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STATE SAFETY OVERSIGHT PROGRAM

Annual Report for 1999


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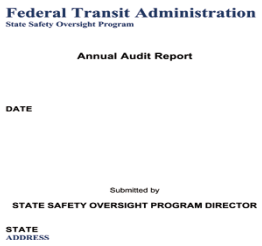
Federal Transit Administration
State Safety Oversight Program

Annual Audit Report

DATE

Submitted by
STATE SAFETY OVERSIGHT PROGRAM DIRECTOR

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13. ABSTRACT (Maximum 200 words)

The Federal Transit Administration's (FTA) State Safety Oversight Rule (49 CFR Part 659) requires oversight for all rail transit agencies in revenue operation after January 1, 1997. This report summarizes activities performed to implement the State Safety Oversight Program during Calendar Year 1999. Information provided by State Oversight Agencies documenting the safety and security performance of the rail transit industry in 1999 is presented, including a discussion of the probable causes of accidents and unacceptable hazardous conditions. This report also highlights procedures and policies, developed by State Oversight Agencies and rail transit systems, which have been particularly effective in supporting the objectives of the State Safety Oversight Program.

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PREFACE

The *State Safety Oversight Program Annual Report* for 1999 represents the cooperative efforts of many people. For their guidance and technical direction, the authors give special thanks to Mr. Hiram Walker, Mr. Jerry Field, Mr. Frank McCarron, and Mr. Roy Field of the Federal Transit Administration's Office of Safety and Security. The State Oversight Agencies, who implement FTA's program and provide the data, procedures, and policies upon which this report is largely based, have demonstrated the possibilities and effectiveness of a joint government and industry partnership for rail transit safety oversight. The American Public Transportation Association (APTA), the Bureau of Transportation Statistics (BTS), the FTA National Transit Database (NTD) Program, the Transportation Research Board (TRB), and the National Transportation Safety Board (NTSB) provided additional data and analysis to support State reports and analysis. Thanks are also extended to Mr. Sam Carnaggio, Mr. Sam Nassif, Mr. David Vozzolo, Mr. Glen Bottoms, and Mr. Gary Delorme of the Federal Transit Administration for their insights and suggestions. Their combined efforts greatly improved the content of this report. Finally, the authors wish to thank Mr. James Harrison of the Volpe National Transportation Systems Center for his invaluable contributions to, and management of, the preparation of this report.

METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC	METRIC TO ENGLISH
LENGTH (APPROXIMATE)	**LENGTH (APPROXIMATE)**
1 inch (in) = 2.5 centimeters (cm)	1 millimeter (mm) = 0.04 inch (in)
1 foot (ft) = 30 centimeters (cm)	1 centimeter (cm) = 0.4 inch (in)
1 yard (yd) = 0.9 meter (m)	1 meter (m) = 3.3 feet (ft)
1 mile (mi) = 1.6 kilometers (km)	1 meter (m) = 1.1 yards (yd)
	1 kilometer (km) = 0.6 mile (mi)
AREA (APPROXIMATE)	**AREA (APPROXIMATE)**
1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)	1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)	1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)	1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)	10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres
1 acre = 0.4 hectare (he) = 4,000 square meters (m^2)	
MASS - WEIGHT (APPROXIMATE)	**MASS - WEIGHT (APPROXIMATE)**
1 ounce (oz) = 28 grams (gm)	1 gram (gm) = 0.036 ounce (oz)
1 pound (lb) = 0.45 kilogram (kg)	1 kilogram (kg) = 2.2 pounds (lb)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)	1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons
VOLUME (APPROXIMATE)	**VOLUME (APPROXIMATE)**
1 teaspoon (tsp) = 5 milliliters (ml)	1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 tablespoon (tbsp) = 15 milliliters (ml)	1 liter (l) = 2.1 pints (pt)
1 fluid ounce (fl oz) = 30 milliliters (ml)	1 liter (l) = 1.06 quarts (qt)
1 cup (c) = 0.24 liter (l)	1 liter (l) = 0.26 gallon (gal)
1 pint (pt) = 0.47 liter (l)	
1 quart (qt) = 0.96 liter (l)	
1 gallon (gal) = 3.8 liters (l)	
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)	1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)	1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)
TEMPERATURE (EXACT)	**TEMPERATURE (EXACT)**
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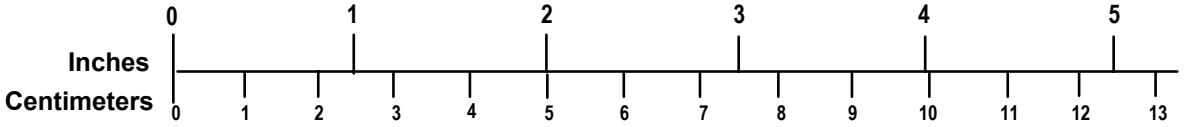

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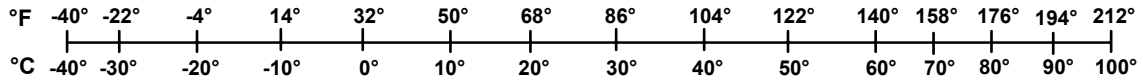

For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50 SD Catalog No. C13 10286

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State Safety Oversight Annual Report

The *State Safety Oversight Annual Report* summarizes FTA, State, and rail transit agency activities to implement 49 CFR Part 659 requirements in 1999.

Executive Summary

In response to congressional concern regarding the potential for catastrophic accidents and security incidents on rail transit systems, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) added Section 28 to the Federal Transit Act (codified at 49 U.S.C. Section 5330). This section required the Federal Transit Administration (FTA) to issue a Rule creating the first state-managed oversight program for rail transit safety and security. This report summarizes activities performed to implement FTA's State Safety Oversight Program during Calendar Year 1999.

Information provided by State Oversight Agencies documenting the safety and security performance of the rail transit industry in 1999 is presented, including a discussion of the probable causes of accidents and unacceptable hazardous conditions. This report also highlights procedures and policies, developed by State Oversight Agencies and rail transit agencies, which have been particularly effective in supporting the objectives of the State Safety Oversight Program.

Rule Reporting Requirements

FTA published "Rail Fixed Guideway Systems; State Safety Oversight" on December 27, 1995 (codified at 49 CFR Part 659), subsequently referred to as the State Safety Oversight Rule or Part 659. This Rule sets forth FTA's requirements to improve the safety and security of Rail Fixed Guideway Systems (RFGS). Only those States with RFGS meeting the following definition must comply with FTA's State Safety Oversight Rule:

"Any light, heavy or rapid rail system, monorail, inclined plane, funicular, trolley, or automated guideway that is included in FTA's calculation of fixed guideway route miles or receives funding under FTA's formula program for urbanized areas and is not regulated by the Federal Railroad Administration (FRA)." (§659.5)

In 1999, FTA's State Safety Oversight Program affected 32 RFGS located in urban areas throughout the country. In total, these agencies operated 12 heavy rail systems, 20 light rail systems, 1 cable car system, 4 automated guideways, and 3 inclined planes.

FTA's State Safety Oversight Rule (49 CFR Part 659.45) requires that, by March 15 of each year, State Oversight Agencies (SOAs) must submit to FTA an annual report summarizing oversight activities for the preceding twelve months, including a description of the most common probable causal factors of accidents and unacceptable hazardous conditions. In 1999, in response to congressional concern and NTSB recommendations, FTA developed an *Annual Reporting Template* to facilitate the collection of causal data in a format that could be quantified at year's end. 1999 is the first year for collecting causal data in this format under the State Safety Oversight Program. Prior to 1999, causal data collected in the annual report was descriptive in nature and not quantifiable.

Ridership statistics reported by the American Public Transortation Association (APTA) indicate that 1999 saw the highest levels of passenger ridership in nearly four decades.

To capture FTA, State, and RFGS activity for 1999, this report presents information obtained from a variety of sources, including *Annual Reports* submitted by the States to FTA, the National Transit Database (NTD), State submittals for FTA's State Safety Oversight Audit Program, analysis from FTA's Triennial and State Management Review Oversight Programs, and procedures, plans and documents from RFGS around the country.

1999 Ridership

Ridership estimates for 1999, available from American Public Transportation Association (APTA), indicate that, combined, the 32 RFGS affected by the Rule provided approximately 3 billion unlinked passenger trips, accounting for roughly 35 percent of all trips made on public transportation and the highest rail ridership in nearly four decades. Each weekday in 1999, approximately 4 million people used rail transit service for more than 8.1 million unlinked trips. In 1999, these rail transit agencies made possible a high level of personal mobility for the nation's 250 million urban and suburban residents and nearly 7 million urban business establishments.

1999 Safety Performance

Historically, the rail transit industry provides the safest means of transportation available in the United States. As reported by the Bureau of Transportation Statistics in the *Transportation Statistics Annual Report 1999*, for the four years between 1995 and 1998, the number of fatalities in rail transit has been a full order of magnitude less than other modes of transportation. Fatalities in rail transit are even lower when suicides are removed from the total count, as this category of fatalities comprises more half of the people killed in rail transit service each year.

Key findings from data submitted by States for 1999 are presented below:

- Fatalities - Of the 112 State-reported fatalities in 1999, 73 were the result of suicides—a consistent trend when compared with 1998 NTD results.

- Collisions - States reported 100 collisions in 1999, resulting in 21 fatalities and 138 injuries requiring medical attention away from the scene.

- Derailments - States reported 6 total derailments in 1999 resulting in no fatalities and 1 injury requiring medical treatment away from the scene.

- Rail Grade Crossings - Sixty-seven accidents at rail grade crossings resulted in 18 fatalities and 97 injuries requiring medical treatment away from the scene in 1999.

- Fires - States reported 5 total fires meeting FTA's definition of accident. These fires were all on heavy rail systems and resulted in no fatalities and 61 injuries.

- Other reportable incidents - In 1999, States reported a total of 2,449 of these incidents, resulting in 2,542 injuries requiring medical treatment away from the scene. These incidents include slips, trips and falls, car door injuries, passenger injuries while boarding and alighting rail vehicles, injuries occurring on escalators, stairs, and elevators and medical emergencies.

Implications of RFGS Data

Analysis of RFGS safety data reported by the States for 1999 indicates the following findings for those incidents categorized as collisions, derailments, rail grade crossing accidents and fires:

- 94 percent of these accidents were collisions and grade crossing accidents
- Collisions and grade crossing accidents occurred predominantly on light rail systems (78 percent)
- Light rail transit experienced 72 percent of the fatalities resulting from collisions and rail grade crossings accidents
- Light rail experienced 63 percent of the injuries from collisions, grade crossing accidents, derailments, and fires
- 92 percent of single person injuries occurred on heavy rail

The following table identifies additional findings resulting from analysis of State data for 1999:

In 1999, heavy rail service provided 8 times as many passenger trips as light rail operations and experienced 25 fewer fatalities related to collisions and rail grade crossing accidents as light rail operations.

		Implications for Safety Improvements
		• Awareness training • Fencing • Platform edge detection
		• Increased operator supervision and observation • Dedicated refresher training programs • Dispatcher training and observation • Discipline and rule enforcement • Drug and alcohol awareness • Proficiency training
		• Rail yard work rules and procedures • Automatic speed controls • Vehicle maintenance and inspections • Proficiency training
		• Rail grade protection and design standards • Elimination of rail grade crossings • Coordination with State DOT/highway authorities • Public education • Operation Lifesaver
		• Station design standards and materials selection • Car door spring-back mechanisms • Lighting • Signage • Passenger awareness campaigns
		• Training and Discipline • Safety observations and testing • Safety management culture • Drug and alcohol awareness
	-	• SSPP and policy revisions • Operator bulletins • Discipline and rules enforcement • Safety management culture • Public education campaigns
		• Escalator design • Signs and markings • Housekeeping and maintenance • Station announcements • Data analysis

In March 2000, FTA issued its Safety Action Plan to publicize its program for supporting rail transit industry efforts to eliminate accidents, injuries, and property damage.

RFGS safety data reported by the States for 1999 indicates clear trends in accidents experienced by the industry. Predominantly, as light rail transit has become a more popular mode of service, it has experienced higher rates of collisions, derailments, and rail grade crossing accidents.

Light rail is an attractive public transportation alternative for many reasons: its relatively low capital cost, its ability to operate both on and off streets, and its capacity to transport passengers with frequent stops in heavily congested areas. However, unlike heavy rail systems, which operate largely within exclusive right-of-way, the majority of light rail transit systems operate portions of their systems within unrestricted right-of-way on city streets, in mixed traffic, within median strips, and in pedestrian malls. This situation results in numerous, and sometimes continuous, roadway-light rail grade crossings. In some cases, light rail systems share grade crossings with mainline railroads.

Rail grade crossings and intermingling with street traffic create an operating environment for light rail transportation wrought with the potential for catastrophic occurrences. With at least 7 new light rail systems planned in the next decade, and an equal number of extensions under design and construction for existing light rail service, this vulnerability will only increase. Addressing this environment, through technology solutions and procedures and training, must remain a priority to improve the safety performance of the industry, and to mitigate increasing trends in light rail fatalities and injuries.

Heavy rail systems continue to struggle with the safety issues involved in the movement of large numbers of people through stations to subterranean or elevated platforms. Passenger injuries on escalators, stairwells, corridors and while boarding and alighting trains remain this mode of service's primary safety concern. In addition, major heavy rail systems, constructed in the 1970s, are now aging, and must deal with the safety impacts of deteriorating infrastructures on operations, thus increasing emphasis on the importance of maintenance inspections and procedures to safe operations.

FTA Activity

The past year was a busy one for FTA's Office of Safety and Security. Throughout the year, compliance monitoring activities required close coordination with Regional Offices, SOAs, and RFGS, strengthening essential interfaces. In 1999, FTA's Office of Safety and Security continued *Phase I* of the State Safety Oversight Audit Program. The Office also initiated programs to revise 49 CFR Part 659; to coordinate with the Federal Railroad Administration (FRA) on shared use operations; to develop policy and programs to support the integration of New Start systems into the State Safety Oversight Program; and to promote integration of system safety concepts in transit operations through training and technical assistance. Further, FTA ensured the integration of safety and security into other management programs with the continued application of its triennial review process.

Prior to May of 2000, FTA developed and published the *FTA Safety Action Plan,* which outlines recommendations in the areas of operational best practices, human factors, and design standards. An interdepartmental task force, designated in 1999 by the FTA

Administrator, put forth these recommendations. In support of the recommendation to integrate system safety and security concepts into all phases of project development, the Office of Safety and Security developed *Keeping Safety on Track* and *Compliance Guidelines for States with New Start Projects*.

These publications signal FTA's commitment to the future of rail safety through all means available: regulation, policy, and information dissemination. FTA has increased its activities to support the creation of a new safety culture with the goal of examining and implementing ways in which current oversight practices can be coordinated to fully integrate system safety at every level of project management.

State Activity

In 1999, States made tremendous strides in their implementation of 49 CFR Part 659 requirements. By the year's end, more than half (12) of the SOAs had designated at least one full-time equivalent (FTE) to their SSO programs, up from only six Agencies when the Program began in 1997. In addition, in 1999, thirteen States used contractors to support some elements of their program. Contractors were most commonly used to conduct three-year safety reviews and to develop System Safety Program Standards and oversight procedures and documentation. Throughout 1999, 14 States revised their System Safety and Security Program Standards.

In 1999, only one State (New York) conducted independent accident and unacceptable hazardous conditions investigations. FTA's Rule states that an investigation "may involve no more than a review and approval of the transit agency's determination of the probable cause of an accident or unacceptable hazardous condition" (Part 659.5). However, if an oversight agency is using the rail system's investigation report to meet its regulatory requirements, this report assumes special significance. The majority of States, which have delegated their 49 CFR Part 659.41 responsibility for accident investigation to the RFGS within their jurisdiction, now perform a careful and thorough review and approval of the accident investigation forms submitted to them. Such formal review and approval constitutes the SOA's official endorsement of the accident investigation conducted on its behalf.

In 1999, States worked closely with the RFGS in their jurisdictions to improve the performance of hazard analysis and the identification of unacceptable hazardous conditions (UHCs). In total, 23 unacceptable hazardous conditions were reported by RFGS in 1999. States have refined notification, investigation, and reporting procedures for addressing these conditions.

During this past year, FTA renewed its effort to ensure that all States began incorporating and tracking the implementation of all corrective action plans submitted by transit agencies. The majority of corrective actions were a result of the internal safety audits conducted by transit systems. It should be noted that not all of the corrective actions that resulted from internal audits met FTA's threshold for reporting, thus SOAs were not required by Part 659 to track their implementation and resolution. States and transit agencies, however, recognized the benefit of coordinating corrective action tracking activities to ensure their successful implementation.

States made tremendous strides in their implemen tation of FTAs' State Safety oversight Rule requirements in 1999.

State Three-year Safety Reviews provide a wealth of information regarding rail transit industry implemen tation of System Safety Program Plans.

In 1999, States required 968 corrective actions plans and approved 553.

17 States conducted three-year safety reviews at 19 RFGS in 1999. Two of the 17 States continued to perform ongoing safety reviews of every safety critical aspect of the transit system's operations, and a third implemented this process for the first time. Further, 14 States used in-house personnel to support the conduct of these reviews. Combined, these reviews resulted in 272 required corrective action plans.

Introduction

This report summarizes activities performed to implement the State Safety Oversight Program during Calendar Year 1999. Information provided by State Oversight Agencies documenting the safety and security performance of the rail transit industry in 1999 is presented, including a discussion of the probable causes of accidents and unacceptable hazardous conditions. This report also highlights procedures and policies, developed by State Oversight Agencies and rail transit systems, which have been particularly effective in supporting the objectives of the State Safety Oversight Program.

This report uses the following acronyms to refer to key participants in the State Safety Oversight Program:

- U.S. Department of Transportation (DOT)
- Federal Transit Administration (FTA)
- State Safety Oversight Agency (SOA)
- Rail Fixed Guideway System (RFGS)
- National Transportation Safety Board (NTSB)
- National Transit Database (NTD)
- American Public Transportation Association (APTA)

The State Safety Oversight Rule is referred to as the Rule or 49 CFR Part 659.

Reporting Requirements

49 CFR Part 659.45 requires that, by March 15 of each year, SOAs must submit to FTA an annual report summarizing oversight activities for the preceding twelve months, including a description of the most common probable causal factors of accidents and unacceptable hazardous conditions. Prior to 1999, causal data collected in the annual report was descriptive in nature and not quantifiable.

In 1999, in response to congressional concern and NTSB recommendations, FTA developed an *Annual Reporting Template* to facilitate the collection of causal data in a format that could be quantified at year's end. 1999 is the first year for collecting causal data in this format under the State Safety Oversight Program. Data presented in this report will be used as a benchmark for future analysis.

The *State Safety Oversight Annual Report* addresses recommendations from the U.S. DOT Office of the Inspector General and the NTSB to analyze the causes of rail transit accidents.

To capture FTA, State, and RFGS activity for the year, this report presents information obtained from a variety of sources, including *Annual Reports* for 1999 submitted by the States to FTA, the National Transit Database (NTD), State submittals for FTA's State Safety Oversight Audit Programs, analysis from FTA's Triennial and State Management Review Oversight Program, and procedures, plans and documents from RFGS around the country.

Using This Report

Chapter One of this report outlines Rule requirements. Chapter Two describes the operations of the affected rail transit systems for 1999. Chapter Three highlights RFGS safety performance, based on data submitted by the SOAs for 1999 in their Annual Reports and NTD trend summaries. Chapter 4 highlights FTA activity for the year. Included in this chapter is a discussion of findings from FTA's State Safety Oversight Audit Program. Further, this chapter highlights effective oversight practices used by SOAs. Chapter Five summarizes State management activity and provides a description of State accomplishments for the year. The report's final chapter summarizes RFGS security performance.

It should be noted that when evaluating the data collected for this report, any attempt to determine industry averages based on aggregate numbers would be misleading. As the State Safety Oversight Rule affects many different types and modes of operation that meet FTA's definition of *rail fixed guideway system*, accident data collected from the nation's larger transit systems will not necessarily provide statistical meaning to smaller agencies.

This situation can be frustrating. SOA Program Managers and RFGS Operators are interested in comparisons: How are they performing relative to their peers? The information presented in this report – whether from the SOA Annual Reports or the NTD -- does not support this type of analysis. Currently, FTA is working to revise NTD to support more meaningful comparisons between and among peer rail transit agencies. In order to make useful comparisons, transit agencies and other users of NTD data must understand the operating environments and characteristics of their peer agencies. For example, data users need to understand the agencies' climatic conditions (e.g., prevalence of winter operations), which effect fuel consumption and maintenance costs, and provisions of labor agreements and work rules (e.g., restrictions on split runs), which affect labor productivity. At the current time, the NTD does not provide contextual information necessary to interpret peer agency data.

However, the information contained in this report and in the NTD does support national and local efforts to monitor and continually improve transit safety and security. This report provides the most inclusive information available on accident and incident contributing factors in the rail transit environment. Reported causal data identifies hazards in the nation's transit infrastructure and operations. The collection of this information enables FTA, SOAs, and RFGS to quantify the reasons for transit accidents, leading to the identification of safety deficiencies and their ultimate resolution. In this way, all involved parties can more effectively work toward the goal of eliminating transit-related deaths, injuries, and property damage.

FTA's decision to begin collecting causal data through the State Safety Oversight Program should promote more focused discussion of industry-wide safety issues. A copy of FTA's *Annual Report Template* is located in Appendix A. FTA anticipates that the dissemination of the information collected for this report will assist SOAs and RFGS in the identification of areas within current safety programs that need strengthening to ensure greater safety for the nation's riding public.

Safety Data: The Challenge

FTA is currently reviewing its safety data collection and analysis capabilities and programs. Agency-wide discussions regarding the integrity of FTA's safety data collection program, combined with recent recommendations from the Office of the Inspector General (OIG) and the NTSB have raised concerns that FTA does not have the statistical data necessary to justify modifications to its safety program, to request legislative changes, and to obtain the necessary resources to carry out its safety mission.

To address this situation, FTA's Office of Safety and Security is working to identify:

- FTA needs for safety data
- Strengths and weaknesses of FTA's current safety data collection programs
- Safety data collection practices of SOAs and other U.S. Department of Transportation modes that could possibly serve as models for FTA

FTA is in a unique position among DOT modal authorities. Unlike the Federal Railroad Administration (FRA) or the Federal Aviation Administration (FAA), FTA does not have extensive safety regulatory authority.

At the current time, FTA's safety authority is limited to enforcement of three legislative mandates: *49 USC 5329* (investigation of conditions that may cause a serious hazard of death or injury), *49 USC 5331* (substance abuse and management testing and programs), and *49 USC 5330* (state safety oversight of rail fixed guideway systems). FTA's limited safety authority has resulted in the limited collection of accident and incident data from transit properties.

At the current time, FTA only collects summary information for the accidents and incidents that occur in the transit industry. FTA does not receive an individual report for each incident meeting its definition of "accident," "fatality," or "injury." Instead, each year, as part of a reporting submission to the National Transit Database, approximately 400 urban transit agencies file *Transit Safety and Security Form 405*. This form collects information on the number of collisions, derailments/buses going off the road, personal casualties, and fires, including fatalities and injuries for patrons, employees, and others.

Each year, based on NTD submissions, FTA's Office of Safety and Security, working with the Volpe National Transportation System Center (Volpe Center), produces "Safety Management Information Statistics," which presents trend analysis of Form 405 data by transit mode. This report also includes ratios that standardize incidents across properties, such as "accidents per 100,000,000 vehicle miles" and "fatalities per 100,000,000 passengers."

This level of analysis provides a useful overview of transit safety and enables cross-modal comparisons. However, it does not support FTA's ability to identify specific safety problems at transit properties. Without this capability, FTA cannot effectively use its *49 USC Section 5329(a)* authority to investigate a "condition in equipment, a facility, or an operation receiving FTA financing that the Secretary believes causes a serious hazard of death or injury."

FTA's safety authority is supported by three legislative mandates:

49 USC 5329

49 USC 5331

49 USC 5330

FTA is currently evaluating proposed changes to NTD. A report summarizing recommended revisions is available for review and comment on FTA's web site: http://www.fta.dot.gov

Most importantly, the data collected in Form 405 contains no information on the *probable cause* of accidents or incidents, and thus prevents FTA from performing any systemic causal analysis to support policy-making and improved safety oversight for the transit industry. This lack of data is a major obstacle to developing and evaluating FTA's safety role.

With the implementation of FTA's State Safety Oversight Program, NTD accident and incident data for rail transit agencies are now supplemented through annual reports from the States to FTA summarizing the probable causes of all accidents meeting FTA's 49 CFR Part 659.5 definition of "accident." While this information is still collected in summary form, FTA is now able to perform limited causal analysis for the nation's RFGS.

The State Safety Oversight Program is a product of federalism – the shared local, State and Federal responsibility for transit safety. To date, FTA's expanded safety oversight role has been implemented through its administration of the State Safety Oversight Program and its interaction with the States. 49 CFR Part 659 has empowered the States to take an active role in transit safety oversight. The collection and analysis of safety data is an important component of this role.

FTA's Office of Safety and Security is interested in hearing from States regarding their opinions and experiences with safety data collection and analysis. In particular, FTA would like to know SOA Program Manager and RFGS safety and operations personnel opinions on the following data issues:

Accident Notification. If FTA wants "real-time" reporting of accidents, then the agency must establish a system for accident notification. A key issue that must be addressed by FTA is which agency should notify – the transit property or its State Safety Oversight Agency. Further, FTA must determine whether headquarters or the Regional Offices would receive and process the notifications.

Definitions and Accuracy. FTA must carefully specify its definitions for "accident," "incident," "fatality," and "injury." Further, FTA must resolve situations where multiple reports could possibly be provided, due to an overlap in reporting definitions (i.e., an "accident" that also produces a "fatality"). FTA must also develop a system for ensuring the accuracy the reported data. Two available models include the FRA records inspections process and the State Safety Oversight on-site safety review.

Timeliness of Reports. FTA must also determine *how frequently it wishes to receive accident and incident information*. Different data can be obtained from a notification and a formal accident report. Further, if both types of reports are to be provided, then FTA must develop a database of sufficient capability to track and map all incoming reports.

Categories of Data. Information that could be collected by FTA during *accident notification* includes the following:

- Transit agency
- Time and date of accident
- Location of accident
- Brief narrative
- General vehicle information
- Fatalities
- Injuries
- Property damage (preliminary)

- Grade crossing information (if applicable)

Additional Information that could be collected by FTA from a *formal accident report* includes the following:

- Accident conditions (Weather; Temperature; Time of day; Visibility; Traffic congestion; Grade crossing protection)
- Track information (Mainline; Yard)
- Operator Information
  - Age
  - Prior violations
  - Drug and alcohol testing performed
- Structures information
- Switches and signals information

Summary information that could be collected by FTA in *monthly or annual reports* include the following:

- Number of accidents
- Collisions
- Derailments
- Fires
- Other
- Number of incidents
- Number of passenger fatalities
- Number of passenger injuries
- Number of employee fatalities
- Number of employee injuries
- Number of other fatalities
- Number of other injuries
- Property damage from accidents
- Location of accidents
- Escalator/elevator safety incidents
- Vehicle information

Accident/Incident Analysis. To ensure appropriate use of the collected accident/incident data, FTA must determine what types of analysis should be performed and how this analysis could guide FTA programs. FTA's "Safety Management Information Statistics" annual report provides many useful rates and measure for assessing the occurrences of accidents and incidents. These measures could be supplemented with information on the probable cause of accidents and special analysis regarding vehicles, equipment, human factor issues, and the state of infrastructure.

State and RFGS personnel interested in contributing to FTA's evolving safety data collection and analysis program should contact FTA's Office of Safety (202-366-0197) or post a message to FTA's safety and security web site (http://transit-safety.volpe.dot.gov)

The forms used by FRA to provide detailed information on individual accidents are available on FRA's homepage: http://www.fra.dot.gov.

In 1999, all affected States had obtained appropriate legal authority to implement Part 659 requirements.

Chapter 1: Overview

This chapter summarizes Rule requirements and presents a chronology of the events that led to the creation of FTA's State Safety Oversight Program. It also provides information on the operations and safety performance of the affected RFGS in 1999.

Background

In response to congressional concern regarding the potential for catastrophic accidents and security incidents on rail transit systems, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) added Section 28 to the Federal Transit Act (codified at 49 U.S.C. Section 5330). This section required FTA to issue a Rule creating the first state-managed oversight program for rail transit safety and security.

FTA published "Rail Fixed Guideway Systems; State Safety Oversight" on December 27, 1995 (codified at 49 CFR Part 659), subsequently referred to as the State Safety Oversight Rule or Part 659. This Rule sets forth FTA's requirements to improve the safety and security of RFGS. Only those States with RFGS meeting the following definition must comply with FTA's State Safety Oversight Rule:

"Any light, heavy or rapid rail system, monorail, inclined plane, funicular, trolley, or automated guideway that is included in FTA's calculation of fixed guideway route miles or receives funding under FTA's formula program for urbanized areas and is not regulated by the Federal Railroad Administration (FRA)." (§659.5)

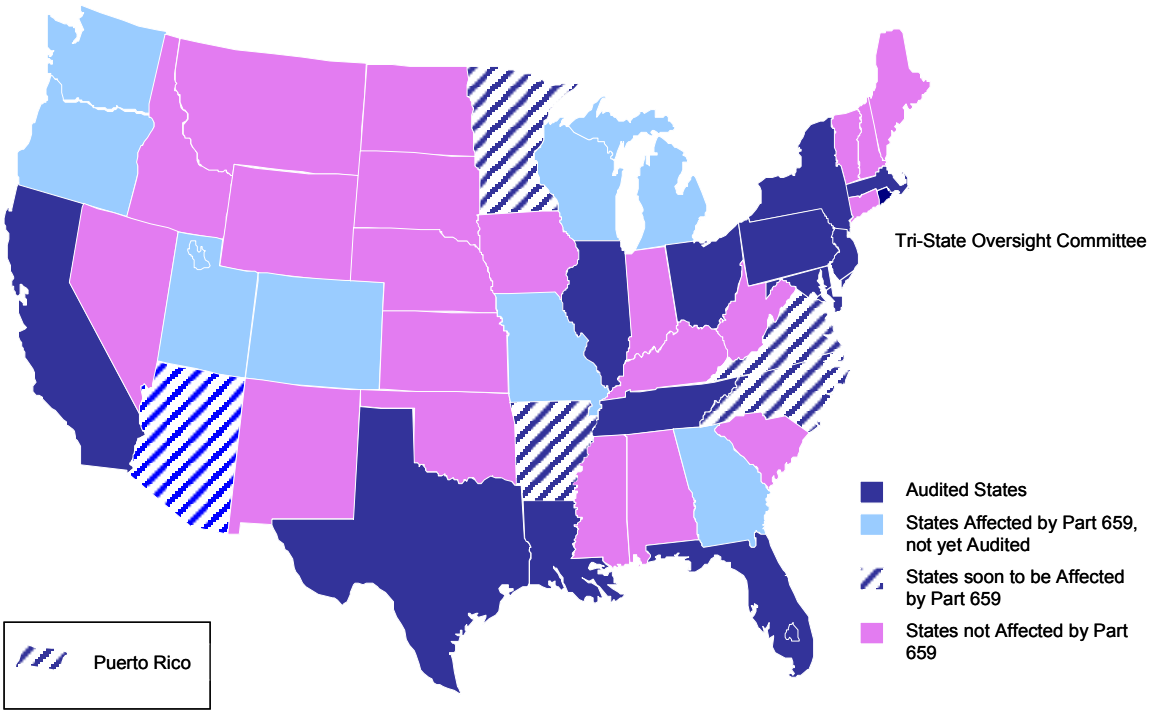
This definition covers 35 rail transit systems operating in 21 States and the District of Columbia. At the current time, 22 SOAs have been designated to implement Part 659 requirements. Six of these Agencies have previous experience with the provision of safety oversight. The remaining 16 Agencies were created to implement Part 659 requirements. SOAs have a variety of legal authorities, including safety responsibilities that exceed FTA minimum requirements. The majority of SOAs are divisions of State Departments of Transportation or Public Utilities Commissions, empowered by enabling legislation or gubernatorial order to implement Part 659 regulations.

	#
Department of Transportation	13
Utilities Commission	3
Port Authority	1
Oversight Committee	1
Consumer Industry and Services	1
Economic Development	1
Transportation Safety Board	1
Regional Funding Agency	1

FTA and the States

To support monitoring activities for the Rule, FTA initiated the State Safety Oversight Audit Program. Findings from this program are presented in Chapter Four of this report. To date, 13 of the 22 affected States have been audited. These States are identified in the map below. In addition, those States with rail transit agencies expected to initiate revenue service in the next decade are also indicated.

U.S. Map – Affected States



NTSB has played a major role in the creation of FTA's State Safety Oversight Program, as indicated in the *SSO Program Timeline* on the following page. During the late 1980's, the NTSB worked with FTA to investigate possible mechanisms for improving rail transit safety and security oversight. In July of 1991, NTSB released its *Oversight of Rail Rapid Transit Safety* (NTSB\SS-91\02). This safety study contributed to the development of ISTEA requirements for State oversight and made the following recommendations to FTA:

R-91-33: Document and evaluate the effectiveness of existing State oversight activities of rail rapid transit safety and develop guidelines for use by State and local governments that address the critical elements of an effective oversight program

R-91-34: Monitor safety oversight programs implemented by the State and local governments to determine that the elements of an effective program are in place, that adequate financial resources are available, and that the mechanism through which the oversight is being accomplished is appropriate given the nature of the particular transit system

R-91-35: Use funding authority to ensure independent and effective oversight for UMTA-funded projects and UMTA-assisted systems

NTSB has evaluated, and is now satisfied with, the implementation of FTA's Rule. NTSB has determined the status of these recommendations as *Closed-Acceptable Action*. NTSB continues to monitor FTA and State activity for 49 CFR Part 659 and to coordinate with all agencies regarding the State Safety Oversight Program.

Affected RFGS include both the oldest heavy rail transit systems in the country (MBTA, NYCT, and SEPTA) and the newest light rail operations (UTA, Denver RTD, NJT Hudson-Bergen, and DART). Affected RFGS also include the Detroit People Mover, inclined planes in Chattanooga, Pittsburgh, and Jacksonville, and the historic cable cars operated by Muni in San Francisco.

(1740 - New York) -- reputed first use of ox carts for carrying of passengers

(1827 - New York) --first horse-drawn urban stagecoach

(1832 - New York) --first horse-drawn street railway line

(1835 - New Orleans) oldest street railway line still operating

(1850 - New York) --first use of exterior advertising on street railways

(1856 – Boston) --first fare-free promotion

(1868 - New York) --first cable-powered (& first elevated) line

(1870 Pittsburgh) -- first inclined plane

(1871 – New York) – first steam powered elevated line

(1873 - San Francisco) -- first successful cable-powered line

	Event
1946	California Public Utilities Commission (CPUC) is named with broad powers to regulate safety, standards of services, and rates for utilities and transportation companies in California
1967	National Transportation Safety Board (NTSB) is created to investigate every civil aviation accident and significant accidents in other modes of transportation, including mass transit
1968	Urban Mass Transportation Administration (UMTA) is established by the President's Reorganization Plan No. 2 to administer Federal grants to mass transit agencies and to address "the need for fast, safe, and efficient [public] transportation"
1971	NTSB releases its first study of rapid rail transit safety and the role of UMTA in promoting safety.
1974	American Transit Association and Institute for Rapid Transit merge to form the American Public Transit Association (APTA)
1975	NTSB conducts its first Major Investigation for rail transit safety at the Massachusetts Bay Transportation Authority (MBTA)
1978	First NTSB Recommendations are issued to the Secretary of the U.S. Department of Transportation to establish a State Safety Oversight Program for rapid rail transit
1980	NTSB holds a 2-day public hearing on rail rapid transit safety and oversight issues
1980	State legislation requires the inspection of subway cars, buses, trolleys, and trackless trolleys by the Pennsylvania Department of Transportation (PennDOT) and the State police.
1982	UMTA Investigative Authority is established in section 22, as amended by Public Law 97-424. Using this authority, UMTA is able to investigate unsafe conditions in mass transit
1982	APTA creates the Rail Safety Review Board (RSRB) to support transit industry efforts to improve safety
1984	New York State Public Transportation Safety Board (PTSB) is created to oversee all rail and bus systems in the State of New York
1986	UMTA issues "State Regulation and Oversight of Public Transit Safety," an assessment of existing State Safety Oversight Programs
1987	UMTA exercises its investigative authority under section 22 to conduct a safety investigation of Southeastern Pennsylvania Transportation Authority (SEPTA)
1989	UMTA exercises its investigative authority under section 22 to conduct a safety investigation of New York City Transit Authority (NYCTA)
1989	APTA releases the first edition of its Rail Safety Audit Program Manual, including the "Manual for the Development of Rail Transit System Safety Program Plans"
1991	NTSB releases "Oversight of Rail Rapid Transit Systems" and issues new recommendations to UMTA requesting State oversight of public transportation (R-91-33 thru R-91-35)
1991	Intermodal Surface Transportation Surface Efficiency Act (ISTEA) is enacted into law, and requires the Federal Transit Administration (FTA - formerly UMTA) to issue regulations creating a State Safety Oversight Program (section 5330)
1992	FTA issues an Advanced Notice of Proposed Rulemaking (ANPRM) soliciting public comment on implementation of ISTEA State safety oversight requirements
1993	FTA publishes a Notice of Proposed Rulemaking (NPRM) soliciting additional public comment on the requirement for States to oversee the safety of rail fixed guideway systems
1995	FTA's Final Rule for "Rail Fixed Guideway Systems; State Safety Oversight" is issued
1996	FTA issues Implementation Guidelines for State Safety Oversight of Rail Fixed Guideway Systems and provides training around the country
1997	States make Initial Submissions to FTA concerning safety oversight programs and activities
1998	States make Initial Submissions to FTA concerning security oversight programs and activities
1999	FTA initiates Phase I of the State Safety Oversight Audit Program
2000	First State Safety Oversight Program Annual Report

Table 1: SSO Program Timeline

State	SOA	Transit System	Rapid Rail	Light Rail	Cable Car	Automated Guideway	Inclined Plane
California	CPUC	BART	◆				
		LACMTA	◆	◆			
		Muni		◆	◆		
		SDTI		◆			
		SRTD		◆			
		SCVTA		◆			
Colorado	CPUC	RTD		◆			
DC, Maryland, Virginia	TOC	WMATA	◆				
Florida	FDOT	JTA				◆	
		MDTA	◆			◆	
Georgia	GDOT	MARTA	◆				
Illinois	RTA	CTA	◆				
Louisiana	LDOTD	RTA		◆			
Maryland	MDOT	MTA	◆	◆			
Massachusetts	DTE	MBTA	◆	◆			
Michigan	CIS	DTC				◆	
Missouri, Illinois	DMCRS	BSDA		◆			
New Jersey	NJDOT	NCS/LR		◆			
		HBLRS		◆			
New Jersey, Pennsylvania	DRPA	PATCO	◆				
New York	PTSB	NFTA		◆			
		NYCT	◆				
Ohio	ODOT	GCRTA	◆	◆			
Oregon	ODOT	Tri-Met		◆			
Pennsylvania	Penn-DOT	CCTA					◆
		PAT		◆			◆
		SEPTA	◆	◆			
Tennessee	TDOT	CARTA					◆
		MATA		◆			
Texas	TxDOT	DART		◆			
		IT		◆			
Utah	UDOT	UTA		◆			
Washington	WDOT	KCT		◆			
		Monorail				◆	
Wisconsin	WisDOT	Kenosha		◆			

Table 2: States and RFGS Affected by Part 659

SOAs have a wide range of legal structures and authorities. California is responsible for the most agencies (six); New York oversees the agency with largest daily ridership (NYCT), and three SOAs provide oversight for agencies operating in more than one State (TOC WMATA, Missouri – Bi State, and DRPA – PATCO)

CONTACTS

	Phone Numbers
California Public Utilities Commission	415-703-4142
Colorado Public Utilities Commission	303-894-2855
Delaware River Port Authority	856-968-2091
Tri-State Oversight Committee (Washington DC, Maryland, and Virginia)	202-671-0537
Florida Department of Transportation	850-414-4525
Georgia Department of Transportation	404-651-9201
Illinois Regional Transportation Authority	312-917-0771
Louisiana Department of Transportation and Development	225-37 9-1928
Maryland Department of Transportation	410-865-1120
Massachusetts Department of Telecommunications and Energy	617-305-3559
Michigan Department of Consumer and Industry Services	517-373-7246
Missouri Department of Economic Development	573-751-7122
New Jersey Department of Transportation	609-292-6893
New York Public Transportation Safety Board	518-457-6500
Ohio Department of Transportation	614-466-8957
Oregon Department of Transportation	503-986-4094
Pennsylvania Department of Transportation	717-787-1207
Tennessee Department of Transportation	615-253-1042
Texas Department of Transportation	512-416-2833
Utah Department of Transportation	801-965-4284
Washington Department of Transportation	360-705-7912
Wisconsin Department of Transportation	608-266-3662

Table 3: State Safety Oversight Agency Contacts

Rule Requirements

FTA's Final Rule for State Safety Oversight requires each State with an RFGS operating within its borders to designate an Oversight Agency with sufficient legal authority to comply with the minimum requirements established in Part 659. Specifying the exact details of how the Oversight Agency operates is beyond the scope of Part 659, and is left for each Oversight Agency to determine. FTA does not require a single approach to establishing the legal, financial, or procedural mechanisms used to provide oversight.

FTA's State Safety Oversight Audit Program outlines seven distinct functions that must be performed for compliance:

- Oversight Agency Designation and Authority (§659.21)
- Oversight Agency Program Management (§659.47, §659.23, §659.31, and §659.45)
- System Safety/Security Program Standard Preparation and Adoption and RFGS System Safety/Security Program Plan Review and Approval Process (§659.31 and §659.33)
- Accident/Unacceptable Hazardous Conditions Investigations and Corrective Actions (§659.39, §659.41, and §659.43)
- Three-Year Safety Reviews (§659.37)
- Requiring and Reviewing RFGS Internal Safety Audit Process Reporting (§659.35)
- Oversight Agency Certification and Reporting to FTA (§659.45 and §659.49).

The requirements are further sub-divided into the following:

- The obligation of the *State* to designate the Oversight Agency.
- The authorities and responsibilities of the *Oversight Agency* in developing the requirements and programs necessary to comply with FTA's State Safety Oversight Program.
- The role of the *rail transit system* in complying with the program developed by the Oversight Agency

The State

The primary responsibility of the state is to designate an Oversight Agency (or Agencies) to oversee the safety of the rail transit systems operating within its borders. When the rail system operates only within a single state, that entity must be an agency of the state; when it operates in more than one state, the affected states may designate a single entity to oversee that system. In neither case may the state designate the rail transit system as the Oversight Agency.

Additional information on Rule requirements is available in the following FTA documents: *Imple mentation Guidelines for State Safety Oversight of Rail Fixed Guideway Systems*; *Transit System Security Program Planning Guide*; *Transit Security Procedures*; *Transit Security Handbook*; *Keeping Safety on Track*; and *Compliance Guidelines for States with New Starts Projects*. Copies of these documents can be requested from FTA's Safety and Security clearinghouse (617-494 2108).

The Oversight Agency

The designated State Oversight Agency is required by Part 659 to perform seven distinct functions. These activities constitute the core of FTA's State Safety Oversight Rule. The Oversight Agency must:

- **Develop a System Safety Program Standard (Program Standard)**. This written document defines the relationship between the Oversight Agency and the rail transit system and guides the rail transit system in developing its System Safety Program Plan (SSPP).

    - The Program Standard must, at a minimum, comply with the American Public Transit Association's Manual for the Development of Rail Transit System Safety Program Plans (APTA Manual) and include specific provisions addressing the personal security of passengers and employees.

- **Require, review and approve, and monitor the implementation of an SSPP that complies with the Oversight Agency's Program Standard at each rail transit system.** By January 1, 1997, the Oversight Agency must review and approve, in writing, the rail transit system's SSPP. The security provisions of the SSPP, however, do not have to be approved initially by the Oversight Agency until January 1, 1998. After the initial approvals, the Oversight Agency must review, as necessary, the rail transit system's SSPP and determine whether it should be updated.

- **Require each rail transit system to report the occurrence of accidents and unacceptable hazardous conditions within a period of time specified by the Oversight Agency**. The Oversight Agency must investigate such events in accordance with established procedures. The Oversight Agency may conduct its own investigation, use a contractor to conduct an investigation, or review and approve the investigation conducted by the rail transit system or the National Transportation Safety Board (NTSB), or use a combination of these methods.

- **Require the rail transit system to implement a Corrective Action Plan.** The Oversight Agency must require the rail transit system to minimize, control, correct, or eliminate, hazardous conditions identified during investigations, in accordance with a Corrective Action Plan drafted by the rail transit system and approved by the Oversight Agency.

- **Conduct on-site visits at each rail transit system at a minimum of every three years to perform a formal Safety Review**. In a Safety Review, the Oversight Agency must assess whether the rail transit system's actual safety and security practices and procedures comply with its SSPP. Once this Review is completed, the Oversight Agency must prepare a report containing its findings and recommendations, an analysis of the efficacy of the rail transit system's SSPP, and a determination of whether the SSPP should be updated.

- **Require the rail transit system to conduct safety audits according to the Internal Safety Audit Process detailed in the APTA Manual (Checklist Number 9)**. In addition, the Oversight Agency must require the rail transit system to compile and submit an Annual Audit Report for review.

- **Report to FTA**. The Oversight Agency must submit three kinds of reports to FTA: an Initial Submission; an Annual Submission; and a Periodic Submission.

The Rail Transit System

While the requirements in Part 659 are directed at the states and the Oversight Agencies, the rail transit agencies play an important role in the State Safety Oversight Program.

To comply with Part 659, the Oversight Agency must require each rail transit system within its jurisdiction to perform the following activities (at a minimum):

- Develop an SSPP that complies with the Oversight Agency's Program Standard.
- Classify hazardous conditions according to the **APTA Manual Hazard Resolution Matrix**.
- Report, within the time frame specified by the Oversight Agency, any accident or unacceptable hazardous condition.
- Obtain the Oversight Agency's approval of a Corrective Action Plan and then implement the Plan so as to minimize, control, correct, or eliminate the particular unacceptable hazardous condition.
- Conduct safety audits that comply with the **Internal Safety Audit Process, APTA Manual (Checklist Number 9).**
- Draft and submit to the Oversight Agency a report summarizing the results of the safety audit process.

Affected RFGS have worked closely with their SOAs, developing procedures, reporting forms, and System Safety and Security Program Plans to implement SOA Program Standard requirements.

Definitions

Accident means any event involving the revenue service operation of a rail fixed guideway system if as a result:

(1) An individual dies;
(2) An individual suffers bodily injury and immediately receives medical treatment away from the scene of the accident; or
(3) A collision, derailment, or fire causes property damage in excess of $100,000.

APTA Guidelines means the American Public Transportation Association's "Manual for the Development of Rail Transit System Safety Program Plans," published on August 20, 1991.

FRA means the Federal Railroad Administration, an agency within the U.S. Department of Transportation.

FTA means the Federal Transit Administration, an agency within the U.S. Department of Transportation.

Hazardous condition means a condition that may endanger human life or property. It includes unacceptable hazardous conditions.

A complete listing of SSO Program definitions is available in FTA's *Implementation Guidelines for State Safety Oversight of Rail Fixed Guideway Systems*.

Investigation means a process to determine the probable cause of an accident or an unacceptable hazardous condition; it may involve no more than a review and approval of the transit agency's determination of the probable cause of an accident or unacceptable hazardous condition.

Rule refers to the State Safety Oversight of Rail Fixed Guideway Systems regulations promulgated by the Federal Transit Administration and defined at 49 CFR Part 659.

Safety means freedom from danger.

Safety review means a formal, comprehensive, on-site review of the transit agency's safety practices to determine whether they comply with the policies and procedures required under the transit agency's system safety program plan.

Security means freedom from intentional danger.

System safety program plan (SSPP) means the document adopted by the transit agency in accordance with the State's system safety program standard.

System safety program standard (SSPS) means the standard developed and adopted by the State which, at a minimum, complies with the APTA Guidelines and which addresses the personal security of passengers and employees.

Unacceptable hazardous condition (UHC) means a hazardous condition determined to be an unacceptable hazardous condition using the APTA Guidelines' Hazard Resolution Matrix (APTA Guidelines, checklist number 7).

Graphical Representation

The graphic on the next page depicts the relationship between FTA, the State, and the RFGS as each element of Part 659 is implemented and serves as a guide when documenting the procedures necessary to carry out rule requirements.

STATE SAFETY OVERSIGHT GUIDE

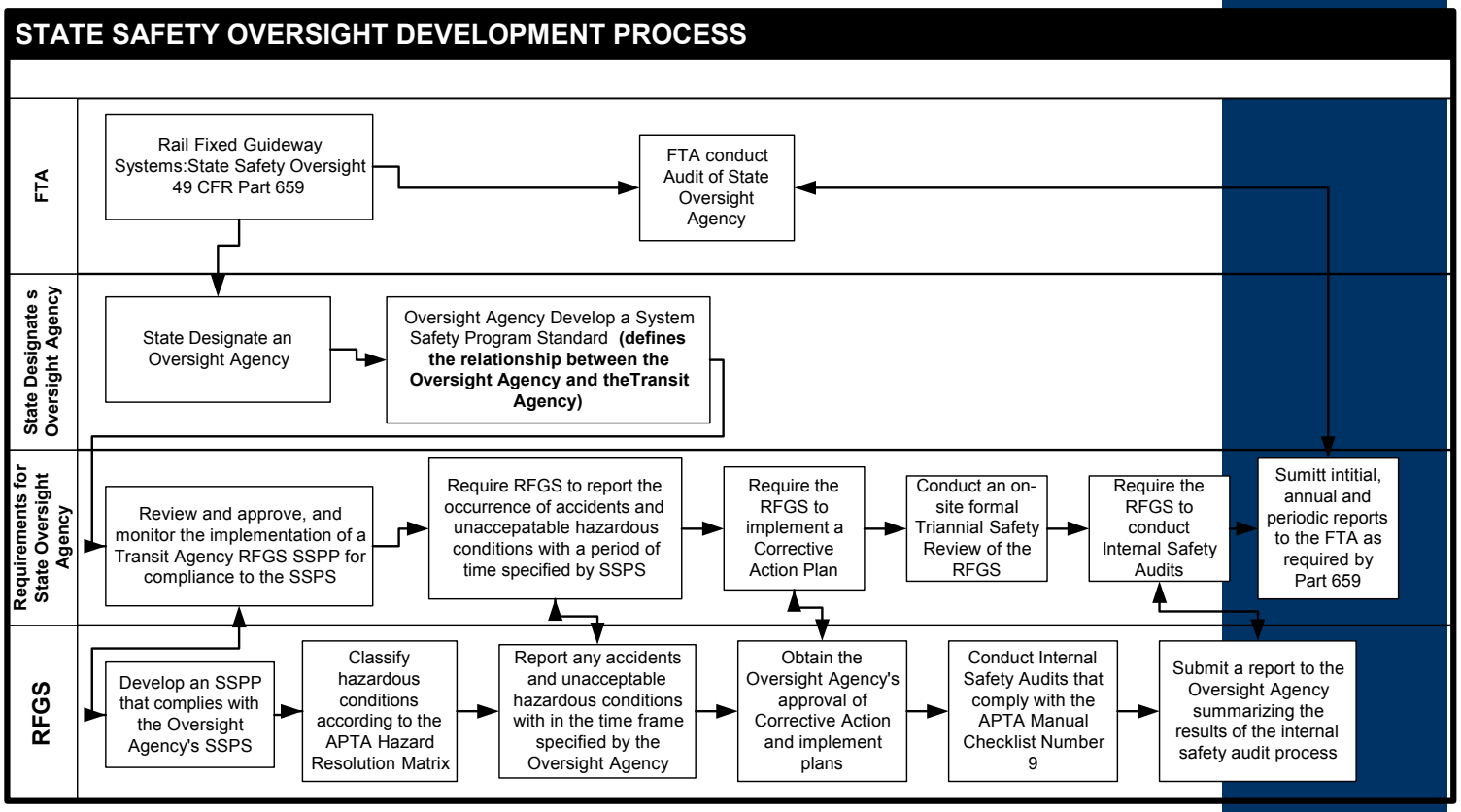


Figure 1: SSO Development Process

Rail transit remains one of the least expensive modes of transportation for public consumers.

Chapter 2: 1999 RFGS Performance

In 1999, FTA's State Safety Oversight Program affected 32 RFGS located in urban areas throughout the country. In total, these systems operated 12 heavy rail systems, 20 light rail systems, 1 cable car system, 4 automated guideways, and 3 inclined planes. Table 4 highlights key features of this service, including directional route miles, number of vehicles, and average fare.

[redacted]	[redacted]	[redacted]	[redacted]	Stations
HEAVY RAIL MARTA (Atlanta) MTA (Baltimore) MBTA (Boston) CTA (Chicago) GCRTA (Cleveland) LACMTA (Los Angeles) MDTA (Miami) NYCT (New York) PATCO (Philadelphia-NJ) SEPTA (Philadelphia) BART (San Francisco) WMATA (D.C., MD, VA)	1,490	10,000	$.96	973
LIGHT RAIL MTA (Baltimore) MBTA (Boston) NFTA (Buffalo) GCRTA (Cleveland) DART (Dallas) RTD (Denver) Island Transit (Galveston) LACMTA (Los Angeles) MATA (Memphis) RTA (New Orleans) NJ Transit (Newark) SEPTA (Philadelphia) PA Transit (Pittsburgh) Portland Tri-Met (Portland) RTD (Sacramento) Bi-State (St. Louis) SDTI (San Diego) Muni (San Francisco) Santa Clara VTA (San Jose) King Co. DOT (Seattle)	739.2	1,300	$.55	583
OTHER CARTA (Chattanooga) DTC (Detroit) JTA (Jacksonville) CCTA (Johnstown) MDTA (Miami) PA Transit (Pittsburgh) Muni (San Francisco) Monorail (Seattle)	26	170	$.62	50

Table 4: Mode Service Features

Ridership estimates for 1999, available from APTA, indicate that, combined, these 32 RFGS provided approximately 3 billion unlinked passenger trips, accounting for roughly 35 percent of all trips made on public transportation. Each weekday in 1999, approximately 4 million people used rail transit service for more than 8.1 million unlinked trips. In 1999, these rail transit agencies made possible a high level of personal mobility for the nation's 250 million urban and suburban residents and nearly 7 million urban business establishments.

	1999 Ridership (annual unlinked passenger trips)
Heavy Rail	2,685,998,000
Light Rail	286,671,000
Other	96,000,000
TOTAL	**3,068,669,000**

Table 5: 1999 Ridership – Annual Unlinked Passenger Trips

Table 6 presents RFGS operating data, including average weekday unlinked trips, based on 1998 NTD reports (the most recent year for which such data are available). Rail transit use is heavily concentrated in several large cities, including Washington D.C., Philadelphia, Boston, and San Francisco, with the largest single market for rail transit being the metropolitan New York City area. According to the NTD reports for 1998, the average length of a passenger trip is 5.1 miles for heavy rail service, 4.1 miles for light rail service, and approximately 1 mile for all other RFGS modes (automated guideway, cable car and inclined plane).

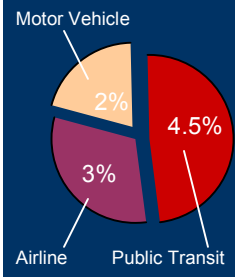
Over the last few years, heavy rail systems have made consistent gains in ridership, posting their highest levels in 15 years in 1999, up 11 percent from 1984. Table 7 shows these gains. New rail service at WMATA and BART, on-going capital improvements at NYCT and MBTA, and the opening of Tren Urbano in San Juan should support this trend well into the next decade.

Since 1984, passenger trips on all other rail fixed guideway modes (light rail, automated guideway, inclined plane and cable car) have more than doubled. In large part, this increase is due to the opening of new light rail service in Baltimore, Denver, St. Louis, Miami, Los Angeles, and Dallas. This trend is also expected to continue. Over the last six months, FTA has welcomed three new light rail systems:

- UTA TRAX opened in Salt Lake City in December 1999
- NJT Hudson-Bergen Light Rail opened in April 2000
- The Kenosha Transit Streetcar Project opened in June 2000.

These three New Starts may increase light rail ridership by at least 5 percent in 2000. Expansions of existing systems in Denver, New Jersey, San Diego, Salt Lake City, Portland, and New Orleans, and New Starts in Phoenix, Little Rock, Minneapolis/St. Paul and Norfolk, may cause this number to increase by as much as 50 million unlinked passenger trips within the next decade.

Last year, Americans took more than 3 billion trips on rail transit, the highest ridership in nearly four decades. Public transportation usage continues to outpace growth in other modes of transportation such as airlines and highways.



The current level of public transportation usage marks the fourth straight year of ridership increases and amounts to an increase of over 15 percent increase since 1995.

NYCT moves more passengers by rail transit each weekday than all other RFGS combined.

				Average Weekday Unlinked Trips
1. NYCT (HR)	$1,900,000,000	7,400,000,0000	322	5,000,000
2. WMATA (HR)	$370,000,000	1,100,000,000	1,486	730,000
3. MBTA (HR & LR)	$255,000,000	600,000,000	1,038	610,000
4. CTA (HR)	$310,000,000	900,000,000	356	515,000
5. SEPTA (HR & LR)	$170,000,000	420,000,000	2,174	375,000
6. BART (HR)	$290,000,000	990,000,000	103	280,000
7. MARTA (HR)	$97,000,000	500,000,000	804	250,000
8. Muni (LR & CC)	$100,000,000	125,000,000	49	160,000
9. LACMTA (HR & LR)	$85,000,000	200,000,000	4,070	115,000
10. Maryland MTA (HR & LR)	$57,000,000	115,000,000	1,795	70,000
11. San Diego Trolley (LR)	$26,000,000	155,000,000	570	67,000
12. MDTA (HR & AG)	$65,000,000	105,000,000	285	60,000
13. Cleveland RTA (HR)	$35,000,000	85,000,000	458	42,000
14. St. Louis Bi-State (LR)	$19,000,000	96,000,000	2,354	42,000
15. PATCO (HR)	$26,000,000	95,000,000	323	40,000
16. DART (LR)	$28,000,000	60,000,000	689	37,000
17. Portland Tri-Met (LR)	$22,000,000	65,000,000	592	36,000
18. PA Transit (LR & IP)	$28,000,000	36,000,000	775	30,000
19. Sacramento RTD (LR)	$15,000,000	40,000,000	295	27,000
20. NFTA (LR)	$14,000,000	16,000,000	1,575	25,000
21. Santa Clara VTA (LR)	$26,000,000	35,000,000	300	23,000
22. New Orleans RTA (LR)	$8,000,000	16,000,000	75	19,000
23. Denver RTD (LR)	$8,000,000	13,000,000	2,406	16,000
24. New Jersey Transit (LR)	$7,000,000	13,000,000	6,559	15,000
25. Seattle Monorail (AG)	$2,000,000	2,500,000	84	6,000
26. Detroit People Mover (AG)	$9,000,000	3,000,000	3	5,000
27. MATA (LR)	$2,000,000	960,000	348	4,000
28. CARTA (IP)	$660,000	430,000	128	1,000
29. JTA (AG)	$1,000,000	105,000	242	800
30. CCTA (IP)	$360,000	20,074	94	300
31. Island Transit (LR)	$200,000	90,000	12	150
32. King County (LR)	Not Available	Not Available	Not Available	Not Available
HR = Heavy Rail; LR = Light Rail; AG = Automated Guideway; IP = Inclined Plane; CC = Cable Car				

Table 6: Rail Transit Usage

Public expenditures to operate, maintain and invest in public transportation systems in the United States amount to $15.4 billion each year, according to the 1997 study *"Dollars and Sense: The Economic Case for Public Transportation in America."* The study reports that the estimated mobility and efficiency benefits of public transportation have a value between $62 billion and $78 billion annually, increasing the economic return on the public's dollars by nearly six times the total annual investment.

	Mode of Transit		
			Total
1984	2,231	165	2,396
1985	2,290	168	2,458
1986	2,333	155	2,488
1987	2,402	173	2,575
1988	2,308	186	2,494
1989	2,542	209	2,754
1990	2,346	225	2,571
1991	2,172	235	2,407
1992	2,207	235	2,442
1993	2,046	236	2,282
1994	2,169	334	2,503
1995	2,033	301	2,334
1996	2,157	312	2,469
1997	2,430	324	2,754
1998	2,393	342	2,735
1999[1]	2,686	352	3,038

[1] *NTD data (1984 to 1998); APTA ridership estimates (1999)*

Table 7: Unlinked Passenger Trips by Mode (in millions)

In 1998, the most recent year for which NTD information is available, the nation's heavy and light rail systems had the following operating and capital expenses:

	Operating Expenses		
			TOTAL (in millions)
1992	$3,555.1	$308.9	$3,864
1993	$3,668.6	$315.9	$3,984.5
1994	$3,786.2	$412.8	$4,199
1995	$3,522.9	$376.1	$3,899
1996	$3,401.9	$441.6	$3,843.5
1997	$3,473.7	$472.5	$3,946.2
1998	$3,529.6	$502.5	$4,032.1

Table 8: RFGS Operating Expenses 1992-1998

The Safety Management Information Statistics (SAMIS) 1998 Annual Report is a compilation and analysis of transit safety and crime statistics reported under the FTA's National Transit Database Reporting System by FTA-funded transit systems in the United States during 1998. This report was prepared under the sponsorship of FTA's Office of Safety and Security. The statistics for the tables, charts, and graphs were generated by the John A. Volpe National Transportation Systems Center (Volpe Center) in Cambridge, MA. http://transit-safety.volpe.dot.gov.

	Capital Expenses		
			TOTAL (in millions)
1992	$2,054.1	$494.9	$2,549
1993	$1,901.5	$488.3	$2,389.8
1994	$2,070.1	$544.1	$2,614.2
1995	$2,560.5	$688.4	$3,248.9
1996	$2,228.0	$849.9	$3,077.9
1997	$2,346.1	$876.5	$3,222.6
1998	$2,350.8	$840.6	$3,191.4

Table 9: RFGS Capital Expenses 1992-1998

When these expenses are combined, and divided by the total number of unlinked trips provided by heavy and light rail service in 1998, the resulting figure indicates that, on average, each unlinked trip can be valued at approximately $2.65. This amount is comparable to the cost of operating an automobile for 8.5 miles.

Chapter 3: 1999 RFGS Safety Performance

Background

This section of FTA's Annual Report presents data on the safety performance of the rail transit industry in 1999. Historically, the rail transit industry provides the safest means of transportation available in the United States. Table 10 below presents annual fatalities by mode of transportation between 1995 and 1998, as reported by the Bureau of Transportation Statistics in the *Transportation Statistics Annual Report 1999* and the Federal Railroad Administration *Annual Report for 1999*. For the four years between 1995 and 1998, the number of fatalities in rail transit has been a full order of magnitude less than other modes of transportation. Fatalities in rail transit are even lower when suicides are removed from the total count, as this category of fatalities comprises more half of the people killed in rail transit service each year.

				1998
Aviation (including air carriers, commuter air, on-demand air taxi, and general aviation)	963	1,089	753	667
Highway (including commercial and personal vehicles)	41,817	42,065	42,013	41,471
Rail (including freight and commuter railroads)	1,146	1,039	1,063	1,008
Rail Transit (including heavy and light rail, automated guideways, inclined planes, and cable cars)	94	80	80	79
Waterborne (shipping and recreational boating)	875	759	867	844

Table 10: Fatalities by Mode 1995-1998

Service provided by rail transit agencies is safer than any other mode of transportation regulated by U.S. DOT. FTA and State oversight of the rail transit industry supplements, but does not supercede, each rail transit agency's primary responsibility for this safe level of service or the accomplish ment in achieving it.

In spite of the rail transit's excellent record, safety issues do exist which must be addressed. Primarily, expanding light rail service does increase exposure to greater vulnerability for rail grade crossing accidents and collisions.

FTA is committed to supporting the efforts of rail transit systems to reduce further the number of accidents, injuries and incidents. The highest priority of the U.S. Department of Transportation is to "promote the public health and safety by working toward the **elimination** of transportation-related deaths, injuries, and property damage." Although great progress has been made over the last few decades, new safety problems, particularly involving rail grade crossings in light rail systems and the deterioration of signal systems supporting automatic train control in heavy rail operations, threaten to reverse this progress.

The analysis of safety data is an important first step in developing technology, procedures, and public education campaigns aimed at successfully improving the level of safety and security in the rail transit environment. In addition, the growing number of New Start systems and expansions to existing systems provides the opportunity to design, construct and operate the safest rail transit facilities and equipment ever placed into revenue service. Understanding current safety problems is essential to supporting this endeavor.

Summary of Findings

Key findings from data submitted by SOAs for 1999 are presented below:

Fatalities - Of the 112 State-reported fatalities in 1999, 73 were the result of suicides—a consistent trend when compared with 1998 NTD results.

Collisions - States reported 100 collisions in 1999, resulting in 21 fatalities and 138 injuries requiring medical attention away from the scene.

Derailments - States reported 6 total derailments in 1999 resulting in no fatalities and 1 injury requiring medical treatment away from the scene.

Rail Grade Crossings - Sixty-five Light Rail accidents at rail grade crossings resulted in 18 fatalities.

Fires - States reported 5 total fires meeting FTA's definition of accident. These fires were all on heavy rail systems and resulted in no fatalities and 61 injuries.

Other reportable incidents - In 1999, States reported a total of 2,449 of these incidents resulting in 2,542 injuries.

Probable Cause - Human factors represented roughly fifty percent of the probable causes for incidents that did not include single person events.

A detailed discussion and representation of these findings follows.

RFGS Safety Data Sources

FTA's Office of Safety and Security collects information on RFGS performance from two sources:

- State Safety Oversight Agency Annual Reports
- National Transit Database (Form 405)

Annual Reports. SOAs are responsible for identifying and reporting to FTA all events meeting the Rule's definition of accident. As specified in Part 659.5, this definition includes:

> "Any event involving the revenue service operation of a rail fixed guideway system if as a result:

(1) An individual dies;

(2) An individual suffers bodily injury and immediately receives medical treatment away from the scene of the accident; or

(3) A collision, derailment, or fire causes property damage in excess of $100,000."

SOAs collect and track information on the type and number of events meeting FTA's definition, the number of fatalities and injuries resulting from these events, and their probable causes. In 1999, SOAs reported this information for the 32 affected RFGS using FTA's *Annual Report Template*. Reports for 1999 were submitted to FTA's Office of Safety and Security by March 15, 2000. RFGS safety data for 1999 were reported in five categories:

- Collisions
- Derailments
- Rail Grade Crossing Accidents
- Fires
- Other Reportable Events (including suicides and single-person injuries requiring treatment away from the scene)

National Transit Database. Over the last decade, rail transit systems reported first safety--then later security--data directly to FTA. *All rail transit agencies receiving direct federal financial assistance under FTA's formula grant program must report this data annually to retain eligibility for federal funds*. This information is collected on Form 405 of the National Transit Database Reporting System. Safety incidents that meet the following definition must be reported:

- Involve property damage exceeding $1,000
- Require medical treatment of a passenger or an employee, either on-site or in a hospital
- Result in a fatality within 30 days

Security incidents are reported according definitions developed by the Federal Bureau of Investigation (FBI) for the Uniform Crime Reporting System.

FTA's Office of Safety and Security analyzes this data in the Safety Management Information Statistics (SAMIS) report, published annually. SAMIS identifies numeric trends in the occurrences of these events and tracks annual industry performance. 1998 is the most recent year for which this analysis has been performed.

In 1998, the 32 affected RFGS reported the following safety occurrences meeting NTD's definition:

- Total Incidents: 14,277
- Total Fatalities: 77
- Total Injuries: 12,135
- Total Collisions: 570
- Total Derailments: 51
- Total Rail Grade Crossing Incidents: 69
- Total Fires: 2,896

A detailed discussion of security occurrences reported to NTD for 1998 is located in Chapter 6 of this report.

While, definitions used in NTD and FTA's State Safety Oversight Program differ (NTD definitions are triggered by much lower thresholds than 49 CFR Part 659 definitions), wherever possible in this report, trend data is used from NTD to provide a context for 1999 data reported by the States.

It is critical that transit agencies develop and implement procedures to collect and report incidents that meet various agency reporting thresholds. FTA relies on the accuracy of the reported data to direct safety efforts and future funding.

Sixty five percent of all fatalities reported by rail transit agencies in 1999 were the results of suicides. The vast majority of these suicides occurred on heavy rail systems.

Total Number of Occurrences

In 1999, as indicated in Table 11 below, States reported that the 32 affected RFGS experienced 100 collisions, 6 derailments, 67 rail grade crossing accidents, 5 fires, and 2,449 other events meeting FTA's definition (including suicides and single-person injuries; such as slips, trips, and falls and medical emergencies; requiring medical treatment away from the scene). Combined, these events resulted in 112 fatalities and 2,839 injuries. Light rail experienced 63 percent of the injuries from collisions, grade crossing accidents, derailments, and fires.

			Injuries
Collision	100	21	138
Derailment	6	0	1
Rail Grade Crossing Accident	67	18	97
Fire	5	0	61
Other	2,449	73	2,542
TOTAL EVENTS	**2,627**	**112**	**2,839**

Table 11: 1999 Total FTA Reportable Occurrences

Suicides. In 1999, of the 112 total fatalities, 73 were the result of suicides. This number corresponds to NTD data from previous years:

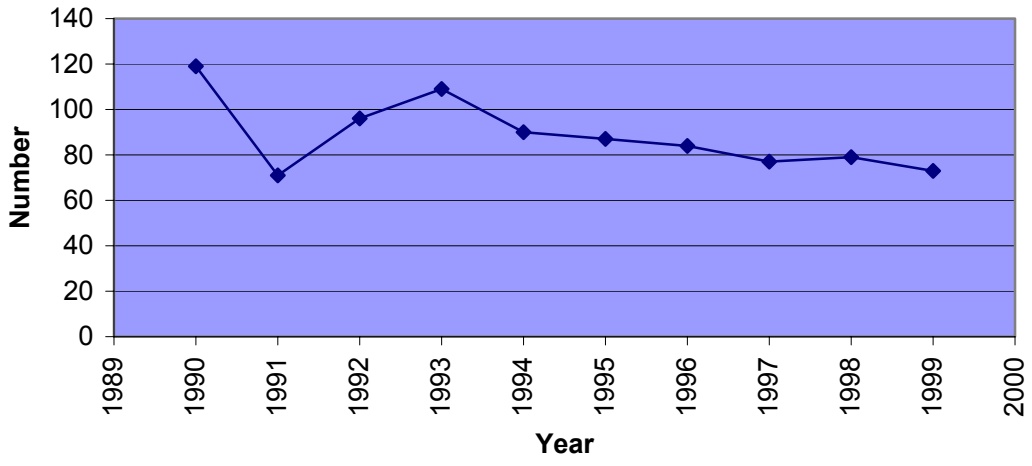


Chart 1: Reported Rail Suicides Since 1990

In 1999, States reported the following breakdown of suicide fatalities by mode:

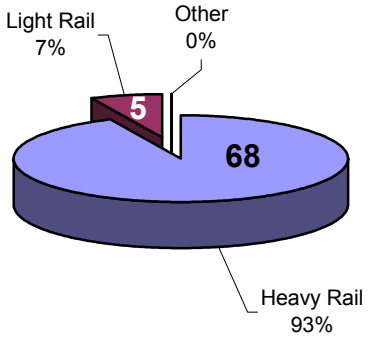


Figure 2: 1999 Reported Rail Suicide Fatalities

Collisions. States reported 100 collisions in 1999, resulting in 21 fatalities and 138 injuries requiring medical attention away from the scene.

			Injuries
Heavy Rail	29	8	29
Light Rail	66	10	89
Other	5	3	20

Table 12: 1999 Reported Rail Collisions

In 1999, heavy rail systems provided approximately 8 times more unlinked passenger trips than light rail systems and approximately 54 times more unlinked trips than other rail systems. Therefore, the greater number of collisions for light rail systems reported in 1999 is actually even more significant when compared against the level of service provided. In 1999, based on the number of unlinked passenger trips, a collision on light rail service was 18 times more likely than on heavy rail service.

NTD data, which uses a much lower threshold for the definition of "collision," reports the following trend since 1996:

Light rail agencies, because of their more challenging operating environments, experience more collisions than heavy rail operations, even though heavy rail service provides 8 times as many unlinked passenger trips. Data reported by the SOAs indicate that light rail agencies also experienced twice as many "serious" collisions as heavy rail operations in 1999.

Derailments are an unusual occurrence in rail transit service. SOAs reported a total of 6 for 1999; and NTD reports indicate that, while the number of derailments is rising, the industry total for all derailments meeting NTD thresholds remains under 55, annually.

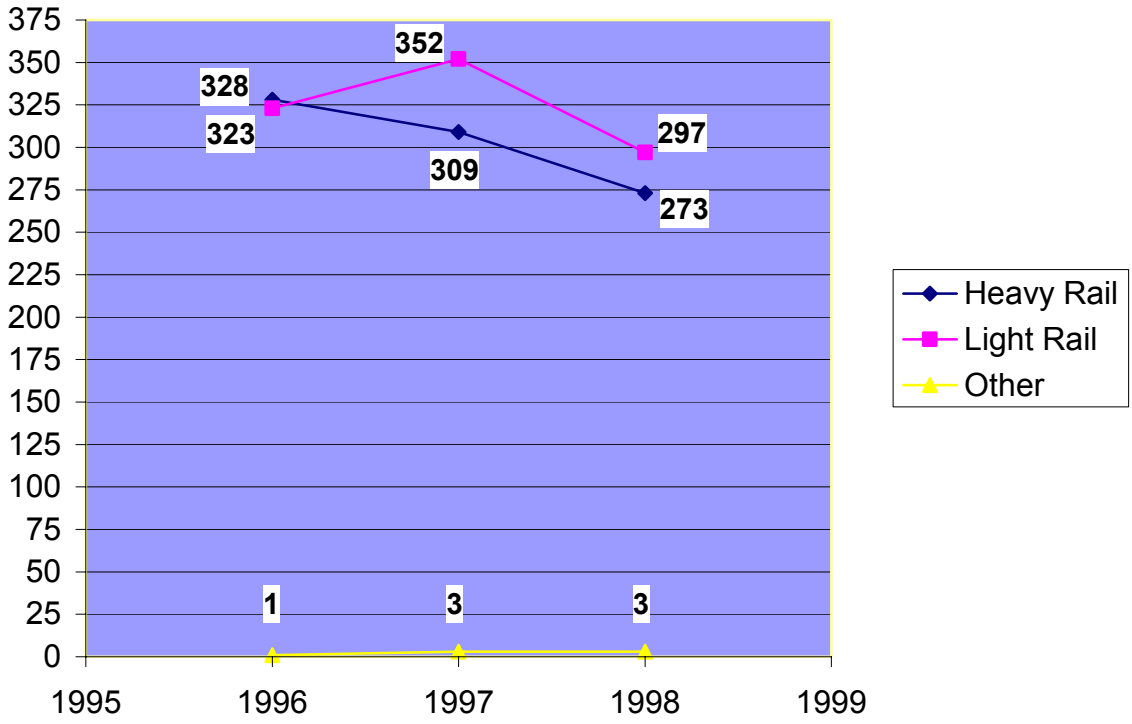


Chart 2: NTD Collisions by Mode Since 1996

When taken together, the State data and the NTD reports indicate that light rail operations are more likely to have collisions that result in fatalities and injuries than heavy rail operations.

Derailments. States reported 6 total derailments in 1999 resulting in no fatalities and 1 injury requiring medical treatment away from the scene.

			Injuries
Heavy Rail	1	0	0
Light Rail	5	0	1
Other	0	0	0

Table 13: 1999 Reported Derailments

Heavy rail systems operate 8 times as many rail vehicles as light rail systems over twice as many miles of track to provide 13 times as many annual vehicle miles of revenue service and 11 times as many annual passenger miles of service. Using these measures, data reported by States for 1999 indicate that light rail systems are more than 50 times as likely to have a derailment meeting FTA's definition as heavy rail systems.

NTD reports for derailments, which also use a lower definitional threshold than FTA's State Safety Oversight Program, indicate a similar trend:

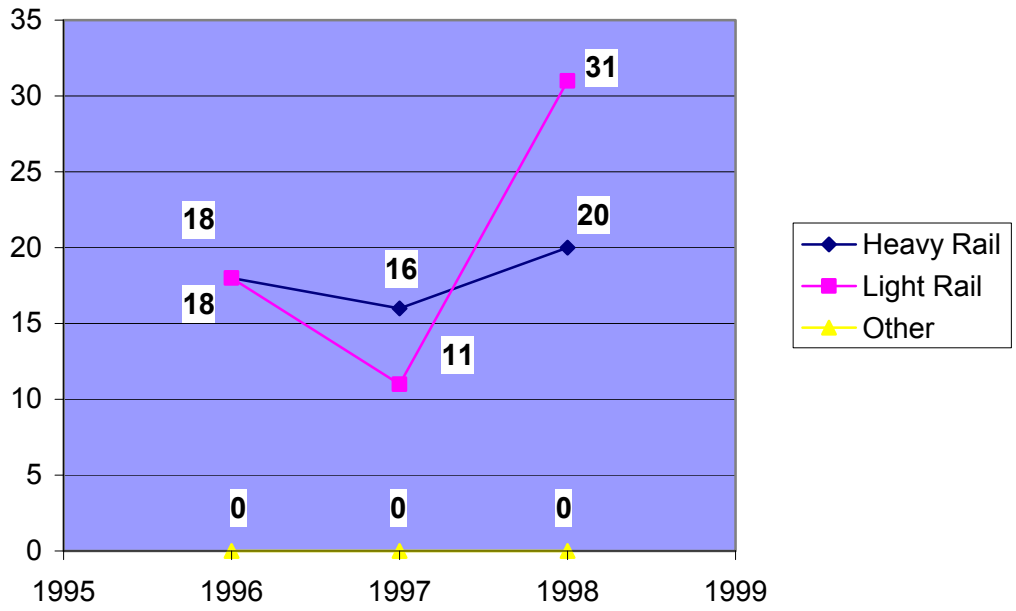


Chart 3: NTD Reported Derailments Since 1996

Rail Grade Crossing Accidents. Only 1 heavy rail system has rail grade crossings, as such, these accidents are primarily associated with light rail systems. In 1999, States reported that the 20 U.S. light rail operations experienced 65 rail grade crossing accidents meeting FTA's definition, resulting in 18 fatalities and 94 injuries requiring medical treatment away from the scene. Heavy rail operations experienced 2 rail grade crossing accidents, resulting in no fatalities and 3 injuries.

			Injuries
Heavy Rail	2	0	3
Light Rail	65	18	94
Other	0	0	0

Table 14: 1999 Reported Rail Grade Crossing Accidents

Rail grade crossing safety remains a priority for light rail operations and is of paramount concern to the planning and design of New Start systems. According to NTD data, available for rail grade crossing fatalities since 1995, the number of fatalities related to this type of accident is increasing:

Rail grade crossings are rising with the expansion of light rail service. FTA is working closely with other DOT agencies to develop recommen dations and guidelines to support improvements in grade crossing design, maintenance, and operation.

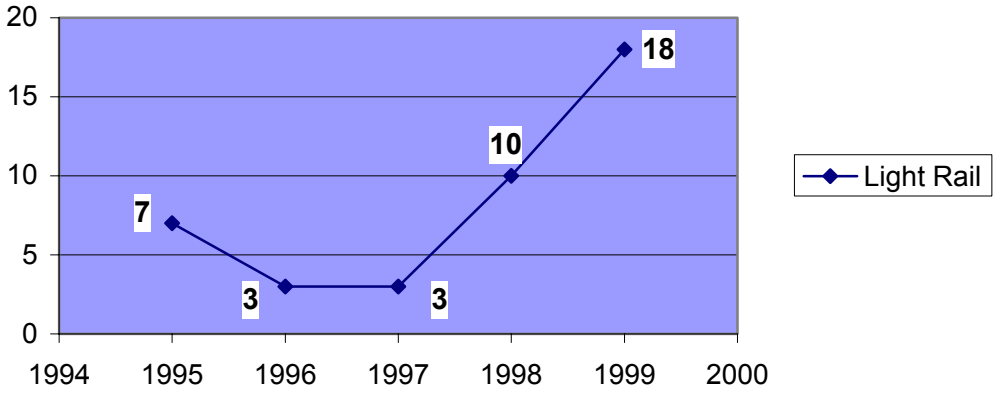


Chart 4: 1995-1999 Rail Grade Crossing Fatalities – Light Rail

Fires. In 1999, States reported 5 total fires meeting FTA's definition of accident. These fires were all on heavy rail systems and resulted in no fatalities and 61 injuries. The majority of these injuries were to transit employees.

			Injuries
Heavy Rail	5	0	61
Light Rail	0	0	0
Other	0	0	0

Table 15: 1999 Reported Fires

Slips, trips, and falls are a major safety concern for heavy rail operations and result in the majority of safety claims made against rail transit systems each year.

Other Reportable Events FTA's definition of accident requires States to report any incidents that require medical treatment away from the scene, including slips, trips and falls; car door injuries; and medical emergencies. In 1999, States reported a total of 2,449 of these incidents resulting in 2,542 injuries.

		Injuries
Heavy Rail	2,242	2,344
Light Rail	204	195
Other	3	3

Table 16: 1999 Other reportable Events

Even with its higher level of service, according to data reported by the States, heavy rail systems are 1.6 times more likely to experience an incident resulting in a passenger injury meeting FTA's definition than light rail systems. 92 percent of single person injuries occurred on heavy rail.

Probable Causes for FTA-reportable Accidents

Probable cause for those accidents meeting FTA's definition involving collisions, derailments, rail grade crossing, and fires are comprised mainly of human factors causes and the actions of other motorists or passengers. This breakdown, as illustrated in Table 17, supports numerous studies that have been conducted in the rail transit environment. Slips, trips, and falls remain the primary cause for Other Reportable Events.

In 1999, the actions of other motorists and pedestrians were responsible for the majority of serious rail grade crossing accidents reported by rail transit agencies to the SOAs. Human factors issues were largely responsible for those collisions and derailments reported to the SOAs.

Probable Cause – Not including "Other Reportable Events"	
Category of Cause	**Percent of Total (%)**
Car Equipment Failure	5
Human Factors – Rule Violation	22
Human Factors – Procedure Violation	16
Human Factors – Drug and Alcohol Violation	2
Human Factors – Inattentiveness	10
Faulty Operating Procedures	1
Track Deficiency	2
Signal Deficiency	5
Cable Deficiency	1
Other Vehicle	23
Passenger	9
Pedestrian	2
Miscellaneous	2
TOTAL	**100**

Table 17: Probable Cause – Excluding "Other Reportable Events"

Rule and procedural violations accounted for roughly 75 percent of human factor probable causes.

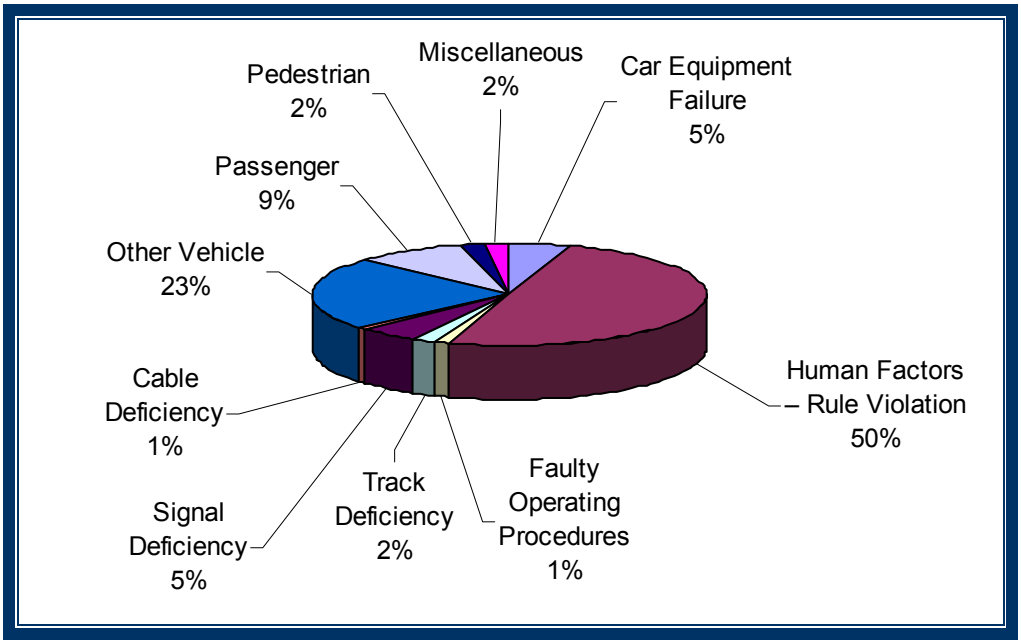


Figure 3: Probable Cause – Excluding "Other Reportable Events"

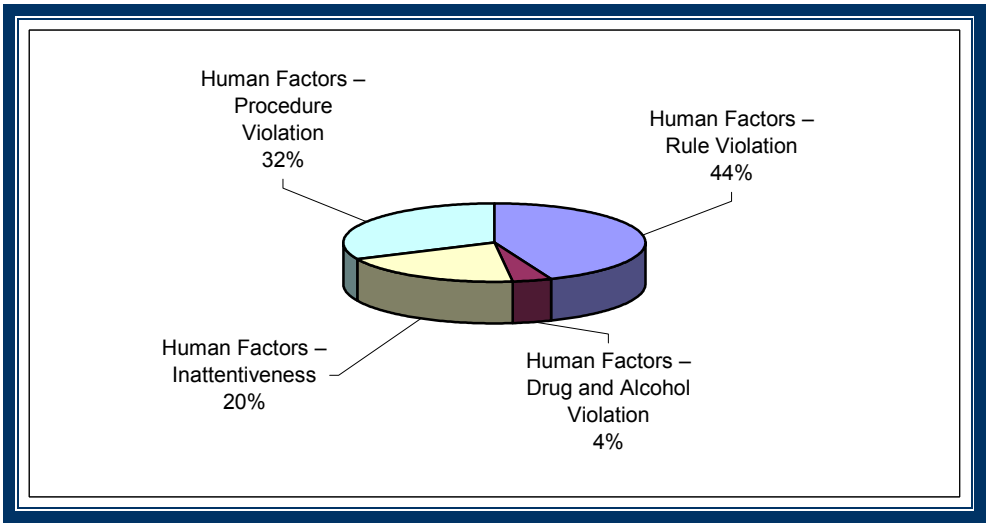


Figure 4: Probable Cause - Human Factors

It is clear from Figure 3, above, that when combined, human factors represent fifty percent of the probable causes for incidents that do not include single person events. Figure 4 indicates that when probable cause is determined as human factor, more than seventy-five percent of these probable cause determinations are due to rules and procedures violations.

Probable Cause – "Other Reportable Events"	
Category of Cause	**Percent of Total (%)**
Slip, Trip or Fall in Station	65
Injury Boarding/Deboarding Train	10
Medical Emergencies	8
Injury While Riding Train	5
Car Door Injury	5
Escalators/Stairwells	3
Assaults	2
Other	2
TOTAL	**100**

Table 18: Probable Cause – "Other Reportable Events"

Table 18 and Figure 5 illustrate that for those incidents that include single person events, the probable cause is predominantly due to slips, trips, and falls.

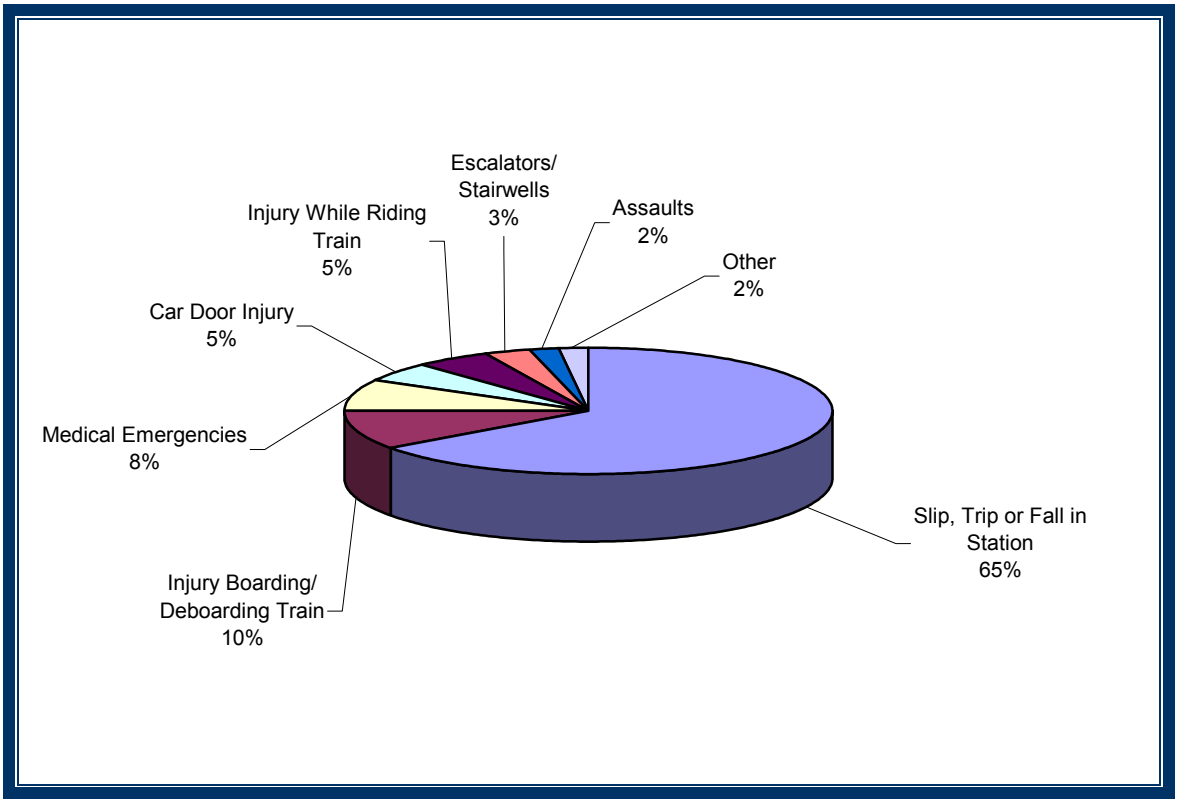


Figure 5: Probable Cause – Other Reportable Events

Passenger movement through stations to train platforms remains a major safety concern for the rail transit industry resulting in 65 percent of "Other Reportable Events" categorized by SOAs in 1999.

When all costs associated with accidents are fully considered, accident costs represent approximately 5 percent of the total transit agency operating budget $200,000,000 industry wide.

Cost of Occurrences to Rail Transit Industry

Supplementary information submitted by State Oversight Agencies, in their Annual Reports for 1999, indicates that these occurrences resulted in an estimated **$6 million in damage to rail transit property**. This amount does not include damage to other vehicles and property not owned by the rail transit agencies resulting from these occurrences. Nor does this amount reflect the actual costs of accidents to the rail transit agencies, including the following components:

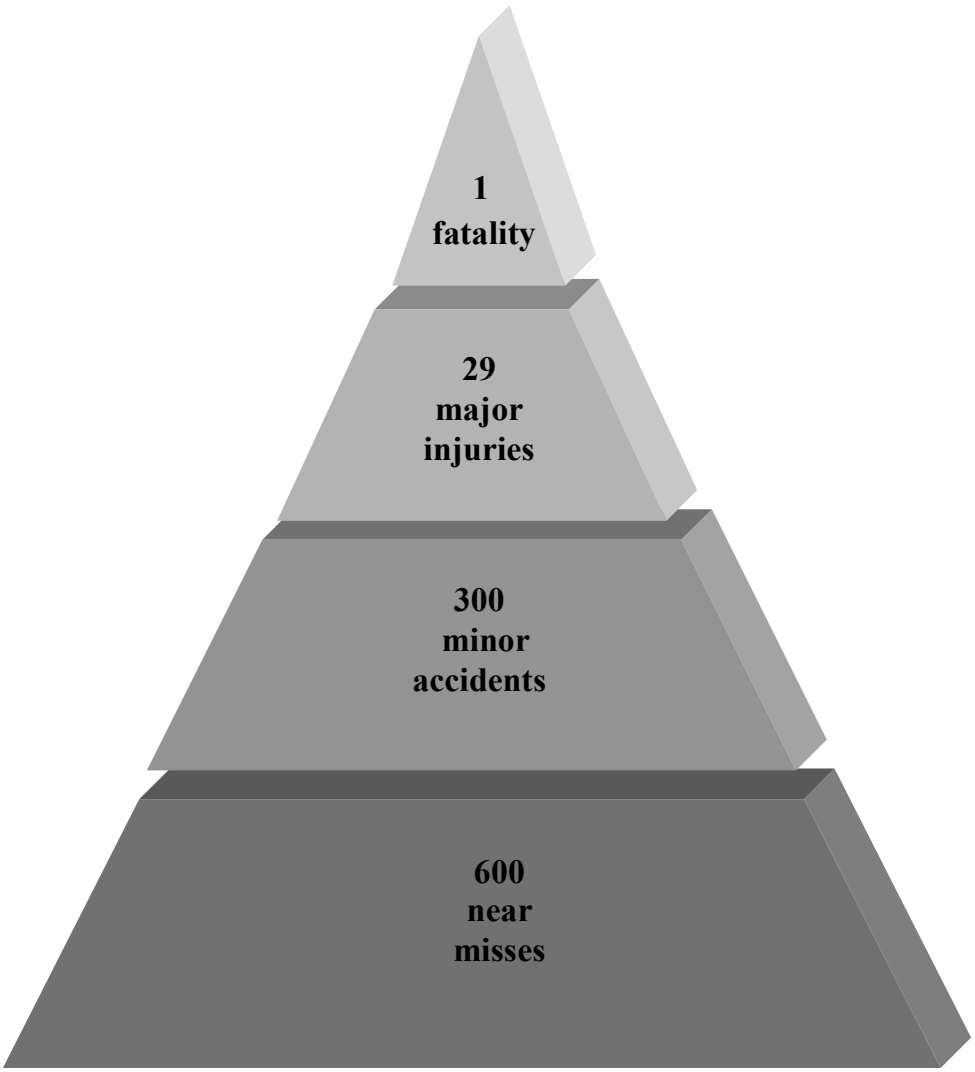
- Payments for settlement of injury or death claims, including awards to dependents and for plaintiff legal fees
- Payments for property damage claims not covered by insurance. Such claims might include:
  - Replacement costs for vehicles, property, or other damaged items
  - Loss of function and operations income
  - Recovery and salvage of damage equipment
  - Expenditures of emergency equipment and supplies
  - Costs of emergency assistance
  - Administrative costs
  - Plaintiff's legal fees
  - Lost time and wages
- Legal fees for defense against claims
- Punitive damages assessed
- Costs of accident investigation
- Corrective actions to prevent recurrences
- Slowdowns in service while accident causes are determined and corrective actions are taken
- Penalties for failure to take action to correct hazards
- Lost time of transit personnel
- Increased insurance costs
- Loss of public confidence and ridership
- Loss of prestige
- Degradation of morale

According to research conducted for the U.S. Department of Transportation by the Abacus Technology Corporation, ("Liability Cost and Risk Analysis Studies," 1996), when all costs associated with accidents are fully considered, most rail transit agencies pay approximately 5 percent of their total operating budgets to the costs of accidents or approximately $200,000,000, annually.

The Heinrich Ratio. To support efforts to quantify the relationship between accidents, such as those meeting FTA's 49 CFR Part 659 definition, and near misses in transit service, many transit agencies apply the Heinrich Ratio. This ratio states that for every serious accident there are tens of major injuries, hundreds of minor injuries, and 600 near misses. Each accident reflects only a minor percentage of the total costs associated with the occurrence.

Most transit safety experts agree that unsafe practices and conditions are responsible for the vast majority of accidents resulting in serious consequences. Although the exact proportions vary, depending on the findings of particular studies, most experts agree that the proportions identified in the Heinrich Ratio generally hold true. The Heinrich Ratio demonstrates that efforts to reduce unsafe practices and conditions will have a proportional impact on the number of serious accidents to occur.

The Heinrich Ratio is a useful tool for safety managers and others concerned with assessing the impacts of safety incidents on transit operations.



While transit is a very safe mode of transportation, safety issues do exist. Rail grade crossing incidents and collisions on light rail systems continue to result in fatalities. Derailments are rising in heavy and light rail operation, and passenger injuries resulting from slips, trips, and falls and car door malfunctions continue to challenge heavy rail operations.

Implications of RFGS Safety Findings

RFGS safety data reported by the States for 1999 indicates clear trends in accidents experienced by the industry. Predominantly, as light rail transit has become a more popular mode of service, it has experienced higher rates of collisions, derailments, and rail grade crossing accidents.

Light rail is an attractive public transportation alternative for many reasons: its relatively low capital cost, its ability to operate both on and off streets, and its capacity to transport passengers with frequent stops in heavily congested areas. However, unlike heavy rail systems, which operate largely within exclusive right-of-way, the majority of light rail transit systems operate portions of their systems within unrestricted right-of-way on city streets, in mixed traffic, within median strips, and in pedestrian malls. This situation results in numerous, and sometimes continuous, roadway-light rail grade crossings. In some cases, light rail systems share grade crossings with mainline railroads.

Rail grade crossings and intermingling with street traffic create an operating environment for light rail transportation wrought with the potential for catastrophic occurrences. With at least 7 new light rail systems planned in the next decade, and an equal number of extensions under design and construction for existing light rail service, this vulnerability will only increase. Addressing this environment, through technology solutions and procedures and training, must remain a priority to improve the safety performance of the industry, and to stall increasing trends in light rail fatalities and injuries.

Heavy rail systems continue to struggle with the safety issues involved in the movement of large numbers of people through stations to subterranean or elevated platforms. Passenger injuries on escalators, stairwells, corridors, as well as while boarding and alighting trains remain this mode of service's primary safety concern. In addition, major heavy rail systems, constructed in the 1970s, are now aging, and must deal with the safety impacts of deteriorating infrastructures on operations, thus increasing emphasis on the importance of maintenance inspections and procedures to safe operations.

The table below identifies those practices that have proven effective in the rail transit environment to address particular safety findings from the 1999 State data. Focus on these practices should support improvements in the long-term safety performance of both light and heavy rail service.

		Implications for Safety Improvements
		• Awareness training • Fencing • Platform edge detection
		• Increased operator supervision and observation • Dedicated refresher training programs • Dispatcher training and observation • Discipline and rule enforcement • Drug and alcohol awareness • Proficiency training
		• Rail yard work rules and procedures • Automatic speed controls • Vehicle maintenance and inspections • Proficiency training
		• Rail grade protection and design standards • Elimination of rail grade crossings • Coordination with State DOT/highway authorities • Public education • Operation Lifesaver
		• Station design standards and materials selection • Car door spring-back mechanisms • Lighting • Signage • Passenger awareness campaigns
		• Training and Discipline • Safety observations and testing • Safety management culture • Drug and alcohol awareness
	-	• SSPP and policy revisions • Operator bulletins • Discipline and rules enforcement • Safety management culture • Public education campaigns
	-	• Escalator design • Signs and markings • Housekeeping and maintenance • Station announcements • Data analysis

Table 19: Practices for Addressing Safety Concerns

Light rail transit (LRT) service provided in mixed-use traffic conditions, involving automobiles, motorcycles, bicycles, and pedestrians, adds a disparate element to the traffic stream that must be addressed through hazard analysis to determine system design, signage, and signaling to protect the driving, walking, and riding public.

Special Issue: Rail Grade Crossing Safety

Data submitted by States, as well as reports made to the National Transit Database by the rail transit agencies, indicate that, since 1995, rail grade crossing accidents have been responsible for 80 fatalities and over 600 injuries meeting the NTD definition. This category of accident is by far the most significant safety problem in public transportation. Light rail transit (LRT) service provided in mixed use traffic conditions, involving automobiles, motorcycles, bicycles, and pedestrians, adds a disparate element to the traffic stream that must be addressed by system design, signage, and signaling to protect the driving, walking, and riding public.

Overall, LRT systems are many times safer than the motor-vehicle highway system with which they share right-of-way. Light rail vehicle (LRV) operators are rarely responsible for those accidents that do occur at rail grade crossings. Police reports and LRT incident reports indicate these accidents are caused primarily by motorist and pedestrian inattention, disobedience of traffic laws, and confusion about the meaning of LRT traffic control devices. These causes are also clearly reflected in the data submitted by the States in their Annual Reports to FTA.

Motorist/pedestrian inattention and violation of traffic rules must be addressed by public education campaigns, such as Operation Lifesaver, and law enforcement. In addition, appropriate action must be taken in system planning, design, and traffic engineering to minimize confusion and facilitate the correct decision-making process for motorists and pedestrians encountering rail grade crossings. DOT is currently considering the development of uniform traffic control system standards and application guidelines for LRT service through modification of the Federal Highway Administration's Manual on Urban Traffic Control Devices (MUTCD).

The MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. The MUTCD is published by FHWA under 23 CFR Part 655, Subpart F. In the Millennium Edition of MUTCD, FHWA proposes to add a series of standard signs for installation at highway-light rail transit crossings. FHWA believes that these signs will provide options and flexibility to local decision-makers concerned with safety and traffic control at specific light rail transit grade crossings. FHWA proposals can be accessed at the following web site:

http://mutcd.fhwa.dot.gov/kno-2000body.htm#part10

FRA is also investigating the application of Intelligent Transportation Systems (ITS) technology to rail grade crossings and to supporting design standards for grade crossings on shared use track.

The following table identifies the number of light and heavy rail grade crossings as reported by the rail transit agencies to FTA and a description of shared use and shared corridor operations with FRA and whether an FRA waiver has been obtained for light rail service.

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	FRA Waiver Obtained for Light Rail Operations
Light Rail Operations					
MTA (Baltimore)	42	37	Yes	No	Yes
MBTA (Boston)	67	0	No	No	No
NFTA (Buffalo)	0	0	No	No	No
GCRTA (Cleveland)	26	1	No	Yes	No
DART (Dallas)	57	39	No	Yes	No
RTD (Denver)	2	2	No	Yes	No
Island Transit (Galveston)	151	0	No	No	No
NJ Transit (Hudson-Bergen)	12	2	No	No	No
LACMTA (Los Angeles)	100	28	No	Yes	No
MATA (Memphis)	12	12	No	Yes	No
RTA (New Orleans)	98	22	No	Yes	No
NJ Transit (Newark)	1	1	No	No	No
SEPTA (Philadelphia)	45	5	No	No	No
PA Transit (Pittsburgh)	36	36	No	No	No
Portland Tri-Met (Portland)	100	29	No	Yes	No
RTD (Sacramento)	101	37	No	Yes	No
UTA (Salt Lake City)	33	33	Yes	No	Yes
Bi-State (St. Louis)	12+8	12	No	No	No
SDTI (San Diego)	86	86	Yes	Yes	Yes
Muni (San Francisco)	0	0	No	Yes	No
Santa Clara VTA (San Jose)	26	26	No	Yes	No
King Co. DOT (Seattle)	17	4	No	Yes	No
Heavy Rail Operations					
CTA (Chicago)	25	25	No	No	No

Table 20: RFGS Rail Grade Crossings

Rail Grade Crossing Accidents. Current RFGS data collected by States for rail grade crossing accidents does not permit the classification of accidents by rail grade crossing characteristics. FTA is currently developing a classification system that will permit such future analysis. However, classification analysis has been performed through research conducted by Korve Engineering for the Transportation Research Board (TRB). Their study supports improved understanding of the underlying causes of accidents and conflicts between LRVs and motor vehicles through the analysis of the experiences of 10 selected light rail agencies. This report, *Integration of Light Rail Transit into City Streets* (Hans Korve, Jose Farran and Douglas Mansel; Washington, D.C.: Transportation Cooperative Research

The report, *Integration of Light Rail Transit into City Streets* by Hans Korve, Jose Farran, and Douglas Mansel, sponsored jointly by FTA and the Transportation Research Board through the Transportation Cooperative Research Program, provides the most comprehen-sive study of rail grade crossing safety in light rail transit performed to date.

Light rail vehicle accidents in shared rights of way account for the largest proportion of accidents for each of the 10 systems surveyed for the TRB study, even though this type of alignment generally constitutes the smallest proportion of route miles at each surveyed agency.

Program, 1996), classifies LRT alignments and examines aggregate accident statistics at high-accident locations. This report makes following observations based on an evaluation of rail grade crossing accidents meeting NTD definitions:

- The average for LRV accidents per year per mainline track mile in shared rights-of-way generally indicates that, as the proportion of route miles in shared rights-of-way increases, so does the proportion of LRV collisions per million revenue vehicle miles

- The most common type of collision in most cities involved vehicles turning in front of LRVs. These collisions accounted for 86 percent of all accidents in Baltimore, 64 percent in San Jose, 59 percent in Sacramento, 56 percent in Los Angeles, and 41 percent in Portland.

- Pedestrian accidents accounted for up to 27 percent of the total accidents. Although the percentages for pedestrian accidents are less than those for auto-turn accidents, the pedestrian accidents are more severe.

- Right-angle collisions were significant in several systems, notably in San Francisco, Boston and Portland.

The table below, excerpted from the Korve study, indicates that LRV accidents in shared rights-of-way account for the largest proportion of each of the 10 surveyed system's accidents, even though this type of alignment generally constitutes the smallest proportion of route miles.

	of-Way Under 35 MPH[1]	
		Percent of Total Accidents
Baltimore	18	89
Boston	32	100
Buffalo	20	100
Calgary	7	71
Los Angeles	23	79
Portland	52	90
Sacramento	26	85
San Diego	11	75
San Francisco	70	100
San Jose	44	98

[1]Integration of Light Rail Transit into City Streets (Hans Korve, Jose Farran and Douglas Mansel; Washington, D.C.: Transportation Cooperative Research Program, 1996), pg. 3.

Table 21: LRT Shared Right-of-Way

Detailed review of accidents at the 10 systems determined that "the safety problems experienced by these systems reflect a combination of factors, including alignment decisions, geometric design features, and traffic control devices, which in the aggregate violate motorist and pedestrian expectancy, thereby contributing to "risky behavior" – that is, decision-making and subsequent actions that significantly increase the likelihood of an accident."[1] The study determined the most common safety-related problems, ranked in order of decreasing severity:

	Safety Problems – Ranked by Severity[2]
1	Pedestrians trespassing on side-aligned LRT rights-of-way where there are no sidewalks
2	Pedestrians jaywalking across LRT/transit mall rights-of-way after receiving unclear messages about crossing legality
3	Inadequate pedestrian queuing areas and safety zones
4	Two-way or contra-flow side-aligned LRT operations
5	Motorists making illegal left turns across the LRT right-of-way immediately after termination of their protected left-turn phase
6	Motorists violating traffic signals with long red time extensions resulting from LRV preemptions
7	Motorists violating red left-turn arrow indications when the leading left-turn signal phase is preempted by an approaching LRV
8	Motorists failing to stop on a cross street after the green traffic signal indication has been preempted by an LRV
9	Motorists violating active and passive NO LEFT/RIGHT TURN signs where turns were previously allowed, prior to LRT construction
10	Motorists confusing LRT signals, especially left-turn signals, with traffic signals
11	Motorists confusing LRT switch signals (colored ball aspects) with traffic signals
12	Motorists driving on LRT rights-of-way that are delineated by striping
13	Motorists violating traffic signals at cross streets, especially where LRVs operate at low speeds
14	Complex intersection geometry resulting in motorist and pedestrian judgment errors

[2]*Integration of Light Rail Transit into City Streets* (Hans Korve, Jose Farran and Douglas Mansel; Washington, D.C.: Transportation Cooperative Research Program, 1996), pp. 4-6.

Table 22: Safety Problems – Ranked by Severity

Pedestrian safety issues are the single most significant concern regarding the design and operation of light rail vehicle grade crossings. The failure of motorists to comply with traffic rules and rail grade crossing safety indications and devices is also a major concern.

Findings from the NTSB support this analysis. An NTSB safety study of accidents at active rail grade crossings determined that "many of the accidents at active crossings have involved highway vehicle drivers who did not comply with train-activated warning devices installed at the crossings. This failure to comply often includes driver actions resulting from a deliberate decision, such as driving around a lowered crossing gate are or ignoring flashing lights." (NTSB, "Safety at Passive Grade Crossings, 1998, pg. 2.) Changing the decision-making patterns of motorists and pedestrians at active rail grade crossings is a top priority in any program designed to reduce accidents.

To address this priority, the Korve study identifies 5 basic principles to guide LRV system planning and selection of traffic control devices:

Maintaining the existing expectations of pedestrians and motorists must be a primary consideration in the design of light rail service to ensure compliance with traffic and safety rules, indications, and devices.

1. Respect the existing urban environment
2. Comply with motorist, pedestrian and PRV operator expectancies
3. Strive to simplify decisions and minimize road-user confusion
4. Clearly transmit the level of risk associated with the surrounding environment
5. Provide recovery opportunities for errant pedestrians and motorists

Sound LRT alignment decisions during the planning stages and good design geometry are essential to the safe operation of an LRT system. As described in the Korve study, the five basic principles identified above translate into the following guidelines for roadway geometry and traffic control devices:

- Unless a specific urban design change is desired (e.g., converting a street to a pedestrian mall), attempt to maintain existing traffic and travel patterns

- If LRT operates within a street right-of-way, locate the LRT trackway in the median of a two-way street where possible. If LRT is designed to operate on a one-way street, LRVs should operate in the direction of parallel motor vehicle traffic, and all unsignalized midblock access points (such as driveways) should be closed (it follows that two-way LRT operations on one-way streets, especially contra flow, should be avoided wherever possible). Further, where LRT is side-aligned, conflicting LRV and motorist vehicle movements should be signalized to minimize motor vehicles stopping on the LRT alignment, as well as general motorist confusion

- If LRT operates within a street right-of-way, separate LRT operations from motor vehicles by a more substantial element (e.g., low-profile pavement bars, rumble strips, contrasting pavement texture, or mountable curs) than painting or striping

- Provide LRT signals that are clearly distinguishable from traffic signals in design and placement, and whose indications are meaningless to motorists and pedestrians without the provision of supplemental signs

- Coordinate traffic signal phasing and timing to preclude cross-street traffic from stopping on and blocking these tracks

- Use traffic signal turn arrows or active, internally illuminated signs to actively control motor vehicle turns in conflict with LRV operations

- Provide adequate storage areas (turn bays or pockets) for turning traffic wherever possible

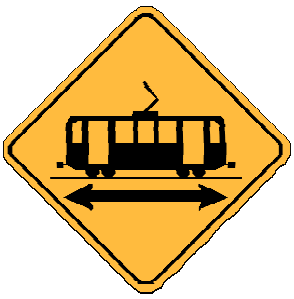
- Provide separate turn signal indications to avoid conflicts. The motor vehicle left-turn phase should follow, not precede, the LRV phase

- Use flashing, internally illuminated signs displaying the front view LRV symbol or the side view LRV symbol to warn motorists making conflicting turns of the hazards involved in violating traffic signals

- Create separate, distinct pedestrian crossings by providing refuge areas between roadways and parallel LRT tracks

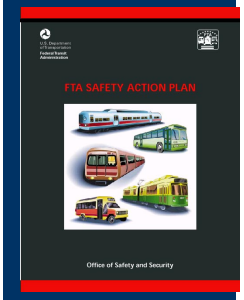
- Channel pedestrian flows to minimize errant or random crossings
- At unsignalized crossings, use pedestrian gates and/or barriers to make pedestrians more alert when they cross LRT tracks and direct pedestrians crossing the tracks to walk in the direction of the approaching LRV
- Maximize the visual impact (conspicuity) of LRVs
- For on-street operations, load or unload LRV passengers from or onto the sidewalk or a protected, raised median platform and not the roadway itself

The NTSB supports these basic parameters for the design of active grade crossings in LRT service, and, in its 1998 Safety Study entitled "Safety at Passive Grade Crossings," recommends that, wherever possible, passive grade crossings (those crossings with only traffic control devices, such as crossbucks, stops signs, or pavement markings) be eliminated, consolidated (through separation and closure), or equipped with active warning devices. In the event that these actions are infeasible, NTSB recommends that passive crossings be equipped with stop signs (at a minimum), and that standards for ITS warning systems be developed in a timely manner to ensure eventual application of an alert system for motorists and pedestrians.



Research is underway to develop Intelligent Transportation Systems (ITS) to support improved rail grade crossing safety at both active and passive grade crossing sites.

Chapter 4: FTA Activity



The past year was a busy one for FTA's Office of Safety and Security. Throughout the year, compliance monitoring activities required close coordination with Regional Offices, SOAs, and RFGS, strengthening essential interfaces. In 1999, FTA's Office of Safety and Security continued *Phase I* of the State Safety Oversight Audit Program. The Office also initiated programs to revise 49 CFR Part 659; to address requirements from NTSB for bus safety oversight; to coordinate with the Federal Railroad Administration (FRA) on shared use operations; to develop policy and programs to support the integration of New Start systems into the State Safety Oversight Program; and to promote integration of system safety concepts in transit operations through training and technical assistance. Further, FTA ensured the integration of safety and security into other management programs with the continued application of its triennial review process. Required by its grants management process, triennial reviews monitor grantee performance in twenty-two separate areas and are administered by FTA's Regional Offices. One subsection of the review is a verification of compliance with specific FTA safety and security requirements.

Prior to May of 2000, FTA developed and published its *FTA Safety Action Plan* brochure, which outlines recommendations in the areas of operational best practices, human factors, and design standards. An interdepartmental task force, designated in 1999 by the FTA Administrator, put forth the recommendations. In support of the recommendation to integrate system safety and security concepts into all phases of project development, the Office of Safety and Security developed a *Keeping Safety on Track* brochure and *Compliance Guidelines for States with New Start Projects*.

These publications signal FTA's commitment to the future of rail safety through all means available: regulation, policy, and information dissemination. FTA has increased its activities to support the creation of a new safety culture with the goal of examining and implementing ways in which current oversight practices can be coordinated to fully integrate system safety at every level of project management. The past year's activities are summarized below.

Compliance Monitoring

Throughout 1999, FTA worked with States to support their efforts to come into compliance with Part 659 program requirements. Table 23: Initial Submission Requirements, below, identifies all initial submissions that must be made to FTA by a State to be considered in compliance with the Rule. FTA requires subsequent submissions, including the SOA's Annual Certification and Annual Report, by March 15 of each year. By the end of the year, only one State had funds withheld for failure to comply with Rule requirements.

	49 CFR Part 659 Reference
Oversight Agency Name and Address	§659.45(a)(1)
RFGS Name and Address	§659.45(a)(2)
Certification of Compliance	§659.49
System Safety Program Standard	§659.45(a)(3)(i) and §659.31(a)(1)
System Safety Program Standard (Security Component)	§659.45(a)(3)(i) and §659.31(a)(2)
Oversight Agency Procedures	§659.45(a)(3)
Description of Program	§659.45(a)(3)
Process for Reviewing and Approving RFGS SSPP	§659.45(a)(3)(ii) and §659.33
Process for Investigating Accidents and Unacceptable Hazardous Conditions	§659.45(a)(3)(iii) and §659.39 and §659.41
Process for Ensuring the Correction, Elimination, Minimization, or Control of Investigated Hazardous Conditions	§659.45(a)(3)(iv) and §659.43
Completed SSPP Review Checklist	§659.33
Completed Security Plan Review Checklist	§659.33

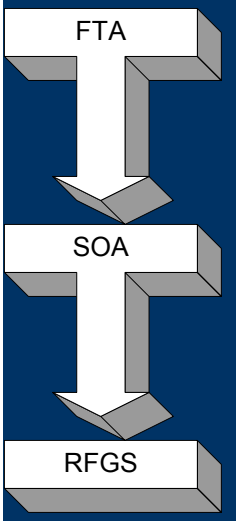
Table 23: Initial Submission Requirements

In addition to tracking State compliance, FTA's Office of Safety and Security and Regional Offices actively worked with SOAs to support the resolution of RFGS compliance issues involving the conduct of the internal safety audit process, the implementation of corrective actions, the reporting of accidents and unacceptable hazardous conditions, and three-year safety review findings. FTA's Office of Safety and Security also prepared status reports on Program performance for Congress, NTSB, and the DOT, Office of the Inspector General.

Audit Program

The State Safety Oversight Audit Program remained a priority for FTA's Office of Safety and Security throughout the year. The Audit Program provides FTA with the opportunity to identify the requirements of Part 659 that have been most difficult for SOAs to implement. Further, it supports communication with the States that results in the greater sharing of technical information, the solicitation of best practices, and the development of activities that promote an increased coordination between all stakeholders responsible for ensuring that system safety objectives are being identified and met each year. The following sections provide a brief overview of the audit program, discuss audit findings, and highlight the "Lessons Learned" from the Audit Program in 1999, as well as FTA's efforts to assist States in successful program implementation.

The strategic goal for FTA's Office of Safety and Security is to "promote public health and safety by working toward the elimination of transportation related deaths, injuries and property damage and the improvement of personal security and property protection." The Office has a staff of eight employees to administer all transit safety programs. FTA has an annual budget of approximately $900,000 for the State Safety Oversight Program.



FTA has audited 13 Oversight Agencies since the program began in fall 1998:

- Ohio Department of Transportation
- Florida Department of Transportation
- Tennessee Department of Transportation
- California Public Utilities Commission
- Texas Department of Transportation
- New York Public Transportation Safety Board
- Pennsylvania Department of Transportation
- Maryland Department of Transportation
- Louisiana Department of Development and Transportation
- Tri-State Oversight Committee
- Massachusetts Department of Telecommunications and Energy
- New Jersey Department of Transportation
- Illinois Regional Transportation Authority

These agencies represent the industry's full range of safety oversight experience, oversight authority, resource allocation, and geographical diversity.

FTA's Audit Program supports current monitoring efforts by providing detailed, on-site evaluations of State practices to implement Part 659. These audits identify deficiencies in implementation, and require State Safety Oversight Agencies to initiate immediate responses. The Audit Program tracks and evaluates Oversight Agency responses, and will result in the initiation of withholding activities against any States that fail to bring their programs into compliance.

Throughout 1999, States worked closely with FTA to resolve identified deficiencies and areas of concern. **To date, all deficiencies have effectively been addressed**. No funds have been withheld from a State for failure to comply with audit findings.

FTA's Office of Safety and Security intends to audit each affected State at least once every three years. The Program will be revised at the initiation of each triennial audit cycle to reflect changes to FTA's Rule, safety policies, and authority. FTA expects that the first full audit cycle will be complete by the end of calendar year 2001.

Audit Findings

FTA's Audit Program issues two types of findings. A **deficiency** is an area in which the Oversight Agency fails to comply with a requirement in the FTA regulation or does not follow one of the procedures set forth in its own System Safety Program Standard. In keeping with FTA's 659.7 authority, if the Oversight Agency does not correct the deficiency within 60 days, FTA may initiate the fund withholding process. To date, all states have complied with FTA's findings of deficiency.

FTA issues a finding of an **area of concern** when it detects a weakness in the oversight program that, while not a deficiency, should be addressed by the oversight agency to improve the program's effectiveness. FTA encourages Oversight Agencies to address area of concern findings within 60 days to avoid an "open concern" classification that is tracked by FTA.

Among the thirteen completed audits, there were 75 deficiencies and 76 areas of concern. Table 24 demonstrates the number of findings by audit category, as a percentage of the total number of findings.

			AREAS OF CONCERN	
				% of Total
Designation of Oversight Agency	1	1	0	0
Program Management	4	5	11	16
Program Standard and SSPP/Security Plan Review and Approval	**18**	**24**	**22**	**29**
Accident and UHC Investigation and Corrective Action Plans	**35**	**47**	**39**	**52**
Three-year Safety Reviews	5	7	2	3
RFGS Internal Safety Audit Process	8	11	1	1
Reporting	4	5	1	1
TOTAL	**75**	**100**	**76**	**100**

Table 24: Audit Findings

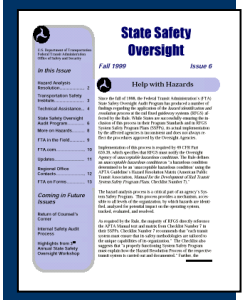
It is clear from the above table that the majority of audit findings occur in State implementation of requirements for SSPP and Security Plan review and approval and accident investigation. While findings for the RFGS Internal Safety Audit Process Category do not represent a large portion of the overall findings, the Internal Safety Audit Process finding of deficiency consistently indicates that the RFGS is not performing these audits or is performing them inadequately. Therefore, though it is difficult to make an immediate distinction of its importance in the table, this category of finding certainly demands attention due to its level of criticality within the implementation of a system safety program plan and safety program.

Accident Investigation

The audit category "Accident/Unacceptable Hazardous Condition Investigation and Corrective Action Plans" accounts for approximately half of all audit findings. Key findings in this area include the *failure* of oversight agencies to implement and follow procedures for:

- The notification and reporting of accident and unacceptable hazardous conditions
- The submission of status reports
- Procedures for Oversight Agency participation and evaluation of investigations
- The preparation, review, and approval of final accident reports
- The development of clear standards to guide the performance of hazard assessment to identify and document unacceptable hazardous conditions.

Part 659.47 allows for the Oversight Agency to use contractors to establish investigation procedures, conduct investigations, and review corrective action plans. Further, Oversight Agencies may designate the rail transit system to perform accident investigations on their behalf. Since these activities define the way in which the Oversight Agency fulfills its Part 659.41 requirements, as well as track and enforce the implementation of


State Safety Oversight

Fall 1999 Issue 6

Help with Hazards

FTA's *State Safety Oversight Newsletter* Issue #6 provides a detailed discussion of the recommended process for corrective action plans and includes sample forms and State practices.

corrective actions to mitigate hazardous conditions, FTA places a high priority on the approval of procedures to guide these activities by the Oversight Agency. Sample procedures and forms to guide State accident investigation activity are located in Appendix B.

Corrective Actions

Key findings in this area include the failure of States to require, review, and approve corrective action plans from transit agencies for all conditions identified as a result of the following:

- Investigations
- Internal Safety Audit Process
- Three-year Safety Review
- Hazard Analysis
- Request of Oversight Agency

Further, audits revealed that often, corrective actions are not formally documented, tracked, or verified for implementation. In many cases informal practices are developed to address this requirement, but documentation, tracking and verification of corrective action plan implementation must be improved to ensure that all hazards are being mitigated. Sample procedures are located in Appendix C.

Response to Findings

In response to these findings, States have developed new procedures, forms, and practices to manage accident notification, reporting, investigation, and the review and approval of Final Reports. Further, States have developed both manual and automated systems to track corrective actions and have worked with the transit agencies to prepare monthly and quarterly summary reports highlighting the status of all open corrective actions.

In 1999, in response to audit findings, FTA issued its first State Safety Oversight Technical Advisory on accident investigation and corrective action plans. In the spring of 2000, FTA published its *Hazard Analysis Guidelines for Transit Projects* to assist the RFGS in the preparation of hazard analyses to effectively provide the highest practical level of safety and security for its passengers and employees.

To address the ongoing difficulty of implementing a successful hazard identification and resolution process, States can reference FTA's *State Safety Oversight Newsletter, Issue 6* as it provides more assistance and clarity on this topic. Sample hazard analysis forms and procedures are contained in FTA's *Hazard Analysis Guidelines for Transit Projects* and included in Appendix D.

SSPP Review and Approval

FTA's SSO Audit evaluates the States implementation of its System Safety Program Standard, as well as its policies for requiring, reviewing, and approving the RFGS SSPP. States must formally document their review and approval of transit agency SSPPs using written checklists and standardized criteria. States also must develop procedures for managing SSPP updates and revisions.

FTA requires that the SOA Program Standard must document the procedure to be used by RFGS to submit SSPP modifications, new procedures or appendices (particularly those relevant to SOA's implementation of Part 659.41 authority for accident and unacceptable hazardous condition investigation), revised organizational charts, or other items prepared in response to an SOA request outside the annual review. For example, revisions to hazard analysis

policies and/or accident investigation procedures should be submitted to the SOA for incorporation into the SSPP as soon as they are available. Inclusion of this critical information in the SSPP and SOA records should not wait until the next SSPP revision process. The Audit Program has consistently made findings regarding the lack of formal procedures to require, review, and approve updates to the RFGS SSPP.

In addition to the update procedures, the preamble to the Rule states that the Program Standard **must** define the relationship between the Oversight Agency and the RFGS *and* guide the development of the SSPP by defining its required contents, as well as identify the controls necessary to measure the efficacy of the SSPP.

The Program Standard **must** describe all required interactions between the Oversight Agency and the rail transit system and reflect current procedures and practices used to guide this interaction. Below is a list of the points of interaction consistently found to be deficient or not well documented in the Program Standard:

- Delivery of Program Standard
- Submittal of SSPP
- Review and Approval of SSPP and issue of formal approval
- Submittal of SSPP updates to SOA
- Review and Approval SSPP Updates and issue of formal approval
- Accident notification procedures and timeframes
- Authority and Role of SOA in Accident Investigation
- Unacceptable Hazardous Condition notification procedures and timeframes
- Authority and Role of SOA in Unacceptable Hazardous Condition Investigation
- Submission of Accident Investigation reports to SOA
- SOA review and approval of RFGS Accident Investigation reports
- Submission of Unacceptable Hazardous Condition reports to SOA
- SOA review and approval of RFGS Unacceptable Hazardous Condition Investigations reports
- Submission of Corrective Action Plans to SOA (for accidents, unacceptable hazardous conditions, internal safety audits and Three-year Safety Reviews)
- SOA review and approval of RFGS Corrective Action Plans
- RFGS submission of Annual Report documenting the Internal Safety Audit Process to SOA
- SOA review of RFGS Internal Safety Audit Process and report
- RFGS role in SOA Three-year Safety Review
- RFGS response to Three-year Safety Review report

Response to Findings

Throughout the year, FTA's Audit Team provided technical assistance to those States resolving findings. "Best practices," including forms, reports, procedures, and on-site activities, were distributed to States and shared with the SOAs. At the end of the audit week, SOAs are given sample materials and flow charts that help to identify and describe the points of interaction necessary for effective program implementation. A sample SSPP review checklist is included in Appendix E.

Internal Safety Audit

States must require that this process be performed, and that it be carried out to the standard specified in the APTA Manual, Checklist Number 9. In 1999,

APTA's *Manual For the Development of Rail Transit System Safety Program Plans* provides the standard for SSPP development and is incorporated into FTA's Rule. This Manual provides an industry created format for developing a System Safety Program Plan (SSPP) and provides recommendations for how to conduct formal evaluations on how well the SSPP has been implemented by the agency.

The ISAP is required in Pat 659.35:

Must follow guidelines specified in the APTA Manual, Checklist Number 9

ISAP results must be reported annually to the State

Security must be incor porated into the ISAP process

several audited States were in the process of working with their transit agencies to develop this process, including its schedule, process and checklists, and report format. State Oversight Agencies are encouraged to participate in these internal audits and, where possible, to coordinate this activity with their own three-year safety reviews. States also must require the timely submission of annual reports documenting transit agency activities to carry out this process.

Overall, the number of FTA findings for this audit category were relatively few, but large in magnitude. Of the 11 deficiency findings in this category, it was found that 5 RFGS were not performing internal safety audits during the year and another 3 were performing these audits in a manner that did not meet Rule requirements. Further, it became evident during the FTA audits that only 6 RFGS were auditing all 14 elements identified in APTA's Checklist Number 9, and as required by Part 659.35, each year.

Response to Findings

FTA's Rule specifies that states must require the ISAP. While Part 659 currently only provides for the review of RFGS annual reports that document internal safety audit activities, a handful of States have developed procedures requiring that the report is reviewed and *approved* by the Oversight Agency. This, along with SOA adoption of internal safety audit findings and subsequent corrective actions into its own tracking system, ensures that SOA's would be involved in the process of tracking the implementation of corrective actions. Appendix E contains examples of procedures that SOAs have developed to direct oversight of the internal safety audit process; included are sample checklists used for the conduct of the internal safety audit, as well as a checklist for the review and approval of RFGS annual reports.

Rule Revision

On April 16, 1999, the FTA Administrator convened an interdepartmental task force of transportation professionals and safety experts to examine the Federal role in transit safety. Additionally, the industry, APTA, Community Transportation Association of America (CTAA), and unions provided technical information on industry practices to the task force. Findings from this task force were evaluated, and FTA's Office of Safety and Security, in cooperation with FTA's Office of Research, Demonstration and Innovation and FTA's Office of Planning, developed a *Safety Action Plan* to put them into action.

The *Safety Action Plan* calls for the revision of 49 CFR Part 659 to more effectively integrate system safety concepts into the developmental phases of transit projects. The proposed rule will:

- Include the integration of system safety in the planning, design and construction process
- Employ *Safety Certification* in the total project development process

The *Safety Action Plan* also calls for FTA to:

- Partner with APTA in revising its rail safety guidelines
- Proactively work with organizations developing new transit projects
- Develop training and technical assistance opportunities that will assist industry in maximizing the

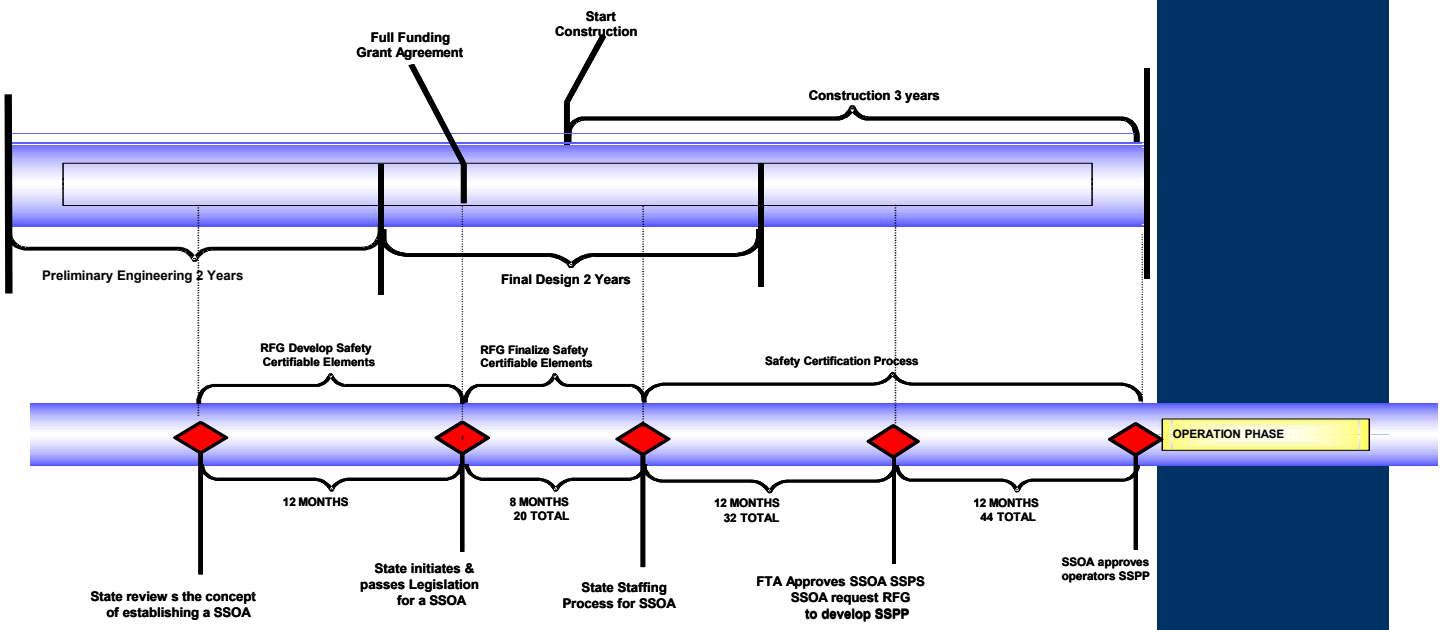
implementation of FTA's system safety programs
- Enhance its data collection and analysis processes

In support of the *Safety Action Plan*, FTA developed *Keeping Safety on Track, Building New Partnerships in Safety*, which outlines FTA's objectives and future programs for ensuring the incorporation of system safety into *all* phases of project development. The brochure highlights the importance of integrating safety into the preliminary phases of project development using the safety certification process, recommending a process for States with New Starts but without existing SOAs, and stressing FTA's commitment to working with all organizations involved in RFGS development.

The following diagram illustrates FTA's approach to incorporating planning, design and construction into its Rule revision by drawing the correlation between State Safety Oversight Program Development milestones and the average length of project development phases.

Rail Transit System Safety Life Cycle Phases:

- Planning
- Design
- Construction
- Testing
- Operations
- Disposal



As indicated in the figure above, it is recommended that States with New Starts designate an Oversight Agency at the time of FTA's evaluation of a proposed major capital project for entrance into the "preliminary engineering" phase. FTA recognizes the benefits to safety, quality assurance, and financial management when system safety is incorporated early in project development. An Oversight Agency designated at this point could develop safety certification requirements in its Program Standard and participate actively in the planning and design of the system. Table 25 outlines FTA's recommended approach to the safety certification process.

Increased coordination can provide a high degree of assurance that system safety objectives are fully integrated throughout all phases of major capital investment projects

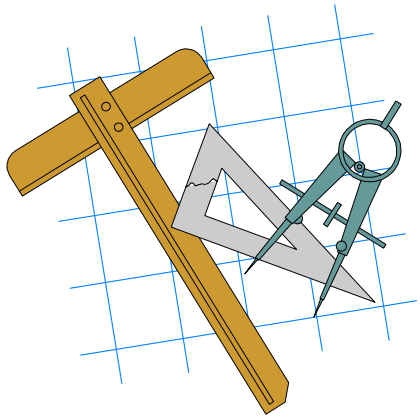
FTA's Regional Offices and Project Management Oversight (PMO) Program contractors provide valuable resources for State Oversight Agencies.

Recommended Safety Certification Process

		Oversight Agency Activity
1	Specify Safety Requirements to guide planning, design and construction	Issue a Pre-Revenue Service Program Standard that requires the RFGS to prepare and submit a list of all criteria, standards, codes, and recommended guidelines that should be used to guide the planning, design and construction of the New Start Project
2	Performance of Hazard Analysis during all New Start project development phases	The Pre-Revenue Service Program Standard should require that hazard analysis be performed during all New Start Project development phases, appropriate to the complexity of the design and as specified in the agency's Safety Requirements
3	Identification of "Safety Critical Elements"	The Pre-Revenue Service Program Standard should require the identification, documentation and submission of all "safety-critical elements"
4	Development of Safety Certification Plan	The Pre-Revenue Service Program Standard should require that the transit agency specify a process for ensuring that safety-critical elements are appropriately planned, designed, constructed and tested in a formal Safety Certification Plan.
5	Safety Certification verifying that the New Start is safe for passengers, employees, emergency responders and the general public.	The Pre-Revenue Program Standard should require that the rail transit agency submit to the Oversight Agency a formal safety certification for the New Start Project, supported by appropriate documentation verifying the implementation of the Safety Certification Plan.

Table 25: Recommended Safety Certification Process

This process is explained in greater detail in FTA's *Compliance Guidelines for States with New Start Projects*.



Hazard Analysis

With the publication of *Hazard Analysis Guidelines for Transit Projects*, FTA provided general guidance regarding industry standards for the performance of this analysis during critical phases in transit projects and to meet basic requirements set forth in FTA's State Safety Oversight Rule.

FTA defines hazard analysis as "a process for utilizing all known safety data on a system (1) to identify all possible hazards, (2) to develop controls that mitigate or eliminate the hazards, and (3) to verify that selected controls actually will reduce the dangers associated with the hazards to an acceptable level."

Hazard analysis should be performed during all stages of the transit project's life cycle:

- ***Planning*** – begins with research conducted into the viability of a project and concludes with the creation of a concept and the decision to develop a preliminary design

- ***Design*** – begins with the formalization of the concept for the project into alternatives for analysis and concludes with full-scale engineering development of the selected alternative

- ***Construction*** – begins with the development, fabrication, or construction of the engineered design for the selected alternative and concludes with the delivery of the completed project

- ***Testing*** – begins with inspection, review, and checkout of the delivered project and concludes with the determination that the delivered project meets the engineering specification

- ***Operation*** – begins with the initiation of the completed project in service and concludes with the determination that the project has fulfilled its service requirements and must be replaced or removed from operations

- ***Disposal*** – begins with the removal of the project from service and concludes with its final disassembly

An effective program for hazard identification and resolution requires coordination at all levels of the transit agency. FTA's Hazard Analysis guidelines demonstrate that, while safety management must spearhead this effort, each transit department must assume responsibility for safety. Hazards are as likely to be identified and resolved by operating departments as by the safety department

Types of Hazard Analysis. FTA's Hazard Analysis guidelines discuss the following types of analysis:

Preliminary Hazard Analysis (PHA) – the initial effort in hazard analysis during the system design phase of the system life cycle.

Subsystem Hazard Analysis (SSHA) – performed to identify design hazards in subsystems of a larger, major system. The analysis should find functional failures of the subsystem that will result in accidental loss.

System Hazard Analysis (SHA) – examines the entire system for its level of safety by integrating outputs from

The Department of Defense has formally adopted MIL STD-882D, created as a performance standard to outline the primary requirements for conducting a system safety effort. The document is available at: http://www.afmc.wpafb.af.mil/HQAFMC/SE/ssd.htm

The System Safety Society, chartered in California in 1964, works to advance the state-of the-art of system safety through the use of information dissemination, professional training, and the communi cation of the system safety movement and discipline to all levels of management, engineering, an other professional groups. Their web-site can be accessed at http://www.sys tem safety.org/

SSHAs and all critical subsystem relationships that comprise the overall system.

Operating Hazard Analysis (OHA) – performed to identify hazards that may arise during operation of the system, to find causes of these hazards, to recommend risk reduction alternatives, and to impose acceptable risk on the system. This type of analysis is required by 49 CFR Part 659.

Software Safety Analysis (SSA) – performed to identify potential software contributions to hazards through undesired and unexpected outputs.

Fault Tree Analysis (FTA) – analyzes sets of events arranged in systems to identify and prevent undesirable outcomes. FTA structures relations between events in a system into a Boolean logic model that leads to accident causation.

Security Analysis (SA) – performed to assess how different system components can be arranged to result in specific security incidents.

FTA's Hazard Analysis guidelines encourage the following view of the hazard identification and resolution process:

1. A hazard is a condition
2. An accident occurs when that hazard is present and some stimulus also occurs
3. Hence: Accident = Hazard + Stimulus
4. Risk is the probability of occurrence of that accident multiplied by the consequences of that accident
5. Hence: Risk = Probability of Accident x Consequence of Accident (often in dollars)
6. Hazard Identification and Resolution recommends controls that will ***reduce*** the probability of the accident and the consequences of the accident (should is occur) to a level of risk (again often quantified in terms of dollars) acceptable to management.

Application of the hazard identification and resolution process is often referred to as "***hazard management***," defined as

> "An element of the system safety engineering function that evaluates the safety effects of potential hazards considering acceptance, control, or elimination of such hazards with respect to expenditures or resources. The feasibility of hazard elimination must be considered in terms of financial, legal, and human constraints."

When Hazard Analysis is Performed?

	Planning	Design	Construction	Operations	Disposition
Preliminary Hazard Analysis (PHA)					
Subsystem Hazard Analysis (SSHA)					
System Hazard Analysis (SHA)					
Software Safety Analysis (SSA)					
Operating Hazard Analysis (OHA)					
Fault Tree Analysis (FTA)					
Security Analysis (SA)					

Design Standards

FTA's *Safety Action Plan* also identifies design standard initiatives based on the coordination with industry and policy partners. FTA's goal is to identify existing standards available to support the design and procurement of rail transit vehicles, equipment, facilities, and operations.

Recognizing the safety implications inherent in the lack of unified and comprehensive design standards for transit equipment and facilities, FTA has been working with its policy partners to identify existing standards that support the provision of safe and efficient service and offer opportunities to adopt industry best practices. FTA will pursue design standard initiatives by:

- Participating in various technical committees sponsored by industry groups including American Public Transportation Association, American Railway Engineering & Maintenance of Way Association, American Society of Civil Engineers, and other industry forums

- Participating in the DOT Technical Working Group on grade crossing safety
- Engagement in the joint FTA/FRA policy for shared trackage

- Active involvement in the development of bus standards with industry and stakeholders

- Continued sponsorship of the Construction Roundtable in order to facilitate the discussion of issues impacting transit design and construction

- Participating in the development of Intelligent Transportation Systems Architecture

Standards and guidelines to support State initiatives to monitor the planning, design, and construction of major rail capital projects are available from the following organizations:

APTA – American Public Transportation Association
ASCE – American Society of Civil Engineers
ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME – American Society of Mechanical Engineers
ASTM – American Society for Testing and Materials
FHWA – Federal Highway Administration
FRA – Federal Railroad Administration
IEEE – Institute of Electrical and Electronics Engineers
ISO – International Standards Organization
NGVC – Natural Gas Vehicle Coalition
NFPA- National Fire Protection Association
NHTSA – National Highway Traffic Safety Administration
SAE – Society of Automotive Engineers
TCRP – Transit Cooperative Research Program
TSC – Transit Standards Consortium

Substance Abuse Management Oversight Program

FTA's State Safety Oversight Program works closely with the Volpe Center to identify key findings from FTA's Substance Abuse Management Oversight Program. These findings highlight key areas affecting RFGS operations.

FTA received drug and alcohol reporting forms for Calendar Year 1998 from 2,477 individual employers representing 1,631 transit systems and 846 contractors. Of the 2,477 individual employers, 885 were large operators, 382 were small operators, and 1,240 were rural operators. A total of 1,606 of the total employers reported being a member of a consortium.

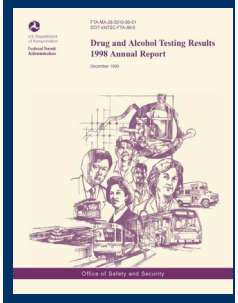
Approximately 72 percent of all employers reported no positive drug test results, and 96 percent of employers reported no alcohol test results greater than .04 percent. Thirty-five percent of contractors submitted a greater percentage of forms with at least one positive drug test result, compared to 23 percent of transit systems. Five percent of contractors submitted forms with at least one alcohol test result greater than .04 percent (5 percent), compared to 3 percent of transit systems.

In 1998, transit agencies collected 111,490 specimens for random drug testing. Of that number, 1,196 specimens tested positive for one or more of five prohibited drugs. Random drug testing accounted for 55.5 percent of the total specimens collected and 35.6 percent of the total positive specimens (of 3,355 positive specimens). The overall positive random test rate was 1.07 percent industry-wide. Positive random test results were 0.93 percent for transit systems and 1.69 for contractors. The 1997 random rate of positive test results was 1.21 percent. There was little disparity in the percent of random drug positives between large, small, and rural operators (1.06 percent, 1.19 percent, and 1.12 percent, respectively). Marijuana and cocaine were detected most frequently in the specimens that tested positive for drugs.

The 1998 alcohol-testing program performed by large, small, and rural operators revealed the following: of the total of 41,206 random alcohol screening tests conducted, 54 confirmation results greater than .04 were documented (.13 percent).

Nationwide, in 1998, there 15 accidents reported that resulted in a post-accident alcohol test result of .04 or greater (bus and rail combined). No fatalities resulted from these accidents.

In the 1999 State Annual Reports to FTA, drug and alcohol use and/or abuse was identified as the probable cause for 2 percent of all accidents meeting FTA's definition.



Detailed analysis of DAMIS reports is available in FTA's "Drug and Alcohol Testing Results, 1998."

Coordinating with FRA

In May of 1999, FTA's Office of Safety and Security coordinated with the Federal Railroad Administration (FRA) to develop the *Joint Policy Statement on Shared Use of the General Railroad System*. The policy statement proposes,

"that regulation of light rail service on the general railroad system, under conditions of temporal separation from conventional rail movements, be handled through application of complementary strategies. FRA regulations would generally be employed to address hazards common to light rail and conventional operations for which consistent handling is necessary, while other hazards would be handled under FTA's State Safety Oversight."

This policy further explains how the two agencies intend to coordinate use of their respective safety authorities with regard to shared use operations. The policy also summarizes how the process of obtaining waivers for FRA safety regulations may work, especially where the light rail and conventional rail operations occur at different times of day. This policy specifies that the active involvement of the State Safety Oversight Agency is an important criterion for the granting of light rail safety waivers by FRA.

In late November, FTA and FRA successfully initiated this process and the Utah Transit Authority was granted a waiver and, in December, the SSO Program welcomed its first "New Start" State – Utah. A copy of the Joint Policy Statement is available on FRA's web page (www.fra.dot.gov).

In evaluating light rail waiver requests, FRA may grant a petition for waiver subject to the following conditions:

- FRA is in receipt of documentation from FTA indicating that the State has implemented an approved State Safety Oversight Program which fulfills Part 659 minimum requirements

- Temporal separation is ensured during normal scheduled operations, under planned operations, such as service for special events, and in the case of necessary detour movements of freight trains.

- Requirements for accident and incident reporting to both FRA and the State Safety Oversight Agency are satisfactorily resolved through appropriate procedures.

- Hours of Service record keeping and reporting issues are satisfactorily resolved.

- Additional operational practices, including communication and coordination with affected freight operator(s), the use of flaggers at crossings, recording keeping, equipment requirements, and emergency features, are successfully developed to address FRA concerns and the intent of FRA regulation 49 CFR Part 211.

Additional information on the waiver process can be obtained from:

Jerry Fisher
Office of Safety and Security, FTA
400 Seventh Street, S.W.
Washington, D.C. 20590
Telephone: (202) 366-2896

New Starts

Throughout the year, FTA also coordinated SSO activities and provided technical assistance to New Start States. FTA developed internal policies for notifying the Governor of New Start States and requesting information regarding the State's plans for designating an oversight agency to carry out Part 659 requirements. FTA's notification of each new State with projects within the preliminary engineering phase increases the opportunity for system safety oversight and integration during the project's most critical stages. Table 26 identifies New Starts projects in States without designated rail transit safety oversight agencies that will initiate revenue service in the near future.

		Projected Revenue Service
Arizona	Central Phoenix-East Valley LRT	September 2006
Arkansas	River Rail Trolley	December 2001
Minnesota	Hiawatha Corridor Light Rail	March 2003
North Carolina	Triangle Transit Regional Rail	December 2004
Puerto Rico	Tren Urbano Heavy Rail	August 2002
Virginia	Norfolk-Virginia Beach LRT	June 2005

Table 26: New Starts

As indicated in the Figure below, the first point in New Start capital investment process that requires FTA decision-making is the approval granted by FTA for the capital investment project to enter preliminary engineering. Consistent with 49 U.S.C. 5309(e)(6) and 5328(a)(2), FTA will approve entry of a proposed project into preliminary engineering based on prescribed evaluation criteria. Additional factors "relevant to local and national priorities and relevant to the success for the project" also support this evaluation. It is possible that the designation of an Oversight Agency could influence this evaluation as an "additional factor."

An Oversight Agency designated at this point could develop safety certification requirements in its Program Standard and participate actively in the planning and design of the system. While there is some risk that a project approved for preliminary engineering may not be selected to proceed to final design or may not receive a full funding grant agreement (FFGA), FTA believes that the benefits of safety oversight during this period outweigh the possibility that a bureaucracy will be created for a project that will never be constructed. Further, it may be possible for FTA, State, or local resources to provide funding to support oversight activities during this phase, reducing the burden required to implement safety oversight. For these reasons, FTA recommends that the Oversight Agency be designated as early in the New Start process as possible – by preliminary engineering at the latest.

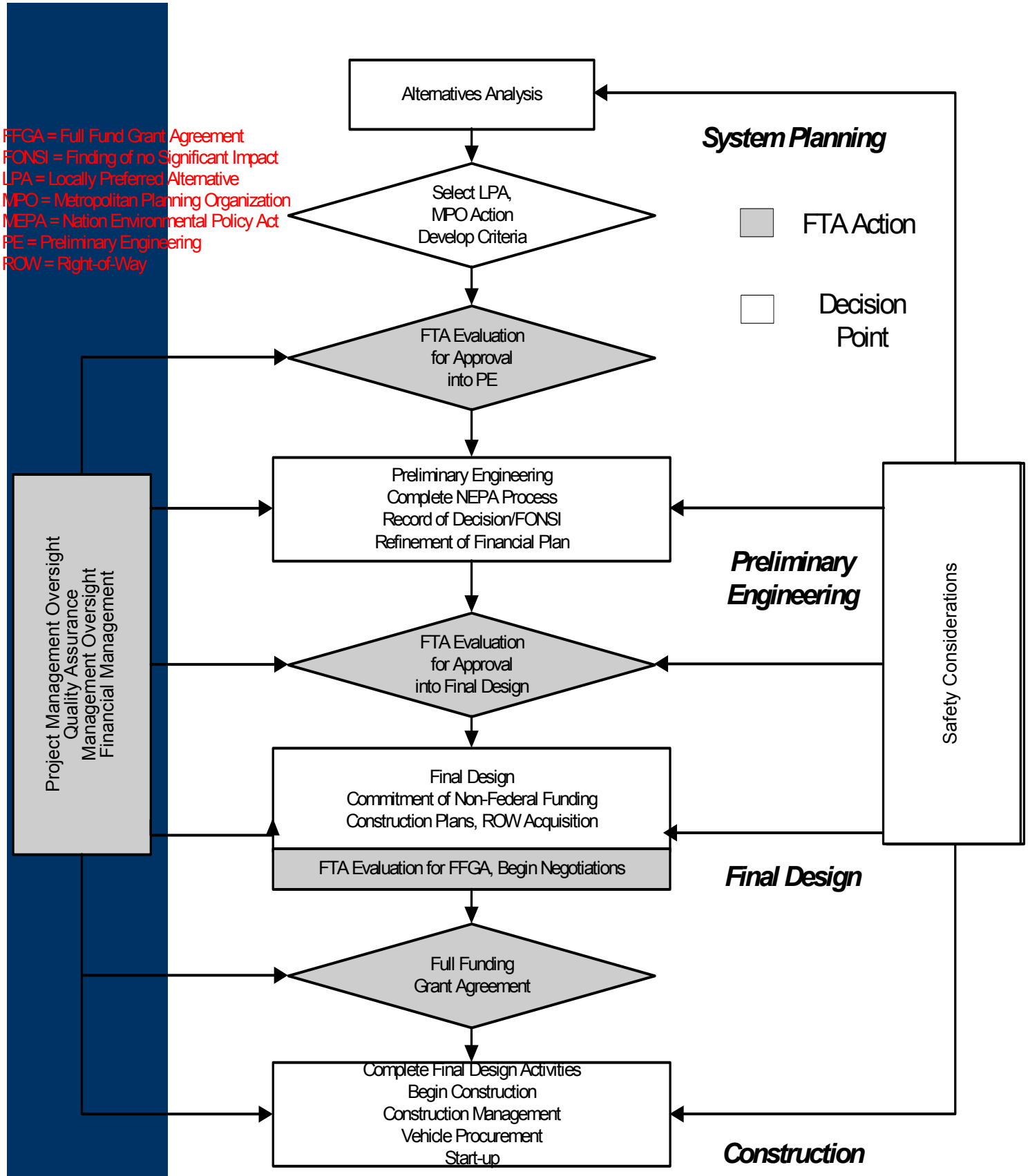


Figure 6: New Start Process

FTA's Office of Safety and Security is working with the Offices of Planning and Engineering and the Regional Offices to incorporate safety certification into the major capital project development process. At the time of the original Rule, FTA limited the scope of Part 659 requirements to transit agency operations. However, since the Rule's inception, FTA has actively encouraged Oversight Agencies to address safety during all pre-revenue phases. Including safety in the rail transit planning, design and construction process is the most effective method for identifying and resolving hazards and ensuring the compliance of design and construction with pre-established safety requirements.

Incorporating safety during the planning, design and construction phases is traditionally accomplished through the safety certification process. The goal of this process is to certify that all practical steps have been taken to optimize the operational safety of the rail system, modification, or extension before, during, and after construction, prior to the initiation of revenue service. FTA believes that incorporating this process into the oversight agency program standard will ensure that a higher level of safety is designed into new transit systems and extensions to existing transit agency operations.

The safety certification process recommended by FTA is depicted in the graphic below, which outlines roles and responsibilities within the safety certification process.

Safety Certification offers many benefits:

- Verifies that appropriate codes, guidelines, and standards have been reviewed to provide a basis for safety and security considerations in the design criteria
- Verifies that specifications and drawings are in conformance with the appropriate sections of the design criteria
- Verifies contract deliverables (including facilities, equipment, and systems) against contract specifications and drawings for compliance with codes, specifications and safety and security requirements
- Verifies that all contract deliverables are appropriately tested for conformance to specifications prior to initiation into revenue service
- Verifies that all procedures, rulebooks, training, and policies are appropriate and in place prior to the initiation of revenue operations.

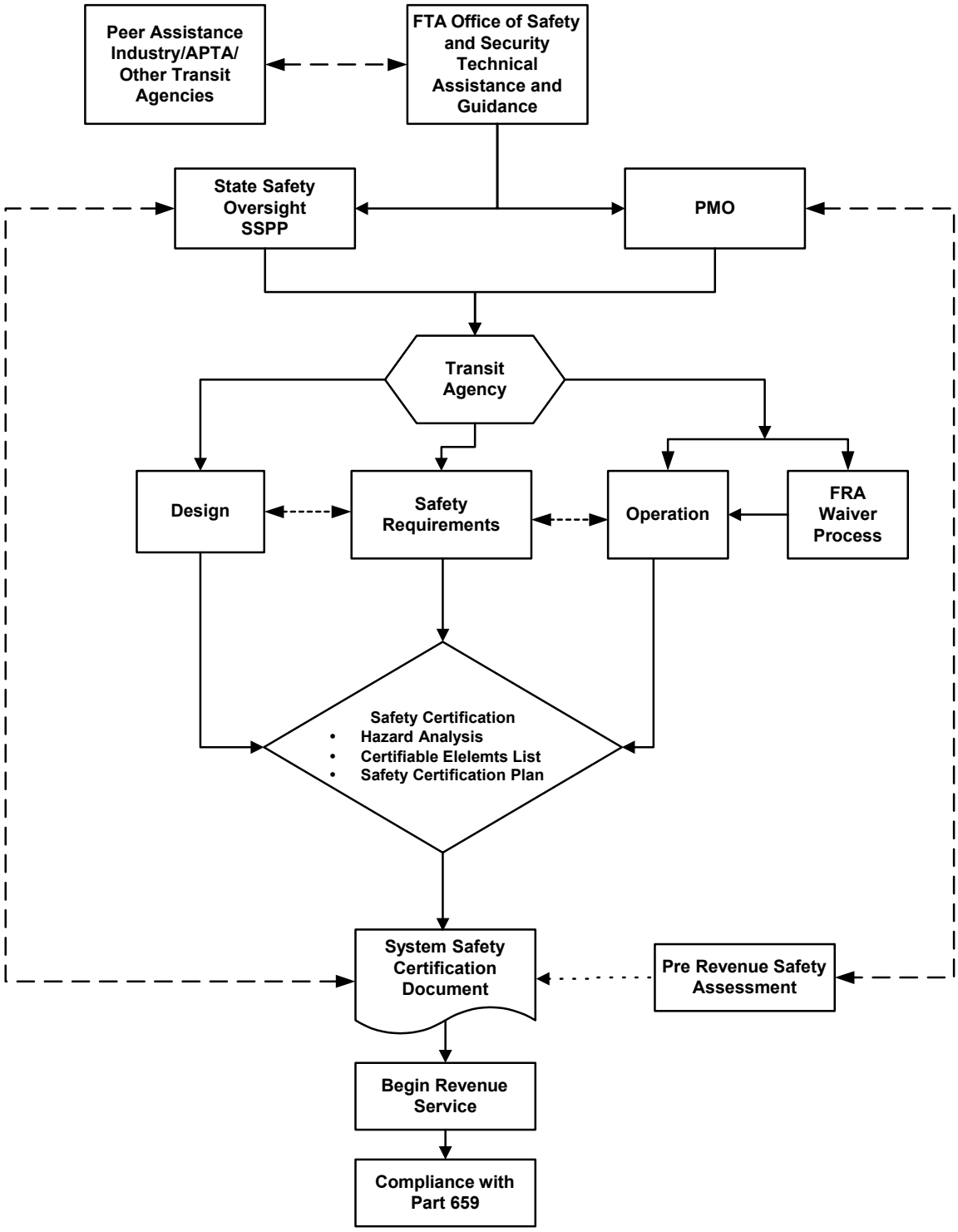


Figure 7: Safety Certification Process

Training and Technical Assistance

To support training opportunities for State and transit safety professionals, FTA's Office of Safety and Security developed a new, two-day workshop on system safety offered by the Transportation Safety Institute (TSI). FTA also revised its Rail System Safety and Transit System Security courses to address State Safety Oversight and to explain Part 659 requirements. To encourage participation in TSI programs, FTA established a certification for *Transit Safety and Security Technician*. This certification is available to any participant who has completed TSI's series of designated transit safety and security courses within a three-year period. These courses include the following:

- Transit System Safety
- Rail System Safety
- Transit Industrial Management
- Transit System Security
- Effectively Managing Emergencies
- Transit Rail Accident Investigation

To obtain the *TSI Course and Seminar Catalog*, or to request to host a TSI course, or receive information about the *Safety and Security Technician Certification Program*, please contact TSI at the following address:

Transportation Safety Institute
Transit Safety and Security Division
DTI-80
P.O. Box 25082
Oklahoma City, OK 73125-5050
Phone: (405) 954-3682
Fax: (405) 954-0367

In the fall of 1999, FTA developed *Hazard Analysis Guidelines for Transit Projects* to support performance of this analysis in the rail transit industry, as required by 49 CFR Part 659, and also to respond to NTSB recommendation R-97-22 that requires FTA to:

"Revise the grant application process to require a comprehensive failure modes and effects analysis, including human factors analysis, be provide for all federally funded projects that are directly related to the transport of passengers."

In December, FTA's Office of Safety and Security conducted the *Third Annual State Safety Oversight Workshop*. Hosted by the Oregon Department of Transportation in Portland, the Workshop was attended by 17 Oversight Agencies.

Throughout 1999, FTA continued to publish both the *State Safety Oversight Newsletter* and the *Transit Security Newsletter* to update the industry on new developments, practices, and trends affecting the Program.

TSI's course catalog is available by calling (405) 954-3682.

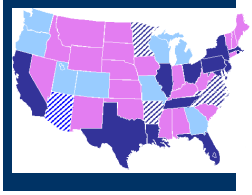
Chapter 5: State Activity

State Accomplishments in 1999
• 12 Revised State Program Standards • 24 Revised Transit Agency System Safety and Security Program Plans • 1 State Technical Advisory • 10 State Programs for Corrective Action Plan Tracking and Monitoring • 8 State Programs for On-site Participation in Transit Agency Accident Investigations • 5 State Programs for On-site Participation in Transit Agency Internal Safety Audits • Improvements in Safety Data Tracking and Analysis, Including Electronic Databases 5 States • Additional Resources Allocated to Safety Oversight, Including Full-time Staff in 4 States • Resolution of Transit Agency Compliance Issues, Including Internal Audit Programs and Hazard Analysis in 4 States

Program Management

In 1999, States made tremendous strides in their implementation of 49 CFR Part 659 requirements. By the year's end, more than half (12) of the SOAs had designated at least one full-time equivalent (FTE) to their SSO programs, up from only six Agencies when the Program began in 1997. In addition, in 1999, thirteen States used contractors to support some elements of their program. Contractors were most commonly used to conduct three-year safety reviews and to develop System Safety Program Standards and oversight procedures and documentation.

	States with less than Full-time Equivalents (FTEs) for SSO Programs
California Colorado Florida Maryland Massachusetts New Jersey New York Oregon Pennsylvania Tennessee Texas Utah	TOC Georgia Illinois Louisiana Michigan Missouri DRPA Ohio Washington Wisconsin



Program Standard and SSPP Review and Update

Throughout 1999, 14 States revised their System Safety and Security Program Standards. For many States, determining the appropriate level of detail for the Program Standard has proven to be one of the most challenging components of complying with Part 659 requirements. This situation is complicated further when the Program Standard must be issued as a formal regulation or administrative code. States revised their Program Standards to improve coordination with the rail transit agencies in their jurisdictions and to specify procedures and timeframes to govern the interaction between the SOA and RFGS for key safety activities, including:

- The submission, review and approval of the RFGS SSPP
- RFGS accident and unacceptable hazardous condition notification
- The submission, review and approval of RFGS investigation procedures, reports, and corrective action plans
- The conduct of three-year safety reviews
- The status tracking of corrective actions.

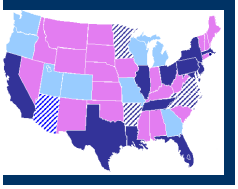
States required, reviewed, and approved updated SSPPs and Security Plans for 23 of 32 affected RFGS in 1999. *1999 marks the first year in which each RFGS affected by 49 CFR Part 659 has an SSPP and Security Plan in place*. States had formally approved these Plans for all but one affected RFGS in 1999.

States developed checklists and report templates to document their activities to evaluate SSPP and Security Plan updates.

Accident and Unacceptable Hazardous Condition Reporting and Investigation

In 1999, only one State (New York) conducted independent accident and unacceptable hazardous conditions investigations. FTA's Rule states that an investigation "may involve no more than a review and approval of the transit agency's determination of the probable cause of an accident or unacceptable hazardous condition" (Part 659.5). However, if an oversight agency is using the rail system's investigation report to meet its regulatory requirements, this report assumes special significance. The majority of States, which have delegated their 49 CFR Part 659.41 responsibility for accident investigation to the RFGS within their jurisdiction, now perform a careful and thorough review and approval of the accident investigation forms submitted to them. Such formal review and approval constitutes the SOA's official endorsement of the accident investigation conducted on its behalf.

In addition, in 1999, the majority of States formally reviewed and approved the accident investigation procedures used by the RFGS in their jurisdictions to conduct investigations. States also participated in RFGS accident and hazardous conditions investigations in increasing number, observing both the conduct of the investigations and RFGS implementation of its SOA-approved procedures. The majority of States (15) now have procedures that encourage on-scene observation of RFGS investigations.



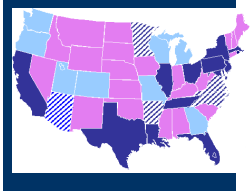
In 1999, States worked closely with the RFGS in their jurisdictions to improve the performance of hazard analysis and the identification of unacceptable hazardous conditions (UHCs). In total, 23 unacceptable hazardous conditions were reported by RFGS in 1999. States have refined notification, investigation, and reporting procedures for addressing these conditions.

States worked with RFGS to develop written procedures for conducting hazard analysis during transit operations, as detailed in the APTA Manual, Checklist Number 7. States also conducted meetings with RFGS safety personnel to review UHC identification and reporting requirements. Two States (California and Florida) developed guidelines to clarify reporting and investigation requirements.

The hazard analysis process is a critical part of an agency's System Safety Program. This process provides a mechanism, accessible to all levels of the organization, by which hazards are identified, analyzed for potential impact on the operating system, and resolved. States worked with RFGS to implement the APTA Manual, Checklist Number 7, which recommends that "each transit system must ensure that its safety methodologies are tailored to the unique capabilities of its organization." The Checklist also suggests "a properly functioning System Safety Program must explain how the Hazard Resolution Process of the respective transit system is carried out and documented." Further, the Checklist states, "that Hazard Identification is an ongoing process, viable throughout the system life cycle."

In 1999, FTA's Audit Program discovered that UHCs, as determined by the RFGS, are not always communicated to the SOAs, as is required by Part 659. One of the reasons that RFGS struggle with implementing this requirement is that, in a majority of the incidents, the occurrence of an UHC is readily apparent, obvious, and requires immediate resolution during operations (i.e., suspension of service, removal of vehicle from service, etc.). Rarely is formal analysis performed in these instances. Therefore, documenting the occurrence of the UHC is viewed by the transit agency as an additional and unnecessary reporting burden. These agencies believe that, if they have addressed the UHC, then the condition no longer exists, and therefore does not have to be reported to the Oversight Agency. This practice is in direct opposition to the intent of FTA's Rule, which requires Oversight Agency notification of the occurrence of these conditions, whatever their corrected status. Further, the Rule requires the RFGS to submit to the Oversight Agency, for review and approval, both an investigation report (if the Oversight Agency has designated this responsibility to the RFGS) and a Corrective Action Plan describing how the identified UHC will be resolved. These activities are central to the effective implementation of FTA's Rule and must be performed for each identified UHC. In 1999, States worked with RFGS to resolve these deficiencies.

SOAs revised their Program Standards to require the RFGS SSPP to provide a clear description of the hazard classification system, including explicit definitions for each category of hazard severity and probability. (Quantitative criteria can be particularly helpful in clarifying distinctions among categories.) Further, SOAs and RFGS worked together to develop the framework—reflected in the SSPP—from which the transit agency is required to implement criteria for UHC



determinations that will, in fact, represent the unique methodologies and capabilities of the transit agency.

SOAs also revised their Program Standard to require transit agencies to perform Hazard Analysis to support the following activities:

- Accident Investigation
- New Procurements
- System Modification
- Findings from Safety Data Trend Analysis
- Change in Operating Procedures or Rule Book
- Changes to "Critical Safety Items List"
- Special Studies or Investigations
- At the Request of the Oversight Agency

.

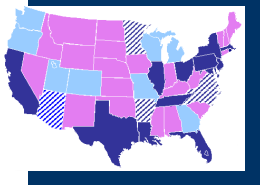
Corrective Action Plans

During this past year, FTA renewed its effort to ensure that all States began incorporating and tracking the implementation of all corrective action plans submitted by transit agencies. As the table below indicates, the majority of corrective actions were a result of the internal safety audits conducted by transit systems. It should be noted that not all of the corrective actions that resulted from internal audits met FTA's threshold for reporting, thus SOAs were not required by Part 659 to track their implementation and resolution. States and transit agencies, however, recognized the benefit of coordinating corrective action tracking activities to ensure their successful implementation. As the Table below indicates, in 1999, States required 968 corrective actions plans and approved 553.

Corrective Action Plans

Category	Number Submitted	Approved	Open
Investigations	23	20	3
3 YR Safety Reviews	272	171	101
ISAP	670	359	311
Other	3	3	0

Table 27: Corrective Action Plans



Internal Safety Audit Process

In 1999, States actively supported the development of improved internal safety audit programs at the RFGS within their jurisdictions. States shared checklists and techniques, and, in some instances, coordinated the conduct of the internal safety audit process with their three-year safety review. States also observed internal rail transit agency safety audits with increasing frequency.

Three-year Safety Reviews

FTA has recognized and accepted a number of different approaches to the conduct of Three-year Safety Reviews. The Rule requires that the review is performed on-site, examines both agency documents and facilities, and at a minimum, includes a comprehensive analysis of the efficacy of the SSPP and a determination of whether it should be updated. Further, the State must track the implementation of corrective actions that result from the review.

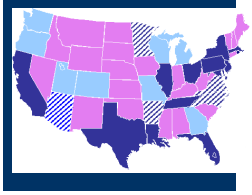
To allow maximum flexibility States may perform the review once every three years or on an ongoing basis. In addition, States may perform the review using its own qualified staff members, or contract these services out to a qualified consultant. In case of the latter, the consultant must be a contractor to the State, and must report findings directly to the State.

FTA has recognized through the analysis of Program Standards and procedures, as well as information obtained from 1999 Annual Reports, that most States use a similar methodology to guide the planning, conduct, and development of the final report for the safety review process.

In 1999, FTA saw greater coordination between the SOA and the RFGS than during any other year. During the past year, States devoted a significant portion of their resources to the performance of these reviews and the subsequent follow-up activity. States consistently shared with transit systems the review schedule and the checklists developed to evaluate the RFGS SSPP. Audit checklists were forwarded to the RFGS for review and approval, thus allowing the RFGS to coordinate its internal audit activities with those of the States', as well as provide the transit agency with proper advance notice of the areas for which the agency must provide documentation and identify key personnel responsible to participate in the audit process. Transit agencies responded in kind by sharing with the SOA its schedule and checklists used to perform its required internal safety audit. This coordination strengthened the relationship between the State and RFGS and facilitated the efficient and effective review of safety critical items.

Upon receiving the States' checklists, most RFGS were given the opportunity to review the checklists for a pre-determined number of days and respond with the submission of documents relevant to the review. Pre-audit submissions provided States with an initial review that resulted in the development of preliminary concerns and a list of RFGS documentation required to verify safety activities.

Once the preliminary review was performed by the State, each SOA applied its own checklist in evaluating documents and data maintained by the RFGS, conducting interviews with transit agency personnel, and observing RFGS operations.



In all cases, the audit results were delivered to the RFGS for review and comment. Though timeframes varied from State to State, transit agencies were allowed a specific period of time to evaluate each finding and respond to the State with any exceptions to the findings and with corrective action plans to address findings with which they concurred. In many States, the process of allowing RFGS appropriate time to comment on findings strengthened the relationship between the two agencies and resulted in an expedition of corrective action implementation. A handful of States, however, determined that the "appeals" process was too lengthy and allowed for too much time to pass before implementing actions to correct findings.

It is clear from both the States' Annual Reports to FTA and the SSO Audit Program that Three-year Safety Reviews have improved SOA understanding of RFGS safety issues. This understanding has resulted in the development of Memoranda of Clarification, Technical Advisories, and revised Program Standards, SSPPs, and Security Plans. Resolution of three-year safety review findings has also provided a greater opportunity for SOA coordination with Regional Offices, PMOs, and FTA's Office of Safety and Security.

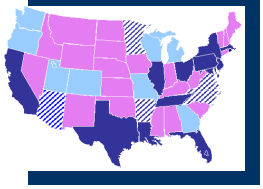
17 States conducted three-year safety reviews at 19 RFGS in 1999. Two of the 17 States continued to perform ongoing safety reviews of every safety critical aspect of the transit system's operations, and a third implemented this process for the first time. Further, 14 States used in-house personnel to support the conduct of these reviews. Combined, these reviews resulted in 272 required corrective action plans.

Approximately 75% of the States that performed safety reviews submitted the final reports to FTA. An evaluation of the Annual Reports, combined with the information obtained through the conduct of 13 FTA SSO audits, revealed common concerns regarding the RFGS implementation of its SSPP. Several of the SOA findings addressed either the misapplication ("not following procedures") of procedures documented in the RFGS SSPP or the lack of, or inconsistency with, documented procedures representing actual safety activities. Review findings consistently documented deficiencies and areas of concern in the following areas:

- Maintenance – policies, personnel staffing, rules, procedures, practices, facilities, equipment, inspection records, testing procedures, and quality control
- SSPP Implementation – rules, procedures, and emergency preparedness
- Documentation of procedures in SSPP

Maintenance

Several findings indicated that established maintenance procedures (track, facilities, preventative) were not being followed or well documented as required by the transit systems' procedures manuals. Of particular concern to the States was the lack of proper verification that maintenance activities were being performed as well as, in some cases, the lack of standard operating procedures and checklists to guide rail personnel through inspections. Other maintenance concerns included the following areas:



- Lack of proper training procedures
- Inspection of "out of service" vehicles prior to being returned to service
- Failure to appropriately "sign-off" on preventative maintenance activities
- Out-of-date procedures manuals
- Failure to replace system components within specified time period
- Inconsistent performance of mileage interval inspections
- Need for upgrading track maintenance standards

SSPP Implementation

During the conduct of Three-year Safety Reviews in 1999, SOAs observed many instances where transit agencies were not in compliance with the policies and procedures established in their SSPPs. Besides the concerns regarding the appropriate and consistent implementation of maintenance procedures—identified above—States recognized failures of transit systems to properly implement portions of the following areas of their SSPPs:

- Hazardous materials programs
- Emergency preparedness training
- Updating the SSPP
- Internal safety audit process
- Tracking and implementing corrective actions
- Enforcement of operating rules
- Performance of hazard analysis

Documentation of Procedures in SSPP

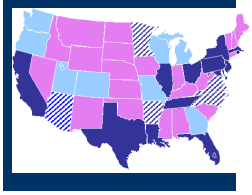
On many occasions, safety reviews identified the need for a transit agency to update its SSPP to reflect current practices. In many instances, the RFGS did not have a process in place to perform this critical function. In 1999, many RFGS received capital grant funding to extend or modernize their current service; however, in some cases, States observed that the policies and procedures within the SSPP were not commensurate with the new projects and, therefore, the RFGS was unable to ensure a consistent system safety approach to project development. In other cases, inconsistencies between current practice and prescribed activities were found in the following areas:

- Dispatcher training material was out of date
- Accident notification telephone numbers were incorrect
- Referenced procedures manuals were no longer used
- Accident investigation procedures
- Training procedures were not updated

Reporting to FTA

In 1999, SOAs continued and improved upon earlier efforts to collect safety information from the RFGS within their jurisdictions. SOAs improved procedures and forms for accident and unacceptable hazardous condition notification and developed monthly and quarterly reporting systems for the transmission of information from the RFGS regarding the status of corrective action plans. States also completed FTA's *Annual Report Template*, providing causal safety data for all of those occurrences meeting 49 CFR Part 659.5 definitions.

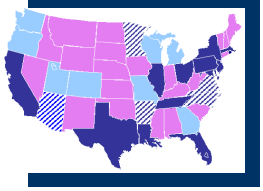
For the Calendar Year 1999, all SOAs completed FTA's *Annual Reporting Template* and provided annual certifications in support of their implementation of 49 CFR Part 659 requirements.



Several SOAs prepared *Periodic Submissions* in response to specific requests from FTA's Office of Safety and Security. States also attended Quarterly Meetings sponsored by FTA's Regional Offices, reporting on their activities and contributing to Federal oversight of major capital transit development projects.

Results from submitted Annual Reports are presented in both this chapter and in Chapter Two. State submission of these Reports allows FTA to provide probable cause information on accidents meeting Part 659.5 definitions.

As stated in Chapter One, States provided data for 32 RFGS systems in 1999 (UTA, NJ Transit Hudson-Bergen, and Kenosha Transit did not have operation data for 1999.) Combined, these RFGS experienced 100 collisions, 6 derailments, 67 rail grade crossing accidents, 5 fires, and 2,449 other events meeting FTA's definition (including suicides and single-person injuries; such as slips, trips, and falls and medical emergencies; requiring medical treatment away from the scene). Combined, these events resulted in 112 fatalities and 2,839 injuries. Chapter 3 of this report provides a detailed analysis of this data.



Chapter 6: RFGS Security Performance

In FTA's State Safety Oversight Rule, safety requirements are specified in detail, while security requirements are referred to only in general terms. Specific security requirements are not issued in Part 659 because security is interpreted as part of the Oversight Agency's safety oversight program; thus, the tools developed to support RFGS safety oversight must also be used by the State to support security oversight. General security requirements identified in Part 659 are outlined in Table 28.

Security Oversight Activities	
Include passenger and employee security in the Program Standard.	§659.31
Require, review and approve, and monitor the Implementation of a System Security Program Plan (Security Plan) at each rail transit system. The Security Plan can be Part of the SSPP, or it can be a separate document.	§659.33 (a),(b),(c)
Include security in the on-site Three-year Safety Review.	§659.37
Include security in the Internal Safety Audit Reporting requirements.	§659.35
Include security activities in annual reporting to FTA.	§659.45

Table 28: Security Requirements

In 1999, all but one State had adopted a System Security Program Standard. Also, in 1999, all but one State had successfully required, reviewed, and approved a System Security Program Plan from each affected RFGS within its jurisdiction. The vast majority of States referenced FTA's Transit System Security Program Planning Guide to provide the basic requirements and outline for this document. For most RFGS, a typical Security Plan includes, at a minimum, the following components:

- RFGS management commitment and policy regarding security,
- Introduction to the RFGS System Security Program,
- RFGS description
- Management of the Security Plan,
- Description of system security responsibilities,
- System security threat and vulnerability identification and resolution process,
- Security Plan implementation and verification, and
- Security Plan evaluation and modification procedures.

Security at the 32 RFGS affected by Part 659 in 1999 was provided by organizations with varying degrees of police powers operating under specialized conditions, including the following:

- Dedicated sworn police force with jurisdiction for the entire RFGS,
- Contracted non-sworn security,
- Contracted local law enforcement (off-duty police officers and formal contracts for municipal police services),
- Non-contracted local law enforcement, and
- Combinations of the above.

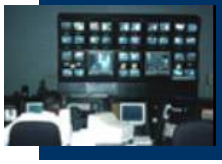
Agency-to-agency variations in design, equipment, policies, and procedures are significant, and influence security staffing and management. No single security organization description is adequate for all affected RFGS; each security program has evolved to address local conditions and resources.

		Sworn Transit Police
Denver RTD JTA Miami Metro-Dade	LACMTA Muni SDTI SRTD SCVTA CTA New Orleans RTA BSDA NYCT Portland Tri-Met	BART WMATA MARTA Maryland MTA MBTA NJT PATCO NFTA GCRTA PAT SEPTA DART

Table 29: Use of Security Enforcement by Agency

In 1999, States reviewed the security programs implemented by these different organizations as part of their Three-year Safety Review programs, and made findings addressing training, equipment, resources, communications, coordination with external organizations, and the need for drills and exercises.

FTA's State Safety Oversight Program does not collect data on crimes that occur on the affected RFGS. To provide an overview of the level and types of crime to occur in the rail transit environment for this *Annual Report*, RFGS Form 405 submissions to the National Transit Database (NTD) were reviewed. At the current time, the most recent security data available is for 1998. The following discussion provides



a general description of transit crime levels at the affected RFGS for that year.

The affected RFGS reported 97,232 criminal occurrences to NTD in 1998. These crimes can be divided into three subgroups for the purpose of analysis: violent crimes, property crimes, and quality of life offenses. These groupings are useful in providing a framework for discussion regarding the range of events that occur in the transit environment. NTD Form 405 uses a system of classification (Part I and Part II crimes) based on definitions used by the Federal Bureau of Investigation (FBI). The relationship between the FBI definitions and the three sub-groupings used in this Report is illustrated in Table 30,below:

			Quality of Life Crimes
Part I			
Homicide	▼		
Forcible Rape	▼		
Robbery	▼		
Aggravated Assault	▼		
Burglary		▼	
Larceny/theft		▼	
Motor vehicle theft		▼	
Arson		▼	
Part II			
Other assaults	▼		
Vandalism			▼
Sex offenses			▼
Drug abuse violations			▼
Driving under the influence			▼
Drunkenness			▼
Disorderly conduct			▼
Trespassing			▼
Fare evasion		▼	
Curfew and loitering laws			▼

Table 30: NTD – FBI Crime Data Relationship

Figure 8 represents 1998 crime level data, as reported by RFGS for quality of life, property, and violent crime. Quality of life and property crimes account for over 94 percent of all crimes on RFGS. Violent crime occurs relatively infrequently, accounting for only 5.3 percent of all RFGS crime. Figure 9 shows the breakdown of crime by system type.

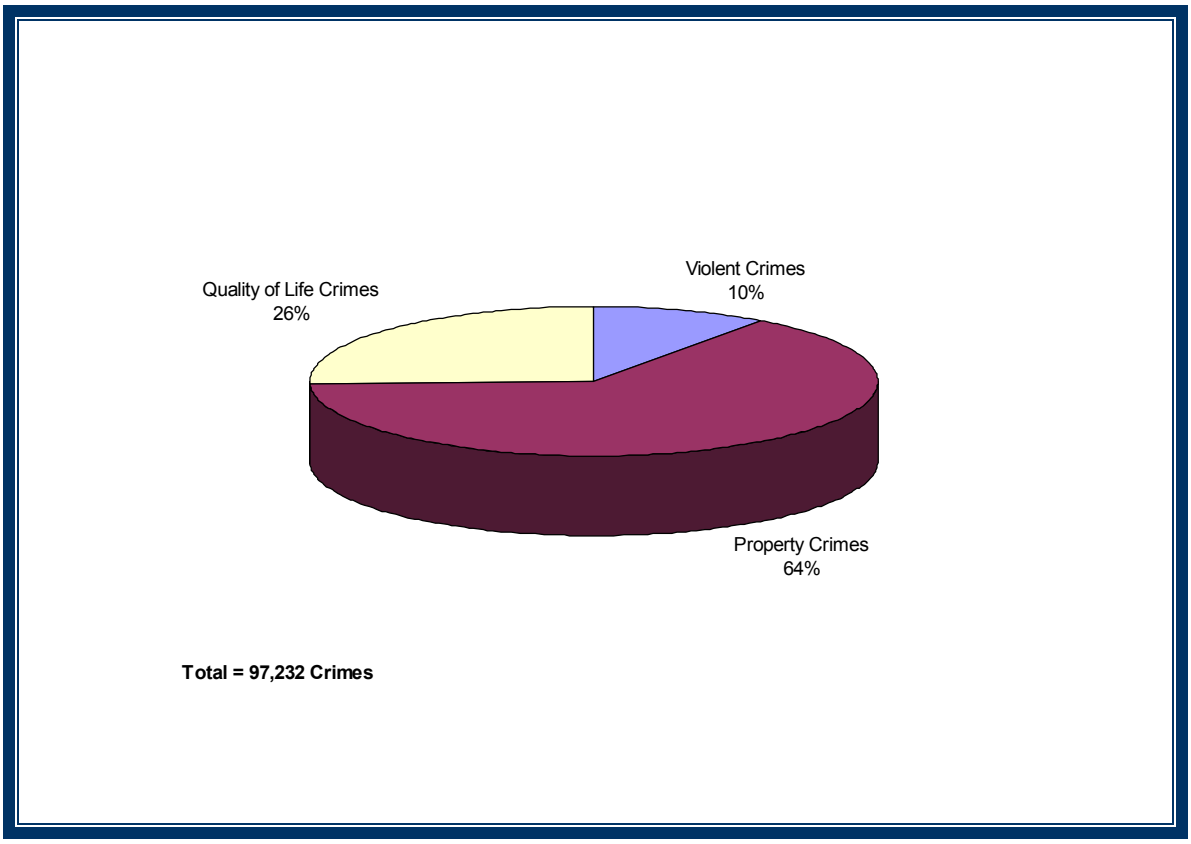


Figure 8: Rail Fixed Guideway System Crimes by Type, 1998

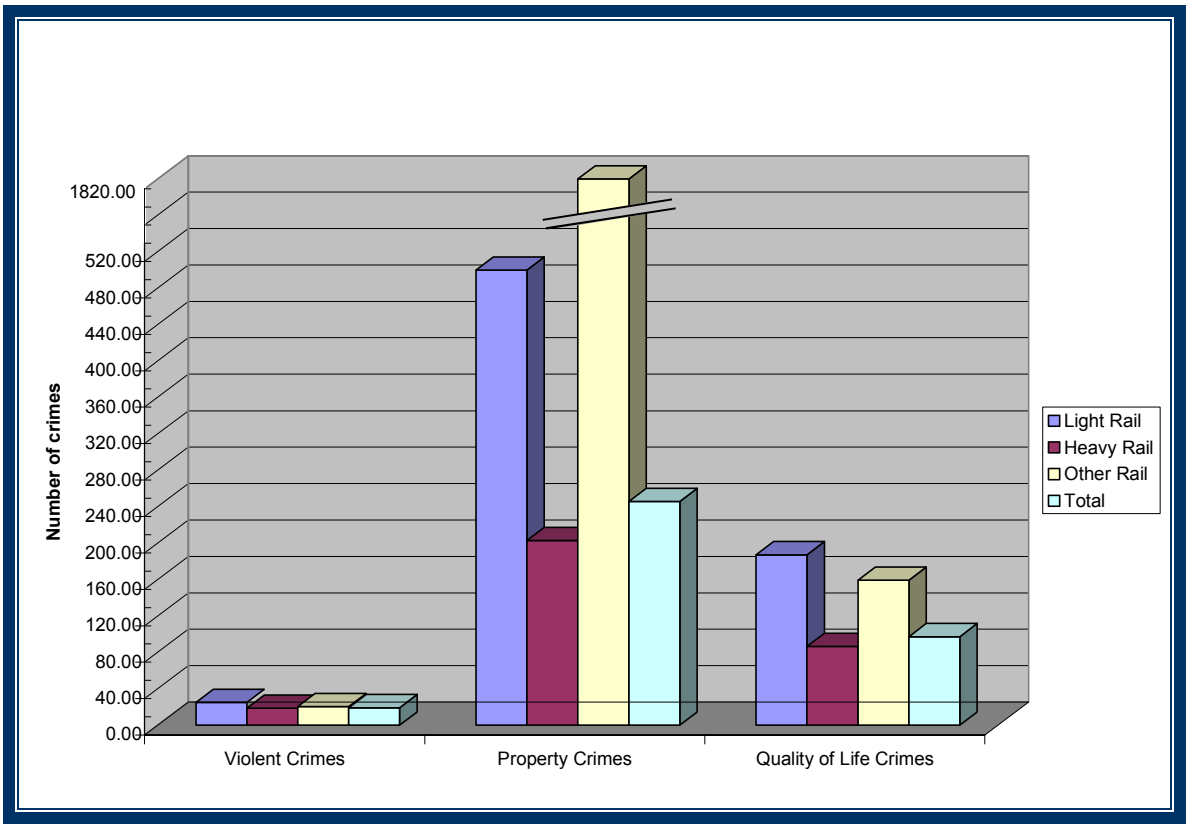


Figure 9: Rail Fixed Guideway System Crimes per 10 Million Passenger Trips by Mode, 1998

RFGS Quality of Life Crimes

Figure 10, Figure 11, and Figure 12 present data on quality of life (QOL) crime in RFGS. Key findings include:

- The most common QOL crimes are disorderly conduct and drunkenness, which account for over 70 percent of QOL crimes on RFGS
- Though these crimes are especially pervasive in terms of gross numbers in heavy rail, the rates of occurrence of these crimes are higher in light rail
- Trespassing and loitering account for about 10 percent of QOL crimes,
- About half of QOL crime arrests occur on vehicles (46.3 percent) and about half in transit stations (47.3 percent)
- Rates of trespassing were exceptionally high in the Other Rail category due to high rates on Automated Guideway systems (versus the relatively low number of unlinked passenger trips)

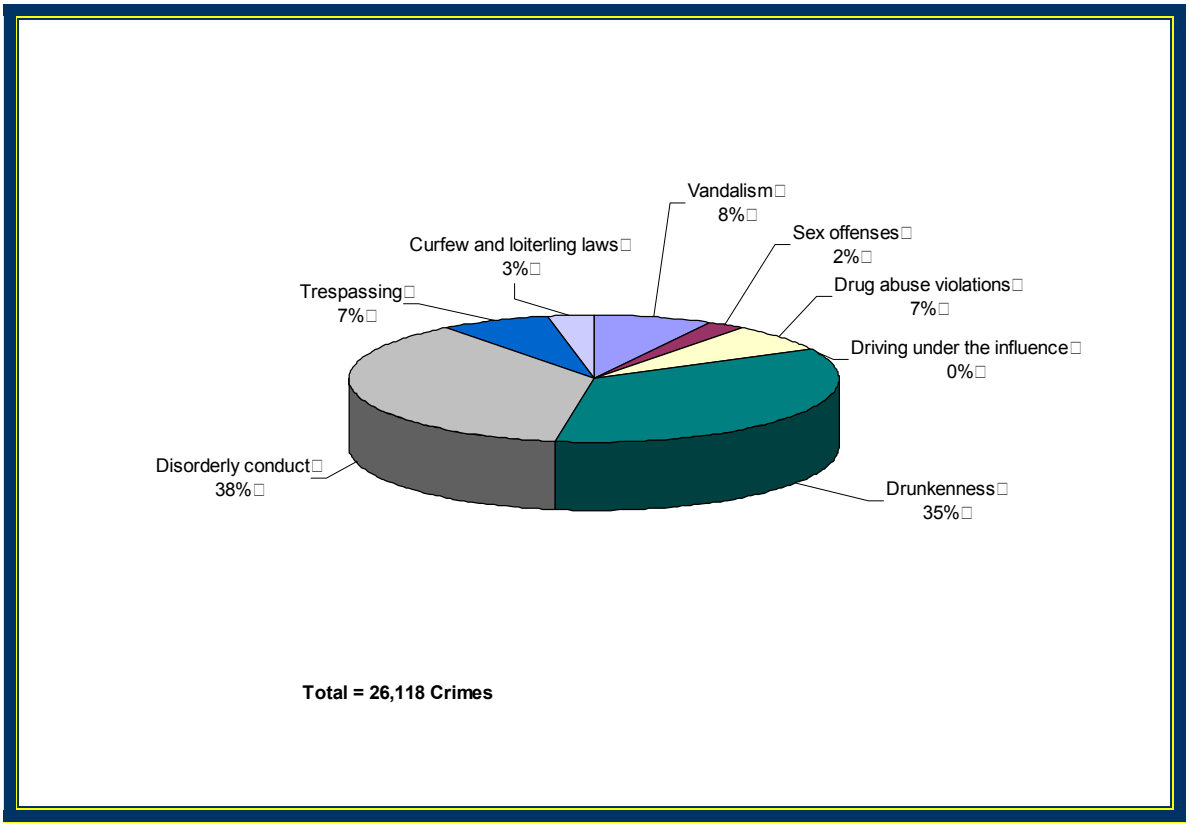


Figure 10: Rail Fixed Guideway System Quality of Life Crimes, 1998

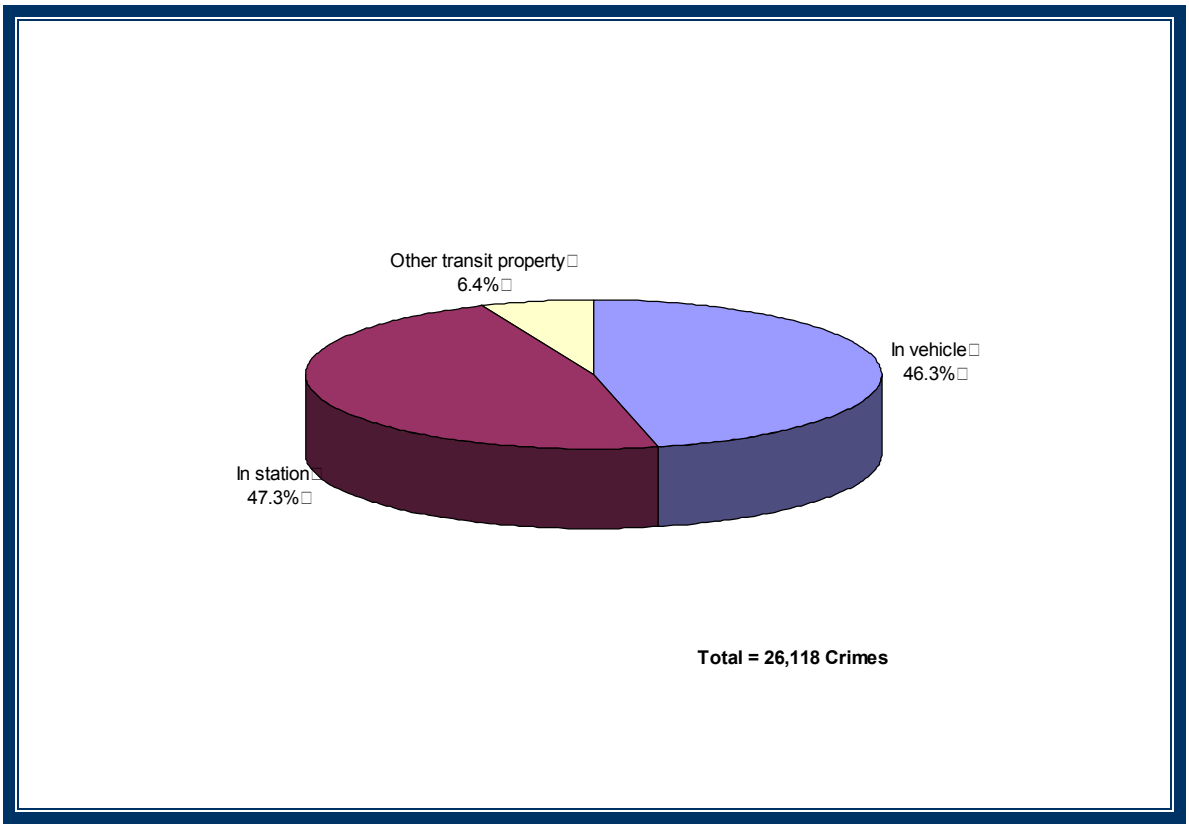


Figure 11: Rail Fixed Guideway System Quality of Life Crimes by Location, 1998

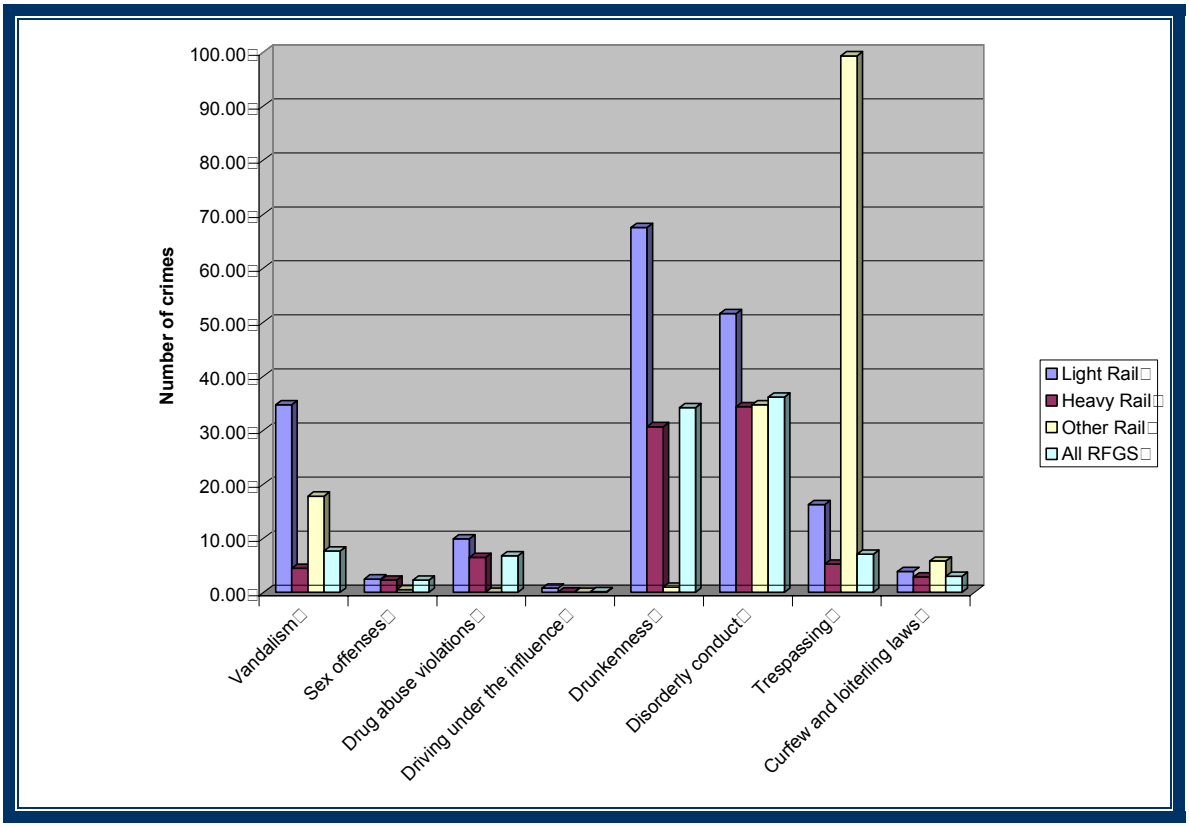


Figure 12: Rail Fixed Guideway System Quality of Life Crimes by Mode (per 10 Million Passenger Trips)

RFGS Property Crimes

Figure 13, Figure 14, and Figure 15 present data on RFGS property crimes. Key findings include:

- Fare evasion accounts for over 85 percent of property crimes in the RFGS environment
- Theft and burglary account for less than 15 percent of reported property crime offenses
- Due to high numbers of incidents on automated guideway systems, the highest rate for fare evasion is in the Other Rail category (over ten times the rate experienced on heavy rail systems and almost four times that of light rail systems)
- Rates for burglary, arson, and motor vehicle theft are low across all RFGS
- Nearly 80 percent of property crimes occur in stations
- Only about a fourth of property crimes occur in RFGS vehicle

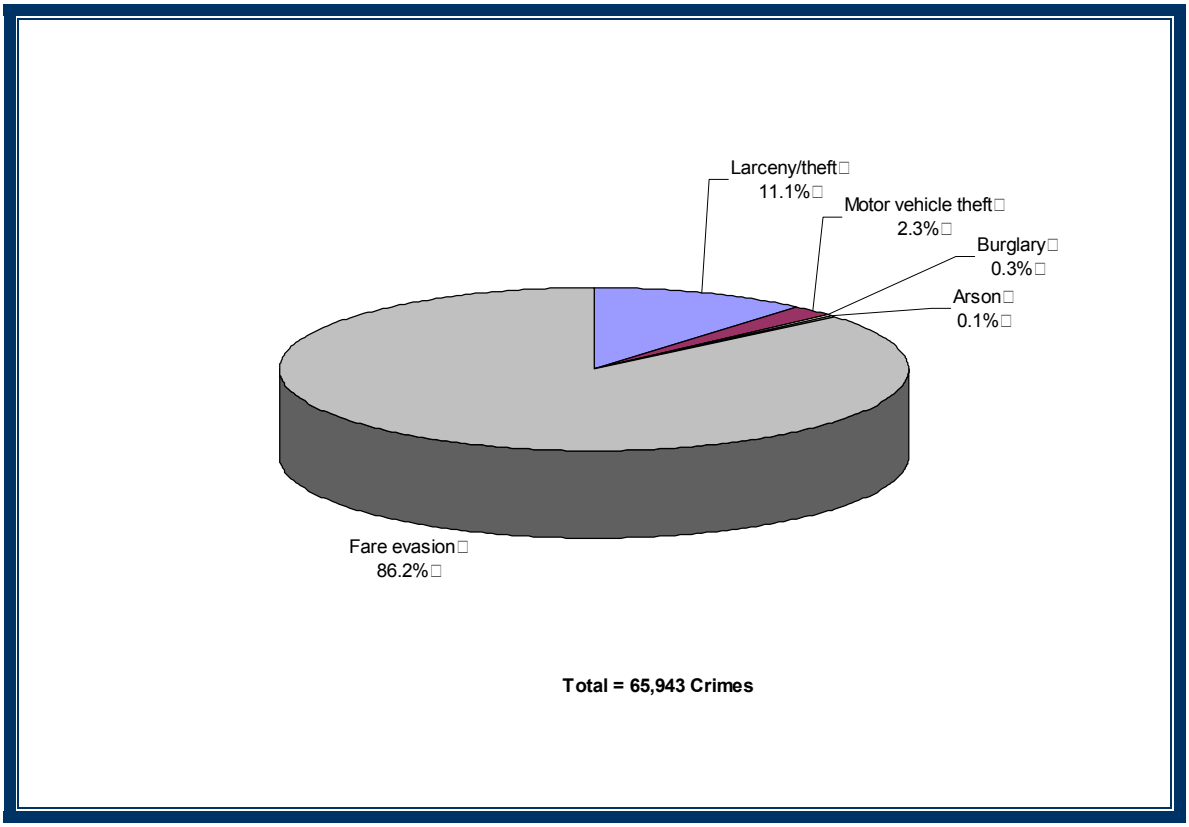


Figure 13: Rail Fixed Guideway System Property Crimes, 1998

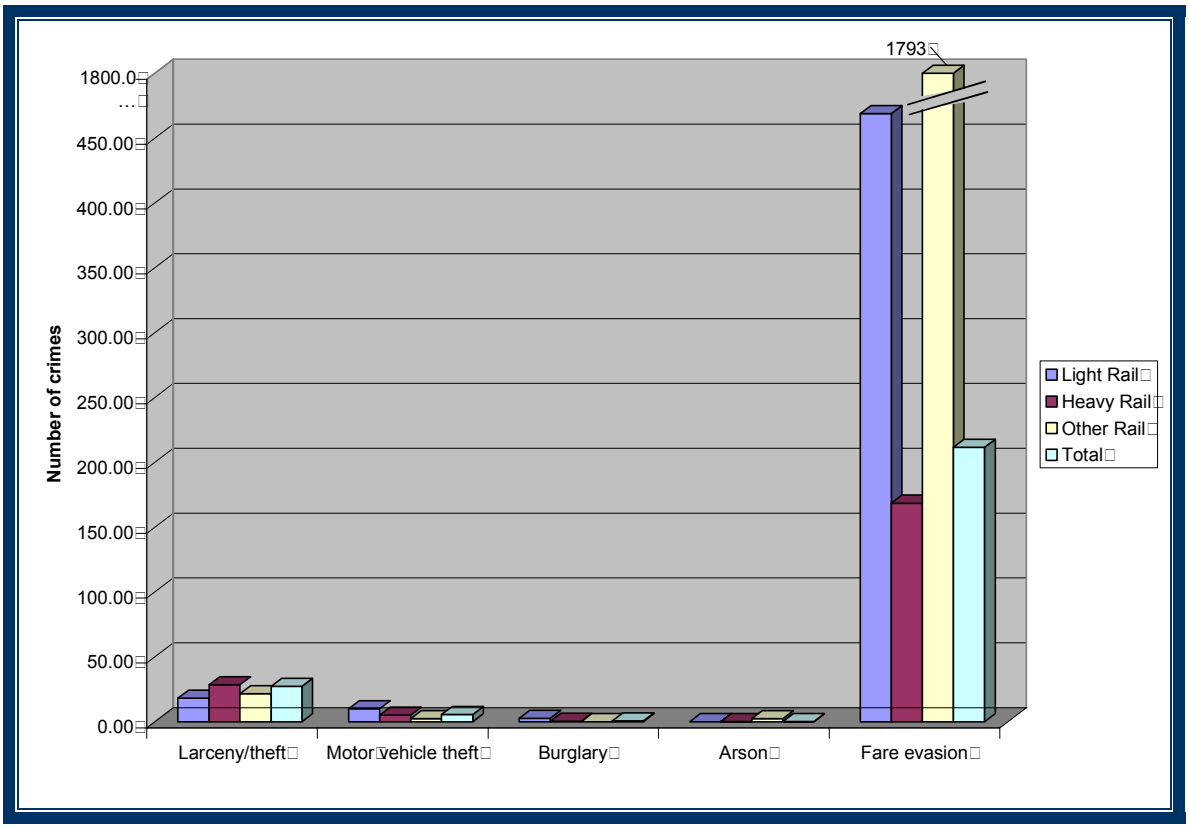


Figure 14: Rail Fixed Guideway System Property Crimes by Mode (per 10 Million Passenger Trips)

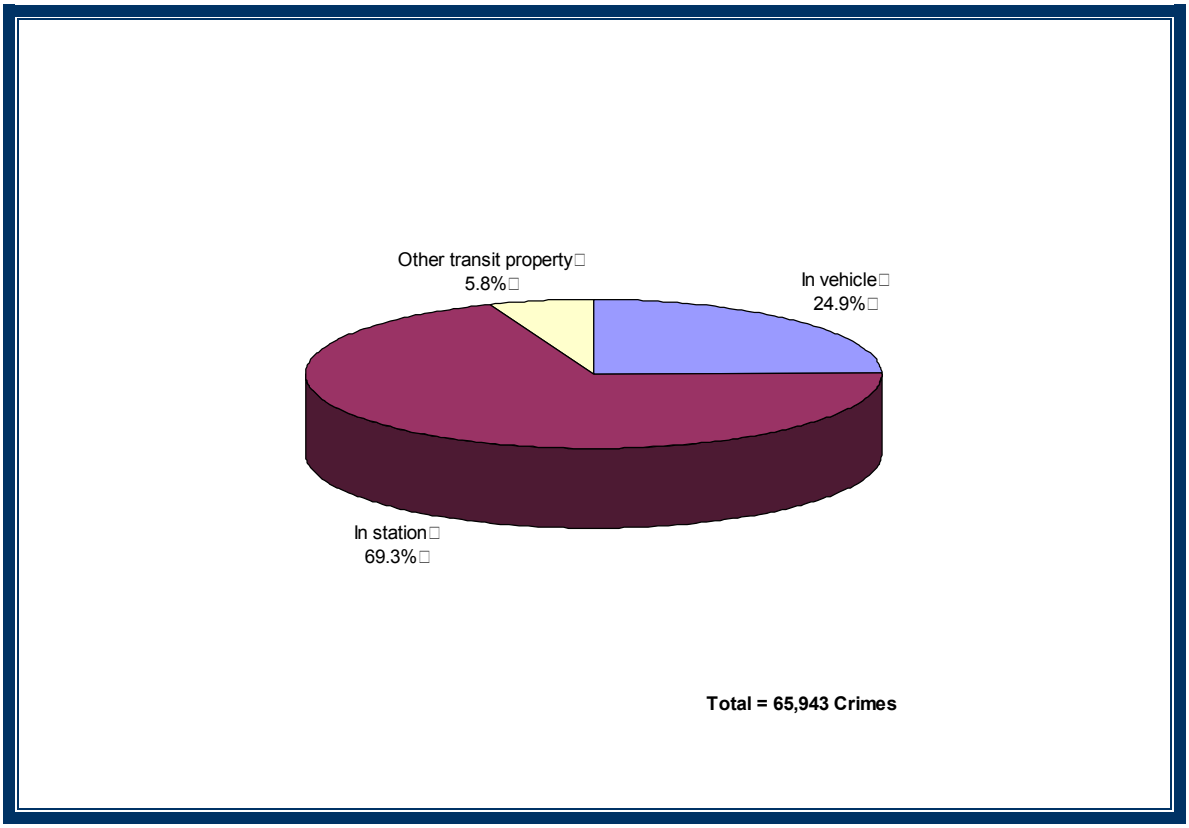


Figure 15: Rail Fixed Guideway System Property Crimes by Location, 1998

RFGS Violent Crimes

According to reported data from the affected RFGS, violent crimes occur relatively infrequently. Figure 16, Figure 17, and Figure 18 present data on RFGS violent crime. Key findings include:

- Only a small minority of crime occurring on RFGS (around five percent) is of a violent nature. Of this fraction, the most serious violent crimes (homicide and forcible rape) comprise less than one percent of the total incidents of violent crime occurring on RFGS property
- Incidents of assault on operators and passengers account for almost 43 percent of the violent crime experienced
- Robberies, the taking of items and money from victims using violence or the threat of violence, are a significant problem on RFGS, accounting for 56.5 percent of violent crimes
- Eighty percent of violent crimes occur in stations
- The location of the remainder of violent crimes is split roughly evenly between vehicles and other transit property

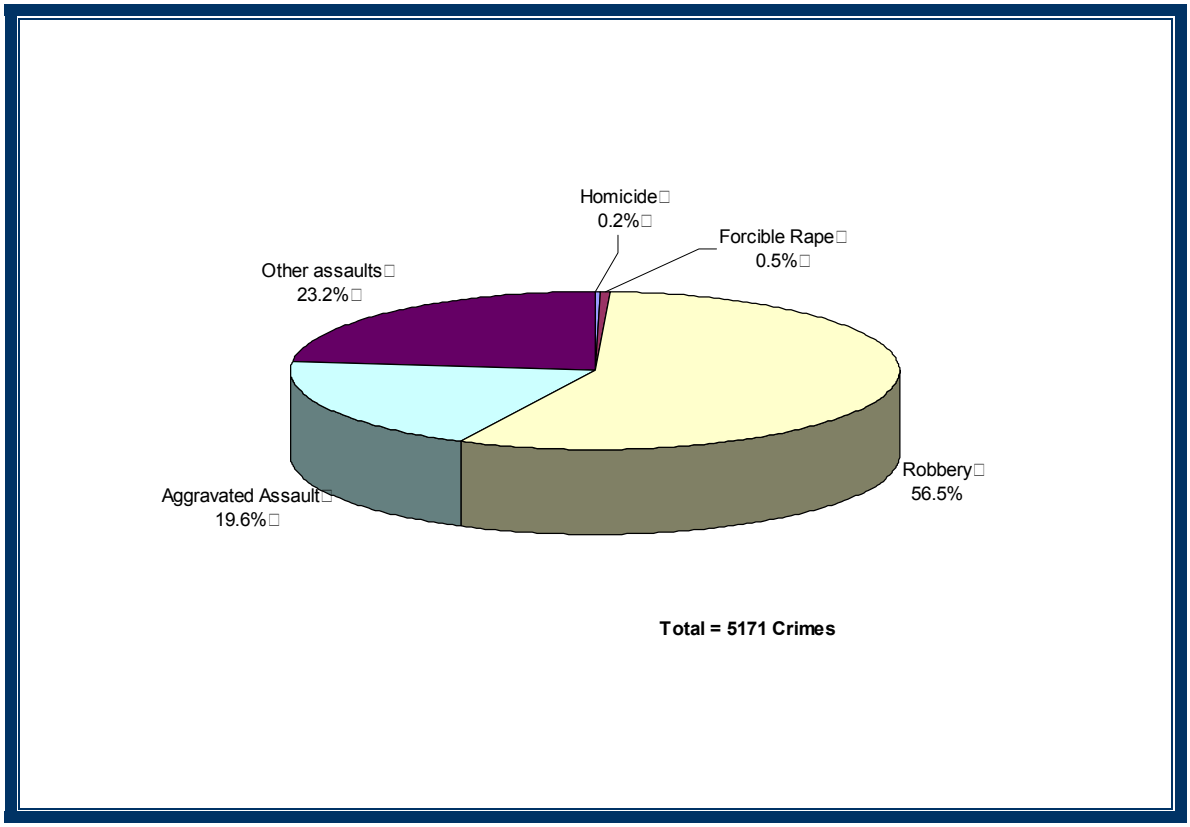


Figure 16: Rail Fixed Guideway System Violent Crimes, 1998

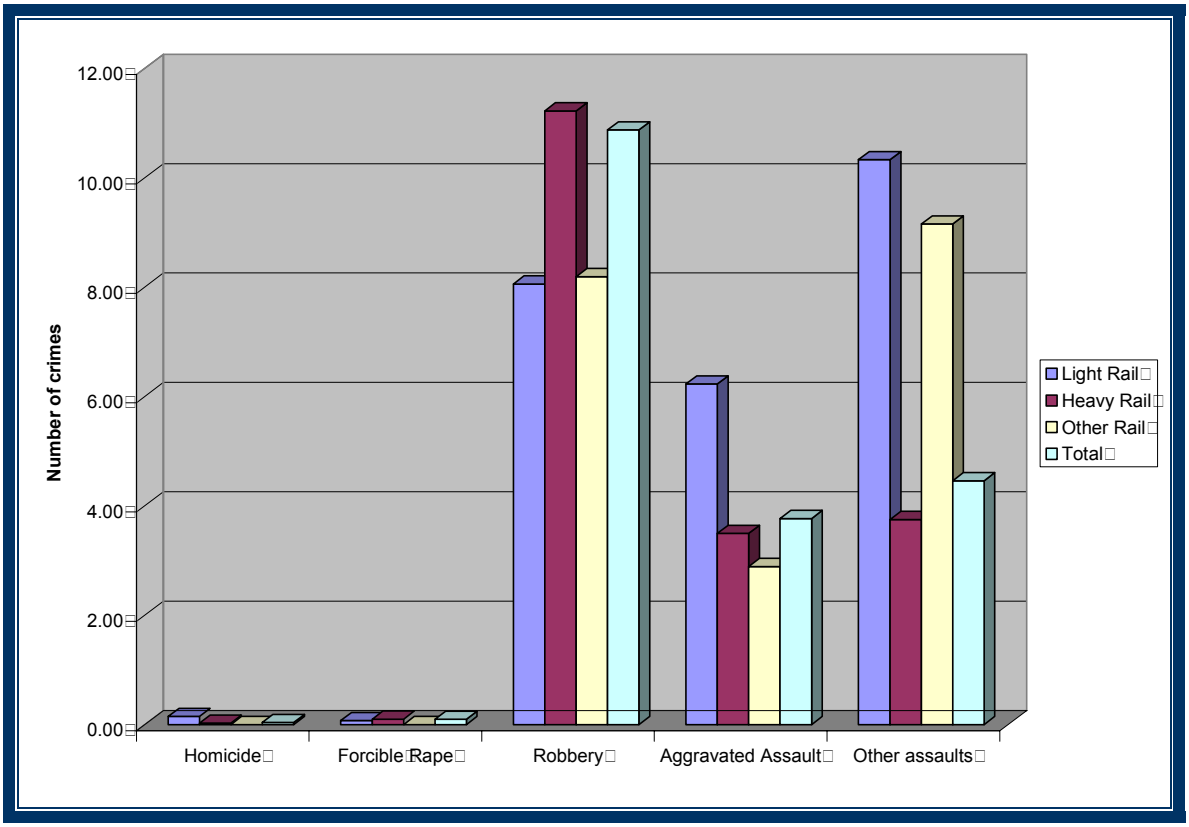


Figure 17: Rail Fixed Guideway System Violent Crimes by Mode (Per 10 Million Passenger Trips)

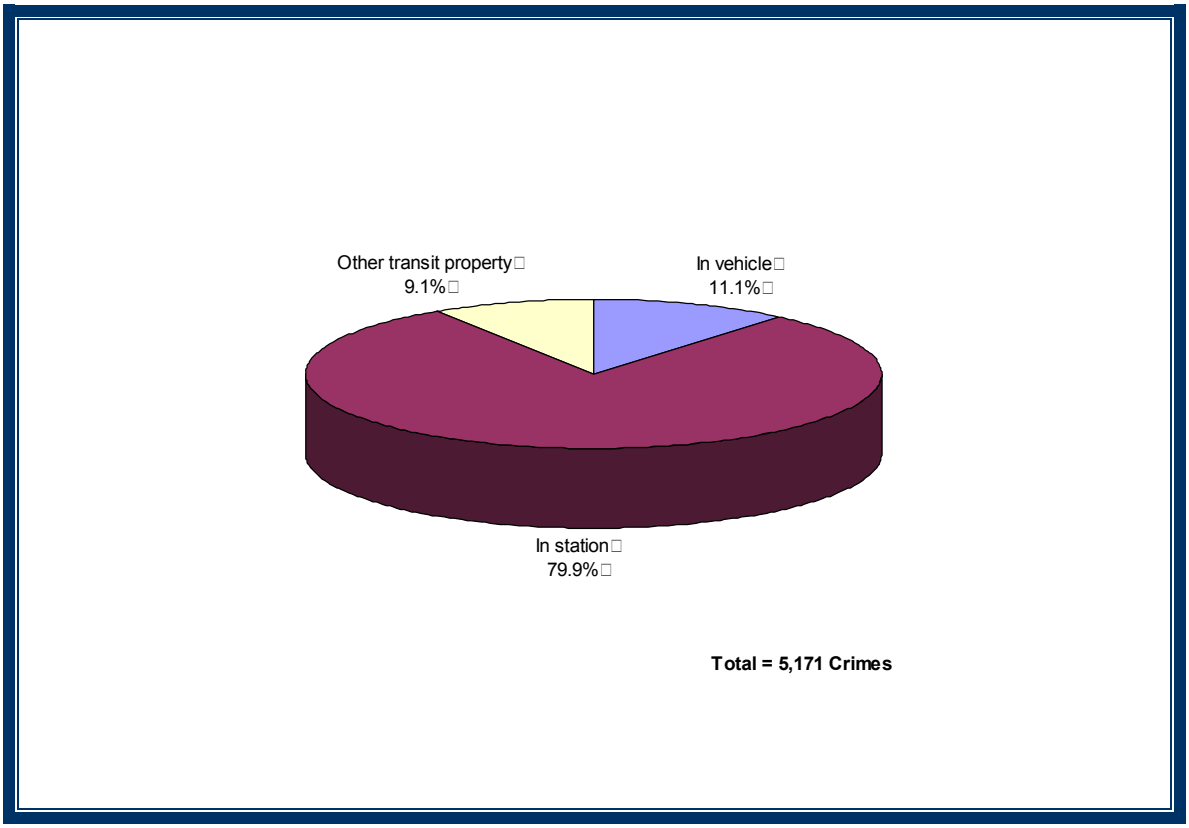
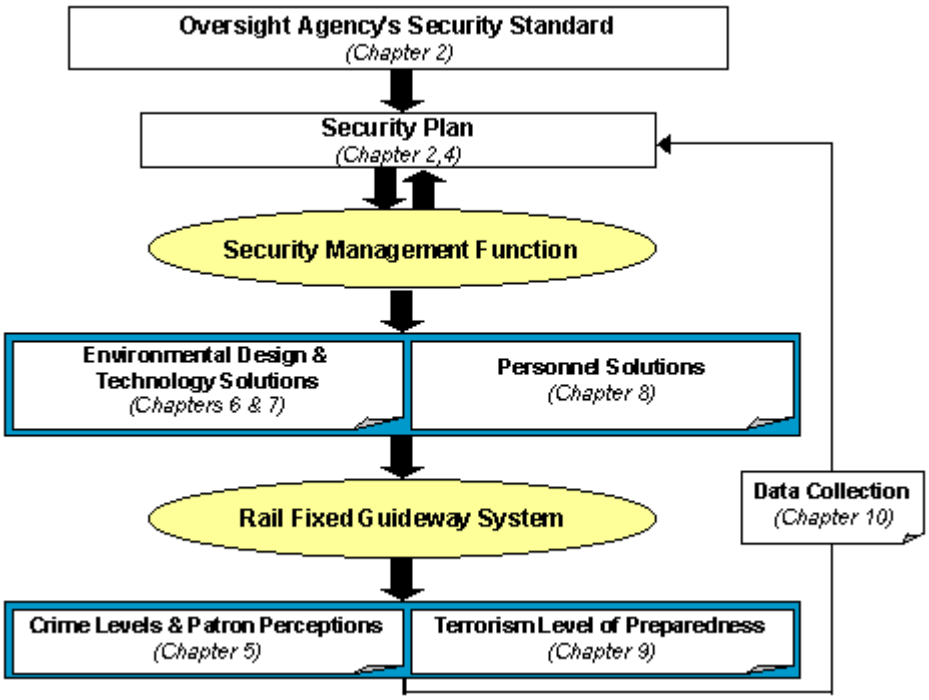


Figure 18: Rail Fixed Guideway System Violent Crimes by Location, 1998

System Security

The Oversight Agency plays a central role in ensuring the application and appropriate functioning of the system security process. An SOA's Program Standard will guide this process, requiring that system security be incorporated at each transit agency. The Security Plan, required by the Oversight Agency, should document and support implementation of a System Security Program to integrate security functions and resources into a coherent and more effective program, as well as discuss the security management function.

Oversight Agency review and approval of the Security Plan will further support efforts to enhance security coordination and to improve vital security management processes. The SOA's role in system security is outlined in the figure below. This figure has been excerpted from FTA's *Transit Security Handbook*, and identifies the management functions necessary to implement a *systems* approach to security.



Appendix A
Annual Report Template

Federal Transit Administration

State Safety Oversight Program

Annual Audit Report

DATE

Submitted by

STATE SAFETY OVERSIGHT PROGRAM DIRECTOR

STATE
ADDRESS

Federal Transit Administration

State Safety Oversight Program

Annual Audit Report

TABLE OF CONTENTS

PROGRAM MANAGEMENT
(Table 1)

Table 1: Annual Activity for Program Management	
Check If Performed	**ACTIVITY**
	Changes in Responsibility for Program (Summarize)
	Changes Made to Enabling Legislation or Internal Procedures (Summarize)
	Changes in Personnel Responsible for Program (Summarize)
	Changes in Organization or Address (Summarize)
	Use of Contractors/Contracts (Summarize)
	Other (Summarize)

Program Standard and System Safety/Security Program Plan Review and Approval (Tables 2, 3, and 4)

Table 2: Annual Activity for Program Standard and RFGS System Safety/Security Program Plans	
Check If Performed	**ACTIVITY**
	Revisions to System Safety Program Standard (Summarize)
	Activities to Review and Approve Revised RFGS System Safety Program Plans (SSPPs), including major issues requiring RFGS modification (Summarize)
	Activities to Review and Approve RFGS System Security Program Plans (Security Plans), including major issues requiring RFGS revision (Summarize)
	Other

Table 3: Chronology of System Safety Program Plan Submission and Approval				
RFGS	Date of Initial SSPP Submission to Oversight Agency	Date of Initial SSPP Approval	Date of SSPP Revisions, Submitted since Initial Approval (if applicable)	Date of Approval of Revised SSPPs (if applicable)

Table 4: Chronology of System Security Program Plan Submission and Approval				
RFGS	Date of Initial Security Plan Submission	Date of Initial Security Plan Approval	Date of Security Plan Revisions, submitted since Initial Approval (if applicable)	Date of Approval of Revised Security Plans (if applicable)

Accident and Unacceptable Hazardous Condition Investigations (Tables 5 through 12)

Table 5: Annual Activity for Accident and Unacceptable Hazardous Condition Investigations

Check If Performed	ACTIVITY
	Activities to Develop or Revise Investigation Procedures or Procedures for Requiring, Reviewing, Approving, and Monitoring Corrective Action Plans (Summarize)
	Activities to Receive Notifications and Status Reports (Summarize)
	Activities to Perform Investigations (Summarize)
	Activities to Review and Approve Investigation Reports (Summarize)
	Activities to Review and Approve Corrective Action Plans (Summarize)
	Activities to Track Implementation of Approved Corrective Action Plans (Summarize)

Table 6: Number of FTA-Reportable Accidents

RFGS	Collisions	Derailments	Rail Grade Crossings	Fires	Other

Table 7: Fatalities for FTA-Reportable Accidents

RFGS	Collisions	Derailments	Rail Grade Crossings	Fires	Other

Table 8: Injuries for FTA-Reportable Accidents

RFGS	Collisions	Derailments	Rail Grade Crossings	Fires	Other

Table 9: Property Damage for FTA-Reportable Accidents

RFGS	Collisions	Derailments	Rail Grade Crossings	Fires	Other

Cause Type	Number of Causes for FTA-Reportable Accidents
Car Equipment Failure	
Body (including doors, frame, stairs)	
Propulsion Unit (power unit failure)	
Trucks (wheel/brake failure)	
Human Failure	
Operating Rule Violation	
Operating Procedures Violations	
Drug/Alcohol Violation	
Inattentiveness	
Operations	
Crowd Control	
Improper Procedures	
Track	
Track Component Deficiency	
Track Component Failure	
Signal	
Signal Component Deficiency	
Signal Component Failure	
Cable	
Cable Component Deficiency	
Cable Component Failure	
Other Vehicle	
Passenger	
Pedestrian	
Miscellaneous (specify)	

Table 11: Number of Unacceptable Hazardous Conditions and

RFGS	No. of FTA-Reportable Unacceptable Hazardous Conditions in 1999	Probable Causes Identified

RFGS	Submitted Corrective Action Plans	Approved Corrective Action Plans	Open Corrective Action Plans

Three-Year Safety Reviews (Tables 13 and 14)

Table 13: Annual Activity for Three-Year Safety Reviews

Check If Performed	ACTIVITY
	Activities to Develop or Revise Checklists or Procedures to Conduct the Reviews (Summarize)
	Activities to Schedule the Reviews (Summarize)
	Contractor Activities for Three-Year Safety Reviews (Summarize)
	Activities to Perform the Reviews (Summarize)
	Review Findings (Summarize)
	Activities to Require Updates in the RFGS Safety/Security Plans (Summarize)
	Activities to Approve Required Updates in the RFGS Safety/Security Plans (Summarize)
	Activities to Review and Approve Corrective Action Plans (Summarize)
	Activities to Track Implementation of Approved Corrective Action Plans (Summarize)
	Planned Activities for 2000

Table 14: Corrective Action Plans Resulting from Three-Year Safety Reviews			
RFGS	**Submitted Corrective Action Plans**	**Approved Corrective Action Plans**	**Open Corrective Action Plans**

Internal Safety Audit Process (Tables 15 and 16)

Table 15: Annual Activity for Internal Safety Audit Process	
Check If Performed	**ACTIVITY**
	Activities to Develop or Revise Procedures for Requiring and Reviewing Annual Reports from the RFGS Documenting Their Internal Safety Audit Process (Summarize)
	Activities Performed by RFGS to Conduct Internal Safety Audit Process (Summarize)
	Activities Performed by State to Require Annual Report from RFGS Documenting Internal Safety Audit Process (Summarize)
	Activities Performed by State to Review Annual Report from RFGS Documenting Internal Safety Audit Process (Summarize)
	Activities Performed by State to Identify and Approve Corrective Action Plans Resulting from Internal Safety Audit Process (Summarize)
	Activities Performed by State to Monitor Implementation of Corrective Action Plans
	RFGS Planned Activities for the Year 2000 Internal Safety Audit Process

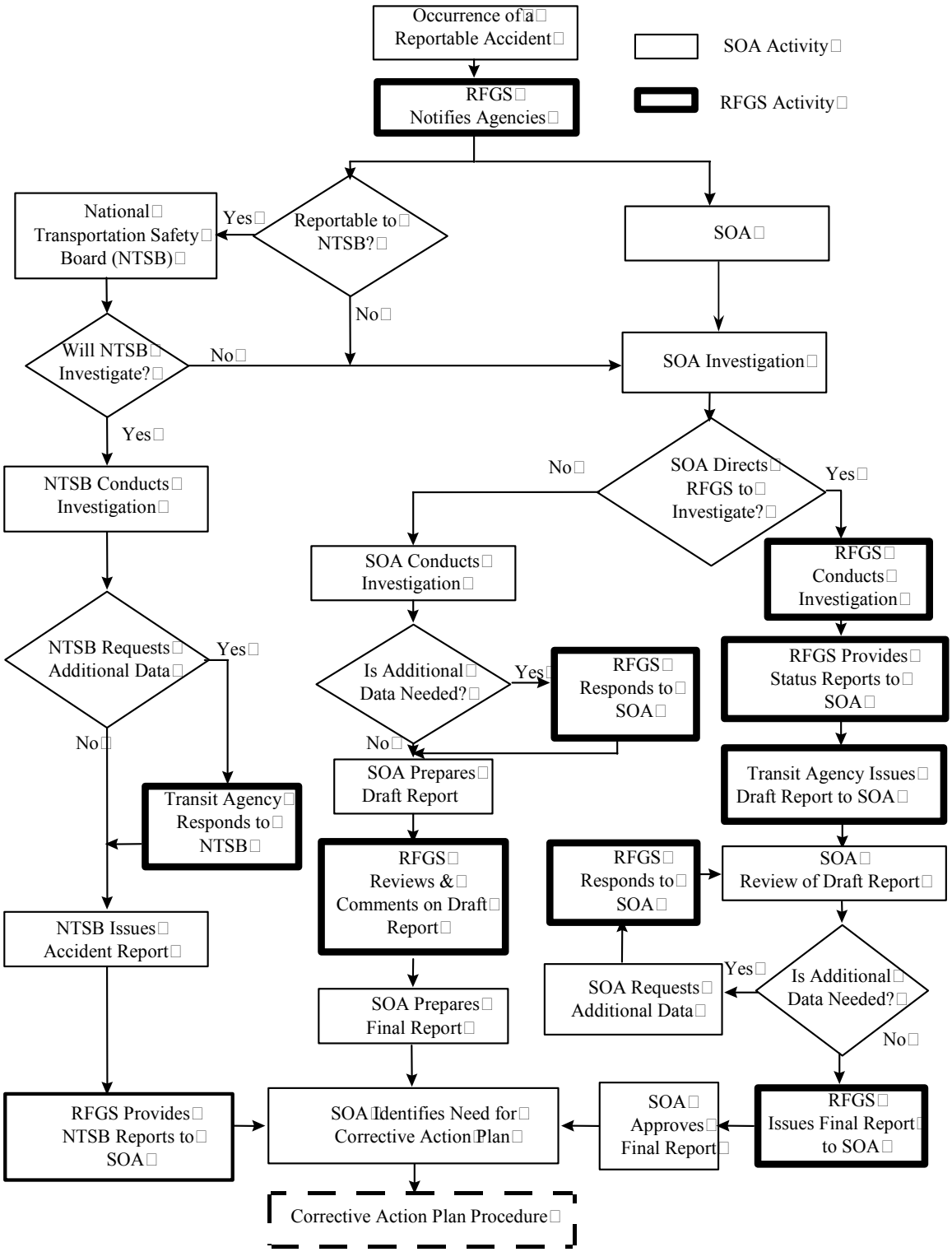
Table 16: Corrective Action Plans Resulting from Internal Safety Audit Process			
RFGS	**Submitted Corrective Action Plans**	**Approved Corrective Action Plans**	**Open Corrective Action Plans**

Reporting and Certification (Table 17)

Table 17: Annual Activity for Reporting and Certification	
Check If Performed	**ACTIVITY**
	Activities to Prepare 2000 Certification of Compliance with FTA's Rule (Summarize)
	Activities to Prepare 2000 Certification of No Conflict of Interest (Summarize)
	Activities to Prepare Annual Report (Summarize)

ATTACH: Completed Certificates and Annual Report.

Appendix B
Accident/Unacceptable Hazardous Conditions Notification Reporting Investigation



Flowchart Showing Oversight Program Accident Investigation Process

Accident and Unacceptable Hazardous Condition Notification and Reporting:

1. *A RFGS shall report accidents and unacceptable hazardous conditions to PTN within 24 hours of occurrence or discovery by telephone or facsimile (see **TxDOT/FTA/SSPP Form 1**);*
2. *TxDOT shall record and track all reportable accidents and unacceptable hazardous conditions in writing within 48 hours of occurrence or discovery (see **TxDOT/FTA/SSPP Form 2**);*
3. *A RFGS shall report accidents and unacceptable hazardous conditions in writing within 30 days of the last day of the reporting month and include a final corrective action plan (see **TxDOT/FTA/SSPP Form 3**);*
4. *A RFGS shall report accidents and unacceptable hazardous conditions in writing within 30 days of the last day of the reporting month in a summary report (see **TxDOT/FTA/SSPP Form 4**).*

These reports shall be submitted on TxDOT mandated forms according to the aforementioned procedures and deadlines either by mail or by facsimile.

Oversight Agency Contact:

The Texas Department of Transportation (TxDOT) Public Transportation Division (PTN) has been designated as the state oversight agency. Authority to oversee the safety and security of rail fixed guideway systems is contained in the Texas Administrative Code (TAC) Title 43., Part I., Chapter 31., Subchapter F – Rail Safety Oversight Program. Note that TxDOT and PTN can be used interchangeably.

<u>The mailing address is</u>:

Texas Department of Transportation
Public Transportation Division
125 East 11th Street
Austin, Texas 78701-2483

<u>The primary contact person is</u>:

Ms. Susan Hausmann
Transit System Safety Manager

512.416.2833
512.416.2830 fax
shausman@mailgw.dot.state.tx.us

TEXAS DEPARTMENT OF TRANSPORTATION PROCEDURES FOR
ACCIDENT AND UNACCEPTABLE HAZARD
INVESTIGATION, NOTIFICATION, CORRECTIVE ACTION, and TRACKING

This procedure describes the Texas Department of Transportation's (TxDOT's) program for overseeing the investigation of accidents and unacceptable hazardous conditions for each Rail Fixed Guideway System (RFGS).

The purpose of the procedure is to establish a standard set of instructions for TxDOT to follow when overseeing accident and hazard investigations to assure they are conducted in a credible manner; that contributing causes are correctly identified; and that an acceptable corrective action plan is implemented.

Each RFGS is required to investigate all accidents and unacceptable hazardous conditions reported to TxDOT. TxDOT will oversee and monitor those investigations either by going on-site to the agency or by reviewing documents submitted by the RFGS and communicating by telephone.

TxDOT shall determine if:

1. The RFGS's investigation is conducted in a credible and thorough manner;
2. All facts are gathered and analyzed properly;
3. Accurate conclusions are made;
4. Probable cause and contributing causes are correctly identified;
5. A corrective action plan is developed and implemented;
6. Corrective actions are tracked.

TEXAS DEPARTMENT OF TRANSPORTATION PROCEDURES FOR REPORTING ACCIDENTS AND UNACCEPTABLE HAZARDOUS CONDITIONS

TxDOT shall be notified either by telephone or facsimile within 24 hours of occurrence or discovery of all reportable accidents or unacceptable hazardous conditions. The information on TxDOT ***TxDOT/FTA/SSPP Form 1*** *shall be recorded by the person receiving the telephone notification or shall be faxed to PTN. The data included on* ***TxDOT/FTA/SSPP Form 1*** *includes the basic information on the accident or unacceptable hazardous condition.*

After ***TxDOT/FTA/SSPP Form 1*** *is initiated, the RFGS is required to submit a full briefing on the record of investigation activities performed, causal factors, and the corrective action plan. Based on that information and as the investigation progresses, TxDOT staff shall initiate the completion of* ***TxDOT/FTA/SSPP Form 2.*** *When all the required entries have been made, PTN shall sign the report and forward both completed forms to the appropriate file.*

TEXAS DEPARTMENT OF TRANSPORTATION PROCEDURES FOR ACCIDENT OR UNACCEPTABLE HAZARDOUS CONDITION FINAL REPORT/CORRECTIVE ACTION PLAN

All reportable accidents and unacceptable hazardous conditions, including those requiring immediate 24 hour notification by telephone or facsimile must be reported to TxDOT on ***TxDOT/FTA/SSPP Form 3****. If* ***TxDOT/FTA/SSPP Form 3****, prepared by the RFGS, is complete in all respects (causal factors, corrective action, scheduled completion dates) then the only oversight activity that must be documented on* ***TxDOT/FTA/SSPP Form 2*** *is that* ***TxDOT/FTA/SSPP Form 3*** *has been reviewed and accepted.*

If ***TxDOT/FTA/SSPP Form 3*** *is incomplete for any reason, TxDOT is responsible for overseeing the rest of the investigation and the completion of* ***TxDOT/FTA/SSPP Form 2****.*

In addition to the individual report on ***TxDOT/FTA/SSPP Form 3,*** *each RFGS is required to submit a monthly summary report on* ***TxDOT/FTA/SSPP Form 4*** *covering the accidents that occurred and the unacceptable hazardous conditions that were identified during the month.*

TxDOT/FTA/SSPP Form 3 *must be completed and submitted to TxDOT for each accident or unacceptable hazardous condition identified during the reporting month. This form is due 30 days after the end of the reporting month.*

TxDOT/FTA/SSPP Form 4 *is due 30 days after the end of the reporting month regardless of whether or not a reportable accident or unacceptable hazardous condition was identified during the month.*

TEXAS DEPARTMENT OF TRANSPORTATION – Form 1
NOTIFICATION TELEPHONE/FAX REPORT OF ACCIDENT OR UNACCEPTABLE HAZARDOUS CONDITION

ACCIDENT [ ] **UNACCEPTABLE HAZARDOUS CONDITION [ ]**

RAIL TRANSIT AGENCY:	DATE:
REPORTED BY:	
TIME REPORTED:	REPORTED TO:
PERSON ASSIGNED TO OVERSEE INVESTIGATION:	

ACCIDENT:		
DATE:	TIME:	LOCATION:
FATALITIES	INJURIES:	ESTIMATED DAMAGE: $

UNACCEPTABLE HAZARDOUS CONDITION:	
DATE:	TIME REPORTED:
BY WHOM:	PROBABILITY:
SEVERITY:	HOW IDENTIFIED:

BRIEF DESCRIPTION OF THE ACCIDENT OR UNACCEPTABLE HAZARDOUS CONDITION:
PREPARED BY:

TEXAS DEPARTMENT OF TRANSPORTATION – Form 2
ACCIDENT /UNACCEPTABLE HAZARDOUS CONDITION TRANSIT AGENCY INVESTIGATION REPORT

ACCIDENT [ ] **UNACCEPTABLE HAZARDOUS CONDITION [ ]**

RAIL TRANSIT AGENCY:	DATE OF OCCURRENCE:

RECORD OF INVESTIGATION ACTIVITIES PERFORMED AND RESULTS:	
DATE	ACTIVITIES AND RESULTS

CAUSAL FACTORS:

CORRECTIVE ACTION PLAN AND SCHEDULE:	
SCHEDULED COMPLETION DATE:	ACTIVITY:
PREPARED BY:	DATE:

TEXAS DEPARTMENT OF TRANSPORTATION – Form 3
ACCIDENT OR UNACCEPTABLE HAZARDOUS CONDITION
FINAL REPORT/CORRECTIVE ACTION PLAN

ACCIDENT [ ] **UNACCEPTABLE HAZARDOUS CONDITION [ ]**

RAIL TRANSIT AGENCY:	DATE:

ACCIDENT:		
DATE:	TIME:	LOCATION:
FATALITIES	INJURIES:	ESTIMATED DAMAGE: $
TYPE OF ACCIDENT:		

UNACCEPTABLE HAZARDOUS CONDITION:	
DATE AND TIME IDENTIFIED:	HOW IDENTIFIED:
TYPE OF HAZARDOUS CONDITION:	
LOCATION:	
WHO IDENTIFIED:	
SEVERITY:	PROBABILITY:

DESCRIPTION OF THE ACCIDENT OR UNACCEPTABLE HAZARDOUS CONDITION:

DIAGRAMMATIC SKETCH OF THE ACCIDENT AREA OR UNACCEPTABLE HAZARDOUS CONDITION:

CAUSAL FACTORS

CORRECTIVE ACTION PLAN AND SCHEDULE:	
SCHEDULED COMPLETION DATE:	ACTIVITY:
PREPARED BY:	DATE:

TEXAS DEPARTMENT OF TRANSPORTATION – Form 4
ACCIDENT AND UNACCEPTABLE HAZARDOUS CONDITION MONTHLY SUMMARY REPORT

RAIL TRANSIT AGENCY:	FOR THE MONTH OF:	YEAR:

ACCIDENT SUMMARY:

TYPE OF ACCIDENT	NUMBER OF OCCURRENCES	INJURIES		FATALITIES	
		Employees	Others	Employees	Others
Derailment, Main					
Derailment, Yard					
Collision at Gated Crossing					
Collision at Non-Gated Crossing					
Collision, Rail Transit					
Collision with Person on Platform					
Collision with Person, Other					
Other Accident Not Included Above					
TOTALS					

NUMBER OF UNACCEPTABLE HAZARDOUS CONDITIONS IDENTIFIED:

I certify to the best of my knowledge and belief this report is true and correct and contains all accidents that occurred and all unacceptable hazardous conditions that were identified during the month stated.

SIGNATURE:	
TITLE:	DATE:

Appendix C
Corrective Action Plans

Corrective Action Plans

A. Requirements

UDOT has established procedures to review and implement corrective action plans.

B. Objective

The objective of this procedure[1] is to ensure that corrective action plans are developed and implemented for deficiencies identified as a result of the safety oversight program. Deficiencies may range in seriousness from a finding in a safety review regarding the implementation of the SSPP to a finding in an accident investigation of an unacceptable hazardous condition.

C. Corrective Action Plan Procedures

Corrective action plans are required for deficiencies identified through the on-site safety review, accident and unacceptable hazardous condition (UHC) investigations, the annual safety audit, or other means by which a hazardous condition may be brought to the attention of UDOT. The flowchart in Figure 7 illustrates the corrective action plan process.

1. UDOT will inform the transit agency in writing when a deficiency is identified for which a corrective action plan must be prepared. The notification requiring the transit agency to develop a corrective action plan and the time frame for the development of a corrective action plan depends on the deficiency identified:

    a. On-Site Safety Review.
    Upon notification of the findings of the final report, or receipt of the final report, the transit agency will have 30 work days to develop a plan of action or methodology to correct identified deficiencies.

    b. Accident Investigations.
    Regardless of which agency conducts the accident investigation process (the transit agency or UDOT directly), the final report must contain findings and recommendations for addressing deficiencies or unsafe conditions identified during the process. The resolution of these deficiencies will be the primary responsibility of the transit agency, with assistance provided by UDOT, as may be required. Upon receipt of the final report, the transit agency will have 30 days to develop a plan of action or methodology to correct identified deficiencies.

    c. Hazardous Conditions.
    Regardless of which agency conducts the unacceptable hazardous condition investigation process (the transit agency or UDOT directly), the final report must contain findings and recommendations for addressing deficiencies. The resolution of these deficiencies will be the primary responsibility of the transit agency, with assistance provided by UDOT, as may be required. Upon receipt of

[1] This procedure is adopted to comply with 49 CFR Part 659, Subpart C, § 659.43.

the final report, the transit agency will have 30 work days to develop a plan of action or methodology to correct identified deficiencies.

d. Annual Safety Audit.
If UDOT rejects the annual safety audit report, the transit agency will have 20 work days to develop a plan of action or methodology to correct identified deficiencies.

e. Other.
In the course of performing or reviewing on-site safety reviews, investigations, annual safety audits, or any other means by which UDOT becomes aware of a hazardous condition that requires immediate attention, the UDOT will notify the transit agency in writing of the identified hazardous condition and direct the transit agency to prepare a corrective action plan.

2. This plan of action must include the following information:

   a. Identify noted deficiency
   b. Process, plan, or mechanism to address and resolve deficiency
   c. Time-frame for implementation of plan of action
   d. Department(s) and person(s) who will be responsible for implementation
   e. Cost of resolving deficiency
   f. Other critical information

3. The plan of action will be forwarded to UDOT for approval. UDOT will notify the transit agency in writing of its acceptance or rejection of the plan of action within 15 work days, after receipt of the plan.

4. If UDOT approves the corrective plan, it will notify the transit agency. The transit agency may be required to re-evaluate that aspect of its audit process which was found to be deficient. UDOT, at its discretion, may schedule a follow-up on-site review to evaluate the status and appropriateness of the implemented corrective action plan. UDOT will continue to monitor the status of the corrective action plan as part of its continuous review program. This monitoring will include on-site reviews if required.

5. If UDOT rejects the corrective plan, the transit agency will have 15 work days to address noted deficiencies in the plan, and submit a revised plan to UDOT. UDOT, at its discretion, may arrange for a meeting with the transit agency to discuss the noted deficiencies.

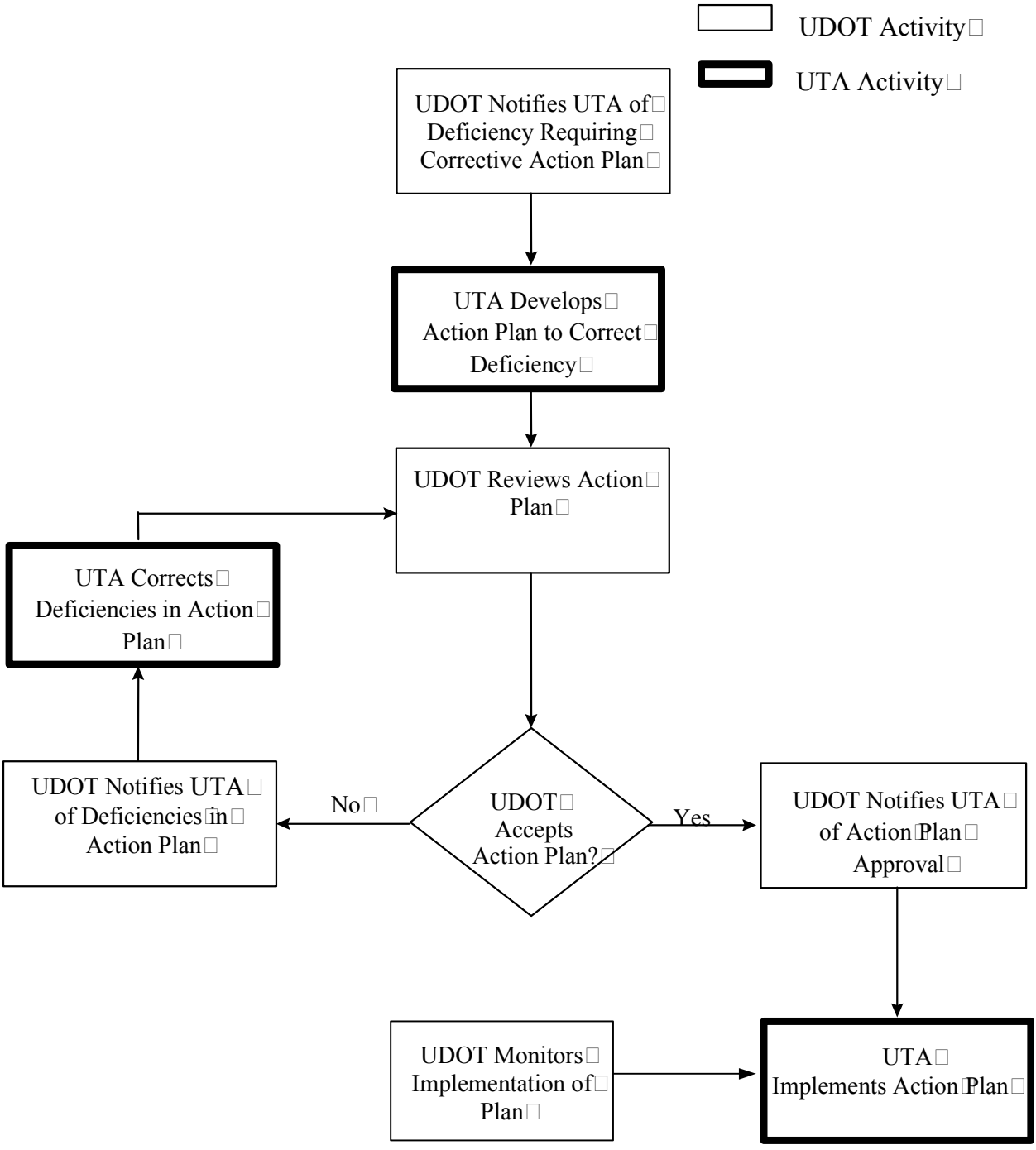


Figure 7. Flowchart Showing Corrective Action Plan

Appendix D
Hazard Analysis

SAMPLE
Light Rail Preliminary Hazard Analysis (PHA)
For Service on Shared Use Track

System: Track – Shared Use Issues	**Preliminary Hazard Analysis Shared Use Track Issues and Resolution**	Prepared by: Joe Safety
PHA No.: 1		Reviewed by: Sam Safety Manager
		Approved by: Donald Safety Director
Rev No. 1		Date: 6/16/00

General Description		**Hazard Effect**	**Hazard Risk Index**	**Corrective Action**	
No.	Hazard Description	Effect on Subsystem/ System		Possible Controlling Measures and Remarks	Resolution
1	Train movements occur which place a light rail train and a freight rail train on the same track	Potential for train collision and/or derailment. Potential for serious injury/death to passengers and employees. Track/property damage. Service interruption.	I/C	**TEMPORAL SEPARATION** on shared use track, ensuring strict segregation of light rail and freight rail operations by time of day so that the two types of equipment never share the same track at the same time. Wherever possible, temporal separation should be supported by physical means of separation, including proper control of switches and derails. Light rail automatic train control; Freight rail automatic train control, block signal system, or train orders. Hours of service rules and dispatcher's record of train movement.	Verify during design reviews and FRA waiver process.

General Description		Hazard Effect	Hazard Risk Index	Corrective Action	
No.	Hazard Description	Effect on Subsystem/ System		Possible Controlling Measures and Remarks	Resolution
2	DURING CONDITION OF TEMPORAL SEPARATION -- Signal or track system failure occurs during light rail operations and is not communicated to freight rail operations.	Potential for train collision and/or derailment. Potential for serious injury/death to passengers and employees. Track/property damage. Service interruption.	I/C	Joint implementation of FRA Rules (49 CFR Part 233); jointly developed reporting procedures and requirements; operations and dispatcher training and forms; communications systems and protocols. Human factors engineering in light rail Control Center and console design. Computer-aided dispatch technology. Appropriately trained and qualified light rail dispatchers.	Verify during design reviews and FRA waiver process.
3	DURING CONDITION OF TEMPORAL SEPARATION -- Signal or track system failure occurs during freight rail operations and is not communicated to light rail operations.	Potential for train collision and/or derailment. Potential for serious injury/death to passengers and employees. Track/property damage. Service interruption.	I/C	Joint implementation of FRA Rules (49 CFR Part 233); jointly developed reporting procedures and requirements; operations and dispatcher training and forms; communications systems and protocols. Human factors engineering in light rail Control Center and console design. Computer-aided dispatch technology. Appropriately trained and qualified light rail dispatchers.	Verify during design reviews and FRA waiver process.
4	DURING CONDITION OF TEMPORAL SEPARATION --Roadway workers perform maintenance on track or signal systems, undetected by light rail operations	Potential for roadway worker injury/death. Track/property damage. Service interruption.	I/C	FRA Rules (49 CFR Parts 214, 217, and 218). OSHA standards. Training and track safety certification. Jointly developed and agreed upon procedures for worker safety and communications. Flagging and signal restrictions. Dispatcher procedures and training.	Verify during design reviews and FRA waiver process.

General Description		Hazard Effect	Hazard Risk Index	Corrective Action	
No.	Hazard Description	Effect on Subsystem/ System		Possible Controlling Measures and Remarks	Resolution
5	DURING CONDITION OF TEMPORAL SEPARATION -- Track inspections are being performed by freight rail operator, with responsibility for maintenance, undetected by light rail operations	Potential for inspector injury/death. Track/property damage. Service interruption.	I/C	FRA Rules (49 CFR Parts 214, 217, and 218). OSHA standards. Training and track safety certification. Jointly developed and agreed upon procedures for worker safety and communications. Flagging and signal restrictions. Dispatcher procedures and training.	Verify during design reviews and FRA waiver process.
6	DURING CONDITION OF TEMPORAL SEPARATION -- Grade crossing warning devices inoperative due to train approach detection failure, damage/broken gate, or loss of power. Failure occurs during light rail operations and is not communicated to freight rail operations	Potential for serious injury/death to passengers and employees due to train/motor vehicle collision resulting in derailment. Potential serious injury/death to person(s) being struck by train.	I/C	Crossing warning indications will be available to light rail operators if gates are not closed, requiring stopping the train. Light rail operations must report failures according to FRA regulations (49 CFR Part 234). Joint policies and procedures for communicating failures between light rail and freight rail operations; training and forms; communications equipment.	Verify during design reviews and FRA waiver process.

General Description		Hazard Effect	Hazard Risk Index	Corrective Action	
No.	Hazard Description	Effect on Subsystem/ System		Possible Controlling Measures and Remarks	Resolution
7	DURING CONDITION OF TEMPORAL SEPARATION --Ineffective and/or incorrect information provided to light rail or freight rail operations due to confusion or misinterpretation of instructions by dispatcher.	Potential for delay in response to light rail/freight rail operations under abnormal or emergency conditions. Incorrect train routing or movement. Potential for serious injur/death to passengers and employees due to derailment/collision as a result of incorrect route setting. Property damage and service interruption.	I/C	Information displayed in light rail Control Center consoles will be logical and structured to indicate messages according to priorities. Information will be categorized into specific groups to enhance dispatch efficiency. Human factors engineering will be implemented in Control Center design. Procedures will be developed for managing communications with freight rail operations. Dispatchers will be trained and qualified.	Verify during design reviews and FRA waiver process.
8	DURING CONDITION OF TEMPORAL SEPARATION --Loss of emergency phone service along alignment, due to component failure, improper use or vandalism.	Unable to secure aid for victim of accident/assault. Unable to report suspicious activities. Unable to report emergency.	II/D	Phone units will use redundant internal components to minimize outages. Reporting and maintenance procedures and training for shared equipment.	Verify during design reviews and FRA waiver process.
9	DURING CONDITION OF TEMPORAL SEPARATION – Bomb threat received by light rail operation, not communicated to freight rail operation	Service interruption. Passenger and employee fear. Potential for death and injury; property damage.	III/C	Access control and intrusion detection measures for safety critical facilities. Policies and procedures for evaluating threats and communicating them with freight rail operations and local authorities. Search and evacuation procedures. Emergency communications systems. Appropriately trained and qualified personnel.	Verify during design reviews and FRA waiver process.

General Description		Hazard Effect	Hazard Risk Index	Corrective Action	
No.	Hazard Description	Effect on Subsystem/ System		Possible Controlling Measures and Remarks	Resolution
10	DURING CONDITION OF TEMPORAL SEPARATION – Adverse weather conditions force detour of freight rail train on shared use track during light rail operations.	Potential injury/death due to train collision/derailment. Property damage. Service interruption.	III/C	Emergency operations plan, policies and procedures. Automatic train control, block signal detection and intrusion detection for light rail operation. Redundant communications system between light rail and freight rail operations. Trained and qualified dispatchers.	Verify during design reviews and FRA waiver process.

Appendix E
SSPP Review and Approval Checklist

CPUC CHECKLIST FOR REVIEW OF SYSTEM SAFETY PROGRAM PLANS

(Excluding the Security Portion of the SSPP, which is covered by separate checklist)

Transit Agency: _____ **Submittal Date:** _____

Plan Title: _____ **Rev. No.** ____ **Plan Date:** _____

The System Safety Plan is:

____ Acceptable ____ Unacceptable, Revise and Resubmit

Reviewed by: _____ **Date:** _____

Chk No.	SSPP Requirements	Included Y	Included N	Page Ref.	Comments
1	Policy Statement and Authority for System Safety Program Plan • Approval of the SSPP by the CEO or Board • Authority of the Transit Agency • Authority of the System Safety Program Plan				
2	Description of Purpose for System Safety Program Plan • Purpose of the SSPP • System Safety Definitions				
3	Clearly Stated Goals for System Safety Program Plans • A list of goals that are long term, meaningful, and realizable				
4	Identifiable and Attainable Objectives • A list of objectives that are quantifiable and achievable through the implementation of various management policies				
5	System Description / Organizational Structure • A description of the system • Organization charts that show the lines of authority and responsibility for operations, maintenance, engineering, system safety, and security				
6	System Safety Program Plan Control and Update Procedure • Frequency of review of SSPP • Procedure and responsibilities for reviewing and updating SSPP, including submittal for CPUC approval				
7	Hazard Identification / Resolution Process • Identification of departments involved, including their roles and responsibilities • Hazard identification methodology • Hazard analysis and resolution matrix				

8	Accident / Incident Reporting & Investigation
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Policy regarding which accidents/incidents will be investigated
	  • Procedure for conducting investigations
	  • Notification and reporting requirements to the CPUC and other external agencies				

9	Internal Safety Audit Process • Audit responsibilities and authority • Audit Process • Audit Reporting Requirements - see CPUC RTSS-5 Checklist requirements				

10	Facilities Inspections
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Inventory of facilities with safety-related characteristics
	  • Frequency of inspections
	  • Methods for tracking and resolving problems identified				

11	Maintenance Audits / Inspections
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Procedures, manuals, and forms used
	  • Records maintained
	  • Methods for tracking and resolving problems identified				

12	Rules / Procedures Review (O & M)
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Description of the purpose and function of various rule/ procedure instruments such as bulletins, special notices, etc.
	  • Process for reviewing and modifying rules and procedures
	  • Monitoring and enforcement of rules and procedures (written examinations, field observations, audits)				

13	Training and Certification Review / Audit (O & M)
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Description of training programs, including frequency of refresher training
	  • Description of certification requirements and records				

14	Emergency Response Planning, Coordination, Training
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Periodic, scheduled meetings, emergency drills, and other contact with outside agencies
	  • Purpose and scope of the Emergency Response Plan or procedures				

15	System Modification Review / Approval Process
	Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Hazard Analyses
	  • Safety Certification Process
	  • hazards worked into Hazard Resolution Process
	  • testing, verification, and validation
	  • exceptions and work-arounds only when absolutely necessary and only when approved by levels of top management
	  • sign-off and other accountability requirements
	  • inclusion of organizational entities, including operating and safety departments				

16	Safety Data Acquisition / Analysis • Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes • Acquisition of data, analysis of data, uses of data				
17	Interdepartmental / Interagency Coordination • Description of the process for coordinating activities and exchanging information between various internal departments and external agencies				

18	Configuration Management
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Process and authority for configuration design modifications to existing facilities and equipment
	  • Process for transferal of documentation (as-builts) for new facilities and equipment at the completion of a project from the contractors to the transit agency
	  • Control, storage, and retrieval of documentation (plans, drawings, specification, etc.)				

19	Employee Safety Program • Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes • Description of state and federal requirements				
20	Hazardous Material Programs • Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes • Identification of state and federal regulations that must be followed				

21	Drug and Alcohol Abuse Programs
	• Identification of all departments covered by this element, and identification of each department's commitment to safety, including roles, responsibilities, and implementation methods or processes
	  • Reference to federal DOT requirements
	  • Description of the program including policies adopted, procedures uses, etc.
	  • List of safety sensitive positions, including security				

22	Contractor Safety Coordination • Safety requirements that contractors must follow when working on, or in close proximity to, the transit agency's property				
23	Procurement • Measures and controls in place for the procurement of hazardous materials • Measures and controls to prevent procurement of defective or deficient materials and equipment • Specialty items requiring safety review				

Appendix F
Internal Safety Audit Process

CHECKLIST NO.		**AUDIT DATE**		INTERVIEWS CONDUCTED:
DEPARTMENT:		AUDITORS:		
AUDIT CATEGORY:		INSPECTIONS & OBSERVATIONS CONDUCTED:		
REFERENCE CRITERIA				

METHOD OF VERIFICATION

INTERNAL SAFETY AUDIT CHECKLIST NO. _____	DATE:_____	AUDITOR(S):
DEPARTMENT:_____ CATEGORY:_____	COLUMN DEFINITIONS: 1 – Meets Plan Requirements 2 – Meets Plan Requirements with Comments 3 – Needs Improvement (See Comments) 4 – Not Audited (See Comments)	

ITEM	ITEM DESCRIPTION	1	2	3	4	COMMENTS

RESULTS AND SUPPLEMENTAL COMMENTS
RECOMMENDATIONS
CORRECTIVE ACTIONS
IMPLEMENTATION SCHEDULE AND RESPONSIBILITY FOR RECCOMENDATIONS AND CORRECTIVE ACTIONS

CHECKLIST NO.	1	**AUDIT DATE**	12-8-99	INTERVIEWS CONDUCTED: Tom Transit Roy Rail Sammy Supervisor Orin Operator Danny Dispatcher
DEPARTMENT: **Transportation**		AUDITORS: Joe Smith Jane Doe		
AUDIT CATEGORY: Rules/Procedures Review		INSPECTIONS & OBSERVATIONS CONDUCTED: Observed Dispatchers Observed Yard Supervisor Spot-check Review -- Qualification Exam Records		

REFERENCE CRITERIA

System Safety Program Plan, dated July 18, 1999
- Section 6.1 – Rules and Instructions for Employees
- Section 6.2 – Rules for Employees
- Section 6.3 – Standard Operating Procedures

Transportation Standard Operating Procedures, dated October 10, 1997
Train Operator Recertification Program, dated January 3, 1998
Central Control Operations/Training Manual, dated September 5, 1998
Controller/Supervisor Qualification Exam, dated March 1998
Line Supervisor Recertification Program, dated February 1997
Yard Supervisor Qualification Exam, dated July 16, 1997
Line Supervisor Qualification Exam, dated March 4, 1998

METHOD OF VERIFICATION

Reviewed the current Transportation Standard Operating Procedures Recertification Programs and Qualifications Exams of the Transportation Department to determine whether or not:

(1) The SOPs reflect the operating characteristics of the current system
(2) Other departments referenced on certain SOPs (for distribution) have received current copies
(3) Bulletins and updates have been properly distributed
(4) Qualification Exams reflect SOPs
(5) Dispatchers and supervisors are knowledgeable concerning SOPs

ISAP CHECKLIST NO. 1		**DATE**:12-8-99				**AUDITOR(S)**: Joe Smith Jane Doe
DEPARTMENT: Transportation CATEGORY: Rules/Procedures Review		COLUMN DEFINITIONS: 1 – Meets Plan Requirements 2 – Meets Plan Requirements with Comments 3 – Needs Improvement (See Comments) 4 – Not Audited (See Comments)				
ITEM	**ITEM DESCRIPTION**	**1**	**2**	**3**	**4**	**COMMENTS**
1	Transportation SOPs		**X**			Update Forms and SOPs (101, 102, 105, 107, and 110) to reflect new department names Update Contact Names and numbers (102)
2	Train Operator Recertification Program		**X**			Update Yard Diagram Schematic
3	Central Control Operations/Training Manual			**X**		Update Emergency Call List Update Forms (101, 102, 105, 107, & 110)
4	Controller/Supervisor Qualification Exam	**X**				No changes needed.
5	Line Supervisor Recertification Program		**X**			Update Forms (101, 102, 105, 107, & 110) Update Yard Diagram Schematic Update Bulletin 97-4
6	Yard Supervisor Qualification Exam		**X**			Update exam questions to reflect new department names
7	Line Supervisor Qualification Exam		**X**			Same as above

RESULTS AND SUPPLEMENTAL COMMENTS

All Items require the update of Forms, Exams, and SOPs to reflect new department names.

Yard Diagram Schematic must be updated.

Interviewed personnel were knowledgeable in agency SOPs.

SOPs had been effectively distributed to appropriate departments.

Updates and bulletins were distributed and read.

Qualification Exams were administered appropriately and reflected agency SOPs.

RECOMMENDATIONS

R1 – Update Forms 101, 102, 105, 107, and 110

R2 – Update SOPs and Exam Questions to reflect new department names

R3 – Update contact names and numbers

R4 – Update Yard Diagram Schematic

R5 – Update Bulletin 97-4

CORRECTIVE ACTIONS

CA1 -- Update Emergency Contact List

IMPLEMENTATION SCHEDULE AND RESPONSIBILITY FOR RECCOMENDATIONS AND CORRECTIVE ACTIONS

Emergency Contact list will be updated by the Yard Supervisor by 1-15-00.

All other updates will be performed during the SOP/Exam semi-annual review. Th Safety Director will work the Superintendent of Transportation to ensure that these updates are completed by 7-15-00.

RTSS - 5

PROCEDURE FOR OVERSEEING TRANSIT AGENCY INTERNAL AUDITS AND FOR REVIEWING ANNUAL INTERNAL AUDIT REPORTS

1.0 SCOPE

This procedure describes the Rail Transit Safety Section's (RTSS) program for overseeing transit agency internal audits and for reviewing annual internal audit reports submitted to the Commission.

2.0 PURPOSE

The purpose of this procedure is to establish a standard set of instructions for RTSS staff to follow when witnessing internal audits and reviewing annual internal audit reports.

3.0 REQUIREMENTS

3.1 The Manager of the RTSS has overall responsibility for the application and use of this procedure.

3.2 Each rail transit agency is required by General Order 164 to conduct annual internal audits, to inform the Commission staff prior to the start of each audit, and to submit annual internal audit reports to the Commission. The scope of each transit agency's internal audit program must include system safety elements relevant to internal audits as described in the APTA Guidelines. A full cycle of the internal audit program must be completed once every three years, with a portion of the full cycle completed each year.

3.3 The attached checklist (CPUC checklist) provides a list of requirements for the annual internal audit reports. See Attachment 1. The designated RTSS Representative shall witness transit agency internal audit activities, in whole or on a sample basis, and will monitor the internal audit program.

3.4 Each transit agency's Annual Internal Audit Report (in final form) is required to be submitted to the Commission staff by February 15th of each year. Prior to the submittal date, the designated RTSS Representative shall request to review the transit agency's draft internal audit report. The designated RTSS Representative will evaluate the report using the CPUC checklist, will inform the

transit agency if there are any areas that require the internal audit report to be corrected (internal audit report deficiencies), and will try to facilitate the completion of the final audit report by the submittal date.

3.5 Copies of completed CPUC checklists will be included in the CPUC's annual report to the FTA, along with a description of any internal audit report deficiencies that were not corrected by the submittal date of February 15th.

ATTACHMENT 1

CPUC CHECKLIST FOR REVIEW OF ANNUAL INTERNAL AUDIT REPORTS

Transit Agency	Submittal Date	Reviewer	Review Date

No.	Item Description	1	2	3	Comments
1	The report is an official document issued under the signature of the General Manager or other prominent authority within the organization.				
2	The report has been appropriately distributed to the General Manager and pertinent department managers.				
3	The report contains a statement establishing the authority of the unit-in-charge of conducting the audit.				
4	The report shows that the unit-in-charge of conducting the audit is independent from the units that were audited.				
5	The report describes the administrative process to deal with problems and disagreements regarding audit findings, recommendations, and corrective action plans.				
6	A table is included in the report that identifies the scope of the complete internal audit program conducted on a 3-yearly basis. This table needs to list system safety elements relevant to internal audits as described in the APTA Guidelines, and for each system safety element, it needs to list the departments covered by the internal audit program.				
7	A table is included in the report that identifies the portion of the internal audit program covered in the subject annual report. (i.e. a subset of the table addressed in No. 6 above)				
8	Consistent checklists were prepared in advance, were used throughout the audit, and are included in the report.				
9	Each checklist includes the method of verification, results of the audit activity, and recommendations if applicable.				
10	The report describes the method used to develop corrective action plans and schedules to address audit recommendations, including identification of the department(s) responsible.				
11	The report describes the method used to track corrective action plans through implementation, including identification of the department(s) responsible.				
12	The report addresses the adequacy and effectiveness of the SSPP.				

Column Definitions: **1 - Satisfactory**
2 - Improvement Needed in all Subsequent Audit Activities and Reports
3 - Unacceptable - Report Must be Corrected and Resubmitted