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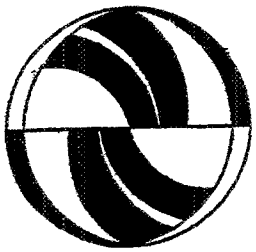

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JOURNEYS TO CRIME:
ASSESSING THE EFFECTS OF A LIGHT RAIL LINE ON CRIME IN THE NEIGHBORHOODS

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Abstract

The implementation of new transit lines is some times dogged by concerns that such lines may increase crime rates in station neighborhoods. Affluent communities have often complained that transit lines transport crime to the suburbs. This study focuses on the Green Line transit system in Los Angeles and examines its effects on crime in the adjacent areas. The Green Line light rail system passes through some high-crime inner city neighborhoods and terminates at its western end in affluent suburban communities The study examines neighborhood level and municipality-wide crime trends for five years before and five years after the inception of the line. A piecewise regression model is developed to evaluate the impact of the opening of the line in the station neighborhoods. GIS analysis is also utilized to identify spatial shifts in crime hot spots for the municipalities abutting the Green Line. At the end, the study establishes that the transit line has not had significant impacts on crime trends or crime dislocation in the station neighborhoods, and has not transported crime from the inner city to the suburbs.

Introduction

Does a transit line bring crime to the neighborhoods adjacent to its transit stops? Does a mass transit system that passes through crime-ridden inner city areas help transport crime to the suburbs? Is such a line expanding the range of action of potential criminals by facilitating their "journeys to crime"? Such concerns have early on dogged the planning and implementation of light rail lines in Los Angeles because of their alignment through areas vulnerable to crime.

Criminologists have called transit stations "crime attractors" and "fear generators" (Felson et al. 1990; Brantingham and Brantingham, 1995) because they can generate crime and disorder by producing crowds. Urban railway stations have been described as behavior settings that gather flows of people on their way to work, shopping, or recreation. Some are easy targets; being tired, preoccupied, carrying packages or other stealable objects (Myhre and Rosso, 1996). But in addition to crime occurring at the station, some have argued that mass transit systems have the potential of "exporting" crime from one area to the other. According to Canadian criminologists Paul and Patricia Brantingham *"transit shapes the crime pattern of the city by moving large proportions of high-risk populations around the city along a limited number of paths and depositing them at a limited number of destination nodes; awareness spaces and target search points become tightly clustered Transit shapes the types of crime that are likely to be committed, by shaping the opportunity and the getaway potential of high-risk populations"* (1991: 93)

Some have also noted the dual nature of the relationship between transit crime and the environment of adjacent neighborhoods, noting that the socio-physical characteristics of the immediate station area affect the danger at a transit station At the same time, the presence of a station affects the danger in the immediate neighborhood (Block and Block, 2000). In an earlier work we have used the Green Line transit system in Los Angeles to examine the first part of the "transit crime-environment" equation We have thus analyzed the effects of socio-demographic and physical characteristics of station neighborhoods on crime incidence at the station (Loukaitou-Sideris, Liggett, and Iseki, 2002). We found that station crime was strongly related to ridership. Less serious crime (e g. vandalism) was higher in stations located in dense neighborhoods with higher proportions of youth. Such crime tended to occur more in unkempt neighborhoods with deteriorating building stocks Certain design characteristics of the station were related to platform crime against people At the same time some socio-demographic indicators of the neighborhood (income, household size, concentration of youth) were also related to station crime. Finally, certain land uses in the transit neighborhood (notably the presence of liquor stores) were strongly correlated with station crime

The present study focuses on the examination of the effects of the Green Line on its adjacent areas We are particularly interested in investigating the possible crime influences of this inner city line on its outlying suburban areas. More specifically the study will respond to the following questions:

1 Have the neighborhoods adjacent to Green Line stations experienced more crime after the introduction of the line?

2 Has the introduction of the line contributed to a shift or a dislocation of crime within the municipality?

3 Is there a concentration of hot spots of crime in areas adjacent to the station Are these hot spots correlated with particular land uses?

4. Has the introduction of this line that passes through high-crime inner city areas brought more crime to the outlying affluent suburban communities located at its western segment?

In the paper that follows we will first outline the theoretical background of our study by summarizing criminological theories that seek to explain a perpetrator's journey to crime and move through city spaces. This will be followed by a literature review of empirical studies that have investigated the crime effect of transit systems on neighborhoods Finally, we will present the findings of our empirical research and will respond to the aforementioned questions.

Urban Structure, Mobility, and Crime

A study of crime that involves an investigation of possible transit influences on surrounding areas requires examination of the concept of "journey to crime," the trip that an offender takes to access potential crimes (Plano, 1993) Criminal justice theory has sought to trace the relationship between a criminal's mobility and the incidence of crime As early as the 1930s ecological theorists have described movements through space as related to opportunity structures; arguing that criminals tend to move and act in city zones where more opportunities for crime are evident (Lind, 1930, White, 1932). Some decades later Broggs (1966) similarly suggested that environmental opportunities, which vary throughout an urban area, determine crime rates. In a well-known article of the 1970s,

Capone and Nichols argued that "*criminal mobility is related to urban structure and the analysis of movement behavior will yield insight into offender decision-making and spatial preferences and contribute significantly to our understanding of the urban system as a crime opportunity structure*" (1976.200).

In the last decades criminologists have become increasingly interested in the spatial distribution of crime, as well as the journeys of criminals to commit crimes Picturing criminals as rational decision-makers they have noted that "*from a criminological perspective, if a person is searching for a target to rob, and several potential targets exist, all things being equal, the closest target will be chosen All things are never equal, but it is argued that on the whole, there is a strong spatial bias that results in more short trips than long trips within any particular category of time*" (Brantingham and Brantingham, 1984.237). Theoretical work on the geometry of crime has assumed that the range of criminal activity for offenders is determined by a "constricted awareness space" that is based on their familiarity with particular places (home, work, school, mall, park, etc.), and from areas adjacent to the paths that lead them to these sites (Brantingham and Brantingham, 1991).

Empirical studies have shown that criminals can often travel beyond their immediate neighborhood to commit property crimes (robbery, burglary, car theft) (Capone and Nichols, 1976; Pyle, 1976). Capone and Nichols (1976) distinguished between "open space occurrences" and crime occurrences at "fixed premises," arguing that the former tend to be more spontaneous and not involving long travel, while the latter tend to require advance planning and often longer journeys to crime However, differentiation exists between fixed premises, with liquor stores, supermarkets, and cash

checking establishments requiring lengthier trips, while residences, grocery stores, and gas stations exhibiting shorter average journeys to crime Concluded Capone and Nichols "*Urban structure and criminal mobility are inextricably linked, for criminal movement behavior is the product of an essentially rational structure of decision-making process that involves evaluation of an objective urban opportunity structure, the differential attractiveness of particular elements of that structure, and the universal constraint of distance* (1976:211).

While there is a consensus that criminals may be willing to travel a certain distance to reach potential targets, some criminologists have also promoted the "distance decay theory." This argues that criminal travel patterns are characterized by a distance decay function—the further the distance of a place from a criminal's place of residence (or point of origin) it is less likely that this criminal will travel to that place in order to commit a property crime This is attributed to the fact that potential offenders do not have a good reconnaissance of distant areas (Pino, 1993). Pyle (1976) studying crimes committed in 27 public housing estates in Cleveland found that for crimes against persons the average distance between the offender's origin and destination was just under two miles For property crimes the average travel distance was 2.3 miles (Pyle, 1976) Similarly, examining the distribution of robbery incidents in Miami, Capone and Nichols (1976) found that the frequency of robbery trips declined with increasing distance from the residential location of offenders. While findings from these studies seem to support the distance-decay function, this theory has been recently denounced by Koppen and Keuser (1997) According to them, studies showing a distance-decay of journeys to crime

rely on correlations in aggregate data that cannot be good predictors of correlations in individual criminal behavior.

Regardless if the journey to crime is influenced by a consideration of distance or not, it is well known that other factors also intervene to enhance or decrease the appeal of a potential site as a target. These include the type of existing land uses[1], level of police and natural surveillance, environmental factors (visibility, lighting, urban form condition, etc), area accessibility[2], and perceived opportunities for escape

The Effect of Transit Lines on Neighborhood Crime: Literature Review

The criminological theories outlined in the previous section seem to give support to the notion that transit lines can expand a criminal's range of action For one, rapid transit systems can compress the amount of time necessary for a criminal to reach his/her destination, and can familiarize him/her with an increased number of outlying areas. Second, the imposition of a major transportation artery such as a transit line or a freeway in an area increases the area's accessibility In describing the "geometry of crime" Paul and Patricia Brantingham (1981) have argued that a concentration of criminal activities occurs close to major transportation arteries and highways. Such contentions have supported the notion that transit lines might bring increased crime to the areas they serve, and have often fueled a neighborhood's reaction against the "intrusion" of a railway line, especially in more wealthy, suburban areas (Poister, 1996). A study of resident and business perceptions prior to the initiation of construction activities for a MARTA station in Atlanta found that crime (after construction) was the second most major concern of residents, after traffic congestion (Ross and Stein, 1985)

While theory and public perception seem to agree that new transit lines have the potential to bring more crime to the surrounding neighborhoods, empirical research on the subject is quite mixed. Very few studies have analyzed the effect of railway stations on their surrounding areas Examining the environs of Chicago railway stations Block and Davis (1996) found that the bulk of robberies were not concentrated immediately at the station, but about 1-1½ blocks away Block and Block (2000) found the same pattern in Bronx, where fifty percent of all street robberies had occurred within about 700 feet of a transit station. The researchers argued that the high level of guardianship at the stations negated the great number and good choice of potential targets Instead crime was displaced in the near vicinity

There is little empirical research that has investigated the issue of transit-related crime in outlying residential or commercial areas by perpetrators who have used the transit system The findings of such studies are contradictory In a study that analyzed police crime reports for transit related crime in an unnamed city, Shellow et al (1974) found that criminal predators tended to work in familiar for them territories and were not likely to use public transit as a means for extending their territory or as a means for escape Examining crime patterns of the neighborhoods around three Baltimore stations for three years before and three years after the metro line's opening Piano (1993) found that reported crime was on an upward and erratic trend after the opening of the stations. However, lack of accurate crime locations prevented him from attributing the crime increases to the stations' opening, or from identifying any distance trends or clustering patterns of the crime occurrences An analysis of burglary trends before and after the opening of two MARTA stations in suburban Atlanta found no evidence to suggest that

burglaries have increased after the opening of the stations (Poister, 1996). In a study of crime patterns before and after the opening of the Blue Line in Los Angeles Loukaitou-Sideris and Banerjee (1994) found that in most station areas the introduction of the light rail line has reduced crime incidence in the immediate station neighborhood. The study also found that the station area was relatively safer than their larger surrounding communities, a fact attributed to the high deployment and visibility of transit police.

The review of the literature reveals that the empirical research about the effect of transit on the crime rates of adjacent neighborhoods is quite inconclusive The few studies on the topic have produced mixed or contradictory results

The Context

In this study we use the Los Angeles Green Line as a case study to explore the impact of a transit line on crime in its adjacent neighborhoods. We also want to test the validity of the assumption that a transit line can transport crime from high-crime inner city areas to low-crime, suburban neighborhoods.

The Green Line is a light rail line that runs a total of 19 6 miles from Norwalk (to the east) to El Segundo (to the west) in Los Angeles County (see map in Figure 1) The line has fourteen stations and had a daily average ridership of 23,000 passengers in 2000. For the most part (16.3 miles) the line operates in the middle of the I-105 Freeway As it nears El Segundo the line leaves its alignment in the freeway median and continues for another 3 3 miles to its western terminus in Redondo Beach Four suburban stations are located along this segment, all on elevated structures

[Figure 1 about here]

The Green Line corridor passes though communities that are quite different. The fourteen station neighborhoods vary significantly in terms of their land uses and socio-demographic characteristics. The suburban 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. In terms of racial characteristics, the western neighborhoods are primarily white, the inner city neighborhoods are primarily Latino and African American, while the eastern neighborhoods are more diverse ethnically. Some stations are within primarily residential areas (although the ratio of single and multi-family housing varies) Some stations are surrounded by industrial facilities, some by primarily commercial uses, while others have a mixture of uses in their vicinity

Crime rates in the jurisdictions[3] along the Green Line corridor also vary significantly (see Table 1) At its middle section the line has stations in high-crime inner city areas (e g Vermont, Harbor, Avalon, Wilmington, and Long Beach Blvd stations) At its eastern edge the Green Line crosses communities with generally low to average crime rates (cities of Downey and Norwalk) At its western edge the Green Line runs through (or comes very close to) the low-crime suburban beach communities of El Segundo, Manhattan Beach, and Redondo Beach The fact that the line passes through both high-crime inner city areas and low-crime suburban areas makes it a good case to test the validity of the perception that rapid transit brings crime to the suburbs.

[Table 1 about here]

Research Design

Crime data was collected for six cities adjacent to the Green Line and surrounding 12 of the 14 stations (we were unable to get data for areas adjacent to the Lynwood station #3 and the Norwalk station #1). Crime data by type[4] and location for 1990 through 1999 was obtained from the cities of Downey, Los Angeles (LAPD service areas in the vicinity of the station), Hawthorne, El Segundo, Manhattan Beach and Redondo Beach. Data was geocoded and aggregated to the station neighborhood level (1/2 mile radius around each station) to generate a quarterly time series database for the ten-year period[5]. In order to identify long-term trends, the crime series data sets were first adjusted for quarterly (seasonal) variation and then smoothed using three-month moving averages (Smith, 1991, Poister, 1996) Similarly crime trend data was created for the larger municipalities/LAPD service areas abutting the Green Line over the ten-year period. This allowed us to study crime trend changes by quarter during the 10-year period both at the station neighborhood level and larger municipality level These trends were also compared to county crime trends during the same period. Additionally, the geocoded crime data was used for GIS analysis which attempted to identify spatial shifts in crime hot spots for the municipalities abutting the Green Line

The study of the Green Line entails a methodological problem, since for the most part the line runs in the middle of the I-105 Freeway, which could also theoretically increase the accessibility of likely offenders to outlying suburban areas In order to separate the crime effects of each station on the adjacent neighborhoods we examined the level of crime in the areas around the Green Line stations during three different time intervals 1) January 1991 to September 1993 (prior to the opening of the I-105

Freeway); 2) from October 1993 to August 1995 (when the Green Line started operation), and 3) from September 1995 to December 1999.

Additional data collected for our earlier study (Loukaitou-Sideris et al. 2002) provided information on socio-economic characteristics of the population in the station neighborhood as well as the primary land uses in the neighborhoods We also had data from the Los Angeles Metropolitan Transit Authority (MTA) on boardings and alightings (ridership) by station (Table 2).

[Table 2 about here]

Crime Trend Analysis

Figures 3 through 5 show quarterly crime trends over the 10-year period for the 12 station neighborhoods studied. As a control, trends in quarterly crime for the larger municipality/LAPD service area surrounding each station and for LA County as a whole are also shown Non-auto related serious crime (Type 1) against persons began decreasing in Los Angeles County from a peak of about 145,000 crimes per quarter at the end of 1991 to a low of under 80,000 crimes per quarter by the end of 1999 (Figure 2) Type 1 crime related to autos also declined over the same time period. Starting at the end of 1991, the number of crimes decreased from a peak of about 35,000 in 1991 to a low of about 12,000 in 1999.

[Figures 2 about here]

Most areas surrounding the Green Line stations experienced similar declining trends in Type 1 crime Our analysis focused on whether or not crime trends in the station neighborhoods (operationalized as ½ mile radius surrounding the station) differed significantly from trends in the larger jurisdictions along the Green Line and/or the

county as a whole Was there an increase in crime after the freeway or Green Line opened? Or, in the case of a decrease in station neighborhood crime, was the decrease less than what would be expected based on larger area trends?

[Figures 3-5 about here]

To evaluate the impact of both the opening of the I-105 Freeway and the opening of the Green Line (shown by reference lines on the graphs) on crime in the station neighborhoods, the following piecewise regression model was developed for each station.[6]

$$Total\ crimes = b_0 + b_1*Time + b_2*FWOPEN + b_3*GLOPEN + b_4*IPOSTFW + b_5*IPOSTGL + b_6*CONTROL$$

where

Total crimes = number of Type 1 No Auto, Type 1 Auto, or Type 2 crimes in the station neighborhood seasonally adjusted and smoothed

Time = quarter (2nd quarter 1990 is time 0)

FWOPEN = dummy variable for opening of Century Freeway
= 0, before 4th quarter 1993 (*Time* < 14)
= 1, 4th quarter 1993 and after (*Time* >= 14)

GLOPEN = dummy variable for opening of Green Line
= 0, before 3rd quarter 1995 (*Time* < 21)
= 1, 3rd quarter 1995 and after (*Time* >= 21)

IPOSTFW = (*Time*-14)**FWOPEN* (Measures change in slope after freeway opens)

IPOSTGL = (*Time*-21)**GLOPEN* (Measures change in slope after Green Line

opens)

CONTROL = Total crime at local city/jurisdiction level or at LA County level

Tables 3 and 4 show results of fitting the piece-wise regression model to crime time series data for each of the station neighborhoods In the Table 3 models, crime trends at the local jurisdiction/city level are used for control while Los Angeles county crime trends are used as control in Table 4. Significant changes in slope and intercept post freeway and post Green Line are indicated with a "+" or "-" in the corresponding table cell, and positive changes (increases in crime) following the opening of the Green Line are further highlighted with shading.

[Tables 3 and 4 about here]

Inner City Stations

After the opening of the Green Line, crime in the inner city stations followed the declining trends witnessed throughout Los Angeles County (Figures 3-5) However, for four inner city stations (#6, #7, #8, and #10) the decrease in non-auto related Type 1 crime was less than what would be expected based on the larger area trends (Table 3) These four stations were in jurisdictions with significantly higher crime rates than the county as a whole (Table 1) They tended, however, to have lower numbers of crimes than other stations in similar areas (see bar charts in Figure 6 which compare average crime levels in station neighborhoods[7]). For example, the neighborhoods around stations #6 and #7 had lower numbers of crimes than stations #4 and #5

[Figure 6 about here]

The four inner city stations that witnessed a significant increase in slope in non-auto related Type 1 crime had different land uses. Stations #6 and #7 were primarily in

residential neighborhoods with similar population density and demographic characteristics The neighborhood around station #8 in the city of Hawthorne had a low population density and primarily industrial land uses Families that lived in this station neighborhood were mostly middle income homeowners Station #10, which is close to the LA airport, was surrounded by vacant lots and parking lots with some industrial and office buildings

Two inner city station neighborhoods (#6 and #8) also witnessed a significant increase in slope for the post Green Line Type 2 crime trend. In particular, the neighborhood of Harbor Station (#6) saw an absolute increase in Type 2 crime following the station opening

The Eastern Suburbs

Crime data for the suburban city of Downey was only available from late 1993 so it was difficult to compare pre and post I-105 Freeway crime trends. Non-auto related Type 1 crime peaked for the City as a whole shortly after the Green Line opened and has been declining since then (Figure 3) In contrast, non-auto related crime in the neighborhood of station #2 has remained relatively stable at about 25 crimes per quarter, while Type 2 crime has increased indicating that the introduction of the Green Line may have had some negative influence on station neighborhood crime rates (Table 3)

The Western Suburbs

We gave particular emphasis in documenting and analyzing shifts in crime trends at the western end of the line to test the assumption that an inner city line brings crime to the suburbs. Significantly, we did not observe any increase in crime trends in the suburban stations at the west end of the line. In fact, in station #14 in Redondo Beach we witnessed

a statistically significant decrease in crime in the station neighborhood after the line's opening (Table 3). Comparing station neighborhood crime to the countywide crime trends, we again did not see significant changes in the western suburban stations, with the only exception of an increase in auto-related crime in station #13 (Table 4)

More specifically, the City of El Segundo, which is at the western end of the I-105 freeway, has relatively low levels of crime Type 1 crime (which increased in the period after the freeway opened) has been decreasing since the opening of the Green Line (about a 50% decrease) Auto-related Type 1 crime has also been cut in half. The two station neighborhoods in El Segundo (#11 and #12) had few crimes, however, auto related crime has been increasing in recent years (Figure 4) The regression model for station #11 shows a significant post Green Line increase in slope for auto related Type 1 crime after controlling for local trends (i e trends in the City of El Segundo)_ It should be noted, however, that when numbers of crimes are small (in this case auto related Type 1 crime hovers between five and ten crimes per quarter), a difference of just a few crimes can make it look as if there is a significant change in trend

Station #13 is located at the boundary of El Segundo and Manhattan Beach in an area of relatively new (since early 1990s) upscale retail and commercial development[8]. While Type 1 crime has been decreasing in the adjacent municipalities since 1993, we see a different picture in the area immediately surrounding station #13, where such crime is in an upward trend since the early 1990s However, there has been no significant change in this trend (i.e. increase in slope) with the opening of the Green Line (Figure 3) Rather the increase in crime is most likely attributable to new developments since the early 1990s, such as office buildings, restaurants, movie theaters, and specialty stores that

have attracted many visitors to the area Station #14, which is on the boundary of Redondo Beach and southern Hawthorne, is the western terminus of the Green Line As with station #13, there was an increasing trend in Type 1 crimes in the ½ mile around this station although this has leveled off or decreased slightly since the opening of the Green Line (the regression models show a significant negative change in slope) (Figure 3). There was significantly more Type 2 crime in the area around station #14 (about three times the level as at station #13) (Figure 4) While there was considerable fluctuation in the Type 2 crime trend it seemed to be gradually increasing (Figure 5) Particular land uses around station #14, such as a continuation high school and a large discount retail shopping area may be contributing to crime here

Hot Spot Analysis

Crime specialists often argue that a localized decrease in crime may be elusive, as crime may be dislocated to neighboring sites in response to certain changes (e g more policing, new land uses, etc.) Therefore, in this part of the study, GIS and spatial analysis techniques were employed to examine changes in the spatial distribution of crimes in the communities served by the Green Line Geocoded crime data was converted into crime density grid maps (using ArcView Spatial Analyst) to identify and map hot spots of crime (concentrations of incidents) Analysis of these maps was followed up by observational studies of the areas identified as hot spots of crime.

Maps showing average crime density (hot spots of crime) for the periods before and after[9] the opening of the Green Line can be seen in Figures 7 and 8 The maps in Figure 9 show the differences in crime concentrations between the two time periods

The upper map in Figure 9 shows hot spots of crime increase, where the lower map indicates areas where crime has decreased.

[Figures 7, 8, 9 about here]

Figures 7 and 8 show high concentrations of both Type 1 and Type 2 crimes in the LA Central area before and after the introduction of the Green Line, although a significant decrease in crime density can be noticed (Figure 9). Our field work showed that the few crime density increases or shifts in density in the LA Central area took place in public housing developments

Crime in the city of Hawthorne was primarily concentrated along the commercial corridor of Hawthorne Boulevard (Figure 10), which runs south from station #9, as well as in the southeast corner of the city, an area quite far from the Green Line. Both these areas have seen a decrease in crime density since the opening of the Green Line Only one new hot spot has emerged in the neighborhood just south of the Green Line between stations #8 and #9 (Figure 9). in a residential area with single-family detached dwelling units of varying condition (many with bars on the windows and doors as shown in the photo in Figure 11).

There were no hot spots of serious (Type 1) crime and only a few hot spots of Type 2 crime in the western suburbs. There has been a slightly higher concentration of Type 1 crime near station #12 in El Segundo since the Green Line opening but this is likely due to the increased development in the Overall, the before and after pictures do not show any significant changes in the concentration of crime.

Conclusion

At the end of our study we find no evidence that this transit line has opened up new and outlying territories for exploitation by potential criminals Overall, most station neighborhoods have either experienced no change or have witnessed a reduction in crime after the introduction of the Green Line Transit has certainly not brought more crime to the affluent suburban areas, which have continued to enjoy relatively higher levels of safety and prosperity than the county average. Some crime increase was witnessed in the inner city, where limited spill-over effects of crime from more high-crime to less crime ridden areas were observed However, major shifts and dislocation of crime have not occurred within the municipalities that surround the Green Line We were also unable to notice a relationship between hot spots of crime and proximity to a transit station Rather the existence of hot spots could be better explained by the presence of certain land uses (e g. concentration of retail along a busy commercial street, existence of a high school or a public housing development).

Our findings cannot prove or disprove the distance decay theory, as we were not aware of the points of origin of the different criminals who have committed crimes in station neighborhoods However, it seems clear that criminals have not used the Green Line to access potential targets, miles away The journey to crime has not become easier because of the Green Line.

Acknowledgements

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Endnotes

[1] Rhodes and Conly (1981) found that criminals tend to be primarily attracted to commercial and transitional areas, followed by industrial areas Residential areas are considered less attractive. Multiple-family housing tend to attract more crime than single-family housing.

[2] Comparisons of high- and low-crime neighborhoods have shown that area accessibility is associated with high crime (Eck and Weisburd, 1995)

[3] The Green Line crosses thirteen political jurisdictions. Norwalk, Downey, Paramount, South Gate, Lynwood, City of Los Angeles, Inglewood, Hawthorne, El Segundo, Manhattan Beach, Redondo Beach, Lawndale, and unincorporated areas of Los Angeles County.

[4] 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 less serious nature against people and their property, such as petty theft, disorderly conduct, vagrancy, non-aggravated assaults, drug violation, etc) For purposes of this study we further divided Type 1 crime into non-auto related crimes versus auto-related crimes

[5] It should be noted that crimes used in this study do not include crimes at the stations or the station parking lots, which were reported in [redacted]. We are looking rather at changes in crime levels in the neighborhoods surrounding the stations and shifts in crime locations in the larger jurisdictions around the Green Line

[6]Variables associated with the opening of the I-105 freeway were not considered in the models for stations #2, #13 and #14 We did not have sufficient data to develop a pre-freeway trend for station #2 Stations #13 and #14 are not located in the vicinity of the I-105

[7]We were unable to collect crime data for the full ½ mile radius surrounding some of the stations due to differences in political jurisdictions Crime data collected for each station neighborhood was weighted to account for area differences for comparison purposes in the bar charts.

[8] Since this station as well as station #14 are not particularly close to the I-105 Freeway and are located within a few of blocks of the older 405 Freeway, the regression models used for both stations do not include dummy variables for the I-105 Freeway

[9] Crime density maps are based on data for seven quarters before and seven quarters after the opening of the Green Line

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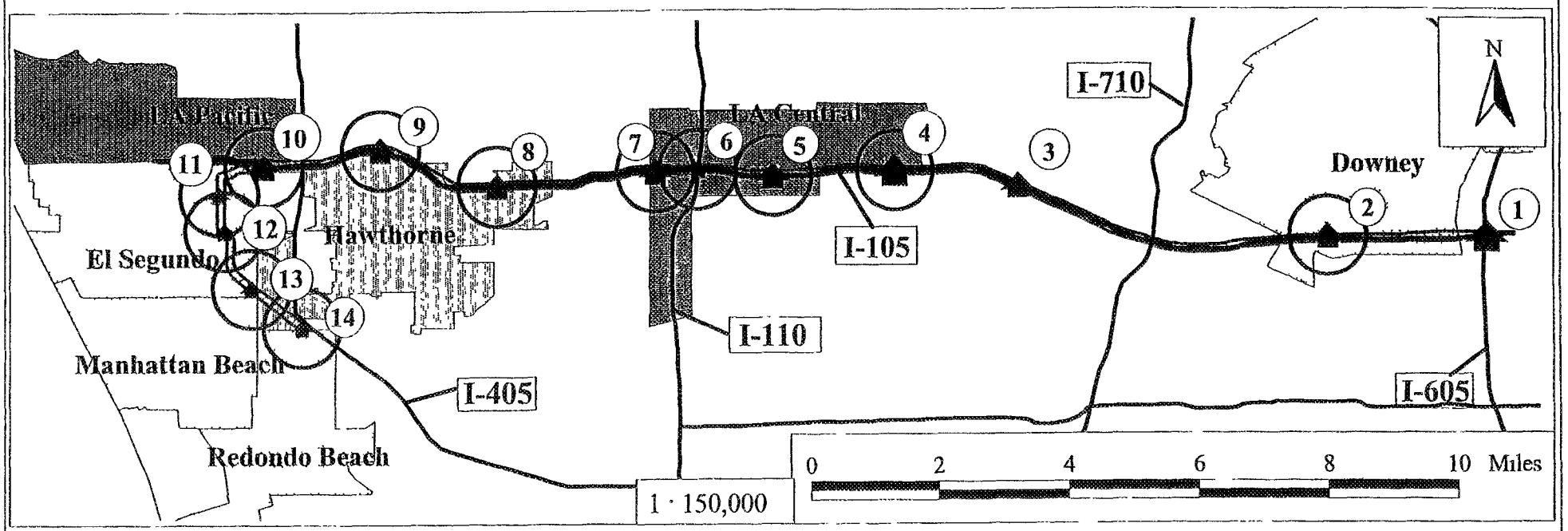
Figure 1. Map of Metro Green Line with Political Jurisdictions



Average Weekday Ridership

- 500 - 1500
- 1500 - 4500
- 4500 - 9000
- **0.5 Mile Radius Circle for Study Stations**
- **Metro Green Line**

Type1 Crime as % of County Rate

- Below
- About the same
- Above

ID	Station
1	Norwalk
2	Lakewood (Downey)
3	Long Beach Blvd
4	Wilmington
5	Avalon
6	Harbor
7	Vermont
8	Crenshaw
9	Hawthorne
10	Aviation
11	Mariposa
12	El Segundo
13	Douglas
14	Marine

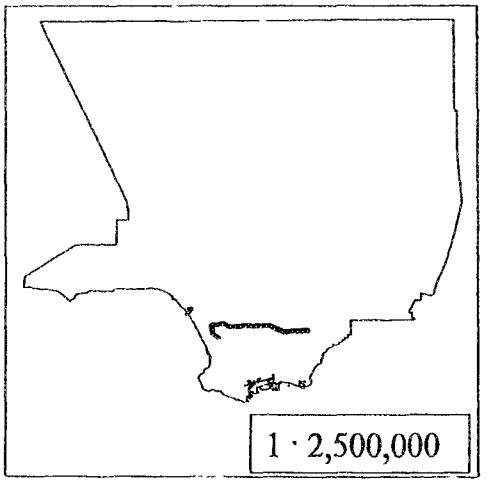


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Table 1: Jurisdiction Crime Rates*

City/LAPD Service Area	Stations	Type 1 Crime as % of County Rate
Downey	2	72 1%
LAPD/Southeast	4,5,6,7	165 2%
Hawthorne	8,9	116 4%
LAPD/Pacific	10	148 3%
El Segundo	11,12	87 5%
Manhattan Beach	13	78 0%
Redondo Beach	14	81 2%

* Green Line Security Analysis, April, 1991

Table 2: Station Neighborhood Characteristics

Station	Ridership	Neighborhood Characteristics (1/2 mile radius)			
		Primary Land Use	Population	% Low Income	%Owner Occupied
2	2066	Residential	5836	21%	50%
4	8383	Multi-family Residential, Retail	7425	58%	29%
5	1696	Residential	6884	54%	45%
6	1325	Residential, Retail	6668	45%	41%
7	2373	Residential, Retail	8223	42%	34%
8	2392	Residential, Industrial	2409	20%	58%
9	2285	Residential, Retail	11363	40%	24%
10	2748	Vacant, Parking, Industrial, Office	705	12%	72%
11	1358	Industrial, Office, Vacant, Parking	21	n/a	n/a
12	1034	Industrial, Office, Parking	20	n/a	n/a
13	691	Office, Retail, Industrial	1706	9%	84%
14	1064	Office, Retail, Industrial	1680	15%	42%

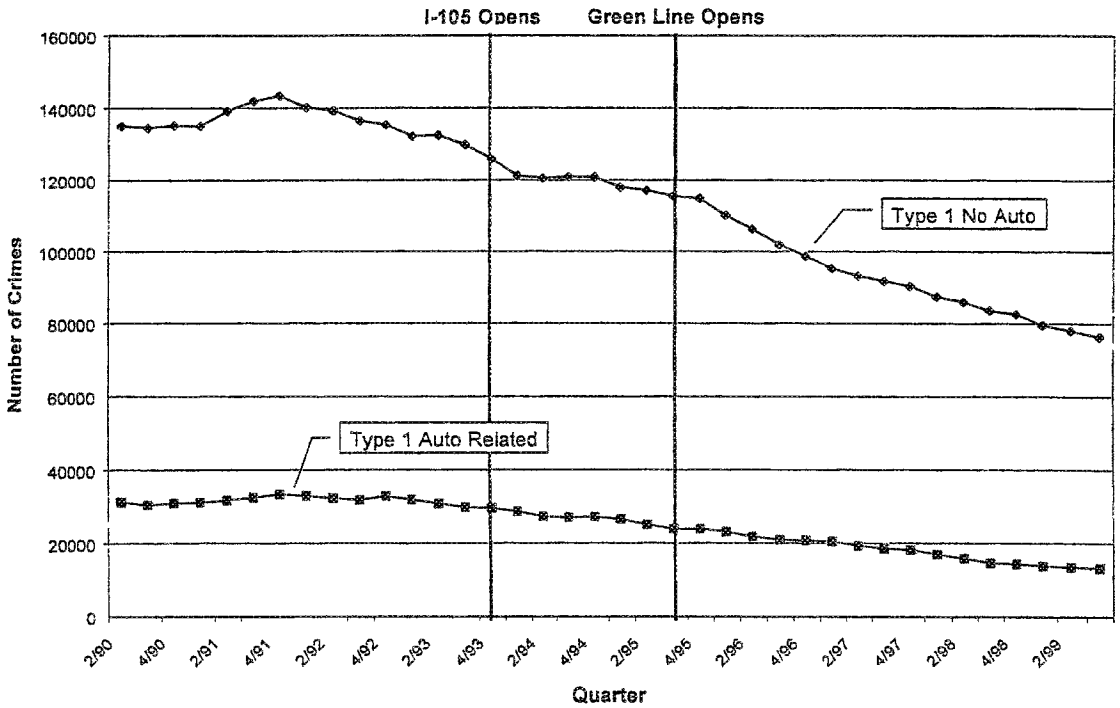

Figure 2: Los Angeles County Crime Trend (1990-2000)

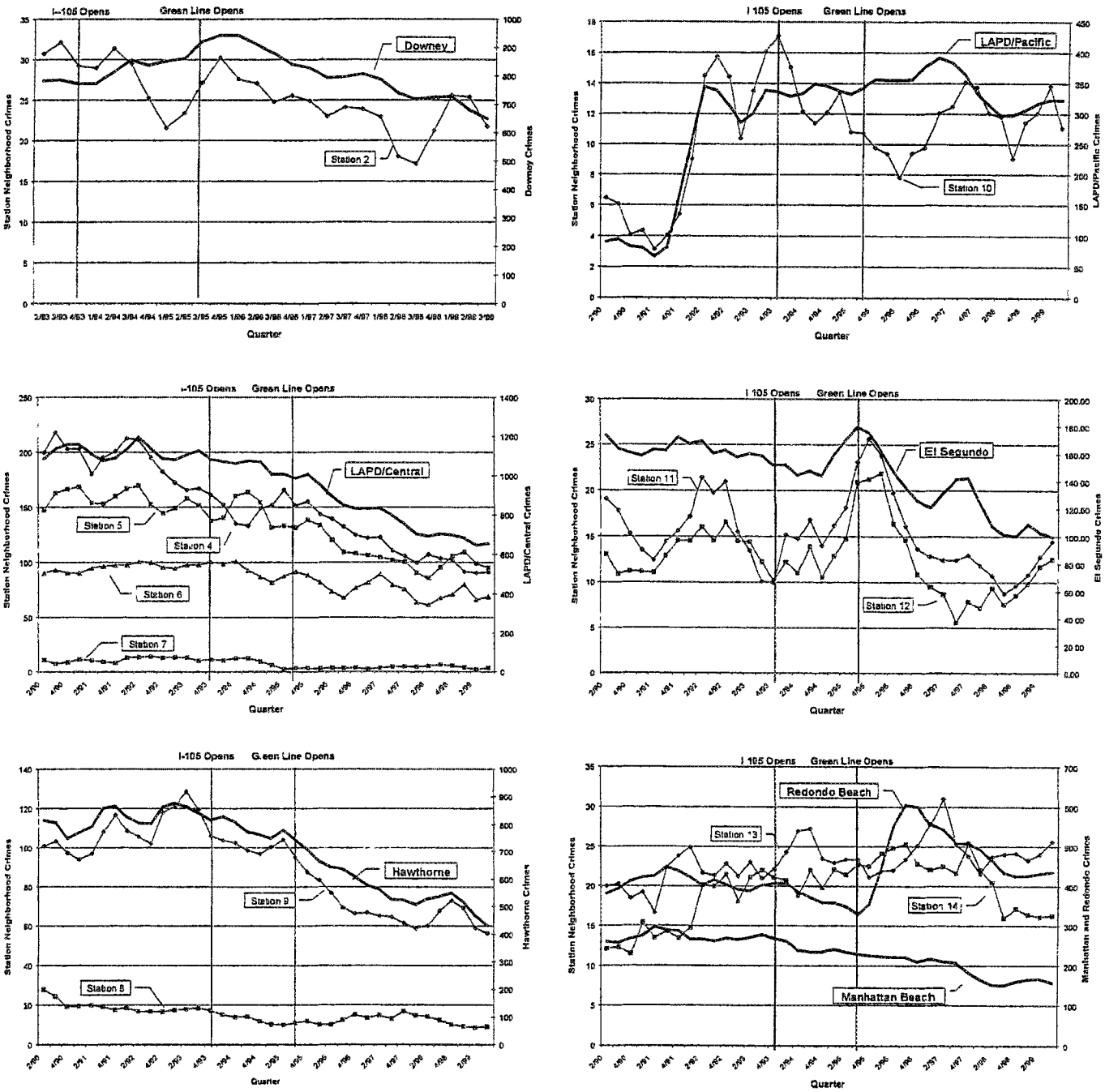

Figure 3: Type 1 Non-Auto Crime Trends in Station Neighborhoods and Corresponding Local Crime Jurisdictions

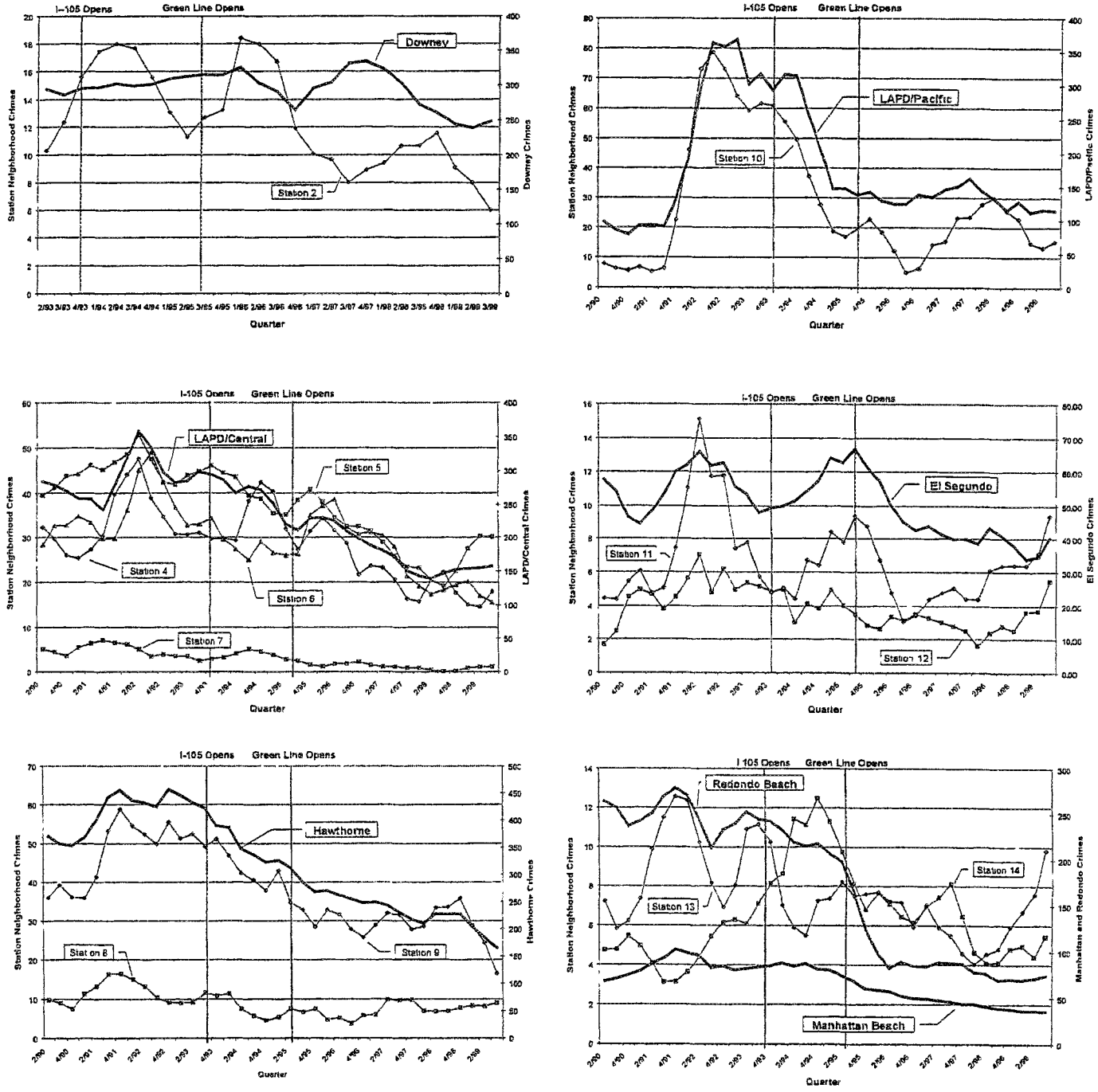

Figure 4: Type 1 Auto-related Crime Trends in Station Neighborhoods and Corresponding Local Crime Jurisdictions

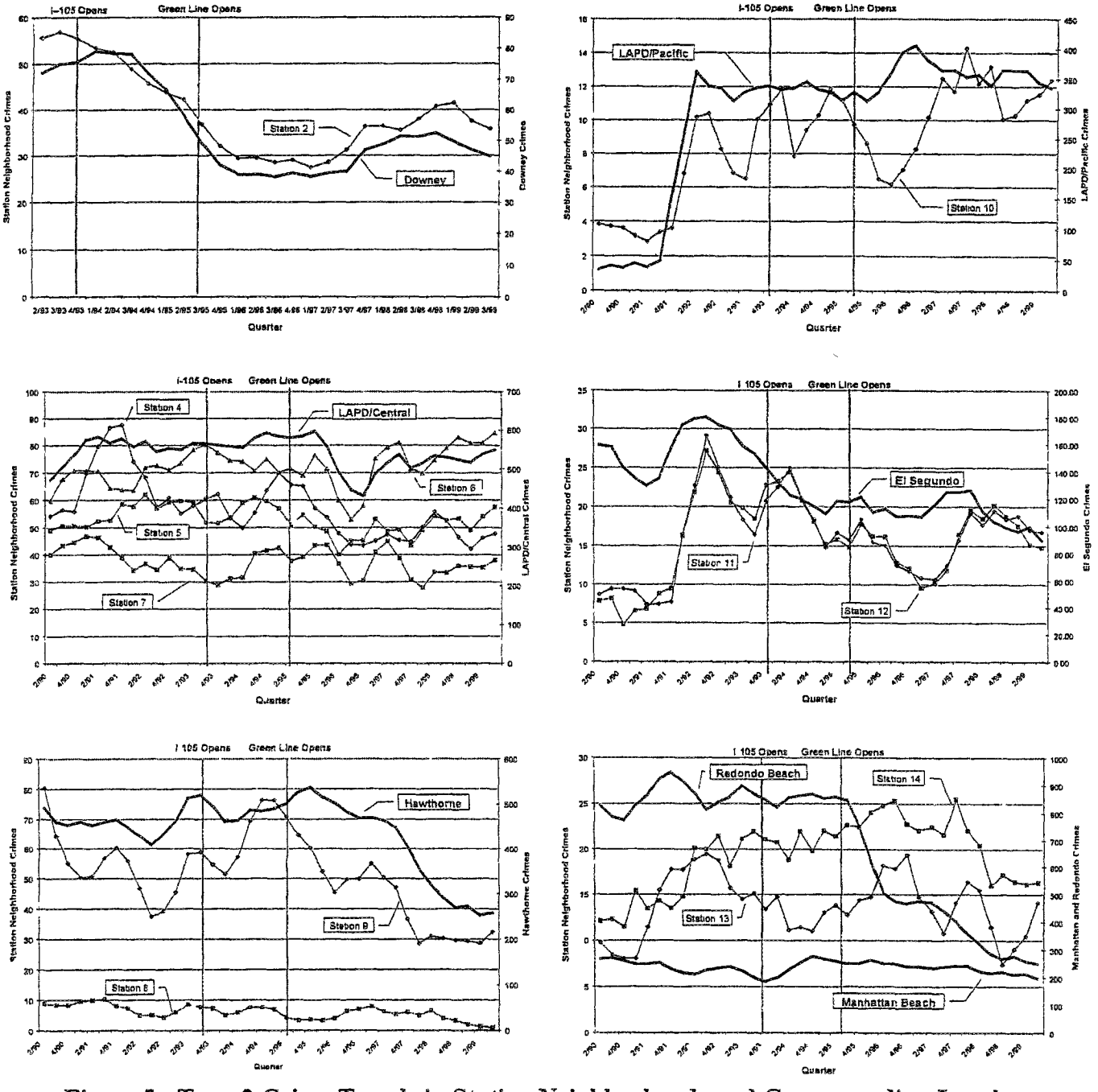

Figure 5: Type 2 Crime Trends in Station Neighborhoods and Corresponding Local Crime Jurisdictions

Table 3:

a) Change in Slope Controlling for Local Jurisdiction Crime Trend

Station	Type 1 Crime				Type 2 Crime	
	Non Auto Related		Auto Related			
	Post Fwy	Post GL	Post Fwy	Post GL	Post Fwy	Post GL
2-Lakewood (Downey)	X	+	X		X	+
4-Wilmington	+		+	-		
5-Avalon						
6-Harbor	-	+			-	+
7-Vermont	-	+			+	-
8-Crenshaw		+				+
9-Hawthorne					+	
10-Aviation	-	+				
11-Mariposa			-	+		
12-El Segundo					-	
13-Douglas (MB)	X		X		X	
14-Marine (Redondo)	X	-	X	-	X	-

b) Change in Intercept Controlling for Local Jurisdiction Crime Trend

Station	Type 1 Crime				Type 2 Crime	
	Non Auto Related		Auto Related			
	Post Fwy	Post GL	Post Fwy	Post GL	Post Fwy	Post GL
2-Lakewood (Downey)	X		X		X	
4-Wilmington	-			-		
5-Avalon						
6-Harbor			-	+		
7-Vermont				-		
8-Crenshaw						
9-Hawthorne	-	-	+			-
10-Aviation						-
11-Mariposa			-			
12-El Segundo						
13-Douglas (MB)	X		X		X	
14-Marine (Redondo)	X		X	-	X	

-	significant negative change ($p < .05$) in slope or intercept following freeway (Fwy) or Green Line (GL) opening
+	significant positive change ($p < .05$) in slope or intercept following freeway (Fwy) opening
+	significant positive change ($p < .05$) in slope or intercept following Green Line (GL) opening
X	variable not included in model

Table 4:

a) Change in Slope Controlling for County Crime Trend

Station	Type 1 Crime			
	Non Auto Related		Auto Related	
	Post Fwy	Post GL	Post Fwy	Post GL
2-Lakewood (Downey)	X	+	X	-
4-Wilmington	+		+	-
5-Avalon				
6-Harbor	-	+		
7-Vermont	-	+	+	
8-Crenshaw	-			+
9-Hawthorne				+
10-Aviation	-		-	+
11-Mariposa	+		+	
12-El Segundo				
13-Douglas (MB)	X		X	+
14-Marine (Redondo)	X	-	X	-

b) Change in Intercept Controlling for County Crime Trend

Station	Type 1 Crime			
	Non Auto Related		Auto Related	
	Post Fwy	Post GL	Post Fwy	Post GL
2-Lakewood (Downey)	X	+	X	
4-Wilmington				
5-Avalon				
6-Harbor				+
7-Vermont			+	-
8-Crenshaw				
9-Hawthorne		-		
10-Aviation				
11-Mariposa				
12-El Segundo				
13-Douglas (MB)	X		X	
14-Marine (Redondo)	X		X	-

-	significant negative change ($p < .05$) in slope or intercept following freeway (Fwy) or Green Line (GL) opening
+	significant positive change ($p < .05$) in slope or intercept following freeway (Fwy) opening
+	significant positive change ($p < .05$) in slope or intercept following Green Line (GL) opening
X	variable not included in model

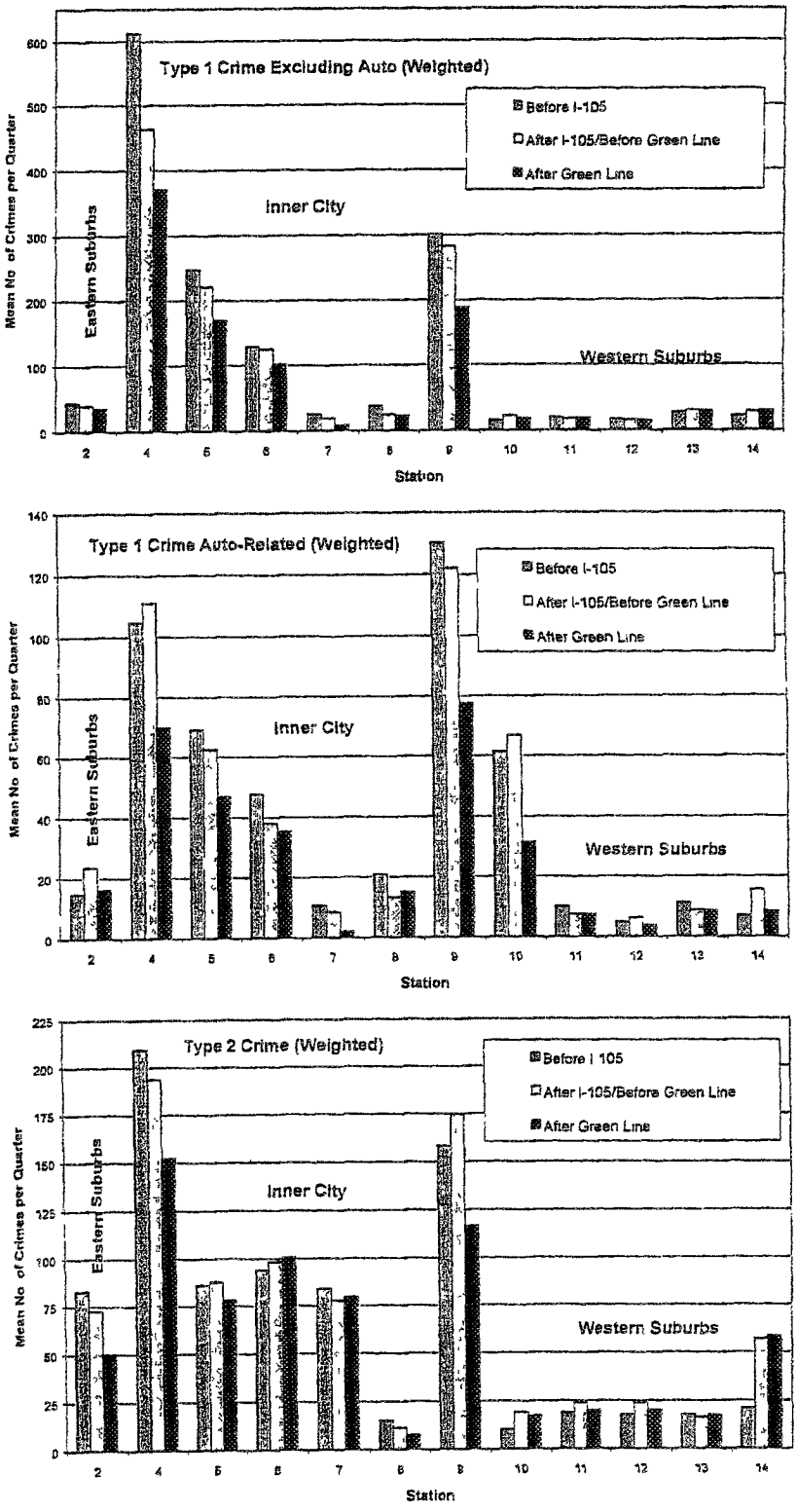

Figure 6: Average Quarterly Crime Rate in Station Neighborhoods

Figure 7. Type 1 Crime Hot Spots Before and After the Green Line Opening

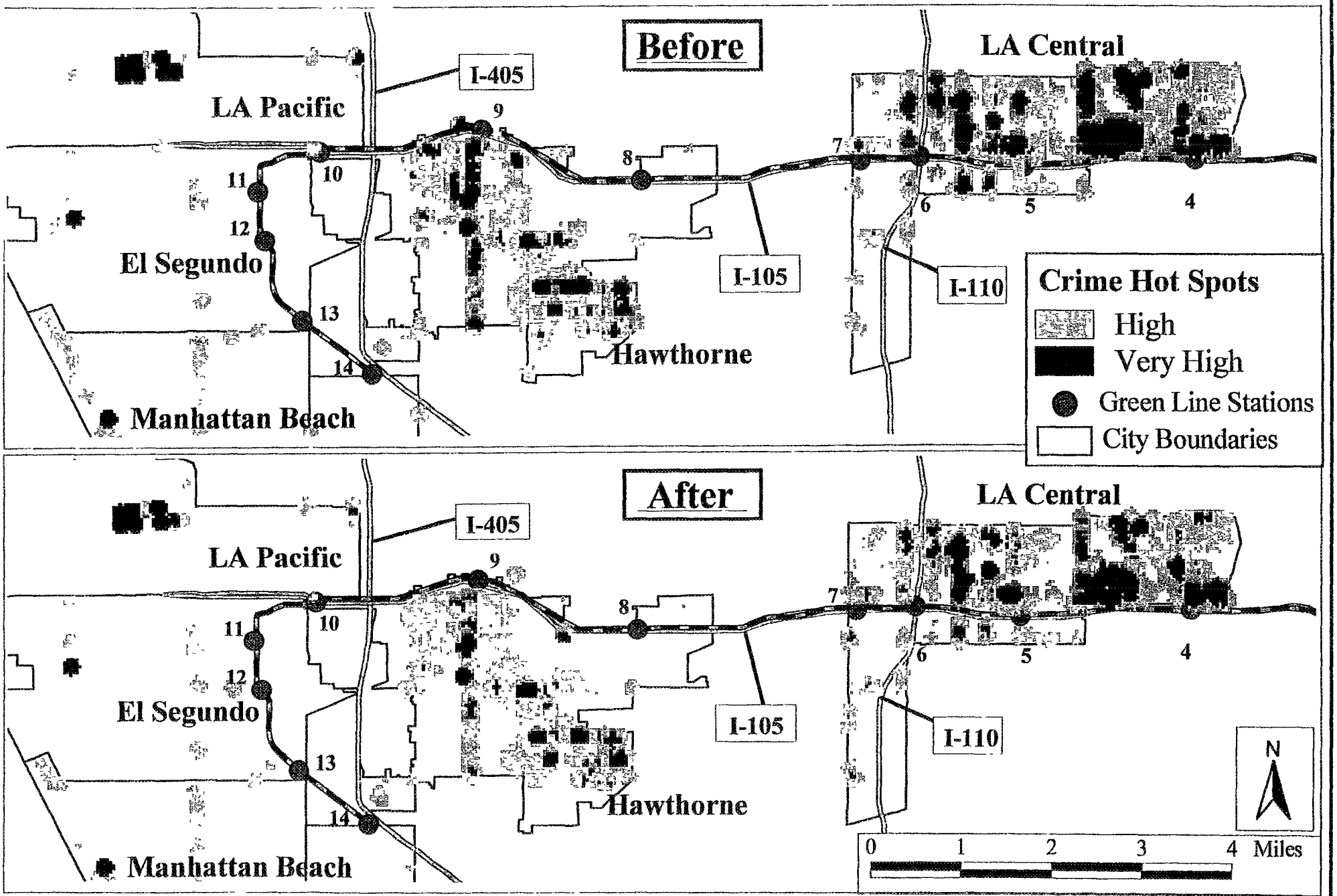

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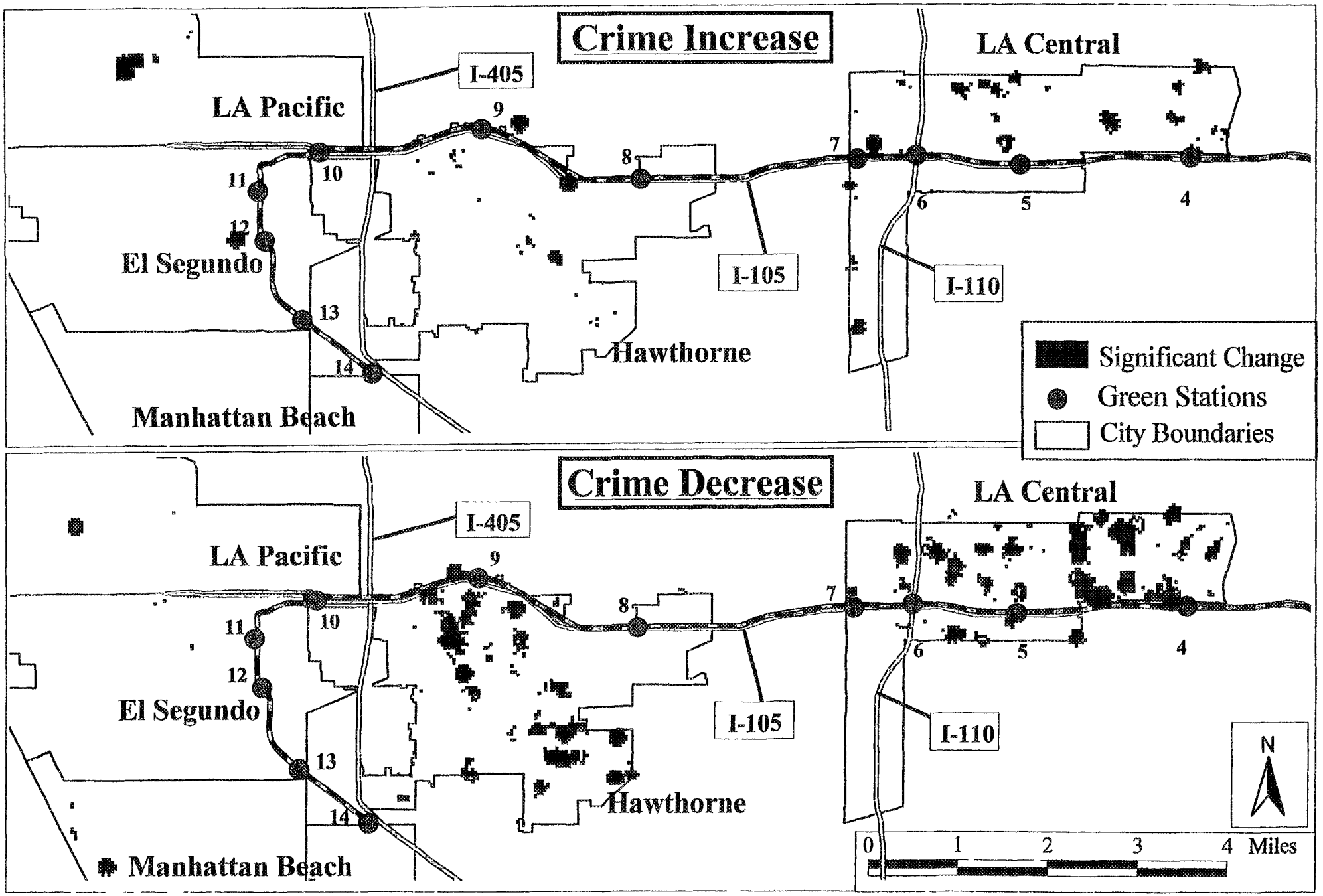
Figure 9. Type 1 Crime Density Change Before and After the Green Line Opening



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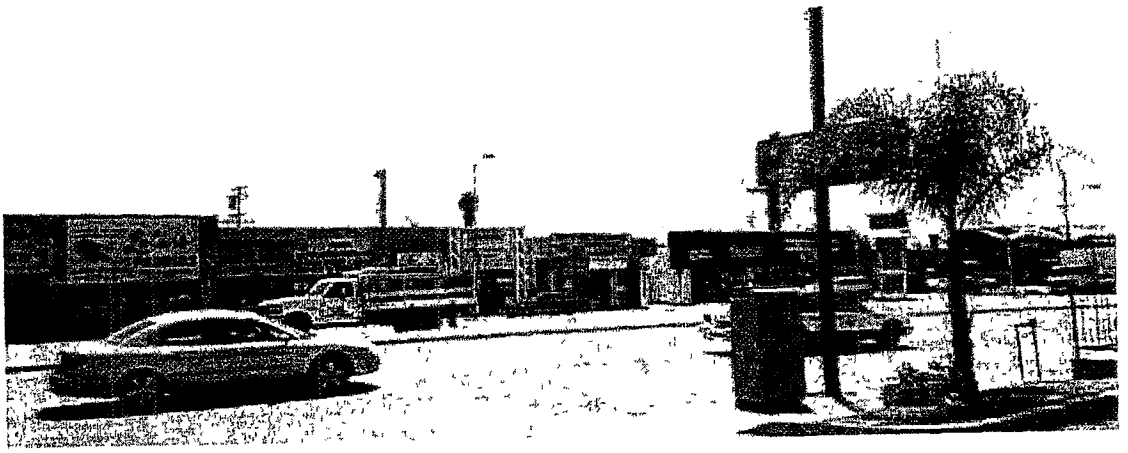

Figure 10: Hawthorne Blvd. South of Station #9

Figure 11: Single Family Neighborhood with Increased Crime