

TRANSIT COOPERATIVE RESEARCH PROGRAM

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TCRP Synthesis 18

Bus Occupant Safety

A Synthesis of Transit Practice

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Synthesis of Transit Practice 18

Bus Occupant Safety

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National Research Council**

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it

The need for TCRP was originally identified in *TRB Special Report 213--Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of vice configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices

TCRP was established under FTA sponsorship in July 1992. Proposed by the U S Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academy of Sciences, acting through the Transportation Research Board (TRB), and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at anytime. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end-users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. TCRP results support and complement other ongoing transit research and training programs.

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The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the Transit Development Corporation, the National Research Council, or the Federal Transit Administration of the U.S. Department of Transportation

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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The Transportation Research Board, the Transit Development Corporation, the National Research Council, and the Federal Transit Administration (sponsor of the Transit Cooperative Research Program) do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the clarity and completeness of the project report.

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PREFACE

A vast storehouse of information exists on many subjects of concern to the transit industry. This information has resulted from research and from the successful application of solutions to problems by individuals or organizations. There is a continuing need to provide a systematic means for compiling this information and making it available to the entire transit community in a usable format. The Transit Cooperative Research Program includes a synthesis series designed to search for and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in subject areas of concern to the transit industry.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

*By Staff
Transportation
Research Board*

This synthesis will be of interest to transit agency general managers, bus operations, safety, and risk management staffs, as well as agency human resources, personnel, and training staffs. It offers information on the current practices of transit agencies to reduce injuries to bus occupants during collisions and injuries to passengers while boarding, riding, and leaving the bus.

Administrators, practitioners, and researchers are continually faced with issues or problems on which there is much information, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered or not readily available in the literature, and, as a consequence, in seeking solutions, full information on what has been learned about an issue or problem is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to the available methods of solving or alleviating the issue or problem. In an effort to correct this situation, the Transit Cooperative Research Program (TCRP) Synthesis Project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common transit issues and problems and synthesizing available information. The synthesis reports from this endeavor constitute a TCRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to a specific problem or closely related issues.

This report of the Transportation Research Board covers characteristics of bus occupant safety and transit agency programs for reduction of accidents/incidents such as those addressing driver and customer safety, vehicle improvement needs and safety inspections, bus stops and stations, safety management, and state transit agencies and transit operating companies. Appendices offer examples of inspection and accident report forms, as well as examples of training and award programs.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, available information was assembled from numerous sources, including a number of public transportation agencies. A topic panel of experts in the subject area was established to guide the researchers in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

1	SUMMARY	
3	CHAPTER ONE	INTRODUCTION
		Purpose and Scope of Synthesis, 3
		Approach and Organization, 3
5	CHAPTER TWO	CHARACTERISTICS OF BUS OCCUPANT SAFETY
		National Transit Statistics, 5
		Annual Cost of Collisions and Passenger Accidents, 5
		Service Impacts of Collisions and Passenger Accidents, 5
		Types of Accidents and Incidents, 6
		Causes of Accidents and Incidents, 7
9	CHAPTER THREE	TRANSIT INDUSTRY PROGRAMS FOR REDUCTION OF ACCIDENTS AND INCIDENTS
		Driver Programs, 9
		Customer Safety Programs, 11
		Vehicle Improvement Needs, 12
		Vehicle Safety Inspections, 16
		Bus Stops and Stations, 16
		Safety Management Programs, 19
		State Transit Agencies and Transit Operating Companies, 22
24	CHAPTER FOUR	CONCLUSIONS
27	REFERENCES	
28	BIBLIOGRAPHY	
29	GLOSSARY	
30	APPENDIX A	SURVEY FORMS
34	APPENDIX B	LOCAL TRANSIT AGENCIES, STATE TRANSIT AGENCIES, AND TRANSIT MANAGEMENT COMPANIES THAT PARTICIPATED IN THE STUDY
36	APPENDIX C	INFORMATION ON TRAINING PROGRAMS
37	APPENDIX D	SAFE DRIVING AWARDS PROGRAMS
41	APPENDIX E	CUSTOMER EDUCATION AND TRAINING PROGRAMS
44	APPENDIX F	BUS SAFETY INSPECTION FORMS
47	APPENDIX G	ACCIDENT REPORT FORMS
55	APPENDIX H	COMPROMISES MADE BY OPERATORS TO MAINTAIN SCHEDULES

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Information on current practice was provided by many transit agencies. Their cooperation and assistance were most helpful.

BUS OCCUPANT SAFETY

SUMMARY

The safety of bus occupants (customers and drivers) continues to be a major concern to transit agencies large and small. In spite of the many efforts by the transit industry to reduce injuries from collisions and passenger slips and falls, the numbers remain high. For the motor bus transit mode in 1993, a total of 38,873 injuries were reported. Of these injuries, 20,801 resulted from collisions or bus-left-the-road incidents, 6,886 were injuries to passengers from slips and falls while boarding or leaving the bus, and 10,337 were injuries to passengers while onboard the bus.

The purpose of this synthesis is to provide information on the current practices of transit agencies to reduce injuries to bus occupants during collisions and injuries to passengers while boarding, riding, and leaving the bus. The practices of transit agencies providing fixed-route service with heavy-duty buses were examined. An investigation was conducted on a number of topics including driver selection and training, safety incentive programs, safety management issues, guidelines for the location and design of bus stops, customer education and training programs, vehicle design considerations, and safety inspection practices. This synthesis integrates information gathered from a review of the literature, and from site visits, surveys, and telephone conversations with personnel from local and state transit agencies, and transit management companies. The following observations were drawn from the information collected.

All transit agencies contacted during the study reported having programs to select and hire quality driver candidates and to provide driver training. Typically, the initial training is a combination of classroom instruction and in-vehicle training over a 4- to 6-week period. Two transit agencies reported using simulators in their training programs.

More than 90 percent of the agencies contacted have programs to provide recognition, awards, and incentives for drivers who were not charged with a preventable accident for a year or longer period. Most said they hold annual banquets to recognize the recipients of these awards.

Most transit agencies (96 percent of the survey respondents) also provide educational and training information for their customers. The education efforts include safety brochures and posters, public service announcements, and safety messages on schedules, tickets, and transfers. Many transit agencies have instructors and buses for training school children and people with special needs on how to use their bus system in a safe manner.

The vehicle issues needing safety improvements most frequently mentioned in the survey are: the driver workstation, driver vision, and doors and door controls. Improvements are also desired in handrails and stanchions and in brake lights. The workstation research needs are being addressed by a Transit Cooperative Research Program (TCRP) project (F-4, "Bus Operator Work Station Evaluation and Design Guidelines") to develop design guidelines for operator workstations based on ergonomic and biomechanical principles. Many transit agencies reported "bus struck in the rear" as their most frequent accident type. Several transit agencies are actively engaged in projects to improve visibility of the rear of their buses, particularly when braking or when stopped. Some assemblies of current brake lights

do not always remain sealed, allowing dirt and water to enter the assemblies, thus reducing the effectiveness of the braking signal.

Guidelines for location and design of bus stops were received from four transit agencies. While the four guidelines vary somewhat in their preferences between far-side, near-side, and mid-block bus stop locations, all generally follow the recommended practices for bus stops of the Institute of Traffic Engineers. The transit and traffic conditions at a proposed bus stop location largely dictate the type of bus stop to be used.

In the survey of bus transit agencies, most of the respondents (85 percent) reported that they have a system safety plan for their bus operations. Some have safety committees to coordinate and manage the safety activities of their system. These committees generally have representation from all departments. Most survey respondents (89 percent) conduct periodic safety audits of their operations. Several transit agencies reported that their insurance pool or carrier conducts the audit. Most of the transit agencies (more than 81 percent of survey respondents) make safety reports to top management. Two-thirds of the respondents provide their boards with periodic reports on the safety of their agency.

All agencies have procedures to be followed by bus drivers and their supervisors when a system vehicle or employee is involved in an accident or incident. All agencies also have procedures for the review of all accidents and incidents. Many agencies use the standards established by the National Safety Council for judging whether an accident is preventable or nonpreventable.

All transit agencies maintain data files on the number and types of bus and passenger accidents and incidents. About 60 percent reported that they collect data on accident causal factors. Most transit agencies found that a computerized data base of accidents and incidents was an important and effective management tool in identifying and analyzing hazards and in evaluating the effectiveness of a proposed safety solution.

The safety programs offered by state agencies included insurance pools, system safety assistance, safety training, safety audits, and vehicle safety inspections. Generally, the state agencies work with the small city and rural agencies and those providing service to elderly and handicapped riders. Of the 32 state transit agencies responding to the survey, 75 percent provided some type of safety training assistance, and 72 percent reported performing vehicle safety inspections. Nine states have programs offering an insurance pool for public transit agencies in their state, either directly or through a state transit association or consortium of transit agencies.

All management companies responding to the survey have policies and programs concerning safety training of their staff, and most have system safety audit programs. Two companies reported having a safety goal along with other performance measures in their contracts with transit agencies. The safety goal is defined in terms of the number of vehicle accidents per 100,000 vehicle miles.

CHAPTER ONE

INTRODUCTION

The topic of bus occupant safety sounds straightforward and simple, but in fact it is quite complex. Ensuring a safe environment for passengers and drivers requires all transit departments to work as an integrated safety-sensitive team. Creating this environment begins with Human Resources in selecting and hiring candidate drivers. It continues with Training in teaching the needed driving skills and defensive driving practices, as well as how to be sensitive to a wide range of sometimes difficult customers. Transportation is the center that provides operational supervision of the drivers in normal and emergency situations, and the management of driver remedial and incentive programs. Maintenance performs the inspections and repairs to ensure that buses are ready and safe for revenue operations. In many agencies, Maintenance is responsible for developing the technical (including safety) requirements for the next bus procurement. Public Relations develops and implements the educational and training programs for potential customers--school children, people with disabilities, seniors, and the general public--on how to use the bus system safely. Service Development and Planning considers safety factors when laying out a new route, the location of stops, and the setting of service schedules. Safety and Risk Management has a combination role of safety advocacy, hazards analysis and control, safety coordination and support, and performance management and feedback. Management establishes policies and sets priorities that establish the environment for an efficient and safe transit system.

The importance of safe operations in transit is paramount, the passengers and employees depend on it and the public insists on it. Bus occupant safety is a significant part of overall bus safety. For example, in 1993 the injuries from slips and falls compared with the injuries from collisions were 17,992 and 19,875 respectively (1). A recent study of more than 5,000 passenger injuries at a large transit agency found that approximately one-third of all injuries occurred during boarding and alighting, and an additional one-fourth of the injuries occurred while the bus was stopping (2).

Bus occupant safety is concerned with reducing injuries to passengers and drivers that occur during collisions, and reducing injuries to passengers while boarding, riding, and alighting the bus. There are several sources of information on the number of collisions, fatalities, and injuries that occur in bus transit, but there is much less information on the full cost of these accidents. Table 1 provides an overview of some measures of bus safety for 1993. These data were obtained from the Safety Management Information Statistics (SAMIS) 1993 *Annual Report*. The source of the SAMIS data is the completed Section 15 Transit Safety Forms (405) from 380 motor bus transit agencies. The terminology and definitions used in the table are those used in the SAMIS report, and can be found in the glossary of this report.

TABLE (1)

OVERVIEW OF BUS ACCIDENT AND INCIDENT STATISTICS FOR 1993 (1)

Description of Measure	
Number of Injuries	38,873
Number of Fatalities	83
Number of Incidents	45,580
Number of Collisions	28,587
Number of Personal Casualty Injuries	17,992
Property Damage (costs for occurrences of \$1,000 or more)	\$30,503,353

PURPOSE AND SCOPE OF SYNTHESIS

This synthesis provides information about the current practices of transit agencies to reduce bus crashes and to reduce injuries to passengers while boarding, riding, or leaving the bus. This study has focused on the factors that might be controlled by transit agencies. Therefore, accident causal factors such as roadway design and environmental conditions as they relate to bus crashes were not addressed. Such information can be found in a recent study by the University of North Carolina (2). For additional sources of information on roadway design and traffic engineering factors as they relate to highway accidents, the reader is referred to the Bibliography.

For this project, the issues investigated include driver selection and training, safety incentive programs, safety management considerations, guidelines for bus stops, passenger education and training, vehicle design considerations, and safety inspection practices. The scope of the study is further defined to include

- Investigation of the types and causes of occupant injuries from collisions and injuries to passengers from incidents while boarding, riding, or alighting a bus,
- Operations of heavy-duty buses requiring a commercial drivers' license (CDL) in fixed-route service,
- Investigation of the financial and service impacts of accidents and incidents, and
- Identification of countermeasures being used in transit to reduce injuries from accidents.

APPROACH AND ORGANIZATION

The information contained within this synthesis is an integration of information gathered from a review of the literature

and from visits, surveys, and telephone conversations with local and state transit agencies and transit management companies. A survey was sent to 61 large, medium, and small local transit agencies with all of the geographic areas being represented and field visits were made to eight transit agencies. In all, 35 local transit agencies provided information for this synthesis. Also, all state departments of transportation were sent a survey, and 32 responded. Nineteen transit management companies were sent a survey, and responses were received from six companies.

Chapter 2 provides information on the characteristics of bus occupant safety in terms of national safety statistics and various safety measures. Information is also presented about the

types of accidents and incidents that occur, insight on causal factors, and some general information on costs and service impacts of accidents. Chapter 3 discusses the state of practice of transit agencies in the matter of bus occupant safety. That is, information on various practices and programs used by transit agencies to reduce the injuries occurring in collisions and the injuries to passengers from slips and falls while boarding, riding, and leaving the bus. Chapter 4 summarizes key study findings and provides conclusions and recommendations for further study. The appendixes contain a listing of all local and state transit agencies and transit management companies that participated in this study, copies of the surveys that were used, and examples of transit practices.

CHAPTER TWO

CHARACTERISTICS OF BUS OCCUPANT SAFETY**NATIONAL TRANSIT STATISTICS**

The latest available national statistics on transit safety are reported in Safety Management Information Statistics (SAMIS) 1993 *Annual Report (1)*. Information on bus fleet size and operating statistics are reported in the *National Transit Summaries and Trends, 1993 Section 15 Report Year (3)*. In 1993, more than 62 percent of the passenger trips on public transit were provided by motor buses. A fleet of some 44,000 buses traveled over 1.8 billion miles and carried some 4.6 billion passengers in 1993. The importance of the motor bus mode relative to other transit modes in terms of annual passenger trips is shown graphically in Figure 1. Additional operating statistics for motor bus systems are given in Table 2.

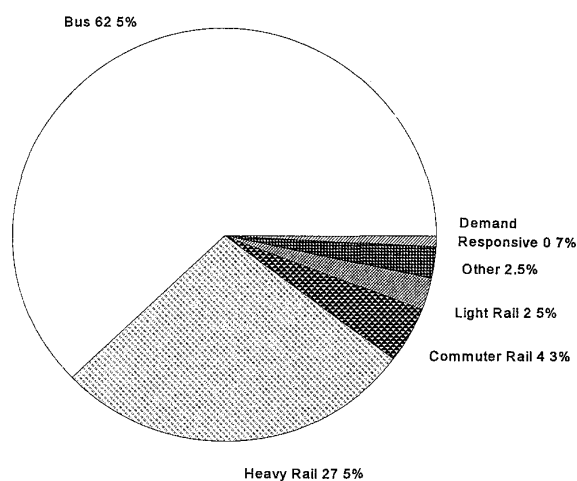


FIGURE 1 Annual passenger trips by transit mode for 1993 (3).

TABLE 2

OPERATING STATISTICS FOR MOTOR BUSES
IN 1993 (1)

Unit of Measure	Numbers
Vehicle Miles	1,690,116,674
Passengers	4,584,626,750
Passenger Miles	16,341,531,238

The injury data in the SAMIS report (see Table 1) include injuries to all persons involved (including occupants of other vehicles). The report does not distinguish between injuries to bus occupants and injuries to passengers in the other vehicle involved in a collision. Personal casualty injuries are

by definition passenger injuries, and are directly an indicator of bus occupant safety. A further breakdown of the personal casualty injuries is given in Table 3, which also provides insight as to where these injuries occur.

TABLE 3

PERSONAL CASUALTY INJURIES ON BUSES IN 1993 (1)

Description	Number	Percent of Total
Boarding and Alighting Injuries	6,886	38.3
On-Board Injuries	10,337	57.4
Station/Stop Injuries	769	4.3

Table 4 provides various measures of safety in terms of rates of occurrence for different units of exposure for selected transit modes. These measures provide national benchmarks, and are useful when comparing the safety experience of a transit system to a national average.

ANNUAL COST OF COLLISIONS AND PASSENGER ACCIDENTS

Information on the cost of collisions and passenger accidents is sparse and difficult to interpret because of a lack of commonality in the collection of accident cost data. Eleven of the transit systems provided information on both the cost and the number of accidents and incidents occurring on their system. Their responses to the question on the annual cost of accidents and incidents ranged from approximately \$1,000 to nearly \$19,000 per occurrence. The higher cost estimates are believed to include indirect costs such as overhead, labor, and business losses. In 1993, the national average property damage cost per accident was \$381 (3). From the information provided in the survey responses, the direct costs of an accident or incident are approximately \$1,000 per occurrence. The Wisconsin Mutual Transit Insurance Company (WMTIC) reported that their loss experience over a 25-month period (1982 to 1984) was \$783,220 (4). There were 690 incidents (collisions and passenger accidents) during that period, resulting in an average cost per incident of approximately \$1,135.

SERVICE IMPACTS OF COLLISIONS AND PASSENGER ACCIDENTS

Information on the service impacts of collisions and passenger accidents is even more elusive than accident cost information.

TABLE 4

NATIONAL SAFETY STATISTICS FOR SELECTED TRANSIT MODES IN 1993 (1)

Description of Rate Measurement	Motor Bus	Demand Responsive	Light Rail	Heavy Rail
Injuries per Million Passengers				
Collisions per 100,000 Vehicle-Miles	8.48	44.01	5.24	1.04
Fatalities per Million Vehicle-Miles	1.69	0.68	1.64	0.13
Boarding and Alighting Injuries per Million Passengers	0.05	0.03	0.55	0.16
On-Board Injuries per 100,000 Vehicle-Miles	1.50	13.50	1.32	0.55
On-Board Injuries per Million Passenger-Miles	0.61	0.26	0.70	0.23
Station/Stop Injuries per Million Passengers	0.17	0.62	0.92	3.91
	0.17	0.62	0.94	3.91

Many of the responses to the survey question were "not tracked," "unable to estimate," and "not available," and many were left blank. While the information provided was limited, the types of service impact measures that are being used by transit systems are of interest. Their responses are given below:

- A 272-bus system reported that they had "281 missed trips" in 1994 due to accidents.
- A 50-bus system estimated their service loss to be 1 hr per accident.
- A 190-bus system estimated an annual loss of 519 vehicle-hr for 89 accidents.
- A 160-bus system estimated an annual loss of 200 hr for 25 accidents.
- A 92-bus system estimated 60-hr lost from all schedules for 38 incidents.
- A 20-bus system estimated an annual loss of 10 hr for 20 incidents, and
- A 58-bus system responded "none, pull the line with other vehicle."

TYPES OF ACCIDENTS AND INCIDENTS

The information available in SAMIS on types of accidents and incidents is limited to the data reported on the Section 15 Safety Form 405. On the Form 405, collisions are recorded as with other vehicles, objects, or people; and noncollisions are subdivided into derailments (buses going off the road), personal casualties, and fires. The personal casualty data provide some information on the type of accident or incident that occurred, as can be seen in Table 3.

All transit agencies contacted during this study maintain data bases on vehicle and passenger accidents and incidents. Usually, these data bases were created from accident reports completed by the bus driver and the supervisor investigating the accident. Several transit agencies provided information on their accident data. Reports were received from three systems on their accidents and incidents occurring over a period of 1 year. One was from a large agency (more than 500 buses), one was from a small agency (fewer than 100 buses), and one was from a medium-sized system (fewer than 500, but more than

100 buses). An indication of the types and frequency of accidents and incidents that occur in bus transit can be obtained from these reports. Minor accidents and incidents (where property damage was less than \$1,000) were included in these reports. The data from these reports are given in Tables 5, 6 and 7.

Additional information on the type of accident by initial point of impact on the bus was found in *Traffic Safety Facts 1994 (5)*, a compilation of motor vehicle crash data from the U.S. Department of Transportation Fatal Accident Reporting System (FARS) and the General Estimates System (GES). The bus category in the report includes school buses and intercity coaches along with transit buses, but it provides information on the distribution of bus crashes by point of first impact (where the bus was struck by the other vehicle). Table 8 contains the percentage distribution for vehicle crashes by point of first impact on the bus.

TABLE 5

ACCIDENT HISTORY OF A MEDIUM-SIZED BUS AGENCY FOR 1 YEAR (4)

Collisions	Number	Percent of Total
At Intersections	27	12.9
Between	48	22.9
Rear-End Collisions in Traffic ¹	11	5.2
In Loading Zone ¹	60	28.6
With objects	36	17.1
With Pedestrians	9	4.3
	19	9.0
Miscellaneous	210	100.0

Incidents	Number	Percent of Total
Boarding ²	40	16.9
Alighting ²	64	27.0
On Board	88	37.1
Wheelchair	24	10.1
Miscellaneous	21	8.9
	237	100.0

¹There were 57 occurrences of the other vehicle hitting the bus in the rear, or 27.1% of total collisions.

²There were 32 occurrences of passengers being struck by the door when boarding and alighting, or 13.5% of total incidents.

TABLE 6
ACCIDENT HISTORY OF A SMALL AGENCY FOR 1 YEAR (4)

Collisions	Number	Percent of Total
At Intersections	9	25.7
Between	11	31.4
Rear-End Collisions in Traffic ¹	1	2.9
In Loading Zone ¹	8	22.9
With Objects	6	17.1
With Pedestrians	0	--
Miscellaneous	0	--
	35	100.0

Incidents	Number	Percent of Total
Boarding ²	34	20.9
Alighting ²	47	28.8
On Board	51	31.3
Wheelchair	5	3.0
Miscellaneous	26	16.0
	163	100.0

¹There were 6 occurrences of the other vehicle hitting the bus in the rear, or 17% of total collisions.

²There were 17 occurrences of passengers being struck by the door when boarding and alighting, or 10.4% of total incidents.

CAUSES OF ACCIDENTS AND INCIDENTS

The New York State Public Transportation Safety Board (PTSB) was created in 1984 for investigating serious bus and rail public transportation accidents, and recommending actions to be taken to reduce the possibility of similar accidents occurring. All public transit bus agencies in the state of New York must notify the PTSB of the following occurrences:

- All fatal accidents,
- All injury accidents that cause five or more injuries requiring medical attention, and

TABLE 9
BUS PROBABLE ACCIDENT-CAUSE CATEGORIES (6)

	1988	1989	1990	1991	1992	1993	1994	Total	% Total
Transit System									
Driver	38	41	38	22	19	30	29	217	33
Equipment/Maintenance	28	28	23	21	20	30	27	177	27
Other Party									
Other Vehicle	22	32	33	31	30	39	26	213	33
Passenger	0	2	1	0	1	0	0	4	1
Pedestrian, Bicyclist	2	7	1	0	1	4	3	18	3
Miscellaneous	1	2	4	7	3	0	3	20	3
Totals	91	112	100	81	74	103	88	649	100%

- All accidents caused by mechanical failure including, but not limited to, all fires that occur in revenue service requiring passenger evacuation or response by police or fire department.

TABLE 7
ACCIDENT HISTORY OF A LARGE AGENCY FOR 1 YEAR (4)

Collisions	Number	Percent of Total
At Intersections	205	16.8
Between Intersections ¹	669	54.7
In Loading Zone ¹	162	13.2
With Objects	128	10.5
With Pedestrians	15	1.2
Miscellaneous	44	3.6
	1,223	100.0

Incidents	Number	Percent of Total
Boarding ²	42	17.3
Alighting ²	50	20.7
On Board ²	150	62.0
	242	100.0

¹There were 90 occurrences of the bus being struck in the rear by another vehicle, or 7.4% of total collisions.

²There were 18 incidents of passengers being struck by door, or 7.4% of total incidents.

TABLE 8
BUSES INVOLVED IN COLLISIONS BY INITIAL POINT OF IMPACT (5)

Initial Point of Impact	Percent of Total
Front	27.6
Left Side	28.5
Right Side	18.5
Rear	25.4
	100.0

TABLE 10

BUS DRIVER PROBABLE ACCIDENT-CAUSE TYPES (6)

Accident Type	1988	1989	1990	1991	1992	1993	1994	Total	% Total
Failure to drive defensively	9	12	15	5	13	17	14	85	39
Failure to perform pre-trip inspection	2	1	1	2	1	0	1	8	3
Failure to yield right-of-way	3	1	3	0	0	0	0	11	5
Following too closely	7	5	9	3	0	2	0	26	12
Improper use of equipment	5	9	5	4	3	4	0	30	14
Improper use of mirrors	2	0	0	1	0	1	0	4	2
Speeding	7	1	5	1	1	0	0	15	7
Use of drugs/alcohol	3	12	0	5	0	0	1	21	10
Other	0	0	0	1	1	2	13	17	8
Totals	38	41	38	22	19	30	29	217	100%

TABLE 11

BUS EQUIPMENT PROBABLE ACCIDENT-CAUSE TYPES (6)

Accident Type	1988	1989	1990	1991	1992	1993	1994	Total	% Total
Brakes	13	12	7	4	5	4	4	49	28
Electrical systems	5	6	3	6	4	9	6	39	22
Rear door interlocking system	3	3	3	2	2	3	3	19	11
Steering	0	0	1	2	0	0	1	4	2
Wheels	3	1	3	5	1	0	0	13	7
Wheelchair lifts	0	2	0	1	5	4	5	17	10
Other: tires, suspension....	4	4	6	1	3	10	8	36	20
Totals	28	28	23	21	20	30	27	177	100%

A team from the PTSB investigates all public transportation accidents that meet the above criteria. The findings of the accident team are then reviewed by the board, and a probable cause and contributing factors are determined. The PTSB maintains a data base on these accidents, and 649 bus accidents were on file as of the end of 1994. An annual report also is published each year by the PTSB. In the 1994 Annual Report, several tables provided information on the types and probable causes of serious bus accidents that have occurred in the state of New York. Table 9 provides a breakdown of probable

accident cause categories from 1988 to 1994 as determined by the PTSB. Table 10 gives a detailed breakdown of the bus driver probable accident causes by subtypes for the same period. It is of interest to note that the PTSB, in its judgment, had found that for those accidents in which the bus driver was determined to be the probable cause, 65 percent over the 7-year period could be attributed to "failure to drive defensively." Table 11 provides a breakdown of probable accident cause for bus equipment failure for the same 7 years, and underscores the importance of safety inspections.

CHAPTER THREE

TRANSIT INDUSTRY PROGRAMS FOR REDUCTION OF ACCIDENTS AND INCIDENTS

The following sections discuss the information gathered by surveys and interviews of the transit agencies to learn about programs for reducing injuries to passengers and drivers during revenue service. Where appropriate, examples are discussed to provide additional insight and understanding. The transit agencies and management companies that provided information for this synthesis are listed in Appendix B.

DRIVER PROGRAMS**Selection and Hiring Practices**

All transit agencies surveyed used personal interviews to screen driver applicants. Many used additional screening tests during the hiring process. These tests, in general, are intended to identify candidates who would be productive, responsible, and safe drivers. Survey responses on the types of additional tests used are given in Table 12.

TABLE 12
SCREENING TESTS USED FOR DRIVER APPLICANTS

Chicago Test	Seattle Video	Drug and Alcohol	Other
1	8	23	15

The 15 agencies that reported the use of "other" tests provided the following information on the tests used. The numbers in parenthesis indicate how many transit agencies reported using the test.

- Preemployment physical exam (4),
- Math test (4),
- London House Personnel Selection Inventory Test (3)
- Map orientation test (2),
- Reid Psychological System's Customer Service Questionnaire (2),
 - Reading test (2),
 - Preemployment driving test,
 - Review of driving record, and
 - Background investigation and fingerprint check.

Two agencies indicated that they plan to use the Bus Operator Selection Survey (BOSS) program being developed by the American Public Transit Association (APTA) when it becomes available.

Driver Training

All of the transit agencies reported that the initial training for new drivers involves a combination of classroom instruction and in-vehicle training. Typically, the initial training day involves 2 to 3 hours in the classroom followed by the remainder of the day in a bus to learn and practice bus driving skills. The actual length of the initial training depends on the progress of the individual. The range of total hours of initial training is from 20 hours to 300 hours.

In addition to the initial driver training, most of the agencies reported providing training programs to help drivers in customer sensitivity and handling, particularly in dealing with difficult customers and those with special needs. Also, most have a program of refresher training. Many have schedules to cycle all of the drivers through a refresher course every 2 to 3 years. Others do refresher training based on a supervisor's recommendation of observing some unsafe driving behavior or the occurrence of one or more accidents in a year. A percentage breakdown follows of the types of training programs most frequently reported by the 27 local transit agencies that returned survey forms:

- 93 percent, defensive driving training,
- 93 percent, customer sensitivity training program,
- 85 percent, driver refresher training program,
- 22 percent ADA related training programs, and
- 19 percent, training programs dealing with emergency situations and procedures.

In addition, transit systems reported offering training programs in the areas of commercial driver license (CDL), right-to-know, and operator personal enhancement.

Defensive Driving Training

The importance of defensive driving can be seen by reviewing the statistics given in Table 10, where 65 percent of the bus-driver probable cause accidents in the PTSB bus accidents data base were attributed to "failure to drive defensively." The National Safety Council (NSC) claims that 78 percent of collisions are attributable to driver error. Some of the transit agencies that provide defensive driving training had developed their own defensive driving programs. Other transit agencies reported using the following commercially available programs: The Smith System; Defensive Driving Course DDC-4 (NSC); Coaching the Transit Bus Driver (NSC); Defensive Driving Course--PC (PDA), and Bus Maneuvering and Defensive

Driving Course (TS1). Information on these companies is given in Appendix C.

The defensive driving programs have many common elements: maintaining an awareness of the traffic environment, the anticipation of and allowances for other driver's behavior, the provision of adequate time to make safe driving decisions, and reinforcement of good driving practices and behavior.

The Smith System places emphasis on in-vehicle training with "behind-the-wheel" skill drill sessions. The training is structured around what is referred to as the "Five Keys to Space Cushion Driving." The Smith System keys are called:

"Aim High in Steering"®
 "Get the Big Picture"®
 "Keep Your Eyes Moving"® "Leave Yourself an Out"®,
 "Make Sure They See You"®.

The NSC provides a wide variety of safety educational and promotional materials to members and nonmembers. The NSC training materials are available in all media including an interactive personal computer (PC) program. The Professional Development Associates (PDA) has developed an interactive self-paced defensive driving PC program for transit operators based on the NSC defensive driving courses. The program is divided into eight sessions as follows:

What Is Defensive Driving--Defines defensive driving, introduces collision prevention practices and discusses conditions contributing to collisions.

The Condition of the Driver--Examples of how the driver's physical condition, emotions, and attitudes can affect driving, and ways to deal with these hazards.

Know Your Equipment--Emphasizes the differences in operating a bus versus a car. Stresses the importance of pre-trip inspections.

Preventing Collisions--Instructs proper following distances, side clearances, and visual techniques.

Hazards and Defensive Strategies--Teaches safe driving strategies for when traffic, weather, road, and light conditions are less than optimal.

Driving Maneuvers--Teaches safety in lane changes, approaching intersections, and freeway operations.

Service Stops--Illustrates proper procedures for making near- and far-side stops. Teaches methods for minimizing passenger falls.

Summary and Review--Reviews all of the key defensive driving techniques taught in the course.

The PDA course is a self-paced interactive computer program. The program has individual "bookmarks" that help student drivers pick up where they had stopped.

Tri-Met in Portland, Oregon, conducted an evaluation of some 690 driver performance profiles before and after receiving Defensive Driving Workshop (DDW) training. The evaluation periods were the 24 months before DDW training and the 24 months after DDW training. The results of their evaluation are given in Table 13.

Tri-Met acknowledges that evaluation of training programs is not an exact science because of the numerous environmental factors that may not be controlled and can influence training outcomes. However, the results are impressive and certainly indicate the potential of defensive driving training.

TABLE 13

EVALUATION RESULTS OF DEFENSIVE DRIVING WORKSHOP TRAINING (4)

Accidents-- Claims	Number-- Prior 24 Months	Number-- After 24 Months	Change Percent
Preventable	396	196	45 ¹
Non-Preventable	652	534	18
Pending Appeal	0	22	
Driver No Fault	446	420	6
Total Accidents	1,494	1,172	22

¹Assumes that the 22 pending appeal are preventable.

Simulators Used In Driver Training

Two agencies, Winston-Salem Transit Authority and New Jersey Transit Corporation, reported using simulators in training their drivers. New Jersey Transit has two types of simulators. They have a four-station driver trainer simulator system at their Camden facilities, and an eight-station simulator system at their Maplewood facilities. An interactive vehicle maneuvering trainer (VMT) in which the driver sits at a replica of a front of a bus with a driver workstation is also located the Maplewood facility. In an adjoining room, a scale mock-up of streets, intersections, railroad crossings, people, buses and cars, and buildings provide a diorama model on which to run scenarios of driving situations. A 1/16-scale model maneuverable bus equipped with TV cameras is under the control of the driver seated at the VMT workstation. The TV cameras see what a driver would see when seated in the scale-model maneuverable bus. Large-screen television monitors provide real-life images of the scene (forward, left, and right) for the student driver. A street and vehicle environment can be set up for a wide variety of training exercises.

The VMT simulator is used for initial and refresher training. As a training and evaluation tool, the VMT can simulate a traffic situation similar to what it was in an accident and have the driver run a prescribed route. Instructors can observe unsafe driving behavior and "coach" the student driver in the use of defensive driving techniques.

The driver trainer simulator has training stations that are a real-world mock-up of driving controls, instruments, and seating of a typical bus. The simulator system projects views of traffic situations on a screen for the student drivers to view. An instructor can set up individual or group driving exercises. A PC controls the displays, monitors the individual's responses, and keeps records of how each individual responds to a particular driving lesson. The simulators at New Jersey Transit were manufactured by Doron Precision Systems of Binghamton, New York.

The driver trainer simulators are used to check the hand-eye coordination, reaction times, and general driving skills of student drivers. They also are used to reinforce proper driving habits and defensive driving principles for driver refresher training.

The driver trainer simulator used by Winston-Salem Transit is similar to the one used by New Jersey Transit. The simulators are made available by the North Carolina Department of Transportation (NC DOT) Public Transit Division. NC DOT has a 40-ft MCI bus equipped as a training classroom. The bus has a Doron driver trainer simulator with two stations. It also has a PC with training programs, video, and slide projection systems. The classroom bus is available to train transit staff on-site at the more than 100 public transit agencies in North Carolina.

Driver Incentive Programs

Of the 27 local transit agencies that responded to the survey, 25 have some type of safe driving incentive program. The types of incentives reported are given in Table 14. Several transit agencies follow the NSC safety awards programs. The recognition and awards mentioned in the survey responses include pins, patches, plaques, certificates; belt buckles, clocks, rings, gold watches, dinner certificates; Honor Rolls for safe driving recognition for 10, 20 and 30 years; and Driver-of-the-Month and Driver-of-the-Year awards. The bonuses include U.S. Savings Bonds (\$25 to \$100) and cash awards as high as \$1,500 for 35 years of safe driving (no preventable accidents). Examples of three safety driving award or bonus programs are given in Appendix D.

TABLE 14
DRIVER SAFETY INCENTIVE PROGRAMS OF SURVEY RESPONDENTS (4)

Recognition/ Awards	Bonuses	Perks	Dinners/ Banquets	None
93%	33%	15%	44%	7%

Connecticut Transit has a "Safety Sweepstakes" program. All drivers earning Safety Awards (no preventable accidents) each month also receive a Safety Sweepstakes game card. An example of the game card is shown in Figure

2. On each card are four true or false questions taken from the Operator's Rule Book or from study materials for the commercial driver's license. The drivers who correctly answer all four questions have their game cards entered into a drawing for the month. The winner receives a \$100 U.S. Savings Bond. All game cards are entered into an annual drawing, and the winner receives one week off at full pay.

The Regional Transportation Commission of Clark County (Las Vegas) has a similar incentive program. In addition to using the NSC safe-driver pins and certificates and the safety pins from their corporate office (ATC/Vancom), they have a

monthly drawing for all coach operators and maintenance personnel who did not have a preventable accident for the previous month. The winners have receive such items as a 13-in. color television, portable cassette recorders, shopping certificates, and tickets to a Las Vegas Stars baseball game.

The other incentives that were frequently mentioned by the transit systems were award breakfasts, lunches, and dinners and annual rodeos. At most transit agencies, the bus roadeo is open only to those drivers who have had no preventable accidents in the past year. These drivers are recognized for their skills at the transit agency's annual awards banquet. In 1995, more than 121 transit agencies sent their champions to participate in the APTA International Bus Operator's Rodeo. Following the competition, the participants are recognized for their excellence in safe driving skills at the Awards Ceremony held during the APTA Annual Meeting.

CUSTOMER SAFETY PROGRAMS

All but one of the transit agencies that responded to the survey have some type of customer safety education or training program. They were asked what types of programs they had to instruct their customers on how to use the bus system safely. Their choices were: education programs (written material); training (with an instructor and vehicle); or school programs. They were also asked if they had a public awareness program (radio, TV and newspapers) on the safe use of the bus system. The responses to the survey question on customer safety programs are given below.

- Customer educational programs--67%,
- Customer training with instructor and bus on the safe use of their services--52%,
- Safety education programs for school children--81%, and
- Media public awareness program of the services--44%.

Three of the agencies said that they had coloring books for school children that contain safety messages. The Riverside (California) Transit Agency (RTA) provided an example of their coloring book, and excerpts from the coloring book are given in Appendix E.

The Dallas Area Rapid Transit (DART) has an extensive educational program designed for school children, grades 1 through 12. They have course materials, a video and a teacher's guide. The components of this educational program include riding the bus safely, reading a bus schedule, the use of transfers, taking care of public equipment (buses), bus stop safety, paying your fare, the Clean Air Act, and the importance of public transit. They also have "presenters" who do on-site training with a bus. After an oral presentation, the presenter reviews all safety aspects of riding the bus while taking a demonstration ride on the bus. Information on the DART program, and examples of other customer safety education materials, are given in Appendix E.

The Greater Richmond Transit Company has a Mobile Information Bus which is a standard bus that was redesigned in

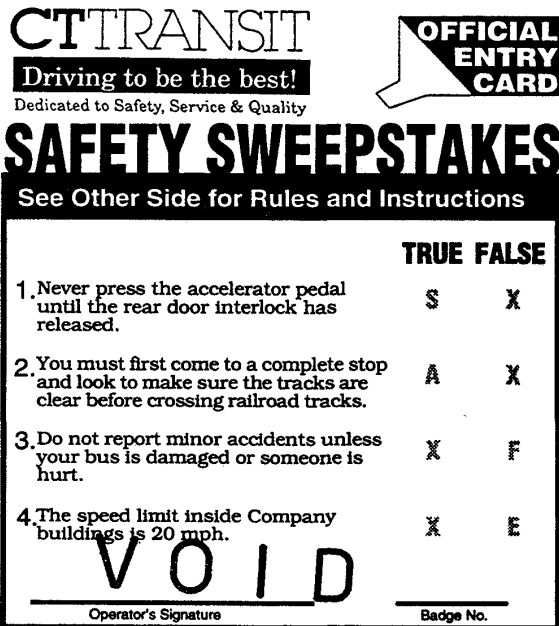


FIGURE 2 Example safety sweepstakes card.

1984 to serve as an educational tool for children and adults. The bus features exhibits of the history of public transit in Richmond, the city's route system, automated fare boxes, and wheelchair-accessible buses. A Customer Service Representative is with the bus to answer questions and to provide information.

VEHICLE IMPROVEMENT NEEDS

The survey responses to the question on which vehicle issues are in greatest need of improvement from a safety perspective are given in Table 15. The "other" vehicle safety improvement needs mentioned were: steps (stairwells), mirrors, integration of workstation, rear center brake light, and darker tinting on driver's windshield.

Bus Operator Workstation

The driver workstation was selected as a bus issue that needs attention by 40 percent of those who completed the survey. A TCRP project on improving the driver workstation is under way at the Pennsylvania Transportation Institute (PTI). The project entitled, "Bus Operator Workstation Evaluation and Design Guidelines" is expected to be completed in 1996 (7). This project is building on an earlier study done by the Canadian Urban Transit Association (CUTA) entitled "Ergonomic Study of the Driver's Workstation in Urban Buses" (8).

SAFETY SWEEPSTAKES - - RULES AND INSTRUCTIONS

CONGRATULATIONS! You have received this card in recognition of your years of driving without a preventable accident. Follow these instructions to enter the CTTRANSIT SAFETY SWEEPSTAKES.

- Determine whether each statement on the other side of this card is "TRUE" or "FALSE." All of the information you need is available in your Operator's Rulebook or CDL study materials.
- Scratch off the silver box under the correct column -- True or False -- for each statement. If your answer is correct, a letter will appear. The letters for all four correct answers will spell the word SAFE.
- Only cards with the four correct answers clearly showing the letters SAFE can be entered in the Safety Sweepstakes. An incorrect answer will invalidate your entry.
- If you have all four correct answers, sign your card and indicate your badge number clearly. Turn your card in to the Assistant Superintendent, Superintendent, or Manager in your division. Entries must be turned in by the end of the month to be included in that month's sweepstakes drawing.
- Contact your supervisor if you have any questions about these instructions.

 Issuer's Initials Division Month/Year

TABLE 15

VEHICLE SAFETY IMPROVEMENT NEEDS (4)

Item	Number of Times Selected
Doors and Door Controls	8
Driver Vision	9
Driver Workstation	11
Brakes	6
Interior Lighting	4
Handrails and Stanchions	6
Sun Visors/Screens	5
Brake/Turn Signal Lights	5
Flooring	6
Other	5

The objective of the TCRP project is to develop design guidelines for bus operator workstations based on ergonomic/biomechanical principles with sufficient adjustability to accommodate a range of potential operators from females whose height and weight fall in the 5th percentile of the U.S. adult population to males in the 95th percentile. The project approach involved three general stages: information gathering, concept development, and design engineering and validation.

In the first stage, a survey of transit bus operators was conducted to gain knowledge about their workstation requirements and preferences. The transit operators ranked controls and displays by frequency of use and provided their perceptions on desirable and undesirable features of current bus workstations including problems of driver ingress and egress.

TABLE 16

MAJOR WORKSTATION ATTRIBUTES INVESTIGATED IN LABORATORY MOCK-UP AND TO BE EVALUATED IN THE PROTOTYPE WORKSTATION (7)

Attribute	Anticipated Benefit
Hanging pedals	Provides less dynamic coupling with the floor and therefore reduced vibrations felt by the driver. Provides better ergonomics and greater adjustability with less cost when compared to treadle pedals (either stationary or adjustable).
Left instrument panel	Contains controls that are used when operator begins shift and then are used infrequently; adjustable in the vertical and fore/aft directions.
Right instrument panel	Contains controls that are used frequently and includes the ODA ^(a) ; adjustable in the vertical and fore/aft directions.
Center instrument panel	Indicators for vital information such as speed, air pressure, and telltales. Dimensioned for maximum visibility.
Tilt-telescope-tilt (T ³) steering wheel	Provides the three degrees of freedom required for the anticipated population to position the steering wheel.
Stop request on front window pillar	To provide maximum visibility of sign and minimum eye movement from road; conspicuous location.
Turn signals and high beams	Floor-mounted buttons on an angled platform to provide for comfort angles.
Cold blast protector	Protects driver from intrusive passengers and cold It can be stowed if not desired.
Low profile farebox	Farebox height is set at 39 in., standard for a table, so that people can reach it but does not obstruct the visibility of the road.

^{a)}ODA: Operator Digital Assist contains information of current schedule, farebox information and controls, transfer printer, destination sign controls, and a display for messages.

This effort was followed by an ergonomic system design process using the inputs from the transit operators survey and the literature research. A laboratory workstation mock-up was constructed to better understand and validate the concepts that emerged from the analysis and design process. The major attributes that were investigated in the workstation mock-up are given in Table 16. A jury of 103 males and females covering the range of the target population evaluated the mock-up and found

- The workstation mock-up was able to accommodate the desired range of operators,
- The evaluation provided information on the amount of adjustment required to accommodate the desired operator population range,
- The jury evaluations on the average indicated a satisfaction with the visibility, reach, comfort, and adjustability of the workstation mock-up, and
- The jury evaluation demonstrated the need for the tilt-telescope steering wheel and the functionality of the hanging pedals.

A prototype workstation incorporating the findings of the mock-up investigation will be evaluated in a bus at the PTI test track in the spring of 1996. The final report and guideline recommendations are expected to be available in late 1996.

Driver Vision

To improve driver vision, many transit agencies are using larger mirrors that are remotely controlled, and some are equipped with heating elements to keep the mirror free of frost and fog. A concern of one transit agency was driver blind spots caused by the width and location of the window frame structure of their buses. Pedestrians, particularly children, crossing in front of the bus could be hidden by these blind spots. A continuing problem for some is an inadequate view of the rear door exit area for the driver to monitor that passengers alight safely. This is a more severe problem when the bus is crowded with many standees. One agency reported that small children are more likely to be caught in a rear door partly because they are not as visible in the driver's mirror system. The right side mirror is also key to observing that exiting passengers are clear of the bus.

Some transit agencies have problems with cold and humid conditions that cause the entry door windows to fog up, restricting the driver's vision of passengers wishing to board. Most buses use hot air to keep the door window clear; however, some transit agencies in the colder climates still have problems in keeping the windows clear. A transit agency in Herten, Germany has tiny heating wires embedded in the door glass to keep the door windows defrosted and sclear. They also have very fine heating wires (not visible with the unaided eye) in the windshield glass for defrosting the windshield.

Doors and Door Controls

Each year there are incidents of passengers being caught in or struck by doors while either boarding or leaving. The San Francisco Municipal Railway (MUNI) reported 135 such incidents on their buses in 1994 (9). Two-thirds of these incidents involved the rear door while passengers were alighting. MUNI found that buses with "slide-glide" doors (inwardly opening doors versus outwardly opening doors) had greater relative risks of passengers being struck or caught by the door. In 1994, buses with inwardly opening doors accounted for nearly 80 percent of the rear door incidents in the MUNI bus fleet.

A paper by Hundenski reported that young passengers (under age six) were especially at risk of being struck or caught by inwardly opening rear doors (10). In the paper it was suggested that a possible cause for the higher relative risk was that the child was in the step well and not visible in the bus mirror system.

The Ottawa-Carleton Regional Transit Commission (OC Transpo) has modified its slide-glide doors by removing about 4 in. of the lower metal door structure and replacing it with a rubber boot. Then, if a passenger's foot is caught by the door, there is no injury. See Figure 3 for photo of the door modification.

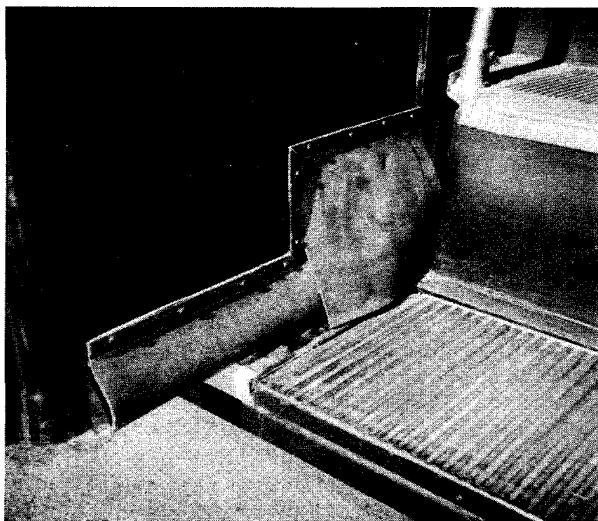


FIGURE 3 Rubber bottom modification on slide-glide door by OC Transpo

Handrails, Stanchions, and Edge Markings

In general, the practice followed for handrails, stanchions, and edge markings for heavy-duty buses are specified in the "White Book" (11). Passenger-assists in the form of stanchions or handholds are provided for the safety of standees and for boarding and alighting. There are handholds in the

back of each transverse seat. The placement of the handholds and stanchions is designed to accommodate a 5th percentile female boarding, leaving, and moving about the bus. The edge of the vestibule floor and nose of step-treads have a contrasting 2-in. white band (bright yellow is optional). Padding of the seat backs to minimize potential injuries during severe braking is also specified.

The "Easier Access" project, a recent study conducted by the Ontario Ministry of Transportation and several Ontario transit systems, examined the accessibility aspects of bus transit agencies (12). The goal of the project was to encourage senior citizens and persons with mild disabilities to use conventional transit. A number of the research findings dealt with grab rails, stanchions, edge markings, and lighting and have been incorporated into the bus specifications of most Ontario transit agencies. The vehicle features from the Easier Access project that are required by a Ministry Directive

(13) for low-floor buses in Ontario are listed below:

- Kneeling feature,
- Enlarged lettering, high-contrast color destination signs, yellow on black background,
- Lights to illuminate vehicle floor at entrances and exits,
- Flood lights over entrance and exit doors,
- Bright yellow handrails, grab rails, and stanchions,
- Yellow stanchions at each priority seat with "next stop" button,
- Bright yellow nosing on edge of flooring at entrances and exits as well as ramps and any interior steps,
- Grab rails at vehicle entrances and exits, and
- Floor heater at front entrances of vehicle.

The number and placement of grab rails and stanchions vary among agencies. In the United States, the bus manufacturers follow the practice given in the White Book for the location and size and shape of grab rails and stanchions. A study conducted by the Canadian Urban Transit Association (CUTA) on interior bus design issues found that transit agencies favored increasing the number of stanchions and the use of overhead grab rails. As would be expected, opinions on what is needed differ with the number of stanchions in use, varying from 7 to 21 (12).

Brake Lights and Warning Signals

Many of the transit agencies reported that a very frequent accident type was "bus struck in rear by other vehicle." Several indicated it was the most frequent accident type. The bus may be stopped in traffic or be slowing down in traffic, or stopped in a bus stop zone. It was also reported that the driver of the other vehicle frequently responded: "I didn't see the bus." The left rear corner of the bus was given as the most likely impact point.

Several agencies were found to be working on projects to improve visibility of the rear of their buses, particularly when the bus is braking or is stopped. A problem frequently mentioned

in connection with brake lights was that because assemblies are not always sealed, dirt and water can get into the assemblies, reducing the effectiveness of the braking signal. Others agencies are experimenting with size, intensity, and placement of the lights.

Metropolitan Atlanta Area Rapid Transit Authority (MARTA) is experimenting with a larger (10-in. diameter), high, center red lamp that flashes. New Jersey Transit is specifying on new bus purchases a new brake light configuration that has the brake lights a little closer together and lower, and with sealed beam lamps to eliminate the problems of dirt and moisture. Metropolitan Transit Authority of Harris County (Houston Metro) has just started a project to evaluate several designs to improve the visibility of the rear of their buses when stopping. The designs will include various lamp systems that will be 4 to 7 inches in diameter with sealed beam units. Some configurations will use LED lamps, and some will flash under control of an on-board control unit. In addition, there will be reflective tape (1 1/2-in. wide) that will outline the engine compartment access door.

The Capital District Transportation Authority (CDTA) in Albany, New York, has a sign on the right rear corner of their buses to warn drivers in following vehicles to watch for passengers exiting. See Figure 4 for a photograph of the sign. They also have a sign for passengers over the front door that reads "Notice--When exiting do not pass in front of bus." The sign is used because they also transport school children, who are generally told to pass in front of school buses when exiting. The problem was of particular concern to CDTA because



FIGURE 4 Warning sign of passengers exiting bus used on CDTA buses.

their buses have somewhat larger driver blind spots for people (particularly small people) crossing in front of the bus.

Deceleration Alert System

A number of transit agencies have all or part of their fleet equipped with a deceleration alert system (DAS). The DAS is a light configuration in which an array of lamps is activated according to the mode of the bus. When the accelerator pedal is released, the flashing amber lights of DAS are activated. When brakes are applied, the amber lights are turned off and a DAS center red light is activated along with the other bus brake lights. DAS provides a signal to a driver following the bus that the bus driver has released the accelerator pedal, and may initiate braking. A photo of an MTA Long Island bus that is equipped with DAS is shown in Figure 5.

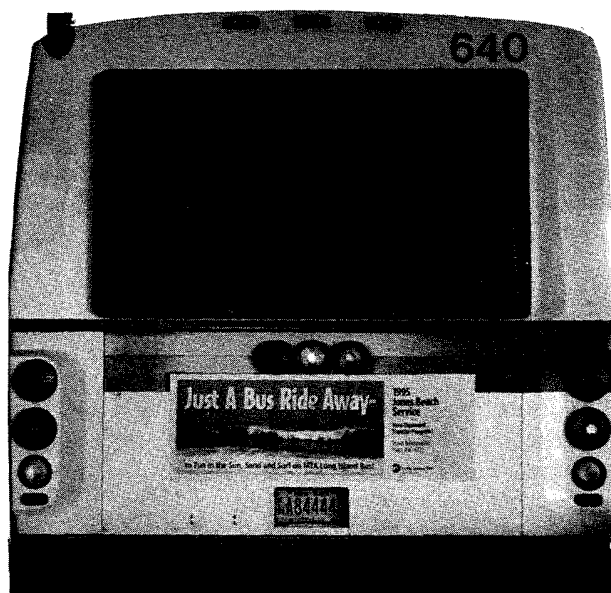


FIGURE 5 An MTA Long Island bus equipped with DAS.

The Phoenix Transit System has had DAS installed on its buses since 1985. During the initial evaluation period of 18 months, buses with DAS had 57 rear-end accidents while buses without DAS had 82 rear-end accidents (a 30 percent reduction). The comments received from other agencies that have tried DAS were generally quite favorable; however, there were a few that questioned the effectiveness in reducing rear-end collisions. There had been reported problems in some states in obtaining permission to install DAS-like systems on a transit bus, but they seem to be disappearing.

The only DAS evaluation report found was one prepared by the Texas A&M University for the Houston Metro (14). The accident experience of a test fleet of 30 buses equipped with DAS was compared with the accident experience of other

buses on similar routes over an 18-month period. A lower collision rate was observed on the buses equipped with DAS, but the difference was not considered to be statistically significant ($p < .16$).

Emerging Technologies

The Intelligent Transportation Systems (ITS) programs in the United States and the PROMETHEUS and DRIVE programs in Europe are developing and testing a number of new technologies that hold promise for improving vehicle safety. Some examples are collision avoidance systems, improved night vision technology and display technology, and communication and warning systems to alert drivers of potential hazards, such as slippery road conditions or dense fog on the road ahead. A radar system to alert drivers about an obstacle in the road or that they are closing in on a vehicle is being evaluated on Greyhound coaches. Radar can also be used to alert a driver that a vehicle is in a blind-spot. The Environmental Concept Bus, recently introduced by Volvo, uses closed circuit TV in place of mirrors. The TV monitors provide the driver with an unobstructed view of vehicles on the left side, right side, and rear of the bus. The use of antilock brake systems (ABS) has been required on buses and trucks in Europe for some time. The U.S. trucking industry is now adopting ABS as an effective way to reduce accidents caused by slippery road conditions. The use of ultraviolet driving lights is being tested in Europe to improve night-driving vision.

VEHICLE SAFETY INSPECTIONS

Bus equipment failures were found as the probable cause for 27 percent of the serious bus accidents in the state of New York (see Tables 9 and 11). These data emphasize the importance of safety inspections. All transit agencies surveyed said that the driver is required to inspect the bus before it is pulled from the yard. Many transit agencies require drivers to use and sign a multiform checklist. If a defect is found during the inspection, a form is filled out and sent to maintenance. Many times a "Defect Report" is integrated with the "Daily Inspection Form." Examples of these forms may be found in Appendix F.

Some items such as "door interlocks," emergency exits, lifts and ramps, and securement systems are checked on a weekly basis by maintenance. From the survey responses, the maintenance inspection intervals varied from 1,500 to 12,000 miles.

BUS STOPS AND STATIONS

Twelve of the transit agencies surveyed reported they had guidelines for the location and design of bus stops. Two reported that state guidelines were used. Four provided copies of their bus stop design guidelines: King County Department of Metropolitan Services (Seattle Metro); Metropolitan Transit

Authority of Harris County (Houston Metro); Regional Transportation Commission of Clark County, Nevada (Citizens Area Transit); and Riverside Transit Agency (RTA) California.

Location

Typically, there are three choices for the location of bus stops: far-side, near-side, and mid-block stops. Far-side stops are located immediately after intersections in the direction of bus travel. Near-side stops are located prior to intersections in the direction of bus travel. Mid-block stops are located 300 feet or more beyond or before an intersection.

The four guidelines varied somewhat in their preferences for bus stop location. Two preferred far-side stops where feasible, another preferred near-side stops where feasible, and the fourth decided bus stop location on a case-by-case basis. In general, all four guidelines followed the suggestions given by the Institute of Traffic Engineers recommended practices for Proper Location of Bus Stops (15).

Seattle Metro

To decide the proper location of a bus stop, Seattle Metro makes the choice between far-side, near-side, and mid-block stops based on the traffic and transit operational conditions at a proposed location (16). The conditions under which near-side bus stops were recommended are:

- Traffic is heavier on the leaving side than on the approach side of the intersection.
- The cross street is a one-way street where the traffic flows from right to left.
- At intersections controlled by signals, a stop sign, or a yield sign, and transit operations are more critical than traffic and parking.
- Where there is a route right turn and curb space is critical but traffic is not critical, a near-side stop should be established before the turn.

The advantages of a near-side stop cited are:

- Less interference with traffic turning into the bus route street from a side street, and
- Passengers generally alight closer to a crosswalk.

The disadvantages cited for near-side stops are:

- If there is a high traffic volume of right turns at an intersection, conflicts can arise when a vehicle attempts a right turn from the left of a stopped bus.
- A bus standing at a near-side stop obscures the sight distance of pedestrians crossing the street, as well as a driver entering the street from the right.
- A bus stopped at a near-side stop can obscure the view of a stop sign.

The Seattle Metro guidelines recommended far-side stops under the following conditions:

- Traffic is heavier on the approach side than on the leaving side of the intersection,
- The crossing street is a one-way street where the traffic flows from left to right,
- At intersections where frequent left and right turns occur,
- At intersections where bus routes and heavy traffic movements diverge, and
- At intersections controlled by signals, stop signs, or yield signs and when traffic or parking is critical and transit operations are not critical.

The advantages cited for far-side stops are:

- There is less conflict with vehicles making right turns.
- Buses turning left to approach a far-side (around the corner) stop begin their left turn from the proper lane.
- Buses stopped in a zone do not obstruct the sight distance for vehicles crossing the bus route from the right street.
- Buses can find a gap to enter the traffic stream without interference at signalized intersections, except where there are frequent turning movements into the street with the bus route.
- Waiting passengers assemble at less crowded sections of the sidewalk away from the intersection.
- Buses stopped in the zone do not obscure traffic control devices or pedestrian movements at the intersection.

The disadvantages cited for far-side stops are:

- Vehicles parked illegally in the bus stop obstruct buses from entering the stop and cause traffic to back up across the intersection.
- Stops on a narrow street may block traffic on both the bus route and the cross street.
- A bus standing at a far-side stop obscures sight distance to the right for a vehicle entering the bus street from the right.
- For stops with occasional heavy demand, the overflow may obstruct the cross street.

The Seattle Metro guidelines favored mid-block stops when the following conditions are present:

- Traffic or physical street characteristics prohibit a near-or far-side stop adjacent to the intersection.
- A large passenger generator exists at mid-block, and heavy loading makes the location desirable.
- A mid-block stop should be located at the far side of a mid-block pedestrian crosswalk, if one exists, so that standing buses will not block a motorist's view of pedestrians in the crosswalk.

The advantages given for mid-block stops are:

- Buses stopped in a zone cause a minimum of interference with sight distance of both vehicles and pedestrians.

- Stops can be located close to major generators of passengers.
- Waiting passengers assemble away from busy intersections.
- Nearby driveways may add to the pull-in and pull-out space.

The disadvantages cited are:

- A greater zone length is needed requiring the removal of more curb parking.
- Pedestrian jaywalking is more prevalent.
- Passengers from cross streets must walk farther and faster.

Citizens Area Transit (CAT)

The CAT guidelines (17) favored far-side stops because it was believed that they typically pose fewer potential conflicts with other vehicular traffic and pedestrians. Mid-block stops were recommended to minimize walking distance where long block lengths exist, and in situations where the bus stop could be located adjacent to educational facilities, medical facilities, senior citizen housing, or other major passenger generators. Near-side stops are considered when they provide a closer proximity to major passenger generators, and at high-volume transfer locations where it might be unsafe for pedestrians to cross the intersections. The CAT guidelines cited these advantages for far-side stops:

- Buses can safely enter the traffic stream at signalized intersections by taking advantage of traffic gaps created by the traffic signal.
- Passengers boarding and alighting are less likely to cross in front of the bus.
- Stopped buses interfere with traffic at intersections where the traffic volumes are heavier on the approach leg than on the departure leg.
- Buses stopped in the zone do not obstruct the sight line for vehicles entering an intersection from a side street.
- Sight distance is improved for pedestrians using the intersection.

Riverside Transit Agency (RTA)

The RTA guidelines favor, whenever possible, far-side stops (18). Under certain circumstances, near-side and mid-block stops may be required. The RTA guidelines for stop locations are as follows:

- When a bus is required to make a left turn at an intersection, the preferred location for the bus stop is on the far side of the intersection, after the left turn is completed.
- When the transit route alignment requires a right turn, and the curb radius is short, a mid-block location, well before the execution of the right turn movement, is preferred. If a mid-block stop is not possible, the stop should be located on

the far side of the intersection, after the bus completes the right turn movement.

- If there is a high volume of right turns at an intersection, the preferred location for a bus stop is on the far side of the intersection. This recommendation holds for buses turning right and for those traveling straight through the intersection.
- A near-side bus stop location should be used in circumstances where the accumulation of buses at a far-side stop could exceed the length of the bus zone, and additional length is not available, causing backup into the intersection.
- At complex intersections, such as those with multiphase signals or dual right or left turn lanes, far-side bus stops are preferred because they remove the buses from the complicated traffic activities occurring within and near the intersection.
- When transfer activity between two lines exhibits a strong directional pairing (i.e., heavy volumes from east bound to north bound), placing one stop near-side and one stop far-side can minimize pedestrian activity within the intersection.
- When a large percentage of passengers using a stop is destined for a single-trip generator (school, office, shopping center, or similar generator), the stop should be located to minimize pedestrian activity through the intersection. Depending on the location of the generator, the preferred stop could be far-side or near-side.

Houston Metro

The Houston Metro guidelines (19) gave a preference to near-side bus stops whenever possible. The rationale and conditions under which near-side bus stops were preferred were given as:

- Paving and lighting conditions are generally better at the crosswalk locations. Near-side bus stop locations take advantage of these conditions more than far-side bus stop locations, which are generally located 200 ft or more from the intersection.
- At near-side bus stops, the front of the bus is adjacent to the crosswalk and passengers wishing to cross in front of the bus are encouraged to use it. In contrast, at a far-side bus stop passengers crossing in front of the bus would be jaywalking.
- Buses pulling out into traffic from a near-side stop have the width of the intersection, enabling a long, easy, and tapered pull-out and reducing the chance of sideswiping other vehicles proceeding in the same direction.
- Near-side stops require the bus to come to a full stop at the intersection. The bus is under better control through the intersection and is less likely to be involved in a collision or in contact with pedestrians.
- Fewer emergency stops are required with near-side bus stops because of the more controlled operating conditions of all vehicles. The result is fewer rear-end collisions and fewer passenger falls on board the bus.
- The driver's attention may be diverted by cross traffic and turning vehicles as the bus proceeds through an intersection to a far-side stop. At a near-side stop, the driver can pay more attention to the waiting passengers at the stop.

- A driver has a better view of approaching passengers at a near-side stop--those directly ahead, those coming from the left, and those coming from the right. At far-side stops, the driver can only directly see passengers to the front.
- At intersections controlled by traffic signals, about half of the time buses approaching the intersection would be required to stop because of the traffic signal. Far-side stops would require the bus to stop again. This would increase the number of stops and starts with a corresponding increase in traffic friction and accident potential.
- With a near-side stop, the bus can take advantage of the red phase to load passengers while waiting for a green light.
- For routes with frequent service, a bus may not be able to pull into a far-side stop because of other buses, causing a potential following bus to block traffic and creating an accident hazard.
- Near-side stops require somewhat less parking prohibition than what is required with far-side and mid-block stops.
- Near-side stops most frequently have the desired sidewalks, curb cuts, crosswalks, and median cuts close to the stop needed for accessibility for passengers with disabilities

The Houston Metro guidelines recognized certain conditions when far-side stops may be preferred. Those conditions were:

- Where there is heavy other vehicle right-turn movement, a far-side stop may be justified to avoid obstructing that movement.
- At transfer points, a far-side stop may reduce the need for transferring passengers to cross a street.
- Where buses make a right turn from a heavy to light traffic street, a far-side stop on the light traffic street would free the heavy traffic movement.
- A route right turn with a short turn radius may dictate a far-side stop after the turn.
- Where the route makes a left turn at an intersection, the bus stop should be a far-side stop.

The Houston Metro guidelines recommend consideration of a mid-block stop where there is a major passenger generator such as a school, hospital, employment center, or densely populated residential area.

Bus Turnouts and Pullouts

Bus turnouts and pullouts are paved areas outside of the travel lane designed to allow buses to stop safely out of traffic. While advantageous from a traffic operational standpoint, turnouts and pullouts can create delays for buses trying to reenter the traffic stream. In general, the guidelines recommend consideration of a bus turnout or pullout when one or more of the following conditions are present:

- Speeds on the traffic lane(s) are 35 mph or higher.
- Stop has a history of a high accident rate.
- Passengers with disabilities use the stop.

- Sight distance at stop (on curve or crest of hill) is poor.
- Stop is a transfer point.
- Stop has high passenger volumes during peak hours.
- Number of vehicles queued behind a stopped bus is high (greater than 10), or queue causes blockage of cross street traffic.

The general dimensions for a turnout or pullout given in the guidelines are:

- 40 to 60 ft for the approach taper
- 50 to 80+ ft for the berth(s)
- 40 to 60 ft for the exit taper,
- 10-ft minimum to 12-ft desired width of the turnout or pullout.

Bus Stop Pads

The guidelines recommended the construction of landing (or loading) pads at all bus stops. The dimensions of the pad should be a minimum of 8 ft in width (perpendicular to the street) and 10 or more ft in length depending on the passenger volume. The U.S. Department of Transportation regulations for the Americans with Disabilities Act requires a pad with minimum clear dimensions of 8 ft wide by 5 ft long, and a firm and stable surface (49 CFR Parts 37 and 38). The ADA regulations allow a slope for drainage of up to a minimum of 2 percent perpendicular to the street.

Amenities and Signs

The guidelines recommend consideration of providing a shelter when one or more of the following conditions are present:

- Stop is located near a school, senior citizen center, or a major activity center.
- Stop is a transfer point, and
- Stop has a large number of passengers per day (10+ passenger per hour).

The farthest extension of the shelter roof, trash receptacle, or other fixture at the street front should have a minimum clearance of 2 ft from the curb face to avoid conflict with bus movements. The shelter design should take into consideration the number of waiting passengers anticipated, and provide for wheelchair access and maneuverability.

To avoid possible conflicts with passengers and buses, all of the guidelines recommended that the bus stop sign be set back from the curb by at least 2 ft and the bottom of the sign be a minimum of 7 ft from the sidewalk surface.

SAFETY MANAGEMENT PROGRAMS

System Safety Plans and Programs

System safety has been defined by the U.S. Department of Transportation as

The application of Operating, Technical, and Management techniques and principles to the safety aspects of a system throughout its life to reduce hazards to the lowest level possible through the most efficient use of available resources.

System safety as a management practice appears to be well recognized by transit managers. In the survey conducted of bus transit agencies, most of the respondents (85 percent) reported that they had a system safety plan for their bus operations. Training and workshops on system safety are offered by the Transportation Safety Institute of the U.S. Department of Transportation. Several references are provided in the Bibliography for those interested in further information on system safety.

A recent FTA report (20) provides a thorough discussion of what one should keep in mind when developing and implementing a system safety program and recommends that the program should accomplish the following:

- Include everyone--all departments (operations, maintenance, service development, management, human resources, safety, etc.), employees, and passengers.
 - Have the full support of top management and board of directors in the form of a written safety policy and the provision of adequate resources.
 - Designate one individual as the responsible safety authority and ensure that the individual has direct access to top management.
 - Identify and define the safety roles and responsibilities of all departments and individuals.
 - Establish a proactive safety program with emphasis on identifying and resolving hazards prior to their resulting in accidents.
 - Provide mechanisms for employee safety accountability including rewards and disciplinary actions.
 - Provide mechanisms to promote cooperation and conflict resolution between departments and external agencies that support the transit system.
 - Establish continuous monitoring process, including safety databases, of the safety program to ensure that goals are being achieved.
 - Prepare and document a system safety program plan.

An example of such a plan is the draft "System Safety Program Plan, Operations" being considered for implementation by the Los Angeles County Metropolitan Transportation Authority (LACMTA) (21). The intent of the program is provided at the beginning of the plan by the following "MTA System Safety Policy Statement."

Safety is a primary concern of the Los Angeles County Metropolitan Transportation Authority (MTA). The System Safety Program Plan, Operations (SSPP) has been developed as a means of integrating safety into all system operations. Through the use of the procedures contained in the SSPP, we can achieve an optimal level of safety in MTA operations and services.

The SSPP establishes mechanisms for identifying and addressing hazards associated with the MTA bus and rail system. It also provides a means of ensuring that proposed bus or rail

system modifications are implemented with thorough evaluation of their potential effect on safety.

Each department has responsibilities under the Plan and shall support its implementation. Departments also shall provide the on-going support necessary for achievement of Plan objectives. Individual employees have responsibilities under the Plan, and supervisors and managers must enforce the safety requirements pertaining to their employees. A key to the success of the SSPP is for employees to be aware that they are accountable for meeting the safety requirements of their positions. Beyond this, however, its success depends on all employees actively identifying potential hazards and taking into consideration the safety of others as well as their own.

We must appreciate the fact that our decisions often affect the safety of those in other operations. By following the process described by the SSPP, we will have continuing opportunities to improve overall performance and safety.

The LACMTA System Safety Program Plan (SSPP) identifies and defines 16 safety functions which are listed below:

- Hazard Identification and Resolution Design Review
- System Modification Review and Control
- Rules and Procedures Review
- Equipment/Design Modification Review and Control
- Procurement
- Facility and Equipment Inspections
- Employee and Public Communication
- Safety Training
- Emergency Response Planning, Coordination & Training/Drills
- Safety Data Acquisition/Analysis
- Occupational Health and Safety
- Environmental Protection/Business Plans
- Interdepartmental/Interagency Coordination
- Accident and Incident Investigation
- Internal Safety/Operational Audits.

Within these functions, the LACMTA draft plan establishes the following eight programs:

- Hazard Identification and Resolution Program
- Safety Alert Program
- Accident Investigation Program
- Injury and Illness Prevention Program
- Occupational Health Programs
- Yard Safety Program
- Division Safety Meeting Program
- Safety Training Program.

The LACMTA is considering establishing a Bus Operations Safety and Service Committee (BOSSC) to coordinate the system safety activities within the MTA. The committee would comprise staff from operations, engineering, safety, maintenance, instruction, service, and facilities departments. Other organizational

departments would be involved as a situation warrants. At scheduled meetings of the BOSSC, members would apprise the committee of any system safety issues involving their department and the level of compliance with system safety requirements such as inspections, tests, maintenance, certification, training, employee communications, procurement, and accident and incident investigations.

Examples of MTA Safety Programs

The purpose of the Hazard Identification and Resolution Program is to identify and analyze hazards and to recommend corrective actions to resolve the identified hazard. Hazards are characterized as to severity and probability to establish a priority for corrective action and resolution. Any hazardous condition that an employee experiences can be reported by submitting an "Unsafe Condition or Hazard Report."

The Safety Alert Program is structured to raise the level of safety awareness of drivers and other operations staff and the public with respect to bus safety issues. These messages are communicated by safety alerts, safety exit messages, safety brochures, school programs, and by public service announcements in the mass media. Safety exit messages are placed on signs posted at the exits to the yard as a final reminder to drivers as they begin a work shift. Safety messages also are placed on items used by passengers such as timetables, transfers, and monthly passes.

The Division Target Line Program enables a division manager to develop a loss prevention program specifically designed for a line that has experienced high accident and injury related costs. Following the selection of a target line and accident and injury type, the program is announced to division employees and program materials are distributed. Division training personnel disseminate information, conduct training, perform ride checks, supervise safety inspections, and implement any other actions that have been prescribed in the program. After a 3-month intervention period, division management analyzes the loss experience on the targeted line and compares the current loss experience with a similar period in the previous year. Participants in the program receive recognition for reductions of 10 percent or more in the frequency or cost of traffic accidents, or lost time in occupational injuries

Accident and Incident Procedures

All transit agencies had procedures to be followed by a bus driver and the supervisor when a system vehicle or an employee is involved in an accident or incident. Typically, the procedures would include the following steps: providing aid to injured, reporting accident to central control, calling for police and emergency services, seeing to evacuation of passengers as may be required, gathering facts concerning the accident, obtaining witness information, passing out courtesy cards to passengers, and filling out accident or incident report forms. Detailed examples of recommended procedures may be found in the Wisconsin Safety Manual (22) and in the MTP Safety

Manual (23). Examples of accident forms are given in Appendix G.

All agencies contacted have a procedure for review of all accidents and incidents. This is generally accomplished by operations and safety personnel. Some respondents have a safety committee that reviews all accidents and incidents, makes judgments as to accident preventability or nonpreventability, and makes suggestions for corrective actions. Many of the agencies use the standards established by the National Safety Council for judging whether an accident is preventable or nonpreventable.

Other Management Safety and Loss Prevention Practices

Eighty-nine percent of the survey respondents said that they conduct periodic safety audits of their operations. Generally, these are done by the safety staff, although some transit agencies reported that a safety committee, with representatives from various departments or an internal audit group, performs the safety audits. Several said that their insurance pool or insurance carrier would perform the safety audits. Safety audits were generally conducted on a periodic basis. The audit frequency ranged from monthly to annually. Some also conduct random safety audits. APTA is currently considering developing a bus system safety audit program similar to its successful rail safety audit program.

Six transit agencies reported having a management incentive program for achieving or exceeding a specified annual safety goal. In some cases, the safety incentive is included as one element of a merit program of goals and objectives for their managers. At the Utah Transit Authority, if a division goes one year without lost time for industrial accidents, all division personnel receive a dinner certificate for two and a gift certificate.

Several of the transit agencies favor "ride checks," both announced and undercover, as a tool to identify safety problems such as improper operator driving behavior, possible schedule problems, and possible route traffic problems. Ride checks are useful in identifying what refresher training might be needed to correct observed unsafe driving practices. Some transit systems have found that ride checks during initial training using peers as checkers is an effective training tool.

Most of the transit agencies (more than 80 percent of the survey respondents) make periodic reports on safety to top management. Two-thirds provide their board with periodic safety reports on their operations. Some indicated that reports on safety are made to their board on an as-needed basis.

Insight on the possible impacts of tight schedules on driver behavior was provided by Tri-Met. Over the years, the training staff at Tri-Met have collected an interesting list of possible driver compromises to maintain schedule. These compromises point out the importance of management awareness of the potential impacts of schedules on driver behavior, and of communicating the priorities for drivers to follow when confronted with a schedule problem. The list is provided in Appendix

H. For each compromise, the associated possible impacts on

work rules are noted, such as defensive driving, ride quality, customer sensitivity, bus zone operations, and door operations.

In their responses to the survey, transit agencies were asked to identify programs that had been successful in improving safety for their system. The responses named programs discussed earlier such as defensive driving and refresher training, operator ride checks, safety incentives, safety awareness committees, accident review boards, and bus rodeos. The New Jersey Transit Corporation Bus Division (NJT Bus) identified their "Visions 2000 Program" as being particularly effective in improving safety in their operations.

In the early 1990s, NJT Bus conducted an internal review and concluded that, in general, safety was not a primary focus area for upper- and mid-level managers. Visions 2000, a comprehensive system safety plan, was adopted to build a "safety first attitude" in all personnel. The following excerpt states the overall goal of the program.

The purpose of Visions 2000 is to chart a course for NJT Bus Safety Management Program through the 1990's and into the 21st century. Visions 2000 includes an honest and comprehensive analysis of the current state of safety at NJT Bus, along with an integrated and comprehensive action plan intended to produce a company-wide safety culture, which will result in accident reductions among the best of any transit system in North America

A major element of the Visions 2000 Program is a comprehensive safety training program to provide safety training for all levels of employees. The program includes training programs such as the "Accident Repeater Program" for the systematic identification, evaluation, and retraining of drivers who have repeat accidents. The Visions 2000 Program has resulted in a positive change in the safety attitude of employees, and the quantitative goal of achieving a 25 percent reduction in accidents and their associated costs was reported as being achieved.

Connecticut Transit (CT) has just begun a program of "Lights On for Safety" with the objective of reducing accidents with other vehicles. All CT buses are to operate with their driving lights on at all times.

Computer Accident and Incident Data Bases

All of the transit agencies responding to the survey maintain data files on the number and types of bus and passenger accidents and incidents occurring in their system. About 60 percent reported that they also collect data on causal factors. Most transit agencies maintain their accident data in a computer data base. A computerized accident data base is a safety management tool of increasing importance and is regarded by some as an essential element of their safety program. It is a tool that greatly facilitates trend and comparative analyses, both the evaluation of effectiveness of safety countermeasures and the identification of hazards, and a factor analysis of the possible cause of accidents. An example of what can be accomplished with a computerized accident data base is shown

in a report from the San Francisco Municipal Railway (MUNI). The MUNI publishes an annual report on number, rates, and trends of accidents on its system (9). The report also analyzes findings of possible accident causes. The computer data base enables one to analyze the accident data by many factors such as vehicle type, accident type, location, customer age, division, mode, operator, and line. An example of one of their findings is that buses with three steps were involved in a disproportionate share of accidents when passengers board or leave the bus compared with buses with only two steps.

Programs To Reduce Questionable Claims

An increase in questionable claims has been a problem for some transit agencies. A survey was conducted on transit tort liability in late 1995 by *The Urban Transportation Monitor*. It found that most of the agencies (94 percent) had been involved in tort liability lawsuits over the past 5 years, and 80 percent of these lawsuits required a settlement. Controlling fraud was reported as one of the important unresolved issues in transit tort liability lawsuits (24).

An attempt was made in the synthesis survey to obtain information as to whether or not transit agencies were experiencing a problem with exaggerated or false claims. The survey question was: "Please indicate the magnitude of 'false' claims for your system." The choices were major, moderate, small, and minimal. The responses were subjective, and the question would have been clearer had the word "exaggerated" been used rather than "false." Twenty-four transit agencies responded to the question. Their responses were:

- Major--1 system
- Severe--2 systems
- Moderate--4 systems
- Small--5 systems
- Minimal--12 systems
- No response--3 systems.

While three transit agencies reported the problem as major or severe, the majority (more than 60 percent) classed the problem as small to minimal. The practices that were reported being used to reduce questionable (exaggerated, false, frivolous) claims are:

- Intensive investigation and litigation,
- Use of a claimant index file or diary to check for frequent claim filers,
- Pictures at accident scenes,
- Use of a national database of claimants, and
- Supervisor training and independent investigations.

Connecticut Transit recently installed onboard TV cameras in some of its buses in the hope that this might provide objective information as to what happened on the bus during an accident and might also act as a deterrent to anyone tempted to file an exaggerated or false claim.

The Southeastern Pennsylvania Transportation Authority (SEPTA) has tested several video surveillance systems in recent years. According to an article in *Urban Transport News*, the initial results were reported to have shown reductions in casualty claims of 32 percent, and that SEPTA officials believe a reduction of 25 percent in claims could be realized with full use of video cameras on bus routes with high claims (25).

STATE TRANSIT AGENCIES AND TRANSIT OPERATING COMPANIES

Surveys were conducted of both state transit agencies and transit operating companies to gather information on their safety programs. Responses were received from 32 state agencies (64 percent). Six transit management companies provided responses to the survey. The names of the respondents are listed in Appendix B.

State Transit Agencies

The safety programs offered by state agencies included insurance pools, systems safety assistance, safety training, safety audits, and vehicle safety inspections. Generally, the state agencies worked with the small city, rural, and transit agencies serving elderly and handicapped populations (Section 16 and 18 systems).

Most of the respondents (75 percent) said they provide some type of safety training. In some cases, states provide only funding assistance for safety training of transit personnel, but others have staff or contractors to provide safety training. The safety training programs mentioned in the survey responses are: Passenger Assistance Techniques (PAT), the AAA Driver Training Program, driver training programs that include defensive driving training, and train-the-trainer safety programs. Some reported that the safety training was provided through their state transit association or state transit insurance pool.

Several states reported that they use the Rural Transit Assistance Program (RTAP) training materials. A catalog of training programs including safety training has been prepared under RTAP and is available from the Community Transportation Association of America (CTAA) (13).

Most of the states (72 percent) that responded to the survey have vehicle safety inspection programs. Many times these vehicle inspections were carried out by the highway patrol agency of the state. Thirty-one percent of the states reported that assistance is provided to establish system safety programs at transit agencies in their states.

Florida has a statute on "Equipment and Operational Safety Standards Governing Public-Sector Bus Transit agencies" referred to as "Rule Chapter 14-90," which establishes minimum equipment and operational safety standards for all public and private bus transit agencies that receive some financial assistance from the state. It also requires a system safety program plan, system safety audits, and vehicle safety inspections for all covered bus transit agencies.

State Insurance Pools

Nine states reported having programs offering an insurance pool for public transit agencies in their states, either directly or through a state transit association or consortium of state transit agencies. Many of these state insurance pools began during the insurance crisis in the 1990s. For more information on insurance and risk management, the reader is referred to *TCRP Synthesis 13: Risk Management for Small and Medium Transit Agencies*.

The Wisconsin Mutual Transit Insurance Company (WMTIC) was one of the earliest groups formed. In addition to serving as the insurance company for public transit agencies in Wisconsin, it provides, with assistance from the Wisconsin DOT, safety training, safety audits, and vehicle inspection programs. A system safety manual

(22) was prepared by WMTIC for its members to provide guidelines on many safety issues, such as employee selection, employee testing, employee training, employee evaluation, vehicle design, preventive maintenance, facility safety, routing, scheduling, and bus stop placement factors.

The Michigan Transit Pool (MTP) is a consortium of transit agencies in Michigan, and is the largest self-insurance program for public bus transit agencies in the United States. In addition to the insurance function, the MTP conducts safety audits of its members and provides general safety assistance to

its members. The MTP has recently published a comprehensive guidebook on the management of safety for its members. The manual includes chapters on: risk and safety management, accident investigation and evaluation, bus operator selection and training, safety incentives and disciplinary procedures, safety considerations in operations, vehicle design, preventive maintenance, and facility safety. The manual is available to the public from the MTP (23).

Transit Management Companies

Six transit management companies provided responses to the Transit Management Company survey, and their names are listed in Appendix B. All had company programs concerning the safety training of their staff. Five companies reported having system safety audit programs, and three provided assistance to their customers in system safety. Two companies reported having a safety goal in their contracts with transit agencies. The goal was defined in terms of the number of vehicle accidents per 100,000 vehicle miles. Having a measurable safety goal in the contract ensures that safety is given high priority in the management of the transit agency along with other contract performance measures. One company reported that they have an awards incentive program to recognize drivers with safe driving records.

CHAPTER FOUR

CONCLUSIONS

Bus occupant safety continues to be of concern to the transit community. In spite of all of the efforts by the transit industry to reduce injuries from collisions and passenger slips and falls, several thousand injuries occur to transit riders each year. The purpose of this study was to provide information on the current practices used by transit agencies to reduce these injuries. Information was gathered from the literature and contact with transit agencies. From the information gathered, the following observations were made.

National safety statistics for transit lack data concerning accident type, causal information, and cost information. Individual transit agencies have data at this level of detail, but such detailed data are not gathered at a national level. Cost information is reported at a national level only when an accident involves property damage over \$1,000. Annual average costs for accidents or incidents that were reported in the survey of transit agencies was from \$1,000 to nearly \$19,000 per occurrence. The higher number is thought to include indirect costs such as overhead, labor, and business losses.

In the SAMIS 1993 Annual Report, 38,873 injuries were reported as resulting from the motor bus transit mode figure of 45,580 incidents (collisions, left roadway, personal casualties, and fires). Of those injuries, 20,801 resulted from collisions with other vehicles or with fixed objects or were bus-left-road accidents. There were 6,886 injuries to passengers from slips and falls or from being caught in a door while boarding or leaving the bus. The risk of injury is higher during alighting than during boarding. MUNI reported that buses with three steps generate a higher incidence of boarding and alighting accidents than those with two. Total onboard injuries reported were 10,337. Most of these were due to passengers not being seated when the bus was braking or accelerating.

While bus accidents have a direct impact on service, only a few of the transit agencies surveyed reported that they keep information on service impact from accidents or incidents. Most of those that track service impacts use measures such as the annual loss of revenue vehicle-hours from the schedule due to accidents and incidents or vehicle-hours lost per accident or incident. The information provided shows that service impacts of accidents and incidents range from 1/2 to 6 vehicle-hours lost per occurrence.

Strategies for accident prevention should take into account the fact that lack of defensive driving was reported by transit to be a major cause of collisions that are judged to be preventable. Driver error was reported by NSC as being responsible for 78 percent of motor vehicle collisions. The New York PTSB found that 65 percent of accidents in which the bus driver was judged to be the probable cause were attributed to "failure to drive defensively." The PTSB also found that in some of these accidents environmental, vehicle, or roadway factors were contributing elements.

Training in defensive driving is included in the training programs of 86 percent of the transit agencies responding to the survey. Many use training materials provided by the NSC, the Smith System, or Professional Development Associates. Tri-Met conducted an evaluation of the effectiveness of their defensive driver workshop involving nearly 700 drivers over a 4-year period. Tri-Met observed a 45 percent reduction in accidents judged to be preventable after the workshop, compared to driver accident records before the workshop. Over the same period, there was a reduction of 22 percent of all accidents (preventable and nonpreventable) for the study population.

As a way of encouraging defensive driving, more than 90 percent of the transit agencies contacted during the study have programs to provide recognition, awards, and incentives for drivers not charged with a preventable accident for a year or longer. These include certificates, pins, patches, plaques, belt buckles, watches, and dinner certificates. Bonuses range from \$25 U.S. Savings Bonds to cash awards reaching as high as \$1,500 for 35 years of safe driving (no preventable accidents). Most transit agencies hold an annual awards banquet to recognize the recipients of these awards.

Educating customers in safety procedures is also an activity of most transit agencies (96 percent of the survey respondents have educational and training programs for their customers). Most transit agencies have customer safety brochures and safety messages are frequently printed on tickets, schedules, and transfers. School children and customers with special needs can receive training in the safe use of the bus systems from instructors provided by many transit agencies.

Safety improvements required within the vehicle that were cited most frequently by the transit survey respondents were the driver workstation, driver vision, doors, and door controls. Improvements also were desired in handrails and stanchions and in brake lights. (A TCRP research project to develop design guidelines for operator workstations will be completed in late 1996. Based on ergonomic and biomechanical principles, the workstation designs will accommodate the broadest range of the operator population, from the 5th percentile female to the 95th percentile male.)

To improve driver vision, many transit agencies are using larger mirrors that are remotely controlled and equipped with heating elements to defrost them. To dissipate frost and fog, defrosting wires have been incorporated in bus windshields and front-door glass. MUNI found that buses equipped with slide-glide doors (inwardly opening doors) had greater relative risks of having passengers being struck or caught by the door than did buses equipped with outwardly opening doors.

The Canadian "Easier Access" project investigated several bus designs to improve access and safety for senior citizens and passengers with disabilities. The project recommendations included the use of bright yellow color on handrails, grab rails,

and stanchions; increased lighting at entrances and exits; and bright yellow nosing on the edges of flooring at entrances and exits, ramps, and steps.

Improvements to the bus exteriors can also be a factor in reducing accidents. Many transit agencies reported "bus struck in rear" as their most frequent accident type. Several transit agencies are engaged in projects to make the rear of their buses more visible. Another problem frequently cited was that brake light assemblies did not always remain sealed, allowing dirt and water to get in, reducing the visibility of the braking signal.

Placement of bus stops can also play a role in rider safety. Of the 12 transit agencies surveyed that reported having guidelines for the location and design of their bus stops, four provided copies of the design guidelines. Two reported using state guidelines. While the guidelines vary in their preferences for far-side, near-side, or mid-block bus stop locations, all generally follow the suggestions given by the Institute of Traffic Engineers *Recommended Practices for Bus Stop Location*. Local conditions largely dictate the final placement of a proposed bus stop.

Safety activities are a major concern and 85 percent of the bus transit agencies surveyed have a system safety plan. Most of the transit agencies (more than 81 percent of the survey respondents), make periodic reports on safety to top management. Two-thirds of the respondents provide their boards with periodic reports on the safety of their agency. Some coordinate and manage safety activities through an agency safety committee. All the departments are represented (operations, engineering, safety and risk management, maintenance, training, service, and facilities).

The safety programs offered by state agencies include insurance pools, systems safety assistance, safety training, safety audits, and vehicle safety inspections. Generally, the state agencies worked with the small city, rural, and transit agencies serving elderly and handicapped customers (Section 16 and 18 transit agencies). Of the 32 state transit agencies responding to the survey, 75 percent provide some type of safety training assistance. Most states (72 percent) reported having vehicle safety inspections. Nine states reported having programs offering an insurance pool for public transit systems in their states, either directly or through a state transit association or consortium of transit agencies.

All agencies have procedures to be followed by the bus driver and the supervisor when the bus or an employee is involved in an accident or incident, as well as a procedure for the review of all accidents and incidents. Many transit agencies use NSC standards when judging whether an accident is preventable or nonpreventable.

All responding transit agencies maintain data files on the number and types of bus and passenger accidents and incidents. About 60 percent of the systems reported that they collect data on causal factors. Most agencies have found that a computerized database of accidents and incidents is an important and effective management tool in identifying and analyzing safety problems and in evaluating the effectiveness of a proposed safety solution.

Eighty-nine percent of the survey respondents said they conduct periodic safety audits of their operations. Several transit agencies reported that their insurance pool or insurance carrier would perform safety audits.

In a recent survey by *The Urban Transportation Monitor*, controlling fraud was reported as one of the most important unresolved issues in transit tort liability. Because an increase in questionable claims is a problem for some transit agencies, an attempt was made in the survey conducted for this synthesis to ascertain whether or not agencies were experiencing a problem with exaggerated or false claims. Twenty-four provided information; while three agencies reported the problem as major or severe, more than 60 percent classed the problem as small to minimal. Both Connecticut Transit and Southeastern Pennsylvania Transportation Authority are testing the effectiveness and practicality of using onboard video to deter riders from filing exaggerated or false claims. Initial results are promising.

Six transit management companies responded to the survey; they all have policies and programs concerning safety training of their staff. Five reported having safety audit programs, and three said they provide safety assistance to their customers. Two companies reported having in their contracts with transit agencies a safety goal defined in terms of the number of vehicle accidents per 100,000 vehicle miles.

On the basis of information gathered for this synthesis, the following research topics have been identified as worthy of further study:

- There is a need for more standardization of data and clearer definition of safety terms to facilitate communication and understanding of safety status and trends within the transit community. There is a need for better and more consistent reporting of accidents and incidents, and for the analysis of causes and problem sites.
- There is a need for better information on the total cost of accidents and incidents in transit, both to provide for a fuller understanding of such costs and to provide a justification for larger and targeted investments in safety programs by the transit community.
- Few reports in the literature document the effectiveness of safety countermeasures. There is a need for the systematic evaluation of new safety programs to help transit managers decide which safety program best meets their needs.
- Bus struck by other vehicle in the rear is a frequent type of collision in transit. During this study, several agencies were experimenting with a variety of brake light changes including location, size, intensity, and flash rate. An industry program could be established to investigate all proposed approaches, and to prepare an evaluation report for the transit industry on the cost and effectiveness of each.
- The effectiveness of a safety program, whether it is a training program, an incentive program, or a change in bus brake light program, is difficult to measure. A new safety program often is first tried as a pilot project conducted in revenue service, where control of the experiment is difficult. There is a need for better understanding in the transit community of the importance of experimental design and control when conducting

safety projects (experiments), and a need for statistical evaluation of the results of the project.

- This synthesis focuses on transit industry programs to reduce accidents and incidents and passenger injuries on heavy-duty buses operating in scheduled fixed-route service. A similar study of bus occupant safety focusing on paratransit operations is suggested. While there are issues in common, there are also many differences such as the type of vehicle, the type of operations, and the customer mix that suggest the need for a separate study.

- The issue of bus safety is also related to the design of the

roadway, including signs, signals, and road markings, which are under the responsibility of traffic and design engineers. Roadway factors could be addressed in another synthesis entitled *Bus Safety and Roadway Design*. This synthesis could obtain input from traffic engineers and designers (at the state and local levels) on details and recommendations for placement of bus stops relative to sight distances, and on the geometrics, traffic control devices, and intersection features that affect bus crashes. Also, current practice and recent innovations in accident countermeasures as they relate to roadway design could be discussed.

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GLOSSARY

Accident, Vehicle--An incident involving a moving vehicle. Includes collisions with another vehicle, object, or person (except suicides) and derailment/left roadway.

Accident, Passenger--Same as Vehicle Accident, except that Personal Casualties incidents on the vehicle and entering/exiting the vehicle are also included.

Collision with Object--An incident in which a transit vehicle strikes an obstacle other than a vehicle or person (e.g., building, utility pole). Reports are made if the accident results in death, injury, or property damage over \$1,000.

Collision with People--An incident in which a transit vehicle strikes a person. Except where specifically indicated, collisions with people do not include suicide attempts. Reports are made if the incident results in death, injury, or property damage over \$1,000.

Collision with Vehicle--An incident in which a transit vehicle strikes or is struck by another vehicle. Reports are made if the accident results in death, injury, or property damage over \$1,000.

Fatality--A transit-caused death confirmed within 30 days of a transit incident.

Fire--Uncontrolled combustion made evident by flame and/or smoke which requires suppression by equipment or personnel. There are no thresholds; all fires are reported.

Incident--Collisions, personal casualties, derailments/left roadway, fires, and property damage greater than \$1,000 associated with transit agency revenue vehicles and all transit facilities.

Injury--Any physical damage or harm to a person. There are no thresholds; all injuries are reported.

Left Roadway--A non-collision incident in which a transit vehicle leaves the road on which it travels. This also includes roll-overs. Reports are made for all occurrences.

Motor Bus--Rubber tired passenger vehicles that operate on roadways. Motor bus service implies fixed routes and schedules.

Passenger Miles--The total number of miles traveled by transit passengers (e.g., a bus that carries 5 passengers for a distance of 3 miles incurs 15 passenger miles).

Personal Casualty Associated with Escalator--An incident in which a person is hurt while using an escalator in a transit facility. Any incident in this category is a subset of Personal Casualty in Stations/Bus Stops.

Personal Casualty Associated with Lifts--An incident in which a person is hurt while using a lift to get on or off a transit vehicle. This is a subset of the Entering/Exiting a vehicle in the Personal Casualty category.

Personal Casualty Entering/Exiting a Vehicle--An incident in which a person is hurt while getting on or off a transit vehicle (e.g. falls or door incidents).

Personal Casualty in Stations/Bus Stops--An incident in which a person is hurt while using a transit facility. This includes anyone on transit property (e.g., patrons, employees, trespassers) but does not include incidents resulting from illness or criminal activity.

Personal Casualty on Vehicle--An incident in which a person is injured on a transit vehicle, but not as a result of a collision, left roadway, or fire.

Suicide--A person ending his or her own life intentionally. This is a subset of Collision with People.

Transit Property--All facilities which are directly controlled by a transit agency or provided to a transit agency for its use. This includes stations, rights-of-way, bus stops, and maintenance facilities.

Transit Property Damage--The dollar amount required to repair or replace transit property damaged during an incident.

Vehicle Miles--The total number of miles traveled by transit vehicles.

APPENDIX A

Survey Form

**TRANSIT COOPERATIVE RESEARCH PROGRAM
SYNTHESIS TOPIC - "BUS OCCUPANT SAFETY"
SURVEY OF TRANSIT AGENCIES**

PURPOSE: TO OBTAIN INFORMATION FROM TRANSIT AGENCIES CONCERNING THE SAFETY OF THEIR SYSTEM WITH FOCUS ON PROGRAMS TO REDUCE VEHICLE ACCIDENTS AND TO REDUCE PASSENGER INJURIES WHILE BOARDING, RIDING, AND ALIGHTING THE BUS.

AGENCY NAME _____

CONTACT PERSON _____ **DATE** _____

TITLE _____ **TEL. NO.** _____

ADDRESS _____

(STREET)

(CITY)

(STATE)

(ZIP)

(PLEASE ANSWER THE FOLLOWING QUESTIONS. IF MORE SPACE IS NEEDED, USE THE COMMENT SECTION ON PAGE 4.)

GENERAL INFORMATION

**IF POSSIBLE, PLEASE PROVIDE A COPY OF YOUR FY 94 SECTION 15 INFORMATION ON:
(PLEASE INDICATE THE YEAR IF OTHER THAN FY 94)**

TRANSIT SYSTEM IDENTIFICATION -- FORM 001
TRANSIT SAFETY -- FORM 405 (BUS ONLY IF POSSIBLE)
TRANSIT SYSTEM SERVICE -- FORM 406 (BUS ONLY IF POSSIBLE)

IF NOT, PLEASE PROVIDE THE FOLLOWING INFORMATION:

NUMBER OF BUSES: IN FIXED ROUTE _____ **AND IN PARATRANSIT** _____
POPULATION OF SERVICE AREA _____ **1994 RIDERSHIP** _____

TRAFFIC ENVIRONMENT IN SERVICE AREA (PLEASE CHECK ALL THAT APPLY)

LOW DENSITY SUBURBAN **MEDIUM DENSITY URBAN**
HIGH DENSITY CENTRAL BUSINESS DISTRICT **LOW DENSITY RURAL**
HIGH SPEED EXPRESSWAY

INFORMATION ON BUS AND PASSENGER ACCIDENTS

DO YOU HAVE DATA ON VEHICLE AND PASSENGER ACCIDENTS? YES **NO**
(PLEASE CHECK ALL THAT APPLY.)

VEHICLE ACCIDENTS **TYPE OF ACCIDENTS** **CAUSAL FACTORS**
PASSENGER ACCIDENTS **TYPE OF ACCIDENTS** **CAUSAL FACTORS**

ESTIMATE THE TOTAL ANNUAL COSTS OF ACCIDENTS/INCIDENTS \$ _____
(WHAT IS INCLUDED? DIRECT COSTS? OVERHEAD? RELATED BUSINESS LOSS COSTS?)

ESTIMATED THE ANNUAL SERVICE IMPACTS: e.g. VEHICLE HOURS LOST _____
OTHER MEASURES? _____

PLEASE INDICATE THE MAGNITUDE OF "FALSE" CLAIMS FOR YOUR SYSTEM.

MAJOR **SEVERE** **MODERATE** **SMALL** **MINIMAL**

DO YOU HAVE POLICIES/PROGRAMS TO REDUCE SUCH CLAIMS? YES **NO**
PLEASE EXPLAIN _____

DRIVER PROGRAMS (PLEASE CHECK ALL THAT APPLY)

SELECTION AND HIRING TESTS/SCREENS:

CHICAGO TEST **SEATTLE VIDEO TEST** **DRUG AND ALCOHOL TEST**
PERSONAL INTERVIEW **OTHER TESTS** **EXPLAIN** _____

INITIAL TRAINING:

CLASSROOM **IN VEHICLE** **SIMULATOR** **TOTAL HOURS** _____

OTHER TRAINING:

DEFENSIVE DRIVING **CUSTOMER SENSITIVITY** **REFRESHER** **OTHER**
LIST PROGRAM NAMES _____

INCENTIVES FOR SAFE DRIVING?

RECOGNITION **AWARDS** **PERKS** **BONUSES** **OTHER**
PLEASE DESCRIBE _____

CUSTOMER PROGRAMS (PLEASE CHECK ALL THAT APPLY)

- EDUCATIONAL PROGRAMS? (On how to use the bus service safety)
- TRAINING PROGRAMS? (With an instructor and vehicle- on safe use of bus service.)
- SCHOOL PROGRAMS? (On how to use the bus service safety.
- PUBLIC AWARENESS PROGRAMS? (On bus safety-TV/radio/newspapers)

COULD YOU PROVIDE EXAMPLE MATERIALS? _____ IF SO, WHAT MATERIALS
COULD YOU PROVIDE? _____

VEHICLE ISSUES (PLEASE CHECK ALL THAT APPLY)

PLEASE INDICATE THOSE VEHICLE ISSUES WHICH ARE IN GREATEST NEED OF
IMPROVEMENT FROM A SAFETY PERSPECTIVE.

- DOORS/DOOR CONTROLS DRIVER VISION DRIVER WORKSTATION
- BRAKES INTERIOR LIGHTING HANDRAILS/STANCHIONS
- SUN VISOR/SCREENS BRAKE/TURN SIGNAL LIGHTS FLOORING
- OTHER _____

SAFETY INSPECTIONS (PLEASE CHECK ALL THAT APPLY)

PLEASE INDICATE THOSE INSPECTIONS PERFORMED DURING THE "DAILY DRIVER
INSPECTION" AND THOSE INSPECTIONS PERFORMED DURING MAINTENANCE. ALSO,
INDICATE THE INSPECTION INTERVAL FOR THOSE PERFORMED BY MAINTENANCE.
(EXPRESS THE INSPECTION INTERVALS IN CALENDAR UNIT, e.g. DAILY, WEEKLY, OR IN
VEHICLE UNITS, e.g. VEHICLE-MILES, VEHICLE-HOURS.)

ITEM	D	M	INTERVAL
BRAKES	<input type="checkbox"/>	<input type="checkbox"/>	_____
DOORS/DOOR CONTROLS	<input type="checkbox"/>	<input type="checkbox"/>	_____
TIRES	<input type="checkbox"/>	<input type="checkbox"/>	_____
MIRRORS	<input type="checkbox"/>	<input type="checkbox"/>	_____
LIGHTS-BRAKE/TURN/FLASH	<input type="checkbox"/>	<input type="checkbox"/>	_____
LIGHTS-DRIVING	<input type="checkbox"/>	<input type="checkbox"/>	_____
LIGHTS-INTERIOR	<input type="checkbox"/>	<input type="checkbox"/>	_____
LIFT/RAMP	<input type="checkbox"/>	<input type="checkbox"/>	_____
SECUREMENT DEVICES	<input type="checkbox"/>	<input type="checkbox"/>	_____
STEERING	<input type="checkbox"/>	<input type="checkbox"/>	_____
INTERLOCKS	<input type="checkbox"/>	<input type="checkbox"/>	_____
BUS INTERIOR-SEATS, FLOOR	<input type="checkbox"/>	<input type="checkbox"/>	_____
EMERGENCY EXITS	<input type="checkbox"/>	<input type="checkbox"/>	_____
SAFETY EQUIP. FIRST AID	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____

BUS STOPS/STATIONS

DO YOU HAVE A CHECKLIST OR GUIDELINES FOR LOCATION AND DESIGN OF A BUS
STOP? YES NO IF YES, WOULD YOU PLEASE PROVIDE A COPY?

FROM YOUR EXPERIENCES, WHAT ARE THE MOST LIKELY CAUSES OF ACCIDENTS
AT A BUS STOP? _____

MANAGEMENT

DO YOU HAVE A SYSTEM SAFETY PLAN? YES NO

DO YOU CONDUCT SAFETY AUDITS OF YOUR OPERATIONS? YES NO
WHO? _____ HOW OFTEN? _____

DOES MANAGEMENT HAVE AN INCENTIVE PROGRAM FOR ACHIEVING OR EXCEEDING
AN ANNUAL SAFETY GOAL? IF SO, PLEASE ELABORATE. _____

DO YOU HAVE PERIODIC REPORTS TO MANAGEMENT ON SAFETY? YES NO
CAN COPIES BE MADE AVAILABLE? YES NO

DO YOU MAKE PERIODIC REPORT SON SAFETY TO YOUR BOARD? YES NO
CAN COPIES BE MADE AVAILABLE? YES NO

PLEASE LIST ANY PROGRAM(S) THAT YOU FEEL HAS BEEN VERY SUCCESSFUL IN
REDUCING ACCIDENTS ON YOUR PROPERTY. _____

ADDITIONAL COMMENTS

PLEASE RETURN COMPLETED SURVEY BY JULY 28, 1995 TO :
ROLLAND D. KING
1266 SOUTHPORT CIRCLE
COLUMBUS, OHIO 43235
TEL. NO (614) 451-4195
THANK YOU VERY MUCH FOR YOUR PARTICIPATION.

TRANSIT COOPERATIVE RESEARCH PROGRAM
SYNTHESIS TOPIC - "BUS OCCUPANT SAFETY"
SURVEY OF STATE AGENCIES

PURPOSE: To obtain information on State programs concerning the safety of public transit buses with specific focus on programs to reduce vehicle accidents and passenger accidents while boarding, riding, and alighting the bus.

AGENCY NAME _____

CONTACT PERSON _____ DATE _____

TITLE _____ TEL. NO. _____

ADDRESS _____
(STREET)

(CITY) (STATE) (ZIP)

(PLEASE ANSWER THE FOLLOWING QUESTIONS. IF MORE SPACE IS NEEDED, USE THE COMMENT AREA ON THE NEXT PAGE.)

NUMBER OF PUBLIC TRANSIT SYSTEMS UNDER JURISDICTION? _____
TOTAL NUMBER OF BUSES INVOLVED? _____

(1) DO YOU HAVE STATE PROGRAMS CONCERNING THE SAFETY OF PUBLIC TRANSIT BUSES?
(PLEASE CHECK ALL THAT APPLY)

- AN INSURANCE POOL FOR PUBLIC TRANSIT AGENCIES
- ASSISTANCE IN ESTABLISHING A SYSTEM SAFETY PROGRAM
- SAFETY TRAINING PROGRAMS
- SYSTEM SAFETY AUDIT PROGRAMS
- VEHICLE SAFETY INSPECTION PROGRAMS
- OTHER

PLEASE EXPLAIN _____

(2) DO YOU COLLECT INFORMATION/DATA ON TRANSIT AGENCIES THAT YOU OVERSEE? YES NO (PLEASE CHECK ALL THAT APPLY)

- BUS ACCIDENTS
- PASSENGER ACCIDENTS
- CAUSAL FACTORS OF ACCIDENTS
- INJURIES
- COST OF ACCIDENTS
- OTHER

PLEASE EXPLAIN _____

(3) COMMENTS _____

PLEASE RETURN COMPLETED QUESTIONNAIRE BY JULY 21, 1995 TO:

ROLLAND D. KING
1266 SOUTHPORT CIRCLE
COLUMBUS, OH 43235
TEL. & FAX NO. (614) 451-4195

THANK YOU VERY MUCH FOR YOUR PARTICIPATION.

TRANSIT COOPERATIVE RESEARCH PROGRAM
SYNTHESIS TOPIC - "BUS OCCUPANT SAFETY"
SURVEY OF MANAGEMENT COMPANIES

PURPOSE: TO OBTAIN INFORMATION ON COMPANY PROGRAMS CONCERNING THE SAFETY OF PUBLIC TRANSIT BUS FLEETS THAT THEY MANAGE/OPERATE WITH SPECIFIC FOCUS ON PROGRAMS TO REDUCE VEHICLE ACCIDENTS AND PASSENGER ACCIDENTS WHILE BOARDING, RIDING, AND ALIGHTING THE BUS.

COMPANY NAME _____
CONTACT PERSON _____ DATE _____
TITLE _____ TEL. NO. _____
ADDRESS _____
(STREET)

(CITY) (STATE) (ZIP)

(PLEASE ANSWER THE FOLLOWING QUESTIONS. IF MORE SPACE IS NEEDED, USE THE COMMENT AREA ON THE NEXT PAGE)

NUMBER OF PUBLIC TRANSIT SYSTEMS THAT YOU MANAGE/OPERATE? _____
TOTAL NUMBER OF BUSES INVOLVED? _____

TYPES OF SERVICES? FIXED ROUTE PARATRANSIT OTHER
PLEASE EXPLAIN _____

- (1) DO YOU HAVE COMPANY PROGRAMS/POLICIES CONCERNING THE SAFETY OF THE BUS FLEETS THAT YOU MANAGE/OPERATE?
(PLEASE CHECK ALL THAT APPLY)
- SAFETY TRAINING OF STAFF
 - VEHICLE SAFETY PROGRAMS
 - SYSTEM SAFETY AUDIT PROGRAMS
 - ASSISTANCE TO CUSTOMERS IN SYSTEMS SAFETY
 - OTHER

PLEASE EXPLAIN _____

- (2) DO YOUR CONTRACTS WITH TRANSIT AGENCIES INCLUDE SAFETY GOALS?
YES NO
IF YES, WHAT ARE THE GOALS? _____

AND, HOW ARE THEY MEASURED? _____

- (3) DO YOU COLLECT SAFETY INFORMATION/DATA ON THE FLEETS THAT YOU MANAGE/OPERATE? YES NO (PLEASE CHECK ALL THAT APPLY)

- BUS ACCIDENTS
- PASSENGER ACCIDENTS
- CAUSAL FACTORS
- INJURIES
- COST OF BUS ACCIDENTS
- OTHER

PLEASE EXPLAIN _____

- (4) ADDITIONAL COMMENTS _____

PLEASE RETURN COMPLETED QUESTIONNAIRE BY JULY 21, 1995 TO:

ROLLAND D. KING
1266 SOUTHPORT CIRCLE
COLUMBUS, OH 43235
TEL. & FAX NO. (614) 451-4195

THANK YOU VERY MUCH FOR YOUR PARTICIPATION.

APPENDIX B**Local Transit Agencies, State Transit Agencies, and Transit Management Companies That Participated in the Study****Local Transit Agencies**

The following 35 local transit agencies provided information for this study either by field trip interview or by responding to the Transit Agency Survey.

Ann Arbor Transportation Authority, Ann Arbor, Michigan
 Cambria County Transit Authority, Johnstown, Pennsylvania
 Capital District Transportation Authority, Albany, New York
 Central Ohio Transit Authority, Columbus, Ohio
 Chemung County Transit System, Elmira, New York
 City of Dubuque (Key Line), Dubuque, Iowa
 City of Jackson Transportation Authority
 Connecticut Transit, Hartford, Connecticut
 Culver City Municipal Bus Lines, Culver City, California
 Dallas Area Rapid Transit, Dallas, Texas
 Eugene-Lane Transit District, Eugene, Oregon
 Gary Public Transportation Corporation, Gary, Indiana
 Greater Richmond Transit Company, Richmond, Virginia
 King County Department of Metropolitan Services (Seattle Metro), Seattle, Washington
 Lincoln Transportation System, Lincoln, Nebraska
 Long Beach Transit, Long Beach, California
 Los Angeles County Metropolitan Transportation Authority, Los Angeles, California
 Memphis Area Transit Authority, Memphis, Tennessee
 Metropolitan Atlanta Rapid Transit Authority, Atlanta, Georgia
 Metropolitan Transit Authority of Harris County (Houston Metro, Houston, Texas)
 MTA Long Island Bus, Garden City, New York
 MTA New York City Transit, Brooklyn, New York
 Missoula Urban Transportation District, Missoula, Montana
 New Jersey Transit Corporation, Newark, New Jersey
 Orange County Transportation Authority, Orange, California
 Phoenix Transit System, Phoenix, Arizona
 Regional Transportation Commission of Clark County, Las Vegas, Nevada
 Riverside Transit Agency, Riverside, California
 San Francisco Municipal Railway, San Francisco, California
 Southeastern Pennsylvania Transportation Authority, Philadelphia, Pennsylvania
 South Coast Area Transit, Oxnard, California
 Tri-County Metropolitan Transportation District of Oregon, Portland, Oregon
 Utah Transit Authority, Salt Lake City, Utah
 Washington Metropolitan Area Transit Authority, Washington, D.C.
 Winston-Salem Transit Authority, Winston-Salem, North Carolina

State Transit Agencies

The following 32 state transit agencies provided information for this study:

Alabama Department of Transportation
 Alaska Department of Transportation
 Arkansas State Highway & Transportation Department
 California Department of Transportation
 Colorado Department of Transportation
 Connecticut Department of Transportation
 Florida Department of Transportation, Public Transit Office
 Hawaii Department of Transportation
 Idaho Transportation Department, Division of Public Transportation
 Iowa Department of Transportation
 Kansas Department of Transportation, Office of Public Transportation
 Louisiana Department of Transportation and Development
 Maine Department of Transportation
 Michigan Department of Transportation
 Minnesota Department of Transportation, Office of Transit
 Missouri Highway & Transportation Department
 Montana Department of Transportation
 Nebraska Department of Roads
 Nevada Department of Transportation
 New Hampshire Department of Transportation
 New Jersey Transit, Inc.
 New York State Department of Transportation
 Ohio Department of Transportation, Office of Public Transportation
 Oklahoma Department of Transportation
 Pennsylvania Department of Transportation, Bureau of Public Transportation
 Rhode Island Department of Transportation
 South Dakota Department of Transportation, Division of Air, Rail & Transit
 Tennessee Department of Transportation, Office of Public Transportation
 Texas Department of Transportation
 Virginia Department of Rail & Public Transportation
 Wisconsin Department of Transportation
 Wyoming Department of Transportation

Transit Management Companies

The following transit management companies provided information for this study:

Antelope Valley Bus, Inc., Lancaster, California
ATC/Vancom, Las Vegas, Nevada
DAVE Transportation Services, Inc., Santa Ana, California

Diversified Paratransit, Inc., Pomona, California
Laidlaw Transit, Inc., Los Angeles, California
R. V. Goebel Family, Inc., Cleveland, Ohio

APPENDIX C

Information on Training Programs

DEFENSIVE DRIVING PROGRAM

National Safety Council

The National Safety Council (NSC) provides safety educational materials, safety incentive program materials, and defensive driving courses to member and non-member transit systems. They also have a number of Chapter Affiliates throughout the country. Their address and telephone number are:

National Safety Council
P. O. Box 588
Itasca, IL 60143-0588
(800) 621-7619

Professional Development Associates

The Professional Development Associates (PDA) has developed a Transit Operator version of their Defensive Driving Course. Their address and telephone number are:

Professional Development Associates
31600 West Thirteen Mile Road, Suite 128
Farmington Hills, MI 48334
(810) 737-9600

The Smith System

The Smith System safety training programs are built around their "Five Keys to Space Cushion Driving." The programs emphasize "on-road" training. Their address and telephone number are:

Smith System
Driver Improvement Institute, Inc.
1106 West Pioneer Parkway
Arlington, TX 76013
(800) 777-7648

TRANSPORTATION SAFETY INSTITUTE PROGRAMS

The Transportation Safety Institute (TSI) began conducting transit training in 1976. Through the Institute, the FTA Office of Safety and Security has introduced the concepts of system safety to the transit industry. The courses offered depend on demand, and the current courses of the Mass Transit Bus Safety Program are listed below:

Operational Bus System Safety Awareness
Bus Accident Investigation Seminar
Advanced Problems in Bus Accident Investigations
Fire/Life Safety Training Seminar
Prevention of Passenger and Bus Accidents Seminar
Instructor's Course in Bus Accident Investigation
Bus Accident Casualty Extrications
Systems Safety Planning Seminar

Their address and telephone number are:

Mass Transit Division, DTI-80
Transportation Safety Institute
P.O. Box 25082
Oklahoma City, OK 73125-5050
(405) 954-3682

APPENDIX D

Safe Driving Awards Programs

Examples of safe driving awards programs from three transit agencies are given in the following sections.

SAFE DRIVING AWARDS PROGRAM AT CENTRAL OHIO TRANSIT AUTHORITY

A motor coach operator is required to work a full year without a preventable accident. Doing so entitles him/her to a safe driving award for whatever number of years he/she has earned. For instance: the operator earning years 1 through 35 will always receive a \$100.00 savings bond, a certificate of merit card (signed by the General Manager and the Director of Transportation) and a year pin signifying the particular year earned.

The following is a list of the awards operator is to receive for a specified number of years:

5 Years--Certificate signed by the General Manager, plus a 5 year pin, certificate of merit card and \$100.00 Savings Bond.

10 Years--Certificate signed by the General Manager, plus a 10 year pin, certificate of merit card and \$100.00 Savings Bond.

15 Years--Certificate signed by the General Manager, plus a 15 year pin, certificate of merit card, \$100.00 Savings Bond and a wooden plaque with the operator's name and the date the award was earned.

20 Years--Certificate signed by the General Manager, plus a 20 year pin, certificate of merit card, \$100.00 Savings Bond and watch engraved with name, number of years and date award was earned.

25 Years--Certificate signed by the General Manager, plus a 25 year pin, certificate of merit card, \$100.00 Savings Bond and a \$1,500.00 Savings Bond.

30 Years--Certificate signed by the General Manager, plus a 30 year pin, certificate of merit card, \$100.00 Savings Bond and a \$1,000.00 check made payable to the operator.

35 Years--Certificate signed by the General Manager, plus a 35 year pin, certificate of merit card, \$100.00 Savings Bond and a \$1,500.00 check made payable to the operator.

NOTE: The 15, 20, 25, 30, and 35 year awards are presented at the board meeting. The certificates are framed

in a silver frame except for the 15 year award, which is in a black frame. The 5 and 10 year award certificates are also placed in black frames.

SAFETY AWARDS AND RECOGNITION PROGRAM AT NJT BUS

Introduction

An important Safety Program element is the recognition of high level performance and the general motivation of the workforce to achieve organizational safety goals. While awards in themselves cannot solve an organization's ills, they are highly effective when used as part of a totally comprehensive safety program.

Scope

The awards and recognition program at NJT Bus covers the following parameters.

- A. **Safe Driving Individual Awards** are given to bus operators who achieve from between 2 to 35 years of safe driving. Each operator receives a set of patches which signify the number of consecutive years of safe driving attained. Patches are given to operators at garage ceremonies held each year.

In addition to patches, operators receive added awards at certain milestones as follows:

- 2 years-- bronze lapel pin
- 4 years--bronze lapel pin
- 5 years--silver lapel pin
- 10 years--safe driving watch
- 15 years--gold lapel pin
- 20 years--mantle clock
- 25 years--gold lapel pin
- 30 years--mantle clock
- 35 years--gold lapel pin with diamond.

Operators achieving the 10/20/30 year milestones are also recognized via press release to local newspapers.

B. **Group Awards**

Teamwork and group achievements in safety are vital in producing success. To foster group performance NJT Bus has a Group Safety Award Program as follows:

1. **Group Awards Operations**

Group Awards are given to the five garages system-wide with the largest reduction in vehicle accidents. Awards are based on improvement on the garage's previous record. Recognition includes an invitation to the annual Safety Awards Brunch, as well as a plaque, banner, and gift/memento for each garage employee.

2. **Group Awards Maintenance**

Group Awards are given to the five locations system-wide with the largest reduction in OSHA reportable injuries. Awards are based on improvement over the previous year's record.

C. **Safe Driver Awards Banquet**

Operators achieving 10/20/30 year milestones are invited with their guest to the Annual Safety Awards Brunch. At the brunch, they are recognized for their efforts by co-workers, supervisors, senior management, and their union. An honor roll of safe drivers is also printed and distributed to all locations.

D. **Maintenance Individual Awards**

Each year, Operations recognizes the Maintenance employees who have completed one year without an OSHA Reportable Accident. Recognition is in the form of a coffee mug or other gift.

E. **Management Awards**

Periodically, the General Manager recognizes garages and management teams for performance. Safety is one of the parameters measured in these garage/management awards.

F. **Miscellaneous Recognition/Awards**

While a structured program is important, it is equally vital that spontaneous recognition be given for special safety efforts.

Additionally, efforts to publicize safety accomplishments both individual/company-wide are critical in maintaining safety as part of the company culture. NJT efforts include:

1. **Safety Honor Roll** published each spring. This list recognizes safe drivers attaining 10/20/30 years of safe driving.

2. **Special Efforts--Any** employee who has accomplished a special safety effort is recognized at the quarterly General Manager's recognition ceremony. Recognition includes a certificate or plaque.

3. **Special Promotions**--Special awareness efforts are done anytime an accomplishment/event of special significance occurs (APTA award or other recognition).

1995 RTA OPERATOR'S INCENTIVE PROGRAM

I. Operator Incentive Plan

A. Group Award (Overview)

The RTA Operator Incentive Plan will consist of teams chosen by lot at each bid. Teams will compete to attain the highest point total in each bid period or trimester of the calendar year. Each trimester team member of the winning group will receive a gift certificate.

B. Individual Award (Overview)

1. In addition to the group awards, each operator successfully meeting the requirements of the program will receive individual recognition. Full-time operators will be able to compete for Operator of the Bid and ultimately for Operator of the Year. The employee's entire record will be used to evaluate his/her standing at the end of each bid period. The winning operator each bid will receive a parking slot for the following bid, certificate of achievement, their picture posted in the operators' lounge and Agency Board Room, and will also receive a gift certificate. The operator with the best overall record at the end of the year will be chosen as Operator of the Year.

2. Part-time operators are eligible for group awards, but cannot compete for Operator of the Bid and/or Operator of the Year.

3. Each team will elect a captain to act on its behalf in reviewing team performance and represent the Team on the Driver's Communications Committee. The Captains of each team will be responsible for monitoring the group's performance and acting as liaison between members and management. Captains attending meetings will receive two (2) hours straight time pay if they are attending during non-paid work time.

4. Each team will be assigned an alphabetical letter and each team's standings will be posted monthly as to their ranking in points.

5. Two hundred (200) points will be assigned to each team at the beginning of the trimester. The following points will be added or subtracted from this total over the course of the bid and the team with the highest points total at the end of the bid will be declared the winner.

Operators will be assigned points or will lose points for their groups as follows:

- a. Injury free bid(industrial) Plus 5 points
- b. Accident free (vehicular/passenger) Plus 5 points

Preventable Accidents including any that have gone Through the committee review procedure during the bid period.

Minus5 points

- c. Attendance—Perfect Attendance Plus 3 points
(Per bid period)
- ½ days Minus ½ point
- 1 day Minus 1 point
- 2-5 days (consecutive) Minus2 points
- 6-20 days (consecutive) Minus3 points
- 21-29 days (consecutive) Minus4 points

Counted Absences (for the purpose of this program) Will be defined as any full or partial day missed for Any reason EXCEPT vacations, holidays, jury duty, Agency-required court appearances, depositions, bereavement, military duty of 30 days or fewer for annual training Or activation to duty status, maternity Leave and union business for elected officials.

d. MOU/Rule Book Violations

- Suspensions Minus 3 points
- Miss Outs (non worked) Minus 1 1/2 points
- Miss Outs (worked) Minus ½ point
- Late Arrival Minus ½ point
- Not in complete uniform Minus 1 point
- Complaint (Chargeable) Minus 1 point
- Other Written Warnings Minus 2 points

- e. Attendance at bus Roadeo Plus 1 point
- Participation in Road Plus 5 points
- First Place Winners Plus 3 points
- Second Place Winners Plus 2 points
- Third Place Winners Plus 1 point

- f. Verifiable written commendations Plus 1 point/
bid period

*Commendations must be verifiable (phone no, or return address required) received by mail or personally delivered by their author. No more than one commendation from the same individual in a 12 month period. Commendations received with multiple names will be counted as one total point toward a group total and will not be applied to the operator individually.

II. General

1. New employees will not be assigned to a group until completion of 120 days probation.
2. Employee missing more than 30 days of their scheduled working time in a bid period are not eligible for an award. Missed work is defined as non-excusable absences (as outlined in this plan).
3. Eligibility for Operator of the Bid completion is based on highest score with no chargeable accidents, written warnings or industrial injuries.
4. Eligibility for Operator of the Year competition is based on highest score with perfect attendance, no written warnings/traffic violations, industrial injuries, preventable vehicular or passenger accidents.

III. Awards and Annual Safety and Awards Banquet

A. Operators Incentive Plan Awards

1. **Team Award**--he team finishing the bid period with the highest point total will receive a \$100 gift certificate for each team member.
2. **Individual Award**--The operator will the best overall record for each bid period will receive a \$100 gift certificate, reserved parking space for the following bid and have their picture posted in the Drivers' Lounge and Board Room Second place Winners will receive a \$50 gift certificate and third Place winners will receive a \$25 gift certificate.
3. **Individual Effort**--At the end of each bid period, operators contributing Perfect Individual Effort (PIE) in the categories of safe driving (zero preventables) and/or attendance will earn a piece of pie and a chance at the "slice-of-the-pie" drawing (3 prizes) held at the year end Annual Awards Banquet. Only PIE winners will be eligible for this Drawing.
4. **Individual Perfect Attendance**--Operators with perfect annual attendance will be recognized with a certificate of achievement and chance at the "slice-of-the-pie" drawing.
5. **Individual Safety Awards**--Operators with an accident free driving record (no preventable vehicular accidents) for the year will receive a certificate of achievement and an additional chance at the "slice-of-the-pie" drawing.

6. **SAFE PROGRAM** – Operators that achieve a perfect safety record (zero traffic violations, preventable passenger, vehicular and industrial accidents) will receive the Superintendent’s Award for Excellence (SAFE). Members of the SAFE Team will receive a special citation and lapel/collar pin marking their excellence.
7. **Individual Annual Award**—The Operator of the Year will receive a \$300 gift certificate and dinner for two at a local restaurant, a jacket, patches for their uniform, certificate of achievement, the bus of his/her choice for one year and a special parking space for their personal auto, a clock, and appropriate publicity in local and national publications. Second place operators will receive a special plaque and a \$150 gift certificate. Third place

operators will receive a special plaque and \$75 gift certificate.

B. Annual Awards Banquet

A banquet will be held every year to honor all of RTA’s Incentive Program winners. Invited to attend will be the members of each trimester’s winning team, individual trimester winners (1st-3rd), operators with accident free annual driving records and all operators with perfect annual attendance (no counted absences as defined by the attendance policy). The Operators of the Year will be announced and honored along with all recipients of SAFE Program awards. Prize drawings will be held for recognition of the perfect individual effort (PIE) recipients. All of the above will be invited to the banquet along with one guest each.

APPENDIX E

Customer Education and Training Programs

Excerpts from typical customer education and training programs from three transit agencies are given in the following sections. The Dallas Area Rapid Transit (DART) program is an example of a comprehensive educational program for school children. The Riverside Transit Agency developed a coloring book for your school children. An example of a safety brochure was obtained from Long Beach Transit.

DART TRANSIT EDUCATION PROGRAM

The Dallas Area Rapid Transit (DART) service area has an estimated population of 1.4 million people, a geographic area of approximately 900 square miles and serves 16 cities. Most of these cities had never been served by mass transportation before the 1983 DART referendum.

In keeping with the DART's overall mission statement, the program was designed to meet the following objectives:

- To provide information and education about public transportation agencies, specifically Dallas Area Rapid Transit
 - To increase citizen awareness and patronage
 - To teach background detail, safety aspects, and good citizenship relating to mass transportation.
 - To coordinate with and increase understanding between DART and instructors and students
 - To develop an interest and incentive for the use of [public transportation by future generations of riders.
 - To provide a cost-conscious, efficient community out-reach and education effort.

The DART education project has been designed as a three-pronged program that includes a comprehensive transit curriculum, classroom presentations and instructor development, and transit related field trips. The student, the instructor, and DART will be enriched by the results of the process.

The presentation for all elementary grades consists of the following:

1. Introduction to the DART systems
2. Information needed to ride the bus
3. Safety and citizenship

DARTRAN, a robotic transit genius, serves as further motivation for learning and presents his 6-minute sound-recorded program for the younger students. Collateral materials include an education comic book, schoolbook covers, and other useful supplements.

The presentations for middle school and high school students emphasize the present and future transit system, what the rail project will mean for the region, how DART services relate specifically to the students and society, and what career options are available in the transit industry. A double-projection audio slide show is included in the presentation to reinforce student services offered by DART. The slide show emphasizes the independence that DART offers teens to get to destinations that would otherwise require parental chauffeuring or automobile availability. A VHS video will also be available for classroom presentation. Literature and other useful material supplements also are available.

RTA
Riverside Transit Agency
Coloring Book



Dear Parent/Teacher:

This coloring/activity book is designed to teach your child about the public transit system in Western Riverside County. The Riverside Transit Agency (RTA) provides valuable transportation services to people throughout our 2,500 mile service area. RTA is a safe, efficient, and inexpensive way for your child and family to travel to school, work, recreation, shopping, and just about anywhere you want to go.

Children are never too young to begin learning about public transportation and its importance in our community and to the environment. By using RTA, your family can help reduce traffic congestion and provide cleaner air for all of us.

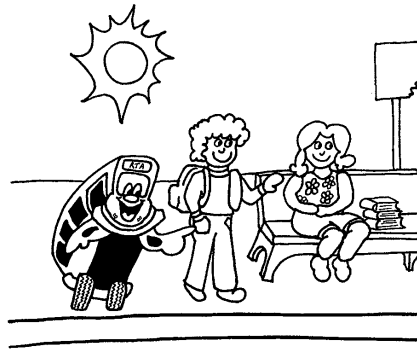
Now is the time for your children to learn how to ride the bus, while they are young and have you as a role model. Then, when they are old enough to ride on their own, you can feel confident about choosing RTA for your children's transportation needs.

If you need help planning your child's or family's trip, please call our Information Center at 682-1234 from Riverside/Marano Valley, or 1-800-800-7821 from outlying areas, and an information clerk can tell you which bus to take.

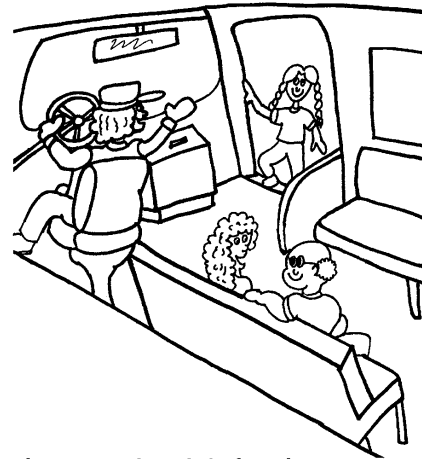
Sincerely,

Susan Hafner

Susan Hafner
General Manager



Arrive at your bus stop early. Stand away from the curb so the driver can pull over safely to pick you up.



Always enter through the front door.



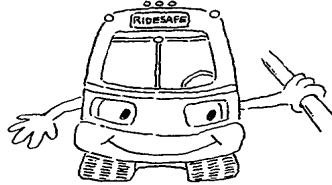
Exit through the rear door. Be careful and look for cars when you cross the street.

Riding The Bus SAFETY RULES



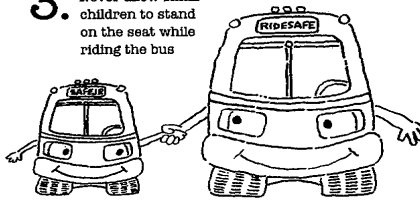
LONG BEACH TRANSIT

1. Always hold the handrails and stanchions to steady yourself when standing or walking on a bus.



2. Signal that you would like to get off one block in advance and remain seated until the bus comes to a complete stop.

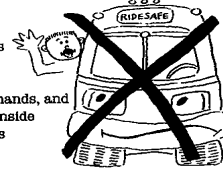
3. Never allow small children to stand on the seat while riding the bus



4. Don't change seats while the bus is in motion

5. Never stand or sit in any of the bus stairwells

6. Always keep your head, hands, and arms inside the bus



7. Be good neighbors. don't distract the operator or other passengers with unnecessary conversation, yelling or causing a commotion on the bus

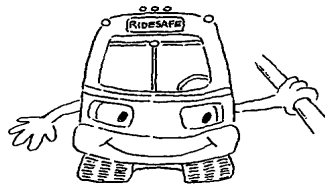
Ride Safe
With
Long Beach
Transit!

Paseo en el Camión REGLAS de SEGURIDAD



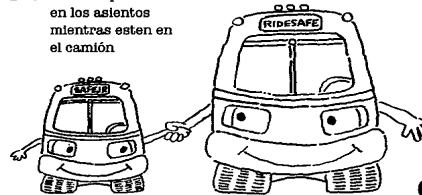
LONG BEACH TRANSIT

1. Deténgase siempre de las barandas y puntales para que se estabilice cuando este de pie y caminando en el camión



2. Indique que desea bajarse un bloque de antemano y favor de permanecerse sentado hasta que pare completamente el camión

3. Nunca permita que niños se paren en los asientos mientras esten en el camión



4. Favor de no cambiarse de asientos mientras el camión esté en movimiento

5. No se pare o siente en los escalones

6. Siempre mantenga su cabeza, sus manos y brazos adentro del camión.



7. Sea un buen vecino . no distraiga al chofer o a los otros pasajeros con pláticas innecesaria, gritos, o escándalo en el camión

¡Pasée Con
Seguridad
en el
Tránsito
de Long Beach!

APPENDIX F

Examples of Bus Safety Inspections Forms

Examples of pre-trim inspection and defect report forms from three transit systems are given in the following pages. Most transit systems use a multi-page form, and one function

Of the form is to provide maintenance with information concerning defects that were found, and another is to provide a checklist for the driver.

SOUTH COAST AREA TRANSIT DAILY BUS INSPECTION AND DEFECT REPORT

Vehicle No. _____
Date _____

Coach Run _____
Time Off _____

	OK	DEFECT
AIR EQUIPMENT		
Door Operation		
Windshield Wipers		
Air Ride ___ Springs ___		
Leaks		
BODY		
Body Damage		
Steps ___ Flooring ___		
Driver's Seat		
Passenger Seats & Cushions		
Mirrors		
Stanchions		
BRAKES		
Drag ___ Pull ___		
Squeal ___ Soft ___		
Parking Brake		
CONDITION OF TIRES & WHEELS		
Front		
Rear		
Lugnuts		
ELECTRICAL		
Batteries ___ Starter ___		
Generator ___ Horn ___		
All Lights		
Passenger Buzzer		
Destination Signs		
ENGINE		
Hot Engine ___ Oil Leaks ___		
Water Leaks ___ Oil Press ___		
FRONT END		
Steering		
INTERIOR		
Clean ___ Dirty ___		
INTERIOR EQUIPMENT		
Fire Extinguisher		
Emergency Reflector Kit		
Two-way Radio		
Farebox		
Air Conditioning		
Climate Control		
TRANSMISSION		
Slipping		
Leaks		
Shifting		
WHEELCHAIR LIFT		
DESCRIPTION OF DEFECTS: _____		

Signature of Operator _____

Garage Copy

RIVERSIDE TRANSIT AGENCY OPERATORS' DEFECT REPORT

BUS: _____ DATE: _____

DOORS	W/C LIFT	AC/HEAT	EXT LIGHTING
<input type="checkbox"/> Stick	<input type="checkbox"/> No Power	<input type="checkbox"/> Defroster	<input type="checkbox"/> Headlights
<input type="checkbox"/> Too Fast	<input type="checkbox"/> Deploy	<input type="checkbox"/> No Heat	<input type="checkbox"/> Tail Lights
<input type="checkbox"/> Too Slow	<input type="checkbox"/> Platform	<input type="checkbox"/> No A/C	<input type="checkbox"/> Turn Signals
<input type="checkbox"/> Won't Close	<input type="checkbox"/> Restraint	<input type="checkbox"/> A/C Light	<input type="checkbox"/> Flashers
<input type="checkbox"/> Won't Open	<input type="checkbox"/> Stow	<input type="checkbox"/> Blowers	<input type="checkbox"/> Clearance

ELECTRICAL	SUSPENSION	BRAKES	BODY DAMAGE
<input type="checkbox"/> Dome Lights	<input type="checkbox"/> Air Leak	<input type="checkbox"/> Pull L / R	<input type="checkbox"/> Bumpers
<input type="checkbox"/> Guages	<input type="checkbox"/> Leans	<input type="checkbox"/> Lock up	<input type="checkbox"/> Front End
<input type="checkbox"/> Telltale Lamps	<input type="checkbox"/> Won't Raise	<input type="checkbox"/> Soft	<input type="checkbox"/> Rear End
<input type="checkbox"/> Horn	<input type="checkbox"/> Kneeler	<input type="checkbox"/> Noisy	<input type="checkbox"/> Left Side
<input type="checkbox"/> Chime	<input type="checkbox"/> Noisy	<input type="checkbox"/> Parking Brake	<input type="checkbox"/> Right Side

WINDOWS	MIRRORS	FAREBOX	RADIO
<input type="checkbox"/> Broken	<input type="checkbox"/> Broken	<input type="checkbox"/> Jammed	<input type="checkbox"/> Dead
<input type="checkbox"/> Etched	<input type="checkbox"/> Too Loose	<input type="checkbox"/> In Bypass	<input type="checkbox"/> Static
<input type="checkbox"/> Won't Open	<input type="checkbox"/> Too Tight	<input type="checkbox"/> Won't Take Bill	<input type="checkbox"/> Volume
<input type="checkbox"/> Won't Close	<input type="checkbox"/> Won't Adjust	<input type="checkbox"/> Won't Register	<input type="checkbox"/> Won't Transmit
<input type="checkbox"/> Need Cleaning	<input type="checkbox"/> Spot Mirror	<input type="checkbox"/> Other	<input type="checkbox"/> Won't Receive

ENGINE	TRANSMISSION	TIRES
<input type="checkbox"/> Stop Light	<input type="checkbox"/> Low Power	<input type="checkbox"/> Trans Light
<input type="checkbox"/> Check Light	<input type="checkbox"/> Won't Start	<input type="checkbox"/> Won't Shift
<input type="checkbox"/> Overheats	<input type="checkbox"/> Oil Leaks	<input type="checkbox"/> No Forward
<input type="checkbox"/> Smokes	<input type="checkbox"/> Fuel Leaks	<input type="checkbox"/> No Reverse
<input type="checkbox"/> Vibrates	<input type="checkbox"/> Water Leaks	<input type="checkbox"/> Slips
<input type="checkbox"/> Stalls	<input type="checkbox"/> Noisy	<input type="checkbox"/> Leaks
		<input type="checkbox"/> Flat
		<input type="checkbox"/> Damaged
		<input type="checkbox"/> Low Air
		<input type="checkbox"/> Low Tread
		<input type="checkbox"/> Uneven Wear
		<input type="checkbox"/> Loose Lugs

STEERING	OTHER ITEMS
<input type="checkbox"/> Hard	<input type="checkbox"/> Wipers
<input type="checkbox"/> Shimmies	<input type="checkbox"/> Headsign
<input type="checkbox"/> Excessive Play	<input type="checkbox"/> Accelerator
<input type="checkbox"/> Pulls R / L	<input type="checkbox"/> Interlock
<input type="checkbox"/> Sensitive Edge	<input type="checkbox"/> Amigo Straps
<input type="checkbox"/> Emerg Exits	<input type="checkbox"/> Int Dirty
<input type="checkbox"/> Grafitti	<input type="checkbox"/> Ext Dirty
<input type="checkbox"/> Seats	<input type="checkbox"/> Other

ADDITIONAL INFORMATION: _____

OPERATORS' TRIP RECORD				
#	TIME IN	TIME OUT	RUN	SIGNATURE
1				
2				
3				
4				

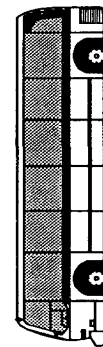
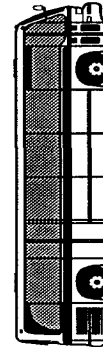
REPAIR ACTION: (SHOP USE ONLY) _____

MECH SIGNATURE: _____ DATE: _____

PRE-OPERATION CHECKLIST

BUS: _____ HUB: _____ DATE: _____

BODY DAMAGE
Circle Damaged Areas



DRIVER

1 2 3 4

- Water Level
- Telltale Lamps
- Horn
- Mirrors: Right Left Interior
- Door Controls
- Headsign Test
- Passenger Chime
- Climate Control
- Defroster
- Interior Lighting
- Farebox
- Emergency Equipment
- Front and Rear Steps
- Wheelchair Lift
- W/C Belts and Straps
- Sensitve Edge
- Headlights
- Brake Lights
- Turn Signals
- Emergency Flashers
- License Plates and Light
- Clearance Lamps
- Windshield/Windows
- Wipers/Washers
- Body (Front)
- Body (Rear)
- Body (Left)
- Body (Right)
- Decals and Logos
- Tire (Flat): RF LF LR RR
- Tire (Low): RF LF LR RR
- Tire (Worn): RF LF LR RR
- Loose Lugs: RF LF LR RR
- Driver's Seat and Seat Belt
- Static Air Pressure Loss
- Applied Air Pressure Loss
- Radio Check
- Parking Brake
- Interlock
- Speed Sensor

NOTE: Defective items must be repaired before leaving the yard, or written up on the front side of this defect report.

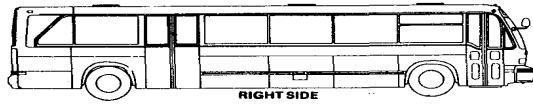
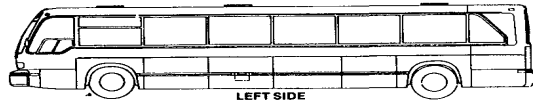
Nº 4239



Date: _____ **Operators Defect Card** Bus: _____

BUS PRE-TRIP CHECK **ACCIDENT**

NOTE any damage on bus body.



Press Hard, ballpoint only. Check (✓) each item below, if defective.

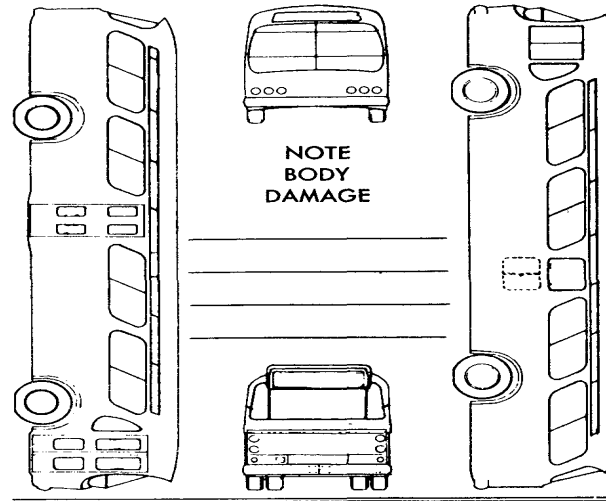
CHECKLIST:

- | | |
|--|---|
| <p>INSIDE</p> <ul style="list-style-type: none"> () Parking Brake () Start Engine () Radio () Farebox (light) () Oil Pressure (light or gauge) () Air Pressure (gauge) () Low Air Warning () Windshield Wiper & Washer () Heater — Defroster () Mirrors () Air Conditioner () Telltale lights or Buzzers () Horn () Apply Rear Wheel Brakes in Emergency (Manual Control) () Windows () Seats () Steering Wheel-Play () Fire Extinguisher and Highway Devices () Turn Signal Operation () Front & Rear Door Operation and Interlock () Turn on all lights including 4-way Flasher | <p>OUTSIDE</p> <ul style="list-style-type: none"> () Service Doors () Tires () Wheels, Lugs () Clearance Lights () Reflectors <p>FRONT</p> <ul style="list-style-type: none"> () Ft. Destination Sign () Destination Sign Light () Headlight () Turn Signal Lights () License Plate <p>SIDES</p> <ul style="list-style-type: none"> () Entrance and Exit Doors () Side Destinations Sign () Destination Sign Light <p>REAR</p> <ul style="list-style-type: none"> () Tail Lights () Stop Lights () Turn Signal Lights () License Plate/Light () Rr Destination Sign (if applies) () Destination Sign Light (if applies) |
|--|---|

PROBLEMS

OPERATOR'S SIGNATURE _____

OPERATOR'S COPY



MECHANIC REPORT ON DEFECT

DATE REPAIRED _____

SIGNATURE OF MECHANIC _____

W.O. # _____

APPENDIX G

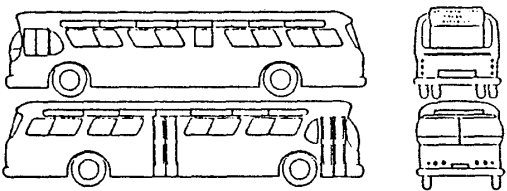
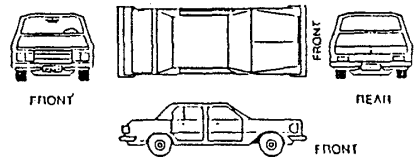
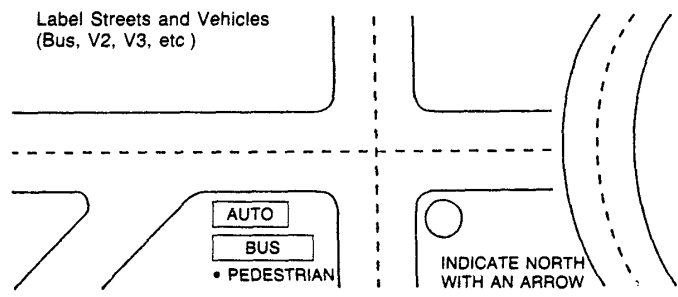
Examples of Accident Report Forms

Some transit systems have different reports for passenger accidents and vehicle collisions, and some use only one form for both incidents. Most transit systems also have a supervisor's

report of the accident. Examples from three transit systems of accident/incident and supervisor forms are given in the following pages.

PHOENIX TRANSIT SUPERVISOR'S FIELD NOTES AND ACCIDENT REPORT							
REPORT NUMBER / /		1 <input type="checkbox"/> COLLISION 2 <input type="checkbox"/> PTS PROPERTY DAMAGE					
DATE OF ACCIDENT / /	DAY OF WEEK M T W T F S S	TIME : AM : PM					
PTS VEHICLE # [][][][]	NUMBER OF COURTESY CARDS [][]	DIRECTION OF TRAVEL N S E W					
ROUTE [][][]		PLACE ACCIDENT OCCURRED: CITY _____					
ON WHAT STREET: _____		INTERSECTING STREET: _____					
WEATHER CONDITIONS	STREET CONDITION	LIGHT CONDITIONS	TYPE OF ACCIDENT	DRIVER'S CONDITION	WERE PICTURES TAKEN		
<input type="checkbox"/> CLEAR <input type="checkbox"/> CLOUDY <input type="checkbox"/> RAIN <input type="checkbox"/> FOG	<input type="checkbox"/> WET <input type="checkbox"/> DRY <input type="checkbox"/> ICY	<input type="checkbox"/> DAYLIGHT <input type="checkbox"/> DUSK <input type="checkbox"/> DAWN <input type="checkbox"/> DARK	<input type="checkbox"/> ANGLE <input type="checkbox"/> HEAD-ON <input type="checkbox"/> REAR-END	<input type="checkbox"/> COMPOSED <input type="checkbox"/> UPSET <input type="checkbox"/> INJURED	<input type="checkbox"/> YES <input type="checkbox"/> NO		
TRANSIT VEHICLE			OTHER VEHICLE				
D R I V E R	NAME (LAST, FIRST, MIDDLE)		D R I V E R	NAME (LAST, FIRST, MIDDLE)			
	ADDRESS			ADDRESS			
	CITY	STATE		ZIP	CITY	STATE	ZIP
	DRIVER'S LIC #			STATE	DRIVER'S LIC #		STATE
V E H I C L E	OWNER (LAST, FIRST, MIDDLE)		V E H I C L E	OWNER (LAST, FIRST, MIDDLE)			
	ADDRESS			ADDRESS			
	CITY	STATE		ZIP	CITY	STATE	ZIP
	LIC #	YEAR		MAKE	COLOR	LIC #	YEAR
WERE THERE ANY INJURIES <input type="checkbox"/> YES <input type="checkbox"/> NO							
NAME	ADDRESS, CITY, STATE, ZIP	PHONE	AGE	SEX	NATURE		
(on pts bus)							
(other vehicle)							
POLICE REPORT #		POLICE OFFICER					

WERE INJURED TRANSPORTED? <input type="checkbox"/> YES <input type="checkbox"/> NO	BY WHOM?	WHERE TAKEN?
IF A COLLISION WITH AN OBJECT		
DESCRIBE OBJECT		
EXTENT OF DAMAGE TO OBJECT		
LOCATION OF OBJECT		
NAME OF OWNER	ADDRESS	PHONE
BASED ON YOUR OBSERVATIONS, WHAT DIRECTLY CAUSED THE ACCIDENT:		
<input type="checkbox"/> VISIBILITY	<input type="checkbox"/> SPEED OF BUS	<input type="checkbox"/> WEATHER
<input type="checkbox"/> OPERATOR ERROR	<input type="checkbox"/> ROAD HAZARD	<input type="checkbox"/> OTHER VEHICLE
<input type="checkbox"/> OTHER EXPLAIN. _____		

MARK DAMAGED AREAS OF VEHICLES		
		
DAMAGE DESCRIPTION _____ _____	DAMAGE DESCRIPTION _____ _____	
DRAW A DIAGRAM OF ACCIDENT WITH ALL VEHICLES INVOLVED:		
Label Streets and Vehicles (Bus, V2, V3, etc)		
		
PLEASE INDICATE WITH AN "X" WHERE YOU FIRST SAW HAZARD		
SUPERVISOR SIGNATURE		DATE

PHOENIX TRANSIT PASSENGER ACCIDENT/INCIDENT REPORT

EMPLOYEE		BUS #		
DATE	/	/	DAY	TIME : AM PM
ROUTE		LOCATION		
<input type="checkbox"/> INJURY	<input type="checkbox"/> FARE EVASION	<input type="checkbox"/> ALTERCATION	<input type="checkbox"/> VANDALISM	
<input type="checkbox"/> ONBOARD <input type="checkbox"/> ALIGHTING <input type="checkbox"/> BOARDING <input type="checkbox"/> SITTING	<input type="checkbox"/> COIN <input type="checkbox"/> DOLLAR <input type="checkbox"/> TRANSFER	<input type="checkbox"/> OP/PASS <input type="checkbox"/> PASS/PASS <input type="checkbox"/> STUDENTS	<input type="checkbox"/> ONBOARD <input type="checkbox"/> OUTSIDE	
WAS PASSENGER REMOVED BY?		<input type="checkbox"/> AMBULANCE	<input type="checkbox"/> POLICE	<input type="checkbox"/> SUPERVISOR
PASSENGER'S APPEARANCE		POINT OF OCCURRENCE		
<input type="checkbox"/> APPARENTLY NORMAL <input type="checkbox"/> ILL <input type="checkbox"/> INTOXICATED <input type="checkbox"/> HANDICAPPED <input type="checkbox"/> UNCONSCIOUS		<input type="checkbox"/> FRONT STEPS <input type="checkbox"/> REAR STEPS <input type="checkbox"/> FRONT OF BUS <input type="checkbox"/> MIDDLE OF BUS <input type="checkbox"/> REAR OF BUS	<input type="checkbox"/> BEFORE ENTERING BUS <input type="checkbox"/> AFTER LEAVING BUS <input type="checkbox"/> APPROACHING BUS STOP <input type="checkbox"/> STANDING AT BUS STOP	
DID ANOTHER VEHICLE CAUSE THE ACCIDENT/INCIDENT? <input type="checkbox"/> YES <input type="checkbox"/> NO				
LICENSE # _____ STATE _____ MAKE _____ YEAR _____ COLOR _____				
ACTION OF VEHICLE: <input type="checkbox"/> STOPPING <input type="checkbox"/> MOVING TO CURB <input type="checkbox"/> TURNING LEFT <input type="checkbox"/> STARTING <input type="checkbox"/> MOVING FROM CURB <input type="checkbox"/> TURNING RIGHT <input type="checkbox"/> CROSSING INTERSECTION <input type="checkbox"/> CHANGING LANES				
ACTION OF BUS: <input type="checkbox"/> COMING TO STOP <input type="checkbox"/> STANDING STOP <input type="checkbox"/> STARTING UP <input type="checkbox"/> EMERGENCY STOP <input type="checkbox"/> OTHER — EXPLAIN _____				

NAME OF INJURED	ADDRESS, CITY, ZIP	PHONE	AGE	INJURIES
1. _____				
2. _____				
3. _____				
WITNESSES	ADDRESS, CITY, ZIP	PHONE	AGE	INJURIES
1. _____				
2. _____				
3. _____				

WERE INJURED TRANSPORTED? <input type="checkbox"/> YES <input type="checkbox"/> NO	BY WHOM?	WHERE TAKEN?
IF A COLLISION WITH AN OBJECT		
DESCRIBE OBJECT		
EXTENT OF DAMAGE TO OBJECT		
LOCATION OF OBJECT		
NAME OF OWNER	ADDRESS	PHONE
INVESTIGATION REPORT		
DESCRIBE THE ACCIDENT:		
SUPERVISOR SIGNATURE		DATE

BUS OPERATOR ACCIDENT-INCIDENT REPORT		Division _____		
		Fill In All Blanks Applicable - Be Specific (Use Black Ink Only)		
OPERATOR _____		ID# _____	BLOCK# _____	BUS# _____
DAY/DATE OF ACCIDENT _____	TIME OF ACCIDENT _____ M	NO PASSENGERS ON BUS _____	NO. COURTESY CARDS DISTRIB _____	APPROX. SPEED AT TIME OF INCIDENT: _____ MPH
LOCATION OF ACCIDENT (Include Town) _____				
TYPE OF OCCURENCE <input type="checkbox"/> COLLISION—INJURIES <input type="checkbox"/> PASSENGER—INJURIES <input type="checkbox"/> INCIDENT—NO INJURIES <input type="checkbox"/> INCIDENT—INJURIES <input type="checkbox"/> COLLISION—NO INJURIES <input type="checkbox"/> PASSENGER—NO INJURIES	WEATHER CONDITIONS <input type="checkbox"/> CLEAR <input type="checkbox"/> RAINING <input type="checkbox"/> FOG <input type="checkbox"/> SNOWING <input type="checkbox"/> SLEET <input type="checkbox"/> _____	ROAD CONDITIONS <input type="checkbox"/> DRY <input type="checkbox"/> WET <input type="checkbox"/> ICY <input type="checkbox"/> SNOWY <input type="checkbox"/> SLUSHY <input type="checkbox"/> _____	MOTION OF BUS <input type="checkbox"/> STOPPED — TRAFFIC <input type="checkbox"/> STOPPED — BUS STOP <input type="checkbox"/> BRAKING <input type="checkbox"/> ACCELERATING <input type="checkbox"/> TURNING <input type="checkbox"/> OTHER	LIGHT CONDITIONS <input type="checkbox"/> DAYLIGHT <input type="checkbox"/> DAWN/DUSK <input type="checkbox"/> DARK — NO LIGHT <input type="checkbox"/> DARK — STREET LIGHTS
Complete the Following if COLLISION				
PLATE # OF OTHER VEHICLE _____	MAKE/MODEL/YEAR/COLOR _____	NO PASSENGERS IN OTHER VEHICLE _____	DIRECTION OF BUS (Circle) _____	DIRECTION OF OTHER VEHICLE (Circle) _____
STATE: _____			N S E W	N S E W
NAME OF OTHER DRIVER _____		DRIVER'S LICENSE NO _____	STATE: _____	OWNER OF OTHER VEHICLE _____
ADDRESS OF OTHER DRIVER _____		ADDRESS OF OWNER _____		
STREET: _____		STREET: _____		
CITY: _____		CITY: _____		STATE: _____
DAMAGE TO BUS YES _____ NO _____ (If Yes Fill Out Vehicle Damage Sheet)		DESCRIBE DAMAGE TO OTHER VEHICLE OR PROPERTY _____		
INSURANCE CARRIER OR AGENT & CODE # _____		INSURANCE POLICY NO. _____		
Complete the Following if PASSENGER INJURY (Check all that apply)				
NATURE OF ACCIDENT <input type="checkbox"/> FRONT STEPS <input type="checkbox"/> WHILE BOARDING <input type="checkbox"/> AFTER BOARDING <input type="checkbox"/> ALIGHTING <input type="checkbox"/> SEATED <input type="checkbox"/> STANDING	<input type="checkbox"/> REAR STEPS <input type="checkbox"/> FRONT DOOR <input type="checkbox"/> REAR DOOR <input type="checkbox"/> OFF BUS	NATURE OF INJURY <input type="checkbox"/> HEAD <input type="checkbox"/> ARM <input type="checkbox"/> LEG <input type="checkbox"/> HAND <input type="checkbox"/> FOOT <input type="checkbox"/> BODY	<input type="checkbox"/> BLEEDING <input type="checkbox"/> BRUISE <input type="checkbox"/> FRACTURE <input type="checkbox"/> MULTIPLE INJURY <input type="checkbox"/> NOTHING VISIBLE	CONDITION OF STEPS <input type="checkbox"/> DRY <input type="checkbox"/> WET (RAIN) <input type="checkbox"/> WET (SNOW) <input type="checkbox"/> ICY <input type="checkbox"/> OTHER
		KNEELER <input type="checkbox"/> UP <input type="checkbox"/> DOWN	LIFT/RAMP <input type="checkbox"/> IN USE <input type="checkbox"/> NOT IN USE	BUS UP TO CURB? <input type="checkbox"/> YES <input type="checkbox"/> NO
				IF STOPPED, NOT UP TO CURB, GIVE REASON _____ LIC # OF VEHICLE IN BUS STOP _____
FOR ALL PASSENGER INJURIES, INDICATE LOCATION OF PASSENGER ON THIS DIAGRAM AND SHOW LOCATION OF CURB (IF BOARDING OR ALIGHTING ACCIDENT). IF OFF BUS, INDICATE APPROXIMATE DISTANCE FROM BUS.				
Witnesses:	(2)	(3)	(4)	
Name _____				
Address _____				
City _____				
Phone No. _____				

REPORT OF ACCIDENT OR UNUSUAL OCCURRENCE

CLASSIFICATION _____

ACCIDENT REPORT NO. _____

DATE OF ACCIDENT _____

TIME _____ AM PM

INSURANCE CLAIM NO. _____

COMPANY _____

CITY _____

STATE _____

STREET ON WHICH ACCIDENT OCCURRED:	AT INTERSECTION WITH:
IF NOT AT INTERSECTION: _____ FT. <input type="checkbox"/> N. <input type="checkbox"/> S. <input type="checkbox"/> E. <input type="checkbox"/> W.	NEAREST INTERSECTING STREET:

VEHICLE NO 1 (transit vehicle) DRIVER'S NAME: DRIVER'S ADDRESS: WITH CO. YRS. VEHICLE NO. CHAUFFEUR LIC. NO. ROUTE RUN NO. C.S.O. NO. PARTS VEHICLE DAMAGED: INVESTIGATION BY: <input type="checkbox"/> CITY POLICE <input type="checkbox"/> COMPANY <input type="checkbox"/> STATE POLICE <input type="checkbox"/> SHERIFF <input type="checkbox"/> OTHER OBSERVER'S NAME AND ADDRESS:	VEHICLE NO 2 (other vehicle) DRIVER'S NAME: PHONE NO. DRIVER'S ADDRESS: CITY STATE DRIVER'S LIC. NO. STATE BIRTHDATE INSURANCE COMPANY VEHICLE MAKE YEAR LIC. NO. STATE REGISTERED OWNER: OWNER'S ADDRESS: PARTS OF VEHICLE DAMAGED: NAMES OF OTHER OCCUPANTS:
---	---

(If more space needed-attach supplemental list)

PERSON(S) INJURED: In bus Other vehicle Pedestrian

NAME: _____

Injured Removed By: Ambulance Aid Car Police Fire Dept. Supervisor Other

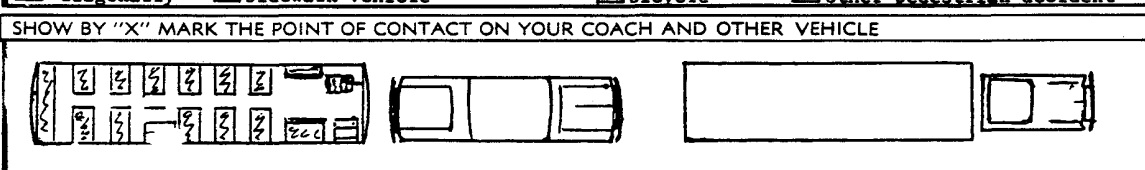
TYPE ACCIDENT:	WEATHER:	ROAD CONDITION:	ROAD SURFACE:	TRAFFIC CONTROL:
Check one <input type="checkbox"/> traffic <input type="checkbox"/> passenger <input type="checkbox"/> pedestrian <input type="checkbox"/> observation <input type="checkbox"/> miscellaneous <input type="checkbox"/> vandalism <input type="checkbox"/> other	Check one <input type="checkbox"/> clear <input type="checkbox"/> cloudy <input type="checkbox"/> rainy <input type="checkbox"/> snowing <input type="checkbox"/> foggy <input type="checkbox"/> sleet <input type="checkbox"/> other	Check one <input type="checkbox"/> dry <input type="checkbox"/> wet <input type="checkbox"/> icy <input type="checkbox"/> snowy <input type="checkbox"/> muddy <input type="checkbox"/> other	Check one <input type="checkbox"/> concrete <input type="checkbox"/> blacktop <input type="checkbox"/> gravel <input type="checkbox"/> dirt <input type="checkbox"/> brick or cobble <input type="checkbox"/> other	Check one <input type="checkbox"/> stop sign <input type="checkbox"/> yield sign <input type="checkbox"/> traffic signal <input type="checkbox"/> RR semaphore <input type="checkbox"/> flagman <input type="checkbox"/> no control <input type="checkbox"/> other

PASSENGER ACCIDENT (check one or more)

<input type="checkbox"/> fell boarding	<input type="checkbox"/> front door	<input type="checkbox"/> straight	<input type="checkbox"/> object in aisle
<input type="checkbox"/> fell in bus	<input type="checkbox"/> rear door (push type)	<input type="checkbox"/> turning	<input type="checkbox"/> struck by object
<input type="checkbox"/> fell before boarding	<input type="checkbox"/> rear door (manual)	<input type="checkbox"/> ejection	<input type="checkbox"/> dispute with others
<input type="checkbox"/> fell alighting	<input type="checkbox"/> struck by doors	<input type="checkbox"/> illness	<input type="checkbox"/> disturbance
<input type="checkbox"/> fell after alighting	<input type="checkbox"/> starting	<input type="checkbox"/> assault	<input type="checkbox"/> faulty equipment
<input type="checkbox"/> ft. from curb	<input type="checkbox"/> stopping	<input type="checkbox"/> other	<input type="checkbox"/> soiled clothing

PEDESTRIAN ACCIDENT (check one or more)

<input type="checkbox"/> with signal	<input type="checkbox"/> against signal	<input type="checkbox"/> no signal	<input type="checkbox"/> in crosswalk	<input type="checkbox"/> not in crosswalk
<input type="checkbox"/> diagonally	<input type="checkbox"/> sidewalk vehicle	<input type="checkbox"/> bicycle	<input type="checkbox"/> other pedestrian accident	



TOTAL NUMBER PASSENGERS _____ OPERATOR'S SIGNATURE _____ DATE OF REPORT _____

TOTAL NUMBER OF NAMES _____

APPENDIX H

Compromises Made by Operators to Maintain Schedules

In the following pages, a list compiled by the Tri-Met training staff of possible actions that operators may make to

Maintain schedules is presented along with an indication of which operational or service areas could be compromised.

Compromise	Defensive Driving	Ride Quality	Customer Sensitivity	Bus Zone	Door Operations
1 Exceed speed limit	X				
2 Turn corners too fast, not cover brake	X	X			
3 Not pull to curb, blocks traffic				X	
4 Pass up customers—didn't see them soon enough			X	X	
5 Punch transfers, fix mirrors, eat, etc. while driving	X				
6 Push stale green lights, rush yellow lights	X				
7 Drive too fast for conditions—space, weather, etc	X				
8 Running hot	X		X		
9 Not check mirrors frequently enough—if driving too close or too fast, an operator does not have time to check mirrors	X				
10. Driving in overly aggressive manner	X				
11 Running the bus too hard, abusing brakes, using extra fuel, damaging tires	X	X			
12. Following closer than 4 seconds	X				
13. Not maintaining proper space cushions	X				
14 Stopping on opposite side of intersection from the bus stop in order to make or use the traffic light	X		X		X
15 Not using brake light early to warn vehicles to the rear that the bus is slowing or stopping	X				
16 Pulling into service stops too fast		X		X	
17 Not giving good customer service—lack of patience with elderly, disabled, etc			X		
18. Opening the door before the bus is stopped				X	X
19 Closing the door with customer still blocking right vision				X	X
20 Not watching the door until completely closed					X
21 Not keeping hand on the door handle while door is closing					X
22 Not checking the left side and mirror before moving foot from brake and moving bus	X			X	X
23 Not checking the right side before pulling out	X			X	
24 Not checking the interior mirror for disposition of customers before pulling out	X			X	
25 Pulling out with customer still standing in the stairwell—not behind the yellow line	X			X	
26. Pulling out too fast—considering type and disposition, elderly, disabled, holding packages, etc.			X	X	
27. Being too aggressive in pulling back into the flow of traffic	X			X	
28. Using door interlock to hold the bus—having foot on accelerator before door is closed	X			X	X
29. Not waiting for intending customers not directly at the bus stop		X		X	
30. Not doing good pre-trip before pullout	X				
31. Shortling if garage time to or from the end of the line is inadequate		X			
32 Not passing on road conditions, route information, vehicle defects, etc., during road relief		X			
33. Not taking necessary comfort breaks for food, water, or using the restroom					

THE TRANSPORTATION RESEARCH BOARD is a unit of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. It evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society. The Board's purpose is to stimulate research concerning the nature and performance of transportation systems, to disseminate information that the research produces, and to encourage the application of appropriate research findings. The Board's program is carried out by more than 270 committees, task forces, and panels composed of more than 3,300 administrators, engineers, social scientists, attorneys, educators, and others concerned with transportation; they serve without compensation. The program is supported by state transportation and highway departments, the modal administrations of the U.S. Department of Transportation, the Association of American Railroads, the National Highway Traffic Safety Administration, and other organizations and individuals interested in the development of transportation.

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Robert M. White is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce Alberts and Dr. Robert M. White are chairman and vice chairman, respectively, of the National Research Council.