the technical and economic feasibility of a retrofit requirement. Our understanding at the time of the NPRM was that significant strengthening of the motorcoach structure would be needed to accommodate the additional loading from the seat belts, particularly for the older buses. NHTSA estimated in the NPRM that the service life of an affected bus can be 20 years or longer. We estimated that the cost of retrofitting can vary substantially, depending on the age of the vehicle retrofitted, needed structural cost to support additional loading from seat belts during a crash, the lifetime fuel cost incurred by adding structural weight to the bus and the weight of the belts themselves.

It was not apparent that establishing requirements similar to or based on the proposed requirements for new motorcoaches would be cost effective, or feasible from an engineering perspective. It was our impression at the time of the NPRM that the cost of engineering expertise needed for a retrofitting operation would be beyond the means of bus owners (for-hire operators), many of which are small businesses.

Commenters were sharply divided in their opinion of the merits of a retrofit requirement. In general, motorcoach manufacturers and operators strongly opposed a retrofit requirement as being economically and technically untenable. Seat suppliers did not support a retrofit requirement. Consumer advocates and individual members of the public strongly supported a retrofit requirement.

Many industry commenters emphasized that the cost of retrofitting will impact many small businesses that do not have large profit margins. We agreed with the point that public policymakers need to consider that retrofitting costs could divert financial resources from other safety-related efforts, such as

[3] See Docket No. NHTSA-2010-0112.

driver training and bus maintenance. We understood that many consumer groups and individuals want to accelerate the installation of seat belts in the entire motorcoach fleet by requiring retrofitting. However, comments from those in favor of retrofitting did not present information offsetting the economic and technical challenges of a retrofit requirement. We did not obtain useful information from the comments regarding implementing enforcement for a retrofit program. While visually inspecting buses to see if there are seat belts at passenger seating positions may be feasible, NHTSA did not receive any comments addressing the feasibility of assessing the seat belt system to see if the seat belts and anchorages would hold in a crash and withstand the loading from the passengers. A seat belt requirement that does not have a way to assess whether belt systems will adequately restrain passengers cannot be enforced and is of diminished value.

Final Rule

On November 25, 2013, NHTSA issued a final rule requiring lap/shoulder belts for each passenger seating position in all new over-the-road buses, and in new buses other than over-the road buses with GVWRs greater than 11,793 kg (26,000 lb), see 78 FR 70416.

The main goal of this rulemaking is to reduce occupant ejection. Ejections account for 78 percent of the fatalities in heavy bus rollover crashes and 28 percent of the fatalities in non-rollover crashes. Lap/shoulder belts installed on the vehicles could reduce the risk of fatal injuries in rollover crashes by 77 percent, as reported in the Final Regulatory Impact Analysis (FRIA).[4]

Another goal of the final rule is to improve passenger crash protection in crashes generally, particularly frontal crashes. The agency indicated in the FRIA that NHTSA's Vehicle Research and Test Center (VRTC) conducted a full-scale, 30 mph) barrier crash of an over-the-road bus and a comprehensive sled test program involving instrumented test dummies representing 5th percentile adult females, 50th percentile adult males, and 95th percentile adult males. In the VRTC tests, lap/shoulder belts at forward-facing seating positions were effective at preventing critical head and neck injury values as measured by the test dummies.

[4] See Docket No. NHTSA-2013-0121.

This rulemaking also responded to MAP-21. Section 32703(a) of the act states that, not later than 1 year after the date of enactment of the act, the Secretary shall prescribe regulations requiring safety belts to be installed in motorcoaches at each designated seating position.[5]

The final rule excluded all school buses, prison buses, and non-over-the-road transit buses and perimeter-seating buses from the seat belt requirement. The final rule did not adopt the definition for "motorcoach" proposed in the NPRM. The final rule adopted the definition of "over-the-road bus" to define the motorcoach, which is consistent with the definition in MAP-21.

The final rule amended FMVSS No. 208, "Occupant crash protection," (49 CFR 571.208), and FMVSS No. 210, "Seat belt assembly anchorages" (49 CFR 571.210), to apply the standard to over-the-road buses except school buses, as mandated by MAP-21, and from our authority under the National Traffic and Motor Vehicle Safety Act ("Vehicle Safety Act") (49 U.S.C. 30101 et seq.) to buses other than over-the-road buses with GVWRs greater than 11,793 kg (26,000 lb), excluding transit buses, school buses, perimeter-seating buses, and prison buses.

NHTSA decided not to issue a rule on retrofitting seat belt systems on buses subsequent to initial manufacture. Information from bus manufacturers indicated that establishing requirements to equip buses with seat belts in all passenger seating positions subsequent to initial manufacture would not be cost effective or reasonably feasible from an engineering perspective. Significant strengthening of the bus structure would be needed, if achievable, to accommodate the additional seat belt loading, particularly for those buses that have been in service longer. In some buses, retrofitting with seat belts might not be structurally possible.

The following summary of various comments from bus manufacturers, seat manufacturers, bus associations, and others indicate that retrofitting motorcoaches would be costly and burdensome.

The bus manufacturing company Van Hool said any program to retrofit existing buses would be expensive, would face practical difficulties, and should be voluntary. It noted that there are a variety of different design standards in older motorcoaches.

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[5] The act also directs the Secretary to consider various other motorcoach rulemakings, in provided timeframes, and a number of research programs for possible future rulemaking.

American Seating, a seat manufacturer, indicated that retrofitting is not financially feasible. It added that if NHTSA decides on a voluntary retrofitting program, NHTSA should also provide requirements for the retrofit, including limitations on vehicles suitable for retrofit based on manufacture date.

Peter Pan Bus Lines commented that retrofitting motorcoaches that are less than 5 years old is expensive and unnecessary and there is no way for the operator to certify that retrofitted vehicles would meet the government standard. It believes that, if NHTSA decides to regulate retrofits, it should be voluntary or the retrofit standard should be implemented in a similar manner as the Americans with Disabilities Act (ADA), where operators were given 12 years (the average fleet turnover rate) to equip their fleet with lifts.

The American Bus Association (ABA) commented that in some cases the installation of seat belts would also require structural reinforcements. In such cases, ABA believes that the technical and economic challenges to a retrofit requirement would disproportionately affect small businesses. It noted that the vast majority of motorcoach operators (approximately 80%) are small businesses with less than 10 employees operating fewer than 7 motorcoaches. The ABA believes that the only way to ensure consistency in the evaluation and upgrading of in-use motorcoaches to a retroactive manufacturing standard is to establish Federal specifications and a Federal inspection and evaluation program. Without Federal grants for motorcoach operators to perform such retrofits, ABA believes many operators would not be able to finance such vehicle upgrades.

The ABA stated that if NHTSA should decide that retrofits are necessary, a voluntary retrofit program could potentially be implemented for vehicles that were originally built to European standards (or to the FMVSS) but that were sold without seat belts. ABA also believed that NHTSA does not have the authority to impose retroactive, vehicle-based performance standards.

Touring bus and motorhome manufacturer Prevost supported ABA's suggested approach on retrofitting and feels that the burden is mostly on operators. It commented that it would be helpful if NHTSA supported realistic retrofit solutions and considered that it may take some time.

Coach manufacturer Setra estimated that the cost of a retrofit requirement for its buses would be on the order of $85,000 per bus. It commented that retrofitting an existing motorcoach would involve: removing existing seats; removing the flooring; removing the engine in order to gain access to the bus structure at the rear; welding in new frame structure to accommodate FMVSS No. 210 seat belt requirements; reinstallation of the engine; reinstallation of removed parts; installation of seats; and verification of compliance of the critical elements to meet the FMVSS. It said this level of investment would cause economic hardship to motorcoach operators.

School bus manufacturer IC Bus stated it does not believe a retrofit requirement is financially feasible.

Custom bus and RV manufacturer Turtle Top, Inc., stated it does not believe retrofitting is possible without a structural assessment of each bus and extensive work. It does not support any retrofit requirement.

Twenty-seven operators submitted identical form letters commenting that any retrofit requirement would either put their companies out of business or severely restrict their operations.

Nearly three dozen operators[6] commented that they do not have the technical capacity to test vehicles to ensure that they would comply with any new performance requirements and no way to ensure or certify that their vehicles, once equipped with seat belts, would meet the government standards. These motorcoach operators believe that since they cannot retrofit their motorcoaches, they would be forced to replace their current fleet with new motorcoaches, and concurrently, their existing fleets would be severely devalued, which would put them out of business.

Arrow Coach Lines, Inc., commented that retrofitting used motorcoaches with seat belts would be difficult, since buses in the fleet will have different levels of deterioration. It stated that no regulatory body or efficient process exists to determine what buses could be retrofitted. The cost of retrofitting will also be very high and could result in safety compromises.

Chicago Sightseeing Co., Inc., did not support any type of retrofitting for existing motorcoaches and felt that NHTSA should put wording in the new regulation that expressly does not encourage installation of seat belts in existing motorcoaches. It stated that any type of retrofit should never become the burden of the carrier.

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[6] Rockport Tours; Black Hills & Western Tours; Gray line of the Black Hills; Chicago Sightseeing; All-ways Trans Plus; Black Tye Limousines /Safety Coach Lines Ltd.; Rills Bus Service; Sun Travel; Trailways; Knoxville Tours; Burke International Tours, Inc.; D & F Travel, Inc.; Anderson Coach & Travel; McIlwain Charters and Tours; FBC Travel, Inc.; Kelton Tours Unlimited, LLC; Jalbert Leasing, Inc.; C&J Lines; River City, LLC; Hagey Coach, Inc.; Atchison Transportation Services; Bailey Coach; Bus Supply Charters, Inc.; Woodlawn Motor Coach, Inc.; Capital Tours; Motorcoach Association of South Carolina; Academy Express, LLC; Kingsmen Coach Lines; 5 Star Transportation; Royal Charters, Inc.; McIwain Charters; and Trans-Bridge Lines.

Greyhound Lines, Inc., commented that any retrofitting should be on a voluntary basis. However, it added that NHTSA should set a date by which all motorcoaches on the road must have lap/shoulder belts. Greyhound noted a previous USDOT rulemaking in which all over-the-road buses were required to be lift-equipped within 12 years of the effective date. Greyhound noted that this effective date was chosen because that time frame represents the average over-the-road bus fleet turnover rate. While Greyhound believed that a voluntary requirement is the best approach, it also saw merit in the NHTSA proposal to require all motorcoaches manufactured within 5 years of the effective date to have lap/shoulder belts installed. This approach would not require older buses that might not be able to support lap/shoulder belt loading to have seat belts installed and would encourage operators to purchase newer motorcoaches with seat belts before the effective date. It further believed that this approach would limit the economic impact of a retrofit requirement on smaller businesses. Greyhound commented that it did not believe that allowing lap belt retrofits is appropriate. It believed that any retrofitted belts must comply with the same requirements set for originally installed equipment.

Touring and charter bus company Coach USA commented that a retrofitting requirement is not technically practical or economical due to the various designs of motorcoaches over the years. It added that retrofitting may not even be possible in some older vehicles. The structure of older vehicles may not be able to support the necessary modifications and, without standards to ensure that the seats and the structure of the motorcoach can withstand the forces imposed in a crash, could result in additional safety risks. Coach USA further noted that a retrofit requirement could easily push motorcoaches over the statutory weight limits for operation on highways. Coach USA noted that the NPRM does not make clear how retrofitting would occur. It commented that without guidance, motorcoach operators do not have the technical capabilities to design and perform the necessary modifications. Manufacturers could supply kits, but the operators would not be able to properly assess the condition of the motorcoaches involved and could be reluctant to do so.

Sunshine Travel did not feel retrofits should even be considered because it would not be cost effective. It also stated that retrofitting has the potential to put smaller companies out of business.

Star Shuttle & Charter commented that a retrofit requirement would put it out of business and reduce the value of its existing fleet. It requested that NHTSA establish a multi-year grant program, whereby operators could obtain funding for retrofitting or acquisition of new seat belt equipped coaches.

Plymouth & Brockton Street Railway Company expressed concern about the possibility of having to retrofit its existing buses with seat belts, citing the cost involved. It noted that in many cases, the cost to retrofit buses would exceed the resale value of the buses involved. The company said a retrofitting requirement would put it in the position of having to buy all new buses or simply being unable to use the buses it already owns. It urged NHTSA to require seat belts in new buses but let the natural process of vehicle attrition allow companies to fully comply with the regulation over time.

Fabulous Coach Lines commented that retrofitting older coaches with seat belts would be extremely costly and create a false sense of security, since the after-market seat belts are not reliable.

United Motorcoach Association (UMA) opposed a retrofit requirement for existing motorcoaches. It noted that the motorcoach industry is “capital intensive, competitive and generally a marginally profitable business, at best.” The UMA added that any retrofit requirement or retrofit standard would likely divert financial resources from other safety related efforts, such as training and maintenance. UMA believes that these efforts are at the core of the current motorcoach industry safety record, and any diversion of resources could have the undesirable effect of increasing, rather than decreasing, motorcoach accidents and the related injuries and fatalities.

UMA further commented that a retrofit requirement would either drive companies out of business or drive up costs of an already safe mode of transportation, adversely affecting customers who require economical transportation, such as students and the elderly. Additionally, the variety of motorcoaches in use will drive the cost of retrofitting these vehicles up, since what is required for each vehicle will depend on factors such as the original manufacturer and age of the vehicle. The UMA commented that the cost to retrofit a vehicle could easily range between $30,000 and $60,000; however those estimates remain highly speculative because the structural integrity of every coach remains unknown. It noted that about 90 percent of motorcoach companies are small businesses that typically can maintain only small capital reserves to cover such exigencies as highway breakdowns or business income gaps. The UMA further noted that a retrofit requirement could create a cottage industry of unqualified seat belt installers, particularly for motorcoaches not used for public transportation and owned by institutions such as colleges, churches, and the like. It suggested that the absence of a retrofit requirement could also result in the largest number of seat belt equipped motorcoaches on the road in the shortest time through the ongoing purchase of new vehicles.

AC Transit and the American Public Transportation Association (APTA) commented that it is not feasible to require retrofitting on existing bus fleets, as the costs associated with a retrofit could prove devastating to public transportation commuter services.

Lorenz Bus Service, Inc., commented that it is not clear how passenger safety will be enhanced in the event that NHTSA chooses to require existing motorcoaches to be retrofitted with seat belts. It concurred with NHTSA's conclusion that retrofitting may not have been feasible or cost-effective from an engineering standpoint.

Prestige Bus Charters (now part of Village Tours & Travel) commented that it would be very difficult to absorb the cost to retrofit its buses. However, it supported requirements for new coaches to be equipped with seat belts.

Monterey-Salinas Transit commented that there could be service reductions with retrofitting based on cost to retrofit and out-of-service time needed to retrofit motorcoaches.

Orange County Transportation Association (OCTA) commented that NHTSA should pay greater attention to the potential fiscal consequences. It argued that public transit agencies nationwide are experiencing unprecedented funding shortages and the costs for installing seat belts systems in new or existing buses would present a financial hardship that public transportation agencies may be unable to absorb without cuts to other capital improvements or overall service levels.

Cost

NHTSA assessed the technical feasibility, benefits, and costs with respect to the application of the seat belt requirements to buses manufactured before the date on which the final rule applies to new vehicles. Based on that assessment, NHTSA decided not to require retrofitting seat belts on used buses. To learn more about retrofitting, the NPRM requested comment on issues concerning the structural viability of used buses to accommodate seat belts and the crash forces from belted passengers, the reinforcement needed to the bus structure to accommodate the loads, and the cost of retrofitting. Our hypothesis at the time of the NPRM was that the cost of and engineering expertise needed for a retrofitting operation would be beyond the means of bus owners (for-hire operators), many of which are small businesses. The above comments on the retrofit issue supported a finding that the impacts would be unreasonable. After considering the low likelihood that a retrofit requirement would be technically practicable at a reasonable cost, the cost impacts on small businesses, and the low benefits that would accrue from a retrofit requirement, NHTSA decided not to pursue a retrofit requirement for seat belts.

For the final rule, NHTSA examined a range of costs and included the lifetime fuel costs for the weight of the belts themselves. Weight would vary depending upon the needed structural changes, and lifetime fuel cost would vary depending upon the age of motorcoaches that would be retrofitted.

NHTSA estimated that the service life of a motorcoach can be 20 years or longer. We also estimated that the cost of retrofitting can vary substantially. We based our estimated low and high costs of retrofitting on a cost teardown study of motorcoach seats, and lap/shoulder belts. We estimated a low installation cost of $14,650, based on the assumption that the most recent buses can be retrofitted with new seats with lap/shoulder belts and no new structure. Costs were derived directly from tear-down studies of three different motorcoach seat designs.[7]

Under this scenario, there is little weight gain and fuel costs are only included for the weight of the belts themselves, because new motorcoaches would meet the new FMVSS standard.[8] As would be expected, retrofitting becomes less cost effective as a bus gets older, because costs remain the same in our example (but may actually increase in real life), but benefits decrease as there is less remaining life for the bus. To retrofit a motorcoach with lap/shoulder belts and reinforced structure so as to meet FMVSS No. 210 to support the loads during a crash, we estimated it could cost $40,000 per vehicle.[9] The

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[7] Ludtke & Associates. (n.a.) Cost and weight analysis of three motor coach operating systems; Two with and one without three-point lap/shoulder belt restraints (Final Report, Volume 1, Task Orders 0001 & 0003, Contract DTNH22-08-C-0079). Publisher unknown.

[8] Costs assumed for this scenario were derived from teardown studies of three different motorcoach seat designs. One design did not include lap/shoulder belts but was adjusted to include belts based on the average seat belt cost of the other two systems. All three systems were two-position seats. After adjusting for inflation, the average derived system cost was $519.23 Individual system totals were $393.48, $523.68 and $557.92, plus (87.10+$78.14)/2 or $82.62 to adjust for the belts missing from the third seating system.) Installation labor was estimated to require two workers working two 8 hour days paid at $20/hour or $640/vehicle. For a 54-passenger bus, 27 seats would be needed, so total costs were estimated to be $14,659. The weight costs are derived from the lifetime increase in fuel costs of $1,077 at the 3 percent discount rate and $794 at the 7 percent discount rate (which are decreased by the percentages above based on age and remaining life). NHTSA used a 5.98 lb. incremental weight estimate for the lap/shoulder belt system, based on the cost/weight tear-down study for domestic motorcoaches.

[9] This estimate reflects an assumption that new seats and additional structure will be required. For this scenario we assume the costs are $40,000 for new seats and structure. However, we do not have an estimate of the weight of additional structure and only the fuel costs of the belts themselves are included - $1,077 at the 3 percent

existing fleet size was estimated to be 29,325 motorcoaches. Hence, the fleet cost of retrofitting lap/shoulder belts was estimated to be $1.173 billion ($40,000 × 29,325). These costs did not include increased remaining lifetime fuel costs incurred by adding structural weight to the motorcoach. NHTSA thus estimated that retrofitting would cost from $14,650 for a recent bus that requires no new structure to $40,000 for aolder bus that require added reinforcement. We note that belts are already required in buses in Australia and, based on the designs used there, Griffiths, Paine and Moore estimated costs to retrofit motorcoaches in Australia at $750 perseat in 2005.[10] [11] It was unclear from their presentation whether the term "seat" meant seating position or a two-passenger seat. If the former for a standard 54-seat bus this would imply a total retrofit cost of $40,500, nearly identical to NHTSA's original estimate. If the latter, it would imply a total cost of $20,250, an estimate that falls well within the range of cost estimates adopted by NHTSA. In the final rule, NHTSA concluded that these costs render retrofit requirements economically unfeasible for small motorcoach operators.

Benefits

The high cost of equipping older buses with lap/shoulder belts and the structural changes required to make them effective was the primary basis for NHTSA's decision to not require retrofitting in older motorcoaches. However, NHTSA did examine a range of potential safety impacts that might occur under a range of hypothetical safety belt use rates. Since there is little data available on use rate in buses covered by the final rule, we examined a range of belt use and derived a break-even point in usage later in the analysis. The rates examined in the analysis were 15 percent and 83 percent. At the high end of the range, we assumed that belt use on covered buses would be no higher than the use rate in passenger vehicles, which was 83 percent for 2008 (taken from the 2008 National Occupant Protection Use Survey [NOPUS]). At the low end of the range, we looked at use rates in Australia in buses that have lap/shoulder belts in motorcoaches, and found use rates reported at about 20 percent or less.[12] Thus, we assumed a belt use rate of 15 percent for the low end of the range. There are no

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discount rate and $794 at the 7 percent discount rate of fuel costs (which are decreased by the percentages above based on age and remaining life).

[10] Griffiths, M., Paine, M., & Moore, R. (2005). Three point seat belts in coaches - The first decade in Australia. Brisbane, Australia: Queensland Transport. Also published as Paper No. 05-0017-O in Proceedings of the 19th International Technical Conference on the Enhanced Safety of Vehicles, Washington, DC, June 6-9, 2005. Available at www-nrd.nhtsa.dot.gov/pdf/esv/esv19/05-0017-O.pdf. Original paper does not cite specific cost See also Griffiths, Paine, & Moore, 2005, presentation at the ESV conference citing $750/seat cost.

[11] Faulks, I. J., & Irwin, J. D. (2009. Motorcoach and School Bus Occupant Protection and Passenger Safety in Australia. Sydbey, Australia: Macquarie University.

[12] Griffiths, Paine, & Moore, 2005, *op cit*.

available representative statistics for the United States, and those studies that have been done indicate even lower usage rates for U.S. motorcoach occupants may be possible. The annual target population used in the final rule and in this analysis was 20.9 fatalities (16.8 passengers and 4.1 drivers in covered buses), and 7,934 injuries (6,532 passengers and 1,402 drivers in covered vehicles). For the final rule, NHTSA thus examined scenarios where safety impacts would range from savings of 1.5 fatalities and 142 injuries at a 15 percent use rate, and 8.4 fatalities and 788 injuries at an 83 percent use rate (see Table 1).

Table 1

Potential Benefits at Assumed Usage Rates of 15 Percent and 83 Percent

	Injuries Prevented Assumed Usage		Equivalent Fatalities Assumed Usage	
	15%	83%	15%	83%
MAIS 1	89.2	493.8	0.25	1.38
MAIS 2	40.6	224.6	1.77	9.79
MAIS 3	9.8	54.4	0.79	4.37
MAIS 4	1.8	10.1	0.36	2.01
MAIS 5	0.9	5.0	0.61	3.35
Subtotal	142.4	787.9	3.8	20.9
Fatality	1.5	8.4	1.52	8.39
Total Equivalent Fatalities			5.30	29.31
Total Equivalent Fatalities@3%			4.16	23.03
Total Equivalent Fatalities@7%			3.18	17.58

Table 2 presents the cost per equivalent life saved for the break-even points for buses up to 5 years old. This table shows two scenarios for the cost of motorcoach retrofit at $14,650 and $40,000.

Table 2

Cost per Equivalent Life Saved for Retrofit of Lap/Shoulder in Passenger Seats of Older Large Buses by Age of Bus

	Cost per Equivalent Life Saved 15% Use ($Millions) (3% to 7% discount)	Cost per Equivalent Life Saved 83% Use ($Millions) (3% to 7% discount)	Break-Even Point in Usage (%) (3% to 7% discount)
Scenario 1 (Low Cost $14,650)			
Age 1	$8.9 – 11.5	$1.6 – 2.1	39 – 53%
Age 2	9.6 – 12.4	1.7 – 2.2	43 – 56
Age 3	10.3 – 13.3	1.9 – 2.4	47 – 59
Age 4	11.2 – 14.4	2.0 – 2.6	51 – 62
Age 5	12.0 – 15.5	2.2 – 2.8	54 – 64
Scenario 2 (Cost of $40,000)			
Age 1	$23.4 – 30.4	$4.2 – 5.5	76 – 81 %
Age 2	25.2 – 32.8	4.6 – 5.9	77 – 82
Age 3	27.2 – 35.5	4.9 – 6.4	79 – 83
Age 4	29.5 – 38.4	5.3 – 6.9	80 – >83
Age 5	31.8 – 41.5	5.8 – 7.5	82 – >83

The cost per equivalent life saved for all scenarios examined under the 15 percent use rate exceeded the comprehensive value of benefits for buses of all ages. Under the highly optimistic assumption that use rates in motorcoaches would match the use rate in passenger vehicles (83%), all scenarios were cost-beneficial. However, as noted and based on available data, this use rate does not seem feasible at this time.

In the final rule, NHTSA applied a value of statistical life (VSL) of $6.3 million based on then current USDOT guidance. Using the value of $6.3 million per life saved, even with the lowest cost estimate for a retrofit ($14,650/bus and no fuel cost), NHTSA estimated that seat belt usage had to be 21 to 28 percent for a 1-year-old bus discounted at 3 percent and 7 percent rate, respectively, to break even. This rate increases by 2 to 3 percentage points per year to get to 29 to 38 percent by age 5 (see Table 3).

Under the higher installation cost assumption ($40,000, with fuel costs only for the weight of the belts and not for added structure), and using the VSL of $6.3 million per life saved, the break-even point in belt usage is 56 to 78 percent for a 1-year-old bus discounted at 3 percent and 7percent , respectively, rates and quickly becomes higher than seat belt usage in light vehicles (see Table 3).

Taken as a whole, available data indicates that even these most optimistic break-even use rates are unlikely to be achieved, and that break-even rates for later years are even less likely. There is no actual record of seat belt use rates by motorcoach passengers in the United States. In a pilot study of Alabama students on school buses specially equipped with seat belts, belt use rates were as low as 5 percent, but averaged overall to about 51 percent.[13] In 2003, a study was conducted on seat belt use on 12 school buses in Queensland, Australia. Half the school buses were fitted with seat belt sensors. Even when encouraged by parents and teachers, seat-belt-wearing rates were low. Students frequently removed the belts to talk over the high-backed seats to peers. The usage rates varied highly from 14 percent to 89 percent, with an overall average rate of 45 percent.[14] Observations of an in-depth analysis from ECBOS (Enhanced Coach and Bus Use Occupant Safety) of 31 large bus crashes in Europe that were

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[13] Turner, D. S., Lindly, J. K., & Tedla, E. (2009). Preliminary Report on School Bus Seat Belt Use Rates. Huntsville, AL: University Transportation Center for Alabama, University of Alabama. Available at: http://web.alsde.edu/docs/documents/120/Pilot_Project_Seat_Belt_Use_Rates.pdf

[14] Griffiths, Paine, & Moore, 2005, *op cit*.

considered to be severe show belt use rates are often low, around 3 percent.[15] In one case, two full large buses, both equipped with 2-point lap belts, hit each other with no one wearing their restraints. Similar studies in Australia, where 3-point lap belts on large buses have been mandatory since 1994, show use rates may be less than 20 percent.[16] Motorcoach belt use rates in Sweden have remained low at around 6 to 8 percent, despite generally high use rates in passenger vehicles that exceed 90 percent.[17]

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[15] Albertsson, P., Falkmer, T., Kirk, A., Mayrhofer, E., & Björnstig, U. (2006, February). Case Study: 128 injured in rollover coach crashes in Sweden – Injury outcome, mechanisms and possible effects of seat belts. *Safety Science*, *44*(2), pp. 87 – 109. Available at www.sciencedirect.com/science/article/piiS0925753505000858

[16] Griffiths, Paine, & Moore, 2005, *op cit*.

[17] Albertsson, P. (2005). Occupant Casualties in Bus and Coach Traffic – Injury and Crash Mechanisms. Umeå, Sweden: Umeå University.

Table 3

Break-Even Usage by Vehicle Age and Assumed Cost, Final Rule

VSL = $6.3 Million					
			Break-Even Usage		
$14,650 Retrofit Cost			3% Discount Rate	7% Discount Rate	
Age 1			21%	28%	
Age 2			23%	30%	
Age 3			25%	32%	
Age 4			27%	35%	
Age 5			29%	38%	
$40,000 Retrofit Cost					
Age 1			56%	73%	
Age 2			60%	78%	
Age 3			65%	85%	
Age 4			71%	93%	
Age 5			77%	100%	

Further Analysis

For this Report to Congress, NHTSA conducted further analysis in light of two subsequent developments. The first is a recent decision by USDOT to increase its recommended VSL to $9.2 million, roughly a 50 percent increase over the $6.3 million VSL that was used in the 2008 FRIA.[18] The VSL is used to value safety benefits from proposed regulations, and as such, can potentially influence conclusions regarding the relative costs and benefits of a rule. The second development is the installation of electronic stability control (ESC) on later model year motorcoaches. The 2012 final rule on lap/shoulder belts for motorcoaches was based on data from 2000 to 2009, a time when ESC was virtually unknown on motorcoaches. However, NHTSA has subsequently estimated that 80 percent of new motorcoaches in 2012 had ESC as standard equipment. ESC is highly effective (40 to 56%) in preventing rollovers and run-off-road crashes. In light of these developments, NHTSA has conducted further analysis to examine the impact of these changes.

To conduct this analysis, we were required to adopt informed assumptions regarding future events. The first is that ESC will be required on all motorcoaches in 2018. In June 2015 NHTSA published a final rule (FMVSS 136) requiring motorcoaches to be equipped with ESC beginning June 24, 2018. Thus, newly produced motorcoaches will be equipped with ESC by 2018.

A second assumption addresses the timing of any future retrofit requirement. This is relevant because with all new motorcoaches required to have seat belts effective November 28, 2016, or roughly the 2017 model year, a significant portion of the existing on-road fleet will already have seat belts, and thus would not require retrofitting. Any new retrofit requirement would require both rulemaking and lead time. Congress passed MAP-21 in 2012; this act also incorporated the Motorcoach Enhanced Safety Act of 2012, which tasked NHTSA to issue a motorcoach seat belt final rule within 1 year of passing of the act. NHTSA issued a final rule on November 25, 2013, amending FMVSS No. 208 to require lap/shoulder seat belt for each seating position in (a) all new over-the road buses regardless of weight; and (b) in new buses other than over-the-road buses with GVWRs over 11,793 kg (26,000 lb.).

[18] Memorandum to Secretarial Officers and Modal Administrators from Peter Rogoff, Acting Under Secretary for Policy and Kathryn Thomson, General Counsel. (2014, June 13). "Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in U.S. Department of Transportation Analyses – 2014 Adjustment." Washington, DC: Department of Transportation.

NHTSA had issued an NPRM on August 18, 2010 (75 FR 50958). This was the culmination of approximately 3 years of planning and research. The total time between publication of the NPRM and the final rule was more than 3 years. Both the NPRM and final rule required a significant amount of time for coordination within DOT and between DOT and the Office of Management and Budget (OMB).

We note that retrofitting motorcoaches would be a far more complex process than OEM installation. Further, responsibility for retrofitting would typically fall upon entities such as schools, churches, and bus fleet managers who have no experience with designing, manufacturing, engineering, or testing motor vehicle modifications. NHTSA thus anticipates that a retrofit rulemaking process would require a significant amount of research on NHTSA's part, as well as a fairly lengthy lead time allowance to enable small businesses to devise methods of compliance. In the case of retrofitting motorcoaches with seat belts, NHTSA would need to conduct a survey on motorcoach build and construction types that exist today and assess the structural integrity of the passenger deck. Depending on construction type and age of motorcoach, each would require a varied amount of structural enhancement to withstand FMVSS No. 210 forces (seat belt pull forces). We estimate 2 to 3 years to research and develop a viable proposal to include all motorcoaches as defined in the MAP-21 act and to develop an enforcement strategy to test FMVSS No. 210 compliance on used motorcoaches.

Once NHTSA has the necessary data, we estimate another year to develop an NPRM and another 2 years to address all the comments and petitions before issuing a final rule to retrofit seat belts on existing motorcoaches. Thus, it may take 5 to 6 years to get to a final rule.

Assuming NHTSA would start surveying, researching, and drafting a retrofit strategy in 2016, the final rule on seat belt retrofit based on the above discussion may be issued in 2022. Because of the complexity in motorcoach build types and because most of the 3,000 or more motorcoach operators are small businesses, a longer lead time would be necessary for the identified motorcoaches to be retrofitted with seat belts. Assuming a phase-in period of 5 years after the final rule,[19] the 100 percent effective date would be 2027. By the 2027 time frame, it would be 10 years since 100 percent compliance of the seat belt mandate in new motorcoaches. Because of decreased remaining useful lifetime, NHTSA may determine that it is unreasonable to retrofit motorcoaches older than a specific

[19] This would not be an unreasonable amount of lead time. We note that the American Bus Association also commented to NPRM that Federal Disabilities Act provided manufacturers 12 years to comply with the law as it required redesign of certain section of the passenger deck and layout of passenger seats to accommodate wheelchairs for people with disabilities.

age. We note that under the assumed rulemaking and lead time timeframes, the only motorcoaches available for being retrofitted would be more than 10 years old.

The regulatory paradigm that a FMVSS typically work under is self-certification, which relies on NHTSA's testing of new exemplar vehicles to the requirements of a standard in order to assess compliance. This strategy obviously cannot be used when assessing used vehicles for compliance. Without a reasonable and objective process for enforcement, it may be difficult to identify the poor seat belt installations. The agency will have to develop a new strategy to assess compliance. One method could be to attempt to purchase retrofitted motorcoaches from fleet operators with excess capacity. However, NHTSA cannot force operators to sell their vehicles to NHTSA for compliance testing purposes and some may simply be too small to be able to lose the capacity. Another option may be for NHTSA to purchase a used motorcoach and have a retrofit performed similar to those of some other operators' buses, and to test this modified design. However, it would be uncertain whether this specific vehicle would be sufficiently close to other retrofitted buses in service for NHTSA to force a recall. In the end NHTSA may have to depend on operators retrofit claims and limit compliance assessment to visual inspection, as opposed to destructive testing, which would diminish the effectiveness of compliance requirements.

For our analysis, we assume the rulemaking and lead time scenarios discussed above, i.e., that the year that retrofit requirements would become effective would be 2027. This means that the first year that retrofit could be required would be 2027. By that time, vehicles that are one year old would be 2026 models, which would already incl6ude both belts and ESC. In addition, motorcoaches 2 to 9 years old would already have belts and ESC, 10-year-old motorcoaches would have belts, and at least 80 percent of them would also have ESC. Because MY 2017-2026 motorcoaches would already have belts, the first fleet that could benefit from retrofitting would be 11-year-old vehicles produced in 2016. These vehicles and all vehicles produced from 2012 forward would already have ESC in at least 80 percent of the fleet.

As with the final rule, we examined the impact of a range of potential belt usage rates. However, we have modified that range to reflect what we believe to be a more likely usage rate outcome. For our lower range analysis we examined a usage rate of 10 percent. This rate was chosen based on belt use experience in motorcoaches in Sweden, documented in studies by Albertsson (2005), Cedersund (2003), and Gustafsson and Thulin (2002), which note that despite high belt usage rates (above 90%) in passenger cars, belt use in motorcoaches was only 6 to 8 percent. For our upper end usage rate, we use

50 percent based on the average use rates observed for school buses in Alabama reported by Turner, Lindly, and Tedla (2009) and in Australia documented by Griffiths, Paine, and Moore (2005). However, we note that the upper range is based on school bus experience, which we expect to be an optimistic proxy for motorcoach experience, since school students belt usage is often policed by drivers and bus monitors. In Australia, Griffiths, Paine and Moore noted that typical belt use rates for motorcoaches (as opposed to school buses) were likely around 20 percent. However, this was an opinion not supported by specific data or research cited in their paper. Nonetheless, it is likely that 50 percent voluntary belt use in motorcoaches, while more reasonable than the 83 percent then-current belt use rate in passenger vehicles, is still a highly optimistic result to expect, and motorcoach usage ranging from 10 to 20 percent is likely a more realistic expectation. Thus, while we examine a rate of 50 percent derived from school buses, we believe that actual motorcoach use is more likely to be closer to the 10 percent rate derived from studies that examine motorcoach use.

We again analyzed two basic metrics – break-even belt usage rates and cost per equivalent lives saved. The results are shown in Tables 4 to 7. As mentioned previously, vehicles that are 10 years old in 2027 will already have belts as a result of the 2012 final rule mandating lap/shoulder belts for all new motorcoaches effective in November 2016. The first year for which retrofitting would be applicable would therefore be 2016 models that would be 11 years old. Tables 4 and 5 present the results for the most optimistic cost assumption of $14,650, which assumes no structural reinforcement required for retrofitting.[20] For the motorcoach fleet 11 years old and older, break-even use rates start out in the 27-

[20] We note that the University of Massachusetts at Amherst (UMA) has conceptualized a prototype seat belt retrofit kit with a preliminary cost estimate of around $6,250 and a preliminary weight estimate on a 54-passenger-seat motorcoach of around 1,100 lbs. Its design includes two 3-point seat belts, a mounting plate and hardware, and tubing and rib support. Its design anticipates using existing seats, but replacing each mounting structures with a central structure that attaches to the T-rail beneath the motorcoach floor. However, UMA's estimate does not include additional materials, tools, and labor needed to modify existing floor or seat designs to accommodate the new structural mountings, downtime costs to each business that must take its motorcoaches out of service for the conversion process, fleet expansion costs to make up for loss of seating capacity, loss of cargo capacity, and the cost of additional padding necessary to protect occupants from the exposed vertical support structure that anchor the seat to the motorcoach floor track. The cost does not anticipate any structural redesign or reinforcement for any existing make/model motorcoaches, regardless of age and current structural integrity. Their cost estimate assumes that seat belts would be obtained at a 30 percent quantity discount, even though a large portion of these buses are owned and operated by small businesses, churches, schools, etc., which would not necessarily be able to obtain volume discounts. The estimate also optimistically assumes that all metal castings used in the design would be produced in high-volume production by one supplier, which implies that all 3,000 motorcoach operators would use exactly the same seat design fix for their own fleets. Their estimate also does not appear to adequately account for indirect costs such as research and development that would be experienced by the supplier or by the businesses that would be required to modify their fleets. At a manufacturing level these costs, which also include return on capital (profit), typically increase direct manufacturing costs by 40-

to 31 percent range (depending on the discount rate) in year 11 and climb to over 100 percent in the older vehicles.[21] Under a 10 percent usage rate assumption, the cost/equivalent life saved for a 10-year-old bus ranges from $30- to $36 million, which exceeds the $11.2 million average VSL[22] for the remaining life-years of vehicles of that age, and climbs steadily to a high of over $210 million for buses near the end of their useful lives. For the full 10- to 22-yearold fleet, the cost/equivalent life saved ranges from $43 to $49 million. Under a 50 percent usage rate assumption, the cost per equivalent life saved is $6.1- to $7.1 million for MY 2016 vehicles, and eventually rises to about $42- to $43 million for vehicles near the end of their useful lives. Thus, a 50 percent use rate would produce cost-beneficial results for younger vehicles provided they did not require further reinforcement, which would raise compliance costs further. For the full 10- to 22- year-old fleet, the cost/equivalent life saved ranges from $8.7 to $9.8 million. As noted previously however, a 50 percent use rate is highly unlikely for motorcoaches.

Tables 6 and 7 present results that are based on the cost of $40,000 per vehicle, which reflects added structural reinforcement required for retrofitting. For the 11-year-old and older motorcoach fleet, break-even use rates start out in the 72 to 84 percent range (depending on the discount rate) in year 11 and quickly climb to over 100 percent in the older vehicles. Under a 10 percent usage rate assumption,

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60% or more. It's also unclear whether their estimate includes the cost of overhead and profit that would accrue to the garage or body shop that actually modifies the motorcoach. Although NHTSA does not have any specific numbers to assign to each of the tasks, even if the direct manufacturing piece cost estimate derived by UMA is accurate, this represents only one part of a complex conversion process, and the cost of actually converting a 54-seat motorcoach to include lap/shoulder belts would exceed the UMA estimate by a significant margin. Finally, we note that the UMA design is conceptual, and no test data was provided on FMVSS No. 210 performance. It is thus unclear whether this design concept would actually comply with FMVSS No. 210. Further, the design incorporates a stiff vertical metal structure between the two seating positions that would create a new safety hazard for occupants of rear seats in any frontal collision or rollover crash mode. This hazard would likely require further design refinements that would necessitate use of padded structures to prevent serious injury to rearward occupants. There is also a significant concern as to whether the design would be successfully installed on all existing motorcoach designs and model years. A successful application on one model years design could not be taken as evidence that it would function as well on all designs without different structural reinforcements specific to each make/model.

[21] Note that this analysis assumes the same ESC effectiveness for motorcoaches as for other heavy vehicles. NHTSA does not have specific ESC effectiveness rates for motorcoaches. To test the sensitivity of these calculations to this issue, we re-ran break-even points assuming an effectiveness rate that was roughly a third of the average rate for all heavy vehicles. Under these circumstances, break-even rates decreased roughly 2 to 4 percentage points in scenarios involving the $14,650 cost and 6 to 8 percentage points in scenarios involving the $40,000 cost. We also examined the impact on cost/equivalent fatality and found that this alternate effectiveness assumption reduced the cost per equivalent fatality by roughly 15 percent. None of these impacts would be enough to change this studies overall conclusions.

[22] The $9.2 million VSL adopted by DOT was for the year 2014. DOT guidance also directs agencies to increase the VSL annually to reflect an assumed real growth in income. The resulting VSLs thus increase for future years.

the cost/equivalent life saved for a 11-year-old bus ranges from $82 to $96 million, which substantially exceeds the $11.2 million average VSL for the remaining life-years of vehicles of that age, and climbs steadily to a high of $572 to $583 million for buses near the end of their useful lives. For the full 11-to 22-year-old fleet, the cost/equivalent life saved ranges from $117-$132 million. Under a 50 percent usage rate assumption, the cost per equivalent life saved is $16.4-$19.2 million for MY 2016 vehicles, and eventually rises to $114 to $117 million for vehicles near the end of their useful lives. For the full 11-to 22-year-old fleet, the cost/equivalent life saved ranges from $23 to $26 million. Thus, under this higher per-vehicle retrofit cost assumption, even a 50 percent use rate would produce costs that exceed benefits by a significant margin. As noted previously however, a 50 percent use rate is unlikely for motorcoaches.

Table 4

Break-Even Usage, Equivalent Lives Saved, Total Cost, and Cost/Equivalent Fatality by Vehicle Age, 10 Percent Belt Use and $14,650 Assumed Retrofit Cost/Vehicle (relevant vehicle age cells are shaded)

$14,650 Retrofit cost, $9.2 Million VSL, 10% Use Rate								
	Breakeven Usage Rate		Equivalent Lives Saved@ 10% Belt Use Rate		Total Costs		Cost/Equivalent Life Saved	
	3%	7%	3%	7%	3%	7%	3%	7%
Vehicle Age								
1	13.83%	17.65%	2.09	1.61	$34,414,243	$33,836,269	$16,497,418	$21,039,884
2	14.80%	18.72%	1.95	1.52	$34,216,927	$33,682,316	$17,560,868	$22,206,495
3	15.87%	19.91%	1.81	1.42	$33,952,458	$33,460,225	$18,744,407	$23,503,979
4	17.03%	21.19%	1.68	1.33	$33,540,930	$33,089,913	$20,019,105	$24,891,624
5	18.28%	22.56%	1.54	1.23	$32,979,752	$32,568,624	$21,393,121	$26,376,272
6	19.63%	24.03%	1.41	1.14	$32,275,935	$31,903,220	$22,881,626	$27,972,974
7	21.11%	25.62%	1.28	1.05	$31,426,799	$31,090,878	$24,493,683	$29,688,121
8	22.72%	27.34%	1.16	0.96	$30,448,891	$30,148,032	$26,255,350	$31,548,229
9	24.49%	29.22%	1.04	0.87	$29,349,077	$29,081,438	$28,188,022	$33,572,099
10	24.71%	29.22%	0.99	0.83	$28,143,739	$27,907,407	$28,322,815	$33,428,534
11	26.76%	31.35%	0.88	0.75	$26,839,540	$26,632,545	$30,552,034	$35,725,061
12	29.09%	33.75%	0.77	0.66	$25,459,137	$25,279,486	$33,076,712	$38,306,298
13	31.77%	36.50%	0.67	0.58	$24,018,667	$23,864,358	$35,981,066	$41,254,843
14	34.92%	39.70%	0.57	0.50	$22,530,981	$22,400,025	$39,380,043	$44,682,603
15	38.70%	43.52%	0.48	0.43	$21,018,502	$20,908,945	$43,467,864	$48,783,502
16	34.31%	38.13%	0.51	0.46	$19,493,935	$19,403,872	$38,373,047	$42,571,824
17	39.08%	42.91%	0.41	0.38	$17,973,149	$17,900,742	$43,529,382	$47,707,332
18	45.59%	49.40%	0.33	0.30	$16,475,172	$16,418,661	$50,549,699	$54,690,454
19	55.11%	58.90%	0.25	0.23	$15,012,551	$14,970,269	$60,839,230	$64,925,871
20	70.67%	74.42%	0.18	0.17	$13,594,586	$13,564,962	$77,666,296	$81,681,578
21	101.37%	105.07%	0.11	0.11	$12,233,769	$12,215,338	$110,883,062	$114,814,929
22	192.74%	196.41%	0.05	0.05	$10,942,569	$10,933,976	$209,840,848	$213,708,665
Years 11-22			5.20	4.60	$225,592,557	$224,493,180	$43,362,275	$48,811,116

Table 5

Break-Even Usage, Equivalent Lives Saved, Total Cost, and Cost/Equivalent Fatality by Vehicle Age, 50 Percent Belt Use and $14,650 Assumed Retrofit Cost/Vehicle (relevant vehicle age cells are shaded)

$14,650 Retrofit cost, $9.2 Million VSL, 50% Use Rate								
	Breakeven Usage Rate		Equivalent Lives Saved@ 50% Belt Use Rate		Total Costs		Cost/Equivalent Life Saved	
	3%	7%	3%	7%	3%	7%	3%	7%
Vehicle Age								
1	13.83%	17.65%	10.43	8.04	$34,414,243	$33,836,269	$3,299,484	$4,207,977
2	14.80%	18.72%	9.74	7.58	$34,216,927	$33,682,316	$3,512,174	$4,441,299
3	15.87%	19.91%	9.06	7.12	$33,952,458	$33,460,225	$3,748,881	$4,700,796
4	17.03%	21.19%	8.38	6.65	$33,540,930	$33,089,913	$4,003,821	$4,978,325
5	18.28%	22.56%	7.71	6.17	$32,979,752	$32,568,624	$4,278,624	$5,275,254
6	19.63%	24.03%	7.05	5.70	$32,275,935	$31,903,220	$4,576,325	$5,594,595
7	21.11%	25.62%	6.42	5.24	$31,426,799	$31,090,878	$4,898,737	$5,937,624
8	22.72%	27.34%	5.80	4.78	$30,448,891	$30,148,032	$5,251,070	$6,309,646
9	24.49%	29.22%	5.21	4.33	$29,349,077	$29,081,438	$5,637,604	$6,714,420
10	24.71%	29.22%	4.97	4.17	$28,143,739	$27,907,407	$5,664,563	$6,685,707
11	26.76%	31.35%	4.39	3.73	$26,839,540	$26,632,545	$6,110,407	$7,145,012
12	29.09%	33.75%	3.85	3.30	$25,459,137	$25,279,486	$6,615,342	$7,661,260
13	31.77%	36.50%	3.34	2.89	$24,018,667	$23,864,358	$7,196,213	$8,250,969
14	34.92%	39.70%	2.86	2.51	$22,530,981	$22,400,025	$7,876,009	$8,936,521
15	4.00%	43.52%	2.42	2.14	$21,018,502	$20,908,945	$8,693,573	$9,756,700
16	34.31%	38.13%	2.54	2.28	$19,493,935	$19,403,872	$7,674,609	$8,514,365
17	39.08%	42.91%	2.06	1.88	$17,973,149	$17,900,742	$8,705,876	$9,541,466
18	45.59%	49.40%	1.63	1.50	$16,475,172	$16,418,661	$10,109,940	$10,938,091
19	55.11%	58.90%	1.23	1.15	$15,012,551	$14,970,269	$12,167,846	$12,985,174
20	70.67%	74.42%	0.88	0.83	$13,594,586	$13,564,962	$15,533,259	$16,336,316
21	101.37%	105.07%	0.55	0.53	$12,233,769	$12,215,338	$22,176,612	$22,962,986
22	192.74%	196.41%	0.26	0.26	$10,942,569	$10,933,976	$41,968,170	$42,741,733
Years 11-22			26.01	23.00	$225,592,557	$224,493,180	$8,672,455	$9,762,223

Table 6

Break-Even Usage, Equivalent Lives Saved, Total Cost, and Cost/Equivalent Fatality by Vehicle Age, 10 Percent Belt Use and $40,000 Assumed Retrofit Cost/Vehicle (relevant vehicle age cells are shaded)

$40,000 Retrofit cost, $9.2 Million VSL, 10% Use Rate								
	Breakeven Usage Rate		Equivalent Lives Saved@ 10% Belt Use Rate		Total Costs		Cost/Equivalent Life Saved	
	3%	7%	3%	7%	3%	7%	3%	7%
Vehicle Age								
1	36.22%	46.69%	2.09	1.61	$90,156,358	$89,578,384	$43,218,941	$55,701,141
2	38.85%	49.62%	1.95	1.52	$89,903,272	$89,368,661	$46,140,305	$58,920,079
3	41.77%	52.87%	1.81	1.42	$89,460,339	$88,968,106	$49,389,089	$62,495,230
4	44.92%	56.35%	1.68	1.33	$88,608,228	$88,157,211	$52,886,353	$66,315,562
5	48.33%	60.08%	1.54	1.23	$87,338,771	$86,927,643	$56,654,425	$70,399,878
6	52.03%	64.10%	1.41	1.14	$85,670,133	$85,297,418	$60,734,783	$74,789,393
7	56.04%	68.42%	1.28	1.05	$83,594,057	$83,258,136	$65,152,240	$79,501,699
8	60.44%	73.12%	1.16	0.96	$81,154,975	$80,854,116	$69,977,994	$84,609,310
9	65.27%	78.24%	1.04	0.87	$78,370,907	$78,103,268	$75,270,539	$90,163,719
10	65.97%	78.32%	0.99	0.83	$75,286,120	$75,049,788	$75,765,159	$89,897,439
11	71.56%	84.15%	0.88	0.75	$71,918,431	$71,711,436	$81,866,319	$96,194,164
12	77.92%	90.70%	0.77	0.66	$68,329,536	$68,149,885	$88,774,273	$103,268,311
13	85.24%	98.20%	0.67	0.58	$64,563,457	$64,409,148	$96,719,022	$111,345,518
14	93.81%	106.91%	0.57	0.50	$60,655,353	$60,524,397	$106,014,486	$120,731,456
15	104.14%	117.34%	0.48	0.43	$56,666,686	$56,557,129	$117,191,025	$131,955,717
16	92.46%	102.95%	0.51	0.46	$52,632,469	$52,542,406	$103,604,954	$115,277,303
17	105.50%	116.00%	0.41	0.38	$48,596,456	$48,524,049	$117,696,332	$129,321,620
18	123.24%	133.71%	0.33	0.30	$44,611,137	$44,554,626	$136,877,450	$148,411,170
19	149.24%	159.64%	0.25	0.23	$40,711,367	$40,669,085	$164,985,166	$176,381,315
20	191.72%	202.01%	0.18	0.17	$36,923,177	$36,893,553	$210,943,271	$222,154,960
21	275.53%	285.67%	0.11	0.11	$33,281,367	$33,262,936	$301,651,919	$312,646,416
22	525.01%	535.06%	0.05	0.05	$29,820,714	$29,812,121	$571,858,769	$582,689,107
Years 11-22			5.20	4.60	$608,710,149	$607,610,772	$117,003,226	$132,111,631

Table 7

Break-Even Usage, Equivalent Lives Saved, Total Cost, and Cost/Equivalent Fatality by Vehicle Age, 50 Percent Belt Use and $40,000 Assumed Retrofit Cost/Vehicle (relevant vehicle age cells are shaded)

$40,000 Retrofit cost, $9.2 Million VSL, 50% Use Rate								
	Breakeven Usage Rate		Equivalent Lives Saved@ 50% Belt Use Rate		Total Costs		Cost/Equivalent Life Saved	
	3%	7%	3%	7%	3%	7%	3%	7%
Vehicle Age								
1	36.22%	46.69%	10.43	8.04	$90,156,358	$89,578,384	$8,643,788	$11,140,228
2	38.85%	49.62%	9.74	7.58	$89,903,272	$89,368,661	$9,228,061	$11,784,016
3	41.77%	52.87%	9.06	7.12	$89,460,339	$88,968,106	$9,877,818	$12,499,046
4	44.92%	56.35%	8.38	6.65	$88,608,228	$88,157,211	$10,577,271	$13,263,112
5	48.33%	60.08%	7.71	6.17	$87,338,771	$86,927,643	$11,330,885	$14,079,976
6	52.03%	64.10%	7.05	5.70	$85,670,133	$85,297,418	$12,146,957	$14,957,879
7	56.04%	68.42%	6.42	5.24	$83,594,057	$83,258,136	$13,030,448	$15,900,340
8	60.44%	73.12%	5.80	4.78	$81,154,975	$80,854,116	$13,995,599	$16,921,862
9	65.27%	78.24%	5.21	4.33	$78,370,907	$78,103,268	$15,054,108	$18,032,744
10	65.97%	78.32%	4.97	4.17	$75,286,120	$75,049,788	$15,153,032	$17,979,488
11	71.56%	84.15%	4.39	3.73	$71,918,431	$71,711,436	$16,373,264	$19,238,833
12	77.92%	90.70%	3.85	3.30	$68,329,536	$68,149,885	$17,754,855	$20,653,662
13	85.24%	98.20%	3.34	2.89	$64,563,457	$64,409,148	$19,343,804	$22,269,104
14	93.81%	106.91%	2.86	2.51	$60,655,353	$60,524,397	$21,202,897	$24,146,291
15	104.14%	117.34%	2.42	2.14	$56,666,686	$56,557,129	$23,438,205	$26,391,143
16	92.46%	102.95%	2.54	2.28	$52,632,469	$52,542,406	$20,720,991	$23,055,461
17	105.50%	116.00%	2.06	1.88	$48,596,456	$48,524,049	$23,539,266	$25,864,324
18	123.24%	133.71%	1.63	1.50	$44,611,137	$44,554,626	$27,375,490	$29,682,234
19	149.24%	159.64%	1.23	1.15	$40,711,367	$40,669,085	$32,997,033	$35,276,263
20	191.72%	202.01%	0.88	0.83	$36,923,177	$36,893,553	$42,188,654	$44,430,992
21	275.53%	285.67%	0.55	0.53	$33,281,367	$33,262,936	$60,330,384	$62,529,283
22	525.01%	535.06%	0.26	0.26	$29,820,714	$29,812,121	$114,371,754	$116,537,821
Years 11-22			26.01	23.00	$608,710,149	$607,610,772	$23,400,645	$26,422,326

Conclusions

NHTSA's original analysis of retrofitting lap/shoulder belts on motorcoaches assessed the feasibility, benefits, and costs with respect to the application of the seat belt requirements to buses manufactured before the date on which this final rule applies to new vehicles. Based on that assessment, NHTSA decided not to require retrofitting of used buses with seat belts.

Subsequent to that decision, several significant developments occurred that might affect estimates of the scope and value of safety benefits that might result from retrofitting. These include a recent decision by USDOT to increase its recommended VSL to $9.2 million, roughly a 50 percent increase over the $6.3 million VSL that was used in the 2008 FRIA.[23] Since the VSL is used to value safety benefits from proposed regulations, it can potentially influence conclusions regarding the relative costs and benefits of a rule. The second development is the installation of electronic stability control on later MY motorcoaches. The 2012 final rule on lap/shoulder belts for motorcoaches was based on data from 2000 to 2009, a time when ESC was virtually unknown on motorcoaches. However, NHTSA has subsequently estimated that 80 percent of new motorcoaches in 2012 had ESC as standard equipment. ESC is highly effective (40 to 56%) in preventing rollovers and run-off-road crashes. An increased VSL would tend to increase the value of safety benefits from belts, while ESC technology would tend to reduce the size of the motorcoach crash problem and thus reduce potential safety benefits from lap/shoulder belts. In light of these developments, NHTSA has conducted further analysis to examine the impact of these changes. Overall, the net impact of these changes does not alter the basis from which NHTSA derived its conclusion that retrofitting motorcoaches was impractical. There is still a low likelihood that a retrofit requirement would be technically practicable at a reasonable cost, the cost impacts are still likely to be significant for small businesses, and the benefits that would accrue from a retrofit requirement are likely to be low.

[23] Ibid.

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