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People Saving People

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National Highway Traffic Safety Administration

Evaluation Program Plan

Calendar Years 2004-2007

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 databases of motor vehicle crashes that can be analyzed to find out what vehicle and behavioral safety programs work best.

This four-year plan presents and discusses the vehicle and behavioral 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, data collection, analysis, internal review, approvals, publication, review of public comments, and the last phase of preparing recommendations for subsequent agency action:

- A few evaluations based on relatively simple analyses of existing data (FARS, NASS) can be completed within a year.

- Many evaluations involve fairly complex statistical analyses of existing data and require closer to two years from start to finish, including all planning and reviews.

- At least two and up to four years are needed if new data must be collected by a contractor; the longer time applies if survey data require additional clearances.

- Long-term evaluations involving several phases as technologies evolve or that call for periodic follow-up studies can take five years or more.

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 also have been evaluated. So have promising safety technologies that were not mandatory under Federal regulations, such as antilock brake systems for passenger vehicles. The plan for calendar years 2004-2007 includes evaluations of new and existing vehicle and behavioral safety programs, regulations, technologies and consumer information programs.

Vehicle safety evaluations address crash avoidance, crashworthiness/aggressiveness, damage protection (bumpers), and recalls. They study passenger cars, light trucks, heavy trucks, motorcycles and low-speed on-road vehicles. Behavioral safety evaluations address impaired driving, occupant protection, motorcycle safety, speeding, enforcement, and emergency care (injury survivability).

Future evaluations have been subdivided into two groups. The topics that, as of January 2004, appear to be top priorities are tentatively scheduled for 2004, 2005, 2006 or 2007 starts. As stated above, evaluations take at least a year, and sometimes many years from start to finish; the write-ups discuss approximately how long each evaluation will require. Sometimes, the order of the evaluations may need to be rearranged as new priorities emerge. "Other Potential Evaluations" address topics that now seem a lower priority, but depending on circumstances might supplement or replace some projects in the first group.

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 five years. The most recent plan before this one was published on May 8, 1998 (*Federal Register*, Volume 63, p. 25543).

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EVALUATIONS UNDERWAY

FUTURE EVALUATIONS

SUMMARIES OF PAST EVALUATIONS

LIST OF ABBREVIATIONS

ABC	America Buckles Up Children Mobilization (National Safety Council)
ABS	Antilock brake system
ADL	Automatic door locks
ADT	Average daily traffic
ALR	Administrative licensing revocation
BAC	Blood alcohol concentration
CHMSL	Center high mounted stop lamp
DWI	Driving while intoxicated
ECE	Economic Commission for Europe
EMS	Emergency medical services
EMT	Emergency Medical Technician
EPA	Environmental Protection Agency
ESCS	Electronic stability control system
EWR	Early Warning Reporting system for notifying NHTSA about possible vehicle defects
FARS	Fatality Analysis Reporting System (a census of fatal crashes in the United States since 1975)
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulation
FMVSS	Federal Motor Vehicle Safety Standard
GES	General Estimates System, a part of NASS

GVWR	Gross Vehicle Weight Rating (specified by the manufacturer, equals the vehicle's curb weight plus maximum recommended loading)
HIC	Head Injury Criterion
HID	High intensity discharge headlamp
IIHS	Insurance Institute for Highway Safety
IPT	Integrated Project Team (at NHTSA)
LATCH	Lower anchors and tethers for children
LBS	Linked braking systems (for motorcycles)
LTV	Light trucks and vans (includes pickup trucks, SUVs, minivans and full-sized vans)
MDB	Moving deformable barrier
MIL	Malfunction indicator lamp for heavy-truck ABS
MY	Model year
MVOSS	Motor Vehicle Occupant Safety Survey
NAFTA	North American Free Trade Agreement
NASS	National Automotive Sampling System (a probability sample of police-reported crashes in the United States since 1979, investigated in detail)
NCAP	New Car Assessment Program (consumer information supplied by NHTSA on the safety of new cars and LTVs, based on test results, since 1979)
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NMSL	National Maximum Speed Limit (55 mph, 1974-87)
NOPUS	National Occupant Protection Use Survey (statistics for the United States, since 1994, from a national observational survey based on a probability sample)
NPRM	Notice of Proposed Rulemaking

PCI	Passenger compartment intrusion
pdf	Portable document format
SAE	Society of Automotive Engineers
SSF	Static stability factor
STOP-DWI	Special Traffic Options Program for Driving While Intoxicated
SUV	Sport utility vehicle
Thor-Lx/HIIIr	Lower extremity (Lx) retrofit (r) for the version of the Hybrid III (HIII) anthropomorphic dummy that is named THOR; the modification enhances the dummy's capability of measuring leg injuries
TREAD	Transportation Recall, Enhancement, Accountability and Documentation Act of 2000
TTI(d)	Thoracic Trauma Index for the dummy in a side-impact test
TTMA	Truck Trailer Manufacturers Association
VMT	Vehicle Miles of Travel

EVALUATIONS UNDERWAY

EVALUATIONS NEARING COMPLETION

On-off switches for air bags

Background Air bags have on the whole saved thousands of lives. However, some people - infants, out-of-position children and adults of very small stature or with certain medical conditions – may be at increased risk if exposed to some types of air bag deployments. 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. The rule was intended to accommodate high-risk passengers until advanced air bags became available. By mid-2001, 11.7 million pickup trucks and 171,000 passenger cars or cargo vans were 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. As a related issue, find out if an increasing percentage of children are riding in the back seat, where there is no problem of interactions with deploying air bags.

Approach A survey of the use of on-off switches was conducted at fast-food restaurants, shopping center parking lots and similar locations in 2000. Since the correctness of the switch setting depends entirely on who is in the seat at that moment, the survey was performed while vehicles were occupied. Unlike shoulder belt use, the setting of the on-off switch could not be observed from a distance; it was necessary to talk to people in stopped vehicles in a friendly environment. The interview included questions about drivers’ reasons for turning the switch on or off, their opinions on the risks and benefits of air bags.

Status An Evaluation Note, *Preliminary Results of the Survey on the Use of Passenger Air Bag On-Off Switches*, was published in July 2001. A comprehensive report has been prepared and is undergoing final revisions.

Rear window defoggers (FMVSS 103)

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.

Objectives Estimate the effectiveness of rear window defoggers in reducing crashes in which a driver is backing up, changing lanes, or performing other tasks facilitated by vision through the rear window.

Approach Statistical analysis of State crash data from the 1980's onward.

Status A draft evaluation report is circulating within the agency.

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 is not 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.

Approach Detailed information has been obtained about the model years in which trucks were first equipped with side door beams or other side-structure modifications. FARS data have been analyzed by the methods developed in the 1982 and 1999 evaluations of FMVSS 214 for passenger cars.

Status A draft evaluation report is circulating within the agency.

EVALUATIONS UNDERWAY, STARTED BEFORE 2003

Lives saved by vehicle safety equipment, 1960-2002

Background Since 1979, NHTSA has issued over 40 comprehensive evaluations of FMVSS or other vehicle safety programs or technologies. 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 lives saved by each of the individual FMVSS and vehicle safety technologies evaluated to date - and the total number of lives saved - in each individual calendar year since 1960. 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; (3) Safety technologies are often introduced before a FMVSS takes effect. The procedure must be designed to avoid "double-counting" of benefits when the same life is "saved" by two different FMVSS. Project the future benefits when all vehicles on the road meet all the existing FMVSS. Provide a single document describing the FMVSS and safety programs evaluated by NHTSA, and summarizing the evaluation methods and findings.

Approach The actual fatality cases on FARS will be inflated to estimate the number of fatalities that would have occurred if none of the FMVSS or safety technologies had been implemented. For example, one actual fatality case on FARS of a person who used 3-point safety belts, given that safety belts reduce fatality risk by 45 percent, corresponds to 1.82 hypothetical fatalities if safety belts did not exist. Cases are inflated one step at a time, starting with the most recent applicable FMVSS (depending on the crash type, occupant's seat position, etc.) and working back to the earliest.

Status Completion expected in 2004 or 2005.

Cost of NHTSA vehicle safety standards, 1968-2002

Background Since the late 1970's, NHTSA has sponsored many cost studies of safety equipment to meet the FMVSS. Cost studies are based on a detailed engineering "teardown" analysis of the individual pieces and assemblies of which the system is composed, employing a process known as "reverse engineering". The system components are physically torn down into their most elemental parts to identify the process operation by which each elemental part is made in terms of labor minutes; direct materials and scrap, machine occupancy hours or stations times; and machinery, equipment, and tooling utilized. The cost estimates are used in combination with effectiveness evaluations to inform the public about the costs and benefits of FMVSS. Fifty-four studies, covering approximately 30 standards, have been completed with the results scattered among many hard-copy contractor's reports. Different reports compute costs using different economic years and may be inconsistent in their method of averaging costs across models.

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 estimates were derived. The report will estimate the total cost of meeting the FMVSS in passenger cars and the cost and weight per car, year-by-year, back to model year 1968. Previously unreleased contractor studies will be made available to the public in "pdf" format.

Approach Cost and weight data for major components will be extracted from contractor and NHTSA reports and compiled into a summary report. 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 using the gross domestic product implicit price deflator from the Bureau of Economic Analysis.

Status Completion expected in 2004 or 2005.

Safety belt pretensioners and load limiters (Phase 2: FARS data analysis)

Background Some safety belts may be more effective than others. Two technologies for improving the performance or use of belts are widely available as of 2003. 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 63 percent of MY 2002 light vehicles) retract the safety belt to remove any slack almost instantly in a crash. Load limiters (installed on 84 percent of MY 2002 light vehicles) prevent belt forces from reaching unsafe levels by causing parts of the safety belt to stretch or deform at a predetermined, safe force level. NHTSA's Phase 1 evaluation shows that the combination of pretensioners and load limiters significantly reduces HIC, chest acceleration, and chest deflection scores on 35 mph frontal NCAP tests.

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 – in all crashes and in frontal crashes. Estimate the effect of pretensioners and load limiters on fatal and serious head, chest, and abdominal injuries. Look at the effectiveness of each technology by seating position, to determine whether they perform differently.

Proposed Approach Information will be obtained from NHTSA's *Buying a Safer Car* about the initial installation dates of these technologies, by make-model, and manufacturers will be contacted if necessary for clarification. 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 – in all crashes and in frontal crashes. 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.

Status The Phase 1 evaluation, "NCAP Test Improvements with Pretensioners and Load Limiters" was published in March, 2003. The evaluation may require 2-3 years until sufficient FARS data accumulate.

Side impact protection (Phase 2: effect of FMVSS 214 in cars; Phase 3: 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 Rating starting in model year 1999. The upgraded FMVSS 214 aimed to reduce fatal thoracic injuries when a car is struck in the side by another vehicle. Even before the rule was issued, manufacturers improved test performance, or phased out poor performers, especially among 2-door cars. Phase 1 of this evaluation showed that 2-door cars with good test performance had lower fatality risk in side impacts than poor performers. The manufacturers have provided NHTSA with detailed lists and diagrams showing what changes were made to achieve compliance during the phase-in period (viz., structure plus padding, padding only, or minor changes only). Since 1997, NHTSA has supplied consumers with information on side impact test results (at a higher speed than the basic FMVSS 214 compliance test) as part of the New Car Assessment Program (NCAP).

Objectives *Phase 2:* Evaluate the change in side-impact fatality risk after FMVSS 214 vs. just before the standard: for all cars, by car type (2-door vs. 4-door), by type of vehicle modification (structure plus padding vs. padding only), and as a function of how much the test criterion TTI(d) was reduced when the standard was implemented in a make-model. Estimate the consumer cost of vehicle modifications in response to the new standard. *Phase 3:* Study the correlation between test results on Side NCAP and fatality risk in actual side-impact crashes.

Approach *Phase 2:* The Phase 1 evaluation report includes the analysis plan for Phase 2 and describes, on a year-by-year basis, the vehicle modifications made in response to FMVSS 214. A database of TTI(d) performance, for post-standard and pre-standard cars will be assembled from compliance tests of post-standard cars and matching tests of pre-standard cars. Based on FARS, NASS and R.L. Polk registration data, the side-impact fatality rate will be compared in make-models before vs. after the implementation of FMVSS 214. Fatality rates can be computed per vehicle exposure year, relative to a control group of frontal crashes, or per 100 towaway crashes (NASS only). *Phase 3:* A database of TTI(d) performance will be assembled from Side NCAP tests (higher speed than FMVSS 214 compliance tests). The correlation between Side NCAP scores and actual fatality risk will be analyzed by methods similar to the Phase 1 report.

Status The Phase 1 report was published in 1999. Cost analyses based on "teardown" have been completed. The test criterion TTI(d) was measured in seven pre-standard make-models for comparison with results in compliance tests for vehicles meeting FMVSS 214. Phase 2 may require 2-3 years and Phase 3, 4-5 years until sufficient crash data accumulate.

Antilock Brake Systems (ABS) for heavy trucks (FMVSS 121)

Background In 1996, NHTSA amended FMVSS 105 (hydraulic brake system) and FMVSS 121 (air brake system) to require ABS and a malfunction indicator lamp (MIL lamp) on all new heavy vehicles (GVWR greater than 10,000 pounds). Implementation was performed over a three-year period: air-brake truck tractors manufactured on or after March 1, 1997, air-brake trailers and single-unit trucks manufactured on or after March 1, 1998, and hydraulic braked trucks manufactured on or after March 1, 1999. The purpose of ABS is to help maintain directional stability and control during braking and possibly reduce stopping distances on some road surfaces, especially on wet roads. ABS may prevent crashes involving loss of control, skidding, jackknife, and possibly trucks with conventional brakes unable to stop in time to avoid hitting another vehicle.

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

Proposed Approach NHTSA plans to collect medium and heavy truck crash data from one or more large State police agencies for a period of 2-3 years. Every crash involving a tractor-trailer, a bobtail tractor, or a medium or heavy single-unit truck will be investigated and data sent to NHTSA. Statistical analyses of the effectiveness of the new medium/heavy duty truck anti-lock brake standard will be assessed using the State police accident reports and NHTSA supplemental crash report forms, along with FARS and State crash data files. 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, multi-vehicle) vs. a control group of crash involvements that do not involve braking. In addition, information about what vehicles have 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, durability, and reliability of the ABS will be studied in government and/or private trucking fleets.

Status. Collection of crash data will begin in 2004 with the North Carolina State Highway Patrol and will continue until late 2005. Statistical analyses will begin in 2006. The survey of maintenance costs, durability, and reliability of ABS is underway. The teardown analysis has been completed.

Truck underride protection (FMVSS 223 and 224)

Background NHTSA issued FMVSS 223 and 224 in January 1996 to reduce the number of deaths and serious injuries that occur when light duty vehicles collide with the rear end of trailers and semi-trailers. FMVSS 223 specifies the height, width, length, and strength requirements for rear impact guards for trailers and semi-trailers; whereas, FMVSS 224 establishes requirements for the installation of rear impact guard on trailers and semi-trailers with a GVWR of 10,000 pounds or more manufactured on or after January 1998. However, the Truck Trailer Manufacturers Association (TTMA) had already issued a voluntary Recommended Practice in April 1994 that included all the essential elements of the subsequent NHTSA standards except for the energy absorption requirement. Between January 1952 and 1998, trailers and semi-trailers were Federally regulated by Federal Motor Carrier Safety Regulations (FMSCR) or their predecessors that mandated rear impact guards, which allowed substantially smaller guards than the NHTSA standard and the TTMA recommended practice and imposed no strength tests on the guards. This standard does not apply to pole trailers, pulpwood trailers, low chassis vehicles, special purpose vehicles, "wheels back" vehicles, or temporary living quarters.

Objectives Evaluate the effectiveness of the new rear impact guard safety standard. Compare the crash performance of guards on trailers meeting the NHTSA standard and/or TTMA recommended practice to the smaller "pre-TTMA" guards on trailers meeting only the 1952 FMSCR standard. Compare the striking vehicle (car, pickup truck, SUV, or van) passenger compartment intrusion (PCI) underride rate of the "pre-TTMA" guard and the PCI underride rate of the new NHTSA and/or TTMA guard for trailers. Examine the crash performance of the rear-end structures of single-unit trucks. Estimate the cost per vehicle for the initial installation and subsequent maintenance of the rear impact guard. Examine the durability and reliability of the rear impact guard.

Proposed Approach NHTSA plans to collect medium and heavy truck crash data from one or more large State police agencies for a period of 2-3 years. Because some type of rear impact guard was 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. Statistical analyses of the effectiveness of the new NHTSA rear impact guard will be assessed using the State police accident reports and the NHTSA supplemental crash report forms, along with examination of selected cases from the NASS system. In addition, the long-term trends of fatalities in underride and rear-impact crashes will be studied in FARS. The cost for the initial installation of the rear impact guard will be estimated from "teardown" analyses or from information provided by manufacturers. Maintenance costs and durability of the rear impact guards will be studied in government and/or private trucking fleets.

Status. Collection of data will begin in 2004 with the North Carolina State Highway Patrol and will continue until late 2005. Statistical analyses will begin in 2006. The survey of maintenance costs and durability of the rear impact guards is underway.

EVALUATIONS BEGUN IN 2003 – VEHICLE SAFETY

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 has been 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. As of 2003, most vehicles have received upgraded padding or other energy-absorbing materials. However, an increasing proportion of vehicles are being equipped with 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: these will be evaluated separately (see "Side air bags + head air bags," 2004 starts – vehicle safety).

Objectives Estimate the effect of the new padding and energy-absorbing materials on the risk of fatal and serious head injuries. Estimate the consumer cost of vehicle modifications in response to (or in anticipation of) the new standard.

Proposed Approach The cost of FMVSS 201 modifications (without head-impact air bags) will be estimated from "teardown" analyses. Head injury rates in pre-standard cars and in post-standard cars with energy-absorbing padding 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.

Status "Teardown" analyses of head-impact areas in FMVSS 201 vehicles without head air bags, and in comparable pre-standard vehicles, are underway. A contract has been awarded to perform head-impact tests, similar to the FMVSS 201 compliance test, on pre-standard vehicles. The evaluation is likely to require at least four years for sufficient crash data to accumulate.

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. Suppliers depowered their air bags by removing some of the propellant. This redesign took place in time for the 1998, or at the latest, the 1999 model year (but some air bags may have had little change from 1997 to 1999). 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 conceivably be less effective than pre-1998 air bags for unbelted occupants. 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 some of those in NHTSA's 1996 evaluation of air bags, will be used to compare fatality risk with pre-1998 and depowered air bags. Statistical analyses of NASS data, similar to those in the 2001 *Fifth/ Sixth Report to the Congress: Effectiveness of Occupant Protection Systems and their Use*, 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. The manufacturers furnished NHTSA with extensive test data (rise rates, tank pressures) in response to Information Requests. These data, supplemented if necessary by additional test procedures, will be used to classify the air bags. Initial statistical analyses can be completed in 2004, but more time may be needed if (1) additional test data have to be collected or (2) the initial FARS database is not large enough for statistically meaningful results.

LATCH – impact on safety seat use, cost, effectiveness

Background In March 1999, NHTSA amended FMVSS 213 and 225 establishing a uniform child restraint attachment system known as LATCH, Lower Anchors and Tethers for Children. LATCH allows installation of child safety seats in vehicles without use of the vehicle's current safety belts. FMVSS 225 requires vehicles to be equipped with an independent child restraint anchorages system that consists of two lower anchorages and one upper anchorage for the tether. FMVSS 213 requires child restraints to be equipped with a means of attaching to these anchorage systems. The anchorage system was phased into the fleet and child safety seats, but requires all passenger vehicles and child safety seats manufactured after September 1, 2002 to have the LATCH. The system is designed to make child safety seats easier to install correctly and increase their effectiveness.

Objective Determine the impact on child safety seat use and cost. Specifically, find out if consumers are using the LATCH system to install child safety seats, if they are easy to install, and the percentage that are being installed correctly. As a related issue, find out if children are using the appropriate child safety seat for their age, weight, and height.

Proposed Approach A survey on the use of LATCH will be conducted at fast-food restaurants, shopping center parking lots and similar locations. Since lower anchorage installation 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 and the passenger air bag on-off switch survey. The survey will include older vehicles without LATCH anchorages to evaluate the compatibility of LATCH equipped child safety seats in these vehicles. The interview will include questions to the drivers about their knowledge of LATCH, ease of installation using the LATCH system, and reasons for not using LATCH to secure child safety seats. Cost of the anchorage system in vehicles and on child safety seats will be estimated from "teardown" analyses or from information provided by manufacturers. Additionally, injury rates to children in NASS will be compared by vehicle type (with or without LATCH), safety seat type (with or without LATCH) and tether use.

Status A contract to conduct the survey has been awarded. The survey will be conducted in the spring and early summer of 2005, followed by statistical analyses and the preparation of a report.

Booster seat use and effectiveness

Background NHTSA recommends that children who have outgrown child safety seats, are less than 8 years old, and are less than 4'9" tall should be in booster seats. When properly used, booster seats can help prevent injury to older children by making adult-sized safety belts fit more effectively. Without a belt-positioning booster seat, the lap belt can ride up over the child's stomach and cause serious internal injuries in a crash, and the shoulder belt can cross the face, causing the child to slide out from underneath it causing serious injury to the head, face and neck.

Objective Estimate the effectiveness of booster seats in reducing fatality and injury risk to children. Compare the fatality and injury rates of children 4 to 7 years old in booster seats, safety belts, and no belts. Estimate the use of booster seats by children 4 to 7 years old.

Proposed Approach Statistical analysis of FARS and NASS data, by methods similar to those used in the 1986 evaluation of safety seats, to assess the relative fatality and injury risk to children aged 4 to 7 years in booster seats, safety belts, and unrestrained. A survey of the restraint use by children will be conducted at fast-food restaurants, shopping center parking lots similar to the approach used in past surveys at "Hardee's" on the misuse of child safety seats. Other sources of booster seat usage will also be explored.

Status A contract to conduct the survey has been awarded. The survey will be conducted in the spring and early summer of 2005, followed by statistical analyses and the preparation of a report.

EVALUATIONS BEGUN IN 2003 – BEHAVIORAL SAFETY

Comparative analysis of State assessments of impaired driving programs

Background NHTSA currently offers States an opportunity for an outside review of their respective impaired driving programs. At the request of the individual States, NHTSA has completed assessments of 30 different State impaired driving programs. NHTSA assembles teams of non-federal experts who use NHTSA guidelines to assess State activities in such programmatic areas as management, control, prevention, deterrence, driver licensing, community programs, data and records, and evaluation. The team provides its recommendations for improvements to the State's programs.

Objectives NHTSA desires an overall examination of the completed impaired driving program assessments for the initial purpose of determining common programmatic strengths and weaknesses that the assessed States may share (Phase One). A follow-on evaluation (Phase Two), if warranted, would be an effort to document the impact of the assessment program on the ability of States to improve impaired driving programs.

Approach Phase One is a comparative analysis of completed Impaired Driving Program State assessments done by reviewing the reports, compiling findings and recommendations, synthesizing the compiled information by program area, and developing an overall summation. Phase Two would be an outcome evaluation done to assess the cost-effectiveness of assessment efforts by identifying actual outcomes in State programs that occurred as a result of an assessment; identifying pending program changes due to assessment results; identifying practical benefits of the assessment process according to the States; identify recommended process improvements that may make assessments more responsive to State needs; and, indicate areas of potential refinement in the assessment process. Completion of Phase One is expected in 2004.

National statistical analysis of impaired driving trends

Background Impaired driving has been a principal culprit in fatal motor vehicle crashes. During the past two decades, tireless efforts were made through national movements toward legislative enactments (blood alcohol concentration (BAC) laws, administrative licensing revocation (ALR) laws, legal drinking age laws, etc.) to deter impaired driving. In addition, many programs that were funded by the States or by the local community chapters were created to reduce the impaired driving rate. As a result, involvement of impaired drivers in fatal crashes has decreased at a steady rate from 57 percent in 1982 to an all time low of 41 percent in 1994. However, it then leveled off and has remained close to 41 percent since 1994.

Objectives Statistically analyze national trends on alcohol involved crashes and alcohol related traffic stops since 1982, taking into account a wide variety of demographic and economic factors as well as alcohol consumption and programs to reduce impaired driving. Study the relationships between impaired driving trends and population by age group and vehicle type (e.g., motorcycles vs. other passenger vehicles). Examine the effectiveness of deterrence programs such as public information and education, legislation (BAC laws, ALR law, etc.), enforcement, prosecution, and adjudication. Identify other external factors (liquor taxes, etc.) that may contribute to the trends and estimate their impact.

Proposed Approach FARS data will be analyzed on a time series and cross-sectional basis (State-by-State). Economic and demographic factors will be compiled from government sources such as NASS reports and State data. Information on State legislative enactment/effective dates and other program activities are available from NHTSA files. Completion of the statistical analyses is expected in 2004.

FUTURE EVALUATIONS

I. EVALUATIONS PLANNED TO START IN 2004 – VEHICLE SAFETY

Side air bags + head air bags

Background Whereas most of the initial FMVSS 214 vehicles used padding and/or upgraded structure to protect occupants from thoracic or abdominal injury in side impacts, by MY 2001, 22 percent of new passenger vehicles had special air bags designed to provide an additional cushion between the occupant and the side structure. By MY 2003, many vehicles were also equipped with head air bags to enhance protection against head injuries, as required by FMVSS 201, and to help prevent occupant ejection through side windows. Available technologies include: (1) Door-mounted side air bags; (2) Seat-mounted side air bags; (3) Seat-mounted, integral torso + head air bags; (4) Roof-rail-mounted, tubular head air bags; and (5) Roof-rail-mounted head "curtain" air bags. Side air bags and head 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 in side impacts. Study the effect of head-impact air bags on fatality rates, head-injury rates, and occupant ejection rates. Compare the effectiveness of the various types of side air bags and head air bags. Estimate the cost of head air bags. Compare the Thoracic Trauma Indices [TTI(d)] and other measures of test performance of vehicles with side air bags/head air bags to similar vehicles without the air bags.

Proposed Approach FARS (including the enhanced FARS file with cause-of-death information) and NASS data will be analyzed by methods developed in earlier evaluations of frontal air bags and side impact standards to determine the effect of side air bags and head air bags on fatality and serious-injury risk, as well as the effect of head air bags on occupant ejection. Databases of test performance, for vehicles with and without side air bags/head air bags will be assembled from FMVSS 214/FMVSS 201 compliance tests and Side NCAP tests. The cost of these air bags will be estimated from "teardown" analyses. The evaluation may require 2-3 years or more until sufficient FARS data accumulate for a definitive, final report; the agency may possibly also issue an interim report.

Electronic stability control systems – cost and effectiveness

Background Electronic stability control systems (ESCS) assist drivers to better control their vehicles during dangerous situations such as spinning and rollover. They rely on the control systems that are embedded in the microcomputer to record data on the actual state of the vehicle (driver and vehicle behavior) and compare it with its nominal state to determine if the vehicle is out of control and make the adjustments accordingly. ESCS may help drivers to maintain their vehicles on the road and prevent rollovers and collisions with fixed objects. Only a few automakers in the industry have implemented this system on their product lines as of 2001. Thus, crash data with ESCS are just now becoming available for statistical studies.

Objectives Study the effect of electronic stability control systems on single-vehicle crashes, including rollovers and impacts with fixed objects, by crash type, vehicle type and model year, atmospheric condition, and driver behavior. Estimate the consumer cost of this system.

Proposed Approach FARS and State crash data and Polk registration data will be used to compare single-vehicle crash involvement rates on vehicles with ESCS and those of the same make models without ESCS. The cost of ESCS will be estimated by "teardown" studies. The evaluation may require 2-3 years or more until sufficient crash data accumulate for a definitive, final report; the agency may possibly also issue an interim report.

Rollover information - trend of static stability factor and rollover risk

Background Rollover crashes are one of the most significant safety problems for all classes of light vehicles, especially light trucks. According to the 2001 FARS, there were 10,647 vehicles involved in fatal rollover crashes. FARS shows that 20 percent of light vehicles in fatal crashes involved rollover. The proportion differs greatly by vehicle type: 16 percent of passenger car vehicles were involved in rollover, compared to 25 percent for pickup trucks, 19 percent for vans, and 35 percent for sport utility vehicles (SUVs). The 2001 General Estimates System (GES) estimates that 296,000 light vehicles were involved in a rollover crash. Eighty-two percent of rollover crashes are single-vehicle crashes. The TREAD Act of 2000 specified that the agency develop and promulgate consumer information on the rollover performance of light trucks and SUVs. This measure of rollover resistance, the Static Stability Factor (SSF) was added to the MY 2001 NCAP tests and is reported in Buying a Safer Car on a scale of 1 to 5 stars. The SSF is a measure that equals one half of the track width divided by the height of the center of gravity above the road. This measurement identified the location of the center of gravity of the vehicle and correlated this to the risk of a tripped rollover crash. Linear and logistic regressions were run in 2000, using MY 1994 to 1998 vehicles, to determine and verify the relationship between SSF and rollover rate. It was found that the correlation of SSF to rollovers per single vehicle crash is remarkably robust in an area as complex as rollover.

Objectives Track the trend of the SSF to determine if current models have a higher SSF (and are therefore less prone to rollover). Determine whether there has been a trend to lower rollover rates in the most recent models. Compare SSF and rollover rates for earlier and later vehicles when there has been a major model redesign.

Proposed Approach Use State crash data to determine rollover rates of current as well as earlier model year vehicles. Obtain track width and height of center of gravity data on earlier model year vehicles for which NHTSA has current SSF measures, particularly those that have undergone a major design change. This evaluation can probably be completed within a year, since it is based on analyses of existing data; it should be updated from time to time.

EVALUATIONS PLANNED TO START IN 2004 – BEHAVIORAL SAFETY

New York State STOP-DWI law and "Pay Your Own Way" program

Background The New York State Special Traffic Options Program for Driving While Intoxicated (STOP-DWI) was developed in 1980 in an effort to decrease alcohol-related fatalities and injuries in the State. The program objective was to lay the foundation for the development of effective, self-funding, local programs. Each New York county has a STOP-DWI Program which has led to the development of creative programs and increased cooperation between localities. Since the program's inception in 1981 and 2000, there have been significant decreases in alcohol-related crashes, fatalities, and injuries in New York State and, the annual average for collected fines has risen from less than $500,000 to $22 million. The counties retain the fine money to operate the program. No taxpayer money has been spent since the inception of the program. The STOP-DWI Program is considered to be an exemplary and effective program, and therefore may be worth examining in order to determine standards and mechanisms that may potentially benefit impaired driving programs in other States. New Jersey and New Mexico are also developing self-sustaining programs to reduce impaired driving.

Objectives Determine why the New York STOP-DWI Program (and, possibly, self-sustaining programs in other States) have been successfully implemented. Compare STOP-DWI Program outcomes to outcomes of impaired driving programs in other States. Determine aspects of the STOP-DWI program that may be desirable for other States to emulate.

Proposed Approach In coordination with the New York State Department of Transportation, perform a process-based evaluation to examine how the STOP-DWI Program works and why it produces successful results. This would include examining the organization of the STOP-DWI program; determining specifics of how the program works; determining specific program successes and shortcomings; determining sources and uses of resources; determining factors that make the program work in New York; and, identifying potential obstacles in other States. The data collection effort would include identifying and interviewing relevant New York State and local officials and identifying and reviewing relevant program documentation including pre- and post-program data. Consider extending the evaluation to other States with self-sustaining programs. The evaluation may require 2-3 years, depending on the extent of data collection.

State motorcycle safety programs

Background More than 100,000 motorcyclists have died in traffic crashes since the enactment of the Highway Safety Act of 1966. The number of motorcyclist fatalities greatly decreased from 1980 to 1997, but from 1997 to 2001, fatalities increased almost 49 percent. In 2002, 3,244 motorcyclists were killed and an additional 65,000 were injured in traffic crashes in the United States. Both fatalities and injuries increased from 2001 totals. NHTSA focus in the motorcycle safety arena centers on preventing motorcycle crashes; decreasing motorcycle crash injuries and fatalities; increasing the proportion of properly licensed motorcyclists; promoting motorcycle safety education; supporting helmet laws; and, encouraging use of helmets and other protective gear. Rider education has been a priority in NHTSA grants and State motorcycle safety programs.

Objective Much information is needed regarding motorcycle safety programs, especially regarding the effectiveness of rider training programs and on alcohol-related motorcycle fatalities. Investigate relationship between State spending on motorcycle safety programs and motorcycle-related fatalities and injuries. Determine if funding is effectively focused on motorcycle safety issues.

Proposed Approach Review State spending data and determine spending by motorcycle safety program area (e.g., rider training, impaired riding, licensing requirements, helmet and protective gear laws, etc.). Review motorcycle crash data. Correlate the spending data with the crash data. Compare motorcycle crash rates and characteristics, especially those of young drivers, in States with extensive rider education programs and States without such programs (taking into account external factors such as climate and population density). The evaluation may require 1-3 years, depending on the extent of data collected about State programs, and whether a contractor or NHTSA staff gathers the data.

Statistical comparison of observed belt use on the road, in potentially fatal crashes, and occupant ejection

Background Between 1991 and 2001, observed on-the-road safety belt use by front seat occupants increased from 54 to 73 percent, or to express it another way, unrestrained travel decreased from 46 to 27 percent. However, during these years, the number of occupants who were ejected in crashes and fatally injured increased from 9,052 to 9,468.

Objective Explain the discrepancy between increased belt use and the trend in ejection, considering factors such as: 1) the shift from passenger cars to LTVs, 2) discrepancy between observed belt use on-the-road and by crash-involved drivers, 3) demographic shifts.

Proposed Approach Safety belt use data from NOPUS and fatality data from FARS will be analyzed to address questions such as: (1) Does the increase in the number of LTVs on the road play a role in the increase of ejected occupant injuries and fatalities? (2) What is the relationship between the observed belt use increase on the road and people who are involved in rollovers? (3) What are the correlations between ejection rates and other contributing factors (high speed driving, driver age/gender, etc.)? This evaluation can probably be completed within a year, since it is based on analyses of existing data.

II. EVALUATIONS PLANNED TO START IN 2005 – VEHICLE SAFETY

Motorcycle brake systems

Background Motorcycle fatalities have steadily increased from 1997 to 2002. Motorcycle brake systems, and the riders' misuse/underuse of the systems, are potential factors in many crashes. Two promising technologies are available in production motorcycles: antilock brake systems (ABS); and combined braking systems (CBS) that apply the brakes on both wheels when only one lever/pedal is applied. Currently, NHTSA is conducting a joint research project with Transport Canada to quantify the performance of a various motorcycle brake systems, including ABS and CBS, based on a series of stopping tests, on dry and adverse surfaces, with straight-line braking and braking in a curve.

Objectives: Estimate the crash-reducing effectiveness of ABS and CBS. Determine the relationship between motorcycle stopping distances/brake types and crash rates. Determine the proportion of new motorcycles in recent model years that are equipped with ABS or CBS, and classify the fleet by stopping-distance performance.

Proposed Approach: Building on the current NHTSA/Transport Canada study, develop a more comprehensive database by motorcycle make-model to determine the influence of stopping distance/brake type on motorcycle crashes. Work with the motorcycle manufacturers to (1) obtain statistics on motorcycle sales by brake type (ABS, CBS, percentage of motorcycles with front and rear hydraulic brakes, a combination of hydraulic and cable brakes, and all cable brakes, etc.); (2) identify the brake types of crash-involved motorcycles from their VINs. Based on FARS, State crash data and registration data, compare the crash rates/distributions of motorcycles with ABS, CBS and conventional brakes, and of make-models with different performance levels in stopping-distance tests. The evaluation is likely to take 3 years, since it combines extensive data collection and statistical analyses.

Glare problems with LTV headlamps and auxiliary lamps (FMVSS 108)

Background FMVSS 108 specifies requirements for original and replacement lamps, reflective devices, and associated equipment. The goal is to reduce traffic crashes and related deaths and injuries by providing adequate roadway illumination. The agency wants to enhance the conspicuity of motor vehicles so that their presence is perceived and their signals understood, both in daylight, darkness, or other conditions of reduced visibility. However, with the introduction of high intensity discharge headlamps (HIDs) and look-alike halogen bulbs, the high-mounted headlamps on the popular LTVs, and the upswing in auxiliary lamp use, consumers have registered complaints about glare issues. Glare, whether at levels that are annoying or disabling, increases the stress for drivers in the more dangerous nighttime environment that can result in a greater safety risk.

Objective Quantify the range of glare problems from lamps in today's passenger vehicles. Determine if the effects of glare from HIDs, high-mounted headlamps, and auxiliary lamps increases crashes, injuries, and fatalities.

Proposed Approach Examine and analyze crash data from the FARS, NASS, and State data files to identify crash cases impacted by glare. Measure the headlight aim and the headlamp mounting height on LTVs. Develop a laboratory test setup to assess the degree of glare from various passenger vehicles (based on quantitative measurement and/or judgment by volunteers). Determine if specific LTV make-models have more issues/complaints with glare. Determine if there is a difference in glare from direct view (headlamps shining directly into the eyes of oncoming drivers) or from indirect view (headlamps shining directly into the mirrors of preceding passenger vehicles). Determine which type of glare produces more stress for drivers in the nighttime environment. Determine which type of glare increases the possibility of crashes. Determine if specific age groups are more affected by glare. Review consumer complaints. The evaluation is likely to take 3 years, since it combines extensive data collection and statistical analyses.

Cost of rear-center 3-point belts

Background Studies have shown that lap/shoulder belts are more effective than lap belts in reducing fatalities in motor vehicle crashes. However, the installation of a lap/shoulder belt in the rear-center position is more complicated than the outboard seats since it cannot be anchored to the side roof rail. Currently, rear center seats are only required by FMVSS 208 to have a lap belt. On December 4, 2002, the President signed into law "Anton's Law" and NHTSA was directed to issue a final rule by December 2004 that would require a lap and shoulder belt assembly for each rear designated seating position in a passenger motor vehicle with a GVWR rating of 10,000 pounds or less. A phase-in would commence in September 2005, and the requirement would be met by September 2007.

Objective Determine the incremental consumer cost and weight of rear-center 3-point belts.

Proposed Approach The cost of rear-center 3-point belts will be estimated by "teardown" studies and compared to rear-center lap belts. The analysis can be completed within a year.

EVALUATIONS PLANNED TO START IN 2005 – BEHAVIORAL SAFETY

Analysis of unique features that raise belt use in Washington, California and Oregon

Background Three Pacific Coast States, Washington, California and Oregon ranked 1st, 2nd, and 4th in the nation in safety belt use rates during 2002. NHTSA would like to discover the ingredients that contribute to high belt use and, where possible, identify strategies that other States could employ to increase belt use. Some hypotheses include a strong, long-term commitment by police to enforce belt laws, high visibility of enforcement because traffic is concentrated in densely urbanized areas, accident-prone environment due to heavy traffic and high speeds on roadways that caution drivers to buckle up more.

Objectives Identify demographic, geographic, enforcement, public awareness, behavior, perception, and other factors that appear to increase belt use in California, Oregon, and Washington (and, possibly, in other places with high belt use, such as Arizona, Hawaii, Maryland, New Mexico, Puerto Rico, Utah or Vermont).

Proposed Approach Conduct interviews with enforcement personnel. Survey motorists in high belt-use States and compare their attitudes to motorists in States with lower levels of belt use (in the 50s, 60s, 70s). Replicate earlier surveys in some of the high belt-use States to identify what the differences are now compared to what they were when their rates were lower. Perform statistical analyses of demographic and geographic data in high belt use States and in comparison States to identify components that may contribute to belt use increase. The evaluation may require 2-3 years, depending on the extent of data collection.

National statistical analysis of speed limits and fatality risk

Background Prior to Congress passing legislation to regulate the National Maximum Speed Limit (NMSL) to 55 mph in January of 1974, many States posted limits as high as 75 mph. Thirteen years later, in April of 1987, Congress passed another legislation to allow States to increase speed limits to 65 mph on certain interstate highway sections in rural areas where the population is less than 50,000. On November 28, 1995, Congress passed the National Highway System (NHS) Designation Act, which delegated the responsibility of speed limit designation to State governments. As a result, many States have raised speed limits on interstates and other roads in both rural and urban areas. The relationships between posted speed limits, actual travel speeds, and crash/fatality rates are complex.

Objectives Study the relationships between posted speed limits; enforcement levels; travel speeds of free-flowing traffic; average daily traffic (ADT) crashes, injury and fatality rates per mile, by crash type; and travel speeds of crash involved vehicles. Estimate the changes in crashes and fatalities when speed limits are raised or lowered, by road type. Examine crash trends at lower speeds in heavily congested metropolitan areas due to increasing number of registered vehicles and licensed drivers.

Proposed Approach Statistical analyses of FARS and State crash data, FHWA speed data and State ADT data. Speed limits, speeds, ADT and crashes will be tracked and compared for specific roadway segments over time. The evaluation may require 2-3 years, depending on the complexity of acquiring and assembling necessary data from existing sources. The study could be a cooperative effort with FHWA and/or FMCSA.

III. EVALUATIONS PLANNED TO START IN 2006 – VEHICLE SAFETY

Effect of Early Warning Reporting systems on voluntary and NHTSA-initiated defect recalls

Background The TREAD Act of 2000 empowered NHTSA to expand its sources of information about potential vehicle defects in order to strengthen and expedite the process of discovering, investigating and remedying defects. By 2002, NHTSA had established an Early Warning Reporting (EWR) system whereby vehicle and equipment manufacturers notify the agency when they receive claims about potential defects resulting in fatality, injury or property-damage crashes, consumer complaints, warranty damage claims, and safety recalls in other countries. Manufacturers began sending quarterly EWR reports in 2003. The majority of recall campaigns are voluntary, initiated by manufacturers. NHTSA anticipates that the additional information generated with EWR will enable manufacturers to identify needs for voluntary recalls more thoroughly and promptly.

Objective Review the voluntary and NHTSA-initiated recall campaigns since the implementation of EWR and find out in what proportion of them NHTSA or a manufacturer used data from EWR as a primary or secondary source for triggering the investigation. Compare recall campaigns before and after EWR in terms of: number of campaigns per year, number of vehicles or parts recalled per year, percent voluntary vs. NHTSA-initiated recalls, average time from manufacture till NHTSA or a manufacturer learns about a potential defect, average time from initial notification to implementation of the recall campaign.

Proposed Approach Statistical analyses of databases compiled and maintained by the Office of Defects Investigation, NHTSA. The evaluation may require 2-3 years or more until sufficient case histories accumulate for a definitive, final report; the agency may possibly also issue an interim report.

Integrated safety belts

Background Integrated safety belt systems mount the entire safety belt directly to the seat, rather that to the floor or pillar. Integrated systems are intended to provide a more consistent and comfortable fit and more effectively hold occupants in their seats during a crash. NHTSA does not require integrated safety belt systems, but some manufactures are installing these systems in some of their vehicles in several seating positions. By model year 2003, approximately 45 percent of all sport utility vehicles were equipped with integrated safety belts and some sport utility vehicles are offering them in the second row for the inboard seating position.

Objective Determine the effectiveness of integrated safety belts in reducing fatalities and injuries. Compare the fatality and injury rates of occupants using integrated safety belts, non-integrated safety belts, and no belts. Examine effectiveness by type of crash (frontal, side, rear and rollover). If possible, compare the use rates of integrated and non-integrated safety belts.

Proposed Approach Statistical analyses of FARS, NASS and State crash data will be used to compare fatality and injury risk of occupants using integrated safety belts, non-integrated safety belts, and no belts. Compare NCAP test performance of dummies protected by integrated vs. non-integrated safety belts. If any States will be collecting make-model information in their belt use surveys, compare belt use in the make-models with integrated and non-integrated safety belts. This evaluation can probably be completed within a year, since it is based on analyses of existing data.

Cost of advanced air bags (FMVSS 208)

Background Older designs of air bags have saved thousands of lives; NHTSA estimates 10,789 as of April 1, 2003. However, over the same time span air bags have also been linked with the deaths of 229 people, most of whom were children. NHTSA must ensure that future air bag designs continue to offer life-saving benefits, while minimizing the possibility of death in low speed crashes. Advanced air bag systems are designed to control how quickly an air bag deploys and how fully it inflates depending on the circumstances of the crash. Circumstances that influence the performance of an advanced air bag system can include the severity of the crash and whether occupants are wearing safety belts. Newer technologies in advanced air bag systems respond to the size of the occupants and the distance they are seated from the air bag. In May 2000, NHTSA upgraded the requirements for air bags in passenger cars and light trucks. The upgrade was designed to meet the goals of (1) improving protection for occupants of all sizes, belted and unbelted, in moderate to high speed crashes and (2) of minimizing the risks posed by air bags to infants, children, and other occupants, especially in low speed crashes. During the first stage phase-in, from September 2003 through August 2006, increasing percentages of motor vehicles will be required to meet requirements for reducing air bag risks. The second stage phase-in, from September 2007 through August 2010, increasing percentages of motor vehicles will be required to meet the increased maximum test speed for the belted rigid barrier test.

Objective Determine the incremental consumer cost and weight of advanced air bags.

Proposed Approach The cost of components used in advanced air bags will be estimated by "teardown" studies and, if necessary, compared to the cost of corresponding components in 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. Initial cost analyses can be completed within a year; however, one or more follow-ups may be necessary as later-generation advanced air bags are phased in.

EVALUATIONS PLANNED TO START IN 2006 – BEHAVIORAL SAFETY

DWI task forces' effectiveness

Background The number of alcohol-related fatalities has remained nearly level since 1994. The alcohol-related fatality rate remained at 0.63 fatalities per 100 million vehicle miles traveled (VMT) for 2000 and 2001. NHTSA formed an Alcohol Integrated Project Team (IPT) to identify strategies or solutions that would have the greatest potential to reduce alcohol-related fatalities. The IPT determined that the success of the impaired driving national strategy is heavily dependent upon a system-wide approach at the State and community levels. This includes State infrastructure improvements, State legislation, and various programs. One infrastructure recommendation is that every State create or reinvigorate an office or committee to lead the program to reduce impaired driving. Such groups exist in many States, usually under the name, "DWI task force." NHTSA believes that a State impaired driving task force can be an effective tool for galvanizing State and local attention to the impaired driving problem; for identifying needed improvements to State laws and/or agency programs; and for providing political support for difficult and costly changes.

Objectives Determine goals of the respective State DWI task forces. Identify impaired driving programmatic tasks and functions that are performed by DWI task forces. Identify who (agency, personnel, etc.) performs similar tasks in States that do not have DWI task forces. Compare and contrast these task performance findings. Identify actual outcomes that have resulted from DWI task force efforts.

Proposed Approach Perform a comparative analysis of programmatic tasks and functions in States with and without DWI task forces. The comparison methodology will consist of documenting and describing the current State DWI task force situation/system through reviewing relevant documents; interviewing relevant persons; documenting improvements; and collecting pre and post-program data. The evaluation may require 2-3 years, depending on the extent of data collection.

Factors that encourage communities/police to devote resources to traffic enforcement

Background A visible, credible law enforcement presence is a critical piece of influencing safer driver behavior and research has shown that the chances of getting caught are more important than the size of any penalty. Despite this, traffic enforcement efforts and associated violation citations and conviction rates can vary widely between jurisdictions and even within jurisdictions over time.

Objective Identify factors that motivate law enforcement agencies to increase their traffic enforcement efforts (e.g., public demand, information campaigns, traffic congestion, politics, holiday seasons, etc.). Identify factors that lead to a decrease in traffic enforcement efforts by the agency. Identify how various law enforcement agencies determine their use of resources (manpower, time, money, etc.) in the traffic enforcement role. This study may be a useful supplement to an FY 2004 Traffic Injury Control project to analyze the costs and benefits of highly visible law enforcement.

Proposed Approach Survey local law enforcement and State highway patrol agencies and officials in order to determine factors that cause increases and decreases in traffic enforcement activities and their methodology for determining resource use for traffic enforcement efforts. The evaluation may require 2-4 years, depending on the extent of data collection.

Comparative analysis of State DWI classification, prosecution, and conviction processes

Background Impaired driving does not have a consistent definition across States. Thus, States have their own descriptions and methods of dealing with impaired driving situations. Also, many regard the entire DWI process as being very lengthy, manual, and complex.

Objectives Examine State DWI classification, prosecution, and conviction process. Identify DWI process key issues that may be shared among the States.

Proposed Approach Select representative States for the study based on arrest and alcohol related crash data obtained from the States and FARS reports. Understand DWI laws and the judicial process in each of the selected States in terms of how a person can be detected, arrested, prosecuted, found guilty, and sentenced to jail or prison for DWI. Perform comparative analyses of the DWI processes. The evaluation may require 2-3 years, depending on the extent of data collection.

IV. EVALUATIONS PLANNED TO START IN 2007 – VEHICLE SAFETY

Effectiveness of advanced air bags

Background In 2000, NHTSA amended FMVSS 208 to make future air bags substantially less hazardous to out-of-position occupants, but also more effective for correctly positioned occupants. These “advanced” air bags will implemented step-by-step. MY 2004-2006 will phase in air bags that will not deploy at all (“suppression”) or deploy only at a low level of force ("low-risk deployment") if a small child is present, or if an older child/small adult is out-of-position, close to the air bag. The technology for suppression and low-risk deployment includes sensors that detect the weight and/or position of an occupant. Furthermore, these air bags will need to pass a barrier and offset test with 5th percentile female dummies in addition to the current barrier test with a 50th percentile male dummy. MY 2008-2010 will phase in a 35 mph barrier test with the belted 50th percentile male dummy, an increase from the current 30 mph.

Objective Monitor the overall fatality-reducing effectiveness of advanced air bags, and compare it to pre-2004 air bags. Estimate their effectiveness for child passengers, small adult drivers, and in offset or oblique frontal crashes. Monitor the performance of suppression and low-risk deployment systems in actual crashes. Compare the seating distribution of child passengers with advanced air bags and pre-2004 air bags: are more children sitting in the front seat?

Proposed Approach Statistical analyses of FARS data, similar to those in NHTSA's 1996 evaluation of air bags, will be used to estimate the fatality-reducing effectiveness of advanced air bags, overall and for selected populations or crash types. The NASS Crashworthiness Data System, possibly supplemented with additional data elements, will provide data on the crash performance of suppression and low-risk deployment technologies. Special Crash Investigations will furnish initial results on a case-by-case basis. State crash data will show if there has been any change in the distribution of child passengers' seating positions. This evaluation will continue for 5 years or more, as new designs of advanced air bags are phased in; however, NHTSA will issue interim reports for important findings.

Injury vulnerability and adequacy of current vehicle interiors for older occupants

Background Older occupants have high fatality risk in crashes: for each year of increasing age, the probability of death, given the same physical insult, increases by several percent. NHTSA evaluations found that some safety devices may be less effective for older occupants, such as safety belts (especially in the back seat) and perhaps the early frontal air bags. These considerations suggest comprehensive review of older occupants' vulnerability to injury and of the adequacy of current vehicle interiors and safety devices for protecting older occupants.

Objective Compare the injury sources, types and severities of older and younger occupants in various types of crashes, and identify situations where older occupants are especially vulnerable. Estimate the effectiveness of various safety devices as a function of the occupant's age.

Proposed Approach Statistical analyses of NASS data can be used to compare the injury sources and patterns of younger and older occupants, by crash type. Effectiveness analyses for specific safety technologies can be repeated, with the same methods and data as earlier NHTSA evaluations, expanding the data sets if necessary to permit statistically meaningful separate estimates for various occupant age groups. The effort is likely to require 2 years.

EVALUATIONS PLANNED TO START IN 2007 – BEHAVIORAL SAFETY

Factors that contribute to speeding/not speeding in States, counties, or specific roads

Background Excessive-speed driving is not distributed uniformly around the United States. Obviously, there are States, jurisdictions, or specific highways where driving at excessive speeds is more prevalent than elsewhere. NHTSA would like to discover the ingredients that contribute to low incident of speeding and high proportion of travel at safe, moderate speeds. Some hypotheses for moderate speed environment include strict enforcement, low speed limits, and dangerous road conditions.

Objectives Identify demographic, geographic, enforcement, public awareness, behavior, perception, and other characteristics of areas where motorists drive at a safe, moderate speed.

Proposed Approach Identify States, areas within States, or specific roadways where 'speeding' and 'non-speeding' were generally observed on urban and rural roadways by analyzing FHWA speed data. Perform a series of analyses of speed limits, travel speeds, State ADT data, speed enforcement activities, population by age group, ethnic and cultural background, speed awareness campaigns to understand drivers' behavioral tendency to speed and not to speed. The evaluation may require 2-3 years, depending on the extent of data collection.

National historical statistical analysis of injury survivability

Background In recent years, Emergency Medical Services (EMS) systems, which provide crash scene services, transportation to the hospitals, and en-route life support, have vastly improved due to the technological advancement of transport vehicles and equipments. Numbers of trained and certified Emergency Medical Technicians (EMTs) have increased as well. Furthermore, due to the incredible advances in biomedical engineering, pharmacology, and medical research, physicians in trauma centers/hospitals are highly skilled and better equipped with the most advanced instruments and the most effective medicines. Injury survivability is believed to have increased over the years due to the quality of medical care.

Objectives Determine if occupants' survival rates have improved since 1979, given the same injury and controlling for occupant age/gender.

Proposed Approach Since 1979, NASS has collected detailed information on motor vehicle crash related injuries. Statistical analysis of NASS data will be performed to assess the relative outcome of various types of injuries. The injury data reported in the NASS database will be categorized as either 'fatal' or 'non-fatal'. Survivability rates will then be compared over a 28+ year period (1979-2006) to determine whether survival rates for various types of injuries have increased significantly. The evaluation, based on existing data, may take 1-2 years.

V. OTHER POTENTIAL EVALUATIONS – VEHICLE SAFETY

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.

Objective Study the relationship between NCAP scores and fatality risk in actual head-on collisions for passenger cars, light trucks and vans equipped with frontal air bags.

Proposed Approach 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. This evaluation can probably be completed within a year, since it is based on analyses of existing data.

ABS for cars and light trucks – follow-up evaluation

Background Initial studies of existing Antilock Brake Systems (ABS) for light trucks (1993) and passenger cars (1995) did not show a significant overall fatality reduction. Benefits for multivehicle crashes on wet roads and for pedestrian crashes were offset by increases in run-off-road crashes including rollovers. Extensive research by NHTSA and others never really explained the observed increase in run-off-road crashes (although one study hinted at a combination of impaired driving and inexperience with ABS). Subsequent crash analyses (1998-2001) suggest these negative effects may have waned, but still didn't show a significant net fatality reduction. ABS is due for a follow-up evaluation, because the public has received extensive information about how to use ABS, and many years of on-the-road experience with the systems. The design of ABS may also have changed over the years.

Objectives Determine the effect of ABS, if any, on fatal and non-fatal crashes, by crash type, vehicle type and model year, vehicle age, driver characteristics, and roadway/environmental characteristics. Track the effect of ABS on run-off-road crashes over time. Identify groups of drivers, if any, that currently experience significant reductions in crashes or fatalities with ABS.

Proposed Approach Statistical analyses of the effectiveness of FARS and State crash data files and registration data: crash involvement rates will be compared for recent-ABS, early-ABS and non-ABS vehicles, for various types of crashes where ABS might have an effect relative to a control group of crash involvements that do not involve braking, or on a per-vehicle-year basis. The analyses will emphasize identifying those populations that experienced an increase in run-off-road crashes, and conversely those populations that significantly reduced crashes with ABS. The evaluation, based on existing data, may take 1-2 years.

Interaction between car and LTV bumpers in low-speed collisions

Background The bumper standard establishes requirements for the impact resistance of vehicles in low-speed front and rear collisions for passenger motor vehicles. NHTSA regulates the height and impact capabilities of bumpers on passenger cars only. The agency has chosen not to regulate bumper performance or elevation for LTVs because of the potential compromise to the vehicle utility in operating on loading ramps and off road situations. LTVs may have bumpers higher off the ground than those of passenger cars. If the taller vehicle's bumper is several inches above the passenger car's bumper, the car may experience costlier damage in a low-speed collision.

Objectives Determine the adequacy of the bumper standard on preventing excessive damage costs in low-speed collisions between passenger cars and LTVs.

Proposed Approach Measure the heights of car and LTV bumpers. Analyze insurance data and/or State crash data to determine the effect of bumper mismatch on collision damage in low-speed collisions. Perform low-speed collision tests of cars versus LTVs, with LTV bumpers set at different heights, and measure the range of damages. Compare the range of damages with low-speed collision tests of car versus car. The evaluation could take 2-4 years, depending on the need for additional test data.

Effectiveness and use of rear-center lap/shoulder belts; effect on occupant seating patterns

Background Given equal safety equipment, the rear-center seat is the safest place in a vehicle. However, at this time, lap/shoulder belts are required at all outboard seats, while only lap belts, a less effective device, are required at the rear-center seat. On December 4, 2002, the President signed into law "Anton's Law", P.L. 107-318, which directs NHTSA to issue, by December 2004, a regulation requiring lap/shoulder belts for each rear seating position in passenger motor vehicle with GVWR 10,000 pounds or less. It is anticipated that phase-in would start on September 1, 2005 and all passenger vehicles manufactured after September 1, 2007 would be required to have rear-center lap/shoulder belts, but manufactures are already equipping some of their vehicles with center rear lap/shoulder belts. NHTSA's 1999 evaluation found that rear outboard lap/shoulder belts are 15 percent more effective in reducing fatalities than lap belts alone.

Objectives Estimate the effectiveness of lap/shoulder belts in reducing fatality and injury risk of back center seat occupants – in frontal crashes and overall. Compare the rates of overall injury and serious abdominal injuries of back center seat occupants wearing lap/shoulder belts, lap belts only, and no belts. Compare belt use rates of back center seat occupants in cars equipped with lap/shoulder belts vs. cars equipped with lap belts only. Estimate overall safety benefits of sitting in the back seat, relative to sitting in the front seat of a vehicle. Find out if occupancy of the rear-center seat increases for adults and adolescents when lap/shoulder belts are available, making it the safest place in the vehicle.

Proposed Approach Statistical analyses of FARS and State crash data, by methods similar to those used in the 1999 evaluation of back outboard lap/shoulder belts (e.g., double-pair comparison), to assess the relative fatality and injury risks of lap-belted, lap/shoulder-belted and unrestrained occupants. The evaluation may require several years until sufficient FARS data accumulate.

Automatic door locks – cost and effectiveness

Background NHTSA has proposed upgrading FMVSS 206, Door Locks and Door Retention Components. The agency is concerned with door latch integrity, mainly to prevent ejection in a crash. Rollover crashes are of particular concern. NHTSA is also considering adding a door opening test requirement to Standard No. 206. The purpose of this requirement would be to reduce the risk of injury in the event that a crash results in a fire. The requirement would accomplish this by increasing the chance that vehicle occupants can exit or be extricated from the vehicle after a crash.

In addition, FMVSS No. 208 and No. 214 currently test vehicles with the doors in the unlocked position. In 2001, General Motors submitted to the agency a petition requesting that the agency amend its FMVSS No. 208 and 214 tests procedures to allow vehicles equipped with Automatic Door Locks (ADL) to be tested in the locked position. In November 2002, GM sent a letter to NHTSA requesting that NCAP be allowed to test with the doors in the locked position. In vehicles equipped with ADL, all doors automatically lock either when the shift lever is moved out of ‘Park’ or when the vehicle reaches a certain speed. ADL improve the likelihood that doors will stay closed in the event of an accident, retaining the structural integrity of the vehicle and lowering the chance of occupant ejection. In addition, they prevent doors from being opened accidentally and/or by children. Currently, a small percentage of the fleet has ADL.

Objectives In both their petition and the subsequent letter, GM asserted that ADL are a safety device. Compare vehicles with and without ADL in real world data files to determine if ADL prevent or mitigate occupant ejections, as well as determining whether there is a tendency for doors with ADL to jam more or less frequently than those without ADL. Estimate the cost to manufacturers for installing ADL.

Proposed Approach Information will be obtained about which makes, models, and model years of vehicles are equipped with ADL. For those vehicles on which ADL are an option, information on the percent of vehicles equipped with them will need to be obtained from manufacturers. Examine and analyze NASS and FARS to determine whether vehicles equipped with ADL have a lower incidence of occupant ejections and "fell from moving vehicle" cases. Use NASS data to determine rates of correct door operation, coming open during collision, and becoming jammed for vehicles with and without ADL. The study should be controlled for vehicle type, vehicle weight, occupant age, and gender. In addition, since the feature can be disabled, and in some cases are factory set at "No doors lock/none unlock," detailed NASS information on the actual setting used would be necessary to determine a "when used" effectiveness. Where this is not possible, an "as used" effectiveness can be estimated. A teardown study will be used to determine cost. The evaluation may require several years until sufficient crash data accumulate.

Correlation of Thor-Lx/HIIIr responses on NCAP and lower extremity injury in crashes

Background Lower extremity injuries are the most frequent AIS 2+ injured body region for occupants in air bag equipped vehicles. About half of these injuries occur below the knee and, of those, ankle and foot injuries are the most frequent and responsible for long-term impairment. Laboratory tests simulating frontal impacts with toe pan intrusion have shown that the Thor-Lx/HIIIr responses are repeatable and the Hybrid III dummy upper body responses (HIC, chest G, chest deflections, and femur force) are not affected by the type of leg (below knee) used. An NPRM is being drafted to bring the Thor-Lx/HIIIr into Part 572 of the Code of Federal Regulations. The Thor-Lx/HIIIr is also the likely lower extremity device that will be used in future frontal and frontal-offset high-speed testing.

Objectives Compare the risk of AIS 2+ below-knee injuries in NCAP tests using the Thor-Lx/HIIIr to that in real world full frontal crashes. This will provide an estimate of the performance of the proposed injury criteria when applied to the Thor-Lx/HIIIr measurements in assessing lower extremity injury risk. This vehicle crash test data would also assist in determining countermeasures to mitigate lower extremity injuries.

Proposed Approach Compile a database of the risk of various below knee injuries for different vehicles tested in the NCAP program with the Thor-Lx/HIIIr. It may be necessary to perform tests on additional older vehicles to supplement available NCAP data. Estimate the average risk of injury based on sales volume. Estimate the risk of various AIS 2+ below knee injuries from NASS CDS data files, CODES, and/or other sources of injury data, and compare to that obtained from the NCAP test data. The evaluation could take 2-5 years, depending on the need for additional test data, and until sufficient crash data accumulate.

LTV trends – height and aggressiveness

Background In recent years, several factors may be reducing the average height and rigidity of the front structures of LTVs: manufacturers' efforts to increase crash compatibility of LTVs, introduction of "crossover" SUVs based on passenger-car chassis, and efforts to make LTVs lower to the ground in order to improve NCAP rollover-resistance ratings. The Insurance Institute for Highway Safety (IIHS) has designed a moving deformable barrier (MDB) that they claim is representative of the front structure of typical SUVs and that they propose to use for impact tests into the sides of other vehicles – but the "typical" SUV may have changed.

Objective Determine if LTVs are getting lower to the ground and/or less rigid, and whether or not the IIHS barrier is representative of modern-day SUVs.

Proposed Approach Frontal NCAP tests use load cells to measure the average height-of-force applied by the vehicle's frontal structure to the barrier, and they provide measures of frontal rigidity. These statistics can be supplemented by measurements of bumper height. Trends in height-of-force, rigidity and bumper height can be monitored and compared to the levels used in the IIHS barrier. This evaluation can probably be completed within a year, since it is based on analyses of existing data; it should be updated from time to time.

Side window ejection – correlation with vehicle parameters

Background Approximately 59 percent of the rollover fatalities come from the 10 percent of the rollover-involved occupants who are ejected, partially or completely, from the vehicle. Of the fatal ejections, by far the highest proportion, 56 percent, are ejected through side glazing. By contrast, only 14 percent are ejected through side doors.

Objectives Estimate the effects of side window configurations (such as the size and location), characteristics of door latches, and other vehicle parameters on fatality and injury risk, and on occupant ejection rates in side impacts and rollovers. Additional factors related to window and door ejections will also be examined. Belt use is a critical factor and must be taken into account; as is the vehicle type and the number of doors (e.g., 2-door car, 4-door pickup truck, etc.)

Proposed Approach Develop a database of measurements relating to the size and location of side windows by make/model, and compare ejection rates as they relate to these factors by a statistical analysis. FARS and NASS data will be analyzed by methods developed in earlier evaluations of air bags, side impact, and rollover standards to determine the relationship between side window configuration and ejection rates, controlling for other factors such as belt use and vehicle type/number of doors. The evaluation could take 2-4 years, depending on whether the data on side window configurations can be assembled from existing sources or need to be measured by a contractor.

Belt use in the back outboard seats

Background Most observational belt use surveys only report front safety belt use. In 1994 and 1996, NHTSA conducted the National Occupant Protection Use Survey (NOPUS) *shopping center study*. This study collected observational back safety belt use information at selected shopping centers. The data was collected at two or three shopping centers in each of 50 geographical selected sites, but the data could not produce national estimates of back safety belt use and was discontinued after 1996. However, in the early 1990's, the majority of vehicles on the road were only equipped with lap belts in the back seat and their use could only be observed in stopped vehicles by peering into the rear window. Today, most vehicles on the road are equipped with lap/shoulder belts in the back outboard seats, and can be observed from a distance.

Objective To produce national estimates of shoulder belt use in the back outboard seats, if possible both the left and right outboard seats. (The location of the data collectors for safety may make it impossible to observe shoulder belt use for the back outboard passengers seating behind the drivers. It may also be impossible to observe shoulder belt use for the back outboard passengers in vehicles with tinted windows.)

Proposed Approach Expand NOPUS *controlled intersection study* to provide shoulder belt use for back outboard seat occupants. The controlled intersection study currently provides detailed information about shoulder belt use by type of vehicle and person characteristics for driver, right front passengers, and child restraint information for children under eight years old. The *controlled intersection study* is a multi-stage, probability-based sample so the data can produce national estimates of belt use. With sufficient lead time, this effort can be added to the next scheduled NOPUS, and results will be available together with the other NOPUS findings.

Safety standards in low-speed vehicles – effectiveness, cost, belt use

Background FMVSS 500 requires low-speed vehicles to have headlamps, stop lamps, turn signal lamps, tail lamps, reflex reflectors, parking brakes, rearview mirror, windshields, safety belts and vehicle identification numbers. "Low-speed vehicles" are small, 4-wheeled motor vehicles with top speeds of 20 to 25 miles per hour. Increasingly, these vehicles are used for personal transportation on roads that also carry other traffic – e.g. for shopping and personal errands within retirement communities or other planned communities. Most conventional golf cars, as originally manufactured, are exempt from FMVSS 500, because they have a top speed of less than 15 miles per hour.

Objective To determine the effectiveness, cost and use of safety belts in low-speed vehicles.

Proposed Approach Statistical analyses (if possible) of State crash files, where large retirement communities exist, will compare injury and fatality risk of belted and unbelted occupants of low-speed vehicles. (Low-speed vehicles crashes may not be reported in the

State crash files because most of these crashes will have minor damage and no injuries if on public roads or will not be on public roads.) A survey of the use of safety belts in low-speed vehicles will be conducted in retirement or other planned communities where these vehicles are prevalent, perhaps as an added task in an ongoing occupant-protection study. The cost of installing safety belts in low-speed vehicles will be estimated from "teardown" analyses or from information provided by manufacturers. The belt-use survey and cost analysis can be completed in 1-2 years; the effectiveness analysis may be postponed unless vehicles of this type become far more common.

Heavy truck aggressiveness in frontal and side impacts

Background Approximately one-third of fatal collisions between heavy trucks and passenger vehicles are head-on collisions, and one-third involve the front of the heavy truck hitting the side of the passenger vehicle. Heavy trucks are inevitably massive and rigid vehicles that present a risk to any collision partner. However, NHTSA's 2003 study of passenger vehicle weight and safety suggests that small cars and LTVs have exceptionally high risk of fatal collisions with heavy trucks. Since both small and large passenger vehicles are greatly outweighed by the heavy trucks, that suggests the small vehicles may have a compatibility problem in addition to the mass imbalance.

Objective Study fatal-collision rates between passenger vehicles and heavy trucks, especially where the front of the truck hits the front or the side of the passenger vehicle, and identify factors in either vehicle that increase risk.

Proposed Approach NHTSA's 2003 evaluation of vehicle weight and fatality risk developed methods and databases to study collision compatibility of cars and LTVs. Similar methods and data will be developed for studying collisions between passenger vehicles and heavy trucks, to statistically identify design factors in either vehicle that increase risk. A case-by-case review of these collisions in NASS will be helpful in identifying potential factors. The evaluation is based on existing data and it is likely to take about 2 years.

Relationship between vehicle type and aggressive driving

Background NHTSA defines aggressive driving as "the operation of a motor vehicle in a manner that endangers or is likely to endanger persons or property." A popular stereotype suggests that some vehicles (body types or styles, makes, models) are driven more aggressively than others. Is that actually true? If so, are the differences "real" or do they merely reflect the demographics of the drivers? Finally, is there anything about the designs or performance of certain vehicles that motivates normally defensive drivers to become more aggressive?

Objectives Establish an estimate of aggressive driving rates by vehicle types. Quantify the aggregate number of aggressive-driving behaviors per vehicle year or mile (violations, culpable crash involvements, etc.) by vehicle body type and style. Disaggregate these aggressive-behavior rates by drivers' age, gender, and other geographic/demographic factors. For drivers who use two or more vehicles, compare their aggressive-behavior rates in the different vehicles – to see if the same person changes their driving style as they move from one vehicle type to another.

Proposed Approach Registration, licensing, violation, crash and possibly mileage (at inspection) data from one or more large States would be linked and jointly analyzed to compute aggressive-behavior rates by vehicle type and driver age/gender. Alternatively, one or more large insurance companies may be able to compute some of these rates from their files. If the data also specify drivers' ZIP codes, they could be linked to geodemographic data indicating average income, education, urbanization. The evaluation could take 2-4 years, depending on the difficulty of acquiring and assembling the data.

Cost of upgraded head restraints (FMVSS 202)

Background Head restraints are extensions of the vehicle's seats that limit head movement during a rear-impact crash, thus, reducing the probability of neck injury. Since January 1, 1969, passenger cars have been required by FMVSS 202 to have head restraints in the front outboard seating positions. The Standard also applied to light trucks manufactured after August 31, 1991. NHTSA estimates that 272,000 whiplash injuries result from rear impact collisions each year. Although whiplash injuries may be of a relatively minor severity, they entail large societal costs. It is the consensus of the biomedical community that whiplash injuries occur as a result of movement of the head and neck relative to the torso. Consequently, reducing the gap between the occupant's head and the head restraint should reduce the movement of the head relative to the torso, resulting in lower whiplash rates. NHTSA submitted an NPRM in 1999 for public comment, which upgrades FMVSS 202 by requiring head restraints to be higher, closer to the head, and available in front and rear outboard positions. NHTSA is currently working on the Final Rule.

Objective Determine the incremental consumer cost and weight of upgraded head restraints.

Proposed Approach The cost of upgraded head restraints will be estimated by "teardown" studies and compared to the cost of baseline head restraints in the same or similar make-models. The analysis can be completed within a year, after the new standard takes effect.

OTHER POTENTIAL EVALUATIONS – BEHAVIORAL SAFETY

Safety belt programs targeting youth: resources, public awareness, effects

Background For more than 25 years, 16-20 year-olds, especially males have had the highest fatality and injury rates per capita. Of the number of occupants killed and injured, the percentage of unrestrained 16-20 year-olds is still one of the highest among the age groups. In 2001, the percentage of non-belted 16-20 year-olds killed in motor vehicle crashes is 60 percent. Over the years, more and more States have implemented safety belt programs and campaigns like Buckle Up America, Click It or Ticket, and Operation ABC Mobilization to increase belt use rate and reduce fatalities. Since teenagers are considered high risk, many law enforcement officials, campaign leaders, and supporters of occupant protection demonstration projects make every effort to communicate the message across young people and provide strict enforcements during the campaign and mobilization week.

Objectives/Proposed Approach Evaluate the impact of safety belt programs targeting youth by (1) Reviewing the Buckle Up America annual reports and Section 157 Safety Incentive Grants for Use of Safety Belts; (2) Identifying the programs' goals, objectives, structure, strategies, resources, funding, etc.; (3) Gathering survey data from the semi-annual Motor Vehicle Occupant Safety Survey (MVOSS) telephone surveys, the recent Click It or Ticket surveys, and the NOPUS surveys on 16-20 year olds to study their awareness and opinions of the programs and their attitudes towards belt use; (4) Identifying any 'best practices' approaches from the results of the annual reports and surveys; and (5) Determining belt use trends among youths through FARS and NOPUS data. The evaluation is likely to take about 2 years.

Factors that encourage/discourage States from enacting primary belt laws

Background States with primary belt laws allow police officers to stop a vehicle for the sole purpose of ticketing drivers and front seat passengers for not wearing their safety belts. On the contrary, police officers in secondary belt law States are not allowed to stop and ticket drivers for lack of belt restraints as a main reason for stopping a vehicle. In 2003, average belt use was estimated to be 83 percent in the States with primary laws and 75 percent in the States with secondary laws. Although many efforts have been made in the past by various States' officials, political leaders, campaign participants, safety belt use coalitions, etc. to enact primary belt laws, only 20 States have been successful as of 2002. Some of the secondary belt law States have made exemplary efforts in the last few years to enact primary belt laws. There were many attributed factors involved in the attempts to secure passage. Two major obstacles, that played an important role in the States' failures to enact legislation, were personal freedom and racial profiling.

Objective Since each State has its unique history with regard to political structure, seat belt legislation, public's perception and behavior on safety belt laws, a thorough understanding of the factors that encourage or discourage individual States from enacting primary belt laws will be identified and analyzed.

Proposed Approach Case studies will be conducted from representative States with the following status: 1) primary law for more than 10 years, 2) recent upgrade to primary law, 3) secondary law with no attempts to upgrade, 4) repeated attempts to upgrade to primary law. These case studies will be conducted through interviews with law enforcement officials, lawmakers, public relation specialists, traffic safety professionals, and community activists. The evaluation may require 2-3 years, depending on the extent of data collection.

Safety belt initiatives for diverse/high-risk populations

Background In 1999, NHTSA's ten regional offices developed new strategies and initiated program activities to encourage safety belt use by minority populations. Examples of the activities include bilingual translation of occupant protection materials, culturally relevant program materials, diversity forum, etc. NHTSA also targets high-risk populations with historically lower belt use, such as pickup-truck drivers.

Objectives/Proposed Approach Evaluate the effectiveness of safety belt initiatives in diverse communities and high-risk populations through (1) Interviews with the regional offices and reviews the literature on diverse safety belt initiatives; (2) Descriptions of the programs' goals, objectives, strategies, funding sources, resources, and organization structure, etc.; (3) Surveys of focus groups for these populations to study their awareness and opinions of the programs, attitudes towards belt use, etc.; and (4) Analyzing belt use trends for those groups that are specifically identified in FARS and/or NOPUS data (e.g., pickup-truck drivers). The evaluation may require 2-3 years, depending on the extent of data collection.

Information campaigns about the life-saving potential, and possible hazards of air bags

Background NHTSA estimates that, as of April 1, 2003, 10,789 lives have been saved by air bags. However, air bags have been linked with the deaths of 229 people over the same time period with many of the victims being children. In response to these tragedies, public awareness programs have been conducted in an effort to inform the public as to the benefits of air bags as well as the potential dangers that air bags can pose. NHTSA is currently revising its messages to parents about the potential hazards of air bags for children.

Objective Examine the effectiveness of air bag information campaigns, especially any new campaign incorporating NHTSA's revised safety message, as evidenced by public awareness of the life-saving potential and possible hazards of air bags. Determine how the messages are received by the target audience.

Proposed Approach Examine the processes and outcomes of the various air bag information campaigns. Perform a literature review of the campaign plans to examine the organization, methodology, expected outcomes. Examine any existing evaluation reports of specific campaign outcomes including studies regarding public knowledge and perceptions of air bags and their proper use.   Compare expectations to actual outcomes. Survey a sample from the target audience to document how the messages were perceived by the target audience. Develop an overall summation report of the various campaigns. The evaluation is likely to take 3-4 years, because it will require developing and conducting a survey.

Comparative analysis of State assessments of occupant protection programs

Background NHTSA's Occupant Protection Assessment Program is a tool that States can use for planning and evaluating their occupant protection programs. NHTSA's various regional offices serve as facilitators in this process by helping to assemble a team of technical experts with a high level of expertise in Occupant Protection program assessment, development, and implementation. The assessments assist State Highway Safety Offices in reviewing their occupant protection programs, noting program strengths and accomplishments; making suggestions for improvement; and, identifying areas where they can provide assistance. The assessments can be used as a tool for planning purposes and for maximizing the use of grants and funding available for occupant protection programs.

Objectives NHTSA desires an overall examination of the various assessments in order to: determine common strengths and weaknesses that States may share; compile a list of best practices; identify assessment impacts on State occupant protection programs; and, indicate areas of potential refinement in the assessment process.

Proposed Approach Perform a comparative analysis of completed Occupant Protection Program State assessments by reviewing the reports, synthesizing the findings and recommendations, and developing an overall summation. The evaluation can be completed within a year.

SUMMARIES OF PUBLSHED EVALUATION REPORTS

January 2004

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 databases. 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, 44 comprehensive evaluations of regulations, safety programs, consumer information programs, or safety technologies have been published. Here is a list of the 44 studies including summaries of principal findings [except where findings were superseded in a follow-up evaluation]:

2003

Vehicle Weight, Fatality Risk and Crash Compatibility of Model Year 1991-99 Passenger Cars and Light Trucks (NHTSA Publication DOT HS 809 662)

There is little association between vehicle weight and fatal-crash rates in the heavier light trucks and vans. However, in other groups of model year 1991-99 vehicles, fatality rates increased as weights decreased. Pickup trucks and SUVs of these model years had, on the average, higher fatality rates than passenger cars or minivans of comparable weight. Model year 1991-99 light trucks and vans, especially those with high, rigid frontal structures, were more aggressive than cars when they struck other vehicles.

NCAP Test Improvements with Pretensioners and Load Limiters (NHTSA Publication DOT HS 809 562)

Safety belt pretensioners pull belts snug as a crash begins. Load limiters allow belts to yield slightly during a crash to reduce the force on the wearer's chest. In New Car Assessment Program (NCAP) frontal barrier crashes at 35 mph, the combination of pretensioners and load limiters reduced average Head Injury Criterion (HIC) by 232, chest acceleration by 6.6 g's and chest deflection by 10.6 mm, for driver and right front passenger dummies, relative to cars and light trucks of the same make-models without these features.

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)

[Findings have been superseded by the 2003 evaluation - see above.]

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 2003 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.]