

How NHTSA Would Analyze the Costs and Benefits of Fire Safety

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ABSTRACT

The objective of this paper is to describe the general methodology used by NHTSA to perform cost-effectiveness analyses and cost-benefit analyses. This general method will then be directed towards how one could analyze fire countermeasures, providing two analyses as examples. First, for crash related fires, NHTSA's 2003 analysis on fuel tank integrity will be used. Second, for non-crash related fires, NHTSA's 2001 analysis of radiator caps will be used. The paper will describe what data sources were used to determine the target population, the severity of injuries, the costs of burns by injury severity, the cost of the fire countermeasures, etc. While not analyzing any specific fire countermeasure, the methodology will be described in enough detail that others could potentially follow the methodology and make estimates for their own purposes.

INTRODUCTION

COST-EFFECTIVENESS ANALYSES AND COST-BENEFIT ANALYSES

The general method NHTSA uses to conduct cost-effectiveness analyses and cost benefit analyses for rulemaking can be summarized by answering the following questions:

- 1) What types of vehicles will the rulemaking be applicable to (passenger cars, light trucks, heavy trucks, motorcycles, or what)?
- 2) How many fatalities, injuries, crashes or property damage incidents occur that relate to the rulemaking? A target population for the particular rulemaking is estimated from NHTSA's crash files or other sources. How this target population is focused depends upon the problem, the countermeasures, and sometimes the effectiveness estimates.
- 3) What are the countermeasures that can mitigate the problem? NHTSA must show that there is at least one countermeasure that can save lives, or

reduce injuries or crashes or property damage, that is cost effective before it can regulate.

- 4) What are the benefits of the alternative countermeasures? The effectiveness of the countermeasures must be developed or estimated and applied to the target population to determine the potential benefits. Effectiveness might be estimated from crash data of countermeasures already on the road, by a test fleet of research vehicles, by research testing, by theory and engineering analysis, etc.
- 5) What are the disbenefits of the alternative countermeasures? Some countermeasures can lead to an increase in injuries in other crash modes.
- 6) What are the costs of the alternative countermeasures? These are developed on a per countermeasure basis, per vehicle basis, and on a total cost basis (multiplying the cost per vehicle times the number of vehicles that currently don't comply). NHTSA determines the incremental cost for that countermeasure. If the countermeasure adds weight to a vehicle, the fuel costs over the lifetime of the vehicle are discounted back to present value so that they can be added to initial vehicle costs.
- 7) What is the net cost per equivalent life saved? For this calculation, net costs are total costs minus monetized savings (for example if the rule reduced property damage). To determine equivalent lives saved, non-fatal injuries are converted to equivalent fatalities using comprehensive values for different injury severity levels. Comprehensive values include both economic impacts (e.g., medical costs) and lost quality of life considerations. Since the benefits of safety rulemakings take place when a crash occurs (or is avoided), these benefits are discounted over the lifetime of the vehicle types in question at a 3 percent and 7 percent discount rate.
- 8) What are the monetized net benefits or net costs? In valuing reductions in premature fatalities, NHTSA uses a value of \$3.7 million per statistical life (in 2004 dollars). The number of discounted equivalent lives saved is

multiplied by \$3.7 million and compared to total incremental costs.

- 9) Typically, if the cost per equivalent life saved is less than the value of a statistical life, a final rule is issued. But cost per equivalent life saved is one only of the factors considered in determining whether to proceed with a rulemaking.

CRASH AND INJURY RELATED

Fuel Tank Integrity Final Rule:

In December 2003, the agency issued a final rule requiring a new rear impact test (a 50 mph rear impact offset test using a moving deformable barrier) for passenger vehicles under 10,000 pounds GVWR (passenger cars, pickups, SUVs and vans). The analysis accompanying that final rule estimated the following:

Target Population:

Over the past 11 years passenger vehicles averaged 1,279 fires annually in fatal crashes, based on FARS (Fatality Analysis Reporting System). This involves all types of crashes, including passenger vehicles struck by other types of vehicles. In addition, there are an estimated 4,000 passenger vehicle crashes involved in injury crashes with fire and over 5,000 property-damage-only passenger vehicles with fire (based on 2001 NASS-GES). However, examining only multi-vehicle crashes like our test procedure, where a passenger vehicle catches on fire after being struck in the rear by another passenger vehicle, and using estimates of the percent of the time in which the fire (rather than the trauma of the crash) was the cause of death or injury (using FARS and NASS-CDS data), there are 58 fatalities and 119 non-fatal injuries annually in the target population. The non-fatal burn injuries were mostly minor and were typically not the maximum injury to the occupant. Therefore, they were not included in the benefits analysis. The agency examined a number of fatal crashes to determine what percent of the 58 fatalities were like our test set-up in severity and further refined the target population to 16 to 28 fatalities.

Benefits:

Vehicles that pass the Final Rule rear impact requirements will provide protection against crashes in which the impact produces a 39 to 50 percent higher delta V (which corresponds to 110 percent more energy being dissipated in the crash) compared to the current requirements. Effectiveness for this specific test and target population, based on engineering judgment, was estimated to be 50 to 75 percent. Benefits are estimated to range from 8 to 21 lives saved annually, once all vehicles on-the-road meet the final rule.

Costs:

The countermeasures examined included changes to the fuel tank guard and to the fuel filler neck. Based on a contractor's cost tear-down study of these changes, the average costs for vehicles which would need corrective action is \$5.31 per vehicle (in 2002 dollars). Based on an estimate of 46 percent of the fleet not meeting the new final rule currently, when spread out over the entire fleet, costs are estimated to be \$2.45 per vehicle ($\$5.31 \times .46 = \$2.45$). Total costs for the new vehicle fleet sales for passenger cars and light trucks of 16.8 million vehicles are estimated to be \$41 million annually ($16.8 \text{ million} \times \$2.45 = \$41 \text{ million}$).

Cost-Effectiveness:

\$1.96 to \$5.13 million per life saved ($\$41 \text{ million} / 8 \text{ lives} = \$5.13 \text{ million/life}$ and $\$41 \text{ million} / 21 \text{ lives} = \$1.96 \text{ million/life}$). NHTSA decided to issue the final rule even though there was some uncertainty about whether the cost per equivalent life saved exceeded the value of a statistical life.

NON-CRASH, INJURY RELATED

Radiator Caps:

In 2001, NHTSA issued a Notice of Proposed Rulemaking on radiator caps. A Preliminary Regulatory Evaluation was written, which focused on scalding injuries from steam from the radiators, after a radiator cap was opened. These weren't burns, but a similar methodology would apply to scalding injuries as to burns.

Target Population:

In order to estimate the target population for these non-crash events, the agency went to the National Electronic Injury Surveillance System (NEISS), run by the Consumer Product Safety Commission, which collects consumer product related injury data in a national probability survey of hospital emergency departments, encompassing 91 of the 6,127 hospitals across the United States. An estimated 29,759 radiator scaldings occurred per year in the mid-1990s. The NEISS data could be broken down between minor, moderate, and serious burns and whether the patients were treated and released or hospitalized. In addition, data were collected from two hospital trauma centers, John's Hopkins in Baltimore, Maryland and the University of California San Diego Regional Burn Center. These trauma centers keep data detailed enough to identify radiator cap scalding injuries, length of stay and hospital charges, among other pieces of information. Combining information from the trauma centers and the Consumer Product Safety Commission Injury Cost Model, cost estimates were made for different levels of injuries from burns. These cost estimates included medical costs, work days lost, pain and suffering, and legal and public costs.