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PRELIMINARY REGULATORY IMPACT ANALYSIS

FMVSS No. 218, Motorcycle Helmets: Novelty Helmets

Office of Regulatory Analysis and Evaluation
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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This Preliminary Regulatory Impact Analysis examines a proposed rule which sets forth an interpretation of § 30102(a)(7)(C) of the Safety Act, as amended by the Moving Ahead for Progress in the 21st Century (MAP-21) Act, Pub. L. No. 112-141, 126 Stat 405 (July 6, 2012), and proposes two main changes to the motorcycle helmet safety standard, Federal Motor Vehicle Safety Standard (FMVSS) No. 218. The first proposed change is to add a definition of "motorcycle helmet." The second proposed change modifies the existing performance requirements of the standard by adding a set of dimensional requirements. The dimensional criteria and test procedures would identify those helmets whose physical characteristics indicate that they cannot meet the existing performance requirements of the standard. Monetary values of these impacts are in 2012 economics.

Some of the amendments made by this proposed rule will help more fully realize the benefits of motorcyclists using 218-certified motorcycle helmets by making it easier for State and local law enforcement officials to enforce existing State helmet use laws. This will be achieved by providing information that State and local law enforcement officials can use to identify novelty helmets, thereby increasing the percentage of motorcyclists wearing 218-certified helmets.

The benefits and costs of the amendments depend on how many motorcyclists (operators and passengers) will change from using novelty helmets, which do not comply with FMVSS No. 218, to using FMVSS 218-certified helmets. Behavioral change among motorcyclists as a result of the rule is difficult to predict. However, the agency believes that 5 to 10 percent of the novelty helmet users in States that have a Universal Helmet Law ("Law States") would eventually make a switch, and that this is a modest and achievable projection. Therefore, the

analysis estimates benefits and costs of the rule for the 5- and 10-percent projections (i.e., the 5- and 10-percent scenarios). In addition, the analysis also estimates a hypothetical maximum potential benefit of the rule which corresponds to a theoretical scenario in which all novelty helmet users in Law States become 218-certified helmet users (the 100-percent scenario). Cost-effectiveness and net benefits of the rule were also estimated based on these three scenarios. Note that the analysis did not quantify nonfatal injury benefits at this time because of concerns about our ability to accurately measure these benefits with our current data sources. In addition, the agency did not estimate potential private disbenefits to riders who would prefer to wear novelty helmets, but switch to 218-certified helmets to avoid being ticketed or fined for violating state law. The proposed rule is highly cost-effective under any of the three scenarios.

Interpretation of § 30102(a)(7)(C) of the Safety Act

Congress passed the National Traffic and Motor Vehicle Safety Act of 1966 (Safety Act) with the express purpose of reducing motor vehicle accidents, injuries, and property damage. To promote this end, the Safety Act provided for the establishment of motor vehicle safety standards for motor vehicles and equipment in interstate commerce, 15 U.S.C. §1381. The Safety Act empowers the Secretary of the Department of Transportation to establish and enforce mandatory motor vehicle safety standards and to issue rules and regulations for the design of vehicles and equipment covered by the Act. 15 U.S.C. §§1392(a) and 1407 codified as 49 U.S.C. § 30107 and 49 U.S.C. § 30111. The Secretary has delegated this authority to NHTSA. 49 CFR 1.95. In pertinent part, motor vehicle equipment is defined in § 30102(a)(7)(C) of the Safety Act (as amended) as follows:

(7) “motor vehicle equipment” means--

(C) any device or an article or apparel (except medicine or eyeglasses prescribed by a licensed practitioner) that is not a system, part, or component of a motor vehicle and is manufactured, sold, delivered, offered, or intended to be used only to safeguard motor vehicles and highway users against risk of accident, injury, or death.

Protective equipment, such as motorcycle helmets, is motor vehicle equipment under the Safety Act. Recognizing the need for minimum performance standards for helmets and other protective equipment, in 1970, Congress amended the Safety Act of 1966 to substantially expand the definition of "motor vehicle equipment" to include motorcycle helmets and other protective equipment that did not meet the originally enacted definition of the term. Specifically, the amended definition of "motor vehicle equipment," was expanded to include "any device, article or apparel not a system, part, or component of a motor vehicle (other than medicines, or eyeglasses prescribed by a physician or other duly licensed practitioner) which is manufactured, sold, delivered, offered or intended for use exclusively to safeguard motor vehicles, drivers, passengers, and other highway users from the risk of accident, injury or death."[1] The evolution of the amendment's text during Congress' consideration of that amendment, establishes that Congress intended to authorize NHTSA to set standards for all helmets used by motorcyclists.

In 2012, the MAP-21 Act modified this definition of "motor vehicle equipment" in two ways. First, the definition was amended by specifically adding the term "motorcycle helmet" to the description of regulated items. Second, the MAP-21 Act amended the definition of "motor vehicle equipment" by replacing the phrase " . . . manufactured, sold, delivered, offered or intended for use exclusively to safeguard motor vehicles, drivers, passengers, and other highway users. . ." with ". . . manufactured, sold, delivered, or offered to be sold for use on public streets, roads, and highways with the apparent purpose of safeguarding motor vehicles and highway use.

[1] Ibid.

The agency's interpretation of this definition, based on an examination of the text of the 2012 MAP-21 amendment and the evolution of the original 1970 definition before its enactment as well as its legislative history, concludes that Congress meant to grant NHTSA authority to regulate motorcycle helmets and that any determination of what constitutes motor vehicle equipment must be governed by an objective standard and not controlled by the subjective intent of a manufacturer or seller. This conclusion is supported by the explicitly pronounced Congressional goal of reducing deaths and injuries resulting from the use of helmets that did not provide a minimum level of safety. The agency's interpretation further notes the absence of any suggestion in the legislative history that Congress meant to have the definition negated by subjective declarations of intended use that are contrary to an objective measure of actual sale, use and "apparent purpose."

Amendments

The agency is proposing to add a definition of "motorcycle helmet" to section S4 of FMVSS No. 218 to effectuate NHTSA's interpretation of the statutory definition of motor vehicle equipment in the accompanying Notice of Proposed Rulemaking explaining that novelty helmets are motor vehicle equipment, and help ensure that helmets being used by motorcyclists on highways meet the minimum performance standards set forth in FMVSS No. 218.

NHTSA observes that these performance standards serve well to create a repeatable, reproducible standard to which helmet manufacturers produce compliant products, yet are ill suited for enforcing laws that restrict the importation and use of novelty helmets. Authorities seeking to enforce motorcycle helmet laws face a particular set of challenges when confronted with motorcyclists using novelty helmets. This rule proposes design metrics oriented toward

laboratory and field enforcement of FMVSS No. 218, which will be sufficient to determine novelty helmets.

Benefits

The benefits of the proposed rule largely depend on how many motorcyclists will chose to change from using a novelty helmet to a 218-certified helmet ("compliant"). The behavioral change and decision for making the change among motorcycle helmet users is largely uncertain. Five-percent and 10-percent scenarios, in which 5 and 10 percent[2] of novelty motorcycle helmet users in States that have a Universal Helmet Law (hereafter referred to as "Law States") switch to 218-certified helmets as a result of the proposed rule are evaluated in this analysis. Undiscounted, the estimated range of lives saved is 12 to 48 annually. By saving these lives, the discounted total monetized benefit of the proposed rule ranged from $95.9 million to $438.3 million. These monetized benefits include both quality of life valuation based on the value of statistical life (VSL)[3] and societal economic savings.

Additionally, for comparison purpose, the benefit of a hypothetical scenario in which 100 percent of novelty helmet users in Law States switch to compliant helmets is also included in the analysis, which assumes theoretical maximum benefits of the proposed rule including enforcement policy. Under this hypothetical 100-percent scenario, 235 to 481 lives would be saved and discounted monetized benefits would be $1.9 billion to $4.4 billion. This scenario is theoretical since some novelty-helmeted motorcyclists would still be expected to circumvent the

[2] This represents 0.6% and 1.2% of riders in "helmet" states that would make the change. The proportion of motorcyclists nationally is even lower.

[3] The value contains intangible consequences such as value of quality of life, pre-tax wage portion of the market productivity, and household productivity. The VSL value is expected to increase 1.07 percent annually. The increase rate was set by the DOT 2013 guideline on VSL.

helmet laws by continuing taking the risk of wearing novelty helmets. Therefore, the estimated costs and benefits for the 100-percent scenario are not used (and not appropriate) for determining the effects of the proposed rule. However, they do indicate the potential social cost savings that are offered by FMVSS No. 218-compliant helmets and the importance of educating the public to this potential.

The following table lists the discounted injury benefits (i.e., lives saved and injuries reduced) and monetized savings. The lower bounds represent the savings for the 7 percent discount rate and the higher bounds represent savings for the 3 percent discount rate. In addition to discount rates, the estimated benefit ranges also reflect two different approaches that were used to derive the benefit target population and the injury risk reduction rates. Details are described in the main body of the analysis. Furthermore, due to great uncertainty in deriving the estimated portion of non-fatal injuries attributed to the head, the benefits attributed to non-fatal head injuries are not quantified in this analysis.[4]

Discounted Benefits of the Proposed Rule
(2012 dollars)

	# Lives Saved	Societal Economic Benefits (in Millions))	VSL Benefits (in Millions)	Total Benefits (in Millions)
5-percent scenario	9 – 22	$3.0 – $7.4	$92.9 – $211.9	$95.9 – $219.3
10-percent scenario	19 – 43	$6.4 – $14.4	$185.8 – $423.9	$192.2 – $438.3
100-percent scenario	186 – 433	$62.5 – $145.4	$1,819.3 – $4,247.4	$1,881.7 – $4,392.7

VSL: value of statistical life
Note: the lower bounds represent the estimated benefits at a 7 discount rate and the higher bounds represent the estimated benefits at a 3 percent discount rate. Additionally, the wide range of benefits also reflects the two approaches that were used for deriving the benefit target population and risk reduction rates. Details are described in the main body of the analysis.

[4] *See* Chapter IV, Benefits of the Preliminary Regulatory Evaluation, FMVSS No. 218 Motorcycle Helmet Labeling (Docket No. NHTSA-2011-0050-0001). Based on 2003 – 2005 Crash Outcome Data Evaluation System (CODES) data from Maryland, Utah and Wisconsin, and 2005 – 2007 NASS-GES.

Costs

The regulatory costs of the proposed rule are derived from the incremental cost increase due to purchasing a 218-certified helmet versus a novelty helmet, and the cost of State and local law enforcement acquiring preliminary screening tools.

The incremental cost per replaced novelty helmet is estimated to be $48.92. The estimated costs of the proposed rule are based on 5 percent and 10 percent of consumers in Law States replacing novelty helmets with compliant helmets. The estimated consumer cost ranged from $0.6 million to $1.2 million, where 12,150 to 24,300 novelty helmets would be replaced by compliant helmets. Under the maximum benefit scenario in which 100 percent of novelty helmet users would switch to compliant helmets, the incremental cost to consumers is $11.9 million, where 243,000 novelty helmets would be replaced by compliant helmets.

The cost of the preliminary screening tools is estimated to be $81.43 per complete kit per year, for a total cost of $0.6 million (assuming each of the 7,214 State and local law enforcement agencies in only the States that require motorcycle helmet use will purchase one complete screening tool kit).

The total regulatory cost of the proposed rule including the cost of novelty helmet replacement and screening tool kits ranged from $1.2 million to $1.8 million. For achieving the maximum benefit (i.e., 100-percent scenario), the estimated total regulatory cost is $12.5 million.

Regulatory Costs of the Proposed Rule
(2012 dollars)

	# of Novelty Helmets Assumed to be Replaced	Total Cost of Replacing Novelty Helmets* (in Millions)	Annual Cost of Screening Tools (in Millions)**	Total Regulatory Cost (in Millions)
5-percent scenario	12,150	$0.6	$0.6	$1.2
10-percent scenario	24,300	$1.2	$0.6	$1.8
100-percent scenario	243,000	$11.9	$0.6	$12.5

* $48.92 per minimally-compliant helmet which replace novelty helmets
** $81.43 per screening tool kit per year

Note that a complete set of recommended screening tools includes three type components. We estimated the cost is $264.67 per complete kit. The total first year investment in screening tools for the 7,214 State and local law enforcement agencies would be $1.9 million. Because one of the tools would need to be replaced only every five years, one-fifth cost for that specific component was used for estimating for the annual costs of the screening tools as shown above. In other words, the difference between the first year cost and the annual cost is the allocation of the tool costs over their useful life.

Net Costs

The net cost of the proposed rule is the regulatory cost minus the societal economic savings. The societal economic savings is greater than the regulatory cost for all three scenarios. As a result, there would be a net monetary benefit greater than a net cost for the proposed rule.

Net Cost per Equivalent Life Saved

The net cost per equivalent life saved would be negative since the estimated net cost for all three scenarios are negative for both discount rates. This indicates that the proposed rule is very cost-effective measured against the VSL of $9.50 million[5] for model year (MY) 2016 in 2012 economics.

[5] The value contains intangible consequences such as value of quality of life, pre-tax wage portion of the market productivity, and household productivity for year 2016. The VSL value is expected to increase 1.07 percent annually which was set by the DOT 2013 guideline on VSL. Please consult Appendix B for details.

Net Benefits

A net benefit is the difference between the VSL benefit[6] and the net cost. The estimated net benefit ranges from $94.7 million to $436.5 million. The maximum net benefit could range from $1.9 billion to $4.4 billion as shown in the table below. The estimated net benefits vary widely since the behavioral change of motorcyclists is highly uncertain, and the proposed rule has potential to impact all novelty helmet users. The benefits are considered conservative as they do not include any reduction in novelty helmet use in Non-Law States that may occur as a result of the proposed rule, nor have any benefits been attributed to non-fatal head injuries.

Net Benefits*
(= VSL Benefit – Net Cost)
(in **Millions** of 2012 dollars**)**

	3% Discount Rate		7% Discount Rate	
	Low	High	Low	High
5-percent scenario	$108.5	$218.1	$94.7	$191.0
10-percent scenario	$217.5	$436.5	$190.4	$382.6
100-percent scenario	$2,133.8	$4,380.3	$1,869.2	$3,838.8

***** Excludes benefits from non-fatal injuries prevented and any utility lost by novelty helmet riders who switch to FMVSS 218 compliant helmets. Since any such utility is obtained in violation of State law, its status is uncertain. See "Non-quantified Impacts" section for further discussion.

[6] Based on the DOT 2013 guideline, which establishes $9.1 million for VSL in 2012 economics and an annual increase rate of 1.07 percent for VSL

Summary of Costs and Benefits

The following table summarizes the annualized total costs, total benefits, and net benefits for both 3 and 7 percent discount rates. Two plausible scenarios are presented, 5 percent and 10 percent of novelty helmet users in Law States switch to compliant helmets. The benefits of the proposed rule are based on these two plausible scenarios. A maximum potential benefit is also presented in the table.

Annualized Costs and Benefits
(in **Millions** of 2012 dollars)

	Regula-tory Costs*	Societal Economic Savings	VSL Savings	Total Benefits**	Net Benefits***
3 Percent Discount					
5-percent scenario	$1.2	$3.7 - $7.4	$106.0 – $211.9	$109.7 – $219.3	$108.5 - $218.1
10-percent scenario	$1.8	$7.4 - $14.4	$211.9 - $423.9	$219.3 - $438.3	$217.5 - $436.5
100-percent scenario	$12.5	$71.2 - $145.4	$2,075.1 – $4,247.4	$2,146.3 – $4,392.7	$2,133.8 - $4,380.3
7 Percent Discount					
5-percent scenario	$1.2	$3.0 - $6.4	$92.9 – $185.8	$95.9 - $192.2	$94.7 - $191.0
10-percent scenario	$1.8	$6.4 - $12.8	$185.8 - $371.6	$192.2 - $384.4	$190.4 - $382.6
100-percent scenario	$12.5	$62.5 - $127.6	$1,819.3 – $3,723.7	$1,881.7 - $3,851.3	$1,869.2 - $3,838.8

*Cost are not discounted since they occur at the time of purchase
** = Societal Economic Savings + VSL Savings
*** = Total Benefits – Regulatory Costs

Lead Time

The agency is proposing a lead time of two years from the publication of the final rule for manufacturers to comply with the revisions.

CHAPTER I. INTRODUCTION

This Preliminary Regulatory Impact Analysis examines the impact of a proposed rule which sets forth an interpretation of § 30102(a)(7)(C) of the Safety Act, as amended by the Moving Ahead for Progress in the 21st Century (MAP-21) Act, Pub. L. No. 112-141, 126 Stat 405 (July 6, 2012), and proposes two main changes to the motorcycle helmet safety standard, Federal Motor Vehicle Safety Standard (FMVSS) No. 218. The first proposed change is to add a definition of "motorcycle helmet." The second proposed change modifies the existing performance requirements of the standard by adding a set of dimensional requirements. The dimensional criteria and test procedures would identify those helmets whose physical characteristics indicate that they cannot meet the existing performance requirements of the standard. While the proposed definition is certainly an underpinning of existing helmet laws, the costs and benefits of the rule are estimated here to be mainly derived from the application of the dimensional requirements in States with Universal Helmet Laws ("Law States").

Note that the cost and benefit assessment in this analysis is based on the new 2013 DOT guidelines on the value of statistical life (VSL) (see Appendix B for details). Therefore, the approach used in this analysis differs from that which was used in the recent amendments to FMVSS No. 218 on May 13, 2011 (hereafter referred to as the FMVSS No. 218 Upgraded Helmet Labeling final rule) (Docket No. NHTSA-2011-0050-0001). Monetary values in this analysis are in 2012 economics.

Following is a summary of the incidence of motorcyclist fatalities and injuries, incidence of novelty helmet use, the FMVSS No. 218 Upgraded Helmet Labeling final rule, and the authority over safety equipment granted to the agency.

Motorcyclist Fatalities and Injuries

Since 1999 motorcyclist fatalities and injuries have shown an overall increasing trend, with some remission in 2009. Based on NHTSA's Fatality Analysis Reporting System (FARS), there were 4,612 motorcycle fatalities in 2011, which was an 86 percent increase over the 1999 level of 2,483 fatalities. Table I-1 shows the motorcyclist fatality trend from 1999 to 2011 by helmet use.[7]

Table 1-1
Motorcyclist Fatalities by Helmet Use
Calendar Year 1999-2011

	Helmeted		Unhelmeted		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent Increase*
1999	1,313	53%	1,080	43%	90	4%	2,483	-
2000	1,492	52%	1,283	44%	122	4%	2,897	17%
2001	1,603	50%	1,484	46%	110	3%	3,197	29%
2002	1,653	51%	1,517	46%	100	3%	3,270	32%
2003	1,909	51%	1,689	45%	116	3%	3,714	50%
2004	2,176	54%	1,760	44%	92	2%	4,028	62%
2005	2,535	55%	1,898	41%	143	3%	4,576	84%
2006	2,740	57%	1,973	41%	124	3%	4,837	95%
2007	2,941	57%	2,103	41%	130	2%	5,174	108%
2008	3,017	57%	2,106	40%	135	3%	5,312	114%
2009	2,439	55%	1,911	43%	112	3%	4,462	80%
2010	2,565	57%	1,868	41%	85	2%	4,518	82%
2011	2,666	58%	1,843	40%	103	2%	4,612	86%

*over the 1999 calendar year
Data source: 1999-2011 FARS

Non-fatal motorcyclist injuries also show an upward trend. Based on the agency's National Automotive Sampling System-General Estimates System (NASS-GES), there were 81,000 police-reported non-fatally injured motorcyclists in 2011, which is about a 62 percent

[7] Generated by the National Center for Statistics and Analysis, National Highway Traffic Safety Administration on October 03, 2012

increase over the 1999 level of 50,000 non-fatally injured. Table I-2 shows the non-fatally injured motorcyclists by helmet use from 1999 to 2011.

Table I-2
Non-fatally Injured Motorcyclists by Helmet Use
Calendar Year 1999-2011

	Helmeted		Unhelmeted		Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent Increase*
1999	30,000	60%	16,000	32%	3,800	8%	50,000	-
2000	32,000	55%	20,000	34%	5,100	9%	58,000	16%
2001	35,000	58%	21,000	35%	4,500	8%	60,000	20%
2002	35,000	54%	26,000	40%	3,400	5%	65,000	30%
2003	37,000	55%	23,000	34%	7,100	11%	67,000	34%
2004	44,000	58%	25,000	33%	6,800	9%	76,000	52%
2005	53,000	61%	29,000	33%	5,600	6%	87,000	74%
2006	53,000	60%	26,000	30%	8,100	9%	88,000	76%
2007	65,000	63%	31,000	30%	7,000	7%	103,000	106%
2008	59,000	61%	31,000	32%	6,900	7%	96,000	92%
2009	55,000	61%	30,000	33%	4,700	5%	90,000	80%
2010	52,000	63%	26,000	32%	4,200	5%	82,000	64%
2011	51,000	63%	25,000	31%	5,700	7%	81,000	62%

Percentages may not add due to rounding.
*Over the 1999 calendar year.
Data source: 1999-2011 NASS-GES

As shown in Table I-3, motorcycle registrations have increased by 103 percent between 1999 and 2011 (the latest available data) and VMT has increased by 75 percent over the same period. The increased rate of 86 percent in the number of motorcyclist fatalities is disproportionately high compared to trends of fatalities among other types of vehicles. Fatality rates for motorcyclists have only started to decrease (negligibly) from 1999. The number of fatalities per 100,000 registered motorcycles has decreased from 60 in 1999 to 55 in 2011 yet the trend for years between 1999 and 2009 was significantly higher. The number of fatalities per 100 million VMT on motorcycles has increased from 23 in 1999 to 25 in 2011. The sheer

number of motorcyclist fatalities and injuries and the disproportionately high fatality rates represent a pressing need for tangible improvements in motorcycle safety.

Note that the Federal Highway Administration (FHWA) updated the methodology for estimating vehicle miles traveled (VMT) in March 2011.[8] The net effect of these changes is an increase in motorcycle VMT.

Table I-3
Motorcycle Registration, Miles Traveled, and Fatality Rate per 100,000 Registered Motorcycles
Calendar Year 1999-2011

	Vehicle Registration		Total Miles Traveled		Fatality Rate			
	Registration	% Increase Over 1999	Miles (Millions)	% Increase Over 1999	Per 100,000 Motorcycles	% Increase Over 1999	Per 100 Million Miles	% Increase Over 1999
1999	4,152,433	-	10,584	-	**59.80**	-	23.46	-
2000	4,346,068	5%	12,175	15%	**66.66**	11%	23.79	1%
2001	4,903,056	18%	11,120	5%	**65.20**	9%	28.75	23%
2002	5,004,156	21%	11,171	6%	**65.35**	9%	29.27	25%
2003	5,370,035	29%	11,384	8%	**69.16**	16%	32.62	39%
2004	5,767,934	39%	14,975	41%	**69.83**	17%	26.90	15%
2005	6,227,146	50%	13,773	30%	**73.48**	23%	33.22	42%
2006	6,678,958	61%	19,157	81%	**72.42**	21%	25.25	8%
2007	7,138,476	72%	21,396	102%	**72.20**	21%	24.18	3%
2008	7,752,926	87%	20,811	97%	**68.52**	15%	25.52	9%
2009	7,929,724	91%	20,822	97%	**56.36**	-6%	21.46	-9%
2010	8,009,503	93%	18,513	75%	**56.41**	-6%	24.40	4%
2009	8,437,502	103%	18,500	75%	**54.66**	-9%	24.93	6%

Source: Highway Statistics, 1999 - 2011, Federal Highway Administration

[8] The report of motorcycle VMT by States was optional prior to 2007. VMT reported by States often were a standard proportion of total VMT and not a direct estimate through surveys or roadside observation. Beginning in 2007, FHWA began requiring States to collect and report motorcycle VMT. In addition, FHWA has worked with NHTSA and States to improve the motorcycle travel data collection and reporting methodologies.

Incidence of Novelty Helmet Use

Head injuries are the leading cause of motorcycle fatalities and MAIS 4-5 injuries.[9,10] Using the 2000-2002 FARS Cause of Death files, the agency estimated that about 60 percent of helmeted motorcyclist fatalities were caused by head injuries compared to the 80 percent of unhelmeted motorcyclist fatalities.[11] These statistics further validated that motorcycle helmets are an effective countermeasure in reducing motorcyclist fatalities. In 2004, the agency estimated that helmets were 37 percent effective against overall motorcyclist fatalities.[12]

Wearing novelty helmets undermines the safety of motorcyclists. Novelty helmets are generally identifiable by their lack of coverage or thickness of interior padding. They typically lack the strength, energy absorption capability, and size necessary to protect their users.[13] These novelty helmets do not meet the safety requirements of FMVSS No. 218. The agency's recent compliance test data on novelty helmets show that these helmets not only failed the FMVSS No. 218 performance requirements, they also failed with significantly wide margins.[14]

NHTSA does not have sufficient information to discern why motorcyclists wear novelty helmets. We believe that novelty helmets initially became popular after the enactment of helmet

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[9] MAIS (Maximum Abbreviated Injury Scale) represents the maximum injury severity of an occupant at an Abbreviated Injury Scale (AIS) level. AIS ranks individual injuries by body region on a scale of 1 to 6: 1=minor, 2=moderate, 3=serious, 4=severe, 5=critical, and 6=maximum (untreatable).

[10] This was estimated using data from Maryland, Utah, and Wisconsin in the Crash Outcome Data Evaluation System (CODES) during 2003 – 2005.

[11] The 60 and 80 percent were imputed from the 30 and 51 percent reported in the Traffic Safety Facts titled "Bodily Injury Locations in Fatally Injured Motorcycle Riders", DOT HS 810 856, October 2007. The imputation process is described in Chapter IV, Benefit Chapter of the analysis.

[12] Motorcycle Helmet Effectiveness Revisited, March 2004, DOT HS 809 715, National Center for Statistics and Analysis, NHTSA.

[13] Traffic Safety Facts, Motorcycle Helmet Use in 2006 – Overall Results, DOT HS 810 678, November 2006, National Center for Statistics and Analysis, National Highway Traffic Safety Administration.

[14] Traffic Safety Facts Research Note, Summary of Novelty Helmet Performance Testing, DOT HS 810 752, April 2007, Office of Behavioral Safety Research, National Highway Traffic Safety Administration.

laws. We believe that they did so partially because they were a sign of protest against those laws and wearing them provided riders with a basis for arguing that they should not be ticketed for failure to wear a helmet and partially because they misperceived novelty helmets are a less expensive way of complying with the law. Novelty helmets are generally less expensive, lighter and smaller than certified helmets which may help explain why riders may choose novelty helmets. The incorrect perception of the protection level that novelty helmets can provide might also explain why motorcyclists wore novelty helmets in states without helmet laws.

Novelty helmet usage nationally has been estimated to be as low as 9 percent and as high as 16 percent per year. There is no obvious trend over the 9 year period that NHTSA has been collecting the data. According to the National Occupant Protection Use Survey[15] (NOPUS), in 2011 nationally about 66 percent of the motorcyclists wore a 218-certified helmet, 8 percent of motorcyclists wore a novelty helmet, and 26 percent did not wear helmets. NOPUS is a probability-based observational survey of motorcycle helmet use in the U.S.[16] The NOPUS uses a complex multistage probability sample, statistical data editing, imputation of unknown values, and complex estimation procedures. The survey observes helmet usage at a random selection of roadway sites between 8 a.m. and 6 p.m. starting in 2002.[17] The observers categorized DOT-compliant helmets as helmets that cover the motorcyclists' ears, helmets with full facial coverage, and helmets appearing to be at least 1-inch thick.

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[15] NOPUS data is collected between the hours of 7 am and 6 pm, likely creating an upwardly biased estimate of actual helmet use since nighttime use is probably lower than daytime use. National Highway Traffic Safety Administration, *An Analysis of Motorcycle Helmet Use in Fatal Crashes.* August 2008. (DOT HS 801-111).

[16] NOPUS are conducted by Westat, Inc. under the direction of the National Center for Statistics and Analysis in NHTSA under Federal contract number DTNH22-00-D-07001. NOPUS also observes child restraints, seat belt, and driver cell phone use.

[17] In 2007, the data collection times changed to between 7 am and 6 pm.

At this time, 47 states, the District of Columbia, Guam, the Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands have some form of helmet law for motorcyclists. Three states, Illinois, Iowa and New Hampshire, do not require any rider of any age to wear a helmet. Twenty Eight states have helmet laws requiring specific riders (usually those under 18 year of age) to wear helmets. Nineteen states, the District of Columbia, the Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands have a universal helmet law (i.e., Law States), requiring helmets for all riders. Of the 19 mandatory helmet law states, 18 have laws providing that motorcyclists must wear a helmet that complies with FMVSS No. 218. Alabama's statute contains its own definition of what constitutes a legal helmet while Oregon's statute states that a helmet must have a sticker indicating that the helmet meets FMVSS No. 218. (See Ala. Code Ala. Code § 32-12-41 (1967), Or. Rev. Stat. § 801.366 (1995)). Eight states, California, Mississippi, Nebraska, New York, Tennessee, Virginia, Washington, and West Virginia, have statutes explicitly stating that motorcyclists must wear a helmet that meets FMVSS No. 218. The Georgia, Louisiana, Maryland, Massachusetts, Missouri, Nevada, New Jersey, North Carolina, and Vermont mandatory helmet laws provide that the standard helmets must meet shall be established administratively. These nine states have promulgated regulations adopting FMVSS No. 218 as the standard helmets must meet.

There is a strong correlation between helmet use and the existence of mandatory helmet laws. When universal helmet laws are enacted, helmet use increases by as much as 80 percent. When universal helmet laws are repealed or modified, helmet use falls dramatically. The 2000 amendment to the Florida law reduced helmet use from 99 percent to 53 percent. The 2003 changes to the Pennsylvania law reduced helmet use from 82 percent to 58 percent.[18] In Law

[18] Motorcycle Safety Guide: Universal Helmet Laws Increase Helmet Use, Centers for Disease Control and Prevention, http://www.cdc.gov/motorvehiclesafety/mc/guide/laws.html

States in 2011, 84 percent wore a 218-certified helmet, 12 percent wore a novelty helmet, and 4 percent did not wear helmets. In Non-Law States, 50 percent wore a 218-certified helmet, 5 percent wore a novelty helmet, and 45 percent did not wear helmets. As shown in Table I-4, the general trend appeared to be an increase in 218-certified helmet use both in Law and No-Law States. However, there is no discernible trend for novelty helmet use. The swings in novelty helmet usage from year to year suggest difficulty identifying novelty helmets, as well as some survey variance. In order to fully reap the benefits of compliant helmets, better enforcement against the use of novelty helmets by motorcyclists is necessary.

Table I-4
Estimated Helmet Use

Year	Law States		Non-Law States		Nationally	
	218-Certified Helmets	Novelty Helmet Use	218-Certified Helmets	Novelty Helmet Use	218-Certified Helmets	Novelty Helmet Use
2002	73%	27%	46%	7%	58%	14%
2003	*	*	*	*	*	*
2004	71%	16%	48%	6%	58%	11%
2005	67%	12%	38%	8%	48%	9%
2006	68%	15%	37%	13%	51%	14%
2007	74%	23%	42%	8%	58%	16%
2008	76%	19%	50%	4%	63%	11%
2009	86%	11%	55%	8%	67%	9%
2010	76%	22%	40%	8%	54%	14%
2011	84%	12%	50%	5%	66%	8%

*2003 NOPUS did not survey motorcycle helmet use.
Source: 2002 - 2011 NOPUS

The 2011 NOPUS helmet usage rates were chosen for the analysis as they represent the most current data available for novelty helmet use. As shown in Table I-4, in 2011, about 96 percent of motorcyclists in Law States wore a helmet. Of the helmeted users, 88 percent (= 84 /

96) wore a 218-certified helmet and 12 percent (= 12 / 96) wore a novelty helmet. The 88 and 12 percent were used as the weights to adjust the relative risk between 218-certified and novelty helmets. The relative risk then is used to determine the portion of head injuries for these two helmet types.

Recent Amendments to FMVSS No. 218

To reduce counterfeit certification and labeling commonly found on novelty helmets, the agency issued the FMVSS No. 218 Upgraded Helmet Labeling final rule in May 2011 requiring additional information on motorcycle helmet certification labels, as described below:

- The manufacturer's name and/or brand name and the helmet model designation above the "DOT" symbol;
- The word "certified" in a horizontally centered position beneath the "DOT" symbol on said exterior label; and
- The term "FMVSS No. 218" between "DOT" and "Certified" on the exterior label.

Additionally, the Upgraded Helmet Labeling final rule aids the agency's enforcement of the FMVSS No. 218 standard by:

- Specifying a range of load application rates for the quasi-static helmet retention test;
- Specifying test velocity tolerance limits and removing specifications on drop height in the impact attenuation test;
- Providing tolerances for the helmet conditioning specifications and drop assembly weights; and
- Revising the requirements related to size labeling and location of the DOT symbol.

The agency expected that the Upgraded Helmet Labeling final rule would allow the consumers to better differentiate new FMVSS No. 218-compliant helmets from novelty helmets. As a result, the agency expected that some novelty-helmeted consumers would switch to a FMVSS No. 218-compliant helmet for safety reasons. The FMVSS No. 218 Upgraded Helmet Labeling final rule estimated that a proportion of novelty helmet users will switch to 218-certified helmets as a result of the rule. As there is uncertainty about the behavioral shift, the benefits were estimated for a 5-percent change, a 10-percent change, and at full compliance (100 percent). A 5-percent switch among motorcycle helmet users in States where motorcycle helmets are universally required was estimated to reduce the number of novelty helmets by 5 percent, and save 13-26 lives using the most recent data available (2011 data). A 10-percent switch among motorcycle helmet users in States where motorcycle helmets are universally required is estimated to reduce the number of novelty helmets by 10 percent, and save 26-53 lives. In this analysis, the 10-percent scenario will provide the "baseline" scenario or the assumed state in the future. The 100-percent scenario would save 256 to 526 lives. Note that this 100-percent scenario is considered a purely theoretical possibility since some novelty-helmeted motorcycle riders still would be expected to circumvent the helmet Law by continuing taking a risk to wear novelty helmets. Therefore, the estimated benefits for this 100-percent scenario are intended to demonstrate the potential importance of wearing compliant helmets, but are not used (and inappropriate) for determining the likely effects of the proposed rule.

Authority

The agency has the authority to enforce FMVSS as it does other motor vehicle safety standards under the Safety Act hereby "a person may not manufacture for sale, sell, offer for

sale, introduce or deliver for introduction in interstate commerce, or import into the United States, any motor vehicle or motor vehicle equipment manufactured on or after the date an applicable motor vehicle safety standard prescribed under this chapter takes effect unless the vehicle or equipment complies with the standard and is covered by a certification issued under section 30115 of this title." In the past, motorcycle helmets that do not meet the requirements of FMVSS No. 218, which have been sold in the U.S., have commonly been labeled as "Not for on-road use" while being marketed as a motorcycle helmet.[19] Additionally, manufacturers and importers of helmets designed with the intent of being used on-road, whether or not they have been labeled as such, have the responsibility prior to sale of meeting certain technical and safety related responsibilities under 49 USC 301 §30112 and 49 USC 301 §30115. The responsibilities after sale are provisioned under 49 USC 301 §30116 – 30120.

Furthermore, based on an examination of the text of the 2012 MAP-21 amendment and the evolution of the original 1970 definition before its enactment as well as its legislative history, the agency concludes that Congress meant to grant NHTSA authority to regulate motorcycle helmets and that any determination of what constitutes motor vehicle equipment must be governed by an objective standard and not controlled by the subjective intent of a manufacturer or seller.

Need for Regulation

Novelty helmets are sold as the safety gear to be worn by riders for road use. However, these helmets provide almost no head protection especially during severe head impact crashes. The proposed rule would assist local enforcement agencies in determining compliance with their State helmet laws and mitigate the fatalities, injuries, and societal costs that are caused by the use

[19] This observation is based on a sample of helmets NHTSA purchased in the past. We believe some novelty helmets continue to be labeled as "Not for Road Use" in an effort to disclaim legal responsibility to comply with FMVSS No. 218. Other novelty helmets contain no labeling.

of improper helmets. The deterrent intent of the proposed rule is similar to other enforcement improving approaches such as the improvement of counterfeit currency detection.

NHTSA believes that at least some portion of novelty helmet use results from inadequate or asymmetric information, a major indication of market failure. As previously discussed, reasons for novelty helmet use may vary, but likely include some misjudgment regarding the risk associated with motorcycles and false expectations regarding the protection that would be provided by some novelty helmet designs. In general, problems of inadequate information can be addressed by providing greater information to the public. However, inadequate rider information is not the primary target of this proposed regulation.

In addition to riders' misperceptions, novelty helmets can be lower cost, and some consumers find them to be more comfortable or stylish. When consumers choose to wear novelty helmets, these consumers unnecessarily reduce their safety and burden society with an unnecessary diversion of economic resources. Roughly three quarters of all economic costs from motor vehicle crashes are borne by society at large through taxes that support welfare payment mechanisms, insurance premiums, charities, and unnecessary travel delay. These costs may be even higher for motorcycle riders, who often experience more serious injuries when colliding with larger vehicles and without protection from vehicle structures or seat belts. NHTSA also believes that this regulation is warranted by a compelling public need, specifically, the need for States to properly enforce the laws that they have passed in order to promote public safety. This proposed rulemaking is designed to enable both the identification of novelty helmets and enforcement of these laws. These requirements do not force individuals who do not currently wear complying helmets to wear complying helmets. Rather, by making it easier for law

enforcement officials to enforce helmet laws, they make it more likely that riders will choose to purchase compliant helmets in order to avoid prosecution and fines.

NHTSA has worked with state law enforcement and safety officials for decades. The agency has repeatedly received reports from these sources regarding the difficulty of enforcing state helmet laws when the state law provides that a helmet must meet FMVSS No. 218. A series of court decisions[20] from Washington State illustrate the difficulties that local law enforcement agencies face in enforcing mandatory helmet laws. These decisions implied that FMVSS No. 218 is a complex performance standard intended to apply to helmet manufacturers and not to helmet users and did not address the difficulties of proof for law enforcement agency to show that a helmet does not meet FMVSS No. 218. The proposed rule is to remedy this by the adoption of objective physical criteria which can be employed by helmet users and law enforcement to determine if a helmet complies with FMVSS No. 218.

[20] State v. Maxwell, 74 Wash. App. 688, 878 P.2d 1220 (1994); City of Bremerton v. Spears, 134 Wash.2d 141, 949 P.2d 347 (1998).

CHAPTER II. AGENCY INTERPRETATION AND PROPOSED AMENDMENTS

The following chapter describes the Agency's interpretation that novelty helmets are motor vehicle equipment and further improvements to the motorcycle helmet standard, FMVSS No. 218 which seek to further increase the ability of law enforcement to identify novelty helmets.

A. Interpretation – Novelty Helmets are Motor Vehicle Equipment

Congress passed the National Traffic and Motor Vehicle Safety Act of 1966 (Safety Act) with the express purpose of reducing motor vehicle accidents, injuries, and property damage. To promote this end, the Safety Act provided for the establishment of motor vehicle safety standards for motor vehicles and equipment in interstate commerce. 15 U.S.C. §1381. The Safety Act empowers the Secretary of the Department of Transportation to establish and enforce mandatory motor vehicle safety standards and to issue rules and regulations for the design of vehicles and equipment covered by the Act. 15 U.S.C. §§1392(a) and 1407 codified as 49 U.S.C. § 30107 and 49 U.S.C. § 30111. The Secretary has delegated this authority to NHTSA. 49 CFR 1.95.

Protective equipment, such as motorcycle helmets, is motor vehicle equipment under the Safety Act. In pertinent part, motor vehicle equipment is defined in § 30102(a)(7)(C) of the Safety Act (as amended) as follows:

(7) "motor vehicle equipment" means--

(C) any device or an article or apparel (except medicine or eyeglasses prescribed by a licensed practitioner) that is not a system, part, or component of a motor vehicle and is manufactured, sold, delivered, offered, or intended to be used only to safeguard motor vehicles and highway users against risk of accident, injury, or death.

Complete analysis of the legislative history is detailed in the accompanying NPRM. Examination of the legislative history of this amendment makes it abundantly clear that Congress intended that NHTSA have the authority to set performance standards for helmets and, consequently, restrict the marketing and sale of such helmets to those meeting such standards. NHTSA concludes that novelty helmets are motor vehicle equipment under the definition found in § 30102(a)(7)(C) of the Safety Act.

In 2012, the MAP-21 Act modified this definition of "motor vehicle equipment" in two ways. First, the definition was amended by specifically adding the term "motorcycle helmet" to the description of regulated items. Second, the MAP-21 Act amended the definition of "motor vehicle equipment" by replacing the phrase " . . . manufactured, sold, delivered, offered or intended for use exclusively to safeguard motor vehicles, drivers, passengers, and other highway users. . ." with ". . . manufactured, sold, delivered, or offered to be sold for use on public streets, roads, and highways with the apparent purpose of safeguarding motor vehicles and highway users. . . ."

The agency's interpretation of this definition, based on an examination of the text of the 2012 MAP-21 amendment and the evolution of the original 1970 definition before its enactment as well as its legislative history, concludes that Congress meant to grant NHTSA authority to regulate motorcycle helmets and that any determination of what constitutes motor vehicle equipment must be governed by an objective standard and not controlled by the subjective intent of a manufacturer or seller. This conclusion is supported by the explicitly pronounced Congressional goal of reducing deaths and injuries resulting from the use of helmets that did not provide a minimum level of safety. The agency's interpretation further notes the absence of any suggestion in the legislative history that Congress meant to have the definition negated by

subjective declarations of intended use that are contrary to an objective measure of actual sale, use and "apparent purpose."

B. Proposed Amendments to FMVSS No. 218

1. Adding a Definition for Motorcycle Helmet

The agency is proposing to add a definition of "motorcycle helmet" to section S4 of FMVSS No. 218 to effectuate NHTSA's interpretation of the statutory definition of motor vehicle equipment and ensure that helmets being used on highways meet the minimum performance standards established for such helmets by FMVSS No. 218.

Neither the Safety Act nor NHTSA's regulations currently provide a precise definition of what constitutes a motorcycle helmet. FMVSS No. 218 currently states that regulated helmets are those helmets designed for highway use. Section S1 of FMVSS No. 218 states that the standard establishes minimum performance requirements for helmets designed for use by motorcyclists and other motor vehicle users. Section S3, stating what the standard applies to, sets forth that the standard applies to all helmets designed for use by motorcyclists and other motor vehicle users.

The term "motorcyclist" is not defined by the Safety Act. Under the term's ordinary meaning, a "motorcyclist" is an operator or passenger of a motorcycle.[21] As employed in FMVSS No. 218, a "motorcyclist" is a user of a "motor vehicle." As the term "motor vehicle" is restricted under the Safety Act to those vehicles "manufactured primarily for use on public streets, roads, and highways," the existing statutory and regulatory text defines motorcycle

[21] A motorcycle is a vehicle with motive power having a seat or saddle for the use of the operator and designed to travel on not more than three wheels in contact with the ground, 49 CFR 571.3. Any vehicle with three or fewer wheels manufactured for use on public streets, roads, and highways including motor scooters, mopeds, and 3-wheeled trikes, are therefore motorcycles.

helmets as helmets designed for use by operators of vehicles manufactured primarily for use on public highways. Manufacturers, sellers and, to a degree, buyers of novelty helmets are well aware of the implications of these terms. There is little question that novelty helmets are marketed and sold to "motorcyclists" – operators and passengers of motorcycles. However, by disingenuously designating these helmets as "not for highway use" manufacturers and sellers are circumventing their legal responsibilities.

The proposed definition would read:

Motorcycle helmet (1) Except as provided in paragraph (2), any hard shell headgear is a motorcycle helmet and an item of motor vehicle equipment if it is either—

(A) manufactured for sale, sold, offered for sale, introduced or delivered for introduction in interstate commerce, or imported into the United States, for use on public streets, roads, and highways with the apparent purpose of safeguarding highway users against risk of accident, injury, or death, or

(B) manufactured for sale, sold, offered for sale, introduced or delivered for introduction in interstate commerce, or imported into the United States by entities that also manufacture for sale, sell, offer for sale, introduce or deliver for introduction in interstate commerce, or import into the United States either motorcycles, helmets certified to FMVSS No. 218, or other motor vehicle equipment and apparel for motorcycles or motorcyclists, or

(C) described or depicted as a motorcycle helmet in packaging, display, promotional information or advertising, or

(D) imported into the United States under the applicable designation(s) for motorcycle helmets in the Harmonized Tariff Schedule of the United States.

(2) Paragraphs (1)(B), (1)(C) and (1)(D) do not apply to a helmet that is properly labeled and marked by its manufacturer as meeting a standard (other than a standard for motorcycle helmets) issued or adopted by the U.S. Consumer Product Safety Commission, ASTM International, National Operating Committee on Standards for Athletic Equipment, Snell Memorial Foundation, American National Standards Institute, The Hockey Equipment Certification Council, International Mountaineering and Climbing Federation, SFI Foundation, European Commission CE Marking (CE), or the Fédération Internationale de l'Automobile and such labeling and marking and the manner in which it is done are in accordance with that standard.

2. Proposed Amendments to Performance Requirements

The existing performance requirements of FMVSS No. 218 establish criteria requiring that compliance with the standard be evaluated through the use of laboratory tests that require specialized equipment and training not accessible to the public. Although these performance standards serve well to create a repeatable, reproducible standard to which helmet manufacturers produce compliant products, they are not effective in assisting with the enforcement of existing laws restricting the importation and use of novelty helmets. Many States[22] with helmet use laws have adopted a requirement that motorcyclists subject to the law must use a helmet that complies with FMVSS No. 218. Although such a requirement advances the laudable goal of ensuring that motorcyclists use helmets meeting minimum performance requirements, it creates an additional burden for State and local authorities who must enforce these helmet laws. In many jurisdictions, establishing a violation requires the State to prove either that a motorcyclist was

[22] A total of 19 States and the District of Columbia are required all motorcyclists to be helmeted, Effective April 12, 2012. Of these States, 17 exclusively require FMVSS No. 218-certified motorcycle helmets be worn and four refer to FMVSS No. 218.

not wearing any helmet or that the helmet worn by the motorcyclist did not meet the performance requirements incorporated in the State helmet law. Given the popularity of novelty helmets and the widespread availability of "DOT" stickers and other facsimiles of actual manufacturer certifications, successful enforcement of such a State helmet law requires proof that a particular helmet, even when marked with the symbol "DOT," does not meet FMVSS No. 218.

To assist State and local governments with the means to effectively enforce their helmet laws and prevent or reduce the entry of novelty helmets into the United States, NHTSA undertook an examination of the physical characteristics of helmets certified to FMVSS No. 218 and novelty helmets to determine if a set of simple criteria could be developed to differentiate between the two groups of helmets.

Accordingly, NHTSA proposes to amend FMVSS No. 218 to incorporate a series of simple tests that would evaluate the physical characteristics required to meet current standards of helmet performance. These tests would serve to establish whether further testing is needed to fully and fairly determine if a helmet meets the existing performance requirements of FMVSS No. 218. Helmets not meeting the proposed requirements would be deemed to be not in compliance with FMVSS No. 218. Helmets meeting the proposed requirements would be subject to further evaluation through laboratory tests to determine if they provide the required minimum levels of performance needed to adequately protect users. Any helmet with an inner liner that is less than 0.75 inch (19 mm) thick would be considered incapable of complying with FMVSS No. 218. Moreover, NHTSA proposes that any helmet with a liner meeting the minimum thickness criteria must also be sufficiently resistant to deformation to ensure that the liner is capable of some level of energy absorption. Finally, because the combined thickness of the liner and the shell together is also a reliable predictor of likely compliance with the

performance requirements of FMVSS No. 218, NHTSA also proposes that any helmet whose combined shell and inner liner thickness is less than 1 inch (25 mm) and whose liner meets the same resistance to deformation would also presumably not be able to comply with the standard.

The aforementioned criteria are of little use to customs inspectors or State and local law enforcement officials if tools and techniques for ascertaining helmet inner liner thickness and composition are not readily available or are only available at significant cost. Similarly, the procedures employed in examining helmets should not be complex. Accordingly, the proposed test could be performed on easily accessible areas of a helmet using simple tools and provides a guideline that could be adapted to reference cards carried by port inspectors or law enforcement personnel conducting traffic stops.

To reduce the possibility of error caused by variations in helmet designs, NHTSA is proposing that the measurements of inner liner thickness, combined helmet/inner liner thickness and inner liner resilience be conducted in a limited area at the crown or apex of the helmet. Helmets providing the minimum level of impact and penetration resistance required to meet FMVSS No. 218 must have a robust shell and liner in this area. In addition, the test area proposed in this notice is intended to be located, measured and marked using simple tools that are readily available at low cost. This is best achieved by focusing at the topmost area of the helmet. Finally, it is not NHTSA's intention to discourage manufacturers from designing helmets with ventilation channels. None of the helmets NHTSA examined as part of this study had ventilation holes that would interfere with the procedures proposed in this document.

NHTSA's intention is that thickness measurements are made along the shortest line that passes through the helmet to measure the thinnest cross section and avoid artificially inflating the thickness. Therefore, we propose that this measurement be made along a line that is at or near

perpendicular to a plane tangent to a point on the outer shell near the apex of the helmet. Interested parties may refer to the accompanying NPRM for further detail.

Note that NHTSA has previously attempted to compile a list of FMVSS No. compliant helmets and distribute the list. The agency found that it does not have sufficient resources to identify all of the certified helmets in the marketplace. Moreover, once such a list is established, it will be questioned as not being sufficiently inclusive, particularly if it does not identify helmets that do not comply with FMVSS No. 218. Testing every helmet in the marketplace would be difficult, if not impossible, and extremely expensive. As the NPRM makes clear, NHTSA does not have the resources to support such a test program. In addition, the list might need to be update constantly. Papers are easily destroyed and lost. Furthermore, it might cause confusion for the law enforcement if they carried different versions of the list. Using computer or electronic devices to access the list is considered more efficient than the paper forms. Equipping each law enforcement officer with such an electronic device will be too expensive compared to that of the proposal. Therefore, using a compliant helmet list is not considered.

CHAPTER III. BENEFITS

This chapter estimates the benefits of the proposed dimensional criteria as implemented in enforcing existing laws prohibiting importation and use of novelty helmets. The benefit of the proposed definition of motorcycle helmet is only realized in conjunction with implementation of the other actions in this proposed rule, and the benefits and costs of such will not be estimated independently in this analysis.

Monetized benefits including VSL and societal economic benefits are estimated based on the 2013 DOT new guidelines on VSL value and the treatment of VSL. VSL reflects the aggregation of individuals' willingness to pay for fatal risk reduction. Societal economic benefits which reflect the tangible costs of reducing fatalities and injuries include savings from medical care, emergency services, insurance administration, workplace costs, legal costs, property damage and travel delay, as well as lost productivity. After-tax market productivity is inherent to VSLs because it determines the individual's valuation of their potential material consumption. Household productivity is inherent to VSLs because it is a routine activity that is part of life experience. Both aspects are potentially threatened by behaviors that increase risk, and are thus inherently already reflected in the VSL. Therefore, the societal economic savings as categorized here and VSL savings are mutually exclusive portions of the total benefits. These benefits are required to be discounted at 3 and 7 percent to reflect their values in 2012 dollars. The process of deriving the discounted monetized benefits differs from what was used in the previously amendments that were based on the pre-2013 guidelines. Appendix B discusses the new guidelines and the discounting process. This chapter thus does not discuss the discounting process in detail.

The analysis utilizes the information introduced in the regulatory analysis for the FMVSS No. 218 Upgraded Helmet Labeling final rule. The information includes the real world safety problem, helmet use rates, laboratory helmet test data, and head injury probability curves. The real world safety problem is used to identify the safety population that would be impacted by the proposed rule. The helmet use rates, laboratory test data, and injury curves are used to estimate the fatality/injury reduction rates (See Docket No. NHTSA-2011-0050-0002.1).

Generally, the size of the benefit depends on three components: (1) fatality and injury population that would be affected by the proposed rule (target population), (2) the injury reduction rate from switching novelty helmets to minimally compliant 218-certified helmets, and (3) the rate of novelty helmet users who would switch to compliant helmets. The overall injury benefit of the proposed rule is equal to the product of these three components and can be expressed mathematically by this generic formula:

$$B = P * R * S$$

Where, B = Benefit of the rule,

P = Target population,

R = Injury reduction rate between minimally compliant 218-certified and novelty helmets, and

S = The assumed rate of novelty helmet users who switch to compliant helmets.

The following sections summarize the process of deriving the target population (P) and injury reduction rates (R). Both P and R are functions of head injury risk probabilities. A normalization process bridging the helmeted motorcyclists' and unhelmeted passenger vehicle

occupants' HIC_{15} (head injury criterion)[23] would impact the injury risk probabilities and thus would affect the outcomes of P and R. Consequently, for each scenario, two sets of benefits corresponding to the two normalization processes were generated.[24] The agency considers any estimates that fall between the two benefits as viable. Therefore, the analysis presents the benefits for each scenario as a range bounded by these two benefits.

As for the rate of novelty helmet users who would switch to 218-certified helmets (S), the analysis examines three scenarios similar to those developed for the FMVSS No. 218 Upgraded Helmet Labeling final rule since benefits of both regulations would largely depend on how many motorcycle riders will change from using a novelty helmet to a 218-certified helmet. The three scenarios are:

1) 5 percent of the novelty helmet users in Law States would make the switch (5-percent scenario),
2) 10 percent of the novelty helmet users in Law States would make the switch (10-percent scenario), and
3) All novelty helmet users in Law States would make the switch (100-percent scenario).

We do not have novelty-helmet use statistics specifically linked to motorcycle helmet enforcement. However, from the experience with safety belts, from 1998 to 2007, use rates in jurisdictions with stronger belt enforcement laws continued to exhibit higher use rates than those with weaker laws.[25] A 2006 NHTSA research note finds that belt use jumped 4.0 percentage

[23] HIC is a measure of the likelihood of a head injury arising from an impact. HIC_{15} is the impact measured over 15 milliseconds.

[24] The full derivation of the normalization process is in Chapter III of *FMVSS 218 Motorcycle Helmet Labeling* (Docket#: NHTSA-2011-0050).

[25] NHTSA, Analyzing the First Years Of the Ticket or Click It Mobilizations (2010), DOT HS 811 232

points from 2004 to 2005 in South Carolina after the state strengthened its belt law to a "primary" enforcement law from the secondary enforcement before the full effective of the primary law in December 2005.[26] This means that at least 12 percent of unbelted occupants had become belted due to the enforcement level. Furthermore, from several studies[27,28,29] examining the high-visibility enforcement programs for increasing safety belt use in 2004 and 2005, in 2004, belt use increased by an average of 2.4 percentage points across 50 States and the District of Columbia. In 2005, the improvement is 2.0 percent among the 22 primary law States and 1.2 percent among the 25 secondary law states. These percentages imply that at least 10 percent of unbelted occupants would wear safety belts in order to reach the overall 2.0 to 2.4 percent increase in belt use. The 2008 study by Hedlund, et al.[30] compared 16 states with high seat belt use rates and 15 states with low seat belt use rates. They concluded that the single most important difference between the two groups was the level of enforcement.

From these studies, we believe that an estimate that 5 to 10 percent of novelty-helmeted riders in Law States would make the switch is plausible. This represents 0.6% and 1.2% of riders in "helmet" states that would make the change. The proportion of motorcyclists nationally is even lower. The 100-percent scenario is considered a theoretical condition. This scenario is

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[26] NHTSA, Traffic Safety Fact, Research Note, Safety Belt Use in 2005 ─ Use Rates in the States and Territories (2006), DOT HS 809 970

[27] Solomon, M. G., Chaffe, R. H. B., & Cosgrove, L. A. (2007), May 2004 Click It or Ticket Seat Belt Mobilization Evaluation. DOT HS 810 716., National Highway Traffic Safety Administration

[28] Solomon, M. G., Chaudhary, N. K., & Cosgrove, L. A. (2004), May 2003 Click It or Ticket Seat Belt Mobilization Evaluation, DOT HS 809 694, National Highway Traffic Safety Administration

[29] Solomon, M. G., Gilbert, S. H., Nichols, J., Chaffe, R. H. B., Tison, J., & Chaudhary, N. K. (2007), Evaluation of the May 2005 Click It or Ticket Mobilization to Increase Seat Belt Use, DOT HS 810 778, National Highway Traffic Safety Administration

[30] Hedlund, J., Gilbert, S. H., Ledingham, K., & Preusser, D. F. (2008), How States Achieve High Belt Use Rates, DOT HS 810 962. Washington, DC: National Highway Traffic Safety Administration

presented to demonstrate the importance of using FMVSS No. 218-compliant helmets. Since it is more of a theoretical scenario, the estimated benefit and cost for this specific scenario are not used (and not appropriate) for determining the cost-effectiveness of the proposal. Examining these three scenarios, the agency believes that the analysis addresses the uncertainty surrounding the behavioral change among motorcyclists.

Limiting the estimated benefit to Law States is because the primary impact of the proposal is to assist law enforcement to identify novelty helmets and consequently motorcyclists would be more aware of the consequence of not wearing a 218-certified helmet. Without a helmet Law and enforcement, the impact of this proposal is expected to be insignificant. The benefit of the proposed rule does not account for any possible switch from No-Law States since the agency would like to take a relatively conservative approach to assess the benefits.

For the purpose of this analysis, it will be assumed that motorcyclists currently wearing novelty helmets that switch to 218-certified helmets, will switch to minimally compliant helmets. By measuring the impacts against the minimally compliant 218-certified helmets, the estimated benefits thus are considered to be conservative. A complete description of the differences in the fatality and injury risk reduction between novelty helmets, minimally compliant 218-certified helmets, and average 218-certified helmets is in the FMVSS No. 218 Upgraded Helmet Labeling final rule. Complete compliance test reports of 218-certified helmets are available online at www.nhtsa.gov/cars/problems/comply/index.cfm.

A. Target Population

Fatal Target Population

Based on the agency's compliance test results, the 218-certified helmets exhibited significantly higher performance than did the novelty helmets. Since head injuries were the leading cause of motorcycle fatalities and MAIS 4+ injuries, switching from novelty helmets to 218-certified helmets would thereby reduce motorcycle head fatalities and injuries.[31] The real-world crash data sources used to derive the baseline target population for benefit estimation are 2011 FARS and the 2002 - 2004 FARS linked Multiple Causes of Death (Linked MCoD). FARS is a census of fatalities that occurred in fatal crashes and was used to derive motorcyclist fatalities. However, these two data sources did not record the injured body regions to allow the analysis to directly discern head injuries from other body region injuries. Alternatively, the 2000-2004 Linked MCoD data were used to discern the size of fatalities that head injuries were cited as cause of death. The available methods for estimating the non-fatal injury population of motorcycle head injuries have been shown to be inconsistent and highly uncertain.[32] As such the benefits are considered to be conservative as they only consider the impact on fatalities.

Finally, because FARS and MCoD did not record helmet type (i.e., FMVSS No. compliant helmets vs novelty helmets), several non-crash data were also used to discern the proportion of head injuries that resulted from novelty helmets and derive the target population. These data included 2011 NOPUS on helmet use, the 2011 motorcycle registration data, and lognormal head injury risk curves.

[31] Based on data available from the Crash Outcome Data Evaluation System (CODES) from Maryland, Utah, and Wisconsin (2003 – 2005).

[32] See Chapter IV Section A-2 of Final Regulatory Evaluation FMVSS 218. Motorcycle Helmet Labeling (Docket NHTSA-2011-0050).

As stated earlier, the baseline target population for the benefit analysis is limited to fatal head injuries for motorcyclists wearing novelty helmets. It is not possible to retrieve the baseline target population directly from FARS due to its lack of helmet type and body region coding information. Therefore, deriving the baseline target population involves a series of steps:

(1) Estimate initial, helmeted fatal population,

(2) Estimate the proportion of the initial helmeted population where the primary cause of death involved the head,

(3) Estimate the portion of head injuries that occurred while wearing a novelty helmet, and

(4) Derive the baseline target population of the rule.

This series of steps can be expressed by a generic mathematical formula as follows:

$$P = I * P_H * P_N$$

Where P = Baseline target population of the rule

I = Initial helmeted population

P_H = Proportion of head injuries in the initial helmeted population (i.e., in I)

P_N = Proportion of helmeted head injuries wearing novelty helmets.

The following subsection describes this process and explains how each data source was used during the process. Note that P_N is a function of risk probability and would vary depending on the normalization approach that bridge the helmet testing performance and head injury criterion. Therefore, P_N has two outcomes as does the target population, P. The remaining two elements, I and P_H would not be affected by the normalization approach.

However, during the process, some adjustments need to be made in order to account for the impact of the FMVSS No. 218 Upgraded Helmet Labeling final rule. Since the Upgraded

Helmet Labeling final rule went into effect on May 13, 2013, there is not sufficient data for us to validate the true effects of the Upgraded Helmet Labeling rule. Therefore, this analysis uses the maximum plausible effects, i.e., the effects of the10-percent scenario, as estimated in the Upgraded Helmet Labeling final rule as the effects of that rule. These effects are excluded from the baseline target population of this proposed rule by decreasing novelty helmet use rate in Law States by 10 percent. The reduction would reduce the overall helmeted head injury population that were derived before the effective of the FMVSS No. 218 Upgraded Helmet Labeling final rule. It also would impact the portion of helmeted head injuries that belongs to novelty helmets. Therefore, the derived initial helmeted head population (i.e., $I * P_H$) and novelty helmets portion (i.e., P_N) will be further adjusted to accounting for the benefits of the Labeling final rule in this proposed rule. The following subsections discuss the process of deriving benefits and the appropriate adjustments.

A.1 Initial Helmeted Fatal Population (I)

The 2011 FARS was used to derive the initial fatal helmeted population. In 2011, there were 4,612 motorcyclist fatalities. Of these 4,612 fatalities, 1,791 wore a helmet in Law States during the crash. Table III-1 lists these motorcyclist fatalities by State and helmet use. Thus, the initial helmeted fatal population is equal to 1,791, i.e., $I = 1,791$. For some fatalities, their helmet use status was coded unknown. These fatalities were distributed proportionally across the known helmet use status.

Table III-1
Motorcyclist Fatalities by State and Helmet Use Status

State	Universal Law*	Helmeted		Unhelmeted		Total Numbers
		Number	Percent	Number	Percent	
Alabama	**Yes**	88	90%	10	10%	98
Alaska	No	9	90%	1	10%	10
Arizona	No	58	43%	78	57%	136
Arkansas	No	25	40%	39	60%	64
California	**Yes**	388	94%	26	6%	414
Colorado	No	28	36%	50	64%	78
Connecticut	No	11	29%	25	71%	36
Delaware	No	4	22%	15	78%	19
District of Columbia	**Yes**	2	50%	2	50%	4
Florida	No	201	43%	263	57%	464
Georgia	**Yes**	134	90%	15	10%	149
Hawaii	No	7	22%	25	78%	32
Idaho	No	8	47%	9	53%	17
Illinois	No	34	24%	111	76%	145
Indiana	No	20	17%	98	83%	118
Iowa	No	2	6%	34	94%	36
Kansas	No	13	29%	32	71%	45
Kentucky	No	29	41%	42	59%	71
Louisiana	**Yes**	65	81%	15	19%	80
Maine	No	4	27%	11	73%	15
Maryland	**Yes**	65	85%	11	15%	76
Massachusetts	**Yes**	32	88%	4	12%	36
Michigan	**Yes**	107	91%	11	9%	118
Minnesota	No	17	41%	25	59%	42
Mississippi	**Yes**	52	90%	6	10%	58
Missouri	**Yes**	72	88%	10	12%	82
Montana	No	9	47%	11	53%	20
Nebraska	**Yes**	21	91%	2	9%	23
Nevada	**Yes**	36	88%	5	12%	41
New Hampshire	No	2	14%	12	86%	14
New Jersey	**Yes**	85	91%	8	9%	93
New Mexico	No	6	13%	39	87%	45
New York	**Yes**	159	93%	11	7%	170
North Carolina	**Yes**	157	93%	11	7%	168

State	Universal Law*	Helmeted		Unhelmeted		Total Numbers
		Number	Percent	Number	Percent	
North Dakota	No	4	29%	10	71%	14
Ohio	No	45	27%	120	73%	165
Oklahoma	No	19	19%	79	81%	98
Oregon	**Yes**	36	90%	4	10%	40
Pennsylvania	No	102	51%	97	49%	199
Rhode Island	No	6	40%	9	60%	15
South Carolina	No	27	21%	102	79%	129
South Dakota	No	3	21%	11	79%	14
Tennessee	**Yes**	97	84%	18	16%	115
Texas	No	217	46%	254	54%	471
Utah	No	10	36%	18	64%	28
Vermont	**Yes**	7	88%	1	13%	8
Virginia	**Yes**	95	99%	1	1%	96
Washington	**Yes**	72	100%	0	0%	72
West Virginia	**Yes**	21	78%	6	22%	27
Wisconsin	No	9	10%	79	90%	88
Wyoming	No	3	19%	13	81%	16
Total		2,727	59%	1,885	41%	4,612
Law States		1,791	91%	177	9%	1,968

*As of March 2013
Note: fatalities with unknown helmet use status were distributed proportionally across the know helmet use.
Source: 2011 FARS

A.2 Fatal Head Injury Portion (P_H)

The second step of the target-population identifying process is to estimate the proportion of the initial helmeted fatal population who had deaths caused by a head injury (i.e., P_H). The head portion, P_H, was imputed from the statistics reported on an agency research note.[33] The research note reports injured body regions for motorcyclist fatalities based on the 2000 – 2002 Linked MCoD files.[34,35] The Linked MCoD files are the linked files between FARS and the

[33] Titled "Bodily Injury Locations in Fatality Injured Motorcycle Riders", October, 2007 by Rajesh Subramanian, National Center for Statistics and Analysis, NHTSA, DOT HS 810 856

[34] MCoD motorcycle fatal cases that were used for this assessment all had "motor vehicle traffic crashes" as the underlining cause of the death. MCoD also recorded up to 15 unique injury conditions (e.g., chronic organ

National Center for Health Statistics (NCHS) Multiple Cause of Death (MCoD) data. MCoD data included all recorded deaths in the U.S. according to death certificates. However, not every incident in FARS can be linked to the NCHS' MCoD due to lack of death certification data for some cases. Also, it should be noted that the "Cause of Death" is the coded injury location, and does not indicate the severity of those locations.[36] The assumption that the injury coded was the *cause* of death in this analysis may overstate the effectiveness of helmets in some cases. NCHS' MCoD files were generally released two years behind the release of FARS. Therefore, P_H was estimated instead of derived for the actual head fatalities.

The imputed percentage of head fatal injuries were adjusted from the injured body region distribution reported in the research note for those who had only one (Group 1) and those who had two coded causes of death (Group 2).[37] Together, these two Groups comprised 84 percent of helmeted motorcyclist fatalities, 63 percent Group 1 and 21 percent Group 2. When limiting the population to these two Groups (i.e., Group 1 + Group 2), 75 percent were Group 1 and 25 percent were Group 2.

Table III-2 shows the injured body region distribution for fatalities in Groups 1 and 2 and the imputed percent that was contributed to head injuries. The initial injured body region

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conditions, heart and liver issues, etc.) and their corresponding body location that coronary or medical examiners found significant. However, these coded injury conditions and body regions were not identified as "the direct or primary cause of death" nor they were indicative of severity. Therefore, the PRIA estimated the portion of fatal cases in which head injuries were most likely the primary cause of the death for individuals with injuries to multiple body regions.

[35] Also maintained by the National Center for Statistics and Analysis within the agency.

[36]Based on the MCoD information, the underlying cause of death for motorcycle crashes is "motor vehicle traffic crashes". Generally, it would not be the "norm" for medical examiners (ME) to include all the significant body injuries. Typically, the ME is looking for a single cause. If there are multiple diagnoses made and there were multiple severe injuries, we might see that "multiple blunt traumas", for example, was coded. "Multiple blunt trauma" is a common cause of death. If the autopsy is available and an internal examination was performed, it is often easy to determine the primary injury.

[37] A maximum 10 causes of deaths can be coded for each fatality in the MCoD files.

distributions shown in the table were adopted from the research note. Numbers under the column "% Contributed to Head" represent the imputed percentages. Imputation by category for multiple and unspecified injured body regions was based on the proportion of head injuries to other known body region injuries. For example, for the category "Multiple Location and Unspecified," head injuries comprised about 61 percent (= 19/[19 + 3 + 6 + 3]) of known specified injury body regions. Therefore, 61 percent of the injuries under this category (which accounted for 69% of all Group 1 cases) would be attributed to head injuries. This translated to an imputed percentage of 42 percent (= 61% * 69%) that would be head injuries.

For Group 2, for each of the two-injured body region categories (e.g., head + neck), the portion attributed to head injuries was based on the relative size of initial head injuries to the other injured body regions (i.e., head, neck, thorax, abdomen, and other areas) reported in Group 1. For example, 13 percent of Group 2 had head and neck as causes of death. Among these injuries, 86 percent (= 19 / [19 + 3]) would be attributed to head injuries. The 86 percent is the head portion within head (19 percent) and neck (3 percent) injuries reported in Group 1. As a result, 11 percent of "Head and Neck" (= 86 * 13) was attributed to head injuries.

Overall, about 60 percent of all helmeted motorcyclist fatalities would be caused by head injuries, i.e., $P_H = 0.60$. The 60 percent is the weighted head injury portion based on the relative size of these two Groups with Group 1 weighted by 75 percent and Group 2 by 25 percent. Applying the 60 percent to the initial helmeted motorcyclist fatalities of 1,791 derives the total number of 1,075 helmeted head fatalities (= $I * P_H = 1,791 * 0.6$).

Table III-2
Percent of Body Injury Distributions for Helmeted Fatalities
Having At Most Two Coded Injury Locations

Only One Recorded Injury Location (75 percent of Total)

Contributing Injury Location	Initial Percent	% Contributed to Head
Head	19%	19%
Neck	3%	0%
Thorax	6%	0%
Abdomen	3%	0%
Multiple Location and Unspecified	69%	42%
Total	100%	61%

Two Recorded Injury Locations (25 percent of Total)

Contributing Injury Location	Initial Percent	% Contributed to Head
Head + Head	20%	20%
Head + Neck	13%	11%
Head + Thorax	15%	11%
Head + Abdomen	5%	4%
Head + Multiple Location and Unspecified	7%	4%
Multiple Location + Unspecified	10%	6%
Other + Other	30%	0%
Total	100%	56%

A.3 Novelty Helmet Portion (P_N) With Head Fatal Injuries

The third step is to determine the proportion of the helmeted head injuries who were wearing novelty helmets, i.e., P_N. As described in the final regulatory analysis for the FMVSS No. 218 Upgraded Helmet Labeling final rule, the proportion is a function of the novelty helmet usage rate and the relative head injury risk of novelty helmet users to that of 218-certified helmet users. The risk probabilities of head injury varied depending on the normalization approaches. Thus, P_N has two outcomes.

As described earlier, this analysis uses a baseline that would account for the impact of 10-percent scenario from the FMVSS No. 218 Upgraded Helmet Labeling final rule. A 10-percent of novelty helmet users in Law States switched to a minimally 218-certified helmet would reduce

the initial helmeted head injury baseline that was derived from the 2011 FARS. In addition, the proportion of helmeted head injuries from the novelty helmets would also decrease.

Two sets of P_N were derived. The first set of P_N is the novelty-helmeted proportion in the current helmeted head injuries. This set of P_N is used to estimate the benefit of the Labeling final rule. This benefit then is excluded from the initial head injury baseline to derive the expected helmeted head injuries. The second set of P_N is the projected novelty-helmeted proportion in the expected head injuries. This set of P_N is used to derive the target population of the proposed rule for benefit analysis. The 2010 NOPUS on motorcycle helmet usage in Law States combined with the risk probability of head injuries were used to estimate the first set of P_N. A revised helmet usage from NOPUS would be used to derive the second set of P_N. NOPUS is a probability-based observational survey of motorcycle helmet use in the U.S.[38] The survey observes helmet usage at a random selection of roadway sites between 8 a.m. and 6 p.m. starting in 2002. The observers categorized DOT-compliant helmets as helmets that cover the motorcyclists' ears, helmets with full facial coverage, and helmets appearing to be at least 1-inch thick. Please refer Table I-4 for NOPUS survey results on motorcycle helmet use from 2002 to 2011. Note that NOPUS did not survey motorcycle helmet use in 2003.

The 2011 NOPUS helmet usage rates were chosen for the analysis as this is the most current data available. As shown in Table I-4, in 2011, about 96 percent (= 84 + 12) of motorcyclists wore a helmet in Law States. Of the helmeted users, 88 percent (= 84 / 96) wore a 218-certified helmet and 12 percent (= 100 – 88 percent) wore a novelty helmet. The 88 and 12 percent were used as the weights to adjust the relative risk between 218-certified and novelty helmets for deriving the expected head injury population. Adjusting for the assumed 10 percent

[38] NOPUS are conducted by Westat, Inc. under the direction of the National Center for Statistics and Analysis in NHTSA under Federal contract number DTNH22-00-D-07001. NOPUS also observes child restraints, seat belt, and driver cell phone use.

switch to 218-certified helmets from the previous rulemaking, the novelty helmet use rate in Law States would be 11 percent = (12 – 12 * 0.1) and the 218-certified helmet use rate would be 89 percent. The 89 and 11 percent were used for calculating the projected P_N.

The estimation of risk of head fatal injuries at any given head injury criterion (HIC) value (i.e., HIC_{15}) and the process of translating peak acceleration (peak g) into its normalized HIC_{15} are described in the final regulatory evaluation of FMVSS No. 218, Upgraded Helmet Labeling (see NHTSA-2011-0050-0002.1, Chapter III). The HIC value includes the effects of head acceleration and the duration of the acceleration noted by the index (e.g., HIC_{15}, HIC_{36}, etc.) in a crash. The HIC_{15} that was used in the Labeling final rule and this proposal represents a short duration impact and thus is consider appropriate to be used to assess the motorcycle helmet performance in a crash. Two normalization approaches were established in that final rule. One is the 218-based normalization approach and the other one is the EU-based approach. These two approaches differ in how the peak g values were translated into HIC_{15}. The lognormal head injury probability curves (or Hertz curves) were developed by the agency in 1993 to determine the probability of various MAIS severity head injuries based on HIC_{36}.[39] These curves were derived using logistic regression on real-world crash data and assumed that the head injury threshold levels were a lognormal distribution. An extended version of these curves based on HIC_{15} was later used in the regulatory analysis for the FMVSS No. 208, Advanced Air Bags rule in 2000[40,41,42]. These extended Hertz HIC_{15} curves were used here for estimating the risk of head injuries at specific HIC_{15} value. The formulas for these extended curves are:

[39] Hertz E. (1993) A Note on the Head Injury Criteria (HIC) as a Predictor of the Risk of Skull Fracture, 37th Annual Proceedings of the Association for the Advancement of Automotive Medicine.

[40] NHTSA, Final Economic Assessment, FMVSS No. 208 Advanced Air Bag (2000), NHTSA Docket No. NHTSA-2000-7013-2.

$$\text{AIS}1+\text{Injury}=\Phi\left(\frac{\ln(1.42857*\text{HIC}_{15})-5.35669}{1.00948}\right)$$

$$\text{AIS}\,2+\text{Injury}=\Phi\left(\frac{\ln(1.42857*\text{HIC}_{15})-6.96362}{0.84687}\right)$$

$$\text{AIS}\,3+\text{Injury}=\Phi\left(\frac{\ln(1.42857*\text{HIC}_{15})-7.45231}{0.73998}\right)$$

$$\text{AIS}\,4+\text{Injury}=\Phi\left(\frac{\ln(1.42857*\text{HIC}_{15})-7.65605}{0.60680}\right)$$

$$\text{AIS}\,5+\text{Injury}=\Phi\left(\frac{\ln(1.42857*\text{HIC}_{15})-7.69637}{0.58750}\right)$$

$$\text{Fatality}=\Phi\left(\frac{\ln(1.42857*\text{HIC}_{15})-7.73243}{0.55431}\right)$$

Where Φ = cumulative normal distribution.

Under the 218-based normalization approach, the average peak acceleration for novelty helmets is 937g which equates to 1,897 HIC_{15}. At this HIC_{15} level, the probability of having fatal head injuries for an average novelty helmet user is 62.20 percent. The maximum allowable peak acceleration for minimally compliant 218-certified helmets is 400g which equates to 700 HIC_{15}. Therefore, the probability of having fatal head injuries for a minimally compliant 218-certified helmet user is 6.84 percent. The relative risk of novelty helmets and minimally compliant 218-certified helmets is 9.1 to 1 (62.2/6.84). In other words, a novelty helmet user was 9.1 times more likely to die from a head injury than a minimally compliant 218-certified helmet user. When factored in with the exposure data (i.e., helmet usage), the weighted relative risk of a novelty helmet to a minimally compliant 218-certified helmet became 0.0746 to 0.0602,

[41] Eppinger et al., (1999) Development of Improved Injury Criteria for the Assessment of Advanced Automotive Restraint Systems II, NHTSA Docket No. NHTSA-1999-6407-5.

[42] Eppinger et al. (2000) Supplement: Development of Improved Injury Criteria for the Assessment of Advanced Automotive Restraint Systems II, NHTSA Docket No. NHTSA-2000-7013-3.

where 0.0746 = 0.6220 * 0.12 and 0.0602 = 0.0684 * 0.88. Therefore, in Law States, 55 percent (= 0.0746 / [0.0746 + 0.0602]) of helmeted motorcyclists that experienced a head injury as a result of a crash were using novelty helmets. In this case, $P_N = 0.55$.

Using the EU-based normalization approach, the average peak acceleration of novelty helmets is 937g which equates to 2,920 HIC_{15}. At this HIC_{15} level, the probability of having fatal head injuries for an average novelty helmet user is 86.19 percent. The maximum peak acceleration for minimally compliant 218-certified helmets is 400g which equates to 1,077 HIC_{15}. Therefore, the probability of having fatal head injuries for a minimally compliant 218-certified helmet user is 23.87 percent. The relative risk of novelty helmets and minimally compliant 218-certified helmets is 3.6 to 1 (86.19/23.87). In other words, a novelty helmet user was 3.6 times more likely to die from a head injury than a minimally compliant 218-certified helmet user. When factored in with the exposure data (i.e., helmet usage), the relative weighted risk of a novelty helmet to a minimally compliant 218-certified helmet became 0.1034 to 0.2101, where 0.1034 = 0.8619 * 0.12 and 0.2101 = 0.2387 * 0.88. Therefore, 33 percent (= 0.1034 / [0.1034 + 0.2101]) of helmeted head injuries in Law States used novelty helmets, i.e., $P_N = 0.33$.

Similarly, repeating the above processes using the revised helmet use rates of 11 and 89 percent derives the projected P_N. The weighted relative risk of a novelty helmet to a minimally compliant 218-certified helmet using the 218-based normalization process became 0.0684 to 0.0609, where 0.0684 = 0.6220 * 0.11 and 0.0609 = 0.0684 * 0.89. Therefore, in Law States, 53 percent (= 0.0684 / [0.0684 + 0.0609]) of helmeted motorcyclists that experienced a head injury as a result of a crash were using novelty helmets after the effectiveness of the FMVSS No. 218, Upgraded Helmet Labeling final rule. The projected P_N is 0.53. Using the EU-normalization process, the weighted relative risk of a novelty helmet to a minimally compliant 218-certified

helmet became 0.0948 to 0.2124, where 0.10948 = 0.8619 * 0.11 and 0.2124 = 0.2387 * 0.89. The projected P_N is 0.31.

A.4 Target Fatal Population (P)

The total target fatal population is the multiplication of the expected helmeted head injuries and the projected novelty helmet proportion. The expected helmeted head target population is the initial helmeted head population minus the benefit of the FMVSS No. 218 Upgraded Helmet Labeling final rule. Thus, the target fatal population for the benefit calculation for this proposal can be noted as:

P = expected helmeted head target population * projected novelty helmeted portion

$= (I * P_H - I * P_H * P_{N0} * 0.1 * R) * P_{N1}$

$= I * P_H * (1 - P_{N0} * 0.1 * R) * P_{N1}$

Where, P = Target population of the proposal

I = Initial target helmeted injuries

P_H = Head injury portion in helmeted injuries

P_{N0} = Initial novelty helmet portion

P_{N1}= Projected novelty helmet portion

R = Risk reduction rate

0.1 = 10-percent scenario (i.e., 10 percent of novelty helmet users had switched to a 218-certified helmet).

The FMVSS No. 218 Upgraded Helmet Labeling final rule would save 26-53 lives[43] using the 2011 data. The target population for this proposal is:

218-Based Normalization Approach

$$P = I * P_H * (1- P_{N0} * 0.1 *R) * P_{N1}$$

$$= 1,791 * 0.60 *(1 – 0.60 * 0.1 * 0.890) * 0.53$$

$$= 541.$$

EU-Based Normalization Approach

$$P = I * P_H * (1- P_{N0} * 0.1 *R) * P_{N1}$$

$$= 1,791 * 0.60 *(1 – 0.60 * 0.1 * 0.723) * 0.33$$

$$= 325$$

Note that the detail discussion on reduction rates is presented in the next section "B. Fatality Risk Reduction Rates". The derived fatal risk reduction rate of 0.890 for 218-Based Normalization approach and 0.723 for the EU-based Normalization approach from that section are used to calculate the above target population.

B. Fatality Risk Reduction Rates

Risk reduction rate measures the percent of head injuries that would be reduced if motorcyclists switched from wearing an average novelty helmet to a 218-certified helmet that met the minimum requirements specified in the FMVSS No. 218 (i.e., minimally compliant 218-certified helmets). Due to helmet type collection and coding in the real-word crash databases

[43] In 2009, there were 1,574 helmeted fatalities in Law States. A 10-percent switch from novelty helmet use to compliant helmet use, 61 (= 1,574 * 0.6 * 0.72 * 0.1 * 0.890) would be saved based on the 218-normalization approach, and 35 (= 1,574 * 0.6 * 0.51 * 0.1 * 0.723 based on the EU-normalization approach.

and the lack of comparable exposure data, a direct comparison of the safety effectiveness (or injury reduction effects) between FMVSS No. 218-certified and novelty helmets currently is not feasible. Therefore, helmet laboratory test results and associated HIC-based head injury probabilities were used to estimate the injury reduction rates.

Based on the impact attenuation tests, novelty helmets had an average peak acceleration of 937g. The risk probability of head injuries at this level is compared to a peak acceleration of 400g because that is the maximum allowed by FMVSS No. 218 for a helmet to be certified. However, most 218-certified helmets tested by the agency exceed this minimum requirement, and on average, have a peak acceleration of 128g which is significantly lower than the maximum allowable peak acceleration of 400g. Thus, the estimated reduction rates using the risk probability at 400g as the baseline are considered to be conservative.

As previously stated, the lognormal HIC_{15} head injury curves and the process of translating peak g to HIC_{15} from the final regulatory evaluation for FMVSS No. 218 Motorcycle Helmet Labeling, (issued on May 26, 2011; Docket No. NHTSA-2011-0050-0002.1) were used to derive the probabilities of head injuries. Essentially, before using the HIC_{15} injury probability curves, peak acceleration was first translated into HIC_{15} which was then normalized by a factor of 0.190 and 0.292 for the 218- and EU-based normalization approaches, respectively. After estimating the injury risk probability, the reduction rate (R) was calculated as:

$$R = \frac{p_N - p_D}{p_N}$$

Where, R = Risk reduction rate

p_N = Probability of risk of head injury for wearing an average novelty helmet

p_D = Probability of risk of head injury for wearing a minimally compliant 218-certified helmet.

Table III-3 shows the average probabilities of having fatal and MAIS 4+ head injuries for motorcyclists wearing a minimally compliant 218-certified helmet and a novelty helmet. The last row of the table presents the derived head injury reduction rates. As shown, under the EU-based approach, if a minimally compliant 218-certified helmet had been used instead of a novelty helmet, the chance of a motorcyclist having fatal head injuries would be reduced by 72.3 percent. The chance of having MAIS 5+, MAIS 4+, MAIS 3+, and MAIS 2+ head injuries would be reduced by 68.5, 65.4, 50.3, and 29.2 percent, respectively, using the EU-based approach, if motorcyclists wearing novelty helmets, had instead worn a minimally compliant 218-certified helmet.

Note that the fatality reduction rate of 72.3 percent in the EU-based approach and of 89 percent in the 218-based approach is higher than the overall helmet effectiveness of 37 (See Table III-3 under 'Fatalities'). This is because the risk reduction rates estimated in Table III-4 are for "head" fatalities. The 37 percent is estimated for "all" fatalities including deaths due to other body region injuries and it was derived from a helmeted population that includes novelty helmet users as well as users of 218-certified helmets. The risk reduction rates also indicate that minimally compliant 218-certified helmets would reduce high severity head injuries to lower severity head injuries, but they would not completely eliminate these head injuries. For example, the risk reduction rate for MAIS 1+ head injuries is 2.3 percent which is relatively small compared to the 29.2 percent for MAIS 2+ injuries.

Table III-3
Head Injury Probability and Risk Reduction Rates

218-Based Normalization Approach

Risk Probability	Fatalities	MAIS 5+	MAIS 4+	MAIS 3+	MAIS 2+	MAIS 1+
Minimally Compliant 218-certified (p_D)	0.0684	0.0897	0.1088	0.2309	0.4737	0.9378
Novelty (p_N)	0.6220	0.6386	0.6590	0.7295	0.8668	0.9942
Risk Reduction Rate (%)	89.0	86.0	83.5	68.4	45.4	5.7

EU-Based Normalization Approach

Risk Probability	Fatalities	MAIS 5+	MAIS 4+	MAIS 3+	MAIS 2+	MAIS 1+
Minimally Compliant 218-certified (p_D)	0.2387	0.2713	0.3004	0.4389	0.6710	0.9752
Novelty (p_N)	0.8619	0.8619	0.8688	0.8838	0.9474	0.9984
Risk Reduction Rate (%)	72.3	68.5	65.4	50.3	29.2	2.3

C. Benefits of the Proposed Rule

Benefits were derived by multiplying the target population, its corresponding risk reduction rate, and the behavioral change among helmet users in the various scenarios. The estimated injury benefits (i.e., lives saved) are then transformed to economic values. Safety benefits can occur at any time during the in-use lifetime of a motorcycle helmet and are required to be discounted to reflect their values in 2012 dollars. Discounting is achieved by applying an appropriate discount factor to the undiscounted benefit. Appendix B details a process of deriving the discount factors for injury benefits and monetized benefits.

C.1 Injury Benefits

218-Based Normalization Approach

The maximum potential benefits of the proposed rule are estimated by applying the risk reduction rate (89.0%) to the number of estimated target fatalities in Law States. The proposed

rule would potentially save 481 lives if 100 percent of the novelty helmet users in Law State switched to 218-certified helmets. Under the 10-percent scenario, the proposed changes to FMVSS No. 218 would yield an estimated benefit of 48 lives saved (= 541 * 89% * 10%). Under the 5-percent scenario, the estimated benefits are 24 lives saved (= 541 * 89% * 5%).

EU-Based Normalization Approach

The maximum potential benefits of the proposed rule are estimated by applying the risk reduction rate (72.3%) to the number of estimated fatalities in Law States. The rule would potentially save 235 lives if 100-percent of the novelty helmet users in Law State switched to 218-certified helmets. Under the 10-percent scenario, for the proposed enforcement policy, the estimated benefits are 24 lives saved (= 325 * 72.3% * 10%). Under the 5-percent scenario, the estimated benefits are 12 lives saved (= 325 * 72.3% * 5%).

Overall, undiscounted, the rule would potentially save a maximum of 235 to 481 lives under the 100-percent scenario, 24 to 48 lives saved under the 10-percent scenario, and 12 to 24 lives saved under the 5-percent scenario.

C.2 Discount Factors

Safety benefits can occur at any time during the in-use lifetime of a motorcycle helmet and are required to be discounted to reflect their values in 2012 dollars. The discounting procedures for future benefits and costs in regulatory analyses are based on the guidelines published in OMB Circular A-4 and OMB Circular A-94 Revised. In support of the regulatory analysis, the guidelines state, "An attempt should be made to quantify all potential real incremental benefits to society in monetary terms to the maximum extent possible."

There is general agreement within the economic community that the appropriate basis for determining discount rates is the marginal opportunity costs of lost or displaced funds. When these funds involve capital investment, the marginal, real rate of return on capital must be considered. However, when these funds represent lost consumption, the appropriate measure is the rate at which society is willing to trade-off future for current consumption. This is referred to as the "social rate of time preference," and it is generally assumed that the consumption rate of interest, i.e., the real, after-tax rate of return on widely available savings instruments or investment opportunities, is the appropriate measure of its value.

Estimates of the social rate of time preference have been made by a number of authors. Robert Lind[44] estimated that the social rate of time preference is between zero and six percent, reflecting the rates of return on Treasury bills and stock market portfolios. Kolb and Sheraga[45] put the rate at between one and five percent, based on returns to stocks and three-month Treasury bills. Moore and Viscusi[46] calculated a two percent real time rate of time preference for health, which they characterize as being consistent with financial market rates for the period covered by their study. Moore and Viscusi's estimate was derived by estimating the implicit discount rate for deferred health benefits exhibited by workers in their choice of job risk. OMB Circular A-4 recommends agencies use a 3 percent discount rate as the “social rate of time preference” and 7 percent as the return to capital investment.

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[44] Lind, R.C., "A Primer on the Major Issues Relating to the Discount Rate for Evaluating National Energy Options," in Discounting for Time and Risks in Energy Policy, 1982, (Washington, D.C., Resources for the Future, Inc.).

[45] J. Kolb and J.D. Sheraga, "A Suggested Approach for Discounting the Benefits and Costs of Environmental Regulations”, unpublished working papers.

[46] Moore, M.J. and Viscusi, W.K., "Discounting Environmental Health Risks: New Evidence and Policy Implications," Journal of Environmental Economics and Management, V. 18, No. 2, March 1990, part 2 of 2.

Effective in February 2013 the Office of the Secretary for the U.S. DOT issued revised guidance on the treatment of VSL in regulatory analyses. The new guidance establishes a VSL of $9.1 million for analyses based on 2012 economics, $8.98 for analyses based on 2011 economics, and $8.86 million for analyses based on 2010 economics. The guidance further requires that the VSL be adjusted to reflect real increases in VSL that are likely to occur in the future as consumers become economically better off, in real terms, over time. The basis for this adjustment is projected real earnings increases from the Congressional Budget Office. These projected earnings indicate an annual average real increase of 1.07 percent (=0.0107). In other words, the real VSL grows at a rate of 1.07 percent annually, which means the previous year's VSL should be increased by a factor of 1.0107 (= 1 + 0.0107) annually. To implement the new guidelines, two separate sets of discount factors were derived. One set is for discounting injury (i.e., lives saved and injuries reduced) and societal economic benefits and the other set is for discounting VSL.

The agency used the following assumptions and guidance to derive the discount factors under 3 and 7 percent discount rates for motorcycle helmets:

1) The in-use lifespan of a 218-certified motorcycle helmet is 10 years. Any new model-year of 218-certified helmets can survive the first five years. Afterwards, the chance of survivability would decrease by 20 percent each year until it reached less than 0.1 percent at year 10.
2) The purchase of new 218-certified motorcycle helmets would not alter motorcyclists' traveling patterns. In other words, the annual motorcycle miles traveled (VMT) is independent of the age of the helmets. Moreover, data on motorcycle helmet VMT by motorcycle helmet age are not available. VMT therefore was set to be a constant 1 over the helmet in-use life.

3) The distribution of weighted annual motorcycle VMT (i.e., weighted by survivability) is a proxy measure for the distribution of motorcycle crashes over the motorcycle helmet's lifetime. This measure takes into account both helmet survival rates and changes over time in annual average exposure to VMT.
4) VSL value will increase by a factor of 1.0107 annually (the 1.0107 factor)
5) The 2012 VSL value is $9.1 million based on the 2013 guidelines.

Multiplying the percent of a helmet's total lifetime vehicle mileage that occurs in each year by the discount factor and summing these percentages over the years of the helmet's life, results in a factor of 0.9000 under a 3 percent discounted rate and 0.7906 under a 7 percent discounted rate. Multiplying the weighted factor for injury benefits by the corresponding 1.0107 factor increase per year derives the discount factor for VSL. The discount factor for VSL is 0.9295 and 0.8148 for the 3 percent and 7 percent discount rates, respectively. The present value of the injury benefits at the 3 percent discounted rate, for example, is equivalent to 0.9000 of the initial estimates. The present VSL value is 0.9295 of the initial estimated value. Costs incurred in the present, such as those for the preliminary screening tool kits, are not discounted. The process of deriving these discount factors is detailed in Appendix B and thus is not repeated here. Table III-4 shows these discounting factors.

Table III-4
Discounting Factors at 3 and 7 Percent Discount Rates

Motorcycle Helmet Age	For Injury Benefits		For VSL	
	3%	7%	3%	7%
1	0.1408	0.1381	0.1408	0.1381
2	0.1367	0.1291	0.1382	0.1305
3	0.1327	0.1207	0.1356	0.1233
4	0.1289	0.1128	0.1331	0.1165
5	0.1251	0.1054	0.1305	0.1100
6	0.0972	0.0788	0.1025	0.0831
7	0.0707	0.0552	0.0754	0.0588
8	0.0457	0.0344	0.0492	0.0371
9	0.0222	0.0161	0.0242	0.0175
10	0.0000	0.0000	0.0000	0.0000
Total	**0.9000**	**0.7906**	**0.9295**	**0.8149**

VSL: value of statistical live

C.3 Discounted Benefits

The section presents the discounted injury benefits, VSL, and societal economic benefits. The discounted injury benefit is the product of undiscounted injury benefits and the appropriate discount factor. The discounted VSL benefits would be the multiplication of the undiscounted injury benefit, the starting VSL value, and the VSL discount factor. For the societal economic benefits, the discounted benefit would be the product of the undiscounted injury benefit, the combined unit costs, and the injury benefit discount factor. The following uses the 5-percent scenario at a 3 percent discount rate as an example to demonstrate the calculation of the discounted benefits of the proposed rule. Table III-5 presents the discounted benefits for the proposed rule.

Example: 5-Percent Scenario at a 3 Percent Discount Rate

The discounted injury benefit is the product of undiscounted injury benefit and injury benefit discount factor. Therefore, the proposed rule would save 11 - 22 lives at a 3 percent discount rate, where

11 = 12 * 0.9000,

22 = 24 * 0.9000.

For the 7 percent discount rate, simply replace the discount factor 0.9000 above by 0.7906.

For VSL benefits, the 2016 model year is used in this analysis as the stating year to calculate the VSL benefits. The 2016 VSL value in 2012 dollars is $9.50 million [=$9.1 * $(1.0107)^4$]. Therefore, the estimated VSL benefit would range from $106.0 million to $211.9 million where

$106.0 million = 12 * $9.5 million * 0.9295,

$211.9 million = 24 * $9.5 million * 0.9295.

For VSL at a 7 percent discount rate, simply replace the discount factor 0.9285 by 0.8149 in the above calculation.

For the societal economic benefits, the undiscounted benefit would be the product of the undiscounted injury benefit, the combined unit costs, and the injury benefit discount factor. The combined unit cost for a fatality is $335,770 which is the sum of the medical care, emergency services, insurance administration, workplace costs, and legal costs as shown in Appendix B. The discount factors for discounting societal economic benefits are the same as those that are used for discounting the injury benefits. Therefore, for the 5-percent scenario, at a 3 percent

discount rate, the societal economic benefits would range from $3.7 million to $7.4 million, where

$3.7 million = 12 * $335,770 * 0.9000,

$7.4 million = 24 * $335,770 * 0.9000.

Combining the VSL and societal economic savings derives the total benefits of the proposed rule. The total benefit of the proposed thus would range from $109.7 million to $219.3 million for this given example.

In summary, at a 3 percent discount rate, the estimated benefits of the proposed rule would be:

- 5-percent scenario
  - $109.7 million to $219.3 million total benefit
    - $3.7 million to $7.4 million societal economic savings
    - $106.0 million to $211.9 million VSL
  - 11 – 22 lives saved
- 10-percent scenario
  - $219.3 million to $438.3 million total benefit
    - $7.4 million to $14.4 million societal economic savings
    - $211.9 million to $423.9 million VSL
  - 22 – 43 lives saved
- 100-percent scenario
  - $2,146.3 million to $4,392.7 million total benefit
    - $71.2 million to $145.4 million societal economic savings

    - $2,075.1 million to $4,247.4 million VSL
- 212 – 433 lives saved.

At a 7 percent discount rate, the estimated benefits of the proposed rule would be:

- 5-percent scenario
    - $95.9 million to $192.2 million total benefit
        - $3.0 million to $6.4 million societal economic savings
        - $92.9 million to $185.8 million VSL
    - 9 – 19 lives saved
- 10-percent scenario
    - $192.2 million to $384.4 million total benefit
        - $6.4 million to $12.8 million societal economic savings
        - $185.8 million to $371.6 million VSL
    - 19 – 38 lives saved
- 100-percent scenario
    - $1,881.7 million to $3,851.3 million
        - $62.5 million to $127.6 million societal economic savings
        - $1,819.3 million to $3,723.7 million VSL
    - 186 – 380 lives saved.

Table III-5
Discounted Societal Economic and VSL Benefits
(2012 dollars)

5-percent Scenario

	3% Discount Rate		7% Discount Rate	
	Low Benefits	High Benefits	Low Benefits	High Benefits
Fatal Equivalents	11	22	9	19
Societal Economic Benefit	$3,693,470	$7,386,940	$3,021,930	$6,379,630
VSL Benefit	$105,963,000	$211,926,000	$92,898,600	$185,797,200
Total Benefits*	$109,656,470	$219,312,940	$95,920,530	$192,176,830

10-percent Scenario

	3% Discount Rate		7% Discount Rate	
	Low Benefits	High Benefits	Low Benefits	High Benefits
Fatal Equivalents	22	43	19	38
Societal Economic Benefit	$7,386,940	$14,438,110	$6,379,630	$12,759,260
VSL Benefit	$211,926,000	$423,852,000	$185,797,200	$371,594,400
Total Benefits*	$219,312,940	$438,290,110	$192,176,830	$384,353,660

100-percent Scenario

	3% Discount Rate		7% Discount Rate	
	Low Benefits	High Benefits	Low Benefits	High Benefits
Fatal Equivalents	212	433	186	380
Societal Economic Benefit	$71,183,240	$145,388,410	$62,453,220	$127,592,600
VSL Benefit	$2,075,108,750	$4,247,350,250	$1,819,264,250	$3,723,685,550
Total Benefits*	$2,146,291,990	$4,392,738,660	$1,881,717,470	$3,851,278,150

*= Societal Economic Benefit + VSL (Value of Statistical Life) Benefit
Note: The combined unit cost for a fatality is $335,770; The 2016 VSL value is $9.5 million

D. Non-Quantified Impacts

We note that our current analysis addresses both the marginal cost of the NHTSA-compliant helmets and the lives saved due to riders shifting from novelty helmets to DOT-compliant helmets in States with helmet laws. However, there are a number of impacts which we have not quantified. The first is the impact of nonfatal injuries prevented. Although motorcycle crashes produce a substantial number of nonfatal head injuries, we have chosen not to quantify nonfatal injury benefits at this time because of concerns about our ability to

accurately measure these benefits with our current data sources. Nonfatal injuries make up a substantial portion of the societal impact from motorcycle crashes, so our quantified safety impact is conservative. Further discussion of this is included in the benefits section of the PRIA. We also note that our estimates of fatality impacts may be understated. As noted in the Appendix A, novelty helmets performed so poorly that they topped-out the accelerometers used to measure their performance. The level of damage incurred by novelty helmets exceeded the ability of the equipment to measure it. Since our fatality benefits are based on the relative performance of NHTSA-compliant and novelty helmets, our estimate of fatalities prevented is thus conservative as well.

A second unquantified impact is the utility that riders get from novelty helmets. Novelty helmets are worn by some riders in States with helmet laws despite the threat of legal sanction for a number of reasons, including lower price, a preference for their design, perceptions of comfort, as a political statement, or in the general mistaken belief that they do provide safety. NHTSA has estimated the benefits and costs that could occur if a portion of users in states with helmet laws switch to NHTSA-compliant helmets. However, one intangible outcome of riders switching to safer helmets is a possible loss of whatever utility they experienced by wearing the novelty helmet.

In states with helmet laws, the only states for which we have measured costs and benefits, novelty helmets are illegal. There is dispute within the economic community regarding the proper way to treat benefits derived from illegal activities. For example, some economists (Becker, 1968)[47] have stated that they believe that gains from illegal activities should have equal standing in public policy decisions based on cost benefit analysis. Under this approach, there is

[47] Becker, Gray S. (1968), "Crime and Punishment: An Economic Approach," *Journal of Political Economy*, 76 (March/April), pp. 169-217

no societal loss from theft, for example, because the value of stolen goods is just a transfer from one member of society to another. The gain or enjoyment experienced by the criminal is balanced equally against the loss or pain experienced by the victim.

By contrast, Trumbell (1990)[48] and Zerbe (1991)[49] argued that illegal acts should not be included as benefits in public policy decisions because those who receive the illegal benefits are operating outside of societal norms and do not have standing in the decision. In proscribing these actions, legislatures implicitly state that such gains are ill-gotten and ipso facto do not benefit society. Trumbell further argued that inclusion of illegal activities as benefits undermines public confidence in the validity of public policy decisions based on cost benefit analysis.

As noted, there are a variety of possible reasons why motorcycle riders wear novelty helmets. Those who switch to NHTSA-compliant helmets will experience a loss of some level of utility. The loss will be a function of the reasons for wearing novelty helmets. Those who wear novelty helmets because they mistakenly believe they provide safety will experience both an added cost for the new NHTSA-compliant helmet and a decreased risk of death and injury. As demonstrated in our analysis of costs and benefits, the benefits of this tradeoff greatly exceed the costs.

For others, those who chose novelty helmets for non-safety reasons such as comfort, fashion, or making a political statement, there may be an additional, intangible loss. However, as

[48] Trumbull, William N. (1990), "Who Has Standing in Cost-Benefit Analysis?," *Journal of Policy and Management*, Vol. 9, No. 2, pp. 201-218

[49] Zerbe, Richard O. (1991), "Comment: Does Benefit Cost Analysis Stand Alone? Rights and Standing" *Journal of Policy and Management*, Vol. 10, No. 1, pp. 96-105

noted above, there is a difference of opinion on whether utility from activities that are illegal should be considered in this context. Those who do choose to shift would presumably value their lost utility at less than their added risk of prosecution, but it is difficult to quantify the value of such activities.

The agency requests comments on the issue of considering benefits lost due to diminished opportunities that violate State law.

In states without helmet laws, novelty helmets are not illegal and the cost benefit calculation could be different. Riders might experience a loss of utility from not being able to wear novelty helmets without the benefit of decreased risk of death (or cost of a legal helmet) should they decide to forgo a helmet altogether. However, we note that existing novelty helmets will not be confiscated, and riders who own novelty helmets could continue to wear them in non-law States for as long as the helmets last. The loss of utility in these States would be to riders who would no longer be able to purchase one because non-compliant helmets will not be available. The agency requests comments on the costs and benefits of this rule for riders in states without helmet laws, and on how that calculation affects the overall costs and benefits of this rule.

Finally, we note that we have not estimated any safety impact for cases in which a rider decides to wear no helmet instead of a complying helmet. There are several reasons for this. First, in law States, the effect of this rule is to increase enforcement and prosecution of novelty helmet violations. Wearing no helmet at all would make riders even more vulnerable to arrest because their violation would be more visible to law enforcement. We thus believe this scenario is unlikely to occur with any significant frequency. Second, as noted above, in non-law states, existing riders are free to continue to wear their novelty helmets. Nothing in this rule prevents

that. In the long run, if this rule is effective in reducing the availability of novelty helmets, there may be riders who will choose to ride without a helmet instead of a NHTSA-compliant helmet. However, as noted previously, test results indicate that novelty helmets provide virtually no safety protection, and any safety impact would thus be minimal.

Overall, we believe that the net effect of these unquantified impacts - nonfatal injuries prevented, and possibly lost utility to some riders--is a conservative estimate that understates the potential net benefits of the rule. Nonetheless, our analysis indicates that the rule is highly cost-beneficial, even with these conservative limitations.

CHAPTER IV. COSTS AND LEAD TIME

This chapter discusses the regulatory costs associated with conducting a roadside test to enforce existing helmet laws and the incremental cost to consumers who switch from a novelty helmets to 218-certified helmets, the net cost, and the proposed lead time for the rule to become effective. The net cost is the difference between the regulatory cost and the societal economic benefits. The cost of the proposed rule is estimated for the 5-percent, 10-percent, and 100-percent scenarios.

A. Regulatory Costs

This section describes the potential regulatory costs associated with the proposed rule, which include (1) the incremental cost to novelty helmet users who are assumed to switch to minimally compliant 218-certified helmets and (2) the cost of tools to conduct a roadside test of helmets to enforce existing helmet laws.

The incremental cost to each motorcyclist who switches from a novelty helmet to a 218-certified helmet is the price difference between the current average cost of a 218-certified helmet and a novelty helmet. In the Final Regulatory Evaluation[50] that accompanied the FMVSS No. 218 Upgraded Helmet Labeling final rule, the agency concluded that these novelty helmets need a new liner and a thicker and larger shell that weighs 31 percent more in order to become 218-certified helmets (Appendix A). Based on an assumed 100 percent markup from the manufacturer price to the retail price, this results in a consumer price increase of $46.00 per helmet (in 2008 economics). The incremental cost increase due to the final rule on Upgraded Helmet Labeling was $0.02 (in 2008 economics). The incremental shift to a minimally

[50] "Final Regulatory Evaluation, FMVSS No. 218, Motorcycle Helmet Labeling," (May 2011). National Highway Traffic Safety Administration, Docket No. 2011-0050-0002.

compliant helmet will then total $46.02 prior to this proposed rule (in 2008 economics). The Gross Domestic Product Inflator conversion factor for the 2008 to 2012 economics (as of March 28, 2013) is 1.063 (=115.388/108.565) for vehicle parts and equipment. Therefore, the incremental shift to a minimally compliant helmet in 2012 economics is $48.92 (= $46.02 x 1.063).

Motorcyclists might have more than one helmet. Thus, the total cost to novelty helmets users that switched to 218-certified helmet users would depend upon the number of novelty helmets that would be replaced with 218-certified helmets. The number of novelty helmets sold annually in the U.S. could not be obtained and was therefore prorated from the annual sale of 3.6 million 218-certified helmets.[51] It is estimated that 55 percent[52] of compliant helmets are sold within Law States for a total of 1,980,000 using the 2011 NOPUS helmet use rates Within helmeted users, 88 percent wore a 218-certified helmet and 12 percent wore a novelty helmet. The ratio of novelty helmets to 218-certified helmets is estimated to be 0.1346 (= 12 / 88). Thus, the total novelty helmets sold would be 270,000 (= 1,980,000* 0.1346). In the FMVSS No. 218 Upgraded Helmet Labeling final rule, the agency examined the impact of a 5-percent and 10-percent switch from novelty helmets to 218-certified helmets. This analysis assumes that the Upgraded Helmet Labeling final rule will encourage 10 percent of novelty helmet users in Law States to switch to minimally compliant 218-certified helmets, which would reduce the number of novelty helmets sold in Law States by 27,000. Thus, the remaining number of novelty helmets estimated that this proposed rule targets is 243,000 (= 270,000 – 27,000).

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[51] United States International Trade Commission, Harmonized Tariff Schedule of the United States as of April 9, 2013, heading/subheading 6506-10-3030 and 6506-10-6030

[52] The process of developing the percentage of compliant helmets sold in Law States was documented in the FMVSS No. 218 Upgraded Helmet Labeling final rule. The 2010 NOPUS helmet user rates were used in this analysis to derive the 58 percent.

The proposed rule will cause some consumers to shift from novelty helmets to 218-certified helmets at a cost of $48.92 per helmet. If 5-percent of novelty helmet users switch to compliant helmets, the incremental cost would be $0.6 million (= 243,000 helmets x 5% x $48.92). If 10 percent of novelty helmet users switch to compliant helmets, the incremental cost would be $1.2 million (= 243,000 x 10% x $48.92). If 100 percent of novelty helmet users switch to compliant helmets, the incremental cost would be $11.9 million (= 243,000 x 100% x $48.92).

The tools NHTSA used to conduct trial tests of certified and novelty helmets during development of the NPRM are listed in Table IV-1. The tool kit in this cost analysis includes T-pins, an outside caliper with gauge, and a force gauge. Other tools may be useful as well. The T-pins are the most likely used tool and could be carried in a police vehicle. The tool kit includes 2 sets of 40 T-pins or 80 T-pins that can be distributed to police officers. These tools were selected because they are commercially available, relatively inexpensive, and are easy to use. It should not be construed, however, to mean that State or local law enforcement will be required to purchase a specific set of tools.

Table IV-1
Sample of a Complete Tool Kit to Study Physical Characteristics of Motorcycle Helmets
Annual Cost

Purpose	Description	Manufacturer	Units Per Agency[53]	Cost per Unit[54] (2012 dollars)	Total Cost per Kit (2012 dollars)
Measure inner liner thickness	Size 28 – 1 ¾ inch Nickel Plated Steel T-Pin (40-count pack)	Dritz	2	$3.56	$7.12
Measure combined thickness of shell & inner liner	0-8 inch Outside diameter caliper	iGAGING	1	$28.50	$28.50
Apply compressive force to the non impact-attenuating liner	Push style force gauge 1-10 lbf range 6.3 mm diameter flat probe	Wagner Instruments	1	$229.05	$45.81 (1)
Total Cost					$81.43(2)

(1)This is one-fifth cost of this specific piece since this piece needs to be replaced once every five year.
(2) The total cost per a complete tool kit is $264.67 (=$7.12 + $28.50 + $229.50)

The agency anticipates that the preliminary screening tests would be conducted by State and local law enforcement at motorcycle helmet checkpoints, in a court room, or by a single police unit. Based on the state and local enforcement statistics published by the Bureau of Justice Statistics,[55] more than half of local police departments employed fewer than 10 full-time officers, and the overall median size was 8 full-time officers. Each kit contains 80 reusable T-pins which can be distributed to law enforcement agents in the field, and one caliper (for more precise measurement) which can be used at checkpoints, station headquarters, or in the courtroom. NHTSA does not believe that all officers on patrol at any given time would need to

[53] Since T-pins would be easy to drop or lose, we have estimated that two packages would be sufficient on average. The caliper and force gauge could be brought to motorcycle checkpoints or court as necessary.

[54] The cost of these items was observed in 2011. The cost has been adjusted to 2012 dollars to be consistent with the economics used in this report. The Consumer Price Index for all items was used to adjust the values from the original unit costs of $3.50, $28.00, and $225.00 respectively.

[55] Available at: http://bjs.ojp.usdoj.gov/index.cfm?ty=tp&tid=71#data_collections (last accessed 2/15/12)

be equipped with a complete kit, so one kit can be shared among officers within a law enforcement agency. Therefore, it is assumed that each State and local law enforcement agency in Law States will obtain a tool kit similar to that described in Table 12. One tool kit per agency is considered adequate for estimating the annual cost of the tool kits. Of these three components in the tool kit, the force gauge is expected to be replaced every 5 years. Therefore, its initial unit cost was divided by 5 to derive the annual cost for force gauge. The estimated annual cost per screening tool kit thus is $81.43 (2012 dollars).

The number of law enforcement agencies in each State was obtained from the Bureau of Justice Statistics.[56] The average cost per Law State to have each State and local enforcement agency equipped with one inspection kit is $27,973 as shown in Table IV-2. In comparison to other motorcycle morbidity and mortality prevention measures, the average State budget for motorcycle education and training is $836,830.[57] The total annual cost of all preliminary screening tool kits would be $587,439 (= 7,214 x $81.43) if each agency purchases T-pins, calipers and a force gauge.

[56] Available at: http://bjs.ojp.usdoj.gov/index.cfm?ty=tp&tid=71#data_collections (last accessed 2/15/12)

[57] Baer, J., Ayotte, K., and Baldi, S., (2010). *Evaluation of State Motorcycle Safety Programs.* National Highway Safety Administration. Washington, D.C. Available at: http://www-nrd.nhtsa.dot.gov/Pubs/811269.PDF (last accessed 2/15/12)

Table IV-2
Estimated Costs for a Complete Screening Tool Kit for Law States
(2012 dollars)

Law State	Number of State and Local Law Enforcement Agencies	Total Cost of Preliminary Screening Tool Kits
Alabama	417	$33,956
California	509	$41,448
District of Columbia	4	$326
Georgia	628	$51,138
Louisiana	348	$28,338
Maryland	142	$11,563
Massachusetts	357	$29,071
Michigan	571	$46,497
Mississippi	342	$27,849
Missouri	576	$46,904
Nebraska	225	$18,322
Nevada	76	$6,189
New Jersey	550	$44,787
New York	514	$41,855
North Carolina	504	$41,041
Oregon	174	$14,169
Tennessee	375	$30,536
Vermont	69	$5,619
Virginia	340	$27,686
Washington	260	$21,172
West Virginia	233	$18,973
Total, Law States	7,214	$587,439
Average Cost per Law State		$27,973

Source: Bureau of Justice Statistics, 2008

NHTSA assumes that states' time spent on enforcement of helmet laws will not increase under this proposed regulation. The enforcement officers would still enforce the helmet laws during the assigned duty hours. No additional time or costs would be expected beyond the routine enforcement activities. The preliminary screening criteria and tools proposed by the rule would make the enforcement of helmet laws more efficient. In addition, the proposed rule would improve the chance of withstanding scrutiny in courts of law since the proposed rule provides

law enforcement personnel and judges with an objective measure of a helmet's ability to comply without conducting a destructive test of the item in question. Therefore, the agency believes that a more effective enforcement capability and an improved chance of withstanding scrutiny in courts of law would deter the use of novelty helmets in States with mandatory helmet laws.

The total regulatory costs of the proposed rule are summarized as below:

- $1.2 million for the 5-percent scenario; $0.6 million for screening tool kits + $0.6 million in consumer cost (12,150 novelty helmets replaced)
- $1.8 million for the 10-percent scenario; $0.6 million for screening tool kits + $1.2 million in consumer cost (24,300, novelty helmets replaced)
- $12.5 million for the 100-percent scenario; $0.6 million for screening tool kits + $11.9 million in consumer cost (243,000 novelty helmets replaced)

Note that as footnoted in Table IV-1, a complete screening tool kit includes three types of recommended tools. We estimated that a complete kit would cost $264.67 per kit. Therefore, the first year investment in screening tools for the 7,214 State and local law enforcement agencies is estimated to be $1.9 million (=$264.67 * 7214). The first year cost of the proposed rule for the 5-percent and 10-percent scenario thus would be $2.5 million (= $1.9 million tool kit cost + $0.6 million consumer cost) and $3.1 million (= $1.9 + $1.2 million), respectively. For the theoretical 100-percent scenario, the first-year cost is estimated to be $13.8 million (=$1.9 + $11.9 million). In essence, the difference between the first year cost and the annual cost is the allocation of the tool costs over their useful life.

B. Net Costs

The net cost of the proposed rule would be the regulatory cost minus the societal economic savings. The societal economic savings (see Table III-5) of the proposed rule are greater than the regulatory costs that were estimated in the previous subsection. As a result, there would not be net costs.

C. Lead Time

NHTSA is proposing a lead time of two years from the publication of the proposed rule for manufacturers to comply with the new requirements. Based on NHTSA's survey of helmets, NHTSA believes that helmets currently sold in the market place will comply with the new screening criteria; however, manufacturers may wish to re-submit their helmets to independent laboratories to generate data on which they base their re-certification. The agency believes that a lead time of two years to be a sufficient and reasonable time to allow the manufacturers the opportunity to recertify their products to the updated regulations.

CHAPTER V. COST-EFFECTIVENESS AND BENEFIT-COST ANALYSIS

This chapter provides cost-effectiveness and benefit-cost analysis of the proposed enforcement program and the preliminary screening requirement. The Office of Management and Budget (OMB) requires all agencies to perform cost-effectiveness and benefit-cost analyses in support of rules, effective January 1, 2004.[58]

Cost-effectiveness measures the net cost per equivalent life saved (i.e., per equivalent fatality), while benefit-cost measures the net benefit, which is the difference between benefits and net costs in monetary values. Injury benefits are expressed as fatal equivalents in cost-effectiveness analysis and are further translated into monetary value in benefit-cost analysis. Fatal equivalents represent the savings throughout the motorcycle helmet in-use lifetime and are discounted to reflect their present values (2012 economics).

A. Fatal Equivalents

To calculate a cost per equivalent fatality, nonfatal injuries must be expressed in terms of fatalities. This is done by comparing the values of preventing nonfatal injuries to the value of preventing a fatality. As described in Appendix B, VSL is used to determine the relative ratio of nonfatal injuries to fatalities (i.e., relative injury factor). VSL measurements inherently include a value for lost quality of life plus a valuation of lost material consumption that is represented by measuring consumers' after-tax lost productivity. The societal economic costs including medical care, emergency services, insurance administrative costs, workplace costs, and legal costs were treated as part of savings that would reduce the regulatory costs. Therefore, societal economic

[58] See OMB Circular A-4.

costs were excluded from the determination of the relative injury factors. Table V-1 shows the relative injury factors.

Table V-1
Relative Injury Factor

	MAIS 1	MAIS 2	MAIS 3	MAIS 4	MAIS 5	Fatality
Factor	0.0030	0.0470	0.1050	0.2660	0.5930	1.000

Source: Appendix B

Fatal equivalents are derived by applying the relative injury factor shown in Table 15 to the estimated injury benefits. In this analysis, the fatal equivalents would be equal to the number of fatalities reduced since non-fatal injury benefits were not quantified. As discussed earlier, benefits are realized throughout a helmet's life. Thus, fatal equivalents are required to be discounted at 3 and 7 percent. Table V-2 shows the undiscounted and discounted fatal equivalents examined in the benefit chapter (Chapter III). The low end of benefits is estimated using the EU-based normalization approach and the high end of benefits is derived using the 218-based normalization approach.

As shown, undiscounted, the proposed rule would save 12 to 24 fatal equivalents for the 5-percent scenario under which 5 percent of novelty helmet users would switch to wearing a 218-certified helmet as a result of the rule. At a 3 percent discount rate, the proposed rule would save 11 to 22 fatal equivalents for the 5-percent scenario. At a 7 percent discount rate, the proposed rule would save 9 to 19 fatal equivalents for the 5-percent scenario.

Under the 10-percent scenario, undiscounted the proposed rule would save 24 to 48 fatal equivalents, under which 10 percent of novelty helmet users would switch to wearing a 218-certified helmet as a result of the proposed enforcement policy. At a 3 percent discount rate, the proposed rule would save 22 to 43 fatal equivalents for the 10-percent scenario. At a 7 percent

discount rate, the proposed rule would save 19 to 38 fatal equivalents under the 10-percent scenario.

Table V-2
Fatal Equivalents by Discount Rate

Scenario	Undiscounted	3% Discount Rate	7% Discount Rate
5%			
EU-Based Normalization	12	11	9
218-Based Normalization	24	22	19
10%			
EU-Based Normalization	24	22	19
218-Based Normalization	48	43	38
100% (Maximum)			
EU-Based Normalization	235	212	186
218-Based Normalization	481	433	380

The maximum potential number of lives saved is also provided in Table V-2. Under the 100-percent scenario, undiscounted, the proposed rule would save 235 to 481 fatal equivalents, under which 100 percent of novelty helmet users would switch to wearing a 218-certified helmet as a result of the proposed enforcement policy. At a 3 percent discount rate, the proposed rule would save 212 to 433 fatal equivalents for the 100-percent scenario. At a 7 percent discount rate, the proposed rule would save 186 to 380 fatal equivalents under the 100-percent scenario.

B. Cost-Effectiveness

The cost-effectiveness analysis derives the cost per equivalent life saved (i.e., cost per fatality), which is equal to the net cost divided by the total fatal equivalents (in this case, it's actually cost per life saved). As shown in Chapter IV, Costs, the net costs of the proposed rule are negative for all three scenarios. Since there is no value in providing a net cost per equivalent life saved. Thus, cost effectiveness calculations are not necessary.

C. Net Benefits

Benefit-cost analysis derives the net benefits which is the difference between the injury benefits and the net costs of the rule in monetary values. Thus, benefit-cost analysis differs from cost-effectiveness analysis in that it requires that benefits be assigned a monetary value, and that this value be compared to the net cost to derive a net benefit. In essence, the net benefit is the difference between VSL savings and the net cost (or the different between the total benefits and regulatory cost).

Table V-3 summaries the net benefits of the proposed rule. As shown, at a 3 percent discount rate, the net benefits of the proposed rule would range from $108.5 million to $218.1 million for the 5-percent scenario and from $217.5 million to $436.5 million for the 10-percent scenario. At this discount rate, the maximum net benefit would range from $2,133.8 million to $4,380.3 million.

At a 7 percent discount rate, the net benefits of the proposed rule would range from $94.7 million to $191.0 million for the 5-percent scenario and from $190.4 to $382.6 million for the 10-percent scenario. At this discount rate, the maximum net benefit would range from $1,869.2 million to $3,838.8 million.

Table V-3
Net Benefits (2012 dollars

	3% Discount		7% Discount	
	Low	High	Low	High
5-percent scenario	$108,474,653	$218,131,123	$94,738,713	$190,995,013
10-percent scenario	$217,536,745	$436,513,915	$190,400,635	$382,577,465
100-percent scenario	$2,133,816,991	$4,380,263,661	$1,869,242,471	$3,838,803,151

D. Summary

The estimated costs and benefits of the proposed rule depend upon the number of novelty helmet users that would switch to wearing a 218-certified helmet. The total cost of the proposed rule includes the cost of preliminary screening kits for each State and local law enforcement agency in Law States and the incremental cost of buying a 218-certified helmet for novelty helmet users when they make the switch. The last cost item depends on the number of novelty helmet users that will switch to using a 218-certified helmet. The total cost of the screening kits would be $0.6 million.

Table V-4 summarizes the fatal equivalents, regulatory cost, and net benefit statistics of the enforcement policy at the 3 and 7 discount rates and under the 5-percent and 10-percent scenario, respectively. The proposed rule is cost beneficial by comparing costs to monetized economic benefits, and there is a net benefit.

Table V-4
Cost-Effectiveness and Net Benefits
(2012 Dollars)

5% Scenario	3% Discount Rate		7% Discount Rate	
	Low Range Benefits	High Range Benefits	Low Range Benefits	High Range Benefits
Fatal Equivalents	11	22	9	19
Societal Economic Benefit	$3,693,470	$7,386,940	$3,021,930	$6,379,630
VSL Benefit	$105,963,000	$211,926,000	$92,898,600	$185,797,200
Total Benefit (1)	$109,656,470	$219,312,940	$95,920,530	$192,176,830
Regulatory Cost*	$1,181,817	$1,181,817	$1,181,817	$1,181,817
Net Benefit (2)	$108,474,653	$218,131,123	$94,738,713	$190,995,013

10% Scenario

	3% Discount Rate		7% Discount Rate	
	Low Range Benefits	High Range Benefits	Low Range Benefits	High Range Benefits
Fatal Equivalents	22	43	19	38
Societal Economic Benefit	$7,386,940	$14,438,110	$6,379,630	$12,759,260
VSL Benefit	$211,926,000	$423,852,000	$185,797,200	$371,594,400
Total Benefit (1)	$219,312,940	$438,290,110	$192,176,830	$384,353,660
Regulatory Cost*	$1,776,195	$1,776,195	$1,776,195	$1,776,195
Net Benefit (4)	$217,536,745	$436,513,915	$190,400,635	$382,577,465

100% Scenario

	3% Discount Rate		7% Discount Rate	
	Low Range Benefits	High Range Benefits	Low Range Benefits	High Range Benefits
Fatal Equivalents	212	433	186	380
Societal Economic Benefit	$71,183,240	$145,388,410	$62,453,220	$127,592,600
VSL Benefit	$2,075,108,750	$4,247,350,250	$1,819,264,250	$3,723,685,550
Total Benefit (1)	$2,146,291,990	$4,392,738,660	$1,881,717,470	$3,851,278,150
Regulatory Cost*	$12,474,999	$12,474,999	$12,474,999	$12,474,999
Net Benefit (4)	$2,133,816,991	$4,380,263,661	$1,869,242,471	$3,838,803,151

* Costs are not discounted, since they occur at the time of purchase, whereas benefits occur over the vehicle's lifetime and are discounted back to the time of purchase.
(1) = Societal Economic Benefit + VSL Benefit
(2) Total Benefit – Regulatory Cost

CHAPTER VI. REGULATORY FLEXIBILITY ACT, UNFUNDED MANDATES REFORM ACT, AND MARKET FAILURE ANALYSIS

A. Regulatory Flexibility Act

The Regulatory Flexibility Act of 1980 (5 U.S.C. §601 et seq.), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996, requires agencies to evaluate the potential effects of their proposed and final rules on small businesses, small organizations, and small governmental jurisdictions in the United States.

5 U.S.C. §603 requires agencies to prepare and make available for public comment an initial and a final regulatory flexibility analysis (RFA) describing the impact of proposed and final rules on small entities if the agency decides that the rule may have a significant economic impact on a substantial number of small entities. Each RFA must contain:

(1) A description of the reasons why action by the agency is being considered;

(2) A succinct statement of the objectives of, and legal basis for, a proposal or final rule;

(3) A description of and, where feasible, an estimate of the number of small entities to which the proposal or final rule will apply;

(4) A description of the projected reporting, record keeping and other compliance requirements of a proposal or final rule including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;

(5) An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap, or conflict with the proposal or final rule;

(6) Each final regulatory flexibility analysis shall also contain a description of any significant alternatives to the final rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the final rule on small entities.

1. Description of the reasons why action by the agency is being considered

NHTSA is considering this action to propose dimensional criteria as implemented in enforcing existing laws prohibiting importation and use of novelty helmets in order to reduce the number of motorcyclist head injuries. The enforcement policy would apply the National Traffic and Motor Vehicle Safety Act of 1966 (15 U.S.C. 1392) in order to prevent manufacturing for sale, selling, offering for sale, introducing or delivering for introduction in interstate commerce, or import into the United States, motor vehicle equipment, including motorcycle helmets, manufactured on or after the date an applicable motor vehicle safety standard prescribed under this chapter takes effect unless the vehicle or equipment complies with the standard and is covered by a certification issued under section 30115 of Title 49 USC. The 218-certified helmets have been found to be very effective in reducing head injuries and performed very well compared to novelty helmets.

2. Objectives of, and legal basis for, the proposal or final rule

Under 49 U.S.C. 322(a), the Secretary of Transportation (the "Secretary") has authority to prescribe regulations to carry out the duties and powers of the Secretary. One of the duties of the Secretary is to administer the National Traffic and Motor Vehicle Safety Act, as amended (49 U.S.C. 30101 et seq.). The Secretary is authorized to issue Federal Motor Vehicle Safety Standards (FMVSS) that are practicable, meet the need for motor vehicle safety, and are stated in

objective terms.[59] The Secretary has delegated the responsibility for carrying out the National Traffic and Motor Vehicle Safety Act to NHTSA.[60] NHTSA is proposing this rule under the Authority of 49 U.S.C. 322, 30111, 30115, 30117, and 30166; delegation of authority at 49 CFR 1.95.

3. Description and estimate of the number of small entities to which the proposal or final rule will apply

The rule applies only to motorcycle helmet manufacturers and will not affect motor vehicle manufacturers and motorcycle manufacturers. Business entities are defined as small businesses using the North American Industry Classification System (NAICS) code, for the purposes of receiving Small Business Administration assistance. One of the criteria for determining size, as stated in 13 CFR 121.201, is the number of employees in the firm. The affected business category is Miscellaneous Manufacturing, Motorcycle Helmet Manufacturers (NAICS 3391136, 131). To qualify as a small business in this category, the firm must have fewer than 500 employees. Although the breakout of motorcycle helmet manufacturers is not available from the overall NAICS 339113 group (Surgical Appliance and Supplies Manufacturing, Table VI-1 infra), it is reasonable to assume that nearly all motorcycle helmet manufacturers would be small businesses based on available data about the NAICS 339113 industry group.

[59] 49 U.S.C. 30111(a).

[60] 49 U.S.C. 105 and 322; delegation of authority at 49 CFR 1.95.

Table VI-1
2007 Economic Census

2007 NAICS code	Meaning of 2007 NAICS code	Number of establishments	Employees (1 – 19)	Employees (20-99)	Employees (100+)	Number of employees
339113	Surgical appliance and supplies manufacturing	2,209	1,488	488	233	107,322

Data was gathered from the Automated Commercial Environment (ACE) database maintained by the CBP. The number of manufacturers exporting helmets (HTS 6506106030, 6506103030) to the United States was 355 in 2009. This number however may not represent the actual number of manufacturers of imported helmets as some of the 355 may be import/export companies or other "middle men." Additionally, we do not know how many of the imported helmet manufacturers are small businesses.

From data available to DOT through compliance testing, there is one domestic motorcycle helmet manufacturer that would qualify as a small business under the definitions described above. Table VI-2 provides information about the small domestic manufacturer in MY 2011. There is one other manufacturer, NXT Helmets, who has an existing website; however, there are numerous other indications that this manufacturer is no longer in operation and, therefore, they have not been included in this analysis.

Table VI-2
Small Motorcycle Helmet Manufacturers

Manufacturer	Employees	Estimated Sales	Sales Price Range
Super Seer Corporation	< = 50	NA	$28 – $660*

NA: Not available
* Based on the range of 218-certified helmets tested by the agency in 2006 – 2008

Thus, the agency believes that the rule will not have a significant economic impact on small motorcycle helmet manufacturers. If there is any impact on the other small manufacturers, the impact would be positive. The agency projects that some portion of novelty helmet users would be expected to make a switch and thus would increase their sales of 218-certified helmets. In theory, some manufacturers of novelty helmets, that do not also make 218-certified helmets, would be forced to switch to manufacturing 218-certified helmets or face losing business. Thus, the enforcement program could potentially have an effect on competition. However, this would not be the case for the small domestic manufacturers listed in Table VI-2, since they produce 218-certified motorcycle helmets.

4. Description of the projected reporting, record keeping and other compliance requirements for small entities

The proposed rule would not require reporting, record keeping, or compliance requirements for small businesses.

5. Duplication with other Federal rules

There are no relevant Federal regulations that duplicate, overlap, or conflict with the final rule.

6. Description of any significant alternatives to the proposed rule

There are no alternatives to the proposed rule presented here. To achieve benefits, the proposed rule would rely on enforcement of the Safety Act, and provides a preliminary screening procedure in support of the enforcement program.

B. 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 State, 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 the year 2012 results in $141 million (115.366/81.602 = 1.414). The assessment may be included in conjunction with other assessments, as it is here. This proposed rule would not result in expenditures by State, local or tribal governments of more than $141 million annually as the Federal government (1) is not requiring States to purchase all of the preliminary screening tools described in the cost section and (2) provides grants to States for other motorcycle safety related programs and would likely aid in offsetting the costs estimated in this analysis. These effects have been discussed previously in this Preliminary Regulatory Impact Analysis (see Chapter IV, Costs).

APPENDIX A. COST ESTIMATE FOR CONVERTING A NOVELTY HELMET TO A 218-CERTIFIED MOTORCYCLE HELMET

The agency compared several FMVSS No. 218-certified and "novelty" motorcycle helmets to estimate the end user unit cost if a novelty helmet is converted to a FMVSS No. 218-certified helmet.[61]

The term novelty helmet is a term that describes a helmet that is similar in form to a motorcycle helmet designed for on-road use, but is not certified to meet the safety requirements specified in FMVSS No. 218. In general, novelty helmets have little or no impact attenuating lining inside the shells and are not made to withstand the penetration requirements of the motorcycle helmet safety standard.

Two steps were used in making the cost estimate. First, we measured the weight and volume of three 218-certified motorcycle helmets and three novelty helmets. The measurements were used to determine the increase in material for the shell and the lining inside the shell. The 218-certified helmets used for the comparison are Bell Drifter made with a fiberglass shell and polystyrene lining, ZAMP made with a composite thermoplastic shell and polystyrene lining, and Skullcap made with an ABS shell and polystyrene lining. All of the 218-certifed motorcycle helmets and novelty helmets are partial helmets, as shown in the table below (Table A-1).

[61] The cost analysis described here is drawn from the Final Regulatory Evaluation, FMVSS 218 Motorcycle Helmet Labeling, issued May 26, 2011 (Docket No. NHTSA-2011-0050.1).

Table A-1
Shell Measurements

Measurement	218-Certified Helmets			Novelty Helmets		
Make Model	Bell Drifter	Z AMP S2	Daytona Skullcap	Shengchao 3	(Unknown) Dante II	Soar EZ Rider
Type	Partial	Partial	Partial	Partial	Partial	Partial
Weight (gm)	748	586	548	460	410	302
Density (gm/cc)	1.47	0.8	1	1.07	0.86	2
Material	Fiberglass + Polyester Resin	Composite Thermoplastic	ABS	*	*	*

* Data not available

The measurements showed that the 218-certified helmet shells have an average weight of 627 grams. When the high-end Bell Drifter (with a fiberglass shell) was excluded from the weight analysis, the average weight of the remaining two 218-certified helmets was 567 grams. We excluded the fiberglass shell because we are trying to estimate what a manufacturer of novelty helmets (that compete on price and design) would do if they had to pass FMVSS No. 218 and still compete in the market. Changing to the high cost fiberglass shell is not a strategy that is consistent with this lower cost market strategy. The average weight of the novelty helmets was 391 grams. The average weights showed that the shell of the novelty helmets needs to be 176 grams thicker/larger (567 – 391 = 176 grams) when compared to the 218-certified helmet shells.

For the lining (or liner), the measurements showed that the 218-certified helmets have an average weight of 149 grams. Polystyrene (whether expanded or foamed) was used for the lining inside the 218 helmets. For the novelty helmets, a visual inspection of the lining showed that the novelty helmets are equipped with a “comfort” lining. The comfort lining would have little or no

impact-attenuation ability in crashes.[62] The measurements made for the lining are shown below (Table A-2).

Table A-2
Liner Measurements

Measurement	218-Certified Helmets			Novelty Helmets		
Make Model	Bell Drifter	Z AMP S2	Daytona Skullcap	Shengchao 3	(Unknown) Dante II	Soar EZ Rider
Type	Partial	Partial	Partial	Partial	Partial	Partial
Weight (gm)	128	202	118	48	44	36
Density (gm/cc)	0.04	0.05	0.05	*	*	*
Material	Expanded Polystyrene	Foam Polystyrene	Expanded Polystyrene	*	*	*

* Data not available.

In addition to the weight analysis, we reviewed manufacturing cost data (which includes material, labor, and burden) provided in a report titled "Cost, Weight, and Lead Time Analysis: Motorcycle Helmets," dated July 2000.

The manufacturing cost data show an average cost of $28.88 for polycarbonate shells and an average cost of $9.81 for the lining. (See Table A-3).

[62] A NHTSA research note titled "Traffic Safety Facts, Summary of Novelty Helmet Performance Testing," dated April 2007 showed that the Dante II and EZ Rider had a peak acceleration of 989 g and 992 g, respectively, when subjected to S5.1 Impact attenuation test specified in FMVSS No. 218. The standard requires a minimum peak acceleration of 400g. We do not have peak acceleration data for the Shengchao 3 helmet.

Table A-3
Manufacturing Costs

Model	Manufacturing Costs in 2000 Economics	
	Shell Material[63]	Lining Total[64]
Bieffe/DGM	$22.56	$9.31
CXX	$10.40	$10.53
		$9.46
SHOE Fiberglass		$9.98
Cyber	$31.67	$8.82
		$11.61
HJC Fiberglass		$8.32
AFX	$31.25	$9.51
BELL	$35.12	$10.10
Bieffe/Trial Fiberglass		$9.21
KBC	$48.57	*
		$9.81
Bieffe	$22.56	$11.09
Average	*$28.88*	*$9.81*

* Data not available.

As shown in the weight analysis, the novelty helmets have an average shell weight of 391 grams and the 218-certified helmets have an average shell weight of 567 gram, a difference of 176 grams (31%). By applying the 31% to the $28.88 shell average cost, we estimated an incremental cost of $8.95 per helmet in 2000 economics. The material cost data showed an average lining cost of $9.81 per helmet. As discussed, the comfort lining inside novelty helmets has little or no impact-attenuating capability. Therefore, we assumed that all novelty helmets require a new liner that is similar to a typical liner used in a 218-certified helmet. Accordingly, we estimated a total incremental manufacturing cost of $18.76 ($\$8.95_{shell} + \$9.81_{lining}$) if a novelty

[63] Fiberglass shells were excluded from the average shell cost.

[64] Some helmets have more than one material cost for the lining.

helmet is converted to a 218-certified helmet.[65] With 100-percent markup, we estimated a total incremental cost of $37.52 per helmet in 2000 economics.[66] By adjusting the $37.52 with the Index for Gross Domestic Product of 1.224 (= 108.481 / 88.648),[67] we estimated an incremental cost of $46.00 per helmet in 2008 economics.

In summary, our best estimate of the consumer cost to switch from a novelty helmet to a complying polycarbonate motorcycle helmet is $46.00 in 2008 economics. This is based on the assumption that novelty helmets require the addition of an impact-absorbing liner to meet the standard. Note that the 218-certified helmets perform very well as shown in Tables A-4 to A-6.

[65] A visual inspection performed on the lining used in novelty helmets showed that the lining was made from inexpensive sponge type materials. Although exclusion of these materials in the cost estimate would overestimate the incremental cost, the impact would be insignificant.

[66] We only have anecdotal information on the markup of motorcycle helmets. According to the cost report, the total manufacturing cost for the polycarbonate shell used in a Bell motorcycle helmet was $45.77 and $10.10 for the lining in 2000 economics (total of $68.37 in 2008 economics, $137 with 100% markup and $103 with 50% markup). We do not have data to show whether this helmet is a partial or full cover helmet. A web-based retailer sells Bell helmets in a price range of $59.95 to $119.95 plus $10.59 shipping for partial polycarbonate helmets, with an average price of $100 including shipping. (Note that full cover Bell helmets are more expensive, from $159.95 to $549.95. However, none of the full cover helmets were made from polycarbonate.) Based on the on-line retail prices for Bell partial polycarbonate helmets, it appears that the 100% markup used in the analysis would not underestimate the incremental cost. There may well be a difference in the markup for products sold on-line and products sold in a retail motorcycle store.

[67] National Income and Product Account Table, Price Indexes for Gross Domestic Product as of August 27, 2009.

Table A-4
Impact Attenuation Test Results
Ambient Conditioned 218-Certified Helmets
2007 Helmet Test Information

	Brand	Model	Size	Peak Acceleration (g)
1	Advanced Carbon Composites	EXT-002 sold as HD-5050	M/L	192
2	Advanced Carbon Composites	EXT-2 DOT Polo sold as HD-5054	S/M	244
3	AFX	FX-66	XL	109
4	Akuma	F-14	L	94
5	Arai	Vector	XL	157
6	Bell	Drifter	XL	106
7	Caberg	104	M	98
8	Daytona Helmets	Skull Cap	M	112
9	EXL SPORTS by HM Distributing	EXL-115	XL	127
10	EXL SPORTS by HM Distributing	EXL-662	Youth L	126
11	Gmax	GM35 HALF DRESS	XL	91
12	GPX	Shorty	XL	110
13	Harley Davidson	Trespasser	S	112
14	HJC	Vulcan-2	M	145
15	HJC	AC-3	M	178
16	Hot Leathers	NH70/H200FB	M	116
17	Icon Motosports	Mainframe	M	148
18	Icon Motosports	Domain	S	127
19	KBC	VR-2	S	131
20	MotoX	MT-A101	M	99
21	Nolan	N84	M	92
22	none listed: purchased from Dealer Leather	200	XL	100
23	Outlaw sold by LeatherUp	V530	XL	110
24	Rodia	RHD-EX	L	93
25	Rodia	RHD 200	XL	103
26	Rodia	RHD 200	XL	122
27	Scorpion	VX-14	M	119
28	Shark	RSI	M	100
29	Shoei	Multitech	M	102
30	Suomy	J10 SPEC 1R/EXTREME	L	102
31	V-Can	V530	L	89
32	Vega by HD Power Sports Products Co., Ltd	Mach-1	M	140
33	Vega Helmet	Summit II	S	90
34	VOX Racing	VOX-803	XL	146
35	Winex	VX-4	S	124
36	Z1R	Metro	S	114
37	Zamp	S-2	M	95
38	Zox	Old School	L	120
	2007 Average			121

Table A-5
Impact Attenuation Test Results
Ambient Conditioned 218-Certified Helmets
2006 Helmet Test Information

1	Advanced Carbon Composites	EXT-002	L/XL	278
2	AFX	FX-97	S	93
3	Arai	Profile	M	160
4	AXCEL by Answer Racing	Comet Comp	M	113
5	Bell	Zephyr	M	88
6	CKX	VG-200	XL	88
7	Cyber	U-12	XL	92
8	Daytona Helmets	Skull Cap	M	105
9	Fox	Tracer Pro	M	165
10	Fulmer	AF-M Modus	XL	111
11	GMAX	GM48S	XL	80
12	HCI	100	XL	113
13	HJC	Symax	XL	95
14	HJC	AC-2M	S	143
15	Hot Leather	NH30X/Doing 0401	XL	204
16	Icon Motor Sports	Domain	S	129
17	KBC	TK-8	XL	114
18	Kerr Helmets	H205	M	109
19	M2R	MR11	S	120
20	Mossi	A-633	XL	91
21	Nolan	N-102	XL	80
22	NXT	05	XL	132
23	Raider	Shorty (A-618)	XL	108
24	Scorpion	EXO-700	L	138
25	Shoei	St. Cruz	M	115
26	Shoei	V-Moto	XL	98
27	Sixsixone	Flight Helmet	XL	118
28	Skid Lid	U-69	XL	121
29	Suomy	NOMAD	XL	96
30	THH	T-69	S	123
31	ThorMX	Force	M	149
32	Troy Lee Designs	Speed	M	97
33	Vance Leather/Mad Mac/NetVent Inc./BWO (Biker Wear Online)	HC2102/200	M	118
34	V-Can	V500	S	104
35	Vega	Nitro, NT-100	XL	89
36	XPEED	XF-904	M	132
37	Zamp	S-2/ST-211	M	104
38	Zamp	RZ-10	M	116
39	ZOX	Alto	XL	114
	2006 Average			119
	2006 and 2007 Average			120

Table A-6
Impact Attenuation Tests, 2006
Ambient Conditioned **Novelty** Helmets

	Brand	Model	Size	Peak Acceleration (g)
1	Frenchy's Helmets, Inc.	Dante II	L	989
2	The Helmet Source	German	L	989
3	Hot Leathers	Hawk	M	984
4	Helmets R Us	Smokey	M	988
5	Iron Braid	ACC Polo	M/L	636
6	Helmets Etc.	Super Eagle	S	981
7	Barney's Leather	100EZ Rider	S	992
	Average			937

Note: accelerometers for this type of tests were unable to accurately measure peak acceleration approaching 1000 g. The actual g measures in upper 900 g most likely were higher than indicated.

APPENDIX B. REVISED VALUE OF STATISTICAL LIFE AND ITS IMPACT ON REGULATORY ANALYSIS

This Appendix discusses the new 2013 U.S. DOT guideline on the value of statistical life (VSL) and its impact on the regulatory analysis. Effective in February 2013 the Office of the Secretary for the U.S. DOT issued revised guidance on the treatment of VSL in regulatory analyses. The new guidance establishes a VSL of $9.1 million for analyses based on 2012 economics, $8.98 for analyses based on 2011 economics, and $8.86 million for analyses based on 2010 economics.[68] The guidance further requires that the VSL be adjusted to reflect real increases in VSL that are likely to occur in the future as consumers become economically better off, in real terms, over time. The basis for this adjustment is projected real earnings increases from the Congressional Budget Office. These projected earnings indicate an annual average real increase of 1.07 percent (=0.0107). In other words, the real VSL grows at a rate of 1.07 percent annually, which means the previous year's VSL should be increased by a factor of 1.0107 (= 1 + 0.0107) annually. The resulting VSL represents the real VSL in base year economics. The process of deriving VSL at a specific year over the base year (i.e., 2010, 2011, or 2012) thus can be represented by the following mathematical formula:

$$VSL_n = VSL_{y0} * 1.0107^{(n-y0)} \quad \text{---------- (1)}$$

Where, VSL_n = VSL at year n in the base year economics, $n \geq {}^{y}{}_{0}$

VSL_{y0} = the base VSL value

y0 = the base year (i.e., 2010, 2011, or 2012).

[68] Please see a 2013 Office of the Secretary memorandum on the "Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses." http://www.dot.gov/regulations/economic-values-used-in-analysis.

For example, if 2012 VSL value is used, y0 = 2012 and VSL_{y0} = $9.10 million. Therefore, VSL_{2016} = $9.50 million [= $9.1*1.0107^{(2016-2012)}$]. Table B-1 shows the adjusted VSL from 2016 to 2025 by three economics.

Table B-1
Adjusted VSL values for 2016 to 2025 by Three Economics

	Economic Base (Million)		
Model Year	2012 $ ($9.10 Million)	2011 $ ($8.98 Million)	2010 $ ($8.86 Million)
2016	$9.4958	$9.4708	$9.4442
2017	$9.5974	$9.5722	$9.5453
2018	$9.7001	$9.6746	$9.6474
2019	$9.8039	$9.7781	$9.7507
2020	$9.9088	$9.8827	$9.8550
2021	$10.0148	$9.9885	$9.9604
2022	$10.1219	$10.0953	$10.0670
2023	$10.2303	$10.2034	$10.1747
2024	$10.3397	$10.3125	$10.2836
2025	$10.4504	$10.4229	$10.3936

VSL Savings

To reflect these changes in the benefit assessment process, VSL should be brought forward from the base year to the year when the proposed rule will be fully effective and to the subsequent year over that fleets potential lifetime (10 year for motorcycle helmets, 30 years for passenger cars and 37 years for LTVs, etc.) using Formula 1. Each year's VSL is then applied to the corresponding discounted benefits that occur in the same year. The result reflects the present value (i.e., base year) of the benefits for that year. The total benefits accumulating over the vehicles life represents the present value of safety benefits for that model year's fleet. This process is illustrated for an example case in Table B-2 below, which assumes a 2012 economic basis, a model year lifetime safety benefit of 100 fatalities for a lifetime of 10 years, and a 2016

effective date. In this table, the "Adjusted VSL" was computed by raising the 2012 VSL to that specific model year. Weighted Exposure is the product of Survival Probability and Exposure (VMT). Weighted Exposure Proportion is the portion of total Weighted Exposure that occurs in each specific year. The Raw Discount factor is the mid-year discount factor and the Exposure-Weighted Factor is the product of Weighted-Exposure Proportion and the Raw Discount Factor. The Discounted lives saved is the product of Exposure-Weighted Discount Factor and the 100 lives saved over the models lifetime and the Value of Lives Saved is discounted lives saved multiplied by the Adjusted VSL.

Table B-2
Example for Deriving Discounted Injury Benefits and Associated VSL Saving
(**3%** Discount Rate, 2012 Dollars)

						Discount Factor (3%)		Discounted Injury Benefits		
Model Year	Age	Survival Probability	Exposure (VMT)	Weighted Exposure (VMT) (a)	Weighted Exposure Proportion (b)	Raw (c)	Exposure-Weighted (d)	Lives Saved (e)	Adjusted VSL (million) (f)	Value of Lives Saved (million) (g)
2016	1	1	1	1	0.1429	0.9853	0.1408	14.0800	9.4958	133.7009
2017	2	1	1	1	0.1429	0.9566	0.1367	13.6700	9.5974	131.1965
2018	3	1	1	1	0.1429	0.9288	0.1327	13.2700	9.7001	128.7203
2019	4	1	1	1	0.1429	0.9017	0.1289	12.8900	9.8039	126.3723
2020	5	1	1	1	0.1429	0.8755	0.1251	12.5100	9.9088	123.9591
2021	6	0.8	1	0.8	0.1143	0.8500	0.0972	9.7200	10.0148	97.3439
2022	7	0.6	1	0.6	0.0857	0.8252	0.0707	7.0700	10.1219	71.5618
2023	8	0.4	1	0.4	0.0571	0.8012	0.0457	4.5700	10.2303	46.7525
2024	9	0.2	1	0.2	0.0286	0.7778	0.0222	2.2200	10.3397	22.9541
2025	10	0	0	0	0	0.7552	0.0000	0.0000	10.4504	0.0000
Total							0.9000	90.000		882.5614

a = Survival Probability * Exposure; b = $\frac{b}{\sum a}$; c = $\frac{1}{(1+3\%)^{age-0.5}}$; d = b*c; e = 100*d

f = \$9.1 * $1.0107^{(\text{Model Year}-2012)}$; g = f*e

As shown in Table B-2, the calculation of discounted lives saved (i.e., injury benefit) is not impacted by the 2013 guideline. The discounted total injury benefit thus can still be derived by applying a discount factor to the undiscounted total injury benefit as done in prior regulatory analysis. The discount factor is the cumulative exposure-weighted discount factor (i.e., 0.90 as show in the "Total" row) and can be mathematically presented as:

$$d_{injury} = \sum_{j=1}^{n} d_j,$$

Where, d_{injury} = discount factor for injury benefit

j = age of motorcycle helmets (or vehicle)

n = the lifespan of motorcycle helmets (or vehicles), and

d_j = exposure-weighted discount factor at age j.

The process of deriving d_j is well established in prior regulatory analyses thus it is not further explained in this Appendix. The discounted total VSL value for fatalities at a discount rate can be mathematically noted as:

$$VSL_T = \sum_{j=1}^{n} VSL_j * B * d_j --- (2)$$

Where, VSL_T = the total VSL saving (i.e., $882.56 million in the given example)

VSL_j = adjusted VSL at motorcycle helmet age j (or vehicle age j)

B = undiscounted fatal benefit (i.e., 100 lives saved in the given example)

d_j = exposure-weighted discount factor at age j

j = motorcycle age (or vehicle age)

n = lifespan of motorcycle helmets (or vehicle age).

As we understand the process of adjusting VSL, for given a starting year and the subsequent years of VSLs can be calculated as:

$VSL_1 = VSL_1 * 1.0107^0$ (starting VSL)

$VSL_2 = VSL_1 * 1.0107$

$VSL_3 = VSL_2 * 1.0107 = VSL_1 * 1.0107^2$

.
.
.

$VSL_j = VSL_1 * 1.0107^{(j-1)}$

Substituting $VSL_1 * 1.0107^{(j-1)}$ for VSL_j in Formula 2, the formula then can be transformed to:

$$VSL_T = \sum_{j=1}^{n} VSL_j * B * d_j$$

$$= \sum_{j=1}^{n} VSL_1 * 1.0107^{j-1} * B * d_j$$

$$= B * VSL_1 \sum_{j=1}^{n} 1.0107^{j-1} * d_j \quad -----(3)$$

The transformation shows that the discounted total VSL savings can be derived by applying a discount factor, i.e., $\sum_{j=1}^{n} 1.0107^{j-1} * d_j$ to the starting VSL_1. Let's call this modified discount factor d_{VSL}. This modified discount factor thus associates for both normal discounting and real growth in the U.S. The value of $VSL_1 * d_{VSL}$ can be considered as the VSL savings per live saved over the lifetime of the vehicle fleet. Using d_{VSL} simplifies the VSL discounting calculation. Since d_{VSL} (as well as d_{Injury}) is independent of the starting model year and the base economic year, the same d_{VSL} is able to apply to any rules with the same regulatory applicability (e.g., rules

applicable to passenger vehicles only). This would reduce the computational workloads when the effective date is changed or when the what-if analysis is commended. Change only needs to be made to reflect the effective date and economic base is the starting VSL, i.e., VSL_1. For example, if the fully effective data moves to 2017 for the given example, VSL_1 would be the 2017 SVL value which is \$9.60 million (= \$9.1 million * $1.0107^{(2017-2012)}$) in 2012 economics.

Table B-3 illustrates the process of deriving $d_{VSL.}$ As shown in Table B-3, at a 3 percent discount rate, d_{VSL}= 0.9295. The total discounted VSL savings for the given example thus is \$882.6 million (= 100* \$9.4958 million * 0.9295). The discrepancy between this savings and that shown in Table B-2 is due to rounding. Note that the numbers shown in the "1.0107 factor" column are 1.0107 to the (j-1) exponential. At each age j, the discount factor for VSL is the product of the 1.0107 factor and the injury benefit discount factor. The total cumulative VSL factor is the sum of individual exposure-weighted discount factors over the lifespan of motorcycle helmets.

Table B-3
Deriving Discount Factors for VSL Benefits
(**3%** Discount Rate)

						Discount Factor (3%)	Discount Factor For Benefit (3%)		Discount Factor For VSL Value (3%)
Model Year	Age	Survival Probability	Exposure (VMT)	Weighted Exposure (VMT) (a)	Weighted Exposure Proportion (b)	Raw (c)	Exposure-Weighted (d)	1.0107 Factor (e)	Exposure-Weighted (f)
2016	1	1.0	1.0	1.0	0.1429	0.9853	0.1408	1.0000	0.1408
2017	2	1.0	1.0	1.0	0.1429	0.9566	0.1367	1.0107	0.1382
2018	3	1.0	1.0	1.0	0.1429	0.9288	0.1327	1.0215	0.1356
2019	4	1.0	1.0	1.0	0.1429	0.9017	0.1289	1.0324	0.1331
2020	5	1.0	1.0	1.0	0.1429	0.8755	0.1251	1.0435	0.1305
2021	6	0.8	1.0	0.8	0.1143	0.8500	0.0972	1.0547	0.1025
2022	7	0.6	1.0	0.6	0.0857	0.8252	0.0707	1.0659	0.0754
2023	8	0.4	1.0	0.4	0.0571	0.8012	0.0457	1.0773	0.0492
2024	9	0.2	1.0	0.2	0.0286	0.7778	0.0222	1.0889	0.0242
2025	10	0.0	0.0	0.0	0.0000	0.7552	0.0000	1.1005	0.0000
Total							**0.9000**		**0.9295**

a = Survival Probability * Exposure; b = $\frac{b}{\sum a}$; c = $\frac{1}{(1+3\%)^{age-0.5}}$; d = b*c; e = 1.0107^{age-1}; f = d*e

Table B-4 shows the process of deriving d_{injury} and d_{VSL} for a 7 percent discount rate. As shown, at a 7 discount rate, d_{injury} = 0.7906 and d_{VSL} = 0.8149. Therefore, at a 7 percent discount rate, the given example would save 79 (= 100 * 0.7906) lives and the equivalent VSL savings of $773.8 million (= 100 * $9.4958 million * 0.8149). The discounted VSL benefit per live saved would be $7.738 million (= $9.4958 million * 0.8149).

Table B-4
Deriving Discount Factors for VSL Benefits
(**7%** Discount Rate)

						Discount Factor (7%)	Discount Factor For Benefit (7%)		Discount Factor For VSL Value (7%)
Model Year	Age	Survival Probability	Exposure (VMT)	Weighted Exposure (VMT) (a)	Weighted Exposure Proportion (b)	Raw (c)	Exposure-Weighted (d)	1.0107 Factor (e)	Exposure-Weighted (f)
2016	1	1.0	1.0	1.0	0.1429	0.9667	0.1381	1.0000	0.1381
2017	2	1.0	1.0	1.0	0.1429	0.9035	0.1291	1.0107	0.1305
2018	3	1.0	1.0	1.0	0.1429	0.8444	0.1207	1.0215	0.1233
2019	4	1.0	1.0	1.0	0.1429	0.7891	0.1128	1.0324	0.1165
2020	5	1.0	1.0	1.0	0.1429	0.7375	0.1054	1.0435	0.1100
2021	6	0.8	1.0	0.8	0.1143	0.6893	0.0788	1.0547	0.0831
2022	7	0.6	1.0	0.6	0.0857	0.6442	0.0552	1.0659	0.0588
2023	8	0.4	1.0	0.4	0.0571	0.6020	0.0344	1.0773	0.0371
2024	9	0.2	1.0	0.2	0.0286	0.5626	0.0161	1.0889	0.0175
2025	10	0.0	0.0	0.0	0.0000	0.5258	0.0000	1.1005	0.0000
Total							**0.7906**		**0.8149**

a = Survival Probability * Exposure; b = $\frac{b}{\sum a}$; c = $\frac{1}{(1+7\%)^{age-0.5}}$; d = b*c; e = 1.0107^{age-1}; f = d*e

The total VSL savings of a rule should also include the savings from reducing non-fatal injuries. The VSL savings for non-fatal injuries would be derived using the same process. Therefore, the generalized Formula for the total discounted VSL savings (i.e., the expansion of Formula 3) that includes both MAIS injuries and fatalities is:

$$VSL_T = \sum_{k=1}^{6} B_k * VSL_{1,k} * d_{VSL} \quad ------(4)$$

Where, VSL_T = total discounted VSL benefit

B_k = undiscounted MAIS k injury benefit with k=6 as fatal injuries

$VSL_{1,k}$ = starting VSL value for MAIS k level

d_{VSL} = discount factor for VSL.

Societal Economic Benefits

Societal economic benefits include savings from medical care, emergency services, insurance administration, workplace costs, legal costs, property damage and travel delay, as well as lost productivity. These savings are also a part of regulatory benefits. The 2012 value of the societal economic components are shown in Table B-5. After tax lost productivity and household productivity are excluded since these are considered to be inherently already included in VSL estimates. After-tax market productivity is inherent to VSLs because it determines the individual's valuation of their potential material consumption. Household productivity is inherent to VSLs because it is a routine activity that is part of life experience. Both aspects are potentially threatened by behaviors that increase risk, and are thus inherently already reflected in the VSL. Therefore, the societal economic savings as categorized here and VSL savings are mutually exclusive portions of the total benefits.

Table B-5
Economic Unit Costs (2012 Dollars)

	MAIS1	MAIS2	MAIS3	MAIS4	MAIS5	Fatal
Medical	$3,687	$24,203	$72,020	$203,390	$514,968	$34,224
EMS	$128	$279	$485	$1,093	$1,122	$1,097
Market Prod	$308	$4,403	$12,578	$18,737	$77,224	$104,800
Household Prod	$0	$0	$0	$0	$0	$0
Ins. Adm.	$976	$9,099	$24,881	$42,584	$89,812	$48,885
Workplace	$355	$2,750	$6,007	$6,615	$11,535	$12,254
Legal	$198	$6,559	$20,819	$44,361	$105,166	$134,510
Crashworthiness Subtotal	$5,652	$47,293	$136,790	$316,780	$799,827	$335,770
Travel Delay	$1,094	$1,192	$1,324	$1,407	$12,882	$12,882
Property Damage	$5,063	$5,207	$8,954	$12,949	$12,439	$13,529
Crash Avoidance Total	$11,809	$53,692	$147,068	$331,136	$825,148	$362,181

Note that these values were revised from their 2010 values that were initially developed to respond the new 2013 VSL guideline[69] by applying the Gross Domestic Product Inflator (as of March 28, 2013) of 1.040 (= 115.388/111.002). Values listed on the "Crashworthiness Total" line are primarily associated with bodily injury and should apply to regulatory savings for Crashworthiness standards. Crashworthiness standards generally would prevent injuries in the event of a crash but these standards do not prevent the crash itself. Therefore, property damage and travel delay costs are excluded. Values listed on the "Crash Avoidance" line should apply to Crash Avoidance standards (i.e., those that help prevent the crash from occurring in the first place). These costs include property damage and travel delay in addition to the bodily injury related costs (i.e., crashworthiness total).

Societal economic benefits are computed by multiplying the per-unit economic costs per injury for each injury severity level times the number of injuries of each severity prevented by the rule. As with VSL benefit, societal economic benefits occur over the fleet's lifetime, and are assumed to occur in proportion to exposure. These benefits should thus be discounted to present value. Since these costs are not subjected to the progressive increase adjustment factor that was required for VSL, the discounting process for societal economic benefits is identical to that for injury benefits. Thus, the discounted societal economic benefit, therefore, can be noted as:

[69] Economic Unit Costs in 2010 dollars.

	MAIS 1	MAIS 2	MAIS 3	MAIS 4	MAIS 5	Fatal
Medical	$3,545	$23,272	$69,250	$195,567	$495,162	$32,908
EMS	$123	$268	$466	$1,051	$1,079	$1,055
Market Prod	$296	$4,234	$12,094	$18,016	$74,254	$100,769
Household Prod	$0	$0	$0	$0	$0	$0
Ins. Adm.	$938	$8,749	$23,924	$40,946	$86,358	$47,005
Workplace	$341	$2,644	$5,776	$6,361	$11,091	$11,783
Legal	$190	$6,307	$20,018	$42,655	$101,121	$129,337
Crashworthiness Total	**$5,433**	**$45,474**	**$131,528**	**$304,596**	**$769,065**	**$322,857**
Travel Delay	$1,052	$1,146	$1,273	$1,353	$12,387	$12,387
Property Damage	$4,868	$5,007	$8,610	$12,451	$11,961	$13,009
Crash Avoidance Total	**$11,353**	**$51,627**	**$141,411**	**$318,400**	**$793,413**	**$348,253**

$$BE = (\sum_{k=1}^{6} B_k * U_k) d_{Injury} - - - -(5)$$

Where, BE = discounted societal economic benefit

B_k = undiscounted MAIS k injury benefit with k=6 as fatal injuries

U_k = the combined societal unit cost components for MAIS k injuries, i.e., crashworthiness subtotal (or crash avoidance subtotal)

d_{Injury} = the discount factor for injury benefit as described previously

Net Cost

Based on the 2013 DOT guideline, the societal economic benefits would be subtracted from the regulatory cost to determine the net cost of a rule. Therefore, the net cost can be noted mathematically as:

$$C_N = C_g - \left(\sum_{k=1}^{6} B_k * U_k\right) d_{Injury} - - - - - -(6)$$

Where, C_N = Net Cost of a regulation

C_g = regulation cost

B_k = undiscounted MAIS k injury benefit with k=6 as fatal injuries

U_k = the combined societal unit cost for MAIS k injuries

d_{Injury} = the discount factor for injury benefit.

Fatality Equivalents

Cost-effectiveness analysis requires that nonfatal injuries be converted as fatality equivalents. This involves dividing the value of each injury severity category by the value of a

fatality to determine how many injuries equal a fatality. Previously, the basis for this valuation was comprehensive costs of each severity level. Because VSL is now treated separately instead of as an overall comprehensive value, relative injury factors should also be based on factors that reflect the VSL rather than comprehensive costs. These factors are listed in Table B-6 below.

Table B-6
Relative Injury Factor

	MAIS 1	MAIS 2	MAIS 3	MAIS 4	MAIS 5	Fatality
Factor	0.0030	0.0470	0.1050	0.2660	0.5930	1.000

The total number of undiscounted fatality equivalents is the sum of the all converted fatality equivalents and can be represented as:

$$FE = \sum_{k=1}^{6} B_k * f_k$$

Where, FE = total fatality equivalents

B_k = undiscounted MAIS k injury benefit with k=6 as fatalities

f_k = relative injury factor for MAIS k.

The relative injury factor f_k were based on the VSL value. These factors thus can be considered as the injury portion of VSL. Therefore, the total discounted VSL benefit (Formula 4) can alternatively be noted as:

$$VSL_T = \sum_{k=1}^{6} B_k * VSL_{1,k} * d_{VSL}$$

$$= \sum_{k=1}^{6} B_k * VSL_1 * f_k * d_{VSL}$$

$$= VSL_1 * d_{VSL} \sum_{k=1}^{6} B_k * f_k$$

$$= \mathrm{VSL_1} * \mathrm{d_{VSL}} * \mathrm{FE} - - - - - - - - - - (7)$$

Where, VSL_T = total discounted VSL benefit

B_k = undiscounted MAIS k injury benefit with k=6 as fatal injuries

$VSL_{1,k}$ = starting VSL value for MAIS k level

VSL_1 = starting VSL value for a fatality

d_{VSL} = discount factor for VSL

f_k = relative injury factor for MAIS k

FE = total undiscounted fatal equivalents.

Note that the relative injury ratios and fatal equivalents cannot be used for deriving the societal economic savings since these ratios do not reflect the proportion of the societal economic costs for MAIS injuries.

After subtracting the monetary value of economic benefits, the net cost per equivalent life saved is calculated by dividing the net costs calculated above by the discounted value of equivalent fatalities prevented. When judging the result, the value to be used would be the calculated VSL per live saved over the lifetime of the vehicle fleet, i.e., the value of VSL_1*d_{VSL}.

Pre-2013 DOT VSL guidelines and Corresponding Regulatory Analysis

Regulatory analyses corresponding to a pre-2013 DOT value of a statistical life (VSL) guideline used the comprehensive costs to estimate the benefit of a rule. Before 2007, the comprehensive costs were derived using a guideline on a VSL of $3.0 million. In 2007, the DOT revised this guideline and raised the VSL from $3.0 million to $5.8 million. In 2009, the DOT revised the VSL again to $6.0 million. VSL includes QALYs, household productivity, and the after-tax portion of market productivity. The increase of VSL to $6.0 million reflected a re-examination of the literature on VSL. The QALYs for MAIS injuries were adjusted further to reflect the revised QALYs within VSL but the relative injury-to-fatal ratios of QALYs were maintained as estimated in the 2000 report. Table B-7 shows the adjusted unit cost estimates in 2009 values by cost items. As shown, the revised comprehensive cost for a fatality was estimated to be $6.34 million for crash avoidance countermeasures and $6.32 million for crashworthiness countermeasure. The QALYs for a fatality was estimated to be $5.1 million. QALYs for MAIS injuries were derived by applying QALY injury-to-fatal ratios published in the 2000 report to the $5.1 million. The relative injury/fatal ratios under "comprehensive cost" were used to derive fatal equivalents for benefits accrued from crash avoidance countermeasures and ratios under "injury comprehensive cost" were used for crashworthiness countermeasures. The total undiscounted regulatory benefit therefore was the multiplication of the "comprehensive cost" for a fatality and total number of fatal equivalents. The undiscounted benefits was then discounted to present value by a factor, i.e., d_{Injury} as described previously.

Table B-7
Unit Costs Reflecting the 2009 DOT Guideline on
Value of a Statistical Life (VSL) of $6.0 Million
(2009 dollars)

CPI	Cost Item	MAIS 1	MAIS 2	MAIS 3	MAIS 4	MAIS 5	Fatal
1.0317	Medical	$3,427	$22,504	$66,964	$189,111	$478,816	$31,822
0.9964	EMS	$121	$264	$458	$1,034	$1,061	$1,038
1.0146	Market Productivity	$2,324	$33,246	$94,959	$141,452	$583,016	$791,199
1.0146	Household Productivity	$760	$9,730	$28,007	$37,222	$198,423	$254,548
0.9964	Insurance Admin.	$923	$8,607	$23,538	$40,285	$84,964	$46,246
1.0146	Workplace Cost	$335	$2,595	$5,670	$6,243	$10,886	$11,565
0.9964	Legal Costs	$187	$6,206	$19,695	$41,967	$99,490	$127,250
1.0146	Travel Delay	$1,033	$1,124	$1,249	$1,327	$12,157	$12,157
0.9964	Property Damage	$4,789	$4,926	$8,471	$12,250	$11,768	$12,798
	QALYs	$9,423	$192,756	$270,949	$810,994	$2,763,979	$5,053,153
Revised Comprehensive Costs		$23,321	$281,958	$519,960	$1,281,886	$4,244,560	$6,341,776
Injury Subtotal*		$17,500	$275,908	$510,240	$1,268,308	$4,220,635	$6,316,821
Relative Injury-To-Fatal Ratios							
QALYs		0.0019	0.0381	0.0536	0.1605	0.5470	1.0000
Comprehensive Cost		0.0037	0.0445	0.0820	0.2021	0.6693	1.0000
Injury Comprehensive Cost*		0.0028	0.0437	0.0808	0.2008	0.6682	1.0000

QALYs: Quality-Adjusted Life Years
* Excluding travel delay and property damage and specifically used for crashworthiness countermeasures