

The CAFE Standards and Safety:

Response to Question One of the NHTSA Request for Comments

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1 May 2002

The discussion of the CAFE standards and adverse safety effects should not diminish the ultimate goal of improved fuel economies. In response to question one of the National Highway Traffic Safety Administration request for public comments, revised CAFE standards should not simply be expressed in terms of a miles per gallon number. Instead, the standards should indicate how Americans want these fuel economy standards to be met in terms of weight reduction and new technologies. In this filing I will argue that the complexities of the safety issue are not well understood. However, there is evidence that vehicle weight plays a role in the severity of vehicle crashes. Weight reduction of the heaviest vehicles should be used in the short-term to accomplish more strict fuel economy standards while new technologies are being developed.

As the NHTSA assesses revisions to the CAFE standards, there has been significant discussion of the impact that the CAFE standards have had on public safety. The public, understandably, is concerned about recent findings that the CAFE standards have led to a decline in vehicle safety. In 1992 the National Research Council published a report which concluded that weight reduction, encouraged by the CAFE standards, contributed to an additional 2,000 fatalities annually. Some political pundits have touted this finding as damning evidence that the CAFE standards should be revoked. In the “Fact and Comment” section of his magazine, Steve Forbes stated: “A panel at the National Academy of Sciences concluded that the original CAFE requirements had contributed to as many as 2,6000 traffic deaths in a single year.” [1] This statement is not only misleading, but also it indicates that there is a common misconception about the relationship between the CAFE standards and safety. The CAFE standards mandated a number for the fuel economy of car and light truck fleets, but these regulations did not specify

how manufacturers would achieve those numbers. Auto manufacturers had many options; they chose weight reduction, which in turn may have contributed to those additional deaths.

1. Safety is not a well-understood issue.

Vehicle safety is a complex issue, and researchers only recently are taking important steps to understand this complexity. The discussion of the CAFE standards and their impact on safety has revolved around the perceived effects of weight reduction on vehicle safety. This discussion is natural since auto manufacturers historically have met the CAFE standards through significant weight reduction of their lower-end vehicles. Current studies indicate that weight reduction has cost lives in vehicle crashes; the preponderance of this evidence cannot be dismissed.

Systems to keep automobile passengers safe on the road include, but are not limited to: the highway itself; signs and warnings; vehicle design; restraints and air bags; and driver education. The functioning and improvement of *all* these systems helps to minimize traffic injuries and fatalities. Notwithstanding the complexity of these systems and their interactions, researchers have attempted to identify what causes crashes and what determines crash severity. Driver behavior and environmental conditions play a major role in crash determination, which seems logical. [2] In their dissent on safety issues, Greene and Keller cite research that supports this claim. [3, p 117] Additionally, vehicle characteristics certainly affect crashes, but the exact relationship is difficult to isolate since certain vehicle characteristics are correlated with driver behavior. Research studies are only beginning to control for these complex relationships.

The findings of safety studies are not as straightforward as they are often portrayed to the general public. Researchers recognize the complex interactions that determine safety and

explicitly state that these relationships are not adequately understood right now. The 1992 National Research Council report concluded: “Although the data and analyses are not definitive, the Committee believes that there is likely to be a safety cost if downweighting is used to improve fuel economy (all else being equal).” [4] The safety conclusion drawn here is not entirely valid since the data and analyses are not definitive. There is evidence that weight reduction reduces safety while improving fuel economy, but this finding is certainly not definitive.

2. There is evidence that vehicle weight plays a role in the severity of vehicle crashes.

Historically CAFE standards have been met through weight reduction, and there is evidence that weight reduction has adverse safety effects. Most studies that consider the impact of CAFE standards on safety attempt to isolate the effect of weight reduction on safety. [5, 6] Considering the limitations of current safety studies, I do not argue that this evidence should be outright ignored; nor do I argue that it should be accepted with open arms. Considering the increasing amount of evidence, there is most likely a relationship between weight reduction and safety, but that relationship is not necessarily cause-and-effect. Simply because auto manufacturers have met CAFE standards with weight reduction, and weight reduction likely has an adverse effect on safety, it cannot be concluded that CAFE standards themselves have an adverse effect on safety.

3. Effects of vehicle weight may be confounded with other vehicle characteristics.

To take one documented example of the confounding variables in vehicle safety, consider the relationship between vehicle weight and vehicle size. Weight and size are related simply

because larger vehicles tend to weight more than smaller vehicles. Although this relationship is not universally true, it has been considered true for many purposes. The effects of vehicle weight alone are difficult to separate from size effects due to the high correlation between the two factors. Recognizing this problem, researchers have begun to control for the weight/size relationship. They have found that vehicle size may account for some of the adverse safety effects previously attributed to vehicle weight. The NAS committee, recognizing this problem, stated: “Despite this [weight/size] confounding, carefully controlled research has demonstrated that, given a crash, larger vehicles provide more occupant protection independent of mass.” [3, p 73] Vehicle size seems to play a part in determining the safety of vehicles. Thus, with due consideration to the changes in vehicle size, weight reduction could be achieved without sacrificing vehicle safety. Auto manufacturers then would have to consider the important vehicle dimensions, or crush space, in order to reduce the severity of vehicle crashes. Weight reduction outside the crush space could result in better fuel economies and safer vehicles.

4. Weight reduction in the short-term and new technologies in the long-term would allow automobile manufacturers to comply with more stringent CAFE standards.

Independent of the factors that determine the safety of vehicles, CAFE standards do not have to be met through weight reduction. According to chapter four of the NAS study: “It is technically feasible and potentially economical to improve fuel economy without reducing vehicle weight or size and, therefore, without significantly affecting the safety of motor vehicle travel.” [3, p 70] While I am not directly concerned with the technical feasibility of the alternative methods to achieve fuel economy, these alternatives could be reasonable, safe

solutions in the future, even if currently they are not economically viable. The fact that there are feasible future solutions should not be outweighed by economic infeasibility right now.

Although CAFE standards do not necessarily have to be met by weight reduction, auto manufacturers may try weight reduction since it has been the most cost effective measure so far. The NAS committee asked direct questions of auto manufacturer representatives concerning this issue. The committee concluded: “The extensive downweighting and downsizing that occurred after fuel economy requirements were established in the 1970s suggest that the likelihood of a similar response to further increases in fuel economy requirements must be considered seriously.” [3, p 70] Without proper regulations, the auto industry most likely would attempt to meet more stringent CAFE standards through additional weight reduction of their fleets. New CAFE standards must require auto manufacturers to comply without reducing weight among the lightest vehicles. Again quoting the NAS report: “The net societal impact of a change in the average mass of the light-duty vehicle fleet can be an increase, a decrease, or no change at all. The outcome depends on how that change in mass is distributed among the vehicles that make up the vehicle fleet.” [3, pp 71-2] With proper consideration to the change in weight distribution, fuel economy standards can be met through weight reduction without adverse safety effects.

What if manufacturers reduced weights of only the heaviest vehicles? The heaviest vehicles would then pose a reduced risk to lighter vehicles, and heavier vehicles would have greater fuel economy. Once the weight of a vehicle is above 3500 pounds, additional vehicle weight doesn't tend to provide additional safety. The fatality rate in a 4000, 4500, or 5000 lb vehicle is approximately the same as a 3500 lb vehicle for both single- and two-vehicle crashes. (See Figures 4-7 and 4-8 of NAS report.) Reducing the weights of the heaviest vehicles by 500 or 1000 lb would result in improved fuel economy without adverse safety consequences.

The effect of a two-vehicle crash on either vehicle is determined by the ratio of their weights, not by the absolute weights. If one vehicle is significantly heavier than another, the heavier vehicle will pose an increased risk to the occupants of the lighter car. Compare the differences in safety for the occupant of a 3000 lb vehicle that collides with a 4000 lb or 5000 lb vehicle. The 4000 lb vehicle will cause the 3000 lb vehicle to decelerate slower than the 5000 lb vehicle would have, thus posing a smaller safety threat. Relative vehicle weights affect safety, not actual weights. By discouraging heavier vehicles through policy changes, auto manufacturers can meet more stringent CAFE standards in the short-term through cost-effective weight reduction, while developing new technologies for the long-term.

5. CAFE standards are important and can be achieved without adverse safety effects.

The importance of improved fuel economy in the United States cannot be ignored. In the long term, environmental effects may prove devastating if we continue to spew greenhouse gases into the atmosphere. Both environmentally and economically, it makes sense to reduce our consumption of fossil fuels. Economic concerns are certainly more pressing in recent months, given the lack of political stability in the Middle East. One effective way to reduce our dependence on foreign oil is through improved fuel economy. Safety concerns should not completely stall, but caution, the move toward new, fuel-efficient vehicles. CAFE standards are clearly an important step in the right direction. We must, however, take that step without sacrificing lives.

Weight reduction is not the only way to achieve improved fuel economy. The NHTSA should encourage auto manufacturers to explore alternative technologies, while making it economically feasible to do so. If, as shown in the past, auto manufacturers must meet the

revised standards in a timely fashion through weight reduction, manufacturers don't have to cut the weights of their low-end cars again. Selective weight reduction could produce improved fuel economy without reduced safety. Regulations that require greater weight reduction of heavier vehicles would decrease the weight differential between the heaviest and lightest vehicles and thus improve fuel efficiency and safety.

References

- [1] Forbes, Steve. "Bloody Bad Idea." *Forbes Magazine* (1 April 2002): 27.
- [2] Yun, John M. "Offsetting Behavior Effects of the Corporate Average Fuel Economy Standards." *Economic Inquiry* 40, no. 2 (April 2002): 260-70.
- [3] National Research Council. *Effectiveness and Impact of Corporate Average Fuel Economy(CAFE)Standards*. Washington DC: National Academy Press, 2002.
- [4] National Research Council. *Automotive Fuel Economy: How Far Should We Go?* Washington DC: National Academy Press, 1992.
- [5] Evans, Leonard and Michael C. Frick. "Car Size of Car Mass: Which has Greater Influence on Fatality Risk?" *American Journal of Public Health*. 82 (1992): 1105-12.
- [6] Crandall, Robert W. and John D. Graham. "The Effect of Fuel Economy Standards on Automobile Safety." *Journal of Law and Economics*. 32 (1989): 97-119.