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Evaluation Program Plan
1998 - 2002

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PREFACE

The National Highway Traffic Safety Administration (NHTSA) has rigorously evaluated its major programs as a matter of policy since 1970. The evaluation of the effectiveness of the Federal Motor Vehicle Safety Standards (FMVSS) began in 1975. The Government Performance and Results Act of 1993 and Executive Order 12866, "Regulatory Planning and Review," issued in October 1993, now oblige all Federal agencies to evaluate their existing programs and regulations. Previously, Executive Order 12291, issued in February 1981, also required reviews of existing regulations. Even before 1981, however, NHTSA was a leader among Federal agencies in evaluating the effectiveness of existing regulations and technologies. There are large data bases of motor vehicle crashes which can be analyzed to find out what vehicle and traffic safety programs work best.

This five-year plan presents and discusses the programs, regulations, technologies and related areas NHTSA proposes to evaluate, and it summarizes the findings of past evaluations. Depending on scope, evaluations typically take a year or substantially more, counting initial planning, contracting for support, OMB clearance for surveys, internal reviews, approvals, publication, review of public comments, and the last phase of preparing recommendations for subsequent agency action.

Most of NHTSA's crashworthiness and several crash avoidance standards have been evaluated at least once since 1975. A number of consumer-oriented regulations, e.g., bumpers, theft protection, fuel economy and NCAP have also been evaluated. So have promising safety technologies, such as antilock brake systems, that were not mandatory under Federal regulations. The plan for the next five years includes evaluations of new and existing vehicle safety regulations, technologies and consumer protection programs, plus the completion of an assessment of the highway safety program.

The agency welcomes public comments on the plan. The plan will be periodically updated in response to public and agency needs, with a complete revision scheduled every four years. The most recent plan before this one was published on June 10, 1994 (*Federal Register*, Volume 59, p. 30090).

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EVALUATIONS NEARING COMPLETION

Highway Safety Assessment

Background Congress enacted legislation in 1966 to encourage States to take more action against rising traffic safety problems. The 1966 law authorized the National Highway Traffic Safety Administration to give grants and technical assistance to States and communities - as a Federal assist to their own knowledge and resources. Federal grants and technical assistance represent a small portion of the total resources States and localities need for highway safety related programs. The Federal program is intended to provide guidance and stimulate activities that address the most serious highway safety problems.

NHTSA is responsible for evaluating this Federal role and reporting conclusions about its effects to the Administration and Congress. Planning for the assessment began in 1991 with the goal of seeking national trends since the early 1980's on State and community responses to Section 402 (and other) Grants and Federal technical assistance. The focus was on the Priority Program areas at that time: alcohol/drug countermeasures, occupant protection, police traffic services, traffic records systems, emergency medical services, motorcycle and pedestrian/bicycle safety.

Objective The Assessment's goal is to identify and describe national trends over a longer period (1980-1993) to show how States and communities used Federal support (Section 402, 403, 408 and 410).

Approach Methods for assessing the effectiveness of NHTSA's support to State highway safety programs consist of documenting, through interviews and statistical information, the chronology of events and activities over a span of at least 10 years, for program elements within the 7 highway safety priority program areas. These highway safety histories or "tracings" are then reviewed against several criteria. Assessments were performed in 10 States, one in each of NHTSA's Regions, to be representative of the grant programs' utility nationwide in the development of State and community highway safety activities.

Tasks Completed A pilot assessment in Washington (Region 10), focusing on an analysis of the feasibility of methods and procedures, was completed in December 1992. In 1993 and 1994, information and data were collected in nine other states: Connecticut (Region 1), New Jersey (Region 2), Pennsylvania (Region 3), North Carolina (Region 4), Ohio (Region 5), New Mexico (Region 6), Kansas (Region 7), Colorado (Region 8), and Nevada (Region 9). During 1995 through 1997, assessment reports were written for these nine states. An interim report based on four states (Washington, New Jersey, North Carolina, Kansas) was published in 1996.

Status The draft Final Assessment Report for the 10 states is nearing completion.

Auto theft and recovery

Background The Motor Vehicle Theft Law Enforcement Act of 1984 required passenger car lines with higher-than-average theft rates to have major parts marked with the Vehicle Identification Number, as a deterrent to professional car thieves and as an aid in recovering stolen parts. The Anti-Car Theft Act of 1992 expanded the parts-marking requirement to vans and utility vehicles weighing less than 6,000 pounds with higher-than-average theft rates and half the passenger car, van and SUV lines with lower-than-average theft rates. The expanded requirements became effective on December 13, 1994 (1996 is the first model year affected by the new coverage). In 1997, NHTSA was directed to provide a report to Congress addressing: procedures for collecting and disseminating information on thefts and recoveries; data on motor vehicle thefts and recoveries; the market for stolen parts and exports; the cost of marking major parts of passenger motor vehicles; the experience of Federal, State and local officials in arresting and prosecuting passenger motor vehicle thieves; information concerning comprehensive insurance premiums and payouts for vehicle theft; and the adequacy of laws and parts marking systems. The Anti-Car Theft Act required NHTSA to coordinate the Report to Congress with the Justice Department. The Act also required the Attorney General to study the effects of parts marking and to provide its findings to NHTSA.

Objectives The main objective of the study is to determine to what degree parts marking has affected thefts and recoveries for the vehicle lines with marked parts. The other areas to be studied are similar to those of the 1991 report to Congress: "Auto Theft and Recovery - Effects of the Motor Vehicle Theft Law Enforcement Act of 1984."

Proposed Approach The Federal Bureau of Investigation's files on motor vehicle thefts and recoveries covering 1984 through 1995, where available, by vehicle class, make, line and model year were used to establish trends. In combination with annual registration data reported to R.L. Polk by the states, theft and recovery rates were calculated, and trends over the 11 year period were analyzed. Information from the 1991 report was updated with current information for the other requirements for the report.

Tasks Completed A Preliminary Report was announced in the *Federal Register* for public comment and placed in the docket in June 1997.

Status Following receipt of the public comments on the Preliminary Report, a draft Final Report has been prepared, including a summary and discussion of these comments. This draft is undergoing review in preparation for transmission to the Congress.

Center High Mounted Stop Lamps (FMVSS 108)

Background FMVSS 108 was amended to require Center High Mounted Stop Lamps on passenger cars in model year 1986 and on light trucks in model year 1994. The lamps make it easier to see that vehicles are braking. They are designed to reduce rear impact crashes. The evaluation plan for this standard, published in 1983, called for repeated statistical analyses of effectiveness, partly because of concerns that effectiveness might drop as drivers become "acclimatized" to the lamps.

Tasks Completed The first evaluation, based on a mid-1986 NASS special study, found that cars equipped with the lamps were 15 percent less likely to be struck in the rear than cars without the lamps. In a second evaluation, based on 1987 data from 11 State files, effectiveness had dropped to 11 percent. A subsequent study by the Insurance Institute for Highway Safety, based on data through 1991, showed a 5 percent crash reduction. In other words, effectiveness continued to drop after 1987 and its long-term value was still unknown.

In March 1998, NHTSA issued a third evaluation that tracks the effectiveness of CHMSL, year by year, from 1986 through 1995, based on statistical analyses of police-reported crash files from eight States. Effectiveness declined from 1987 to 1989, but then leveled off. During 1989-95, CHMSL reduced rear impact crashes by 4.3 percent. This is the long-term effectiveness of the lamps. The effectiveness of CHMSL in light trucks is about the same as in passenger cars.

Status The March 1998 evaluation report has been published for public comment (*Federal Register*, Volume 63, p. 17043). Comments are due on August 5, 1998.

Cost of air bags for light trucks (FMVSS 208)

Background Automatic occupant protection was phased into light trucks during 1994-97; beginning in 1998, the protection must include air bags for the driver and passenger. This teardown study supports the evaluation of the effectiveness of automatic occupant protection for light trucks completed in 1996.

Proposed Approach A representative sample of pickup trucks, vans and utility vehicles was selected for analysis. The air bags, belts and other equipment used to meet FMVSS 208 were torn down and their cost and weight estimated.

Status The contractor has completed a draft final report.

EVALUATIONS UNDERWAY, STARTED BEFORE 1998

Odometer Fraud

Background The illegal practice of rolling back odometers is a significant problem, estimated to cost the American consumer between $2 billion and $4 billion, annually. In 1972, Congress enacted Title V of the Motor Vehicle Information and Cost Savings Act to prohibit odometer tampering and to provide consumer protection against this fraud. To implement this statute, NHTSA promulgated a regulation which requires written odometer disclosure whenever vehicle ownership is transferred (Part 580). Subsequent amendments have strengthened the regulation to require that odometer disclosure be a condition of title transfer, and that dealers and other marketers of motor vehicles maintain specific records to create a "paper trail" of a vehicle's history that will facilitate investigations into cases of suspected odometer fraud. Since 1978, NHTSA has maintained an odometer fraud enforcement program, which has focused primarily on investigating suspected cases of fraud.

Objectives To develop a statistically accurate estimate of the magnitude of the odometer fraud problem; to estimate the total costs of odometer fraud; to assess State efforts toward implementing Truth in Mileage Act (TIMA) regulations; to assess the Federal and State efforts to investigate and deter odometer fraud; to assist in developing recommendations to strengthen future efforts to combat odometer fraud at the Federal and State levels.

Approach Probability sampling methods will be used to estimate the incidence rate of odometer fraud. Cost estimates will be developed using both direct and indirect costs. A survey to the State Department of Motor Vehicles will be used to develop information on State efforts to comply with TIMA regulations and their efforts to combat odometer fraud. An assessment of the efforts of Federal enforcement efforts will also be conducted.

Status The development of a national statistically accurate estimate for the incidence rate of odometer fraud and the assessment of the states efforts to implement TIMA regulations are underway. The development of a cost estimate for odometer fraud and an assessment of the Federal efforts to investigate and deter odometer fraud will be started in 1998.

Heavy truck conspicuity (FMVSS 108)

Background Effective December 1993, FMVSS 108 required that new trailers be outfitted with a reflectorized material which will make them more readily visible and detectable by other motorists: "conspicuity enhancement." The aim is to reduce the incidence of "other vehicle striking large truck" types of crashes. The treatment works by reflecting incident light, for example, from the approaching headlights of another vehicle, and it is expected to be effective in reducing nighttime collisions and, possibly, also daytime collisions.

Objectives To determine whether the reflectorized treatment results in a significantly lower crash involvement rate for large trucks.

Approach Collision rates for reflectorized (i.e., treated) vehicles and untreated vehicles will be compared, using actual on-road crash data. Since some necessary data are not reported in State crash files, a special crash-reporting agreement with police agencies of two States will be used.

Status A supplementary truck-tractor trailer crash report form has been developed to collect information on whether the truck-tractor trailer had reflectorized tape and the pattern, color and condition of the tape if present. The Florida Highway Patrol and the Pennsylvania State Police are collecting and supplying NHTSA with the supplementary reflectorized tape information and the state police accident report form for crashes involving truck-tractor trailer vehicles for two years. The data collection effort will extend into 1999.

Motor vehicle content labeling

Background The American Automobile Labeling Act requires that all new passenger cars, multipurpose vehicles and trucks lighter than 8,500 pounds Gross Vehicle Weight bear labels providing information regarding the extent to which their parts are of United States or Canadian origin, beginning October 1, 1994. NHTSA issued a regulation in July 1994 specifying the form and content of the label as well as the procedures manufacturers are to follow in developing the information. The label also indicates the country of final assembly and the origin of the engine and transmission. This information will introduce another choice factor into the car-buying decision-making process.

Objectives The evaluation objectives are to track the trends in U.S.-Canadian content in vehicles sold in the United States; to assess the effects of the new regulation on potential and actual vehicle purchasers and to learn if purchasers peruse and understand the labels; and to study the reactions of motor vehicle manufacturers and dealers to the regulation.

Approach NHTSA is conducting three surveys: (1) a national telephone survey of potential and actual new vehicle purchasers; (2) a letter survey of new vehicle dealers; and (3) a letter survey of domestic and foreign-based manufacturers. A statistical analysis of vehicle sales for model years 1994-1998 will track the overall trends in U.S.-Canadian content and compare sales trends for vehicles with increasing or decreasing U.S.-Canadian content.

Manual 3-point belts for back-seat occupants (FMVSS 208)

Background A 1986 report by the National Transportation Safety Board (NTSB) documented cases in which back-seat occupants sustained serious abdominal injuries from the lap belt in frontal crashes, and it raised doubts about the effectiveness of the lap belt alone for back-seat

occupants. A 1987 statistical study by NHTSA did find net benefits for lap belts: a 17-26 percent reduction of fatality risk relative to unrestrained back-seat occupants. However, no fatality reduction was seen in frontal crashes. NHTSA amended FMVSS 208 to require 3-point (lap-shoulder) belts at the outboard positions of the back seat, effective model year 1990 for cars and model year 1992 for light trucks; most model year 1989 cars already met the requirement. The Regulatory Impact Analysis estimated that 3-point belts would be 10 percent more effective than lap belts.

Objectives Estimate the effectiveness of 3-point belts in reducing fatality and injury risk of back-seat occupants - in frontal crashes and overall. Compare the rates of overall injury and serious abdominal injuries of back-seat occupants wearing 3-point belts, lap belts only, and no belts. Compare belt use rates of back-seat occupants in cars equipped with 3-point belts vs. cars equipped with lap belts only. Estimate the overall safety benefit of sitting in the back seat, relative to sitting in the front seat of a vehicle.

Approach Statistical analyses of FARS and State crash data, by methods similar to those used in the 1987 evaluation of lap belts (e.g., double-pair comparison), to assess the relative fatality and injury risks of lap-belted, 3-point-belted and unrestrained occupants. Estimate the rates of serious abdominal injuries, using the FARS Multiple-Cause-of-Death supplementary file. Track the belt-use rates of back-seat occupants in the National Occupant Protection Use Survey (NOPUS).

Status The statistical analyses are underway.

Side impact protection (FMVSS 214 upgrade) + Side NCAP

Background A major upgrade of FMVSS 214 requires satisfactory performance in a dynamic side impact test for a percentage of cars in model years 1994-96, for all cars starting in model year 1997 and for all light trucks under 6000 pounds Gross Vehicle Weight starting in model year 1999, in addition to the existing static test of side door strength that has been in place for cars since 1973 and light trucks since 1994. The upgraded FMVSS 214 aimed to reduce fatal thoracic injuries when a car is struck in the side by another vehicle, whereas the original FMVSS 214 had only been found to reduce fatalities in side impacts of cars with fixed objects. Due to the long lead time for this rule, there has been uncertainty about what changes manufacturers made to achieve compliance, what cars needed changes, and when the changes were made. Additionally, since 1997, NHTSA has supplied consumers with information on side impact test results as part of the New Car Assessment Program (NCAP).

Objectives Estimate the effect of the new standard on fatality and injury risk in side impacts. Study the correlation between Thoracic Trauma Index (TTI) and other measures of dynamic test performance with the risk of fatality or injury in actual side impacts. Estimate the consumer cost of vehicle modifications in response to (or in anticipation of) the new standard.

Proposed Approach Detailed information needs to be obtained, on a year-by-year basis, about vehicle modifications made in response to, or in advance of the requirement. A data base of dynamic test performance, for post-standard and pre-standard cars will be assembled from various sources (compliance tests, Side NCAP tests, R&D tests of pre-standard cars, manufacturers' tests of pre- and post-standard cars - possibly supplemented by tests of pre-standard vehicles performed especially for this evaluation). FARS and NASS data will be analyzed by methods developed in the 1982 evaluation of the original FMVSS 214. The correlation of TTI and other test parameters with actual fatality risk will be studied by methods similar to the 1994 evaluation of NCAP. The cost of the vehicle modifications will be estimated, where possible, from "teardown" analyses or from information provided by manufacturers.

Status A data base of test results for post-standard and pre-standard cars has been acquired. Cost analyses, including a chronology of changes implemented to meet the standard, are underway.

Cost data base and summary of NHTSA cost evaluations

Background Since the beginning of the FMVSS evaluation program in the late 1970's, cost studies of safety equipment to meet the standards have been done. Cost estimates are used in combination with effectiveness data to determine the cost-benefit of FMVSS. The results are currently scattered among many hard copy reports: over two dozen studies covering almost 30 standards have been completed.

Objectives Compile all the existing cost estimates into a single report and inflate all costs to the most recent economic year. The report will describe what vehicle modifications were made in response to the various FMVSS and explain how cost information has been used in NHTSA cost effectiveness studies. In addition to a written report, NHTSA will prepare two electronic databases from the more recent studies (based on vehicles made in the 1990's): one for use within NHTSA on the local area networks; and the second for use by the public on the Internet.

Proposed Approach From contractor and NHTSA reports, cost and weight data for major components will be extracted and compiled into a summary report. Completed cost effectiveness studies will be reviewed as well as regulatory analyses to determine and document how cost data has been used. Care will be taken to determine the economic year used for the cost data in the study. All cost data will be brought to the most recent full economic year for which the Bureau of Labor Statistics has consumer index information. The data sets selected for the two electronic databases will include the capability of selecting the economic year for the cost data.

Cost of side door strength in light trucks (FMVSS 214)

Background FMVSS 214 was extended to light trucks in September 1993, specifying the static requirements for side impact protection, and in September 1998 for the dynamic requirements. A comprehensive effectiveness evaluation for this standard in light trucks is scheduled to start in 1995. This teardown study of light truck side structures will support that evaluation.

Proposed Approach Inquiries to manufacturers and other data indicate that light trucks meeting the static requirements of FMVSS 214 also met the dynamic requirements without further modifications. Thus, only the cost to meet the static requirement will be studied. A representative sample of pickup trucks, vans and utility vehicles will be selected for a cost analysis of FMVSS 214. The side door beams and other structures used to meet the door strength requirement will be torn down for cost estimation.

EVALUATIONS STARTING IN 1998

On-off switches for air bags

Background Whereas air bags have on the whole saved thousands of lives, there are some people - infants, out-of-position children and adults of very small stature or with certain medical conditions - who should not be exposed to an air bag deployment. In May 1995, NHTSA issued a final rule allowing manufacturers to install an on-off switch for the passenger air bag in vehicles that cannot accommodate a rear-facing child seat anywhere except in the front seat: e.g., pickup trucks and cars with small rear seats. By mid-1998, approximately 2,500,000 pickup trucks, but no passenger cars, will have been equipped with the switches.

In November 1997, NHTSA issued another final rule enabling owners of **any** passenger car, pickup truck, van or SUV to obtain an on-off switch for their passenger **and/or** driver air bags if they transported people in one of the high-risk groups. The benefit of these regulations is contingent on the correct use of the switches: that the air bag is turned off when a high-risk individual is seated behind it, and turned on at other times.

Objectives Determine the percentage of on-off switches that are being properly used - i.e., "off" for high-risk occupants, "on" at other times. More generally, find out how many vehicles have received on-off switches, and estimate the consumer cost of the switches. As a related issue, find out if an increasing percentage of children is riding in the back seat, where there is no problem of interactions with deploying air bags.

Proposed Approach A survey of the use of on-off switches will be conducted at fast-food restaurants, shopping center parking lots and similar locations. Since the correctness of the switch setting depends entirely on who is in the seat at that moment, the survey must be performed while vehicles are occupied. Unlike shoulder belt use, the setting of the on-off switch cannot be observed from a distance; it will be necessary to talk to people in stopped vehicles in a friendly environment - e.g., the approach successfully employed in past surveys at "Hardee's" on the misuse of child safety seats. The interview would include questions about drivers' reasons for turning the switch on or off, their opinions on the risks and benefits of air bags and the price they paid for having the switches installed (if they were not standard equipment).

Supplementary information could be obtained: (1) Within NHTSA, the number and types (e.g., driver or passenger) of requests to install on-off switches. (2) From the National Occupant Protection Use Survey (NOPUS) and State crash files: trends in the percentage of child passengers who ride in the back seat. (3) From a survey of unoccupied vehicles at PMVI and emissions inspection stations: the percent of switches that are "on" or "off" (without regard to whether this is the right or the wrong setting).

Effectiveness of depowered air bags

Background In 1997, NHTSA amended FMVSS 208 to make the unbelted test for air bags less stringent and, in effect, allow "depowered" air bags. The goal was to offer immediate relief, in new vehicles, from some of the hazards of air bags to out-of-position occupants. NHTSA projected that depowered air bags would benefit out-of-position occupants and reduce drivers' arm injuries, but might be less effective than current air bags for belted drivers and, particularly, unbelted passengers. Without a statistical analysis of each of these effects, based on actual crashes, it is difficult to assess the net effect of depowering.

Objective Vehicles would be grouped according to the characteristics of their air bags. The fatality risk in vehicles with depowered air bags would be compared to the corresponding risk in the same or similar make-models prior to depowering. Effects would be estimated for belted and unbelted occupants; for child passengers, young adults and old adults.

Proposed Approach Statistical analyses of FARS data, similar to those in the 1996 evaluation of air bags, will be used to compare fatality risk with current and depowered air bags. Statistical analyses of NASS data, similar to those in the 1996 Report to the Congress, will explore the effect on arm injuries and overall injury risk. The effect of "depowered" bags cannot be accurately studied without knowledge of what bags are depowered and by how much. Tank tests are used for measuring the performance characteristics of air bag inflators and have been performed on a large variety of vehicles. However, the tank test is only a measure of the inflator's aggressiveness and may not properly characterize the overall aggressiveness of the system. This evaluation would be expedited if a significant proportion of pre-1997 air bags can already qualify as "depowered." An Information Request has been sent to the manufacturers to provide data on model year 1990-98 vehicles in support of this effort. Since the design of air bags may change during the next few years, it is anticipated that one or more interim analysis reports will be issued.

Cost of advanced air bags

Background What is the cost of advanced air-bag technology? If advanced air bags start to show up in production vehicles in Fall 1998, we will not be able to statistically analyze their effects in the 1997-2000 time frame, but we will be able to estimate the actual cost of the technology.

Approach The cost of advanced air bag systems will be estimated on a component-by-component basis and compared to the cost of baseline air bags in the same or similar make-models. Advanced technology might include weight sensors, position sensors, multilevel crash severity sensors, multilevel inflators and other means to tailor the deployment characteristics. At this time a contractor is doing a baseline cost study which includes getting cost estimates of an air bag system that has two inflation forces.

Child safety seat registration (FMVSS 213)

Background Registration of child safety seats is designed to increase the number of consumers responding to recalls of faulty seats. Starting in March 1993, FMVSS 213, "Child Seating System," required manufacturers to (1) supply consumers with self-addressed, stamped registration cards; (2) permanently affix labels containing registration instructions to the seat; and (3) keep records of owners for a period of six years after the date of manufacture.

Objectives Determine the percentage of safety seats that are registered by consumers. Compare the percent and rate of responses to recalls before and after the registration requirements took effect. Ascertain consumers' perceptions of the importance of registration and recalls, their awareness of the registration cards, and the reasons why they did or did not respond to recalls. Find out how seat loaner programs deal with seat registration and recalls. Find out what information dealers provide consumers about seat registration and recalls.

Proposed Approach NHTSA will compute seat registrations as a percentage of sales, using data supplied by the seat manufacturers, if possible, or data obtained in a consumer survey. The numbers of seats recalled and repaired will be compared during given periods before and after registration requirements took effect, using data compiled by NHTSA Safety Assurance. If the post-registration repair rates are significantly higher than the pre-registration repair rates, then the standard can be considered effective.

NHTSA will survey safety seat owners to discover why consumers responded the way they did to registration and recall efforts (e.g., no knowledge of a registration card or a recall, perceived importance of the reason for recall, complexity of the recall process, past injury to a child in a faulty seat, the seat is no longer used, etc.).

NHTSA also plans to survey safety seat manufacturers to determine what, if any, efforts are made to educate or inform consumers of the seat registrations. In addition, NHTSA will survey retailers to determine if they (1) provide consumers with any information about child safety seat registrations; (2) are provided information from the manufacturers concerning the seat registrations. Loaner programs will be surveyed on how they register seats and what information they supply to recipients.

PROPOSED FUTURE EVALUATIONS

1999 STARTS

Benefits data base and summary of NHTSA effectiveness evaluations

Background Since 1979, NHTSA has issued over 30 comprehensive evaluations of FMVSS or other vehicle safety programs. The last section of this document summarizes them. In general, each report estimated the benefits of a FMVSS (lives saved, injuries avoided, crashes avoided) by applying an effectiveness estimate to a baseline number of annual fatalities, injuries or crashes. The "baseline" was typically the year that the report was written. The estimates in the various reports are not directly comparable, and they are not strictly accurate today, because they involve many different, past baselines.

Objectives Estimate the benefits of each of the applicable FMVSS and vehicle safety programs evaluated to date - and the total of all these benefits - in each individual calendar year since 1968. The process will take into account: (1) the variation of baseline fatalities from year to year; (2) even after a FMVSS takes effect, many pre-FMVSS vehicles remain on the road, and the benefits are achieved only on the newer, post-FMVSS vehicles. The procedure must be designed to avoid "double-counting" of benefits when the same life is "saved" by two different FMVSS. Another goal is to project the future benefits when all vehicles on the road meet all the existing FMVSS. The results will be documented in a written report and also encoded in a data base that can be updated from time to time and furnished for public inspection on the Internet.

Head restraints for light trucks (FMVSS 202)

Background FMVSS 202 (Head Restraints) has the objective of protecting occupants from whiplash injuries in rear-impact crashes. The standard took effect for passenger cars on January 1, 1969 and was extended to pickup trucks, vans and sport utility vehicles on September 1, 1991. In many cases, head restraints were introduced before the effective date. A 1982 evaluation showed that head restraints significantly reduced the probability of injury to occupants of passenger cars.

Proposed Approach Detailed information will be obtained about the model years in which trucks were first equipped with head restraints. Crash data from Pennsylvania (which specifically identifies neck-pain injuries) and other States will be statistically analyzed: the probability of whiplash injury, or any type of injury, in rear-impact crashes will be compared for trucks equipped with head restraints and trucks without the restraints. If there are substantial variations in the height of fixed head restraints in different make-models, injury rates will be compared in the models with the higher and the lower restraints.

Light truck aggressivity in frontal and side impact

Background Since 1992, the number of fatalities in collisions between cars and light trucks has exceeded the number in car-to-car collisions. In car-light truck collisions, 80 percent of the fatalities are occupants of the cars. It is unknown to what extent the imbalance merely reflects the fact that the average light truck substantially outweighs the average car and to what extent, if any, a truck is more "aggressive" than a car of the same weight: trucks' frontal structures may be more rigid than cars, and trucks' high sills or hoods may cause the most rigid part of the truck to ride over the sill of the car and/or contact softer parts of the car. A prerequisite for the analysis is accurate data on the weights of current light trucks and, if possible, their sill, bumper and hood heights and force deflection characteristics.

Proposed Approach Accurate data on the weights of light trucks, directly comparable to weight data on passenger cars, can be obtained from safety compliance and NCAP test files at NHTSA and perhaps from fuel economy test files at EPA. Information on sill, bumper and hood heights may be obtained by direct measurement or from the manufacturers. Data on structural rigidity may be gleaned from barrier test results. FARS data will be used to study the relative risk of car and truck occupants in head-on and front-to-side collisions as a function of the relative weight, height and rigidity of the vehicles, controlling for the age and gender of the drivers.

2000 STARTS

Head injury protection (FMVSS 201 upgrade)

Background In 1995, the agency amended FMVSS 201 (Occupant Protection in Interior Impact) to set new requirements, or upgrade existing requirements on the energy-absorbing capabilities of the A and B pillars, roof rails, and other vehicle interior components associated with serious head injuries in crashes. The regulation will be phased in for new cars and light trucks over a five-year period, starting with 10 percent of model year 1999 production and concluding with 100 percent of model year 2003 production. It is anticipated that most vehicles will get upgraded padding or other energy-absorbing materials. Some vehicles will obtain special air bags designed to protect occupants from head impacts with roof rails or pillars and to reduce the risk of occupant ejection through side window areas.

Objectives Estimate the effect of the new padding and energy-absorbing materials on the risk of fatal and serious head injuries. Estimate the effectiveness and cost of head-impact air bags. Estimate the consumer cost of vehicle modifications in response to (or in anticipation of) the new standard. Study the effect of head-impact air bags on occupant ejection rates.

Proposed Approach Starting in the year 2000, information will be obtained from the manufacturers about vehicle modifications made in response to, or in advance of the requirement. The cost of these modifications, including head-impact air bags, will be estimated from "teardown" analyses or from information provided by manufacturers. Head

injury rates and occupant ejection rates in pre-standard cars, post-standard cars with energy-absorbing padding, and post-standard cars with head-impact air bags will be compared in NASS data and in the enhanced FARS file that includes cause-of-death information. Overall fatality rates will also be compared in FARS data. The statistical analyses will extend well beyond the 1998-2002 time frame of this evaluation program plan.

Effect of side door strength in light trucks (FMVSS 214)

Background Two basic standards (FMVSS 214 - Side Door Strength and FMVSS 216 - Roof Crush Resistance) that protect occupants in side impacts and rollover crashes took effect for passenger cars during 1973 and were extended to pickup trucks, vans and sport utility vehicles, with an effective date of September 1, 1993. FMVSS 216 will not be included in this evaluation, because most trucks met the standard without additional modification. FMVSS 214, on the other hand, necessitated changes in the side structures of light trucks. Both standards were found to be effective for passenger cars in earlier NHTSA evaluations; that was one basis for extending them to light trucks.

Proposed Approach Detailed information will be obtained about the model years in which trucks were first equipped with side door beams or other side-structure modifications. FARS and NASS data will be analyzed by the methods developed in the 1982 evaluation of FMVSS 214 for passenger cars.

Safety belt pretensioners, load limiters and adjustable anchors

Background Some safety belts may be more effective than others. Three technologies for improving the performance or use of belts are widely available as of 1997. Although they are not mandatory for meeting NHTSA standards, the agency regards them with favor and provides consumer information on their availability, by make-model, in *Buying a Safer Car*. Safety belt pretensioners (installed on 7 percent of MY 97 passenger cars) retract the safety belt to remove any slack almost instantly in a crash. Load limiters (30 percent of MY 97 cars) prevent belt forces from reaching unsafe levels by causing parts of the safety belt to stretch or deform at a predetermined, safe force level. Adjustable anchors (89 percent of MY 97 cars) allow occupants to make belts more comfortable by changing the height of the shoulder strap and keeping the belt away from their necks. Another promising technology, the integrated belt system, was just beginning to appear in 1997.

Objectives Compare the overall fatality- and serious injury-reducing effectiveness of conventional safety belts and the effectiveness of belts equipped with one or more of these improvements. Estimate the effect of pretensioners on fatal and serious head injuries, load limiters on chest and abdominal injuries. Study the effect of adjustable anchors on belt use and neck injuries.

Proposed Approach Information will be obtained from the manufacturers about the initial installation dates of these technologies, by make-model. Statistical analyses of FARS data, such as double-pair comparison analyses, will be used to estimate overall belt effectiveness before and after the introduction of the belt improvements. Injury rates by body region, before and after the belt improvements, will be compared in NASS data and in the enhanced FARS file that includes cause-of-death information. Belt use, before and after the introduction of adjustable anchorages, will be compared in NOPUS.

2001 STARTS

Antilock Brake Systems for heavy trucks (FMVSS 121)

Background In 1996, the agency amended FMVSS 121 to require Antilock Brake Systems (ABS) on truck tractors manufactured on or after March 1, 1997 and other air-braked vehicles (such as semitrailers and single-unit trucks) manufactured on or after March 1, 1998. After March 1, 2001, truck tractors must also have lamps that signal ABS malfunctions in any trailer. In addition, FMVSS 105 requires ABS on hydraulic-braked vehicles with a GVWR over 10,000 pounds, manufactured on or after March 1, 1999. The purpose of ABS is to help maintain directional stability and control during braking, and possibly reducing stopping distances on some road surfaces, especially on wet roads. ABS may prevent crashes involving loss-of-control, skidding, jackknife and, perhaps, those where trucks with conventional brakes were unable to stop in time to avoid hitting another vehicle.

Objectives Estimate the effect of ABS - on tractors and trailers - on single-vehicle and multivehicle crashes, by road surface condition, especially crashes involving loss of control, skidding or jackknife. Estimate the cost per vehicle for the initial installation and subsequent maintenance of ABS and its related control and malfunction-warning systems. Study the in-use durability and reliability of ABS.

Proposed Approach Information about what vehicles had ABS will be obtained from truck and trailer manufacturers. The cost for the initial installation of ABS will be estimated from "teardown" analyses or from information provided by manufacturers. Maintenance costs and durability will be studied in government and/or private truck fleets. Statistical analyses of the effectiveness of ABS for truck tractors and single-unit trucks will be performed using FARS and State crash data files, and analysis methods similar to those in NHTSA's evaluations of light-vehicle ABS: crash involvement rates will be compared for ABS and non-ABS vehicles, for various types of crashes where ABS is likely to be effective (loss-of-control, skidding, jackknife, multivehicle) vs. a control group of crash involvements that do not involve braking. In order to study the effectiveness of ABS for truck trailers, a supplementary crash report form will be developed to record the VINs of trailers involved in crashes, plus relevant information about the crash (skidding, jackknife). These forms would be collected in addition to the accident reports by two or more State police agencies for several years, similar to the procedure in the ongoing evaluation of heavy truck conspicuity. The trailer VINs would be compared to manufacturer-supplied lists or codes to determine the ABS status of the trailers.

Rear window defoggers and wipers

Background Rear window defoggers became available as optional or standard equipment in most cars during the 1970's or 1980's and are popular with consumers. Rear window defoggers allow the driver to see through the rear window under adverse weather conditions. Clear vision is especially important when the driver wants to back up or change lanes. Subsequently, rear-window wipers have been installed on a smaller group of vehicles for even better vision.

Objectives Estimate the effectiveness of rear window defoggers and (if possible) wipers in reducing crashes in which a driver is backing up, changing lanes, or performing other tasks facilitated by vision through the rear window. The study will include passenger cars and, if possible, light trucks (subject to availability of information on installation of defoggers and wipers).

Proposed Task Statistical analysis of State crash data from the mid-1970's onward. (The sample of vehicles with rear-window wipers may be too small for meaningful results.)

2002 STARTS

Truck underride protection (FMVSS 223 and 224)

Background In January 1996, NHTSA issued FMVSS No. 223 and 224 to regulate rear underride guards on heavy combination trucks, in order to reduce fatalities and injuries to occupants of light duty vehicles that strike the rear of these trucks. FMVSS 223 specifies height, width, length, and strength requirements of rear underride guards. FMVSS 224 requires all trailers and semi-trailers manufactured after January 1998 with GVWR of 10,000 pounds or more to have a rear impact guard. The standard does not apply to single unit trucks, truck tractors, pole trailers, low chassis trailers, special purpose vehicles and "wheels back" vehicles. Most pre-standard trailers currently on the road have rear impact guards, although these guards do not necessarily meet FMVSS 223.

Proposed Approach Because rear impact guards of some type were installed on most trailers even before the FMVSS 223 and 224 standards were in effect, a conventional "before vs. after" statistical study is unlikely to show significant differences. The performance of the guards in crashes will be examined in selected cases from the NASS system and/or a special study in which NASS investigators perform follow-up investigations of rear-impact crashes upon receiving notification of these crashes from state police. (This notification system could be joined to the proposed data collection effort in the evaluation of ABS for truck trailers.) In addition, the long-term trends of fatalities in underride and rear-impact crashes will be studied in FARS. NHTSA will perform a cost analysis of the guards based on "teardown" and manufacturer-supplied information.

New Car Assessment Program (NCAP) follow-up evaluation (cars and light trucks with air bags)

Background In 1994, NHTSA published a study that showed significant correlations between New Car Assessment Program (NCAP) scores - HIC, chest g's and femur loads - and the fatality risk of belted drivers in actual head-on collisions. The crash data base for that study included model year 1979-91 passenger cars. Only 5 percent of the cars in that data base were equipped with air bags, and light trucks were not included. Today, all new cars sold in the United States are equipped with air bags, and light trucks account for over 45 percent of new-vehicle sales.

Method The analyses in the 1994 study will be repeated with a data base that includes light trucks as well as passenger cars and contains a large proportion of vehicles equipped with air bags. The 1994 study compared the fatality risk of the two drivers in a head-on collision between a car with "good" NCAP scores and a car with "poor" scores, after adjustment for differences in the weights of the cars and the drivers' age and sex. The follow-up study will investigate if similar correlations between NCAP scores and fatality risk exist in vehicles equipped with air bags, and it will examine the interaction between air bags, NCAP performance and fatality risk.

Side air bags

Background Whereas most current vehicles use padding or upgraded structure to protect occupants from thoracic or abdominal injury in side impacts, 6 percent of MY 1997 passenger cars have special air bags designed to provide an additional cushion between the occupant and the side structure. They might have an additional advantage of blocking occupant ejection in certain crashes. Side air bags are not mandatory, but NHTSA regards them with favor and provides consumer information on their availability, by make-model, in *Buying a Safer Car*.

Objectives Estimate the effect of side air bags on fatality and injury risk, and on occupant ejection rates in side impacts. Compare the Thoracic Trauma Indices (TTI) and other measures of dynamic test performance of vehicles with side air bags to similar vehicles without the air bags. Estimate the consumer cost of side air bags.

Proposed Approach A data base of dynamic test performance, for vehicles with and without side air bags will be assembled from compliance and Side NCAP tests. FARS and NASS data will be analyzed by methods developed in earlier evaluations of air bags and side impact standards to determine the effect of side air bags on fatality and serious-injury risk, and on occupant ejection rates. The cost of side air bags will be estimated by "teardown" studies.

OTHER POTENTIAL EVALUATIONS

The agency's Strategic Execution Plan of July 1996 describes program areas where regulations, consumer information or advanced technologies are approaching their final form. They will be the subject of tomorrow's evaluations. In general, given the probable lead-time in the regulations and the additional time needed for post-standard vehicles to accumulate exposure, these evaluations would not start before 2003. However, it is possible that a shift in priorities could move some of the studies into the 1998-2002 time frame.

Ejection mitigation The agency is developing regulations to increase the strength of door latches and is considering measures to reduce occupant ejection through side window areas.

Fuel system integrity upgrade The agency is considering a possible upgrade of current fuel system integrity requirements (FMVSS 301)

Child safety seat anchorages The agency is considering a system of anchorages in vehicles, including tether anchorages, with compatible appurtenances on child safety seats, that would allow installation of safety seats in vehicles without use of the vehicle's current safety belts. The objective would be to make safety seats easier to install correctly, and to increase their effectiveness in certain types of crashes.

Intelligent Transportation Systems (ITS) technology The agency anticipates and encourages increased use of advanced crash avoidance technologies such as radar braking, automatic steering or throttle control, navigation systems and collision warning systems.

Antilock Brake Systems (ABS) follow-up The agency published studies of the effectiveness of existing ABS systems for light trucks (1993) and passenger cars (1995), indicating limited benefits or even an increase in certain types of crashes. Major changes in the design of ABS over the years, or far-reaching efforts to educate consumers about the proper use of ABS could potentially improve their benefits and necessitate a follow-up evaluation.

International harmonization - functional equivalence The agency is considering testing vehicles to selected European or international safety standards in lieu of FMVSS, at the manufacturer's option, if NHTSA deems these foreign standards are functionally equivalent to the FMVSS. The evaluation would compare the safety performance, in actual crashes, of vehicles tested to the international standards and those tested to the FMVSS.

Radial tires The introduction of radial tires was an important vehicle modification in the United States in the 1960's and 70's. In addition to pocketbook advantages over bias-ply tires, radials might also have significant safety impacts such as improved traction and directional control, or changes in the rate of crashes due to tire failures.

Safety effects of heavily tinted glass A growing number of vehicle owners are purchasing vehicles with heavily tinted side and rear glazing. If this trend continues, it may be appropriate to determine if the glazing adversely affects drivers' ability to see other vehicles on the road.

SUMMARIES OF PUBLSHED EVALUATION REPORTS

March 2003

A systematic program to evaluate the effectiveness of the Federal Motor Vehicle Safety Standards (FMVSS) was initiated in 1975, when NHTSA was just beginning to establish its own crash data bases. The first "preliminary" evaluation of a standard was published in 1979 (side door strength) and the first "final" evaluations in 1981 (energy-absorbing steering assemblies, bumpers). Since 1979, 42 comprehensive evaluations of regulations, safety programs, consumer information programs, or safety technologies have been published. Here is a list of the 40 studies including summaries of principal findings [except where findings were superseded in a follow-up evaluation]:

2002

Evaluation of Child Safety Seat Registration (NHTSA Publication DOT HS 809 518)

Since March 1993, manufacturers of child safety seats have been required to provide a postage-paid registration form with each new child safety seat. Seat registration has increased from 3 percent prior to 1993 to 27 percent in 1996-2000. The repair rate for recalled child safety seats increased from 13.8 percent prior to 1993 to 21.5 percent.

Preliminary Report: The Incidence Rate of Odometer Fraud (NHTSA Publication DOT HS 809 441)

There are an estimated 452,000 cases of odometer rollback per year in the United States. The difference between the inflated prices that consumers paid for rolled-back vehicles and the prices they would have been willing to pay if they had known the true mileage average $2,336 per case of odometer rollback, amounting to $1,056 million per year in the United States.

2001

The Effectiveness of Head Restraints in Light Trucks (NHTSA Publication DOT HS 809 247)

The purpose of a head restraint is to prevent whiplash injuries in rear-impact crashes. Head restraints reduce overall injury risk in light trucks in rear impacts by a statistically significant 6 percent. When all light trucks on the road have head restraints, they will be preventing approximately 15,000 nonfatal injuries per year. (See also the 1982 evaluation of head restraints in passenger cars.)

The Effectiveness of Retroreflective Tape on Heavy Trailers (NHTSA Publication DOT HS 809 222)

Retroreflective tape enhances the visibility of heavy trailers in the dark. The tape reduces side and rear impacts by other vehicles into trailers by 29 percent in dark conditions (including dark-not-lighted, dark-lighted, dawn and dusk). In dark-not-lighted conditions, the tape reduces side and rear impacts by 41 percent. When all heavy trailers have the tape, it will prevent an estimated 191-350 fatalities, 3,100-5,000 injuries and 7,800 crashes per year.

Evaluation of the American Automobile Labeling Act (NHTSA Publication DOT HS 809 208)

In a survey of 646 recent or imminent new-vehicle buyers, over 75 percent were unaware of the existence of automobile parts content labels. Among those who had read the labels, many said they used the country-of-assembly information, but none said they used the numerical U.S./Canadian parts content score. Overall U.S./Canadian parts content in new cars and light trucks dropped from an average of 70 percent in model year 1995 to 67.6 percent in 1998. However, it increased from 47 to 59 percent in transplants while dropping from 89 to 84 percent in Big 3 vehicles: trends undoubtedly influenced by the 1995 U.S.-Japan Agreement on Autos and Auto Parts and the North American Free Trade Agreement (NAFTA).

2000

Fatality Reduction by Safety Belts for Front-Seat Occupants of Cars and Light Trucks: Updated and Expanded Estimates Based on 1986-99 FARS Data (NHTSA Publication DOT HS 809 199)

Manual three-point belts reduce fatality risk, relative to the unrestrained front-seat occupant, by 45 percent in passenger cars and by 60 percent in pickup trucks, vans and sport utility vehicles. The analyses reconfirm the agency's earlier (1984-89) estimates of fatality reduction.

1999

Evaluation of FMVSS 214 - Side Impact Protection: Dynamic Performance Requirement; Phase 1: Correlation of TTI(d) with Fatality Risk in Actual Side Impact Collisions of Model Year 1981-1993 Passenger Cars (NHTSA Publication DOT HS 809 004)

The test injury criterion TTI(d) has a statistically significant association with fatality risk in actual side-impact crashes on the highway. In model year 1981-93 cars, make-models with low TTI(d) on the FMVSS 214 test tend to have low fatality risk. The relationship is stronger in 2-door than 4-door cars. Reducing TTI(d) by one unit is associated with an estimated 0.927 percent reduction of fatality risk in side impacts of 2-door cars. The association in the corresponding analysis of 4-door cars was not statistically significant.

Effectiveness of Lap/Shoulder Belts in the Back Outboard Seating Positions (NHTSA Publication DOT HS 808 945)

Lap/shoulder belts reduce fatality risk by 44 percent relative to unrestrained back-seat occupants of passenger cars, and by 15 percent relative to lap-belted occupants. Lap belts reduce fatality risk by 32 percent relative to unrestrained occupants. Lap/shoulder belts are effective in all crashes, but lap belts only in nonfrontal crashes. Lap-belted occupants have substantially higher abdominal-injury risk than unrestrained back-seat occupants in frontal crashes, but lap/shoulder belts reduce abdominal injuries by 52 percent and head injuries by 47 percent relative to lap belts.

1998

Highway Safety Assessment: A Summary of Findings in Ten States (NHTSA Publication DOT HS 808 796)

Assessment of 1980-1993 safety programs in ten states showed that Federal grants and technology were used to address safety priorities as intended by Congress. Federal grants, amounting to less than two percent of total safety spending by States and communities, have acted as seed money to resolve important highway safety problems. Programs started with Federal funds were often extended or replicated elsewhere with State funds. Occupant protection programs, however, remain heavily dependent on Federal funds.

Auto Theft and Recovery - Effects of the Anti Car Theft Act of 1992 and the Motor Vehicle Theft Law Enforcement Act of 1984 - Report to the Congress (NHTSA Publication DOT HS 808 761)

Theft rates, which had increased during the 1980's, declined from 714 per million in 1990 to 597 in 1995. Parts marking and factory-installed anti-theft devices have had beneficial and complementary effects on auto thefts and/or recoveries. The Acts have given law enforcement tools to deter thefts, trace stolen vehicles and parts, and apprehend and convict thieves.

The Long-Term Effectiveness of Center High Mounted Stop Lamps in Passenger Cars and Light Trucks (NHTSA Publication DOT HS 808 696)

Throughout 1989-95, cars equipped with Center High Mounted Stop Lamps were 4.3 percent less likely to be struck in the rear than cars without the lamps. (In 1987, when the lamps were first introduced, the reduction was 8.5 percent.) The effectiveness of CHMSL in light trucks is about the same as in cars. At the 1989-95 effectiveness level, when all cars and light trucks on the road have the lamps, they would prevent 194,000-239,000 crashes, 58,000-70,000 nonfatal injuries and $655 million in property damage per year.

1997

Relationship of Vehicle Weight to Fatality and Injury Risk in Model Year 1985-93 Passenger Cars and Light Trucks (NHTSA Publication DOT HS 808 569); **Relationships between Vehicle Size and Fatality Risk in Model Year 1985-93 Passenger Cars and Light Trucks** (NHTSA Publication DOT HS 808 570)

A 100-pound reduction in the weight of passenger cars, with corresponding reductions in other size parameters such as track width, is associated with an estimated increase of 302 fatalities per year. However, a 100-pound reduction in light trucks is estimated to decrease overall fatalities in crashes, including occupants of other vehicles and pedestrians, by 40 per year (not statistically significant). When light trucks are reduced in weight and size, they become less hazardous to car occupants, pedestrians, bicyclists and motorcyclists.

1996

Fatality Reduction by Air Bags: Analyses of Accident Data through Early 1996 (NHTSA Publication DOT HS 808 470)

Driver air bags reduce overall fatality risk by an estimated 11 percent in passenger cars and light trucks (essentially unchanged from the 1994 and 1992 NHTSA analyses). Passenger air bags are beneficial for right-front passengers age 13 or older. Air bags provide a life-saving benefit for belted as well as unbelted drivers. The fatality risk for child passengers age 0-12 in cars with passenger air bags is currently higher than in cars without them. Current air bags are significantly less effective for drivers age 70 or older than for younger drivers.

1995

Preliminary Evaluation of the Effectiveness of Antilock Brake Systems for Passenger Cars (NHTSA Publication DOT HS 808 206)

ABS significantly reduced multivehicle crashes on wet roads: fatal crashes by 24 percent, and nonfatal crashes by 14 percent. Fatal collisions with pedestrians and bicyclists were down a significant 27 percent. However, these reductions were offset by statistically significant increases in single vehicle, run-off-road crashes (rollovers or impacts with fixed objects). Fatal run-off-road crashes were up by 28 percent, and nonfatal crashes by 19 percent in the ABS-equipped cars, as compared to similar cars without ABS.

1994

Fatality Reduction by Automatic Occupant Protection in the United States (Proceedings of the 14th Conference on Enhanced Safety of Vehicles)

The fatality risk of front-outboard occupants in cars with motorized 2-point belts (without disconnect) is 6 percent lower than in cars with manual belts; the risk in cars with non-motorized 3-point belts is the same as in cars with manual belts. [This report's findings on air bags have been superseded by the 1996 evaluation - see above.]

An Evaluation of the Effects of Glass-Plastic Windshield Glazing in Passenger Cars (NHTSA Publication DOT HS 808 062)

Following an amendment to the glazing standard (FMVSS 205) in 1983, two manufacturers equipped some of their cars with glass-plastic windshields. Crash data indicate the injury reduction potential of these windshields is less than predicted. Fleet and warranty data show that durability problems are greater than anticipated. While glass-plastic windshields add $65 to the cost of a new car, their replacement costs are estimated to exceed $1,700.

Correlation of NCAP Performance with Fatality Risk in Actual Head-On Collisions (NHTSA Publication DOT HS 808 061)

There is a statistically significant correlation between the performance of passenger cars on the NCAP test and the fatality risk of belted drivers in actual head-on collisions. In a head-on collision between a car with "good" NCAP performance and a car of equal mass with "poor" performance, the driver of the "good" car has, on the average, about 15-25 percent lower fatality risk. The steady improvement in NCAP scores during 1979-91 was paralleled by a 20-25 percent reduction of fatality risk for belted drivers in actual head-on collisions.

1993

Preliminary Evaluation of the Effectiveness of Rear-Wheel Antilock Brake Systems for Light Trucks (Submitted to NHTSA Docket No. 70-27-GR-026)

Rear-wheel ABS significantly reduced the risk of nonfatal run-off-road crashes in light trucks: rollovers by about 30-40 percent, side impacts with fixed objects by 15-30 percent and frontal impacts with fixed objects by 5-20 percent. The reductions mostly did not carry over to fatal run-off-road crashes. Collisions with pedestrians and bicyclists were reduced by 5-15 percent. Involvements in multivehicle crashes were not reduced, and may even have increased with rear-wheel ABS.

1992

Evaluation of the Effectiveness of Occupant Protection - Federal Motor Vehicle Safety FMVSS 208 - Interim Report (NHTSA Publication DOT HS 807 843)

Air bags and automatic belts have significantly reduced the risk of nonfatal injury and occupant ejection. [This report's findings on fatality reduction for air bags have been superseded by the 1996 evaluation; for automatic belts - by the 1994 evaluation.]

An Evaluation of the Uniform Tire Quality Grading Standards and Other Tire Labeling Requirements (NHTSA Publication DOT HS 807 805)

Consumers and tire dealers were surveyed about their knowledge and utilization of tire quality grades and other tire information supplied in response to Federal regulations. The ratings for treadwear were viewed as "important" by 29 percent of consumers who had recently purchased tires, and the ratings for traction, by 27 percent. The majority of consumers are not aware that these ratings are printed on the tires.

1991

Auto Theft and Recovery - Effects of the Motor Vehicle Theft Law Enforcement Act of 1984 - Report to the Congress (NHTSA Publication DOT HS 807 703)

[Findings have been superseded by the 1998 evaluation - see above.]

Effect of Car Size on Fatality and Injury Risk

[Findings have been superseded by the 1997 evaluation - see above.]

1990

Motor Vehicle Fires in Traffic Crashes and the Effects of the Fuel System Integrity Standard (NHTSA Publication DOT HS 807 675)

Modifications to fuel systems in response to FMVSS 301 reduced the frequency of fires in nonfatal crashes of passenger cars by an estimated 14 percent; fatalities in cars and light trucks, however, were not affected. During 1975-88, the number of fire-related fatalities has increased from 1,300 to 1,800, primarily due to an aging vehicle fleet.

1989

An Evaluation of Door Locks and Roof Crush Resistance of Passenger Cars - Federal Motor Vehicle Safety Standards 206 and 216 (NHTSA Publication DOT HS 807 489)

Door latch improvements implemented during 1963-68 (preceding or responding to FMVSS 206) save an estimated 400 lives per year, reducing the risk of ejection in rollover crashes by 15 percent. The shift from hardtops to pillared cars with stronger roof support, in response to FMVSS 216, saves an estimated 110 lives per year.

An Evaluation of Center High Mounted Stop Lamps Based on 1987 Data (NHTSA Publication DOT HS 807 442)

[Findings have been superseded by the 1998 evaluation - see above.]

1988

An Evaluation of Occupant Protection in Frontal Interior Impact for Unrestrained Front Seat Occupants of Cars and Light Trucks (NHTSA Publication DOT HS 807 203)

During the 1960's and early 1970's, the manufacturers modified instrument panels of cars and light trucks, installing padding, reducing the rigidity of structures and extending the panel downward and toward the passenger. The improvements reduced fatality risk and serious injury risk by nearly 25 percent for unrestrained right front passengers of cars in frontal crashes, saving up to 700 lives per year.

1987

An Evaluation of the Bumper Standard - As Modified in 1982 (NHTSA Publication DOT HS 807 072)

To reduce regulatory burden on manufacturers, damage resistance requirements for bumpers were relaxed in model year 1983: the impact test speed was lowered from 5 to 2.5 mph. The net costs to consumers did not significantly change. A small increase in the repair cost over the lifetime of the car is offset by a reduction in the initial cost of the lighter bumpers. (See also the 1981 evaluation of bumpers.)

A Preliminary Evaluation of Seat Back Locks for Two-Door Passenger Cars with Folding Front Seatbacks (NHTSA Publication DOT HS 807 067)

FMVSS 207 requires a locking device for front seats with folding seatbacks, designed to limit the forward motion of the seatback in a collision. These locks or other seat components often separate at moderate crash speeds when they are impacted by back-seat occupants. No statistically significant injury or fatality reductions were found for seat back locks in any of the crash data files or in sled tests.

Fatality and Injury Reducing Effectiveness of Lap Belts for Back Seat Occupants (SAE Paper 870486)

[Findings have been superseded by the 1999 evaluation - see above.]

The Effectiveness of Center High Mounted Stop Lamps - A Preliminary Evaluation (NHTSA Publication DOT HS 807 076)

[Findings have been superseded by the 1998 evaluation - see above.]

1986

Fuel Economy and Annual Travel for Passenger Cars and Light Trucks: National On-Road Survey (NHTSA Publication DOT HS 806 971)

The actual fuel economy of model year 1978-81 vehicles was measured by a national survey in which drivers maintained log books of mileage and fuel purchases. On-road fuel economy of cars increased by 41 percent during model years 1977-81; the fuel economy of light trucks increased by 17-26 percent. However, the actual on-road fuel economy is consistently 15-20 percent below laboratory (EPA) ratings.

An Evaluation of Child Passenger Safety: The Effectiveness and Benefits of Safety Seats (NHTSA Publication DOT HS 806 890)

A correctly used safety seat reduces fatality risk by an estimated 71 percent and serious injury risk by 67 percent. But misuse can partially or completely nullify this effect. In 1984, when 39 percent of safety seats were correctly used and 61 percent were misused, the average overall fatality reduction for safety seats (correct users plus misusers) was 46 percent. In all, 192 children were saved by safety seats and lap belts in 1984.

1985

An Evaluation of Windshield Glazing and Installation Methods for Passenger Cars (NHTSA Publication DOT HS 806 693)

The High Penetration Resistant windshield doubled the impact velocity needed for the occupant's head to penetrate the windshield, reducing serious facial lacerations by 74 percent, preventing 39,000 serious lacerations and 8,000 facial fractures per year. Adhesive bonding of the windshield halved the incidence of bond separation and occupant ejection through the windshield portal in crashes, saving 105 lives per year.

1984

Effectiveness - Manual Lap and Lap/Shoulder Belts (Chapter IV-A of "Final Regulatory Impact Analysis - Amendment to Federal Motor Vehicle Safety Standard 208 - Passenger Car Front Seat Occupant Protection," NHTSA Publication DOT HS 806 572)

Manual lap-shoulder belts are estimated to reduce the fatality risk of drivers and right-front passengers by 40-50 percent [reconfirmed and superseded by the 2000 evaluation - see above], and serious injury risk by 45-55 percent, relative to an unrestrained occupant. The manual lap belt, alone, is estimated to reduce fatality risk by 30-40 percent and serious injury risk by 25-35 percent.

1983

An Evaluation of Side Marker Lamps for Cars, Trucks and Buses (NHTSA Publication DOT HS 806 430)

Side marker lamps were installed in response to FMVSS 108 to enable a driver to see another vehicle that is approaching at an angle at night. The lamps reduced nonfatal nighttime angle collisions by 16 percent, preventing 106,000 crashes, 93,000 injuries and $347 million in property damage per year. The lamps have not been effective in reducing fatalities.

A Preliminary Evaluation of Two Braking Improvements for Passenger Cars - Dual Master Cylinders and Front Disc Brakes (NHTSA Publication DOT HS 806 359)

Dual master cylinders, by providing a backup braking system in case of certain types of brake failure, prevent 40,000 crashes, 260 fatalities, 24,000 injuries and $132 million in property damage per year. Front disc brakes, which improve vehicle handling under various braking conditions, are estimated to prevent 10,000 crashes, 64 fatalities, 5,700 injuries and $32 million in property damage per year.

Evaluation of Federal Motor Vehicle Safety Standard 301-75, Fuel System Integrity: Passenger Cars (NHTSA Publication DOT HS 806 335)

[Findings have been superseded by the 1990 evaluation - see above.]

1982

An Evaluation of Side Structure Improvements in Response to Federal Motor Vehicle Safety Standard 214 (NHTSA Publication DOT HS 806 314)

Side door beams were installed in passenger cars to reduce the velocity and depth of door intrusion in side impact crashes. The beams are especially effective in side impacts with fixed objects, preventing 480 fatalities and 4,500 hospitalizations per year. In vehicle-to-vehicle side impacts, they prevent 4,900 nonfatal hospitalizations per year, but have not reduced fatality risk.

An Evaluation of Head Restraints - Federal Motor Vehicle Safety Standard 202 (NHTSA Publication DOT HS 806 108)

The purpose of a head restraint is to prevent whiplash injury in rear-impact crashes. There are integral (fixed) and adjustable head restraints; 75 percent of adjustable restraints are left in the "down" position by occupants. In 1982, integral head restraints reduced injury risk in rear impacts by 17 percent; adjustable restraints by 10 percent. The 1982 mix of head restraints prevented 64,000 whiplash injuries per year. [Subsequently, manufacturers have enlarged adjustable restraints to provide better protection, even in the "down" position. See also the 2001 evaluation of head restraints in light trucks.]

1981

An Evaluation of the Bumper Standard (NHTSA Publication DOT HS 805 866)

In order to reduce car repair costs for consumers, damage resistance tests were established for bumpers in model year 1973 and upgraded in 1974 and 1979. The bumper standards did not significantly change net costs for consumers: the savings in repair costs over the lifetime of the car are almost equal to the increase in the initial cost of the bumpers. (See also the 1987 evaluation of bumpers.)

An Evaluation of Federal Motor Vehicle Safety Standards for Passenger Car Steering Assemblies: Standard 203 - Impact Protection for the Driver; Standard 204 - Rearward Column Displacement (NHTSA Publication DOT HS 805 705)

Energy-absorbing, telescoping steering columns reduced the risk of serious injury due to steering-assembly contact by 38 percent. Rearward column displacement was reduced by 81 percent. The standards prevent 1,300 fatalities and 23,000 hospitalizations per year. The performance of energy-absorbing steering assemblies is degraded under nonaxial impact conditions.

1979

An Evaluation of Standard 214 (NHTSA Publication DOT HS 804 858)

[Findings have been superseded by the 1982 evaluation - see above.]