Draft

A Review of
The Traffic Safety Aspects
of
CUMULATIVE REGULATORY EFFECTS ON THE COST OF AUTOMOBILE TRANSPORTATION (RECAT)

Prepared for the
Insurance Institute for Highway Safety

by

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INTRODUCTION

The Final Report of the Ad Hoc Committee on the Cumulative Regulatory Effects on the Cost of Automotive Transportation (RECAT) was reviewed under the aspect of highway safety.

Due to the limited time available only the more obvious points could be discussed, and no analyses could be performed.

The review concentrated on the following points:

- The estimates of the price increase of passenger cars due to the Motor Vehicle Safety Standards.
- The analysis of the benefits offsetting the cost of the Motor Vehicle Safety Standards.
- The recommendation on how to deal with those standards where such an analysis could not be satisfactorily performed.

1. The Change of Automobile Prices Due to Safetv Features

The report states "The cumulative effects of recent legislative and regulatory action ... will increase the initial cost and operating expenses of passenger cars substantially." The legend of Table 1 reads "Estimated Average Increase in the Retail Price of an Automobile by 1976 Resulting from Compliance with Presently Planned Regulations Relative of Safety, Damage, Limiting Design, and Emission Control." Another statement is, "Thus, large added cost ... are to be imposed on automobile consumers."

These statements are misleading. If features costing a certain amount are required on new automobiles, it is not necessary and even unlikely that prices will go up by a corresponding amount.

How much automobile manufacturers will increase the cost of automobiles as a consequence of an increase in production cost depends on the market and competitive situation and is not easy to determine. However, even if they would share part of the added cost with the consumer, the total cost—in terms of resources used—would remain unchanged.

A more important aspect, however, is recognized in the report, stating: "The typical automobile buyer now spends several hundred dollars on optional "extras" for personal convenience. If these funds are pre-empted to pay for pollution control devices, the public may respond by buying either proportionally fewer cars or cheaper cars (i.e., "less car per car") while keeping the annual national expenditure on automobiles approximately constant." If this were the case, these buyers of automobiles would incur no monetary cost, though they would incur cost in terms of lowered convenience or less emotional satisfaction, which would be traded off against improved safety.

A similar effect, however, may also occur on the manufacturer's level. Even the basic models of cars contain certain decorative and other features, e.g., the annual model change, on which the buyer has no option. Their purpose is presumably to influence marginal buyers to buy at all or to buy a specific make or model, though they might be of little value to the average buyer (who does not refrain from buying

cars with these features because his consumer's surplus from a car is so great as to overcompensate the higher cost). Considering the imposed cost of safety features, it might be rational for manufacturers to eliminate some of these non-optional, non-essential features. In this case, no, or only a small increase in the price may result; the result would be a loss of non-functional utility to the marginal consumers, to whom these features were intended to appeal, and no loss, possibly a gain to other consumers.

These brief arguments can only illustrate that the cost of required safety features will not necessarily result in equal changes in prices.

An interesting observation can be made in Table D-13: pure price increases and quality changes were greatest in 1971 cars, when no cost changes occurred due to the Motor Vehicle Safety Standards or the Exhaust Emission Standards.

To realistically estimate the price increases in automobiles due to the actual cost of meeting the Motor Vehicle Safety Standards--in terms of resources consumed, and possible also other utilities foregone--a thorough understanding of the factors determining demand on the automobile market, and pricing and design policies of the manufacturers is required.

2. Cost Benefit Analyses

The report states correctly "A simple assessment of the cost of compliance with regulatory actions is not very useful since the cost may well be balanced or exceeded by the socially desirable goals that these actions are designed to achieve..." Therefore, cost benefit analyses of several Motor Vehicle Safety Standards were performed.

2.1 Cost

Though recognizing that DOT estimates of motor vehicle accident cost range as high as $46 billion annually, the report assumes total accident cost for 1970 to be $18.6 billion, derived from assuming the cost of a traffic-

fatality as $140,000, the cost of a personal injury as $2750 and the cost of a property damage involvement as $178. $5.2 billion insurance administrative cost was not included. Apparently not recognized were other costs(a very extensive list of cost factors of accident is given by Tilton*). Joksch and Wuedermann** estimate the traffic-accident related court and police cost to be nearly half a billion dollars in 1968. Therefore, one can assume an amount $6 billion higher than the $18.6 billion as a realistic low estimate, and even the DOT estimate of $46 billion does not appear unreasonable. Therefore, benefit estimates in the report should be increased by at least one/third and possibly more than doubled.

When discussing damage limiting bumpers, the report states: "if reduced insurance administrative cost are passed on to consumers, the bumper benefit will substantially exceed the cost." This is strange: from an overall point of view, which the report usually appears to take, it makes no difference whether savings in cost are passed on. On the other hand, if only the cost and benefits to the automobile user are to be counted, a much more complicated analysis would have to be performed, since many accidents cost are not cost to the victim (e.g. the medical cost paid for by an employer financed group insurance).

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* P.D. Tilton, A General Framework for Analysis of the Costs of Traffic, Home and Public-Accidents, Stanford Research Institute, October 1964.

** Comparative Estimates of Losses in Transportation Accidents, The Travelers Research Corporation, January 1970.

2.2 Cost Benefit Analyses of Early Safety Features

"Early" passenger car safety features are: interior padding, head restraints, collapsible steering columns, dual braking systems, lap belts and three-point harnesses. The final conclusion of the report is that there is a substantial margin of expected benefit over estimated cost for lap-belts (even assuming only 25% usage) and collapsible steering columns. They conclude that there is no significant margin of benefit over cost for the others.

If one considers the underestimation of benefits, which we discussed in the preceeding section, a substantial margin of benefits over cost would result.

An important refinement in estimating benefits, is made in Table II-2, where injuries are distinguished as "dangerous", "serious" and "not serious". However, it is not indicated how the loss figures for the three degrees of injury were obtained.

Collapsible Steering Column

The report relies on one source * for estimates of injury reductions due to the collapsible steering column, namely 8.76% of fatalities, 10.35% of dangerous injuries, 11.06% of serious injuries and 4.18% of not serious injuries. On the basis of all information available at that time, Joksch and Wuedermann** estimated that energy absorbing steering columns save 10% of vehicle occupant fatalities, with a range from 6 to 17%. Recent data by Levine and Campbell ***

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* L.B. Lave and W.E. Weber "A Benefit Cost Analysis of Auto Safety Features," Applied Economics 2, 1970, 265-275.

** Estimating the effects of crash Phase Injury Countermeasures, Contract F-11-7228 with the NHSB. The Travelers Research Corporation, March 1970.

*** Effectiveness of Lap Seat Belts and the Energy Absorbing Steering System in the Reduction of Injuries. Highway Safety Research Center, University of North Carolina, Chapel Hill, N.C., Nov. 1971.

indicate a 15% reduction in serious injury by the energy absorbing steering column, and about 7% reduction in all injuries. A more thorough analysis of the problem would have considered a reasonable range of potential injury reductions, rather than one estimate based on one single source. With the range estimated by us, one could have proceeded as follows: A low estimate would be obtained by assuming an only 6% reduction in fatal and dangerous injuries, a high estimate by assuming a 17% reduction in fatal, dangerous and serious injuries--in both cases we will assume no reduction in not serious injuries. Using RECAT's dollar benefits, we obtain total benefits in the pessimistic case of $40, and $141 in the optimistic cases. Assuming, as discussed above, actual benefits to be one/third higher than the RECAT estimates, net benefits--subtracting $22 for the energy absorbing steering column--are $31, or $158 respectively. In the pessimistic case, about 2000, in the optimistic case about 6000 lives will be saved. The result of this analysis could be expressed in the following way: an investment of $1,000,000 in energy absorbing steering columns will result in net benefits of $1,400,000 to $7,500,000 (including the economic values of lives lost) and save 2 to 6 fatalities (to highlight the non-economic aspect of lives saved).

Three-Point Harness

In this case, the report uses only one estimate of injury reductions, based on a Swedish study, though other estimates are discussed in Appendix II-C. This is especially critical, since the Swedish study considered only one make of car, Volvo, which is not comparable with the average American car. Joksch and Wuerdermann (loc. cit) also used Volvo data as basis for estimates, but utilizing corrollary information arrived at a most likely reduction of fatalities by 45%, with a range from 40 to 65%. Since the potential benefit estimates for three-point harnesses are extensively used in the later discussion of the air bag, a

more thorough analysis using a range would have been highly desirable.

Head Restraints

For an estimate of the effects of head restraints, RECAT relies on a European source that is not available to us. To our knowledge, no relevant American data were available at that time. Therefore, very careful consideration of the uncertainty of the estimate would have been desirable. We will illustrate how much the benefits estimates are off by using the results of a recent study. ** Neck injury claims in the first car in a rear end collision are reduced by 18% in cars with head restraints. Applying this to estimates of 1 to 1.2 million neck injuries, and comparing this with about 3.6 million automotive injuries (National Center for Health Statistics, Health Interview Survey), results in an estimate of about 5% injury savings. Even if we assume no reduction in fatalities, application of the 5% to all injuries results, using RECAT's loss data, in benefits of $21 per car lifetime versus the report's estimate of $9.36. If we adjust the benefits by adding one/third, $28 results. Obviously the conclusion of the report "With the others--...and head restraints--there is not a significant margin of benefits over costs" is not confirmed. Though this evaluation could be made only after the new data have become available, a less categorical statement should have been made, considering the extremely limited information used.

Dual Braking Systems

Dual braking systems are mainly a crash-preventing device (though they might also be injury reducing in some cases where they can not prevent a crash, but reduce its severity). Therefore, they not only reduce fatalities and injuries,

** Brian O'Neill, William Waddon, Albert B. Kelley, Automobile Head Restraints: Frequency of Neck Injury Insurance Claims in Relation to the Pressure of Head Restraints, American Journal of Public Health, Dec. 1971.

but also property damage. This is taken into account in the report.

As a pre-crash standard, they provide benefits not only to the purchaser, but also to others. This raises the question how cost-benefits analysis can be meaningfully applied in such a situation. There is no reason to assume that a device is not worthwhile if the savings of cost to others are less than the cost of it to the purchaser. How much more it could cost and still be considered worthwhile is a question of public-policy.

This difference is recognized by the custom that a victim of an accident can obtain monetary compensation for pain and suffering from another party at fault, but that it is not possible to insure oneself for compensation of one's own pain and suffering.

2.3 Cost Benefit Analyses of Proposed Safety Features

Occupant Restraints

Lap belts and shoulder harnesses with warning system, and with ignition interlock, and the air bag are discussed. U.S. and foreign experience on the use of lap and shoulder belts is discussed. On the effect of warning and interlock systems, only one very limited study was available. The results, however, have to be used with very great caution. Not only did the experiment last a mere 30 days, no actual observations of usage were made. Rather, the drivers were interviewed and responses "almost always", "more than half the time", "less than half the time" and "almost never" were translated into 95%, 65%, 35% and 5% respectively. The results, however, are reported as, e.g., 78.8%!

Though this problem is discussed in great detail, no systematic approach is used to estimate 1) what are the incremental cost and benefit of seat belts with warning system over existing systems as currently used, 2) what are the incremental cost and benefit of systems with ignition interlocks over those with warning systems only, and 3) what are the incremental cost and benefit of air bags over lap belts and harnesses with ignition interlock? To organize the discussion in this or a similar manner would have clarified the situation considerably.

In this problem, uncertainty plays a major role. Despite this, only for the effects of the air bag DOT's "optimistic" and "pessimistic" estimates are used; for the effects of shoulder harnesses only the one figure of 52% reduction derived from the Volvo study is used--characterized as "hard evidence"--without considering the uncertainty caused by its transfer to a considerably different traffic and vehicle situation. A more convincing analysis--though likely with not much more conclusive results--could have been performed with the available information.

Some important problems are recognized and discussed in the report: the possibility of hearing damage, eye damage, injury to out-of-position occupants and the reliability of the systems in crashes and at other times. What has not been recognized is that it is a worthwhile subject for analysis to estimate when such damages--and the aversion against the risk of such damages--become small enough to be traded off against the safety benefits of air bags. This is a challenging, though quite complicated problem.

One thing the report succeeds in demonstrating: that there is no clear-cut case for or against the air bag.

Flammability

The report estimates the average incremental retail cost of this standard to $7.67 (please, note the accuracy of this figure) and estimates the lifetime savings of losses as between $3.20 and 7.05, concluding "The estimated cost of meeting the requirement exceeds our largest estimated benefit by a small margin," or "The most optimistic estimate of its benefits indicates...that it will benefit less than it costs."

We suggest a different look at the problem. Assuming the pessimistic estimate of the report--$3.20 losses saved per vehicle--the net cost of the standard are $4.50 per vehicle. However, 19% of 870 fatalities could be saved according to the pessimistic estimate. This amounts to one life over the total lifetime of 70,000 vehicles. Then the net cost--after accounting for the economic effects of the life not lost--for a life saved would be about $300,000. Savings in injuries are in addition. As discussed elsewhere * it appears plausible that the subjective value of a life (possible also including the effect of risk aversion) can be estimated as two to five times as high as its economic value. Therefore, it does not appear unreasonable to spend this amount to save one life. In addition, many people consider the possibility of burning in a car with greater

* Joksch and Wuerdemann, Comparative Estimates of Transportation Accident Losses.

apprehension than other ways of dying; thus, they are probably willing to pay even more to reduce the risk of this kind of death.

The report estimates 870 fatalities due to fire. Joksch and Wuerdermann** estimate this to about 800, however, with a range from 600 to 1100. Thus, a considerable range of uncertainty exists. Consideration of it would improve the benefitsunder optimistic assumptions, worsen them under pessimistic assumptions.

** Data Requirements for the Evaluation of Motor Vehicle Safety Standards.

2.5 The Cost-Benefit Analyses of this Report in General

The report states "...the dollar values assigned to various cost and benefits are in practically all cases "estimates"..... In sum, the cost and benefit estimates which appear in this report represent nothing more than this committee's best effort based upon available data. Thus, the reader should view these estimates as "ballpark" figures subject to correction as a result of technological advances and more comprehensive data gathering."

Despite this, statements are made "...there is not a significant margin of benefit over cost" or "The most optimistic estimate of the benefits indicates that it will benefit less than it cost", even though changes of the estimates within realistic ranges of accuracy results in significant increases in benefits. Only sometimes are "optimistic" and "pessimistic" estimates of the effects used, which result in a much more realistic appraisal of the benefits. In an important case, that of shoulder harnesses, this was not done, even though relevant information was available.

The non-economic benefits of savings of lives and injuries are not considered, even though this can be done relatively easily, as illustrated in our discussions. Neither is the well known human characterictic of risk aversion considered, which results in a willingness to spend more than the expected loss to avoid possible large losses (the example of insurance illustrates that people are easily willing to pay about twice the expected loss to avoid large monetary losses).

Therefore, the cost benefit analyses of the report do justice neither to the information available, nor to the special aspects of value of life and risk aversion important in traffic safety.

2.4 Other Points

Safety Benefits of the Interstate System

Safety benefits of the Interstate System are estimated by multiplying the death and injury rates for Interstate highways and those for non-Interstate highways and comparing the resulting totals. This procedure implies the assumption that without Interstate highways, the same number of miles would have been traveled on other highways. This is unlikely: due to the speed and convenience of travel, Interstate highways generate travel which otherwise would not have occurred. Thus, accidents which would otherwise not have occurred, will occur (implicitely, the user trades these accidents off against the utility he gets out of the additional travel). Therefore, it is a conceptually very difficult problem to estimate the "true" savings in accidents resulting from the Interstate System. The commonly used method overestimates the benefits, since it counts a reduction of accidents also for those vehicle miles of travel which would not have occurred without the existence of the Interstate highways.

The Use of Death Rates

In Table II-11 death rates per vehicle miles of travel are used in the following way: The reduction in the death rates for the years 1967 to 1970 against 1966 is determined, and multiplied with the vehicle miles of travel in each year, resulting in an estimate of "lives saved." This, quite common procedure, implicitly assumes proportionality between fatalities and vehicle miles of travel, under otherwise unchanged circumstances. Joksch and Wuerdemann* have presented arguments and some empirical evidence that this is not so; accidents and fatalities, are likely to depend in a more complicated manner on vehicle miles of travel. Another study by Joksch and Wuerdemann,† quoted in a footnote of the table, gives empirical formulas for the number of automobile occupant fatalities in relation to vehicle miles of travel, a time trend and industrial production. These formulas are not compatible with the assumption that fatalities depend proportionally on vehicle miles of travel. On the basis of these studies we feel strongly that fatality rates per vehicle mile of travel are meaningless for the evaluation

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*Data Requirements for Evaluation of Motor Vehicle Safety Standards. Contract DOT-HS-033-1-038, The Center for the Environment and Man, Inc., September 1971.

†Estimating the Effects of Crash Phase Countermeasures.

3. Recommendations of the Report

The report states: "In particular, careful consideration of and, where possible, demonstration of technical feasibility and early, adequate cost benefit analysis ... would serve to demonstrate ...that the proposed regulation was in fact both likely to be both beneficial and practical. Comparative analysis of variants of a specific regulation would permit a rational and defensible choice of the ones to be promulgated. Moreover, comparison of benefit-cost margins among different regulations would permit establishing a list of priorities for imposition of safety standards ..." We fully agree with this, provided that the cost benefit analysis is conceptually sound, taking into account the non-economic cost and benefits, and technically correct. Analysis of the kind presented in this report, even if refined,would not be sufficient.

The report further states: "It is true that not all safety standards, and particularly not all those concerned with accident prevention, are amenable to cost-benefit analysis. In the main, this comes about because of lack of pertinent data concerning the causes of accidents. This deficiency needs to be rectified through an intensive data gathering program aimed at identifying and classifying vehicular safety hazards and their relative quantitative relationship to collision rates ..." To some extent, we agree with this. For instance, in the case of air bags, the available information appears not sufficient for a cost-benefit analysis into which much confidence could be placed.

To collect more data, however, is not necessarily the best solution to this problem. During the time one is waiting for better accident data, accidents and fatalities are occurring, and the long-term gain from finding the best rather than the second best solution may not be worth the current losses, especially if one considers that a fatality saved today is much more worth than a fatality saved several years from now.

In relatively simple contexts, statistical decision theory deals with such problems: how much information should one collect to make a better decision, without increasing the cost of information collective beyond the expected gain from an improved decision? In more complicated contexts, involving several courses of action and several decisions over a longer time period, decision analysis* deals with such problems. These methods have been successfully applied to a wide variety of problems.

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*R.A. Howard, Decision Analysis; Applied Decision Theory. In: Proceedings of the Fourth International Conference on Operational Research, D.B. Hertz, J. Melese (eds.). Wiley - Interscience 1966.

IEEE Transaction on Systems Science and Cybermetics. Special Issue on Decision Analysis. September 1968. Vol. SSC-4, No. 3