

The Long Beach – Los Angeles Rail Transit Project

Metro Blue Line

System Operations Safety Program Plan



LOS ANGELES COUNTY
TRANSPORTATION
COMMISSION



Transit Consultants of Southern California

A Joint Venture of:

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LONG BEACH - LOS ANGELES

RAIL TRANSIT PROJECT

METRO BLUE LINE

SYSTEM OPERATIONS SAFETY PROGRAM PLAN

NOVEMBER 1989

Prepared for the

Los Angeles County Transportation Commission

by

Transit Consultants of Southern California

Project Assurance Division

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SYSTEM OPERATION SAFETY PROGRAM PLAN

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LOS ANGELES COUNTY TRANSPORTATION COMMISSION
POLICY STATEMENT

EXECUTIVE DIRECTOR'S POLICY STATEMENT
SYSTEM OPERATIONS SAFETY PROGRAM PLAN

The Los Angeles County Transportation Commission (LACTC) was organized and chartered to provide safe, reliable and effective service to the residents of Los Angeles County. Safety is a primary concern that affects all levels of LACTC activities, including planning, design, construction, testing, operations and maintenance of all rail transit systems. Therefore, all LACTC personnel and appropriate contractors are charged with the responsibility of insuring the safety of passengers, employees, property and the general public which come in contact with the LACTC systems.

The LACTC Design and Construction Directorate is empowered and authorized to develop, implement and administer a comprehensive, integrated and coordinated system safety program, including a specific plan to identify, prevent, control and resolve unsafe conditions during design, construction, testing, operations and maintenance of LACTC rail transit systems.

Accordingly, the Director, Design and Construction, is empowered to order the cessation of unsafe activities or operations which are evaluated as presenting an immediate and serious hazard within the system and to conduct unannounced inspections aimed at identifying and eliminating unsafe practices, operations and/or conditions not corrected by immediate management/supervision.

Date

Neil Peterson
Executive Director

1.0 INTRODUCTION

- 1.1 Authority
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1.0 Introduction

This System Operations Safety Program Plan (SOSPP) has been prepared to define the technical and managerial system safety activities to be undertaken by the Los Angeles County Transportation Commission (LACTC) during revenue service of the Long Beach - Los Angeles (LB/LA) rail transit system. It provides the background, description, organization, management and requirements of the LB/LA rail transit system operations safety program.

1.1 Authority

The legal entity empowered to design, construct and commission the LB/LA rail transit system is the LACTC. In 1976, enabling legislation, passed as AB 1246 (which revised Part 3 of Division 10 of the Public Utilities Code and other State of California codes) created the LACTC.

The LACTC has delegated revenue service operation of the system to the Southern California Rapid Transit District (SCRTD), which was created in 1964 by the State of California enabling legislation under Part 2 of the Public Utilities Code.

Chapter 5, Article 5, Section 30646 of the State of California Public Utilities Code empowered the California Public Utilities Commission (CPUC) to oversee and regulate the safety aspects of transit properties. Under this authority, the PUC governs the safety rules and procedures of Transit System Operators, monitors the use of safety appliances and conducts inspections to monitor adherence to the rules and procedures promulgated by Transit System Operators.

The California Occupational Safety and Health Administration (CAL/OSHA) has regulatory and enforcement power over construction activities and certain industrial activities not related to trackage and rolling stock operating on such trackage.

The California Administrative Code (CAC), Title 19, establishes that local fire jurisdictions have responsibility for fire and panic safety. Fire jurisdictions include the State of California fire marshal, the County of Los Angeles Fire Marshal and the Fire Marshals of the Cities of Long Beach, Los Angeles, Compton and Carson through which the LB/LA rail transit system passes.

The National Transportation Safety Board (NTSB) has the responsibility and authority to conduct investigations of transportation accidents and to make recommendations for corrective action at the federal level.

1.2 Purpose

This SOSPP formalizes and documents LACTC's planned actions whereby established operation safety goals and objectives can be achieved, within schedule and budget constraints. It establishes the safety philosophy for the LB/LA rail transit system and provides a means for implementing that philosophy throughout the operation of the system.

This plan has been developed to:

- o establish the safety operation program on a systemwide basis;
- o provide the medium through which the LACTC identifies its commitment to safe system operation;
- o furnish the framework for implementation of LACTC's policies for safe system operation;
- o allow for portions of safety self-certification and satisfy insurance underwriting requirements;
- o satisfy jurisdictional requirements;
- o meet or exceed transit industry practices; and,

- o provide a structured approach for recommending corrective actions to eliminate, minimize or control the potential for accidents.

The LACTC defines system safety as that state of operation which precludes the existence or creation of catastrophic and critical hazards and/or failures. This state is planned to be achieved through the coordinated management efforts of the responsible administrative and technical departments under the direction of the LACTC.

1.3 Scope

The SOSPP will be used by the LACTC as its safety guideline document during revenue service of the LB/LA rail transit system. The system elements encompass the operation personnel; the patrons; the management structure; the policies, procedures and operating rules; the fixed facilities including the yards and shops, the dedicated right-of-way, the trackway structures and the central control facility; the articulated transit vehicle; the passenger stations; the traction power substations; transit signalling and train control; street signalling and gating; the inter- and intra- facilities communications; the fire/life safety and security prevention, detection and suppression subsystems; and, landscaping.

The LACTC has delegated authority for system revenue operation to the SCRTD. The LACTC will maintain jurisdictional cognizance of the operations and the status of conditions potentially affecting safety.

The LACTC will foster established relations with the affected governmental entities and the interested citizens' groups regarding safety concerns which might arise during system operation.

Investigations and analyses in support of this SSOPP will be conducted to a level commensurate with those conditions required to achieve the identified operating system goals in revenue service.

1.4 Goals

The long range LACTC goal for the LB/LA rail transit operating system is to establish and maintain a level of safety in service which is at least comparable to the best achieved by other similar North American transit systems. To support this broad ambition, the LACTC has identified the following, realizable specific goals:

- o safe, secure and dependable revenue service for patrons;
- o security of system facilities and equipments;
- o occupational safety and well-being of system employees;
- o compliance with the safety related codes and regulations promulgated by the concerned authorities having jurisdiction;
- o maintenance and overhaul of facilities and equipments to standards consistent with design life expectancy;
- o identification, elimination, and control of potential safety hazards and failures;
- o verification of the level of safety in revenue service; and,
- o provision for appropriate actions and measures to obtain necessary safety related agreements, permits and approvals from outside agencies, where applicable.

1.5 Policies

The LACTC will verify achievement of its stated system safety operation goals by:

- o emplacement of its emergency preparedness plans and procedures;

- o reviewing and updating procedures periodically;
- o conducting periodic internal operations audits to affirm that safe practices are being followed;
- o maintaining communication links with emergency response forces;
- o conduct of accident and incident reporting and investigation;
- o inspection of facilities and equipment;
- o implementation of a maintenance data collection and reporting system;
- o adherence to developed operating rules and practices;
- o conduct of maintenance audits and inspections;
- o training and certifying operating personnel;
- o monitoring hazardous materials programs;
- o monitoring for drug and alcohol abuse;
- o identification and resolution of potential hazards and failures by means of operation hazard analyses and failure mode and effects analyses; and,
- o determination of subsystem reliability and maintainability to assure system equipment availability.

1.6 Updates

The LACTC designated officer for safety will update this SOSPP on an as required basis. Such updates will result from evaluations of program effectiveness; inputs from organizational elements; adjustments to tasks

commensurate with operations budgets and schedules; and, redesignation of personnel responsibilities, as required.

The methods by which changes, corrections and modifications can be made, as well as approval requirements, will be determined by the LACTC.

1.7 Reference Documents

The following listed documents are incorporated within this SSOPP by reference.

- (1) Rail Safety Audit Program Manual, APTA, 01 June 1989
- (2) System Safety Program Requirements, MIL-STD 882B, 30 March 1984
- (3) LB/LA RTP Design and Performance Criteria, LACTC, latest revision 6 September 1989.
- (4) LB/LA RTP System Safety Certification Plan, LACTC, November 1988
- (5) LB/LA RTP System Safety Program Plan (preliminary engineering through activation), LACTC, October 1985 and Appended July 1986
- (6) LB/LA RTP Operations and Maintenance Plan, LACTC, January 1988
- (7) LB/LA RTP Emergency Preparedness Plan, LACTC, June 1989
- (8) LB/LA RTP Rules & Procedures for Conducting Test Operations, LACTC, April 1989
- (9) LB/LA RTP Requirements for Interim Maintenance Data Collection and Reporting, LACTC, July 1989 (draft)
- (10) LB/LA RTP System Description, LACTC, revision 6, February 1987

- (11) LB/LA RTP Test Program Plan, LACTC, November 1987.
- (12) LB/LA RTP Start-up Team Safety Indoctrination, LACTC, March 1989.
- (13) LB/LA RTP Configuration Management Plan, LACTC, latest revision 16 August 1988.
- (14) Metro Red Line RTP guidelines for the preparation of Safety and System Assurance Analyses, SCRTRD, 5-001, March 1987.
- (15) C.A.R.E. - Community Assessment of Risk to Employees, presented at the American Transit Association's (APTA) 1989 Rapid Transit Conference.

2.0 SYSTEM DESCRIPTION

2.1 History

2.2 Scope of Service

2.3 Physical Plant

2.4 Operations

2.5 Maintenance

2.6 System Modifications

2.7 Organizational Structure

2.0 System Description

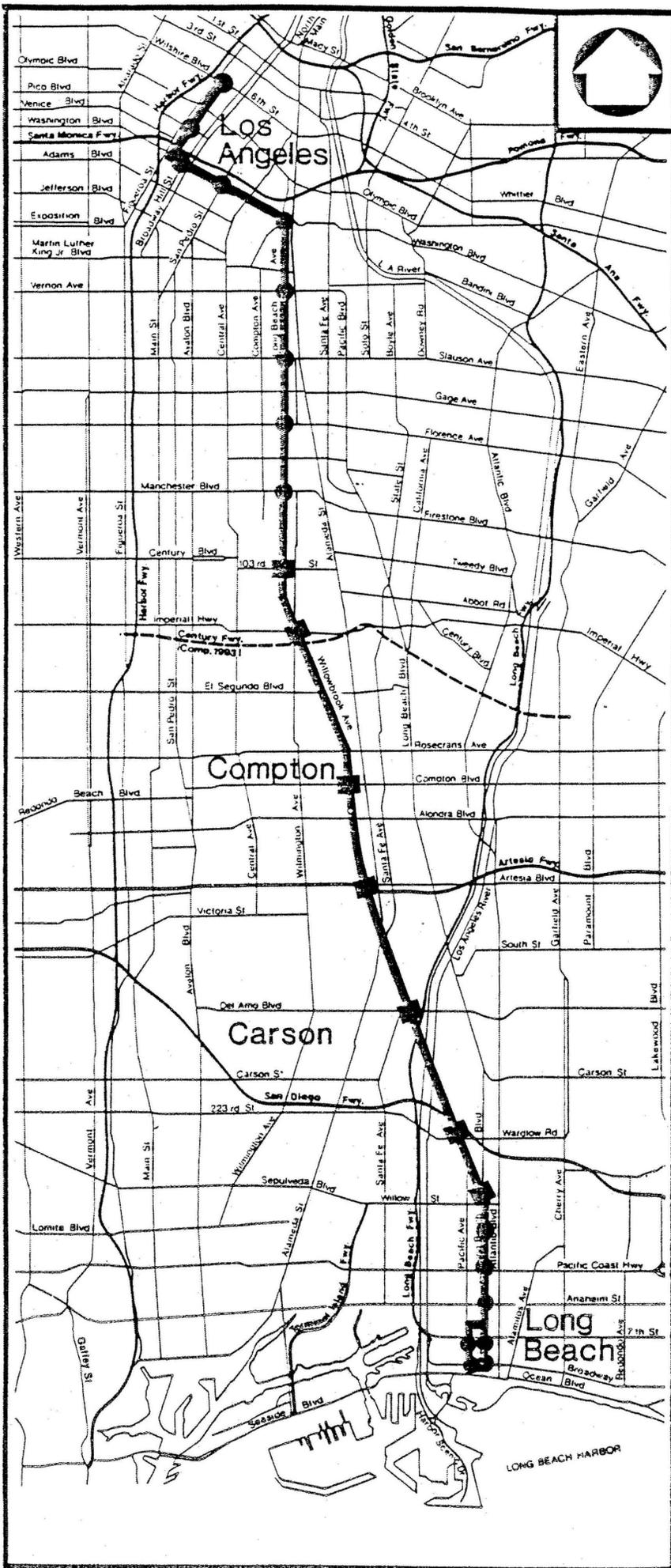
The LB/LA rail transit system is defined and the system's organizational structure is described.

The system operates between downtown Long Beach and downtown Los Angeles. It is planned to be one element of a regional rail transit system. The line is approximately 21.5 miles in length and is made up of three route segments (see Figure 2-1): downtown Los Angeles; mid-corridor; and, downtown Long Beach. It will pass through the cities of Compton and Carson and through the unincorporated areas of Florence-Graham, Willowbrook, and Dominguez Hills.

Of the total length, the large middle segment of about 15 miles will follow an existing railroad right-of-way of the Southern Pacific Transportation Company (SPTC). The system also involved relocation of approximately 12.0 miles of the railroad along much of this corridor. There are two at-grade crossings of the LRT and the SPTC. These crossings are located near the Washington Boulevard and Florence Avenue stations. The remaining 6.5 miles of the route will follow city streets at both ends with the northernmost end (approximately one mile) being in a subway in downtown Los Angeles and the southernmost end being a loop configuration in downtown Long Beach. Train movement will normally be in the forward direction on the right-hand track in double track segments and in a clockwise direction in the downtown Long Beach loop.

2.1 History

The Los Angeles County Transportation Commission (LACTC) was created by state law in 1976 to improve the transportation decision-making process in Los Angeles County. It is responsible for setting policies, establishing priorities, and coordinating activities between the various transportation operators and agencies in the county.



LEGEND

Station ●

Station with Available Parking ■

Figure 2-1

System Map

**Long Beach-Los Angeles
RAIL TRANSIT PROJECT**
LOS ANGELES COUNTY TRANSPORTATION COMMISSION

On November 4, 1980, the citizens of Los Angeles County approved Proposition A which, in part, provided for the funding, design, and construction of rail transit systems in Los Angeles County. The LACTC was given responsibility for programming these revenues for public transit improvements.

In November, 1981, the LACTC made an in-depth examination of the possibility of implementing a light rail transit system between the central business districts of Los Angeles and Long Beach. Other rapid transit opportunities in the County of Los Angeles were evaluated and their strengths and weaknesses were compared with those of a LB/LA rail transit system.

On March 24, 1982 the LACTC adopted the following action as it relates to the LB/LA rail transit system:

"The Commission will proceed with the engineering, environmental assessment, and right-of-way negotiations on the Long Beach-Los Angeles light rail line and declares its intent to construct this line, presuming costs, patronage, construction schedule, and environmental impact data, presently known, are confirmed on completion of the above activities."

Thereafter, the LACTC established the authority to design and construct the LB/LA rail transit system. Subsequent to the design/build decision, it was determined that the Southern California Rapid Transit District (SCRTD) would be the operating authority for revenue service.

On August 23, 1989, LACTC activated the Rail Construction Corporation (RCC), a subsidiary of the LACTC. The RCC is responsible for designing and constructing all rail transit systems within Los Angeles County.

Engineering of the LB/LA rail transit system was initiated in 1984 and construction was started in 1986. Activation testing began during the winter of 1989 and initial commissioning is scheduled for July 1990.

2.2 Scope of Services

The system is designed for an anticipated 54,700 passenger trips per day by the year 2000. Initially, during peak periods, service intervals are 11 minutes using 2-car trains. Ultimately, 6 minute intervals are planned. For the design year, 10 minute service intervals are planned for the off-peak periods.

Service intervals of 10 to 30 minutes are offered during holidays and weekends. During late night hours, the interval can be up to 60 minutes.

The system provides service 15 to 20 hours a day, 5 to 7 days a week, initially and 24 hours a day, 365 days a year, in the design year.

Provision is made for future expansion of capacity with modest operational disruption. The stations presently provide for 2-car trains whereas with future expansion accommodation of 3-car trains will be possible.

2.3 Physical Plant

A brief description of the LB/LA rail transit system is included in this section. More detail can be obtained from Reference Document (10).

2.3.1 Route Alignment

The alignment for the LB-LA Rail Transit Project consists of three segments.

Los Angeles Segment

The northern end of the line consists of a double-track subway structure at the 7th/Flower Street station, which is designed as a joint station with the Metro Red Line Rail Project. The line proceeds south under Flower Street and the tracks emerge from a portal located between 11th and 12th streets. From the portal, the double tracks continue at grade on the east side of Flower Street in a semi-exclusive right of way. At Washington Boulevard, the alignment turns eastward, continuing in the middle of the street toward the SPTC right-of-way at Long Beach Avenue, where the tracks turn south to begin the mid-corridor segment.

Mid-Corridor Segment

The route proceeds through the mid-corridor segment primarily at-grade in a double-track, semi-exclusive right-of-way. The mid-corridor is adjacent to, and shares the right-of-way with SPTC freight rail operations. The tracks are grade-separated at Slauson Avenue, Firestone Boulevard, Rosecrans Avenue, Dominguez Junction, Del Amo Boulevard, and Cota Crossing (over the Union Pacific Railroad). The mid-corridor segment ends at Willow Street in Long Beach, where the alignment leaves the former SPTC right-of-way (SPTC has abandoned the southern portion of this segment) to follow city streets.

The main yard and shop site and a maintenance-of-way satellite yard site are also located in this segment. The main yard is located between the Del Amo and Wardlow stations and has an ultimate storage capacity of 64 vehicles. The main yard serves as the heavy repair shop for all vehicles. The maintenance-of-way satellite yard is located just north of the Washington station.

Long Beach Segment

The route in Long Beach consists of tracks running north and south along Long Beach Boulevard in a reserved median from Willow Street to

8th Street. South of 8th Street, the route forms a single track loop running south on Long Beach Boulevard, west on 1st Street, north on Pacific Avenue, and east on 8th Street. Trains operate around the loop in a clockwise direction. The northbound track crosses the southbound track at-grade, on Long Beach Boulevard at 9th Street.

2.3.2 Stations

There are 22 stations along the line, all but four having center platforms. The center platform stations which are at grade or aerial, are neither fully enclosed nor air-conditioned, but a canopy is provided over a portion of each platform. The 7th/Flower Street subway station is a side-platform station that connects directly with the mezzanine level of the Metro Red Line Rail portion of the station. Three of the four stations on the Long Beach loop have single track platforms. Provisions are being made for the addition of a station at Hill Street in north Long Beach.

2.3.3 Vehicles

Passenger vehicles are articulated and approximately 90 feet long. Each car is equipped for independent two-way operation, with an operator's cab at each end. A single pantograph is located on the roof of each car for power collection from the overhead contact system. The capacity of each vehicle is 76 seated passengers, 107 standing passengers at normal loads and 161 standing passengers at crush loads. The vehicle fleet for the year 2000 will consist of 54 vehicles. Initially, only 33 are needed.

2.3.4 Central Control Facility

The transit system central control, police, fare inspection, and SCRTD bus dispatch functions are located in a two-story structure adjacent to the crossing of the LB/LA rail transit alignment and the I-105 freeway. The Central Control Facility (CCF) functions as the nerve center of system operations. Every aspect of mainline and station operations,

mainline maintenance activities, and any maintenance-of-way that affects mainline operation are directed, coordinated, and monitored from the CCF. The CCF serves also as a police dispatch center, police southern area substation, and the bus dispatch center for the SCRTD bus system.

2.3.5 Maintenance Yard and Shops

The main yard and shops site consists of approximately 17 acres in the City of Long Beach. The boundaries are the Long Beach Freeway, the Southern California Edison right-of-way, Carson Street and the Union Pacific Railroad right-of-way. The primary functions of the main yard and shops are to provide vehicle storage and yard operations; vehicle maintenance; and, component repairs and overhauls. The last two functions will serve several LRT lines in the overall system.

A network of roadways lead to the primary yard buildings and service roadways are provided to the train storage tracks, material storage areas and yard operational control building. The site is fenced and single-point entry for normal operations is controlled by a guard 24 hours a day.

Yard operations personnel control activities necessary to provide trains to and receive trains from mainline operations. An operations office facility on the second floor of the ancillary shop houses the train operator reporting area and operations administration. All train or vehicle movements within the yard are directed by personnel from the maintenance and yard scheduling room located on the second floor of the operations center and ancillary shops building.

Storage tracks allow efficient placement of 2-car or 3-car trains and are directly accessible to the mainline connecting trackway. The main yard is sized to accommodate a 64 vehicle fleet.

The vehicle maintenance shop is capable of providing vehicle service and inspection; heavy repair; and, component repair and maintenance.

The main shop building is sized to support heavy repair to up to 200 cars for all the LRT lines in the planned Los Angeles Basin transit network. The service and inspection facilities are sized to support 90-96 cars. Separate areas in the building are designated for the various functions and shops listed below:

- | | |
|------------------------------------|---|
| vehicle service and inspection | preventive maintenance; corrective repair; and, vehicle wash <track;< td=""> </track;<> |
| heavy repair | corrective repair; major overhaul; body repair; wheel truing; and painting; |
| vehicle and component repair shops | electronics; electrical; air conditioning; pneumatic; pantograph; machine/sheet metal; welding; truck wheel and axle; parts cleaning room; and, battery room. |

Material storage is located in the vehicle maintenance shop; and, support and administration areas are provided.

Ancillary buildings include an operations center and ancillary shops building; the vehicle washer and paint booth; and, the traction power substation. The operations center and ancillary shops have an inspection pit and an access platform for pantograph inspection. The vehicle washer contains automatic washing equipment, platforms for manual washing, wastewater treatment and recycling equipment, and storage drums for cleaning solutions. The substation provides yard traction power and electrical power to the shops.

2.3.6 Safety Features

The primary consideration in the design of the LB/LA rail transit system is to protect passenger and transit personnel from potential

accidents. These accidents might be caused by system operations or failure of system elements. Measures have been taken to eliminate or control identified potential hazards and/or failures.

The critical system elements are designed to be fail-safe; that is, the system reverts to a safe condition when failure occurs. The following list identifies the principal safety features incorporated into the design of the system.

Operations:

- o recognizable station access locations;
- o availability of maps showing water, gas and fuel line shutoff valve locations in the event of emergency conditions;
- o public address communications;
- o platform, fare collection area, concourse and station walking surfaces utilizing slip-resistant materials;
- o emergency walkways to passenger stations from the trackway;
- o station platform edges utilizing different color and texture materials to distinguish from the main platform area; and
- o emergency exits from the tunnel segment as well as from station platforms.

Guideway:

- o screening on selected overpasses to protect guideway and vehicles from objects falling or being thrown;

- o fencing along the mid-corridor segment of the guideway;
- o railroad crossing gates at mid-corridor vehicular grade crossings;
- o safety walkways throughout the tunnel and on both elevated and at-grade guideway;
- o emergency trip switches located by blue lights at traction power substations; and,
- o back-up subway station emergency power.

Vehicle:

- o handholds for passengers;
- o public address communications;
- o emergency lighting for 60 minutes upon power failure; and,
- o propulsion, brake, and operator control subsystems on vehicles interlocked to prevent undesired vehicle movements.

Signaling:

- o circuits directly related to system safety to be fail-safe; and,
- o block signaling in the midcorridor and subway segments (the street-running segments are controlled by the coordinated vehicular traffic signal system).

Escalators, Elevators:

- o status indicators provided.

2.3.8 Security Features

High levels of perceived as well as actual security are provided for passengers, employees and the general public. Enforcement is the responsibility of the dedicated Police Force and the law enforcement organizations of the communities along the system alignment. Overall security features include the following:

- o closed-circuit television cameras (CCTV) for surveillance at each station, monitored at Central Control;
- o two-way communications between patrons at stations and Central Control; between passengers and vehicle operators; and, between vehicle operators and Central Control;
- o lighted open stations;
- o intrusion alarms at traction power substations and maintenance facilities;
- o train operator on-board lead car;
- o silent alarms provided between vehicle operators and Central Control;
- o external indicators of "trouble" cars; and,
- o fare inspectors and police randomly riding the trains as well as police assigned to patrol stations in accordance with police procedures.

2.3.8 Fire/Life Safety Features

Fire prevention and protection features for people and the physical elements of the system against injury or damage due to fire, smoke, or explosions are integral to the system design. These features comply with state and local codes and regulations and federal guidelines.

Shelter stops do not require fire detection or suppression equipment. Station facilities with equipment rooms or other ancillary spaces are provided with fire detection and suppression equipment as required. Automatic fire alarms can be sounded over the public address (PA) system and manual fire alarm capability is provided by an emergency call-for-assistance telephone system. The PA system may be used also to direct station evacuations.

Emergency management panels are located at or near the main entrance of each elevated and the one subway station. These monitor the activation and location of any fire or supervisory signal generated at the station facility. The EMP enclosures contain the emergency phone to Central Control, a PA microphone, and controls to shut down any escalators. Central Control is thereby made aware of the activation of fire detection and suppression devices and will have direct phone communication with all the appropriate fire departments, police, sheriff, and ambulance services.

The emergency fans for directing smoke removal in the 7th/Flower subway station and subway section of the LB/LA rail transit are interlocked with those in the Metro Rail portion of the subway and controlled at the Metro Rail Control Center.

Signal and communication equipment rooms as well as the Central Control Facility are equipped with Halon extinguishing systems which release inert gas to extinguish fire.

The passenger vehicle is constructed of fire resistant materials. Materials known to produce excessive smoke and toxic fumes are avoided.

Vehicle equipment is located under the vehicle floor which has a one-hour fire-resistant rating. The power collection devices and braking resistors are located above the fire hardened roof of the vehicle.

2.3.9 Provisions for Disabled Passengers and Employees

The policy of the LACTC permits system accessibility to the disabled. State codes are followed which allow disabled patrons and employees who lead independent lives to use the system independently.

Ramps are provided at all at-grade stations to allow wheelchair access to the platforms. Aerial and subway stations have elevators. Equipment used by the system patrons are within reach of wheelchair users. Platforms are at the same height as the vehicle floor. Audible warning on-board the vehicles indicate when doors are to be closed.

2.4 Operations

The standard operating policies and procedures for the mobilization of the LB/LA rail transit system and for the fast, controlled and predictable responses to various types of emergencies by the appropriate public safety emergency resources are established in Reference Document (7), Emergency Preparedness plan. An emergency is defined as an incident threatening life safety or causing damage which threatens life safety in any LB/LA rail transit facility, equipment or right-of-way.

Training of system operating and maintenance personnel is an on-going activity. This activity emphasizes safety indoctrination of personnel at the operating system level to advise as to sound practices and procedures to be followed to preclude creation and existence of potential hazards and/or failures. The training activity undertaken during system activation has been established in Reference Documents (8) and (12).

Additionally, special training courses are conducted for the system operating and maintenance personnel by the principal contracted suppliers of each of the system elements, as for instance, the vehicle, the automatic train protection, the overhead catenary, the traction power substations and the communications system elements.

Mainline and tail track operations are directed from the central control facility (CCF), located at the Wilmington/I-105 intersection adjacent to the Imperial Highway station. Communication links between central control, fixed facilities, and trains include telephones, radios, CCTV, a public address system, and a data transmission system. Yard control personnel, located at the main yards and shops in Long Beach near the Long Beach Freeway and Carson Street, are responsible for all train movements within the yard area.

The system can operate seven days per week, 24 hours per day, ultimately. Closing the system down during midnight hours is not precluded. Trains operate with consists of 1 or 2 vehicles, depending upon service demand. The length of some city blocks in downtown Los Angeles and in Long Beach limits the maximum train length to two vehicles. The operation of three-car trains requires approval of the appropriate municipality.

Peak-hour, adjusted peak-link volume patronage is estimated to be 2,864 in design year 2000 and 1,862 in the initial yard 1990. An average peak-period seated-to-standee loading ratio of 1:1 (76 seated + 76 standing = 152 passengers per vehicle) is desirable to avoid overcrowding and to allow reasonable fare inspection capability.

During normal operations, except for trains entering or leaving the mainline during service level transition periods, trains carry passengers over the entire length of the system for each trip, stopping at each of the stations. The normal direction of traffic is on the right-hand track in the direction of travel. Trains run between stations at the maximum speeds consistent with safety, civil speed

limitations, passenger comfort, and vehicle and signal equipment performance levels during all hours of system operation.

Scheduled intermediate turnback (short turning) operation are not planned for the basic LB-LA route. However, patronage projections for future line extension may warrant intermediate turnback operations. Routine intermediate turnback operations may be accommodated at certain mid-corridor stations (Washington to Willow) which have the necessary special trackwork.

All normal mainline train operations, including all operations at pocket tracks and terminal station tail tracks are to be performed under the authority and direction of central control personnel in accordance with established operating schedules, rules, and procedures.

Abnormal mainline operations usually result from equipment failures (either vehicle or wayside) and incidents that hinder system performance and disrupt operations beyond normal schedule recovery capabilities. The impact that these failures and incidents have upon operations is influenced by the following factors:

- o nature of failure;
- o location of failure;
- o headways operated at time of failure; and,
- o strategy used to recover from the failure.

Failure recovery response procedures will be developed for situations where:

- o a train cannot move;

- o a train can move, but at reduced speed;
- o a train can move in one direction only;
- o track segment outage occurs due to loss of overhead catenary voltage or voltage insufficient for propulsion;
- o track segment outage occurs due to defective track or failure of a signal component;
- o train derailment occurs;
- o track blockage results from vandalism or accident involving nontransit vehicles;
- o fire occurring on, or adjacent to the transit system trackway; and,
- o suicide or attempted suicide curtails operations.

Detailed system operation features are delineated in Reference Documents (6), Operations and Maintenance Plan, and (7), Emergency Preparedness Plan.

2.5 Maintenance

The philosophy for vehicle and wayside maintenance has been established. Defined are the basic functional requirements, personnel, equipment, and facilities associated with:

- o vehicle maintenance;
- o vehicle and wayside component repair and overhaul;
- o vehicle and wayside support and administration; and,
- o maintenance-of-way (located at the Metro Red Line Rail yard and shop site).

Additional details are provided in Reference Document (6).

Controlled maintenance over the life of a system is economical, conducive to manageable operating costs, and contributes to availability of facilities and equipment. An efficient systemwide maintenance program has been developed with consideration given to interfaces with mainline revenue operations. Functionally, the maintenance organization established is a service organization responsible for making available to operations, on a timely basis, the facilities and equipment necessary to perform intended functions safely, efficiently, and economically.

The primary features of the LACTC maintenance program are:

- o assurance that safety, comfort, satisfaction, and convenience of passengers and employees is promulgated;
- o adequate protection of property is provided;
- o system downtime is minimized; and,
- o operating costs are acceptable.

To achieve these primary features, the maintenance practices outlined in the following paragraphs are employed.

Preventive maintenance, which includes routinely scheduled tasks such as lubrication, cleaning, replacing filters and electrical inspection, is stressed in order to:

- o reduce service failures and resultant corrective maintenance;
- o prolong equipment life;

- o provide for inspection to ensure operational safety and system dependability;
- o minimize system maintenance costs; and,
- o optimize shop loading schedules.

Corrective maintenance as practiced consists of troubleshooting, repairing failed equipment, and returning the equipment to service. The goal of corrective maintenance is to return a failed piece of equipment into service as quickly as possible in order to minimize system downtime and to reduce the time required to restore operational service. To accomplish this goal, corrective maintenance provides two distinct methods for troubleshooting and repairing system elements and elements subsystems.

The restoration to service of a failed system element is accomplished, where possible, by a technique called unit exchange. This involves exchanging the lowest level replaceable unit. When a system element fails, diagnostic technicians respond to the failure and correct the problem, if possible, by replacing the failed unit from a supply of like units previously tested and adjusted to perform the intended function. Unit exchange requires that equipment and facilities be designed and configured so that repairs can be accomplished in this fashion and that provisions are made in manufacturing to assist the diagnostic technician in quickly and effectively determining the problem. This involves incorporation of special fault indicators, portable test equipment and a supply of critical replacement units.

Corrective maintenance of assemblies or components consists of troubleshooting and repairing failed assemblies or components and then testing and adjusting the assemblies or components to meet the intended function and to ensure the correctness of the repair. To accomplish the corrective maintenance of failed assemblies or components, equipment and facilities are provided so that repairs and overhaul activities are accomplished in the component repair shop under

conditions of efficient shop layout, cleanliness, competent supervision, adequate testing and quality control.

Testing is accomplished by the use of test apparatus configured to perform static and dynamic testing at the vehicle or wayside system level; and, static bench testing at the subsystem and assembly levels. This achieves the following objectives:

- o ensures proper function of items under test;
- o provides for timely and accurate failure diagnosis; and,
- o reduces the time required to restore equipment to serviceable conditions by identifying the lowest-level, failed replaceable component.

In certain instances, it is more cost effective to have assembly or component repair and overhaul work performed by service contracts. The degree to which component or assembly repair and overhaul work is contracted out to local service shops or to the original equipment manufacturers is determined based on the following factors:

- o LACTC policies and practices;
- o availability of suitable contractors;
- o logistics, inventory, and material-handling requirements;
- o labor agreements;
- o special equipment requirements and costs;
- o availability of special skills and workload of District forces;

- o liability implications;
- o equipment warranty implications; and,
- o relative costs.

Maintenance scheduling maintains all vehicle and wayside workload schedules (preventive maintenance, corrective repairs, overhauls and modifications). This function coordinates maintenance requirements with operations, engineering, and inventory control personnel to ensure availability of vehicles; wayside elements; parts and materials; and, the resolution of problems. Maintenance scheduling maintains also all vehicle and wayside maintenance records and documentation and provides the backup for the preparation of the annual maintenance budgets. In conjunction with this, maintenance scheduling provides the interface with the Operator's maintenance information system (Reference Document (9) for the LB/LA rail transit system maintenance data.

2.6 System Modifications

This subsection is TO BE DEVELOPED by a joint LACTC/SCRTD coordinating committee using the following APTA guidelines (Reference Document (1)):

"An overview of the manner in which safety is assured in connection with modifications and changes to the system should be provided.

The transit system should describe the process for system modification. This would include how changes are developed, implemented, documented, and evaluated for their impact on the safety of system elements and the overall system. It would also include a description of the lines of authority, levels of responsibility, and inter- and intra-

organizational interfaces during the change process.

The modification and change process should be addressed from the hardware and software as well as capital and operating perspectives. This is to assure that the impact on safety is not overlooked regardless of whether modifications are being made to such elements of the system as, for example, train control, and rules and procedures. Any modification to the system has the potential for impacting safety. Thus an important part of this subsection will be a description of how the transit organization evaluates proposed modifications for their safety criticality. This initial evaluation often determines the subsequent attention that is given to safety in the modification process."

2.7 Organization Structure

This subsection is TO BE DEVELOPED by a joint LACTC/SCRTD coordinating committee using the following APTA guidelines (Reference Document (1)):

"The transit system should provide or reference:

- o detailed organization diagrams along with the title of each position;
- o a separate chart that details the structure of the System Safety Unit and identifies the key positions at all levels; and,

- o diagrams showing the relationship and lines of communications between the System Safety Unit and other units of the organization.:

In addition, the organization charts may show the relationship of the transit system to the representatives of the various political jurisdictions through which the fixed guideway transit system operates."

System operation safety is assured by formal system safety management and safety assurance accountability vested in the LACTC/SCRTD designated System Safety Unit. Principal activities include authority to:

- o order cessation of unsafe activities or operations which are evaluated as presenting an immediate and serious hazard within the total transit system;
- o conduct unannounced inspections aimed at identifying and eliminating unsafe practices, operations or conditions not corrected by immediate management/supervision;
- o enforce provisions of the System Operations Safety Program Plan and applicable safety related rules, regulations and codes;
- o analyze safety procedures, methods of operation, maintenance and emergency procedures, hazardous situations to assure a safe operating and working environment; and, subsequently, submit results with recommendations to involved departments and the Executive Director;
- o assure that training is conducted for all personnel as well as review all training plans for the inclusion of safety for all departments;

- o conduct periodic inspections of all locations, identify and report problem areas, issue recommendations, brief appropriate managers, and follow up on all inspections for compliance;
- o investigate all major accidents and fires, as well as random choice accidents and repetitive accidents/incidents by either location or type of accident;
- o Review, advise and recommend procedural rulings, changes, modifications;
- o define tasks which could result in controlling or reducing the number of hazards;
- o develop rules/procedures and identify requirements for development of rules/procedures;
- o provide for hazards identification and analyses;
- o coordinate workmen's compensation interests (administered by LACTC/SCRTD Risk Management) with system safety interests and participate with Risk Management for reduction of claims; and,
- o report regarding system operations safety to other agencies as required or appropriate.

Functions other than those which are within the direct authority and responsibility of the designated System Safety Unit involve the following:

- o overall system operation management;
- o purchasing;

- o employee relations;
- o training;
- o risk management;
- o union/management relations; and,
- o the system operations safety review board.

3.0 SYSTEM SAFETY UNIT ACTIVITIES

3.1 Management

3.2 Methodology

3.2.1 System Considerations

3.2.2 Hazard Identification

3.2.3 Hazards Assessment

3.2.4 Hazards Resolution

3.3 Safety Tasks

3.4 Tasks' Matrix

3.0 System Safety Unit Activities

This Section describes the System Safety Unit's responsibilities and how it is organized and staffed to carry them out. It states job requirements of staff members and the scope of their responsibilities. It describes some of the techniques and methodologies that should be utilized in fulfilling safety responsibilities. This Section also sets forth the tasks that are the responsibility of the System Safety Unit, and presents a schedule, or matrix, for their accomplishment.

Section 3.0 and 4.0, together present a practical approach to assuring that the System's Safety Unit responsibilities are fulfilled. While local conditions and requirements may dictate variations in organization and division of responsibilities, the System Safety Unit must be able to demonstrate that these responsibilities are being met.

3.1 Management

This Subsection is TO BE DEVELOPED by a joint LACTC/SCRTD coordinating committee using the following APTA guidelines (Reference Document (1)):

"The responsibilities of the system safety unit are set forth and the relationship of the unit to the transit organization as a whole is described. Interfaces are delineated, as are chain-of-command and authority."

3.2 Methodology

The accomplishment of the goals and objectives of the LACTC System Operations Safety Program Plan (SOSPP) are realized through the use of proven system safety techniques and analyses. The System Safety Unit, along with other operator managers, organizations and

departments and selected Los Angeles County agencies, has developed a safety methodology and will undertake certain tasks as required to assure that the use of the techniques and the systematic analyses contribute to achievement of the safety goals and objectives.

The methodology employed, along with specific system safety tasks, provides for a systematic method of identifying, analyzing, assessing and resolving the causes of accidents. The application of proven hazards identification methods permits the timely identification, elimination or control of hazards and/or failures.

The products of this system safety methodology will be provided to management. This information will include the identification of hazards and faults as well as the probable cause and effects. By evaluating causes, conditions, and combinations thereof, together with the resolutions available, informed management decisions can be made. The methods for hazard identification, assessment, resolution, system safety activities, trend analysis, failure reporting and accident rate analysis are outlined below.

The basis for development of the methodology presented is MIL-Std 882B, Reference Document(2), and is incorporated also in the LACTC's LB/LA System Safety Program Plan, Reference Document (5), which addresses the LB/LA system implementation phase.

3.2.1 System Considerations

The LB/LA rail transit system is comprised of employees, patrons, rolling stock, hardware, fixed facilities, procedures, and the environment. Each operational system element can be described in terms which identify performance expectations under design conditions for normal, abnormal and emergency operations as previously described in Section 2.0.

3.2.2 Hazard Identification

One objective of hazard identification activities is to define those conditions and faults which have the potential for causing an accident. Two basic methods exist for orderly and thorough identification of hazards:

- o inductive hazard identification; and,
- o deductive hazard identification.

The inductive process involves the analysis of system components and associated failure states to identify effects on the total system. Failure states are identified as conditions such as: fails to open, fails to close, opens when not required and closes when not required.

The deductive hazard identification process involves defining an undesired effect and then deducing the combination of conditions or faults of the system and the causes necessary to produce that effect.

Experience from other transit systems are also sources of input information which aid both the inductive and deductive processes.

INDUCTIVE HAZARDS ANALYSIS

The techniques for inductive hazard resolutions are:

- o preliminary Hazards Analysis (PHA) Figure III-1
- o subsystem Hazards Analysis (SSHA) Figure III-2
- o interface Hazards Analysis (IHA) Figure III-3
- o operating Hazards Analysis (OHA) Figure III-4

FIGURE III-1

PRELIMINARY HAZARDS ANALYSIS

SYSTEM XYZ LRT SYSTEM
SUBSYSTEM TITLE WAYSIDE SIGNALING

PROPERTY NAME
PRELIMINARY HAZARD ANALYSIS

REVISION ____ DATE _____

PREPARED BY _____

PAGE _____ OF _____

HAZARD	CAUSE OF HAZARD	TRIGGERING EVENT	POTENTIAL ACCIDENT	HAZARD CATEGORY	POTENTIAL ACCIDENT PREVENTION MEASURES	RESOLUTION
SIGNAL DISPLAYED IMPROPERLY	TRACK CIRCUIT MALFUNCTION	TRAIL TRAIN MOVES INTO OCCUPIED CONTROL AREA	REAR-END COLLISION	1	MAKE CERTAIN FAIL-SAFE PHILOSOPHY IS PROPERLY APPLIED IN CONJUNCTION WITH FULL ANALYSIS OF EQUIPMENT RELIABILITY PROPERTIES	

The PHA is the initial, comprehensive, qualitative analysis performed during the design phase. Information from the analysis is used in the development of safety criteria and requirements to be included in an equipment or performance specification as shown on Figure III-1. A PHA may be used as a basis of a follow-on subsystem hazards analysis. The PHA may be performed in a narrative or matrix format, depending on the availability of definitive drawings, specifications and other data specifying functional system element characteristics.

The SSHA is an expansion of the PHA, to the component level. It allows determination, from a safety point-of-view, the functional relationships of the components and equipment comprising a subsystem. The analysis identifies the components and equipment whose performance degradation or functional failure could result in hazardous conditions. The analysis includes hazard modes as depicted in Figure III-2 that occur in the subsystem components (the SSHA has also been referenced to as a Fault Hazard Analysis (FHA) and a Hazard Modes and Effects Analysis (HMEA) in various publications). This type of analysis may be based upon and developed in conjunction with a reliability Failure Modes and Effects Analysis (FMEA) which is performed for reliability and maintainability purposes.

The IHA is an analysis which defines the safety integration or interface requirements of the total system and was previously known as a System Hazards Analysis. It is performed with regard to subsystem interfaces to determine the potential safety problem areas of the total system. Figure III-3 depicts the IHA format.

The OHA is an analysis that is performed to determine operational safety requirements for personnel, procedures and equipment, applicable during the system revenue operation life-cycle. Recent UMTA guidelines changed the previous term of Operations Hazards Analysis to the current term Operating Hazards Analysis. Engineering data, procedures and instructions developed from the engineering design and initial test program are used in support of this effort. The OHA format is depicted on Figure III-4.

FIGURE III-2

SUBSYSTEM HAZARDS ANALYSIS

PROPERTY NAME

REVISION DATE

SUBSYSTEM TITLE WAYSIDE SIGNALING

SUBSYSTEM HAZARD ANALYSIS

PREPARED BY

PAGE OF

HAZARD	CAUSE OF HAZARD	TRIGGERING EVENT	POTENTIAL ACCIDENT CATEGORY	POTENTIAL ACCIDENT HAZARD	PREVENTION MEASURES
WAYSIDE SIGNAL IMPROPERLY DISPLAYED	AMPLIFIER GAIN INCREASE RELAY FAILURE	TRAIL TRAIN MOVES INTO OCCUPIED CONTROL AREA	REAR-END COLLISION	RECEIVER COUPLING TION MUST USE FAIL-SAFE DESIGN	USE NON-WELDABLE CONTACTS: DESIGN FOR KNOWN MINIMUM PICK-UP VOLTAGE

FIGURE III-3

INTERFACE HAZARDS ANALYSIS

SYSTEM XYZ LRT SYSTEM
 SUBSYSTEM TITLE VEHICLE
 SUBSYSTEM TITLE WAYSIDE SIGNALING

PROPERTY NAME

REVISION DATE

INTERFACE HAZARD ANALYSIS

PREPARED BY

PAGE OF

HAZARD	CAUSE OF HAZARD	TRIGGERING EVENT	POTENTIAL ACCIDENT	HAZARD CATEGORY	POTENTIAL ACCIDENT PREVENTION MEASURES	RESOLUTION
TRAIN DOES NOT SHUNT TRACK CIRCUIT	EFFECTIVE SHUNT RESISTANCE TOO HIGH	TRAIL TRAIN MOVES INTO OCCUPIED CONTROL AREA	REAR-END COLLISION	1	DEVELOP PROCEDURES TO PERIODICALLY CLEAN RAILS WELD STAINLESS STEEL BEADS ON INFREQUENTLY USED RAIL SPECIFY LOW RESISTANCE FOR TRUCK	

In conjunction with conduct of the OHA, Sneak Circuit Analysis is conducted on hardware and software to identify latent (sneak) circuits and conditions that might inhibit desired functions or cause undesired functions to occur, without a component having failed. The analysis employs recognition of topological patterns which are characteristic of circuits and electrical/electronic systems.

DEDUCTIVE HAZARD ANALYSIS

A technique for conduct of deductive analysis is the fault tree analysis as depicted on Figure III-5. It is an analytical tool used to evaluate events, faults, and occurrences as well as their combinations that could cause or contribute to the occurrence of a defined undesired event. A qualitative or quantitative analysis may be conducted.

3.2.3 Hazards Assessment

The purpose of hazards assessment activities is to determine the acceptability of assuming the hazard risk or to determine the necessity of recommending corrective measures. System safety hazard assessments may include specific input reviews and comments from appropriate organizational departments. Safety, along with cost, schedule, potential losses and impact of perceived safety is considered in these assessments.

The categories of potential hazards based on MIL-STD-882B are as follows.

CATEGORY I: CATASTROPHIC - operating conditions are such that personnel error, environment, design deficiencies, subsystem or component failure or procedural deficiencies may cause death or serious injury to personnel or major system loss, thereby requiring immediate cessation of the unsafe activity or operation.

FIGURE III-4

OPERATING HAZARDS ANALYSIS

SYSTEM/SUBSYSTEM VEHICLE TRAIN CONTROL
 ACTIVITY RECALIBRATION OF TACHOMETER AFTER
INSTALLATION OF NEW WHEELS

PROPERTY NAME
 OPERATING HAZARD ANALYSIS

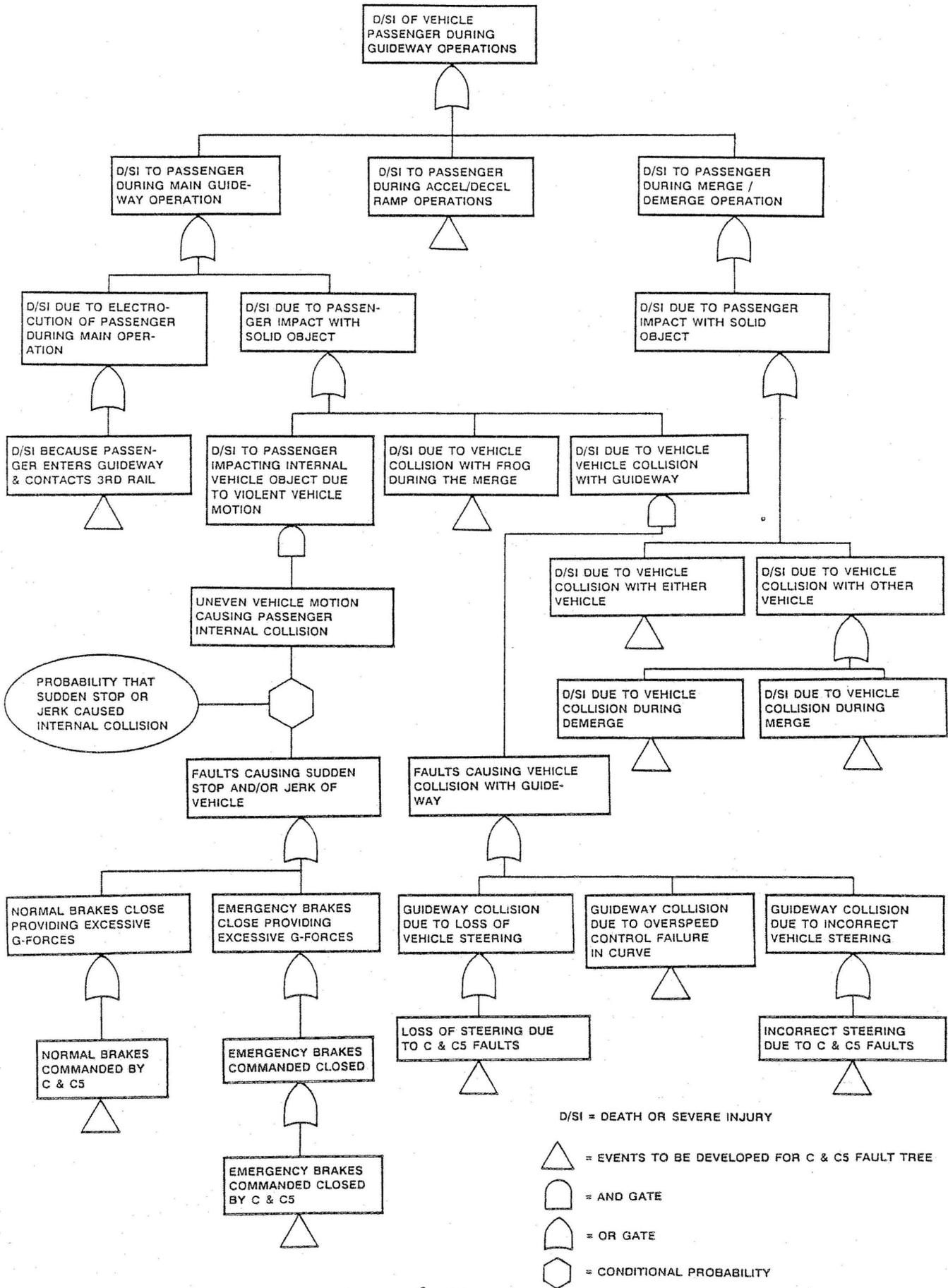
REVISION ____ DATE _____

PREPARED BY _____

PAGE _____ OF _____

TASK NUMBER	TASK DESCRIPTION	HAZARD	POTENTIAL ACCIDENT	HAZARD CATEGORY	POTENTIAL ACCIDENT PREVENTION MEASURES	PROCEDURE NUMBER	RESOLUTION
(1)	MEASURE DIAMETER OF WHEEL	INCORRECT MEASUREMENT MEASURED WHEEL FROM WRONG AXLE	DERAILMENT	1	CHANGE PROCEDURE TO INCLUDE: - CHECK BY 2nd PERSON - INSTRUCTION ON WHICH WHEEL TO MEASURE	001	PROCEDURE 001 CHANGED
(2)	DETERMINE TACHOMETER COMPENSATION FROM WHEEL WEAR TABLE	TABLE READ INCORRECTLY	DERAILMENT	1	CHANGE PROCEDURE TO INCLUDE: - CHECK BY 2nd PERSON	001	PROCEDURE 001 CHANGED
(3)	OPEN DOOR TO TRAIN CONTROL EQUIPMENT			-		001	-
(4)	SET WHEEL WEAR COMPENSATION SWITCH TO PROPER SETTING	SET WRONG SWITCH	DERAILMENT	1	CHANGE PROCEDURE TO INCLUDE: - CHECK BY 2nd PERSON	001	PROCEDURE 001 CHANGED
(5)	CLOSE DOOR TO TRAIN CONTROL EQUIPMENT			-		001	-

FIGURE III - 5
FAULT TREE ANALYSIS (FTA)



CATEGORY II: CRITICAL - operating conditions are such that personnel error, environment, design deficiencies, subsystem or component failure or procedural deficiencies may cause personnel injury or major system damage thereby requiring immediate corrective action.

CATEGORY III: MARGINAL - operating conditions may cause minor injury, minor occupational illness or minor system damage such that personnel error, environment, design deficiencies subsystem or component failure or procedural deficiencies can be counteracted or controlled without major personnel injury or major system damage.

CATEGORY IV: NEGLIGIBLE - operating conditions are such that personnel error, environment, design deficiencies, subsystem or component failure or procedural deficiencies will not result in personnel injury or system damage.

The probability that a hazard will occur during the planned life expectancy of the system can be described as probable occurrences per unit of time, events, population, items, or activity. A qualitative hazard probability may be derived from research, analysis, evaluation of safety data derived from LB/LA rail transit system operating experience or historical safety data from similar systems. Supporting rationale for assigning a hazard probability will be documented in the operation hazard analysis reports when developed. An example of qualitative hazard probability characterization is shown in Table III-I.

3.2.4 Hazards Resolution

The best method of resolving potential system hazards is to eliminate them. However, this may at times be impossible or impractical. Determination of the method to be employed can be made by conducting a thorough analysis of the system, considering the possible trade-offs between various alternatives and the system safety requirements. The philosophy dictating these analyses should result in the

TABLE III-1

HAZARD PROBABILITY CLASSIFICATIONS
(Source: M/L - STD 882B)

Descriptive Word	Level	Specific Individual Item	Fleet or Inventory
Frequent	A	Likely to occur frequently	Continuously experienced
Reasonably Probable	B	Will occur several times in life of an item	Will occur frequently
Occasional	C	Likely to occur sometime in life of an item	will occur several times
Remote	D	So unlikely, it can be assumed that this hazard will not be experienced	Unlikely to occur but possible
Extremely Improbable	E	Probability of occurrence cannot be distinguished from zero	So unlikely, it can be assumed that this hazard will not be experienced
Impossible	F	Physically impossible to occur	Physical impossible to occur

resolution of alternatives. For example, MIL-STD-882B specifies actions to satisfy such requirements. In the order of precedence these are:

- design or redesign for minimum hazards;
- use of safety devices;
- use of warning devices; and,
- develop special procedures.

Prior to discussion of the use of precedence for the control of system hazards, it is necessary to point out the inherent need in basic design for consideration of man's limitations as an operational constraint. The frequency of occurrences of accidental behavior which results in damaged equipment or personnel injury is directly related to human errors that might be committed during the operation and maintenance of equipment. General knowledge about human errors permits the reduction of these occurrences by imposing appropriate human factor constraints on system design.

There have been various methods used to determine risk assessment due to hazards. One such method used successfully is described in Reference Document (15). When developing its procedures, the LB/LA rail transit system operator may find the approach described appropriate.

The choice of method to be used to resolve or minimize the effects of a potential hazard are dictated by design complexity, operational requirements, economic restrictions or other system factors. A discussion of four possible actions which may be used follows.

DESIGN OR REDESIGN FOR MINIMUM HAZARDS

The probability that the system will enter a hazardous mode can be reduced or minimized during design or redesign, depending on the system design function, by considering fail-safe devices and features in design or redesigning to achieve high system reliability.

Fail-safe features are incorporated to cause the system to transfer from a high loss or risk mode to a lower loss or risk mode upon the occurrence of a component failure. The inclusion of a fail-safe device does not reduce the probability of occurrence of failure, but alters the nature or magnitude of the loss or risk. Care must be taken to ensure that the alternate mode of failure does result in an acceptable loss or risk. The advantage of using fail-safe devices is that components, circuits or subsystems need not be duplicated to provide an acceptable loss or risk level.

The frequency of occurrence of a failure can be reduced by increasing component reliability. High reliability can be a function of such factors as the design of the components, the manufacturing process, the degree and type of quality control and how long a component has been stored in relation to its shelf life. When higher reliability is required, an alternative to increasing component reliability is to provide redundant components.

USE OF SAFETY DEVICES

Safety devices are incorporated to reduce the magnitude of the loss or risk once a hazardous mode has occurred. These include interlock switches, protective enclosures, safety pins for instance. Care must be taken to ascertain that the operation of the safety device reduces the loss or risk and does not introduce additional hazard. Safety devices should permit the system to continue to operate in a limited manner.

USE OF WARNING DEVICES

Failure warning devices of systems are technically an audio/visual portion or a fail-safe system in which the human is the responder. The effectiveness of any failure warning system is additionally dependent on the human's ability to perceive and react.

PROCEDURES AND TRAINING

The frequency of occurrence of a hazardous event can be reduced by defined operating procedures which are properly enforced and by an explicit training program in the use of the operating procedures. The training required to obtain a desired level of operational skill is a function determined by the complexity of the task and the receptiveness of the person to the training effort.

The magnitude of the loss or risk, once the hazardous mode has been entered, may be minimized by prompt and accurate execution of specific emergency procedures by trained and qualified personnel in those cases where time and circumstances permit corrective or remedial action. Where it is impossible to eliminate or adequately control a hazard through design selection or use of safety and warning devices, procedures and training are used to control the hazard.

Procedures may include the use of personal protective equipment. Precautionary notations are standardized where required or whenever possible. Safety critical tasks and activities may require certification of personnel proficiency, as determined by the designated Officer of the System Safety Unit.

3.3 System Safety Tasks

The information contained in this subsection defines the tasks and subtasks of the System Operation Safety Program defined in this SOSPP. This plan will be reviewed and updated periodically by the

designated organizational System Safety Unit to identify expansion and modification of task activities as and if required. Activities listed are for identification purposes and implementation occurs as required by the System Safety Unit. Certain system safety tasks have been implemented prior to the development of this SOSPP. Thus, the Schedule matrix exhibited in subsection 3.4 displays schedule goals.

The activities being conducted and to be conducted during the LB/LA rail transit system revenue operation are as follows:

- o conduct transit system safety coordination to ensure that safety information is passed to all sections of the organization;
- o represent the transit system at safety meetings seminars and other transit systems, and ensure that the information gained at these meetings is made available to other affected divisions or sections of the transit system's organization;
- o conduct or participate in all accident and incident investigations to ensure that the safety implications of accidents or incidents are investigated;
- o collect and exchange safety data with other transit systems;
- o review maintenance records and failure reports and analyses to identify safety problems related to maintenance actions (formal safety analysis techniques are often used in such reviews);
- o develop corrective actions and assist in the evaluation of solutions to the safety problems uncovered through analyses and failure report data (such corrective actions should be tracked to completion);
- o participate in training activities to assure that safety elements are part of the curriculum and that safety information is disseminated to all affected employees;

- o perform appropriate analyses to assist in identifying and resolving hazards involving those related to maintenance, operation, and accident/incident investigation;
- o update the System Operation Safety Program Plan on a periodic basis;
- o conduct safety inspections and perform system safety audits on a regular basis to monitor system-wide compliance with this SOSPP;
- o provide liaison with outside emergency response organizations and assist in such activities as familiarization training and emergency preparedness drills;
- o develop/update safety rules and procedures, including emergency preparedness plans;
- o assure awareness of and compliance with pertinent legislation, regulations, and standards; and,
- o evaluate proposed system modifications from the safety perspective.

3.4 Task' Matrix

The matrix presented in Table III-2 identifies principle activities, interfaces with other units and expected reporting intervals.

TABLE II-2

Interfaces, and Key Activities
Safety Unit Tasks

	INTERFACES				ACTION	FREQUENCY			
	Opns	Maint	Admin	Other		day	month	Qr/An	Other
Coordination/Coord. Comm. Mtgs.	X	X	X	X	RPT/ REC			QTR (min)	
Interagency Coord./ Seminars, Info exchange	X	X	X	X	RPT/ REC				as reqrd
Accident/Incident Investigation	X	X	X	X	RPT/ REC				as reqrd
Data Exchange	X	X	X	X	RPT		X	QTR ANNL	
Review Maintenance & Failure Data	X	X		X		X			
Hazard Identification & Resolution	X	X	X	X	RPT/ REC				as reqrd
Training	X	X	X	X			X	ANNL	
Deductive Analyses	X	X		X	RPT/ REC				as reqrd
Inductive Analyses	X	X		X	RPT/ REC				as reqrd
System Operations Safety Program Plan Revision	X	X	X		REC			ANNL (min)	
Inspection/Audits	X	X		X	RPT/ REC		X		
Emergency Response Liaison	X	X		X	RPT/ REC		X		as reqrd
Develop/Update SOP's & Emergency Plans	X	X		X	RPT/ REC				as reqrd
Assure Compliance with Regs & Standards	X	X		X	RPT/ REC				as reqrd
Review Proposed System Modifications	X	X	X	X	RPT/ REC				as reqrd

RPT/REC: report and recommendations.

4.0 SAFETY RELATED ACTIVITIES OF OTHER UNITS

4.1 Safety Related Tasks

4.2 Task Matrix

4.1 Safety Related Tasks

The safety-related tasks which are to be accomplished by other units of the organization are identified. Included are training, personnel, procurement, management oversight, security, operations, and maintenance. Safety is the responsibility of all and each segment of the organization, each continuously contributing to the total System Safety Operations Program.

The following list represents the types of task which are assignable to other sections of the organization. Tasks should be developed for each unit to be treated separately in the Program Plan.

The principal inter-and intra-organizational tasks are as follows:

- o prepare failure and unsatisfactory condition reports on problems, failures and unsatisfactory conditions encountered during normal operations to ensure that appropriate elements are notified of the problem and corrective actions are undertaken;
- o conduct analyses of failures to determine the cause or causes for the failures and to identify where corrective actions are warranted;
- o develop corrective action requirements by determining trends or failure patterns;
- o conduct operator training and refresher training to ensure that all operator personnel are continuously aware of the hazards in the system and of the correct actions to take in an emergency;
- o conduct maintenance training and refresher training to ensure that all maintenance personnel are aware of the safety hazards in performing maintenance tasks;

- o participate in investigations of accidents and incidents by assigning a qualified representative to the accident/incident investigations;
- o conduct emergency and disaster plan evaluation and training to identify problems in implementing the plans, to ensure knowledge of these plans by the transit system staff and to maintain the proficiency of appropriate emergency personnel;
- o develop/update operating, maintenance and emergency rules and procedures;
- o implement and maintain compliance with pertinent legislation, regulations and standards;
- o maintain configuration control for all safety-critical systems and subsystems; and,
- o evaluate proposed system modifications from the safety perspective.

4.2 Tasks Matrix

The responsibilities, interfaces and key activities of safety related tasks involving other organizational units than the Safety Unit are identified in the matrix presented as Table IV-1, following.

TABLE IV-1

**Responsibilities, Interfaces, and Key Activities
Safety Related Tasks of Other Organizational Units**

	RESPONSIBILITIES				ACTION	INTERFACES			
	Opns	Maint	Admin	Other		Opns	Maint	Admin	Sfty
Safety Coordination/ Coord. Comm. Mtgs.	X	X	X	X	RPT/ REC	X	X	X	X
Unsatisfactory Cond/ Failure Reports	X	X	X	X	RPT	X	X	X	X
Failure Analyses	X	X	X	X	RPT/ REC	X	X	X	X
Hazard Identification and Resolution	X	X	X	X	RPT/ REC	X	X	X	X
Develop Corrective Actions	X	X	X	X	RPT/ REC	X	X	X	X
Operator Training: Initial & Recurrent	X			X			X	X	X
Maintenance Training: Initial & Recurrent		X		X		X		X	X
Accident/Incident Investigation	X	X	X	X	RPT/ REC	X	X	X	X
Emergency Procedures: Development/Training	X					X	X	X	X
Audits/Quality Checks			X		RPT	X	X		X
Devlop/Revise Rules & SOP's	X	X				X	X	X	X
Compliance with Regs & Standards	X	X	X					X	X
Configuration Management		X		X	RPT				X
Preventive Maint. & Plant Insp. Document	X	X			RPT				X
Review Proposed System Modifications	X	X	X	X	REC	X	X	X	X

RPT/REC: report and recommendation.

**5.0 SYSTEM SAFETY OPERATION PROGRAM PLAN
IMPLEMENTATION AND MAINTENANCE**

5.1 Program Schedule

5.2 SOSPP Update

5.3 Safety Audits

5.0 SOSPP Implementation and Maintenance

Implementation of the System Operations Safety Program Plan will assure that safety is an integral and continuous part of planning, specification, design, test, operation, maintenance, construction, procurement and disposal activities. Plan updates, audits and reviews, and the development of directives, guidelines and instructions to implement the provision of this plan are described.

5.1 Program Schedule

The detailed schedule for performing and implementing specific system safety activities in accordance with requirements of this plan will be finalized by the LACTC/SCRTD System Safety Unit to meet the needs of the LB/LA rail transit system in achieving the purpose of this System Operations Safety Program. Broad action and reporting internal have been identified previously in Tables III-2 and IV-1.

5.2 SOSPP Updates

It is the responsibility of the System Safety Unit Officer to periodically have this SOSPP updated as necessitated by the LB/LA rail transit system operation and growth. The System Safety Review Board may participate by review and concurrence with any significant revisions to the Plan as determined. Initially, annual Plan reviews and modifications, if necessary, are contemplated.

Procedures for updates are TO BE DEVELOPED jointly by LACTC/SCRTD.

5.3 Safety Audits

To ensure that the objectives and requirements of the System Operations Safety Program Plan are being accomplished, the Audit Program will:

- o include activities for ensuring adequate on-the job safety surveillance during system installation, checkout, maintenance, operating, and modification operations;
- o determine compliance with management safety policies as contained in this SOSPP and the LACTC's operating rules, regulations, standards, codes, procedures; and,
- o recommend specific corrective action plans to eliminate or minimize the effects of any deviations from compliance.

LACTC/SCRTD organizations and applicable contractors are subject to planned and periodic audits by the System Safety Unit with participation by safety specialists and risk management specialists from other organizations, as appropriate.

The System Safety Unit Officer has the authority and responsibility to conduct audits of system safety support activities and to provide formal reports of findings to the Executive Director and the System Safety Review Board to ensure effective corrective action is taken to resolve deficiencies.

The System Safety Unit Officer is responsible for developing and distribution of standard procedures to be followed during the conduct of formal reviews and audits. The reviewed organization will be informed of the audit/review and will be provided with information regarding the purpose, scope and content of the planned system safety review/audit. Preliminary findings will be communicated as soon as practical to enable expeditious corrective action, based on internal and external audits.

The purpose of internal system safety audits is to perform official evaluations of accomplishments, problems and trends related to total system safety. The System Safety Unit is responsible for the direction of the reviews and audits of organizational divisions or departments and applicable contractors to determine performance

related to required system safety activities. Audit guidelines will be developed by the System Safety Unit and will be approved by the Executive Director to measure the success in implementation of safety policies, procedures and requirements. Upon completion of each review and audit, the System Safety Unit will issue a report of the results and specify areas of deficiency, prepare recommendations, identify corrective actions and distribute copies of the report to the Executive Director, the System Safety Review Board and to the audited organization.

Federal, state or local agency audits of the SOSPP implementation may be conducted. The System Safety Unit Officer will ensure all appropriate internal notifications are made and schedules are formulated to accommodate the reviews by such agencies.

The System Safety Unit Officer will coordinate the distribution of the results of the audits to the Executive Director and the System Safety Review Board. The Executive Director will assign responsibilities for corrective action to appropriate managers. Implementation of required corrective actions will be defined and progress assessed by the Executive Director's office to ensure compliance.

The Executive Director will review and respond to recommendations regarding the audit of system safety activities. An assessment will be made by the Executive Director or his designees regarding the adequacy, responsiveness, thoroughness and effectiveness of the implementation of this SOSPP. The assessment will be transmitted to the System Safety Review Board.

6.1 SYSTEM SAFETY PROGRAM VERIFICATION

- 6.1 New System
- 6.2 Operational System
- 6.3 Occupational Safety and Health
- 6.4 Construction Safety
- 6.5 Fire Protection
- 6.6 Safety Information and Reporting
- 6.7 Safety Training

6.0 System Safety Program Verification

Verification of compliance with the implementation activities is accomplished through reviews, tests, analyses, reports, inspections, audits, investigations, and drills.

6.1 New System

Verification of safety compliance with safety requirements contained in the specifications is accomplished by using coordinated reviews of contractual documentation, system design reviews, assessment of failure modes and criticality analyses, fault free analysis, preparation of test procedures, testing, and review of test results. Adherence of configuration control and other appropriate management procedures are assessed.

6.2 Operational Systems

Verification of safety compliance is accomplished through the review of accident/incident reports, comparison of performance to safety goals, investigations into cause and needed corrective action, inspections of facilities and equipment, adherence to configuration control and management procedures, review of operating procedures and safety rules, and emergency drills.

6.3 Occupational Safety and Health

Verification of compliance is accomplished through use of surveys, inspections, and analysis of injury/illness reports.

6.4 Construction Safety

Verification of compliance during construction is accomplished through reviews of contract specifications, testing, and inspection of on-site work activities.

6.5 Fire Protection

Verification of compliance with fire protection requirements is accomplished through the use of emergency drills, inspections, incident investigations and periodic testing of fire protection and fire suppression systems.

6.6 Safety Information and Reporting

Verification of compliance is accomplished through a review of information contained in safety data bases. Audits of reports and investigations are conducted.

6.7 Safety Training

Verification of training is accomplished by reviewing and monitoring on-going safety training activities for content to assure appropriateness of training to on-the job requirements. Testing is conducted to assure adequacy of training. Certification and re-certification of employees in safety-critical jobs is affirmed.

APPENDIX I
SYSTEM SAFETY CHECK LIST

- A. CHECK LIST**
- B. CHECK LIST DESCRIPTION**

The following information is re-printed here verbatim from APTA's Rail Safety Audit Program Manual, Reference Document (1). The information provides additional commentary explaining the basis for this SOSPP, identifies guidelines and can be used to assisting the implementation of this SOSPP and verification of the safety acceptable status of the LB/LA rail transit system.

SYSTEM SAFETY CHECK LIST

A. CHECK LIST

1. POLICY STATEMENT AND AUTHORITY FOR SYSTEM SAFETY PROGRAM PLAN
 2. DESCRIPTION OF PURPOSE FOR SYSTEM SAFETY PROGRAM PLAN
 3. CLEARLY STATED GOALS FOR SYSTEM SAFETY PROGRAM PLAN
 4. IDENTIFIABLE AND ATTAINABLE OBJECTIVES
 5. SYSTEM DESCRIPTION/ORGANIZATIONAL STRUCTURE
 6. SYSTEM SAFETY PROGRAM PLAN CONTROL AND UPDATE PROCEDURES
 7. HAZARD IDENTIFICATION/RESOLUTION PROCESS
 8. ACCIDENT/INCIDENT REPORTING & INVESTIGATION
 9. INTERNAL SAFETY AUDIT PROCESS
 10. FACILITIES INSPECTIONS
 11. MAINTENANCE AUDITS/INSPECTIONS
 12. RULES/PROCEDURES REVIEW
 13. TRAINING AND CERTIFICATION REVIEW/AUDIT
 14. EMERGENCY RESPONSE PLANNING, COORDINATION, TRAINING
 15. SYSTEM MODIFICATION REVIEW/APPROVAL PROCESS
 16. SAFETY DATA ACQUISITION/ANALYSIS
 17. INTERDEPARTMENTAL/INTERAGENCY COORDINATION
 18. CONFIGURATION MANAGEMENT
 19. EMPLOYEE SAFETY PROGRAM
 20. HAZARDOUS MATERIALS PROGRAMS
 21. DRUG AND ALCOHOL ABUSE PROGRAMS
 22. CONTRACTOR SAFETY COORDINATION
 23. PROCUREMENT
-

B. CHECK LIST DESCRIPTION

1. POLICY STATEMENT AND AUTHORITY FOR SYSTEM SAFETY PROGRAM PLAN

1.1 Policy Statement

The transit system should establish the System Safety Program Plan as an operating document that has been prepared for, and approved by, transit system top management. Reference should be made to the management approval either by enabling signature on the title page or by other means. This approval should be by the chief executive officer or the governing board.

1.2 Authority

The body empowered to develop the fixed guideway transit system should be identified by its legal name. Any authorizing and implementing legislation which may have been required to establish that body should be cited. This information should include federal, state and local statutes enacted to establish the transit system as the operating and/or developing entity for the transportation system or systems in the area. If the area served has multiple political jurisdictions, the interface responsibilities among these jurisdictions should be defined.

The Authority statement in the System Safety Program Plan should define as clearly as possible the authority for establishment and implementation of the System Safety Program and how that authority has been delegated through the organization.

2. DESCRIPTION OF PURPOSE FOR SYSTEM SAFETY PROGRAM PLAN

This section addresses the intent of the System Safety Program Plan and defines why it is being written. It should emphasize that the System Safety Program Plan establishes the safety philosophy of the whole organization and provides the means for implementation. For example, a System Safety Program Plan could be implemented for the following reasons:

- ☐ Establishment of a safety program on a systemwide basis
- ☐ Provision of a medium through which a property can display its commitment to safety
- ☐ Provide a framework for the implementation of safety policies and the achievement of related goals and objectives
- ☐ Satisfy federal and state requirements
- ☐ Meet accepted industry standards and audit provisions
- ☐ Satisfy self insurance provisions

In addition, the relationship of System Safety to system operations should be defined. All departments involved must have a clear definition of their individual responsibilities relative to the scope of the System Safety Program. Authority for plan implementation must be provided for all plan participants in detail.

This section should also contain System Safety definitions applicable to the operating system and provide reference where appropriate, to other related terms which should be defined in the appendix.

3. CLEARLY STATED GOALS FOR SYSTEM SAFETY PROGRAM PLAN

The overall goal of a System Safety Program for fixed guideway transit systems is to identify, eliminate, minimize, and/or control safety hazards and their attendant risks by establishing requirements, lines of authority, levels of responsibility and accountability, and methods of documentation for the organization. A transit system should begin with this overall goal and develop specific goals applicable to its own program. These should be system-specific goals, tailored to the individual needs of the system.

In specifying system safety goals, a transit system should be guided by the following:

- ❑ A goal must by nature be long-term. Inasmuch as the System Safety Program extends throughout the life of the transit system, the goal must have broad and continuing relevance.
- ❑ A goal must be meaningful. Goals are characterized by their broadness and continuing relevance. But they must not be so broad as to be meaningless. Specific, desired results must be identified.
- ❑ A goal must be realizable. Any goal that meets the first two criteria but cannot be reached is meaningless. A goal in some real sense must be attainable.

For example, a goal might be to establish and maintain a high level of safety comparable to other fixed guideway transit systems in the U.S. This goal is long-term, meaningful, and realizable. Likewise other goals might be: (1) to identify, eliminate, minimize, and/or control all safety hazards; and (2) to provide appropriate actions and measures to obtain necessary safety-related agreements, permits and approvals from outside agencies, where applicable.

4. IDENTIFIABLE AND ATTAINABLE OBJECTIVES

Objectives are the working elements of the System Safety Program, the means by which the identified goals are achieved. Unlike goals, objectives must be easily quantifiable, however, they must still be meaningful in that they provide a framework for the day to day activities that provide for a safe transit operation. Objectives are usually met through the implementation of Policies.

Policies are central to the System Safety Program and must be established by top management. The transit system should therefore be guided by the following:

- ❑ Policies set the framework for guiding the safety program, on a relatively long-term basis
- ❑ Policies should be assessable
- ❑ Policies are methods for reaching a specified objective

An example of a safety policy would be to establish a safety program incorporating public, patron, employee, and property safety, including fire protection, loss prevention,

and life safety requirements. The policies established by a specific transit system should depend on the goals defined by that system and on its system safety philosophy.

5. SYSTEM DESCRIPTION/ORGANIZATIONAL STRUCTURE

The objectives of this section are to define both the transit system physical characteristics, including service and performance parameters, and the organizational structure of the system

5.1 System Description

This section should briefly describe the system's characteristics. The information presented should be sufficient to allow non-technical and non-transit persons to understand the system and its basic operations. The following components should be included in the System Description:

- History
- Scope of Service
- Physical Plant
- Operations
- Maintenance
- System Modifications

5.2 Organizational Structure

This section should provide or reference:

- 5.2.1 Detailed organizational diagrams showing the title of each position
- 5.2.2 Detailed diagram of the structure of the system safety unit identifying the key positions at all levels
- 5.2.3 Diagrams showing the relationship and lines of communications between the system safety unit and other units of the organization
- 5.2.4 The relationship of the transit system to local political jurisdictions

6. SYSTEM SAFETY PROGRAM PLAN CONTROL AND UPDATE PROCEDURES

This section establishes the frequency of review of the System Safety Program Plan and describes the method by which updates, corrections, and modifications will be made to the Plan. The procedure should state whether the Plan will be updated on demand or at selected intervals. This subsection should also include a description of the steps required for developing and issuing a change. Top management approval of the change should be included as a step when appropriate. Any change in safety goals or safety policies should be considered a top management decision.

7. HAZARD IDENTIFICATION/RESOLUTION PROCESS

The Hazard Identification/Resolution Process is perhaps the heart of the System Safety Program. While there has been much written about the level of formality needed for this section of the program, it remains an individual matter for each transit system to fit the

proper process to its respective organization. The important element which must be included in a fully developed System Safety Program is the mechanism, accessible to all levels of the organization, by which hazards are identified, analyzed for potential impact on the operating system, and resolved in a manner acceptable to general management.

A Hazard Resolution Process consists of three primary components:

- ▣ HAZARD IDENTIFICATION
- ▣ HAZARD CATEGORIZATION
- ▣ HAZARD RESOLUTION

The process offered here is taken from Military Standard 882(B). While this standard offers an extremely formal manner of addressing hazard resolution, it does provide a good way of ensuring that all hazards are addressed adequately and the resolution process documented properly. It is emphasized, however, that this method is offered as a sample only. Each transit system must ensure that its safety methodologies are tailored to the unique capabilities of its organization. It should therefore not be construed that the hazard categorization methodology offered by Mil Std 882(B) is a mandatory part of all System Safety Programs. However, a properly functioning System Safety Program must explain how the Hazard Resolution process of the respective transit system is carried out and documented.

7.1 HAZARD IDENTIFICATION

In its Hazard Identification procedure, a transit system describes the methods used for ensuring that as many hazards as possible can be identified and entered into the Hazard Resolution process before they cause problems. While it is virtually impossible to identify every hazard, there are various formal processes, as well as the time tested method of direct observation and input from field personnel on situations and designs which could cause accidents or injuries. These methods may include such exercises as Preliminary Hazard Analysis (PHA), Operating Hazard Analyses (OHA), Critical/Catastrophic Items List (CCIL), Fault Tree Analysis, Subsystem Interface Analysis, and various Human Factors Analyses.

These formal Hazard Analyses processes prove most useful in new start rail systems, which need to analyze as completely as possible all aspects of system design. As there is no "history" to provide other means of analyzing the operation, a new rail system should have the necessary hazard analyses built into both design consulting and procurement contracts.

Conversely, systems in operation, especially those which have been operating for a long time, may not necessarily need to get involved with such formal levels of hazard analysis on a regular basis. Usually the input of operating and maintenance personnel can provide the type of data that can be used for a sufficient Hazard Analysis Process. The key factor, however, is that whatever process is used, it must be, as a minimum, formal enough to have been documented in a procedure, available to all units of the organization, reviewed and administered on a routine basis, usually by System Safety staff, and have high level visibility and participation. Any formal process must have appropriate sign-offs and checks and balances built into it. If a respective system uses

the committee approach to safety coordination, hazard identification must be a regular part of the committee activities.

It should be noted that Hazard Identification is an ongoing process, viable throughout the system life cycle. Accordingly, it needs to be coordinated with such other activities as Accident/Incident Investigation so that accidents and incidents which result from previously unidentified hazards are subsequently entered into the Hazard Resolution stage of the process, with all essential documentation of such situations maintained.

7.2 HAZARD CATEGORIZATION

The following sections represent a methodology adopted from Military Standards which can be used to develop a formal process for determining which hazards are acceptable, acceptable with certain conditions applied, and unacceptable. Once again, while there are other methods available for hazard resolution, the key factors are a formal procedure, with normal determination made in advance as to which types of hazards must have which type of resolution. It is also extremely important to design in advance a process for handling exception to the established procedure, as it is virtually impossible to anticipate every situation.

7.2.1 Included in this section is a method for Categorization of all identified hazards. Hazards are normally categorized in terms of severity and probability of occurrence.

7.2.1.1 HAZARD SEVERITY (MIL-STD 882B) - is defined as a subjective measure of the worst credible mishap resulting from personnel error, environmental conditions, design inadequacies, and/or procedural efficiencies for system, subsystem, or component failure or malfunction, categorized as follows:

- ☐ I (Catastrophic) - Death or system loss
- ☐ II (Critical) - Severe injury, severe occupational illness, or major system damage
- ☐ III (Marginal) - Minor injury, minor occupational illness, or minor system damage
- ☐ IV (Negligible) - Less than minor injury, occupational illness, or system damage

7.2.1.2 HAZARD PROBABILITY (MIL-STD 882B) - is defined as the probability that a specific hazard will occur during the planned life expectancy of the system element, subsystem, or component. It can be described subjectively in potential occurrences per unit of time, events, population, items, or activity, ranked as follows:

- ☐ A (Frequent) - Likely to occur frequently (individual); Continuously experienced (fleet/inventory)
 - ☐ B (Probable) - Will occur several times in life of an item; will occur frequently in fleet/inventory
 - ☐ C (Occasional) - Likely to occur sometime in the life of an item; will occur several times in fleet/inventory
-

- ▣ D (Remote) - Unlikely but possible to occur in life of an item; unlikely but can be expected to occur in fleet/inventory
- ▣ E (Improbable) - So unlikely, it can be assumed occurrence may not be experienced; unlikely to occur, but possible in fleet/inventory

Once a hazard is identified, an analysis as to its potential severity and probability of occurrence is performed. The process for this analysis should be standardized by the transit system and documented by an approved procedure. This procedure must be followed as prescribed. While it is possible to develop a qualitative methodology for this type of analysis, the most practical method for rail transit application is simple deductive reasoning, applied on a collective, or organizational basis. The composite management staff of all key line and staff departments, administered by the safety unit, can effectively determine the severity of all but the most difficult or unusual hazards. It is important,

HAZARD RESOLUTION MATRIX				
	I	II	III	IV
A	UN	UN	UN	AC/WR
B	UN	UN	UD	AC/WR
C	UN	UD	UD	AC
D	UD	UD	AC/WR	AC
E	AC/WR	AC/WR	AC/WR	AC

CODES: UN - Unacceptable; UD - Undesirable; AC/WR - Acceptable with review by management staff; AC - Acceptable

Figure 1

however, to determine in advance the exact mechanism for implementation of this process, as well as some type of administrative appeal process, should consensus on categorizing a specific hazard prove to difficult to achieve. A mechanism for outside assistance should also be provided.

Hazards identified on an ongoing basis should be entered into the formal process, the same as those identified by formal analyses techniques associated with new procurement and new system construction. All employees involved in the hazard identification process should know and understand their respective roles.

7.3 HAZARD RESOLUTION

Hazard Resolution is defined as the analysis and subsequent actions taken to reduce to the lowest level practical, the risk associated with an identified hazard. Hazard Resolution is not synonymous with hazard elimination. In a rail transit environment, there are some hazards which are impossible to eliminate and others which are highly impractical to eliminate. Reduction of risk to the lowest practical level can be accomplished in a variety of ways from protective and warning devices to special procedures. There are, however, some hazards which present a risk which cannot be accepted because of severity and high probability which must be eliminated.

Part of the Hazard Resolution procedure should be a predetermined matrix prescribing which identified hazard are acceptable, acceptable with mitigation, and unacceptable. Once this matrix is defined by the transit system, deviation from the prescribed resolution process should occur only through approved, predetermined channels. A sample Hazard Resolution Matrix might look like that contained in figure 1.

In addition to the Hazard Resolution Matrix, a companion procedure must accompany it describing exactly how hazards defined as "unacceptable" and "undesirable" will be reduced to an acceptable level. In addition, any prescribed review by management staff must be predefined to ensure the process cannot be bypassed, although provision can be made for allowing exceptions to the process in an approved manner.

It should be noted that the entire Hazard Resolution process is nothing more than a formalized, predetermined procedure for Risk Acceptance by the transit management staff. It allows for a systematic hazard identification process and a coordinated hazard effects minimization process. Management of the Hazard Resolution process should reside with the safety unit of the transit organization, which should be responsible for all supporting documentation and coordination. The coordination process can take on many different forms, such as safety committees and internal communications mechanisms, however, the key to its success still remains in the predetermined, administered process.

8. ACCIDENT/INCIDENT REPORTING & INVESTIGATION

Conducting investigations of accident and incidents is also related to the Hazard Resolution process in that feedback and follow-up from these investigations should automatically be entered into the Hazard Resolution process. It is virtually impossible to anticipate all hazards before they cause an accident or incident, however, once such an incident occurs, it is incumbent on transit safety management to do everything possible to prevent a recurrence of the respective problem. Accordingly, the Accident/Incident Reporting and Investigation process should include an automatic, formal link to the Hazard Resolution process.

Some of the basic elements necessary for a properly executed investigation of all accident and incidents include the following:

8.1 CRITERIA

A formal policy needs to exist and be fully understood by all organizational elements on exactly which accidents/incidents will be investigated. This policy should include a predetermination on such things as thresholds for automatic activation of an investigation, guidelines on whether incidents should be investigated immediately or after the fact, and who is in charge of each specific level of investigation.

8.2 PROCEDURES

Preparation of appropriate procedures, formats, and approaches for performing investigations must be documented and properly implemented. Verification of full understanding and compliance with such procedures by all organizational elements is also required.

8.3 INTERNAL NOTIFICATION

Predetermination of appropriate notification of accidents and participation in accident investigations should be understood and available to all involved transit personnel.

8.4 REPORTING

Findings, conclusions, and recommendations resulting from investigations should be specified as to type, format, distribution, and retention.

8.5 FOLLOW-UP

Assurance that all recommendations and identified needs for corrective actions are assigned, tracked, reported and verified. This is an extremely important step providing a key element in recurrence prevention.

8.6 DOCUMENTATION

All necessary information pertaining to a specific occurrence should be contained in standard format and stored in a specified location. Uses of incident documentation include ongoing training, especially where human error and procedural error are involved, litigation, where documentation of efforts to prevent such incident can be extremely valuable, especially in establishing that transit management is reasonable and prudent, and budget development, where certain redesigns and equipment purchases can be easily justified.

8.7 EXTERNAL NOTIFICATION

Preparation of necessary reports to all necessary agencies, such as the NTSB, state and local regulatory agencies, and governing boards.

While actual procedures for accident/incident investigation may vary greatly from one transit system to another, especially in such areas as the department in charge and addressing of corrective actions, the ultimate goal remains the same - elimination of accidents. While we know that this goal is virtually unattainable, it is nevertheless a goal which provides a worthwhile target.

9. INTERNAL SAFETY AUDIT PROCESS

System Safety is the formal process of managing a safety program to ensure that all identified safety elements in a given environment are in place and performing as designed. In a transit environment, it is difficult to identify any elements which are not safety related, even if only indirectly so. The Internal Safety Audit Process thus becomes extremely important in determining if all organizational elements, equipment, procedures, and functions are performing as intended, from a safety perspective. It requires constant attention and activity.

In the past there has been a tendency to audit only those organizational elements which deal with such responsibilities and assets as finance. However, it is just as easy for operational and maintenance personnel, at any level, to overlook an important function or process. The assets for which operational and maintenance personnel have responsibility include the safe transportation of passengers, employee safety, and protection of property. These assets are far more valuable and important than those of other audited areas. Because of this, the internal safety audit is absolutely essential to proper System Safety Management. Safety Management and good overall management are inseparable concepts.

A thorough Internal Safety Audit Process must provide top management with a mechanism for documenting the fact that key elements of the organization are performing specified functions. These organizational elements must include all key elements with identified system safety responsibilities. Chapters 10 through 22 of this document provide details on which organizational elements must be included and how the auditing process relates to each.

The audit process must also provide a detailed and approved implementation plan by including the following elements:

9.1 AUDIT RESPONSIBILITY

Normally the System Safety Unit of the transit system would be responsible for implementation and oversight of the Internal Safety Audit Process, however, each transit system must be able to tailor such responsibilities to its own unique organizational structure. The overriding philosophy which must be protected regardless of structure is the independent nature of the audit process. The unit in charge of auditing must not be the unit in charge of implementation of the items being audited.

9.2 AUDIT REPORTING

In order for an internal audit to be effective, the results of the audit must be used for positive, all-encompassing corrective actions. This does not occur if the audit report is not an official document which is automatically provided to all appropriate levels of management. This would include as a minimum, a departmental summary report being provided to the chief executive officer and the individual, respective departments. Various techniques such as audit coordination meetings and management briefings can be used to make the process as unobtrusive as possible, while still providing valuable input to each respective department being audited as to areas of concern and possible corrective actions.

It is also important to design the process so that it is construed as a positive force in the organization. While the internal audit should be as cooperative as possible, there must also be an administrative process to deal with any problems or disagreements which develop. It should be emphasized that the audit process is only a management tool which provides assistance in discovering possible problem areas. By itself it should not be considered an internal regulatory or decision making process. Final authority for all decisions always rests within the management structure as prescribed by the individual organization.

9.3 AUDIT COMPLETENESS

While the audit process usually relies on the concept of spot checking to sample areas being audited for compliance with internal procedures and requirements, it should not contain any surprises or unexpected events. All departments involved need to know when audits will be conducted and how they will examine departmental documents.

While ongoing inspections may be conducted on an unannounced basis, actual audits should be done on a coordinated basis, with full management support. Once schedules are approved by general management, all involved departments must provide absolute cooperation. The following audit elements, as a minimum, must be prescribed as part of the documented audit procedure:

- 9.3.1 CYCLE/SCHEDULE - Audited departments must know when to expect audits. Audits must be scheduled so that they are as unobtrusive as possible. Unannounced inspections or spot audits must be approved as part of the overall audit process with concurrence of general management.
- 9.3.2 CHECK LISTS - A list of items to be audited must be prepared in advance. When necessary, audited departments should be given time to produce necessary documentation. This does not preclude spot check of individual records, such as maintenance records or personnel qualification records, however, the cooperative nature of the audit process must be maintained.
- 9.3.3 DOCUMENTATION - Formal documentation of all aspects of the internal audit process must be maintained. Included in this documentation, should be all necessary reports to general management and respective departments.
- 9.3.4 FOLLOW-UP/CORRECTIVE ACTION - A summary of recommended corrective actions, if any, must be included in the audit report process. Corrective actions approved by general management must then be formally tracked for compliance.

It is also incumbent on the organization to have a periodic external evaluation, or audit, such as the APTA Rail Safety Audit Program, of its internal audit process. In this way assurance can be maintained that all prescribed safety processes within the transit system are being followed. It is recommended that this type of outside evaluation be performed, as a minimum, once every three years.

NOTE: The remaining chapters of this document deal with specific organizational functions which must be included in the Internal Safety Audit Process. It is recognized that respective transit organizations deal with these performance-based characteristics in different organizational ways. The purpose of this document is to specify the end results which must be obtained, not the manner in which these results are achieved.

Transit systems which subscribe to the APTA Rail Safety Audit Program will need to ensure that a clear and available audit trail for the elements describe in chapters 10 through 23 is maintained.

10. FACILITIES INSPECTIONS

The important function of maintenance of all transit facilities is one which must be verified and checked constantly. The first step in this process is to identify and locate all facilities/equipment with safety-related characteristics. Such items as Fire Protection Equipment, emergency communications equipment, and employee safety devices would be included in this category, however, it is not practical to develop a complete list in this document, especially since a custom list for each transit system needs to be developed.

Once again a regular cycle of inspections needs to be developed along with the list of exactly which items are to be inspected. Observations of defective or missing equipment of course should be reported whenever observed. Facilities inspections should also be

closely coordinated with the Hazard Resolution Procedure, as those responsible for Facilities Inspections will frequently be in a position to observe hazardous conditions.

11. MAINTENANCE AUDITS/INSPECTIONS

The internal audit process must contain a mechanism for determining if proper documentation is being kept on all maintenance activities. While the cycle for audits needs to be developed and approved in advance, the concept of spot checking maintenance documents and records can be effective in spotting problems before they cause a negative situation. This process does not need to catch every record keeping error which occurs, but will be able to flag trends in improper record keeping. If required maintenance is routinely not being performed, spot checking of records is an excellent method for such determination, however, the audit process needs to go beyond just the record keeping stage to determine if the problem is a simple record keeping oversight, or actual lack of required maintenance.

It is imperative that proper corrective actions be prescribed, implemented, and tracked as part of this process. Such audit records become extremely valuable tools in establishing that the respective management organization is reasonable and prudent in discharging its professional responsibilities. Since accidents are prevented by such preparation and double checking, the audit/inspection process should be considered an excellent way of minimizing costly litigation.

12. RULES/PROCEDURES REVIEW

Operational considerations need to be included in the internal audit process as well. One of the most important functions of the operations unit is to ensure that rules and procedures are carefully developed, maintained, and followed. The internal audit process must contain a methodology for ensuring uniform, coordinated development and implementation of operating rules and procedures. Likewise, maintenance departments must do the same for maintenance rules and procedures. In the case of maintenance, this applies not only to safety rules, but also to procedures for conducting inspections and making repairs to equipment. Improper maintenance procedures have been the documented cause of numerous accidents in the transportation industry. The safety audit process is designed to minimize this possibility.

Review of departmental records to determine if enforcement methods are up to date and in effect, as well as supplemental spot checks by safety unit personnel (or other units responsible for internal auditing) are essential parts of the internal audit process, relative to Rules/Procedures Review. Proper follow-up and documentation of these elements can prove to be invaluable tools for both accident prevention and litigation purposes.

13. TRAINING AND CERTIFICATION REVIEW/AUDIT

Proper qualification of operating and maintenance personnel is a vital part of a safe transit environment. The internal audit process should ensure that all necessary training is being conducted and documented. It can also provide a valuable method for evaluating the effectiveness of operational training. Not only should certification records of operating (including maintenance) personnel be reviewed for completeness and accuracy as part of the audit process, but the content and presentation of material and testing and grading processes should also be reviewed and evaluated on a periodic basis.

It is essential that any audit efforts in this area be closely coordinated among all involved units of the organization. Evaluation of training techniques might be best approached through a "team" method, where several observers periodically evaluate

course content and presentation. Such characteristics as consistency over several classes, and effective and equitable testing of personnel in both initial and recurrent training should be part of the evaluation process.

14. EMERGENCY RESPONSE PLANNING, COORDINATION, TRAINING

Emergency Response is a primary component of any rail transit System Safety Program. As such it must be given constant attention. A typical self-auditing process for this component would include an approved, coordinated schedule for all emergency response elements. Meetings with outside agencies, emergency drills, and revision and distribution of Emergency Response Procedures can all be scheduled on an annual basis, with necessary approvals and checks for completion built in. Frequently the safety unit of the transit organization is responsible for coordination of these types of emergency response functions. As part of the regular reports to general management issued by the safety unit, status reports on emergency response items can automatically be included. These reports would then provide an audit trail for both internal and external audits.

15. SYSTEM MODIFICATION REVIEW AND APPROVAL PROCESS

During the rail transit system safety developmental process, there were two distinct documents used, one for transit systems in the acquisition, or building stage, and another for transit systems in the operating phase of their respective life cycles. It eventually became apparent that rail transit systems are virtually in a perpetual state of acquisition, as new equipment, system expansions and modifications, and system rehabilitations require constant design and procurement efforts. Ongoing acquisitions and procurements in fact can be more critical than initial design for many reasons. Coordination and compatibility with the existing system, construction efforts under operating conditions, and testing and break-in phases must all be managed as part of the ongoing system safety effort.

It has also become apparent that System Safety Management can be an extremely useful Project Management tool, as a well prepared and thorough System Safety Program serves as an excellent check list for project completion and can easily include a certification process for determining operational readiness of new equipment and system expansions. In order to serve these purposes, however, the System Safety Program must incorporate all necessary coordination processes. Perhaps most important is a detailed, documented approval process with specifics of sign-off requirements and exception capability. Review of preliminary design and acceptance of final design must not occur in a vacuum. While not all units of the organization have the capability to conduct their own design reviews, nor should they be able to, there should be a coordination process which ensures all organizational entities have the opportunity to comment on design specifics. One unit of the organization, usually system safety, should be delegated with the responsibility of ensuring that any hazards associated with system expansions or modifications of any kind are worked into the Hazard Resolution Process. In this way any accepted risks associated with such system changes will be documented and tracked from the outset.

Once the Plan is adopted, a formal process, included in the Plan, should specify what happens when a portion of the system will not be available on time, or equipment which will be placed in service is not complete. Issuance of such directives as "work-arounds" or "exceptions" should occur only when top management determines that they are absolutely necessary. If such exceptions prove to be necessary, all departments involved need to sign off on the process to indicate they fully understand the nature of the exception and what temporary measures are in place to mitigate any potential side effects.

The exceptions in place must also be monitored constantly to ensure that neither the procedure nor the spirit of the mitigating factors are bypassed or removed during the life of the respective exception. If any type of coordinating committee or communication process is maintained by a respective transit system, regular reports must be included to ensure all organizational entities are thoroughly familiar with both the procedure and necessity for each exception.

16. SAFETY DATA ACQUISITION/ANALYSIS

One of the most important services the safety unit provides for the transit organization is the collection, maintenance, and distribution of safety data relative to system operation. This data includes information gathered from within the respective system on various operating characteristics relative to safety. Analysis of this system specific data can be used to determine trends and patterns in system operation. Used as part of the Hazard Resolution process, data collection and analysis can be used to identify hazards before they cause accidents by such techniques as trend analysis. It thus becomes a vital component of efforts to improve system performance, not only in respect to safety but also in overall delivery of service to the riding public.

Exactly what types of analyses are used as part of the data collection process must be determined by the individual needs of each transit system. This decision is based on variable aspects of the system environment such as whether any major system changes or procurements are underway. Frequently, ongoing procurement contracts require a certain amount of safety analysis and data to be provided by suppliers. It must be determined in advance how this data will be used and who will be responsible for its evaluation. Few transit systems can devote the personnel to produce the complex forms of analysis, such as fault tree analysis and failure modes and effects analysis, however, if needed this type of detailed analysis can be obtained through consulting contracts.

Communication with the rest of the transit industry is also a productive source of input into both Data Acquisition and Hazard Resolution processes. This type of coordination can be used to discover potential problems before they even occur at a given system by monitoring events at other systems, especially those with similar components. Participation in industry committees, workshops and conferences, and other efforts in this regard further enhance the value of Data Acquisition.

17. INTERDEPARTMENTAL/INTERAGENCY COORDINATION

Good communications equal good management. As indicated before, System Safety equals good management. It is therefore incumbent on the System Safety Program to ensure the communications process, relative to safety issues, is functioning in proper fashion. There is a great tendency for specific units within the transit organization to keep all matters within the unit. While many issues are not necessarily organization wide news, it should not be up to individual units to decide on the appropriateness of sharing of certain information. The communications process must therefore be spelled out in detail in advance. Deviations from this approved procedure must be brought to general management attention as part of the ongoing Internal Safety Audit Process.

This process also applies to all agencies with which a respective transit agency must coordinate. It is not possible to determine on a generic basis what these agencies should be. Each transit system must develop its own list of agencies with which regular coordination is required. As a minimum, Emergency Response Agencies should be included on the list. Such items as training of emergency response personnel, emergency drills and familiarization processes, and procedures for actual emergencies should be developed in

coordination with these agencies. The procedures must be documented, exercised and administered on a regular basis, most logically by the System Safety unit.

Each transit system must also develop a similar process for any other agencies with which it deals, such as parent agencies and governmental oversight agencies. A regular report process on such coordination must be included as a part of the auditable System Safety documentation.

18. CONFIGURATION MANAGEMENT

Configuration Management is a process which ensures, as much as possible, that all property, equipment, systems design elements, etc., are documented as to configuration, accurately and completely. Any changes to an individual subsystem, or a fleet/inventory wide change must be recorded on as-built drawings in a timely and effective manner. The Configuration Management process must include, as a minimum, procedures for authority to make configuration changes, the process for incorporating these changes into all appropriate documentation, and the process for ensuring that all necessary units, including System Safety, are formally made aware of such changes. It is also recommended that the process be coordinated or combined with the System Modification Review and Approval Process so that system-wide changes can be approved in advance.

Approval of changes, especially individual unit changes, cannot always be approved in advance. It should be a requirement, however, that all units be informed of such changes as expeditiously as possible.

Configuration Management is much more involved and time-consuming during the design and procurement stages of a transit system life cycle. At that time, tracking of design changes, verification of as-built drawings, and maintenance of the process subsequent to delivery are much more involved processes. However, once the process gets out of control, it is extremely difficult and costly to catch up. It can also produce significant safety hazards, as future changes to the system or individual subsystems could have unknown results. Since most transit systems never get out of the procurement stage of their life cycle, it is important to keep the Configuration Management process under control.

19. EMPLOYEE SAFETY PROGRAM

The most valuable resource any transit system has is its employee work force. Time and money are constantly being spent, even without realizing it, on getting the individual members of the work force to a condition of maximum and effective productivity. It is therefore not only essential from an employee consideration perspective, but also from a good management perspective, to ensure as much as possible the safety of our employees.

An Employee Safety Program must be designed to have the best possible input from all necessary units, including the employees themselves. While it is difficult to develop a generic program, as a minimum, those elements required by either local or federal law must be incorporated into the Employee Safety Program. These include such elements as Employee Right To Know requirements for hazardous materials and locally required Occupational Safety & Health requirements. It is emphasized that these are only minimum programs, and efforts should be made to maintain a thorough Employee Safety Program above and beyond these minimums.

20. HAZARDOUS MATERIALS PROGRAMS

Most transit systems come under the jurisdiction of either state or federal Environmental Protection Agencies. It is incumbent on each system to determine which regulations it must follow and then ensure all organizational elements are aware of these requirements and how they must be followed.

Over and above required environmental issues, it is emphasized that transit at the national level is promoted as a "Friend of the Environment"; each transit system should examine its operation to determine where improvements can be made and how to maximize the positive effect that transit use by the general public has on our environment.

21. DRUG AND ALCOHOL ABUSE PROGRAMS

Since virtually all rail transit systems require federal funds for continued growth and operation, the Drug Testing Requirements of the Urban Mass Transportation Administration (UMTA) now form the basis for the drug abuse programs at rail transit systems. Above and beyond these programs, transit systems must also provide a mechanism for ensuring that the same proscriptions are provided for alcohol abuse. The bottom line is protection of the riding public and transit employees. All efforts should be geared toward this end.

22. CONTRACTOR SAFETY COORDINATION

While employees of contractors do not come under the direct jurisdiction of transit systems, when contractors work on transit property, especially under operating conditions, certain requirements must be applied to all members of the contractor work force. This is essential for the safety of passengers, transit employees, contractor employees, and protection of transit property. The contractor and all contractor employees must be clear right from the outset that the transit system is in charge and all necessary rules and procedures will be followed without exception.

This of course places a significant responsibility on the transit system, and the responsible units, for ensuring that all contractor personnel: 1) Are instructed on the procedures, 2) Know the procedures, and 3) Follow the procedures. Sanctions which will be imposed must be spelled out from the beginning, and if possible, included in the contract.

23. PROCUREMENT

System Safety extends to include the routine procurement of supplies, materials, and equipment. Procedures must be in place and enforced to preclude the introduction into the transit environment of unauthorized hazardous materials and supplies, as well as defective or deficient equipment. The existence of and adherence to such procedures and sanctions must be demonstrable for audit purposes.

APPENDIX II

GLOSSARY

The following explanation of terms is re-printed here verbatim from APTA's Rail Safety Audit Program Manual, Reference Document (1). It provides supplementary insight into the specific activities identified in Section 3.0 and 4.0 of this *SOSPP*.

GLOSSARY

- Appeal** The process of filing an official disagreement with any particular finding of an Audit Team regarding an audit item judged to be an Exception.
- Audit** The process of verification of the implementation and conduct of certain activities within an organization by virtue of physical inspection, examination of documentation, and/or other appropriate methods for confirming the prescribed activities are in conformance with stated programs. For purposes of the Rail Safety Audit Program, two types of audits are considered; internal, where staff of the audited transit system perform the audit, and external, such as this Rail Safety Audit Program, where auditors external to the system staff conduct the examination.
- Audit Administrator** The APTA staff person who has been assigned by the APTA Executive Vice President to administer the Rail Safety Audit Program. As the RSAP is a function of the Rail Safety Review Board, this function will normally be performed by the RSRB Secretary, who is presently the APTA Director, Safety and Program Development.
- Audit Checklist** The list of items prepared by the Office of Safety Audit from the respective System Safety Program Plan of the audited system which will be examined in detail by the audit team during the site audit.
- Audit Cycle** As presently defined, the audit cycle will be triennial, meaning each participating transit system will be audited, under the terms and conditions of this Program, once every 36 months (see Master Audit Schedule).
- Audit Review Panel (ARP)** A panel consisting of the Chairman and Vice Chairman of the Rail Safety Review Board, and the Chairman of the Rail Safety Committee, which will rule on the Final Disposition of appealed audit items.
- NOTE:** If the Chairman of the Rail Safety Committee at any respective time is from the same transit system as either the Chairman or Vice Chairman of the RSRB, then the Chairman of the RSRB will appoint another person from the Rail Safety Steering Committee to serve as the third member of the ARP. This appointed person shall be someone from a transit system other than those of the Chairman and Vice Chairman of the RSRB.
- Audit Summary** A narrative description of the state of the System Safety Program at a respective transit system, based on the information gathered by the Audit Team, as well as information provided through the Appeals process and the SSPP itself.
- Conformance** An item on an audit checklist which is found by the Audit Team to be in compliance with the provisions of the respective System Safety Program Plan.
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Corrective Action Plan (CAP)	A Plan filed by a particular audited system describing actions which it will take to implement corrective actions for any audit item found to be in Exception by the Audit Team. The CAP is included as a part of the Final Audit Report.
Exception	An item on an audit checklist which is found by the Audit Team to be in need of improvement in order to be considered in full compliance with the provisions of the System Safety Program Plan.
Final Audit Report (FAR)	The report generated by the Audit Administrator for each Rail Safety Audit after all events of are particular audit are complete. It includes all appeals and corrective actions, as well as the Audit Summary.
Final Checklist (FCL)	The checklist form containing the information on which items will be examined in a particular Rail Safety Audit and the findings of the Audit Team on whether each respective item is either in Conformance or Exception with the System Safety Program Plan of the audited system.
<u>Manual</u>	Any reference to the document entitled; <u>A Manual for the Development of Rail Transit System Safety Program Plans</u> , published by APTA, which contains the approved format and content information for System Safety Program Plans for audit under this program.
Master Audit Schedule	The 36 month cycle maintained by the Audit Administrative staff showing the approximate month each participating transit system will be audited. While the month will generally remain the same from one audit cycle to the next, there may be periodic changes should the need arise. Transit systems entering the program will be encouraged to select a month in the cycle which would occur during periods with as little conflict with the audit process as possible, if available. Unless unusual conditions prevail, only one audit will be conducted per month.
Peer Auditor	An auditor chosen from the ranks of the rail transit industry on a voluntary basis, who has participated in the APTA Auditors' Training Seminar, and has been assigned to an audit team by the Audit Administrator.
Preliminary Audit Report (PAR)	The report generated by the Audit Administrator for each respective audit indicating the initial ratings of the audit items by the Audit Team. The Preliminary Audit Report may be modified by the Audit Administrator based on the results of any appeals filed by the respective audited system. The Preliminary Audit Report does not contain an Audit Summary, as is contained in the Final Audit Report.

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Preliminary Checklist (PCL)	The list of all items which will be examined during a particular Rail Safety Audit. It is prepared in advance of each audit by the Audit Administrator and forwarded to the system to be audited ten days in advance of the site audit.
Senior Auditor	The person appointed by the Audit Administrator to be in charge of a specific audit team.
Staff Auditor	An auditor who is a member of the APTA Safety staff.
System Safety Program Plan	The document containing the specific program for accomplishment of the safety goals and objectives of the respective transit system, including detailed responsibilities for carrying out all portions of the program. In all Program Procedures, this document will be referred to as the <u>SSPP</u> .
