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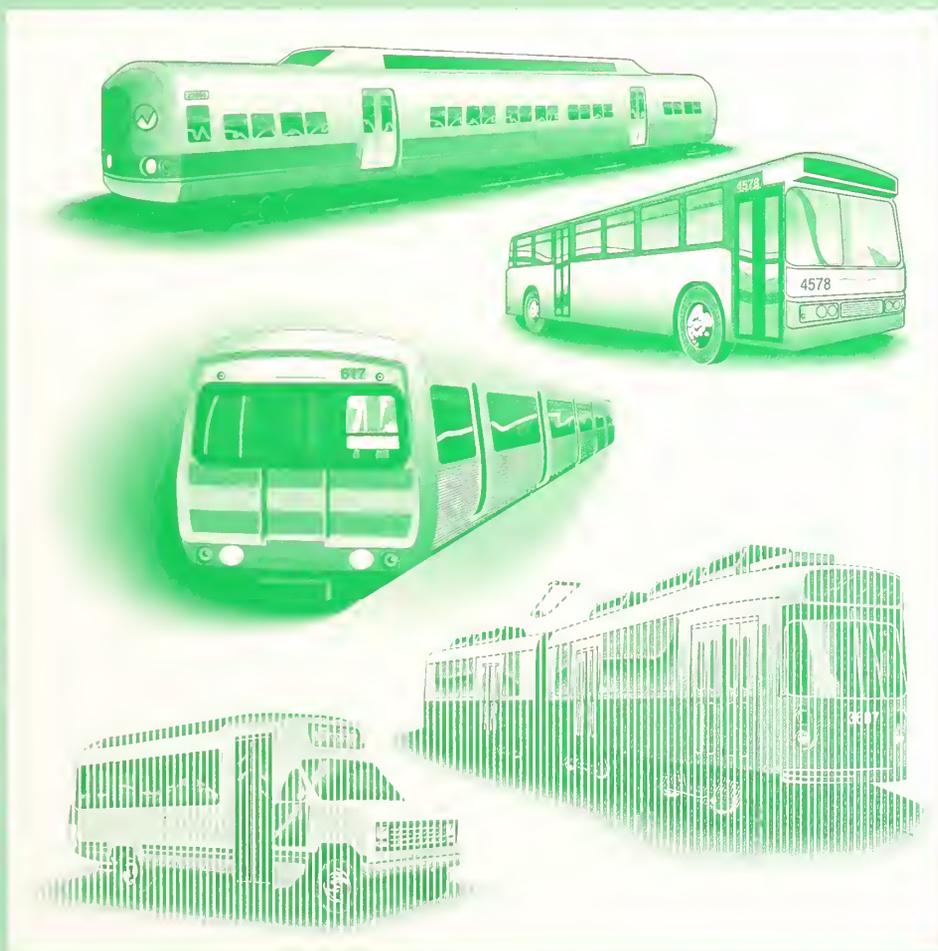


U. S. Department  
of Transportation  
**Federal Transit  
Administration**

# **NEW YORK METROPOLITAN TRANSPORTATION AUTHORITY SAFETY INVESTIGATION**

U.S. Department of Transportation  
Research and Special Programs Administration  
John A. Volpe  
National Transportation Systems Center  
Cambridge MA 02142

June 1993  
Final Report



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13. ABSTRACT (Maximum 200 words)  The Federal Transit Administration (FTA) conducted an intensive investigation of passenger and employee safety on the New York Metropolitan Transportation Authority (MTA) and its operating elements. The investigation stressed the system safety concept and top-down analysis. The investigation reviewed past safety assessments conducted by state and federal agencies to ensure that all previous deficiencies have been corrected. This review was followed by an in-depth, on-site examination of each operating element. The specific related findings for each operating element were summarized in the form of a series of general conditions of concern and are presented in this report. FTA will require the MTA to develop corrective action plans to address the conditions of concern and will monitor MTA's progress in effecting the corrections.		
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## METRIC/ENGLISH CONVERSION FACTORS

### ENGLISH TO METRIC

#### LENGTH (APPROXIMATE)

1 inch (in.) = 2.5 centimeters (cm)  
 1 foot (ft) = 30 centimeters (cm)  
 1 yard (yd) = 0.9 meter (m)  
 1 mile (mi) = 1.6 kilometers (km)

#### AREA (APPROXIMATE)

1 square inch (sq in, in<sup>2</sup>) = 6.5 square centimeters (cm<sup>2</sup>)  
 1 square foot (sq ft, ft<sup>2</sup>) = 0.09 square meter (m<sup>2</sup>)  
 1 square yard (sq yd, yd<sup>2</sup>) = 0.8 square meter (m<sup>2</sup>)  
 1 square mile (sq mi, mi<sup>2</sup>) = 2.6 square kilometers (km<sup>2</sup>)  
 1 acre = 0.4 hectares (he) = 4,000 square meters (m<sup>2</sup>)

#### MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gr)  
 1 pound (lb) = .45 kilogram (kg)  
 1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

#### VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)  
 1 tablespoon (tbsp) = 15 milliliters (ml)  
 1 fluid ounce (fl oz) = 30 milliliters (ml)  
 1 cup (c) = 0.24 liter (l)  
 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<sup>3</sup>) = 0.03 cubic meter (m<sup>3</sup>)  
 1 cubic yard (cu yd, yd<sup>3</sup>) = 0.76 cubic meter (m<sup>3</sup>)

#### TEMPERATURE (EXACT)

$$[(x - 32)(5/9)]^{\circ}\text{F} = y^{\circ}\text{C}$$

### METRIC TO ENGLISH

#### LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)  
 1 centimeter (cm) = 0.4 inch (in)  
 1 meter (m) = 3.3 feet (ft)  
 1 meter (m) = 1.1 yards (yd)  
 1 kilometer (km) = 0.6 mile (mi)

#### AREA (APPROXIMATE)

1 square centimeter (cm<sup>2</sup>) = 0.16 square inch (sq in, in<sup>2</sup>)  
 1 square meter (m<sup>2</sup>) = 1.2 square yards (sq yd, yd<sup>2</sup>)  
 1 square kilometer (kn<sup>2</sup>) = 0.4 square mile (sq mi, mi<sup>2</sup>)  
 1 hectare (he) = 10,000 square meters (m<sup>2</sup>) = 2.5 acres

#### MASS - WEIGHT (APPROXIMATE)

1 gram (gr) = 0.036 ounce (oz)  
 1 kilogram (kg) = 2.2 pounds (lb)  
 1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

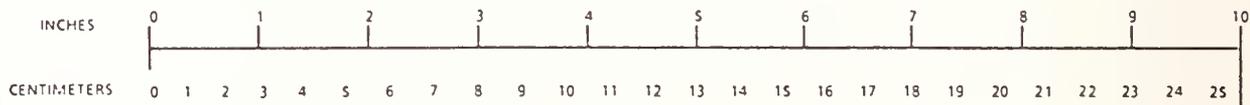
#### VOLUME (APPROXIMATE)

1 milliliter (ml) = 0.03 fluid ounce (fl oz)  
 1 liter (l) = 2.1 pints (pt)  
 1 liter (l) = 1.06 quarts (qt)  
 1 liter (l) = 0.26 gallon (gal)  
 1 cubic meter (m<sup>3</sup>) = 36 cubic feet (cu ft, ft<sup>3</sup>)  
 1 cubic meter (m<sup>3</sup>) = 1.3 cubic yards (cu yd, yd<sup>3</sup>)

#### TEMPERATURE (EXACT)

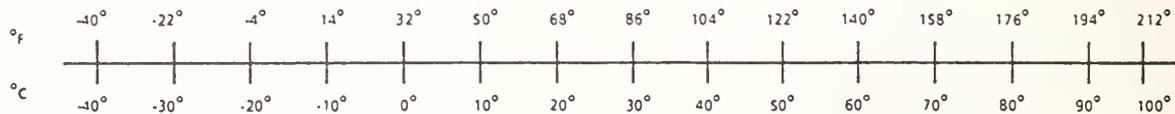
$$[(9/5)y + 32]^{\circ}\text{C} = x^{\circ}\text{F}$$

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25.40

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## PREFACE

Mass transportation systems are important components of the U.S. transportation network. However, the willingness of people to use them depends, in part, on their safety and security while riding. In the late '80s there had been increasing concern generated by life threatening incidents and other serious accidents in New York City's mass transit system. In 1989, Senator Alfonse M. D'Amato and Congressman Guy V. Molinari wrote to the Federal Transit Administration (FTA) (Urban Mass Transportation Administration at that time) to request a full investigation of the safety of the New York rapid rail, commuter rail, and bus operations under the authority and terms of Section 22 of the Urban Mass Transportation Act. FTA conducted an intensive safety investigation of the New York Metropolitan Transportation Authority to address their safety problems. This report provides a summary of the investigation process and results.

This report was prepared by the Safety and Security Systems Division, Office of Transport and Information Resources Management, Volpe National Transportation Systems Center. The authors, William T. Hathaway, David A. Knapton, and Robert A. Rudich, want to acknowledge the contributions that made this report possible. The FTA's Office of Technical Assistance and Safety administered the investigation with Lawrence L. Schulman, Associate Administrator for Technical Assistance and Safety; Steven A. Barsony, Director of the Office of Engineering Evaluations; and Ronald D. Kangas, Project Manager, providing invaluable direction and guidance. Three private organizations, under contract to the FTA -- Battelle Memorial Institute, Booz•Allen and Hamilton, and Interactive Elements Incorporated -- performed the detailed investigations of the New York Metropolitan Transportation Authority and its operating elements. The Federal Railroad Administration (FRA) provided additional assistance by investigating those aspects of the Long Island Rail Road and Metro-North Commuter Railroad that are under its jurisdiction.

This safety investigation, the most intensive yet conducted, would not have been possible without the full cooperation of the New York Metropolitan Transportation Authority and its operating elements. While the MTA staff members that assisted during the course of this investigation are too numerous to mention individually, gratitude is extended to Peter E. Stangl, MTA Chairman and Chief Executive Officer; Linda G. Kleinbaum, Director of Policy Research; Carmen J. Bianco,

Assistant Vice President, NYCTA Office of System Safety; Donald F. Teague, LIRR Executive Director - Safety; William Mahoney, MNCR Director - Safety; and Margaret Connelly, MSBA Manager of Operations Safety and Training, for fostering a spirit of candid interaction. Finally, the authors would like to extend their appreciation to Angela H. Long, formerly of the MTA, for her assistance in planning the overall investigation.

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# 1. INTRODUCTION

Mass transit is increasingly being viewed as the best means to move people in population centers. Energy conservation, traffic congestion, pollution, parking limitations, and increased mobility for all segments of the population are concerns that can be addressed effectively by mass transit systems. However, the systems' riders must feel and be safe<sup>1</sup> and secure<sup>2</sup> to achieve the benefits that large scale use can provide. New York City has the largest mass transit system in the U.S. It integrates rapid rail, bus, and commuter rail to carry the nation's heaviest passenger loads in the densest populated area in the U.S. It is crucial for the New York City transit system to meet the needs of the individual and society since it provides a model for the nation on the benefits and drawbacks of mass transit.

In the late '80s there had been increasing concern regarding life threatening incidents and other serious accidents in New York City's mass transit system. One such accident involved a collision between a vehicle and a work crane that injured an employee, another occurred when an electrical fire stalled a train within a tunnel and demonstrated the inadequacy of emergency measures for swift evacuation of passengers. A high degree of public awareness of such incidents had been generated by the news media coverage. These incidents prompted demands for improvement from the traveling public and elected officials.

This report describes the history, process, and findings of the investigation conducted by the Federal Transit Administration (formerly the Urban Mass Transportation Administration) between June 1989 and November 1992 to create a safe, secure transit system in the New York City area. Authority for the investigation is found in Section 22 of the Urban Mass Transportation Act of 1964, as amended, and Section 339 of the Department of Transportation and Related Agencies Appropriations Act, 1990 (Pub. L. 101-164).

## 1.1 BACKGROUND

On April 20, 1989, Senator Alfonse M. D'Amato and Congressman Guy V. Molinari wrote to the Urban Mass Transit Administration (now FTA) administrator to

1. Safety is defined as freedom from accidental harm.
2. Security is defined as freedom from intentional harm.

request a full investigation of the safety of the New York rapid rail, commuter rail, and bus operations under the authority and terms of Section 22 of the Urban Mass Transportation Act. They stated:

"We are today insisting that you initiate under authority and terms of Section 22 of the Urban Mass Transportation Act, a full investigation of an appalling disregard for the safety of human beings in the New York rapid rail system, and on commuter rail and bus operations. We ask specifically that you investigate conditions in any facility, equipment or operation which could present a safety hazard. We would also suggest that you secure the assistance of other Federal authorities familiar with such safety investigations as necessary.

This investigation should be broad based, thorough and as rigorous as humanly possible. Every potential hazard should be revealed, corrective measures identified and the necessary corrective action taken. Only with this sort of rigorous examination will confidence in the safety of the system begin to be restored.

We urge you to undertake this investigation immediately and keep us advised as to its progress."

On April 21, 1989, the UMTA Administrator, Alfred A. DelliBovi, replied to Senator D'Amato and Congressman Molinari and agreed "to initiate a full and complete investigation of mass transit in New York City." Subsequently, Mr. DelliBovi notified Mr. Robert Kiley, Chairman, Metropolitan Transportation Authority (MTA), of his intention to begin an "extensive, detailed, and exhaustive investigation" which would target the New York City Transit Authority (NYCTA) and later expand, as appropriate, to other operating elements of MTA.

## 1.2 INVESTIGATION AUTHORITY

Section 22 of the Urban Mass Transportation Act of 1964, as amended (49 U.S.C. Section 1618), provides:

The Secretary may investigate conditions in any facility, equipment, or manner of operation financed under this (Act) which the Secretary believes creates a serious hazard of death or injury. The investigation should determine the nature and extent of such conditions and the means which might best be employed to correct or eliminate them. If the Secretary determines that such conditions do create such a hazard, he shall require the local public body which has received funds under this (Act) to submit a plan for correcting or eliminating such condition. The Secretary may withhold further financial assistance under this (Act) from the local public body until he approves such plan and the local public body implements such plan.

Section 339 of the Department of Transportation and Related Agencies Appropriations Act 1990, states:

The Secretary shall conduct a thorough independent safety review of the New York Metropolitan Transportation Authority, including the New York City Transit Authority, the Long Island Rail Road and Metro-North commuter railroads, using available funds or funds withheld from formula money allocated to the New York portion of the New York - Northeast New Jersey urbanized area. The Secretary shall submit a comprehensive plan, within thirty days after the date of enactment of this Act, for conducting such an investigation, including the cost and scope of the investigation and an expeditious schedule for completion of such an investigation.

### 1.3 PURPOSE

This safety investigation had three objectives:

1. Identify safety and security hazards that require MTA correction.
2. Require MTA to develop an action plan to resolve these hazards.
3. Ensure execution and oversight of MTA actions upon FTA approval of the corrective action plan.

The FTA used the U.S. Department of Transportation's Volpe National Transportation Systems Center (Volpe Center) and contract support to help identify the safety and security hazards (first objective). The FTA is directly pursuing the second and third objectives. The intended result of the investigation is to improve the actual and perceived safety of the New York City transit system.

### 1.4 SCOPE

The safety investigation involved a detailed review of MTA and each of its operating elements to identify and assess potential safety and security hazards in equipment, facilities, and operations that could result in injury or death. The Federal Railroad Administration (FRA) cooperated by investigating those aspects of the Long Island Rail Road and Metro-North Commuter Railroad that are under its jurisdiction. This made the review more comprehensive by checking conditions that normally are not included in an FTA investigation.

## 1.5 SYSTEM SAFETY

The concept of system safety was used during this investigation to analyze levels of safety. An explanation of the concept is worthwhile since it is key to the findings and recommendations that resulted.

System safety applies operating, technical, and management techniques and principles to the safety aspects of a system throughout its life to reduce hazards to the lowest level practical by the most effective use of resources. A system can be defined as a composite, at any level of complexity, of people, procedures, materials, tools, equipment, facilities, and software used together in the operational or support environment to perform a task or achieve a specific mission. Potential hazards existing in these elements must be controlled or eliminated to achieve safety objectives. In the context of MTA operations, the elements of the system include personnel, procedures, materials, equipment, tools, facilities, and operating environment.

The system safety process is formalized to ensure that hazards are systematically identified and eliminated or reduced throughout the life of the system. Plans and procedures must be documented and actively controlled to ensure that they remain current and relevant to requirements. Required tasks must be defined for all stages of the system's life. They begin with concept, design, and planning (specifications); extend through manufacture and test; and continue throughout operations until final system disposition. A properly trained and staffed system safety organization must be maintained. The responsibilities, authorities, and functions of all personnel with regard to safety must be clearly and unambiguously defined, and those functions must be consistently performed. Strict accountability for all safety related activity must be established.

System safety is a function not only of engineering and safety personnel, but of high level management as well. Management must ensure that system safety is emphasized in all activities; that safety policies are developed, communicated, and enacted; and that organizational structures support safety goals. Moreover, management participation will promote timely identification and reduction of hazards.

## 2. NEW YORK METROPOLITAN TRANSPORTATION AUTHORITY OVERVIEW

The New York Metropolitan Transportation Authority and its six operating elements make up the greater New York City transit system (the Triborough Bridge and Tunnel Authority is not part of this investigation since it does not receive FTA funds). This complex organization has evolved over time as once independent transit agencies were joined to provide a more coordinated management of public transportation in the New York metropolitan area. Each of the organizations is briefly described below.

The MTA oversees a transit network that covers more area than any other in the world. This network, stretching over three thousand route miles, serves a densely populated area of about five and a half million people each workday. They depend heavily on its safe, efficient operation.

### 2.1 METROPOLITAN TRANSPORTATION AUTHORITY

The New York State Legislature formed the Metropolitan Transportation Authority (MTA) in 1965 to provide unified management of public transportation in the New York City Transportation District. This Transportation District encompasses the five boroughs of New York City and Dutchess, Nassau, Orange, Putnam, Rockland, Suffolk, and Westchester counties. The MTA does not operate any transit service itself; it provides overall financial management and policy direction for its constituent agencies (operating elements).

Board members are appointed for six-year terms by the Governor of New York with the consent of the New York State Senate. The Chairman and five members, three of whom must be New York City residents, are selected by the Governor. The Mayor of New York proposes four members; the County Executives of Nassau, Suffolk and Westchester Counties each proposes one member; and the County Executives of Rockland, Putnam, Dutchess and Orange Counties propose one member collectively. The board is supported by a staff of about 450 people.

MTA board members develop and implement policy and oversee the distribution of money for capital improvements and daily operations by balancing the needs of each of the operating elements against available funding. There is also specific mention in the legislation that gives the MTA broad responsibility and power to provide for public safety.

In addition to their responsibilities to the MTA, the board members serve as the board of directors for each operating element. The Chairman serves as the Chief Executive Officer. He in turn appoints a president (a general manager in the case of the Metropolitan Suburban Bus Authority) to serve as Chief Operating Officer to manage all aspects of day-to-day operations in accordance with MTA policy.

## 2.2 NEW YORK CITY TRANSIT AUTHORITY

The New York City Transit Authority (NYCTA) was formed in 1953 to manage the city's rapid rail and bus transportation. NYCTA operates a complex heavy rail rapid transit system which consists of 26 lines, 469 stations, and 714 miles of track, including 137 miles located within tunnels. On a typical weekday it carries over 3.5 million riders to and from the central business district. The surface division operates a total fleet of 3781 buses over 227 routes throughout the five boroughs; it carries about 750 million passengers annually. It forms, by far, the largest bus operation in the U.S. NYCTA employs over 50,000 and operates on a budget of \$3.5 billion.

The rapid rail system (NYCTA-Rapid) was once a group of private lines that competed for riders. Much of the system was built prior to 1940, some sections date back to 1898. Thus, the network inherited by NYCTA-Rapid lacks many modern design features and was not constructed to make transfers between lines easy. It operates without the benefit of automatic train control and uses some stations and track sections to serve more than one line at the same time. More modern counterparts avoid these practices to reduce their safety risks. Capital expenditures lagged during the post-World War II period until the 1980's. This financial neglect caused considerable deterioration in equipment and service until it approached collapse. This increased the hazards from equipment failure and crowding. Investing over \$12 billion since 1982, the MTA embarked on a program of restoration that will continue into the future.

The bus system (NYCTA-Surface) operates in a harsh environment of weather extremes and congested streets. Average speeds in Manhattan and the Bronx are among the lowest in the nation. As with the rapid rail system, capital funding lagged behind requirements until the '80s. Over 2,400 buses have been replaced since 1982, which reduces the fleet's average age to 7.6 years. NYCTA-Surface operates 19 depots and 5 heavy repair facilities to maintain a high level of service.

### 2.3 LONG ISLAND RAIL ROAD

Long Island Rail Road (LIRR) operates a commuter service over 11 lines with approximately 700 miles of track. It uses 934 electrical multiple unit (MU) cars, 86 diesel locomotives, and 243 coaches, from 134 stations in Manhattan, Brooklyn, Queens, and the length of Long Island. Over 720 trains run each day, and they carry 125,000 commuters throughout the network. The complex track configuration requires a sophisticated scheduling process to enable passengers to make connections as they switch lines to reach various destinations.

While the Metropolitan Commuter Transportation Authority (an MTA forerunner) acquired the LIRR from the Pennsylvania Railroad in 1966, its roots extend to 1834. Capital improvements were begun upon acquisition of this neglected property, and they continue today. The modernization program and the key service area have made LIRR the largest commuter railroad in the nation.

### 2.4 METRO-NORTH COMMUTER RAILROAD

Metro-North Commuter Railroad (Metro-North) is a wholly owned subsidiary of the MTA. It provides commuter rail service to five counties in New York and two in Connecticut with approximately 650 track miles, 116 stations, 69 diesel locomotives, 679 MU cars, and 96 coaches. It carries about 85,000 commuters daily. The New York terminus is at Grand Central Station, which provides connections to the rapid rail system.

The Metro-North was created in January 1983 from the Conrail passenger line that served New York City. The takeover was approved in September of 1982.

Within a three-month period, the entire administrative structure had to be created and prepared to take over operations without disrupting service. In addition, Metro-North took responsibility for labor problems, infrastructure neglect, and a mandated emergency wheel/axle replacement program. The new management aggressively attacked these problems and brought about dramatic improvements.

Connecticut contracts with MTA for Metro-North to provide rail service in the Connecticut portion of the New Haven Line. Metro-North in turn contracts with NJ Transit to operate the 70-mile New York State portions on the Southern Tier and Pascack Valley Lines to provide service west of the Hudson River.

## 2.5 METROPOLITAN SUBURBAN BUS AUTHORITY

The Metropolitan Suburban Bus Authority (MSBA) provides bus service for about one million people throughout Nassau County and parts of western Suffolk County. Considerable feeder service to the LIRR and limited service to Queens endow it with a more suburban character than the rest of the MTA system possesses. It operates 47 routes which cover approximately 890 miles and transports about 30 million passengers per year using 319 vehicles.

## 2.6 STATEN ISLAND RAPID TRANSIT OPERATING AUTHORITY

Staten Island Rapid Transit Operating Authority (SIRTOA) operates a 14-mile heavy rail route and serves 22 stations with approximately 64 rail cars. The track runs the length of Staten Island with the eastern terminal connecting with the Staten Island Ferry for continuation to Manhattan. About 95% of the daily 23,000 passengers continue on to Manhattan.

The system began in 1860 as a private freight and passenger railroad operation. In 1971 the line was taken over by SIRTOA, which switched it to an exclusively rapid rail passenger line in 1988. Its small size permits MTA to use it as a test bed for new equipment that can be applied to the NYCTA rapid rail system.

### 3. INVESTIGATION PLAN

FTA staff realized that the investigation of the New York Metropolitan Transportation Authority would be the most comprehensive ever performed on a public transportation system. The Congressional interest would also make it highly visible. As a result, a detailed plan was needed to guide the process so that all involved parties would know the extent of their involvement. The plan served to:

- Ensure that the investigation was rigorous, cohesive, logical, and properly phased for the time and funds allotted.
- Provide a reference point to determine if the investigation proceeded within the scope and time desired.
- Define the roles of all the participants and permit process management so that contacts between organizations and reporting procedures met all needs.
- Document the degree to which the investigation methods were objective and consistent with accepted practice.

#### 3.1 ROLES

The project organization is shown in Figure 3-1 and participant activities and responsibilities are summarized below.

The FTA Administrator has the ultimate delegated authority for all activities of the investigation.

A Coordinating Committee established by the FTA Administrator, assisted in the evaluation and decision making elements of the investigation. The Coordinating Committee membership included the FTA Chief Counsel, the Associate Administrator for Technical Assistance and Safety, the Associate Administrator for Budget and Policy, the Eastern Area Director, and the Federal Railroad Administration (FRA) Associate Administrator for Safety (to coordinate with FRA inspections of LIRR and Metro-North). The Committee reviewed plans and reports of technical findings and provided recommendations to the Administrator. The

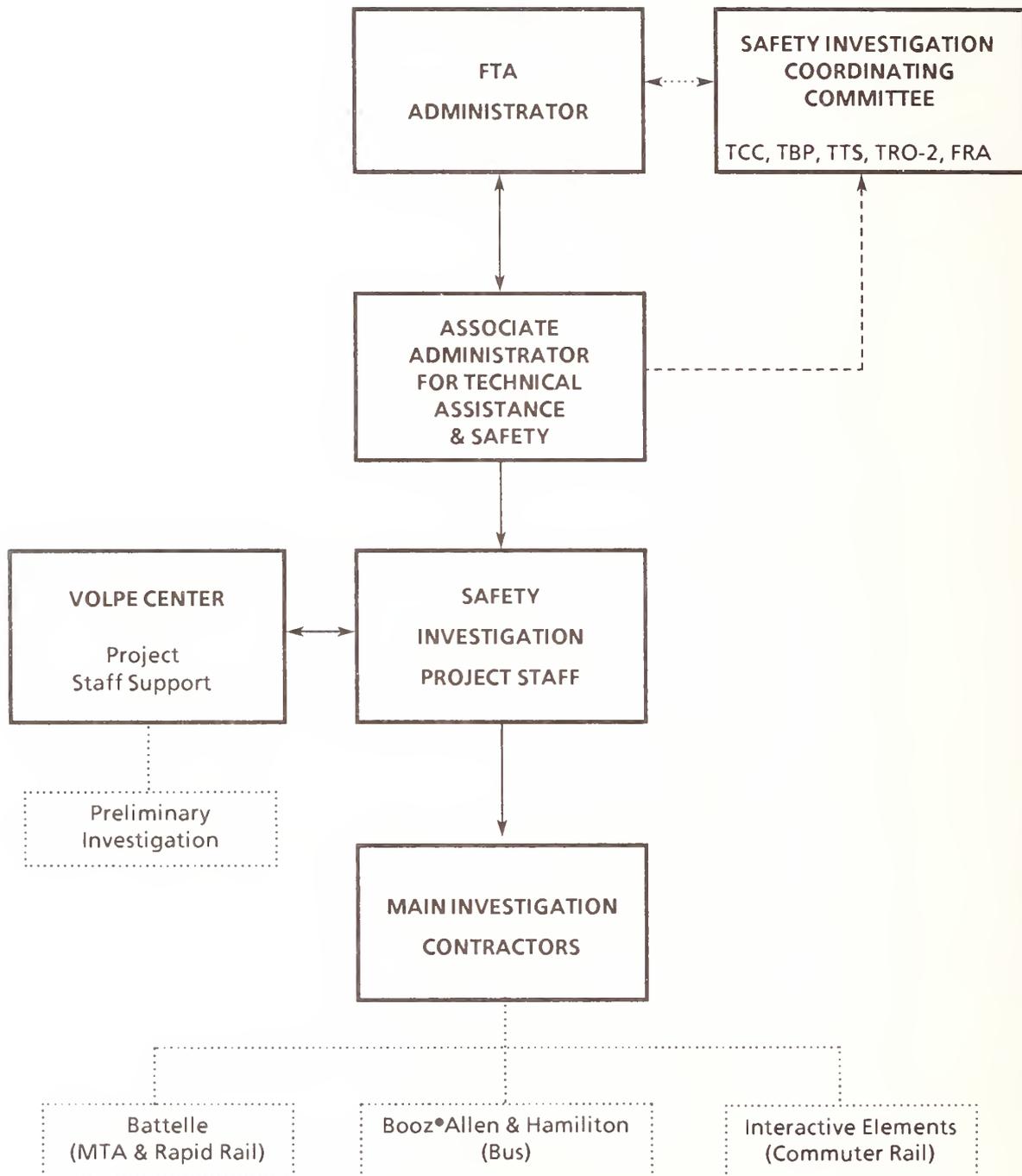


Figure 3-1 Safety Investigation Project Organization

Committee also ensured that issues that arose during the course of the investigation were appropriately handled and coordinated internally or externally. The Committee held periodic meetings for the Project Manager to provide them with status reports on the investigation.

FTA Project Staff managed and directed the day-to-day activities needed to accomplish a successful investigation. The Project Manager reported to the Associate Administrator for Technical Assistance and Safety and gave periodic briefings to the Coordinating Committee and the Administrator, as required. The Project Manager served as the Contracting Officer's Technical Representative (COTR) and provided the technical interface with all contractors. However, the Contracting Officer of the FTA Office of Procurement and Third Party Contract Review retained exclusive authority to negotiate and bind the Government under the terms of the contract between FTA and all contractors.

The Research and Special Programs Administration (Volpe National Transportation Systems Center) was tasked with the following: (1) preparation of a comprehensive plan, (2) preparation of the statements of work for the contractor investigations, (3) performance of a preliminary investigation by a review and analysis of available documentation, including reports from the National Transportation Safety Board (NTSB), the MTA Inspector General, the Public Transportation Safety Board (PTSB), and MTA accident and crime incident data files, which identify safety and security hazards, (4) refinement of the statements of work for the contractor investigations in the light of information developed during the preliminary investigation, (5) participation in the various review and approval processes, and (6) assistance for the FTA Project Manager in the execution of his duties by providing technical expertise. The Volpe Center conducted a Preliminary Investigation to identify safety and security hazards, already cited by oversight agencies, to be added for full scrutiny in the later, more thorough contractor investigations.

Contractors, selected competitively by FTA, conducted the detailed on site investigation. The scope of the investigation and the time constraints led to the award of three contracts. This allowed the MTA organization to be split among the contractors so that they could conduct phased investigations within a limited time frame.

### 3.2 PLAN DEVELOPMENT

FTA project staff enlisted the Volpe Center's expertise to help develop a comprehensive plan which would provide structure and scope for the investigation. The FTA Coordinating Committee reviewed and concurred with the plan. FTA project staff and Volpe Center personnel then met with Senate Committee staff to obtain their approval of the process and approach, as well as to obtain first hand input of their concerns. As noted earlier, the communication between all involved parties was given high priority to foster cooperation and awareness of investigation progress.

### 3.3 PLAN EXECUTION

The resulting plan proposed a multi-phase process that would allow the flexibility to shift emphasis as findings were gathered and the labor support to conduct intensive, broad investigations in a reasonable time. For the first phase, the Volpe Center conducted a preliminary investigation to identify the documented safety needs that earlier separate investigations had uncovered. These were added to the areas of emphasis in the contract work statements as specific items to be verified.

FTA then competitively awarded three contracts to conduct detailed Phase II Investigations. Awards went to Battelle Memorial Institute, Booz•Allen and Hamilton, and Interactive Elements Incorporated. The investigations were split so that the largest operating elements were completed first and significant findings affecting one element could be considered in later investigations. There was significant overlap in the scheduling of the operating element investigations to allow FTA to benefit from feedback of findings from ongoing investigations and still make the best use of limited time.

Having selected contractors for the investigation, the FTA Administrator sent a letter to the MTA Chairman to request a formal kickoff meeting. The attendees discussed the nature of the investigation and agreed on the ground rules for its conduct.

### 3.4 INVESTIGATION TOPICS

The following section summarizes the topics and the areas within them which the plan sets as the minimum requirements for the investigation.

1. Management - structure, financial, safety organization, capital improvements/rehabilitation activities, employment/employee practices, and work rules
2. Operations - operating element description, structure, service provided, performance factors, accident/incident data, rules, practices, procedures, and emergency preparedness
3. Training - course contents, schedule, certification, training staff, and public awareness programs
4. Maintenance - policies, personnel organization and staffing, rules, procedures, practices, facilities, equipment, parts availability, records, inspection and testing procedures, schedules, and quality control
5. Track - rails, ties, ballast, all associated components, equipment, special track, and machinery
6. Vehicles (including buses) - mechanical, electrical, hydraulic, and pneumatic systems
7. Signals, communications, and dispatching - wayside, central, and vehicle borne devices and related controls; the means by which they are interconnected; communication systems, provisions and equipment used for operations and maintenance; communication systems, procedures, rules, and equipment used to notify and maintain contact with external agencies and passengers
8. Stations - portions of the passenger stations which interface directly with the trains, buses, and passengers (human/machine interface) including escalators and elevators

9. Structures - structures associated with the support and operation of revenue service including railway bridges, tunnels, retaining walls, and filled areas
10. Traction Power (train systems only) - generation and distribution of traction power, substations, converters, switch gear, control and monitoring devices, feeder cables, and third rail structures
11. Emergency Equipment - emergency equipment within vehicles, stations and other structures including fire extinguishers, ladders, and emergency lighting
12. Security - plans, provisions, and personnel

## 4. PRELIMINARY INVESTIGATION

The Preliminary Investigation was conducted by the Department of Transportation's Volpe National Transportation Systems Center (Volpe Center). Its scope was limited to identifying and assessing the status of previously documented safety and security issues and recommendations. The Volpe Center team did not conduct on-site investigations nor did it independently judge the validity or status of the issues and recommendations it identified.

### 4.1 RATIONALE

There were two reasons for conducting this Preliminary Investigation. The first was an urgent need to determine if any of the known issues and recommendations reflect safety and security hazards that require immediate corrective action in advance of the Phase II Investigation.

The second reason reflects the goal of getting the maximum return from the resources devoted to the Phase II Investigation. Each contractor required information and insights concerning the findings of previous safety and security investigations conducted of the operating elements, and the extent to which resulting recommended actions had been executed. Without this Preliminary Investigation, each contractor would have had to use resources (which would otherwise be devoted to the Phase II Investigation) to undertake duplicative preliminary investigations.

### 4.2 METHOD

The Preliminary Investigation reviewed documents from previous safety investigations conducted by the National Transportation Safety Board (NTSB), the New York State Public Transportation Safety Board (PTSB), and the Metropolitan Transportation Authority Office of the Inspector General (MTA/OIG). The Volpe Center examined recommendations made by these safety oversight agencies to determine their status and extent of implementation. Recommendations which

have not been certified as completed by the originating agency are considered to be still "open." This information was supplemented by an analysis of safety data and issues identified by the media. Any recommendations or issues that had not been addressed were marked for further study by the contractor investigating the responsible operating element.

#### 4.3 CONCLUSIONS

The Preliminary Investigation reached the following conclusions.

1. The oversight agencies in the State of New York have vigilantly identified safety issues and provided recommendations to resolve them, although they do not have enforcement authority.
2. Of the 471 recommendations identified in the preliminary search, the oversight agencies indicated 246 were still open on January 31, 1991, when the recommendations were last reviewed. Of these 246, the MTA records indicated that 129 have been fulfilled, 29 are scheduled for future implementation, and the remaining are in the process of correction. (Note: These numbers change as new recommendations are made and existing recommendations have been carried out and verified.)
3. The MTA's operating elements have focused their efforts on correcting the most critical safety problems. This focus is evident from the fact that no primary (or direct accident causing) hazards have been identified in the open recommendations. The open recommendations deal with contributory factors.
4. The oversight agencies and the MTA define the status of issues and recommendations differently. The oversight agencies classify a larger number of safety recommendations as open because: (1) they may disagree that a recommendation has been completely implemented, (2) they consider the results of a completed effort so critical to safety that it warrants continual monitoring and, therefore, remains open perpetually or, (3) they have not yet verified the adequacy of the implementation.

Another problem occurs when the MTA rejects a recommendation and the agency does not accept the reason for the rejection. There is no means to resolve the dispute, so the recommendation remains open for the oversight agency.

5. The current safety oversight process uses a reactive approach to safety. The oversight agencies first identify issues based on accident investigations or special studies. Only then do the MTA and its operating elements respond to the problem.
6. Current legislation does not provide a direct safety role for the MTA. The Metropolitan Transportation Authority Office of the Inspector General, although funded by the MTA, performs safety investigations and financial audits independently.
7. The Safety Information and Reporting Analysis System (SIRAS) statistics reveal that the New York City Transit Authority (NYCTA) rapid rail accident rate (accidents per million car miles) for collisions with other trains and obstacles, and derailments is approximately one half that of the rest of the nation's rapid rail transit. But, using passenger casualty rate (casualties per million passengers) as the safety index indicates the rate is approximately twice that of the rest of the nation's rapid rail systems.
8. A review of the operating elements' accident experience indicates fire safety and emergency response are the major concerns of the rapid rail operations. SIRAS statistics indicate that fires (per billion passengers) on the rapid rail system are about 3.5 times more likely than on the rest of the nation's rapid rail systems.
9. A review of the operating elements' security experience reveals that patron and employee security warrants much greater emphasis than previously believed.

#### 4.4 RECOMMENDATIONS

These conclusions support the following recommendations.

1. The MTA should develop a mechanism that provides a continuing review of all open recommendations.
2. The MTA should establish a process to resolve situations when an operating element rejects an oversight agency recommendation and the agency does not accept the rejection's rationale.
3. Phase II Investigation contractors should review the MTA rejected recommendations found unacceptable to the oversight agencies and determine the merit of these recommendations.
4. MTA and its operating elements presently respond to recommendations by simply stating that they will be effected. They should also notify the oversight agency when this has occurred.
5. The news media has been very critical of the MTA's response during emergency situations. This is particularly true of incidents in tunnels. As a result, the MTA has acted to upgrade its emergency response capability. The Phase II Investigation contractors should examine the emergency response capability of the operating elements to determine if the underlying causes of these concerns have been identified and addressed.
6. Incidents involving pedestrians and bicyclists are the most common accidents at the NYCTA-Surface and the Metropolitan Suburban Bus Authority (MSBA). The Phase II Investigation contractors should examine these accident types and determine if the two MTA bus elements are taking the appropriate action to reduce the problem.
7. The Volpe Center believes that the MTA and its operating elements should take a more proactive role to identify and resolve safety and security issues. This may be achieved by adopting the system safety concept and fostering the view that safety in an organization must be addressed from the top down in conjunction with ever present vigilance at the operating level. The Phase II Investigation contractors should

evaluate the extent to which a proactive system safety program is in place and is practiced by the operating elements.

8. The Phase II Investigation contractors should emphasize patron and employee security in their investigation of the NYCTA-Rapid and Metro-North operations. The MTA's operating elements should place more emphasis on the security of patrons and adopt a proactive approach to this issue. This may be accomplished by adopting the system security concept which seeks to prevent breakdowns in security.



## 5. PHASE II INVESTIGATION

The Phase II Investigation began in mid-1991 and entailed an in depth, on-site investigation of passenger and employee safety at the MTA and its operating elements. These investigations were conducted under three competitively awarded contracts. The contractors were guided by the topics established by the investigation plan and augmented by the findings of the Preliminary Investigation. The responsibility for the MTA and its operating elements was divided as follows: Battelle Memorial Institute was assigned the MTA, NYCTA-Rapid, and SIRTOA; Booz•Allen and Hamilton was assigned NYCTA-Surface and MSBA; and Interactive Elements Incorporated was assigned Metro-North and LIRR.

The following sections are the findings submitted by the contractors for each of their assigned elements.

### 5.1 METROPOLITAN TRANSPORTATION AUTHORITY RESULTS

Based on their investigation of the MTA, the Battelle Memorial Institute submitted the following results.

#### 5.1.1 Background

The MTA investigation was limited to safety and security issues directly involving the MTA Board of Directors, headquarters staff, and the relationship that the MTA executive and policy making functions have with the operating elements on safety and security issues. The investigation involved extensive interviews with the MTA Board and senior managers as well as top level managers of the operating elements. In addition, team members attended various Board and Committee meetings and reviewed documents supplied by MTA. Work on this investigation was conducted in two segments--data gathering and preliminary analysis during May through October, 1991, and final analysis during June and July, 1992. The reported information is current through May, 1992.

### 5.1.2 MTA Overview

By any measure, the "MTA family" comprises the largest, most complex transit organization in the country.<sup>1</sup> Table 5-1 and Figure 5-1 illustrate the sheer size and complexity of the organization. The MTA, as an organization, was created in 1965 by the New York State Legislature in response to the worsening state of public transportation in the New York metropolitan area. Creation of the MTA brought existing transit agencies under the oversight of a newly created Board of Directors. Consistent with the apparent intent of the enabling legislation, the Board and its supporting staff focus heavily on policy setting and the acquisition and distribution of capital and operating funds needed by the operating elements while the operating elements retain a great deal of autonomy to conduct operations. However, the same individuals who constitute the MTA Board also constitute the Boards of each of the operating elements. A number of Board committees have direct oversight responsibilities relating to specific operating elements or functions.

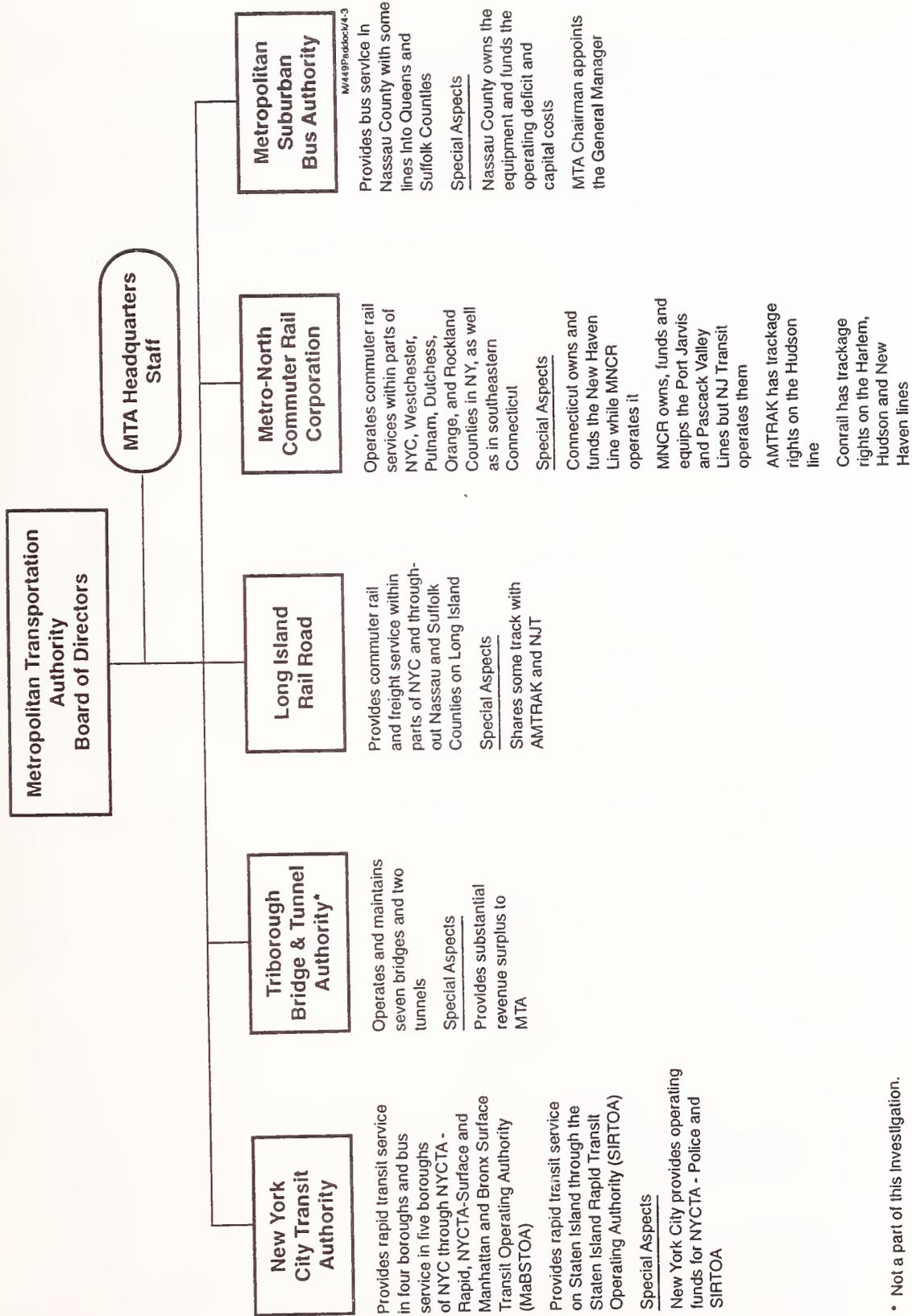
Table 5-1 1991 MTA Operating Statistics

Paid rides (average weekday)	5,462,849	Rail/subway lines and bus routes	325
Employees	64,119	Operating budget (1992)	\$5.4 billion
Rail and subway cars	7,885	Stations	745
Rail route miles	915	Track miles	2,075
Buses	3,973	Bus route miles	2,722
Bridges	7	Tunnels (auto, truck, and bus)	2

Source: *The MTA Network*, Metropolitan Transportation Authority, December 31, 1991.

All levels of the MTA clearly understand that safety and security are vital concerns and that the primary responsibility for these concerns lies with the management of the individual operating elements. The MTA Board does not take an active role in day-to-day safety and security matters and has provided few general policy statements on these subjects. While there remains room for improvement at all the operating elements examined, the investigators generally found the accident statistics to be comparable to those of their peers in the transit industry:

1. The Triborough Bridge and Tunnel Authority is a part of the MTA, but is not included in this investigation because it receives no FTA funds.



\* Not a part of this investigation.

Figure 5-1 MTA and its Operating Elements

NYCTA-Surface: ".....bus accident rates are comparable to those at other large transit systems..."<sup>2</sup>

Metro-North: "In all three cases [collision accidents/passenger mile, collision accidents/passenger trip, non-collision accidents/passenger trip], Metro-North lies at or near the anticipated average performance for the included railroads."<sup>3</sup>

MSBA: ".....MSBA's safety record compares favorably with the safety records of other similarly sized transit properties..."<sup>4</sup>

LIRR: "In the area of passenger safety, the LIRR maintains an accident rate comparable to that of other large commuter rail systems. ...With regard to employee accidents, the situation is less clear."<sup>5</sup>

NYCTA-Rapid: "...NYCTA-Rapid's passenger casualty rate is essentially the same as that of the rest of the U.S. heavy rail transit agencies."<sup>6</sup>

SIRTOA: "While SIRTOA's passenger casualty rate ... was higher than the average rate for the U.S. heavy rail transit industry, the difference in rates was not judged statistically significant."<sup>7</sup>

The Board's actions have had, and will continue to have, major impact on safety and security through its direct involvement in the MTA's capital improvement programs. From 1982 through 1991, the MTA expended or committed some \$16.2 billion on capital improvements, with dramatic impact on the system (see Table 5-2). However, the ten-year program did not accomplish all that was planned. The MTA estimates that some \$50 billion (1988 dollars) will be required for capital improvement in the period 1992-2011. Some \$35 billion is needed to boost the

2. *NYCTA-Surface Summary Report*, Booz•Allen and Hamilton, September, 1992, page 2-2.

3. *Metro-North Commuter Railroad Summary Report*, Interactive Elements Incorporated, August 14, 1992, page 29. (Material in brackets extracted from earlier text.)

4. *Metropolitan Suburban Bus Authority Summary Report*, Booz•Allen & Hamilton, September, 1992, page 2-2.

5. *Summary Report: Long Island Rail Road*, Interactive Elements Incorporated, September 28, 1992, pages 31-33.

6. *Safety Investigation of the New York City Transit Authority*, Battelle Memorial Institute, November 19, 1992, page 24.

7. *Safety Investigation of the Staten Island Rapid Transit Operating Authority*, Battelle Memorial Institute, November 19, 1992, page 20.

system to a "state of good repair"<sup>8</sup> and replace existing equipment and facilities that have exceeded their useful service life. MTA is aggressively pursuing funding to implement this capital improvement program. The state legislature failed to

Table 5-2 Highlights of the MTA Capital Improvement Programs 1982-1991

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New York City Transit Authority

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>● All 6,000 subway cars replaced or overhauled; cars average approximately 30,000 miles between breakdowns, 400% better than in 1982.</li> <li>● All the main line track rebuilt for faster, safer, smoother rides.</li> <li>● Every bus in top condition; all newly purchased or rebuilt.</li> <li>● Nearly all the cars and buses air conditioned, all graffiti free.</li> <li>● 90% of the buses wheelchair lift equipped.</li> </ul> | <ul style="list-style-type: none"> <li>● 56 stations rehabilitated, 6 new ones built.</li> <li>● New subway service and new stations for Queens, Roosevelt Island, and Manhattan.</li> <li>● Numerous maintenance shops, storage yards, and depots newly built or rehabilitated improving train and bus reliability and efficiency.</li> <li>● Staten Island Rapid Transit's entire fleet overhauled, with cars added to lengthen trains and provide more seats, and platforms at 16 stations extended to accommodate them.</li> </ul> |
|---|--|

Long Island Rail Road

- Main line electrified to Ronkonkoma, cutting travel time to NYC up to 1/2 hour.
- Replacement bridge across the channel to Long Beach, eliminating frustrating delays.
- Caemmerer train yard near Penn Station increasing morning rush trains by 21%.
- Nearly 200 new cars, reducing standees west of Jamaica by 83%.
- Trains run 70% longer between breakdowns that interrupt service than in 1982.
- All the track in excellent condition for faster, smoother, safer rides.
- Harold Interlocking rebuilt, easing bottlenecks between Jamaica and Penn Station, allowing trains to run in either direction on any track to avoid delays.
- Completion of Hillside Maintenance Complex for keeping the electric car fleet in good condition.

Metro-North Commuter Railroad

- Over 250 new and rebuilt rail cars and locomotives, putting the entire fleet in good repair, eliminating standees, and providing consistent, reliable air conditioning.
- Maintenance shops rebuilt and expanded, making trains more dependable.
- On time performance over 94%.
- All the track in excellent condition for faster, smoother, safer rides.
- Upper Harlem line electrified, providing direct service to Grand Central and reducing travel time by as much as 21 minutes.
- Power system modernized to handle air conditioning, quicker acceleration, and longer trains.
- Park Avenue Tunnel rehabilitation well under way.

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Source: *No Standing Still: The MTA Capital Program Phase 3, 1992-1996*, Metropolitan Transit Authority, 1991.

8. MTA defines "state of good repair" as the condition wherein (a) over-age system components have been replaced so that each component is within its economic life and (b) the physical plant is adequate to provide the required level of service (*Staff Report of Capital Revitalization for the 1980's and Beyond*, Metropolitan Transportation Authority, November 25, 1980.)

approve a five-year program in October, 1991, but did approve a one-year, \$1.6 billion program. MTA will submit a new five-year program in October, 1992.

Several independent state organizations--notably the New York State Public Transportation Safety Board (PTSB), the office of the MTA Inspector General, and the MTA Capital Program Review Board--are engaged in safety oversight activities, as are various federal agencies--among them the FTA, the FRA (commuter railroads), and the National Transportation Safety Board (NTSB).

### 5.1.3 MTA Conditions of Concern

For the purpose of this study, a condition of concern is defined as a set of circumstances that either hinder the achievement of the highest levels of safety and security or could result, if not remedied, in significant hazards or unsafe conditions.

Many safety and security issues were identified in the assessments of the individual operating elements, and they are described in other sections. Within MTA, there is a clear understanding that safety and security responsibilities lie with the presidents of the operating elements. Given the MTA Board's ultimate responsibility for all agencies within the MTA family, however, each of the conditions of concern applying to the individual operating elements must be regarded as a condition of concern for the MTA Board as well.

The Battelle team identified four specific conditions of concern (described below), which were either unique to the MTA Board/staff activities or pervade the entire MTA family. These conditions of concern relate to MTA's long term ability to achieve and sustain the highest levels of safety and security.

1. ***There are MTA wide deficiencies in the planning, implementation, and acceptance of sound safety concepts and programs.***

System safety is the systematic application of sound management and engineering principles throughout all phases of a system's life cycle to achieve the highest levels of safety consonant with operational effectiveness and cost. Effective system safety programs have at least four key attributes:

- A commitment from the highest levels of the organization to the concepts of system safety.
- A plan that defines the purpose and scope of the system safety program; identifies applicable policies, codes, and standards; sets goals for the organization and its components; defines authorities and responsibilities for the components of the organization; and establishes a hazard identification and control process.
- An effective organizational entity with primary responsibility for enforcing the plan and performing certain activities defined in the plan (e.g., hazard identification).
- Widespread understanding and acceptance throughout the organization of the concepts of system safety.

There is a strong emphasis on safety within the MTA family. At all levels of management throughout the MTA there is a clear, but unwritten, understanding that the primary responsibility for safety lies with the operating element presidents. In recent years, there has been an effort to introduce the concepts and disciplines of system safety into the operating elements. These efforts are focused within the individual operating elements and are subject to the management style and emphasis of the presidents.

The New York State Public Transportation Safety Board (PTSB) has required each of the MTA operating elements to prepare a System Safety Program Plan (SSPP), in accordance with guidelines provided by the PTSB, for PTSB approval. An SSPP should define specific safety goals and the methods to be used to achieve those goals, and should be the foundation of an effective system safety program. There were variations in the content and quality of the SSPPs and the importance assigned to them at the operating elements.

None of the transit agency SSPPs satisfied all of the key attributes of a plan as defined above. A relatively widespread view among operating element managers was that the SSPPs were documents prepared largely to meet a PTSB mandate rather than working guidelines for an effective system safety program. Some operating

element managers were unaware of the existence of an SSPP and others rarely, if ever, referred to it.

The MTA Board and headquarters staff view their role as one of planning, financing, and oversight of certain functions rather than one of providing direction for operating elements' operational activities. The Board has, however, taken policy positions and provided strategic guidance on a number of issues such as the

- Americans with Disabilities Act
- Drug Free Workplace Act
- Employee Assistance Programs
- Equal Employment Opportunity Programs
- Clean Air Act.

No evidence was found to indicate any MTA Board/staff involvement in the establishment of policies relative to the importance, preparation, approval, or implementation of state mandated SSPPs or system safety concepts in general. While the emphasis and commitment to safety at all management levels is apparent, this lack of involvement has resulted in inconsistent implementation of system safety programs at the various operating elements.

The management approach of each operating element's president determines the organizational placement or division of responsibility for the system safety functions. Thus, the organization of safety functions varies at each operating element. The visibility and influence of the system safety function appears limited in some operating elements.

There is less than full understanding of, and commitment to, the principles of system safety throughout the MTA family. The full benefits of system safety programs cannot be realized without full support and understanding from the top levels of management.

2. *There is a tendency on the part of senior MTA personnel to equate the achievement of a "state of good repair" with the achievement of a safe, secure system.*

When MTA executive and senior staff members were interviewed regarding the safety and security aspects of their areas of responsibility, their initial responses were often couched in terms of progress being made toward a "state of good repair." The term, as used by MTA, focuses on the physical condition of the system. Given the badly deteriorated state of much equipment at MTA, it is true that achievement of a "state of good repair" will produce significant improvements in safety, as evidenced, for example, by the impact of vehicle and track restoration at the NYCTA-Rapid.

However, the achievement of a "state of good repair" does not reduce or eliminate certain safety and security risks. Many adverse safety and security conditions exist, or can occur, as a result of the absence of, or deficiencies in, policies, rules, procedures, and managerial initiatives: Examples of these include promulgating and maintaining effective system safety plans, ensuring operating employee fitness for duty, conducting active supervision of operations, and other actions that are within the control of operating elements but are not related to defects in the physical plant.

A tendency to place undue emphasis on a "state of good repair" as a proxy for achievement of a safe, secure system could result in the perception by MTA personnel that this is the primary (or only) requirement to achieve safety and security. While achieving and maintaining a "state of good repair" is a critical factor in ensuring safety and security, it is not by itself sufficient to accomplish these ends, nor can it be substituted for other safety programs and policies.

***3. MTA's current approach to allocating capital resources does not ensure achievement of the highest MTA-wide levels of safety and security.***

If one views the MTA family as a single entity rather than as a collection of operating elements with individual constituencies, it follows that resource allocations within that family should be based on efficiently achieving the greatest good for the total family. This goal requires the ability to both compare all programs on a common basis and allocate resources based on the overall needs.

To date, the MTA Board has consistently allocated 77 percent of available capital funds to the NYCTA and 23 percent to the commuter railroads. The

allocation percentages were originally based on a combination of need and political realities. Those realities may well dictate that the percentages remain constant in the future. At least in the 1992-96 capital program, it appears that these allocation percentages will continue.

Operating elements within MTA are given broad latitude to set priorities for capital projects within their budgets, with the exception of system improvement projects (which represent less than 8 percent of the forecast 1992-2011 capital needs). All projects included in the MTA capital programs fall into one of four need categories,<sup>9</sup> defined as follows:

- **State of Good Repair** - Projects necessary to correct deferred maintenance or to replace equipment that is beyond its useful life.
- **Normal Replacement** - Projects to maintain the system in good repair by replacing components as they reach the end of their useful life.
- **System Improvement** - Improvements that add service or capacity to the existing MTA network in order to reduce congestion; make service more reliable, pleasant and comfortable; reduce travel time; and provide information for customers and employees.
- **Network Expansion** - Projects that expand the system to serve new markets in the regional transportation corridors. Includes new rail lines or additional tracks and service extensions beyond existing terminals.

System improvement projects are subjected to an MTA mandated three part evaluation, yet the key goals and scoring weights for one part of the analysis are set by the operating elements. Facilities replacement projects proposed as state of good repair or normal replacement investments must undergo alternatives analysis to show cost effectiveness, again on an individual operating element basis.

While the operating elements employ their own methods to set priorities, there is no consistent procedure to set priorities for capital projects across the operating elements. Thus, the MTA Board cannot make consistent comparisons among the programs of multiple elements should it wish to do so. To the extent that funds are allocated by a fixed formula, there is little need for a procedure that

9. *1992-1996 Capital Program Proposal*, Metropolitan Transportation Authority, October 1991.

permits comparison of programs across agency boundaries. However, as some elements of the MTA approach a "state of good repair" and other elements remain years from achieving this, allocating resources on the basis of fixed percentages may not result in the highest levels of safety and security across MTA as a whole.

- 4. *Faced with the prospect of static or shrinking funding, MTA will be challenged to achieve and maintain the highest levels of safety and security while simultaneously dealing with pressures to maintain or expand services in the region.***

In the past decade, MTA has made massive investments to raise existing equipment and facilities to a "state of good repair" and maintain them in that condition. These efforts have overcome a major portion of the results of decades of deferred capital investments and maintenance and have contributed materially to improving safety and security within the operating elements. Yet, much remains to be done. MTA estimates that \$50 billion (1988 dollars) of capital funds will be required over the next 20 years, with \$30 billion of that needed just to elevate all the operating elements to a "state of good repair" and maintain them that way.

The MTA's accomplishments in raising both capital and operating funds over the last decade have been substantial. At this time, however, it is far from clear that MTA will be able to sustain their rate of investment. Declines in the region's economy have had a significant impact on the availability of capital funds. Only 60 percent of the funding needed for a proposed \$10 billion five year capital program has been identified. To date, the state legislature has approved only a \$1.6 billion one-year capital program. The decline in the economy also has affected ridership, which, in turn, impacts the availability of operating funds.

Historically, transit systems faced with financial problems have tended to defer capital replacement, maintenance, and operations support functions such as training, oversight, and inspection. This ultimately leads to degraded levels of safety and security. As in the past, the MTA will be faced with major challenges in making the tradeoffs associated with improving the quality of service and expanding services versus ensuring the adequacy of current facilities, equipment, and personnel to provide safety and security for passengers and employees. Its response to those challenges will have a major impact on safety and security for years to come.

## 5.2 NYCTA RAPID RAIL RESULTS

The following results were submitted by Battelle Memorial Institute based on their investigation of the New York City Transit Authority's rapid rail system (NYCTA-Rapid).

### 5.2.1 Background

This investigation involved an in-depth on-site assessment of NYCTA-Rapid, as well as analysis of material provided by NYCTA. At peak levels during the eight weeks of on-site activity, up to 55 individuals in 14 teams were involved. Table 5-3 summarizes the topic areas of the investigation and the techniques used. In assessing NYCTA-Rapid, the team considered compliance with

- Safety related directives
- Industry standards and guidelines
- Established points of reference.

Throughout the assessment, the NYCTA-Rapid was measured against modern practices even though much of it was constructed prior to their development and is exempted from their application. Since the detailed investigations were conducted during the latter half of 1991, this report represents a "snapshot" of NYCTA-Rapid during that period.

### 5.2.2 NYCTA-Rapid Overview

NYCTA-Rapid is the rapid rail arm of NYCTA, which also operates a surface (bus) division. NYCTA is, in turn, a part of the Metropolitan Transportation Authority (MTA), an agency created by the New York State Legislature in 1965 to respond to the worsening condition of transit in the New York metropolitan area.

The NYCTA rapid rail system is among the largest in the world and is, by virtually any measure, the world's most complex. In 1991, it carried roughly one billion passengers. It operates nearly 6,000 rail cars on 714 miles of track to serve 469 stations on 26 routes. It employs nearly 27,000 persons for its operating,

Table 5-3 Investigative Techniques Employed in Each Topic Area

Topic Area	Document Review	Formal Interview	Facility and Equipment Inspection	Observation of Operations
System Safety Policies/Issues	●	●		
Management	●	●		
Operations	●	●	●	●
Security	●	●	●	●
Training	●	●	●	●
Emergency Operations/ Equipment	●	●	●	●
Substance Abuse	●	●	●	●
Track	●	●	●	●
Vehicles	●	●	●	●
Signals, Communications, and Dispatching	●	●	●	●
Stations	●	●	●	●
Structures	●	●	●	●
Traction Power	●	●	●	●

administrative, and support functions, as well as a security force of over 4,000 police officers who are members of the New York City Transit Police Department. NYCTA-Rapid's 1991 operating budget was roughly \$1.3 billion, and it further expended some \$1.6 billion on capital improvements.

From 1982 through 1991, NYCTA expended or committed over \$12 billion for NYCTA-Rapid in two five-year capital programs. However, these programs did not accomplish all the objectives of rebuilding the system by 1992. Plans for further capital improvements have been developed. As part of its next five-year capital program, NYCTA-Rapid requested \$6.5 billion. The state legislature has only authorized a one-year program for 1992 that will provide about \$1.1 billion. NYCTA-Rapid estimates that \$29 billion (1988 dollars) in capital will be required in

the period of 1992-2011, with \$21 billion of that required to achieve a "state of good repair"<sup>10</sup> and maintain it by normal replacement of equipment past its useful life.

While the focus of the investigation was to identify conditions of concern, the investigators observed the progress that has been achieved through the capital programs and other initiatives in each of the investigation topic areas. Table 5-4 provides a summary of the recent progress made in each of the investigation topic areas.

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Table 5-4 Summary of Capital Program Progress at NYCTA-Rapid

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#### Management

Office of System Safety was relocated from the operating departments to the Office of Executive Vice President.

Capital Program Management Department was created for stronger control of capital improvement projects.

Attitude and commitment of the current executives and managers was found to be very positive with respect to safety and security issues.

Current management objectives of the NYCTA President were found to reflect a major emphasis on safety and security, with four of the nine corporate objectives referencing safety and security explicitly.

#### System Safety Policy and Plans

Based on FTA's Section 15 database, NYCTA-Rapid's passenger casualty rate was found to be essentially the same as the rest of the U.S. heavy rail transit industry.

Recent safety initiatives promoted by OSS management included:

- Promulgating new NYCTA-wide policy requiring safety goals and action plans as a part of annual business planning.
- Implementing the DuPont safety training program for management.
- Instituting executive safety inspections to provide more top management involvement in safety activities.

Top Management demonstrated commitment to OSS activities by increasing budget and staff in 1992 when most departments were shrinking in size.

Both employee and passenger accidents declined from 1989 through 1991.

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10. MTA defines "state of good repair" as the condition wherein (a) over-age system components have been replaced so that each component is within its economic life and (b) the physical plant is adequate to provide the required level of service (*Staff Report of Capital Revitalization for the 1980's and Beyond*, Metropolitan Transportation Authority, November 25, 1980).

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Table 5-4 (cont.) Summary of Capital Program Progress at NYCTA-Rapid

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### Operations

Capital improvements greatly reduced slow orders and vehicle-caused delays, improving on-time performance to nearly 91 percent in 1991.

Conductor communications to passengers on trains during routine operation and unusual occurrences has improved substantially.

All RTO employees interviewed had received some refresher training within the previous two years to help maintain their job skills or learn new procedures.

### Track

Capital Programs of 1982-1991 resulted in:

- Reconstruction of 581 mainline miles of track.
- Completion of 16 miles of new mainline track associated with the Archer Avenue and 63rd Street lines.
- Rehabilitation or replacement of approximately 80 percent of mainline switches.

Track system achieved a "state of good repair" in 1991.

NYCTA track standards meet state, federal, and industry guidelines.

Current track conditions provide for safe operations at the given track speeds.

### Stations

Capital Programs of 1982-1991 resulted in reconstruction or rehabilitation of 62 stations (six of these were rehabilitated under the operating budget).

Fire suppression systems were installed on 49 escalators, and standpipes were installed in the deep stations at 168th and 191st Streets.

By the end of 1991, 75 stations had reached a "state of good repair".

NYCTA's Station Manager Program expanded to 100 stations in 1991.

Most stations are now maintained in a graffiti-free condition.

### Structures

Capital Programs of 1982-1991 resulted in the rehabilitation of:

- 36 route miles of subway structures.
- 47 route miles of elevated structures.
- Two route miles of at grade structures.
- One car maintenance facility.
- Coney Island Overhaul Shop.

"Typical" elevated structures (open deck steel structures) and structural elements of the tunnels were found to be in fair to good condition.

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Table 5-4 (cont.) Summary of Capital Program at NYCTA-Rapid

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**Structures (cont.)**

Distances between tunnel emergency exits and between blue light stations were found to meet or surpass requirements in NFPA 130, even though these structures were constructed years before development of the standard.

**Traction Power**

Capital Programs of 1982 - 1991 resulted in:

- Approximately two thirds of the substation enclosures and about one half of equipment achieving a "state of good repair".
- Approximately 147 substations now contain modern silicon diode rectifiers.
- Over 110 miles of third rail have been rebuilt.
- A new Power Control Center, containing the new supervisory control system for the IRT and BMT portions of the system (completed in 1987).

Traction power substations are in good condition.

**Training**

Division of Rapid Transit Operations assumed responsibility for Train Operator instruction in January 1991.

ED&T training course content, instructors, training materials, and safety emphasis were judged adequate to prepare employees to do their jobs.

ED&T training standards complied with those widely adopted by the training industry and were well documented.

**Vehicles**

Capital Programs of 1982-1991 resulted in:

- Heavy overhaul of 4,176 vehicles.
- Purchase of 1,775 new vehicles.

Mean distance between failure has increased from an all-time low of 6,700 miles to over 35,000 miles in 1991.

Entire vehicle fleet was expected to reach a "state of good repair" in 1992.

Vehicle fleet was found to be in good condition, well maintained, and graffiti-free.

**Signals, Communications, and Dispatching**

Capital programs of 1982-1991 resulted in the modernization of approximately 143 miles of signal equipment.

NYCTA-Rapid's signaling implementation substantially conforms to AAR standards.

Signal system was found to be adequately maintained and continuing to perform its desired function.

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## Table 5-4 (cont.) Summary of Capital Program Progress at NYCTA-Rapid

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### Substance Abuse

Substance abuse and drug testing program has been in place since December 1989.

NYCTA successfully negotiated with its unions to reinstate random testing of safety sensitive employees beginning in mid November 1991.

### Emergency Operations and Equipment

RTO Command Center has developed a fairly strong response to "routine" or recurring emergency situations.

Classroom training of line personnel on emergency response issues was found to be generally well developed and implemented.

NYCTA-Rapid conducts up to four full scale emergency drills each year.

NYCTA-developed Fire Safety System (a computerized map of the subway system showing track and station layouts referenced to city streets, including entrances, exits, and emergency features) was found to be an excellent tool for use in managing emergency response.

### Security

Capital Programs of 1982-1991 included:

- Creating off-hour waiting areas.
- Installing security mirrors in stations.
- Eliminating cul-de-sacs in stations.
- Closing unused station entrances and exits.

Felony crime complaints began declining in late 1990, with a decrease of approximately 15 percent in 1991.

Enforcement of misdemeanor offenses, particularly fare evasion, almost doubled from late 1990 through the end of 1991.

NYCTA was the first police department in New York City to receive national accreditation.

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### 5.2.3 NYCTA-Rapid Conditions of Concern

For the purpose of this investigation, a condition of concern is defined as a set of circumstances that either hinder the achievement of the highest levels of safety and security or could result in significant hazards or unsafe conditions if not remedied. The Battelle team identified sixteen conditions of concern grouped into four broad categories:

- Daily operations

- Safety and security strategies
- Emergencies
- Finance and planning.

### Daily Operations

**1. *Rapid rail operating employees' fitness for duty of is not ensured.***

Fitness for duty can be defined as an employee's ability to perform the functions of his or her job, unhindered by physical or emotional conditions that would impair performance. Although fitness for duty is often associated with drug and alcohol abuse, it also applies to other factors that can hinder employees from devoting full attention to their job. The fitness for duty of NYCTA-Rapid employees, many of whom hold safety related positions, is not ensured. This is primarily due to the absence of systems to assess and monitor employees for performance and violations of the substance abuse policies before shifts.

**2. *There are deficiencies in the combination of technology and procedures required for the safe movement of trains at NYCTA-Rapid.***

Unlike modern rail systems, NYCTA-Rapid does not contain sophisticated control and communications networks to assist in safe train operation. There are no central computers, advanced train control, or automatic train operation tools to manage and monitor compliance with rules and procedures. More so than at most other transit agencies, safety at NYCTA-Rapid depends upon the personal ability and integrity of train operators, conductors, tower operators, and associated supervisory personnel to operate service in accordance with the rulebook and other applicable bulletins and orders. NYCTA-Rapid must, therefore, have clearly formulated rules, sufficient supervision, and adequate communications equipment to monitor and manage operation employees. Many of these attributes are deficient given the operating methods used at NYCTA-Rapid.

**3. *Inconsistent operational practices, inadequate vehicle door design, and station conditions result in passengers becoming caught in train doors and dragged.***

"Door draggings" are incidents where passengers or their possessions are caught in a train's doors and dragged along as the train moves. The number of door draggings has remained fairly constant at around 90 events per year since 1988. Before a train moves, it is the responsibility of the conductor to ensure that the doors are closed and that no one is trapped in them. This is normally accomplished visually. If visibility is obscured by crowds or curved platforms, the conductor may rely on the door interlock switches to provide an indication of safe door closing. The very large door closing tolerances found on NYCTA-Rapid cars can fail to detect objects as large as an arm and give a false indication of a closed door--with the resultant possibility of a serious accident.

**4. *NYCTA-Rapid stations contain many hazards for passengers and NYCTA employees.***

Most of the stations on NYCTA-Rapid were built long before the advent of modern building codes. Deferred maintenance has resulted in the creation of additional hazards like worn stairways and deteriorated wooden structures. Station exits are few in number, poorly marked, and often too narrow to satisfy present day codes. Many stations are poorly lit and emergency lighting is almost nonexistent. Approximately 64 percent of the reported passenger casualties and 51 percent of the employee accidents throughout NYCTA-Rapid between January 1989 and the Fall of 1991 occurred within rapid transit stations.

**5. *Confirmed fire and smoke incidents within NYCTA-Rapid have reached their highest levels in five years, primarily due to increases in the number of station fires.***

Fire and smoke in a subway station or tunnel is one of the most dangerous and potentially most catastrophic scenarios faced by NYCTA-Rapid. In 1991, there were roughly 11 confirmed fires per day throughout the system. While there have been substantial reductions in car fires over the last five years, the number of station fires has increased by 269 percent over the same period. Most of these were minor trash fires, but the potential for escalation and/or generation of significant amounts of smoke make each fire a subject for concern.

- 6. Many NYCTA maintenance facilities and other areas contain numerous fire hazards and safety deficiencies that pose threats to NYCTA-Rapid employees.**

Many employees work daily in vehicle maintenance facilities and maintenance-of-way facilities that contain safety hazards. Some of these hazards are a result of construction that predates current standards such as the New York City Building Code and the National Fire Protection Association (NFPA) 101 Life Safety code. Others arise as a result of deferred maintenance and/or poor safety practices. Many buildings contain inadequate emergency exits, fire separations, and electrical systems; and some have no fire protection system. Employees working on the elevated structures are exposed to safety hazards caused by deferred maintenance of the walkways.

#### Safety and Security Strategies

- 7. NYCTA lacks an effective security program to address the security related problems throughout NYCTA-Rapid.**

The New York City Transit Police Department (NYCTPD) is a part of NYCTA, with the chief of transit police reporting directly to the president of NYCTA. Other NYCTA employees tend to think that security is solely the responsibility of the police. NYCTA does not have a security plan, and many RTO employees believe that NYCTPD is unresponsive to security problems on trains. Passengers continue to be exposed to situations that cause perceptions of a lack of security. While there have been recent efforts to better integrate NYCTPD into NYCTA, there continue to be significant problems in doing so.

- 8. Deployment strategies, equipment problems, and the subway environment encumber the ability of Transit Police to achieve their mission.**

Only about 26 percent of the over 4,000 officers are actually engaged in patrolling the subway on a typical day. This translates to about 200 to 400 officers being deployed throughout the subway on an eight-hour shift. The architectural features of many stations are not conducive to security. There are isolated hiding

places not easily seen by anyone; long, narrow, and dimly lit passageways; little functional security equipment to discourage criminal activity; and easy escape routes to crowded streets or to other stations via the trains. The underground environment also makes police communications and response difficult even under the best of conditions. The Transit Police Communications Center is overcrowded, noisy, and a difficult place to work.

**9. *The System Safety<sup>11</sup> Program Plan (SSPP) is of little value for promoting broad acceptance of safety activities related to NYCTA-Rapid.***

A plan is defined as "...a method for achieving an end...a detailed formulation of a program of action..."<sup>12</sup> A well conceived plan defines the actions required, who is to perform them, the responsibilities of the participants, and a schedule for the actions to take place. Only parts of these concepts are evident in the NYCTA-Rapid SSPP. The SSPP is viewed by many as a document prepared to meet a regulatory requirement rather than as a guide for effective action.

**10. *The Office of System Safety's ability to develop preventive safety initiatives is limited by available resources.***

A primary goal of system safety is to identify and mitigate or eliminate hazards before an accident occurs. These activities require adequate resources to perform predictive evaluations. In practice, the Office of System Safety (OSS) spends significant amounts of time investigating events that require a reactive response and coordinating with outside agencies. Approximately 25 percent of the OSS staff are assigned to investigations and another 30 percent to environmental, occupational, and asbestos management programs. This leaves less than half the staff to perform preventive safety analyses and hazard surveys, conduct engineering reviews, address fire safety issues, and handle the necessary coordination with both internal sources and external agencies.

11. System safety is the systematic application of sound management and engineering principles throughout all phases of a system's life cycle to achieve the highest levels of safety consonant with operational effectiveness and cost.

12. *Webster's Ninth New Collegiate Dictionary*, 1983.

**11. *The concept of system safety is not well understood and accepted throughout NYCTA-Rapid.***

Through the OSS, the SSPP, and the establishment of a policy on safety goals, senior management has begun to address safety in a system-wide manner. At the division level within the Rapid Rail Department and in the NYCTA-Rapid support departments, however, an understanding, appreciation, and acceptance of the systems approach to safety is not yet evident.

**12. *The effectiveness of the NYCTA Substance Abuse Program is hindered by deficiencies in drug and alcohol policy/instructions and their implementation.***

Comprehensive drug and alcohol education, testing, and training programs are essential for the safe operation of any transportation system. This is even more acute in rapid rail operations where individual employees have direct control over the movement of large numbers of passengers. While NYCTA has developed a substance abuse program to try to meet these needs, deficiencies in the policy's medical elements and its implementation diminish effectiveness. Deficiencies include inadequate training, ineffective communications, a lack of adequate oversight, and inconsistent application of testing practices. These weaknesses increase the potential for accidents and incidents caused by impaired employees. They may also result in employees not obtaining full benefit of drug education and treatment programs.

Emergencies

**13. *NYCTA-Rapid emergency response is hindered by an ineffective incident management system and inadequate emergency protocols.***

Planning for and dealing with major emergencies in NYCTA-Rapid is a complex process involving a broad range of agencies. Among them are NYCTA-Rapid, the Fire Department of New York, the New York City Police Department, the Emergency Medical Services, and the New York City Office of Emergency Management. The RTO Command Center is responsible for directing and coordinating NYCTA's

response, as well as notifying and coordinating this response with that of the various outside agencies.

A formal Policy/Instruction defines procedures to be followed in emergencies, but the procedures are not adequate for major emergencies requiring the coordinated effort of many people in a variety of organizations. Specific shortcomings include the lack of a formal incident management system (or similar management technique) and the lack of formal protocols for managing communications during emergencies.

- 14. NYCTA's ability to respond to emergency situations is seriously hindered by the poor quality of communication tools and a lack of reliable emergency response equipment.***

A large number of communication tools, special equipment, and facilities are required to handle emergency conditions safely and expeditiously on the rapid rail system. These items include such things as communication devices, lighting, emergency walkways, fire suppression equipment, and decision aids. Many of the current tools and facilities are unreliable or of limited value during emergency conditions. This significantly degrades the capability of NYCTA-Rapid to respond to emergencies in a timely and effective fashion.

#### Finance and Planning

- 15. The inconsistent application of criteria in setting capital program priorities does not ensure that the most important NYCTA-Rapid safety and security issues are being addressed.***

NYCTA-Rapid executives have created a strategic planning process for creation of a capital program. The goal and priority setting for specific projects, however, occurs at the department, division, and subdivision levels. This limits top management's ability to comprehensively and consistently address safety and security issues and evaluate the consequences of their decisions on specific issues.

- 16. NYCTA faces a significant challenge to achieve the highest levels of safety and security while adjusting to economic realities.***

Since 1982, management emphasis at NYCTA has been directed toward a massive capital investment program to bring existing equipment and facilities to a "state of good repair" and to maintain them in that condition to avoid repetition of the deterioration that occurred in the past. Despite the considerable progress that has been made, much still remains to be accomplished, with current estimates of reaching the goal of a "state of good repair" extended to 2015, a projection that may be optimistic in view of the state of the region's economy and past performance in predicting completion dates. NYCTA will have to make many difficult decisions to choose between programs that maintain or expand service and those that have a stronger focus on safety and security.

### 5.3 STATEN ISLAND RAPID TRANSIT OPERATING AUTHORITY RESULTS

The SIRTOA investigation encompasses safety and security issues directly involving the Staten Island Rapid Transit Operating Authority's (SIRTOA) rapid rail system. This investigation involved an in-depth on-site assessment of SIRTOA as well as analysis of material provided by SIRTOA. The on-site activities involved approximately 25 investigators and spanned a period of three weeks. Table 5-3 summarizes the topic areas of the investigation and the techniques used. In assessing SIRTOA, the team considered compliance with:

- Safety related directives
- Industry standards and guidelines
- Established points of reference.

Throughout the assessment, the SIRTOA was measured against modern practices even though much of it was constructed prior to their development and is exempted from their application. Since the detailed investigations were conducted during the latter half of 1991, this report represents a "snapshot" of SIRTOA during that period.

### 5.3.1 SIRTOA Overview

Measured by annual ridership, SIRTOA is among the smallest of the heavy rail transit systems in the United States. The system consists of a single, two-track route that runs the 14-mile length of Staten Island. The eastern terminus of SIRTOA is the Saint George Terminal, which also serves the Staten Island Ferry. SIRTOA provides service for approximately 23,000 people on a typical workday, approximately 95 percent of whom connect with the Staten Island Ferry to and from Manhattan. The line was originally constructed and operated as a traditional railroad and carried both passengers and freight until 1988, when freight service was discontinued. Although rapid transit trains now have exclusive use of the line, much of SIRTOA's design and operational practices still reflect its railroad heritage. SIRTOA's assets are owned by the City of New York. Net operating costs are paid by the City and the local cost of capital improvements are paid by a combination of City and MTA funds.

Although SIRTOA is a separate agency of the MTA, it is managed as a part of the New York City Transit Authority (NYCTA), reporting to the Staten Island borough general manager in the NYCTA Department of Surface Transit. The president of the NYCTA is, ex officio, the president of SIRTOA. Because of its small size and its organizational relationship with the NYCTA, SIRTOA relies on the NYCTA for several services, and, at times, is used as a test bed for new technology for the NYCTA.

In 1982, the MTA initiated a major capital improvement program involving all the transit agencies under its control. From 1982 through 1991, SIRTOA has expended or committed nearly \$155 million in two five-year capital programs. While the capital programs of the 1980's were initially intended to achieve a 100 percent "state of good repair" by 1992, this proved to be an optimistic goal. The MTA now projects a "state of good repair" for all SIRTOA system elements in 1997. Actual future funding levels may impact these projections.

The third five-year capital program proposal was formally submitted to the Capital Program Review Board in October 1991. Of the proposed total \$10 billion MTA request, funding for only \$5.5 billion is identified in the plan. This proposal contained nearly \$148 million for continued improvements at SIRTOA, including \$67 million to upgrade the signaling system as a prototype for eventual installation on

NYCTA's Rapid Transit System. The legislature has approved funding for only a one-year \$1.6 billion program for all of the transit agencies for 1992, with funding to be approved on a quarterly basis. As a result of this legislative action, the proposed \$67 million investment in the SIRTOA signaling system has been deleted from the 1992 plan, and SIRTOA's approved 1992 capital funding is \$9.6 million. A new five-year proposal will be submitted in October, 1992.

While the focus of the investigation was to identify conditions of concern, the investigators observed the progress that has been achieved through capital programs and other initiatives in each of the investigation topic areas. Table 5-5 provides a summary of the recent progress achieved.

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**Table 5-5 Summary of Capital Program Progress at SIRTOA**

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**Vehicles**

SIRTOA's fleet of 64 R-44 cars received a general overhaul in 1990/1991 and were found to be in generally good condition.

Mean distance between failures has risen from an average of 21,000 miles between 1986 and 1990 to over 85,000 miles in 1991.

**Signals, Communications, and Dispatching**

The existing signaling system was found to be well maintained.

**Stations**

At the time of the investigation, 16 of SIRTOA's 22 stations were undergoing rehabilitation.

**Structures**

All 30 of the bridges owned and maintained by SIRTOA have been refurbished in the last 10 years and are in good condition.

With the exception of an old storage facility, SIRTOA's maintenance facilities are of recent construction and are modern in design.

**Traction Power**

All substations and about 10 miles of third-rail have been renovated in recent capital improvement programs and are in good condition.

While the entire right-of-way is not yet protected by fencing, fence installation is in progress.

**Management**

SIRTOA managers exhibited commitment, enthusiasm, and apparent competence.

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Table 5-5 (cont.) Summary of Capital Program Progress at SIRTOA

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**Management (cont.)**

The SIRTOA organization is close knit and free of some of the bureaucratic constraints of the NYCTA.

**System Safety Policies and Plan**

The annual number of passenger accidents has declined from 60 in 1989 to 44 in 1991. While SIRTOA's passenger casualty rate for the period 1989-1991 was higher than the average rate for the U.S. heavy rail transit industry, the difference in rates is not statistically significant.

Reported employee injuries range from 61 to 80 over the period 1989-1991, with no obvious trend.

**Operations**

On-time performance has exceeded 95 percent each year since 1986.

**Security**

Felony complaints and security incidents per passenger have declined steadily in the period 1989 through 1991.

**Training**

The training of SIRTOA personnel was judged adequate for SIRTOA's current needs.

**Emergency Operations and Equipment**

Critical emergency events have occurred very infrequently at SIRTOA in the past few years.

SIRTOA's small size reduces the likelihood of an incident and its at grade right-of-way helps lessen the impact of events, such as car fires, that could be much more dangerous in a subway/elevated environment.

**Substance Abuse**

While under no requirement to perform drug and alcohol testing since leaving the regulatory control of the FRA in 1988, SIRTOA has continued to do so.

**Track**

Approximately 10 of SIRTOA's 28 miles of track have been rebuilt as part of the capital improvement program and spot replacement of components has been done in other sections.

Track inspected was found to be consistent with safe operation at the established speed limits.

Track inspected was found to meet federal and/or industry standards.

SIRTOA's inspection and maintenance programs and personnel were judged effective.

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### 5.3.2 SIRTOA Conditions of Concern

For the purpose of this investigation, a condition of concern is defined as a set of circumstances that either hinders the achievement of the highest levels of safety and security or could result in significant hazards or unsafe conditions if not remedied. The seven conditions of concern identified are discussed below.

**1. *Fitness for duty of operating employees is not ensured.***

Fitness for duty is defined as an employee's ability to perform the functions of his or her job, unhindered by physical or psychological conditions that would impair performance. Although fitness for duty is most often associated with drug and alcohol abuse, it also applies to other factors (e.g., emotional distress) that can hinder employees from devoting full attention to their job. At SIRTOA, the fitness for duty of operating employees, many of whom hold safety related positions, is not ensured. This is primarily due to the absence of procedures to actively assess and monitor employee fitness for duty, combined with deficiencies in the existing substance abuse programs.

**2. *There are deficiencies in the combination of technology and procedures required for the safe movement of trains at SIRTOA.***

The SIRTOA system was originally constructed and operated as a traditional passenger and freight railroad prior to the turn of the century. SIRTOA's signaling system and operational practices still reflect its railroad heritage. While the absence of modern signal technology does not make SIRTOA inherently unsafe, it does result in a system that depends completely on the skills, experience, and personal integrity of train operators, conductors, tower operators, and associated supervisory personnel to provide service in accordance with the rule book and other applicable bulletins and orders. Such a system requires well trained, fit, and conscientious operating employees and supervisors to ensure compliance with established rules and procedures. This investigation revealed shortcomings in a number of areas required to achieve the highest levels of safety in train movement at SIRTOA.

Examples include the following:

- The SIRTOA signal system lacks any form of automatic devices to prevent collisions or violations of speed restrictions.

- The SIRTOA trains lack speedometers.
- The Book of Operating Rules (the operating employee rule book) is outdated and needs revision.
- The train dispatcher, who is responsible for controlling train movements, does not have any visual indication of actual train locations.
- With few exceptions, there are no radios in train operator's cabs.

**3. *SIRTOA stations contain hazards for passengers and employees.***

The investigating team examined, in detail, a sample of eight of the 22 SIRTOA stations and conducted brief examinations of all the stations on the line. Of the stations examined in detail, four had been recently renovated under the capital improvement program. The other four, including the St. George Terminal (which is part of the Staten Island Ferry Terminal), were built between 1938 and 1951 and had not been rehabilitated at the time of the investigation (March, 1992). Safety deficiencies were found in both groups of stations, although more deficiencies were found in the stations that had not been rehabilitated. Deficiencies included:

- Excessive gaps between the vehicles and platforms.
- Lack of emergency telephones on the platforms.
- Inadequate lighting levels and/or configurations.
- Inadequate railings in both old and rehabilitated stations.
- Newly rehabilitated stations with inadequate stairs.
- Waiting areas lacking lighted exit signs, fire-rated doors, and fire alarms.
- Combustible construction materials in the vestibule at the St. George Terminal.
- Deteriorated concrete structures in old stations.
- Deteriorated bridges and pedestrian overpasses that are owned and maintained by others but may impact SIRTOA safety.

**4. *SIRTOA maintenance facilities and other areas contain fire hazards and safety deficiencies that are dangers to employees.***

Many SIRTOA employees work in vehicle and right-of-way maintenance facilities. The New York City Building Code and the National Fire Protection Association Standard (NFPA) 101, Life Safety Code, set fire and life safety standards and guidelines for these types of facilities to reduce the risk of fires, emergencies, and injuries. Some SIRTOA facilities have conditions that do not comply with these standards and codes, for example:

- A water leak creates electrical hazards at the Grant City substation.
- Deficiencies in the emergency exits at the maintenance facilities.
- Some details or construction materials in the walls and ceilings at all three maintenance facilities do not satisfy fire rating requirements.
- Welding areas in the three shops are not well ventilated, and the shop at 331 Bay Street is not properly separated from the surrounding area.
- Flammable materials are stored improperly in the Clifton Car Shop.
- The storage facility at 735 Bay Street lacks fire-rated interior doors, exit doors open inward, and the boiler has no fire barrier to protect a nearby storage area.
- Employee facilities at the St. George Terminal lack proper emergency egress provisions.

**5. *The effectiveness of the SIRTOA substance abuse program is hindered by deficiencies in the formulation and execution of drug and alcohol policy.***

Comprehensive drug education, testing, and training programs are essential for the safe operation of any transportation system. This issue is even more acute at SIRTOA, where safety is highly dependent on the performance of the operating personnel. While SIRTOA has developed a substance abuse program to meet these needs, problems with the policy and its practice diminish the effectiveness. These involve the medical and operational elements. For example:

- The current drug and alcohol policy/instructions are confusing and tend to discourage the attentive reading they require.
  - SIRTOA is not in full compliance with the "Drug Free Workplace Requirements; Notice and Final Rules."
  - The substance abuse program has not been effectively communicated to all employees.
  - Specimen collection procedures do not meet all Department of Health and Human Services requirements.
  - An excessive number of employees have access to individual urine and blood test results.
  - Employees may be unjustly accused of substance abuse as a result of the Medical Review Officer's passive approach to reviewing employees' positive test results.
6. ***There is little commitment to, or involvement in, system safety activities at SIRTOA.***

SIRTOA's formal system safety program is provided by the NYCTA Office of System Safety (OSS). The NYCTA has a single Office of System Safety that formulates safety policy for all NYCTA divisions--NYCTA-Rapid, NYCTA-Surface, and SIRTOA.

Among the deficiencies noted in SIRTOA's system safety program are the following:

- The working relationship between the SIRTOA staff and the OSS is weak, particularly with respect to accident investigations.
- The System Safety Program Plan (SSPP) is viewed more as a compliance document than as a plan for effective action.
- The SSPP is out of date, incomplete, poorly maintained, and contains numerous deficiencies.

7. ***Faced with the prospect of static or shrinking funding, SIRTOA will be challenged to achieve and maintain the highest levels of safety and***

*security while simultaneously dealing with pressures to maintain or expand services.*

Since 1982, management emphasis at the MTA, SIRTOA's parent organization, has been directed toward a massive capital investment program. The program is designed to raise the quality of existing equipment and facilities to a "state of good repair" and maintain that level to avoid a repetition of the past deterioration. Despite considerable recent progress, much remains to be accomplished. Current estimates of achieving a state of good repair at SIRTOA, now extended to 1997, may be optimistic in view of the region's economy and MTA's past performance on fulfilling such predictions. SIRTOA will be faced with major challenges in making the tradeoffs between improving the quality of service and expanding the service area versus maintaining the adequacy of current facilities, equipment, and personnel to ensure safety and security for passengers and employees. Its response to those challenges will have a major impact on safety and security for years to come.

#### 5.4 NYCTA-SURFACE RESULTS

Booz•Allen and Hamilton reported the following results from their investigation of the NYCTA-Surface.

##### 5.4.1 Objective

The objective of the investigation was to examine the current status of passenger and employee safety, develop detailed findings identifying any safety deficiencies, and condense related findings as general conditions of concern for NYCTA-Surface. Because transit security is defined as the prevention of intentional danger, security was also examined from the perspective of the potential to harm passengers or employees.

#### 5.4.2 NYCTA-Surface Overview

The Department of Surface Transit (NYCTA-Surface) operates bus service throughout the five boroughs of New York City--Bronx, Brooklyn, Manhattan, Queens, and Staten Island. NYCTA-Surface serves about 750 million passengers annually and operates approximately 3,400 vehicles during peak service on 227 routes. There are 22 major divisions with about 15,000 employees systemwide; NYCTA-Surface has more employees dedicated to bus operations than any other U.S. transit system. NYCTA-Surface operates 19 depots and 5 heavy repair facilities. Over the last decade, NYCTA has made a major investment in the bus fleet. Since 1982 over 2,400 buses have been replaced; this reduced the average age of the bus fleet to 7.6 years.

During calendar year 1991, a major shift in the safety responsibilities within NYCTA occurred. Significantly increased safety responsibilities (which previously resided in the Office of System Safety for both Rapid and Surface) were shifted to the Department of Surface Transit. An independent Surface Transit Safety group was established within the Transportation Support Services Division, Department of Surface Transit. Individual safety superintendents were also assigned to the five operating divisions. This philosophy brings safety responsibilities closer to the operating divisions and creates additional interdependencies.

#### 5.4.3 Investigation Approach

The NYCTA-Surface investigation scrutinized policies, documentation, organizational structure, operations, equipment and facilities. The following seven topics were investigated in detail:

- Management Review and System Safety Program Plan Evaluation:
  - Review of the System Safety Program Plan (SSPP) for acceptability as a baseline document, for compliance with industry and New York State Public Transportation Safety Board standards, and for adequacy of implementation.

- Assessment of the effectiveness of the safety organization including: the impact of operating element management structure on safety and security; the use of their hazard resolution process; the relationship of financial management and capital improvement programs to safety and security; and the impact of employment practices, labor relations, and work rules on safety.
- **Bus and Emergency Operations:**
  - Review of the transportation organization, system route configuration, service levels, performance indicators, accident and incident data, and operating procedures.
  - Assessment of emergency procedures, emergency preparedness, emergency simulations and drills, interagency agreements for emergency response, and emergency equipment availability.
- **Hiring and Training:** Assessment of the screening and hiring process, training courses, testing, instructor certification qualifications, and public information and awareness.
- **Maintenance Practices:** Review of maintenance policies, organization, and staffing; inspection and testing; facility design and maintenance; preventive maintenance programs; inventory management; data collection and analysis; and quality assurance programs.
- **Physical Systems and Procurement:**
  - Inspections to review the condition of buses, communications and dispatching equipment, passenger loading facilities, command centers, maintenance shops, servicing depots, and bus and equipment storage areas.
  - Assessment of design and procurement practices for buses and for parts.
- **Security:** Evaluation of the investigation process, data analysis, deployment strategies, plans, policies, directives, and equipment; and analysis of security incident trends.

- Substance Abuse: Review of contracts, policies, training, testing, record keeping, and effectiveness.

Bus authority compliance with Federal environmental and occupational health and safety requirements that relate to design or construction of transit systems was not a major focus of the investigation. An assessment of the security of fare media, money, software, or office equipment was specifically excluded from the scope of the investigation.

The investigation of system safety at NYCTA-Surface began with a review of the results of the Phase I preliminary investigation and other background documents. A management plan was then developed and submitted to the FTA for approval. The management plan was designed to provide the investigators, the FTA, and NYCTA-Surface with guidelines and direction relating to the conduct of the investigation. The management plan covered areas such as identifying and reviewing documents, protocols for arranging interviews and collecting data at NYCTA, conducting facility and equipment inspections, and channels for notifying NYCTA of any imminent hazards identified during the investigation. In addition, the FTA reviewed and approved checklists of evaluation criteria within each of the topic areas which were used to guide the course of the investigation.

Visits and interviews were conducted during December 1991 and January and February 1992. Several training courses were attended. Team members interviewed approximately 400 NYCTA staff members at all organizational levels, including managers, executives, superintendents, supervisors, bus operators, and mechanics. In addition, interviews were conducted with staff at the following agencies:

- MTA Board of Directors
- MTA Inspector General
- New York City Police Department
- New York City Fire Department
- New York Public Transportation Safety Board
- Permanent Citizens Advisory Committee
- Transport Workers Union
- Amalgamated Transit Union

Extensive document reviews were conducted to assess current practices and safety standards, including policies, plans, and procedures; management reports; summary performance reports; budget and financial reports; procurement specifications for buses and spare parts; inventory control document; detailed maintenance reports; scheduling documents; incident and accident reports; safety audit reports; deficiency reports; and safety logs. Performance and security incident data were collected and analyzed to identify trends.

Bus operations were observed at 12 of 19 depots during weekday morning pull-outs. Bus operators' performance of pretrip inspections were observed and the general condition of 40 buses at each location was examined. Detailed inspections were conducted on 314 buses (9 percent of NYCTA's bus fleet) at all depots.

Walk-through inspections were conducted at all 22 depot and shop facilities (including the Manhattanville depot under construction) and the Cross-Town paint facility. To determine compliance with safety requirements, inspections were conducted to assess security levels and the state of maintenance facilities, shop equipment, safety signs, and work practices. Facilities were also inspected for compliance with major fire and building safety codes and practices.

The design, procurement, function and maintenance of the NYCTA communications were investigated for vehicles including buses, service, and patrol. Radio system procedures, instructions, and training were evaluated for system use, function, and the ability to serve and protect operators and passengers.

An assessment of the screening and hiring process was conducted. Managers, instructors, superintendents, bus operators and mechanics were interviewed about training courses and testing. Documents such as hiring procedures; tests for bus operators, mechanics, and instructors; course materials; and training records were reviewed. In addition, training courses and bus operator tests were observed.

An analysis of security related trends was performed. In light of these trends, force deployment strategies and security investigation processes, plans, and policies were evaluated.

Bus and parts procurement procedures were evaluated, specifications were reviewed, and facilities and test laboratories were visited. The investigation team was also directed to focus on the nationwide counterfeit bolt problem, as it relates to bus safety in New York. The team found that the NYCTA is well aware of the counterfeit bolt problem and purchases original equipment manufacturer (OEM) bolts for all structural applications and does not deal in the commodity bolt market. As a result of this finding, no bolts were tested for strength or metallurgical content.

Physical inspections of ten bus depots (two from each borough) were conducted to evaluate the effectiveness of internal and external security, employee security, perimeter fencing and lighting, emergency telephone systems, and property protection agent deployment. In addition, bus shelters were inspected throughout the five boroughs.

Substance abuse program statistics and documentation were extensively reviewed. Specimen collection sites were inspected and specimen collection procedures were evaluated. Supervisory training sessions on substance abuse were observed.

#### 5.4.4 Findings Supporting System Safety Goals

Findings of the investigation of NYCTA-Surface demonstrate strong support for system safety goals. The NYCTA president and his staff identified safety as a critical factor in planning every aspect of their operation and there is increased focus on this goal. Safety is addressed in the transit authority's mission statement, as follows:

*To achieve excellence in providing a safe, convenient, comfortable, reliable, cost effective, responsive, and customer oriented public transportation system.*

NYCTA-Surface has achieved some success in implementing and supporting system safety goals, which is summarized here by topic area.

#### Management Review and System Safety Program Plan Evaluation

The NYCTA president has focused on goal setting for each department in which safety is a defined objective. Safety goals will also become a part of the managers'

performance evaluations. In addition, the accident rate for the Surface operations has been steadily decreasing. Accidents decreased from 9 per 100,000 vehicle miles in 1990 to 7.2 per 100,000 miles in 1991, with a goal of 7.0 in 1992.

The Office of System Safety (OSS) has a well defined structure with enhanced visibility within NYCTA. The OSS reporting relationship changed when a new Assistant Vice President of System Safety took office. Since the OSS now reports to the Executive Vice President, its independence and visibility increased. This created a perception that OSS has become more accessible and active in field activities, and its technical skills and capabilities are readily acknowledged. The OSS independence from Surface Transit also provides checks and balances.

The OSS set goals for 1991 that dealt with all aspects of the NYCTA operation. It instituted a series of new safety initiatives to increase the effectiveness of safety efforts through increased employee awareness and professional training. The OSS and other departments have established a liaison with key outside agencies like fire departments, the police, accessibility groups, Public Environmental Safety and Health, and the New York Public Transportation Safety Board (PTSB).

The NYCTA has also established a new safety group called Surface Transportation Safety (STS). This offers the potential for increased safety awareness and improved operational safety since STS focuses on accidents that do not meet PTSB criteria, maintains daily interaction with maintenance and operations units, and identifies operational safety problems for prompt attention. Staffing within STS identifies a chief safety officer who reports directly to the vice president of transportation. STS has established a goal of investigating 60 percent of all surface accidents (including all accidents that meet PTSB criteria). STS participates in reviewing accident and incident information with operators during safety meetings and uses OSS accident data to identify bus routes with the greatest potential for accidents and bus operators with the poorest driving records.

The OSS has an effective hazard resolution process that exceeds typical transit industry practices. OSS uses information generated by numerous inspections and accident reports to develop recommendations. Safety data generated within NYCTA are used by OSS to develop, interpolate, and project trends. Classic geographical data presentations, such as route and location analyses, have been developed and

are beginning to be used by other departments. OSS has begun to send accident statistics to the Department of Surface Transit routinely. In addition, the inspection findings are adequately tracked and corrective actions are generally prompt.

Both the Law Department and OSS focus attention on reducing the number of accidents in which pedestrians are struck by buses. The Law Department and OSS have coordinated activities to ensure that vehicle accident reports are submitted promptly. The NYCTA began an Injury on Duty Task Force which meets on a regular basis to address coordinated approaches across departments to handle employee accidents and resulting Workers Compensation costs.

The NYCTA-Surface 1992 operating budget required senior management to absorb significant reductions while maintaining safe and efficient service. A goal of the budget was to increase supervision of street operations and to improve disciplinary follow-up for accidents. NYCTA-Surface responded by reducing management and administrative personnel and shifting accountability down to the depot level. The NYCTA has avoided cutting safety related budget items by achieving savings through other means, like reductions in inventory levels, health care costs, absenteeism, workers compensation claims, and overtime costs. The result is significant savings without affecting safety or efficiency.

The capital planning function was reorganized to make it more strategically focused and safety oriented. A new corporate planning unit has been created, reporting to the executive vice president. This unit will coordinate the setting of the annual goals statement (including safety), which begins the budget formulation process. NYCTA has also proposed the creation of an Office of Management and Budget, which will report to the president. It will integrate budget functions that previously have not be subject to a systematic review.

The NYCTA capital program is a comprehensive, inventory based process that includes safety and security as priorities. Three key programs have been highlighted as essential to maintain the safe and efficient operation of buses and the safety and security of passengers and employees--bus replacement, construction and rehabilitation of bus depots and shops, and the development of an automatic vehicle location control program.

## Bus and Emergency Operations

The management and staffing of NYCTA-Surface's transportation functions are appropriate for the size, complexity, and geographical dispersion of operations. The borough general manager concept decentralizes authority and places informed, senior decision makers close to depot level operations. Within the borough general manager and chief transportation officer units, the spans of control are narrow and the chains of command are short.

System route configurations are managed as a formal process that is incorporated in the System Safety Program Plan (SSPP). The Office of Scheduling and the Office of Service Planning address safety issues through realistic assessments of passenger loads to avoid overcrowding and bus stop skips. Trip and recovery time studies are completed as part of a comprehensive program to control speeding and operator stress.

NYCTA-Surface compiles an extensive list of performance measures, which it publishes periodically and distributes widely. Use of performance measures, operating data, and information is a central component of the management culture. NYCTA-Surface management routinely receives safety performance data in a format that is meaningful and useful. Significant improvements have been achieved in areas tracked by these performance measures.

NYCTA-Surface has also assembled a compendium of safety related rules, practices, and procedures in the System Safety Manual. Rules, practices and procedures are also communicated through policy and instruction bulletins. Current, detailed emergency procedures are distributed throughout NYCTA-Surface and are incorporated in the body and appendices of the SSPP. These procedures are specific and have become ingrained by years of operational use. The majority of interviewees had emergency procedures readily available and demonstrated detailed knowledge of what to do and whom to notify in an emergency situation. An effective working relationship among the various agencies within New York City is repeatedly demonstrated during "routine" emergencies like water main breaks, street gridlock due to accidents, and major NYCTA-Rapid accidents and delays.

## Hiring and Training

The Department of Human Resources, which has overall responsibility for hiring and screening applicants, is well organized, staffed with competent personnel, and responsive to the needs of NYCTA-Surface. To ensure full compliance with recommendations from MTA/OIG Report 90-23A, a "Procedure for Hiring MaBSTOA/Transit Authority Bus Operators" was developed jointly in May 1991 by Surface Transit and Human Resources. This procedure is now in use.

The new organizational responsibilities for safety, within Surface Transit, are well represented by new management. The entire bus operator training program has been reevaluated and the approach and program development are of high quality. New formal need assessments are conducted to establish the basis for new training program development. Based on pilot program results, the new programs represent significant improvements in bus operator curriculum.

Maintenance training is performed in a highly professional manner. Maintenance instructors are knowledgeable about the subject material and are able to train students to use technical manuals, proper tools and equipment necessary to repair and maintain buses. Mechanics are tested for job knowledge and skills, and reports on their progress are well maintained.

The Department of Customer Service and the Division of Customer Communications have achieved an excellent record in promptly disseminating accurate information to increase public awareness. They are currently undertaking a well structured, imaginative, and highly proactive program to improve safety.

## Maintenance Practices

The maintenance activities at the NYCTA are extremely well organized and documented; NYCTA-Surface goals reflect a tireless pursuit of increased quality in maintenance work. The NYCTA-Surface promotes a policy of reducing and minimizing unscheduled service activities; therefore, the preventive maintenance program is far more extensive at NYCTA-Surface compared to other transit authorities. Maintenance practices are supported by the use of safety related documentation, NYCTA-Surface operational policies, equipment manufacturer

documentation, and technical expertise in the maintenance support group. At the depot level, there is extensive cooperation and communication between maintenance and operations personnel at both line and management levels. Staff allocations, supervision, and depot management are sufficient to provide safe, reliable service at the system's depots.

NYCTA has extensive material test capabilities and vendor qualification standards that ensure procured materials meet specified quality standards dictated by the NYCTA-Surface Technical Services Unit or the recommendation of the original equipment manufacturer. There are a number of system specific checklists and procedures for maintainers to follow, as well as feedback mechanisms to alert the Technical Services Unit to recurring problems. The preventive maintenance program is fully supported by a branch of Technical Services (Maintenance Support), which provides instructions to maintainers to assure that safety related maintenance is performed. Quality assurance responsibilities for maintaining buses are decentralized to the depot level and are handled thoroughly to prevent maintenance related accidents from occurring. Quality assurance inspection of work performed by vendors outside the NYCTA organization is the responsibility of the Office of Technical Services. Its thorough inspections ensure that the work meets the highest standards of the NYCTA.

#### Physical Systems and Procurement

The outstanding condition of buses in the NYCTA-Surface fleet provides a safe and reliable means of transportation. NYCTA's bus procurement system is highly developed, and effectively ensures high quality, functionally safe buses. The technical specification used to purchase buses has been developed over many years and includes only features proven reliable in New York City service. NYCTA's approach to parts procurement is focused on part quality, vendor responsibility and reliability, and cost. NYCTA's parts procurement system is highly structured and controlled, functions in accordance with the documented procedures, and minimizes the risk of unsafe or substandard components being installed on buses.

The NYCTA-Surface maintenance facilities and other structures range in age from 1895 to present day construction. Despite their age, the condition of buildings ranges from fair to excellent with respect to safety. Maintenance and inspection of

facilities is completed with the safety of inhabitants foremost in importance. Fire safety precautions are part of NYCTA-Surface's safety program to instill knowledge of fire emergency procedures.

### Security

Joint operations between the Transit Police Department (NYCTPD) and the New York City Police Department (NYCPD) precincts and detective squads have become common; their liaison and communication is very effective. Information shared between agencies has proved helpful to both agencies in fighting crime on buses and in bus depots.

Although the structure of the NYCTPD is geared primarily to police the subway system, NYCTA has modified the policing policy so that the Surface Crime Unit within the NYCTPD deploys additional enforcement operations to address bus related problems. These operations have proven successful. The NYCTPD develops plans, policies, and directives to articulate a clear mission and goal for security and safety within the NYCTA-Surface system. The NYCTPD also uses a training program to address safety and security issues to help create a safe environment for passengers and employees.

### Substance Abuse

NYCTA has executed contracts with providers of substance abuse services that ensure compliance with relevant sections of federally mandated substance programs and, in some respects, go beyond the federal requirements. The existing NYCTA substance abuse policy (expressed in P/I 6.9 and 6.0.3 and in Appendices E-1 and E-2 to the TWU contract) largely complies with the intent of FTA and Congress as expressed in FTA regulation 49 CFR Part 653, the Drug Free Workplace Act, and the Omnibus Transportation Employee Testing Act of 1991.

NYCTA and its unions have made a commitment to improve safety by voluntarily instituting a random drug testing procedure. NYCTA understands the importance of work force training and education in an effective substance abuse program and has designed training programs for the managers and supervisors as well as for the general work force. As with the training component of the program,

substance abuse testing is sound in design. Federal testing procedures, NIDA certified laboratories, and a medical review officer are used. In some cases, NYCTA's requirements exceed federal standards.

For internal and external reporting, NYCTA assembles a large set of management statistics governing all aspects of its substance abuse program and evaluates the performance of its drug testing laboratory by submitting blind samples to the laboratory for quality assurance testing. Records of drug test results are treated as confidential medical information. NYCTA test results, as compared to 1990 data, (the only year for which industry estimates are available) are generally equivalent to those of other transit operators.

#### 5.4.5 NYCTA-Surface Conditions of Concern

The objective of the NYCTA-Surface investigation was to examine the current status of passenger and employee safety and develop findings identifying safety deficiencies (conditions of concern). For the purpose of the investigation, a condition of concern is a set of circumstances that prevents or impedes the achievement of the highest levels of safety and security, and, if not resolved, may result in significant hazards or unsafe conditions. During the safety investigation of NYCTA-Surface, investigation leaders developed a consensus on the following conditions of concern.

##### Management Review and System Safety Program Plan Evaluation

1. ***The roles, responsibilities and interfaces between the Surface Transportation Safety Unit (STS), the Division Safety Superintendents, and the Office of System Safety (OSS) are not defined clearly.***
  - In the absence of clearly defined roles, responsibilities, and interfaces between the safety organizations, a lack of cooperation, unnecessary friction, and a duplication of effort can result--all of which lessen the quality and effectiveness of the total safety program.
    - Accident/incident investigations are not conducted jointly, and coordination and cooperation are lacking. Although OSS now

routinely provides Surface accident statistics and names of drivers with the highest number of accidents for the past 12 months, STS does not routinely provide OSS with accident reports.

- STS and OSS do not jointly plan and develop the NYCTA and NYCTA-Surface's long term safety requirements to ensure they are properly integrated and complementary.

**2. *The NYCTA-Surface System Safety Program Plan (SSPP) does not embody the full extent of the safety program.***

- A major portion of OSS's assigned responsibilities are not adequately addressed in the SSPP, including:
  - Asbestos removal
  - Environmental health
  - Right-to-know law impact
  - Occupational safety
  - Fire protection.
- Due to the ongoing reorganization within NYCTA-Surface, the SSPP does not accurately reflect the role of the safety activities of the STS and the division safety superintendents.

Bus and Emergency Operations

**3. *Aggressive operation of "gypsy vans"<sup>13</sup> creates the potential for accidents in bus stop areas.***

- Gypsy vans create unsafe situations, particularly in the vicinity of bus stops, where they have been observed cutting off NYCTA buses to solicit rides. These "gypsy vans" are often unregulated, uninsured, and operated by unlicensed drivers.
- Bus service cutbacks make the "gypsy vans" more attractive to bus riders, which in turn leads to even more service cutbacks and more demand for "gypsy van" services.

13. "Gypsy vans" are unsanctioned cars or vans that illegally solicit riders at reduced fares.

- Although NYCTA has instituted an illegal van task force and increased enforcement by the Transit Police Department, the "gypsy van" problem is growing.

#### Hiring and Training

#### **4. *Surface Transportation Training lacks comprehensive control of the process for training bus operators.***

- The cumbersome hiring process discourages the best qualified bus operators, mechanics, and technicians from entering into employment with NYCTA.
  - Hiring and promotion are unnecessarily influenced by the New York City Civil Service Law, which works to the disadvantage of NYCTA.
  - The Notices for Examination for bus operators, for bus maintainers, as well as for promotion for supervisors contain few requirements or references to safety concerns and awareness on the part of applicants.
- #### **5. *There is no uniformity in determining the preventability of bus accidents and decisions concerning preventability are made by inadequately trained personnel.***
- There are no systemwide standards established or being developed to evaluate bus accidents/incidents. Thus, there are no standards for retraining, disciplinary actions, or feedback into curricula (as recommended by the MTA Inspector General).
  - Bus accidents/incident investigations are approached in three different ways. No standard procedure exists for investigation conduct, methods, or approach. Conduct of investigations is based on individual experience.
  - Safety superintendents who evaluate an accident's preventability do not receive formal accident analysis training and must rely on job experience.

## Physical Systems and Procurement

6. *Some bus maintenance and storage facilities, particularly those not originally designed for diesel bus maintenance, do not meet fire or life safety design practices.*
- Personnel and vehicle passageways and work spaces do not always provide safe and accessible use.
  - Condition of emergency equipment and exits pose a safety concern in various depots for both NYCTA and emergency services personnel.
  - Storage of hazardous materials may pose a threat to safe operations if a leak or fire occurs.
  - Hazardous operations are not always performed with safety as a first priority.
  - Some maintenance and storage facilities do not provide an acceptable level of safety. Examples include:
    - Battery rooms that lack adequate ventilation to limit the possibility of ignition from sparks.
    - Bus storage areas that lack adequate ventilation.
    - Flammable liquid dispensing areas that do not have dedicated ventilation systems.
    - Sprinkler shutoff valves that are not clearly marked.
    - Emergency shutoff valves for fueling islands that are not clearly marked.
    - Fire system water pressure gauges that are broken or inoperable due to closed valves.

## Security

**7. *Bus operator harassment, assault, and theft of bus transfers are much worse than data within NYCTA indicate.***

- Bus operator harassment and assault are major problems and the data on these incidents are understated.
  - Bus operator assaults are the largest cause of employee injury.
  - Bus operators are reluctant to report all incidents out of fear of retaliation by aggressive riders.
- Bus transfer theft is a problem because the street value of bus transfers is high. Bus operators are easy targets and transfer theft involves varying degrees of assault on a bus operator; frequently it involves a weapon.

**8. *Property protection and physical security are inadequate at some depots.***

- Depots do not have functioning security alarm systems.
- Closed circuit television systems at all facilities are not in working order.
- The current employee parking sticker system is not operational and sticker/placard control by date or number is nonexistent.
- There is no uniform, systematic employee security policy used at the depot level.
- Many depots have unsecured entrances and exits that can be accessed by unauthorized individuals. In some instances, entrance and exit doors had not been repaired or replaced for over six months.

## Substance Abuse

- 9. *Although NYCTA's substance abuse policies and procedures are well defined and largely comply with the intent of the FTA and Congress, poor implementation threatens the integrity of the substance abuse program. Failure to properly implement NYCTA's own procedures may***

*allow substance abusers to avoid detection and return, untreated, to a safety sensitive position.*

- Medical Assessment Centers do not always follow NYCTA policies and procedures for substance abuse testing. Irregularities and inconsistencies include:
  - Failure to keep specimen in sight or have only the donor handle it until sealed.
  - Failure to inspect public washrooms prior to donors' use.
  - Failure to eliminate adulteration of samples by hot water and other materials accessible to donors within the washrooms.
  - Frequent breaks in chain of custody.
- Failure to adequately train employees, supervisors, and managers results in:
  - Poor enforcement of the policy and procedures, including the lack of a systematic approach to assess safety sensitive employees for fitness for duty prior to letting them assume their duties each day.
  - Supervisors and managers unprepared or unwilling to exercise their responsibilities to remove impaired workers.
  - Breaches in collection procedures that could permit abusing employees to return to duty undetected and untreated.

## 5.5 METROPOLITAN SUBURBAN BUS AUTHORITY RESULTS

The results of the safety investigation of bus operations at the Metropolitan Suburban Bus Authority (MSBA) were written by Booz®Allen and Hamilton.

### 5.5.1 Metropolitan Suburban Bus Authority Overview

MSBA primarily serves Nassau County with some connecting service into Suffolk County and the Borough of Queens. MSBA also provides feeder and inter-connecting service with the Long Island Rail Road (LIRR), the commuter rail network which serves New York City.

MSBA serves approximately 30 million passengers each year, operates slightly over 300 buses on 47 routes, and employs 900 people. The New York State Public Transportation Safety Board (PTSB), for its purposes, defines MSBA as a large sized bus system, although several U.S. transit authorities operate much larger fleets. The fleet is a mix of buses from four different manufacturers. MSBA operates from two facilities: the Mitchel Field depot in Garden City, New York, and the Rockville Centre depot in Rockville Centre, New York. Based on a review of operating and safety data contained in Section 15 reports for 1990, MSBA's safety record compares favorably with the safety records of other similar transit properties (200 to 300 buses).

The present MSBA General Manager, appointed in September 1986, set goals to: reverse a decline in performance trends by improving the quality and level of service; rebuild the organization; reestablish trust and cooperation between management, the unions, other work force elements, the public, and the Nassau County government; and revitalize the bus fleet.

At the conclusion of the Phase I preliminary investigation in January 1991, five open PTSB recommendations pertained to MSBA's operations. While MTA maintains that the recommendations have been implemented and should be closed (see Table 5-6), the PTSB stated that the recommendations require periodic review (therefore, they remain open).

During the Phase II investigation of MSBA, these items were reviewed to ensure that MSBA had instituted these recommendations and was conducting periodic reviews to ensure compliance. All of these recommendations are being addressed.

Table 5-6 Open PTSB Recommendations

SUBJECT	RECOMMENDATION
Training	All drivers comply with NY State Vehicle and Traffic Law
Training	Periodic bulletins on defensive driving
Transit Equipment	Revise inspection to ensure repairs made
Working Conditions	Pre- and post-trip inspections and follow-up
Working Conditions	Encourage full compliance with Federal regulations on substance abuse

### 5.5.2 Investigation Approach

The MSBA investigation scrutinized policies, documentation, organizational structure, operations, equipment and facilities. The following seven topics were investigated in detail:

- **Management Review and System Safety Program Plan Evaluation:**
  - Review of the System Safety Program Plan (SSPP) for acceptability as a baseline document, for compliance with industry and New York State Public Transportation Safety Board standards, and for adequacy of implementation.

Assessment of the effectiveness of the safety organization including: the impact of operating element management structure on safety and security; the use of their hazard resolution process; the relationship of financial management and capital improvement programs to safety and security; and the impact of employment practices, labor relations, and work rules on safety.
- **Bus and Emergency Operations:**
  - Review of the transportation organization, system route configuration, service levels, performance indicators, accident and incident data, and operating procedures.

- Assessment of emergency procedures, emergency preparedness, emergency simulations and drills, interagency agreements for emergency response, and emergency equipment availability.
- Hiring and Training: Assessment of the screening and hiring process, training courses, testing, instructor certification qualifications, and public information and awareness.
- Maintenance Practices: Review of maintenance policies, organization, and staffing; inspection and testing; facility design and maintenance; preventive maintenance programs; inventory management; data collection and analysis; and quality assurance programs.
- Physical Systems and Procurement:
  - Inspections to review the condition of buses, communications and dispatching equipment, passenger loading facilities, command centers, maintenance shops, servicing depots, and bus and equipment storage areas.
  - Assessment of design and procurement practices for buses and procurement practices for parts.
- Security: Evaluation of the investigation process, data analysis, deployment strategies, plans, policies, directives, and equipment; and analysis of security incident trends.
- Substance Abuse: Review of contracts, policies, training, testing, record keeping, and effectiveness.

Bus authority compliance with Federal environmental and occupational health and safety requirements that relate to design or construction of transit systems was not a major focus of the investigation. An assessment of the security of fare media, money, software, or office equipment was specifically excluded from the scope of the investigation.

The investigation of system safety at MSBA began with a review of the results of the Phase I preliminary investigation and other background documents. A

management plan was then developed and submitted to the FTA for approval. The management plan was designed to provide the investigators, the FTA, and MSBA with guidelines and direction relating to the conduct of the investigation. The management plan covered areas such as identifying and reviewing documents, protocols for arranging interviews and collecting data at MSBA , conducting facility and equipment inspections, and channels for notifying MSBA of any imminent hazards identified during the investigation. In addition, the FTA reviewed and approved checklists of evaluation criteria within each of the topic areas which were used to guide the course of the investigation.

The investigation in each topic area was conducted under the direction of a topic leader who was responsible for identifying key interview requirements and developing an interview plan, for identifying and obtaining documents for review, and for directing and coordinating the efforts of the investigative staff.

Site visits were conducted during September and October 1991, and a series of interviews were held with more than 50 MSBA staff members at all levels. MSBA staff were highly cooperative with the investigative activities and were generous in expending their time and providing information.

Extensive document reviews were conducted to assess current practices and safety standards, including policies, plans, and procedures; management reports; summary performance reports; budget/financial reports; procurement specifications for buses and spare parts; inventory control documents; detailed maintenance reports; scheduling documents; incident/accident reports; safety audit reports; deficiency reports; and safety logs. Performance and security incident data were collected and analyzed to identify trends.

Equipment condition and operator performance assessments were based on observations made during in-service bus rides and during bus pull-ins and pull-outs. Detailed inspections were conducted on 15 buses (5 percent of MSBA's fleet); further random inspections were performed on 19 additional buses to ensure findings were representative of fleet condition.

Walk-through inspections were held at MSBA's Mitchel Field and Rockville Centre facilities to assess security levels and to inspect the state of the maintenance

facilities and shop equipment, safety signs, and work practices to determine compliance with safety requirements. Buildings at Mitchel Field and Rockville Centre were also checked for compliance with fire and building safety codes and practices.

Communication equipment and practices were investigated to determine the safety status of the current and proposed systems.

Bus procurement procedures were investigated from specification development to delivery and acceptance of buses. Parts procurement procedures were also investigated. Finally, because there has been a flood of inferior quality bolts plaguing several U.S. markets, random tests of Grade 8 bolts in inventory were conducted to determine compliance with Society of Automotive Engineers standards.

Following the close of the site visits at MSBA, the Summary Report was prepared. A summary of the investigation findings was presented to MSBA on January 9, 1992.

### 5.5.3 Findings Supporting System Safety Goals

Over the past five years, MSBA has focused on improving service and developing a goal-oriented management team approach to problem-solving. The MSBA management commitment to safety is strong. MSBA's management style and philosophy is that of a "family-like operation" with strong personality influences that place a high premium on face-to-face contact. The organization is small, comprising four levels of management from General Manager to bus operator. The excellent safety record reflects the commitment of key staff who work well together, rather than an ingrained and structured process.

#### System Safety Program Plan Evaluation and Management Review

The System Safety Program Plan (SSPP) includes safety areas beyond those required by the PTSB guidelines such as: fire protection standards in accordance with the National Fire Protection Association (NFPA), right-to-know hazardous

materials compliance instructions, chemical safety policy, and occupational safety and health standards.

MSBA has established liaisons with key outside agencies to coordinate safety activities during crises. Focal points for liaison with outside agencies have been established--the general manager communicates with disability access groups; the chief of staff negotiates to obtain security support from the LIRR transit police; and emergency drills are held with local fire departments.

MSBA has several ongoing safety related capital improvement programs, including procuring 400 radios for buses and street supervisors to improve the reliability and quality of voice and data communications. MSBA is also planning to install (pending appropriation of County funds) a \$1.5 million automatic vehicle location system that will enable dispatchers to track the exact location of buses and facilitate prompt dispatch of emergency response services and MSBA supervisors to emergency sites.

The safety mission is supported by the cooperative relationship of union members and MSBA management. The union maintains a positive attitude toward safety, and a total of four shop stewards work with the safety divisions to increase safety awareness and provide training assistance.

There is a process in place for retraining, for disciplinary actions, and for acquainting transferees with MSBA safety rules. The union participates in the orientation of new employees and training assistance to transferees. Operations management employees also receive training in industrial safety before assuming their positions.

### Bus and Emergency Operations

The staffing level and organization of MSBA's Transportation Department are appropriate to current operations. MSBA's staff level is also comparable to other similarly sized transit properties. The chain of command from general manager to bus operator has a minimal three intervening levels including general manager, chief transportation officer, location chief/assistant location chief, dispatchers, and operators.

The functions of the Transportation and Maintenance Departments are tightly coordinated. The chief transportation officer (CTO) and the chief maintenance officer (CMO) share an office suite; both believe that communications between the departments are effective and facilitated by their co-location.

Schedule making is sensitive to safety and security. Adjustments are made to running times to address issues of bus speeding, schedule adherence, and operator stress. There is also coordination of LIRR and MSBA service and well-developed emergency service plans for major LIRR stoppages. The Scheduling Division and Operations Safety and Training Division review existing routes and proposed changes for function and safety, including turning movements, bus stop attributes and location, and bus stop zone length. Trips are added where required to ease passenger crowding and stranding.

At facilities, emergency equipment--such as fire extinguishers, fire hose stations, and fire alarms--is functional and highlighted with signs and arrows. Eyewash stations and first aid kits are available. Tow trucks are well maintained and functional.

#### Maintenance Practices

Safety information is an integral part of the management database. Individual bus histories and component activity reports include one time and repetitive safety failures. MSBA has a closed loop computer system to track operator reported bus defects. Transportation personnel report safety defects on a defect card, and a computer system correlates the repair action or "no defect found" with each event.

Maintenance staff levels and skill levels are adequate. Equipment reliability and availability are improving, and no maintenance work is being deferred. Outside resources are used to eliminate a backlog of deferred work, particularly engine and transmission rebuilds. MSBA's ratio of buses to maintainers is at the median for transit properties of its size.

Equipment reliability and availability have improved significantly each year since 1987. One factor contributing to improved vehicle performance is the revision

of the preventive maintenance (PM) program in 1989. Resources have been reallocated to properly support preventive, corrective, and other maintenance activities. The PM program is based on basic inspections at 4,000-mile intervals, with additional items checked at a 24,000-mile interval comprehensive inspection. MSBA's information system is used to schedule and report on PM inspections.

### Physical Systems and Procurement

Safety is promoted throughout MSBA, by both management staff and hourly employees; the union actively participates in safety activities. The safety mission is reinforced by scheduled inspections and random safety checks conducted by the Labor-Management Safety Task Force, which includes the manager of industrial safety and training, the manager of labor relations, the supervisor of building maintenance, and union representatives. The Task Force logs all deficiencies it finds during inspections at MSBA's facilities.

A maintenance program is in place to check and record facility deficiencies. A thorough maintenance program has been started to check the buildings for industrial safety. Infractions are recorded daily and a monthly Task Force inspection is conducted. Deficiencies are entered into the manager of industrial safety's computerized plant and equipment safety log, prioritized, and scheduled for correction. The safety log is then used to track the resolution of all safety deficiencies in MSBA facilities.

MSBA's parts procurement procedures have many safeguards. Parts procurement focuses on high quality standards. Most repair parts procured by MSBA are original equipment manufacturer (OEM) parts obtained from the same used by bus manufacturers. MSBA relies on NYCTA engineering evaluations to qualify OEM equivalent parts.

### Hiring and Training

Training programs are described as satisfactory by the staff, and no complaints or union grievances were brought to the attention of investigators. New bus operators have three days of classroom training, five days of onboard vehicle instruction, and five weeks of in-service training. The driver training course for new

bus cleaners emphasizes bus maneuvering skills for driving in garage areas and through the bus washer. Refresher courses are required every two years and retraining courses for transferees are individualized to respond to their needs. Defensive driving training courses are available. Course material is updated frequently, as required by equipment changes or recommended by dispatchers.

The public is kept well informed of all changes in bus service through communications between the MSBA command center and the media. All major schedule and service changes are well publicized by "car cards," signs, news releases, handouts, and distribution of updated route maps. Signs and route information postings at bus stops are maintained on a regular basis. Safety aboard buses and when using facilities is also constantly promoted.

### Security

MSBA's current security organization does not fit the classic investigation model, due to the small size of the property and lack of demand for a significantly sized dedicated transit police force. MSBA does not have an in-house transit police division. MSBA's Security Division is small and functions primarily in an administrative capacity, but it also monitors CCTV cameras to provide property protection at Mitchel Field during daytime hours. Crimes aboard buses are reported to the Command Center and not the Security Division. Dispatchers either assist the operator or contact the police to request assistance. If police response is necessary, police from either New York City or Nassau County respond, depending on the location of the incident.

### Substance Abuse

MSBA's substance abuse policies are sound, practical, and comprehensive, providing a proper framework to ensure the integrity of the substance abuse prevention program. The policies provide all necessary information regarding the purpose of the program, authorities and responsibilities for program implementation, prohibited actions and consequences of violation, conditions for testing, provisions for confidentiality, and requirements for reentry. Conditions for testing are delineated. Consequences of testing positive are identified (dismissal for employees in the probationary period; referral for employee assistance program

[EAP] counseling for all others, with one chance only at rehabilitation). EAP confidentiality policies are based on sound professional practices. All terms of the Federal Drug Free Workplace Act that directly apply to workers and supervisors are specifically included in MSBA's substance abuse standard operating procedure. The policies have been negotiated with the unions, which appear to fully support them.

Employees are given information on the substance abuse and EAP programs and appear to be knowledgeable with regard to policies, procedures, and requirements. Information packets concerning substance abuse and the EAP programs are provided to all new employees. These packets include MSBA's Substance Abuse SOP and brochures on substance abuse from the U.S. Public Health Service, the National Clearinghouse on Drug Abuse Information, and New York State. Employees must sign a form acknowledging receipt of the information.

MSBA tests for alcohol by a combination of breath and urine tests, the best approach in the absence of blood testing. Specimen collection procedures on MSBA property exceed Federal guidelines with regard to security and chain of custody requirements. Informed consent is obtained from employees. The Chief Medical Officer reviews and follows up on all positive test results.

MSBA also maintains adequate records on the substance abuse and EAP programs. MSBA's provisions for confidentiality and privacy of records are appropriate and adequate.

#### 5.5.4 MSBA Conditions of Concern

A summary of the conditions of concern, as related to system safety, is presented in this section. The conditions of concern are derived from the findings in each topic area and in many cases apply to more than one topic area of the investigation. The following five conditions of concern indicate areas where MSBA's system safety may be jeopardized in future operations.

1. ***The present organizational climate and structure favor verbal and informal memoranda to communicate safety directives rather than formally documenting them as a basis for system safety planning.***

- The Executive Policy Statement does not define who is responsible for the safety program, nor does it grant any authority.
- The System Safety Program Plan (SSPP) is not a controlled document (numbered or dated), nor is there a procedure in place to control and disseminate revisions.
- The SSPP does not accurately reflect conditions at MSBA and does not differentiate between planned activities and those which are currently in effect.
- The SSPP does not provide a clear description of the safety program or a framework for its implementation.
- No person interviewed could cite MSBA's accident rate nor identify where such information might be found.

**2. *The pursuit of other priorities (e.g., improving fleet performance and employee productivity) has limited the resources available for documenting and analyzing safety related systems and procedures.***

- The present MSBA General Manager, appointed in September 1986, set goals to: reverse a decline in performance trends by improving the quality and level of service; rebuild the organization; reestablish trust and cooperation between management, the unions, other work force elements, the public, and the Nassau County government; and revitalize the bus fleet. This was accomplished.
- Safety is a priority of the MSBA general manager and his staff. However, formal documented support of safety by management is limited.
- Safety is a staff meeting subject, but there is no formal procedure to track assigned actions and then record and verify their completion.
- Routine rehabilitation and replacement of the bus fleet is MSBA's highest financial priority.

- MSBA recognizes that the condition of its bus fleet is a critical determinant of the safety and reliability of its service.
  - Financial constraints may affect MSBA's continued ability to maintain current levels of service and safety.
  - MSBA's operating budget and subsidy requirements will continue to grow based upon new route initiatives and ridership projections.
  - MSBA competes with other public services for county funds.
  - A systemwide hazard resolution process has not been implemented throughout MSBA.
  - Personnel within the Operations Safety and Training Division have had limited exposure to formal system safety training and techniques.
3. ***Written policies, procedures, and information resources do not exist in a form to support the safety program.***
- It is difficult to assess MSBA's safety program effectiveness accurately.
  - No quantified safety goals or standards are included in the SSPP, and there is an apparent reluctance to do so.
  - The present organization can constrain safety operations and reduce effectiveness.
  - Procedures do not officially and routinely place the Safety and Training Divisions in the review cycle for safety related information, nor on distribution lists for such information.
  - MSBA is unable to track accurately the number and type of operational violations by bus operators and dispatchers.
  - There is no formal process or procedure to change work rules.

The above three conditions of concern together pose a potential risk: if a number of key managers suddenly left their positions, their replacements would have no structured, institutionalized safety procedures to continue safe operations.

**4. *Use of a noncertified substance testing laboratory diminishes the credibility of the overall substance abuse program.***

- While the substance abuse and EAP programs are carried out well and in accordance with appropriate policies, procedures, and requirements, the use of a noncertified laboratory with inadequate and cramped quarters, inadequate security, and continuously postponed NIDA certification, has hurt the credibility of the program.

**5. *MSBA does not have adequate technical resources to develop and implement a formal system safety program.***

- Like in many small to midsize transit authorities, midlevel management at MSBA is highly competent, but lacks adequate training in formal system safety planning and implementation.
- Furthermore, they lack adequate safety and training personnel with formal system safety training and experience, as well as budgets, to implement an effective system safety program.

The MSBA management commitment to safety is strong and is effectively communicated to all levels; however, this communication is primarily verbal and very limited in documentation. MSBA's "family-like operation" management style and philosophy places a high premium on face-to-face contact. The small size of the organization minimizes potential problems with this approach. The highly successful safety record reflects the personal commitment of key staff who work well together, rather than an ingrained and structured process.

MSBA must now institutionalize system safety so that it outlives the personalities of the management team. This must be accomplished by formalizing documentation, and structuring an ongoing and systematic safety program.

## 5.6 METRO-NORTH COMMUTER RAILROAD RESULTS

Interactive Elements conducted a Section 22 safety investigation of particular aspects of Metro-North Commuter Railroad. This section presents an overview of the investigation results. It covers that portion of the operations of Metro-North that is not under the jurisdiction of the FRA. The FRA is carrying out a complementary investigation in parallel with this one to ensure a complete review of the railroad's safety programs.

### 5.6.1 General Investigation Results

In the areas covered by this investigation, Metro-North generally has a strong, safety-conscious organization. However, many practices used by the railroad have not been effectively formalized or committed to writing. As a result of the age of its infrastructure, some facilities have safety deficiencies, many of which are the subject of current capital programs. The investigation identified seven particular conditions of concern.

### 5.6.2 An Overview of Safety at Metro-North

Safety is an integral part of the corporate consciousness of Metro-North. The railroad accomplishes its safety performance through an ingrained corporate sensitivity to safety and good interdepartmental working relationships. The formalization of Metro-North's safety activities would provide an important framework for its policies and procedures and ensure consistency and continuity of their application despite changes in personnel, organization, and mission.

Metro-North's corporate culture was forged in a crisis situation after its formation in 1983. A small group of executives put the nation's second largest commuter railroad on track with only three-months notice. This group stayed on to form the nucleus of the railroad's senior management, and many of its members remain today. From the outset, safety has been stressed as a high priority. Safety issues are a regular part of executive staff meetings. Intradepartmental safety

committees composed of personnel from all levels, including representatives from senior management, hold regular meetings. Safety awareness programs have been started for both employees and passengers; these make frequent use of employee and passenger publications to feature safety performance, safety warnings, and other safety related items.

Management undertook to create a safety-conscious atmosphere. Safety performance statistics were reviewed at operations staff meetings. A President's Safety Committee was formed, including representatives from all levels of Metro-North, to communicate safety concerns and solutions throughout the organization. An orderly station appearance, including comprehensive housekeeping standards and a detailed signs program, led to public areas that looked neat and safe. A program of safety incentives was created for employees, with winning individuals and departments given coverage in employee newsletters and other publications. After enduring a strike during the first year of operation, the railroad established positive cooperative relations with labor.

A high priority capital improvement program was used to address safety issues. Despite the absence of a formal method to examine safety issues in the evaluation of capital projects, safety related improvements were made throughout the system. Capital programs have included the recent Grand Central Terminal Master Plan, which addresses major infrastructure problems.

To improve emergency preparedness at Grand Central Terminal and the Park Avenue Tunnel, the railroad entered into comprehensive interagency agreements with the New York City Fire Department.

While these initiatives have been generally effective, the safety program suffers from the absence of formal written procedures. The SSPP is a cumbersome, disorganized document lacking coverage of several important subjects and containing numerous sections that are out of date. The formalization of sound safety programs is important because it helps ensure their continuity in the face of personnel changes. In recognition of this, the railroad has begun to formulate written safety materials, including a strong quality assurance program.

The investigation has identified strengths and weaknesses in the current safety program at Metro-North. The weaknesses have been consolidated into seven conditions of concern; these are discussed later.

### 5.6.3 Investigation Method, Scope, and Approach

Five topic areas determined the scope of this investigation:

- System Safety
- Management Practices
- Physical Systems - Passenger Loading Areas
- Security
- Fire and Life Safety

With one team of investigators assigned to each of the five topic areas, railroad documents were reviewed, personnel were interviewed, and locations were inspected. A sixth topic area, Emergency Operations, was created from materials collected by three of the five topic teams.

In the course of the investigation of Metro-North, the project team examined some 322 documents; conducted 158 interviews; and visited 172 sites, meetings, and related outside agencies.

The investigation was approached from a top down perspective. The team began with the railroad's SSPP. It examined senior management's commitment to safety and the means by which it is infused into the corporate culture. Perhaps, the most important issue, in this regard, is the extent to which employees feel that management believes in safety.

For each safety issue examined during the course of the investigation, the topic teams asked:

- Does a policy exist?
- Is it adequate?
- Is it communicated effectively?
- Is it budgeted for?
- Is it implemented?

- Is its implementation effective?
- Is it monitored (checked, validated, and revised as necessary)?

As a result, it was possible to evaluate not only the policies themselves, but the degree to which the policies affected the safety performance and preparedness of the railroad.

#### 5.6.4 Metro-North Overview

Metro-North Commuter Railroad is one of the nation's largest commuter railroads. It serves an area with a population of about 1,000,000, it employs almost 6,000 people, and it affects the economic existence of thousands of businesses and millions of residents in the New York metropolitan area.

##### Operating Characteristics

The routes operated by Metro-North in New York State and Connecticut include the Hudson Line (74 route miles), the Harlem Line (77 route miles), and the New Haven Line (72 mainline route miles plus three branch lines). The railroad crosses five counties in New York and two in Connecticut.

The New York terminus of the railroad is Grand Central Terminal, a 48-acre complex linking Metro-North to New York's subway system and to hotels, shops, banks, restaurants, and office buildings. The terminal is a beautiful landmark Beaux Arts building. It was built between 1906 and 1913 in the same location as earlier railroad structures.

Going north and east from New York City, the railroad operates 116 stations, served by 650 miles of track. There are four major repair facilities, located at Harmon, North White Plains, Brewster North, and New Haven. The equipment used on this system includes some 69 locomotives, 679 MU cars, and 96 coaches. The staff is organized into eleven departments that report to the president.

Railroad surveys show that Metro-North has a generally satisfied riding public as a result of its on-time performance of 94.8% (1991), and its effective expenditure of capital resources (\$1.33 billion from 1982-1991).

### A Brief History

Metro-North Commuter Railroad was created in 1983 as a result of the Federal government's directive that Conrail leave the passenger railroad business. Until that time, commuter service to New York City was part of Conrail's Metropolitan Region, with all management personnel and systems located in Philadelphia. When Metro-North took over, the on-time performance was 80.3% and the infrastructure and rolling stock had deteriorated.

As a result of its history, the management of Metro-North has proceeded through evolutionary stages. Initially, the railroad operated under crisis management. The takeover from Conrail was approved in September 1982 to take effect on January 1, 1983. This left just over three months to devise and implement the new railroad's management structure and policies. Since there were no administrative systems in place in New York, the executive team faced an enormous task, made yet more difficult because the transition had to happen without disrupting the daily transportation of 85,000 daily commuters.

The negotiation of new labor contracts led to a strike. Furthermore, the transition occurred in the midst of a mandated wheel and axle retrofit program that dramatically affected train speeds and availability of rolling stock.

The railroad's successes in overcoming these and other crises led management into a second stage, characterized by a close knit group dependent on personal relationships. Managers depended on phones more than on memoranda. In large part, the railroad still functions this way. However, Metro-North has begun to evolve into a more formal organization. Steps are currently being taken to institutionalize activities like quality assurance, police procedures, and interdepartmental activities.

The close personal relationships developed in the course of the formation of Metro-North and the stability and continuity of its senior management has fostered

the growth of a strong and effective safety conscious corporate culture. Safety awareness is further promoted throughout the railroad by programs that identify and award safety performance. An example of the large number of such programs is the employee newspaper's recognition of the Brewster Shop, whose employees went one year without an injury that caused an employee to lose time.

#### 5.6.5 Metro-North Conditions of Concern

The Metro-North investigation produced a number of key findings that have been consolidated into seven conditions of concern:

1. *The safety function at Metro-North lacks formal written procedures for many of its important functions. This undermines the authority of safety programs and endangers their continuity and the thoroughness and consistency of their application.*

The preponderance of evidence indicates that Metro-North's safety performance is more the result of the quality and dedication of its staff than of formal, written procedures

The SSPP, prepared in response to the mandate of the New York State Public Transportation Safety Board, does not accurately reflect Metro North practices. While the Plan is intended to be the central safety document for the entire railroad, it is inadequate in several respects, including its lack of fire and life safety or emergency operating procedures. Moreover, its size, organization, obsolescence, and quality of reproduction make it almost useless as a reference document.

While some of these deficiencies are covered in other railroad documents, several important formal policies are absent altogether, including those for procuring hazardous materials, incorporating safety into capital program procurements, creating a hazard identification and resolution process, and establishing a strategic security plan for the Police Department.

Changes in staffing, through the departure of key older employees or the arrival of new hires, means that valuable safety related knowledge can be lost or

inadequately transferred. Without formal, written policies and procedures, there is no way for the accumulated safety knowledge of the present staff to be retained and passed on.

**2. *The use of diesel locomotives in the Park Avenue Tunnel presents fire and life safety hazards and may present an air quality hazard as well.***

Dual mode (electric and diesel) locomotives operate in the Park Avenue Tunnel because Metro-North serves territory that is not electrified. This practice presents two significant safety hazards: the presence of diesel fuel, an inflammable material, is itself a hazard, and the impact of this is multiplied by the fact that if a fire were to occur, the disruption of service would halt the primary ventilating force, the piston effect created as trains move through the tunnel. Accordingly, a serious smoke condition could ensue in an extremely congested tunnel and terminal. The situation would be further aggravated by the difficulty passengers would have detraining.

At present, the locomotives do not have sufficient power to operate on electric power alone, so the diesel engines are run in the tunnel. Thus, diesel fume accumulation in the tunnel presents a possible violation of the Clean Air Act and a potential respiratory hazard. Despite Metro-North's awareness of this problem, it has not evaluated its extent through fuel load calculations or measurements of the quantity and nature of the diesel combustion products in the tunnel. In an attempt to reduce the fume buildup, when possible, the railroad runs the diesels on the better ventilated middle tracks.

Metro-North has taken steps to reduce diesel use in the tunnel. The dual mode locomotives are being rebuilt with higher horsepower engines so that they can function in the tunnel under electric power. They will still need to carry diesel fuel to operate in non-electrified territory.

**3. *There are significant deficiencies in fire protection in Grand Central Terminal, the Park Avenue Tunnel, and along the Park Avenue Viaduct.***

A number of deficiencies exist in the terminal/tunnel/viaduct areas that present fire hazards. In the terminal, fire protection systems are inadequate and the maintenance and inspection procedures for them are weak. In the tunnel, there is a

two-mile stretch without standpipes to supply water. Access for fire department personnel is limited to a number of emergency exits located every eight blocks. While fire hoses could be dropped through ventilation grates, a modest amount of smoke would make it hard for the firefighters to locate the hoses in the resulting haze.

The Grand Central Terminal Master Plan addresses many of these deficiencies. However, funding for the plan has not been identified and, as a result, no timetable exists to begin these remedial actions.

The tenant shops within the terminal do not have any fire protection systems, and businesses in La Marqueta, a marketplace under the Park Avenue Viaduct, show evidence of poor repair and accumulations of debris. A fire in La Marqueta could shut down rail operations in and out of Grand Central Terminal. Other locations along the viaduct include rows of debris-filled vacant buildings that are fire hazards.

**4. *The radio communication systems used by the Metro-North Police Department are inadequate.***

The Metro-North Police Department radio system is antiquated and inadequate. It is frequently wholly or partially out of service. There are many dead spots throughout the signal area at which messages can neither be transmitted nor received. Often, there is so much interference, sometimes from as far away as eastern Massachusetts, that messages cannot be understood.

There is also no way for Metro-North officers to contact local police departments directly. Given the extensive area of operations of Metro-North, local police departments could often provide faster, more effective backup in perilous or potentially perilous situations, if they could be reached. In such situations, the inadequacy of the present system presents its most immediate hazard to the police officers involved. However, there are concomitant significant hazards to passengers, employees, and the public at large.

**5. *The data collection and analysis efforts of the Police Department are inadequate to support its mission.***

The 1992 Executive Budget states "in 1992, the Police Department ... will continue to evaluate its operational methodology to improve performance outcomes, concentrating on the strategic deployment of available police resources." Despite this objective, the Department's Planning Unit, which collects and analyzes police incident data, is understaffed and underequipped and can only track trends in general terms that are inappropriate for strategic planning and deployment.

Metro-North police annually receive approximately 25,000 calls for service and make about 2,000 arrests, one fifth of which are felony arrests. There is one staff member handling the input and analysis of all incident data on a single computer using generic spreadsheet software. From this database, he must generate Uniform Crime Reports (UCRs) and department statistical reports.

As a result of the limitation of computer and programming resources, the UCR categories become the basis for any statistical comparisons of police performance. But because they are based on county wide reporting, they are geographically too broad to be of use for railroad planning.

Without a system for tracking the frequency, location, and nature of criminal incidents throughout the railroad, it is impossible to determine whether or not a serious crime pattern exists. Nor is it possible, if there is such a pattern, to determine a proper response.

The absence of such tools deprives the Metro-North Police Department of the ability to make effective use of its crime protection resources, and thereby deprives passengers, employees, and the public at large of effective police protection.

**6. *The present organizational structure, physical location, staffing, and resources of the Safety Department compromise its ability to fulfill all of its responsibilities.***

The Safety Department at Metro-North does not perform traditional system safety activities (as described in this report) or meet the responsibilities identified in the System Safety Program Plan guidelines prepared by the PTSB and industry organizations like APTA.

Safety is a critically important aspect of all railroad activities. Yet, the Safety Department reports to the Vice President of Operations. While this enhances Safety's ties with the operating departments of the railroad, it has some deleterious effects on Safety's efforts, including:

- The opportunity for conflicts of interest with the operating departments.
- The tendency of other railroad departments to regard safety as solely the responsibility of Operations.
- The difficulty of the Safety Department to gain the attention of the Vice President of Operations and, in turn, other senior management. Operations has by far the largest set of responsibilities and budget of any railroad department, so many concerns compete with those raised by the Safety Department.

The Safety Department is located in an isolated corner of Grand Central Terminal, away from all other headquarters' functions.

Despite its considerable responsibilities, the Safety Department has six persons engaged in a major asbestos management program, in addition to their safety functions. This detracts from the Safety Department's role as overseer and coordinator of other safety efforts. This situation affects their ability to perform the APTA and PTSB mandated functions, and it generates doubts among railroad staff as to the actual commitment of management to safety.

***7. Systems and management resources are allocated in a way that undermines the development of strong safety and security systems.***

In addition to the organizational issues limiting the effectiveness of the Safety Department, discussed above, there are deficiencies in the way management resources are organized and deployed with regard to the safety mission of the railroad. These deficiencies, though diffused throughout the MTA, combine to undermine further progress in improving the safety performance of Metro-North. Because all large organizations tend to be driven by what is measurable, financial issues and cost benefit evaluations often have an overriding influence on decision making. This, in turn, leads to emphasis on those needs where costs and benefits can be most clearly articulated. In a variety of ways, Metro-North has made its

accounting of the costs and benefits of safety and security aspects difficult to obtain or use. The areas include:

### Security Record Keeping

The absence of adequate record keeping for crime and security makes it hard to set realistic goals for the Metro-North Police Department, evaluate its performance, or develop effective plans to staff and deploy the department.

### Inadequate Compilation of Accident Costs

In allocating resources to safety efforts, management does not consider the full costs of accidents and injuries. Without clearer measures of the cost implications of safety, it is difficult, in times of limited resources, for the railroad to convincingly solicit and allocate funds for safety related capital and operating expenditures. This is the result of several factors, including:

- Direct costs of accidents are not regularly compiled and analyzed. The data are available only for severe or catastrophic accidents.
- Indirect costs are neither explicitly estimated nor recognized. This is true despite the belief, at Metro-North and elsewhere in the industry, that the indirect costs of an accident may be four to six times the direct costs.
- Reporting accident claims is unnecessarily complex, obscuring the relationship of accident costs to causative events or operating practices. Among the factors that complicate reporting are these: claims are often paid many years after accidents take place; to conform to accepted accounting practices, the railroad is required to adjust claim liabilities for anticipated costs of future claims; and lump sum claim payments are paid over lengthy periods through the use of structured settlements.

### Limited Safety Department Involvement in the Capital Budget Process

There are no steps in the capital budget process to ensure that Safety Department considerations receive a high priority. The "Matrix Measurement Criteria" used by the railroad to evaluate capital program items does not include

safety as an explicit factor. Furthermore, with the exception of environmental programs, safety issues are not usually addressed in capital budget line items.

#### Lack of Systems Support and Integration in Safety Related Activities

Despite the stated and recognized importance of safety at Metro-North, management has undermined its safety efforts through the misallocation or inefficient use of management resources.

The MIS Department focuses an overwhelming portion of its effort on fiscal and personnel activities. Of the 23 systems it has, only 3 deal with operations issues, and none are used to support safety activities directly. The Safety Department must devote its own limited resources to maintain and analyze safety incident data.

The Safety Department provides accident data to the Medical, Legal, and Risk Management Departments, but it does not typically receive data on accident costs or claims. This data would be useful in safety planning to eliminate, control, or mitigate accident severity and frequency.

Furthermore, the responsibility for several closely related safety activities involves two or more departments. This includes fire and life safety (divided between the Safety Department and the Grand Central Terminal Department), emergency response (no department serving as the central repository for emergency response plans), and safety cost accounting (divided among the Mechanical, Safety, Risk Management, Personnel, and others).

The impact of this situation on safety is subtle but important. In the inevitable competition for scarce resources, safety must have support that is at least as effective as that for other functions of the railroad.

## 5.7 LONG ISLAND RAIL ROAD RESULTS

This section presents an overview of the investigation of the Long Island Rail Road (LIRR) performed by Interactive Elements. It covers that portion of the

operations of the LIRR that is not under the jurisdiction of the FRA. The FRA is carrying out a complementary investigation in parallel with this one to ensure a complete review of the railroad's safety programs.

#### 5.7.1 An Overview of Safety at the Long Island Rail Road

LIRR has recently revised and expanded written procedures at the Long Island Rail Road, including many that directly address safety. These are actively supported by a small group of dedicated employees. At this time, however, it is too early to judge the impact of the new procedures on the railroad's safety performance.

Under the LIRR's current president, the senior management has renewed its interest in safety and endorsed the new procedures. With some lapses in execution, it has begun to put the new procedures into effect. A key component of the safety commitment, the appointment of an executive director of safety with considerable experience in rail operations, has recently been altered by placing the Safety Department under a newly appointed vice president. This shift has given some employees the impression that safety is being downplayed.

The reinvigorated safety program is based on written policies and procedures that are comprehensive and generally conform with sound industry practice. These include a commendable System Safety Program Plan; an excellent curriculum of safety training courses including well-executed emergency simulations; a pocket-sized safety policy manual, endorsed by the entire senior staff, and distributed to every employee of the railroad; a strong capital program to address the safety hazards of a deteriorating infrastructure (incorporating safety as a important criterion for evaluating capital projects); and an active public awareness program. Furthermore, senior management has moved to improve labor/management relations, achieving, during its short tenure, an agreement with labor on safety equipment.

The success of the safety program depends on its consistent, sustained enforcement throughout the LIRR. The safety program includes many new procedures; some were being prepared during the course of this investigation. Much of the safety program has not yet been implemented but part of it is currently

being put into practice. Prior safety initiatives have been hampered by frequent turnover of senior management, the long history of labor/management conflict, and an undisciplined corporate culture. The capital program, intended to cure numerous infrastructure problems, has not been fully funded. In light of the LIRR's history and corporate culture, it is difficult to predict the success of these recent safety efforts.

In general, the security function at the railroad is successfully managed by a well-trained police force whose members are effectively deployed throughout its large jurisdiction. Safety and security are further supported by a broad range of management and information systems that can facilitate implementation of the safety initiatives and provide the data to assess their performance.

The investigation has identified strengths and weaknesses in the current safety program at the LIRR. The weaknesses have been consolidated into eight conditions of concern, which are discussed later.

#### 5.7.2 Investigation Method, Scope, and Approach

Six topic areas determined the scope of this investigation:

- System Safety
- Management Practices
- Physical Systems - Passenger Loading Areas
- Security
- Fire and Life Safety
- Emergency Operations

With one team of investigators assigned to each of the six topic areas, railroad documents were reviewed, personnel were interviewed, and locations were inspected.

In the course of the investigation of the LIRR, the project team examined some 605 documents; conducted 261 interviews; and visited 306 sites, meetings, and related outside agencies.

The investigation was approached from a top down perspective. The team used the railroad's System Safety Program Plan as its starting point. It examined senior management's commitment to safety and the way safety is incorporated into the corporate culture. Perhaps, the most important issue, in this regard, is the extent to which employees feel that management believes in safety.

For each safety issue examined during the course of the investigation, the topic teams asked:

- Does a policy exist?
- Is it adequate?
- Is it communicated effectively?
- Is it budgeted for?
- Is it implemented?
- Is its implementation effective?
- Is it monitored (checked, validated, and revised as necessary)?

As a result, it was possible to evaluate not only the policies themselves but also the extent to which the policies affected the safety performance and preparedness of the railroad.

### 5.7.3 Long Island Rail Road Overview

The Long Island Rail Road is the largest commuter railroad in the United States. It serves over 125,000 daily commuters and their families, it employs almost 6,400 people, and it affects the economic existence of thousands of businesses and millions of residents in the New York metropolitan area.

#### Operating Characteristics

The LIRR operates 10 branch lines: Babylon, Far Rockaway, Hempstead, Long Beach, Montauk, Oyster Bay, Port Jefferson, Port Washington, Ronkonkoma, and West Hempstead. Except for the Port Washington line, all branches converge at Jamaica Station, the headquarters of the railroad, to create a main line to New York City. In addition, the railroad operates a small freight service for Long Island.

The New York City terminus of the railroad is Pennsylvania Station (Penn Station), which is owned by Amtrak and shared by Amtrak, New Jersey Transit, and the Long Island Rail Road. There are 135 LIRR stations distributed over a network of just over 700 track miles. The railroad serves five counties in New York State.

The railroad's major repair facility is the Hillside Maintenance Complex located in Queens. The LIRR equipment fleet consists of 86 locomotives, 935 MU cars, and 243 coaches. The staff is organized into thirteen departments that report to the president.

### A Brief History

The Long Island Rail Road, one of the oldest railroads in the United States, began operating in 1834. It was built not to serve Long Island residents, but to carry long distance travelers from New York City to Long Island where they would board ferries to Boston and other parts of New England. Most of the present day branch lines started as separate railroad companies that were in competition with each other. In 1900, the railroad became a wholly owned subsidiary of the Pennsylvania Railroad.

The Metropolitan Transportation Authority (MTA) purchased the nearly bankrupt LIRR from the Pennsylvania Railroad in 1966 and assumed responsibility for its operation. This vitally important but rundown railroad had not been the beneficiary of capital investments for many years. As a result, its rolling stock was antiquated, its shops were inadequate, and its tracks were in poor condition. On-time performance hovered around 80 percent. Capital improvements were made during the late 1960's and early 1970's. In addition, the MTA, through its five-year capital programs, which began in 1982, provided in excess of \$2.1 billion of funding for major capital improvements.

Since 1978, there have been six chief executives of the Long Island Rail Road. Each hired his own staff. Each reorganized the management structure, reporting lines, and department responsibilities. The emphasis on safety, and particularly employee safety, has varied during these changes in administration. As a result, employees, particularly union personnel, question management's commitment to safety programs. The LIRR unions, on the other hand, have had fairly stable

leadership during this same time period. They resist the new safety efforts, believing that management uses safety issues as a form of harassment.

The frequent changes in senior management, with its accompanying shifts of policies and priorities, and the strong resistance of the unions to management's safety efforts have fostered an atmosphere of hostility and distrust that, except for a small cadre of employees, pervades the corporate culture. The positive programs started by the railroad leadership could yield significant improvements if sustained.

#### 5.7.4 LIRR Conditions of Concern

The LIRR investigation produced a number of key findings that have been consolidated into eight conditions of concern:

1. ***A history of inconsistent management and a corporate culture characterized by confrontation and lack of discipline undermine the effectiveness of safety programs at the Long Island Rail Road.***

The Long Island Rail Road is a large and complex organization, operating over an extended geographical range and interacting with numerous jurisdictions: employees are represented by twelve unions; the railroad operates in five counties of New York State, including parts of New York City; the railroad's western terminal is shared with Amtrak and New Jersey Transit, and is served by the New York City Transit Authority.

In such a context, the execution of a strong safety program requires the formulation of sound safety policies; enlistment of support for these policies at all levels of the organization; and the authority, organizational discipline, and channels of communication to enforce them. This process has been undermined by three general characteristics of the Long Island Rail Road:

- Frequent management changes
- A history of labor/management conflict
- A corporate culture that lacks strong, effective chains of command and organizational discipline

### Management Changes

The frequent turnover in chief executives, with accompanying reorganizations of senior staff and priorities, has led to an inconsistent management approach to safety and inconsistent support for its programs.

The railroad has embarked on a strong formal program for safety. From a policy standpoint, the program is comprehensive, and often well documented. Present senior management has repeatedly voiced strong concern and support for safety, and it has achieved some commendable objectives.

However, the railroad's current president, who took office in April 1990, was preceded by six permanent or interim chief executives since 1978, with an average term of less than two years and four months. Each of them hired his own senior staff, set his own priorities, and promulgated his own view of safety at the railroad. The lack of sustained, consistent support for safety programs has undermined individual initiatives and attitudes toward safety. The length of tenure is not completely under the control of the chief executive. However, it has a dramatic effect on the extent of program execution.

### Labor-Management Relations

The historic schism between management and labor that exists at the Long Island Rail Road hinders the successful implementation of safety programs.

In contrast to management, senior labor officials have generally long tenures at the Long Island Rail Road. They are generally familiar with their crafts, the rail system, and the internal and external political environment. They have earned considerable loyalty from the rank and file and fostered strong ties to community and political organizations. These factors give labor considerable strength when dealing with less experienced senior management. Unfortunately, this strength has, from time to time, been used to delay or resist some of the safety initiatives of management.

Management, for its part, has missed opportunities to solicit the constructive cooperation of labor, including during the recent planning, construction, and

startup of the Hillside Maintenance Facility. Safety committees and "toolbox" meetings, which could provide effective safety forums for the constructive engagement of labor, have been used only sporadically.

On the other hand, labor has taken aggressive actions to counter safety initiatives it believed were inappropriate. These include a lawsuit to prevent the railroad from requiring safety apparel that is universally used throughout the industry, and distributing printed materials questioning the motives of safety committees formed to review practices and accidents.

There is encouraging evidence that some of these trends are being reversed. The current senior management has expressed an intention to improve labor/management relations and, as a result, safety equipment and apparel are part of the newly negotiated labor agreements. This is a promising start.

#### Corporate Culture and Organizational Discipline

The corporate culture at the LIRR works against the safety programs that management is trying to implement. In part, this stems from the historic factors discussed above.

But other attitudes and programs at the railroad also undermine safety. The ubiquitous display of on-time performance statistics creates the impression that on-time performance is more important than safety. Supervisory personnel indicated that production goals were extremely important, thus, they were chary to insist on safety equipment or procedures that reduced productivity or to schedule personnel for training courses. There is a general lack of pride in the workplace and a cavalier attitude toward safety, including poor housekeeping, the use of eye wash basins as trash receptacles, the accumulation of debris throughout the property, and the frequent failure to close marked fire doors.

Moreover, the LIRR rate of employee accidents per labor hour is the highest of all Class B railroads. Other factors contributing to this statistic are the generosity of Federal Employee Liability Act (FELA) settlements of accident claims and the large number of passengers per employee in comparison to other Class B railroads.

Lack of senior management participation at safety events, including accident simulations, adds to the pervasive view that safety is not a genuine priority. At a full scale accident simulation held on a weekend, no management personnel attended as evaluators or observers. Yet at a table top drill, held during the regular work week, numerous managers participated in both capacities.

In 1990, the Safety Department was reorganized to report directly to the president of the railroad and given a strong mandate for railroad-wide safety programs. Less than nine months later, the railroad's organization chart was changed to move the department under a newly created Vice President of Safety, Quality, and Cost Control. Many viewed this shift as one more reversal of the emphasis on safety.

As a result of these present and past conditions, the positive safety efforts currently undertaken will require unprecedented sustained support if they are to be successfully incorporated into the railroad's day-to-day activities and attitudes.

2. ***The Safety Department is working to institute a strong safety program, but it lacks the resources, authority, and corporate support to effectively implement it.***

The Safety Department has instituted strong written safety programs for the railroad. However, it lacks the resources and clear authority to put them into effect.

A variety of safety initiatives have been taken under the present executive director of safety. These include a comprehensive corporate safety policy manual accepted and countersigned by the executive staff and issued in a format that can be carried by every employee; the planned conduct of internal safety audits; the requirement for safety apparel for employees; the establishment of a strong safety training curriculum; and the reinstatement of safety committees. In addition, the department retains its other responsibilities, including fire and life safety and industrial and environmental safety.

In the most disciplined, safety conscious of organizations, the responsibilities of the Safety Department would be considerable for a department of this size and the geographic breadth of its coverage. At the Long Island Rail Road, they are

overwhelming because of the railroad's history and because the department expends a good deal of time seeking management support to persuade other departments to take corrective safety actions (one example is ensuring that fire exits are closed).

Staffing is a serious problem, with inadequate personnel in the department to meet such responsibilities as fire inspections, safety audits, resolution of issues raised under the Community Assessment of Risk to Employees program, or the monitoring of government or department mandated safety training programs.

**3. *There is inadequate provision for the ventilation of the East River Tunnels in the event of an fire.***

The East River Tunnels carry the overwhelming majority of the railroad's passengers into and out of Penn Station each day. At present, the systems for ventilating the tunnels are inadequate.

The tunnel complex consists of four separate, parallel tunnels extending east from the 6th Avenue portal in Manhattan, under the East River, to Queens. The tunnels are about 12,500 feet long, with eight ventilation fans, one at each end of each of the four tunnels.

If all the fans were working, there would be insufficient air flow to handle a fire, according to a recent study done for Amtrak by an outside consultant. In actuality, none of the fans on the east end of the tunnels and only two of the fans on the west end function, and then only poorly. The control of heat and smoke during an emergency evacuation is critical to the safety of evacuating passengers.

The situation is further complicated by long egress routes that could include a half-mile uphill walk followed by a eleven-flight stair climb. Tunnel signs are adequate, but are beginning to deteriorate, and the lighting is limited.

The tunnels are being renovated under a joint Amtrak/LIRR program. However, construction will not be completed for many years. Thus, passengers and employees could be jeopardized in the interim. The railroad, aware of this situation, has developed special procedures in the event of such an emergency.

**4. *Ongoing construction activities for the renovation of Penn Station could adversely affect safe egress in a fire emergency situation.***

The Long Island Rail Road portion of Penn Station is undergoing major renovation. The work involves track and platform restrictions, closing of stairs, installation of escalators, construction of ramps, and the like. During the time that the investigation was being conducted, temporary scaffolding columns were installed, narrowing the station corridors and restricting exit paths for pedestrians.

While regular commuters adjust to these temporary changes fairly quickly, occasional passengers can become confused and disoriented. To alleviate this situation, some signs have been added recently to the site, but many areas remain where signs are difficult to find or read.

If a fire occurred, current conditions would present a safety hazard. The scaffolding installed throughout the main gate area of the concourse considerably reduces headroom, passageway width, and visibility. The artificially low ceiling could aggravate smoke build-up, further limit visibility, and perhaps provoke panic; it obscures signs, further interfering with orderly egress; and the columns that support the ceiling hinder pedestrian movement. If there is crowd pressure against these columns, as could occur during a fire evacuation, the bases could shift and, in turn, cause the scaffolding to collapse.

No planning study was made by the railroad to evaluate the impact of the construction on emergency egress from the station. However, the railroad's access and egress, on both the platform and on the concourse levels, will be improved when the construction project is completed.

**5. *A number of Long Island Rail Road stations show signs of deterioration that could adversely affect passenger and employee safety.***

The majority of stations and passenger loading areas are generally in good condition. However, a significant number are in disrepair, presenting a variety of potential safety hazards. There are 11 stations that are constructed with temporary wood and asphalt platforms that are potential fire hazards. The platforms at a

number of stations create tripping hazards from the deterioration of expansion joints, damage to concrete, and other wear and tear. Some areas show evidence of concrete having fallen from superstructures. This could injure the general public passing below.

Other conditions combine to further undermine passenger safety at certain stations. These include stairway risers that deviate significantly from the building code, defective hand railings, and defective roof gutters and water drainage systems that cause water and ice to accumulate on walkways.

Correction of many of these deficiencies is included in the 1992-96 Capital Program which is, as yet, not completely funded. However, the dangers they present have existed for several years and are growing more serious.

**6. *There are serious deficiencies in the written emergency operating procedures and emergency preparedness of the railroad.***

The Long Island Rail Road has prepared a set of emergency operating procedures for some of its major facilities and locations. While these written procedures are generally comprehensive, and conform to standard practice, some significant elements are overlooked and there are serious inadequacies in their distribution, communication, and integration into practice.

Missing Elements

The railroad does not mandate a central role for its senior transportation officer at an emergency site. General practice places the ranking transportation officer on the site in charge, unless the Fire Department is present, in which case it takes charge.

In addition, several of the procedures fail to provide specific assignments for personnel. The existence of a clear chain of command is necessary for effective response in an emergency. Further, the procedures do not cover all locations or types of emergencies that could arise. This can force personnel to improvise under stressful conditions which may lead to errors.

Emergency operations are further complicated by the absence of interagency agreements between the Long Island Rail Road and emergency response agencies. UMTA (now FTA) and the Volpe Center recommended the establishment of interagency agreements, in *Recommended Emergency Preparedness Guidelines* (March 1985, p. 2-2), to "ensure proper coordination and response...during actual emergency situations." There are also independent, conflicting procedures promulgated by the LIRR Police Department which could interfere.

The new procedures fail to include the Public Affairs Department's role to provide a central, authoritative voice to the public during an emergency. The Department can disseminate vital information on locations to be avoided, alternative means of transportation, and the status and whereabouts of any injured persons. This relieves other emergency personnel from being distracted by the public and answering questions under stressful conditions.

#### Presentation and Communication

Despite the level of detail and comprehensiveness of the written emergency procedures, portions are written in a way that provides little guidance for direct action. The document is large and cumbersome and not paged sequentially, making reference difficult. The document is not "controlled"; indeed, during the course of the investigation, several different versions were produced as "current."

The emergency procedures are not well distributed. As a result, many employees are unaware of their existence. Among those who were, many were unfamiliar with their contents, and some disagreed with them. By limiting the distribution of the emergency procedures, the railroad misses an effective opportunity to promote safety.

#### Integration into Practice

The emergency procedures have not been coordinated with and approved by all senior staff members at the railroad, and not all of them have been tested.

The railroad holds accident simulations that are well organized and executed, but they lack visible support from senior management, and participation from other

levels of the railroad is inadequate. At one simulation, only the participants attended. The absence of observers from senior management convinces railroad employees and outside agencies that management does not support these activities. Train crew personnel play no role at all.

Many railroad employees are not trained in the performance of the emergency operating procedures. The Recommended Emergency Preparedness Guidelines prepared by UMTA (now the FTA) and the Volpe Center indicate the importance of training:

"Mastery of safety rules and emergency procedures on the part of operating personnel should be considered just as important as mastery of the standard rules and standard operating procedures."

Attendance at simulations, which are excellent training opportunities, is not required because employees are not paid to attend. Both the unfavorable labor/management environment and the lack of attendance by senior management act to discourage voluntary participation other employees. Formal training, while available, is often not obtained because the Training Department has no authority to enforce attendance, and supervisors are reluctant to sacrifice "productivity" or incur overtime by sending staff to safety training. In 1991, for example, the Training Department canceled 13 "Right-to-Know" classes concerning hazardous materials because scheduled employees did not attend.

**7. *There are inadequate security controls for entry to the Morris Park, Vanderbilt, and West Side Yards. This creates significant potential for employee assault, trespasser injury, material and equipment theft, vandalism, and sabotage.***

These yards are located in the midst of New York City. Each one is in a heavily traveled and highly populated neighborhood. Access control at railroad facilities is important even in remote locations. The population density of the neighborhoods surrounding these yards makes controlled entry imperative.

The Morris Park facility in Queens has working shops and a live third rail on the property, even though the yard is not actively used. While the individual shops can be secured, the site has neither fencing nor security personnel to control access.

Trespassers could be seriously injured. In addition, the site is wide open, presenting security hazards to railroad employees and property.

At Vanderbilt, in Brooklyn, there is security fencing, but it is in serious disrepair. Furthermore, there is a large accumulation of newsprint refuse from an adjacent Daily News distribution yard leased from the railroad. The combination of the presence of refuse and uncontrolled access is an invitation to vandalism. The situation is further aggravated by the absence of outdoor lighting, which both conceals vandals' activity and increases the potential for slip/trip/fall accidents.

The West Side Yard is the major storage and maintenance yard in Manhattan. It also serves as the staging area for the Penn Station renovation. Fencing and gates are adequate, but there are no security personnel to control entry or secure the gates. Security personnel once stationed at this location have been eliminated to save money. Access control is now the responsibility of each employee entering the yard, with employees required to lock the gate behind them. In actuality, the gates are often left wide open, which, from the street, creates the impression that there are no gates at all. Management has indicated that it depends on the employees working in the yard to detect illegal entry. However, it is unreasonable to expect employees occupied with their work to divert a portion of their attention to this function. During investigation, management indicated that this system was adequate, however, a request for additional security was subsequently added to the 1993 budget request.

**8. *The storage of hazardous materials at shops and along the right-of-way create the potential for a serious safety incident.***

Flammable materials are often left along the right-of-way for use by railroad personnel in the performance of their duties. These create the potential for a severe fire. They present environmental safety hazards as well. The Safety Department has proposed the construction of small, secured storage shacks along the right-of-way for these materials and containment of any leaks. Other flammable materials, such as debris and old wooden ties, are often left along the right-of-way.

In a number of facilities, such as the Long Island City Shops, the Richmond Hill Facility, and the Morris Park Facility, flammable and hazardous materials are not

properly controlled or stored. For the most part, hazards arise from inadequate housekeeping and carelessness: barrels of hazardous materials and batteries are stored next to the perimeter fence; diesel fuel lines, strewn alongside the tracks, dribble diesel fuel; drums of lubricating oil are set next to tracks; and propane gas cylinders are left unattended next to a storage cabinet for flammable gas.



## 6. FEDERAL RAILROAD ADMINISTRATION INVESTIGATION

The Federal Railroad Administration (FRA) conducted a supplemental investigation of the Metro-North Commuter Railroad and Long Island Rail Road as a portion of this larger study coordinated by the Federal Transit Administration. These two operating elements of the MTA are considered commuter railroads and carry freight and Amtrak trains; therefore, FRA regulations apply to certain aspects. FRA examined only those facets for which it has regulatory jurisdiction.

### 6.1 METRO-NORTH COMMUTER RAILROAD RESULTS

Field inspection activities began during the first week of January 1991. Most work was completed by the end of July. On July 25, 1991, FRA Region 1 personnel met with Metro-North management to discuss deficiencies disclosed during the inspection phase of the assessment. FRA revisited the carrier after providing the carrier time to correct deficiencies and address concerns. The follow-up inspections were conducted to determine the extent that these were resolved.

During the assessment, FRA analyzed the impact of the carrier's programs, policies, and procedures on safety. Numerous management and labor employees were interviewed to determine the extent of their knowledge and awareness of Federal regulations and carrier rules and procedures.

Assessment activities included the following:

- Interviews with 28 Metro-North officers and 83 employees.
- Onboard observations of 17 Metro-North passenger trains, 10 Amtrak passenger trains operating on Metro-North, and 7 freight trains operating on Metro-North.
- Observation of 81 operational tests conducted by Metro-North officers on employees.
- Radar speed checks of 204 trains.

- 27 blue-signal inspections at 9 locations.
- Inspection and analysis of carrier accident/incident reports for a 4-month period.
- Examination of a 4-month period of hours-of-duty records (9,950 records) for all employees covered by the Hours of Service Act.
- Evaluation of the Metro-North program for the control of alcohol and drug use, including a review of a 1-year period of records.
- Analysis of the carrier's operating rules and program of operational testing.
- Analysis of the transportation of hazardous materials on Metro-North, including a review of emergency response plans.
- Signal and train control inspection of 87 wayside signals, 163 switches, 26 onboard cab signal units, and 455 records.
- Inspection of 60% of main line track and 11% of yard track, a total of 402 miles, inspection of 588 turnouts including 54% of the main line turnouts, and examination of 637 track inspection records.
- Inspection of 21 bridges and 1 tunnel and the examination of 940 bridge inspection records.
- Inspection of 44% of the diesel and bi-power locomotive fleet, 35% of the multiple unit (MU) locomotive fleet, 47% of the passenger coach fleet, and a representative sample of freight equipment.

In general, FRA found that Metro-North operates with a high degree of safety. Metro-North management provided excellent cooperation during the course of the assessment effort. The following information items focus on the areas of concern identified. These issues have been discussed with carrier management and, in many cases, the carrier has already addressed the concerns. FRA will work with Metro-North to require conformity, in cases of regulatory mandates, and encourage, in cases of recommended practices, resolution of the remaining concerns.

### 6.1.1 Metro-North Concerns

Major concerns identified during the assessment are as follows:

#### Operational Practices

- FRA found instances in which the carrier failed to report employee injuries and other instances in which carrier accident/incident reports contained erroneous information.
- FRA noted instances in which train dispatchers failed to record the required information on the train dispatchers' record of train movements.
- The noise level in the train dispatchers' office is unnecessarily high. FRA observed horseplay and inattention in the train dispatchers' office.
- Employees assigned work duties in and about the right-of-way are required to wear a reflectorized vest. FRA observed that 16% failed to do so.

#### Hazardous Materials

In 1990 Consolidated Rail Corporation (CR) transported 80,000 freight cars on Metro-North, of which 2,700 were loaded with hazardous materials. That same year Springfield Terminal (ST) transported 500 freight cars on Metro-North, of which 150 were loaded with hazardous materials.

- Manuals and other publications furnished to employees do not properly address applicable hazardous materials regulations.
- ST crews failed to have in their possession the required Metro-North publication that addresses hazardous materials procedures.
- The carrier does not provide formal comprehensive hazardous materials training to prepare dispatchers and police department employees whose duties require a working knowledge of the hazardous materials regulations.

### Motive Power and Equipment

- Carrier employees failed to conduct proper single-car air brake tests. The air brake manual describing single-car test procedures is outdated.
- Test devices used to perform single-car air brake tests were found to be defective.
- Presently, Metro-North does not follow the manufacturer's recommended rebuilding procedures for tread brake units (TBUs). The carrier rebuilds all TBUs on a two-year cycle, as recommended by the manufacturer. However, the carrier only performs a visual inspection of certain parts--e.g., pins and bushings--and does not gauge all components as recommended by the manufacturer. The result is a high incidence of worn TBU parts. FRA found a total of 14 defective TBUs during the assessment.

### Signal and Train Control

- On portions of the railroad that use the overhead catenary system for electrical propulsion, a potential exists for an employee or passenger to receive an electrical shock by touching a grounded surface and the car body of a train.

### Track

- On the New Haven Line, at Stam interlocking, excessive gauge in the turnout leads was found at several locations.
- Record inspections disclosed 16 instances when no corrective action was taken following the report of noncomplying conditions.

### Structures

The carrier has approximately 474 undergrade structures, including 6 movable bridges over navigable rivers, and 425 overhead structures, including 120 overhead signal bridges. The FRA inspection team examined 21 bridges and one tunnel, and

reviewed the carrier's records and its published bridge inspection guide and policy manual.

- Metro-North structural inspectors do not receive instructions or guidelines addressing conditions posing imminent hazards to pedestrians and motor vehicles.
- Of the 21 bridges examined, each of the 19 bridges built prior to 1932 exhibited deterioration.
- Several safety concerns relative to the Park Avenue Tunnels remain unresolved. FRA is not satisfied with the carrier's response to concerns pertaining to tunnel evacuation procedures, emergency response plans, fire extinguishers, telephones, and emergency equipment.

#### 6.1.2 Metro-North Response

The aforementioned major concerns and numerous other concerns were brought to the attention of Metro-North senior staff. Except as specifically noted, the carrier initiated corrective actions sufficient to satisfy FRA's concerns. FRA will continue to direct its attention to the few concerns for which the carrier has provided insufficient responses until satisfactory resolutions have been achieved.

### 6.2 LONG ISLAND RAIL ROAD RESULTS

Field inspection activities began during the first week of January 1991. Most work was completed by the end of July. On July 25, 1991, FRA Region 1 personnel met with LIRR management to discuss deficiencies disclosed during the inspection phase of the assessment. After providing the carrier time to correct deficiencies and address FRA concerns, FRA revisited the carrier. Follow-up inspection activities were conducted to determine the extent that identified concerns were resolved.

During the assessment, FRA analyzed the impact of the carrier's programs, policies, and procedures on safety. Numerous employees, both management and

labor, were interviewed to determine their extent of knowledge and awareness of Federal regulations and carrier rules and procedures.

Assessment activities included the following:

- Interviews with 138 LIRR officers and employees.
- Onboard observations of 44 LIRR passenger trains and 5 LIRR freight trains.
- Observation of 63 operational tests conducted by LIRR officers on LIRR employees.
- Radar speed checks of 292 trains.
- 25 blue-signal inspections at 12 locations.
- Inspection and analysis of carrier accident/incident reports for a 4-month period.
- Examination of a 4-month period of hours-of-duty records (26,895 records) for all employees covered by the Hours of Service Act.
- Evaluation of the LIRR program for the control of alcohol and drug use, including review a 1-year period of records.
- Analysis of the carrier's operating rules and program of operational testing.
- Analysis of the transportation of hazardous materials by LIRR, including a review of emergency response plans.
- Signal and train control inspection of 150 wayside signals, 122 switches, 100 onboard cab signal units, and 1,377 records.
- Inspection of 286 miles of track, including 444 turnouts, and the examination of 699 track inspection records.
- Inspection of 23 bridges, 2 tunnels and the examination of 712 bridge inspection records.

- Inspection of 431 locomotives, 84 passenger cars, 92 freight cars, and 11 mechanical repair facilities.

In general, FRA found that LIRR is operated with a high degree of safety. LIRR management cooperated fully during the course of the assessment effort. The following information items focus on the areas of concern identified during the assessment. These issues have been discussed with carrier management. In many cases, the carrier has already addressed the identified concerns. FRA will be working with LIRR to require conformity, in cases of regulatory mandates, and encourage, in cases of recommended practices, resolution of the remaining concerns.

### 6.2.1 LIRR Concerns

Major concerns identified during the assessment are as follows:

#### Operating Practices

The operating practices (OP) inspection team conducted onboard train observations, records inspections, radar speed checks, an evaluation of the train dispatchers' office, and other inspections required by OP regulations.

- While conducting onboard train observations, FRA witnessed several locomotive engineers in noncompliance with 49 CFR part 220 - Radio Standards and Procedures.
- The carrier's specimen collection bottle failed to comply with the requirements of 49 CFR Section 40.23 (b) (1).
- FRA took exception with the manner in which Hours of Service reports were completed by regulated employees.
- FRA took exception with the TIMACS reporting system for recording train information.
- The power dispatchers' office and the train dispatchers' office each use separate internal procedures for the removal and restoration of third-rail power.

- Carrier employees whose duties require them to work in and about the right-of-way are not, contrary to regulations, required to wear a reflectorized safety vest.

### Hazardous Materials

In 1989, LIRR transported 309 loaded hazardous materials cars. In 1990, that number declined to 274 loaded hazardous materials cars. FRA evaluated the carrier's hazardous materials publications and training programs, emergency response plans, and internal and carrier-to-carrier hazardous materials communications. Inspections were conducted at carrier freight yards where hazardous materials cars and shipping papers were examined. Interviews were conducted with labor and management employees to determine knowledge of Federal and carrier requirements for the transportation of hazardous materials.

- The carrier's hazardous materials publications do not include a chart displaying proper train placement of placarded cars.
- The carrier does not provide hazardous materials training, either formal (i.e., classroom) or informal, to operational employees engaged in the transportation of hazardous materials. Operational employees are not aware of the proper application of the Hazardous Material Regulations to job functions.

### Motive Power and Equipment

During the assessment, FRA inspected 41% of the diesel locomotive fleet, 42% of the MU locomotive fleet, and 24% of the passenger coach fleet. A representative sample of the carrier's freight equipment was also examined.

- Carrier employees failed to conduct proper single-car air brake tests. The carrier's air brake manual dealing with single-car test procedures is outdated.
- Test devices used to perform single-car air brake tests were found to be defective.

- Presently, the carrier does not follow the manufacturer's recommended rebuilding procedures for tread brake units (TBUs). The carrier rebuilds TBUs on a six-year cycle while the manufacturer recommends that they be rebuilt every two years. FRA inspections disclosed a total of 31 defective TBUs.

### Signal and Train Control

- FRA found several locations where, if a running rail was broken, the associated track relay would not assume the de-energized position, as required by 49 CFR Section 236.51. This problem is unique to areas that use electric traction power and is caused by a combination of cross bonding near substations and fouling wires near switches.

### Track

During the assessment, FRA inspected 46% of the carrier's main line track and 11% of its yard track.

- Several locations disclosed noncomplying crosstie conditions.
- Several locations disclosed noncomplying cross level conditions.

### Structures

There are approximately 458 undergrade structures, 29 viaducts, and 225 overhead structures on LIRR. FRA inspected a total of 23 structures and reviewed carrier records and the published bridge inspection guide and policy manual.

- Carrier structure inspectors do not receive instructions or guidelines relative to structural conditions posing imminent hazards to pedestrian and motor vehicles.
- A large number of bridges built prior to 1932 exhibit deterioration. The steel substructures (masonry) exhibit stress vertical cracks, spalling, and scouring. The masonry arch structures exhibit hollowing areas of deterioration, spalling, and scouring.

- Tunnel evacuation procedures and emergency response plans for the Atlantic Avenue Tunnels and the Amtrak East River Tunnels are deficient in the areas of lighting, fire extinguishers, telephones, and access markings.

### 6.2.2 LIRR Response

The aforementioned major concerns, and numerous other concerns, were brought to the attention of LIRR senior staff. Except as specifically noted, LIRR initiated corrective actions sufficient to satisfy FRA's concerns. Those few concerns for which the carrier's response has been inadequate will be the subject of FRA's continued attention until a satisfactory resolution is achieved.

## LIST OF ACRONYMS

APTA	American Public Transit Association
CCTV	Closed Circuit Television
CMO	Chief Maintenance Officer
COTR	Contracting Officer's Technical Representative
CPRB	Capital Program Review Board
CTO	Chief Transportation Officer
DOT	Department of Transportation
EAP	Employee Assistance Program
FELA	Federal Employee Liability Act
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
LIRR	Long Island Rail Road
MaBSTOA	Manhattan & Bronx Surface Transit Authority
MIS	Management Information System
MSBA	Metropolitan Suburban Bus Authority
MTA	Metropolitan Transportation Authority
MU	Electrical Multiple Unit

NFPA	National Fire Protection Association
NIDA	National Institute for Drug Abuse
NTSB	National Transportation Safety Board
NYCPD	New York City Police Department
NYCTA	New York City Transit Authority
NYCTPD	New York City Transit Police Department
OIG	Office of the Inspector General
OP	Operating Practices
OSS	Office of System Safety
PTSB	New York Public Transportation Safety Board
RTO	Rapid Transit Operations
SIRAS	Safety Information and Reporting Analysis System
SIRTOA	Staten Island Rapid Transit Operating Authority
SSPP	System Safety Program Plan
STS	Surface Transportation Safety
TBU	Tread Brake Unit
TWU	Transit Workers Union
UCR	Uniform Crime Report
UMTA	Urban Mass Transportation Administration (now FTA)







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