

The Geography of Transit Crime

Documentation and Evaluation of Crime Incidence on and around the Green Line Stations in Los Angeles

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► The Problem: Transit Crime

On 22 December 1984, the nation's TV screens were dominated by images from the Manhattan subway. That day, Bernhard Goetz, a lone, white male passenger, gunned down four young black males that had harassed him for money on the train. In the media hysteria that followed, the victims emerged as evil, while Goetz's act was justified: a legitimate act of self-defense by a terrified citizen in a scary setting. At that moment and for subsequent years, urban railway stations emerged as the nation's primary epitome of urban crime, a "lurid, underground kingdom ruled by murderers, rapists, and muggers where a subway rider's life sometimes has less value than a token" (Rangel 1985, B1).

A number of studies have documented fear of crime at railway stations (Kenney 1987; Ball and Mierzejewski 1992; Levy 1994). Most studies on railway crime have focused on East Coast cities such as New York (Clarke, Belanger, and Eastman 1996), Chicago (Block and Davis 1996), and Washington, D.C. (La Vigne 1996). Researchers have argued that personal security can have a significant influence on travel patterns (Lynch and Atkins 1988). Public concerns over safety may be one of the most important reasons why many choose not to use transit (Hartgen, Ingalls, and Owens 1993). Researchers have found that people's fear of crime is more acute in the transit station than on the street since transit users are often confined within the system and are less able to flee a dangerous situation (Kelling and Bratton 1991). Fear seems to be more prominent among subway users than users of ground transit, who report feeling trapped in underground stations. These fears and feelings of vulnerability are particularly accentuated among women (Wekerle and Whitzman 1995).

Transit crime is a well-known but underreported trend in urban centers. Criminologists agree that public transit tends to frame opportunities for crime, as it moves large proportions of high-risk populations around the city along a limited number of paths and destination points (Brantingham, Brantingham, and Wong 1991). Transit stations are truly public spaces that mix a wide range of constantly interchanging users together

Abstract

The link between the social and physical environment and transit crime is an important one, but it is not well understood or explored. This study explores the environment-transit crime connection by examining in depth the relation between crime incidence at the stations along a light-rail line in Los Angeles and the social and physical characteristics of the stations and their neighborhoods. The study employs a mix of qualitative and quantitative methods to analyze crime statistics, census and ridership data, and built environment data. It documents and evaluates the geography of crime along this light-rail line as well as the impact of sociodemographic and environmental attributes on crime incidence at the station.

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(Richards and Hoel 1980). Offenders can linger anonymously at bus stops and rail stations waiting for potential victims (Block and Davis 1996). Some passengers represent easy targets—being tired or preoccupied, carrying packages or other stealable objects, or being accompanied by young kids that gather their attention (Myhre and Rosso 1996). In large transit systems, transit stations are often called “crime attractors” because they have the potential of generating crime and disorder by producing crowds. In small systems, characterized by low-volume and low-density stations, opportunities for crime may arise because of desolation and lack of surveillance (Felson et al. 1990).

In general, transit stations are no more unsafe than are city streets or other public places. In fact, if we consider only serious crime, rail stations are safer than many city streets because of the high rates of police deployment. As Kenney (1987) reports, less than 3 percent of serious crime occurs on the New York City subway, yet more than 12 percent of the police are assigned to the subway system. However, a few highly publicized crimes in the nation’s subway stations have attracted popular attention and concern. At the same time, less serious incidents, incivilities, and “quality of life violations” (disorderly conduct, public drunkenness, use of obscene language, vandalism) at transit stations, while highly underreported,¹ have intimidated many transit patrons.

Transit crime affects people’s decisions to use public transportation. Acts and perceptions of violence cause loss of ridership and revenue. A report titled *Improving Transit Security*, commissioned by the Federal Transit Administration, argues that “given the sensitivity of transit clientele to even one major crime, reported incidence argues persuasively for diligent monitoring and increasingly effective interventions” (Transit Cooperative Research Program [TCRP] 1997, 5). Thus, many studies have sought to document and analyze transit crime, and almost all transit agencies have instigated crime prevention strategies.

From the various studies that have profiled transit crime, we know the following:

1. Transit crime is mostly a problem of the nation’s larger cities (Siegel 1979, in DeGeneste and Sullivan 1994).
2. The majority of the incidents represent less serious crime and incivilities. A survey of forty-five transit agencies showed that 22 percent (or 8,000 cases) of all reported incidents were of a serious nature. Of the serious crimes, only 2,700 cases were violent (TCRP 1997). The vast majority of the less serious incidents involve vandalism, disorderly conduct, public drunkenness, theft, and harassment. These affect and intimidate other transit patrons (TCRP 1997) but tend to be underreported. Robberies, assaults, and bat-

teries represent the majority of the reported serious crime (TCRP 1997).

3. Crime levels vary for different parts of the transit system and are correlated to neighborhood crime (Richards and Hoel 1980; DeGeneste and Sullivan 1994).
4. Most crime incidents occur in stations rather than on trains (DeGeneste and Sullivan 1994) and at bus stops rather than on buses (Loukaitou-Sideris 1999) since the presence of the train crew or bus driver probably discourages potential offenders.
5. Transit crime varies temporally and spatially. More serious crime tends to happen in late evening and night hours, while less serious incidents occur during rush hours (Shellow, Romnaldi, and Bartel 1974; Pearlstein and Wachs 1982; Levine, Wachs, and Shirazi 1986; Loukaitou-Sideris 1999). Also, different crimes occur in different types of environmental settings (Richards and Hoel 1980). Pickpockets and purse snatching typically happen in crowded situations, where the offender can easily hide in the anonymity of the crowd and rapidly escape the setting. Rape, homicide, and robbery usually occur in settings with low pedestrian traffic, low surveillance, and many concealed areas (dark corners, elevators, restrooms) (Harris 1971; Clarke, Belanger, and Eastman 1996).

While many studies have documented railway crime, most have focused their attention on the social variables of crime: the sociodemographic characteristics of offenders and victims and the social context of station neighborhoods. With few exceptions (Block and Block 2000; Block and Davis 1996; Loukaitou-Sideris and Banerjee 2000), researchers have ignored the spatial environment (type of land uses, urban form attributes) in the immediate vicinity of transit stations. While this can be partly justified for an underground station (La Vigne 1996), which is drastically separated from the rest of the city, a street-level light-rail station is directly affected by and in turn affects its surroundings. In fact, such a station is not too different from a bus stop. As previous research has shown, there is a correlation of certain environmental attributes with bus stop crime (Loukaitou-Sideris 1999; Loukaitou-Sideris et al. 2001; Liggett, Loukaitou-Sideris, and Iseki 2001).

Most studies have documented transit crime in heavy-rail systems and underground stations. There is very little documentation of transit crime on light-rail systems, even though such systems have mushroomed in North American cities in the past two decades. A particular concern regarding light-rail stations comes from their frequent vicinity to major parking facilities. Thus, the security of the passenger and her or his property on the train and station platform is as important as her or his security at the parking lot or along the route from the platform to the parking lot. However, very few empirical studies have examined the security of transit patrons and their cars in park-and-ride facilities (Barclay et al. 1996).

► What Causes Transit Crime?

A Brief Literature Review

Historically, a number of theoretical approaches have sought to explain crime. In general, we can distinguish between two broad categories of theories that use different units of analysis to explain crime (Weisburd 1997). Compositional (or nonecological) theorists focus their attention on the offenders, the people that commit a crime. Nonecological theorists typically argue that intercity variation in crime rates can be adequately explained by the sociodemographic characteristics of urban residents (age, ethnicity, class, social mobility, etc.) and economic factors affecting their neighborhoods (e.g., poverty, unemployment, inequality, etc.). Ecological theorists, on the other hand, cast attention to the context in which a crime takes place. Consequently, their emphasis is concentrated on analyzing where, when, and how crime occurs (Brantingham and Brantingham 1981). A second difference between the two approaches lies in the scale of analysis. Compositional theories tend to look at aggregate sociodemographic and economic data of neighborhoods as independent variables of crime. In contrast, recent ecological approaches tend to analyze the micro-environment of crime, the social and spatial characteristics of the behavior settings in which crime takes place.²

The ecological approach has witnessed a resurgence in the past decades with an ammunition of criminological theories that stress the role of opportunities in crime causation (Clarke et al. 1997), as well as the interaction of offenders with their physical and social environment (Cohen and Felson 1979; Felson 1994), which may influence their choice of targets (Eck and Weisburd 1995). These theories view criminals as rational individuals likely to act when opportunity arises but reluctant to commit crimes where there is a high likelihood of being apprehended (Cornish and Clarke 1986). Explicit in these theories is the importance of place as a setting of crime. The particular sociophysical characteristics of a place (such as the number of people present, the level of surveillability, its physical layout, and environmental attributes) can have positive or negative effects on crime.

Theoretical work on the geometry of crime argues that

offenders seek out criminal victims from a constricted awareness space based on their familiarity with the places or activity nodes where they routinely spend significant amounts of time, such as home, work, school, shopping, and recreational sites, and from areas adjacent to the principal paths they follow in moving between these nodes. (Brantingham, Brantingham, and Wong 1991, 91)

Theorists see transit stations as prime settings where crime against persons can be facilitated. Stations concentrate large

numbers of people that can become targets for pickpocketing, purse snatching, and robbery. Trains move high-risk populations along a limited number of paths, depositing them at a few destination nodes. As Brantingham, Brantingham, and Wong (1991) argue, “Awareness spaces and target search points become tightly clustered” (p. 93).

Empirical studies of transit crime give support to both the compositional and ecological explanations of crime. For one, researchers have found that transit crime is highly correlated with the crime rates in the neighborhood in which a station is located. Poor, inner-city neighborhoods with high proportions of nonwhite population typically have higher crime rates than affluent white suburbs do. On the other hand, the spatial characteristics of a place also affect crime. Examining high- and low-crime bus stops within the same geographic area of downtown Los Angeles, Loukaitou-Sideris (1999) and Loukaitou-Sideris et al. (2001) found a relationship between specific negative environmental attributes and bus stop crime. Yet if viewed separately, the ecological and compositional perspectives run the risk of offering incomplete explanations to crime (Byrne 1986; Taylor, Gottfredson, and Brower 1984). Thus, a more integrated approach is needed that takes into account both physical and social variables and investigates their relative significance in regard to crime.

A review of the literature shows that a combination of different physical and social variables may affect crime at the station. Researchers have argued that “defensible space” characteristics of station design (such as lighting, fencing, specific security hardware, and open design that allows opportunities for surveillance) can discourage crime (Harris 1971). For light-rail stations, the type of platform design may have an effect, depending on the particular neighborhood context. Street-level stations can provide easy escape for criminals. On the other hand, if set within dense urban environments, with good visibility from their surroundings, such stations may provide natural surveillance opportunities (Felson et al., 1990). Conversely, underpass stations (and to a lesser extent overpass stations) may allow offenders to trap their victims without being seen, but they also provide more challenging settings for criminals to escape. Studies have also shown that the urban form characteristics of neighborhoods are important for crime. Particular land uses (e.g., schools, bars, liquor stores, pawnshops, and abandoned buildings) have been found to attract more crime in their vicinity (Block and Block 1995, 2000; Byrne 1986; Greenberg 1986). The presence of physical disorder and incivility, signified by deteriorating building stock and public environments, with concentration of graffiti and litter, is also likely to have an impact on neighborhood crime (Perkins et al. 1993; Skogan 1990).

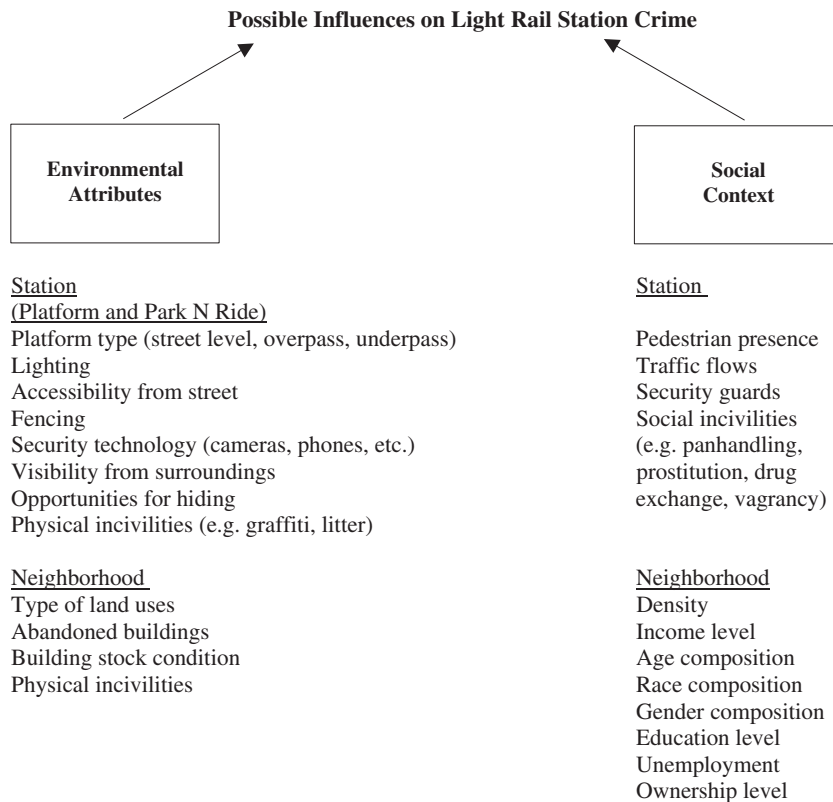


Figure 1. Possible influences on light-rail station crime.

Similarly, social incivilities (the presence of vagrants, drug dealers, and prostitutes) are thought to have a relation to crime at the station (Wilson and Kelling 1982). High numbers of pedestrians at the station were originally thought to detract crime (Angel 1968). Later studies have questioned this assumption. Clarke, Belanger, and Eastman (1996), studying 206 New York subway stations, found that the number of platform robberies was inversely correlated with passenger density at these stations. Others have hypothesized that density affects different types of station crime differently (Harris 1971). Observing the movement of passengers at New York's mass transit terminal, Felson et al. (1996) argued that

crime and disorder are at least likely to occur under two conditions: 1) flow inertia (flow is stable and orderly in the same direction); 2) setting inertia (people are in legitimate behavior settings acting in an orderly fashion). Crime and disorder are most likely to occur under 1) turbulence, in which people are moving in different rates and in different directions; and 2) interstitial idleness, in which people are neither in motion nor in a legitimate behavior setting. (P. 78)

As previously noted, researchers have also hypothesized that the compositional characteristics of the neighborhood surrounding a transit station (its density, income levels, age and race composition, educational level, and unemployment levels of residents) have a likely correlation with transit crime.

Based on our reading of the literature, we have identified the possible influences on light-rail station crime shown in Figure 1.

► Research Design

In this study, we use the Los Angeles Green Line as a case study to explore how different physical and social characteristics at the station and neighborhood affect station crime. The Green Line is a light-rail line that runs for 19.6 miles from Norwalk to El Segundo in Los Angeles County (see Figure 2). The line has fourteen stations and twenty-four separate parking lots and had an average weekday ridership of 26,894 passengers in 1999. This is a small and simple light-rail system that started operating in August 1995.

The Green Line represents a good case to study the relationship between different sociospatial variables and the incidence of crime for the following reasons:

1. The fourteen stations vary significantly in terms of their surrounding land uses. Some stations are within primarily residential areas (although the ratio between single- and multiple-family housing varies). Some stations are surrounded by industrial facilities, some by primarily commercial uses, and others have a mixture of uses in their vicinity.
2. The stations vary significantly in regard to their surrounding environmental conditions, with suburban stations surrounded by well-tended residential environments, and many inner-city stations showing a concentration of graffiti and litter in their vicinity.
3. The station neighborhoods also vary in regard to their sociodemographic characteristics. Neighborhoods at the western end of the line are more affluent than the inner-city neighborhoods in the middle. Neighborhoods at the eastern end can be characterized as middle class. They are ethnically more heterogeneous than the neighborhoods at the western end, which are primarily white.
4. Two different station typologies are encountered in Green Line stations: overpass stations on elevated transit

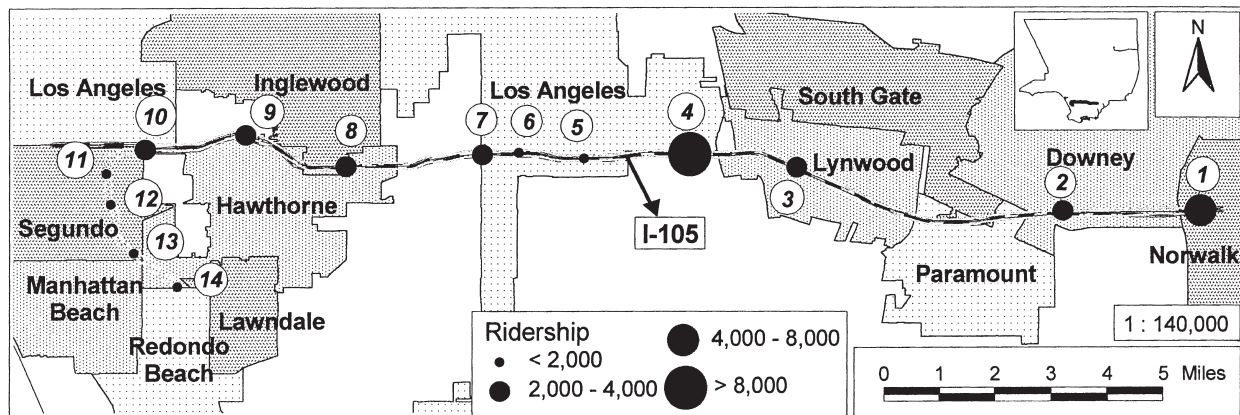


Figure 2. Location of Green Line stations with ridership levels.

guideways and center platforms on the Century Freeway median crossing over a local street and underpass stations, that is, center platforms on the Century Freeway median crossing under a local street.

Our study was set up to address the following questions:

- What is the spatial distribution of crime along the Green Line?
- Where does transit crime occur (on the train, the platform, the parking lot, or the escalators/elevators)?
- Do we find a correlation between station ridership and different types of crime?
- Do we find a correlation between neighborhood density (size of the population residing within a half-mile radius from the station) and crime?
- Do we find a relationship between sociodemographic characteristics of the surrounding vicinity and crime incidence at the station?
- Do we find a correlation between different environmental attributes at the station and in the surrounding vicinity and station crime occurrence? Are high-crime and low-crime areas significantly different in regard to land use mix, design typologies, and station design elements?

► Data Sources

For this study, we obtained crime data for the Green Line from the Transit Services Bureau of the Los Angeles County Sheriff's Department from 1998 onward and ridership data for all Green Line stations from the Los Angeles County Metropolitan Transportation Agency. These data, in conjunction with observation counts at different times of the day at stations, gave us information regarding station density. Demographic data available by census block group for 1997³ were aggregated for

the area within a half-mile radius of each Metro Green Line station.⁴

We conducted a systematic and detailed fieldwork analysis and photographic documentation of the vicinity (one-fourth mile radius) of the station area. We compiled an environmental inventory of each station neighborhood by collecting environmental data and attributes that have been shown to be related to crime incidence (Loukaitou-Sideris et al. 2001). Thus, we mapped the adjoining land uses, the overall condition of the surrounding neighborhood, the concentration of undesirable places (e.g., bars, liquor stores, pawnshops, etc.), the visibility and lighting of platforms and park-and-rides, the flows of pedestrian and vehicular traffic, the degree of formal or informal station surveillance, the existence of fencing and security hardware and equipment at the station, the layout of the platform, and the type of linkages to the surrounding area.

► Crime at the Green Line Stations

Incidents of serious crime (Type 1) and less serious crime (Type 2) at the fourteen stations along the Los Angeles Metro Green Line were reported for the years 1998 and 1999.⁵ During this two-year period, there were a total of 540 crimes, the majority of which (368 crimes) were of a less serious nature (Type 2)—primarily incidents of vandalism. Most of the serious crime (Type 1) was motor vehicle theft and burglary/theft from vehicles or robbery and assault against persons. There was no reported homicide and only one rape (see Figure 3).

Table 1 shows the spatial distribution of crime along the Green Line system. Stations with the fewest number of crimes were found at the western end of the line where the light-rail

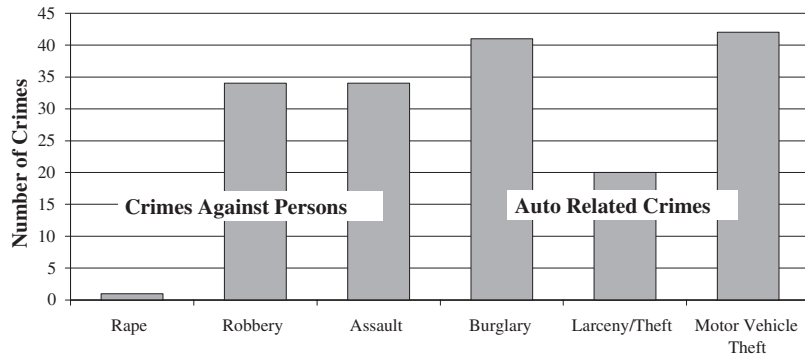


Figure 3. Classification of Type 1 crime.

Table 1.
Crime by station.

Station	Ridership	Crime			Crime per 1,000 Riders			Criminal Activity in Surrounding Areas ^a
		Type 1	Type 2	Total	Total	Type 1	Type 2	
1. Norwalk	4,846	39	27	66	1.36	0.80	0.56	Medium
2. Lakewood	2,066	39	40	79	3.82	1.89	1.94	Low
3. Long Beach	2,493	13	51	64	2.57	0.52	2.05	High
4. Wilmington	8,383	18	24	42	0.50	0.21	0.29	High
5. Avalon	1,696	7	32	39	2.30	0.41	1.89	High
6. Harbor	1,325	5	28	33	2.49	0.38	2.11	High
7. Vermont	2,373	9	41	50	2.11	0.38	1.73	High
8. Crenshaw	2,392	12	12	24	1.00	0.50	0.50	Medium
9. Hawthorne	2,285	12	54	66	2.89	0.53	2.36	Medium
10. Aviation	2,748	8	14	22	0.80	0.29	0.51	Medium/high
11. Mariposa	1,358	1	4	5	0.37	0.07	0.29	Low
12. El Segundo	1,034	2	5	7	0.68	0.19	0.48	Low
13. Douglas (MB)	691	1	7	8	1.16	0.14	1.01	Low
14. Marine (Redondo)	1,064	6	29	35	3.29	0.56	2.73	Low
Total	34,754	172	368	540	1.55	0.49	1.06	

a. From AEGIR Systems, Inc. (1991), appendices.

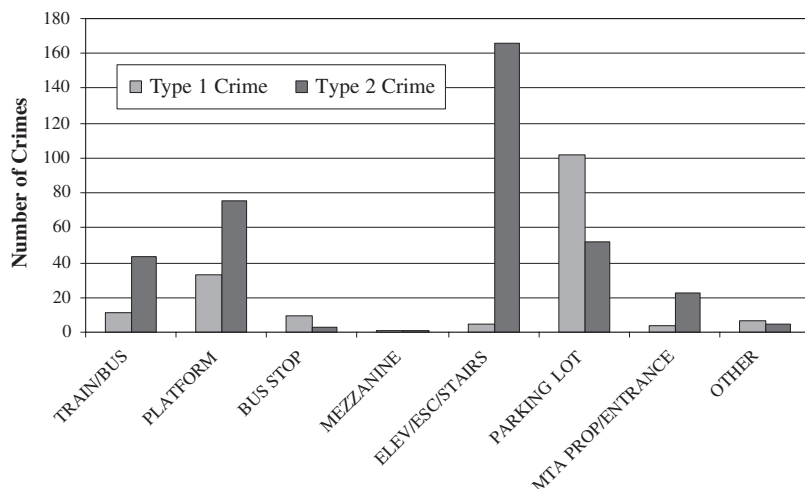


Figure 4. Crime type by location at station.

passes through some rather affluent suburban communities (El Segundo, Manhattan Beach, Redondo Beach) with low criminal activity. The two stations at the eastern end of the line (Norwalk and Lakewood) were found to have the highest numbers of Type 1 crime, even though their surrounding neighborhoods are not suffering from particularly high levels of criminal activity. These two stations have large parking lots. At least half the crimes there were motor vehicle theft or burglary/theft from autos parked in the station parking lots.

In general, Type 1 crime was mostly concentrated at two locations at the Green Line stations: in the park-and-ride lots (60 percent) or on the platform (about 20 percent). Almost all crime in the park-and-ride lots was motor vehicle theft (41 percent) or burglary or larceny/theft from vehicles (50 percent), while on the platform, more than 90 percent of Type 1 crime was robbery or assault against persons.

Type 2 crimes were predominantly in the access routes to the platform from the parking lot or from the street (i.e., stairs, elevators, or escalators). Ninety percent of Type 2 crimes were vandalism, and half of these incidents took place in the access routes. About 20 percent of Type 2 crime occurred on the platform. Figure 4 shows the distribution of Type 1 and Type 2 crimes by location at the station.

The Green Line passes through some low-income inner-city neighborhoods, characterized by a higher incidence of crime than the county average. Stations in these neighborhoods were found to have more Type 2 crime than did other stations in the system. A large proportion of the crime incidents at the Long Beach, Avalon, Vermont, and Hawthorne stations occurred in access routes. These stations had high numbers of vandalism, which tended to be concentrated in the elevator/escalator or stair areas. For the Wilmington station, which had the largest

number of assaults in the system, three-fourths of the crimes took place on the platform. Figure 5 shows the primary locations of crime at the individual stations.

Ridership varied from a high of about eight thousand boardings and alightings per weekday to a low of about seven hundred boardings and alightings, but most of the stations had between one thousand and three thousand riders. There was a correlation between the number of Type 1 crimes and ridership ($r = .486, p < .1$), which grew stronger if we looked only at crimes that occurred on the platform ($r = .785, p < .001$). The number of Type 2 crimes per station, however, was not related to ridership levels. As most Type 2 crimes consisted of incidents of vandalism, we can hypothesize that such acts may not necessarily be committed by riders. Table 1 shows the crime rates per station when normalized by the number of riders.

► Station Crime and Sociodemographic Characteristics of Station Neighborhoods

Based on 1997 census block group data, we found that station neighborhoods differed significantly in terms of the population living within the half-mile radius of a station (see Figure 6). The two stations in the El Segundo area have essentially no population living within the half-mile radius, while inner-city stations are surrounded by neighborhoods with high densities. The mean and median population per station is about five thousand persons.

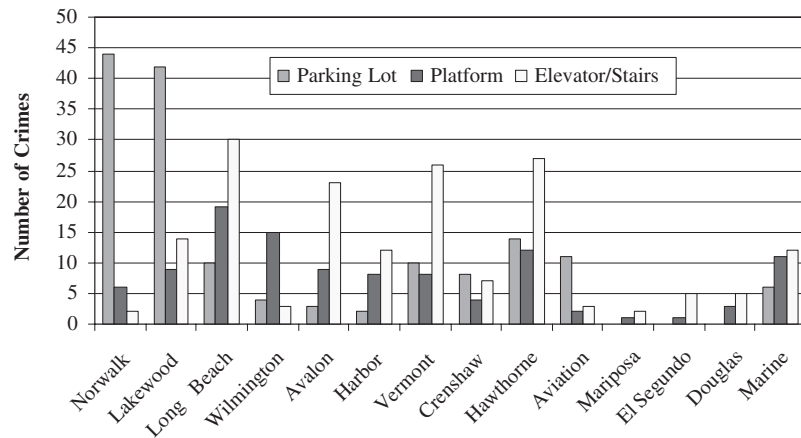


Figure 5. Location of crime at stations.

There was a significant positive correlation between the size of the population living in the vicinity of the station and Type 2 crime, both crime counts ($r = .899$) and crime rates ($r = .542$). Since most Type 2 crime was vandalism, it seems logical that this would be higher where there are more residents. If we exclude the two El Segundo stations from the analysis, the correlation between total population and Type 2 crime counts and crime rates reduces to .855 and .394, respectively. Because the El Segundo stations have essentially no population in the surrounding area, they are not included in the following analysis that looks at the relationship between socioeconomic characteristics of the station neighborhood and station crime statistics (see Tables 2 and 3).

There was a significant relationship between persons per household and numbers of Type 2 crime, which is consistent with our findings with respect to crime and population density in the station area.⁶ We did not find, however, a significant correlation between unit vacancy rates and station crime.⁷ There

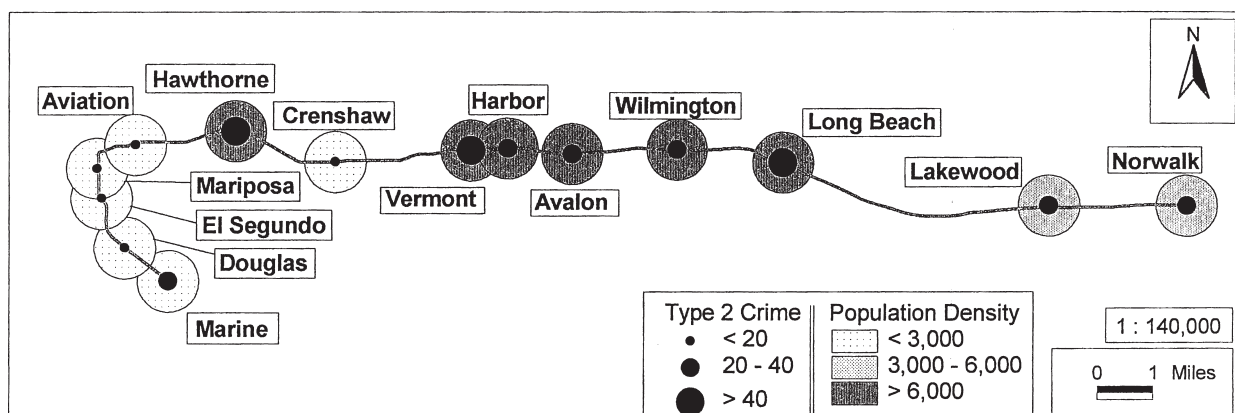


Figure 6. Type 2 crime and population density.

Table 2.
Neighborhood socioeconomic characteristics (within a half-mile radius).

Station	Population Density		Race/Ethnicity (%)			Age (%)			Education (%)		Income (%)		Housing (%)	
	Persons per		White	Black	Hispanic	< 18 Years	18-24 Years	> 65 Years	< High School	Some College	< \$25,000 (Low)	(High) > \$75,000	Owner Occupied	Vacant
	Population	Household												
1. Norwalk	4,598	3.38	64	6	45	27	11	10	13	32	19	23	61	4
2. Lakewood	5,836	3.08	68	5	45	28	11	9	13	30	21	21	50	6
3. Long Beach	9,352	4.58	30	22	79	36	13	7	20	17	39	13	37	3
4. Wilmington	7,425	4.15	18	53	49	39	12	8	20	15	58	8	29	6
5. Avalon	6,884	3.70	17	56	47	34	11	10	20	19	54	7	45	6
6. Harbor	6,668	3.87	21	46	57	35	12	7	20	19	45	13	41	7
7. Vermont	8,223	3.75	18	46	53	35	12	6	18	22	42	12	34	7
8. Crenshaw	2,409	3.22	19	64	24	29	11	6	10	38	20	31	58	7
9. Hawthorne	11,363	4.05	36	12	79	34	13	6	21	19	40	11	24	7
10. Aviation	705	2.92	76	4	26	24	8	14	7	35	12	31	72	3
11. Mariposa	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12. El Segundo	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13. Douglas (MB)	1,706	2.60	82	3	13	20	7	10	4	50	9	53	84	3
14. Marine (Redondo)	1,680	2.55	67	7	30	23	10	7	11	41	15	27	42	8

Table 3.
Correlation between crime and socioeconomic characteristics of station neighborhoods.

Socioeconomic Characteristics (% of Population)	Crime Counts			Crime per 100 Riders		
	Type 1			Type 1		
	Total	Against Persons	Type 2	Total	Against Persons	Type 2
Riders	.486*	.810***	.127			
Population	.127	.324	.855***	.240	.293	.542**
Persons per household	.048	.565**	.644**	-.164	.156	.102
Gender						
Male	-.042	-.681**	.409	.257	.297	.571**
Ethnicity						
White	.205	-.644**	-.333	.261	-.556**	-.071
Black	-.267	.665**	-.072	-.305	.551**	-.171
Hispanic	.158	.199	.905**	.100	.192	.463
Age						
Younger than 18 years	.027	.650**	.569*	-.127	.224	.103
18 to 24 years	.142	.443	.810***	.104	.521*	.429
Older than 65 years	.143	-.293	-.482	.022	-.542**	-.437
Education						
Less than high school	.030	.513*	.745***	.024	-.247	.394
Some college	-.100	-.592**	-.670**	.031	-.107	-.209
Income						
Low income	-.095	.701**	.434	-.158	.545**	.216
High income	-.207	-.601**	-.696**	-.089	-.495*	-.252
Housing						
Owner occupied	-.119	-.581**	-.777***	-.046	-.468*	-.379
Vacant	-.109	.007	-.066	.212	-.149	.416

Note: Statistically significant results appear in bold.

*Significant at the .10 level. **Significant at the .05 level. ***Significant at the .01 level.

was a significant negative correlation between the percentage of owner-occupied units and Type 2 crime counts ($r = -.777$); however, there was no relationship with total Type 1 crime.⁸ There were large differences in station neighborhoods with respect to race and ethnicity. While the percentage white and percentage black residents in the station neighborhood seemed to have no relationship with station crime, there was a strong correlation ($r = .905$) between percentage Hispanic and Type 2 crime counts. Both the Long Beach station and Hawthorne station, which had the highest numbers of Type 2 crime, had surrounding populations nearly 80 percent Hispanic.

Assuming that low-income families are those with household incomes less than \$25,000, we found no correlation between the percentage of low-income families in a station neighborhood and Type 1 or Type 2 crime counts or crime rates. There was a strong negative correlation between the percentage of high-income families in a neighborhood (where high income was defined as more than

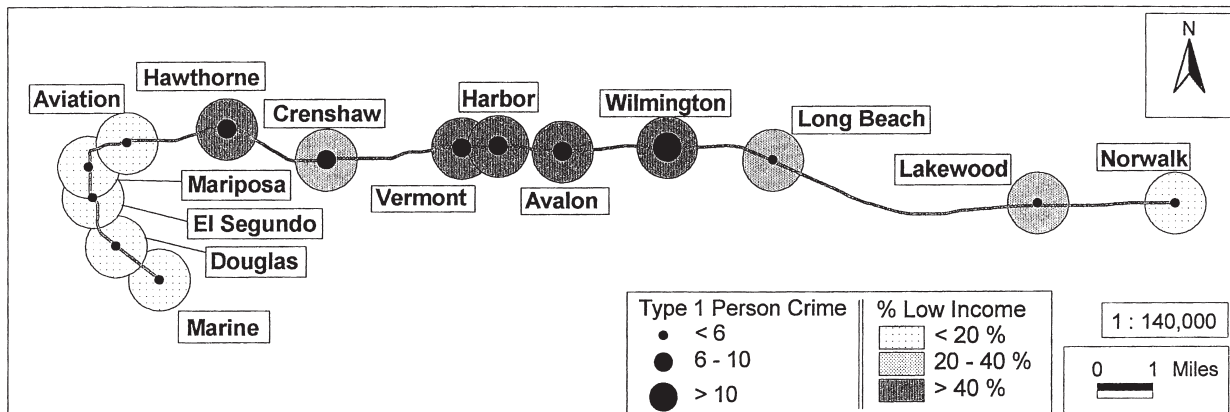


Figure 7. Crime against persons and income.

\$75,000) and Type 2 crime. We also found a strong positive relationship ($r = .745$) between the percentage of the population with no high school education living in the station area and Type 2 crime. Conversely, we found a negative correlation between the percentage of the population with more than a high school education (some college, college, or postcollege) and Type 2 crime. Higher numbers of Type 2 crime were also observed at stations where a higher percentage of the population was younger than 24 years.

The previous analysis showed that certain sociodemographic characteristics of the neighborhoods adjacent to the station have an effect on station crime. In summary, we found higher Type 2 crime counts where there were larger populations, more persons per household, a younger population, and a higher percentage of the population with less than a high school education living in the half-mile radius around the station. Type 2 crime counts were also higher where there was a high percentage of Hispanic population. However, it would be false to make any assumption that a relationship exists between the particular ethnic mix of a neighborhood and crime, as the variable Hispanic is strongly related to all the other variables that correlate positively with Type 2 crime. Type 2 crime counts were lower at stations where there was a higher percentage of owner-occupied units and a higher percentage of high-income households.

While we found no socioeconomic variables related to Type 1 crime counts or crime rates, this is largely due to the inclusion of high numbers of auto-related burglary and theft, which is concentrated in the two stations at the eastern end of the line. If we narrow the scope of Type 1 crime to include only serious crimes against persons, we see a different picture. The number of serious crimes against persons is strongly correlated to ridership. We also found more serious crimes against

persons in areas with more persons per household, more low-income families (see Figure 7), a larger percentage of the population younger than 18, more population with less than a high school education, and a higher percentage of black residents. There were fewer serious crimes against persons in predominantly white high-income neighborhoods, in areas where more of the population was college educated, and where there was a high percentage of owner-occupied housing. The percentage of Hispanic population in the neighborhood was not related to serious crime against persons at the station, which was the opposite of what we found when examining Type 2 crime. It should be noted, however, that these conclusions should be viewed with some skepticism since the number of serious crimes against persons at Green Line stations was quite small.

As mentioned earlier, researchers have found a strong correlation between transit crime and the crime rates at the neighborhood in which a station is located (Hoel 1979). While we are currently collecting and geocoding crime incidence data for many of the neighborhoods adjacent to Green Line stations, for this study we had to rely on information from the *Green Line Security Analysis* (AEGIR Systems, Inc. 1991). This document classified criminal activity in the area surrounding a station on an ordinal scale (low, medium, and high). We can see from the classification in Table 1 that the station neighborhoods at each end of the route fall in the low- and medium-crime categories, while the inner-city stations in the middle of the line fall in the high-crime category. As seen in Table 4, the average number of Type 2 crimes and Type 1 crimes against persons at the station is directly related to the level of crime in the neighborhood of the station. This is not true when we consider all Type 1 crimes because of the high incidence of auto-related crimes at the eastern end stations.

Table 4.
Station crime and level of criminal
activity in surrounding area.

<i>Level of Criminal Activity in Surrounding Area</i>	<i>Average Number of Crimes</i>		
	<i>Type 1</i>		<i>Type 2</i>
	<i>Total</i>	<i>Against Persons</i>	
High	10.40	7.60	35.20
Medium	17.75	4.75	26.75
Low	9.80	2.20	17.00

► Station Crime and Environmental Characteristics of Stations and Their Neighborhoods

Stations

Park-and-Ride Lots

A significant percentage of crime incidents occurred at park-and-ride lots (see Figure 4). Twelve of the fourteen stations have such lots. It is interesting to note that the two stations without lots had very low crime. There was a significant correlation between the number of parking spaces and Type 1 crime ($r = .70, p < .01$).

All lots were partially fenced and adequately lit. They had little or no graffiti, but most of them had some litter. Those with litter tended to have more Type 2 crime (i.e., more vandalism). Parking lots appeared to be quite void of pedestrians, and this desolateness seemed to facilitate criminal activity.

The average walking time from the parking lot to the platform was just more than two minutes, ranging from one to four minutes. There was no relationship between Type 1 crime and walking time; however, we found a moderate positive correlation between Type 2 crime and walking time. Interestingly, there seemed to be no correlation between the existence of parking attendants at the parking lot and crime. The two stations with the highest Type 1 crime counts had parking attendants in the lots, while most of the stations did not (eight of the twelve). The presence of a solitary parking attendant in a big lot full of parked cars was apparently inadequate to deter crime.

Platforms

Ten of the stations were overpass stations, while four were underpass stations. The two high-Type 1 crime stations (Norwalk and Lakewood) as well as the Vermont and Hawthorne stations with high-Type 2 crime counts were underpass stations. A careful examination of the physical environment showed a number of hiding places (under stairways, behind pillars) in the dark underpass stations (see Figures 8 and 9). All station platforms were linked to the street via stairways, all stations were considered to have adequate platform lighting, only one had platform guards (during observation times), and none of the stations had restrooms. There was little to no litter or graffiti on any platform. The five stations with the highest platform crime (Wilmington, Long Beach, Norwalk, Lakewood, and Hawthorne) had also minimal visibility from their surroundings (Figure 10), as they were separated from the adjacent neighborhood fabric by a high-speed freeway and interchange ramps. Unlike many light-rail systems that are well integrated in their surroundings, the location of many Green Line platforms in the midst of a freeway negates the potential for natural surveillance from the adjacent neighborhood and increases the level of platform noise.

Neighborhoods

Land Uses

Most of the stations have little residential land use in the immediate vicinity. While the two high-Type 1 crime stations at the eastern end of the line are surrounded by residential property, the stations are mostly bordered by freeway access ramps. Stations at the low-crime western end of the line have office or light industrial land use in the immediate vicinity, while stations in the center of the line with high-Type 2 crime levels have neighborhood retail in the surrounding area. Only two stations had vacant land in the immediate vicinity, and they had low crime levels.

All but four of the stations had single-family residences within their quarter-mile radius. Both Type 1 and Type 2 crime was higher at stations surrounded by residential land use and lower at stations with primarily office and industrial (light and heavy). This can be explained by the fact that office and industrial areas were also characterized by lower densities than residential areas were. We found higher Type 2 crime in station neighborhoods with significant retail facilities in the quarter-mile area.



Figure 8. Platform at Norwalk station.

Studies have shown that specific land uses are more likely to generate crime than others. Bars, liquor stores, or taverns can have a negative effect on crime (Block and Block 1995). Customers of establishments with cash transactions (pawnshops, check-cashing facilities, automated teller machines [ATMs]) can be targets for robbery. Areas with vacant lots, public parks, and schools often attract youth and gang-related crime (Perkins, Meeks, and Taylor 1992). Looking for specific land uses in the vicinity of stations, we found only one park, two schools, one café, two banks, two civic buildings, and no ATMs. While half the stations had one or more restaurants, there was no relationship with crime levels. Six station neighborhoods had motels, and these stations tended to have higher Type 2 crime levels. Locations of undesirable establishments, which included check-cashing facilities, pawnshops, and liquor stores, were also noted. Nine of the station neighborhoods had one or more liquor stores and/or bars (see Figure 11). There was a strong positive correlation between Type 2 crime and the number of liquor stores ($r = .815$). Only the Hawthorne station had pawnshops in the area, and it had the highest level of Type 2 crime. This station also had three check-cashing

establishments near by. A total of six station neighborhoods (three of which were the highest crime ones) had check-cashing establishments.

Overall Condition

Our fieldwork seemed to support the “broken window” thesis (Wilson and Kelling 1982), which argues that there is a relationship between physical and social incivilities and crime. Station neighborhoods that were considered “decaying”—with littered sidewalks, abundance of graffiti, and deteriorating buildings—also had high numbers of Type 2 crime. In contrast, station neighborhoods considered “prosperous,” “well-kept,” and with good building stock had low crime levels.

► **Multivariate Analysis**

We explored a series of multiple regression models to examine the simultaneous influence of socioeconomic and



Figure 9. Platform at Lakewood station.

environmental characteristics (at the station and its neighborhood) on station crime. When looking specifically at Type 2 crime, all factors that seemed to contribute to higher crime levels were also strongly correlated with population density in the station neighborhood (a majority of correlations greater than .8, significant at the .01 level). Once population density was controlled for, other variables made no additional contribution to explaining variation in Type 2 crime. While we hypothesized that interactive effects among the independent variables might better explain differences in crime levels, we were unable to substantiate this with our data. Given that we had data only for fourteen stations—two of which had virtually no population living within the station area—there were too few cases to draw meaningful results from multivariate analysis.

When we looked at Type 1 crime against persons (i.e., excluding auto-related burglary and theft), we found that two independent variables in a multiple regression equation, station ridership and percentage of low-income population in the station neighborhood, could explain 82 percent of the variation in station crime. The coefficients on both independent variables were significant at the .01 level. Neither physical

characteristics of the station or neighborhood nor other socioeconomic characteristics contributed significantly to the regression model either independently or as interactive terms. When we looked only at auto-related crime, we found no additional variables influencing the crime rates, once the size of the parking lot was taken into account.

► Conclusion

With an average of 1.55 crime incidents per 100 riders, the Green Line can by no means be described as unsafe. However, certain stations suffer from crime more than others do; car thefts are a real concern in certain park-and-ride lots along the system, while they are almost a nonissue in others (see Figure 5). While crime at the station seems to be related to overall crime at the neighborhood, we also noticed some more subtle relationships between the sociodemographic and urban form characteristics of the station neighborhood, the station design, and crime incidence at Green Line stations.



Figure 10. Platform at Long Beach station.

As other studies have shown, we also found that different types of crime take place under different conditions. Crime at the platforms against people was strongly related to ridership—the busiest stations tended to concentrate the most serious crime. Less serious crime (Type 2) tended to be higher in stations located in dense neighborhoods with higher percentages of population with less than high school education. Incidents of vandalism—in particular, graffiti spray-painting on elevators and stairs and platform pillars—comprised the vast majority of less serious crime. Other studies have shown that vandalism in transit stations is most often the work of school-age children and young adults (Hoel 1979). Consistent with these findings, we also found that stations with a high incidence of Type 2 crime also had higher proportions of youth in the adjacent neighborhood. We also noticed that vandalism tended to be higher in stations with neighborhoods with littered sidewalks and deteriorating building stock.

So far, empirical research on crime in railway systems has given very limited attention to incidents occurring at parking facilities. Yet in systems such as the Green Line, many riders are expected to reach the station by car, park at the system's park-

and-ride lot, and walk to the platform. The safety of the rider during his or her walk to and from the lot and the safety of the car property become important. The Green Line is not immune from car thefts and thefts of private property from parked vehicles. Car thefts tended to happen primarily in large lots that were filled with cars but were void of pedestrian activity. Dark and desolate parking areas under the freeway projected a feeling of lack of safety (see Figure 12). Smaller parking lots that were well integrated to their surrounding context and were visible from the adjacent sidewalks had fewer incidents of crime.

Crimes against people (assaults, robberies) tended to happen primarily at the station platforms, elevators, and stairs. Certain design characteristics of the station were found to be related to platform crime. Underpass platforms with no visibility from their surrounding areas had higher crime incidence. At the same time, some sociodemographic characteristics of the station neighborhood were also relevant for serious crime against people at the station. While our results cannot be conclusive because of the small number of serious crimes against people, we found more such crime in low-income



Figure 11. Bar in the vicinity of Long Beach station.

neighborhoods with more persons per household and higher concentrations of youth.

Many of the Green Line stations are located on a platform in the middle of an urban freeway, and they are effectively cut off from surrounding land uses. Therefore, the effect of specific land uses and other urban form characteristics (e.g., layout of streets, existence of alleys, etc.) on station crime does not seem to be as important as in cases in which the railway station is located in the midst of an urban neighborhood. Nevertheless, we found a strong correlation between station crime and the existence of liquor stores in the vicinity.

Our study gives a clear indication that a combination of social and physical variables at the light-rail station and its neighborhood affect station crime. While transit authorities cannot deal with many of the social variables that affect crime on a light-rail system, the study pinpoints to a number of design and policy implications to tackle the physical variables. For one, the security of transit passengers should extend from the platform to the public environment that surrounds the station. The on-street location of light-rail stations provides

opportunities for more visibility from surrounding establishments (Walker 1992).⁹ On the other hand, the physical condition of the surrounding environment seems to be more important for the security of light-rail stations than for underground stations. Therefore, the upkeep, good maintenance, cleanliness, and surveillance of the public environment that surrounds light-rail stations are of paramount importance for the safety of transit passengers.

Second, since many light-rail stations are often in close proximity to park-and-ride lots, the security of these lots and of the routes connecting them to the station is very significant. The study showed that smaller, well-lit lots that were well integrated to the surrounding urban fabric scored well in terms of security. As we saw, the presence of a solitary parking attendant did not prove effective in curtailing automobile thefts and crime. Increased police patrolling of the lot, possibly paid from parking revenue, could help in the reduction of park-and-ride crime. Also, the incorporation of convenience stores and ticket machines in the parking lot could increase pedestrian presence and reduce car thefts.



Figure 12. Parking lot in Wilmington station.

Third, appropriate station and parking lot design that eliminates entrapment spots and hiding places and increases visibility through design and adequate lighting can create “defensible space” (Newman 1972), a station environment whose physical attributes contribute to its better security. Incidents of vandalism that plague transit systems can be reduced through the use of graffiti and vandal-resistant materials.

Finally, a regular security audit by transit authorities will reveal the hot spots of crime on the transit system and will guide a targeted deployment of security personnel to the most dangerous stations during the most dangerous times.

In conclusion, we wish to state that our study, rather than validating the compositional or the ecological theories, found merits in both. Methodologically, our research was limited by the small number of reported crime incidents. More extensive studies are necessary for a better understanding of the importance and interaction of the two theoretical streams.

Authors’ Note: This study has been supported by grants from the John Randolph Haynes and Dora Haynes Foundation and the California De-

partment of Transportation (through the University of California Transportation Center). The authors would like to thank University of California, Los Angeles, graduate students David DeGrazia, Katsumi Nonaka, Jose Rodriguez, Manuel Soto, Kimberly Yu, and Allison Yoh, who helped with the fieldwork and the input of the data.

► Notes

1. An article in *Crime and Justice International* (Sullivan 1997) states that

only about 38% of all crimes committed are reported to police, according to national statistics. Among the crimes which are least reported are attempted robberies and purse snatching. Interestingly, 18.5% of all personal larcenies with contact, 3.4% of attempted robberies, and 6.7% of all robberies which result in injuries occur on public transportation vehicles or within public transportation stations nationwide. (P. 19)

2. The emphasis that ecological studies place on the micro-environment is relatively recent. The scale of early ecological studies was the city as a whole, as studies sought to identify and explain variations in crime within the same city (Shaw and McKay 1929).

3. The 1997 block groups data came from the Caliper Corporation (<http://www.caliper.com/estimate.htm>).

4. Census block group boundaries generally do not align with a half-mile radius circle. Therefore, block group data were allocated based on the proportions of the block group that fell within the half-mile circle. For sophisticated methods of using geographic information systems to evaluate transportation census data, see Hess and O'Neill (1999).

5. For classification purposes, the Federal Bureau of Investigation has classified crime into two major categories: Type 1 crime (criminal homicide, forcible rape, robbery, aggravated assault, larceny theft, burglary, grand auto theft, and arson) and Type 2 crime (crime of a less serious nature against people and their property, such as petty theft, disorderly conduct, vagrancy, nonaggravated assaults, drug violation, etc.).

6. Persons per household ranged from a high of 4.6 in the Long Beach station area to a low of 2.6 in the cities at the western edge of the line.

7. Only from 3 to 8 percent of the units were vacant in the areas surrounding the stations.

8. The percentage of owner-occupied units ranged from 84 percent in the area around the Douglas station (Manhattan Beach) to a low of 24 percent around the Hawthorne station, which had the highest number of Type 2 crimes.

9. As already discussed, this is not always true for the Green Line stations that are located in the middle of a freeway.

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