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A Long-Term Plan for Evaluating the FHWA's Office of Safety Programs

Final Draft

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Preface

Highway safety is one of the most challenging and complex public health problems facing our society today. In order to combat this problem, federal, state, and local governments spend billions of dollars a year on programs that seek to improve highway safety. Some programs may be focused at the local level such as a free bicycle helmet activity at an elementary school or they may be national activities such as an education program focused on safety belt laws. The one thing they all have in common is that they are all working toward a common goal of improving the safety of the Nation's transportation system.

While there is little doubt that the combined efforts of all these programs are positively affecting highway safety, it is important to be able to track the progress of and quantitatively assess the impacts made by these programs. These are requirements for all highway safety transportation organizations, including the Federal Highway Administration's Office of Safety.

The FHWA Office of Safety proactively works with other offices in FHWA to integrate safety improvements, goals and activities in all of FHWA's business functions (e.g. planning, environment, design, engineering, management systems, operations). The Office of Safety closely coordinates FHWA safety strategies and initiatives with other DOT organizations (NHTSA, FMCSA, FRA, OST), and interacts with Congressional staff to communicate the importance of highway safety. The Office of Safety collaborates with FHWA partners, such as the States, American Association of State Highway and Transportation Officials (AASHTO), Governors Highway Safety Association (GHSA), and with other external safety advocacy groups. As the champion of FHWA's safety goal, the Office of Safety advocates and influences field activities to improve highway safety.

As part of its responsibility for strategic and performance plans, the FHWA Office of Safety developed a statement of work requesting the following three tasks:

- A review of current research literature and state-of-the-art practices in the areas of highway safety performance measures and models relating crash causation to program outcomes,
- A review of current Office of Safety performance measures, strategies, and activities, and
- A long-term plan (3 - 5 years) to assist the Office of Safety in identifying gaps in program strategies as well as developing and implementing strategies for measuring program outcomes.

The research for this report was conducted by the U.S. Department of Transportation's John A. Volpe National Transportation Systems Center (The Volpe Center) in Cambridge, MA under a project plan agreement with the FHWA. At the FHWA, the

project is managed by David Smith in the Office of Safety Program Integration and Delivery. At the Volpe Center, the research was conducted by Julie Nixon and Kevin Gay, both of the Motor Carrier Safety Assessment Division in the Office of System and Economic Assessment.

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List of Acronyms

Acronym	Full Name
AASHTO	American Association of State Highway and Transportation Officials
ALDOT	Alabama Department of Transportation
ASAP	Accelerating Safety Activities Program
BAC	Blood Alcohol Concentration
CBO	Community Based Organizations
CODES	Crash Outcome Data Evaluation System
CORRECT	Cost/benefit Optimization for the Reduction of Roadway Environment Caused Tragedies
CTSP	Community Traffic Safety Programs
CVSA	Commercial Vehicle Safety Alliance
CR	Compliance Review
DOT	Department of Transportation
DUI	Driving Under the Influence
DWI	Driving While Intoxicated
EMS	Emergency Medical Services
FAA	Federal Aviation Administration
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulation
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FTE	Full-Time Equivalent
GAO	General Accounting Office
GHSA	Governors Highway Safety Association
GIS	Geographical Information System
HEP	Planning, Environment, & Realty (FHWA Office)
HES	Hazard Elimination for Safety
HMR	Hazardous Materials Regulation

Acronym	Full Name
HPMS	Highway Performance Monitoring System
HSIS	Highway Safety Information System
ISHDM	Interactive Highway Safety Design Model
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MCMIS	Motor Carrier Management Information System
MCSAP	Motor Carrier Safety Assistance Program
MPO	Metropolitan Planning Organization
MVMT	Million Vehicle-Miles Traveled
NASS	National Automotive Sampling System
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
OST	Office of the Secretary of Transportation
PBCAT	Pedestrian and Bicycle Crash Analysis Tool
QALY	Quality Adjusted Life-Year
STEP	Selective Traffic Enforcement Program
VMT	Vehicle Miles Traveled

Executive Summary

Background

The key mission of the Federal Highway Administration's Office of Safety is to make roadways safer. Within the broad highway safety mission, the Office of Safety's principal focus is on highway engineering. However, the Office of Safety also works with highway safety advocacy groups, state and local highway agencies, and other partners and stakeholders to identify safety needs, and to deliver highway user safety awareness and education programs. The FHWA and the Office of Safety support the National highway safety goal of reducing the roadway fatality rate from 1.5 fatalities per 100 MVMT in 2002 to 1.0 fatalities per 100 MVMT by 2008 by emphasizing six strategies:

- Promote Strategic Safety Planning,
- Reduce Road Departure Fatalities,
- Reduce Road Departure Crash Severity,
- Reduce Intersection Crashes,
- Reduce Roadway-Related Pedestrian Deaths, and
- Increase Seat Belt Usage.

The FHWA Office of Safety supports all of these strategies; however, their main emphasis is on roadway departure, intersection, and pedestrian crashes. Additionally FHWA's Office of Safety has a new initiative called the "Focused Approach to Safety". Through this process, states with high overall fatality rates (Opportunity States), and those with high numbers of roadway departure, intersection and pedestrian related fatalities (Focus States) are provided with additional resources. Tracking the progress of and quantitatively assessing the impacts made by these programs is important because it facilitates better decision-making regarding the allocation of resources.

Purpose

The purpose of this report is to develop a generalized plan for evaluating and measuring the effectiveness of the major safety programs of the FHWA's Office of Safety. This report is organized into three sections in order to coincide with the statement of work:

- "Literature Review" on page 1 focuses on surveying the performance measures used to track the progress of various transportation safety programs as well as analytic models that are used in the assessment of the effectiveness of safety programs.
- "An Overview of the FHWA Office of Safety Programs" on page 17 focuses on analyzing and developing short-term recommendations regarding the FHWA's Office of Safety Programs.

- "A Long-Term Plan for Program Evaluation and Effectiveness Measurement in the Office of Safety" on page 27 applies a general program approach to the FHWA's Office of Safety programs in order to develop a long-term plan for constructing program effectiveness models.

The results of the literature review and the overview of the Office of Safety programs are used extensively in the development of the long-term plan. This report does not attempt to develop any effectiveness models for specific Office of Safety programs; instead, a framework for evaluating and assessing each program is provided, which if followed will lead to the development of program effectiveness models.

Literature Review

The purpose of this literature review is to identify useful performance measures and effectiveness models that may be helpful in the development of a plan to evaluate and measure the effectiveness of the Office of Safety programs.

The first part of the literature review focuses on performance measures. Performance measures are used to track the success of a program. A number of performance plans from state transportation agencies were reviewed and analyzed. Common performance measures at the strategic and program level were identified through this review and are summarized in Table ES-1.

Table ES-1. Summary of Performance Measure Survey

Type of Performance Measure	Program Area	Performance Measure
Strategic		• Fatality Rate - Fatalities per 100 million VMT • Pedestrian and Bicycle Fatality Rate - Fatalities per 100,000 population • Pedestrian and Bicycle Fatalities - Absolute number of fatalities • Commercial Vehicle Fatality Rate - Fatalities involving commercial vehicles per 100 million commercial VMT
Program	Roadway/Lane Departure	• Number of head-on crashes per 100 million VMT • Crashes with fixed objects per 100 million VMT • Average number of fatalities per roadway departure crash
Program	Pedestrians & Bicycles	• Number of fatalities under age 15
Program	Intersections	• Fatalities per throughput (i.e. number of vehicles processed per hour) • Violations per throughput • % of intersection fatalities involving pedestrians

Table ES-1. Summary of Performance Measure Survey

Type of Performance Measure	Program Area	Performance Measure
Program	Alcohol	• Fatalities per 100 million VMT involving alcohol • Number of alcohol-involved crashes and fatalities • Number of alcohol-involved crashes and fatalities for persons under age 21
Program	EMS	• Average crash response time by county
Program	Safety Management Systems	• Time required to analyze locations with a high crash frequency

The second part of the literature review is focused on identifying and describing program effectiveness models in use outside of the FHWA. These models are used to estimate the impacts of transportation safety programs. There are two main types of models identified in the review, output-based effectiveness models and outcome-based effectiveness models. Output-based effectiveness models attempt to trace the impacts of the program through a set of logical intermediate steps before arriving at the estimated effectiveness of a program. Outcome-based effectiveness models differ from output-based effectiveness models in that they directly measure the outcomes generated by a program. The following models were researched and summarized in the literature review:

- FMCSA Intervention Model - This output-based effectiveness model measures the effectiveness of roadside inspection and traffic enforcement activities performed on motor carriers. Results are shown in terms of crashes avoided, injuries avoided, and lives saved.
- NHTSA Safety Belt Model - This output-based effectiveness model estimates the number of passenger vehicle occupant lives saved as a result of using safety belts.
- Private Carrier Fleet Effectiveness Model - This output-based effectiveness model uses an alternative approach to estimate the benefits of a carrier safety program. Instead of depending on crashes and insurance costs, the model uses indicators of risky behaviors, such as fuel mileage, maintenance costs, and engine management system data, to measure the effectiveness of a safety program.
- FMCSA Compliance Review Model - This outcome-based effectiveness model estimates the effectiveness of on-site motor carrier compliance reviews performed by safety investigators by analyzing the motor carriers crash rates before and after the compliance review.
- Meta-Analysis Model - This outcome-based effectiveness model is developed by synthesizing research results and by using various statistical methods to retrieve, select, and combine results from previous separate but related studies. This approach results in the development of a set of effec-

tiveness rates for specific safety programs or safety strategies, which could then be used to estimate the effectiveness of a specific safety program.

- Econometric Models - These outcome-based effectiveness models are statistical models consisting of a system of one or more equations typically estimated using advanced regression and other statistical methods, which can be used to analyze the system-wide impacts of various policy, economic and other factors on safety.

An Overview of the FHWA Office of Safety Programs

An overview of the Office of Safety's mission, goals, and safety efforts was conducted. After completing an overview of each program area, a series of observations were made. These observations were categorized into two sections; those related to the Focused Approach to Safety and those related to the Vital Few Safety Programs (Roadway Departure, Intersection, and Pedestrian).

Program Specific Findings.

The observations and recommendations for the Focused Approach to Safety covered integration with sates, funding, performance measures, terminology, and the ASAP grant program. The recommendations for the Vital Few Safety Strategies fell into one of two categories; roadmaps and performance measures. A summary of these observations and recommendations is provided below, while a detailed description can be found in "Observations and Recommendations" on page 21.

Focused Approach to Safety

- State highway safety plans and the FHWA Focus States need to be in alignment when it comes to the areas in which a state should be focusing their efforts. It is important to ensure that States and FHWA programs and activities are coordinated and in agreement to what issues are really facing the states. State plans should be reviewed and brought into alignment with FHWA's identified safety improvement areas.
- An assessment should be conducted regarding what activities are being conducted with the funding provided through the Focus State initiative and whether or not states would be conducting these activities regardless of this additional funding.
- With such a large emphasis on the Focused Approach to Safety, performance measures need to be developed. Performance measures could be split between the three program areas and the Focused Approach, so that each has its own contribution level that combined meet the overall goal. An "improvement rate objective" for each Focus State for a given program area could be set and measured.
- The FHWA terminology for the Focused Approach to Safety is well-intended but could be simplified. One approach would be to eliminate the Focus State terminology and fold those states into the Opportunity States. There would then be four classifications for Opportunity States; Pedestrian, Roadway Departure, Intersection, and Comprehensive. The Comprehensive

classification would contain all of the states previously classified as Opportunity States under the old terminology. The Pedestrian, Roadway Departure, and Intersection classifications would contain all of the states previously classified as Focus States.

- A number of recommendations were specific to the Accelerating Safety Activities Program (ASAP). These include:
  - Grant application materials should be clear as to what entities (federal, state, and/or local) can apply for these grants.
  - A more detailed process description or flow chart would greatly assist the applicant that is not familiar with this program.
  - Interim status reports should be filed using a standard format. At a minimum providing required reporting elements guarantees that similar information will be collected from all grantees.
  - There are four factors used for determining which grant applications will be accepted; however, information is not provided on how applications will be judged against these factors. To evaluate and prioritize proposals, each of these factors should be given weights and a scale. This would allow FHWA to objectively and quantitatively score each proposal.

Vital Few Safety Programs

- Roadmaps should be reviewed periodically to determine if updates are needed based on changes in policies or strategies. Additionally, a process needs to be put in place for roadmaps to be reviewed upon major changes in policies and/or strategies. The Safety Leadership Team quarterly meeting would be a logical forum for doing this.
- Standard nomenclature would help illustrate how performance plans and roadmaps relate to one another. Besides standardizing terminology, a section should be added to the roadmap specific to performance plan support or roadmap activities that directly support the performance plan should be highlighted.
- It would be useful if all roadmaps were in the same format. Additionally, narratives should be in the same format as the roadmaps to allow the reader to easily follow between the two documents.
- All programs currently use outcome measures but there is limited use of output measures. In the case of outreach and educational programs it is especially important to use output measures in order to see if a change in number of states and local organizations that are being reached correlates to a change in the number of crashes.
- The FHWA Office of Safety may be able to partner with a select number of states that have developed high quality, real-time data management systems. These data could be used as early indicators of changes in performance of outcome measures.

- Severity outcome measures should be established and periodically calculated using data from the Highway Safety Information System (HSIS), the Crash Outcome Data Evaluation System (CODES) or states. Examples include cost per injury, fatalities per fatal crash, injuries per fatal crash, and injuries per injury crash by roadway type.
- All three program areas should use the same denominator in expressing the overall fatality goal. This allows contribution levels and progress against the overall fatality goal to be clearly stated. Other denominators may be used at the working level to help shape programs.

A Long-Term Plan for Program Evaluation and Effectiveness Measurement in the Office of Safety

The final section of the report proposes a high level process on how the Office of Safety could go about evaluating and measuring the effectiveness of their programs. The process is summarized in Figure ES-1 and the steps are described in more detail below.

Step 1: Inventory.

A detailed inventory of the Office of Safety's programs should be performed. The inventory is vital for comparing programs and determining which programs or collections of programs should be evaluated and ultimately have their effectiveness measured. After the programs are inventoried, a fundamental decision needs to be made on what programs merit an evaluation. This decision may be based on size of the program (in funding or FTE), perceived importance, or management needs or desires. If a decision is made not to perform an evaluation, the process ends.

Step 2: Evaluate.

Assuming that an evaluation needs to be conducted, the next decision to be made is what type is appropriate. An evaluation can be focused on the program's approach, how well the given approach is being executed and/or the effectiveness of the program. Although the FHWA Office of Safety is primarily interested in effectiveness measurement, it is often important to first evaluate the approach and implementation. Doing this eliminates time potentially wasted developing effectiveness measurement models for programs whose design does not match the stated objectives of the program or that is not being implemented as intended. For programs that are more mature or that have already had an evaluation of the approach and implementation conducted, it may be appropriate to start with the effectiveness measurement effort.

Once a need for program effectiveness measurement has been identified, it needs to be determined if the program meets the effectiveness measurement requirements. Each program needs to be thoroughly analyzed to determine if it meets the following requirements:

- Program has Well-Defined and Measurable Outcomes
- Program is the Sole or Majority Contributor to the Outcomes
- Quantitative Supporting Data is Available for the Program

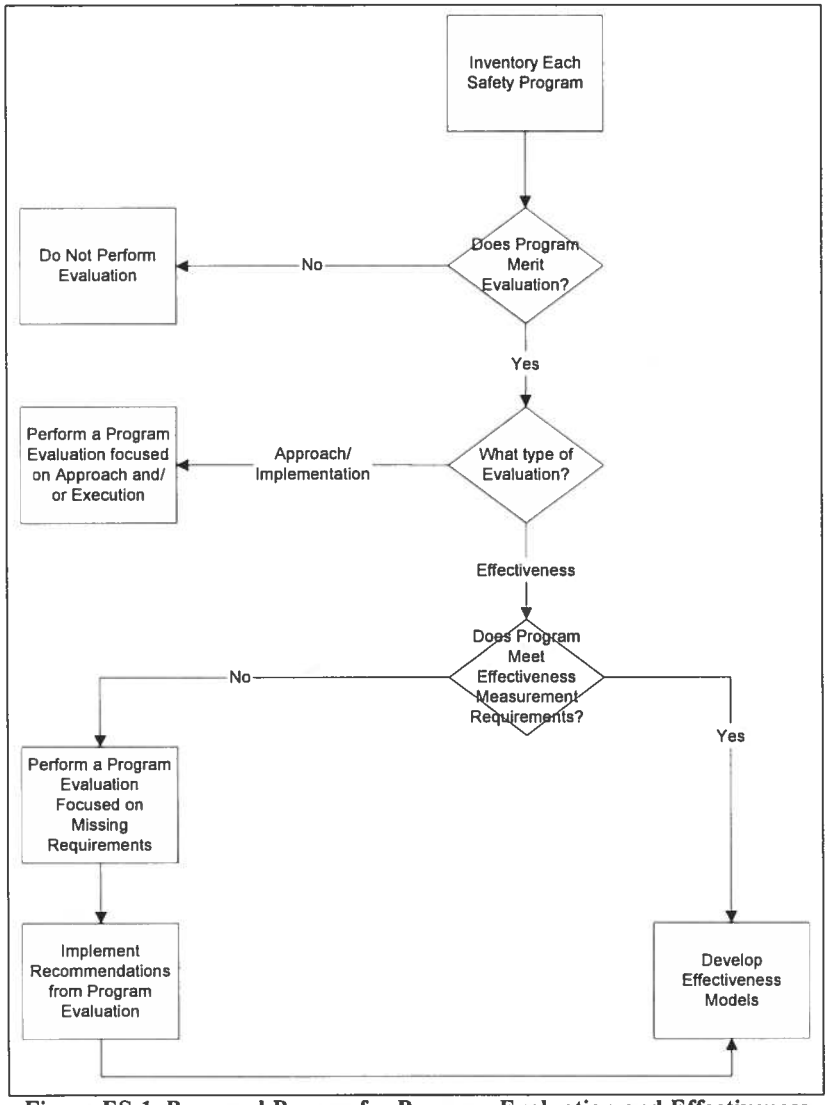

Figure ES-1. Proposed Process for Program Evaluation and Effectiveness Measurement

Step 3: Measure Effectiveness.

If a program meets the basic program effectiveness requirements, then the process of measuring the effectiveness can begin. If the program does not meet these basic requirements, then additional work must be performed to ready a program for effectiveness measurement. If the only requirement not met is the availability of quantitative supporting data, then a focused data collection effort is needed. If the program does not meet the requirements for well-defined/measurable outcomes or the sole/

majority contributor to the outcomes, then this is a more fundamental issue. It is quite likely that measuring the effectiveness of the program in its current state is not feasible. The options at this point are either to abandon efforts to quantitatively measure the program's benefits or to take a step back and perform a program evaluation focused on the missing the elements.

Implementing program evaluation and effectiveness measurement can be a time consuming and resource intensive endeavor. However the payback can make the investment worthwhile. Although highly dependent on available resources and funding, it is estimated that it will take the Office of Safety approximately 6 to 9 months to inventory the programs, develop criteria for determining if an evaluation is needed, what type of evaluation to perform, and to compare all programs to the criteria developed. From this point, an evaluation typically requires 9 to 12 months while implementing recommendations resulting from an evaluation may take over a year. If at this point a program meets the requirements and is ready for effectiveness measurement it may take a year or more to develop effectiveness measurements models. A high-level timeline is available in Figure 4 on page 32.

Findings and Conclusions

There is little doubt that the combined efforts of the FHWA's Office of Safety programs are positively affecting highway safety; however, at this point it is not feasible to measure the individual contribution of each program. Currently, there are a number of obstacles to estimating the effectiveness of each program. Some of these obstacles are minor and can be addressed with short-term corrections; however, others are more fundamental obstacles relating to the design and implementation of the programs. In order to address these obstacles and continue moving towards the goal of program effectiveness measurement, it is recommended that the FHWA Office of Safety take a two-phased approach to implementing program evaluation and effectiveness measurement.

The first phase in the process is to make short-term improvements to the existing programs. These improvements should address some of the potential obstacles to program evaluation and effectiveness measurement. This will allow current programs to be evaluated using a common standard and common effectiveness measures to be defined.

The second phase in the process is to begin implementing the long-term plan. Since this effort will require 3 to 5 years, it can be started in parallel with this first phase. This phase of the implementation will be responsible for making any of the major program definition changes that may be required for program evaluation and effectiveness measurement. While this is a long-term commitment requiring a substantial allocation of resources, it is necessary in order to assess programs, deploy resources efficiently, and support the DOT safety goal.

Literature Review

The purpose of this literature review is to identify safety program performance measures and effectiveness models that may be applied in the development of a plan to evaluate and measure the effectiveness of the FHWA Office of Safety programs. The literature review includes:

(1) Crash Causation

(2) Safety Program Performance Measures, and

(3) Safety Programs Effectiveness Models.

Crash Causation

When a crash occurs, it is generally not the result of one, but of numerous contributing factors, each of which fall into one of three categories:

- Driver factors - DUI, general inattention, speeding, aggressive behavior, and other human factors.
- Roadway factors - lane width, curves, grades, and other design attributes of the roadway.
- Vehicle factors - faulty tires or brakes, potential for rollover, and other characteristics of the vehicle.

A logical question is, what percentage of crashes result from each of these categories? There is a body of research on the subject; however, the research specifically focused on the overlapping impacts of vehicle, driver, and highway causal factors is largely composed of two studies completed in the 1970's.

The Tri-Level Study was conducted by Indiana University. Over 16,000 crashes were investigated to understand the causal factors responsible for the crash. Recent research has mainly focused on analyzing the effect of a specific factor(s) (e.g., speeding, alcohol, access control) in crashes. Figure 1 shows the percentage of crashes due solely to roadway, driver, and vehicle-related factors as well as the percentage of crashes resulting from combinations of these factors. Driver factors were found to be the primary cause of the largest percentage of motor vehicle crashes, followed by roadway and then vehicle factors.

A similar study was performed by Sabey & Staughton in Great Britain in the 1970's, and the results (also shown in Figure 1) are very similar to those in the Tri-Level study. While there are new studies underway which focus on collecting and analyzing

crash causation data (Large Truck Crash Causation Study, One Hundred-Car Naturalistic Driving Study, Drive Atlanta Study), at this time there are no results available.

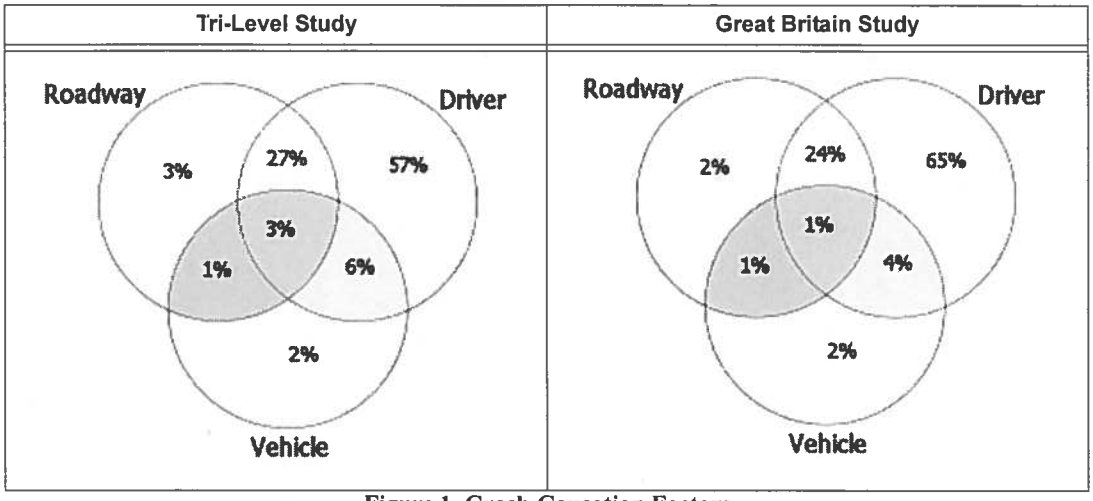

Figure 1. Crash Causation Factors

Understanding the cause of a highway crash is vital for developing safety programs, performance measures, goals, and even evaluating their effectiveness. It is important that a program's goals, measures, and activities are all aligned and incorporate results from all relevant research. For example, if a program is focused on making improvements to the design of various roadways, according to this study, this program could only eliminate less than 1/3 of all the crashes. Crash causation should be considered when setting performance goals and estimating program benefits.

Performance Measures

This section reviews a sample of the safety performance measures utilized at the federal and state levels. The first section focuses on federal agencies that support highway safety, NHTSA, FMCSA, and FHWA. Since all three of these agencies contribute to the DOT performance goal of 1.0 fatalities per 100 million vehicle miles traveled (MVMT), it makes sense to analyze their strategic performance measures as a collective unit. The second section focuses on those agencies that support safety in other modes. The third section covers state strategic and program performance measures. The final section discusses additional measures that were identified from research literature.

Federal Agencies Supporting Highway Safety

NHTSA. Established by the Highway Safety Act of 1970, the National Highway Traffic Safety Administration (NHTSA) is charged with reducing fatalities, injuries,

and economic losses from motor vehicle crashes. The agency uses a multi-disciplinary approach to develop, promote and implement highway safety programs, such as:

- Investigates safety defects in motor vehicles.
- Sets and enforces fuel economy standards.
- Helps states and local communities reduce the threat of drunk drivers
- Promotes the use of safety belts, child safety seats and air bags.
- Establishes and enforces vehicle anti-theft regulations.
- Provides consumer information on motor vehicle safety topics.

In support of the DOT's strategic outcome for safety, NHTSA has identified an agency performance goal of 1.0 passenger vehicle[1] occupant fatalities per 100 million VMT by 2008. In addition to their agency performance goal, NHTSA has program goals for each of their major program areas.

Table 1. NHTSA Program Areas and Goals

Program Area	Program Goal
Motorcycle Safety	Prevent the motorcycle rider highway fatality rate from exceeding 46.0 fatalities per 100 million VMT through 2006.
Non-Occupant Highway Safety	Reduce the rate of non-occupant highway fatalities per 100 million VMT to 0.16 by 2006.
Alcohol	Reduce the rate of fatalities in high BAC (0.08+) crashes per 100 million VMT to 0.51 by 2006.
Safety Belts	Increase safety belt use to 82 percent by 2006.
Child Restraint Seats	Increase restraint use among 0 through 7 year olds to 92 percent by 2006.

FHWA. The Federal Highway Administration (FHWA) is responsible for ensuring the safety and advancing the technology on America's roads and highways. While the majority of roads in the US are not owned by the Federal government, the FHWA provides financial and technical support for constructing, upgrading, and maintaining all roads and highways. Three focus areas, called the Vital Few, have been identified by the FHWA as areas where their effects will make the greatest impact on the Nation's roads and highways. The Vital Few priorities are:

- Safety
- Congestion Mitigation
- Environmental Stewardship and Streamlining

[1] includes passenger cars, light trucks, vans, and SUVs

Within the FHWA, the Office of Safety is focused on improving the safety of the Nation's roads mainly through the use of improved highway engineering approaches. The Office of Safety not only supports the development, testing, and implementation of advanced highway engineering approaches, but they also work with state, local, and other partners to raise safety awareness and promote education and training programs. In support of the DOT goal, the Office of Safety has identified three program areas with the greatest potential for contributing toward this goal.

Table 2. FHWA Office of Safety Program Areas

Program Area	Program Goal
Intersection Crashes	Reduce intersection crash related fatalities by 10% by 2008
Roadway Departure Crashes	Reduce fatalities from roadway departure crashes by 10% by 2008
Roadway-Related Pedestrian Fatalities	Reduce pedestrian fatalities by 10% by 2008

FMCSA. Established in 2000, the Federal Motor Carrier Safety Administration (FMCSA) is tasked with reducing crashes, injuries, and fatalities involving large trucks and buses. FMCSA uses a combination of enforcement programs, educational programs, and partnerships to impact motor carrier safety. Some of their key programs are listed below.

- Develops, maintains, and enforces the Federal Motor Carrier Safety Regulations (FMCSRs)
- Enforces the Hazardous Materials Regulations (HMRs)
- Develops, monitors, and enforces all aspects of the Commercial Driver's License Program
- Develops and maintains Motor Carrier Management Information Systems (MCMIS) for use in targeted inspections and detailed reviews of carriers
- Ensures new entrant motor carriers are knowledgeable about the FMCSRs and HMRs
- Administers a Federal grant program (Motor Carrier Safety Assistance Program) that provides states with financial assistance to enforce FMCSRs and HMRs
- Supports the development of compatible motor carrier safety requirements and procedures throughout North America
- Implements education strategies to increase motor carrier compliance with the safety regulations and reduce the likelihood of a commercial vehicle crash
- Regulates interstate household goods movers

Like NHTSA, FMCSA has set a performance goal of reducing the large truck fatality rate by 41% from 1996 to 2008. This reduction translates into a rate of 1.65 fatalities per 100 million truck VMT. In order to support this goal, FMCSA also develops individual state performance goals (number of fatalities per year). The national and state goals are integrated such that if the individual state goals are met, then the agency's performance goal will also be met.

Federal Agencies Supporting Safety in Other Modes

FTA. The Federal Transit Administration (FTA) has a strategic objective to ensure the safety and advance the technology on the Nation's transit systems. Safety and security are the FTA's primary strategic objectives. The FTA has set a strategic outcome of reducing the rate of transit-related fatalities, injuries[2], and incidents.[3] In 2002, the performance goal established by the agency was to reduce the rate of fatalities, injuries, and incidents by one percent. This performance goal is measured by three separate performance measures:

- The number of fatalities per 100 million transit passenger miles,
- The number of injuries per 100 million transit passenger miles, and
- The number of incidents per 100 million transit passenger miles.

FAA. The Federal Aviation Administration's strategic objective is to provide the safest and most efficient aerospace system in the World. Unlike the FTA, the FAA does not directly contribute to the DOT long-term, highway safety goal; however, aviation safety is the FAA's primary responsibility. The FAA has set a strategic outcome of achieving the lowest possible accident rate and constantly improving safety. The performance of the agency toward achieving this strategic outcome is assessed through the use of four performance goals.

- To reduce the U.S. commercial air carrier fatal accident rate by 80% from the 1994 - 1996 baseline by FY 2007. The rate is calculated by determining the number of fatal accidents per 100,000 departures.
- The annual goal is to reduce the number of general aviation[4] fatal accidents to no more than 374 in 2003 and 349 in 2004. Since not all pilots file flight plans, the FAA does not have the available data to calculate a rate-based measure for this goal.
- The annual goal is to reduce the number of runway incursions[5] to no more than 44 in 2003 and 40 in 2004.
- The annual goal is to reduce the number of high-severity air traffic operational errors[6] to 643 in 2003 and 629 in 2004.

[2] Injuries are defined as any physical damage or harm to a person requiring medical treatment caused by a transit collision, personal casualty, fire, derailment or bus running off the road.

[3] Incidents are defined as collisions, derailments/left roadway, fires, and property damage greater than $1,000

[4] General aviation includes all segments of the aviation industry except commercial aircraft carriers.

[5] A runway incursion is any occurrence in the airport runway environment that creates a collision hazard or results in a loss of required separation with an aircraft.

State Agencies

Strategic safety plans from five states (California, Wisconsin, Florida, New Mexico, and Alabama) were reviewed, and a complete summary of each state's program areas, goals, activities, and results are reported in "Appendix A: Summary of State Highway Safety Plans" on page 33. The states surveyed had two primary types of performance measures, strategic and program level measures. Strategic performance measures are used to communicate the overall progress of the state's safety efforts. These measures are typically intended for senior officials within the state (i.e. governor, secretary of transportation, etc.). Program level measures are intended to track the performance of a specific program, and are much more specific to the program being tracked.

Strategic Performance Measures. To track statewide performance, most states were fairly consistent with the strategic performance measures they used. In fact, the following measures appeared in all of the states' strategic plans:

- Fatality Rate - Fatalities per 100 million VMT
- Pedestrian and Bicycle Fatality Rate - Fatalities per 100,000 population
- Pedestrian and Bicycle Fatalities - Absolute number of fatalities
- Commercial Vehicle Fatality Rate - Fatalities involving commercial vehicles per 100 million commercial VMT

Some states did, however, differ in the performance measures used at the highest level. For instance, the following measures were used in only a few of the states sampled:

- Fatality and Injury Rate - Fatalities and incapacitating injuries per 100,000 population,
- Percentage of Fatalities and Injuries - Total killed and incapacitated persons per total persons exposed in crashes,
- Percentage of Fatal and Injury Crashes - Total fatal and incapacitating injury crashes per all crashes,
- Safety Belt Usage - Percentage of front seat vehicle occupants using a safety belt,
- Insurance Costs - Amount of general liability and auto liability paid by the state for incidents occurring on state highways and roads,
- State Highway System Fatality Rate - fatalities per 100 million VMT on state highways, and
- State Highway System Commercial Vehicle Crash Rate - fatalities involving commercial vehicles per 100 million commercial VMT on state highways.

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[6] An operational error is a failure to apply or follow the rules and procedures that ensure the safe separation of aircraft.

Program Performance Measures. In addition to the strategic performance measures used at the statewide level to gauge overall highway safety, there are number of performance measures that are specific to programs. For instance, the following measures were used by one or more states:

Table 3. Program Specific Performance Measures Used by States

Program Areas	Performance Measures
Roadway/Lane Departure	• Number of head-on crashes per 100 million VMT • Crashes with fixed objects per 100 million VMT
Pedestrians & Bicycles	• Number of fatalities under age 15
Alcohol	• Fatalities per 100 million VMT involving alcohol • Number of alcohol-involved crashes and fatalities • Number of alcohol-involved crashes and fatalities for persons under age 21.
EMS	• Average crash response time by county
Safety Management Systems	• Time required to analyze locations with a high crash frequency

Additional Sources

Throughout the course of this literature review a number of other potential program performance measures were identified. Listed in Table 4 are some of the relevant measures that were used in various studies.

Table 4. Potential Program Specific Performance Measures

Program Areas	Potential Performance Measures
Roadway Departure	• Average number of fatalities per roadway departure crash
Intersections	• Fatalities per throughput (i.e. number of vehicles processed per hour) • Violations per throughput • % of intersection fatalities involving pedestrians
Left-Turn Lane	• Fatalities per 1000 turning movements

Some of the more interesting measures listed in Table 4 are the measures for intersections, because the study attempted to quantify the interaction between pedestrian fatalities and intersection fatalities. It is very likely that these two program areas overlap in their efforts, as the most likely location for conflicts between pedestrians and motor vehicles are intersections.

While most of the program measures identified were very straightforward, one study applied a concept commonly used in the health care industry, and it merits a brief dis-

cussion. In 2002, the University of California Traffic Safety Center, performed a literature review and analysis of traffic safety interventions conducted in the United States. The cost-effectiveness of more than 100 traffic safety programs were reported in terms of cost per life year saved and/or cost per quality adjusted life year saved (QALY).

Commonly used in the health care industry, the quality-adjusted life year measure takes into account both the quantity and quality of life saved by the traffic safety intervention. To compute this measure, weights typically ranging from 0 (i.e. death) to 1 (i.e. perfect health) are multiplied by each year of remaining life in a given state. This measure can be computed for each type of intervention and combined with the cost of the intervention to determine a benefit-cost ratio. These ratios can then be compared among different types of interventions in order to aid in the allocation of resources.

Program Effectiveness Models

The previous section provided a review of commonly used transportation safety performance measures, which are used to track program performance while a program is in operation. Estimating the effectiveness of a program either while it is in operation or after it has concluded generally involves rigorous analysis of the data collected before, during, and after a program was in place. This analysis uses historical data, past program performance, expert opinion and various statistical methods to develop these estimates. The following section is divided into two types of models, output-based models and outcome-based models. The main difference in the types of models is what data is being used to generate the estimates of effectiveness.

Output-Based Effectiveness Models

Output-based effectiveness models attempt to trace the impacts of the program through a set of logical intermediate steps before arriving at the estimated effectiveness of a program. For example, the impact linkages of an activity that distributes safety helmets to children in the community is shown in Figure 2. Once the impact linkages are defined, each of the branches of the tree can be converted to quantitative benefits. This is by far the most challenging part since there are typically many unknowns. Continuing with the example, some potential missing pieces of data are:

- What is the total number of children in the community?
- What percentage of children receiving a helmet actually wear it?
- What is the effectiveness rate of the helmet in a crash?
- What is the average number of bicycle crashes in the community?

Once these pieces of data are identified or estimated, then the process of quantifying the benefits of the program can be completed. Described below are three output-based effectiveness models that were developed for specific safety programs.

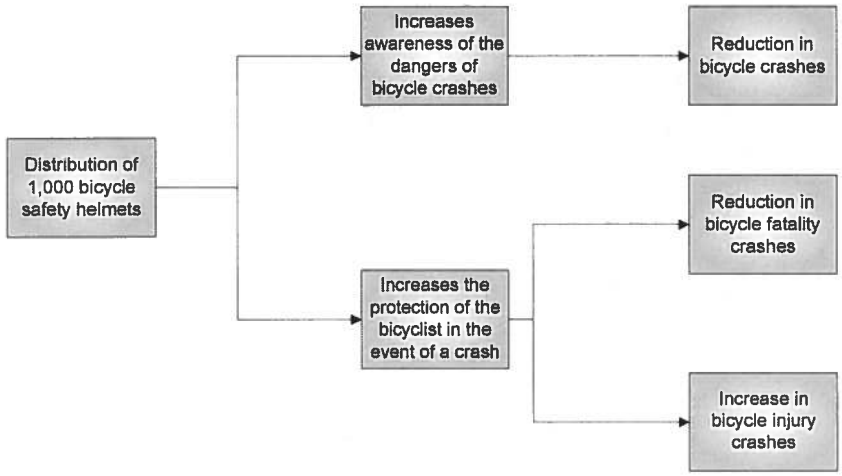

Figure 2. Potential Impacts of a Bicycle Helmet Activity

FMCSA Intervention Model. The Roadside Inspection and Traffic Enforcement Program are two of the Federal Motor Carrier Safety Administration's key safety programs. The Roadside Inspection program consists of roadside inspections performed by qualified safety inspectors following the guidelines of the North American Standard, which was developed by FMCSA and the Commercial Vehicle Safety Alliance (CVSA). Most roadside inspections and traffic enforcements are conducted by the States under the Motor Carrier Safety Assessment Program (MCSAP) administered by FMCSA. The Traffic Enforcement program is based on the enforcement of 21 moving violations noted in conjunction with a roadside inspection.

FMCSA, in cooperation with the Volpe National Transportation Systems Center, has developed an analytic model to measure the effectiveness of roadside inspections and traffic enforcements in terms of crashes avoided, injuries avoided, and lives saved. This model is known as the Intervention Model. The Intervention Model is based on the premise that the two programs—roadside inspection and traffic enforcement—directly and indirectly contribute to a reduction in crashes. The model includes two submodels that are used for measuring these different effects:

- Direct effects are based on the assumption that vehicle and/or driver violations discovered and then corrected as the result of interventions reduce the probability that these vehicles/drivers will be involved in subsequent crashes. The model calculates direct-effect-prevented crashes according to the number and type of violations detected and corrected during an intervention.
- Indirect effects are the by products of the carriers' increased awareness of FMCSA programs and the potential consequences that the programs could impose if steps are not taken to ensure and/or maintain higher levels of safety. In order to measure indirect effects, which are essentially changes in

behavior involving driver preparation and practices and vehicle maintenance, the model calculates responses to exposure to the programs and the resulting reduction in potentially crash-causing violations.

NHTSA Safety Belt Effectiveness Model. Increasing the use of safety belts in the U.S. is a major program supported by NHTSA, FHWA and FMCSA. Each year NHTSA estimates the number of passenger vehicle occupant lives saved as a result of using safety belts. To arrive at these estimates, NHTSA performs safety belt use surveys and uses annual fatality counts to estimate the number of people saved by safety belts.

More specifically, the number of lives saved is the number of passenger vehicle occupants involved in vehicular crashes sufficiently severe that without their safety belt they would have died. At first glance, it may appear that this number could just be looked up from accident data; however, this is not the case. The first complication is determining what criteria does a crash have to meet in order to be defined as sufficiently severe. The second complication is these crashes may include injury and property damage crashes, which are not tracked at a national level.

Since the data is not available to directly determine the number of lives saved, a more indirect method is utilized. To estimate the number of lives saved as a result of safety belt usage, three pieces of data are required:

- Restraint Categories - At a minimum this is whether or a not a safety belt was used; however, it can include more refined categories such as type of safety belt, air bag availability and occupant age.
- Effectiveness Ratings - This is the effectiveness of the safety belt for each of the particular configurations. This rating is determined through rigorous statistical analysis of the Fatal Analysis Report System (FARS) data for the years before and after the safety belt laws were introduced.
- Fatality Counts - For each of the restraint configurations, this is the number of fatalities recorded in FARS.

The next step in the process is to estimate the total number of passenger vehicle occupants involved in sufficiently severe crashes (*TotalOccupants*). Once the total number of occupants involved in sufficiently severe crashes is determined, this number can be multiplied by the effectiveness rate to determine the number of lives saved by safety belts. Conversely, the number of occupants for which safety belts were not effective can be determined as well, which happens to be the number of fatalities reported in which the occupant was wearing their safety belt.

$$LivesSaved = TotalOccupants \cdot Effectiveness \quad [1]$$

$$Fatalities = TotalOccupants \cdot (1 - Effectiveness) \quad [2]$$

Since the effectiveness of safety belts is know as well as the number of fatalities in which the occupant was wearing their safety belt, equation [2] can be rearranged in

order to determine the total number of occupants involved in sufficiently severe crashes (*TotalOccupants*). With this number determined, it merely needs to be multiplied by the effectiveness in order to determine the number of lives saved by safety belts.

In order to solidify this explanation an example is provided. Suppose in a given year, there were 5,544 fatalities where the occupants were using their safety belts. Since safety belts are not effective for 52% of the total occupants, the total number of occupants involved in sufficiently severe accidents while wearing a safety belt can be calculated as shown in [3].

$$TotalOccupants = \frac{Fatalities}{(1 - Effectiveness)} = \frac{5,544}{0.52} = 10,662 \quad [3]$$

Using this result it can be determined that out of the 10,662 occupants involved in sufficiently severe accidents and wearing a safety belt, 5,118 of those occupants were saved by safety belts and safety belts were not effective for 5,544 occupants.

This process can be extended to analyze the potential impacts of increasing safety belt use above the current level. To determine the impact of increasing safety belt usage, a base case and an alternative case would need to be compared. The base case is the number of lives saved with fatalities at the levels reported in FARS. The alternative case would be developed by first determining what level of safety belt usage is to be evaluated. This percentage of safety belt usage along with the safety belt effectiveness can be applied to the total number of occupants involved in sufficiently severe crashes. This results in the number of lives saved in the alternative case (i.e. with an increase in safety belt usage). Finally, by comparing the number of lives saved in the base case and the alternative case, the impact of increasing safety belt usage to the alternative case level can be estimated.

Continuing with the example, the total number of occupants involved in sufficiently severe crashes is 16,889, which includes occupants not wearing their seat belt. If 90% of those people utilized a safety belt, then the 10% without the belts would be killed (1,689). The safety belts would be 48% effective for the remaining 90%. This implies that of the 15,200 occupants utilizing a safety belt, 7,296 would be saved. This is an increase of 2,178 over the base case.

Table 5. Lives Saved Example

Belt Used?	Effectiveness Rate	Fatalities	Total Occupants	Lives Saved
Y	48%	5,544	10,662	5,118
N	52%	6,227	6,227	0

In order to determine the percentage of vehicle occupants currently utilizing their safety belt, NHTSA performs annual surveys and then estimates the national percent-

age from results of the sample surveys. This is why this model is classified as an output model because the output is percentage of vehicle occupants utilizing their safety belt, and this data is used to estimate the number of lives saved each year.

It should be noted that the process described here is a simplified version of what is actually used by NHTSA. In 2003, they began to take into account the combined effects of airbags and safety belts together.

Liberty Mutual Private Fleet Effectiveness Model. In an analysis performed by the Liberty Mutual Research Institute, they provided an alternative approach to measure the effectiveness of carrier or private fleet safety programs. A common approach utilized in the industry is to only look at the number of crashes or the insurance costs that result from these crashes. The problem with this approach is, as previously discussed, crashes typically occur as the result of a series of extremely complex interactions between the road, driver, and vehicle (i.e. contributing factors). Using this approach, safety may appear to have improved, but in reality, the carriers behaviors that are contributing to the crash are still occurring. The only difference is that they have not occurred in conjunction with other necessary contributing factors.

The alternative approach presented in this effort relies on understanding the behaviors and events that contribute to a crash, then these can be used to track performance and estimate the benefits of a safety program. For instance,

- Fuel mileage - Drivers with better fuel mileage than the fleet average are most likely doing a better job of anticipating traffic changes, coasting to stops, and accelerating gradually from stops, and consequently reduce their risk of being involved in a crash.
- Maintenance costs - Similar to fuel mileage, aggressive driving behaviors increase the wear and tear on the vehicle (i.e. brake and tire replacements) which results in high maintenance costs.
- Engine management system data - Since many vehicles are equipped with engine event recorders, data such as average speed, number of hard braking episodes, hard lateral acceleration, turn signal use, and cruise control use can be tracked as well since they are also indicators of safe driving habits.

In addition to being good indicators of safety, each of the potential impacts of a safety program can be translated into a cost differential for the carrier. Improved fuel mileage and decreased maintenance costs are potential benefits from a safety program which should be attributed to that program. This alternative approach captures more of the benefits of a safety program, rather than just the change in crashes or costs of those crashes. Also, like the other two models, this approach does not directly measure the change in a fleet's crash rate, instead it derives the benefits through output data.

Outcome-Based Effectiveness Models

Outcome-based effectiveness models differ from output-based models in that they directly measure the outcomes generated by a program. If this approach was used on the bicycle helmet example, then the effectiveness of the program would have been determined by directly measuring the change in bicycle fatalities. One major difficulty with this approach is that any increase or decrease in the fatality rate could have been the result of influences other than just the bicycle helmet program. To correct for this problem, these models attempt to isolate program effects from all other potential influences on the measure. Described below are three models that directly measure the outcomes of a program, and then also attempt to deal with other factors that impact the measure.

FMCSA Compliance Review Model. The on-site compliance review (CR) is perhaps the single greatest resource-consuming activity of the FMCSA. Thousands of CRs are conducted each year. In 2002, federal and state enforcement personnel conducted over 13,000 CRs on individual motor carriers. It is expected that through education, heightened safety regulation awareness, and the enforcement effects of the CR, carriers will improve the safety of their commercial vehicle operations, and, ultimately, reduce their crash rates.

FMCSA, in cooperation with the Volpe National Transportation Systems Center, has developed an analytic model to determine the effectiveness of the CR program. The CR Effectiveness Model shows the direct impact of compliance reviews on carrier safety, but not the "deterrent" effects (i.e., the "threat" of having a CR). In addition, the model only estimates the benefits that occur in the 12 months following a CR. The model is based on the individual and cumulative "before and after" changes in the safety performance of carriers that received CRs. The model compares a motor carrier's crash rate in the 12 months after an on-site compliance review to its crash rate in the 12 months prior to that review. The model uses crash data reported by the states and power unit data reported by carriers or obtained during compliance reviews, to calculate both crash rates.

Once the change in crash rate of the carriers receiving a CR is determined, it is necessary to account for other factors influencing the change in crash rate. This is done by developing a control group of carriers that operate in similar geographic areas, have a similar number of power units, and were not subjected to a compliance review in the last 12 months. Once the control group is identified, then their crash rates can be computed and incorporated into the rates of the carriers exposed to a compliance review. This control group correction is used to remove external factors that could impact the results.

Meta-Analysis Model. In 1999, the Injury Control Research Centers funded by the Centers for Disease Control performed a systematic review of literature relating to 9 motor vehicle injury prevention strategies. In total, 54,078 citations were identified and subsequently filtered down to 1,111. The reports for the remaining citations were critically reviewed and summarized in this effort.

One approach that was explored in this effort was the use of meta-analysis, which is defined as the technique of synthesizing research results by using various statistical

methods to retrieve, select, and combine results from previous separate but related studies. This technique is also commonly used in the medical fields, and it is typically applied to a set of related studies all with sample sizes too small to yield valid conclusions. The results of these studies are combined using different statistical methods depending on the specifics of the studies, and the meta-analysis results are more valid than each of the individual studies. Unfortunately, most traffic safety intervention studies contain extremely large sample sizes (i.e. all vehicles utilizing an intersection), and many of these studies are conducted during significantly different time periods with vastly different groups. This makes meta-analysis inappropriate for traffic safety intervention in most instances.

This does not preclude this technique from being applied in other instances where the research efforts being analyzed conform more uniformly to the prerequisites of the meta-analysis technique. For instance, a particular countermeasure (e.g. automated red-light running violation detectors) may be tested at just a handful of intersections in any number of different studies. If the sample set is taken to be the intersection, then this technique could be used to combine the results of all the different studies to better understand the overall effectiveness of this particular countermeasure. While this is not a fully developed, operational model, it is another approach for measuring the effects of a particular program.

Econometric Models. Econometric models have been utilized since the early 1970's to analyze the system-wide impacts of various policy, economic and other factors on motor vehicle fatalities. One of the earliest econometric models was developed by Peltzman in 1975 in order to assess the impact of the vehicle design standards established by NHTSA to which all manufacturers of motor vehicles sold in the US had to conform. These design standards included seat belts, energy-absorbing steering columns, penetration-resistant windshields, dual braking systems, and padded instrument panels. Since this time, a significant body of literature has been developed for the impacts of the policy and other factors (see Table 6) on motor vehicle fatalities.

Table 6. Factors Affecting Motor Vehicle Fatalities

Policy Factors	Other Factors
• Automobile Safety Regulations	• Economic Accident Costs
• Alcohol Consumption	• Driver Characteristics
• Drinking Age	• Vehicle Characteristics
• Vehicle Inspection Regulations	• Volume of Driving
• Driving Age	• Type of Driving

Econometric models are simply statistical models consisting of a system of one or more equations typically estimated using advanced regression and other statistical methods. The regression model can take on many different functional forms including linear, probit, logit, poisson, and negative binomial. The data used to develop these models falls into one of three categories:

- time-series - temporal observations of a single unit at regular time intervals
- cross-sectional - observations at a single point in time of multiple different units
- pooled time-series - temporal observations at regular time intervals of multiple different units

Once the regression model is fit to the available data, the statistical significance of each of the factors can be determined. In most case, not all of the factors included in the model will be significant. Additionally the coefficients provide a measure of the impact of the factor.

As an example, a study by Dr. Thomas Corsi assessed the link between motor carrier crashes and FMCSA's motor carrier safety regulations. In addition to variables related to the safety regulations, a large number of other variables were included in the process of fitting a model. One such variable was the operating revenue of the carrier. This variable ended up being statistically significant, and its coefficient was such that a 1% increase in operating revenue resulted in a 0.11% decrease in crash rates. Examples of other studies utilizing this approach include:

- Deregulation of the trucking industry and highway safety
- Driver fatigue and highway safety
- Increasing interstate speed limits to 65 mph and its affect on highway safety.

One potential application of this approach is to analyze the impact of focusing FHWA resources on specific states. Pooled time-series data could be used to determine if a subset of states showed a significant change in their crash rates when compared with a different subset states.

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An Overview of the FHWA Office of Safety Programs

Mission of the Office of Safety

The key mission of the Federal Highway Administration's Office of Safety is to make roadways safer. Together with customers, stakeholders, partners, and other Department of Transportation agencies, the Office of Safety works to reduce the number and severity of crashes on U.S. roadways. Within the broad highway safety mission, the Office of Safety's principal focus is on highway engineering. However, the Office of Safety also works with highway safety advocacy groups, state and local highway agencies, and other partners and stakeholders to identify safety needs, and to deliver highway user safety awareness and education programs. The Office of Safety advocates the integration of safety into roadway planning, design, engineering, environmental management, construction, and operations and maintenance. It also coordinates with the National Highway Traffic Safety Administration, the Federal Motor Carrier Safety Administration, and the Federal Railroad Administration to develop and implement multi-faceted, intermodal safety programs.

The Office of Safety is organized into three units:

- **Office of Safety Design**

  The Office of Safety Design focuses on highway engineering and construction issues related to safety. Program Areas include Intersections, Geometric Design, Road Safety Audits, Roadside Hardware, Road Departure (including Rumble Strips), Railroad Crossings, Nighttime Visibility, and Work Zones.

- **Office of Safety Programs**

  The Office of Safety Programs concentrates on programs that address roadway user behavior, including Pedestrian/Bicyclists, Human Factors, Speed Management, and Older Drivers. The Office of Safety Programs also provides customer assistance for Local Programs; and support for State Programs, including Policy and Guidelines assistance.

- **Office of Program Integration and Delivery**

  The Office of Program Integration and Delivery provides many services including program management, training, communications, and outreach. Services include safety training and education; statistics/data; outreach and communications tools. The Office of Program Integration and Delivery also supports the FHWA's safety performance measurement, strategic planning, and safety legislation programs, and coordinates with the FHWA's Joint Program Office (JPO) in promoting safety applications of Intelligent Transportation Systems (ITS). The Office of Program Integration and Delivery supports the Safety Research program at the FHWA's Turner-Fairbank

Highway Research Center, and coordinates with the FHWA Resource Center in transferring research results.

Goals and Strategies

The FHWA and the Office of Safety support the National highway safety goal of reducing the roadway fatality rate from 1.5 fatalities per 100 MVMT in 2002 to 1.0 fatalities per 100 MVMT by 2008 by emphasizing six strategies:

(1) Promote Strategic Safety Planning,

(2) Reduce Road Departure Fatalities,

(3) Reduce Road Departure Crash Severity,

(4) Reduce Intersection Crashes,

(5) Reduce Roadway-Related Pedestrian Deaths, and

(6) Increase Seat Belt Usage.

The FHWA Office of Safety supports all of these strategies, however their main emphasis is on roadway departure, intersection, and pedestrian crashes. Additionally FHWA's Office of Safety has a new initiative called the "Focused Approach to Safety". Through this process, states with high overall fatality rates (Opportunity States), and those with high numbers of roadway departure, intersection and pedestrian related fatalities (Focus States) are provided with additional resources. FHWA has set goals for each of these safety program areas.

Table 7. FHWA Office of Safety Program Areas

Program Area	Program Goal
Intersection Crashes	Reduce intersection crash related fatalities by 10% by 2008
Roadway Departure Crashes	Reduce fatalities from roadway departure crashes by 10% by 2008
Roadway-Related Pedestrian Fatalities	Reduce pedestrian fatalities by 10% by 2008
Focused Approach	Reduce fatalities by identifying states with the largest potential for improvement and concentrating resources on those states.

Focused Approach to Safety

In the summer of 2004, the Office of Safety launched an approach to safety that better focuses resources and more effectively supports the FHWA and USDOT goal to reduce the fatality rate from 1.5 fatalities per 100 MVMT to 1.0 fatalities per 100 MVMT traveled by 2008. As part of the Focused Approach to Safety, 16 states were identified as having the greatest opportunity to contribute to reducing the national fatality toll. These states, known as Opportunity States, are in the top half of states in terms of overall fatality numbers, and have either a fatality rate above the national average, or a fatality rate improvement trend below the national average. In addition, Focus States are those with a fatality rate above the national average, and above a fatality number threshold value in the emphasis areas of Intersection, Roadway Departure and Pedestrian crashes. See Table 8 for a summary of how Opportunity and Focus States are selected.

Table 8. Comparison of Opportunity vs. Focus States

Classification	# of Fatalities	Fatality Rate / Trend Line
Opportunity State	> Median	Fatality Rate > National Average or Trend Line < National Average
Focus State	> Threshold	Fatality Rate > National Average (No Trend Line Requirement)

Increased emphasis on Opportunity and Focus States does not mean that other states will not receive attention. Since the agency must do everything it can to reduce crashes and fatalities state-by-state, FHWA will continue to support safety activities in every state across the country, particularly those developing and implementing a comprehensive highway safety plan. All states need to take a data-driven approach to identifying their specific safety problems and goals, identifying and implementing appropriate countermeasures and aggressively advancing safety. The FHWA will continue to be an important partner with the states, as well as other agencies and organizations, in these activities.

Accelerating Safety Activities Program[1] (ASAP) funds will be used for Divisions to significantly advance safety at the state, multi-state, and local level. The types of activities that would accomplish this objective could range from educational efforts and information sharing, to workshops and technology demonstrations, to implementing innovative approaches, to data analysis and project prioritization.

[1] Additional details regarding this program are available in "Appendix B: Guidelines for Accelerating Safety Activities Program" on page 45

Vital Few Safety Programs

Roadway Departure Program

Of the 42,643 people killed on the nation's highways in 2003, over 25,000 died when their vehicle left the lane of travel and crashed. In some cases the vehicle crossed the centerline and was involved in a head-on crash or opposite direction sideswipe. In others, the vehicle encroached onto the shoulder and beyond to rollover or impact one or more natural or man-made objects, such as utility poles, bridge walls, embankments, guardrails, parked vehicles, or trees.

The Office of Safety provides highway designers, decision makers, and practitioners with information and guidance that will lead to safer roads and roadsides. The first priority is to keep drivers on the road. Retroreflective signs and pavement markings can help the driver stay in the proper lane. Rumble strips can alert a distracted or drowsy driver that they are starting to drift.

If the car veers out of the lane of travel, every effort must be made to minimize the severity of the crash. Wide shoulders and flat, traversable roadsides will let the driver recover and safely return the vehicle to the roadway. Properly designed breakaway sign and light supports, roadside barriers, and bridge railings will help keep motorists from encountering greater harm. Median barriers can help prevent a high-speed head-on crash.

Intersection Safety Program

A FHWA goal is to reduce roadway related fatalities and injuries by designing safer intersections. Intersection safety is at the forefront of the Nation's roadway problems because of the concentration of fatalities and injuries at intersections. In 2003 over 22% of all fatal crashes occurred at intersections. Highway agencies and organizations should have specialists, programs and strategies to address the intersection safety problem. The Office of Safety Intersection Program develops innovative safety evaluation technologies, technologies to improve safety and mobility using conventional and non-conventional intersection treatments, supports and evaluates novel intersection countermeasures, promotes and disseminates these technologies, and assists public agencies in instituting intersection safety programs.

Pedestrian Safety Program

In 2003, over 4,000 pedestrians were killed on our Nation's highways. There are many different safety problems that pedestrians experience, and a safety countermeasure that works at one location may not address the problem at another location. The Office of Safety Pedestrian Safety Program develops methods to make it easier to determine the true nature of a pedestrian safety problem and to focus on the most appropriate countermeasures. This is done through the development of software and the evaluation of automated technologies to improve pedestrian safety.

The aim of the Office of Safety is to provide analysis and decision making tools to end users such as local pedestrian practitioners. According to the Fatality Analysis Reporting System (FARS), the majority of pedestrian fatalities occur in urban, non-intersection locations. Therefore, much of the FHWA's pedestrian strategic roadmap focuses on locations other than intersections. It is critical to develop and identify

promising safety countermeasures to reduce the number of pedestrian injuries and fatalities, and to identify which safety countermeasures are most likely to have the greatest impact on safety. Pedestrian safety improvements are of little use if people do not know about them. The final stage for many Office of Safety projects involves product delivery. Product delivery can take many forms, from providing support for conferences, developing courses on pedestrian topics, and conducting marketing campaigns.

Observations and Recommendations

After completing an examination of each safety program area a series of observations were made. They were categorized into two sections; those related to the Focused Approach to Safety and those related to the Vital Few Safety Strategies. After each observation, one or more recommendations were developed. These recommendations were generated from the information available at the time of this report and are just one potential approach for addressing the observation. In many cases these observations may present obstacles to program evaluation and program effectiveness measurement. Also it should be noted that this section differs from the plan in the final section of this document in that it discusses specific short-term opportunities for improving the programs versus a more generalized long-term approach to program evaluation and effectiveness measurement.

Focused Approach to Safety

Integration with States.

Observation: As mentioned earlier in the Literature Review, a number of state highway safety plans were reviewed (see "Appendix A: Summary of State Highway Safety Plans" on page 33). Through the course of reviewing these it became clear that different states approach safety in slightly different ways. One of the most notable differences between the states is a focused approach versus a more broad-based approach to safety. For instance, Florida has chosen to hone in on 5 safety areas, while New Mexico has 11 different safety areas. Another point of interest is the alignment of the FHWA Vital Few program areas (roadway departures, intersections, and pedestrians) with the state safety program areas. Table 9 shows for each of the three safety program areas for the 5 states sampled, which states FHWA considers a Focus State, along with which of these three program areas states are concentrating on. In several cases the state objectives do not align to the Focus States developed by FHWA. This could be because the highway safety plan obtained was not the most recent or it could be because the states believe they have bigger problems then the area(s) identified by FHWA.

Recommendation: Regardless of the reason for these differences, an effort needs to be made to ensure that States and FHWA are coordinated and in agreement to what issues are really facing the states. State plans should be reviewed and brought into alignment between state and FHWA identified safety improvement areas.

Table 9. Comparison of FHWA and State Safety Improvement Areas

	Roadway Departures		Intersections		Pedestrians	
	State†	FHWA††	State	FHWA	State	FHWA
Florida	Y	Y	Y	Y	Y	Y
Wisconsin				Y	Y	
New Mexico	Y	Y			Y	
Alabama		Y		Y	Y	
California		Y			Y	Y

†. 'Y' if the state views this safety improvement area as an opportunity
††. 'Y' if the FHWA views this safety improvement area as an opportunity for the state

Funding.

Observation: It is unclear if the $50,000 in additional funding provided to States under the Focused Approach to Safety is adequate to make a difference in the development or enhancement of the States highway safety plan.

Recommendation: Perform an assessment of what activities are being conducted with the funding and whether or not States would be conducting these activities regardless.

Performance Measures.

Observation: The Focused Approach to Safety program does not have its own set of objectives and performance measures.

Recommendation: With such a large emphasis on the Focused Approach to Safety, performance measures need to be developed. Performance measures could be split between the three program areas and the Focused Approach, so that each has its own contribution level that combined meet the overall goal. An "improvement rate objective" for each Focus State for a given program area could be set and measured.

Terminology.

Observation: The FHWA terminology for the Focused Approach to Safety is well-intended but could be simplified.

Recommendation: To simplify and better coordinate program efforts, the Focus State terminology could be eliminated and those states folded into the Opportunity states. There would then be four classifications for Opportunity States; Pedestrian, Roadway Departure, Intersection, and Comprehensive. The Comprehensive classification would contain all of the states previously classified as Opportunity states under the old terminology. The Pedestrian, Roadway Departure, and Inter-

section classifications would contain all of the states previously classified as Focus states.

Accelerating Safety Activities Program (ASAP)[2].

Observation: It is not specified if these grants are open to state and local entities. Item 10 of the grant application makes it seem like this is the case, but the guidelines are written with a FHWA Division perspective. Also the role of the FHWA Division office is not specified. It is not clear if they need to be involved and if so to what extent. The same is true for the Safety Engineer. It is not clear if they are required to be consulted and sign off on the proposal prior to submission, or if this is only a recommended approach.

Recommendation: Grant application materials should be clear as to what entities (federal, state, and local) can apply for these grants. Also, a more detailed process description or flow chart would greatly assist the applicant that is not familiar with this program.

Observation: It appears that an end of the year report is all that is required in terms of reporting.

Recommendation: FHWA should require interim status reports to ensure that programs are proceeding as planned. Also, providing a standard format, or minimum required reporting elements, guarantees that similar information will be collected from all grantees.

Observation: There are four factors used for determining which grant applications will be accepted; however, information is not provided on how applications will be judged against these factors. In addition, it appears that all factors are treated equally.

Recommendation: One approach to addressing this obstacle is to add weights and a scale to each of the four factors to evaluate and prioritize proposals. An example of this is shown in Table 10. This would allow FHWA to objectively and quantitatively score each proposal. For example one project might have a clear need, a large impact potential, meet the cost and leverage guidelines but the feasibility is questionable. Based on the table below, this project would receive 75 points. Another project might not be critical, has a minimal potential impact, meets the cost and leverage guidelines and is feasible. This project would score 80 points. Based on this methodology, the second project would be a higher priority for funding then the first project.

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[2] Additional details regarding this program are available in "Appendix B: Guidelines for Accelerating Safety Activities Program" on page 45

Table 10. Example of Weighted Criteria for ASAP Grant Applications

Scale	Link to Strategic Needs (20 Points)	Impact Potential (20 Points)	Cost/Leverage (10 Points)	Technical Feasibility (50 points)
0	Project is not clearly linked to needs	No impact potential	Project does not meet cost guidelines	Project is not feasible
0.50	Project is not critical	Project is expected to have minimal impact	Project meets cost guidelines but doesn't leverage resources	Feasibility is questionable
1.0	Project is clearly linked to needs	Project is expected to have a large impact	Project meets cost guidelines and does leverage resources	Project is feasible

Vital Few Safety Programs

A number of observations and recommendations are regarding the Office of Safety's three main safety programs that constitute the Vital Few Safety Strategies. These observations are related primarily to the roadmaps and performance measures. The roadmap observations are related to the consistency in which the information is delivered. The following section of observations is related to the performance measures being used by each of the program areas. Roadmaps and a summary of the performance measures used in the annual performance plan can be found in "Appendix C: Focus Area Roadmaps" on page 49 and "Appendix D: FHWA Performance Plans from 2005 and 2006" on page 53.

Roadmaps.

Observation: The roadmaps have not been fully updated to reflect changes in strategy (i.e. the Focused Approach to Safety).

Recommendation: Roadmaps should be reviewed periodically to determine if updates are needed based on changes in policies or strategies. Additionally, a process needs to be put in place for roadmaps to be reviewed upon major changes in policies and/or strategies. The Safety Leadership Team quarterly meeting would be a logical forum for doing this.

Observation: The Intersection Safety Roadmap and the Pedestrian Safety Roadmap both mention Focus States, however they are under two different strategic thrust areas. It is not clear if these programs support different activities or if there a difference in perception as to what type of support is required.

Recommendation: Regular meetings with clear expectations, should be held between the focused approach and technology teams.

Observation: The relationship between performance plans and roadmaps is not clear.

Recommendation: Standard nomenclature would help illustrate how performance plans and roadmaps relate to one another. Besides standardizing terminology, a section should be added to the roadmap specific to performance plan support or roadmap activities that directly support the performance plan should be highlighted.

Observation: The pedestrian and intersection roadmaps follow the same format by categorizing major projects into one of four strategic thrust areas; Problem Identification and Assessment, Analysis and Decision-Making Tools, Develop and Evaluation of Countermeasures, and Product Delivery. The roadway departure roadmap uses a different format.

Recommendation: When comparing safety program areas it would be useful if they were all in the same format.

Observation: In the case of all three roadmaps, narrative statements were also provided. These narrative statements give the details behind the roadmaps. In two cases (Roadway Departure and Intersection) these narratives did not follow the same format as the roadmaps making it difficult to compare the roadmap to the narrative. Interestingly, the roadway departure narrative followed the same format as the pedestrian and intersection roadmaps by categorizing the projects into strategic thrust areas.

Recommendation: Narratives should be in the same format as the roadmaps to allow the reader to compare the two documents.

Performance Measures.

Observation: All programs are using outcome measures, and only the pedestrian safety program is using output measures.

Recommendation: Whenever possible, all programs should use output measures. This is especially important for outreach and educational programs in order to see if a change in the number of states and local organizations that are being reached correlates to a change in the number of crashes.

Observation: All programs currently use data from the Fatality Analysis Reporting System to calculate outcome measures. The time lag in receiving these data of approximately nine months is less than desirable when they are being used for structuring programs.

Recommendation: The FHWA Office of Safety may be able to partner with a select number of states that have developed high quality, real-time data management systems. It is recommended that these data be obtained and used as early indicators of changes in performance of outcome measures.

Observation: The Roadway Departure program has an additional goal of reducing crash severity, however no crash severity outcome measures are used.

Recommendation: Severity outcome measures should be established and periodically calculated using data from the Highway Safety Information System (HSIS), the Crash Outcome Data Evaluation System (CODES) or states. Example measures include cost per injury, fatalities per fatal crash, injuries per fatal crash, and injuries per injury crash by roadway type.

Observation: Currently the roadway departure performance measure is stated in fatalities per vehicle miles traveled, while the other two program areas state their performance measure in terms of fatalities per population.

Recommendation: All three program areas use the same denominator in expressing the overall fatality goal. This allows contribution levels and progress against the overall fatality goal to be clearly stated. Other denominators may be used at the working level to help shape programs.

A Long-Term Plan for Program Evaluation and Effectiveness Measurement in the Office of Safety

The Office of Safety has stressed their desire to measure the effectiveness of their programs. Since the Office of Safety is just beginning this process, what follows is a long-term approach documenting how the Office should proceed. This section is supported by "Appendix E: A Guide to Program Evaluation and Effectiveness Measurement" on page 57, which describes the general approach to performing program evaluations as well as the minimum requirements for developing program effectiveness models.

Proposed Approach

This section describes a high level plan for evaluating the safety programs supported by the FHWA's Office of Safety. Also included is a detailed explanation of the recommended process along with a flowchart in Figure 3.

Inventory Safety Programs

A detailed inventory of the Office of Safety's programs should be performed. The inventory should look at the following:

- Program Resources (FTE's and funding)
- Program Goals and Performance Measures
- Program Inputs/Outputs/Outcomes
- Program Data
- Relationship to Other Programs (similar goals, outputs, outcomes, etc.)

The inventory is vital for comparing programs and determining which programs or collections of programs should be evaluated and ultimately have their effectiveness measured. For example, programs that utilize a large amount of resources, either full-time employees or funding, should be evaluated and have their effectiveness measured. In addition, if logical collections of smaller programs can be formed, then these groupings of programs may also be good candidates for evaluation and effectiveness measurement. While each program alone may not warrant an evaluation of the development of an effectiveness model, the collection of programs may.

Does the Program Merit Evaluation?

After the programs are identified and inventoried, a fundamental decision needs to be made on what programs merit an evaluation. This decision may be based on the size of the program (in funding or FTE), perceived importance, or management needs or desires.

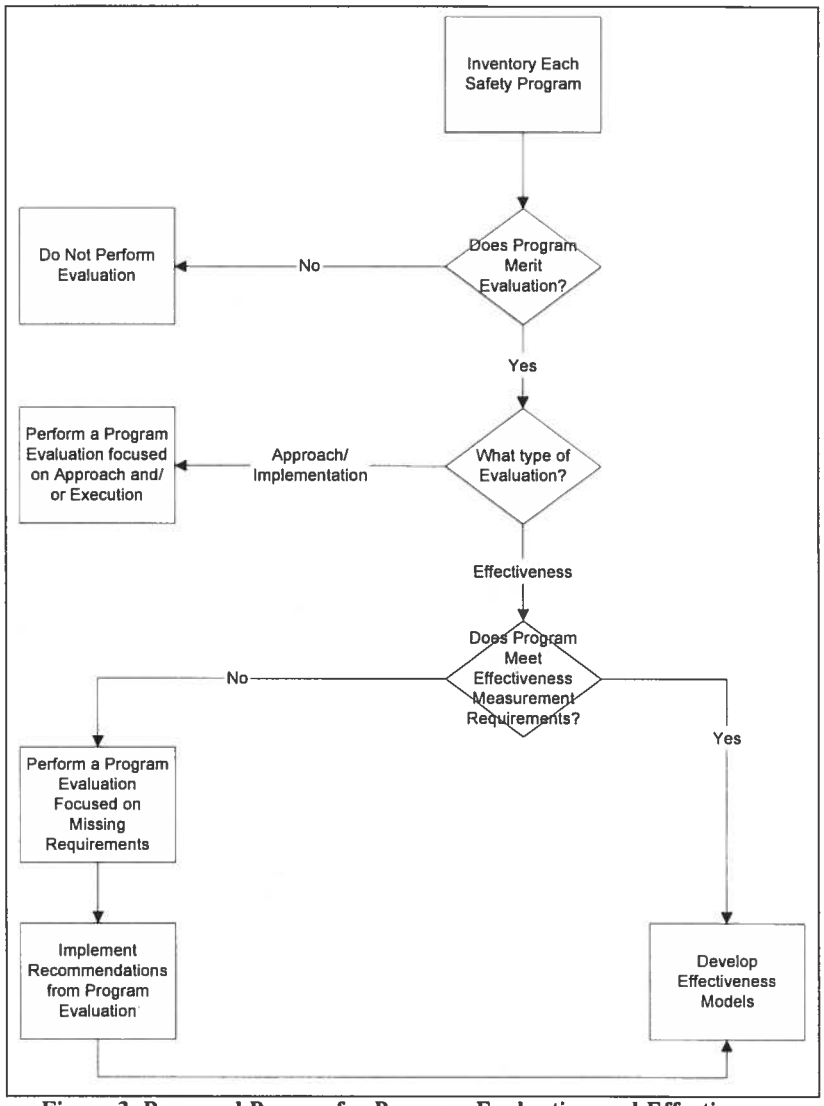

Figure 3. Proposed Process for Program Evaluation and Effectiveness Measurement

What Type of Evaluation is Needed?

Assuming that an evaluation is to be conducted, the next decision to be made is what type is appropriate. An evaluation can be focused on the program's approach, how well the given approach is being implemented and the effectiveness of the program. Although the FHWA Office of Safety is ultimately interested in effectiveness measurement, it is often important to first evaluate the approach and implementation. Doing this eliminates time potentially wasted developing effectiveness measurement models for programs whose design does not match the stated objectives of the program or that is not being implemented as intended. For programs that are more mature

or that have already had an evaluation of the approach and implementation, it may be appropriate to start the effectiveness measurement effort at this time.

Does the Program Meet Effectiveness Measurement Requirements?

Once a need for program effectiveness measurement has been identified, it needs to be determined if the program meets the effectiveness measurement requirements. In "Generalized Requirements for Program Effectiveness Measurement" on page 62, three basic requirements were identified as prerequisites to developing or measuring program effectiveness. In this step, each program needs to be thoroughly analyzed to determine if it meets the following requirements:

- Program has Well-Defined and Measurable Outcomes - All programs are composed of inputs, outputs, and outcomes. Inputs are the resources used to produce outputs. Outputs are the products or services generated from a program. Outcomes are the effects or impacts those products or services have on the target audience. A logical connection should exist between a program's inputs, outputs, and outcomes.
- Program is the Sole or Majority Contributor to the Outcomes - When a program is the sole contributor or at least a majority contributor to an outcome, then changes in the outcome can be attributed to the program once any external factors are accounted for. If a number of programs contribute to an outcome, then it is not always possible to understand the contributions of each program individually to any changes in the outcome.
- Quantitative Supporting Data is Available for the Program - The final requirement to support program effectiveness measurement is quantitative input, output, and outcome data should be readily available.

This analysis should include the development of program logic models to trace the program inputs to the program outcomes. This will assist in determining if the program has defined and measurable outcomes. The sources of data available to each program should be identified and reviewed to determine if the data are suited for use in effectiveness measurement. Not only do the data need to be readily available, but they need to be of sufficient quality.

Results of Comparison

If a program meets the basic program evaluation requirements, then the process of measuring the effectiveness can begin. This process includes further analysis of the program to determine the appropriate effectiveness approach (before/after analysis, direct real-time benefits, etc.) based on the program characteristics and activities.

If the program does not meet these basic requirements, then additional work must be performed to ready a program for effectiveness measurement. If the only requirement not met is the availability of quantitative supporting data, then it may be possible to address this requirement through a couple different approaches. One approach is to construct a nation-wide data collection program like the Highway Performance Monitoring System (HPMS) or MCMIS. A less costly approach, is to collect a sample through a specialized data collection effort (i.e. surveys, on-site data collection, etc.).

Once a plan has been developed and data has been collected then the measurement of the program's effectiveness should be feasible.

If the program does not meet the requirements for well-defined/measurable outcomes or the sole/majority contributor to the outcomes, then this is a more fundamental issue with the program. It is quite likely that measuring the effectiveness of the program in its current state is not feasible. The options at this point are either to abandon efforts to quantitatively measure the program's benefits or to take a step back and perform a program evaluation focused on the missing elements. Which path is chosen likely depends on the resources required to conduct the evaluation of the program, overall program visibility, and requirements imposed by oversight bodies (i.e. Congress, GAO).

Implementation Timeline

Implementing program evaluation and effectiveness measurement can be an expensive and resource intensive endeavor, however the payback often makes this investment worthwhile. Although highly dependent on available resources and funding, it is estimated that it will take the Office of Safety approximately 6 to 9 months to inventory the programs, develop criteria for determining if an evaluation is needed, what type of evaluation to perform, and to compare all programs to the criteria developed. From this point, an evaluation typically requires 9 to 12 months while implementing recommendations resulting from an evaluation may take over a year. If at this point a program meets the requirements and is ready for effectiveness measurement it may take a year or more to develop effectiveness measurements models.

Figure 4 shows a high level implementation timeline. The duration associated with each step is an estimate and would have to be assessed to take into account resources, budget and scope of the project. Steps 1 though 5 are a one time event, unless new programs are developed. New programs could be measured against the same criteria developed in steps 2 and 4 at anytime. Steps 6-10 are specific to individual program evaluations. These steps would be repeated for each program. The timeline assumes that a program evaluation of the approach, implementation and effectiveness is needed. It also assumes that the program doesn't meet the effectiveness measurement requirements. Once again, it should be noted that this timeline is meant to illustrate estimated durations.

Conclusion

In summary, the FHWA Office of Safety should take a two-phased approach to implementing program evaluation and effectiveness measurement. The first phase in the process is to make short-term improvements to the existing programs. These improvements should address the potential obstacles to program evaluation and effec-

tiveness measurement which were identified in "Observations and Recommendations" on page 21. This will allow current programs to be comparably evaluated and common effectiveness measures to be defined.

The second phase in the process is to begin implementing the long-term plan. Since this effort will require 3 to 5 years, it can be started in parallel with this first phase. This phase of the implementation will be responsible for making any of the major program definition changes that may be required for program evaluation and effectiveness measurement. While this is a long-term commitment requiring a substantial allocation of resources, it is necessary in order to assess programs, deploy resources efficiently, and support the DOT safety goal.

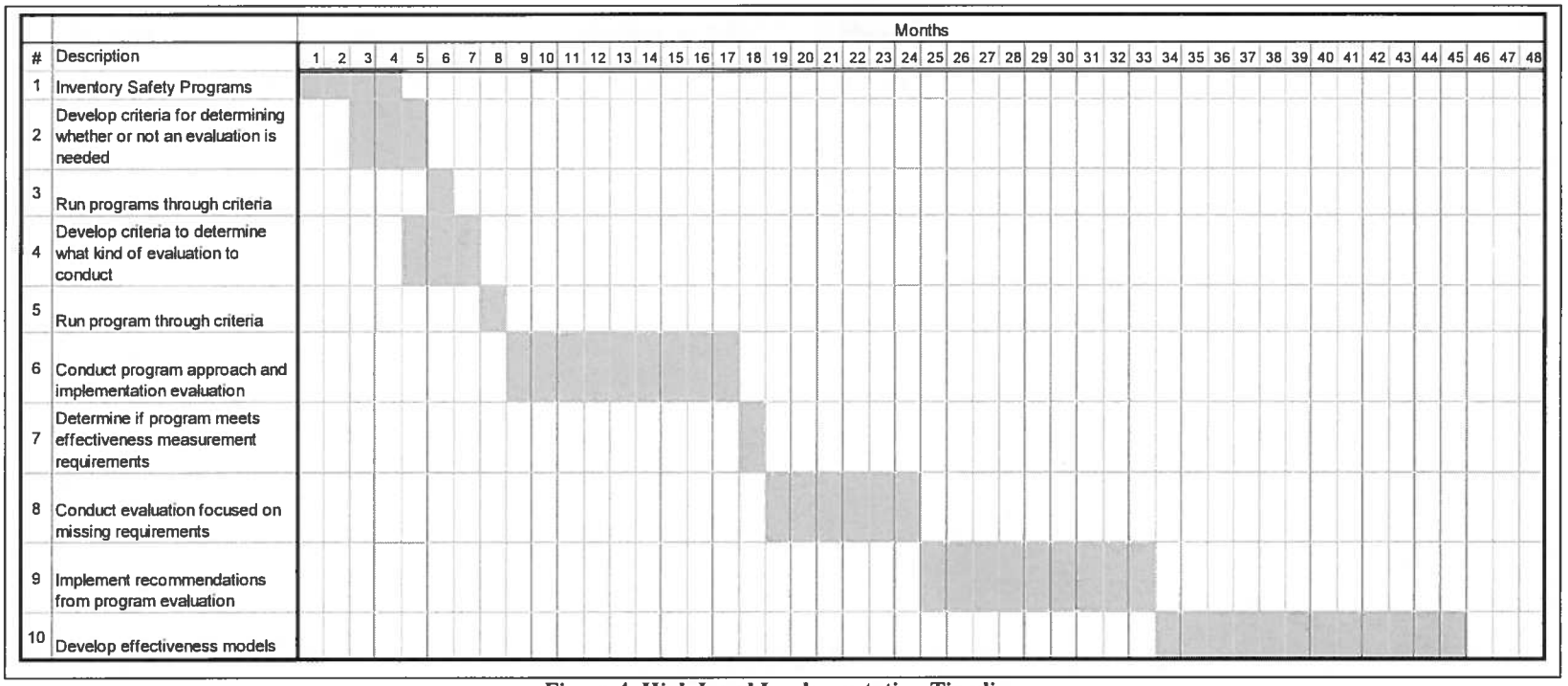

Figure 4. High Level Implementation Timeline

Appendix A: Summary of State Highway Safety Plans

Table 11: Review of Florida DOT's Strategic Highway Safety Plan (2003)

Program	Goals	Primary Strategies/Activities	Results
Keep Vehicles in the Proper Travel Lane and Minimize the Effects of Leaving the Travel Lanes	Reduce the number of crashes due to vehicles leaving their intended travel lanes, and reduce severity of crashes when vehicles do leave their intended travel lanes	7. Identify high risk locations; develop and implement countermeasures 8. Review planned projects for roadway characteristics similar to those of the high risk locations 9. Establish incentive program to promote installation and maintenance of upgraded roadside safety hardware	Outputs • None Identified Outcomes • None Identified
Improve the Safety of Intersections	Improve the safety and operation of intersections by utilizing education, enforcement, and engineering tools and techniques	1. Develop and implement improvement projects 2. Improve the ability to enforce traffic violations at high-crash intersections 3. Develop and deliver an intersection safety education program for the public	Outputs • Identify and implement projects at 20 high-risk locations per district in the next 5 years • Improve traffic violation enforcement at 300 intersections in the next 5 years Outcomes • None Identified
Improve Access Management and Conflict Point Control	Reduce the number of serious injuries and fatalities by apply a comprehensive approach to the management and regulation of driveways, medians, median openings, traffic signal, and freeway interchanges to limit and separate intersecting paths of road users	1. Retrofit or eliminate high-risk two-way left turn lanes or painted traffic separators 2. Retrofit or eliminate high-risk median openings 3. Train engineers, planners, and other decision makers on the safety benefits of access management	Outputs • Implement improvements on 10 centerline miles per year Outcomes • None Identified
Improve Pedestrian and Bicycle Safety	Implement a comprehensive approach to provide a safer pedestrian and bicycle travel environment through the use of engineering, education, and enforcement	1. Identify high-risk corridors; develop corrective measures 2. Identify pedestrian/bicycle facility deficiencies and develop projects to correct them 3. Implement pedestrian and bicycle safety education programs at local schools	Outputs • Implement improvements on 2 corridors per district per year • Implement safety education programs in at least 3 school per year per district Outcomes • None Identified
Improve Information and Decision Support Systems	Identify informational needs of internal and external customers and develop a strategy to deliver needed information to those customers in a timely and accurate manner	1. Establish an Internet web page to inform stakeholders of research and other projects that affect traffic safety 2. Identify, acquire, and implement technologies available to collect, analyze and disseminate traffic safety data	Outputs • None Identified Outcomes • None Identified

Table 12: Review of Wisconsin DOT's Strategic Highway Safety Plan (2004)

Program	Goals	Primary Strategies/Activities	Results
Injury Control - Occupant Protection	To increase statewide average safety belt use to 73% by 2003, to 75% by 2005, and to 77% by 2007 To reduce child occupant injuries and deaths to 2,400 by 2004, 2,300 by 2007 and to 2,200 by 2009	1. Provided funds to conduct enforcement mobilizations to 111 local and county law enforcement agencies 2. Numerous educational activities on child passenger safety and seat belt use 3. Multiple surveys on safety belt use	Outputs • Conduct three statewide mobilizations Outcomes • Increase statewide safety belt use to 69.8%
Alcohol Countermeasures	To decrease the number of alcohol- and drug-related motor vehicle crashes to 8,400 by 2004, 8,200 by 2007, and 8,000 by 2009, and to decrease the resulting deaths and incapacitating injuries to 1,219 by 2004, to 1,023 by 2007 and to 845 by 2009	1. Provide Advanced and Standard Field Sobriety Testing training to officers 2. Saturation patrols which are composed of increased enforcement activities, increased publicity, and pre/post surveys 3. Numerous educational activities	Outputs • Trained 1200 officers • Conduct two saturation patrols during the year (December and July) Outcomes • Reduce alcohol-related crashes by 5% within communities participating in saturation patrols and 3% in non-participating communities
Youth Alcohol	To decrease the number of 15-24 year old drivers and passengers killed or seriously injured in all traffic crashes to 2,057 by 2004, to 1,780 by 2007, and to 1,502 by 2009	1. Combat underage drinking by funding expanded enforcement activities targeting servers, sellers and purchases	Outputs • Support efforts to enforce underage drinking laws in up to 20 communities Outcomes • Decrease the number of 15 - 20 year old drivers and passengers killed and injured in motor vehicle crashes by 15% to 51
Police Traffic Services	To decrease the number of speed-related crashes to 19,192 by 2004, to 17,273 by 2007, and 15,546 by 2009 To decrease the number of people killed or incapacitated in these crashes to 1,662 by 2004, to 1,604 by 2007, and 1,525 by 2009	1. Increased enforcement patrols targeting speeding, red-light running, aggressive drivers and other high risk behaviors 2. Coordinate alcohol saturation patrols with increased high-risk behavior activities	Outputs • Up to 15 speed enforcement activities Outcomes • Decrease speed-related crashes in project communities by 15% and 10% statewide
Traffic Records	To coordinate the development and use of a complete comprehensive state highway safety information system to evaluate highway safety activities	1. Perform annual and ad-hoc safety policy analyses 2. Automate the collection of crash attribute data using the TraCS National Model Software 3. Perform linkage of CODES data (crash, hospital, mortality files) for years 1998 - 2001	Outputs • None Identified Outcomes • None Identified

Table 12: Review of Wisconsin DOT's Strategic Highway Safety Plan (2004) (Continued)

Program	Goals	Primary Strategies/Activities	Results
Injury Control - Emergency Medical Response	To improve traffic crash survivability and injury outcome by improving the availability, timeliness and quality of EMS response	1. Provide first responder equipment and training 2. Provide 911 communicator training	Outputs • Train and provide startup kits for 20 - 30 individuals belonging to First Responder organizations Outcomes • None Identified
Motorcycle Safety	To limit the upward trend of motorcycle riders killed and seriously injured in reportable crashes at 2,010 crashes and 661 killed or seriously injured by 2004, 1,950 and 608 by 2007, and 1,800 and 560 by 2009	1. Increased educational activities focused on training, licensing, equipment, and alcohol 2. Provide additional training for motorcycle safety instructors	Outputs • Increase interest in training class size by 10% by 2004; Enroll 8,000 riders in Basic Rider Course and 400 riders in Experienced Rider Course • Involve 85% of Safety Instructors in annual refresher workshops Outcomes • Reduce impaired riding and alcohol-related crashes by 10% by 2004 • Reduce motorcyclist fatalities and injuries by 8% by 2004
Pedestrian, Bicycle and Pupil Transportation Safety	To decrease pedestrian crashes to 1,440 and combined fatalities and serious injuries to 350 by 2004; 1,200 and 300 by 2007; and 1,000 and 264 by 2009 To decrease bicyclist crashes to 800 and combined fatalities and serious injuries to 100 by 2004; 600 and 75 by 2007; and 400 and 50 by 2009	1. Provide training workshops for teaching safe bicycling skills to children 2. Provide training for the teachers of the bicycling safety workshops 3. Fund combined safety strategies at the local level including local bicycle safety events, increased enforcement, and development of community training programs	Outputs • Assist 20 communities in producing local bicycle safety events for 1,500 children • Assist 20 communities to increase quality enforcement for bicycle and pedestrian safety Outcomes • None Identified
Corridor and Community Safety Programs	To promote increased multidisciplinary safety activities in 15 populous communities representing at least 40% of the state population and 33% of state traffic deaths and serious injuries	1. Fund development of "Safe Communities" according to the NHTSA model 2. Integrate Engineering/Planning Components into the Safe Community Coalitions	Outputs • Form 25 safe community coalitions in WI by 2005 Outcomes • None Identified

Table 13: Review of New Mexico DOT's Strategic Highway Safety Plan (2002)

Program	Goals	Primary Strategies/Activities	Results
Traffic Records	Develop comprehensive traffic records systems that are accessible and of high quality and that can be used in the planning, management, and evaluation of traffic safety programs	1. Distribute and provide web access to traffic safety data and published materials 2. Provide training for staff and community partners in planning, operation, evaluating, and tracking safety programs 3. Incorporate the analysis of traffic safety information in safety program planning management	Outputs • None Identified Outcomes • None Identified
Police Traffic Services	Utilize a comprehensive approach to traffic enforcement and training efforts should focus on how target traffic enforcement can improve the overall safety of a community	1. Provide local agencies with technical assistance to identify, prioritize and address traffic safety problem areas 2. Improve interagency participation and increase sharing of information to address mutual traffic safety problems 3. Utilize selective traffic enforcement efforts to promote compliance with DWI and speeding laws	Outputs • None Identified Outcomes • Decrease traffic conviction rates per 1,000 licensed drivers
Speed	Reduce the number of fatal crashes in which speeding is a contributing factor	1. Provide training, equipment, and technical assistance to enforcement agencies in accordance with a comprehensive statewide speed control plan 2. Educate the public regarding the scope and severity of speeding 3. Promote the use of FHWA funds for monitoring highway construction work zones by uniformed police officers	Outputs • None Identified Outcomes • None Identified
Impaired Driving	Reduce the disproportionally large number of alcohol-related crashes and fatalities	1. Raise public perception of risk of enforcement consequences for DWI among high-risk groups 2. Coordinate with other DWI prevention programs at the national, state, and local levels 3. Increase the effectiveness of specific deterrence systems to alter the behavior of arrested DWI offenders 4. Promote innovative approaches to youth enforcement to prevent underage drinking	Outputs • None Identified Outcomes • None Identified

Table 13: Review of New Mexico DOT's Strategic Highway Safety Plan (2002) (Continued)

Program	Goals	Primary Strategies/Activities	Results
Occupant Protection	Increase the use rates of occupant protection devices, especially among those under age 13	1. Promote the use of occupant protection devices through enforcement, education, and media campaigns focused on the enforcement consequences for non-use 2. Increase public awareness of the importance of occupant restraints for children	Outputs • None Identified Outcomes • None Identified
Safe Communities	Raise the awareness of motor vehicle crashes from isolated incidents to public health issues impacting an entire community	1. Continue the use of the Safe Communities approach in the community DWI program 2. Provide resources, training, technical assistance and monitoring to interested communities 3. Increase and vary the number of partners involved in solving traffic safety issues within a community	Outputs • None Identified Outcomes • None Identified
Pedestrian and Bicycle Safety	Reduce the pedestrian and bicyclist fatalities per 100,000 population	1. Promote community action to reduce pedestrian and bicycle injury among targeted high-risk groups 2. Promote bicycle helmet use among children 3. Increase public awareness of pedestrian safety issues by linking with other enforcement issues such as speed and aggressive driving	Outputs • None Identified Outcomes • None Identified
Roadway Safety	Improve the identification and implementation of safety strategies based on altering roadways	1. Develop and implement traffic safety training to increase knowledge of traffic safety issues 2. Improve communication between traffic engineer workers and others with roles in traffic safety 3. Provide detailed crash information to traffic engineers at the local, district, and state levels 4. Coordinate planning and projects with the FHWA	Outputs • None Identified Outcomes • None Identified
Emergency Medical Services	Continue development of a comprehensive data system for evaluating crash injury outcomes	1. Serve on the EMS Data Standardization Steering Committee to plan the development of the state EMS run report data system 2. Use linked data to assist in planning, managing and evaluating traffic safety problems and strategies	Outputs • None Identified Outcomes • None Identified

Table 13: Review of New Mexico DOT's Strategic Highway Safety Plan (2002) (Continued)

Program	Goals	Primary Strategies/Activities	Results
Motorcycle Safety	Reduce the trend of motorcyclists injured as the result of risky driving behavior, failure to use safety equipment, and lack of awareness by other drivers	1. Promote motorcycle safety through educational efforts focusing on enforcement of operating, licensing, and helmet laws 2. Promote motorcycle training courses through increased media and participation at local events 3. Utilize community traffic safety groups to promote motorcycle education and enforcement initiatives	Outputs • None Identified Outcomes • None Identified
Drivers Education and Training Programs	Educate novice and experienced drivers of all ages in the aspects of becoming a safe driver	1. Provide for regional and statewide training workshops for program instructors and directors 2. Develop a public information and education campaign on state driving laws 3. Evaluate and analyze the effects of the Graduated Driver Licensing System in regards to crashes involving teenagers	Outputs • None Identified Outcomes • None Identified

Table 14: Review of Alabama DOT's Strategic Highway Safety Plan (2005)

Program	Goals	Primary Strategies/Activities	Results
Alcohol/Drugs	Reduce number of alcohol-related injury and fatal crashes	1. Conduct statewide alcohol information/education campaigns 2. Conduct alcohol selective enforcement projects and training workshops for standardized sobriety testing	Outputs • Conduct nine alcohol Selective Traffic Enforcement Program (STEP) projects • Conduct two statewide alcohol blitzes Outcomes • Reduction in the number of reported alcohol-involved fatal and injury collisions by 2% from 2003 • Reduction in the percentage of fatalities that are alcohol-involved from the base value of 24.9% to 23.9% or less • Reduction in the percentage of injuries that are alcohol-involved from the base value of 10.8% to 9.8% or less
Youth Alcohol	Reduce the number of underage (under 21 years of age) alcohol-related crashes, fatalities, and injuries	1. Develop and implement selective enforcement projects and campaigns 2. Develop judicial and law enforcement trainings and meetings on underage drinking laws	Output • Conduct nine youth-alcohol STEP projects • Coordinate enforcement campaign through nine area CTSPs Outcomes • Reduction in the number of reported under-21 years of age (casual driver) alcohol/drugs involved crashes from 1,179 to below 1,139 by end of the reporting year • Reduction in the number of reported under-21 years of age (casual driver) alcohol/drugs involved fatal and injury collisions from the base total of 436 to 432 or less
Occupant Protection	Increase safety belt child restraint usage rates	1. Provide information on increasing restraint usage rate, including age- and size-appropriate restraints for children 2. Develop and implement statewide campaigns on seat best usage and child restraint usage	Outputs • Conduct ten safety belt STEP programs • Perform a minimum of two statewide blitzes Outcomes • Reduction in the number of reported fatalities and injuries for vehicle occupants under four years of age from the base total of 734 to 572 • Increase in safety belt compliance from 77.4% in 2003 to 86% by the end of reporting year 2004 • Increase in child safety seat compliance from 87% in 2003 to 92% by the end of reporting year 2004

Table 14: Review of Alabama DOT's Strategic Highway Safety Plan (2005) (Continued)

Program	Goals	Primary Strategies/Activities	Results
Police Traffic Services/ Speed	To reduce the total fatal and injury crashes To reduce the percentage of speed-related fatalities and injuries	1. Develop and implement enforcement programs and campaigns for statewide maximum speed 2. Develop and deliver trainings for child seat mobilization, diversity, and Spanish language	Outputs • Conduct at least two major statewide maximum speed enforcement programs that will include considerations for aggressive driving Outcomes • Reduction in the total fatal and injury collisions from the base total of 31,691 to 30,567 • To reduce the number of reported speed-related crashes from 7,413 to under 6,987 by the end of 2004 • Reduction in the number of speed-related fatal and injury collisions from the base total of 3,441 to 3,362 or less
Pedestrian	Reduce the number of reported pedestrian-involved fatal and injury collisions	1. CTSP Regional Coordinators will address pedestrian safety as needed	Outputs • None Identified Outcomes • Reduction in the number of reported pedestrian-involved fatal and injury collision from the total of 631 collisions to 626 or less by end of report year 2004
Bicycle	Reduce the number of reported bicycle-involved fatal and injury collisions of those under 15 years of age	1. CTSP Regional Coordinators will address bicycle safety as needed	Outputs • None Identified Outcomes • Reduction in the number of reported bicycle-involved fatal and injury collisions of those under 15 years of age from the total of 148 to 144 or less by the end of reporting year 2004
Emergency Medical Services	To reduce the average response time of EMS personnel	1. State EMS personnel will identify areas of the state that do not meet national minimum response times and schedule training courses in these areas 2. State EMS personnel will continue to recruit and train First Responders in rural areas with high response times	Outputs • None Identified Outcomes • Decrease average response times in under performing counties to meet the national minimum standard by 2005

Table 14: Review of Alabama DOT's Strategic Highway Safety Plan (2005) (Continued)

Program	Goals	Primary Strategies/Activities	Results
Traffic Engineering	To identify and support programs that provide the necessary systems and expertise to enable state and local agencies to identify and analyze critical collision locations for remedial action	1. State ALDOT personnel will continue to implement the CORRECT program that simultaneously addresses all roadway modifications within the Hazard Elimination for Safety (HES) program 2. Special research projects will address paint striping and utility poles	Outputs • None Identified Outcomes • None Identified
Traffic Records	To ensure that all agencies with responsibility for traffic safety have timely access and complete information needed to identify problems, select countermeasures, and evaluate implemented improvements	1. Integrate the state GIS data into the Crash Analysis Reporting Environment 2. Provide training for MPO's and CTSP's in the basics of crash data mining	Outputs • None Identified Outcomes • None Identified

of those resources. However, often this is not the case so the effectiveness of the contributing programs can only be measured through their outputs rather than outcomes.

Quantitative Supporting Data Available

The final requirement to support program effectiveness estimation is quantitative input, output, and outcome data. These data servers two major purposes:

- Research and Development of the Program Effectiveness Model - While there are general approaches for developing models, in almost all cases the models are custom developed and calibrated. In order to develop the methodology it is necessary to analyze data, test hypotheses, and eventually calibrate the final model parameters. This requires a significant amount of historical data.
- Model Input Data - Once the model has been developed, it will presumably be run on a periodic basis to estimate the program's benefits over that period of time. This requires the collection of a defined set of program input data to support the period model runs.

FMCSA's tracks various measures of its programs through the Motor Carrier Management Information System. This system houses multiple years of data on crashes, inspections, violations, reviews, etc. These data were extensively used in the development of their program effectiveness models and is still used in the yearly program effectiveness model runs.

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Table 15: Review of California DOT's Strategic Highway Safety Plan (2004)

Program	Goals	Primary Strategies/Activities	Results
Alcohol/Drugs	Decrease the number of persons killed and injured in alcohol-involved collisions and to reduce the percentage of drivers in alcohol-involved collisions	1. Fund educational, prevention, and enforcement programs 2. Focus on high-risk groups	Outputs • None Identified Outcomes • Decrease the number of persons killed in alcohol-involved collision 2% from the total of 1,254 in 1996 to 1,229 by December 31, 2003 • Decrease the number of persons injured in alcohol-involved collisions 14.5% from the total of 35,654 in 1996 to 30,475 by December 31, 2003
Occupant Protection	Reduce the number of vehicle occupants killed and injured	1. Provide statewide and local public information on seat belt and child safety seat use 2. Increase enforcement 3. Educate community and provide outreach and training	Outputs • None Identified Outcomes • Reduce the number of vehicle occupants killed and injured under the age of four, 23.3% from a total of 3,618 to 2,775 by December 31, 2003 • Increase statewide seat belt compliance 52 percentage points from the June 1996 compliance rate of 86.8% to 92.0% by June 30, 2003
Community Based Organizations	Enhance community access and message credibility in promoting traffic safety within individual communities	1. Fund CBO/governmental agency alliance projects that promote "thinking outside of the box" by forging nontraditional traffic safety partnerships	Outputs • None Identified Outcomes • None Identified
Emergency Medical Services	Provide access to life saving emergency medical services	1. Fund cost effective programs that incorporate effective strategies for improving California's EMS system's ability to meet the needs of motor vehicle collision victims	Outputs • None Identified Outcomes • None Identified
Public Relations, Advertising, Marketing	Reduce number of alcohol injury and fatal crashes	1. Create awareness of risks due to Driving Under the Influence (DUI) and increase awareness of seat belt usage 2. Develop and deliver traffic safety education and enforcement program with local grantees to the state's diverse populations 3. Develop and deliver occupant safety campaign	Outputs • None Identified Outcomes • None Identified

Table 15: Review of California DOT's Strategic Highway Safety Plan (2004) (Continued)

Program	Goals	Primary Strategies/Activities	Results
Pedestrian and Bicycle Safety	Improve overall pedestrian and bicycle safety	1. Provide grants to organizations to conduct traffic safety rodeos and presentations in an effort to increase awareness among various age groups 2. Ensure that programs reach senior population and that they have a multicultural approach in addressing safer driving and walking behaviors	Outputs • Develop comprehensive public information campaigns in two or more languages Outcomes • Reduce the total number of pedestrians killed 9% from the total of 795 in 1996 to 716 by December 31, 2003 • Reduce the total number of pedestrians injured 11% from the total of 16,011 to 14,245 by December 31, 2003 • Reduce the number of pedestrians killed under age 15 by 31% from the total of 90 in 1996 to 62 by December 31, 2003 • Reduce the number of pedestrians injured under age 15 by 20% from the total of 5,156 in 1996 to 4,125 by December 31, 2003
Police Traffic Services	Enforce and encourage compliance with seat belt use, impaired driving, speed limit, red light running, and other traffic laws	1. Provide grants for programs to reduce traffic collisions through selective enforcement and education	Outputs • None Identified Outcomes • Decrease total number of persons killed in traffic collisions 43% from the total of 3,972 in 1996 to 3,800 by December 31, 2003 • Decrease total number of persons injured in traffic collisions 10.3% from the total of 300,106 in 1996 to 297,000 by December 31, 2003
Roadway Safety/Traffic Records	Focus on the operating environment; aid in the identification and analysis of critical locations, the recommendation of traffic safety enhancements and the improvement of the traffic flow to ensure that responsible agencies have the technical expertise to perform necessary analyses	1. Gather and utilize data generated by enforcement and engineering 2. Advocate coordinated system automation efforts to augment local capabilities for the detection, analysis, and resolution of traffic safety issues	Outputs: • None Identified Outcomes • Reduce the time that it takes to analyze high collision locations by 30 percent

Appendix B: Guidelines for Accelerating Safety Activities Program

This appendix explains the intent, eligibility, limitations, and procedures for the Office of Safety's $250,000 Accelerating Safety Activities Program (ASAP), a part of FHWA's Focused Approach to Safety.

Frequently Asked Questions

What activities are eligible for funding?

The purpose of the funds is for Divisions to significantly advance Safety at the State, multi-State, and local level. The types of activities that would accomplish this objective could run the gamut from educational efforts and information sharing, to workshops and technology demonstrations, to implementing innovative approaches, to data analysis and project prioritization. Whatever the specific initiative, the activity should be directed at a need identified to enhance safety.

We will be using Research and Technology funding, thus the attached "Guidelines for Use of Technology and Innovation Funds FY03" needs to be followed. These are the same guidelines Division Offices use for their T2 program. This ASAP funding is not to "substitute for" safety activities you plan to conduct; it is a supplement to your Safety activities. The intent of ASAP is to extend safety activities beyond what you would otherwise be doing with "regular" T2 and GOE funding.

Is there a limitation on the amount of funding to request?

Because we have a limited amount of funding available, we would like to fund as many initiatives as possible. We will accept both blockbuster proposals of up to $25,000, but expect most proposals will be in the range of $5,000 to $10,0000. Proposals less than $5,000 are welcome as well; low-cost efforts can still make a big difference.

What kind of information should our proposal include?

Please use the attached template-it explains the information you will need to include in your proposal. We are looking for a full description and explanation of the activity or initiative, but brief and to the point. The "what" is just as important as the "why" since this will be a competitive process and you want to make the best case for your specific need. Proposals should not exceed 2 pages.

What is the Schedule/Timeline for submitting proposals and getting a decision?

We have established a staggered schedule for submitting proposals to allow for additional time to determine and develop possible initiatives. Please submit your proposals to Erin Kenley here in FHWA's Office of Safety. We will have two cycles for the process per the following schedule:

Table 16. ASAP Schedule Information

	Round 1 Schedule	Round 2 Schedule
Solicitation for project proposals	11/15/2004	2/15/2005
Deadline for proposals	01/17/2005	04/15/2005
Announcement of awards	01/31/2005	05/06/2005

How will the process be evaluated?

The following factors will be considered in the evaluation process:

- Link to Strategic Needs: helps address a critical need, overcomes a barrier identified, or targets a specific sector that has been neglected (is not just a "nice to do" but a "need to do").
- Impact Potential: the extent the initiative is likely to accelerate safety activities in your data-driven, results-oriented process; has short-term and long-term potential to work towards reducing fatalities and the fatality rate in your State.
- Cost/Leverage: support and cost sharing by other partners (including soft-match)
- Technical feasibility: the technical soundness of the proposal based on knowledge of what others are doing or have tried.

Note: A (minimum) three-member panel will rate proposals according to the first three criteria. The fourth criteria (technical feasibility) will be determined by a technical expert. (This was done in Round 1 and it worked well; we will do the same in Round 2).

How will the funds be obligated?

There are two options available to obligate funds:

(3) Funds are obligated through FMIS using an appropriation code.

(4) Funds are obligated using an accounting string provided by the Office of Safety. If option 2 is selected, Division Offices will be required to provide

detailed documentation for transactions (i.e., contract/travel/purchase order numbers; description of items, vendor name, obligated amount, remaining balance, etc.) so that obligations/expenditures can be tracked in Delphi.

Please note that all funds must be obligated within 30 days of approval by the Office of Safety and spent by the end of the fiscal year.

Can I submit multiple proposals?

Yes, you are welcome to submit as many proposals as you'd like. However, where it is logical to group activities, we would suggest you package your activities into one proposal so that your activities are not competing against each other. In cases where there are multiple activities in one proposal, there may be instances where we will only be able to fund a portion of the amount requested. Division Safety Engineers are expected to prioritize proposals if more than one proposal is submitted from a State. Please see Question 10. HSA will be sure to work closely with the submitter to determine priority preference.

Is there anything else I need to know?

If you have an unsuccessful "bid" in Round 1, you can re-submit the same proposal for Round 2.

All successful Division Offices will need to submit an end-of-activity report upon completion of the initiative. This brief report will need to include information on how the funds were used and benefits achieved.

What are some do's & don'ts?

Do: Call the Office of Safety to discuss your idea.

Do: Leverage Resources. Try to pool together from as many sources as you can

Don't: Put in a proposal for more than $25,000.

What is the role of the Division Safety Engineer in submitting ASAP proposals?

The Division Safety Engineer can plan a role in at least three ways: (a) by "endorsing" proposals that are submitted from organizations outside of FHWA in terms of giving their perspective on the value and benefit of the activity (this can be done in the "cover" e-mail; (b) by prioritizing the proposals when more than one is being submitted from within a State; (c) by helping other entities to write the proposal, making sure that the ASAP Guidelines are followed and that activities are eligible for funding.

Template for Accelerating Safety Activities Program Proposal

State:

Name of Project:

Total Estimated Cost:

Amount Requested from Office of Safety:

Contact Person Name and Agency:

Contact Telephone Number:

Project Purpose and Description: Briefly describe the activitie(s) including what is being proposed and when & where it will take place.

Partners: In the table below, identify the major partners and their role and support of the project (funds and staffing). Also list any other partners involved and their role.

Agency/Organization	"Role" Contribution	Financial Commitment

Project Need and "Fit": Describe the need for this project. Also explain how this project relates and supports other initiatives planned, ongoing, or recently conducted, and the relationship of this project to strategic need. Cite data and any anecdotal evidence that explains or demonstrates the need.

Expected Outcomes, Benefits, Results: Briefly describe what you expect to accomplish by conducting this activity. Include the potential impact this initiative could have both within the State and the potential transferability to other States. (Measure of success)

Appendix C: Focus Area Roadmaps

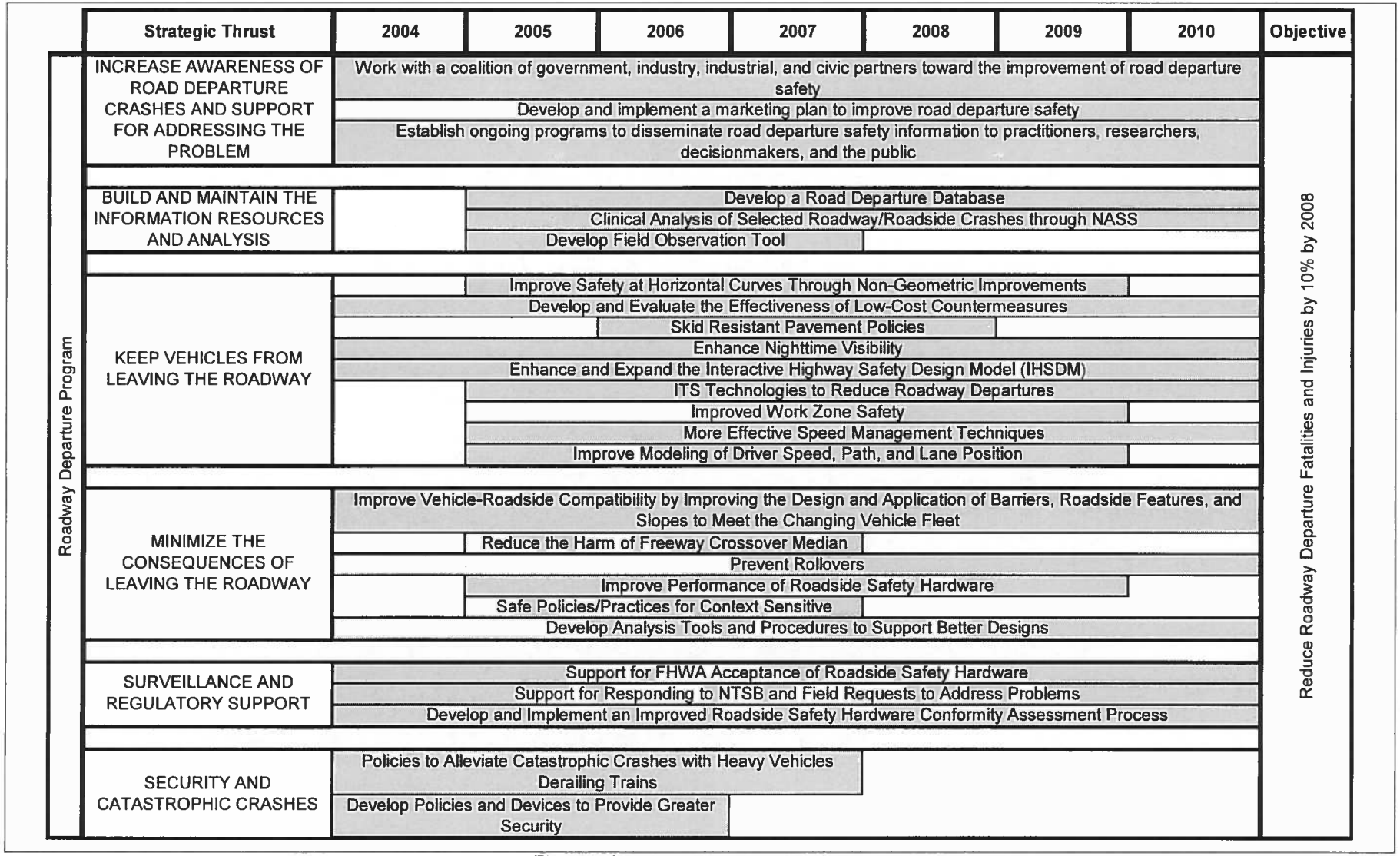

Figure 5. Roadway Departure Roadmap

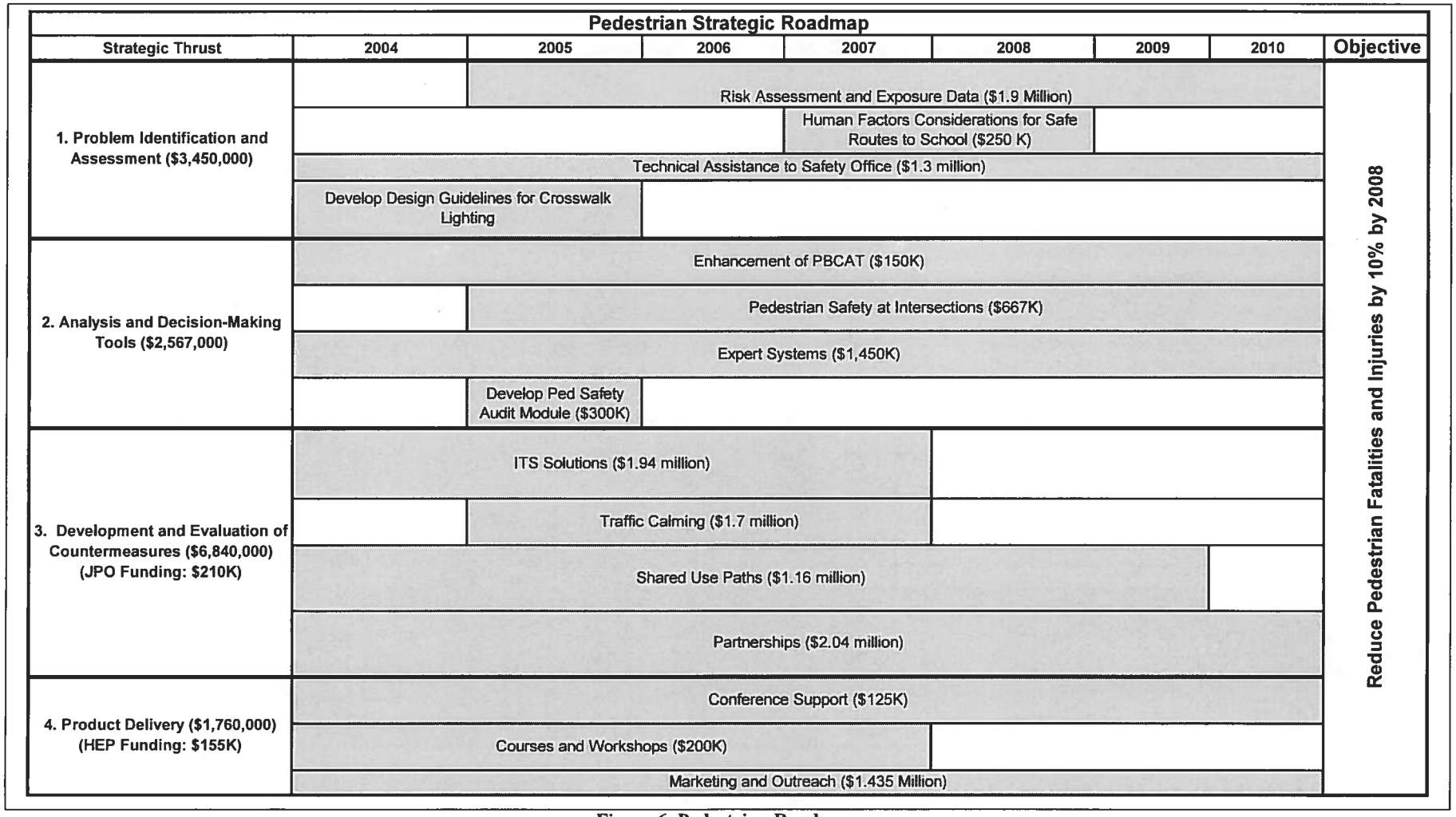

Figure 6. Pedestrian Roadmap

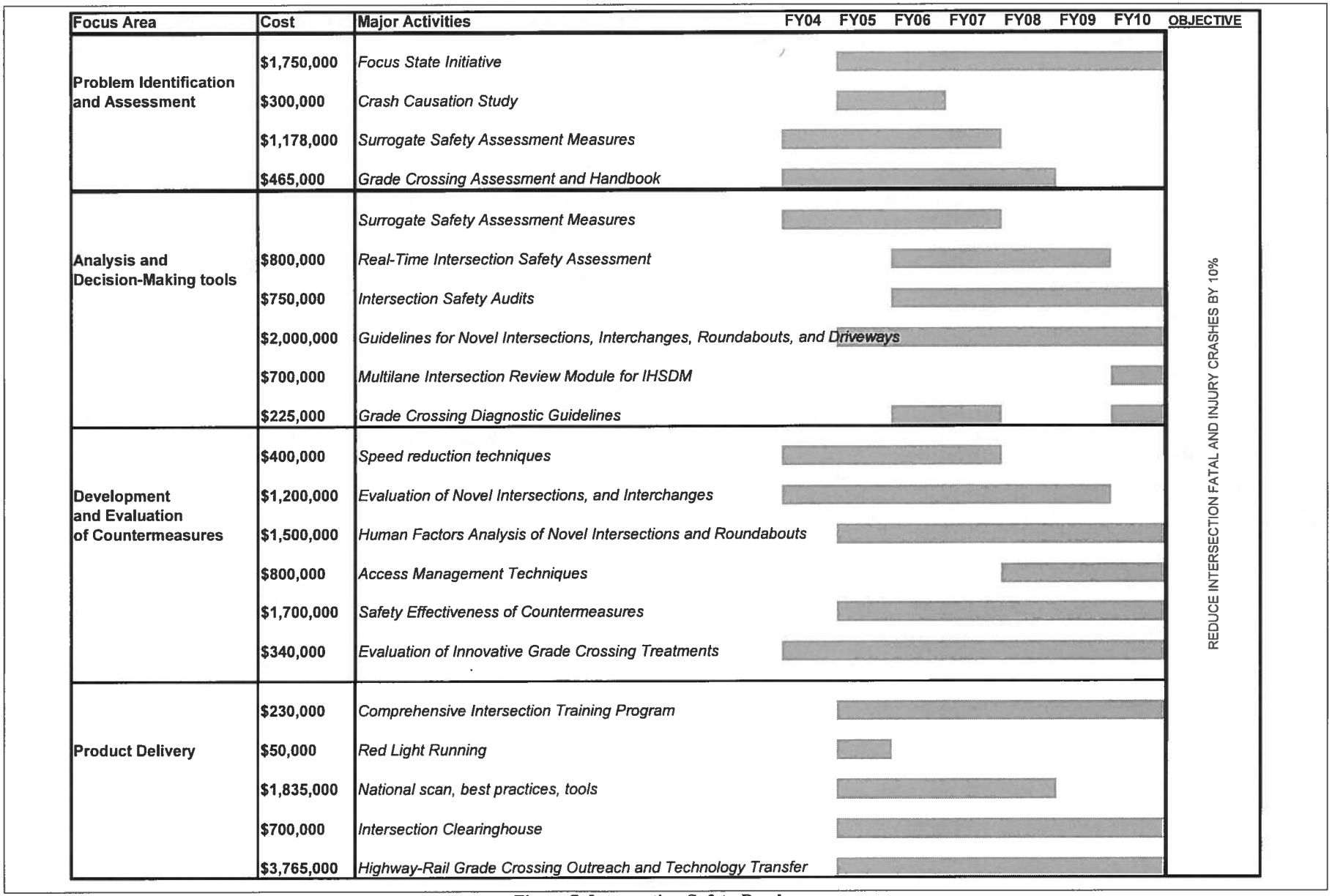

Figure 7. Intersection Safety Roadmap

Appendix D: FHWA Performance Plans from 2005 and 2006

Table 17: Roadway Departure Program Performance Plans

Fiscal Year	2005	2006
Performance Objective	Reduce fatalities involving roadway departure, i.e. run-off-road and head-on crashes	Implement countermeasures to reduce highway-related fatalities
Performance Measure	One-half of roadway departure Focus States improve their roadway departure (per VMT) fatality rate trend line in fiscal year 2005	Reduce roadway departure fatality rate, per 100 million VMT, to 0.82, saving 542 lives
National - All Divisions		All states identify problem locations/corridors and implement countermeasures for roadway departure, intersection, and pedestrian crashes.
National - Focused Divisions	For states with a rural roadway departure rate above the national average (and at least 30 fatalities annually), identify and analyze problem areas and implement a rural freeway safety improvement program that, at a minimum, employs retrofitted rumple strips. For states with two-lane rural roadway departure fatality rates over national average (and equal to or above 250 fatalities annually), implement statewide assessment and improvement programs on two-lane corridors.	Implement planned countermeasures from Roadway Departure Safety Plan to reduce roadway departure i.e., run-off-road and head-on crashes (Vital Few). For States with high rural freeway crashes, identify and analyze problem areas and implement rural freeway safety countermeasures. For States with high two-lane rural roadway departure crashes, implement statewide countermeasures on two-lane corridors.

Table 18: Intersection Program Performance Plans

Fiscal Year	2005	2006
Performance Objective	Reduce intersection related fatalities	Implement countermeasures to reduce highway-related fatalities
Performance Measure	One-half of intersection Focus States improve their intersection fatality rate (per population) trend line in FY2005	Reduce intersection fatality rate, per 100,000 population, to 2.96, saving 198 lives.
National - All Divisions		All states identify problem locations/corridors and implement countermeasures for roadway departure, intersection, and pedestrian crashes.
National - Focused Divisions	For states with intersection fatality rate above national average (per population) and equal to or greater than 175 fatalities: - Identify and analyze problem areas (state and local) and implement intersection safety improvement program - Promote signalized intersection guide	Implement planned countermeasures from Intersection Safety Plan to reduce intersection crashes. (Vital Few) For States with high intersection crashes identify and analyze problem areas and implement intersection safety improvement countermeasures.

Table 19: Pedestrian Program Performance Plans

Fiscal Year	2005	2006
Performance Objective	Reduce Pedestrian-related fatalities.	Implement countermeasures to reduce highway-related fatalities
Performance Measure	One-half of pedestrian Focus Cities improve their pedestrian fatality rate (per population) trend line in FY 2005. One-half of pedestrian Focus States improve their pedestrian fatality rate (per population) trend line in 2005.	Reduce pedestrian fatality rate, per 100,000 population, to 1.53, saving 102 lives.
National - All Divisions		All states identify problem locations/corridors and implement counter-measures for roadway departure, intersection, and pedestrian crashes.
National - Focused Divisions	Develop and implement pedestrian safety plans in cities with highest fatalities per year. For states with pedestrian fatalities above 150 or fatality rate above 2.5, commit to developing pedestrian safety plan.	Implement planned countermeasures from Pedestrian Safety Plan to reduce pedestrian crashes. (Vital Few) For Cities with highest pedestrian crashes, implement countermea-sures from Pedestrian Safety Plan. For States with highest pedestrian crashes, implement countermeasures from Pedestrian Safety Plan.

Appendix E: A Guide to Program Evaluation and Effectiveness Measurement

The need for Federal program evaluation information is growing. With limited resources and increasing demands, organizations are faced with greater expectations for efficiencies and reports of performance. Legislation over the past ten years has resulted in the need for agencies to show how program funds were used and what those programs produced in terms of benefits and results.

Program evaluations are used to answer these questions. The main purpose of evaluation is to improve the quality of a program or a project by identifying its strengths and weaknesses. Programs need to be reviewed or assessed to see if they accomplished the stated objectives. Through evaluation processes, the impact the program is having is also determined. This leads to a decision on whether the program should be continued, modified, expanded or terminated.

What follows is a generalized guide to program evaluation that the Office of Safety can use for evaluating its safety programs.

A Guide to Program Evaluation

Initial Program Assessment

Describe the Program. Program descriptions convey the mission and objectives of the program being evaluated. Descriptions should be sufficiently detailed to ensure understanding of program goals and strategies. The description should discuss how the program fits into the agency. The description enables comparisons with similar programs. Stakeholders might have differing ideas regarding program goals and purposes. Evaluations done without agreement on the program definition are likely to be of limited use. The following are aspects that may be included in a program description.

- A statement describing the problem or opportunity that the program addresses.
- Expected effects that the program must accomplish to be considered successful.
- Program activities including specific steps, strategies, and/or actions.
- Resources including the time, staff, technology, information, and funding available.
- An overview of the history, geography, politics, social and economic conditions under which the program was developed and operates.

Feasibility Assessment. Some programs are much easier to evaluate than others. Typically, programs with multiple goals, objectives, and operational elements are more difficult to evaluate. Some aspects readily lend themselves to quantification, while other aspects do not. When planning an evaluation, the following questions need to be asked:

- What information is needed for the evaluation? Who needs it? What level of evidence is needed? A decision needs to be made on whether the evaluation should focus on process evaluation, i.e., gathering data about program approach and execution such as resources used, activities undertaken, and involvement of participants; or measuring the impacts of the program by collecting information on peoples' reaction, changes in knowledge, attitude, behaviors, and ultimately the impact on highway safety?
- How will the information be gathered? What method (or a combination of methods) is appropriate?
- Can the program be evaluated? Does the program have clear objectives and well-defined activities? Are there enough resources (money, time and expertise) to undertake the evaluation? Are there clearly defined performance standards? Will the evaluation information be used? If the answer to these questions is "no" then it is not feasible to undertake an evaluation of the program without clarifying these issues.

Establish Evaluation Parameters

The evaluation must be focused to assess the issues of greatest concern to stakeholders while using time and resources as efficiently as possible. Not all evaluation design options are equally well-suited to meeting the information needs of stakeholders. After data collection begins, changing procedures might be difficult or impossible, even if better methods become obvious. A thorough plan anticipates intended uses and creates an evaluation strategy with the greatest chance of being useful, feasible, and accurate. Among the items to consider when planning an evaluation are the following:

Purpose. When performing a program evaluation, it is important to identify what components of the program are being evaluated. There are three major components of a given program that may be evaluated:

- Program Approach - This component describes the strategic design of the program. When evaluating this component, alternative program designs are compared.
- Program Execution - This component describes how the program is being executed given the program's strategic design. When evaluating this component, the operational aspects of the program should be analyzed; however, the overall program design should be considered a constant. The purpose of evaluating these operational aspects of the program is to optimize the program's performance under its given strategic approach.
- Program Effectiveness - This component describes the impact of the program on the entities subject to it. In this step, the program impacts would be

estimated and then compared to the performance goals of the program. In some cases it may not be possible to measure the effectiveness of a program, and this component of the evaluation will outline why it is not feasible and what steps need to be taken to allow for the program's effectiveness to be measured at a later date.

Stage of Development. Programs mature and change over time. These stages of development are often referred to as the planning, implementation, and impact phases. During planning, program activities are untested, and the goal of evaluation is to refine plans. During implementation, the goal of evaluation is to characterize real, as opposed to ideal, program activities and to improve operations. During the last stage, enough time has passed for the program's impacts to emerge; the goal of evaluation is to identify and account for both intended and unintended impacts.

Users. User (those that will receive the evaluation findings) involvement is required for clarifying intended uses of the evaluation, prioritizing questions that the evaluation will seek to answer, and preventing the evaluation from becoming a misguided or irrelevant exercise.

Uses. Uses are the specific ways in which information generated from the evaluation will be applied. Uses should be planned and prioritized with input from stakeholders.

Criteria. Depending on the program and objectives of the evaluation, different evaluation criteria may apply. The criteria are the standards, measures and expectations against which performance is compared or evaluated. When developing criteria it may be useful to think in terms of approach, execution, and effectiveness. Depending on which of these aspects is being evaluated the criteria may differ. Also, the criteria should be weighted and/or prioritized as appropriate. These may include:

- Purpose of goals prescribed by law or set by officials
- Policies and procedures established by officials
- Technical standards
- Expert opinion
- Previous performance
- Performance of similar programs
- Best practices of leading organizations

Questions. Questions establish boundaries for the evaluation by stating what aspects of the program will be addressed. Negotiating and prioritizing questions among stakeholders further refines the focus of the evaluation. Certain stakeholders might want to study how programs operate together as a system of interventions to effect change. Other stakeholders might have questions concerning the performance of a single program. Still others might want to concentrate on specific subcomponents or processes of a project.

Methods. Evaluation methods should be selected to provide the appropriate information to address stakeholders' questions. Methodology decisions also raise questions regarding how the evaluation will operate (e.g., to what extent program participants will be involved; how information sources will be selected; what data collection instruments will be used; who will collect the data; what data management systems will be needed. Because each method option has limitations, evaluations that mix methods are generally more effective. Methods tend to fall into one of four categories:

- Observed- inspection or observation of people, property or events
- Documented- such as letters, contracts, accounting records, etc.
- Testimonial- inquires, interviews, or questionnaires
- Analytical- computations and comparisons

Collect Data

Data should be collected and analyzed as previously planned. During this step data should be tested for sufficiency, competence, and relevance as described below.

- Sufficiency- Persuade a knowledge person
- Competence- Data are valid, reliable and consistent
- Relevance- Logical relationship and importance to subject matter

Those involved in an evaluation should collect information that will convey a well-rounded picture of the program and be seen as credible by the evaluation's primary users. Having credible evidence strengthens evaluation judgments and the recommendations that follow from them. The following aspects of data and information (i.e. evidence) gathering typically affect perceptions of credibility:

Indicators. Indicators translate general concepts regarding the program, its context, and its expected effects into specific measures; they provide a basis for collecting evidence that is valid and reliable for the evaluation's intended uses.

Sources. Sources of evidence in an evaluation are the persons, documents, or observations that provide information. Selecting multiple sources provides an opportunity to include different perspectives regarding the program, which enhances the evaluation's credibility. The criteria used for selecting sources should be stated clearly so that users and other stakeholders can interpret the evidence accurately and assess if it might be biased.

Quality. High-quality data are reliable, valid, and informative for their intended use. Well-defined indicators enable easier collection of quality data. Other factors affecting quality include instrument design, data-collection procedures, training, coding or data, data management, and error checking procedures.

Quantity. Quantity refers to the amount of evidence gathered in an evaluation. The amount of information required should be estimated in advance, or where evolving processes are used, criteria should be set for deciding when to stop collecting data.

Quantity affects the potential confidence level or precision of the evaluation's conclusions. All evidence collected should have a clear, anticipated use. Only a minimal burden should be placed on respondents for providing information.

Logistics. Logistics encompass the methods, timing, and physical infrastructure for gathering and handling evidence. Each technique for gathering evidence must be suited to the source(s) and analysis plan. Persons and organizations also have cultural preferences that dictate acceptable ways of asking questions and collecting information, including who would be perceived as an appropriate person to ask the questions. The techniques for gathering evidence in an evaluation must be aligned with the cultural conditions.

Develop Findings

Evaluation findings are justified when they are linked to the evidence gathered and judged against agreed-upon criteria. Stakeholders must agree that conclusions are justified before they will use the evaluation results with confidence. Justifying conclusions on the basis of evidence includes the following elements:

Analysis and Synthesis. Analysis and synthesis are methods for examining and summarizing an evaluation's findings. They detect patterns in evidence, either by isolating important findings or by combining sources of information to reach a larger understanding.

Interpretation. Interpretation is the effort of figuring out what the findings mean and is part of the overall effort to make sense of the evidence gathered in an evaluation. Uncovering facts regarding a program's performance is not sufficient to draw conclusions. Interpretations draw on information and perspectives that stakeholders bring to the evaluation and can be strengthened through active participation or interaction.

Judgement. Judgments are statements concerning the merit, worth, or significance of the program. They are formed by comparing the findings and interpretations regarding the program against one or more selected standards. Because multiple standards can be applied to a given program, stakeholders might reach different or even conflicting judgments. Conflicting claims regarding a program's quality, value, or importance often indicate that stakeholders are using different standards for judgment.

Recommendations. Recommendations are actions for consideration resulting from the evaluation. Forming recommendations requires information beyond what is necessary to form judgments regarding program performance. Knowing that a program is able to reduce fatalities does not translate necessarily into a recommendation to continue the effort, particularly when competing priorities or other effective alternatives exist. Making recommendations requires information concerning the context, particularly the organizational context, in which programmatic decisions are made.

Generalized Requirements for Program Effectiveness Measurement

While program effectiveness modeling is not an exact science, the effectiveness of some programs is more easily measured than for others. Every program needs to be evaluated and assessed independently; however, there does appear to be a set of common requirements that a program should have before extensive effectiveness models can be developed.

Well-Defined and Measurable Outcomes

All programs are composed of inputs, outputs, and outcomes. Inputs are the resources used to produce outputs. Outputs are the products or services generated from a program. Outcomes are the effects or impacts those products or services have on the target audience. A logical connection should exist between a program's inputs, outputs, and outcomes.

For example, FMCSA's Intervention Program provides grants to State's for performing roadside inspections and traffic enforcement interventions. A roadside inspection occurs when a Motor Carrier Safety Assistance Program (MCSAP) inspector conducts an examination on individual commercial motor vehicles and drivers to determine if they are in compliance with the Federal Motor Carrier Safety Regulations (FMCSRs). These inspections can be conducted at a static point, such as a weigh station, where a selection system is used to target carriers for inspections, or they can occur in conjunction with a driver being stopped for a traffic violation (traffic enforcement). Roadside inspections and traffic enforcement stops are the inputs into the Intervention Program.

The outputs produced by this program are measured in terms of inspections performed, traffic enforcement stops performed, and violations corrected. Not all inspections will result in the identification and subsequent correction of violations. Since vehicle and driver violations (e.g. driving while intoxicated, faulty brakes, etc.) have the potential to result in a crash, removing these violations from the environment results in crashes being prevented. This is the primary outcome from the Intervention Program. Taking it one step further, preventing crashes results in preventing fatalities, injuries, and property damage costs.

These logical connections between the input, outputs, and outcomes provide a solid basis from which to begin developing effectiveness models. Identifying these connections is also a useful exercise for clearly, logically identifying and documenting the potential benefits from a program.

Sole or Majority Contributor to the Outcome

While it is common for a number of Federal programs to support a single outcome, identifying the impact of each of the programs independently is often not possible. However, when a program is the sole contributor or at least a majority contributor to an outcome, then it is possible to construct program specific effectiveness models.

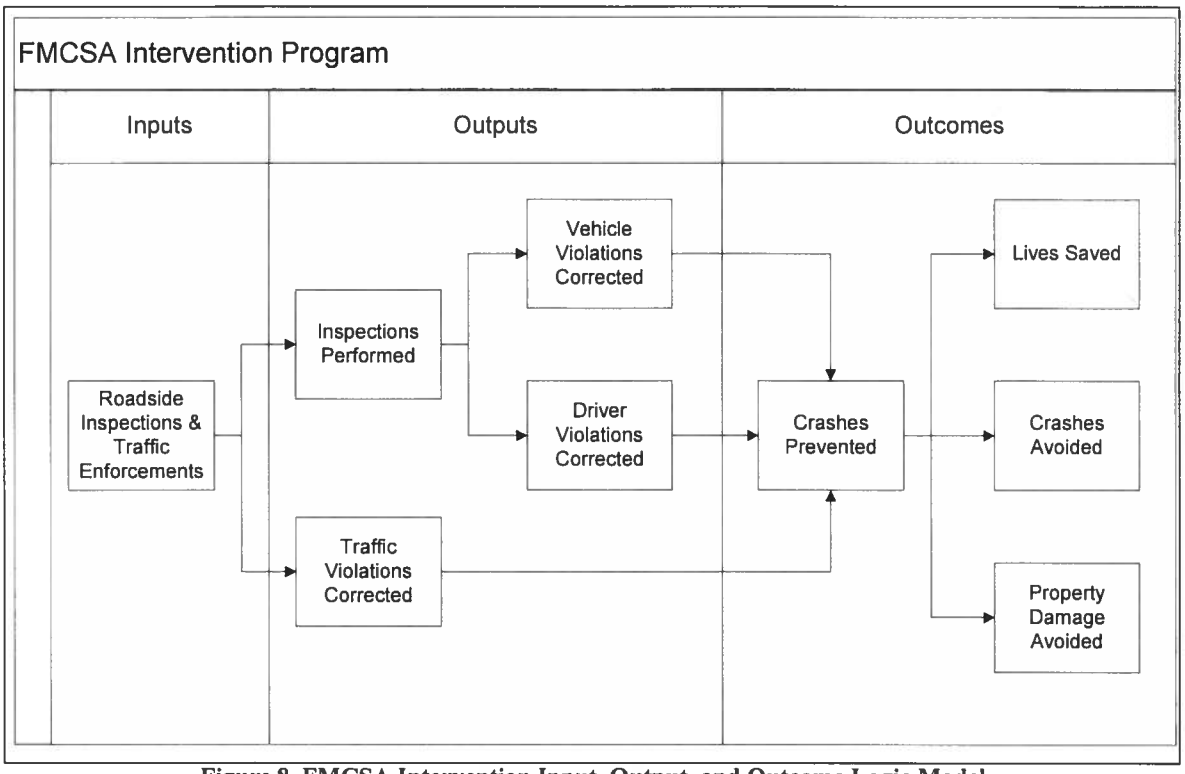

Figure 8. FMCSA Intervention Input, Output, and Outcome Logic Model

For example, FMCSA's Compliance Review Program uses on-site examinations of a motor carrier's records and operations to determine whether the carrier meets the FMCSA safety fitness standard. These examinations focus on reviewing and improving a carrier's operations in the areas of driver behavior, vehicle maintenance, hazardous materials, and safety management. The outcome of this program is a reduction in the crashes for the group of carriers exposed to this program. While there may be other factors at work impacting the crash rates of the carriers individually, as a whole, the Compliance Review Program is the major contributor to the outcome of reducing crashes for these carriers. This has been confirmed numerous times by analyzing crash rates for carriers receiving a compliance review and crash rates for a control groups of carriers that did not receive a compliance review. As a whole, carriers subjected to a compliance review exhibit a reduced crash rate when compared to the population as a whole.

Of course situations will arise where it is not possible to define programs that are sole contributors to an outcome. One approach to handling this is to measure the change in the outcome due to the combined impact of all the contributing programs. From there it maybe be possible to disaggregate the outcomes to the specific contributing programs by quantifying the resources contributed by each program and the effectiveness