

**STAYING ON TRACK:
REVIEW OF PUBLIC SAFETY AND SECURITY
ON LIGHT RAIL SYSTEMS**

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KEY FINDINGS

Note: See Table 1, page 3, for Safety Summary.

1. Overall, traffic safety on transit is significantly better than that on motor vehicles.
2. Within the transit category, comparisons among bus, light and heavy rail are difficult to make due to conflicting data and differing methodologies for accident counting.
3. Overall, surface light rail is very safe relative to the motor-vehicle highway system. The most common traffic safety problems are caused by motorists turning left onto light rail rights-of-way.
4. A range of countermeasures that include careful system planning and design, and education and outreach, can significantly prevent the accidents commonly seen on light rail systems.
5. Transit crime is directly related to neighborhood crime. Property and quality of life crimes comprise the vast majority of rail transit crimes; violent crimes account for only a small percent.
6. Generally, sub-surface rail environments have had greater crime frequencies.
7. Actual and perceived safety and security are inter-related and can have a significant economic impact on the transit system.
8. Different crimes occur in different environments at different times.
9. Overall, transit crimes are more likely to occur at stations than on the transit vehicle. However, this can vary by type of crime.
10. Most transit criminals are juveniles and commit crimes in their own neighborhoods.
11. The presence of homeless and transient people in transit systems can pose a significant quality of life issue for other transit users.
12. Many possible procedures, policies, design features and technological devices can function as countermeasures to crime. Four main categories are:
 - hardware and equipment
 - design and environment
 - community outreach/education and judicial policies
 - personnel and operations.

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1. SAFETY AND SECURITY ISSUES

1. INTRODUCTION

Safety and security on light rail transportation (LRT) systems involves a diverse set of issues that range from traffic accidents to vandalism and graffiti to assaults and robberies. Past studies have focused on a specific type of safety or security issue, a specific type of light rail, such as surface alignment, or a specific city's system. This study aims to take a broad look at the array of safety and security issues related to light rail and reviews past and recent work on:

- traffic-related safety—general patterns, issues, and potential counter-measures.
- security and quality of life crimes—general patterns, issues, and potential counter-measures.

One caveat should be noted: many of the studies and statistics reviewed and presented in this paper compare “light rail” versus “heavy rail.” Technically, both light and heavy rail can be at-grade or underground. Generally, however, existing light rail systems are at-grade while heavy rail systems, because of the need for exclusive right-of-way, are underground. Hence, in several sections light rail and heavy rail are discussed as close substitutes for at-grade and underground systems, since very few studies have compared surface versus subway explicitly. However, it should be understood that the use of light rail versus heavy rail is not a perfect comparison.

Regardless of the system profile or location, safety and security issues will always be present, though they may differ by type and severity. No system can entirely eliminate safety and security concerns; however, with proper planning and design; adequate outreach, education and enforcement; and commitment from transit agency and community; the concern caused by potential issues can be significantly eliminated.

2. TYPES OF SAFETY AND SECURITY ISSUES

Safety and security issues fall into three broad categories. Safety issues are problems that arise as a result of accidental danger, while security issues are the outcome of intentional danger.

- **Traffic-related safety**—These include accidents arising from interactions among:
 - passengers
 - the light rail system
 - other pedestrians and
 - other vehicles or transportation modes
- **Quality of life issues**--These typically do not pose a physical threat to the passenger, but may cause intimidation, increase perception that the system is not secure, and reduce likelihood that public

transit will be used if riders have other transportation options. These are sometimes classified as “Type II” offenses.

- littering
 - vandalism and graffiti
 - panhandling or solicitation
 - homeless and transient presence
 - drunkenness and vagrancy
 - smoking
 - loud noises and music
 - public image of station area neighborhood—vacant storefronts, loitering, security gates/bars on store windows.
- **Security issues**—These constitute more serious crimes, some of which are classified as “Type I” offenses.
 - robberies/theft/pickpocketing
 - assault
 - homicide
 - rape
 - narcotics
 - terrorism.¹

¹ U. S. Department of Transportation, Federal Transit Administration, FTA Office of Safety and Security. *Transit Security Handbook*. Boyd, Maier and Associates, Inc. Washington, DC 20590. May 1998. P. 26.

2. TRAFFIC-RELATED SAFETY

1. GENERAL PATTERNS

a. Overall, traffic safety on transit is significantly better than that on motor vehicles.

The tables in Appendix A are taken from the U.S. Department of Transportation's *1998 Transportation Annual Statistics Report*. The first table includes serial data for fatalities, injuries and accidents, and shows that motor vehicle driving leads to 6 million accidents nationally, of which 3 million result in injuries and 40,000 result in fatalities. Over time, these numbers have been rising. In comparison, transit (including bus and rail modes) safety has been improving over the last ten years. In 1996, roughly 21,000 accidents occurred, with 55,000 injuries and about 260 fatalities.²

However, looking at raw numbers alone does not take into account the different sizes of the U.S. highway, bus and transit system. To measure this, E.L. Tennyson conducted a safety study for private auto travel vs. transit from 1993 to 1995, that uses accident and fatality rates *per million passenger mile*.

Tennyson finds that auto travel incurs a higher *fatality rate* per passenger mile than transit. Injury and accident rates are more difficult to compare, because of differing reporting requirements. Most states do not require the reporting of auto accidents below a set dollar amount, so these numbers will be undercounted. At the same time, many motorist injuries fall within the deductible on the insurance policy in a single-vehicle accident so may not be reported. Conversely, transit employees are required to report all injuries, making the two modes difficult to compare.³

b. Within the transit category, comparisons among bus, light and heavy rail are difficult to make due to conflicting data and differing methodologies for accident counting.

Fatalities--The second table in Appendix A shows the 1996 distribution of transportation fatalities, and indicates 22,000 deaths from passenger car occupancy, 5,412 deaths from pedestrians struck by motor vehicles, 74 deaths by heavy rail transit (subway), and 6 from light rail transit.⁴ Likewise, Tennyson derives fatality rates that show a similar pattern: auto vehicles at 1.44, heavy rail at 0.73, and light rail at

² U.S. Department of Transportation, Bureau of Transportation Statistics. *Transportation Statistics Annual Report 1998*. BTS98-S-01, Washington, DC: 1998. p. 78.

³ E.L. Tennyson, "Rail Transit Safety Analysis." *Transportation Research Record* 1623, pp. 112-117.

⁴ *Ibid*, P. 85. Mean Streets "Pedestrian Safety and Reform of the Nation's Transportation Law," Executive Summary, p. 1.

0.27 fatalities per 100 million passenger miles.⁵ In these studies, heavy rail can be a close proxy for underground alignments, while light rail is generally (but not always) at-grade.

Accidents--The third table shows accident rates for motor bus, light and heavy rail transit, as tallied by the National Transportation Database. Dividing total accidents by total vehicle-miles yields an accident-rate per million vehicle-miles. The data show heavy rail with the lowest injury rate, followed by bus and light rail.⁶ Tennyson, however, shows evidence that heavy rail has the lowest accident rate, followed by light rail and then bus transit.

Tennyson provides one possible explanation of the discrepancy. Because most bus systems lack stations, a bus passenger falling on the curb across the street from the bus stop is not counted as a transit accident, while a passenger falling on a rail station stairway is counted. Hence, bus counts may underestimate actual accident frequencies⁷

c. Overall, surface light rail is very safe relative to the motor vehicle-highway system. The most common traffic safety problems are caused by motorists turning left onto light rail rights-of-way.

In a recent and important study, Korve compares accident statistics for ten surface light rail systems in—Baltimore, Boston, Buffalo, Calgary, Los Angeles, Portland, Sacramento, San Diego, San Francisco, and San Jose. The first table in Appendix B shows basic data for each system, including the total length of track miles, and percentage of system in exclusive (fully grade-separated), semi-exclusive (partially separated), or non-exclusive (not separated) right-of-way.⁸ Figure 1 illustrates the different kinds of rights-of-way.

He finds that overall, LRT systems are safer than the motor vehicle-highway system. The highest-accident locations in the ten systems surveyed did not exceed 4.3 accidents per year, while an average of 15 to 20 accidents per year occurs at major highway intersections.⁹ Eighty percent of the 30 highest-accident locations in the ten systems averaged fewer than four accidents per year.¹⁰

The second and third tables in Appendix B give accident summaries for the ten light rail systems. The second table shows average accidents per year per mainline track mile to range between 0.41 and 3.12 per year, with an average for all systems of 1.11 accidents. The third table isolates accident data for the portions of the systems that are in shared rights-of-way. The last column provides safety indices for each system, which indicate the average number of accidents per track mile per year. These range from 0.5 to 6.1, with an average of 3.7.¹¹

⁵ Tennyson, p. 115.

⁶ U.S. Department of Transportation, Bureau of Transportation Statistics. *National Transportation Statistics Annual Report*. <http://www.bts.gov/btsprod/nts/chp3/tbl3x31.html>. Table 3-31.

⁷ E.L. Tennyson, "Rail Transit Safety Analysis." *Transportation Research Record* 1623, pp. 112-117.

⁸ Korve, Hans. *Integration of Light Rail into City Streets*. Transportation Research Board National Research Council Report 17, National Academy Press, Washington, DC, 1996. p. 17.

⁹ *Ibid.* pp. 3, 7.

¹⁰ *Ibid.* p. 2, 3.

¹¹ *Ibid.* pp. 55, 57.

The accidents that do occur are primarily due to motorist and pedestrian inattention, disobedience of traffic laws, and confusion about the meaning of traffic control devices.¹² The main factors leading to this “risky behavior” are a combination of alignment decisions, geometric design features, and traffic control devices.

Motor vehicles turning left in front of light rail vehicles (LRVs) account for the largest proportion of accidents—64 percent in San Jose, 59 percent in Sacramento, and 41 percent in Portland. Pedestrian accidents account for 27 percent of LRV accidents in Calgary, 15 percent in Portland, and 13 percent in Los Angeles. The most common traffic safety problems included:

- motorists making illegal left-turns across the LRT right-of-way immediately after termination of their protected left-turn phase.
- pedestrians jaywalking across transit mall rights-of-way when messages about crossing legality are unclear.
- pedestrians trespassing on side-aligned LRT rights-of-way where there are no sidewalks.
- inadequate pedestrian queuing areas and safety zones.
- two-way side-aligned LRT operations.
- motorists failing to stop on a cross street after the green traffic signal has been pre-empted by an LRV.
- motorists violating traffic signals with long red time extensions resulting from LRV pre-emptions.
- motorists violating active and passive NO LEFT/RIGHT TURN signs, where turns were previously allowed prior to LRT construction.¹³

2. POTENTIAL COUNTERMEASURES

A range of counter-measures that include careful system planning and design, and education and outreach can significantly prevent the accidents commonly seen on light rail systems.

a. System Planning and Design

From his study findings, Korve defines five key system planning principles:

- respect the existing urban environment (unless a specific design change is necessary) while balancing with objectives of reducing auto-dependency.
- comply with motorist, pedestrian and LRV operator expectations.
- simplify decisions and minimize road-user confusion.
- clearly communicate level of risk associated with surrounding environment.
- provide recovery opportunities for errant pedestrians and motorists.¹⁴

¹² Ibid. P. 7.

¹³ Ibid, pp. 3-4.

¹⁴ Ibid, p. 4, 66-67.

These principles translate into the following guidelines for roadway design and traffic control devices, included in the fourth table of Appendix B, which show possible design solutions for observed problems.

- attempt to maintain existing traffic and travel patterns, unless a specific urban design change is necessary. This should be balanced with the objective of using transit as an alternative to reduce auto-dependency.
- locate the trackway in the median of the street where possible.
- separate LRT operations from motor vehicles by a more substantial element (e.g. low-profile pavement bars, rumble strips, pavement texture, or mountable curbs) than paint or striping.
- clearly distinguish LRT signals from traffic signals.
- coordinate traffic signal phasing and timing to preclude cross-street traffic from stopping on and blocking the tracks.
- provide turn pockets whenever possible.
- provide refuge areas between roadways and parallel LRT tracks.
- channel pedestrian flows to minimize errant or random crossings.¹⁵

b. Education and Enforcement

In addition to appropriate system planning and design, it is critical that public education about the system and enforcement methods take place—both prior to and during system operation. Education about proper safety practices should be provided to pedestrians, motorists and passengers who are traveling within the LRT environment.¹⁶ For example, one critical and often overlooked public outreach tool is the inclusion of LRT education in drivers safety manuals. A number of light rail systems have integrated innovative practices including both design and education components, into their programs. These include:

Calgary—The most prevalent safety issue has been pedestrian jaywalking on the Seventh Avenue Transit Mall. The portions without high platforms to separate the trackway from the rest of the street tend to encourage jaywalking. As a counter-measure, Calgary Transit has installed curbside pedestrian barriers (bollards and chains along outside edge of sidewalk) on the side of one block without high platforms, and has effectively deterred pedestrians from jaywalking, and thus reduced the number of LRV-pedestrian collisions.¹⁷

Portland—The transit agency, TRI-MET has an ongoing problem-identification and resolution system, which has led to a number of system modifications. For example, TRI-MET removed left-turn restrictions across LRT tracks on Morrison Street in downtown Portland, where they interfered with the expected, normal travel patterns of motorists. TRI-MET changed the signal phasing so that LRVs clear the intersection on an all-red signal indication. NO TURN ON RED signs have also been installed.¹⁸

San Jose—SCCTA, San Jose’s transit authority, has installed a number of system sign additions to reduce collisions between LRVs, pedestrians and motor vehicles. These include active, internally

¹⁵ Ibid, pp. 5-6.

¹⁶ Ibid, p. 86.

¹⁷ Ibid, p. 58.

¹⁸ Ibid, p. 60.

illuminated TROLLEY COMING signs, SECOND TRAIN APPROACHING signs, and swing gates in strategic locations.¹⁹

Los Angeles—The Los Angeles County Metropolitan Transit Authority (LACMTA) has used photo enforcement to track, analyze, and respond to conflicting vehicles and LRVs. Using Autoscope technology, high resolution cameras photograph the vehicle and license plate of illegally turning motorists. A traffic citation could then be issued through the mail. This method has allowed the MTA to identify and analyze potential sources of accidents before they occur, and retrofit the light rail system accordingly. For example, the agency is considering installing pedestrian swing gates, queuing areas and safety zones.²⁰

LACMTA also has an ongoing safety education program for adults and children who interact with the system regularly. The agency has implemented a program targeted to individuals who speak English as a second language, and has produced a safety video in English and Spanish. Other outreach efforts:

- Operation Lifesaver safety programs
- tours of the system to expose the public to rail safety
- safety placement game in local fast food restaurants
- handbills and posters in local businesses along the system
- safety bulletins in weekly church programs
- ongoing meetings with businesses along the system.²¹

¹⁹ Ibid, pp. 62-63.

²⁰ Ibid, pp. 59-60.

²¹ Ibid, p. 89.

3. SECURITY AND QUALITY OF LIFE ISSUES

1. GENERAL PATTERNS

a. Transit crime is directly related to neighborhood crime. Property and quality of life crimes comprise the vast majority of rail transit crimes; violent crimes account for only a small percent.

Two studies provide information on crime in the general transit environment. In 1977, the Southeast Michigan Council of Governments (SEMCOG) completed a study of 57 transit systems in the US. Among their findings which have been supported by other studies over the last two decades, is that transit crime patterns generally parallel crime patterns in the surrounding neighborhood. That is, a high incidence of transit crime is likely to occur in those geographical areas with a high incidence of street crime.²²

The first table in Appendix C reproduces data from the SEMCOG study, and shows that transit systems in smaller cities with relatively low levels of serious crime suffer the least from mass transit crime. Conversely, systems located in densely populated major cities with serious crime problems, like New York, experience the most transit crime.²³ A more recent study by the Project for Public Spaces, Inc. has found similar results—that safety is a seamless issue, and it is not only the station that matters, but the surrounding neighborhood. Table 1 also shows that the most common violations are of local ordinances, or less serious offenses, such as disorderly conduct and larceny.

This last observation is corroborated by a 1996 study which used National Transit Database data for rail fixed guideway systems (RFGS), which include light and heavy rail, as well as other types of rail. Findings in this analysis show that RFGS in the US reported 91,551 criminal occurrences in 1996. Quality of life and property crimes (burglary, larceny, vehicle theft) account for over 93 percent of all crimes. Violent crimes (homicide, assault, rape) occur relatively infrequently, totaling 6.6 percent of all RFGS crime.²⁴

The breakdown patterns show:

- the most common quality of life crimes are disorderly conduct and drunkenness, which total nearly 80 percent of all QOL crimes.
- trespassing and loitering account for 9.5 percent of all QOL crimes.
- vandalism totals 6.7 percent of QOL crimes.

²² U.S. Department of Transportation, Urban Mass Transportation Administration. *Transit Security: A Description of Problems and Countermeasures*. Mauri, Ronald et al. October 1984/Reprint May 1985, p. 12. Richards, Larry G. and Lester A. Hoel. *Planning Procedures for Improving Transit Station Security*. U.S. Department of Transportation, February 1980.

²³ *Transit Security*, pp. 18-19.

²⁴ *Ibid*, p. 26.

- fare evasion accounts for over 80 percent of property crimes.
- theft and burglary account for less than 20 percent of property crimes.
- the most serious violent crimes (homicide and rape) comprise less than 1 percent of violent crime incidents.
- robberies, however, are a significant problem, at 56.8 percent of violent crimes.²⁵

b. Generally, sub-surface rail environments have had greater crime frequencies.

Comparison of crime rates in tunnel vs. surface light rail is difficult because there have not been significant, thorough studies looking at quality of life issues and crime levels specific to those light rail profiles. However, one recent study, from the *Transit Security Handbook*, as well as anecdotal evidence, provides some indications.

The 1996 RFGS study shows that property crimes on heavy rail are significantly higher than on light rail, while quality of life crimes on light rail outnumber those on heavy rail. Violent crimes are low and almost the same level for both types of light rail. Within each category, the following patterns hold, and are shown in the figures in Appendix D:

- for quality of life crimes, disorderly conduct violations are more than twice as great on heavy rail as on light rail, but incidents of drunkenness, vandalism and trespassing are higher on light rail.
- for property crimes, fare evasion on heavy rail is nearly five times as great as that for light rail.
- for violent crimes, robbery occurred more frequently on heavy rail, but assaults occurred more often on light rail.²⁶

Anecdotal evidence also indicates that underground stations may be at greater risk for crime than surface or aerial stations. One factor has been the older age of most rail systems with underground components. Many older stations lack good sight lines, have recessed nooks, and are labyrinth-like with long and often narrow passageways, all of which compromise good security. These stations preclude surveillance and communication.²⁷

In New York, waves of subway crime over the years has created peaks of fear among transit riders. In one incident, the closure of nearly 50 underground newsstands made the subway environment more dangerous and easier for crimes to be committed. In another case a few years later, 15 different areas in the New York subway system were closed after a rape occurred in a high-crime passageway. Noted a transit official, “There are a lot of other dangerous nooks and crannies in the subways that need to be cordoned off, and signs need to be posted warning people of the danger.”²⁸

In Europe, a rash of transit vandalism occurred several years ago, that led to significant economic impacts on the transit systems. The resources needed to cope with the problems drained transit budgets

²⁵ Ibid, pp. 28-33. *Transit Security Handbook*, p. 37+.

²⁶ *Transit Security Handbook*, pp. 26-32.

²⁷ Jacobs, Bernard M. *Transportation Subways—Safety and Security Measures*. New York, New York, 1992.

²⁸ Semler, Eric. “Crime Reports Scare Subway Riders.” *New York Times*, June 15, 1989, p. 2. Sims, Calvin. “15 More Areas In Subways to Be Closed.” *New York Times*, March 29, 1991, p. B1.

while encounters between transit staff and offenders lowered employee morale, incited strikes and petitions, and created a sense of insecurity for riders.

In the Netherlands, for example, overautomation of transit facilities led to anonymity which bred increased crime in the subway system. From 7,000 incidents of vandalism in 1965, the figure had jumped to 25,000 in 1975 and over 100,000 in 1986.²⁹

A number of European cities have preferred to build surface stations, believing that public safety will be better. In Rotterdam twenty-five years ago, an underground station became prone to so much vandalism that in 1996 it was replaced by a temporary surface station. Based on this experience, Sheffield, England, avoided building a tram stop below the surface of the street.

Plans to build underground transit facilities in other cities have met with opposition. In Karlsruhe, Germany, the public reacted against construction of a 2 kilometer long transit way, and have voted in a referendum rejecting the proposal in favor of surface. Ten years ago, 60,000 people in Frankfurt signed a petition to protest plans to replace surface transit with underground light rail.³⁰

And in several Belgian cities—Gent, Charleroi, and Antwerp—the same sentiment has prevailed. In Charleroi, nearly all surface tram routes have been replaced by a smaller, underground tram system that has not been successful in attracting the bulk of the former surface passengers. People feel that a surface system that diverts auto traffic will attract more transit users, increase passenger density, and improve safety both in the system and on the street as car traffic declines. Antwerp and Gent have begun to focus more on surface tracks in narrow streets, which are considered to be more “environmentally friendly and safer for pedestrians and passengers.”³¹

c. Actual and perceived safety and security are inter-related and can have a significant economic impact on the transit system.

People’s beliefs about security play a huge part in determining whether they will use the transit system at all. Although real crime levels may be lower than actually perceived by potential transit patrons, the mere perception of lack of safety can have a significant economic impact on the transit system. Studies show a complex interaction effect between actual and perceived security, where a situation of heightened perceived security may help deter actual crime.³²

A number of factors can influence how secure a passenger feels. These include:

- person factors—age, sex, health and experience of the passenger.
- station factors—lighting, cleanliness, maintenance, age of station, visibility.
- situation factors—familiarity of the station, regularity of the trip.
- social factors—size of party, passenger density.³³

²⁹ Batiste, Francois. “Invasion of the Vandals.” *Mass Transit*, March 1991, vol 18, no 3, p. 50-52.

³⁰ UK Development Group, Fact Sheet No. 47, *Urban Transport Planning*, May 1997.

³¹ Ibid.

³² Richards and Hoel, *Planning Procedures*, p. 3.

³³ Ibid, p. 34.

Regardless of actual crime rates, then, perceived crime can have a significant and negative effect on system ridership, system revenue, passenger and employee morale, and can weave a negative spiral of decline between the system and the surrounding neighborhood.

d. Different crimes occur in different environments at different times.

Richards and Hoel, in their summary of previous studies, describe that crime levels vary over time. For example, assaults are most likely during the evening rush hour; robberies are most common on Friday and Saturday nights; and suicides are prevalent during holiday periods.

Different crimes also call for different environments. Crowded stations facilitate picking pockets, while isolated, empty stations permit muggings or rapes. A station may have adequate protection against robbery, but not against homicide. Hence, different station design options can be employed when anticipation of probable crimes takes place.³⁴

e. Overall, transit crimes are more likely to occur at stations than on the transit vehicle. However, this can vary by type of crime.

Several studies show that the majority of transit crimes take place at stations, rather than on the transit vehicle. The offender can then leave the station, rather than using the train as an escape.³⁵ One study of crime in Chicago found that 75 percent of the recorded crimes occurred in stations, especially as transit users waited on platforms.³⁶

The 1996 *Transit Security Handbook* offers additional findings on station versus vehicle security by crime category. The patterns show:

- most quality of life crime arrests occur on trains (62.2 percent) with a smaller percentage in transit stations (31.1 percent).
- the majority of property crimes (80 percent) occur in stations, while only 11.4 percent take place on vehicles.
- 65 percent of violent crimes occur in stations, compared to 27.7 percent in vehicles.³⁷

Another study also found the following aspects of station security:

- proximity to an agent's booth, a courtesy phone or a major user path enhances security.
- poor lighting and hidden areas provide poor security.
- higher passenger volume, stations spaced farther apart, enhance security.
- fewer station levels provide better security.
- residential area stations are more secure than commercial areas.
- absence of parking facilities enhances security.³⁸

³⁴ Ibid, p. 20.

³⁵ Ibid, p. 20.

³⁶ Richards, Larry G. and Lester A. Hoel. "Planning Procedures for Transit Station Security." *Traffic Quarterly*, vol. 34, no. 3, July 1980.

³⁷ *Transit Security Handbook*, pp. 28-32.

³⁸ Ibid, p. 359.

f. Most transit criminals are juveniles and commit crimes in their own neighborhoods.

A number of studies have found the majority of transit offenders to be juveniles.³⁹ Notes participants in a 1992 workshop on managing social problems in transit security,

“Teenagers and pre-teenagers are heavy users of transit systems and young people often do not realize that boisterous behavior, which is acceptable to their peers, may be unacceptable and frightening to other transit users. Young people need to be educated about appropriate transit behavior.”⁴⁰

g. The presence of homeless and transient people in transit systems can pose a significant quality of life issue for other transit users.

Homeless people living in transit facilities can have multiple impacts—they may affect ridership, employee morale, relationships with vendors, and the communities that depend on the transit system. Who are the homeless? A homeless person can be anybody—middle class families whose wage earners have lost their jobs, or seriously ill people with medical and mental health problems. Some may be displaced from overfilled shelters, or may seek freedom from the rules-based restrictions of many shelters.⁴¹

One comprehensive study of homelessness in transit facilities offers several conclusions:

- homeless people tend to gravitate to transit facilities in downtown areas.
- those in transportation centers are usually:
 - youth, mentally ill men and women, substance abusers, permanently transient couples and/or migrants.
 - have no or low income.
 - have multiple problems with substance abuse, mental and physical illness, institutionalization, jail records, lack job skills and education.
 - choosing to stay and use the transit center as a base of operation.⁴²

Resolution of this safety issue will take ongoing efforts among community members, local government, social service providers and transit agencies.

³⁹ Richards and Hoel, p. 20. *Transit Security Handbook*, p. 25. Mauri et al, p. 37.

⁴⁰ U.S. Department of Transportation, Federal Transit Administration. *Transit Security: Exploring New Concepts in Managing Social Problems Workshop*. Oakland, California, 1992. P. 4.

⁴¹ Ibid, p. 11.

⁴² Schwartz, Rita. *The Homeless: The Impact on the Transportation Industry*. For the Port Authority of New York and New Jersey. 1988. pp. 11+.

2. POTENTIAL COUNTERMEASURES

Many possible procedures, policies, design features and technological devices can function as counter-measures to crime. Four main categories are:

- hardware and equipment
- design and environment
- community education and judicial policies
- personnel and operations.⁴³

a. Hardware and Equipment Countermeasures

Items in this category can include:

- alarm systems
- communication devices—phones, two-way radios, public address systems
- surveillance equipment including closed circuit television (CCTV), security mirrors, visual and auditory monitoring, and televue alert systems (TVA)
- evidence gathering equipment such as alarm activated cameras and videotape
- entry control such as turnstiles and gates, prescreening riders, and automatically sealed exits
- fare hardening devices including exact change systems and sealed fareboxes, and
- detection devices (metal detectors and intrusion detectors).⁴⁴

b. Design and Environment Countermeasures

This category of counter-measures is, in a sense an extension of the physical equipment category above, but is much broader in its emphasis. This approach focuses on how the built environment can encourage or prevent the commission of acts of crime and vandalism. Oscar Newman's concept of *defensible space* forms a basis for this approach, and involves arrangements of buildings and spaces to foster a sense of control and cohesiveness among residents of a community to give an image of solidarity and property to outsiders.⁴⁵

The territorial definition and natural surveillance that form the basis of defensible space also relates to the Crime Prevention through Environmental Design, or CPTED approach. Applied to transit facilities, guidelines for design that supports safety can be defined:

- Interior design considerations
 - area easily surveyed by camera or person (good lighting, open space, no barriers or visual obstructions, height-limited fixtures, transparent exterior walls).
 - controlled passenger movements (fare collection at entrance, single entrance/exit area, specified traffic flow patterns, central platform, floating platforms).

⁴³ Richards and Hoels, "Planning Procedures", p. 365.

⁴⁴ Ibid, p. 364. Mauri et al, pp. 59+. Jacobs, p. 2.

⁴⁵ Richards and Hoels, "Planning Procedures", p. 356.

- control passenger convenience services (eliminate restrooms or control access to restrooms, single person restrooms, cluster concessions).
 - manage environment (attractive and clean property, vandalproof surfaces and fixtures, easy maintenance materials, climate control).
 - minimize number of station levels.
- Exterior design issues
 - site selection (high or low crime area, proximity to activity centers).
 - use integrated with neighborhood activities and surrounding environment; connections to safe areas.
 - ease of access (pick up and deliver zones, parking facilities).
 - lighting (vandal resistant, booth status indicator lights).
 - landscaping (perimeter barriers, natural fences, open area between building and outer perimeter).⁴⁶

A recent example of the use of CPTED principles in station design is in San Francisco's Third Street Light Rail station at Bayview Hunters Point, a neighborhood with both actual and perceived safety and security issues. The light rail station design has incorporated station surveillance through CCTV, nighttime lighting at boarding platforms, location of platforms in street medians for better sight-lines, and concentration of stations at fewer stops.⁴⁷

c. Community Outreach and Education and Judicial Policies

These countermeasures include both community outreach and awareness components as well as legal policies that communicate zero tolerance for transit criminal offenses. Elements include:

- Public relations
 - community education and outreach
 - school programs
 - media programs
 - control publicity about incidents
- Judicial policies
 - "swift and certain justice"
 - prosecution of incidents
 - rapid processing of court cases⁴⁸

One cornerstone of the community education element is to develop an effective partnership among the community, the transit agency, and the local government. Transit crimes tend to reflect overall neighborhood crime levels, and have their roots in the communities the transit systems serve. Hence, if

⁴⁶ Richards and Hoels, "Planning Procedures", pp. 364, 370. Jacobs, Bernard, pp. 3-4.

⁴⁷ Pittman and Hames Associates. "Third Street Light Rail Project: Economic Revitalization Strategies Report." City and County of San Francisco Public Transportation Commission Municipal Railway. January 1998. Chapter 11.0

⁴⁸ Richards and Hoels, "Planning Procedures", p. 364.

transit systems want to be proactive and prevent incidents, they must become involved with local communities.

One study points out the lack of awareness that may exist about the high costs of social problems on transit. These problems impact the transit budget and employee morale, lead to higher fares and poorer service, and affect community economic and social well-being. The community can only be as healthy as its transit system, and vice versa.⁴⁹

On the other hand, a well-functioning transit system can create synergy for both transit and the community. The system and its employees can act as “eyes and ears” for the community by training operators to watch for illegal activity and trouble spots in the neighborhood, but members of the community must also send the message that the transit system is a valuable community asset that must be respected by all patrons. In particular, special efforts must be devoted to school/transit partnerships and age-appropriate programs to educate younger riders.⁵⁰

A number of transit systems use school programs successfully to influence the behavior of younger riders. In San Francisco, BART has instituted a “Ride with Pride” program. Then, in January of 1997, BART started “Tag Team,” an anti-graffiti program that involves seven BART departments and a zero tolerance philosophy. Video cameras on trains, an ad campaign, a 48-hour removal program, rewards for reporting vandals, and education to youth using posters, banners, electronic messages at stations, and a rap video have helped to improve the transit environment.⁵¹

In New Jersey, the NJT-Rail police have begun a major crime prevention effort to create an image of safety on the system. The program includes a School Safety program and public relations campaign. WMATA, in Washington, DC, has a program to improve the police officers’ image in the community. Components include free distribution of Washington Redskins football cards with safety messages.⁵²

On Atlanta’s MARTA system, a marketing campaign was begun before actual enforcement activities began. It included distribution of publications, posters in stations and on trains. And on Boston’s MBTA, officers give slide presentations to school children on the hazards of trespassing on transit property. Other transit agencies have hired youths to educate their peers on security issues.

⁴⁹ *Transit Security: Exploring New Concepts*, 1992.

⁵⁰ *Ibid*, 1992.

⁵¹ U.S. Department of Transportation, Federal Transit Administration. *Transit Security Newsletter*. July 1998, no. 8.

⁵² Mauri et al, pp. 82-85.

d. Personnel and Operations

Two key elements of this category are: deployment of security personnel, and presence of transit operations personnel. Important aspects include:

- Manpower deployment
 - visible uniformed security force
 - police always in station (fixed location, station patrolled)
 - police patrol the system (random and regular patrols, saturation patrols, K9 patrols, plain clothes officers, decoy teams)
- Transit employees in station
 - ticket sellers
 - concession operators
 - maintenance people.⁵³

Numerous studies have shown that police saturation is critical to passengers' perceived security. Riders do not necessarily need to see arrests take place, but merely having security presence heightens perceptions of safety. In addition, it is preferable to have sworn police officers with powers to arrest when necessary, rather than contracted private security, who do not have full police powers.⁵⁴

It is also important that transit agencies and local police departments work together before systems begin operation to ensure efficient and effective deployment of security personnel. Numerous examples from other cities reflect such coordination.

In Washington D.C.'s Metro, teamwork between WMATA and the police department has been key. A transit police force of 298 sworn members works with Metro's 8,000+ employees for crime prevention efforts. In the North County Transit District, enforcement officers are allowed free service on all trains and buses, strengthening overall security and cementing the bond with local law enforcement.⁵⁵

In Atlanta, MARTA has a Police Department Crime Suppression Team which specializes in quality of life crimes on the trains—fare evasion; littering; vandalism and graffiti; panhandling; disorderly conduct. And on the Long Island Rail (LIRR), a multi-disciplinary working group of police security and mental health professionals has developed a program for Crisis Intervention Management on trains. Topics include: verbal and nonverbal clues, causes of emotional disturbances, assessing risk, crisis intervention procedures and critical incident stress debriefing.⁵⁶

⁵³ Richards and Hoels, "Planning Procedures", p. 364.

⁵⁴ Mauri et al, p. xiv. Jacobs, Bernard, p. 1.

⁵⁵ U.S. Department of Transportation, Federal Transit Administration. *Transit Security Newsletter*. September 1997, no. 3.

⁵⁶ U.S. Department of Transportation, Federal Transit Administration. *Transit Security Newsletter*. November 1998, no. 10.

In addition to security officers, however, other transit employees can play an important role in preventing crime incidents. A number of studies stress the importance of the station agent or manager's presence as a human connection and source of help should an incident arise.⁵⁷ These employees need to be aware and alert, and trained for crime prevention and response. Creative use of business rental leases to concession vendors can also enhance station security.⁵⁸

In several European cases, the lack of such transit staff have had negative effects on security. For example, in the Netherlands, overautomation and reduction in human staff has led to anonymity in the unstaffed stations and facilitated the rise of crime levels. In Rotterdam, the city began training unemployed youths as street-car companions who inspected tickets, guarded against vandalism, and ensured passenger security. Fare evasion fell 2 percent, while vandalism declined 30 percent.⁵⁹

Similarly, in Paris, the automation of transit stations has led to significant increases in vandalism and resultant costs on the transit budget. Programs have been implemented to fight the crime and vandalism through increased patrol personnel, emergency alarms and camera surveillance, and anti-graffiti efforts.⁶⁰

4. CONCLUSION

No transit system, regardless of location, profile and size, is immune from safety and security concerns. Hence, it is critical that these issues be considered and addressed throughout the project's life, from inception through planning and design to operation.

It is important for communities, transit agencies, and local government to form effective partnerships in addressing potential and actual safety and security problems, through system planning and design; education and outreach; and enforcement.

⁵⁷ Project for Public Spaces, Inc.

⁵⁸ Mahoney, Timothy. "Keeping watch over mass transit." *Security Management*, Jan 1990, vol 34, no 1, p. 50.

⁵⁹ Batiste, p. 1.

⁶⁰ Ibid, p. 2.

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