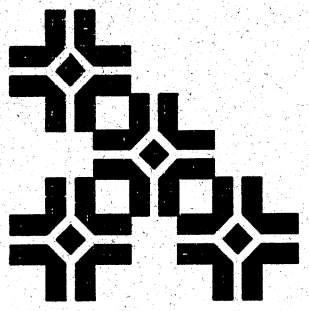
Analyses of Technologies and Methodologies Adopted by U.S. Transit Agencies to Enhance Transit Security



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16. Abstract

Large and small transit agencies in the U.S. are convinced that providing high levels of security for passengers, employees, and system properties contribute to the overall success in the operation of the systems. Accordingly, transit agencies are improving or implementing new security techniques to provide an environment that contributes to the protection, confidence, and comfort of transit commuters. This research investigated successful security programs that have demonstrated to be effective in controlling and preventing transit crime, and enhancing passenger perception of security. Twenty five transit agencies operating guideway and/or bus systems were asked to provide information on security technologies, strategies, and other security related issues. Information on crime statistics from responding transit agencies were used as a basis for a detailed analysis. The analysis of the researched data showed that the highest number of crimes occur against transit properties, followed by the crimes that affect security perception and the crimes against passengers respectively. The most effective strategies to deter crime are uniformed police/security personnel patrolling vehicles and transit properties and the provision of educational and training information for the commuters. Among security technologies, radio integration with closed circuit television surveillance systems is the most effective way to combat different type of transit crimes.

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After an extensive literature research, it was concluded that the work of NJ Transit and TMS Inc. contained the most appropriate definitions and technical descriptions regarding transit security and that most of the information provided in their report was used in our research. Furthermore, the comprehensive work performed by NJ Transit and TMS Inc. is extensively reflected throughout our report.

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1. INTRODUCTION

The report focuses on transit security, which is usually associated with crime and must be clearly differentiated from transit safety, which is the ability to transport people free of accidents. Transit agencies are increasingly convinced that high levels of security contribute to the confidence and comfort of the customers, and therefore to the overall success in the operation of the systems. The Federal Transit Administration (FTA) recognize the importance of security in the U.S. transit systems, which have a transportation infrastructure valued at more than $1 trillion and provide more than five billion trips each year (*NJ Transit, 1996*). The FTA has encouraged transit officials to achieve the highest level of security, according to the FTA's strategic plan. In order to meet this requirement, transit officials are currently implementing, or searching for, innovative and effective ways to enhance the security of passengers, transit employees, stations, surrounding areas, and vehicles.

This study presents successful pilot security technologies and strategies implemented by transit systems in North America. For example, the security program of Long Beach, California incorporated transit vehicle operators in a surveillance program and provided them with direct access to police officials. This program resulted in a significant reduction of response times to incidents and suspicious activities ranging from graffiti and fare fraud to violent crimes. In general, most of the participating agencies used transit police officers to patrol the systems between 1992 and 1995. With police service, the response time to incidents was reduced by as much as 10 minutes in some cases. This is a substantial reduction in response time when compared to using regular security patrol services that are subjected to queues for response, as well as having limited authority to make arrests. Also, the consideration is made that a reduction of two minutes would reduce transit and traffic related fatalities by 308 annually (*Sullivan, 1995*). Public awareness programs have also been effective in informing riders about the presence of security personnel and devices without communicating the perception of an unsafe transit system.

A summary of crime statistics, surveillance technologies, and security strategies is also presented in this report. It is important to recognize that it is impossible to obtain completely accurate security statistics due to unreported incidents and/or information about undetected crimes. In addition, information provided by the different transit systems is not always in a consistent format and may have inherent flaws. As a result, an effort was made to provide accurate data and results within the given conditions.

The information provided in this report was obtained through telephone interviews, surveys, and observations during visits to some of the study agencies. The general characteristics of the ten transit agencies selected for the analysis are presented in **Table 1.** The selection of the participating transit agencies was made based on the completeness and accuracy of responses to the surveys (no distinction was made between the different modes operated by the agency or the size of the systems to perform the analyses).

Table 1. Characteristics of Participating Transit Agencies

Transit Agency	Mode(s) of Service	Service Area (sq-miles)	Service Population (millions)	Annual Passenger Miles (millions)	Fixed Guideway Directional Route Miles	Vehicles Operated in Maximum Service
Metropolitan Atlanta Rapid Transit Authority (MARTA)	Bus	804	1.20	212.80	0.20	559
	H. Rail			378.40	80.80	238
New Jersey Transit (NJ TRANSIT)	Bus	6,559	7.50	754.10	6.70	1,726
	C. Rail			1,086.40	1,171.60	692
	H. Rail			11.90	8.30	16
Portland-Tri-County Metropolitan Transp. District of Oregon (Tri-Met)	Bus	592	1.00	208.10	1.80	499
	L. Rail			46.40	30.20	23
Miami-Metro Dade Transit Agency (MDTA)	Bus	285	1.70	258.00	22.30	517
	H. Rail			113.70	42.20	76
	A. G.			3.60	8.50	19
St. Louis-Bi-State Development Agency	Bus	3,580	2.30	167.10	9.10	561
	L. Rail			42.60	28.00	26
Greater Cleveland Regional Transit Authority (RTA)	Bus	687	1.40	188.20	0.00	636
	H. Rail			53.00	38.20	35
	L. Rail			27.20	26.70	26
Olympia Intercity Transit	Bus	89	0.10	13.60	0.00	70
New York-MTA Metro North	C. Rail	527	4.50	1,843.60	535.40	696
San Francisco- Bay Area Rapid Transit District (BART)	H. Rail	234	1.30	940.00	142.00	406
Los Angeles County Metropolitan Transportation Authority (LACTMA)	Bus	4,070	9.10	1,419.00	24.50	1,948
	H. Rail			7.50	0.00	16
	L. Rail			103.10	43.20	36

Source: 1995 Section 15, National Transit Data Base

2. TRANSIT SECURITY VIOLATIONS

Frequent transit violations reported by the participating agencies range from unruly behavior, vandalism, fare evasion, robbery, and trespassing on rights-of-way to the more sophisticated sabotages that cause lamentable loss of lives and substantial property damage during a single incident. All types of crimes create fear and loss of confidence in transit users. Shooting and bombing incidents have been the most grievous incidents during the last several years and are a major security concern due to the difficulty in controlling and detecting them.

The 10 participating transit agencies reported a total of 89,590 offenses and crimes that occurred between 1992 and 1995. The violations were categorized in this study as crimes against passengers, crimes against system property, and crimes that affect security perception. This categorization observes the classification scheme of crimes and offenses suggested by the FTA in the Transit Security Program Planning Guide.

Of all the reported crimes, 14% were crimes against passengers, 51% were against system property, including fare evasion (the largest of all violations reported), and 35% were crimes that affect security perception. Also, crime statistics indicated that more crimes against passengers occurred at the parking lots, pathways, and surrounding areas involving loss of property, such as car thefts, thefts from vehicles, and muggins. The larger number of violations onboard the vehicles are related to vandalism/graffiti and unruly conduct, which are mostly committed by youngsters. The crimes with less incidence are homicides and rapes; when they do occur it is typically inside the stations/terminals and at adjacent areas where passengers become isolated.

2.1 Crimes Against Passengers

Crimes against passengers can occur in any place, but occur with greater frequency on transit properties where surveillance is inadequate and escape after committing the crime is easy. It also occurs in crowded places where people are not always aware of what is happening around them. Many thefts go unreported because passengers are upset and confused at the moment of the crime or some people do not understand that reporting one single incident may be helpful for security officers to target the locations where crimes occur with greater frequency. The best deterrent to thieves is providing the presence of security personnel integrated with proper communication between vehicle operators, dispatchers, ticket sellers, ticket collectors, maintenance staff, as well as good lighting, better station design, and closed circuit television surveillance systems.

Survey results show that there are seven most prevalent transit crimes that affect passenger security. **Figure 1** and **Table 2** shows the type and number of crimes. **Figure 2** shows the percentage of crimes at the different locations. The definition of the crimes are presented as documented in the report: "Safety & Security Systems Best Practices Technology Assessment" prepared by NJ Transit and TMS, Inc..

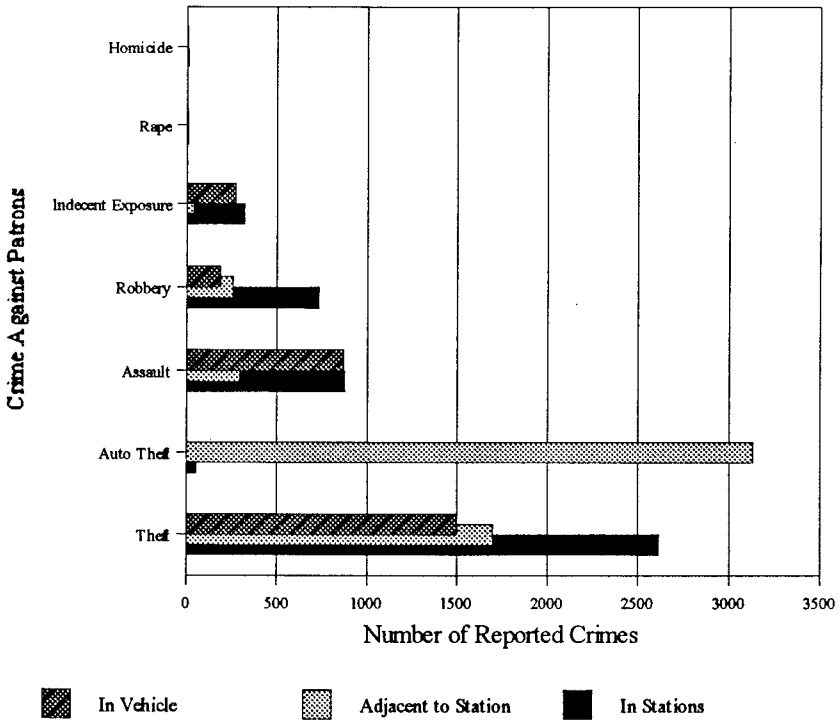


Figure 1. Number of Crimes Against Passengers During 1992-1995

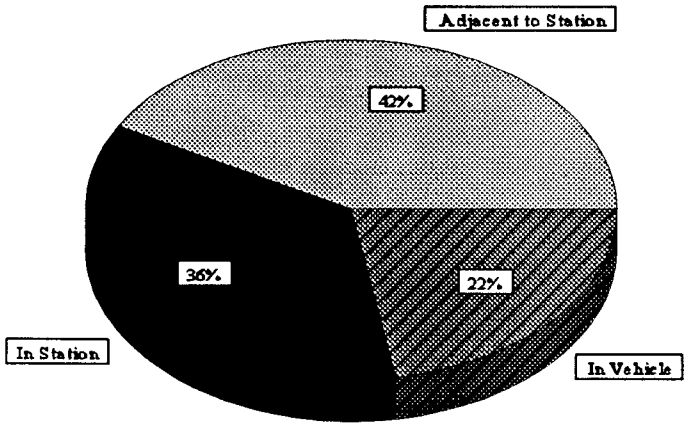


Figure 2. Percentage of Crimes Against Passengers by Location During 1992-1995

Table 2. Number and Location of Crimes Against Passengers During 1992-1995

CRIMES AGAINST PATRONS	Number of Reported Crimes				
	In the Stations	Adjacent to Stations/ Stops	In the Vehicles	Total	%
Theft	2,612	1,696	1,501	5,809	45.00
Auto Theft	51	3,131	21	3,203	25.00
Assault	877	295	870	2,042	16.00
Robbery	731	255	186	1,172	9.00
Indecent Exposure	321	38	272	631	5.00
Rape	8	9	2	19	0.15
Homicide	6	4	2	12	0.10
TOTAL	4,606	5,428	2,854	12,888	100%
PERCENTAGE	36%	42%	22%	100%	

Source: Information Provided by Surveyed Transit Agencies

- *Theft.* Theft is an issue of both actual security and perceived security. Theft occurs in transit systems of all sizes and settings. In some large urban systems, reported losses by passengers is in the hundreds of thousands of dollars each year. However, transit security staff believe that this figure greatly underestimates the magnitude of the problem because many thefts go unreported and a single theft incident totals a significant security issue on its own. Theft of personal property takes place in any portion of a transit system; bus stops, platforms, stations, parking lots, or vehicles. The crime can take place at any point but tends to be during a passenger's journey through the system, including the time when a passenger is waiting for the bus/train, boarding the vehicle, riding the vehicle, or entering or leaving the station.

- *Auto-theft.* Many transit systems with parking facilities experience incidents of vehicle-theft. Securing parking lots is especially difficult for transit systems sharing lot maintenance with other municipal or private authorities. Also, auto-theft occasionally occurs from employee parking lots. Many citizens of communities served by mass transit choose to drive to their destinations rather than risk vehicle damage or theft resulting from leaving a vehicle unattended in a transit parking facility. For the majority of agencies, staffing a parking lot full-time (with system employees or police/security personnel) is financially infeasible.

- *Assault on passengers.* Assault on passengers is a primary concern for all transit agencies. These assaults usually consist of one patron striking another. Simple assaults are far more common than aggravated assaults. Assaults on bus and rail vehicles generally result from problems in the surrounding community (e.g., gang activity or simple disagreements among passengers), which spill-over onto the transit system. Whether on bus or rail, most passenger assaults occur between passengers who know each other. In addition, assaults often involve one or more parties who are under the influence of alcohol or narcotics.

- *Robbery.* Robberies are a serious issue to transit agencies, as are all violent crimes. Two types of robberies are transit agency concerns: system personnel robberies and passenger robberies. Since the 1970s, most bus systems have converted to exact fare collection methods that do not allow an operator access to collected fares. As a result, the incidence of robberies of operators has dropped dramatically. However, robberies of passengers are still a concern. Most robberies of passengers or of system personnel occur at night in isolated areas.

- *Sex Offenses (exhibitionism, prostitution, solicitation).* Although offenders of crimes such as indecent exposure typically do not pose a physical threat to passengers, being a victim of a minor sex offense can be an intimidating experience. Women often base their decisions to ride public transportation on their perception of security. Minor sex offenses occur with more frequency at these types of locations: bus shelters, parking lots, isolated areas of facilities, and at crowed platforms and vehicles. These locations are selected due to the perception that the risk of being cited or arrested is low.

- *Rape*. As with homicides, rapes (or other sexual assaults) on transit agency property are extremely rare occurrences. The threat of a sexual assault, however, is a fear for many women, and plays a role in the decision to utilize public transit.

- *Homicide*. Relatively few agencies have ever experienced a homicide on the system property. Typically, when a homicide does occur, local police handle the investigation; since so few homicides occur on transit systems very few transit police/security departments are equipped to perform homicide investigations.

2.2 Crimes Against System Property

Transit system infrastructure and vehicles have to be protected from a wide variety of threats for assuring a proper operation of the system and providing the transit commuters with an environment that guarantees their confidence and comfort. Fare evasion is the violation with the highest percentage among all offenses against public transit. Approximately, 63% of the total number of crimes against system property (in stations and vehicles) are fare evasions, followed by vandalism/graffiti that accounts for 20% of all reported crimes. Participating agencies reported 28,719 fare evasion incidents with 19,561 cases resulting in arrests during 1992 through 1995, concludes that approximately seven of every ten fare evaders are sanctioned.

There are five major crimes against system property reported by the surveyed transit agencies. The definition of these crimes are presented below as documented in the report: "Safety & Security Systems Best Practices Technology Assessment" prepared by NJ Transit and TMS, Inc.. The number of these crimes reported by surveyed transit agencies is shown in **Figure 3** and **Table 3** and the percentages of crimes at the different locations within the transit system is shown in **Figure 4**.

- *Fare Evasion.* Fare evasion is a key issue for both bus and rail systems. Much of the problems with fare evasion, especially on bus systems, is that while known to be a serious concern, the magnitude of most agencies' fare evasion problem is not well documented. Fare enforcement requires particular attention on the newer rail systems that have adopted barrier-free proof-of-payment systems, with police or uniformed fare compliance officers checking fares on board trains or within designed fare zones. In addition to assuring fare compliance, regular fare checks ensure routine passenger contact with system staff, contributing to patron confidence. Fare evasion includes the following infractions:

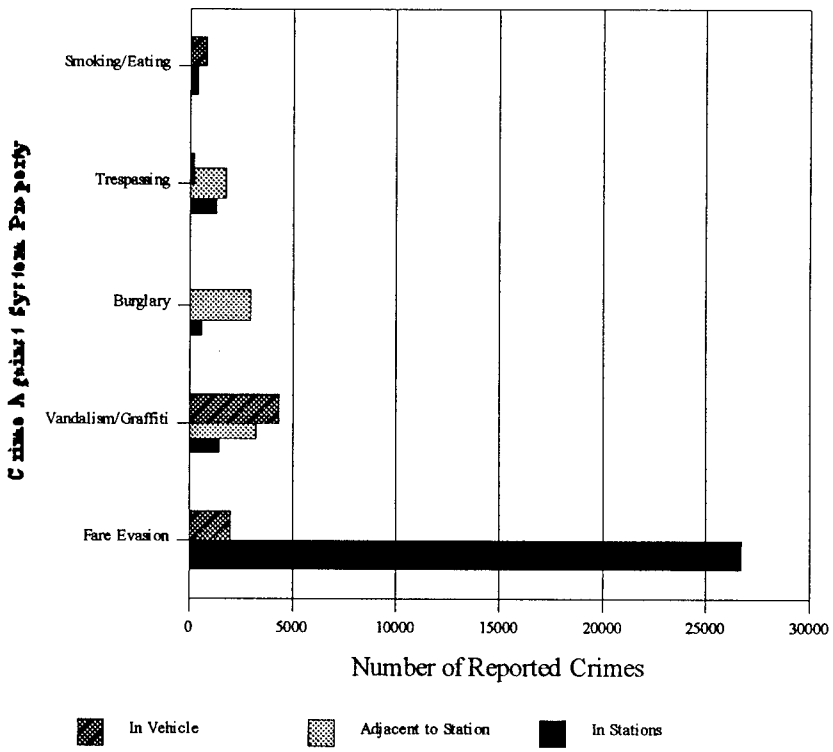


Figure 3. Number of Crimes Against System Property During 1992-1995

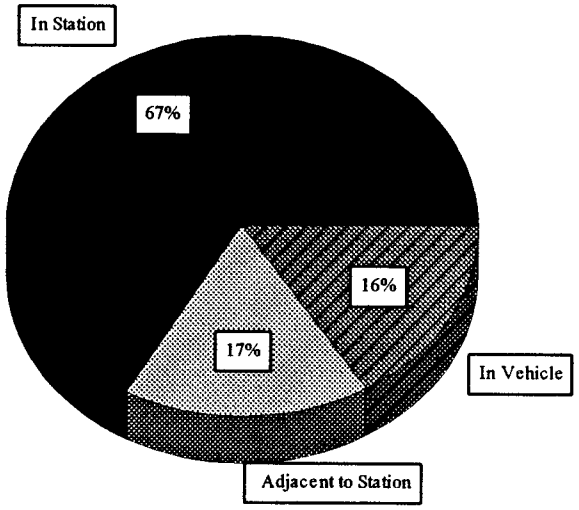


Figure 4. Percentage of Crimes Against System Property by Location During 1992-1995

Table 3. Number and Location of Crimes Against System Property During 1992-1995

CRIMES AGAINST SYSTEM PROPERTY	Number of Reported Crimes			Total	%
	In the Stations	Adjacent to Stations/ Stops	In the Vehicles		
Fare Evasion	26,719	No data	2,000	28,719	63.0
Vandalism/graffiti	1,454	3,217	4,318	8,989	20.0
Burglary	597	2,959	5	3,561	8.0
Trespassing	1,292	1,756	203	3,251	7.0
Smoking/eating	369	3	800	1,172	2.0
TOTAL	30,431	7,935	7,326	45,692	100%
PERCENTAGE	67%	17%	16%	100%	

Source: Information Provided by Surveyed Transit Agencies

- Refusing payment of the fare (or a portion of the fare)
- Jumping turnstiles
- Counterfeiting passes
- Misusing discounted media or monthly passes
- Selling transfers
- Entering revenue areas unlawfully (e.g., back door of the bus, climbing station fences)
- Failing to purchase tickets on barrier-free systems

- *Vandalism/graffiti.* Transit facilities and vehicles are favorite targets of vandals and graffiti "artists," as reflected by the ranking given by the participating agencies. Graffiti artists select the most visible places possible as sites for their work, and transit properties are the ideal location to display their work. Walls adjacent to railway tracks are viewed by thousands of riders daily, and buses and rail cars travel throughout the city, displaying the "artistic work of taggers" as shown in **Exhibit 1**. Rail systems have a large capital investment in vehicles, facilities, and equipment. Therefore, law enforcement officials and security guards at these agencies spend much of their time preventing and responding to property destruction crimes. Graffiti is one of the most serious concern for transit agencies due to the frequency of its occurrence on transit property, the cost of graffiti-removal, and the resulting perception that the transit system is not secure. Vandalism damage may involve broken windows, slashed or damaged seats, etched windows or paint, removal of vehicle equipment, destruction of shelters, and littering.

Exhibit 1. Transit Vehicles are Favorite Targets to Display Graffiti "Art"

- *Burglary.* Burglary differs from theft because it involves forcible, unlawful, or attempted entry into a structure. Transit agency employees are sometimes involved in burglary, either by assisting in a crime or by supplying information (regarding equipment or shipments) to persons committing burglary.

- *Trespassing.* Trespassing is a serious concern to most transit agencies, especially rail systems for the following three reasons:

    - Safety: Trespassing on rail tracks or in subway tunnels is not an uncommon activity resulting in the death of hundreds of people annually. New rail systems often run through existing neighborhoods, interfering with established pedestrian patterns and encouraging pedestrians to walk across tracks rather than using appropriate crossing points.

    - Security: Trespassing may lead to more serious crimes since trespassing is directly related to more serious crimes as are theft and vandalism.

    - Perception: Homeless persons, for example, who trespass on transit property are often intimidating to patrons and heighten the sense that security may be a serious problem at the agency.

- *Smoking/eating/loud music/drinking.* On most systems, local ordinances or system polices prohibit smoking, eating, drinking, and loud music. These policies reduce required maintenance of vehicles, shelters, and stations and provide a comfortable environment for most passengers using the system. Rail systems with dedicated police/security units are more likely than bus systems to have a zero tolerance policy in place. Such a policy involves strict enforcement of

all codes and ordinances, including those for smoking or eating on transit property.

- *Arson.* For bus systems, shelter burning accounts for the majority of arson incidents. Specifically, plexiglass windows found in many shelters are often melted with cigarette lighters. Generally, this offense is categorized as vandalism; however, depending on the extent of the damage, occasionally burnt windows are classified as arson. Some rail systems experience literally dozen of trash fires on their tracks daily. Some are started by vehicle wheel sparking, some by carelessness of passengers who smoke, and yet others are deliberate acts. For both bus and rail, trash can fires are a source of arson arrests. Often, juveniles start these fires, and depending on the extent of the damage, these incidents are classified either as vandalism or arson.

2.3 Crimes Affecting Perception of Security

Violations that affect customers' perceived security level are minor security-related problems that may not result in harm to people or property during a single incident, but may impact the level of ridership with accumulating effects. The number of crimes affecting customer security perception reported by surveyed transit agencies is shown in **Figure 5** and **Table 4.** The percentages of crimes at the different locations within the transit system is shown in **Figure 6**. The definition of these crimes are presented below as documented in the report: "Safety & Security Systems Best Practices Technology Assessment" prepared by NJ Transit and TMS, Inc.:

- *Boisterous/unruly conduct.* Disorderly conduct is related to the loud, rude, or abusive behavior by individuals or groups of passengers. The problem is relatively minor related to others, but it is usually threatening to other passengers. The perception that no one is in control and there might be danger can be sufficient to discourage passengers from using the transit system.

- *Miscellaneous (homelessness, vagrancy, public urination).* Transit property often presents a desirable location for the homeless. Transit agencies typically afford some of the following "amenities," which attract the homeless population: heated/air conditioned facilities, restrooms, some measure of security, and contact with a large population for panhandling activities.

  Although, in most cases, the homeless do not pose a danger to patrons, their presence detracts from the perceived security and quality of transit services. Fare-paying patrons may hesitate to make use of agency facilities installed for their use (such as restrooms), due to the perceived danger presented by the homeless. The homeless community is legally troublesome for many agencies because eviction is usually not an option. If fares are paid by the homeless or if they congregate in areas where no fare is necessary (station, entrances, restrooms, etc.), agency representatives typically have no recourse except to refer them to a Health and Human Service agency, even if their presence intimidates or irritates fare-paying passengers.

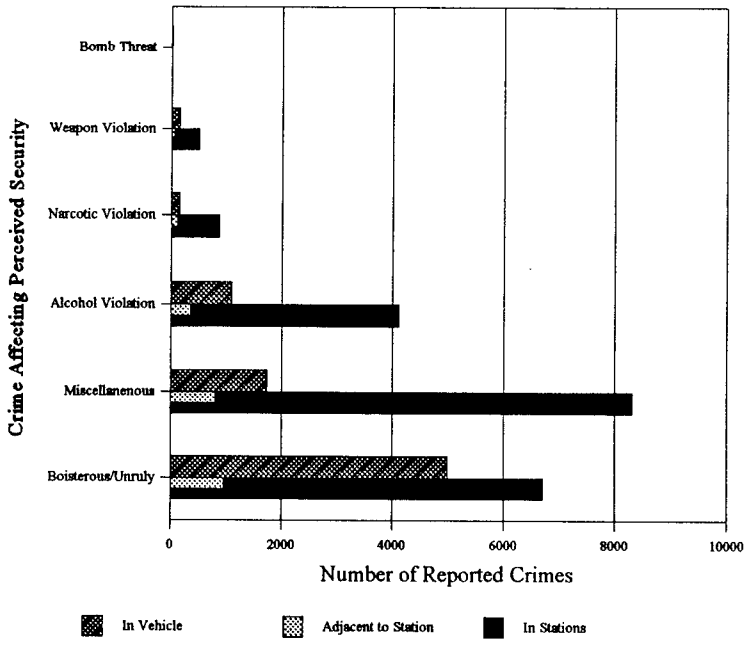


Figure 5. Number of Crimes that Affect Customers' Perceived Security During 1992-1995

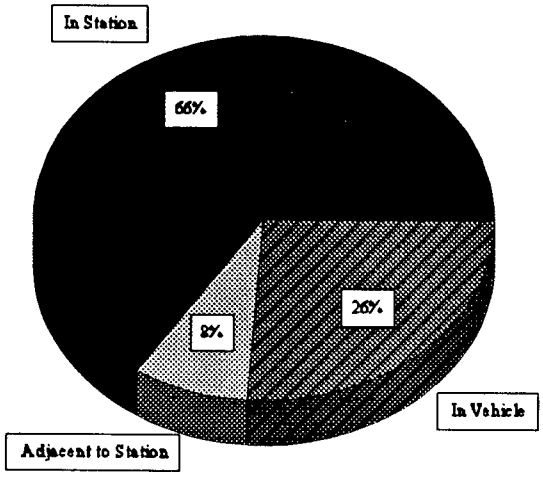


Figure 6. Percentage of Crimes that Affect Customers' Perceived Security by Location During 1992-1995

Table 4. Number and Location of Crimes that Affect Customers' Perceived Security During 1992-1995

CRIMES AFFECTING PERCEIVED SECURITY	Number of Reported Crimes			Total	%
	In the Stations/ Stops	Adjacent to Stations/ Stops	In the Vehicles		
Boisterous/Unruly	6,703	961	4,999	12,663	41.0
Miscellaneous	8,314	807	1,744	10,865	35.0
Alcohol Violation	4,117	362	1,099	5,578	18.0
Narcotic Violation	867	124	158	1,149	3.6
Weapon Violation	501	62	155	718	2.3
Bomb Threat	8	7	13	28	0.1
TOTAL	20,510	2,323	8,168	31,001	100%
PERCENTAGE	66%	8%	26%	100%	

Source: Information Provided by Surveyed Transit Agencies

Public urination is not uncommon at most transit agencies. Bus or rail systems may not provide restrooms, or the restrooms provided are perceived as dangerous. Often, the homeless inhabiting transit facilities will urinate in public areas. Most of the countermeasures are handled by transit operations, and involve system policies, facility design, and maintenance.

- *Alcohol Violation.* Liquor law violations and drunkenness are likely to occur on transit property if they are issues in the community at large. These offenses range in severity from nuisances to disruptive or dangerous behavior. In general, most transit agencies experience a number of these violations. Although, the consequences of these crimes may not be as serious as some other infractions experienced by transit systems. Transit police/security personnel may spend an inordinate amount of time removing intoxicated passengers from vehicles. In addition, the behavior of intoxicated passengers and the sight of passengers consuming alcohol on public transit vehicles create a serious deterrent to many passengers deciding to use public transit.

- *Narcotic violation.* Drug offenses are likely to occur on transit property if they are issues in the community at large. Offenses experienced by surveyed transit agencies include: possession of narcotics, use of narcotics on transit vehicles, and drug-dealing at bus shelters and rail stations

Narcotic offenders are an issue to the transit agency because they are more likely to present a danger to transit personnel and to passengers; commit other crimes, such as robbery and assault; possess a weapon; or intimidate other passengers.

- *Weapon violation.* The number of weapon offenses occurring on transit systems is dependent on the level and the nature of crime in the surrounding neighborhoods. Weapon offenses range in severity from possession of a concealed weapon to the discharge of a weapon on transit property. Weapon violations are often gang-related.

- *Bomb threats.* The incidence of bombs going off, or even discovered in transit vehicles or facilities in the U.S. is extremely low. However, bomb threats have to be considered and seriously evaluated, since the materials and know-how to create bombs is within reach of many individuals.

3. OVERVIEW AND ASSESSMENT OF SECURITY TECHNOLOGIES AND STRATEGIES

"In order to evaluate the appropriateness of a security technology for the transit environment, it is important to understand the type, severity, and frequency of crimes that occur, who the likely victims of the crime are, and the locations where these crimes occur within the transit property and the neighborhoods served by the agency" *(NJ Transit, 1996)*. Additionally, each transit agency needs to identify its level of resources, internal organization, and operational characteristics to facilitate the general managers, transit police chiefs, and security experts with the planning and implementation of goals, strategies, policies, and technologies for immediate response, follow-up, processing, and reporting security threats. Efficiently reporting actual transit-related crimes and incident data allow the anticipation of transit related security risks before they occur and the technology resources may be selected and applied most efficiently to prevent and control such threats. Certain crimes can be controlled and prevented with the implementation of advanced security technologies such as closed circuit television (CCTV) surveillance systems, access control systems, and/or emergency communication systems. Other crimes can be prevented and controlled with the implementation and maintenance of technologies that are part of the facility and vehicle design and that have significant impact on criminal activities and passenger perception, such as enhanced lighting systems, crime/vandalism-resistant coating materials, and access control to limit entry to hazardous areas. These technologies are designed to enhance passenger perception of security and to discourage criminal attempts.

To obtain the ideal level of security in a transit system, it has to implement a combination of advanced security technologies integrated with efficient security policies, police/security personnel prepared to provide quick response, and an appropriate facility design. It has been proven that implementing technologies alone without the support of other factors does not work. A summary of passenger security issues and recommended technologies to prevent and control crimes against passengers is presented in **Table 5**. The system property and vehicle security issues and recommended technologies to prevent and control crimes against system property are presented in **Table 6**.

3.1 Surveillance Systems

Closed Circuit Television (CCTV) surveillance system is one of the technologies used by most of the interviewed transit agencies to combat crime problems in different ways. CCTV surveillance systems have demonstrated to be very efficient when they are effectively monitored and coordinated with security response strategies and if they are installed in the appropriate location, weather, and lighting. The system can be connected with monitors in locations where transit personnel can observe in real time a clear view of the activities in and around the station, surrounding areas, support facilities, and on vehicles as shown in **Exhibit 2**.

Initially, CCTV surveillance systems were camouflaged and installed only to monitor isolated areas and waiting areas at transit stations during off-hours. Some security specialists determined that

Table 5. Passenger Security Issues and Effective Technologies to Prevent and Control Crime

Location	Security Issues	Effective Security Technologies						
		CCTV Surveillance Systems	Emergency Communication Systems	Posted Passenger Information	Appropriate Lighting	Visibility Mirrors	Real-time Transf./sch. Inf. System	AVL
Onboard Vehicles	• Easy escape • Lack of access to assistance • Passenger crowding • Inadequate surveillance	✓	✓	✓	✓	✓	✓	✓
Inside Stations	• Easy escape • Passenger crowding • Inappropriate station design • Inadequate surveillance	✓	✓	✓	✓		✓	
Parking Lots	• Passenger isolation • Remote location • Lack of security personnel • Inappropriate lighting • Inadequate surveillance	✓	✓		✓		✓	
Pathways to Stations	• Passenger isolation • Remote location • Poor design • Inappropriate lighting • Inadequate surveillance	✓	✓		✓	✓	✓	
Platform/Boarding Areas	• Passenger isolation • Lack of access to assistance • Poor design • Inappropriate lighting • Inadequate surveillance	✓	✓	✓	✓	✓	✓	

Source: Surveyed Transit Agencies, Safety & Security Best Practices Technologies Assessment, NJ Transit

Table 6. System Property and Vehicle Security Issues and Effective Technologies to Prevent and Control Crime

Location	Security Issues	Effective Security Technologies					
		CCTV Surveillance	Emergency Communication Systems	Appropriated Lighting	Antigraffiti Protection	Real Time Transf./Sch Inf. System	AVL
Onboard Vehicles	• Easy to escape • Lack of access to assistance • Passenger crowding • Inadequate surveillance systems • Inappropriate lighting	✓	✓	✓	✓	✓	✓
Station/Terminals/Stops	• Remote location • Lack of security personnel • Lack of access to assistance • Easy escape • Inadequate surveillance systems • Inadequate station design • Inappropriate lighting	✓	✓	✓	✓	✓	
Administrative Facilities	• Remote location • Lack of access to assistance • Easy escape • Inadequate surveillance systems	✓	✓				
Revenue Handling	• Remote location • Lack of security personnel • Lack of access to assistance • Easy escape • Inadequate surveillance systems • Inappropriate lighting	✓	✓	✓			
Maintenance Facilities	• Remote location • Lack of access to assistance • Easy escape • Inadequate inventory control • Inadequate surveillance systems	✓	✓	✓			

Source: Surveyed Transit Agencies, Safety & Security Best Practices Technologies Assessment, NJ Transit

Exhibit 2. Surveillance Monitors at MDTA's Control Center

installing CCTVs at visible locations and directly toward fare collection areas, entrances, platforms, escalators/elevators, corridors, parking lots, pathways, blind spots, and in the vehicles provides a sense of security to both transit operators and transit customers, simply by giving the impression that all activities in the system are monitored. Usually, cameras are installed in aluminum or stainless steel housings with plastic dome-shaped faceplate to be protected from vandalism activities. "CCTV technology has demonstrated to be effective in improving detection and response to fare evasion, preventing vandalism and graffiti, improving assistance for passengers with disabilities, improving emergency response and management activities, and the most important: enhancing customers' confidence in the security of the system" *(NJ Transit, 1996).* This technology also improves the effectiveness of security's special operations when responding to hostage situations or for immediate identification of perpetrators. Case after case demonstrates that applications of video integrated with radio technology have become a major trust and now are used to apprehend those individuals who try to beat the judicial system and convict them on the basis of "video doesn't lie." The major inconvenience is the high level of manpower for maintenance and monitoring and the complex integration with communication technologies and security response strategies implicating a very high installation and operation cost.

Video image transmission has been, and is, going through radical changes. The latest mode is the digital encoding and compression techniques to transmit video images, both still images and motion video images. These image transmission techniques are available in the market under three

different standards. The Join Photographic Expert Group (JPEG) offers one of the standards that achieves image compression by employing several previously defined methods that can achieve compression ratios of 3:1 for resulting images virtually indistinguishable from the original and 10:1 to 20:1 for images maintaining acceptable resolution. The Motion Pictures Experts Group (MPEG) has defined a second standard for the compression of high quality motion video to a degree that will allow its transfer at or near the standard compact disk (CD) rate of approximately 300 Kbps. Quality and data rate take precedence over compression time and, as a result, MPEG's application will likely be limited to prerecorded images. The third and widely accepted standard described in the International Telecommunications Union standards is defined for real-time video applications such as video teleconferencing called Px64. Two newer compression techniques have been developed and hold promise for future improvements in video transmission (*Eduards, 1997).*

Advantages of CCTV technology presented in the report prepared by NJ Transit and TMS, Inc.: "Safety & Security Systems Best Practices Technology Ass" are listed below:

In Stations and Surrounding Areas:

- Excellent general monitoring capabilities
- Provides clear documentation of incidents; effective for legal evidence
- Provides station managers and control centers with enhanced incident/emergency response capabilities
- Good record of occurrence patterns of behavior on system
- May have deterrent effect

On-board Vehicles:

- Clear documentation of incidents for use as legal evidence
- May provide improved operator security
- Videotaped documentation alerts police/security to the types of crime occurring on transit vehicles
- "Black box" capability (digital) for operator/vehicle data in the event of an accident
- Ability to reduce fraudulent claims
- May have a deterrent effect on juveniles

Disadvantages of CCTV Technology presented in the report prepared by NJ Transit and TMS, Inc.: "Safety & Security Systems Best Practices Technology Ass" are listed below:

In Stations and Surrounding Areas:

- Spacing and wiring specifications must be determined far in advance to achieve maximum system performance
- Integration with access control systems and alarms can be difficult (older CCTV systems do not interface well with newer technology)
- Real-time monitoring requires interface with new and more expensive technology and staffing

- Time-lapse monitoring may leave systems vulnerable to recording/monitoring failures (i.e., unclear identifications, missed incidents)
- Storage and retrieval of videotape is time consuming

On-board vehicles:

- On-board cameras and videocassette recorders experience more problems with vibration and moisture than do other types of systems
- Technology is still under development (power source and software problems must still be addressed)
- Tape monitoring/archival review is time-consuming
- Power interruptions limit accuracy of time/date stamp
- Technology requires considerable servicing and maintenance
- Technology is sensitive to temperature changes and may malfunction as a result of extreme heat or cold on-board vehicles

Surveyed transit agencies were asked to provide information on the use of CCTV surveillance systems in the stations, surrounding areas, and on-board vehicles. Most of the participating agencies use CCTV system to control crime and enhance perception of security. Responses indicated that 45% of the agencies utilize CCTV systems inside the stations at platforms, waiting areas, and at ticket vending machine areas; 18% at platforms and waiting areas; 18% only at vending machine areas; some agencies have cameras mounted at restroom entrances and elevator/escalator areas; and 19% do not use CCTV systems inside the stations at all. In areas adjacent to stations/stops, only 18% of agencies have CCTVs in the passage-ways. 18% reported to use cameras on-board buses; 2 agencies reported to have CCTVs on-board train vehicles, and four agencies are testing it. Several agencies have video recording equipment installed on selected vehicles that cover routes with high incidence of vandalism and juvenile disturbances. Locations for television surveillance varies; some agencies control the whole system from the control center, others in every individual rail station by the station managers, and others from the transit police stations.

Los Angeles County MTA (LACMTA) rail system employs system-wide video surveillance systems combined with highly visible contracted police on station platforms and riding trains. LACMTA's Blue Line uses fixed color cameras and monitors in subway stations and black-and-white cameras at outdoor stations at platforms, waiting areas, and near ticket vending machines. LACMTA's Green Line has combined cameras with intrusion detection devices to alert staff to the presence of trespassers or obstacles on the right-of-way. This high level of security has served to discourage criminal activity on the trains, in the stations, parking lots, and all other system property areas. Maryland MTA became the first rail system to place analog cameras and recording devices on its rail vehicles. This technology proved highly successful in promoting patron perceptions of security and in reducing the incident juvenile crime on the rail system. Orange Newark Elizabeth Bus Inc. in Newark, New Jersey have experienced a 30% reduction in insurance premiums and a substantial decline in the number of claims for transit crime related incidents filed since the installation of CCTVs

in the 45 transit buses. The agency has used the CCTV systems to fight back against fraud, a tremendous expense and daily threat in the transit industry. It has helped to investigate passenger complaints providing important evidence in the defense claims and allowing an aggressive action in preventing the fraudulent ones from ever being paid.

BART conducted a pilot project in 1995 to test the effectiveness of video surveillance on transit vehicles. Cameras were installed on several buses serving one of the most problematic and a high ridership bus routes. The pilot program showed a decline, over time, in the number of incidents on the route. Of the 36 incidents on this route, four occurred in January on buses equipped with a camera; in February, the figure was one in 25 incidents; and in March, not one of the 28 incidents occurred on the tested buses. In addition, no liability claims or complaints about drivers were reported on the buses with cameras (*Metro, 1997).*

3.2 Communication Systems

Communication technologies are essential to prevent, control, and respond to a diversity of transit crimes. To be effective, the people operating the communication technologies have to be trained to react quickly, calmly, and effectively to the different type of security incidents and to coordinate with the appropriate response force. To prevent and control crime, all surveyed transit agencies use emergency communication devices in the stations. The telephone connected to a center control facility and to the police is the most popular. Adjacent to stations and stops, only one agency has telephones connected to a control facility. Six have intercoms on-board vehicles to communicate with vehicle operators and three have telephone lines connected to control facilities. Most of these devices are antiquated and operate in isolation because the lack of compatibility with more advanced communication and surveillance technologies available in the industry. **Exhibit 3** shows a typical intercom in a train vehicle that allows passenger communication with the operator. Some agencies utilize emergency communication technologies in combination with CCTV systems, intrusion sensors, and other equipment, which allows remote areas to be monitored from a control center. A description of the most common devices utilized by participating transit agencies are summarized below:

Public Phones

Public telephones serve as an amenity and security device. Provision of public telephones should be made throughout stations and in particular on all platforms, at both the paid and unpaid entrances, through parking lots, and at all passenger pick-up areas. The placement of telephones should be identified using the international blue telephone symbols and large enough to be fully visible from anywhere in the area served by the telephone, but should not interfere with collector's or passenger's sight lines. All telephones in the system, including those in parking lots, should have signs giving precise information about the location of the telephone so the callers can relay this information to emergency dispatch personnel. Telephones are, however, subject to the same potential vandalism as other equipment and must be safeguarded and maintained.

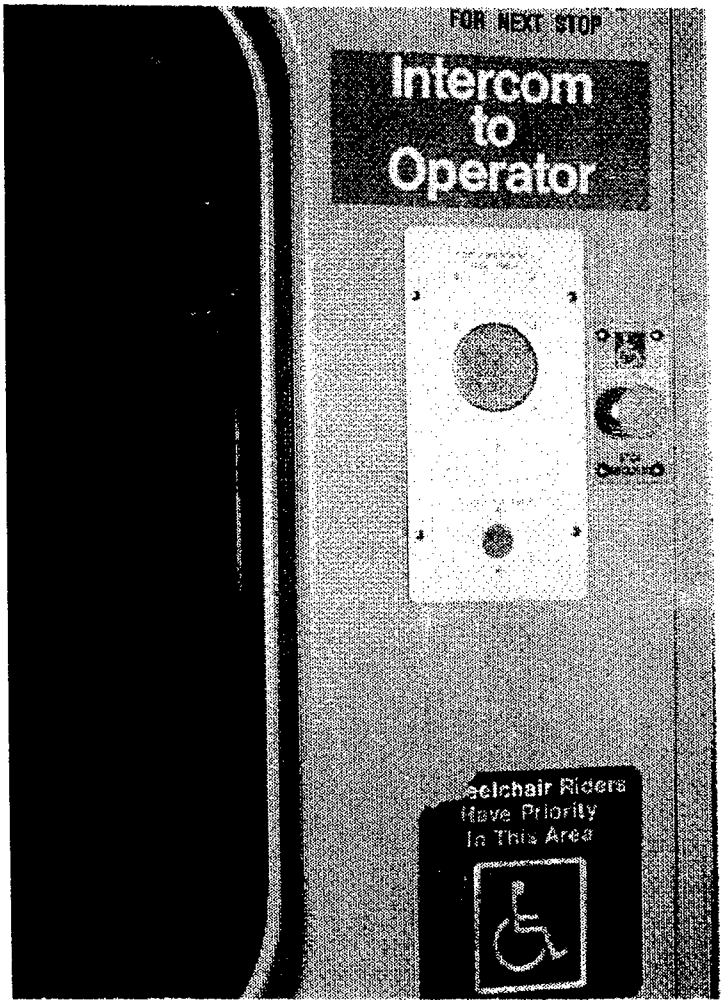


Exhibit 3. Intercom On-Board a Transit Vehicle

Blue Light Police Phones

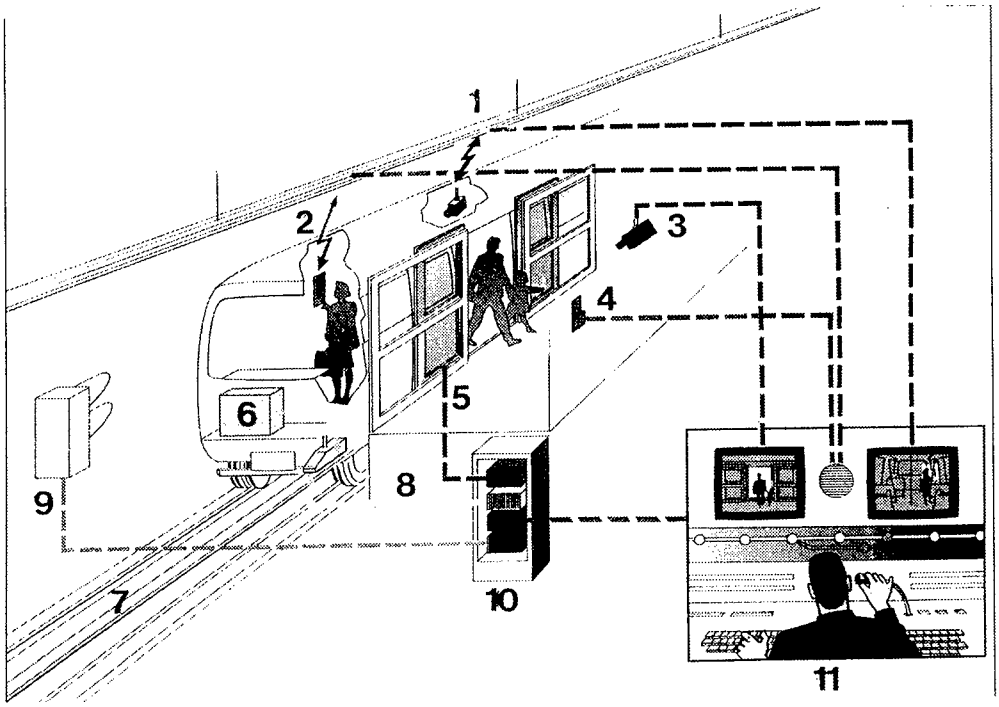
These telephones are connected directly into police departments or security personnel centers and are used primarily at parking lots, garages, and other isolated areas. Same as a public telephone, these phones should have signs giving precise information about the location of the telephone so that callers can relay this information to police or security personnel.

Alarms, Radios, and Call Boxes

Alarms, radios, and call boxes provide a mean for passengers and transit personnel to call for assistance in the event of assault, threat, or some other emergency. Their locations must be planned for the convenience of users. A transit system must also develop procedures for quick response to the alarms or messages, including the inevitable false alarms. Transit stations and vehicles should be equipped with emergency call boxes connected to central controls as shown in **Exhibit 4**, or simple-to-operate intercoms to allow communication between all passengers and the operator. Two-way capabilities allow transit staff to reassure passengers, request specific information, and provide instructions.

Exhibit 4. Police Call Box
Source: Traffic Technology International, Winter'94

The effectiveness of the alarms and call boxes is enhanced when they are used simultaneously with CCTV systems as shown in **Exhibit 5**. Maryland Mass Transit Administration (MTA) in Baltimore has an advanced concept communication exchange system that utilizes infrared color touch screen technology. The system is a multi-line, multi-console radio/telephone voice communication system that has improved communication performance in countless applications. **Exhibit 6** shows one of the communication consoles in MTA. Santa Clara's system equips all train operators, fare inspectors, and bus and rail supervisors with two-way radios and has public access to 911 emergency services at all transit bus centers and light rail stations, as well as loudspeakers with direct links to the rail operations control center.



1 - Train video monitoring
2 - Intercom
3 - Platform video monitoring
4 - Platform intercom
5 - Platform screen doors
6 - On-board automatic train control
7 - Modular transmission carpet
8 - Wayside to train communication
9 - Signaling
10 - Wayside automatic train control
11 - Centralized control room

Exhibit 5. Integration of Communication and CCTV Systems
Source: Automated Train Operation System by MARTA Transport

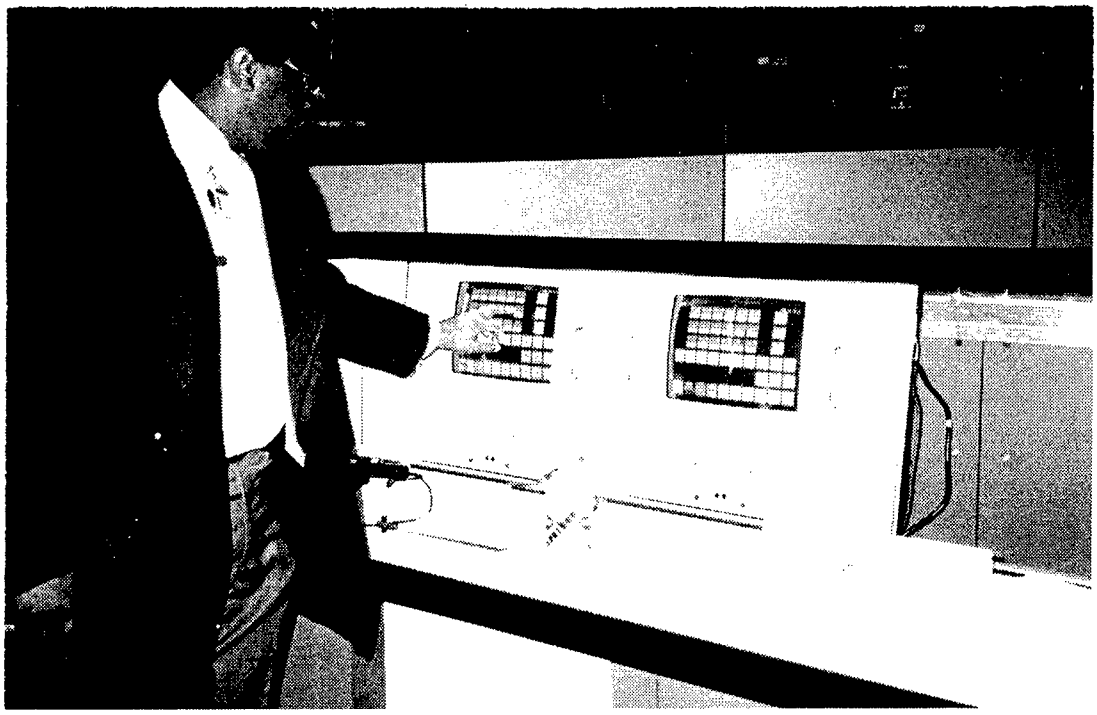


Exhibit 6. Advanced Concept Communication Exchange System at MTA, Baltimore

BART personnel developed a new standard for the design and placement of passenger emergency call boxes in parking lots and garages. Upon implementation of this standard, all existing parking lots and garages will be retrofitted to include the call boxes, and all newly constructed parking facilities will also install the call boxes. The call boxes will be positioned at the same relative location in each parking facility to provide passengers with a consistent configuration since BART personnel believe this enhances security and confidence in the system. All trains on GO Transit in Toronto, Canada are equipped with passenger assist alarms and all stations are equipped with alarm and public address systems.

Public Address Systems

Public address systems allow one-way communication between the system and the passengers. This communication can impart some perception of the presence of transit personnel and the existence of surveillance. This is especially true if announcements are specific to the particular facility, area of the facility, or vehicle, or if CCTV systems monitor the area and enforcement can be remotely enforced. A high degree of security is achieved if transit staff can respond with announcements to situations. For example when passengers are congregated, a general announcement can be made to please keep clear of the platform edge, indicating that the facility is being monitored.

Advertising Placards

Advertising placards show concern for security and may be used to promote programs such as immediate cleanup and repair, passengers reporting programs, and community relations programs. This information can reduce travel anxiety and increase the speed with which passengers move through the system.

Advantages and disadvantages of the emergency communication technologies presented in the report: "Safety & Security Systems Best Practices Technology Assesment" prepared by NJ Transit and TMS, Inc. are summarized in **Table 7**.

3.3 Access Control Systems

The function of the Access Control Systems (ACS) is to restrain access to criminal elements to the transit facilities such as rail stations, bus terminals, parking lots, garages, and restricted areas including administrative and maintenance facilities limiting access to the facility to paying passengers and agency staff. Some components of ACS are physical barriers surrounding the facility and limiting the number of entrance and exit points to and from the paid fare areas and fences or walls with barbed wire at the top restricting access to right-of-way, parking lots, and rail yards. Some systems lock or gate off entrances and exits and close stairways and corridors with lower circulation of passengers during the evening. These measures have demonstrated to be effective to deter trespassing, which is one of the more frequent and serious security problems that goes hand in hand with burglary, fare evasion, graffiti, vandalism, homelessness, and theft occurrences.

Manually Operated ACS

Revolving Doors

Revolving doors are described as the only doors that are both, open and closed providing both access and a barrier for heating and air conditioning. These devices are used for access control to a rail station, bus terminal, and administrative facility entrance/exit in situations where it is necessary or beneficial to isolate a climate-controlled facility interior from the outside weather. They are installed to save energy and reduce levels of noise, pollution, and dust carried into the facility. Revolving doors are expensive, but vendors affirm that the cost of the doors are payed back in as few as two or three years after the installation based on energy savings alone. A revolving door set at six revolutions per minute can provide access to as many as 24 people per minute in both directions *(NJ Transit, 1996).*

Table 7. Advantages and Disadvantages of Emergency Communication Technologies

Technology	Advantages	Disadvantages
CAD/AVL	• Speed in accurately finding vehicles • Time savings for response units • Efficient use of radio frequencies • Secondary use in monitoring operational performance • Enhanced efficiency in use of police /security resources	• Expensive • System complexity • Need to maintain/upgrade hardware/software periodically
"Blue Light" phones	• Easy access of location call source • Permits coverage of "problem areas" • Enhances perception of security • Permits discussion between caller and dispatcher	• Expense of installation • Cost of maintenance • Can become a target of vandalism
Emergency call boxes	• Easy access of location call source • Permits coverage of "problem areas" • Permits discussion between caller and dispatcher	• Expense of installation • Cost of maintenance • Can become a target of vandalism
Emergency signs on vehicles	• Relatively inexpensive	• Operator training • Indirect method of summoning emergency personnel
"Holdup" alarm buttons	• Safety for transit personnel and passengers in cases where radio cannot be used	• Possibility of false alarms • Misuse by operators
Passenger assistance buttons	• Less expensive than emergency call boxes • Permits coverage of "problem areas" • Enhances perception of security	• Unlike phones, passengers cannot give details of situation • Target of vandalism • False alarms
Passenger intercoms	• Efficiency in locating call source • Permits discussion between caller and dispatcher • Permits coverage of problem areas • Enhances perception of security	• Cost of installation • Cost of maintenance
Public pay phone	• Provides supplemental emergency (911) communications at no cost to transit agency • Permits discussion between caller and dispatcher	Cannot be integrated with other communication systems
Silent alarms	• Safety for transit personnel and passenger in cases where radio cannot be used	• Possibility of false alarms • Misuse by operators

Source: Safety and Security Systems Best Practices Technology Assessment, NJ Transit

Turnstiles

Turnstiles are another access control technology used by the transit agencies to count people, allow exit but not entrance, and restrict entrance until authorization is processed when combined with a number of electronic control devices such as a keypass or swipe reader *(NJ Transit, 1996)*. Turnstiles may be an inconvenient device at crowded stations or in case of emergencies that require evacuation as shown in **Exhibit 7**.

Exhibit 7. Turnstiles May be Inconvenient at Crowed Stations
Source: Characteristics of Urban Transportation Systems in Mexico

Lock Systems

Manually operated locks are used to secure stations, restrooms, maintenance, and all other support facilities and are often referred to as "stand-alone security devices." These locks have different modes of operation; with a pin and tumbler, which because its simplicity, cost, reliability, and acceptance is the most popular method for securing a door in the transit environment; combination locks with moveable dials with a series of disk shaped tumblers; keypass/push-button locks, with numbered push-buttons that must be pushed in the right combination to open the lock; and cardkey readers operated with battery devices, which read cards with magnetic strips. Older agencies, particularly, rely on these security devices to limit access to a significant portion of transit facilities and equipment *(NJ Transit, 1996)*.

ACS Electronic Technology

ACS electronic technology has been improved greatly since the first ACS was installed. ACS electronic technology consists of databases to store and manipulate information and innumerably functions from a personal computer including vehicle management, incident response, magnetic swipe card reader, and Personal Identification Number (PIN) entry systems.

Vehicle Management

The focus of the fleet management is to improve the efficiency and effectiveness of transit services and to increase passenger safety and security. The most advanced design, development, and deployment for fleet management is the computer aided dispatch/automatic vehicle locator (CAD/AVL) system. Actually, a CAD/AVL is just one component of the Intelligent Transportation System (ITS) technology that provides important security benefits. A CAD/AVL system is a computer based vehicle tracking system capable of determining a vehicle's location and operating status in real time. It allows a dispatcher from a control center to track vehicle movements and communicate with the vehicle's operator. The dispatcher can fine-tune a vehicle schedule for better on-time performance, allowing patrons to time their arrival more accurately at bus stops. This decreases the length of waiting time, that is when the customers feel vulnerable to crime and improves the overall confidence in the transit system. The sense of security is heightened by real-time annunciator displays, which alert patrons waiting at transit stations/stops to when the vehicle is arriving.

The French company, Jean-Claude Decaux developed a pocket size personal pager called "Infobus system," which provides the traveler with personal messages as regular pages and with information concerning the schedule of the next five buses expected at the selected bus stop in a specific direction. Infobus compares hourly broadcasts of timetable details with the exact positions of buses. It performs these comparisons every 30 seconds and determines each vehicle's speed, and therefore calculates its likely arrival time. The estimated cost for Infobus users is $7.00 every three months plus a deposit of around $130.00 for the pagers, which costs around $140.00 to produce. The information itself is supplied freely by the transport company's fleet monitoring system, which locates its buses either by radio or satellite. The information is sent to a telecom operator who broadcasts the information on a wavelength dedicated to the service (*ITS, 1997).*

Other major benefits from employing CAD/AVL systems include reduction of amount of time for emergency crews to arrive at an accident location. AVL can pinpoint a bus's location within 50 meters. The savings in response time could mean the difference between life and death for a patron experiencing an emergency. A video security system permits the monitoring of events taking place on a transit vehicle as they happen. Additional benefits directly related to CAD/AVL systems are electronic fare box systems, which provide the decrementing farecards that are difficult to counterfeit. Studies showed that by reducing fare evasion, revenues can increase from 3% to as much as 30% (*Passenger Transport, 1996*).

At the present time, over 60 transit authorities throughout the nation are at various stages of considering or installing CAD/AVL systems on their buses to improve fleet management and transit service (*Zhao, Shen, 1997*). Among the participating transit agencies, six responded to having CAD/AVL systems installed. Houston Metro affirmed that it has already seen the enormous security benefits of CAD/AVL systems. Metropolitan Atlanta Rapid Transit Authority (MARTA) installed the latest integrated technology advances in the operation of transit system for improving staff efficiencies and patron services during the 1996 Atlanta Summer Olympics. The CAD/AVL with a silent alarm system was one of the enhancements deployed by MARTA that permitted vehicle radio dispatchers to immediately locate a vehicle for quick emergency response. In addition, while the dispatcher is tracking the vehicle in a silent alarm state, the dispatcher can activate a covert microphone located on the bus to monitor activities on the bus. A discrete symbol change on the bus operator's radio control head is used to signal the bus operator that the dispatcher is listening and that appropriate actions are being taken. Quick emergency response and safety of bus operators and patrons are major features acquired through the implementation of the enhanced silent alarm and covert microphones.

Vehicle Incident Response System

The vehicle incident response system is very important to protect the rail transit system's right-of-way from trespassers and accidental or deliberate placement of obstacles on the track using different sensor technologies such as vibration, weight loading, electronic, or beam sensors. Each of these sensors operates through the advanced transmission of radio or electronic signals over a computerized access control system. The major problems reported on this type o technology is the hypersensitivity to vibration and weight, interference with the transmission of radio waves in the tunnels, operating failures, and software errors. It is recommended to combine sensors and alarms with any mean of monitoring to avoid unnecessary efforts in case of false alarm. Some systems are designed to detect motion using infrared technology while newer systems analyze the video image. These systems vary in level of sophistication from simple motion detection causing the video image to be displayed at the monitoring location to a more selective display generated by motion in a sector of the monitored video image.

There are other neural network technology under study, which may allow compressed video to be electronically monitored for any defined "abnormal" activity beyond the capabilities provided by current technologies. The simplest concept is detection of motion. The motion of an escalator may trigger an abnormal event indication using current technology. A neural network based detection would sense an empty escalator versus one with a person on the escalator, someone walking versus someone running, or even a person smoking.

At the present time, over 60 transit authorities throughout the nation are at various stages of considering or installing CAD/AVL systems on their buses to improve fleet management and transit service (*Zhao, Shen, 1997*). Among the participating transit agencies, six responded to having CAD/AVL systems installed. Houston Metro affirmed that it has already seen the enormous security benefits of CAD/AVL systems. Metropolitan Atlanta Rapid Transit Authority (MARTA) installed the latest integrated technology advances in the operation of transit system for improving staff efficiencies and patron services during the 1996 Atlanta Summer Olympics. The CAD/AVL with a silent alarm system was one of the enhancements deployed by MARTA that permitted vehicle radio dispatchers to immediately locate a vehicle for quick emergency response. In addition, while the dispatcher is tracking the vehicle in a silent alarm state, the dispatcher can activate a covert microphone located on the bus to monitor activities on the bus. A discrete symbol change on the bus operator's radio control head is used to signal the bus operator that the dispatcher is listening and that appropriate actions are being taken. Quick emergency response and safety of bus operators and patrons are major features acquired through the implementation of the enhanced silent alarm and covert microphones.

Vehicle Incident Response System

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Improvements in motion sensing/detection technology could permit a reduction in the number of video monitors that must activate at a given time. In the case of vehicle security, the detection of a weapon could trigger an automatic alarm and transmission of video from the vehicle. Only if an incident that is considered significant where detected by the automated system would the video be displayed at a monitoring point. When the information from the triggering source is displayed, it would indicate the source on the monitor and an alarm could be sounded. This technology, in conjunction with other sensors, could impact fare abuse and improve transit security (*APTA, 1997*).

Magnetic Swipe Card Systems

Magnetic Swipe Card Systems are utilized by transit systems to provide access to parking lots and garages, to restricted areas, in revenue collection facilities, and to support employee photo badging systems. This technology is also used for vehicle management, or the tracking of company vehicles as they are used by system employees. For employee and parking facilities, magnetic cards can be coded for daily, weekly, monthly, or long-term, parking *(NJ Transit, 1996).*

Personal Identification Number

Personal identification number (PIN) entry systems are used primarily in support facilities, machine shops, and inventory control rooms. A simple four number PIN entry system provides thousands of possible combinations to be utilized by employees with a different level of access. Both, magnetic swipe cards and PIN entry systems have demonstrated full audit capabilities to trace employee entrance/exit and prevent intruders entering to restricted areas. BART is considering the implementation of an advanced Biometric Identification System with a magnetic swipe card reader to ensure a high level of security when the new station with air side access at the International Terminal of the San Francisco International Airport is completed. The system will be installed at all restricted access points, defined according to Federal Aviation Administration regulations utilizing advanced computer and electrical equipment supported by fault tolerant software (*NJ Transit, 1996*).

Advantages and Disadvantages of ACS

Surveyed transit agencies reported that by controlling access to the transit system with ACS technologies integrated with other security systems are very efficient in reducing the potential for crime. Some of these technologies may present a problem due to the incompatibility with pre-existing devices. The advantages and disadvantages of ACS devices presented in the report: "Safety & Security Systems Best Practices Technology Ass" prepared by NJ Transit and TMS, Inc. are summarized in **Table 8.**

Table 8. Advantages and Disadvantages of Access Control System Technologies

ACS Technology	Advantages	Disadvantages
Electronic ACS	• Excellent overall monitoring performance • Tie-in with photo ID badging system for centralized access control on a personal computer	• Poor performance in cold weather conditions • Power supply wiring and compatibility • Poor user interface on operating software • Database constraints • Limited auditing/tracking capability • Lack of compatibility with personal computer systems
Motion detectors	• Cost effective • Serves multiple purposes	• Can be annoying • Sensitivity of detector
Stand-alone locks	• Cost-effective • Easy installation • No wiring or door supports required	• Key and control programs can be difficult to manage • Can be violated with no alarm sounded • Do not provide enough security for use in high risk operations and facilities
Turnstiles	• Cost-effective • Count of users • Crowd control/direction	• Maintenance • Upgrading can be difficult
Revolving doors	• Climate control • Count of users	• Space requirements • Limited deterrent to theft of property
Intrusion/obstacle detection systems	• Inexpensive way to monitor R-O-W for trespassers and obstacles at track crossings and other high risk areas	• Software problems • Weather and maintenance problems

Source: Safety and Security Systems Best Practices Technology Assessment, NJ Transit

Assessment of Security Technologies and Strategies

All transit agencies surveyed rely on technologies to prevent and control crime. Some technologies are focused in specific violations as fare evaders and others are used to discourage general crimes and provide security perception. Some transit properties are adopting state-of-the-art technologies such as advanced passenger information systems and advanced vehicle location (AVL) systems to provide effective transit supervision. The location, speed, and other conditions of vehicles equipped with AVL are monitored in real time along the entire route by the central control operators. In cases of a serious incident, immediate assistance may be provided. A passenger information system based on AVL also gives passengers in the stations and stops real-time information about connections, schedules, delays, traffic conditions, in addition to instructions on how to travel from one point to another. Such information allows the passengers to take the necessary actions to avoid being targeted by criminals.

With responses obtained from a preliminary survey about the most common and effective security technologies and strategies used to deter transit crimes, a second survey was prepared and sent to the agencies to obtain their opinion about the importance of selected security technologies and strategies. The participating agencies were requested to do a "Pairwise Comparison." This strategy consists of assuming that the importance value of the first given item is 1.00; the importance of the second item is compared with the first item; then the third item is compared with the second assuming that the value of the second item is now equal to 1.00; i.e., if the importance of the second item is 80% (0.8) of the first item, the third item is compared with the second assuming that the importance of the second item was equal to 1.0; if the importance of the third item is the double of the second item, the value of the third item is 2.0. This procedure is continued until the table is completed. Values could be any number greater than zero, i.e. 0.1,...,10.0,... . A summary of the results obtained is presented in **Table 9.**

Uniformed and plain clothed personnel monitoring the stations, rights-of-way, parking lots, and vehicles resulted to be the most important strategy for controlling and preventing transit crimes. Transit agencies have adopted different types of security patrol that vary according to the needs and characteristics of the system. Security patrols may be contracted patrol personnel, local law enforcement agencies, and contracted local police services. Most of the transit agencies have hired their own security officers or have a dedicated sworn transit police force. Among the surveyed transit agencies, the one with the largest transit police organization is Metropolitan Atlanta Rapid Transit Authority (MARTA), which uses 261 independent transit police officers to patrol the bus and rapid rail systems that serve an average of 470,000 passengers daily within an area of 804 square miles.

Table 9. Importance of Security Technologies Measured by Surveyed Transit Agencies

Technologies/ Strategies	On-board Vehicle	Inside Stations		Adjacent to Stations	
	Normalized Weight		Normalized Weight		Normalized Weight
Public education	56.4%	Public education	28.2%	On foot uniformed security personnel	25.6%
Advance vehicle location system	11.3%	Veh opr, sec perl, opr perl eqp w/ radios	23.5%	Motorized uniformed police officers	16.0%
Vehicle operators, security personnel, operation personnel equipped with radios	7.5%	Advance vehicle location system	9.4%	On foot plain clothed security personnel	12.8%
Staffed focal points	7.5%	Staffed focal points	11.7%	Motorized plain clothed security patrols	12.8%
Citizens riding transit, especially during off-peak hours equipped with radios to communicate with police	3.8%	On foot uniformed security personnel	7.3%	Visibility mirrors at blind corners and intersections	4.9%
On foot uniformed security personnel	3.8%	On foot plain clothed security personnel	5.9%	Vehicle operators, security personnel, operation personnel equipped with radios	3.8%
On foot plain clothed security personnel	3.8%	Citizens riding transit, especially during off-peak hours equipped with radios to communicate with police	4.7%	Staffed focal points	3.8%
Motorized uniformed police officers	1.5%	Appropriate lighting	2.4%	Posted passenger information	3.3%

Table 9. (Continued, 2/2)

Technologies/ Strategies	On-board Vehicle	Inside Stations		Adjacent to Stations	
CCTV (Cameras/monitors)	1.1%	CCTV (Cameras/monitors)	2.4%	Anti-graffiti protection	2.5%
Motorized plain clothed security patrols	0.8%	Visibility mirrors at blind corners and intersections	1.5%	Appropriate lighting	2.1%
Appropriate lighting	0.6%	Motorized uniformed police officers	1.5%	CCTV (Cameras/monitors)	2.1%
Telephone/radio lines connected with central control facility	0.6%	Posted passenger information	0.8%	Telephone/radio lines connected with central control facility	2.1%
Emergency telephone/radio lines connected with police	0.5%	Real time transfers/schedules information systems	0.8%	Emergency telephone/radio lines connected with police	2.1%
Anti-graffiti protection	0.5%	Telephone/radio lines connected with central control facility	0.8%	Citizens riding transit, especially during off-peak hours equipped with radios to communicate with police	1.9%
Real time transfers/schedules information systems	0.2%	Emergency telephone/radio lines connected with police	0.8%	Real time transfers/schedules information systems	1.6%
Posted passenger information	0.2%	Anti-graffiti protection	0.8%	Voice intercoms	1.6%
Visibility mirrors at blind corners and intersections	0.1%	Voice intercoms	0.4%	Public education	0.7%
Voice intercoms	0.1%	Motorized plain clothed security patrols	0.2%	Advance vehicle location system	0.2%
TOTAL	100.0%		100.0%		100.0%

4. DESIGN, POLICING, AND MANAGEMENT STRATEGIES

The crime statistics obtained from the transit agencies showed that 42% of the crimes against patrons occurred adjacent to stations and stops and that 36% occurred in the stations with a high number of passengers being assaulted on transit platforms. To achieve a greater level of security and reduce and control these incidents, an architectural concept of transit facility design is necessary that would provide high visibility and easy observation for security personnel and system staff in general. This involves the creation and maintenance of an environment which will not sustain criminal activity. Design measures to create this environment consider such factors as adequate or enhanced lighting; station, bus stop, and vehicle design with clear sight lines, safe passageways, and open waiting areas for passengers; and access control to limit entry to hazardous areas. Clear, easily understood signage should inform patrons of system rules, procedures for summoning help, and their current location.

When selecting surface stop locations, for example, lighting should allow patrons to observe their surroundings but should avoid the creation of a "fishbowl" effect, illuminating passengers while providing concealment to potential assailants. Street beatification efforts should enhance both personal safety and transit accessibility. Transit stations and bus stops should be designed to avoid "movement predictors" such as tunnels, or walkways that signal a patron's course of travel to a potential assailant. Additional features include clear windscreens on bus shelters or adjacent to doors inside transit vehicles that allow patrons to see other persons without affording potential perpetrators easy accessibility. Similarly, screens placed behind vehicle operator positions can limit victimization of transit personnel.

Techniques for a Better Design

The most common techniques used by the participating transit agencies to prevent crime through environmental design are summarized below:

Appropriate Lighting

The lighting industry is offering a series of architectural lighting fixtures that address the need for lights that improve security. Lighting is a popular and proven crime prevention technique applicable in both transit and nontransit settings. Transit agencies are continuously expanding use of lighting and upgrading its performance quality inside the stations, parking lots, garages, surrounding areas, maintenance facilities, and inside the vehicles. The **Exhibit 8** shows the lighting features at one of the people mover stations in Miami. Interior lighting of transit buses should be provided for the security, comfort, and convenience of passengers since transit buses operate in both, daylight and darkness. Buses function in urban and suburban environments where the streets are artificially lit during nighttime hours and the lighting system should provide a level of lighting that allows passengers to move around the vehicle safely, to read, to see others riding the vehicle, to see outside the vehicle, and for the efficient use of the CCTV systems when installed on the vehicle.

Exhibit 8. Lighting Fixtures at one of the MDTA's People Mover Stations in Miami

Until recently, the lighting industry addressed the challenges by adding more power to the interior lighting system with specifications that resulted in use of 250ma, 340ma and are considering the possibility of adding as much as 500ma output rather than the 195ma typically used during past years. The L20 Interior Lighting System introduced at APTA EXPO'96 by Transmatic is designed to put more light on the reading plane without increasing the "mirror" effect of the windows. The L20

design does so by addressing the distribution of light inside the coach rather than adding light. In this way, desirable characteristics of design such as interchange ability of wearable parts and energy conservation are maximized while the primary objectives are met. The L20 Interior Lighting System is now being evaluated in cities through the U.S. and Great Britain and its commercialization is expected to start late in 1997.

One of the participating agencies that reported being considering design measures to enhance security was Houston Metro, which performed a survey of the location of bus shelters on all of its routes for relocating a number of shelters that were located in front of liquor stores and bars, enhanced lighting and visibility at other shelters, and modified landscaping to increase passenger security.

Entrances/Exits

Entrances/exits are safe if they can be aligned with an area within the facility that experiences high traffic. Alternatively, the entrance/exit may be very wide. The idea is to create a line of observation from outside the facility, through the entrance, into the public area of the facility. In some areas this may require clear doors and walls. Gates and solid doors can be used when the entrance is closed. One security countermeasure involves closing some entrances in evenings to limit the areas that must be supervised. In such cases, the entrance should be clearly indicated as closed at a point before approaching passengers are stopped at a locked door. Some systems use color coded lights at all entrances to indicate their open/closed or exit/entrance status. Although expensive, it is also possible to construct entrances that can be opened and closed by remote control from a personnel booth or even central control.

Fare Boxes/Entrance Gates

To limit access to transit facilities to passengers only, fare collection gates should be located as close to the entrances as possible as shown in **Exhibit 9**. Fare boxes are often subject to vandalism by those attempting to steal fares. The theft of large volumes of fares can usually be deterred by investing in stronger vaults. Fare evasion can be reduced by making it more difficult to circumnavigate the collection point. Jumping over turnstiles can be reduced by using high-channel turnstiles and floor-to-ceiling type gates. Full-height revolving gates are particularly useful at points that are strictly exits; however, they may worry passengers because it is possible for passengers to trap themselves within the revolving gate. Direct observation of the fare collection point from personal booths is a common practice.

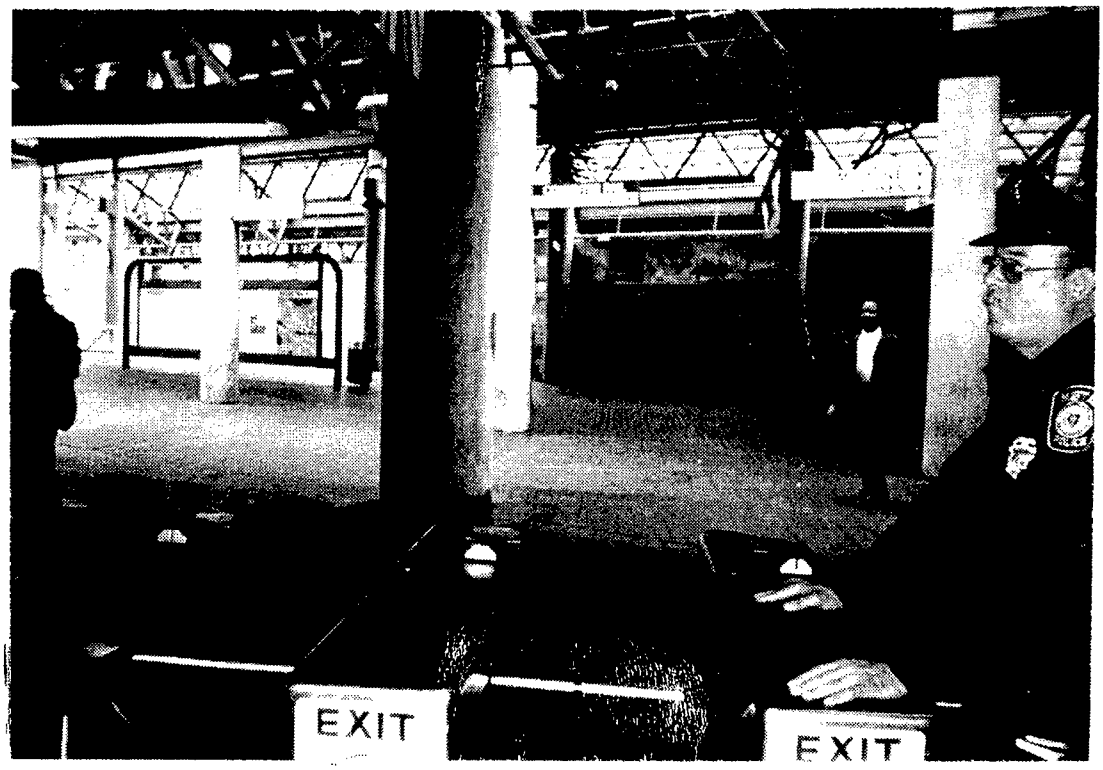

Exhibit 9. Fare Collection Gates Should be Located Close to the Entrances

Safe Waiting Areas

An area closed to the entrance can be set aside as a safe waiting area. Such an area would be clearly marked for use during certain hours and should be supervised by transit personnel. The safe waiting area is shared by all passengers who would otherwise be waiting in a separate location. Such an arrangement must include a means of notifying passengers when their vehicle is approaching with sufficient warning to allow them to reach the boarding area before the transit vehicle moves on. As this requirement must be met for all passengers, including those who may be slow-moving due to age or disability, it is most helpful if the number of minutes before vehicle arrival can be communicated.

Glass or Other Transparent Materials for Walls and Separators in Stations

Transparent materials facilitate surveillance and create a comfortable environment. Passengers waiting for different vehicles can have eye contact and feel safer knowing that there are people around.

Visibility Mirrors at Blind, Angled Corners and Intersections

The mirrors are to be installed when it is not possible to design a station with clear sightliness. It is recommended to install appropriate type of security non-breakable mirrors (flat or convex) considering lighting conditions at those areas. Mirrors are successfully used allowing passengers to avoid potential assailants. Mirrors can be subject to vandalism, so polished stainless steel usually works best because it resists damage and can be cleaned easily.

Transit Policing Strategies

Selecting the appropriate policing program to deter transit crime is perhaps the most challenging task to be performed by the transit agency administrators. The main characteristics to consider for selecting the appropriate approach is dependent on the size of the transit system, the number of political jurisdictions in the service area, and the need for the policing forces to have full police powers (such as making arrests, issuing citations). **Table 10** duplicates the table provided in the Transit Security Procedures Guide prepared by Volpe National Transportation Systems for U.S. Department of Transportation for selecting an approach to policing service. **Table 11** summarizes the characteristics of the participating agencies, the type of police and budget investment in security personnel from 1993 to 1995.

Patrolling transit systems by police or security officers is the most effective technique to deter transit crime. Patrol by uniformed personnel provides both, a visual deterrent and ability to quickly mobilize response to crime and emergencies. Most of the participating transit agencies rely upon sworn transit police officers for policing; other agencies particularly in larger cities adopt specialized police services for patrolling the facilities through either an independent transit police force or specialized units within general service law enforcement agencies. Contract law enforcement, in which a transit agency purchases a specified package of services from an existing police agency, is still another variation. Some systems also use security officers as an alternative to police officers. While non-sworn security officers generally have limited enforcement authority, they are less costly than full police officers, and those systems that use them have found them to be very effective. Additionally, these security officers perform duties such as monitoring park-and-ride lots or providing access control at transit system facilities providing a uniform presence that deters illegal activities and provides more eyes and ears that can call for police service when needed.

A close relationship between system police and a security officer force can enhance the effectiveness of security officers. Police may be involved in the selection of contract security providers, the development of standards, and the training, supervision, and inspection of security staff. Then with a well-developed security force, police can concentrate their efforts on enforcement, problem solving, and the organization of coordinated crime prevention strategies *(Sullivan, 1995)*.

Table 10. Selecting an Approach of Policing Service

Characteristics	Local Police	Local Police Transit Units	Contracted Police Services	Transit Police
Transit system size	Small	Large	Large	Very large
Jurisdictions	One	One	Multiple	Multiple
Full police powers required	Yes	Yes	No	Yes

Source: Transit Security Procedures Guide, U.S. Department of Transportation

Sworn Police Officers

Sworn police officers have full police powers and have the authority to make arrests. They may include local police personnel, special transit units of local forces, or transit police that serve as patrol officers, detectives, undercover agents, or administrative officers. Sworn officers that have the most training and versatile powers are expensive and should be carefully deployed, but their utilization may be indispensable (*US-DOT, 1994).*

Security Officers

Security officers do not have full police powers and cannot make police arrests, but they provide uniform presence to deter crime and can be armed. They can respond to all emergency calls, enforce most rules, interrupt crimes in progress, and make citizen's arrests. In some systems, security guards are used to complement sworn officers to guard revenue and property. Security guards may be present at all revenue transfers and may patrol non-public areas and facilities (*US-DOT, 1994).*

Patrol Guards

Patrol guards are not used to respond to incidents personally but to deter incidents and guard property and facilities. They are usually in uniform and provide a security presence, which is an effective deterrent (*US-DOT, 1994).*

Security Management

Advanced technologies, police and security personnel cannot do much to control and deter crime if there is not a well-developed internal structure to manage the security functions for the planning and design phases or modifications of security operating procedures. There are three main security

Table 11. Type of Police and Budget Investment on Security Personnel by Selected Transit Agencies

Transit Agency	Mode(s) of Service	Service Area (sq-miles)	Service Population (millions)	Size and Type of Police/Security Force (1995)	Budget Invested ($millions)		
					1993	1994	1995
Metropolitan Atlanta Rapid Transit Authority (MARTA)	Bus H. Rail	804	1.20	261 Independent Transit Police Officers	N/A	N/A	10.0
New Jersey Transit (NJ TRANSIT)	Bus C. Rail H. Rail	6,559	7.50	127 Independent Transit Police Officers	6.0	7.0	8.5
Portland-Tri-County Metropolitan Transp. District of Oregon (Tri-Met)	Bus L. Rail	592	1.00	23 Contracted Transit Police Officers	1.5	1.9	2.0
Miami-Metro Dade Transit Agency (MDTA)	Bus H. Rail A. G.	285	1.70	190 Security Officers 6 Sworn Transit Police Officers	6.0	7.4	7.6
St. Louis-Bi-State Development Agency	Bus L. Rail	3,580	2.30	130 Part-time Contracted Police and Security Officers	N/A	1.8	2.5
Greater Cleveland Regional Transit Authority (RTA)	Bus H. Rail L. Rail	687	1.40	143 Independent Transit Police officers and Investigation Division	3.7	3.8	4.3
Olympia Intercity Transit	Bus	89	0.10	5 Contracted Law Enforcement Agents	N/A	0.05	0.1
New York-MTA Metro North Commuter Railroad	Bus C. Rail	527	4.50	198 Independent Police Officers	N/A	N/A	N/A
San Francisco- Bay Area Rapid Transit District (BART)	Bus H. Rail	234	1.30	158 Independent Sworn and 72 Non Sworn Police Officers	13.5	12.1	16.5
Los Angeles County Metropolitan Transportation Authority (LACMTA)	Bus H. Rail L. Rail	4,070	9.10	191 Independent Transit Police Officers	N/A	N/A	8.5

management approaches according to the "Safety and Security Systems Best Practices Technology Assessment," report prepared by Technology and Management Systems, Inc., for NJ Transit. A summary of these approaches is provided below. **Table 12** presents the security management approach used by some transit agencies in the U.S.

Table 12. Security Management Approach Used by Transit Agencies

Corporate (Centralized)Security Management	BART LIRR Maryland MTA Metro-North Houston Metro MARTA
Decentralized Security Management	MBTA NYCT PATH SEPTA
Combined (Centralized/Decentralized) Security Management	Amtrak NJ Transit PATCO WMATA

Source: "Safety and Security Systems Best Practices Technology Assessment," NJ Transit

Corporate (Centralized) Security Management

Corporate security management focuses on centralized responsibility for security operations within the agency to one group or committee, often referred to as the Corporate Security Group (CSG). The CSG is comprised of representatives from the transit police, transit management, engineering, operations, maintenance, procurement, and human resources. The goal of the CSG is to ensure that security issues are considered in all phases of organizational life, including facility design, construction, maintenance, personnel hiring and training, revenue collection, and customer relations.

Generally, while the security remains the primary responsibility of the transit police department, the CSG provides the transit police with valuable support within the agency by identifying issues; assigning clear responsibility for security-related activities, such as maintenance of CCTV equipment, the removal of graffiti, and station closure and opening activities; ensuring that security is addressed in employee screening, hiring, and training; and the polices and procedures for security are incorporated into agency documents. The CSG works to eliminate the duplication of effort in security activities, to standardize technology and equipment, to improve relationships with the vendors and consultants who provide security technology, and to create programs that encourage employees to assume a greater responsibility for security, such as crisis intervention programs for

bus operators and maintenance programs to encourage early notification and removal of graffiti (*NJ Transit, 1996).*

Decentralized Security Management

This type of organization addresses concerns with community relations and officer performance by providing officers with sufficient authority to engage in problem-solving activities that encourage localized solutions to security problems. Under this organization, transit police are assigned directly to police "mini-stations" located in geographic zones through the system. This deployment allows them to work consistently with the management, station, and maintenance personnel in their zones. As a result of the rapport that builds, these personnel often provide valuable information to the police on crime patterns. In addition, police officers work with these personnel to identify and implement technology and procedural solutions to crime problems.

Patrolling the same beat each day encourages officers to develop a sense of pride and ownership in their zones. It also improves the individual officer's knowledge of the specific types of crime problems occurring in their zones, and the perpetrators. This type of organization also relies on communications and computer technology to improve efficiency by allowing officers to perform all administrative and information tasks from the police mini-stations, eliminating the need for officers to report first to a centralized location, then travel to their beats. This type of organization also encourages transit operations and maintenance personnel to work closely with police to address criminal incidents (*NJ Transit, 1996).*

Combined (Centralized/Decentralized) Security Management

Generally, in this organization type, procurement and technology planning decisions are handled by a centralized committee, group, or division; policing and maintenance functions are managed through a decentralized structure (*NJ Transit, 1996).*

5. EXISTING SYSTEMS

5.1 Metro Dade Transit Agency (MDTA)

The Miami metropolitan area is served by several modes of public transportation, being Metro-Dade Transit Authority (MDTA), the agency responsible for the planning and provision of all public transit services, which consist of four major components: the Metrobus fleet, which runs almost 24 hours per day connecting most areas of Dade County; the Metrorail is a 21-mile elevated transit system; the Metromover, a 4.4-mile elevated people mover serving the downtown central business district of Miami; and Special Transportation Services designed to meet the needs of the disabled and elder riders who cannot use regular transit services. The characteristics of the MDTA system are summarized below.

MDTA System Characteristics

Service Area (sq. miles):	285	
Service Population:	1,735,000	
Average Weekday Trips:	243,468	
Number of Vehicles:	496 Buses 32 Demand Response	76 Heavy Rail 19 Aut. Guideway
Number of Stations:	34	
Type of Patrol Used:	Contracted police, own security officers	
Budget Invested in Security Personnel: ($millions)	$6.5 (1992) $6.0 (1993) $7.4 (1994) $7.6 (1995)	

Transit security for all modes of transportation in MDTA is acquired through contracts with Metro Dade Police Department (MDPD), Wackenhut Corporation, and other security companies.

Security Details for the Metrorail

The operators of the Metrorail trains are in a secured compartment while operating the train. The trains are equipped with passenger intercoms for passengers to communicate with the train operator and the 21 stations are equipped with a public address system to announce train arrivals. The control center is responsible for the operation of trains in the entire system, as well as centralizing all voice communications and safety surveillance. Each train has a two-button console: one to open and close the doors, the other to start the train at each station, tasks that follow under the responsibility of the train's operator. In case of an emergency, the train operator, with concurrence from the control center, can override the automatic train stop system and control speed if necessary. Security personnel patrols stations and vehicles are shown in **Exhibit 10**.

Exhibit 10. Security Personnel at MDTA's Metromover Station

Security Details for the Metromover

Security was a major concern in the design of the Metromover system since there are no station or vehicle attendants. Metromover vehicles, which are unmanned are equipped with emergency radios and push-to-initiate conversation buttons to the control centers, door alarms, and side doors that can be opened for emergency evacuation. The system also includes closed circuit television cameras and a public address system. In case of an emergency, the vehicles are automatically and irrevocably stopped. Two locked gates at each platform are the only access to the guideway and the guideway is equipped with emergency walkway with intrusion alarms. An open-platform station design, good lighting, a 53 foot elevated guideway, and the aforementioned CCTV system are employed to deter security problems.

Security Details for the Buses

Unlike the train operators, bus and paratransit operators have direct contact with the public and are responsible for ensuring that patrons pay the proper fare. Operators are directly exposed to patron assaults. In 1995, there were 35 assaults on operators. The agency expended $217,013 on workers compensation claims related to assaults. In 1996, the number of incidents increased to 45. However, the agency experienced a cost of $115,945 which is approximately a 50% reduction in cost. The agency has also experienced an increase in the cost of security related incidents to its patrons. In 1995, the total cost to the agency for liability claims filed by patrons was $15,665 and in 1996, the cost increased by 68% to $49,261. The security technologies used by MDTA are summarized below:

CAD AVLIAVM Tracking/Locator System

The vehicle locator system provides an accurate location of all transit vehicles (buses within 50 feet accuracy) to assist in coordination of emergency responses. The CAD AVLAVM system gives the vehicle operator the assurance that if a problem occurs onboard the vehicle, assistance is readily available. This system also assists in monitoring operational functions such as route adherence and on-time performance.

800 MHZ Communication System

This communication system is equipped with a multi-announcement feature that allows announcements to be transmitted to one or all transit vehicles concurrently via a central control facility, and provides a means for direct contact with the passengers from a central control. The system allows the dispatchers at the central control to prioritize and control their responses to requests from the field and keep frequencies free for emergency transitions. A speaker located above the operator's head is another safety feature that allows the operator to communicate with the dispatcher without using the handset.

Silent Alarm

Each transit vehicle is equipped with a silent alarm. This alarm is used for emergency or life threatening situations. Once the operator activates the alarm, he/she is given a special message through a code which acknowledges the dispatcher's receipt of the silent alarm.

Surveillance Cameras

Cameras are being installed on buses to improve personal security and reduce vandalism. Once installed, signage as shown in **Exhibit 11** will be placed on the buses notifying potential perpetrators and patrons that the bus is being monitored.

Exhibit 11. Signage to be Placed on MDTA's Buses that the Bus Is Being Monitored

Security in System Properties

All MDTA facilities and parking areas are protected 24 hours a day by security guards for employee safety. Metrorail parking garages are also monitored on all levels by surveillance cameras and Wackenhut guards.

5.2 Metropolitan Atlanta Rapid Transit Authority (MARTA)

The Metropolitan Atlanta Rapid Transit Authority (MARTA) provides bus and rail services since 1972. Close to 500,000 passengers ride buses and trains every day. MARTA operates more than 700 buses and 240 heavy rail cars as shown in **Exhibit 12**, which serve 36 stations in over 40 miles. MARTA has won the "Safest Transit System in America" award 17 times in the past 20 years by the American Public Transit Association, and has won the award six times for the safest transit system in North America.

Since 1972, MARTA's police department works each day to enhance safety and security of its transit system. Today, MARTA's Division of Police Service operates with 290 persons, including 261 police officers, and an annual budget of $10 million. Officers are armed, fully certified and have the same powers as other law enforcement officers in Georgia.

MARTA deploys uniformed patrols through stations, vehicles, and system facilities during morning and early afternoon services. Most of the officers patrol on foot rather than riding in cars, which allows them greater visibility and contact with the patrons. Between 3:00 p.m. and 11:00 p.m. on weekdays, and between 5:00 p.m. and 1:00 a.m. on weekends, MARTA assigns a uniformed officer to ride each train in service. MARTA also deploys undercover operations to target specific criminal occurrences on the system and to conduct investigations. General characteristics of the MARTA system are summarized below.

Exhibit 12. One of MARTA's Rail Vehicles and Stations

MARTA System Characteristics

Service Area (sq. miles):	804
Service Population:	1,241,000
Average Weekday Trips:	466,000
Annual Passenger Miles (millions):	213 Buses 378 H. Rail
Number of Vehicles operated in Maximum Service:	559 Buses 238 H. Rail
Number of Stations:	33
Number of Parking Spaces:	19,900
Type of Patrol Used:	Independent transit police, local law enforcement agencies
Number of Security Personnel:	163 (1992) 193 (1993) 220 (1994) 234 (1995) 261 (1996)

Security at Stations

- Roll-up gates at station entrances and exits; motorized gates and lock-and-key doors for station close-down
- Fare gate array which uses magnetic fare card readers and ticket vending machines linked to centralized dispatch locations for monitoring of anti-passback feature
- Alarmed emergency exit doors and ADA gates that feed into centralized dispatch location
- Access and egress signage systems
- Fencing/guard rails along right-of-way and rail grade crossings
- Alarms on TVMs
- Passenger intercoms in stations
- Courtesy phones throughout rail stations and parking lots
- Public pay phones at most stations
- Public address system
- Fire department communications panel
- Fixed/PTZ cameras at station entrances, stairwells, TVMs, platforms, on courtesy phones, near elevators, and restroom entrances
- Monitoring done by centralized dispatch center
- Design of facility to deter graffiti and vandalism with emphasis on clear lines-of-sight along

platforms and at grade crossings, and elevated surveillance points for police patrols
- Graffiti-resistant inside and outside of stations
- Selection of construction materials that can be repaired easily after incidents of vandalism
- Immediate removal of graffiti as soon as it appears
- Selection of vandalism materials for bus shelters
- Emergency phones and alarms in elevator cabs

Security Onboard Vehicles

- Intercom panel in each train car
- Public address system on train that can be initiated by train operator or central control
- Emergency door release that feeds directly to train operator
- Modular seating units on bus and rail vehicles
- Stain-resistant flooring on rail vehicles
- Daily maintenance of train cars and motor buses

Security at Parking Lots

- The twenty-four parking lots are designed with one lane for entrance and one lane for exit
- Employees at all parking lots
- Chain-link fencing surrounding outdoor parking lots
- Minimal landscaping around parking lots
- Well-lit pedestrian pathways from parking lots to stations
- Graffiti-resistant coatings on outdoor parking facilities
- Immediate removal of graffiti as soon as it appears
- Public pay phones in most lots
- Passenger panic buttons in garages
- Limited use of cameras in parking lots

5.3 Metro-North Commuter Rail

Metro-North Commuter Rail started operations in 1831, originally as New York and Harlem Railroad. In January 1983, Metro-North was created as a subsidiary of the Metropolitan Transit Authority. From the onset, safety and security have been stressed as high priority at all levels of management. Metro North is a barrier-free rail commuter system operating 24 hours a day. Trains are manned with several conductors to check tickets. Therefore, Metro-North does not require some of the access control measures as in many other agencies. Some other general characteristics and security technologies used by Metro-North are summarized below.

Metro-North Commuter Rail Characteristics

Service Area (square miles):	527
Population in Service Area:	4,484,000
Number of Vehicles Operated in Maximum Service:	696
Average Daily Ridership:	216, 774
Number of Stations:	116
Miles of Track:	738
Type of Patrol Used:	Independent Police Force
Number of Security Personnel:	200 transit police officers (1995) 200 transit police officers (1996)

Security at the Stations

- Obstruction detection systems to alert driver of debris or trespassers on tracks
- Alarmed emergency exit doors
- Access/egress signage systems
- Perimeter fencing
- Fixed/PTZ cameras at key locations (on station entrance, TVMs and platforms)
- Emergency phones at remote end of station
- Television monitors and visual displays to inform passengers with train arrivals and emergency information
- Police phones throughout rail stations and parking garages that connect to central control
- Public pay phones at all stations
- Waiting areas equipped with emergency phones
- Public address system
- Fire department communications panel

- Graffiti resistant coatings on outdoor station construction\barriers
- Design of stations\selection of materials to minimize vandalism
- Immediate removal of graffiti as soon as it occurs
- TVMs constructed of stainless steel with all components mounted flush to prevent break-ins or vandalism

Security at the Parking Lots/Garages

- Outdoor parking lots surrounded by chain-link rail fencing
- Free parking is available at a number of lots; in these cases, lots are unattended and do not have security hardware in place at access/egress points
- Public pay phones at most lots
- Graffiti\vandal resistant designs and material coatings on outdoor lots and facilities
- Immediate removal of graffiti as soon as it appears
- Enhanced lighting in lots to deter vandalism/graffiti

Security at Restricted Areas

- Intrusion alarm system on restricted doors/gates
- Lock and key mechanisms on most restricted doors
- Chain-link rail fencing/perimeter fencing/barbed wire
- Strict maintenance/operation work order controls
- Facility alarms
- Thorough camera coverage of revenue collection areas; PTZ\fixed cameras in both color and black and white feed into remote monitoring locations
- Fixed cameras on key restricted doors

Security in Elevators

- Emergency alarms
- Maintenance control panel to monitor elevator operation
- Fixed\PTZ cameras on elevator waiting areas in some stations
- Fixed cameras on white courtesy phones placed near elevators
- Emergency phones in elevator cab
- Durable construction materials in elevator floors to protect gear mechanisms
- Stainless steel cab interior
- Routine maintenance

Security On-Board Vehicles

- Public address system on train that can be initiated by train operator
- Emergency door release and stop pull cords

- Public pay phones on board some rail vehicles
- Multiple conductors are present on all trains to take tickets; conductors are equipped with hand held radios that can be used to summon assistance in the case of a security accident
- Modular canvas seating units on vehicles
- Selection of materials designed to resist damage due to graffiti/vandalism (stain resistant flooring, etc.)
- Daily maintenance of train cars
- Glass utilized for train windows that is resistant to breakage due to missile-throwing

5.4 NJ Port Authority Transit Corporation (PATCO)

The Port Authority Transit Corporation (PATCO) began operations in 1969 as the first heavy rail rapid transit system in the United States to utilize one-person train operation under full automatic train control. PATCO deploys security technology to support operational efficiency. Automatic fare collection equipment and CCTV surveillance allows PATCO to operate all its stations without station managers or ticket agents. PATCO's 34-person police force conducts frequent uniformed and undercover patrols to protect PATCO patrons and property *(NJ Transit, 1996).* System characteristics and security technologies used by PATCO are summarized below:

PATCO System Characteristics

Service Area:	127 square miles
Population of Service Area:	718,194
Average Number of Weekday Trips:	40,082
Number of Stations:	25
Number of Vehicles:	121
Type of Patrol Used:	Independed Transit Police
Number of Security Personnel:	35 (1996)

Security at the Stations

- Metal gates with lock-and-key mechanisms
- Localized alarmed emergency exit doors and passenger signage systems
- Automatic fare collection equipment
- Ticket-vending machines
- Cameras are utilized for fare collection areas and station platforms
- CCTVs are also used to aid train operators with line-of-sight problems
- Emergency phones along trackway
- Public address system
- Graffiti-resistant coatings applied to major trouble areas
- Immediate removal of graffiti as soon as it appears
- Graffiti-resistant design of TVMs and fare gate displays
- Protective enclosures for vulnerable fixtures, such as CCTVs, monitors, fire alarms, etc.
- Public pay phones in many stations
- Cameras mounted on the outside of key facilities to provide building surveillance
- CCTVs are used to monitor certain revenue handling\counting, administrative, and maintenance functions

Security at Parking Lots/Garages

- Parking lots at most New Jersey locations (free during the day and a minimal fee for overnight parking)
- Lots are unmanned with gates for access at some lots
- Lighting and fencing
- Public pay phones in most lots
- Restricted Areas
- Most doors are restricted through the use of lock-and-key mechanisms; some use swipe card readers
- Rail yards and maintenance facilities are secured with metal fencing
- Loading dock and inventory control procedures are in place that require multiple sign-offs on the receipt\removal of goods from facilities

Security Onboard Vehicles

- Selection of materials designed to resist damage due to graffiti/vandalism (stain-resistant flooring, plastic seats, etc.)
- Daily maintenance of train cars
- Immediate removal of graffiti as soon as it appears
- Public address system on train that can be initiated by train operator
- No passenger emergency brake
- Passenger alarm buttons in each car (buzzer sounds in operator's cab with light indication for each car)
- Operators have portable radios that "plug in" to the cab and can communicate directly with police using two way radio

5.5 Bay Area Rapid Transit District (BART)

The Bay Area Rapid Transit (BART) System serves San Francisco, Alameda, Contra Costa, and San Mateo counties in California. When BART began operations in 1972, it was the first new metropolitan rapid transit system to be built in the United States in almost 60 years and the world's first fully automated system. To protect BART patrons, employees, and property, the BART Transit Police Department was created in September 1972, and given the same full-time peace-officer authority as city police and the county sheriff's department in 1975 *(NJ Transit, 1996)*. Uniformed and plain clothed officers ride the trains, patrol the stations, and are equipped with police cars for quick response to emergency situations. During 1994, 80.86 patron-related crimes per million passenger trips were reported. This same year, the "zero tolerance program" to enhance security and eradicate fare evasion was implemented; since then, crimes were reduced by more than 10%.

BART has taken steps to make its police force more effective and visible by decentralizing the department into "Zone" or regional facilities. Prior to decentralizing the police department, virtually all police employees worked at their headquarters. In Fiscal Year 1995, four "zone" facilities were created along BART lines, so that a greater police presence could be made and response times to calls could be reduced. Although too early to measure the full impact of decentralizing its police department, after the first three months of the fiscal year, BART experienced a 19% decrease in reported crimes *(Metro, 1997)*

BART developed a new standard for the design and placement of passenger emergency call boxes in parking lots and garages. Upon implementation of this standard all new parking facilities as the one showed in **Exhibit 13** will have call boxes positioned at the same relative location in each parking facility to provide passengers with a consistent configuration.

Exhibit 13. BART's New Parking Facilities are being Equipped with Emergency Call Boxes

BART System Characteristics

Mode of Service	Rapid Rail
Service Area(square miles)	234
Population	1,267,766
Average Weekday Trips	261,750
Annual Passenger Miles (millions):	940
Number of Vehicles Operated in Maximum Service:	406
Number of Stations	34
Number of Parking Lots	29
Type of Patrol Used	Independent transit police
Number of Security Personnel & Budget Invested in Security Personnel: ($million)	201 $11.4 (1992) 195 $12.1 (1993) 202 $13.5 (1994) 230 $16.1 (1995)

Security at the Stations

- Roll-up doors, gates, stainless steel doors, and motorized shutters at station entrances/exits
- Fare gate array (linked to Station Agent Booth control panel in case of emergency-standby power triggers gates to open at exit points during power outages/emergencies)
- Alarmed emergency exit doors/ADA gates that feed into Station Agent Booth
- Entry to passenger bathrooms is controlled through remote systems in Station Agent Booth; whereby Agents can press button to unlock door, or through a lock and key mechanism
- Access/egress signage systems
- Alarmed cross-passage doors in tunnels
- Chain-link rail fencing guard rails along right-of-way, pedestrian bridges
- Fixed/PTZ cameras on station entrances, TVMs, fare gates, and platforms linked to station agent booths
- Cameras from key locations feed into central control
- Fiber optic LAN systems installed in new extension facilities; when operational, system will feed into both Station Agent Booth and central control
- Video recording/still photograph generation is possible off cameras
- Remote police stations have fax machines for the transmittal and reception of still photographs
- Passenger intercoms at remote ends of station
- Television monitors and visual displays to communicate train arrivals and emergency information

- White courtesy phones throughout rail stations and parking garages that connect to central control
- Public pay phones in most stations
- Fire phones in all stations
- Blue light phones every (1,000 feet) along trackway
- Transit radio substations
- Public Address system, which can be accessed through white courtesy phones, station agent's booth, or central control
- Fire department communications panel
- Sacrificial coatings on outdoor station construction\barriers
- Sacrificial coatings were considered on indoor construction, but fire safety concerns about the flammability of these coatings led to the selection of finishing materials that are not highly porous, and provide some natural resistance to spray paint, crayons, and markers
- Immediate removal of graffiti as soon as it appears

Security at Parking Lots/Garages

- Sacrificial coatings on outdoor garage construction\barriers
- Immediate removal of graffiti as soon as it appears
- One lane entrance/one lane exit design scheme
- Automatic parking ticket dispensers at entrance points to lots/garages
- Attended booths in lots/garages
- Access gates (entry controlled by automatic parking ticket dispensers/exit controlled by attendant in booth)
- Chain-link rail fencing surrounding outdoor parking lots
- Line-of sight requirements: no shrubbery/landscaping may exceed 3 feet in height on or around parking lot/garage
- Elevated PTZ cameras on lots
- The agency considered a pilot program with polemounted PTZ cameras with infrared spotlights to "escort" patrons to their cars
- Fixed cameras on each garage level at elevators, stairwells, and white courtesy phones
- Cameras feed into remote locations at lots/garages; some cameras feed into central control
- Video recording/still photography generation is possible off cameras
- White courtesy phones at each level of parking garage and most lots
- Passenger panic (emergency) buttons at each level of parking garage
- Public pay phones at most lots
- BART is considering distributing emergency beepers to patrons free-of-charge; with these beepers, the patron may push a button to call the BART police

Security at Restricted Areas

- Intrusion alarm system on restricted doors/gates wired to Station Agent Booth Control Panel and Central Control
- Most restricted doors utilize lock and key mechanisms; a few utilize swipe card readers
- Chain-link rail fencing/perimeter fencing/barbed wire
- Photo ID badging system for identification of agency personnel
- Strict maintenance/operations work order controls
- Thorough camera coverage of revenue collection areas (PTZ/fixed cameras in both color and black and white feed into remote monitoring locations)
- Fixed cameras on key restricted doors
- Placement of telephone jacks for maintenance/operations call-ins to verify presence in restricted area
- Trip station alarms
- Substation monitoring devices, including motion detectors

Security in Elevators

- Occupation status indicators connected to station agent booth control panel
- Emergency alarms connected to station agent's booth
- Maintenance control panel to monitor elevator operation
- Fixed/PTZ cameras on elevator waiting areas at each level in stations\ garages
- Fixed cameras on white courtesy phones placed near elevators
- Fish-eye cameras in high-crime/isolated elevator cabs
- White courtesy phones by elevators at each level
- Emergency phones in elevator cab
- Durable construction materials in elevator floors to protect gear mechanisms
- Stainless steel cab interior
- Routine maintenance

Security Onboard Vehicles

- Intercom panel on each train car
- Public address system on train that can be initiated by train operator or central control
- Emergency door release and stop pull cords that feed directly to train operator and central control
- Modular canvas seating units
- Stain-resistant carpeting on rail vehicles
- BART is considering the implementation of sacrificial plastic window linings to address the increasing incidents of etching on vehicles; however, the agency is concerned about the flammability of lining material
- Daily maintenance of train cars

5.6 Los Angeles County Metropolitan Transportation Authority (LACMTA)

Los Angeles Metropolitan Transit Authority (LACMTA) has always had problems with graffiti. In 1989, the problem worsened and the Chief of Transit Police created a 20-officer task force dedicated exclusively to this problem. It was observed that youngsters were responsible for most of the vandalism. Undercover officers rode buses and videotaped students painting graffiti. The officers showed the videotapes to parents and teachers to get them involved in a program of rehabilitation created by the police department. Under this program, when a child is arrested for vandalism, the parents have to pay for the damages. Police officers are visiting the schools in highly vandalized areas to distribute transit information and discuss with the students the costs and problems associated with transit crime.

LACMTA bought 196 graffiti-resistant buses in 1995 with most of the interior covered with DuPont Tedlar acrylic and stainless steel seats, which will not show knife carvings or similar damages. These materials help keep a new appearance and last longer. The total cost was $64.4 million, or $328,570 per bus, almost the same cost as buses with no special features. General characteristics and other security features used by LACMTA are summarized below.

Security in the Stations

- Closed Circuit Television (CCTV) cameras/monitors constantly monitored by civilian personnel in dispatch center
- Radios used by police officers, train operators and other rail operation personnel
- Public telephone lines (PTEL) located on platforms which are directly connected to central control facility monitored by CCTV
- Emergency telephone lines (ETEL) monitored by central control dispatchers

LACMATA System Characteristics

Mode of Service:	Bus, light rail, heavy rail
Service Area (square miles):	4,070
Service Population:	9,087,715
Average Weekday Trips:	1,304,338
Number of Vehicles Operated in Maximum Service:	1,912 Buses 16 H. Rail 36 L. Rail
Number of Stations:	56 (22 Blue Line, 20 Red Line, 14 Green Line)
Type of Patrol Used:	Own police force
Number and Budget of Security Personnel ($million):	100 $8.5 (1996)

5.7 Metropolitan Transit Authority of Harris County, Texas

The Metropolitan Transit Authority (METRO) of Harris County in Houston, Texas has 915 buses (operated in maximum service) transporting an average of 284,171 passengers per day with 121 routes within an area of 1,279 square miles. METRO has implemented several programs to combat future personal security incidents experienced by customers at its 11,000 bus stops, 1,200 bus shelters, 22 park and ride lots and 14 transit center lots. Approaches designed to deter the initiation of a criminal act such as providing a more visible presence of police and security guards on buses and transit stops; instituting police bicycle patrol programs; advising transit riders that undercover officers may be on the vehicle; and other such programs that have been implemented to make the transit system safer for customers as follows:

- A test of video surveillance cameras mounted inside a bus. The effective use of cameras and their impact on reducing transit crime is currently being evaluated.

- Hoping to promote the personal security of its customers, METRO has a Safe Haven program that allows persons needing emergency services such as police, fire, or ambulance to flag down a METRO bus and the bus operator will radio for assistance. In addition, if someone needs police or ambulance service, they can board the bus at no charge while waiting for help to arrive.

- Bus operators also keep the community safe by reporting to METRO Police any crimes or emergencies they witness while on their routes. Also as part of its operations, METRO plain cloth officers ride targeted bus routes to detect criminal activity.

- METRO Police has added a bicycle patrol section. Patrolling the downtown area on bicycles provides an effective security element complementing the patrol cars. Not being in a car, the bicycle mounted police officers have a clear observation of their immediate surroundings. The two-wheeled patrols can maneuver easily through downtown traffic and therefore provide quicker reaction times.

Future Security Concepts

As more technology becomes available through implementation of fiber optics and other Intelligent Transportation System (ITS) projects, it is anticipated that this technology will be very useful for transit security. Cameras, supported by fiber optics technology, will be installed at park & ride lots, at transit centers, and at major stops in the downtown area.

Additionally, the Department of Police and Traffic Management will be looking at ways to further apply neighborhood policing programs to transit, such as expansion of the bicycle patrol to areas outside of the current central business district perimeter; additional community outreach programs; and, more public awareness programs.

5.8 Toronto, Canada

The Toronto Transit Commission (TTC) is a fully integrated, multimodal mass transit agency operating in Canada. The system consists of over 37.8 miles of track, 65 stations, and carries over 450 million people a year. It is patrolled by undercover security officers from the Metropolitan Toronto Police, and has the lowest crime rate as compared to other systems of similar size in North America.

Toronto Transit Commission (TTC) system is considered the most secure public transit system in North America. Besides high security technologies in the stations that include passenger assistance alarms, telephones with emergency access on the subway platforms, and specific lighting levels TTC also has a public education program on passenger security, and a staff security training program. TTC authorities mentioned that even having one of the lowest crime rates in North America, they still have transit passengers who are afraid of being assaulted. TTC authorities consider it important to equip the stations with the most sophisticated devices and techniques to make their customers feel more confident.

TTC has a comprehensive treatment of the issues related to making Toronto's public transit system safer. TTC identified two different factors that affect passengers security: Physical Factors and Policy and Operational Factors.

- *Physical Factors*

  - Isolation
  - Movement predictors
  - The location of the collector's booth
  - Sight lines
  - Coherence of a station
  - Lighting
  - Aesthetic factors
  - Signage
  - Surrounding land use
  - Maintenance level

- *Policy and Operational Factors*

  - Research on assaults
  - Ability to identify the precise site of different type of assaults
  - Planning and design process
  - Staff sensitivity and training
  - Public awareness programs
  - Evaluation of programs and policies

6. SUMMARY AND CONCLUSIONS

The major findings from this study are summarized as follows:

1. Selecting the appropriate security technologies and programs for the transit environment depends on the understanding of the type, location, severity, and frequency of crimes that occur at each individual transit agency.

2. The larger number of crimes occur against system property, followed by crimes that affect security perception, and against passengers, respectively.

3. The best deterrent to protect system properties from the crimes with larger incidence (fare evasion and vandalism/graffiti) is the presence of uniformed police/security personnel adjacent to stations and stops and in the stations, specially on transit platforms.

4. The major problems that impact perception of security are loitering, littering, juvenile misconduct to drug and gang activity. Apprehension, prosecution, and punishment on a consistent basis are effective to discourage these crimes.

5. Non-sworn security officers have demonstrated to be very effective for monitoring parking lots and patrolling stations and vehicles, while they are less costly than full police officers.

6. The average investment in security personnel during 1995 reported by the responding transit agencies was $53,400 per security/police, per year. The transit agency with the highest investment in security personnel was BART with $72,000 per officer, per year. BART has 158 independently sworn and 72 non-sworn police officers serving an area of 234 square miles. The lowest budget was $30,000 per officer, per year reported by Greater Cleveland Regional Transit Authority. RTA has 143 independent transit police officers and the Investigation Service Division serving an area of 687 square miles.

7. The ideal level of security may be obtained with the combination of strategies and technologies directed toward those problems targeted by each transit agency. The integration of surveillance systems, radio technology, security response strategies, and appropriate facility design is considered highly effective for protecting transit passengers and property and for reducing the incidence and fear of crime.

8. The involvement of citizens in transit crime prevention was found to be an innovative transit security program with demonstrated effectiveness. Students, families, or persons from community groups riding transit vehicles function as eyes and ears for police during off-peak hours. These persons are equipped with radios connected to police stations to report actual incidents or suspicious activities.

9. The creation of community outreach and public awareness programs were reported by METRO to be innovative and effective strategies. For example in the reward program anyone who provides information to police that results in arrest and conviction receives a reward. In the Adopt-A-Stop program, citizens "adopt" a stop, shelter, or transit center to help keep them clean and free of vandalism. Adopters are also encouraged to report any suspicious activity at their location.

10. Uniformed personnel patrolling downtown areas, parking lots, and surroundings of transit facilities on bicycles provide an effective security element complementing the patrol cars. The two-wheeled patrols can maneuver easily through traffic and narrow areas, and therefore provide quicker reaction times.

11. Most of the transit agencies reported that they are working on a more up-to-date incident reporting system that would capture many different types of events. If a computerized standard record-keeping system that will log incidents by date, location, type, and disposition is created, it would facilitate targeting the problems and furthermore, would help in the decision-making of how to efficiently use technologies, strategies, or a combination.

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APPENDIX:

SAMPLES, LETTERS OF TRANSMITTAL

AND

SURVEY FORMS

METROPOLITAN ATLANTA RAPID TRANSIT AUTHORITY

Lehman Center for Transportation Research

FLORIDA INTERNATIONAL
The Public University at Miami

Miami, October 4, 1995

Stain Martin
Crime Analyst
Metropolitan Atlanta Rapid Transit
Atlanta, Georgia

RE: SECURITY INFORMATION REQUEST

Dear Mr. Martin:

A F.T.A. funded research project entitled "Factors Influencing the Successful Implementation of Intermodal Guideway Transit Systems" is being conducted at Lehman Center for Transportation Research Florida International University. One of the tasks, "Technologies for Enhancing Intermodal Passenger Safety and Security" is underway, and we need to collect information from transit agencies in order to ensure the data used in our research is accurate and up to date.

Please review and complete the attached survey forms. Additionally, we would also like to obtain a copy of the ***System Security Program Plan*** adopted by your agency or similar document that describes how to maximize the safety and security of its passengers, employees, and transit properties.

We hope the results of the research will help the transit community to reduce and prevent transit crimes. Thanks in advance for your cooperation in this important matter. Should you have any questions, please do not hesitate to contact me at (305) 348-4058.

Sincerely,

Diana I. Ospina
Transportation Engineer/Research Associate, LCTR

TRANSIT SAFETY AND SECURITY SURVEY FORM

Date: OCTOBER 10, 1995
Transit Agency: METROPOLITAN ATLANTA RAPID TRANSIT AUTHORITY (MA
Name of the person filling out the form: STAN MARTIN
Position: CRIME ANALYST
Department: DIVISION OF POLICE SERVICES / DEPARTMENT OF RAIL SERVICE
Telephone: (404) 848-5062
Fax: (404) 848-5050

****

Please select one or more types of patrol used by the agency for policing the transit mode(s) operated by the agency.

Type of patrol used by the agency	RR	CR	LR	PM	TR	MB
Independent transit police force	✓					✓
Contracted police						
Own security officers						
Local law enforcement agency						✓
Specialized units within general service law enforcement agency						
Other (please specify)						

RR Rapid rail
CR Commuter rail
LR Light rail
PM People mover
TR Trolleybuses
MB Motor Buses

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations .

Transit mode (please, circle one): (RR) CR LR PM TR MB

Security Technologies Used Inside the Stations	Yes	No
Appropriated lighting	(✓)	( )
CCTV (Cameras/Monitors) at platforms	(✓)	( )
CCTV (Cameras/Monitors) at waiting areas	(✓)	( )
CCTV (Cameras/Monitors) at ticket vending machines areas	(✓)	( )
Telephone line connected to central control facility	(✓)	( )
Emergency telephone line connected to police	(✓)	( )
Voice intercoms	(✓)	( )
Visibility mirrors at blind corners and intersections	(✓)	( )
Passengers information and directions posted	(✓)	( )
Schedules	(✓)	( )
Routes	(✓)	( )
Transfers/Connections	(✓)	( )
Fares	(✓)	( )
Real time transfers schedule information system	( )	(✓)
Active uniformed security patrols	(✓)	( )
Plain clothed security personnel	(✓)	( )
Staffed focal points	(✓)	( )
Radios used by		
Security personnel	(✓)	( )
Train operators	(✓)	( )
Other rail operation personnel	(✓)	( )

Other surveillance techniques and/or devices (please specify)

_____

_____

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): (RR) CR LR PM TR MB

Security Technologies in Areas Adjacent to Stations/Stops	Yes	No
Appropriate lighting	(✓)	( )
CCTV (Cameras/monitors) in passageways connecting with parking areas	( )	(✓)
Telephone lines connected with central control facility	( )	(✓)
Emergency telephones connected to police	( )	(✓)
Voice intercoms	( )	(✓)
Motorized uniformed security patrols	(✓)	( )
Motorized plain dressed security patrols	(✓)	( )
On foot security personnel	(✓)	( )
Staffed focal points	(✓)	( )
Posted passenger information and directions	( )	(✓)
Schedules	( )	(✓)
Routes	( )	(✓)
Transfers/Connections	( )	(✓)
Fares	( )	(✓)
Real time transfers schedule information system	( )	(✓)

Others surveillance techniques and/or devices (please specify)

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): (RR) CR LR PM TR (MB)

Security Technologies On-Board the Vehicles	Yes	No
CCTV (Cameras/monitors)	( )	(✓)
Intercoms to communicate with vehicle operator	(✓)	( )
Emergency telephone lines connected with the central control facility	( )	(✓)
Posted passenger information and directions	(✓)	( )
Schedules	(✓)	( )
Routes	(✓)	( )
Transfers/Connections	(✓)	( )
Fares	(✓)	( )
Yellow hazard strips	(✓)	( )
Anti-graffiti protection	( )	(✓)
Uniformed security patrols	(✓)	( )
Plain clothed security personnel	(✓)	( )
Radio equipment for operator communication	(✓)	( )
Advanced vehicle location system	(✓)	( )

Other surveillance techniques and/or devices (please, specify)

Please complete the information requested for each transit mode operated by the agency providing information for the last five years that statistics are available.

Transit mode (please, circle one): (RR) CR LR PM TR (MB)

INVESTMENTS IN TRANSIT SECURITY

YEAR FY	No. Security Personnel	Budget Invested in Security Personnel	Budget Invested in Security Equipment
19 92	163		
19 93	193		
19 94	220		
19 95	234		
19 96	266		
PROJECTED			

NJ TRANSIT

NJ TRANSIT

POLICE DEPARTMENT

November 8, 1995

Diana I. Ospina
Transportation Engineer/Research Assistant
Lehman Center for Transportation Research

Dear Diana:

Enclosed find the survey which you sent in October. Please accept our apologies for taking so long to complete. Our incident tracking system is antiquated (in my opinion) so much of the data had to be manually interpreted. The good news is that hopefully in the not so distant future a new system will be in place and these type of inquiries will be more easily facilitated and also not so time consuming.

We are unable to furnish our "System Security Program Plan" as you requested. NJ TRANSIT considers this privileged information which is not shared outside of NJ TRANSIT for security reasons.

We are very interested in the results of your survey and would like a copy of the final product when it is available.

Again, I apologize for taking so long and hope it did not inconvenience you to any great extent. If I can be of any future assistance please don't hesitate to contact me.

Sincerely,

Ray L. Dillman
System Administration/Statistical Analyst

FLORIDA INTERNATIONAL
The Public University at Miami

Miami, April 14, 1997

Ray L. Dillman
System Administration/
Statistical Analyst
NJ Transit

RE: SECURITY INFORMATION REQUEST

Dear Mr. Dillman,

A U.S. DOT funded through National Urban Transportation Institute (NUTI) research project entitled "Analyses of Technologies and Methodologies Adopted by U.S. Transit Agencies to Enhance Transit Security " is being conducted at Lehman Center for Transportation Research, Florida International University.

In 1995, we sent a survey form to your agency and we appreciated that you sent us valuable information. However, we are in the analysis process and we found that some additional information is needed in order to complete the analyses. Enclosed you will find tables which summarize the information we received from your agency and forms showing the type and number of reported crimes and arrests for each category, i.e., in stations/stops, adjacent to stations/stops, and in the vehicles.

Please review and complete the attached tables and forms. Additionally, we would also like to obtain a copy of the *System Security Program Plan* adopted by your agency or similar documents that describe how to maximize the safety and security of its passengers, employees, and transit properties.

We hope that the results of this research will help the transit community to reduce and prevent transit crimes. Thanks in advance for your cooperation in this important matter. Should you have any questions, please do not hesitate to contact me at (305) 348-4058.

Sincerely,

Diana I. Ospina
Senior Research Associate, LCTR
Miami, April 14, 1997

Lehman Center for Transportation Research, VH160 - College of Engineering and Design
University Park Campus, Miami, Florida 33199 • (305) 348-3810 • FAX (305) 348-4057

Equal Opportunity/Equal Access Employer and Institution

NJ TRANSIT

POLICE DEPARTMENT

September 24, 1997

Diana I. Ospina
Transportation Engineer/Research Assistant
Lehman Center for Transportation Research

Dear Ms Ospina:

Enclosed find requested crime statistics covering the period Jan 1 - Dec 31, 1996. The report contains data tables for each mode of transportation: bus, rail and light rail in the categories of Reported Crimes and Type/Number of Arrests.

This division is awaiting a more up-to-date police reporting system that would capture many different type of inquiries. This would afford us the opportunity of acquiring data in a more expediant, less time consuming manner and provide requesters with a clearer picture of key transportation security issues.

We are unable to furnish our "System Security Program Plan" as you requested. NJ Transit considers this priviliged information which is not shared outside of NJ Transit for security reasons.

We hope that the 1996 crime statistics, in addition to the data we have previously submitted, help you in your study. We are very interested in the results and would like a copy of the final report when it is available.

Sincerely,

Allison L. Doyle

Allison L. Doyle
System Administration/Statistical Analyst

TRANSIT SAFETY AND SECURITY SURVEY FORM

Date: November 1, 1995
Transit Agency: NJ TRANSIT
Name of the person filling out the form: R.L. Dillman
Position: Statistical Analyst
Department: Police
Telephone: 201-378-6628
Fax: 201-378-6489

****

Please select one or more types of patrol used by the agency for policing the transit mode(s) operated by the agency.

Type of patrol used by the agency	RR	CR	LR	PM	TR	MB

Independent transit police force

Contracted police

Own security officers

Local law enforcement agency

Specialized units within
general service law enforcement agency

Other (please specify)

RR Rapid rail
CR Commuter rail
LR Light rail
PM People mover
TR Trolleybuses
MB Motor Buses

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): RR (CR) LR PM TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 1/93 To (mo/year) 12/93

TYPE	NUMBER OF REPORTED CRIMES		
SEVERE CRIMES	**In the Stations/Stops**	**Adjacent to Stations/Stops**	**In the Vehicles**
Homicide	0	0	0
Rape	0	1	0
Robbery	62	13	2
Assault	80	10	21
Burglary	22	42	0
Larceny Theft	335	101	65
Auto Theft	21	1	0
Indecent Exposure	31	2	0
Narcotic Violation	63	9	13
Alcohol Violation	0	0	0
Vandalism	254	160	130
Weapon Violation	15	3	0
Bomb Threat	13	1	1
Shooting	1	2	0
OTHER CRIMES			
Fare Evasion	208	0	215
Smoking/eating/drinking	29	1	14
Boisterous/Unruly	536	47	184
Trespassing	349	629	7
Miscellaneous			

1811 1022 137

Please complete one form for each transit mode operated by the agency providing the information requested by year, during the last three years.

Transit mode (please, circle one): RR (CR) LR PM TR MB

TYPE AND NUMBER OF ARRESTS

Date: From (mo/year)---1---/---93--- To (mo/year)---12---/---93

CHARGES	NUMBER OF ARRESTS		
	In the Stations/Stops	Adjacent to Stations/Stops	In the Vehicles
Homicide	0	1	0
Rape	0	0	0
Robbery	5	7	0
Assault	53	5	7
Burglary	10	5	0
Larceny Theft	30	6	4
Auto Theft	0	1	0
Indecent Exposure	27	0	1
Narcotic Violation	53	8	17
Alcohol Violation	0	0	0
Vandalism	28	22	5
Weapon Violation	9	1	0
Bomb Threat	0	0	0
Shooting	1	0	0
CITATIONS			
Fare Evasion	26	0	17
Smoking/eating/drinking	24	0	6
Boisterous/Unruly	144	14	44
Trespassing	96	14	0
Miscellaneous			

550 84 101

Commuter Rail

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations .

Transit mode (please, circle one): RR (CR) LR PM TR MB

Security Technologies Used Inside the Stations	Yes	No
Appropriated lighting	(✓)	( )
CCTV (Cameras/Monitors) at platforms (IN NEWLY REHABILITATED FACILITIES)	(✓)	( )
CCTV (Cameras/Monitors) at waiting areas "	(✓)	( )
CCTV (Cameras/Monitors) at ticket vending machines areas	( )	(✓)
Telephone line connected to central control facility	( )	(✓)
Emergency telephone line connected to police	( )	(✓)
Voice intercoms	( )	(✓)
Visibility mirrors at blind corners and intersections	( )	(✓)
Passengers information and directions posted	(✓)	( )
Schedules	(✓)	( )
Routes	(✓)	( )
Transfers/Connections	(✓)	( )
Fares	( )	( )
Real time transfers schedule information system (MAJOR STATIONS)	(✓)	( )
Active uniformed security patrols	(✓)	( )
Plain clothed security personnel	(✓)	( )
Staffed focal points (PEAK HOURS)	(✓)	( )
Radios used by		
Security personnel	(✓)	( )
Train operators	(✓)	( )
Other rail operation personnel	(✓)	( )

Other surveillance techniques and/or devices (please specify)

HOLD UP / INTRUSION ALARMS - & ALARMED TV M'S

COMMUTER RAIL

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): RR CR LR PM TR MB

Security Technologies in Areas Adjacent to Stations/Stops	Yes	No
Appropriate lighting	(✓)	( )
CCTV (Cameras/monitors) in passageways connecting with parking areas	( )	(✓)
Telephone lines connected with central control facility	( )	(✓)
Emergency telephones connected to police	( )	(✓)
Voice intercoms	( )	(✓)
Motorized uniformed security patrols	(✓)	( )
Motorized plain dressed security patrols	(✓)	( )
On foot security personnel	( )	(✓)
Staffed focal points	( )	(✓)
Posted passenger information and directions	( )	(✓)
Schedules	( )	(✓)
Routes	( )	(✓)
Transfers/Connections	( )	(✓)
Fares	( )	(✓)
Real time transfers schedule information system	( )	(✓)

Others surveillance techniques and/or devices (please specify)

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): RR (CR) LR PM TR MB

Security Technologies On-Board the Vehicles	Yes	No
CCTV (Cameras/monitors)	( )	(✓)
Intercoms to communicate with vehicle operator	( )	(✓)
Emergency telephone lines connected with the central control facility	( )	(✓)
Posted passenger information and directions	(✓)	( )
Schedules	(✓)	( )
Routes	(✓)	( )
Transfers/Connections	(✓)	( )
Fares	( )	(✓)
Yellow hazard strips	(✓)	( )
Anti-graffiti protection	( )	(✓)
Uniformed security patrols	(✓)	( )
Plain clothed security personnel	(✓)	( )
Radio equipment for operator communication	(✓)	( )
Advanced vehicle location system	(✓)	( )

Other surveillance techniques and/or devices (please, specify)

Please complete the information requested for each transit mode operated by the agency providing information for the last five years that statistics are available.

Transit mode (please, circle one): RR (CR) LR PM TR MB

INVESTMENTS IN TRANSIT SECURITY

YEAR	No. Security Personnel	Budget Invested in Security Personnel	Budget Invested in Security Equipment
19~~95~~	97	$5,804,700.	$85,560.
19~~94~~	86	$4,814,942.	$91,625.
19~~93~~	75	$4,109,662.	$89,335.
19~~92~~	72	$2,838,317	N/A
19---			
PROJECTED			

LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

Sharon K. Papa
Chief of Police

Los Angeles County Metropolitan Transportation Authority Transit Police Department

South Figueroa Street
os Angeles, CA 90007

213. 972-3601
FAX: 213.972-3604

May 24, 1995

Diana I. Ospina
Transportation/Engineer Associate
Department of Civil and Environment Engineering
Florida International University
University Park, VH 171
Miami, Florida 33199

Dear Ms. Ospina,

Per your request, a member of my staff has prepared a report containing information pertaining to our metro rail systems. The attached report provides staffing/budget for fiscal year 1996, crime statistics, number of train accidents, and the type of technology utilized by the Metropolitan Transportation Authority.

I hope the enclosed information will assist you with your research project for the Federal Transportation Administration. I will be looking forward to receiving your final report on the rail systems. If you have any questions or if further information is needed, you may contact Ms. Vernaci at (213) 972-3648.

Sincerely,

Chief Sharon K. Papa

Los Angeles County Metropolitan Transportation Authority
Transit Police Department

Los Angeles County
Metropolitan
Transportation
Authority
Transit Police
Department

1900 South Figueroa Street
Los Angeles, CA 90007

213. 972.3669
Fax: 213. 972.3666

May 5, 1995

To: Diana I. Ospina

From: Debra Vernaci, Crime Analyst

RE: REQUESTED RAIL STATISTICS

STAFFING:

Line	Sworn Personnel	FY 96 Budget
Red Line	35	$3,262,239
Green Line	56	$4,752,214
Blue Line	100	$8,495,337

TECHNOLOGY:

On all three systems the following types of technology are used:

CCTV Cameras/Monitors - Constantly monitored by civilian personnel in dispatch center.

Radios - Used by police officers, train operators, and other rail operation personnel.

PTEL/Public Telephone Line - Located on the platforms which are directly connected to Central Control Facility and monitored by civilian CCTV monitors.

ETEL/Emergency Telephone Line - Monitored by Central Control Dispatchers.

TRAIN ACCIDENTS: JULY 1994 - MARCH 1995

Line	Total Accidents	# of Injuries	# of Fatalities
Red Line	0	0	0
Blue Line	24	21	5

Of the 5 fatalities that occurred on the Blue Line, 4 were determined to be suicides. Of the 24 train accidents on the Blue Line 3 occurred at the intersection of Washington & Broadway in the City of Los Angeles. For further details regarding train accidents please refer to attached Blue Line report.

RAIL STATISTICS:

Metro Blue Line	July - December 1994	Attachment A
Metro Red Line	January - December 1994	Attachment B

Los Angeles County
Metropolitan Transportation Authority

TRANSIT POLICE DEPARTMENT

METRO BLUE LINE

JULY - DECEMBER 1994

ATTACHMENT A

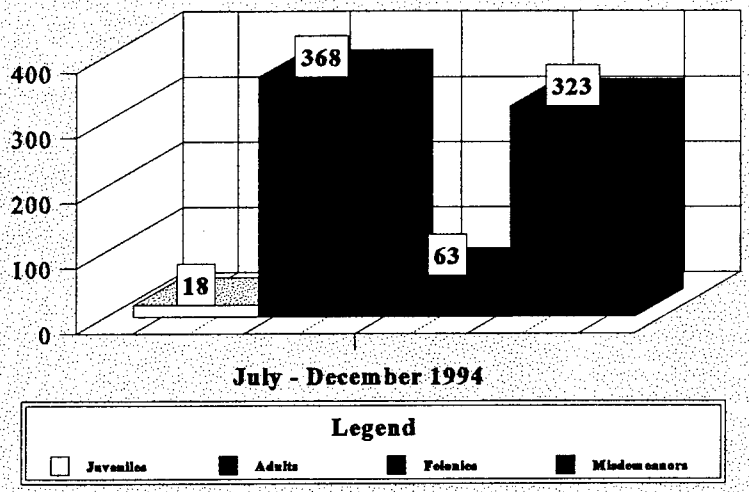
METRO BLUE LINE

REPORTED CRIME

TYPE	On Rail Property	Adjacent to Rails	Away from Rails	TOTAL
PART I CRIMES				
Homicide	0	0	0	**0**
Rape	1	0	0	**1**
Robbery	20	2	8	**30**
Assault	5	1	2	**8**
Burglary	0	0	0	**0**
Larceny Theft	12	5	4	**21**
Auto Theft	0	0	0	**0**
Sub-Total	**38**	**8**	**14**	**60**
OTHER CRIMES				
Indecent Exposure	3	0	0	**3**
Miscellaneous	2	2	0	**4**
Narcotic Violation	29	2	5	**36**
Pass/Transfer Sales	15	2	0	**17**
Vandalism	19	2	0	**21**
Weapon Violation	12	0	1	**13**
Sub-Total	**80**	**8**	**6**	**94**
Grand Total	**118**	**16**	**20**	**154**
Percentages	**76.62%**	**10.39%**	**12.99%**	**100%**

METRO BLUE LINE

Arrests = 386

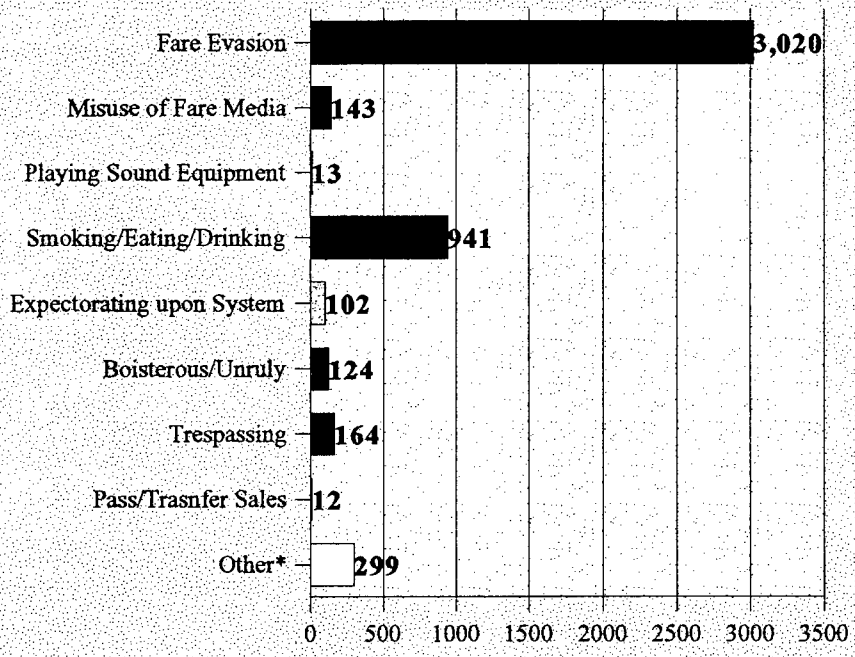


CHARGES	On Rail Property	Adjacent to Rails	Away from Rails	TOTAL
Assault	4	0	2	6
Robbery	4	0	3	7
Larceny Theft	2	2	2	6
Auto Theft	0	0	3	3
Driving Under the Influence	2	1	5	8
Drunk in Public	5	1	2	8
Indecent Exposure	1	0	0	1
Miscellaneous	37	6	5	48
Narcotic Violation	19	1	4	24
Recovered Stolen Vehicle	0	0	1	1
Vandalism	4	0	0	4
Warrants - Misdemeanor/Felony	229	14	20	263
Weapon Violation	7	0	0	7
Total	**314**	**25**	**47**	**386**
Percentages	**81.35%**	**6.48%**	**12.18%**	**100%**

METRO BLUE LINE

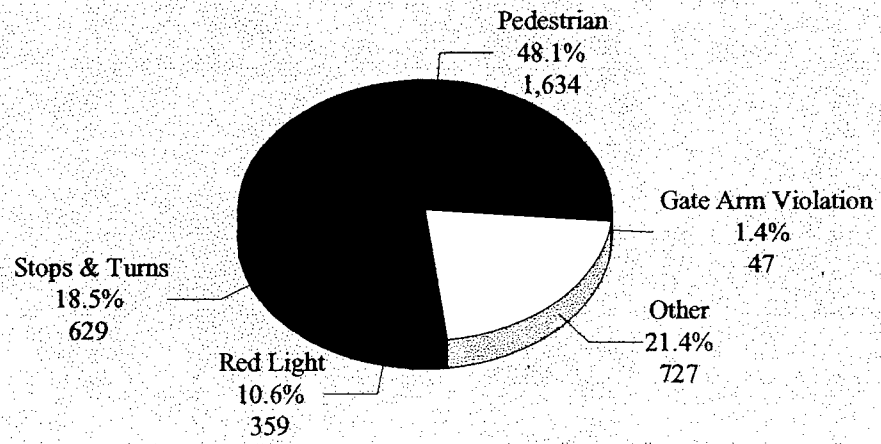
TOTAL CITATIONS = 8,214

Penal Code Citations = 4,818



***Includes B&P and H&S citations.**

Vehicle Code Citations = 3,396



Los Angeles County
Metropolitan Transportation Authority

TRANSIT POLICE DEPARTMENT

METRO RED LINE

JANUARY - DECEMBER 1994

ATTACHMENT B

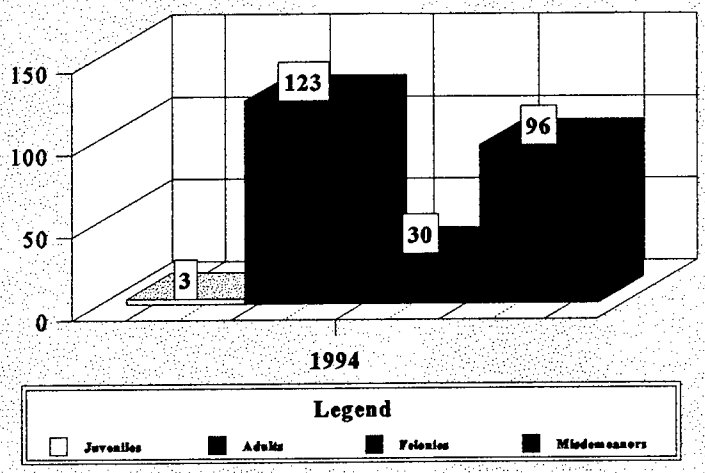
METRO RED LINE

REPORTED CRIME

CHARGES	Mezzanine	Platform	Train	Entrance	Stairs	Other	TOTAL
PART I CRIMES							
Homicide	0	0	0	0	0	0	**0**
Rape	0	0	0	0	0	0	**0**
Robbery	0	3	0	0	1	2	**6**
Assault	1	2	0	1	0	1	**5**
Burglary	0	0	0	0	0	1	**1**
Larceny Theft	0	0	1	0	1	2	**4**
Auto Theft	0	0	0	0	0	0	**0**
Sub-Total	**1**	**5**	**1**	**1**	**2**	**6**	**16**
OTHER CRIMES							
Bomb Threat	0	0	0	0	0	1	**1**
Indecent Exposure	1	0	0	0	0	0	**1**
Miscellaneous	0	1	1	0	1	0	**3**
Vandalism	1	3	5	4	1	1	**15**
Sub-Total	**2**	**4**	**6**	**4**	**2**	**2**	**20**
Total	**3**	**9**	**7**	**5**	**4**	**8**	**36**
Percentages	**8.33%**	**25%**	**19.44%**	**13.89%**	**11.11%**	**22.22%**	**100%**

METRO RED LINE

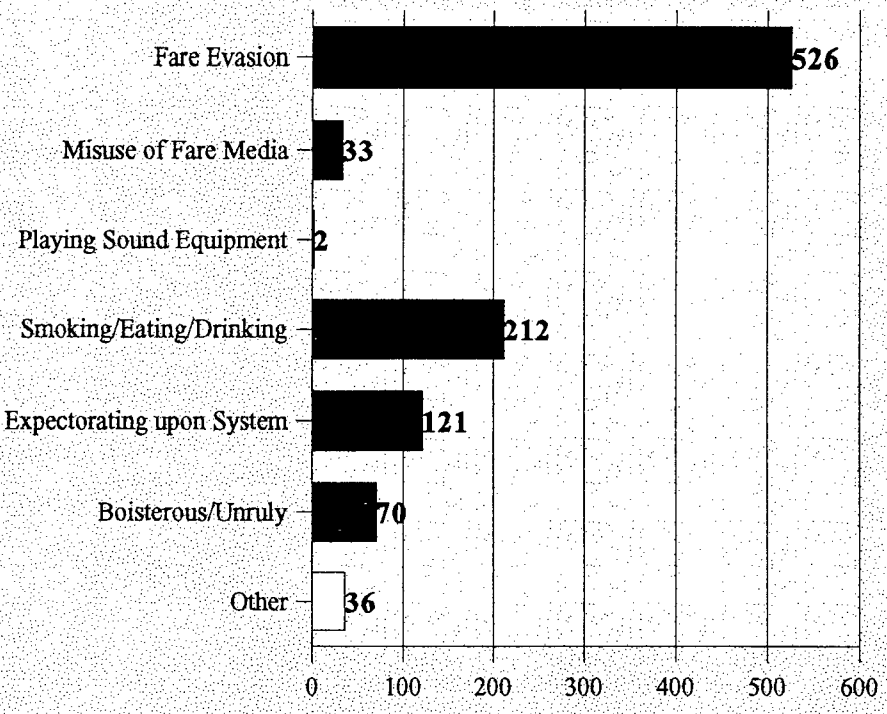
Arrests = 126



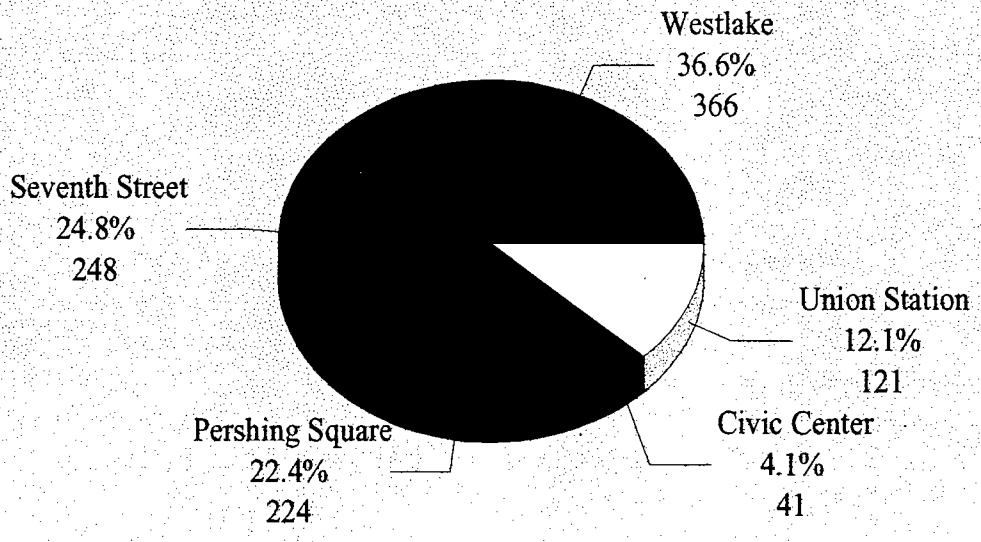
CHARGES	Mezzanine	Platform	Train	Entrance	Stairs	Other	TOTAL
Assault	2	1	0	1	0	1	**5**
Robbery	0	0	0	0	0	1	**1**
Burglary	0	0	0	0	0	1	**1**
Larceny Theft	0	0	0	0	1	0	**1**
Miscellaneous	0	5	1	0	1	2	**9**
Narcotic Violation	2	6	3	3	0	2	**16**
Vandalism	0	0	0	2	0	0	**2**
Warrants - Misd/Felony	13	47	11	9	0	6	**86**
Weapon Violation	1	1	3	0	0	0	**5**
Total	**18**	**60**	**18**	**15**	**2**	**13**	**126**
Percentages	**4.29%**	**47.62%**	**14.29%**	**11.90%**	**1.59%**	**10.32%**	**100%**

METRO RED LINE

TOTAL CITATIONS = 1,000



Citations By Station



TORONTO TRANSIT COMMISSION

TORONTO TRANSIT COMMISSION

PAUL CHRISTIE
CHAIR

HOWARD MOSCOE
VICE CHAIR

BRIAN HARRISON
BLAKE KINAHAN
CASE OOTES
JOE PANTALONE
ALAN TONKS

COMMISSIONERS

DAVID L. GUNN
CHIEF GENERAL MANAGER

ARNOLD S. DUBÉ
GENERAL SECRETARY

October 10, 1995

Diana Ospina
Lehman Center for Transportation Research
Miami, Florida

Dear Ms Ospina:

The information you requested for your survey has been completed as accurately as possible. You have also requested a System Security Program Plan however our Security Department does not have one at present. One of our goals for 1996 is to prepare and document a System Security Plan.

The results of your survey would be beneficial to us for research purposes. We would appreciate a copy of your report once you have collated the information.

Yours Truly,

Mike Walker
Manager Corporate Security

16-21-21

Copy: Terry Andrews

TRANSIT SAFETY AND SECURITY SURVEY FORM

Date: OCTOBER 6/95.
Transit Agency: TORONTO TRANSIT COMMISSION.
Name of the person filling out the form: JUDY SHELGA
Position: TRAINING & PROGRAM DEVELOPMENT
Department: CORPORATE SECURITY
Telephone: (416) 393 6647.
Fax: (416) 397-8750.

****

Please select one or more types of patrol used by the agency for policing the transit mode(s) operated by the agency.

			SUBWAY			SURFACE VEHICLES
Type of patrol used by the agency	(RR)	CR	LR	PM	TR	(MB)

Independent transit police force

Contracted police

Own security officers ✓

Local law enforcement agency ✓

Specialized units within general service law enforcement agency

Other (please specify)

✓ RR Rapid rail
CR Commuter rail
✓ LR Light rail
PM People mover
TR Trolleybuses
✓ MB Motor Buses

TORONTO TRANSIT COMMISSION
CORPORATE SECURITY DEPARTMENT

CRIMINAL OFFENCES (SUBWAY AND SURFACE)

YEAR	SUBWAY	SURFACE	TOTAL
1991	1,762	1,409	3,171
1992	1,909	1,420	3,329
1993	2,007	1,525	3,532
1994	1,835	1,271	3,106
1995	1,800	1,457	3,257
1996	1,688	1,270	2,958

1994 - SUBWAY

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available. (Please make photostat copies where necessary)

Transit mode (please, circle one): (RR) (CR) LR (PM) TR MB — Streetcar — Bus

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) .....**To (mo/year)** .....

[illegible]	NUMBER OF REPORTED CRIMES		
[illegible]	[illegible]	Adjacent to [illegible]	In the Vehicles
Homicide	0	0	0
Rape	0	0	0
Robbery	47	0	6
Assault	210	0	51
Burglary	6	0	0
Larceny Theft ?	143	300	295
Auto Theft	0	184	0
Indecent Exposure	24	0	14
Narcotic Violation	12	0	0
Alcohol Violation	0	0	0
Vandalism	51	140	12
Weapon Violation	17	0	3
Bomb Threat	1	0	0
Shooting	0	0	0
[illegible]			
Fare Evasion	273	0	0
Smoking/Eating/Drinking	169	0	9
Boisterous/Unruly	246	0	47
Trespassing	231	0	0
Miscellaneous	1020	0	53
	2666	624	484

Note: Please fill the empty cells and do corrections where necessary

1994 - SURFACE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available. (Please make photostat copies where necessary)

Transit mode (please, circle one): RR – (CR) – LR – (PM) – TR – (MB) – Streetcar – Bus

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) .....To (mo/year).....

[illegible]	NUMBER OF REPORTED CRIMES		
[illegible]	[illegible]	[illegible]	In the Vehicles
Homicide	0	0	0
Rape	0	0	0
Robbery	0	0	0
Assault	0	5	245
Burglary	0	0	0
Larceny Theft ?	0	4	666
Auto Theft	0	1	0
Indecent Exposure	0	1	14
Narcotic Violation	0	0	6
Alcohol Violation	0	0	0
Vandalism	0	5	113
Weapon Violation	0	0	22
Bomb Threat	0	0	0
Shooting	0	0	2
[illegible] CRIMES			
Fare Evasion	27	0	9
Smoking/Eating/Drinking	0	0	1
Boisterous/Unruly	0	0	10
Trespassing	0	0	0
Miscellaneous	0	0	206
		16	1225

Note: Please fill the empty cells and do corrections where necessary

TRANSIT SAFETY AND SECURITY SURVEY FORM

Date: 10/11/95
Transit Agency: MTA METRO-NORTH RAILROAD
Name of the person filling out the form:
Position:
Department: POLICE DEPT - METRO NORTH
Telephone: 212 340-2723 \ 30001
Fax: 212 340-2020

****

Please select one or more types of patrol used by the agency for policing the transit mode(s) operated by the agency.

Type of patrol used by the agency	RR	CR	LR	PM	TR	MB
Independent transit police force		✓				
Contracted police						
Own security officers						
Local law enforcement agency						
Specialized units within general service law enforcement agency						
Other (please specify)						

RR Rapid rail
CR Commuter rail
LR Light rail
PM People mover
TR Trolleybuses
MB Motor Buses

METRO-NORTH POLICE
DAILY BLOTTER
TYPE OF INCIDENT
LISTING OF ACCEPTABLE ENTRIES

9/21/95

UP-DATED LISTING AS OF 4/30/94

NATURE OF INCIDENT	CODE	WOULD LIKE STATS ON
21 NYCRR 1085		
ACCIDENT - ATV - SNOWMOBILE		
ACCOSTING - FRAUDULENT		
AIDED		
AIDED - ABUSE ADULT		X
AIDED - ABUSE CHILD		X
AIDED - ASSAULT		X
AIDED - DEAD BODY - ACCIDENT		X
AIDED - DEAD BODY - HOMICIDE		X
AIDED - DEAD BODY - NATURAL CAUS		
AIDED - EDP		
AIDED - EMPLOYEE		
AIDED - JUVENILE		
AIDED - RUNAWAY		
AIDED - SUICIDE		
ALARM - BURGLARY		
ALARM - ELEVATOR		
ALARM - ENTRY		
ALARM - FIRE		
ARSON	200	X
ASSAULT		X
ASSAULT - 3rd	13B	X
ASSAULT - AGGRAVATED	13A	X
ASSAULT - FELONIOUS	13C	X
ASSIST OTHER AGENCY		
BRIBERY	510	X
BURGLAR TOOLS	220.1	
BURGLARY	220	X
CHECKS		
CONDITIONS		
CONFIDENTIAL INVESTIGATION		
COUNTERFEITING	250	
CRIMINAL MISCHIEF	290	X
DISORDERLY CONDUCT	90C	X
DRUGS - DANGEROUS	35A	X
DRUGS - PARAPHERNALIA	35B	X
EMBEZZLEMENT	270	X
ESCAPE - MENTAL		
ESCAPE - PRISONER		
EXPLOSIVE DEVICE		X
EXTORTION	210	
FAMILY OFFENSES - NONVIOLENT	90D	
FATALITY		X
FIRE		
FIRE - BUILDING		X
FIRE - SMOKE CONDITION		

DAILY BLOTTER
TYPE OF INCIDENT
LISTING OF ACCEPTABLE ENTRIES

9/21/95

UP-DATED LISTING AS OF 4/30/94

NATURE OF INCIDENT	CODE	WOULD LIKE STATS ON
- FIRE - TRAIN		
- FORGERY	250	X
- FRAUD - ATM	26B	
- FRAUD - CONFIDENCE GAME	26A	
- FRAUD - CREDIT CARD	26B	
- FRAUD - FALSE PRETENSES	26A	
- FRAUD - IMPERSONATION	26C	
- FRAUD - SWINDLE	26A	
- FRAUD - WELFARE	26D	
- FRAUD - WIRE	26E	
- GAMBLING - BETTING	39A	
- GAMBLING - EQUP. VIOLATIONS	39C	
- GAMBLING - WAGERING	39A	
- HARASSMENT	90Z	
- HAZARDOUS CONDITION		
- HOMICIDE - CRIMINALLY NEGLIGENT	09A	
- HOMICIDE - JUSTIFIABLE	09A	X
- HOMICIDE - MURDER	09A	X
- HOMICIDE - NON-NEG MANSLAUGHTER	09A	X
- HOTLINE MESSAGE		X
- JOSTLING	23A	
- KIDNAPPING	100	
- KIDNAPPING - ABDUCTION	100	X
- LARCENY - BAD CHECK(S)	23H	
- LARCENY - GRAND	23H	
- LARCENY - PETIT	23H	X
- LIQUOR LAW VIOLATIONS	90G	
- LOITERING	90B	X
- MENACING	13C	X
- MISSING PERSONS		X
- OFFICER NEEDS ASSISTANCE		
- PARK-WALK-TALK		
- PROPERTY - LOST		
- PROPERTY - POSS. STOLEN	280	X
- PROPERTY - RECOVERED		
- PROPERTY - VANDALISM	290	X
- PROSTITUTION	90Z	
- PROSTITUTION - ASSISTING	40B	
- PUBLIC LEWDNESS	90Z	
- RECKLESS ENDANGERMENT	13A	X
- REVENUE ESCORT 10/40		X
- RINGS		
- ROBBERY	120	
- SEX OFFENSES FONDLING FORCIBLE	11D	X
- SEX OFFENSES FORCIBLE SODOMY	11B	X
- SEX OFFENSES INCEST	36A	X
- SEX OFFENSES RAPE ATTEMPTED	11A	X

DAILY BLOTTER
TYPE OF INCIDENT
LISTING OF ACCEPTABLE ENTRIES

9/21/95

UP-DATED LISTING AS OF 4/30/94

	NATURE OF INCIDENT	CODE	WOULD LIKE STATS ON
-	SEX OFFENSES RAPE FORCIBLE	11A	X
-	SEX OFFENSES RAPE STATUTORY	36B	X
-	SICK		
-	SIGNAL FAILURE		
-	SMOKING		
-	SUSPICIOUS CONDITION		
-	TAMPERING - CRIMINAL	90Z	X
-	THEFT - MOTOR VEHICLE		X
-	THEFT OF SERVICE	23H	X
-	TRESPASSING	90J	X
-	TRESPASSING - 1085		X
-	TRESPASSING - CRIMINAL		X
-	UNUSUAL CONDITION		X
-	VEHICLE & TRAFFIC		X
-	VEHICLE & TRAFFIC - DWI		X
-	VEHICLE - ABANDONED		
-	WARRANTS		X
-	WARRANTS - REARREST		X
-	WEAPON LAW VIOLATIONS	520	X
-	WEAPONS - DANGEROUS	520	X

Please, complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations .

Transit mode (please, circle one): RR (CR) LR PM TR MB

Security Technologies Used Inside the Stations	Yes	No
Appropriated lighting	(✓)	( )
CCTV (Cameras/Monitors) at platforms	( )	(✓)
CCTV (Cameras/Monitors) at waiting areas	( )	(✓)
CCTV (Cameras/Monitors) at ticket vending machines areas	( )	(✓)
Telephone line connected to central control facility	( )	(✓)
Emergency telephone line connected to police	( )	(✓)
Voice intercoms	( )	(✓)
Visibility mirrors at blind corners and intersections (few)	(✓)	( )
Passengers information and directions posted	(✓)	( )
Real time transfers schedule information system	( )	( )
Active uniformed security patrols	(✓)	( )
Plain dressed security personnel	(✓)	( )
Staffed focal points	(✓)	( )
Radios used by		
Security personnel	(✓)	( )
Train operators	(✓)	( )
Other rail operation personnel	(✓)	( )

Other surveillance techniques and/or devices (please specify)

_____

_____

_____

_____

Please, complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): RR (CR) LR PM TR MB

Security Technologies in Areas Adjacent to Stations/Stops	Yes	No
Appropriate lighting ALL	(✓)	( )
CCTV (Cameras/monitors) in passageways connecting with parking areas GCT	( )	(✓)
Telephone lines connected with central control facility	( )	(✓)
Emergency telephones connected to police	( )	(✓)
Voice intercoms	( )	(✓)
Motorized uniformed security patrols ALL	(✓)	( )
Motorized plain dressed security patrols ALL	(✓)	( )
On foot security personnel ALL	(✓)	( )
Staffed focal points ALL	(✓)	( )
Posted passenger information and directions ALL	(✓)	( )
Real time transfers schedule information system GCT	(✓)	( )

Others surveillance techniques and/or devices (please specify)

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please circle one): RR (CR) LR PM TR MB

Security Technologies On-Board the Vehicles	Yes	No
CCTV (Cameras/monitors)	( )	(✓)
Intercoms to communicate with vehicle operator	( )	(✓)
Emergency telephone lines connected with the central control facility	(✓)	( )
Posted passenger information and directions	( )	(✓)
Schedules	(✓)	( )
Routes	( )	(✓)
Transfers/Connections	( )	(✓)
Fares	(✓)	( )
Yellow hazard strips	( )	(✓)
Anti-graffiti protection	( )	(✓)
Uniformed security patrols	(✓)	( )
Plain clothed security personnel	(✓)	( )
Radio equipment for operator communication	(✓)	( )
Advanced vehicle location system	( )	(✓)

Other surveillance techniques and/or devices (please specify)

Please, complete the information requested for each transit mode operated by the agency providing information for the last five years that statistics are available.

Transit mode (please, circle one): RR (CR) LR PM TR MB

INVESTMENTS IN TRANSIT SECURITY

YEAR	No. Security Personnel	Budget Invested in Security Personnel	Budget Invested in Security Equipment
19---			
19---			
19---			
19---			
1995	198		
PROJECTED			

METRO-DADE TRANSIT AGENCY

METRO-DADE TRANSIT AGENCY

METRO-DADE CENTER
111 Northwest First Street-Suite 910
Miami, Florida 33128-1999

December 11, 1995

Ms. Diana I. Ospina
Lehman Center for Transportation Research
Department of Civil & Environmental Engineering
Florida International University
University Park Campus, VH 160
Miami, Florida 33199

Fax: 348-2802

Re: Security Survey

Dear Ms. Ospina:

Enclosed you will find completed security survey forms for each mode operated by the Metro-Dade Transit Agency. Since the responses for Rail and the Metromover were identical one form covers the two modes.

If you have questions about the specific responses please contact Roberto Aleman at 884-7585 for the Rail and Metromover, and Marvin Hinton at 654-6590 concerning the Bus responses. All other question should be directed to me at 375-3204 including any future survey forms.

Sincerely,

Pamela J Levin

Pamela Levin
Chief, Management and Information Services

Enclosures

ONLY TOTALS AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): (RR) CR LR PM TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 1 / 1992 To (mo/year) 12 / 1992

TYPE	NUMBER OF REPORTED CRIMES			
SEVERE CRIMES	In the Stations/Stops	Adjacent to Stations/Stops	In the Vehicles	TOTAL
Homicide				0
Rape				0
Robbery				30
Assault				48
Burglary				85
Larceny Theft				115
Auto Theft				109
Indecent Exposure				31
Narcotic Violation				4
Alcohol Violation				47
Vandalism				80
Weapon Violation				8
Bomb Threat				N/A
Shooting				N/A
OTHER CRIMES				
Fare Evasion				27
Smoking/eating/drinking				N/A
Boisterous/Unruly				154
Trespassing				29
Miscellaneous				N/A

ONLY TOTALS AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): (RR) CR LR PM TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 01/93 To (mo/year) 12/93

TYPE	NUMBER OF REPORTED CRIMES			
SEVERE CRIMES	**In the Stations/Stops**	**Adjacent to Stations/Stops**	**In the Vehicles**	TOTAL
Homicide				0
Rape				0
Robbery				26
Assault				74
Burglary				112
Larceny Theft				132
Auto Theft				63
Indecent Exposure				12
Narcotic Violation				3
Alcohol Violation				32
Vandalism				101
Weapon Violation				6
Bomb Threat				N/A
Shooting				N/A
OTHER CRIMES				
Fare Evasion				38
Smoking/eating/drinking				N/A
Boisterous/Unruly				92
Trespassing				46
Miscellaneous				N/A

ONLY TOTALS AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): (RR) CR LR PM TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 01/1994 To (mo/year) 12/1994

TYPE	NUMBER OF REPORTED CRIMES			
SEVERE CRIMES	**In the Stations/Stops**	**Adjacent to Stations/Stops**	**In the Vehicles**	TOTAL
Homicide				0
Rape				0
Robbery				33
Assault				54
Burglary				60
Larceny Theft				99
Auto Theft				53
Indecent Exposure				14
Narcotic Violation				5
Alcohol Violation				28
Vandalism				86
Weapon Violation				2
Bomb Threat				N/A
Shooting				N/A
OTHER CRIMES				
Fare Evasion				25
Smoking/eating/drinking				N/A
Boisterous/Unruly				92
Trespassing				27
Miscellaneous				N/A

ONLY TOTALS AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): RR CR LR (PM) TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 01/1992 **To (mo/year)** 02/1992

TYPE	NUMBER OF REPORTED CRIMES			
SEVERE CRIMES	**In the Stations/Stops**	**Adjacent to Stations/Stops**	**In the Vehicles**	TOTAL
Homicide				0
Rape				0
Robbery				3
Assault				2
Burglary				0
Larceny Theft				5
Auto Theft				0
Indecent Exposure				2
Narcotic Violation				0
Alcohol Violation				2
Vandalism				1
Weapon Violation				0
Bomb Threat				N/A
Shooting				N/A
OTHER CRIMES				
Fare Evasion				2
Smoking/eating/drinking				N/A
Boisterous/Unruly				1
Trespassing				1
Miscellaneous				N/A

ONLY TOTALS AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): RR CR LR (PM) TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 01/1993 **To (mo/year)** 12/1993

TYPE	NUMBER OF REPORTED CRIMES			
SEVERE CRIMES	**In the Stations/Stops**	**Adjacent to Stations/Stops**	**In the Vehicles**	TOTAL
Homicide				0
Rape				0
Robbery				5
Assault				5
Burglary				3
Larceny Theft				11
Auto Theft				N/A
Indecent Exposure				1
Narcotic Violation				0
Alcohol Violation				4
Vandalism				9
Weapon Violation				0
Bomb Threat				N/A
Shooting				N/A
OTHER CRIMES				
Fare Evasion				2
Smoking/eating/drinking				N/A
Boisterous/Unruly				3
Trespassing				8
Miscellaneous				N/A

ONLY TOTALS AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested, by year, during the last three years data is available.

Transit mode (please, circle one): RR CR LR (PM) TR MB

TYPE AND NUMBER OF REPORTED CRIMES

Date: From (mo/year) 01/1994 **To (mo/year)** 12/1994

TYPE	NUMBER OF REPORTED CRIMES			
SEVERE CRIMES	**In the Stations/Stops**	**Adjacent to Stations/Stops**	**In the Vehicles**	TOTAL
Homicide				0
Rape				0
Robbery				7
Assault				6
Burglary				2
Larceny Theft				43
Auto Theft				N/A
Indecent Exposure				0
Narcotic Violation				0
Alcohol Violation				5
Vandalism				22
Weapon Violation				0
Bomb Threat				N/A
Shooting				N/A
OTHER CRIMES				
Fare Evasion				2
Smoking/eating/drinking				N/A
Boisterous/Unruly				16
Trespassing				6
Miscellaneous				N/A

NOT AVAILABLE

Please complete one form for each transit mode operated by the agency providing the information requested by year, during the last three years.

Transit mode (please, circle one): (RR) CR LR PM TR MB

TYPE AND NUMBER OF ARRESTS

Date: From (mo/year) 01/1992 To (mo/year) 12/1994

CHARGES	NUMBER OF ARRESTS		
	In the Stations/Stops	Adjacent to Stations/Stops	In the Vehicles
Homicide			
Rape			
Robbery			
Assault			
Burglary			
Larceny Theft			
Auto Theft			
Indecent Exposure			
Narcotic Violation			
Alcohol Violation			
Vandalism			
Weapon Violation			
Bomb Threat			
Shooting			
CITATIONS			
Fare Evasion			
Smoking/eating/drinking			
Boisterous/Unruly			
Trespassing			
Miscellaneous			

Please fill the following survey forms expressing your personal experience and opinion about the ***importance of each item to the item directly preceding it***. This type of comparison is called Pairwise Comparison, which means comparing two items only at a time.

Example:

1- Assume in the beginning that the importance of the first item is always 1.00.

2-Compare the second item to the first item. If you think that the importance of the second item is 80% of the first item, write 0.8 for the second item. (Factors can be any number greater than zero, i.e. 0.1, 0.2, ...,0.8, 0.9, 1.0, ...10.0,.....)

3- Now compare the third item to the second item assuming that the importance of the second item is now equal to 1.00. If you think that the importance of the third item is double that of the second item, write 2.00 for item 3.

4- Do the same assuming that item 3 has an importance of 1.00 and compare item 4 to it. If you think that item 4 if 50% important as item 3, write 0.50 for item 4. If they are equally important, write 1.00 for item 4, and so on till you finish the table

Item No.	ITEMS	
1	Appropriated lighting	1.00
2	CCTV (Cameras/Monitors) at platforms	0.80
3	CCTV (Cameras/Monitors) at waiting areas	2.00
4	CCTV (Cameras/Monitors) at ticket vending machines areas	0.50
5	Telephone line connected to central control facility	
6	Emergency telephone line connected to police	
7	Voice intercoms	
8	Visibility mirrors at blind corners and intersections	
9	Passengers information and directions posted	
10	Real time transfers schedule information system	
11	Active uniformed security patrols	
12	Plain clothed security personnel	
13	Staffed focal points	
14	Radios used by Security personnel, Train operators, Other rail operation personnel	

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations .

Transit mode (please, circle one): (RR*) CR LR PM TR MB

Security Technologies Used Inside the Stations

Item No.	ITEMS	Factors
1	Appropriated lighting	1.00
2	CCTV (Cameras/Monitors) at platforms	.5
3	CCTV (Cameras/Monitors) at waiting areas	1.0
4	CCTV (Cameras/Monitors) at ticket vending machines areas	1.0
5	Telephone line connected to central control facility	2.0
6	Emergency telephone line connected to police	1.0
7	Voice intercoms	.5
8	Visibility mirrors at blind corners and intersections	.5
9	Passengers information and directions posted	4.0
10	Real time transfers schedule information system	.25
11	Active uniformed security patrols	4.0
12	Plain clothed security personnel	.5
13	Staffed focal points	2.0
14	Radios used by Security personnel, Train operators, Other rail operation personnel	2.0

* Includes AG Metromover system

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): (RR*) CR LR PM TR MB

Security Technologies in Areas Adjacent to Stations/Stops

Item No.	ITEMS	Factors
1	Appropriate lighting	1.00
2	CCTV (Cameras/monitors) in passageways connecting with parking areas	.5
3	Telephone lines connected with central control facility	2.0
4	Emergency telephones connected to police	1.0
5	Voice intercoms	.5
6	Motorized uniformed security patrols	3.0
7	Motorized plain dressed security patrols	.5
8	On foot security personnel	1.0
9	Staffed focal points	1.0
10	Posted passenger information and directions	2.0
11	Real time transfers schedule information system	.5

* Includes AG Metromover system

Please complete one form for each transit mode operated by the agency checking the technologies used by the agency at the indicated locations.

Transit mode (please, circle one): (RR)* CR LR PM TR MB

Security Technologies <u>On-Board the Vehicles</u>

Item No.	ITEMS	Factors
1	CCTV (Cameras/monitors)	1.00
2	Intercoms to communicate with vehicle operator	2.0
3	Emergency telephone lines connected with the central control facility	.5
4	Posted passenger information and directions	1.0
5	Yellow hazard strips Anti-graffiti protection	.5
6	Uniformed security patrols	2.0
7	Plain clothed security personnel	.5
8	Radio equipment for operator communication	4.0
9	Advanced vehicle location system	.25

* Includes AG Metromover system