

**PUBLIC TRANSIT AND CRIME:
A ROUTINE ACTIVITIES / ECOLOGICAL APPROACH**

by:

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Public Transit and Crime: A Routine Activities/
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Abstract

Key elements in the built environment in which we live may contribute to the occurrence of criminal acts. These same elements can probably also be linked to the fear of crime experienced in different areas.

The relationship between transit and crime patterns is under-researched in environmental criminology. Little is known about the effect of public transit routes upon crime patterns. The *Skytrain* is a light rail public transit service which runs along a single line through four cities in the lower mainland of British Columbia. This study explores the patterns of police calls for service in relation to the nine Skytrain stations located in the city of Vancouver, as well as the land use zonings and discrete land usages which surround each station.

This thesis seeks to understand observed patterns of crime within a 750 meter radius of the Skytrain stations in Vancouver. Of importance to the study are the notions of agglomeration economies and multiplier effects and how these regional science concepts may be applied to the areas around the stations for the purposes of crime pattern analysis. It is thought that the type of land use around any particular station will affect both the *number* of calls for service received by the police for that area, and the *types* of calls for service received by the police for the area.

Vancouver Police data were used to analyze crime patterns around the Skytrain stations. The data include all calls for police service occurring during a four month observational period, spatially coded at the street address level. Data were also provided by BC Transit which listed calls for service received by security personnel at the Skytrain

stations. Data analysis was conducted through the use of spatial mapping techniques including use of crime location quotients.

Analysis of the patterns of the types of calls for service revealed two distinctive *station areas*: a *commercial area* as well as a *residential area*. It was also found that the nine station areas accounted for 49% of the total city of Vancouver calls for police service of the types analyzed for this research.

Dedication

This work is dedicated to my parents, Dr. John B.L. Robinson and Mrs. Barbara J. Geis.

They taught me the value of hard work and a job well done.

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I wish to sincerely thank both Dr. Paul J. Brantingham and Dr. Patricia L. Brantingham.

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Chapter One: Introduction and Background

Introduction

Crime does not generally occur at random, but instead occurs with predictable regularity in space, time and place. Certain key elements within the environment in that we live contribute to and/or aid the occurrence of crimes. These same elements can also be linked to levels of fear of crime in an area. This thesis will argue, from the point of view taken from environmental criminology while incorporating elements from the routine activities theory of crime, that public transit stops are related to increased levels of crime for a certain radius around them. The levels of crime will vary and fluctuate with the different types of land usages that surround each of the stations. Direct observation will be used in order to ascertain what types of businesses, industries or residences exist within a 750 metre radius of each station. Data from the Vancouver City Police as well as the British Columbia Transit Commission will be used to analyze crime patterns both surrounding the stations, as well as within them, on a call for service basis. It is proposed that the ratio level of crime will be higher in areas with Skytrain stations than in the city of Vancouver as a whole.

The type of transit stop that will be analyzed in this research will be that of the Greater Vancouver Light Rail Transit System, otherwise known as the

'Skytrain'.¹ The Skytrain runs through Vancouver, Burnaby, New Westminster and Surrey. The single line runs straight through each of these cities and municipalities and has terminus stations in both Vancouver and Surrey. In both Vancouver and Surrey, the terminus stations are located in busy commercial areas, with high attractors for a variety of users.

The present analysis will be limited to the city of Vancouver. Geographic mapping techniques as well as statistical analyses will be performed to analyze the data and to ascertain any patterns that become apparent for different types of crimes or for crime in general.

Background

Fear of Crime

Perceptual cues exist in the built environment that affect levels of fear of crime. Several cues that have been linked with heightened fear of crime include poor lighting, blocked escape for the passer-by and possibilities for the concealment of a potential offender. (Nasar and Fisher, 1992 and 1993, Loewen, Steel and Suedfeld, 1993) Along with fear-inducing *physical* cues in the environment also exist *social* cues. Within these two broad categories of 'cues' exist both *physical and social incivilities*. From the physical perspective, physical incivilities which include litter, graffiti, vacant lots, abandoned buildings, broken windows, vandalism and dilapidation may convey messages about social conditions, and thus increase fear. (Skogan, 1990; Wilson and Kelling, 1982) From a social perspective, social incivilities such as public drunkenness, drug addicts, street prostitution, gangs or homeless people connote disorder and

¹ Please refer to Figure 2, included as an appendix, for a Skytrain route map through the City of Vancouver.

possible victimization. (Nasar and Fisher, 1993; Perkins, Meeks and Taylor, 1992; Hunt, 1985; Fisher, 1991)

the ecological label of "criminal area" was appended to specific places not because they were thought to be centres of serious criminal activity, but, in 65 percent of the cases, because they were centres of nuisance behaviours like solicitation...or panhandling, were congested or messy, or had a lot of "street people" present. (Brantingham, Brantingham and Butcher, 1986)

Because people suffer routine physical and social incivilities more often than actual criminal victimization, the fear from incivilities affects more people than does fear of actual crime. Research has confirmed that changes in levels of fear relate to changes in levels of social incivilities, but not necessarily to rates of victimization.(Nasar and Fisher, 1993)

Appleton's prospect-refuge theory states that an area with good prospect (open space) is by definition devoid of refuge (hiding spots). He states that the environment that will be perceived as being the safest will not be the one that contains unlimited prospect or refuge, but rather a combination with enough prospect to see the surroundings, but not so much that there is no refuge visible. (Loewen, Steel and Suedfeld, 1993)

Fisher and Nasar (1992) state that the three micro level cues that most affect levels of fear of crime are: refuge, escape and prospect (depending upon different light levels). They state that an area is most safe when victim prospect is high and offender refuge is low and in this respect amend Appleton. Fisher and Nasar believe that designs that provide an open area for escape by potential victims will be less fearsome than those that have bounded areas or dead ends that block escape. (Nasar and Fisher, 1992 and 1993)

Higher levels of fear are found among socially or physically vulnerable people, including minorities, low income individuals, women and the elderly.

Higher levels of fear are experienced after dark. When individuals are fearful, they have been found to adopt different crime prevention behaviours. (Nasar and Fisher, 1992) Three different categories of reactions to fear of crime have been classified as: 1) *Avoidance*-individuals do not go to areas that frighten them; 2) *Protective*-more than one individual will go together with the intent of protection; and 3) *Collective*-more than one individual will go together, not for the express purposes of protecting one or the other, but for 'safety in numbers'.(Nasar and Fisher, 1993)

In areas where crime and fear are present, people regularly evaluate their risk for victimization by scanning their immediate environment for cues of danger. Our immediate surroundings continually change, and accordingly, as we move from place to place we re-evaluate environmental cues and adjust our behaviour accordingly. (Nasar and Fisher, 1992) Areas that may be perceived as having good prospect during the day may not at night, because of the lack of light. Dark and shadowy areas may provide refuge for potential offenders and limit visible escape for potential victims. (Loewen, Steel and Suedfeld, 1993; Nasar and Fisher, 1992)

It must be taken into consideration, however, that when people are making decisions about their relative safety or forming aesthetic images of a building or place it is not only the three elements of prospect, refuge and escape that are considered, but also the factors of shelter, ventilation, availability of food, convenience of exit and entrance, privacy, density, noise level, colours, and textures.(Loewen, Steel and Suedfeld, 1993) This phenomenon is also explained by Nasar and Fisher(1993) who state that:

Macro level characteristics may create conditions for crime and fear, but proximate cues translate the general feelings of fear into site specific fears and opportunities for crime. Potential offenders seek micro level features that support their offense.

Crime and fear of crime concentrate in certain areas. Such areas have been termed 'hot spots'. Hot spots can be different sizes, from a street or community, to a nation. Knowledge about hot spots develops through ongoing direct experience with the environment, and the development of mental maps of the physical and social surroundings. These mental maps have spatial qualities along with locations and meaning of places. These "cognitive structures" help individuals identify objects and predict and evaluate consequences. (Block, 1979; Nasar and Fisher, 1993; Sherman, Gartin and Buerger, 1989)

Patricia Brantingham and Paul Brantingham have described a process by that *potential offenders* develop cognitive maps or "mental templates" about certain areas or actions. Potential offenders use these mental templates when selecting targets. According to the Brantinghams, target selection proceeds through the following steps: 1) the environment emits many cues about its spatial, cultural, physical, legal and psychological characteristics, 2) offenders learn to use these cues to target victims, 3) these cues cluster to make up mental templates against that possible targets may be selected or rejected and 4) successful use of these templates is self-reinforcing. (Hunt, 1985) In determining what is a suitable target, it must not be overlooked that it is a host of subtle micro-level environmental cues that are necessary, including the fear of being seen and the possibility of easy escape. (Hunt, 1985; Nasar and Fisher, 1993)

In this multi-staged decision process of target selection crime patterns are not random and spatial and temporal patterns can be identified. A search procedure for a potential crime opportunity need not be entirely conscious and the actual search process may be minimal. The decision making process is a "mixed, scanning process" that employs "hierarchical and sequential decisions" on the part of the potential offender. (Brantingham and Brantingham, 1978) A criminal follows some decision process (whether unconscious or conscious) in locating

suitable targets and 'good crime situations'. (Brantingham and Brantingham, 1993)
A search for targets involves looking near the potential offender's usual travel paths between his/her major activity nodes.(Brantingham and Brantingham, 1993)
Brantingham, Brantingham and Wong (1990) state that individual criminal activity patterns seem to focus on the end points or 'nodes' of routine daily travel. These nodes may include the offender's home, work, school, favorite shopping areas or entertainment spots. George Rengert (1980) also offers a model of criminal decision making; he states that the decision to commit a crime is a two-staged process that involves the decision to consider a criminal act in association with a decision on how and where to commit the crime.

Also important for Brantingham and Brantingham's (1993) model is the cue emitting potential of the environment. Not all stimuli emitted from the environment are used by people to form their perceptions. The used information can be considered 'cues'. An environment can be considered to be a complex reality that consists of physical objects, spatial relations, social relations and a sociocultural backcloth. A type of cue emitted in the environment is a 'crime cue'. These help criminals locate targets. Environmental cues can be tied together with the multi-level decision making process. An environment can be perceived at many levels. The 'environmental backcloth' of an individual is the infinite number of elements that surround and are a part of an individual and that may be influenced by or influence his or her criminal behaviour.

As stated by Brantingham and Brantingham, clusters of cues may be associated with certain targets. These 'cue clusters' may not only be obtained from the physical environment, but also from a social situation. 'Cues', 'cue clusters' and 'cue sequences' associated with a specific type of offense can be considered a 'template'. According to Brantingham and Brantingham, templates are easily constructed because of a human's capacity for classifying and

generalizing. A template endures by the employment of a reinforcing schema by the individual concerned. Carter and Hill (1980) state that a criminal's template will be affected each time a crime is committed. Either the template will be affected in a positive way (because the crime was successful) or a negative way (the crime was not successful). Either outcome contributes to learning. Templates are individual constructions. Brantingham and Brantingham (1993) state, however, that the variations between templates constructed by different people is finite. Patterns of template construction vary by broad socio-demographic characteristics and are influenced by the experiences of close friends and acquaintances. (Carter and Hill, 1980)

Robert Gifford (1987), detailed five elements of city images that contribute strongly to an individual's 'template construction': paths, edges, districts, nodes and landmarks.

Paths are the routes along that people travel. Paths are roads, walkways and public transit routes. *Edges* are non-traveled lines, such as cliffs, or escarpments, the shores of rivers, lakes or oceans. *Districts* are moderate-sized areas that city residents identify as having a particular character. *Nodes* are well known points that people travel to and from, often at the junction of important paths such as key intersections, transit terminals, and popular plazas and squares. Brantingham, Brantingham and Wong (1990) state that high activity nodes are likely to have disproportionately high levels of crime. *Landmarks* are easily viewed elements either on a grand scale (the tallest building in town), or on a smaller scale (a statue or a unique storefront). These five elements are important components of cognitive maps.

Patterson (1985) suggests four domains of knowledge that each individual needs in order to maintain a minimally functioning cognitive map: 1) recognition (involves knowing where you are and being able to identify the common objects

in the environment); 2) prediction (requires knowing what might happen next and how to make associations between environmental events and objects); 3) evaluation (using the information gathered during the recognition and prediction stages, an individual must decide what his or her options are, and most importantly, that of a range of alternatives could have favourable or unfavourable consequences); and 4) action (once an evaluation is made the individual has to select a course of action).

The presence of certain occupations are types of environmental cues that have been shown to have a lowering effect upon the levels of fear of crime experienced by individuals. (Balkin and Houlden, 1983) In particular, persons in uniform and persons in the employ of government, working in a location in that they have a vested interest, are most effective in reducing fear. Balkin and Houlden (1983) suggest that the reason for this reduction in fear of crime is that persons who work for the government will be perceived as more trustworthy and reliable and thus more likely to provide assistance in a crime situation than will persons of private employ.

Building Design

A mental image of a building or area is partially a function of the amount and type of environmental information with which people are provided. (Hunt, 1985) The type of mental image that an individual develops will depend upon the types of environmental cues that are portrayed by the building or space. Concern with the cues presented "should be directed to the intrinsic physical and social features of a locale and the sensitivities of building users. It is important to employ the perspective of the users when designing places." (Sime, 1986)

A central strategy that should be employed when pursuing these goals is to include users of all areas affected by design decisions in a process that facilitates change rather than working toward a fixed, unbreakable or permanent solution. (Nasar and Fisher, 1993)

When selecting a site for a building, a systematic process must be followed to maximize security and 'user friendliness'. The first step must be the *project definition*. The location, building, operation and economic aspects must be identified. The second step is *site generation*; for instance, small sites can make it difficult to provide an adequate buffer around the perimeter, or to control and check on-site circulation. The third step should be the *site evaluation*; the site must be carefully evaluated against its specific program(s) requirements. (Behrends, 1987).

Careful design and adequate management of the built environment can make major contributions to raising thresholds against undesirable behaviour. Two forms of design are proposed by the 'Delft checklist', a safe design guideline for architects and planners developed recently in The Netherlands:

1) *Socioprevention*: protection with the aid of visible or tangible presence of people who may be expected to intervene if necessary; and, 2) *Technoprevention*: protection of objects, persons, or spaces through technical means, such as burglar proof locks on doors, alarm systems. (van der Voordt and van Wegen, 1993)

The aim of these above methods is to create natural surveillance or to restrict access. Five important design variables that can enable or hinder crime are (van der Voordt and van Wegen, 1993):

- Presence of protective eyes
- Visibility - one must be able to see what is going on
- Involvement and responsibility - encourage people to care for their neighbourhood

- Attractiveness of the environment - well cared for
- Accessibility and escape routes - ease of access is important for formal and informal surveillance.

When considering the environment's influence upon human behaviour, it should be noted that people respond to both concrete and symbolic aspects of their physical settings. (Gutheil, 1992) Three assumptions can be made about the influence of environment on behaviour: 1) behaviour in relation to a physical setting is consistent and enduring over time; 2) the physical setting is not a closed system with fixed boundaries; and 3) a change in one component of the setting affects others, with the potential to change the pattern of behaviour characteristics of the setting. (Gutheil, 1992) Some practical situations that exemplify the above assumptions about building and environmental design follow.

Long corridors and large unpartitioned spaces are contrary to normal experiences. (Gutheil, 1992) These types of situations can provoke feelings of being lost and frustration in individuals, especially when experiencing a new environment for the first time.

Potential victims feel safest in places where offenders lack refuge and the victims have prospect. While low victim prospect protectively cuts off those in the physical frames from the outside, this can sometimes be turned against the individual in that anything that leaves an individual in a "bounded area" could also leave them alone with an offender. An elevator is an example of this point. "Although an elevator has clear prospect and refuge, a victim entering would have no escape from an offender inside." (Fisher and Nasar, 1992)

Transit and Crime

The mode of transportation used by individuals affects crime patterns in five distinct ways within the three different contexts of location, type and timing (Brantingham, Brantingham and Wong, 1991). Different forms of transportation cluster people together people in different ways; shape travel times differently; cluster destinations differently; cluster travel paths differently; and shape the type of crimes that occur by creating different opportunity sets for crime. (Brantingham, Brantingham and Wong, 1991)

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 destinations. These factors create highly focused and limited awareness spaces for the individuals using transit and advance the creation of target search points for potential offenders. Transit contributes to patterns of crime by shaping the criminal opportunity and getaway potential of high risk populations. (Brantingham, Brantingham and Wong, 1991) According to Marcus Felson (1986), offenders, victims and bystanders have ready access to modes of transportation, that can take them quickly to various parts of the city and different census tracts. This spreads out crime and its "players" over a wider area. Building upon the work of the Chicago School, notably E. W. Burgess who, in 1925, developed the 'mobility triangle' (Park, 1967), Andre Normandeau (1968) established five combinations of spatial relationships between victim, offense and offender in that all, but the first, involve mobility: crime neighbourhood triangle, offender mobility triangle, victim mobility triangle, offense mobility triangle and total mobility triangle.

The Skytrain stations vary with the level, frequency and time of usage. There are some peak usage times and there are times when the stations are virtually empty. Amos Hawley (in Felson and Cohen, 1980) defines three

temporal components of community structure that are relevant to the variation of usage of the Skytrain stations: rhythm, tempo and timing. *Rhythm* is the regular periodicity with that events occur, as with the rhythm of work activity. *Tempo* is the number of events per unit of time, such as the number of criminal violations per day on a given street. *Timing* is the coordination among different activities that are more or less interdependent, such as the coordination of one employed person's rhythms with that of another employed person. For Hawley, a community can be defined by spatio-temporal patterns.

The location of Skytrain stations are reflective of the various types of land zones that coexist within an urban environment. Skytrain stations are not all located upon the same type of land usage. Some are located in residential areas, some are located in business areas, and some are relatively isolated from any major land usage. It is proposed by this research that each of these areas differs in the opportunities for crime that it presents. It is also proposed that the majority of crimes associated with Skytrain usage happen outside the official boundaries of the BC Transit Commission property. The official boundaries of the BC Transit Commission comprise of land owned by BC Transit, most of that is used in association with public transit. Richard Block (1995) has recently found evidence in Chicago to support this idea, and in fact, he found that the majority of crimes associated with the Elevated Train in Chicago occur within a radius of 200 metres from the actual El Train stops.

Research on transit systems conducted within the framework of ecological theories of crime is needed. As expressed by Roncek and Maier (1991), it should focus upon non-residential land uses because this:

adds a dynamic aspect to ecological crime research by drawing in some of the activities of people and reasons for their movements throughout the city that can affect their vulnerability to crime. Such work can also inform citizens and policymakers about the

longer term risks and consequences associated with different types of facilities being in different types of residential areas. (Roncek and Maier, 1991)

Rational choice, routine activities and opportunity theories of crime can all contribute to the explanation of crime in and around major transit stops in an urban centre. These transit stops can be referred to as 'nodes' of activity that group together many different activities and many different users with varying motives for using the Skytrain. Different uses of the Skytrain could include travel to work, to school, to recreation, and, as this thesis proposes, to find an opportunity to commit a crime. It is also proposed that the types of crimes committed around each Skytrain station will vary with the type of land use and the types of businesses around each location.

Many theoretical approaches including the routine activities approach (Felson, 1987), the rational model derived from situational crime prevention research (Cornish and Clarke, 1986) and environmental criminology (Brantingham and Brantingham, 1984, 1991) agree with more traditional approaches to the ecology of crime (Burgess, 1925, Baldwin and Bottoms, 1976) in pointing to victim and criminal mobility as a critical element in the set of forces and conditions that structure crime patterns. (Brantingham, Brantingham and Wong, 1991)

Paul and Patricia Brantingham (1993) state that criminal behaviour is highly patterned and frequently localized. Criminal activity is linked to a socio-economic and demographic mosaic as well as to major population attractors. The search for targets involves looking near the usual travel paths between major activity nodes. Many property crimes occur on or near the main roads that carry a high volume of traffic or major public transit stops and, therefore, fall into the awareness spaces of a large number of people. Crime clusters at high activity nodes, along major paths and along edges. "Edge effects" come into play where there is enough distinctiveness from one part of the physical environment to

another that the change is easily noticed. Edges experience high crime rates (Brantingham and Brantingham, 1993). Criminals seek out their targets from an awareness space based upon their familiarity with the places or activity nodes where they routinely spend significant amounts of time and from areas adjacent to the primary paths they follow in moving between these nodes (Brantingham, Brantingham and Wong, 1991).

Brantingham and Brantingham (1978) have devised a model for how offenders make decisions about committing crime in their "opportunity model of crime." Their model assumes motivation and instead addresses the interrelated issues of why particular crimes occur in the times and places they do. 'Motivation', for Brantingham and Brantingham, and indeed for most rational choice and routine activities theorists, is covered already in other models, for example, in learning models and in anomie models. Rengert (1980) states that "crimes occur when an individual is confronted with an opportunity (how and where to commit the crime) that then must be evaluated in terms of whether or not to commit the crime."

Brantingham and Brantingham (1993) state that most researchers now view crime occurrence as the result of an individual's perception of and knowledge about the surrounding environment. Brantingham and Brantingham state that it is important to pay particular attention to how perceptions and knowledge are shaped by underlying states of criminal motivation and the actual presence of criminal opportunities.

Brantingham, Brantingham and Wong (1990) state that, "Criminal events can be understood in terms of the convergence of potential offenders and victims or targets in specific behavioural settings at particular times and places." Sherman, Gartin and Buerger (1989) also found evidence to support the concept that crime is not randomly distributed in space.

Routine activity theory suggests that each successful criminal violation has at least one offender and at least one personal or property target and also requires the absence of any effective guardian capable of preventing its occurrence. (Cohen and Felson, 1979; Felson and Cohen, 1980; Cohen, Felson and Land, 1980; Jackson, 1984; Massey, Krohn and Bonati, 1989) In a situation where there are plenty of suitable targets and not much social guardianship as well as low risk of punishment, some people will rationally choose to commit crimes in their own interest (van Dijk, 1994)

Cohen and Felson emphasize the importance of guardianship. Persons who are related to an individual by secondary group ties (friends as opposed to family) or by no stable social relationships at all and who do not themselves have norm-enforcing role obligations (close family, dependents or close friends), are less likely than those persons related to the individual by primary group ties to act as guardians for the individuals' property. (Cohen, Felson and Land, 1980) They state, however, that the absence (or presence) of any of the three elements is enough to prevent a criminal violation from succeeding.

Surveillability, whether by formal or informal guardians, has been found to have a stronger effect on criminal decision making than territorial markers. What constitutes surveillability and detectability varies with type of crime and the characteristics of the criminal (Brantingham and Brantingham, 1993) Within a mixed area or high-transient population, a sense of belonging or 'owning' is more difficult to develop. Felson (1986) states that although we can predict that crime risk will vary with the population, we must also take into account various "segment specific" potentials that can produce more offenders or victims and fewer guardians for crime. Any point surrounded by many nearby criminal incidents has a higher crime potential because, "Surrounding incidents make a given point risky, since offenders may easily get there; and people living at one

point often travel to proximate points, hence exposing them to nearby risks." (Felson, 1986)

Bars, recreational liquor establishments and malls are all types of businesses that provide potential offenders anonymity and detrimentally affect levels of guardianship (Roncek, Bell and Francik, 1981; Roncek and Maier, 1991; Roncek and Pravatiner, 1989; Verma, 1996). This is supported by the routine activities approach that stresses the importance of the environment as a necessary component of criminal interactions between potential offenders and victims. As an attracting land use, these businesses can and do draw individuals to areas in that they do not reside.

Effects on crime are compounded when recreational establishments are located in areas with physical characteristics that are associated with more anonymity and lower guardianship. Problems of social control can be aggravated by the larger number of people to be controlled and the presence of more people can increase the anonymity of an area and result in people ignoring or less effectively performing the guardianship activities that they might undertake in less busy areas. (Roncek and Maier, 1991)

The importance of movement to crime is among the original themes of routine activities theory, and is used to explain part of the varying levels of victimization of people with different lifestyles. Certain facilities or nonresidential land uses are some of the reasons why people go to different places within the city to carry out their life-styles. Movement about a city can affect the likelihood of offending. Going to locations away from 'handlers' could remove controls and thereby allow willingness to be translated into criminal activity. The intimate handler is someone with whom the offender has a social bond (parent or other) and is able to "seize the handle" and impose informal social control. (Felson, 1987)

Movement can also make potential offenders aware of, and take them to, locations where victims or targets are numerous, available, convenient or vulnerable. For potential victims, travel to areas with nonresidential land uses can take them away from safer havens and expose them to risk either enroute to or at their destinations. (Roncek and Maier, 1991)

Felson (1987) cites Zipf's principle of least effort which states that people tend to find the shortest route, spend the least time and seek the easiest means to accomplish something, geographers and others can predict a large amount of human behaviour from proximity of available routes of travel. Felson states that the principle of least effort leads to the principle of the most obvious; the reasoning criminal finds an interesting target on the routes between home, school, work and recreation neglecting better targets not far from such routes. He also states that by 'engineering bodily convergences', crime prevention can be effected. One of the most important principles for understanding such sociophysical processes, Felson states, is urbanization.

A by-product of urbanization is the street. The street is publicly owned and hence belongs to everyone and is, therefore, supervised by no one, except for an occasional police officer who does not really know who belongs there. The very systems that foster easy movement in an urban centre (e.g., rapid transit and road systems) interfere with informal social control and protection of person and property from intruders. (Felson, 1987)

In a large metropolitan centre some spots appear to draw or assemble offenders and targets, while dumping the resulting offenses on the surrounding neighbours. A large metropolitan centre organizes and sustains daily life for a vast array of human activities. Potential offenders can flow freely about the metropolitan centre and draw illegal sustenance easily via their simple routine activities. (Felson, 1987) Crime control efforts must, therefore, take into account

the natural flows of people and events and try to guide them so that offenders and targets seldom converge in the absence of handlers and guardians.

Felson and Cohen (1979, 1980) relate criminal violations to Hawley's human ecological theory of community structure. They state that criminal violations are in fact sustenance activities. They believe that the vast majority of direct contact predatory violations are rational acts in that people clearly lose and gain sustenance. Since illegal activities must feed upon other activities, the spatial and temporal structure of routine legitimate activities should play an important role in determining the location, type and quantity of illegal acts occurring in a given community or society.

Felson and Cohen believe that routine legitimate activities often provide the wherewithal to commit offenses or to guard against others who do so and may also provide offenders with suitable targets. One can analyze how the structure of community organization as well as the level of technology in a society provide the circumstances under that crime will thrive; for example, many technological advances designed for legitimate purposes including the automobile, small power tools, hunting weapons, highways, rapid transit systems, telephones, etcetera may enable offenders to carry out their own work more effectively or may assist people in protecting their own or someone else's person or property. (Felson and Cohen, 1980) Routine activities may occur at home, in jobs away from home and in other activities away from home.

Target suitability has four components: the *value* of the target affects its desirability for potential offenders, the *visibility* affects its risk of discovery, *access* to a target refers to the suitability of its site for legal and illegal entry purposes of committing a violation, as well as the opportunity for escape, and the *inertia* of a target includes any factors that make it difficult to overcome for illegal purposes (heavy, bulky, attached or locked). (Felson and Cohen, 1980) It is

argued in this thesis that the Skytrain, as an example of a rapid transit system, increases access to targets and also increases the visibility of targets by increasing the number of people who are exposed to certain areas during the course of their routine daily activities.

Recent Related Research

Felson et.al. (1990) detected five different types of transit stations in Newark, New Jersey that resemble the types of stations existing in the Skytrain: the underground station, the station within a building, the outdoor street level station, the overpass station and the underpass station.

The underground may trap victims, but may also trap offenders. It is a large, open underground station that may be quite secure (as in Washington, DC). The station within a building may or may not be easily secured depending upon building factors. The outdoor street level type station may provide offenders with escape, but also provides it to victims while many street level guardians are present at most times. In an overpass type station the offenders, targets and guardians are on more equal footing. The offenders must escape by descending steps. The underpass station has the greatest crime potential. Offenders may be able to attack victims in the underpass where there are few other people around to protect them. Offenders may feel far from trapped while victims are either not seen by or are too separated from potential guardians to be provided quick assistance. Offenders can flee at lower ground level with no stairway.

Felson recommends closing superfluous stairways and channeling riders over the fewest possible routes. Stairways should be stretched out and open at all

spots. Stations can funnel more passengers into a smaller waiting area. Platforms for both directions should face each other. He notes that a sense of being trapped seems to affect perceptions of both victims and offenders.

Felson also recommends that emergency telephones should be located on both sides of the track. Off-hour waiting zones above ground for underpass stations should be created. Improvements in areas surrounding stations are important for security within stations. Urban renewal efforts should give top priority to the immediate vicinities of transit stations. New businesses near underpass stations can provide much more guardianship against crime at very little cost, however, it is important to pick businesses that bring out people such as restaurants or grocery stores with large windows.

Research conducted by Gaylord and Galliher (1991) on 'The Underground Dragon', the transit system in Hong Kong, found several design principles that seemed to influence the low crime rate of the subway system. Hong Kong's Mass Transit Rail system (MTR) enjoys the lowest crime and accident rate of any in the world. Part of this may be attributed to social and cultural factors of Hong Kong society, however the authors feel that the following design principles also have played key roles in reducing criminal opportunity in the worlds busiest transit system:

- an effective communications system between the control centre and the officers who patrol the rail system;
- the design of the stations is one of open platforms and wide tunnels, providing easy observation;
- limited entrances to the stations, that can easily be sealed should a problem occur;
- an exact fare system that eliminates cash transactions;

- the subway is a closed system where doors can be closed and police officers can easily block stairways.

The designers of the MTR in Hong Kong concluded from a study of comparative international information that *crowd* control enhances *crime* control and that physical layout can enhance or frustrate crowd control. Wilson (1985), for instance, argued that disorder and crime are inextricably linked "in a kind of developmental sequence". When building the Hong Kong Mass Transit Railway, an effort was made to keep the stations, no matter how crowded, clean and highly organized.

Levine, Wachs and Shirazi (1986) conducted a study of crime on the bus system in Los Angeles to determine levels of victimization on the bus system and to identify those bus stop locations where more crimes occur. The authors took into account the existing land use and social behaviour around the stops that was identified as problematic. It was realized that little is known about the relative distribution of crimes between the bus stops and other locations on the transit strip.

Levine et al. (1986) found that many crimes that occurred on buses were strongly related to crowding while crimes that occurred outside buses are more affected by general environmental conditions. Upon analysis of three bus stops associated with higher victimization rates, certain environmental characteristics surfaced as being contributors or facilitators to the occurrence of crimes.

It was found that socially disorganized environments containing such elements as prostitution, drug dealing and certain types of shops (adult book shops, fast food stops), as well as patterns of behaviour of those waiting for buses (where they stood, facing in what direction) contributed directly to the level of victimization that occurred at these bus stops. The authors also noted that each of the three bus stops also contained unique elements that contributed to their

victimization rates and that "any program of crime prevention to reduce bus crime must be fitted to the unique aspects of the environment."

For Brantingham, Brantingham and Wong (1990), shopping malls have the potential to become major hot spots for crime, delinquency and other forms of socially obnoxious conduct. Shopping mall crime problems appear to occur in predictable patterns that depend upon the location of the mall, the types of malls situated in a shopping region, the design of the mall and its grounds and facilities, the mall's administrative and security systems and the security systems; used by individual mall tenants. It would seem then, from routine activities theory and ecological crime theory, that the placement of these types of environments along a major transit route could generate a large volume of criminal opportunities.

The location of malls is perhaps the greatest influence on the rate and type of criminal and nuisance behaviour it experiences. Malls placed close to public transit stops, in city centres, with movie theatres or bars are likely to have many more problems. These nodal locations produce problems in nearby areas. The areas surrounding the malls become natural travel paths and natural search areas for criminally motivated persons. Approaches to reducing problems with malls must consider the location of the mall in the social and transport fabric of the city, its design, the mall's administrative and security system and the security approaches taken by the individual tenants' premises. (Brantingham, Brantingham and Wong, 1990).

The design of the physical environment strongly influences individuals' perceptions of well being, happiness and safety. Fear of crime is strongly influenced by social activities that take place in a certain area and the physical design of the environment where these social activities happen.

Block (1995) conducted a study on the elevated train in Chicago, Illinois, to determine the effects that this type of transportation had upon the surrounding

environment. Although Block concentrated mostly upon street robbery it would seem that what he found are generalizable to other crimes. He found that a large peak of reported crimes occurred at a 200 metre radius around each elevated train station, with a second peak at about 500 metres. The stations studied by Block were generally located in areas with a low socio-economic status and a high migratory tendency.

Summary

Cues within the built environment, both physical and social, can affect both levels of crime and levels of fear of crime. The three micro level cues that most affect levels of fear of crime are prospect, refuge and escape. Dark areas, for instance, might provide refuge for offenders while limiting a potential victim's opportunities for escape.

Crime and fear of crime concentrate in certain areas, that have been termed 'hot spots'. (Block, 1979; Nasar and Fisher, 1993; Sherman, Gartin and Buerger, 1989) Knowledge about these 'hot spots' is developed through direct contact with the environment and the development of a 'mental template'. (Brantingham and Brantingham, 1993) A mental template evolves from a multi-stage process including: the cues emitted from the environment and received by potential offenders, the offender learning to target potential victims and the successful use of the template. Mental templates are easily constructed, state Brantingham and Brantingham, due to the human's capacity to generalize and classify. Five elements that are important to template construction are: paths, edges, districts, nodes and landmarks.

The search for a potential target is usually accomplished along an offender's natural travel paths between his or her major activity nodes. Crime

patterns are not random and spatial and temporal patterns can be identified. Public transit can contribute to the shape of patterns of crime. Transit moves large numbers and proportions of the population around the urban environment and deposits them at a limited number of destination nodes. This type of movement results in highly focussed awareness spaces for potential offenders. Movement can make potential offenders aware of, and take them to, locations where victims or targets are numerous, available, convenient or vulnerable. Felson (1987) states that the very systems that allow for easy movement within a city (e.g., rapid transit) interfere with informal social control and the protection of persons and property. Public transit directly can directly affect both the opportunities presented to a potential offender the 'getaway' potential. Public transit can increase the access to targets as well as augment the visibility of a target by increasing exposure of a number of individuals to certain areas during the course of their routine daily activities.

The location of a public transit station or stop can affect the patterns of crime in an area. Different land zonings and specific land usages present different opportunities and potential targets to an offender. Each successful criminal offence will be comprised of three necessary elements: a potential offender, a possible target and the absence of a capable guardian. In a situation where there are plenty of suitable targets and not much social guardianship as well as low risk of punishment, some people will rationally choose to commit crimes in their own interest (van Dijk, 1994). Recreational liquor establishments and malls are all types of businesses that provide potential offenders anonymity and detrimentally affect levels of guardianship. These types of businesses are types of land usage that attract individuals to areas in that they do not reside.

Although research has been conducted on the effects of public transit on crime patterns in an urban environment, the amount of research in this area of

environmental criminology is still somewhat limited. Much of the research has concentrated on patterns of crimes at the actual stations or stops or the actual design of the terminals themselves. It is hoped that the current analysis will help to expand upon the knowledge of how public transit affects crime patterns in the areas around transit terminals.

Following Chapters

Chapter Two deals with data and methodology. Police data and BC Transit data were used for this study. Analysis was conducted via a geographic mapping system that permitted mapping of the reported crimes as well as such statistical techniques as the location quotient of crime. A description of the Skytrain stations that were observed for this study are included as well as a discussion of how these observations were obtained and the associated questions and problems arising from these methods.

Chapter Three will present the results of the analysis. These results will be discussed within the context of the environments in that they were obtained and such meaning(s) as may be gleaned from them.

Chapter Four concludes the discussion. The results are placed within the original context of the thesis question- do crimes pattern in a particular way around the Skytrain stations, and are these patterns related to the types of land usage and businesses that exist in the area?

Chapter Two: Methodology

Purpose of the Study

Transit and how it relates to crime patterns is under-researched. Little is known regarding its effect upon crime patterns along public transit routes. Although this study is limited to nine Skytrain stations in the City of Vancouver, it is hoped that through the analysis of police calls for service in relation to the Skytrain stations, as well as the land zonings and usages that surround each station, more can be understood with regards to this under researched area in environmental criminology.

This thesis seeks to understand observed patterns of crime within a 750 m radius of the Skytrain stations in Vancouver. Of importance to the study are the notions of agglomeration economies and multiplier effects² and how these regional science concepts may be applied to the areas around the stations for the purposes of crime pattern analysis and understanding. Also of importance to this study are the combined effects of certain land use zonings in concert with public transit upon criminal patterns in an area.

²An agglomeration economy results when similar businesses draw economic strength and success from geographic proximity. Multiplier effects occur when certain kinds of activities taking place in one area lead to more activities taking place in that same area. These concepts will be further explained later in this chapter.

Hypothesis of the Study

The hypothesis of this study is that there will be an increased volume of police calls for service within a 750 m radius around each Skytrain station in the City of Vancouver. It is expected that the volume of calls will vary with land use zoning patterns and discrete land usages within the 750 m radius. It is also expected that not all stations will necessarily support the hypothesis due to certain zonings and land usages around the stations. Should differences in results arise other than the expected hypothesis, the stations that do not fulfill the requirements of the hypothesis will be comparatively analyzed with the stations that do fulfill the requirements of the hypothesis to determine whether the non-conforming locations can be attributed to environmental factors.

It is actually expected that within the 750 m radius chosen for analysis, there will be an echo of transit related crimes present at about 200 m from the station and then another echo of related crime about 500 m from the station.

Data Collection

Crime data for this study were obtained for this study from the Vancouver Police Department.³ The data include the calls for police service occurring over a four-month observational time period, spatially coded at the address level. Approximately 30 000 calls for service are received by the Vancouver Police each

³The generosity of the Vancouver Police and BC Transit is acknowledged; without these data, this research could not have been conducted.

month. The data are presently archived on a monthly basis at the research data library at Simon Fraser University. It is only with special permission from the Vancouver Police that these data may be accessed for research purposes. As of the present time, the research data library at SFU is the only archived source of police data for Vancouver.

Crime data for the same four-month observational period were also obtained from BC Transit. The data received from BC Transit listed the calls for service to the security personnel at Skytrain stations. It was hoped that the crime data as recorded by BC Transit security could help to 'fill in' the picture of what the Vancouver Police data would show as happening around each of the Skytrain stations.

Operational Definitions

It is necessary to clarify, at the onset of the analysis, what is meant by the main unit of analysis for this research - 'crime'. What is being analyzed for the purposes of this study is not necessarily a set of exactly legally defined crimes, but what is more the basis for what types of activities contribute to an individual's labeling of an area as being 'criminal' or having a 'bad reputation'. The analysis of the possible criminal areas around the Skytrain stations is based upon all calls for service to the Vancouver Police. These calls for service are specific classifications used by the Vancouver Police when sending an officer to investigate a complaint from the public. These classifications do not necessarily reflect an exact criminal code violation, but rather are a legitimate complaint that

deserve police attention.⁴ It is these types of complaints that influence an individual's perception of an area in either a positive or negative manner.

The definitions of land zoning used for this study are taken directly from the City of Vancouver's Regional Planning Zone Map. These are the official definitions that are used by the city for urban planning purposes.⁵

Description of the Sample

The data used for the present analysis is comprised of calls for police service for the months of May, June, July and August of 1995. Four months were chosen for analysis as it was felt that the 124 214 calls for service contained within these months would be sufficiently representative of reported criminal activity in the City of Vancouver.

It was hoped that limiting the data used for analysis to this time period would allow representative numbers of low occurrence calls for service while still maintaining a workable database.

The total database included a possible 133 different types of calls for service for the Vancouver Police. Some of these classifications are used much more often than others. The most frequent call for service during the time period of this study was an audible alarm (10185). The least frequent call was traffic court attendance (0). It was from this list of 133 different types that the variables for this analysis were picked.

⁴An example of this type of complaint may be a report of a 'suspicious person' or 'suspicious circumstance', or a 'scream heard'.

⁵ Please see Appendix of zone definitions for the exact definitions of the various land zonings that will be used for the analysis of the Skytrain station radii.

Some 27 types of calls for service were selected for initial analysis to determine whether or not they demonstrated a higher than expected rate of occurrence than what could be expected as 'normal' for the city of Vancouver. These were: Audible alarm, Theft from auto, Break and Enter, Theft report, Annoying person, Noise complaint, Suspicious Circumstances, Suspicious Persons, Mischief report, Warrant, Disturbance, Wagon, Stolen Auto Report, Assault Report, Fight, Impaired Driving, Breach of Probation, Mental Case, Robbery Report, Harassment, Drug Arrest, Prowler, Person with a Knife, Screams and Stabbing. These calls are listed in descending order of the frequency with which they actually occurred in Vancouver over the four month study period.

This set of calls for service types was chosen for their cue-emitting potential in an urban environment. It was felt that these 27 types of crimes and calls for service represented both social and physical cues that can probably be linked to levels of fear of crime in an area, as well as actual levels of crime in an area. Events such as Audible Alarms, Annoying Persons, Suspicious Circumstances and Persons, Disturbance, Mental Cases and Screams all can be linked to social disorganization within an area. Social disorganization has been linked to higher levels of crime in an area, as well as higher levels of fear of crime, notably around transit stops. (see Levine and Wachs, 1986)

It was thought that calls for service such as Theft of and Theft from Auto, Break and Enter, Wagon, Impaired Driving, Breaches of Probation, Robberies, Drug Arrests, Persons with a Knife and Stabbings would probably be associated with urban areas that contained certain attracting influences for potential offenders. These attracting influences might include low guardianship of property and person, and might also include high availability of targets and victims.

The land zoning and specific land usage around the Skytrain stations are also important to this study. The 27 calls for service types selected for this

analysis represent calls for service that can be most likely linked to specific land usage and provide for a high, temporary potential offender population, low guardianship and large number of targets. Examples of these types of land usages include restaurant and entertainment districts, shopping malls, recreational liquor establishments, schools, parking lots and sporting event complexes.

Statistical Analyses

Two major methods of analysis were used for this research to determine whether there is any support for the hypothesis that transit stations, when combined with certain land zoning, increase the levels of calls for service to the police. Two main methods were used for analysis of crime patterns around the Skytrain stations: a visual inspection of a graphical point representation and statistical analysis. The visual analysis was performed using a geographical mapping program that mapped individual crimes by their reported address upon a city map of Vancouver. Although the mapping program was able to provide the researcher with what appear to be obvious and clear visual patterns to the data, the interpretation of these patterns can be subjective and inaccurate (Canter, 1993). To compensate for these possibilities and ensure an accurate interpretation of the results, statistical analysis was performed using a method adapted from the regional sciences, the location quotient.

The Location Quotient of Crime

What is it?

The location quotient is originally a measurement tool used in regional science, economics and geography to measure how areas differ in certain patterns of phenomena, for example, employment. When applied to environmental criminology, the location quotient of crime (LQC) is used to analyze how different areas differ *relatively* in their patterns of crime. The LQC is similar to a ratio measure in that it measures the relative difference of one area to another. The LQC is a flexible tool for analysis of patterns as it is only limited by the imagination of the researcher. The areas for comparison may be large or small, complex or simple, and the patterns being compared may be each from either micro or macro environments. The LQC is not dependent upon fixed rates of crime, as are official statistics, nor is it dependent upon the population of an area. The basic notion of the location quotient is:

over some standard geographic area a certain 'normal' proportion of a particular good under study is produced and consumed. The proportion of the good produced and consumed in a smaller study region is compared to the 'normal' proportion characteristic of the 'standard' area. (Brantingham and Brantingham, 1994b)

Since the LQC is a ratio measurement, it centres around how close the value of the measure for a certain region is to 1.00. When the value for an area is above 1.00, it means that the area has a higher proportion of that type of crime relative to the pattern for the larger comparison area of that it is a part. When the value is below 1.00, it means that the area has a lower proportion of that type of crime. (Brantingham and Brantingham, 1994a, 1994b, 1995)

Depending upon the variable used to calculate crime rates- for example, population or number of available targets present at a certain time- observed patterns of crime can vary widely. Results can also be linked to the methods used to calculate these patterns (Brantingham and Brantingham, 1994a).

Equation

$$LQC_{in} = \frac{C_{in}}{C_{in}} \frac{\sum_{n=1}^N C_{in}}{\sum_{n=1}^N C_{in}}$$

where

n = small area under study

N = total number of areas

C_i = count of crime i

C_t = total count of all crimes (Brantingham and Brantingham, 1995).

What does the LQC do?

The location quotient of crime measures patterns of crime in areas as opposed to rates or volumes. (Brantingham and Brantingham, 1994) Location quotients of crime are used to look at what occurs in a specific area and to compare occurrences to what is happening in surrounding areas. (Brantingham and Brantingham, 1995)

LQC's are now being developed as a tool for the microanalysis of crime, in order to introduce a potential measure of subjective views of crime. That is, LQC's are being developed as a measure of crime occurrence that reflects the visual images of crime

someone can have in a city she or he knows. (Brantingham and Brantingham, 1995)

Location quotients of crime are used to look at what occurs in a specific area and to compare occurrences to what is happening in surrounding areas (Brantingham and Brantingham, 1995). LQCs have their strongest potential in microanalysis of crime patterns. This measure questions the validity of those analyses of crime that use the total population as the denominator in calculating a rate. LQC analysis makes apparent any special sectors or areas that are unusually over or under-represented with respect to the phenomena that is being measured. The LQC is a relative measure; a location cannot have high location quotients for all crimes. "The LQC is a measure that identifies an area's relative specialty in crimes.". (Brantingham and Brantingham, 1995)

Advantages and Disadvantages of the LQC

According to Brantingham and Brantingham (1994), some conceptual advantages of the location quotient of crime are:

- parsimony;
- flexibility - the choice of the denominator is left to the discretion of the researcher and is indeed only limited by the researcher's imagination;
- control of focus - allows change between levels of aggregation and allows precise identification of the level of focus with regards to different identified crime problems;
- can be used with small numbers - because it is a relative measure, the LQC measures crimes only with respect to their relative frequency to others in the same area.

A relative disadvantage to the LQC is that it is dependent upon how an area under study is divided into regions for analysis purposes and that the "...denominator ratio will be dominated by the crime mix in the highest crime regions."⁶ (Brantingham and Brantingham, 1994)

The Agglomeration Effect

An agglomeration effect occurs, for example, when types of businesses increase sales when they are grouped together. A well known example of this in North America is found with car dealerships. Just as agglomeration effects can contribute to increased sales or legitimate business, they can also contribute to increased levels of crime in an area, that in turn may lead to the creation of 'hot spots' of crime. Multiplier effects take place in these hot spots, that means that as certain types of crimes generate more criminal activities within the same area, increasingly criminogenic situations are created. (Brantingham and Brantingham, 1994b)

The phenomenon of the node of activity that attracts varied users with differing goals and purposes has been well documented by Brantingham and Brantingham. They have shown that; "When shopping, housing and businesses are concentrated in a highly accessible node, the possibility of that node being an attractor of potential criminals greatly increases." (Brantingham, Brantingham,

⁶Another disadvantage that may become apparent with analysis of crime patterns using location quotients is the stationarity fallacy. The stationarity fallacy is similar to the ecological fallacy in that when an observable pattern of criminal events seems to cluster spatially, it may be because different time periods are being combined. The stationarity fallacy is not addressed in this present analysis because of the need to, at this time, limit the analysis of the micro patterns around the Skytrain stations to a more general level.

and Wong, 1990) Many of the Skytrain stations in Vancouver are located in such places. The stations were designed to be highly accessible, usually at the intersections of major streets, and often in conjunction with a Park and Ride facility or a major bus interchange. It could, in fact, be argued that the stations themselves actually are contributing factors to an agglomeration economy or multiplier effect in that they attract large numbers of people to them for the purpose for that they were designed, that is, transportation.

Individuals must travel to the station to be able to get on the Skytrain, and in the process of travel to the station, or even in the process of travel from the station to their final destination or connecting method of transportation, they are able to closely observe their immediate environment. Most individuals arrive at Skytrain stations in Vancouver by foot. Those who do not usually arrive by bus. This type of pedestrian travel allows one to become closely acquainted with the various legal and criminal opportunities that may be present during their trip. Opportunistic crime and opportunistic purchases, for instance, are similar.

A suitable target (a good) is on display and is seen by a potential offender (customer) who would not have seen it but for the agglomeration effect. Sight of the target (good) triggers the desire to have it and a simple theft (assuming a suitable situation) by the offender replaces an impulsive purchase by the customer. (Brantingham and Brantingham, 1994b)

Skytrain Station Zoning

Central to the analysis of crime patterns around each of the Skytrain stations is the understanding of the land zoning within the 750 m radius

surrounding each station. Zonings entail different land usage which, in turn, provide different attractors to different types of users. Residential land zoning is usually spatially designed much differently than land zoning of a commercial or industrial nature. Variations also exist within each type of zoning. Residential zoning, for instance, may be designed for single family residences, two-family residences and/or high density living. Commercial zoning varies by permitted business type; they may also provide for certain types of housing within the same zoning. Industrial zoning varies by the type of industry permitted in the area and may be dependent upon being closely fitted in purpose to a neighbouring residential or commercial district.

The analysis of this thesis uses the zoning definitions and plans of the City of Vancouver. Official definitions were obtained from the Vancouver Planning Department and are the definitions used for this study. The following discussion describes the environment of each Skytrain station within the context of Vancouver's official zoning guidelines. There are nine Skytrain stations in the City of Vancouver: Joyce Street, 29th Avenue, Nanaimo, Broadway, Stadium, Main Street-Science World, Granville, Burrard and Waterfront. These will be presented in order and the possible attractor influences for criminal activity will be discussed for each.

Joyce Street

Joyce Street station is the first Skytrain stop when proceeding west into Vancouver from the adjoining municipality of Burnaby. The Joyce Street area formerly known as Collingwood is an older area within the City of Vancouver. It had been named such due to the fact that most of the original residents of the area

were from Collingwood, Ontario. The Collingwood area has developed a reputation for crime problems. Until five years ago, many of the buildings central to the area were in a dilapidated state and the community had become divided due to a high migration rate. Recently, efforts have been made to rejuvenate the community as well as impart some sense of community identity and pride.

The location of the Skytrain station is at the centre of the community. Although the station itself is located within a commercially zoned area (C-2C), it is immediately surrounded by many other types of zonings that include: a multiple dwelling district (RM-4N), a comprehensive development district (CD-1), a single-family dwelling district (RS-1), another single-family dwelling district that allows some two-family dwellings (RS-1S), a two-family dwelling district (RT-4N) and (RT-9), and another type of commercial district (C-2).⁷

As is obvious from the above description, the Skytrain station is located amidst a real hodge podge of land usages with at times conflicting purposes.⁸ There is a wide variety of dwelling districts and the commercial districts in this area provide, by definition, for:

a wide range of goods and services, to maintain commercial activities and personal services that require central locations to serve larger neighbourhoods...and to encourage creation of a pedestrian oriented district shopping area by increasing the residential component and limiting the amount of office use. -*City of Vancouver Zoning Districts Map*

It would seem that the aim of the commercial districts in this area is to draw together a wider population from different communities that surround the

⁷Please refer to the Appendix of zoning definitions for the exact definition of each of these districts.

⁸Those seeking a quieter residential component might find it difficult amidst the commercial usages that are intermingled with the residential usages throughout much of the area.

Joyce Street area. It would also seem that a major purpose of this area is to provide easy access for pedestrian activities. Routine activities theory and environmental criminology theory state that people search for criminal opportunities in areas that fall into the realm of their 'normal', legal activities, for example shopping, travelling to work, school and home. (Brantingham and Brantingham, 1978; Brantingham and Brantingham, 1993; Brantingham, Brantingham and Wong, 1990; Cohen and Felson, 1979; Cornish and Clarke, 1986; Felson, 1986; Felson, 1987; Felson and Cohen, 1980; Massey, Krohn and Bonati, 1989; Nasar and Fisher, 1993; Sherman, Gartin and Buerger, 1989) By creating an area that draws people to a central point, that is pedestrian oriented and that has the Skytrain, a major source of pedestrian traffic, the Collingwood area has unwittingly created a node that makes it easy for potential criminals to search for possible targets without significant effort.

Illustration 1 - Joyce Station Entrance



Illustration 2 - Joyce Alleyway



Refer to the enclosed photographs of the Joyce Street Skytrain station vicinity in Figures 1 and 2. The first photograph is of the station entrance. Even though this photograph was taken on a Sunday afternoon there are still several people waiting for buses in front of the station entrance. An apartment building is also noticeable in the background. The second photograph is of an alley way directly across from the station entrance. This photograph makes clear a number of criminal opportunities, especially after dark. The housing is dilapidated, there are a number of unprotected parked cars, an entrance to a parking lot underneath a high-rise apartment building is open and there is no door to prevent unwanted entrance to the garage.

29th Avenue

29th Avenue is the second stop along the Skytrain route as one proceeds west from Burnaby. Unlike its neighbour to the east, Joyce Street, 29th Avenue station is surrounded by relatively few different types of land zonings, most of which are comprised of newer residential areas and smaller commercial usages. Possibly conflicting land zonings are more clearly defined and separated from one another and any mixing of different zonings is minimized in this area of the city.

29th Avenue does not have a reputation for criminal activity in its surrounding area, and this is probably due to the form that the land usages have taken. This Skytrain station is located in a single-family dwelling district (RS-1S), and is also mostly surrounded by this type of zoning. The different zonings that do touch upon the RS-1S and that also fall within a 750 m radius of the station include a comprehensive development district (CD-1), and exclusively single-family dwelling units district (RS-1). There are only small commercial

districts (C-1 and C-2) located nearby, that are self contained and are mostly comprised of "small scale convenience commercial establishments, catering typically to the needs of a local neighbourhood and consisting primarily of retail sales and certain limited service functions..." (City of Vancouver Zoning Districts Map). There is only a small number of any type of larger commercial establishment that may attract individuals from other communities. Generally, the 29th Avenue Skytrain station could be said to service mostly the residents who live in the area and is not generally used by individuals from other parts of the city. There is really not much in this area that would attract any outsiders.

The following photographs of the station entrance and adjoining park make clear the presence of housing immediately next to the park. It is also clear from the photograph that the park is quite large, with tennis courts, and as such may attract a variety of users.

Illustration 3 - 29th Avenue Station Entrance



Illustration 4 - 29th Avenue Park Area



Nanaimo

The Skytrain station at Nanaimo Street in Vancouver is the third station along the Skytrain route when traveling west from Burnaby. Nanaimo is more closely similar in its surroundings to 29th Avenue station than to Joyce Street station. Nanaimo is directly located in and mostly surrounded by a district of single-family dwellings, with some two-family dwellings allowed (RS-1S). Touching upon this district is a single-family dwelling district (RS-1) as well as some commercial districts of the types CD-1, C-1 and C-2.

The area surrounding the Nanaimo Street Skytrain station has only a slight reputation for a higher level of criminal activity than, for example, the area surrounding the 29th Avenue station. This could be due to the fact that the commercial district zoning allows for more population attractor types usages and, although clearly defined, are more interspersed within the residential areas within a 750 m radius around the station. There are not, however, many reasons to go to the Nanaimo Street station for purposes of criminal activity unless you are a resident of the area.

The photograph of the station entrance shows clearly the presence of the adjacent low rise, high density apartment building on one side of the station. The next photograph shows the adjacent housing and large residential area.

Illustration 5 - Nanaimo Station Entrance

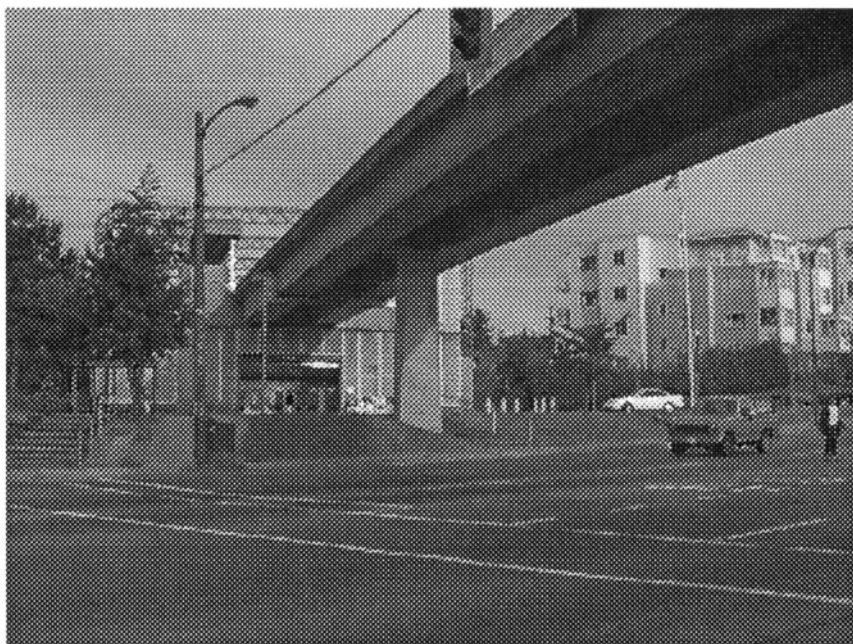
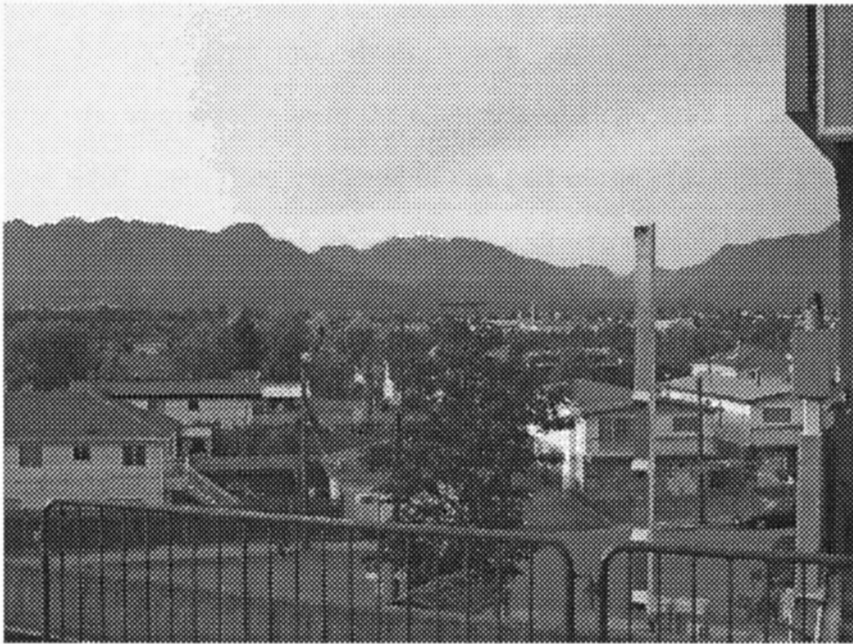


Illustration 6 - Nanaimo Residential Area



Broadway

2

The area surrounding the fourth Skytrain station into Vancouver, traveling west from Burnaby, is very different from the previous three that have been discussed thus far. Situated at the corner of Broadway Street and Commercial Drive, one of the busiest intersections in Vancouver, this station experiences a high level of activity throughout its open hours. The Broadway-Commercial area is an area well known for its 'criminal element'. There are diverse users in the area, especially during the day. During regular business hours there is a constant mix of business type individuals, young 'street-people' and panhandlers, and people who specifically go to the Commercial Drive area to shop in some of the unique retail enterprises that exist in this part of the city. This area of the city is also popular with students seeking less expensive accommodations who are also seeking a wide array of activities within walking distance of their residence. After regular business hours, and especially after dark, the largest population group whose presence is noted on the streets are local residents and those who are visiting the area to stop at one of the numerous restaurants and cafes.

This area is characterized by a wide variety of all types of land zoning, land usage, and users. The Skytrain station itself is located within a commercial district (C3-A) whose major purpose is to provide a wide array of goods and services while maintaining the general character of the area as well as providing for residential units that are compatible with commercial uses (City of Vancouver Zoning Districts Map). This single zoning alone allows for a large number of conflicting goals and activities.

The numerous zonings that fall into a 750 m radius around the Broadway Station include a multiple-dwelling district (RM-6), another multiple-dwelling district (RM-4N), a two-family dwelling district (RT-5, RT-5N), a comprehensive

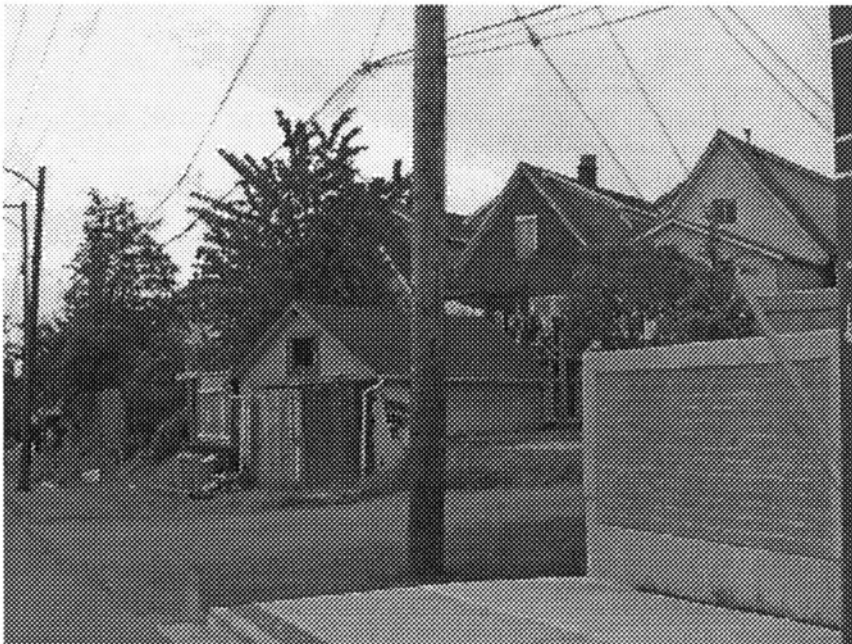
development district (CD-1), a single-family dwelling district that allows two-family dwellings (RS-1S), a single-family dwelling district that conditionally allows multiple-family dwellings (RS-2), a two-family dwelling unit district that allows low density multiple-family dwellings (RT-2), a light industrial district (I-1), and an industrial district that provides employment to many individuals (M-1).

The photograph of the station entrance is quite revealing of the conflicting interests that prevail in this area. Directly adjacent to the station is a bank. In front of the bank is a group of drunk males engaging in some sort of dice game. There is a large number of individuals hanging around inside the station entrance, one of whom was a prostitute (please remember that this is a Sunday afternoon). Directly outside the entrance to the station are a few tables with various items for sale such as jewelry and sunglasses. The second photograph of this station area shows the dilapidated housing that is associated with much of the Broadway station area. Graffiti is visible as well as garbage on the street. This photograph was taken at about 500 m to 600 m from the station.

Illustration 7 - Broadway Station Entrance



Illustration 8 - Broadway Residential Area



Main Street-Science World

The Skytrain station located at Main Street and Terminal Avenue in Vancouver is really the last stop along the route while traveling west before reaching the actual downtown area of Vancouver. The station is located in a scenic area of the city known as False Creek. This is also an ethnically diverse area; the station serves Chinatown, a historical sector of Vancouver. Although not located directly in Chinatown, the station is within walking distance of the area and there are also major bus connectors that lead to this area from the Skytrain station.

Main Street serves a wide array of users. Immediately surrounding the station are offices, residences, small business, a major national and international bus depot, a national train station, commercial rail yards and a major city entertainment site, Science World. Science World attracts visitors of all ages and because of its close proximity to the Skytrain, the mode of transportation used by many of its visitors.

Main Street station is directly on the border between a comprehensive development district (CD-1) and a commercial district (C-1). The comprehensive development district immediately adjacent to the station is one devoted to the development of new high rise, high density residential areas. The commercial district directly adjacent to the station is devoted to:

the development of a high density mixed commercial use neighbourhood, including some residential and compatible industrial uses. For commercial development, a variety of small-scale retail and service uses are encouraged. *-City of Vancouver Zoning Districts Map*

The station is surrounded by variously zoned areas including a comprehensive development district (BCPED), and several industrial districts (M-1, M-2, IC-1, IC-2 and IC-3).

This area is designed to cater to a wide variety of needs and users. The area attracts users from many parts of the city as well as from parts of the province and the country. This station is continually busy during its hours of operation.

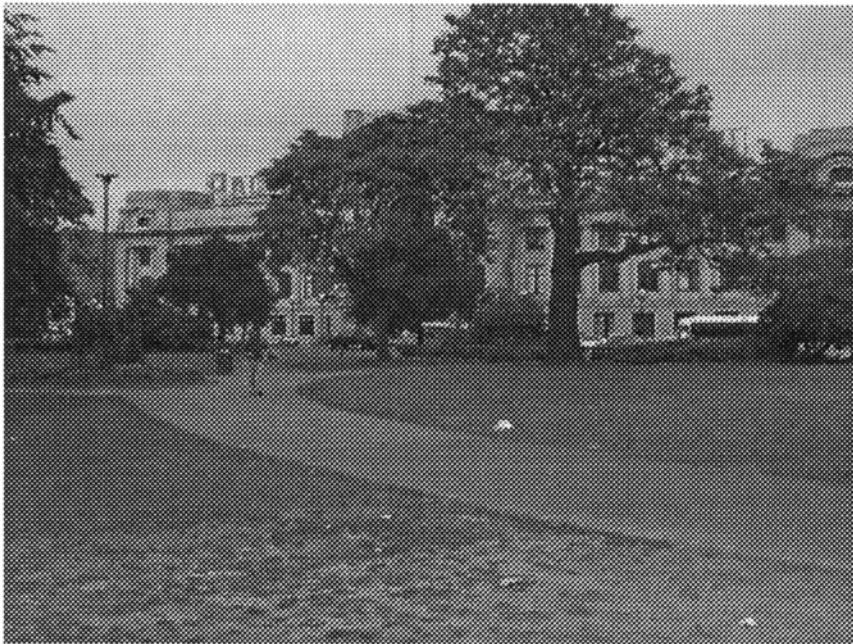
The first photograph of the station entrance illustrates the large number of commercial services that are available in this area. Visible in the picture are a McDonald's and a gas station. The intersection is also quite busy with a number of cars visible. The second image shows the park that is directly adjacent to the station entrance. Evident in this photograph is garbage on the grass, the bus terminal in the background and a lone person walking along a well worn path through the park.

* this can be done in
below it

Illustration 9 - Main Street Station Entrance



Illustration 10 - Main Street Park



Stadium

The Stadium station is the first to be located in what can be termed the downtown area of Vancouver. The station serves a large residential population, two large sport stadium facilities, and two historical areas of the city, Gastown and Chinatown. The residential component of the area surrounding this station is a mix of the old and new. The area is currently being developed with high rise, high density residential buildings. Incorporated into these buildings, usually on the ground floor are small retail shops and small office spaces. The two sporting facilities serve the Canadian Football League football team, the National Hockey League hockey team and the National Basketball Association basketball team as well as the Voodoo Roller Hockey League Team. Between these four sports there is a nearly continuous use of these stadium areas. The Skytrain station is located directly adjacent to these stadiums and is very well used by the fans of the teams at sporting events.

There are many bars and restaurants located near the station. There are also some centres for the performing arts located close to the station. These centres for the performing arts do act as attractors for numerous individuals. The new main branch of the public library is also located within easy walking distance of the station. This new library is quite large and also includes some retail shops and small food establishments on the main floor.

The Stadium station is located in a comprehensive development district (DD), and is surrounded by two more comprehensive development districts (CD-1 and BCPED), as well as two historical districts (HA-1-Gastown and HA-2-Chinatown). The major goals of the comprehensive development districts that surround this area of the city are to "encourage high standards of design and development", and ensure that:

all buildings and developments in the Downtown District meet the highest standards of design and amenity for the benefit of all users who live, work, shop or visit the Downtown. (City of Vancouver Zoning Districts Map)

The Stadium station is located in a major node of activity for the city.

Noticeable in the first photograph of the station entrance are a number of parked cars and run-down buildings. The second photograph shows the two sport and their large parking lots.

Illustration 11 - Stadium Station Entrance



Illustration 12 - B.C. Place and G.M. Place - Sport Stadiums



Granville

The Skytrain station at Granville is located in a unique part of the city. Originally, Granville Street had been a major centre for shopping and upscale entertainment. Granville Street currently presents a very different picture. Located in the heart of the entertainment district in Vancouver, Granville Street has numerous bars, taverns, nightclubs, run down hotels and retail shops of all kinds including tattooing and piercing parlors, sex toy and apparel shops, as well as some alternative clothing shops. Also located along the part of Granville street, close to the Skytrain station, is a large shopping mall which is comprised of both mid-range and up-scale stores.

There are many street people and homeless people along this section of Granville Street and many street musicians as well as small table-top vendors selling jewelry and sunglasses. It is impossible to walk down Granville Street at any time without being approached by numerous individuals looking for money or trying to sell something. As this is still Downtown Vancouver there are many businesses located close by as well as higher quality hotels and retail stores. These higher quality stores are mostly located on streets running parallel to or adjoining Granville Street.

Granville Street is busy at all times and attracts a wide variety of users, from those wanting to see a movie (Granville Street has a high concentration of movie theatres), to those who want to shop, those who are going to and from work, and those who are going to restaurants and bars. There is some residential property in this area but most of it is mixed in with commercial land uses. There is a growing emphasis on the effort to re-take Granville Street and to make it safer as well as more attractive. The effort to do this is, however, modest at best, as noone really seems to want to take responsibility for the clean up of this area or its

decentralization

beautification. It could be the low number of people who actually live directly in this area that contributes to the difficulty of recreating a safe feeling.

The Skytrain station is located within a comprehensive development district (DD). The station is also surrounded by two more comprehensive development districts (CD-1 and CWD), a small historical section (HA-2), and some multiple dwelling districts (RM-5B).

It is worth noting that this area also attracts individuals because of the presence of the Skytrain. Many individuals take the bus or walk to the Granville station just to be able to take the Skytrain to other parts of Vancouver or any of the connecting cities of Burnaby, New Westminster or Surrey.

The first photograph of the station entrance on Granville street shows a number of people walking and waiting for buses as well as a number of older looking buildings. The second photograph is of the other entrance to the station. This picture shows a number of people, numerous parked cars, older buildings and a run-down hotel.

Illustration 13 - Granville Station Entrance

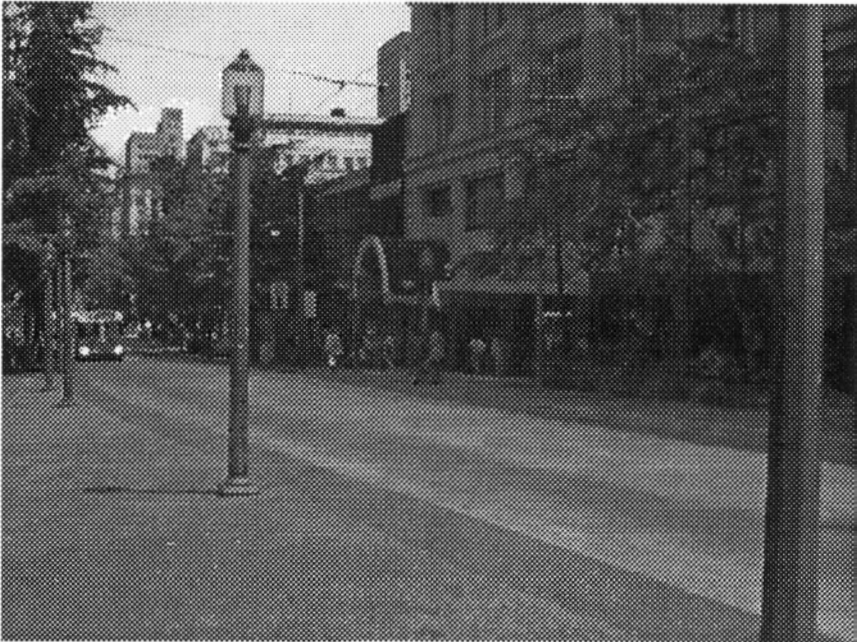


Illustration 14 - Granville Station Rear Entrance



Burrard

Burrard Street station is located in the heart of the central business area of Vancouver. It is within easy walking distance of both Granville station and Waterfront station. Burrard is surrounded by an up-scale shopping district as well as major business buildings and office towers. There are numerous restaurants and bars within walking distance of the station, with many catering to a more mid to up-scale clientele rather than the type of bars and restaurants that are located close to the Granville Skytrain station, that cater to a younger and lower-scale clientele.

Burrard Street station is busy during the day, especially during rush hours. It is also busier during the early evening hours when people are using the Skytrain to get to and from restaurants or entertainment. Burrard station is not very busy during later evening hours, as by this time most of the surrounding shops have closed and most people have already gone home. The closest residential area to Burrard station is the West End of Vancouver. This is an extremely high density area (once the highest in Canada) comprised of numerous high-rise buildings. This area is populated by younger individuals with a large segment of retirees and there is a small number of single family homes within walking distance of the Burrard station that may have a slightly older, more established population.

The Skytrain station is located within a comprehensive development district (DD). It is surrounded by two more comprehensive development districts (CWD and CD-1), as well as by some multiple dwelling districts (RM-5B), and a historical district (HA-2). Although the historical district of Gastown is easily walkable from this station, Gastown is usually accessed, when traveling by Skytrain, by the closer station of Waterfront.

The photograph of the Burrard station entrance makes clear the absence of anything but office towers in the immediate vicinity.

Illustration 15 - Burrard Station Entrance



Waterfront

Waterfront is directly located at the periphery of the historical district of Vancouver known as Gastown. This is one of the oldest parts of the city and it is a large tourist attraction. Waterfront station is also the location for the Seabus terminus. The Seabus is a small passenger ferry that travels regularly across the Burrard inlet to North Vancouver. The Seabus is a well-used and popular mode of transit for commuters who live in North Vancouver but work in Downtown Vancouver. (Deschamps, Brantingham and Brantingham, 1992)

Located in Gastown are numerous up-scale shops of all types. There are many historical sites to see and visit. There are endless restaurants of all types and a wide array of bars and taverns. These drinking establishments are representative of numerous styles and most people can find something to their liking in Gastown, as far as entertainment goes. There are also office buildings located on the periphery of Gastown.

The streets of Gastown are narrow and there is not much parking. Many of the streets are cobblestone. This leads to a lower concentration of vehicles in Gastown and to higher pedestrian traffic. There is a large number of high density residences in Gastown or within easy walking distance of its periphery. Although the edge of Gastown closest to the Waterfront station is fairly up-scale, the opposite end of Gastown is extremely run-down and is actually well known for being a 'worse' area than the Granville Street scenario described above. Gastown is fairly small and the distance from one end to the other is walkable.

Gastown is a popular night entertainment spot, not only for tourists but also for natives of Vancouver and the surrounding suburbs. Gastown is busiest

during regular business hours and later in the evening when people arrive into the area for entertainment purposes. Gastown has a reputation for being a high crime and fear-of-crime area after dark; this could be attributed to the presence of a high crime area at one edge of this historical district.

The Waterfront station is located in a comprehensive development district (DD), and is surrounded by two more comprehensive development districts (CD-1 and CWD) as well as the historical district (HA-2).

As is shown in the first photograph, the Waterfront station is located within an older, historical building. There are a few parked cars visible on the street. The second picture of the Waterfront station area shows the start of the Gastown historical district. Located at this end of Gastown is one of the many busy restaurant/bars situated within the area.

Illustration 16 - Waterfront Station Entrance



Illustration 17 - Waterfront: Popular Restaurant / Bar at Entrance to Gastown



Chapter Three: Analysis and Results

In order to ascertain an accurate picture of the crime patterns that exist around each Skytrain station, it is necessary to proceed through various levels of analysis - from general to more specific. The first two stages of analyses incorporated a determination of the amount of calls for service happening during the study period in the city of Vancouver (in raw numbers) followed by a determination of the quantity of crime that could be ascribed to a 750 m radius around each Skytrain station (in raw numbers). The next steps of analyses include a determination of the actual number of the various calls for service in each Skytrain area, a calculation of the location quotients of crime for each of the station areas on a call by call basis, and finally, an analysis of the call for service patterns within each of the station areas both in terms of raw numbers as well as in terms of the rates per radius area.

of a four month study period

The Stadium station area records the highest total calls for police service during the four month study period, followed by the Granville station area and the Waterfront station area. Of the approximately 120 000 calls for service recorded within the four-month study period, over 57 000 of these calls are accounted for within the nine station areas. While the City of Vancouver represents an area of 112.94km², the total area of the nine Skytrain station areas (750 m radius each) is only 15.9km². The nine station areas account, therefore, for only 14% of the total city area, yet account for 49% of the police calls for service from May, 1995 to August, 1995.

BC Transit Data

389 incidents were reported to Skytrain security officials during the four month study period. Crimes recorded by the Skytrain security officials are usually situated within the official boundaries of the BC Transit commission. While there are few specific offence classifications used by BC Transit to record offences reported to them, instead a short description of each individual incident is recorded. While this may detract from the accuracy of the classification of offences it does add specific knowledge regarding each incident. More qualitative description is thus added to the data.

Few violent offences were recorded during the study period on official Skytrain property. Most offences are of a 'social incivilities' nature and many of the reports were of a 'nuisance' nature. A large number of fare-evasion related offences were recorded as well as a large number of offences related to the presence of intoxicated individuals. A large majority of the offences were recorded as happening at a specific station platform; very few offences were recorded as taking place 'enroute'.

While it is difficult to draw specific conclusions from the BC Transit data with regards to actual numbers of offences, it is possible to glean an overall picture of the crime that happens on BC Transit Skytrain property that is reported

to the Skytrain security officials. A fairly large proportion of 'nuisance' types of calls and few violent offences are recorded within the official boundaries of the BC Transit Commission.

Call by Call

The next stage of analysis entailed a more detailed evaluation on a call for service basis to determine the actual numbers of each call within a 750 m radius around each station. Even at this initial, general level of analysis through the use of a geographic mapping technique, patterns with regards to certain station areas and even certain types of calls for service start to become apparent. Around the Stadium station, for instance, there appeared to be a consistent one-block buffer zone in that very few calls for service were recorded. Calls for mischief around the 29th Avenue station were at least two blocks away from the station. This pattern for mischief was not apparent with any other station.

The Location Quotient of Crime

The next stage of analysis entailed a calculation of the Location Quotients of Crime for each of the Skytrain stations. The LQC's were calculated for 27 different calls for service. The call types were chosen for how they may be possibly associated with transit usage as a mode of transportation as well as how the different types of calls might be representative of 'nuisance' type behaviours. These calls are not necessarily based upon true, legal definitions of crime, however, they are police calls for service that can be attributed by individuals to

be representative of a 'bad area' and contribute a negative perception of the physical environment. The negative perception of the physical environment may be the result of or even result in a higher level of fear of crime, connected with these 'nuisance' behaviours. (Skogan, 1990; Wilson and Kelling, 1982) Calls such as 'family trouble' and 'motor vehicle accidents' are examples of the types of calls for service that were not chosen since they cannot be theoretically (or plausibly) linked to transit presence or usage. Some calls also had totals too small for meaningful LQC's to be calculated (e.g., hostage taking incidents).⁹

A station's crime pattern appeared to be associated with the land zoning pattern surrounding it. General patterns that became initially apparent from the LQC's were as the line proceeded east to west, many LQC's of calls associated with violent crimes became larger, while many of those associated with property offenses became smaller. The calls that have increasing LQC values as one proceeds westerly along the Skytrain route include warrant, wagon calls, persons with a knife, theft from auto, annoyance calls, drug arrests and seized property offenses. LQC's that become smaller as one proceeds westerly along the route include audible alarms, break and enters, noise calls, suspicious persons, suspicious circumstances, screams, stolen autos, prowlers, harassment calls.

Residential Versus Commercial

It seems reasonable to expect that residential and commercial areas will have different crime patterns because of different population attracting influences, and that the residents or workers of these different types of areas will express different concerns about crime.

⁹Refer to the Appendix entitled "LQC" for the exact location quotients of crime for each call for service for each station.

Due to this observed difference in crime patterns associated with the different stations depending upon what their primary land zoning was immediately surrounding them the next stage of analysis was to compare on a call by call basis the different stations in a commercial-downtown area as opposed to a more residential-outside downtown area. Based upon the primary zoning around the Skytrain station itself the 9 stations were divided into two groups, an Outside-residential station area including Joyce, 29th, Nanaimo, Broadway, and an Inside-commercial station area including Main, Stadium, Granville, Burrard, Waterfront.

It was expected from the outset of this stage of analysis that both Broadway and Main Street stations would be atypical. The Broadway station area while being outside the downtown area and having residential land usages around it is also very commercial and retail oriented. The Main Street station area while located inside the downtown area is on the outskirts of the actual downtown and is primarily an industrially classed area as opposed to commercial or retail.

Before proceeding further into the explanation of the results of the LQC analysis of the different station groups, it should be explained that three of the downtown stations (Granville, Burrard and Waterfront) overlap in their 750 m radius. The overlap is only partial and is due to the fact that the stations are located closer than 750 m to one another. It should also be explained that the relatively short walking distance between these three stations and the fact that all three stations are located close to numerous and various population attractors such as movie theatres, restaurants, shopping, historical districts and tourist sites, hospitals, might contribute to a multiplier effect on the calls for service. Public transit is also a major population attractor and the influence of the three Skytrain stations as nodes of activity along with the aforementioned attractors must not be overlooked.

It should also be mentioned that the picture of the crime patterns around the Joyce station will only be partial. This Skytrain station is located close to the boundary between the two cities of Vancouver and Burnaby. As such, not all of the crime data for the 750 m radius around the Joyce Street station is included in this analysis, since the municipality of Burnaby is policed by a different force than is Vancouver. At the time of this analysis, the police data from Burnaby were not available.

Analysis of Two Groups - Residential versus Commercial

This initial analysis of the Location Quotients of Crime was performed on a call for service basis.

AUDIBL - audible alarm : The residential group has with LQC values below .78; the commercial group has LQC values below .86; the commercial values were mostly in .5 range, however. There does not appear to be a pattern here, except that all Skytrain areas are associated with a lower incidence of audible alarm calls than the city of Vancouver as a whole.

TFAUTO-theft from auto : All of the stations, except Nanaimo, Joyce and Broadway have LQC values above 1. The residential group varies between .8 to 1.02 which is very similar to the city wide pattern however, the commercial group had LQC values ranging from 1.35 to 2.33. It would seem that the downtown station areas have a much higher incidence of theft from auto than what could be expected for the City of Vancouver.

BNE- break and enter : There is a strong pattern in calls related to this crime as well. The residential grouped station areas have LQC's ranging from 1.20 to 2.07. These are areas that are high in break and enter. (Broadway is the lowest). The commercial station areas (downtown) are associated with the opposite pattern. LQC values for break and enters ranged from .55 to .72. (Main is the highest).

THEFT- theft : Except for the two end stations, Joyce and Waterfront, the LQC values increase as one proceeds from east to west. The values proceed from .51 to 1.8. There is an obvious pattern here: the areas in the residential section representing a lower than normal picture, while the commercial areas represent a higher than normal picture for theft. This appears to be a reflection of the volume of opportunity that exists in the different environments in which the stations are located.

ANNOY- annoying person : Except for Broadway (1.16), the residentially grouped stations all have LQC's lower than 1. All of the commercial areas have values higher than 1, although, the value for Stadium is only 1.06, that does not represent much of a higher than normal number. The highest LQC is at Waterfront 1.45 and Main is next at 1.44. The commercial group does represent a higher than normal expectation for persons annoying person calls.

NOISE- noise : Interestingly enough, the only station area that had an LQC higher than 1 by any appreciable amount for noise complaints was 29th Avenue (1.17). The next highest LQC was Broadway with 1.07. All of the downtown station areas had low LQC's ranging from .43 (Waterfront) to .79 (Burrard). For

the downtown stations, perhaps the higher LCQ at Burrard is due to a higher residential population included in the 750 m radius than other station areas in the group. Probably, the low LQC's in the commercial group are due to a low residential population. There are also few single family residences in the downtown area, most are high density living zonings. These are comprised mostly of a younger population that may be more tolerant to noise.

SUSCIR- suspicious circumstance : All of the residentially grouped station areas have LQC's higher than 1. The values range from 1.36 at Joyce to 1.16 at Broadway. All of the commercially grouped station areas have LQC's lower than 1. The values ranged from .70 at Main to .68 at Waterfront. There is a consistent trend of decreasing values of suspicious circumstance LQCs as the station areas progress from east to west.

SUSPER- suspicious person : These LQC's follow much the same pattern as the pattern of suspicious circumstance calls did. The numbers, on the whole, decrease from east to west, except for a slight variation in the residential grouping. The values of the LQC's range from 1.45 at Nanaimo to 1.29 for Joyce for the residential grouping and for the commercial grouping, the LQC range from .73 for Stadium area to .89 for Granville.

MSCHF- mischief : There is no real trend to the LQC's for this type of call. The numbers vary from .96 for Joyce to 1.37 for Nanaimo. Station areas with LQC's close to 1 were: Broadway, 1.04, Main with .99, Stadium with 1.03 and Waterfront with 1.09. It would seem that except for Nanaimo, Granville and Burrard areas, the amount of mischief in the areas is pretty normal. At these three

stations, the amount of mischief is slightly higher than normal for the city of Vancouver.

DIST- disturbance : None of the LQC's really vary very far from 1.00. The largest variation occurred at Broadway, that has an LQC of 1.18.

FIGHT- fight: For the residential group of station areas, the LQC's range from .42 for Nanaimo to 1.16 for Broadway. Although Broadway is slightly higher than 1.00 it would seem that these station areas do not for the most part represent higher than normal fight areas. In fact, they would seem to represent lower than normal LQC's. For the commercial areas, Main Street has the lowest LQC with .92 and Stadium has the highest with 1.73. Each of the true downtown station areas has higher than normal LQC's for fights.

ROBBRY- robbery : It was possible to calculate robbery LQC's for all of the stations except Nanaimo. There is not a high enough number of calls for service to calculate a meaningful number for the LQC at Nanaimo. All of the other station areas with the exception of 29th Avenue, show a high LQC for robbery. The values range from 1.24 at Main to 2.19 at Broadway. One explanation for the low volume of robberies at 29th Avenue might be that the area is heavily residential with extremely few commercial establishments. It would seem that robbery is highly over represented with regards to the areas around the Skytrain stations. This finding is supported by Block's (1995) study in Chicago on the Elevated train.

DRUGAR- drug arrests : Although the actual number of calls for service of this type are relatively low in Vancouver, some interesting results appear when

examining the areas around the Skytrain stations. It is not possible to calculate LQCs for Joyce and 29th Avenue areas since there were too few calls for service. Except for the Broadway and Main Street areas with values of .61 and .51 respectively, the LQC for the other station areas range from 1.89 to 2.92. This shows a very high over representation of drug arrests for all of the commercial downtown station areas except for Main Street.

SCREAM- screams heard : This is a low incidence call and as such, LQC's could not be calculated for three stations: Main, Joyce and 29th Avenue. All of the station areas, except for Nanaimo, had LQC's lower than 1.00. Nanaimo had a LQC of 2.26.

STAUTO- stolen auto : The pattern for this offence is clear. The LQC's for this offence decrease as one proceeds from east to west, from the suburbs to the city's business core. The values range from 1.72 at 29th Avenue area to .52 at Waterfront. There could be many hypotheses for this pattern. Perhaps there are more automobiles in the residential areas at times when offenders are looking to steal them. Perhaps, as the Skytrain closes for the night, stranded potential offenders walk from downtown or take the bus to the residential areas to steal a car to complete their journey home. The values for the residentially classed station areas range from 1.15 for Broadway to 1.72 for 29th Avenue area. The LQC's for the commercially classed/downtown station areas range from .52 for Waterfront to .85 for Main.

ASLT- assault : Except for three of the stations, there is an over representation of assaults within the station areas. Only Nanaimo (.96), Main (.80), and Burrard (1.04), do not represent higher than normal pictures for this call

for service. The other station areas have a higher than normal LQC, with values ranging from 1.12 at Granville to 1.54 at 29th Avenue. Interestingly enough, the three highest LQC's are in residentially classed station areas Joyce (1.40), 29th (1.54), and Broadway (1.39).

SEIZED- seized property : Five of the nine stations represent close to normal or low LQC's for this type of call. All of the residential station areas except for Nanaimo have lower than normal LQC's for seized property. Nanaimo's LQC is 1.61, representing a significantly higher than normal LQC. All of the commercial/downtown station areas have higher than normal LQC's except for Burrard. The highest LQC is at Stadium with a ratio of 2.65.

IMP- impaired driving : All of the station areas except for one, have lower than normal LQC's for impaired driving with values ranging from .35 at Broadway to .89 at Stadium. Main Street station area represents a much higher LQC with a value of 2.27. This finding might provide support for the notion that those who are seeking entertainment in the form of a bar or nightclub within a 750 m radius of each Skytrain station use public transportation for their travel.

BREACH- breach of probation : There is no real pattern to this call across the station areas. Values of LQC range from .37 to 2.14. With regards to the residentially classed station areas, the values range from .47 for Joyce to 2.14 for 29th Avenue. Nanaimo also has a high LQC with a value of 1.96. The LQC for the commercial/downtown station areas have values ranging from .37 for Main to 2.05 for Stadium station area. A possible relationship with this call for service could be the presence of residential hotels within the station areas.

MENTAL- mental case : Analysis for the LQC for this call could not be performed at the 29th Avenue area due to insufficient numbers. Of the remaining eight areas, all except for two (Nanaimo and Main) had higher than normal LQC's. The Joyce Street station area has the highest LQC with a value of 1.82, the second highest is Broadway with a LQC of 1.53 and the third highest is Burrard with a LQC of 1.43.

WARANT- warrant : For the most part, the residentially grouped station areas have LQC's lower than 1.00 for this call for service. The exception to this is Broadway station area with a LQC of 1.34. Two of the commercial/downtown stations have higher than normal LQC's for this call with the highest value located at the Stadium station area. Both Main Street area and Burrard Street station area had LQC's lower than 1.00.

WAGON- wagon call : There is a trend for the LQC's for this call for service. The residentially grouped station areas all have LQC's of less than 1.00. The values rise consistently from east to west with a LQC of .53 at Joyce to .94 for Broadway. Except for Burrard, that has an LQC of .93 for this call, all of the downtown station areas have higher than normal LQC's. The values range from only slightly higher than normal at 1.08 for Granville to much higher than normal for 2.32 at the Stadium area.

KNIFE- person with a knife : Three of the stations, all in the residential group (Joyce, 29th Avenue and Nanaimo) did not have high enough numbers of this call for accurate analysis. Of the remaining station areas, five have higher than normal LQC's for this call. The values range from: 1.19 at Main station area to 1.95 at the Stadium station area.

STAB- stabbing : Five of the nine stations have numbers of this offence too low to be accurately assessed. Of the remaining four stations, only the Waterfront and Stadium station areas have higher than normal LQC's for this crime. These two LQC's are much higher than 1.00, 3.41 for the Stadium area and 2.40 for the Waterfront area.

HARASS- harassment : As one proceeds from east to west through the station areas, the LQC for this type of call decreases. The values of the LQC range from 2.07 to .25. It is the residential grouped station areas that have the highest LQC's for this call. Nanaimo has the highest LQC for this group (2.07) and the lowest LQC for this group can be attributed to the Joyce station area (1.02). For the commercial/downtown grouped station areas, the LQC for this call ranged from .25 at the Main Street station area to .96 at the Burrard Street station area.

PROWL- prowler : This is a low incidence call for service in Vancouver and as such, five of the nine stations do not have a high enough number of reported incidents for accurate analysis. Of the remaining four stations, it was the two primarily residential areas that have high LQC's for this call. Joyce reports a LQC of 1.68 and Broadway had a LQC of 1.65. Both of the commercial/downtown station areas, Granville and Burrard, have LQC's of less than 0.20.

ARREST- arrest : Only two of the stations report higher than normal LQC's for this police call. The Nanaimo station area has a LQC of 1.34 and

Broadway station area has a LQC of 1.41. The rest of the stations' area LQC values ranged from .60 at 29th Avenue to .99 at the Stadium station area.

The LQC - A Real Effect?

To determine whether or not there is a real effect of higher calls for service in the station areas, it was decided that a broader base of categories that encompassed a range of LQC values would be of use. A scale of five categories comprising of : very low, low, normal, high and very high, was constructed based upon the relative values of the LQC's. The numerical divisions were as follows:

- very low: 0-0.2
- low: 0.21-0.8
- normal: 0.81-1.2
- high: 1.21-1.8
- very high: 1.81 +

To determine the relative size of the location quotient of crime on a station area basis a score was assigned using the above scale. A value located within the range of very low receives a score of -2, a value within the low range receives a score of -1, a value within the normal range receives a score of 0, a value within the high range receives a score of +1, a value within the very high range receives a score of +2.

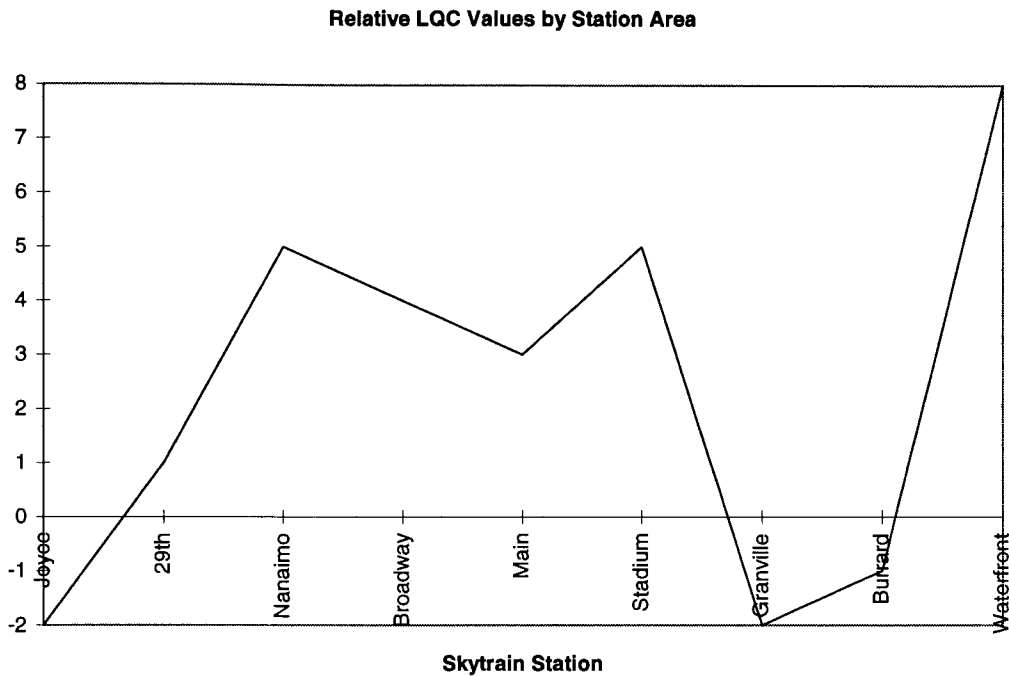


Figure 1: Relative values for each station area

Location quotients of crime were not calculated for a call for service within a station area if there were less than five cases during the four month study period. As a result, seven of the calls for service did not have LQCs for every station area. Robbery, Drug Arrests, Screams Heard, Mental Cases, Persons with a Knife, Stabbing calls and Prowler calls did not receive an LQC value for each of the nine station areas. These seven calls were, therefore, not included in the above calculations of a relative value for each station area.

The objective of the scores is to determine the relative difference of the LQC values associated with each station area. It apparent that the Waterfront station area has a larger number of high LQC scores relative to the other station areas. Nanaimo, Broadway and Stadium station areas also have larger numbers of high LQC values.

The 27 categories of calls for service were assigned scores depending upon how they rated with regards to how many stations at which they scored a high or very high location quotient. Some of the calls for service had high or very high LQC's in the residential station areas, and other calls for service were more predominant in the commercial/downtown station areas. Note that there are three types of calls that have high location quotients for both types of station areas. The breakdown is as follows:

Residential

- break and enter
- suspicious circumstances
- suspicious persons
- screams
- stolen autos
- breach of probation
- harassment
- prowler

Commercial

- theft from auto
- theft
- annoyance
- mischief
- fight
- drug arrest
- seized property
- impaired driving
- warrant
- wagon call
- person with a knife
- stabbing

Both

- robbery
- assault
- mental case

There were four calls for service that had been selected for analysis that did not rate a high location quotient for either type of station area: audible alarms, noise calls, disturbances and arrests.

A brief glance at the two groups of crimes per residential and commercial initially shows a picture of less personal contact, more removed type of crime around the residential station areas, while around the commercial / downtown station areas, the types of crimes that have high LQC's are more personal.

Possible Inter-Relationships

An effort was made to determine possible interrelationships between some of the variables included in the study. This was performed in a visual fashion by studying the patterns and overlaps of the crimes once they were mapped onto a map of Vancouver. This analysis was performed for three groups of two variables: assault and stabbings, stolen autos and theft from autos and annoyance and disturbance calls. These pairings were picked because these types of crimes may be linked easily in the types of opportunities that they present to a motivated offender where guardianship is low, opportunity is high and suitable targets are numerous. (Brantingham and Brantingham, 1978; Cornish and Clarke, 1986; Felson, 1986; Felson and Cohen, 1980; Mayhew, 1991; Roncek and Maier, 1991)

Based upon a visual inspection, it is clear that stabbings occur at the same locations as assaults. One possible explanation for this observation may be that

both of these calls for service can be linked with the same types of environmental cues.

Because of the sheer number of theft from auto and stolen auto calls for service it is difficult to determine if there is a significant relationship on a visual basis alone. The patterns of these offences, however, are different. Significantly more theft from auto occurs across the city, although this call is concentrated in the downtown area. The pattern for stolen autos is not spread across the city, but is concentrated in the downtown areas.

There did not seem to be an overall relationship between annoyance and disturbance calls for service. There was a definite correlation along major roadways such as Kingsway and Broadway and possibly Commercial Drive (a large number of both of these call types was apparent in a straight line along the roadways).

Differing Radii - Clarifying the Picture

In order to clarify further the possible crime patterns around each of the stations, it was decided that an analysis of different radii around each of the Skytrain stations would be useful. Picked for differing radii analysis were the calls for service that had the highest LQC's in the two station area groups. For the residential station area group, therefore, the calls for service that were picked for the radii analysis were break and enters, suspicious persons, suspicious circumstances, stolen autos, breaches of probation and harassment. For the commercial station areas, theft from auto, theft, annoyance, mischief, fights, drug arrests, seized property, persons with a knife and stabbings were picked for analysis. The three calls that had high location quotients of crime for both types

of station areas: robbery, assault and mental cases, were analyzed with different radii for all 9 station areas.

The radii that were picked for analysis purposes were 50 m, 200 m, 400 m, 500 m, 600 m and 750 m. It was felt that these radii would allow not only an accurate picture to emerge with regards to the spatial patterning of offenses and calls for service around the Skytrain stations, but would also contribute to an explanation of how the presence of the transit station affected the crime patterns around it within a 750 m radius. It was also felt that this set of radii would help to pinpoint any 'peaks' or 'echoes' in the numbers of crimes occurring around the stations. Of interest was whether any buffer or crime free zones would become apparent, whether one radius would predominate with regards to the number of calls for service represented in its area, whether the patterns of calls or radii differed with regards to the different types of stations and whether the patterns differed with regards to the different types of calls for service. The analysis of the patterns of calls for service by radii is first performed using raw numbers, followed by an analysis of the patterns by rate of occurrence within each radius.

Analysis of differing radii around the Skytrain stations

The explanation here will be segmented into three sections: calls for service that had high location quotients for all of the station areas at the radius of 750 m, calls for service that had high location quotients for the residential type station areas at 750 m radius, and calls for service that had high location quotients at the commercial/downtown station areas at 750 m radius.

Patterns in Raw Numbers

For all stations

The three types of calls for service that will be included in this section are robbery, assault and mental cases.

Robbery

Joyce - At a radius of 50 m there were 0 robbery calls for service. At a radius of 750 m there were 14. The largest change in number of calls for service occurred at the 200 m radius level. The number jumped from 0 to 9. The next 200 m incurred only 2 more calls as did the 200 m after that (600 m radius). In the last 150 m there was only 1 more call for service for robbery. The raw numbers would therefore seem to point to a tapering off of calls for service for robbery around this station as the radius around it increases.

29th - At the 50 m radius level, this station area recorded 3 (60%) calls for service for robbery. This number seems a bit unusual and out of the normal patterns for the rest of the stations when the total number of robbery calls is taken into account. The number of calls at the 200 m radius is 4 here and only increases to its grand total of 5 at the 600 m level. Here, too, it would seem as if there is a tapering effect as the radius increases in size.

Nanaimo - There were only a total of three calls for service for robbery at this station area in the 750 m vicinity. This makes analysis of patterns difficult for this area. For the first 50 m there were 0 robbery calls. At 200 m there was 1 call for service and this number only increased to three at the 750 m level.

Broadway - A total of 32 calls for service for robbery occurred in the 750 m radius around this station. 7 (22%) of these calls were implemented for the 50 m radius around the station. The largest increase occurred in this area in the 100 m difference between the 400 m radius and the 600 m radius. 12 (38%) calls for service were recorded in this 100 m radius. The number of calls decreased in the last 150 m to 3 (9%) calls between 600 m radius and the 750 m radius.

Main - Of a total of 18 calls for the 750 m radius around this station, 5 (28%) occurred in the 50 m directly around the station. The largest increase in numbers of calls occurred in the 150 m radius between 600 m and 750 m radius. There were a total of 8 (44%) calls for service in this area.

Stadium - Of a total of 123 calls for robbery around this station in a 750 m radius, only 1 (0.8%) occurred in the first 50 m. The pattern of calls for service for robbery around stadium station becomes more intense with the distance traveled from the station. Although 40% of the calls for robbery occur between 400 m and 600 m away from the station, 46% occur between 600 m and 750 m away from the station. It would seem that the area around Stadium station is influenced by something else. One possible strong influence that could account

for this finding is the influence of a high crime area in Vancouver's Skid Road along E. Hastings Street.¹⁰

Granville - From a total of 80 calls for robbery within the 750 m radius of this station, only 6 (8%) occurred within the first 50 m of the station itself. 19% of the number of calls for service occurred within the first 200 m of the station, 36% of the calls for service occurred between the 200 m radius and the 400 m radius, 23% of the calls for service occurred between the 400 m and the 600 m radius and 23% also occurred between the 600 m and the 750 m radius. What must be remembered when looking at the numbers for the downtown stations is that each station area is influenced by the other due to the relatively short distances between the stations. (Less than 750 m). A decaying pattern of offences may not be apparent from each of the downtown stations for this reason.

Burrard - From a total of 71 calls of robbery in the 750 m radius around Burrard station, only 1 (1%) occurred in the first 50 m radius. Within the first 200 m around the station, 4% of the calls for service were requested. Between the 200 m and the 400 m radii, 27% of the total calls for service were requested. Between the 400 m and the 600 m radii 44% of the calls occurred. In the last 150 m around the station, in between the 600 m and the 750 m radii, 25% of the calls occurred.

Waterfront - Two (2%) of 88 calls for service within a 750 m radius around the station occurred in the first 50 m. In the first 200 m around the station only 6% of calls had occurred. In between the 200 m radius and the 400 m radius

¹⁰East Hastings Street is located in the northern most part of Vancouver. It falls within the 750 m radius of both Waterfront and Stadium stations (along their edges).

16% of the calls occurred. In between the 400 m and the 600 m radius 26% occurred and in the last 150 m between the 600 m and the 750 m radius, 52% of the calls for robbery occurred. An explanation for this high percentage of calls occurring in the last 150 m from the Skytrain station may be, as in the case of Stadium station, the influence of the high crime area of E. Hastings Street in Vancouver.

Assault

Joyce - A total of 39 assaults were recorded for the 750 m radius around the Skytrain station. Of these, none occurred within the first 50 m of the station itself. In the first 200 m around the station, 15% of the calls for service occurred. In between the 200 m and the 400 m radii, 15% also occurred. In between the next 200 m radii (400 m and 600 m), 26% of the assaults occurred. In the last 150 m between the 600 m radius and the 750 m radius, 44% of the assaults occurred.

29th - Thirty-six assaults occurred within the 750 m radius around this Skytrain station. Five of these occurred in the first 50 m. It was also only 5 (14%), that occurred within the first 200 m around the station. Between the 200 m radius and the 400 m radius 22% of the assaults occurred. Between the 400 m and the 600 m radius, another 22% occurred. In the last 150 m (between 600 m and 750 m radii) from the station, 42% of assaults occurred.

Nanaimo - A total of 22 assaults were recorded for the period of this study for the 750 m radius around this Skytrain station. Of these, 0 of them occurred within the first 50 m radius around the station itself. Within the first 200 m

radius around the station, only 1 assault is recorded. Between the 200 m radius and the 400 m radius, only 1 assault had been recorded as well. Between the 400 m and the 600 m radius, 36% of the calls for assaults occurred. In the last 150 m from the station, 55% of the calls occurred.

Broadway - Seventy-nine calls for assaults were recorded in the 750 m radius around this Skytrain station. Of them, 13% of the calls occurred within the first 50 m radius. Within the first 200 m radius, 23% occurred. In between the 200 m radius and the 400 m radius, 17% of the calls occurred. In between the 400 and the 600 m radii, 41% of the total calls for assaults took place. In the last 150 m (between the 600 m and the 750 m radii) a total of 19% of the assault calls happened.

Main - Within the 750 m radius around this station, 45 calls for assaults were recorded. 22% of these occurred within the first 50 m of the station. Within the first 200 m, 29% of the total calls for assaults occurred. In between the 200 m and the 400 m radii, only 4% of the calls were recorded. Between the 400 and the 600 m radii, 20% of the calls occurred. Between the 600 m and the 750 m radius around the station, 47% of the total calls were recorded.

Stadium - Three-hundred and twelve assaults were reported to police during the study period in a 750 m radius around this Skytrain station. None of these occurred within the first 50 m radius around the station. Only 1% of the assaults occurred within the first 200 m around the station. 14% of the assault calls were located within the 200 m vicinity between the 200 m and the 400 m radius. In between the 400 m and the 600 m radius 57% of the assault calls took

place. (32% took place between the 400 m and the 500 m radii.) Between the 600 m and the 750 m radii, 28% of the assault calls were recorded.

Granville - A total of 219 assaults were reported within a 750 m radius of this Skytrain station for the period of this study. Six assaults (3%) were recorded in the 50 m vicinity of the station itself. Within the first 200 m of the station, 14% of the assaults had taken place. In between the 200 m and the 400 m radii, 21% of the assaults took place. In between the 400 m and the 600 m radii, 32% of the assaults happened. In the last 150 m around the station, 34% of the total assaults were recorded. Once again, it is important not to lose sight of the overlap of crimes that occur between the downtown Skytrain stations, that are less than 750 m apart.

Burrard - One-hundred and seventy-four assaults were reported within the 750 m radius around this station. Of them, none occurred within the first 50 m around the station itself. Within the first 200 m radius of the station, only 6% occurred. Between the 200 m and the 400 m radii, 23% of the recorded assaults occurred. Between the 400 m and the 600 m radii, 41% of the assaults were reported. In the last 150 m around the station (between 600 m and 750 m), 29% of the assault calls were reported.

Waterfront - A total of 228 calls for assaults were reported for this station, within a 750 m radius. None of these occurred within a 50 m radius of the Skytrain station itself. Within the first 200 m of the station, 6% of the recorded assaults took place. In between the 200 m and the 400 m radius, 18% of the assault calls occurred. In between the 400 and the 600 m radii, 29% of the calls were reported. In between the 600 m and the 750 m radii, 47% of the assault calls

were recorded. The influence here of E. Hastings Street upon the latter number cannot be ignored.

Mental Cases

Joyce - For this station, a total of 17 cases were reported in the 750 m radius around the station. None of these were reported within the 50 m radius around the station itself. 24% of the cases were reported within the first 200 m radius around the station. Within the next 200 m, only 6% (1 case) was reported. In between the 400 m and the 600 m radius, 41% of the mental cases were reported. In between the 600 m and the 750 m radius, 29% of the cases were reported. The raw numbers would seem to point to, at this location, an 'echo' pattern occurring around the station.¹¹

29th - Only four mental cases were reported within the 750 m radius around this station. None of them occurred within the 50 m radius directly around the station. Three of them occurred within the next 150 m and the number remained stable until one more was reported within the last 150 m between the 600 m radius and the 750 m radius. No real distance-decay pattern would seem to prevail here.¹²

Nanaimo - Six cases were reported within the 750 m radius around this station. None of them occurred within the first 50 m around the station. Within the first 200 m, only 1 case was reported. In between the 200 m and the 400 m

¹¹ An 'echo' is found when subsequent peaks of a high number or rate of offences are found after the initial high peak of offences as the distance away from the point of interest increases.

¹² A distance-decay pattern is when as the distance away from the point of interest increases, the number or rate of calls for service decreases.

radii, one more case was reported. In between the 400 m and the 600 m radii two cases were reported and within the last 150 m, two more cases were reported.

Broadway - A total of 29 mental cases were reported to the police in the 750 m radius around this station. Six (21%) of them occurred in the first 50 m of the station. Within the first 200 m of the station, 28% of the cases occurred. In between the 200 m and the 400 m radii, 24% of the calls for service occurred. In between the 400 m and the 600 m radii, another 21% of the calls were recorded. Within the radius of 150 m between the 600 m and the 750 m radii, 28% of the calls were recorded. It would seem that there is a pretty steady percentage of calls regarding mental cases within the 750 m radius around the Broadway station. This station would seem to be the exception with regards to this type of call. All of the other stations had zero or, in the case of Granville, only 4% of the total calls for mental cases within the first 50 m of the station.

Main - Seventeen mental case calls were recorded for the 750 m radius around this station. None of them occurred within the first 50 m of the station itself. In the first 200 m of the station, 24% of the total calls occurred. In between the 200 m and the 400 m radius, 18% of the calls occurred. In the next 200 m radius (between 400 m and 600 m), 12% of the calls occurred. In between the 600 m and the 750 m radii, the largest percentage of mental case calls occurred, 47%.

Stadium - A total of 81 mental case calls were reported for the 750 m radius around this station. None of the calls occurred within the first 50 m. Within the first 200 m of the station, still no calls for mental cases were reported. In between the 200 m and the 400 m radii, 21% of the calls occurred. In between

the 400 m and the 600 m radii, 48% of the mental case calls took place. In the last 150 m radius from the station, the total percentage of mental case calls was 31%.

Granville - Of a total of 90 calls regarding mental cases in the 750 m radius around Granville station, 4% of them were recorded in the first 50 m. In the first 200 m around the station, 9% of the calls were recorded. In between the 200 m and the 400 m radii, 27% of the mental case calls occurred. Between the 400 m and the 600 m radii, 30% of the calls took place. In the last 150 m of the 750 m radius from the station, 34% of the mental case calls were reported.

Burrard - Eighty calls for mental cases were reported within a 750 m radius of the Burrard Street station during the time period of this study. None of these calls occurred within a 50 m radius of the station itself. Only 2 calls (3%) occurred within the first 200 m of the station. In between the 200 m and the 400 m radius, 33% of the mental case calls for this area were recorded. In between the 400 m and the 600 m radius, 43% of the mental case calls were reported. In the last 150 m radius around the station, 23% of the mental case calls occurred.

Waterfront - A total of 64 mental case calls were reported for the 750 m radius around this station. Of these, none were reported for the first 50 m around the station. Within the first 200 m of the station, only 5 (8%) occurred. In between the 200 m and the 400 m radii, 31% of the mental case calls were recorded. Within the 200 m between the 400 m radius and the 600 m radius, 25% of the calls occurred. In between the 600 m and the 750 m radius, 36% of the mental case calls were reported.

For Residential Stations (Joyce, 29th, Nanaimo and Broadway)

For this group of stations the types of crimes that will be analyzed with regards to a distance-decay pattern are break and enters, suspicious persons, suspicious circumstances, stolen automobiles, breaches of probation and harassment calls.

Break and Enter

Joyce - A total of 107 break and enters was reported within a 750 m radius of the station. Only one of these occurred within the first 50 m of the station. Within the first 200 m of the station, 10% of the calls for service were recorded. Within the radius between 200 m and 400 m, 17% of the crimes were recorded. Between the 400 m radius and the 600 m radius were 36% of the reported break and enters. Within the last 150 m radius of the Skytrain station were 37% of the reported calls for service for this crime. It must also be noted that there is a very slight overlap on the edges of the 750 m radius with the 29th Avenue station radius. Perhaps this could account for the higher percentage of break and enters occurring at the 750 m level.

29th - A total of 132 break and enters were reported for this area. No crimes of this type were reported for the 50 m radius around the station itself. Within the first 200 m of the station 8% of the calls for service were recorded. In between the 200 m and the 400 m radius were 24% of this type of call. Within the boundaries of the 400 m and the 600 m radii were found 26% of this type of call. In between the 600 m and the 750 m radii were located 42% of this type of call.

Nanaimo - One-hundred and thirty-nine break and enters were reported within the 750 m radius of this station. Of these, only 3 (2%) occurred within the first 50 m around the station itself. Within the first 200 m, 12% of the reported break and enters for this area were reported. In between the 200 m and the 400 m radius were 22% of the calls for service of this type. Within the boundaries of the 400 m and the 600 m radii were found 30% of the break and enter calls. Within the last 150 m of the 750 m radius was 37% of the calls for service.

Broadway - The 750 m radius around this station reported a total of 200 calls for service for break and enters. There were none reported for the first 50 m radius around the station. Within the first 200 m of the station, only 8 (4%) of the total calls for break and enters were recorded. The radius included within the 200 m in between the 200 m mark and the 400 m mark accounted for 20% of the calls of this type. In between the 400 m radius and the 600 m radius were 43% of the break and enter calls. The last 150 m accounted for 34% of the break and enter calls.

From the analysis of raw numbers of calls for service it would seem that except for the Broadway station (and even for that one except for the last 150 m), the percentage of break and enters steadily increases as one moves away from the station. The reasons for this in the present study may include the fact that there is a slight overlap in the last 100 m or so for these residential station areas and/or that a further radius of 1000m may show a decrease in the number of break and enters being committed with regards to the Skytrain station. The actual number of break and enters that are being committed in these areas within the first 50 m radius of the Skytrain stations is low.

Suspicious Circumstances

Joyce - There were a total of 80 calls for service of this type recorded within the 750 m radius of the Joyce Street Skytrain station. Only two of these were within the first 50 m of the station itself. The first 200 m radius around the station accounted for 9% of the total calls. In between the 200 m and the 400 m radii was 17% of these calls. Within the 400 m to 600 m radii was located 24% of these calls. 52% of the calls of this type were located within the last 150 m of the 750 m radius.

29th - A total of 63 calls of this type were reported for the 750 m radius around this station. Four (6%) were reported within the first 50 m of the station itself. The first 200 m around the station accounted for 11% of these calls. Within the 200 m to 400 m radii were located 19% of these calls for service. In between the 400 m and the 600 m radii were located 33% of the calls. The last 150 m of the 750 m radius around 29th Avenue station accounted for 37%.

Nanaimo - Seventy-five calls for suspicious circumstances were reported within the 750 m radius of this station. Only two of them occurred within the first 50 m radius of the station itself. The first 200 m radius around the station accounted for a total of 5% of these calls. In between the 200 m and the 400 m radii there were 16% of the total calls for suspicious circumstances. Within the boundaries of the 400 m to 600 m radii were located 28% of the calls of this type. In the last 150 m of the 750 m radius was found 51% of the suspicious circumstances calls.

Broadway - There was a total of 138 suspicious circumstances calls for service within a 750 m radius of this station. Only nine of them (7%) occurred within the first 50 m surrounding the station. 17% of these calls were reported within the first 200 m radius of the station. In between the 200 m radius and the 400 m radius was found 17%. In between the 400 m and the 600 m radius was found 38% of the calls of this type. In the last 150 m were recorded 28% of the suspicious circumstances calls for service.

Once again it may be the slight overlap of the first three stations with its neighbour that may account for the rise in the last radius of analysis (150 m). It is apparent with the Broadway station area, that has no overlap with any of the other stations in this analysis within a 750 m radius, that the percentage of suspicious circumstances calls decreased at the point furthest away from the station.

Suspicious Persons

Joyce -A total of 67 suspicious persons calls were recorded within a 750 m radius around this station. None of them occurred within a 50 m radius of the station. The first 200 m around the station accounted for 18% of the total calls of this type. In between the 200 m and the 400 m boundary was found 12% of the calls. Within the 400 m to 600 m radius was 27% of the calls. In the last 150 m of the 750 m radius around this station was found 43% of the suspicious person calls.

29th - A total of 60 suspicious person calls were recorded within the 750 m radius. There were 3 located within the 50 m radius directly around the station.

Within the first 200 m was found 8% of the calls of this type. 23% of the calls were accounted for within the 200 m to 400 m radius. In between the 400 m and the 600 m radii was recorded 28% of the suspicious person calls. The last 150 m of the analysis accounted for 40% of these calls.

Nanaimo - Sixty-two calls of suspicious persons were reported within a 750 m radius of this station. Only two of them were located within the first 50 m of the actual station. 11% of the calls of this type were located within the first 200 m of the station. In between the 200 m and the 400 m radii were found 27% of the suspicious person calls. In between the 400 m and the 600 m radii were located 21% of the calls. In the last 150 m of the 750 m radius were found 40% of the suspicious person calls.

Broadway - There were 144 suspicious person calls recorded within a 750 m radius around this Skytrain station. Ten (7%) of them were located within the first 50 m around the station itself. Within the first 200 m of the station were found 16% of the suspicious person calls for this area. In between the 200 m and the 400 m radii accounted for 20%. Within the boundaries of the 400 m and the 600 m radii were recorded 30% of the suspicious person calls. The last 150 m of analysis accounted for 34% of the suspicious person calls for the Broadway station area.

The numbers of this call steadily increase as the distance increases away from the Skytrain station. In the Broadway area, the amount of increase in the last 150 m is the smallest of the four residentially classed station areas.

Stolen Auto

Joyce - There were a total of 47 stolen auto calls recorded for the 750 m radius around Joyce station. Only 2 of these were found within the first 50 m radius. In the first 200 m of the station were 8 offences (17%). Within the next 200 m radius (between the 200 m and the 400 m radii), 11% of the total stolen auto calls were reported. Between the 400 m and the 600 m radii, 36% of the calls were recorded. In the last 150 m of the 750 m radius, 36% of the total calls were also reported.

29th - A total of 42 stolen autos were recorded within a 750 m radius of this Skytrain station. Only 1 of these was reported within the first 50 m of the station. In the first 200 m radius of the station, there were only 3 reported stolen autos (7%). In between the 200 m and the 400 m radii, 24% of this type of call was reported. In between the 400 m and the 600 m radii, 21% of the total stolen autos were reported. The last 150 m of the 750 m radius accounted for 48% of the calls.

Nanaimo - Thirty-six stolen autos were reported within a 750 m radius of this station during the study period. There was only 1 reported stolen auto within the first 50 m of the station itself. The first 200 m radius around the station accounted for 8% of the total calls of this type. In between the 200 m radius and the 400 m radius, 19% of the stolen auto calls were recorded. The next 200 m accounted for 36% of the stolen auto calls. In the last 150 m another 36% of the calls were reported.

Broadway - There was a total of 68 stolen autos reported in the 750 m radius around Broadway station. Two of these occurred within the first 50 m of the station itself. The first 200 m around the station accounted for 9% of the total stolen auto calls. In between the 200 m and the 400 m radii, 25% of the stolen auto calls were recorded. In between the 400 m and the 600 m radii, 37% of the stolen autos were reported. In the last 150 m of analysis, 29% of the stolen autos were reported.

The patterns of auto theft around the first three stations seems to follow a consistently increasing percentage, with perhaps a slight tapering off at 750 m. Broadway station seems to follow a slightly different pattern. The percentage of reported auto thefts seems to peak around the 500 m radius before tapering off.

Breach of probation

Joyce - There were only five reported breaches within a 750 m radius of the station during the study period. None of these were reported within the first 200 m of the station. Only 1 offence was reported in between the 200 m and the 400 m radii. Another 1 offence was reported in the next 200 m away from the station. In the last 150 m of the 750 m radius, 3 reported breaches were reported.

29th - A total of 19 reported breaches occurred within the 750 m radius of the Skytrain station. One (5%) of these occurred within the first 50 m of the station. One more, for a total of two (10%), were recorded in the first 200 m radius. In between the 200 m and the 400 m radius, accounted for only 5% of the

breach calls. 47% of the breaches of probation were recorded within the 400 m to 600 m radius. The last 150 m accounted for 37% of the calls.

Nanaimo - There were 17 reported breaches of probation around this station. None of them occurred within the first 50 m of the station. Only 1 occurred in the first 200 m of the station. In between the 200 m and the 400 m radii, 35% of the breach calls happened. In between the 400 m and the 600 m radii, 12% of the calls took place. In the last 150 m of the 750 m radius, 47% of the recorded breach calls were recorded.

Broadway - There was a total of 28 reported breaches of probation within 750 m of the Broadway Skytrain station. Two of these took place within the first 50 m from the station itself. Within the first 200 m from the station, 11% of the calls were recorded. Within the 200 m radius to the 400 m radius 21% of the breach calls were accounted for. In the next 200 m from the station were recorded 36% of the calls of this type. In the last 150 m, 32% of the breach calls were recorded.

Two of the first three stations recorded growing percentages of this call up to the 750 m radius. Both 29th Avenue and Broadway station areas had a decreasing percentage of calls appearing by the 750 m radius.

Harassment

Joyce - A total of six reported harassment calls were recorded within a 750 m radius of this station. None of these calls occurred within the first 400 m

of the station. At 500 m, there were three calls reported (50%). In between 500 m and 600 m another 2 calls were reported (33%). In the last 150 m of the station, only 1 more call was reported (17%).

29th - A total of 7 harassment calls were reported in the 750 m radius around this station. None of these calls were reported within the first 200 m of the station. In between the 200 m and the 400 m radii, 29% of the calls were reported. In between the 400 m and the 600 m radii, 43% of the calls were reported. In the last 150 m of the 750 m radius, 29% of the harassment calls were recorded.

Nanaimo - A total of 10 harassment calls were reported for this station area. Only one of them was recorded within the first 50 m of the station itself. Within the first 200 m radius of the station, 20% of the total harassment calls were reported. Within the 200 m to 400 m radii, 10% of the harassment calls were reported. In between the 400 m and the 600 m radii, 50% of the calls were recorded. In the last 150 m of analysis, 20% of the calls took place.

Broadway - Fourteen calls for harassment were recorded within a 750 m radius of this station during the four month study period. None of them occurred within a 50 m radius of the station. The first 200 m radius of the station accounted for 7% of the total calls of this type. The next 200 m away from the station accounted for 21% of the calls. In between the 400 m radius and the 600 m radius were located 57% of the harassment calls. In the last 150 m of the analysis, 14% of the harassment calls occurred.

Each of the stations reported peak percentages of calls in between the 400 m and the 600 m radii. The percentages of calls for harassment declined at the 750 m radius level.

For Commercial Stations: Main, Stadium, Granville, Burrard, Waterfront

This group of stations is comprised of the Main Street, Stadium, Granville Street, Burrard Street, and Waterfront stations. The types of calls for service that will be analyzed with respect to their distance-decay patterns for this group include theft from auto, theft, annoyance, mischief, fight, drug arrest, seized property, person with a knife and stabbing calls.

Theft from Auto

Main - A total of 371 calls of this type were recorded within a 750 m radius of this station during the study period. Ten of these (3%) occurred within the first 50 m from the station. Within the first 200 m radius of the station, 18% of the calls of this type occurred. In between the 200 m and the 400 m radii, 17% of the theft from autos occurred. In between the 400 m and the 600 m radii, 24% of these calls were recorded. In the last 150 m of the 750 m radius, 42% of the theft from autos occurred.

Stadium - A total of 2140 theft from autos occurred within a 750 m radius around this station. Only 34 (2%) of them occurred within a 50 m radius of the

station. Within the first 200 m of the station, 4% of the thefts from autos occurred. In between the 200 m and the 400 m radii were reported 21% this call. In between the 400 m and the 600 m radii, 52% of this type of call occurred. The last 150 m of the 750 m radius accounted for 23% of the calls of this type.

Granville - A total of 2218 thefts from autos were reported in a 750 m radius of the Skytrain station. Only 2 of them (0.09%) occurred within the first 50 m of the station. In the first 200 m from the station were found 6% of the reported thefts from autos. In between the 200 m and the 400 m radii were 28% of the calls of this type. Within the next 200 m were reported 40%. In the last 150 m were recorded 26% of the theft of auto calls.

Burrard - 1785 thefts from auto were reported for this station area. None of them occurred within the first 50 m of the station itself. In the first 200 m from the station, 5% of the calls of this type were reported. In between the 200 m and the 400 m radii, 19% of the theft from auto calls. Within the 400 m to 600 m radius were reported 50% of the calls. In the last 150 m, 25% of the thefts from autos were reported.

Waterfront - A total of 1 759 thefts from autos were reported for this station area. Only 21 (1%) of them occurred within the first 50 m of the station. Within the first 200 m radius from the station itself was 13% of the calls of this type. In between the 200 m radius and the 400 m radius was recorded 23% of the calls. Within the 400 m to the 600 m radii was 33%. In the last 150 m of the 750 m radius from the station were found 31% of the total.

A consistent pattern for the theft from auto offence is a peak of the percentage of crimes occurring in between the 400 m and 600 m radii (except for the Main Street station area).

Theft

Main - A total of 138 thefts were reported for this station area during the study period. 12 of these (9%) occurred within the first 50 m of the station. 20% of the Thefts occurred within the first 200 m from the station. In between the 200 m and the 400 m radii were reported another 20% of the thefts. Within the 400 m to 600 m radii were recorded 36% of the crimes. In the last 150 m from the station were reported 24% of the thefts.

Stadium - 674 thefts were reported for the 750 m radius around the Skytrain station. Only 3 of these (0.4%) occurred within the first 50 m from the station. Within the first 200 m radius from the station occurred 4% of the thefts. In between the 200 m and the 400 m radii 23% of the thefts occurred. In between the 400 m to 600 m radii was where 44% of the crimes took place. 30% of the thefts were reported in the last 150 m of the 750 m radius.

Granville - A total of 843 thefts were recorded for this station area. 12 (1%) them took place within the first 50 m of the station. Within the first 200 m radius 12% of the thefts took place. In between the 200 m radius and the 400 m radius 31% of the thefts were reported. Within the 400 m to the 600 m radii was recorded 33%. The last 150 m accounted for 23% of the total thefts.

Burrard - A total of 754 thefts were reported for the 750 m radius around the Burrard Skytrain station. None of these occurred within a 50 m distance from the station. 11% of the calls were accounted for in the first 200 m from the station. Within the 200 m to 400 m radii were 30%. In between the 400 m to 600 m radii were 31% of the recorded theft calls for this area. In the last 150 m of the 750 m radius were 29% of the total calls of this type.

Waterfront - 705 reported thefts occurred within a 750 m radius of this station. Eight (1%) of these calls were recorded within the first 50 m from the station. Within the first 200 m around the station 8% of the theft calls took place. In between the 200 m radius and the 400 m radius accounted for 26% of the calls of this type. Within the 400 m to 600 m radius were recorded 27% of the theft calls. In the last 150 m were 39% of the theft calls.

For all of the stations except for Waterfront, the pattern of a peak of theft calls for service in between the 400 m to 600 m radius was apparent with a decline at the 750 m level. Perhaps the influence of the aforementioned East Hastings Street is the deciding factor in the still high percentage of thefts reported for the Waterfront station area at the 750 m radius level.

Annoying Person

Main -210 annoying person calls were received for the 750 m radius around the Main Street Skytrain station. Eight of these (4%) occurred within a 50 m radius of the station. 21% of the calls were accounted for in the first 200 m radius from the station. In between the 200 m and 400 m radii, 5% of the calls

were reported. Within the 400 m to 600 m radii, 27% of the annoyance calls were recorded. In the last 150 m from the station 47% of the calls of this type.

Stadium - A total of 601 annoyance calls were recorded for this station area. None of them were within the first 50 m of the station itself. Within the first 200 m from the station were 2% of the calls. In between the 200 m radius and the 400 m radius, 11% of the calls for annoyance were reported. Within the 400 m to 600 m radius was 60% of the calls of this type. In the last 150 m, 28% of the calls were reported.

Granville - 592 annoyance calls were recorded in the 750 m radius around this Skytrain station. Nine of them (2%) happened within the first 50 m from the station. Within the first 200 m from the station were 7% of the calls. In between the 200 m and the 400 m radii, 40% of the calls were recorded. In between the 400 m and the 600 m radii was where 28% of the calls took place. In the last 150 m of the 750 m radius, 25% of the calls were reported.

Burrard - The 750 m radius around Burrard station recorded 546 annoyance calls. None were received within the first 50 m of the station itself. In the first 200 m radius from the station, 6% of the annoyance calls were recorded. In between the 200 m and the 400 m radii, 35% of the calls of this type were reported. In between the 400 m and the 600 m radii, 35% of the calls were once again received. In the last 150 m of the 750 m radius around the station, 25% of the annoyance calls were received.

Waterfront - A total of 620 annoyance calls were received for this station area during the study period. Seven (1%) of these calls occurred within the first

50 m of the station. Within the first 200 m of the station, 6% of the annoyance calls were reported. In between the 200 m radius and the 400 m radius were reported 21%. Within the 400 m to 600 m radius were recorded 28% of the calls of this type. In the last 150 m of the analysis, 45% of the annoyance calls were reported.

While Stadium station, Burrard and Granville all reported peaks at either the 200 m-400 m radius or 400 m to 600 m radius, both Waterfront and Main Street had increasing percentages at the 750 m radius.

Mischief

Main - The Main Street station area recorded a total of 89 mischief calls during the study period. Four of these occurred within the first 50 m of the station (4%). Within the first 200 m of the station occurred 18% of this type of call. In between the 200 m and the 400 m radii, 16% of the mischief calls were recorded. Within the 400 m to 600 m radius was 31%. In the last 150 m, was 35% of the calls of this type.

Stadium - A total of 377 mischief calls were received for the 750 m radius around the stadium station. Of these, 5 (1%) occurred within 50 m of the station itself. The first 200 m accounted for 5% of the mischief calls. In between the 200 m and the 400 m radii, 20% of the calls of this type occurred. In between the 400 m and the 600 m radii, 44% of the mischief calls were recorded. In the last 150 m of the 750 m radius, 33% of the calls took place.

Granville - A total of 392 mischief calls were received for the Granville Street station area. Only two of these (0.5%) occurred in the 50 m radius directly around the station. Within the first 200 m radius of the station, 5% of the calls were recorded. In between the 200 m and the 400 m radii, 28% of the calls were accounted for. 41% of the calls were accounted for within the 400 m to 600 m radius. In the last 150 m of analysis were 26% of the calls.

Burrard - 325 mischief calls were received for the 750 m radius around this Skytrain station. None of them occurred within 50 m of the station itself. The first 200 m radius accounted for 7% of the calls. Within the 200 m radius and 400 m radius were 18% of the mischief calls. In between the 400 m radius and the 600 m radius were 54%. In the last 150 m of analysis occurred 22% of the mischief calls.

Waterfront - A total of 300 calls of mischief occurred within a 750 m radius around the Waterfront Skytrain station. Seven (2%) of these occurred within the first 50 m of the station. Within the first 200 m of the station 13% of the calls were reported. In between the 200 m radius and the 400 m radius were 27% of the calls. Within the 400 m to 600 m radius were 24% of the calls. In the last 150 m of the 750 m radius of analysis, 36% of the mischief calls occurred.

Once again, the three station areas of Stadium, Granville and Burrard all follow the same pattern of a peak of the percentage of crimes occurring at the 400 m to 600 m level, while both Main Street and Waterfront station areas both have still increasing percentages at the 750 m radius.

Fight

Main - Thirty-eight fight calls were received for this station area. Three of them (8%) occurred within the first 50 m of the station. Within the first 200 m of the station were 34% of the calls. In between the 200 m radius and the 400 m radius were 16% of the fight calls. Within the 400 m to 600 m radius were 37% of the calls. In the last 150 m of analysis 13% of the fight calls occurred.

Stadium - A total of 290 calls for fights occurred in the 750 m radius around this Skytrain station. None occurred within the first 50 m around the station itself. Only one fight call (0.3%) occurred within the first 200 m radius around the station. In between the 200 m and the 400 m radii were 12% of the calls of this type. In between the 400 m and the 600 m radii were 47% of the fight calls. In the last 150 m were 41% of the fight calls.

Granville - A total of 189 fight calls were recorded for the 750 m radius around the Granville station. Only one of these (0.5%) occurred in the first 50 m radius. 8% of the calls were accounted for within the first 200 m radius. In between the 200 m and the 400 m radii were 26% of the fight calls for this area. Within the 400 m to 600 m radius were included 37% of the fight calls. In the last 150 m of the station area were 29% of the calls of this type.

Burrard - A total of 166 fight calls were recorded for this station area during the study period. None of them took place within the first 50 m. Nine fights happened (5%) within the first 200 m radius around the station. In between the 200 m radius and the 400 m radius were 19% of the calls of this type. Within

the 400 m to 600 m radii were 43% of the fight calls for service. In the last 150 m of the 750 m radius around this station were 33% of the calls.

Waterfront - A total of 194 fight calls were reported in a 750 m radius around the Waterfront station. None of these occurred within the first 50 m from the station itself. Within the first 200 m of the station 7% of the fight calls were recorded. In between the 200 m radius and the 400 m radius were 16% of the calls of this type. 20% were accounted for within the 400 m to 600 m radius. In the last 150 m of analysis 57% of the calls were reported.

All of the station areas, with the exception of Waterfront, reported peak percentages of fight calls in either the 200 m to 400 m radius (Main Street) or the 400 m to 600 m radius (Stadium, Granville, Burrard). Waterfront still reported an increase in percentage of calls at the 750 m level.

Drug Arrests

Main - Only five calls of this type were reported within the 750 m radius around this Skytrain station. One of these was reported in the first 50 m of the station. This number remained constant until the 500 m mark, where it increased to 2 calls of this type. It was only at the 750 m mark, where the number of drug arrests associated with this station area rose to its total of 5.

Stadium - This station reported a total of 116 drug arrests within its 750 m radius. None of them were recorded in the first 50 m around the station itself.

Only 1 call of this type was recorded within the first 200 m (0.9%). In between the 200 m and the 400 m radius, were 4% of the total calls of this type. Within the 400 m to 600 m radius, 34% of the calls were reported. In the last 150 m of the station area analysis were 60% of the calls of this type.

Granville - A total of 64 drug arrests were reported for this station area. None were reported within the first 50 m radius around the station. Only two calls for service of this type were recorded for the 200 m around the station (12.5%). Within the 200 m to 400 m radii were 58% of this type of call. In between the 400 m radius and the 600 m radius were 16% of the drug arrest calls. The last 150 m of the 750 m radius accounted for 23% of these calls.

Burrard - A total of 59 calls for drug arrests occurred within the 750 m radius of this station. None of them occurred within a 50 m radius of the station. Within the first 200 m of the station, only 1 (2%) of the total calls occurred. In between the 200 m radius and the 400 m radius were 47% of this type of call. Within the 400 m to 600 m radius were 27%. In the last 150 m of analysis for this area were 24% of the drug arrest call for service.

Waterfront - A total of 65 calls of this type were recorded within the 750 m radius of the Skytrain station. None of them occurred within 200 m of the station itself. Only 1 call (2%) occurred within the 200 m to 400 m radius. In between the 400 m to 600 m radius were found 9% of this type of call. In the last 150 m of analysis for this area were 89% of the drug arrest call for service.

The numbers of crimes of this type at the Main Street area are very low, however, taken at face value, lead one to observe a picture of increasing

percentages of drug arrest calls for service as one moves away from the station itself. This is also the case for the Stadium and Waterfront station areas. Both Granville and Burrard experienced a percentage peak at the 200 m to 400 m radius level. The percentages of this type of call decreased steadily for Burrard station, while they peaked again for Granville at the 750 m level (although not as high as the previous peak).

Seized Property

Main - A total of 39 calls for service regarding seized property were recorded for the 750 m radius around this station. Only 1 of them took place within the first 50 m of the station. Within the first 200 m of the station, 10% of the calls of this type were recorded. In between the 200 m and the 400 m radii were 21% of these type of calls. Within the next 200 m away from the station were 46% of the seized property calls for this area. In the last 150 m of the 750 m radius were 23% of the seized calls.

Stadium - A total of 329 seized property calls were recorded in this station area. None of them occurred within the first 50 m of the station itself. Within the first 200 m of the station 2% of the calls occurred. In the next 200 m radius, 5% of the calls were recorded. In between the 400 m and the 600 m radii 34% of the calls were recorded. In the last 150 m of the 750 m radius around the station were 58% of this type of call for this area.

Granville - A total of 111 seized property calls were reported for this station area. Only one of them (1%) occurred within the first 200 m from the

station itself. Within the 200 m to 400 m radii were 32% of the seized property calls. In between the 400 m radius and the 600 m radius were 32% of the calls of this type. For the last 150 m of the analysis of this area were 35% of the calls.

Burrard - A total of 87 seized property calls were recorded for the 750 m radius around the Burrard Street Skytrain station. None of them occurred within the first 50 m of the station. 2% of the calls were accounted for in the first 200 m from the station. In between the 200 m and the 400 m radii were 28% of the seized property calls. In between the 400 m and the 600 m radii were 36% of the calls. 34% of the calls were accounted for in the last 150 m of the 750 m radius around the station.

Waterfront - 166 seized property calls were associated with this Skytrain station area. None of them occurred within the first 50 m of the station itself. Within the first 200 m of the station were 9% of the total calls of this type. In between the 200 m and the 400 m radii were 17%. 15% of the seized property calls were accounted for in the next 200 m. In the last 150 m of the 750 m radius around the station were 59% of the seized property calls.

Excepting the Main Street and Burrard Street station areas, it seems that as distance increases from the Skytrain station the percentage of seized property offences increases. Both Main Street and Burrard experience peaks at the 400 m-600 m radius level.

Person with a Knife

Main - A total of 9 knife wielding calls were reported for this station area for the study period. None of them occurred within 50 m of the station. Three calls of this type (33%) occurred within 200 m of the Skytrain station. In between the 200 m and 400 m radii was no change. (There were still only 33% of the calls accounted for at the 400 m level.) 44% of the calls were contained within the 400 m to 600 m radii. In the last 150 m were 22% of this type of call in this area.

Stadium - A total of 60 knife wielding calls were recorded for the 750 m around this Skytrain station. One of them (2%) occurred within a 50 m radius of the station itself. Within the first 200 m of the station there were 3% of the total calls of this type. In between the 200 m and the 400 m radii were 7% of the calls. 53% of the calls were accounted for in the radius between the 400 m and 600 m marks. In the last 150 m of the 750 m radius were 37% of the total knife wielding calls.

Granville - A total of 22 calls of this type were recorded for the Granville station area. One of them occurred within the first 50 m of the station itself (5%). Within the first 200 m of the station were 18% of the calls. Within the 200 m to 400 m radii were 23% of the calls. 27% of the calls were accounted for in the next 200 m radius. In the last 150 m of the 750 m radius were 32% of the calls of this type.

Burrard - Sixteen knife wielding calls were recorded in the 750 m area around the Burrard Street station. None of these occurred within 50 m of the

station. Two of these calls (13%) occurred within 200 m of the station. In between the 200 m and the 400 m radii were 19% of the total calls of this type. Within the 400 m to 600 m radii were 63%. In the last 150 m away from the station were 6% of the knife wielding calls.

Waterfront - A total of 35 calls of this type were recorded for the 750 m radius around this station. None of them occurred within 200 m of the station. In the 200 m to 400 m radii were 3% of the total calls of this type. In between the 400 m to 600 m radii were 37% of the calls. In the last 150 m of the 750 m radius of the station were 60% of the knife wielding calls for service.

For three of the stations, Main Street, Stadium and Burrard, the peak percentage for this type of call is at the 400 m to 600 m radius level. For the other two stations, the percentage of knife wielding calls increased steadily to the last 750 m radius measurement.

Stabbing

Main - A total of 4 stabbing calls were recorded for the Main Street Skytrain station area. One of the calls was reported for the first 400 m around the station itself. In between the 400 m and the 600 m level were 75% of the calls of this type for this area. There were no calls recorded for between the 600 m radius and the 750 m radius.

Stadium - 47 stabbing calls were received for the Stadium station area. None of them occurred within 200 m of the station itself. In between the 200 m and the 400 m level were 9% of the calls. 57% of the calls occurred between the 400 m and the 600 m level. In the last 150 m of the 750 m radius were 34% of the calls.

Granville - A total of 11 stabbing calls were recorded for the 750 m radius around the Granville Skytrain station. Within the first 50 m around the station were 9% of the calls. This number remained steady until 400 m away from the station. Between the 200 m and the 400 m radii were 18% of the stabbing calls for this area. In between the 400 m and the 600 m radii were 27% of the calls. In the last 150 m away from the station were 45% of the calls of this type.

Burrard - Eight stabbing calls were received for the Burrard Street area. None of them occurred within the first 200 m. Within the 200 m to 400 m radii were 38% of the calls of this type. In between the 400 m to 600 m radii were 25%. In the last 150 m of the 750 m radius around the station were 38% of the calls.

Waterfront - A total of 25 stabbing calls were received for the 750 m radius around the Waterfront station. Only one of them (4%) occurred within the first 50 m from the station itself. Within the first 200 m from the station were still only 4% of the total calls. In between the 200 m and the 400 m radii were 16% of the stabbing calls. 16% were also accounted for within the 400 m to 600 m radius. In the last 150 m away from the Skytrain station were 64% of the calls of this type.

For the first two stations, the peak percentage of stabbing calls for service was between 400 m and 600 m radius. The last three stations all experienced steadily increasing numbers of stabbing calls as the distance increased from the station itself.

Overall for the Commercial/Downtown Stations

Stadium, Granville and Burrard station areas showed a common pattern for many of the calls for service. Within each of these station areas, a higher number of calls was recorded at either the 400 m or 600 m radius. This was not always the case for the Main Street station and was almost never the case for the Waterfront station area. The influence of Hastings Street should not be ignored in this analysis as a possible explanation for the deviation of the Waterfront station from the pattern experienced by the other downtown stations. With regard to the Main Street station area one should not overlook the influence upon calls for service of the unusual mix of land zonings and usages, including family-level entertainment (Science World), a bus terminus, industry, fast food restaurants, park area and run-down hotels and recreational liquor establishments.

Patterns in Rates by Area

While the patterns of the calls for service have been analyzed with respect to the actual raw numbers per concentric ring around each station, this is not the

final stage of analysis for these data. While the previous analysis is informative at a basic level, it does not take into account the fact that as each radius increases in distance away from the station, so does the area encompassed within the radius. The rates have been calculated on the basis of crimes per hectare. This level of analysis and explanation is hoped to be more useful with regards to the understanding of the call for service patterns around the Skytrain stations.

Table 1: Area encompassed within each concentric radius

<i>Radius</i>	<i>50 m</i>	<i>200 m</i>	<i>400 m</i>	<i>500 m</i>	<i>600 m</i>	<i>750 m</i>
area (hectares)	7854	125664	502654	785398	1130972	1767144
areadif (hectares)	7854	117810	376991	282743	345575	636172
increase	50 m	150 m	200 m	100 m	100 m	150 m

-size of area per radius in hectares

The analysis by area will proceed in similar format to the previous level of analysis by raw numbers. The first section will include the three calls for service that were found to have high LQCs for all nine station areas. This will be followed by an analysis of the calls for service that had high LQCs for the residential station areas. Finally, an analysis of the calls for service that recorded high LQCs for the commercial station areas will be included. An explanation for overall possibly unique patterns of calls for service by Skytrain station follows.

All Station Areas: Robbery, Assault and Mental Cases

Robbery

Table 2: Rate of robbery calls for service per radius area

<i>Robbery</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	0	0.763944	0.053052	0.035368	0.028937	0.015719
29th	3.819722	0.084883	0	0	0.028937	0
Nanaimo	0	0.084883	0	0	0	0.031438
Broadway	8.912684	0.424414	0.132629	0.141471	0.231498	0.047157
Main	6.366203	0	0.026526	0.106103	0.028937	0.125752
Stadium	1.273241	0.254648	0.371362	0.884195	0.694495	0.880265
Granville	7.639444	0.763944	0.76925	0.31831	0.260436	0.282942
Burrard	1.273241	0.169765	0.503991	0.919563	0.144686	0.282942
Waterfront	2.546481	0.254648	0.371362	0.31831	0.405122	0.723075

Although the number of robberies that actually occurred in the first 50 m radius around the station appeared low, it can be observed from the data that for seven of the nine Skytrain stations the rate of robberies is highest within the first 50 m in the station area.

Nanaimo and Joyce Street are the two stations that do not have a high rate of robberies in the first 50 m radius. While the rate of robberies peaks within the 200 m radius for the Joyce station area, the rate for the Nanaimo station area remains consistently just above zero. This can be partially explained by the fact that these are both residential areas. The stations at these two locations are located in open and busy areas, where it might be difficult to committ a robbery and remain unseen by others. It is interesting to observe that for 29th Avenue

station area, another highly residential area, the rate of robbery is highest within the first 50 m from the station. This could be due to the fact that the station is located directly adjacent to a fairly large park area, where a person could be robbed without being seen by others.

The remaining six station areas, Broadway, Main, Stadium, Granville, Burrard and Waterfront, all have a much higher number of businesses and a higher volume of people within the first 50 m around the stations. The inverse relationship between the rate of reported robberies and the distance away from the station would seem to provide support for a distance-decay model of reported calls for robbery from a Skytrain station. These data provide support for the hypothesis that the presence of Skytrain stations influences the pattern of robberies in the nine study areas of the City of Vancouver.

Assault

Table 3: Rate of assault calls for service per radius area

<i>Assault</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	0	0.509296	0.159155	0.035368	0.260436	0.267223
29th	6.366203	0	0.212207	0.176839	0.086812	0.235785
Nanaimo	0	0.084883	0.026526	0.176839	0.086812	0.188628
Broadway	12.73241	0.679062	0.371362	0.530517	0.491934	0.235785
Main	12.73241	0.254648	0.053052	0.31831	0	0.330099
Stadium	0	0.254648	1.167137	3.501412	2.257108	1.383274
Granville	7.639444	2.037185	1.352818	1.096402	1.099617	1.178927
Burrard	0	0.93371	1.061034	1.273241	1.041742	0.80167
Waterfront	0	1.103475	1.08756	0.813459	1.273241	1.681935

While there is a definite single, overall pattern attributable within the station areas for robbery, it seems as if there are two distinct patterns for assault

calls. Four of the station areas (29th, Broadway, Main and Granville) record a peak assault rate within the first 50 m radius. These four stations experience a slight dip in the pattern of assault rate within the 400 m radius and thereafter remain steady.

The five remaining station areas all had the lowest rate of assault within the first 50 m radius of the Skytrain station, a slight increase in the rate within the 200 m radius and remained steady until the 750 m mark. The exception to this pattern was Stadium station that recorded a steady increase in the rate of assault calls for service until the 500 m radius and then showed a steady decrease until the 750 m limit.

As in the case of robbery, the patterns to these offences are probably linked to the types of land uses found located within the station areas. The influencing factors, however, are likely different in each station area. 29th, Broadway, Main and Granville station areas all had the highest rates of assault within the first 50 m of the Skytrain station. For 29th Avenue, one such influence may be the park adjacent to the station. The park provides a large, open area in the middle of a highly residential section of the City of Vancouver. This type of area is conducive to recreational activities of many types and for various age groups. In the residential station area surrounding 29th Avenue, there are no other large parks that may be able to function to this same extent. The park is located across the Street from houses, and is hidden from direct observation or surveillance due to the angle at that the houses face. There is also a narrow path that travels

through the park from the Skytrain station to the houses. This type of scenario fits the traditional routine activities description of an area that may provide opportunities to potential offenders with numerous potential targets or victims and low guardianship (Brantingham, Brantingham and Wong, 1990; Cohen and Felson, 1979; Cohen, Felson and Land, 1980; Felson and Cohen, 1980; Jackson, 1984; Massey, Krohn and Bonati, 1989).

For Broadway, Granville and Main, the pattern of a high rate of assaults within the first 50 m of the station might be attributed to the wide array of 'users' of these areas. (The areas adjacent to the stations were described in more detail in the previous chapter.) It can be easily foreseen that conflicts would arise between various types of people within these areas. Within the 50 m radius around these three stations there are also a large number of recreational liquor establishments. Directly adjacent to the Main Street station is a large park that provides access to the main international and national travel bus station. Broadway, Granville and Main Street stations are all also located at very busy intersections, for auto, bus and pedestrian traffic. Within the first 50 m of each of these stations is not much residential land use. The lack of residential land use could imply the existence of fewer capable or caring guardians, in array of suitable targets (retail shops, pedestrians and recreation establishments).

For Nanaimo, Joyce, Stadium, Burrard and Waterfront station areas, the pattern of assault calls for service was different from the pattern for the preceding four station areas. Each of these stations had low rates of assaults

within the first 50 m of the station with a steady rate until the 750 m limit. Stadium station is the exception to this with a peak rate of calls for service for assaults within the 500 m radius. Once again, there are possible environmental explanations for why this pattern exists, but the explanations are not the same for each station area.

Nanaimo and Joyce Street stations are located in primarily residential areas. While there are some commercial and small retail establishments located within the 750 m radius around each of the stations, these are dispersed and few in number. While there is some diversity in the type of 'users' of the areas adjacent to the Skytrain stations this diversity is not nearly so marked as in those surrounding the Broadway, Granville and Main Street stations. The largest groups present in the 50 m radius around the Nanaimo and Joyce Street stations are students going to and returning from school and business people going to and returning from work. While there is potential for conflict here, it is probably minimal and rather limited (not of a physical assault nature). While the LQC for each of these areas identified these station areas as having higher than 'normal' rates of assaults, this may be attributed to the areas themselves, that are generally more deteriorated and older residential sectors of the city (with some new high density building). It is probably the case of an agglomeration effect in these station areas that contributes to the higher than 'normal' (for the city of Vancouver) LQC's of assault. One of the major influencing factors contributing



to the agglomeration effect could be the presence of the Skytrain and the easier access it provides to the Nanaimo and Joyce station areas.

Burrard, Stadium and Waterfront station areas also have low rates of assault calls for service within 50 m of the Skytrain stations. Upon actual inspection of these station areas, it is noticeable how few possibly criminogenic entities, that could facilitate or provoke and assault, exist within the first 50 m of these stations. Burrard and Waterfront stations are directly surrounded by office buildings; Stadium station is located at a wide road intersection leading off a bridge. Most entertainment locales (the presence of which have been linked to higher rates of certain types of crimes; Roncek, Bell and Francik, 1981; Roncek and Maier, 1991; Roncek and Pravatiner, 1989) and retail shops are located farther than 50 m away from these stations. An interesting observation with regards to the Stadium station area is that the rate of assault calls peaks between the 400 m and the 500 m radii. It is this distance from the Skytrain station where two major sport stadiums and their large parking lots are located.

Mental Cases

Table 4: Rate of mental case calls for service per radius area

<i>Mental</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	0	0.339531	0.026526	0.106103	0.115749	0.078595
29th	0	0	0.079578	0	0	0.015719
Nanaimo	0	0.084883	0.026526	0.070736	0	0.031438
Broadway	7.639444	0.169765	0.185681	0.070736	0.115749	0.125752
Main	0	0.339531	0.079578	0.035368	0.028937	0.125752
Stadium	0	0	0.450939	0.63662	0.607683	0.392976
Granville	5.092962	0.339531	0.63662	0.459781	0.405122	0.48729
Burrard	0	0.169765	0.689672	0.353678	0.694495	0.282942
Waterfront	0	0.424414	0.530517	0.282942	0.231498	0.361537

Only two of these Skytrain station areas (Broadway and Granville) experience high rates of mental case calls for service within the first 50 m from the station. The commercial / downtown station areas experience consistently higher rates of this type of call throughout the 750 m radius than do the residentially classed station areas. A contributing factor to this may be a hospital with a psychiatric ward located on Burrard Street. As well, there are more homeless individuals and single room residences in the downtown area. There does not seem to be any overall pattern to the call for mental cases, except a consistently higher ratio of offences, as measured by the LQC.

A possible explanation for the higher rate of mental case calls for service within each of the station areas could be that for many individuals of limited resources, as may be the case for the mentally ill, the most accessible form of transportation is public transit. It could be that many of the mental case calls for service located within the 750 m radius around each of the stations can be attributed to mentally ill individuals using the Skytrain as a means of transportation and then becoming lost once exiting the station.

Both Broadway and Granville Skytrain stations are consistently plagued by a high number of individuals who loiter at the station entrance. A large number of these individuals are Street people either panhandling or selling. A problem at these stations is also the presence of passengers who, upon completing

their trip on the Skytrain wait around to sell their unexpired fare tickets to other passengers for a reduced rate. In an effort to combat the problem of this large number of loitering individuals, BC Transit has started to play classical music at a high volume at the Granville station.

Skytrain stations are an attracting land use to a variety of users and it is this characteristic that probably creates the link between the presence of a Skytrain station and the mental case call for service to the police.

Residential Station Areas

Break and Enter

Table 5: Rate of break and enter calls for service per radius area

<i>BNE</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	1.273241	0.848827	0.477465	0.848827	0.405122	0.628761
29th	0	0.93371	0.848827	0.707356	0.405122	0.864546
Nanaimo	3.819722	1.103475	0.795775	0.671988	0.665558	0.80167
Broadway	0	0.679062	1.034508	1.379344	1.331115	1.068893

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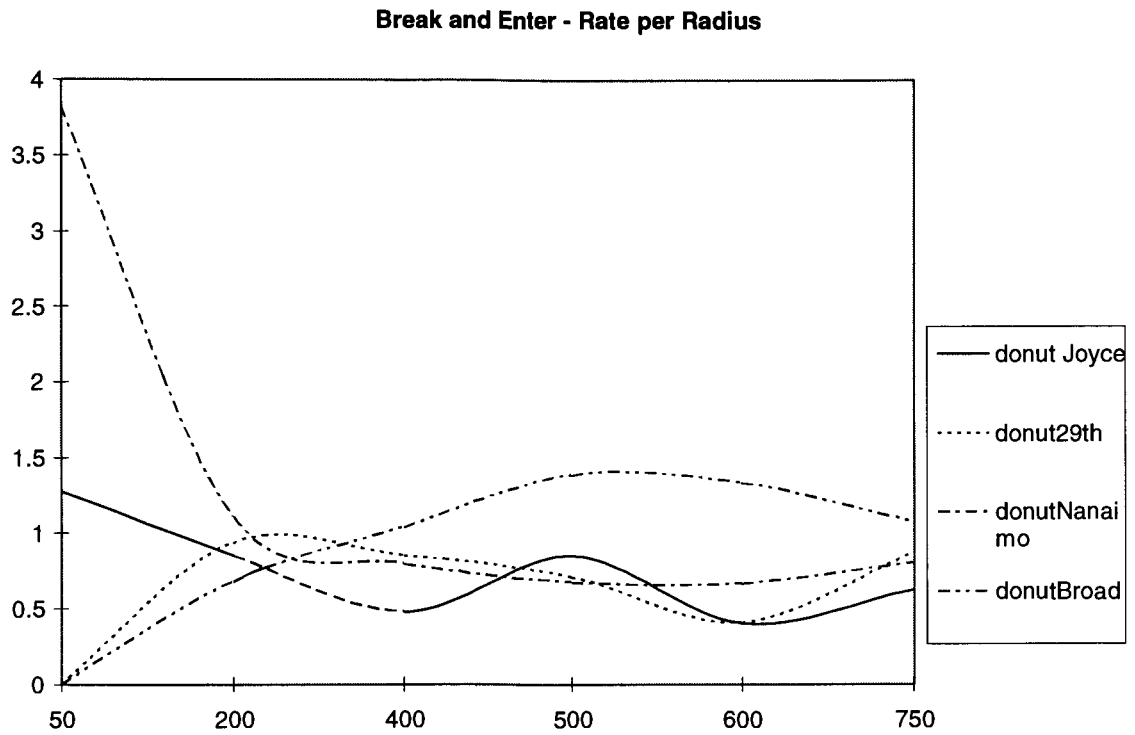


Figure 2: Break and Enter: Rate per Radius

Both Joyce and Nanaimo station areas experience their highest rates of break and enters within the first 50 m of the Skytrain stations. While this is not the case for 29th Avenue and Broadway station areas, it can be observed that all four residentially classed station areas experience similar rates of break and enters within the first 200 m of the station. At this point, each of the stations experiences a decline in the pattern of break and enters, except for the Broadway station area. Joyce, 29th and Nanaimo station areas all have similar rates of break and enters at the 500 m and 750 m radius. Nanaimo has a pretty consistent rate of break and enters after the 200 m radius while Joyce and 29th Avenue both peak again at the 750 m radius. It should be noted that all of the station areas

experience a consistent lowering of peak values of break and enters as the distance increases from the station, except for 29th Avenue and Nanaimo that have a slightly higher rate of break and enters at the 750 m radius than at the 500 m radius. Broadway station area records a highest rate of break and enters within the 600 m radius and declines thereafter. All of these observations can probably be explained through a closer examination of the areas around each of the Skytrain stations.

Both Nanaimo and Joyce station areas had a highest recorded rate of break and enter calls for service within the first 50 m of the station. Each of these stations are directly located within residential areas. Directly across the Street from both of these stations are houses. These houses could easily be noticed and accessed by a potential offender who may only be aware of these potential targets through his or her travels either to and from the Skytrain station from home or work, or by their actual travels on the Skytrain. The rate of break and enters for the Joyce Street station area peaks at the 500 m and the 750 m radius mark, but follows a distance-decay pattern with peaks that are successively lower in value. While the rate of break and enters remains fairly even within the Nanaimo station area, it becomes consistently lower until the 750 m radius. It is the author's belief that the slightly higher rate of break and enters for both the Nanaimo and 29th Avenue, station areas at the 750 m radius is due to the small overlap that exists in the 750 m radii used for the present analysis. This overlap results a small number of calls for service being counted twice in the analysis. It is felt that both,

the Nanaimo and the 29th Avenue station areas would also follow a clear distance-decay pattern of break and enters from the location of the Skytrain station if the overlap in radii did not occur.

The station area surrounding the 29th Avenue Skytrain station did not record a high rate of break and enters in the first 50 m radius, but did experience a high rate of break and enters in the next 150 m around the station. It is felt that this can be explained by the large park adjacent to the station. This park is more than 50 m in width and would account for why no break and enters were reported in this area. In a location with no buildings the opportunity to committ a break and enter is non existent. The park is, however, surrounded by housing, that would explain the sudden rise in break and enters as one travels from the Skytrain station.

The Broadway station area experiences its highest rate of break and enters at the 500 m radius level. After this point the rate of break and enters in this station area declines as one travels farther from the Skytrain station. Upon an examination of the area surrounding the Broadway Skytrain station, it can be observed that it is not really until this distance that a large proportion of residentially zoned area exists. Within the first 350 m of the Skytrain station are really only commercial and retail land usages, including a large grocery store and parking lot.

From the preceeding analysis, it would seem that the Skytrain can be validly linked to a higher rate of break and enters in the residential station areas.

The pattern of break and enters follows a distance-decay pattern from the Skytrain stations and show a clear relationship to the land uses in these station areas.

Suspicious Circumstances

Table 6: Rate of suspicious circumstances calls for service per radius area

<i>SUSCIR</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	2.546481	0.424414	0.344836	0.247575	0.347247	0.64448
29th	5.092962	0.254648	0.31831	0.353678	0.31831	0.361537
Nanaimo	2.546481	0.169765	0.31831	0.212207	0.434059	0.597323
Broadway	11.45917	1.188358	0.63662	0.742724	0.897056	0.613042

The data clearly show that a strong relationship exists between the police call for suspicious circumstances and the presence of the Skytrain station. Joyce, 29th Avenue and Nanaimo stations are each in residential areas, where there can be a number of capable guardians who can report such a call to the police. While at the Broadway station area, a primarily residential land use does not exist until a slightly farther location away from the station, store owners and managers adjacent to the station may be as equally willing as home owners or renters to report such an occurrence to the police. In this regard, the store owners and managers function as effectively in the surveillance of their community as do the home owners and renters.

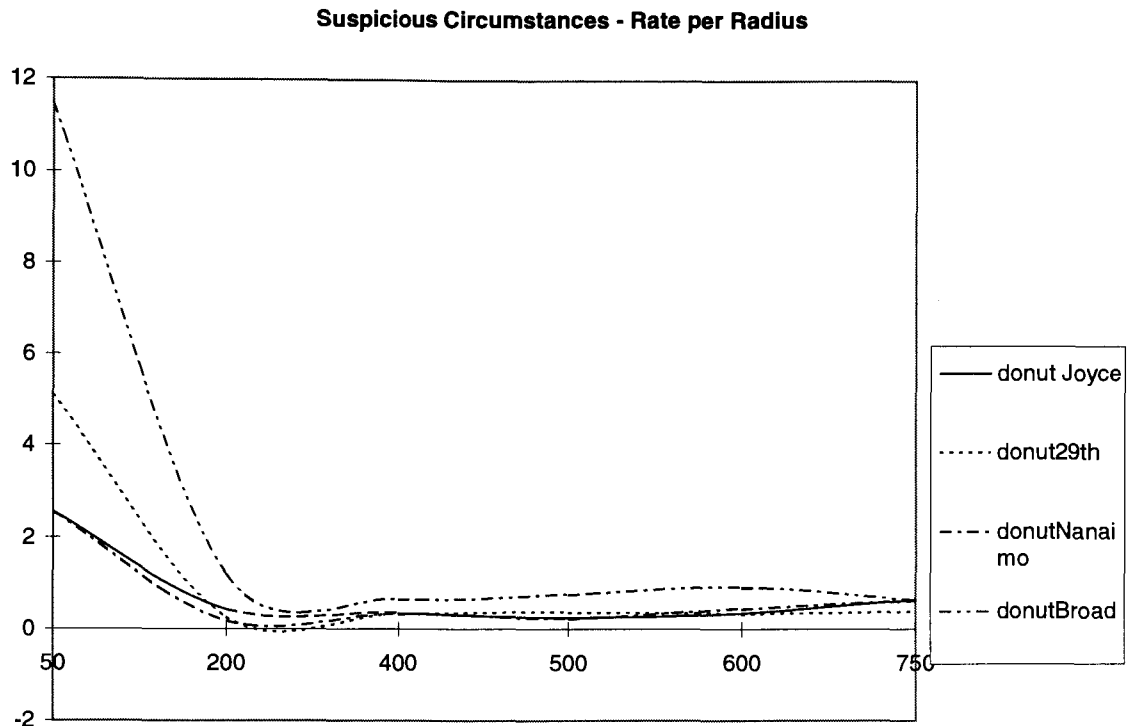


Figure 3: Suspicious Circumstance: Rate per Radius

The relationship between the call for service of suspicious circumstance and the location of the Skytrain station cannot, however, be limited to the guardianship of the individuals located close by the station. Skytrain stations are an attracting land use where a large number of individuals are drawn to and deposited at a limited number of destinations (Brantingham, Brantingham and Wong, 1991).

Suspicious Persons

Table 7: Rate of suspicious persons calls for service per radius area

<i>SUSPER</i>	50m	200m	400m	500m	600m	750m
Joyce	0	1.018592	0.212207	0.282942	0.289373	0.455852
29th	3.819722	0.169765	0.371362	0.212207	0.31831	0.377256
Nanaimo	2.546481	0.424414	0.450939	0.176839	0.231498	0.392976
Broadway	12.73241	1.103475	0.76925	0.707356	0.665558	0.770232

Suspicious Persons - Rate per Radius

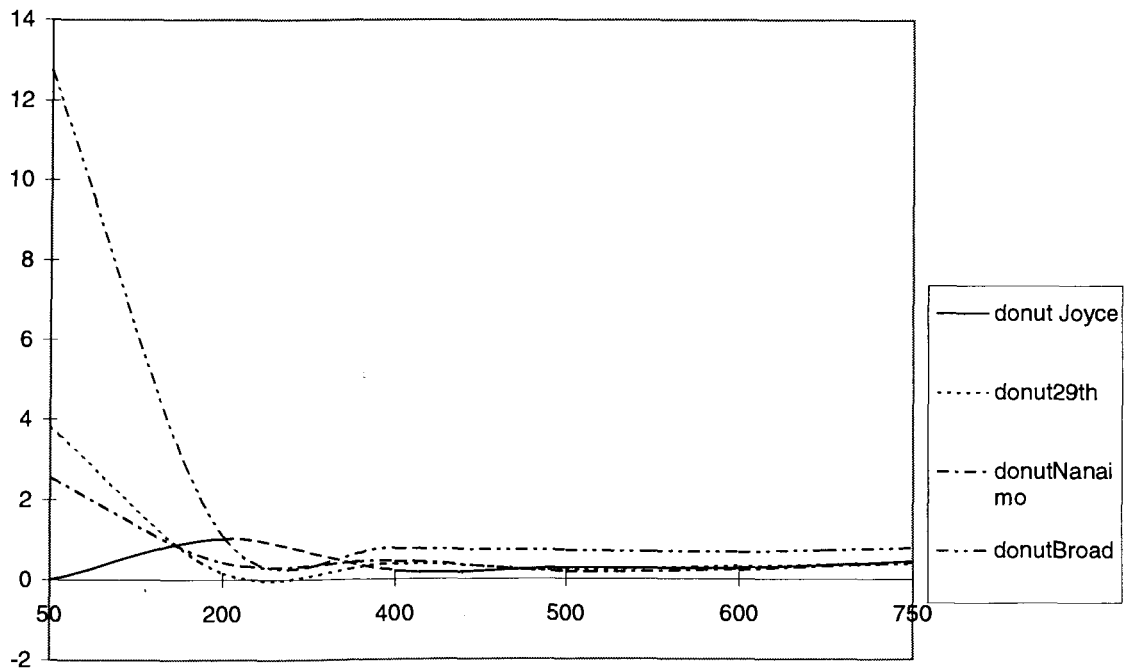


Figure 4: Suspicious Person: Rate per Radius

As with the calls to police of suspicious circumstances, there seems to be a clear relationship between with the call of suspicious persons and the presence of the Skytrain stations. All of the stations show a high rate of calls for service within the first 50 m of the Skytrain station, except for Joyce, that records a higher rate of suspicious person calls within the 200 m concentric ring. While it is not clear why Joyce station area differs from the other three residentially-classed station areas in this regard, it is clear that after the 200 m radius level each of the station areas show a consistently low rate of calls for suspicious persons.

The explanation for the relationship between the high rate of calls for service for both suspicious persons and suspicious circumstances with the location of the Skytrain station are probably quite similar. Both calls can probably be attributed to the attracting nature of a public transit land use.

Stolen Auto

Table 8: Rate of stolen auto calls for service per radius area

<i>STAUTO</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	2.546481	0.509296	0.132629	0.459781	0.115749	0.267223
29th	1.273241	0.169765	0.265258	0.106103	0.173624	0.31438
Nanaimo	1.273241	0.169765	0.185681	0.212207	0.202561	0.204347
Broadway	2.546481	0.339531	0.450939	0.495149	0.31831	0.31438

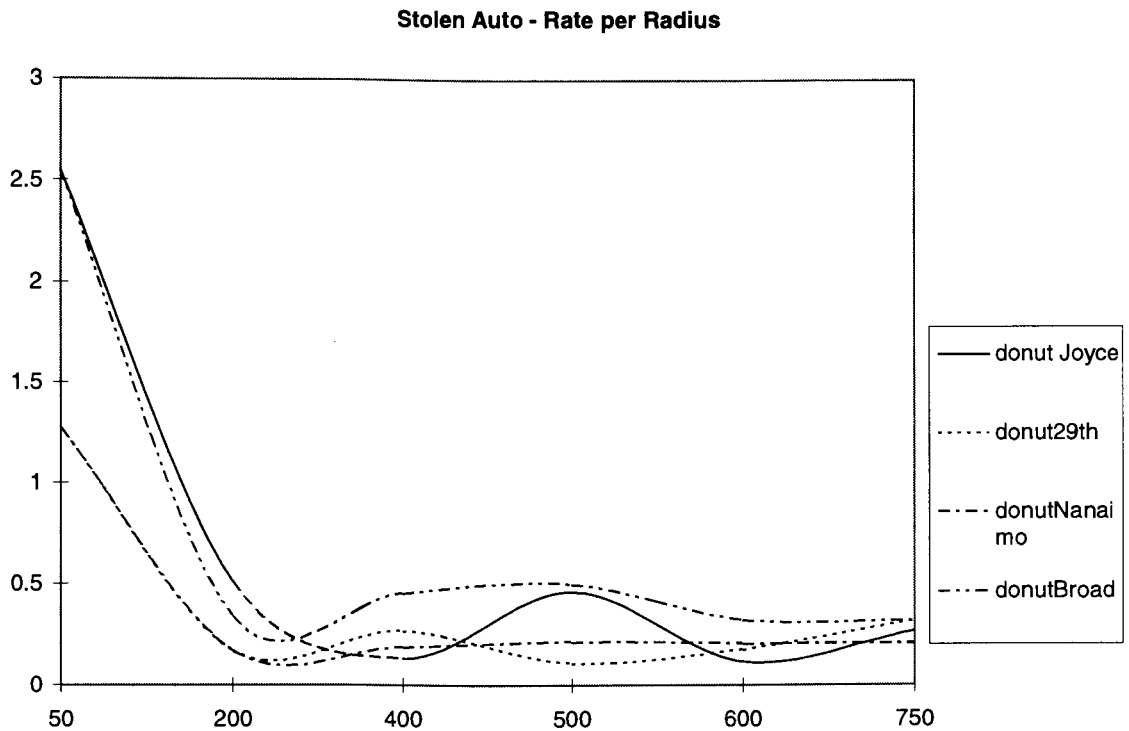


Figure 5: Stolen Auto: Rate per Radius

The calls for service for stolen vehicles show a clear pattern for each of the station areas. Each of the station areas report a high rate of stolen vehicles within the first 50 m radius of the respective Skytrain station. Smaller peaks of stolen vehicles are reported within the 400 m to 500 m concentric ring around the Broadway and Joyce Street station areas, while small peaks of stolen vehicles were reported within the 200 m to 400 m concentric ring around the 29th Avenue and Nanaimo Street stations.

Both Broadway and Nanaimo remained at a steady rate (slightly decreasing) of reported stolen vehicle rates after their respective second peak, while both 29th Avenue and Joyce Street station areas experienced a second,

smaller or equivalent peak of reported stolen vehicles within the 600 m to 750 m radius.

The pattern of offences for stolen vehicles seems to be directly related to the presence of the Skytrain station and follows a distance-decay pattern. Partial explanations for this offence pattern could be that Skytrain service stops circa 1:00am on Friday and Saturday nights, and for many, this may be too early to allow them a ride home on the Skytrain; or, since the Skytrain only runs along one line, many would have to complete their trip home on the bus after exiting the Skytrain. This may suggest that stolen vehicles provide a way home.

Breach of Probation

Table 9: Rate of breach of probation calls for service per radius area

<i>BREACH</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Joyce	0	0	0.026526	0	0.028937	0.047157
29th	1.273241	0.084883	0.026526	0.070736	0.202561	0.110033
Nanaimo	0	0.084883	0.159155	0.070736	0	0.125752
Broadway	2.546481	0.084883	0.159155	0.070736	0.231498	0.141471

Both 29th Avenue and Broadway station areas have high rates of breaches of probation calls for service within the first 50 m of the Skytrain station. Joyce station area does not register a high rate of this call for service. Nanaimo experiences a peak of breach of probation calls to police first within the 200 m to 400 m concentric ring and secondly, with a smaller peak, within the 600 m to 750 m radius. Each of these patterns follow a distance-decay and can probably be

explained through a closer analysis of the land usages that are located within each station area.

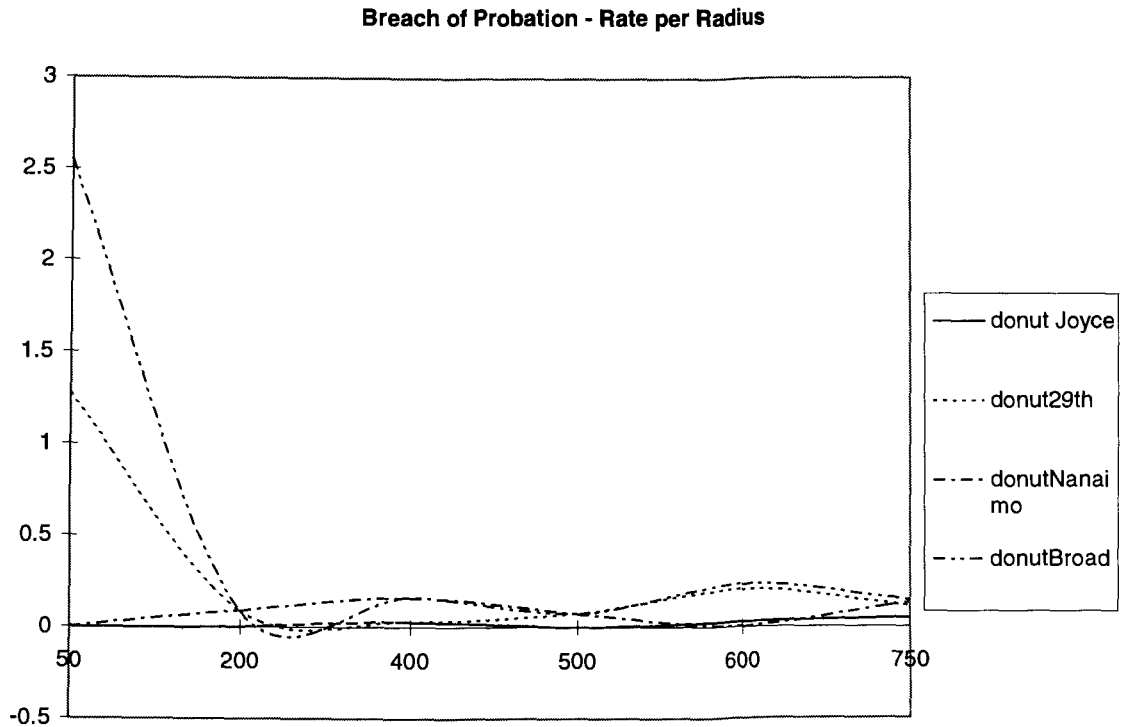


Figure 6: Breach of Probation: Rate per Radius

Of the four residentially-classed station areas, only Broadway and 29th offer any major land usages for entertainment purposes within the first 50 m of the Skytrain station. A large park is located adjacent to the 29th Avenue station while the Broadway station is literally surrounded by restaurants, liquor establishments and retail shops. These types of land uses could provide more opportunities for a breach of probation situation (as well as observation and report thereof) than might a mostly residential area. It is also these types of land use that draws

individuals from other areas. The land usages adjacent to the Skytrain stations at 29th Avenue and Broadway are probably attractive to various individuals from both close by. The park is large, has tennis courts and is the only park of its size in the vicinity. The commercial area around Broadway offers many entertainment and shopping choices to a large variety of individuals which are easily noticed by those who travel the Skytrain as well as those who exit the Skytrain at these stations. Both the commercial area surrounding Broadway as well as the park at 29th Avenue must be walked through after exiting the station in order to proceed if continuing, with the rest of one's trip.

Harassment

Table 10: Rate of harassment calls for service per radius area

<i>HARASS</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
donut Joyce	0	0	0	0.106103	0.057875	0.015719
donut 29th	0	0	0.053052	0.070736	0.028937	0.031438
donutNanaimo	1.273241	0.084883	0.026526	0	0.144686	0.031438
donutBroad	0	0.084883	0.079578	0.212207	0.057875	0.031438

While the Nanaimo station area recorded a high rate of harassment calls for service within the first 50 m radius, Joyce, 29th Avenue and Broadway did not. The latter three stations each reported a peak of harassment calls for service within the 400 m to 500 m radius and then experience a steady decline until the 750 m mark. Nanaimo experienced a smaller, secondary peak of harassment calls

for service within the 500 m to 600 m radius and also decreased sharply within the 600 m to 750 m radius.

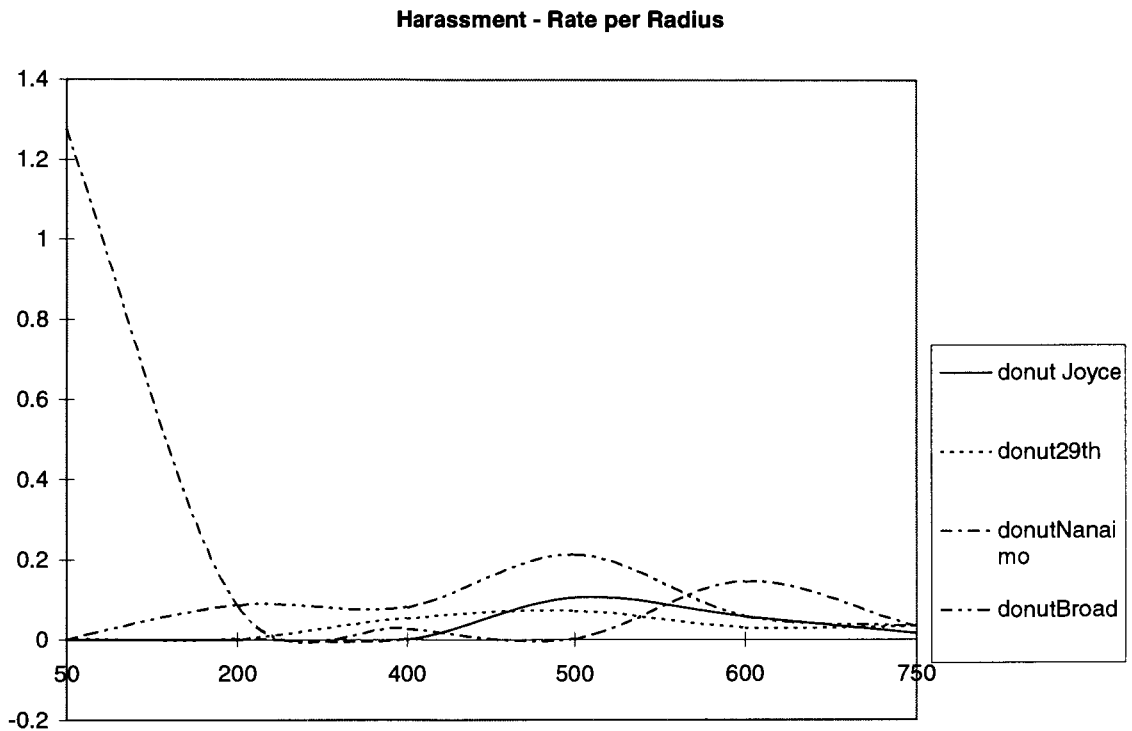


Figure 7: Harassment: Rate per Radius

Harassment seems to follow a distance-decay pattern from the Skytrain stations. While it is difficult to link this type of call for service to any single type of land use, except for perhaps a liquor establishment, it is interesting to notice that it still follows a distance-decay pattern from the Skytrain stations. It could be that where the peaks are located for this type of call are also the locations of recreational establishments within these residential areas. (Although for the Broadway station area, the 500 m peak is located within a primarily residential zoning. This finding may coincide with the fact that harassment calls are actually stalking incidents.)

Commercial / Downtown Station Areas

Theft from Auto

Table 11: Rate of theft from auto calls for service per radius area

<i>TFAUTO</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	12.73241	4.668549	1.644602	1.520815	1.331115	2.436448
Stadium	43.29018	4.668549	12.20189	20.08891	15.56826	7.623725
Granville	2.546481	11.03475	16.47255	11.4238	16.34957	9.069875
Burrard	0	8.063857	9.045314	12.30799	15.91551	7.089278
Waterfront	26.73805	17.31607	10.76949	8.629742	9.954427	8.488271

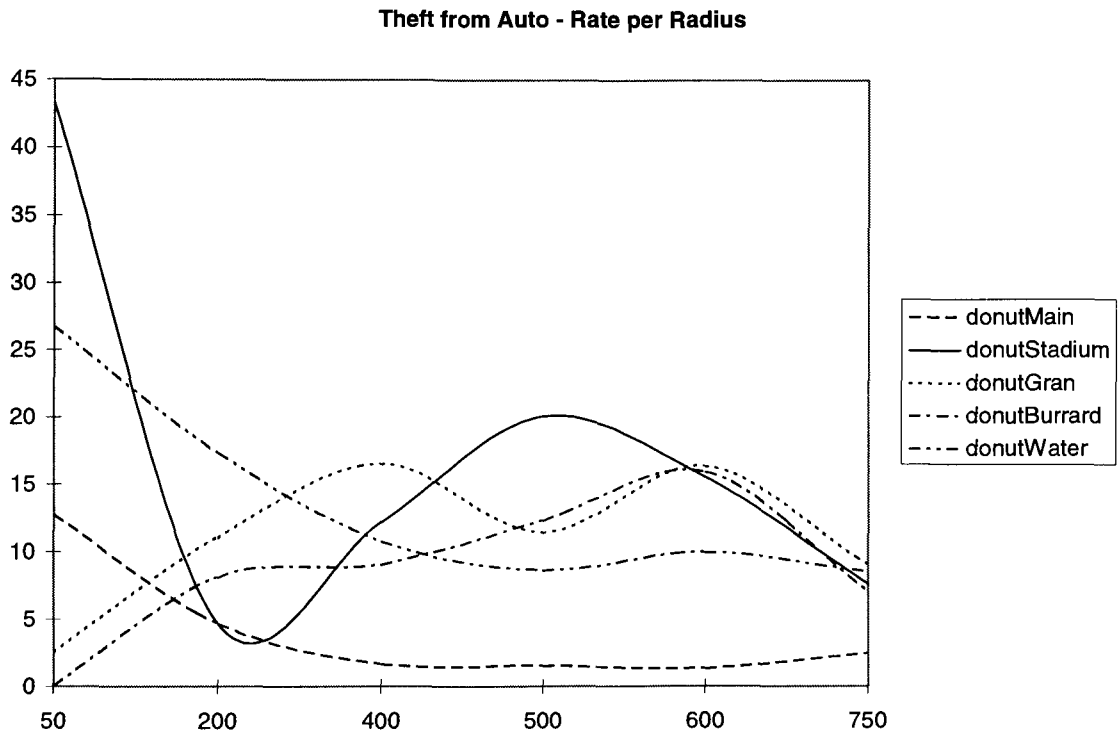


Figure 8: Theft from Auto: Rate per Radius

An important observation of this commercial station area data that differs from that of the residential station area data is not initially obvious. A closer look

at the y-axis of the graph above shows a scale of extremely high rates of calls for theft from auto throughout the station areas. While for many of the previous calls for service most of the rates per concentric circle remained below '1', for all of the radii for this call for service except for the first 50 m from the Burrard Street station, the rate remains well above '1' (in most cases, the rate is above '5'). Main Street, Stadium and Waterfront station areas all experience high rates of theft from auto within the first 50 m from the Skytrain station. While Granville and Burrard do not have high rates of theft from auto within the first 50 m of the station, these station areas do have similar rates of theft from auto within the next 150 m concentric circle from the station as Main, Stadium and Waterfront station areas. The pattern of theft from auto seems distinctly related to the presence of the Skytrain stations in each area. All of the station areas demonstrate a distance-decay pattern for the offence, with the exception of Main Street, that shows a decaying pattern until the last 150 m from the station where the rate of theft from auto climbs slightly.

The crime of theft from auto is obviously dependant upon the of parked, relatively unobserved automobiles from that to steal. It makes sense that for the first 50 m around the Granville and Burrard Street stations that the rate of this crime is low due to the absence of places for vehicles to park. Parking garages are at least 50 m from both of these Skytrain stations. This is not the case for the Main Street, Stadium or Waterfront stations. Main Street station is surrounded by a large amount of Street parking and surface level parking areas at the bus

terminal nearby. Stadium station and Waterfront stations are also located close to plenty of Street parking. These three areas are very busy at all times with high amounts of pedestrian and vehicle traffic. These three Skytrain stations are also very busy.

Waterfront station is the terminus downtown station that provides access to the historical districts of Gastown and Chinatown, Stadium station provides access to the sporting stadiums of the city of Vancouver, Main Street station provides access to Chinatown and the bus terminus as well as a number of site attractions, for example, Science World (a museum-like scientific entertainment spot with an OMNI-MAX theatre), and numerous fast food restaurants. In other words, many people must walk through these areas in order to reach their final destination from the Skytrain or they must walk through these areas on their way to the Skytrain. These people subsequently become aware of the opportunities (both criminal and legitimate) that may present themselves during the course of their travels to and from the Skytrain station. These types of areas usually provide the necessary three elements for commission of criminal offences: (1) potential offenders; (2) potential targets; and (3) low levels of capable guardianship (Brantingham, Brantingham and Wong, 1990; Cohen and Felson, 1979; Cohen, Felson and Land, 1980; Felson and Cohen, 1980; Jackson, 1984; Massey, Krohn and Bonati, 1989).

An important observation for the Stadium station is the large second peak of offences of theft from auto that is recorded within the 400 m to 500 m level. It

is at this distance where the two large stadiums are located along with their very large parking lots.

Theft

Table 12: Rate of theft calls for service per radius area

<i>THEFT</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	15.27889	1.273241	0.742724	0.707356	0.868119	0.518728
Stadium	3.819722	2.037185	4.058454	5.234434	4.253781	3.128085
Granville	15.27889	7.554561	6.976298	4.1734	4.716778	3.112366
Burrard	0	6.960382	5.94179	4.1734	3.240976	3.426746
Waterfront	10.18592	3.989487	4.907282	2.40501	3.443537	4.369888

All of the station areas, with the exception of Burrard, experience their highest rate of theft within the first 50 m of the Skytrain station. Each of the station areas experience a consistently lower rate of reported thefts with increasing distance from the station. The exception to this is Waterfront. A possible explanation for this anomaly is the influence of a high crime area of the city of Vancouver at the periphery of the Waterfront station area.

Theft - Rate per Radius

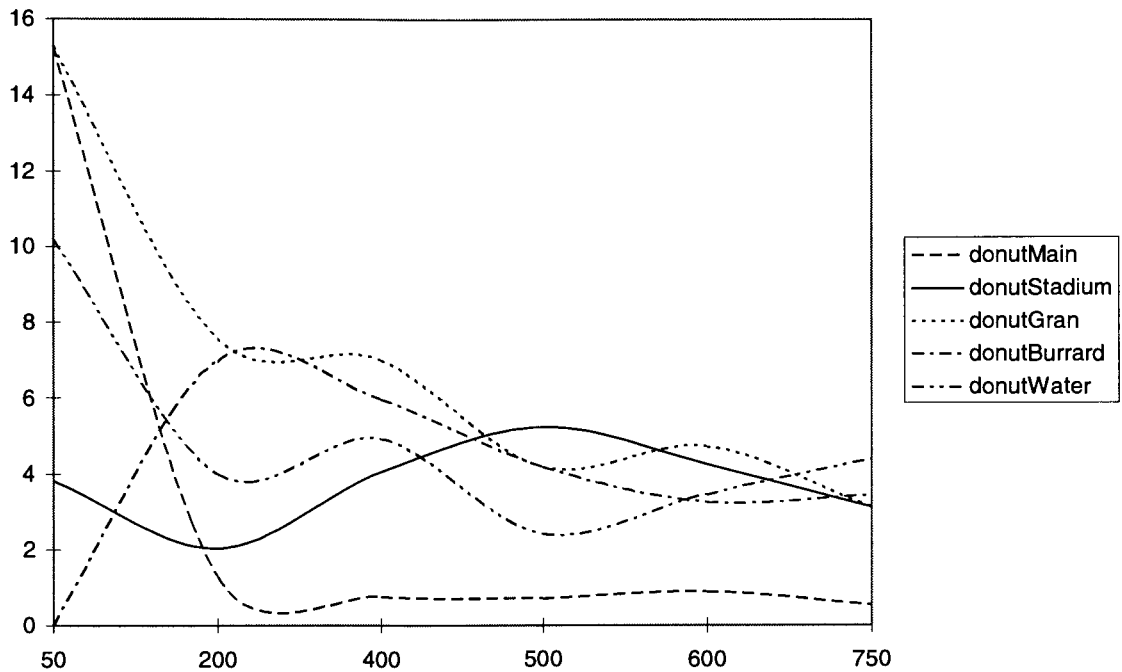


Figure 9: Theft: Rate per Radius

As with theft from auto, the Stadium station area shows a high secondary peak of thefts at the 400 m to 500 m concentric ring area. All of the station areas showed a dip in the rate of thefts at the 200 m radius level. The exception is Burrard station area. The highest rate of thefts recorded in this area was at the 200 m radius level. This rate, however, was similar to the rate of theft recorded for the Waterfront station area. A possible explanation for the delayed initial peak of thefts occurring in the Burrard station area is the relative absence of possible targets within the first 50 m of the station.

Annoying Person

Table 13: Rate of annoying person calls for service by radius area

<i>ANNOY</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	10.18592	2.886012	0.265258	0.459781	1.215366	1.477588
Stadium	0	0.848827	1.750706	3.430676	7.581569	2.609357
Granville	11.45917	2.631364	6.2601	2.652585	2.66223	2.342134
Burrard	0	2.631364	5.013385	3.961193	2.314983	2.106349
Waterfront	8.912684	2.376716	3.527938	2.40501	3.125227	4.33845

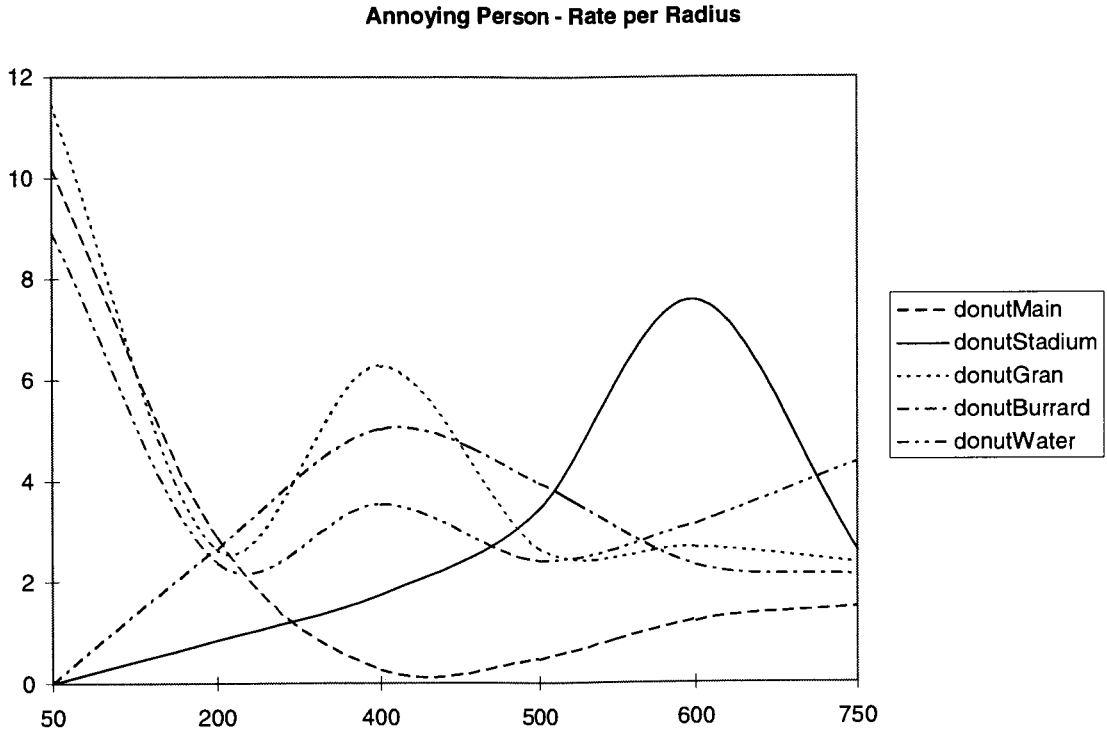


Figure 10: Annoying Person: Rate per Radius

Each of the commercially zoned Skytrain station areas experienced high rates of calls to police for annoying persons in the first 50 m radius around the

station except for Burrard and Stadium. While this low initial rate is not unusual for the Burrard station area, it is somewhat unusual for the Stadium station area. Perhaps the low rate of annoying persons calls directly surrounding the Stadium station is due to the low rate of residences and high amount of empty buildings adjacent to the station. With the exception of the Stadium station area, all of the station areas had similar rates of annoying persons calls to police.

The Stadium station area shows a high peak of annoying persons calls for service at the 600 m radius. This could be due to the fact that some residential zoning is located at this distance from the station. Within the 500 m to 600 m radius is the periphery of the stadium area. Both the Waterfront and Main Street station areas show a slightly rising rate of annoying person calls for service at the 750 m periphery. This is probably due to a combination of the slight overlap that exists between the downtown station areas as well as the influence of the high crime area of Hastings Street, that is also located at the periphery of the Waterfront and Main Street station areas. Otherwise, 'Annoying Person', does show a distance-decay pattern as one increases in distance from the Skytrain stations.

Mischief

Table 14: Rate of mischief calls for service per radius area

<i>MSCHF</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	5.092962	1.018592	0.371362	0.742724	0.202561	0.48729
Stadium	6.366203	0.679062	1.962913	2.369642	2.835854	1.964878
Granville	2.546481	1.443006	2.944369	2.72332	2.401795	1.60334
Burrard	0	1.86742	1.511973	2.122068	3.327788	1.11605
Waterfront	8.912684	2.631364	2.175119	1.343976	0.983868	1.697654

Mischief - Rate per Radius

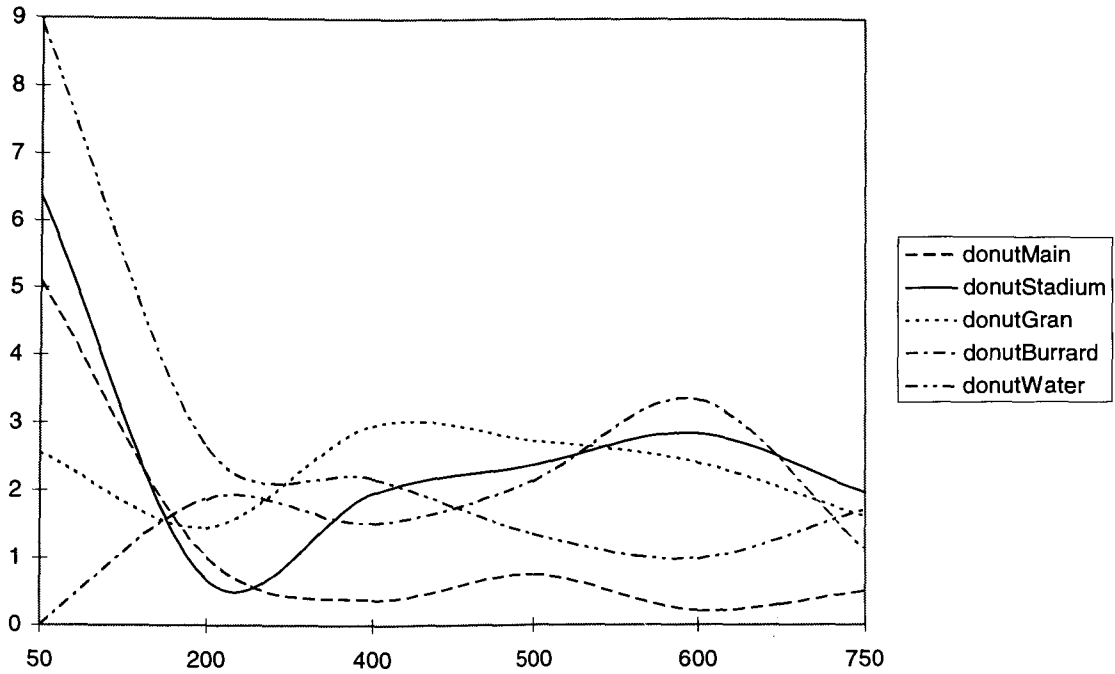


Figure 11: Mischief: Rate per Radius

All of the downtown stations show a consistent high rate of calls for service for mischief within the first 50 m of the Skytrain station, with the usual exception of the Burrard Street station. Burrard does have an initial peak of mischief calls for service at the 200 m radius. The remaining pattern for mischief calls for service is asymmetric. While three of the stations show a clear distance-decay pattern towards the 750 m periphery, as usual the Waterfront and Stadium station areas do not. Most likely, the reasons explaining the slight rise in the rate of calls for service at the 750 m are the overlap of the downtown station areas and the influence of Hastings Street at the 750 m periphery.

Fight

Table 15: Rate of fight calls for service per radius area

<i>FIGHT</i>	50m	200m	400m	500m	600m	750m
Main	3.819722	0.848827	0.159155	0.495149	0	0.078595
Stadium	0	0.084883	0.95493	2.900159	1.533676	1.854844
Granville	1.273241	1.188358	1.326292	1.025666	1.157491	0.864546
Burrard	0	0.763944	0.848827	1.379344	0.925993	0.848827
Waterfront	0	1.103475	0.848827	0.565885	0.665558	1.729092

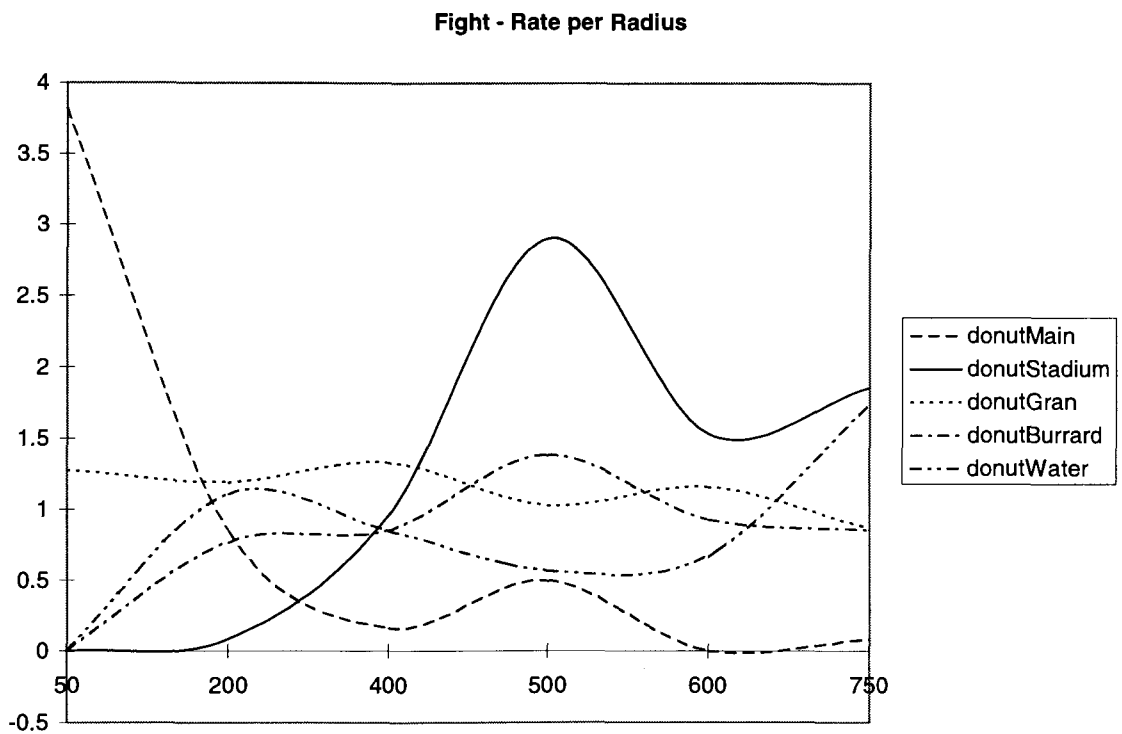


Figure 12: Fight: Rate per Radius

Both the Granville and Main Street station areas record high rates of fights within 50 m of the Skytrain station; three of the downtown station areas, however, do not. While this pattern of a low rate of calls for service within the first 50 m from the station is not unusual for the Burrard station area, it is unusual for both the Stadium and Waterfront station areas.

Also what is not clear from the data, is a distance-decay pattern for 'Fight'. The Granville station area, for instance, records almost an equivalent rate of fights throughout its 750 m radius. The Waterfront station area shows a dramatic increase in the rate of fight calls for service at the 750 m level. Both Stadium and Main Street station areas show an increase in their rate at the 750 m periphery as well. A slight increase at the 750 m radius is easily explained by the slight overlap in the radii of the station areas, however, this reason alone cannot explain the dramatic increase shown by the Waterfront station area. The influence of the high crime and high bar rates along Hastings Street is probably an important factor in explaining the higher rate of fights at the 750 m radius of the Waterfront station area.

The peak of calls for fights to the police within the Stadium station area is located within the 500 m radius. This peak, once again, coincides with the presence of the stadiums and parking lots on one side of the station as well as a number of hotels and liquor establishments in the opposite direction.

For three of the five downtown stations (Granville, Burrard and Main), the pattern for the 'Fight' call for service within the first 50 m of the station is

consistent with other calls for service analysed thus far. This would seem to offer support for the notion that fights are also related to the presence of the Skytrain station in the station areas in the city of Vancouver. What must also be remembered is that fights are also probably related to other factors that may be common throughout the downtown areas of most major cities in North America. The presence of bars, nightclubs and other recreational liquor establishments are important influences upon the rates of certain types of crimes (Roncek, Bell and Francik, 1981; Roncek and Maier, 1991; Roncek and Pravatiner, 1989). Granville Street and the Gastown area both have numerous such establishments located within the respective station areas. This fact might help to explain why the rate of fights is fairly constant within the Granville station area as well as why, after the first 50 m from the Waterfront Skytrain station, the rate of fights is never less than 0.57.

Seized Property

Table 16: Rate of seized property calls for service per radius area

<i>SEIZED</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	1.273241	0.254648	0.212207	0.247575	0.31831	0.141471
Stadium	0	0.594179	0.450939	2.40501	1.302178	3.018052
Granville	1.273241	0	0.928405	0.459781	0.665558	0.613042
Burrard	0	0.169765	0.63662	0.353678	0.607683	0.471571
Waterfront	0	1.273241	0.742724	0.247575	0.520871	1.540464

Both the Granville and Main Street station areas show a high rate of seized property calls for service within the first 50 m from the Skytrain station. While both Stadium and Waterfront station areas do not show a high rate in the first 50 m, they do record higher rates of seized property calls within the next 150 m concentric circle.

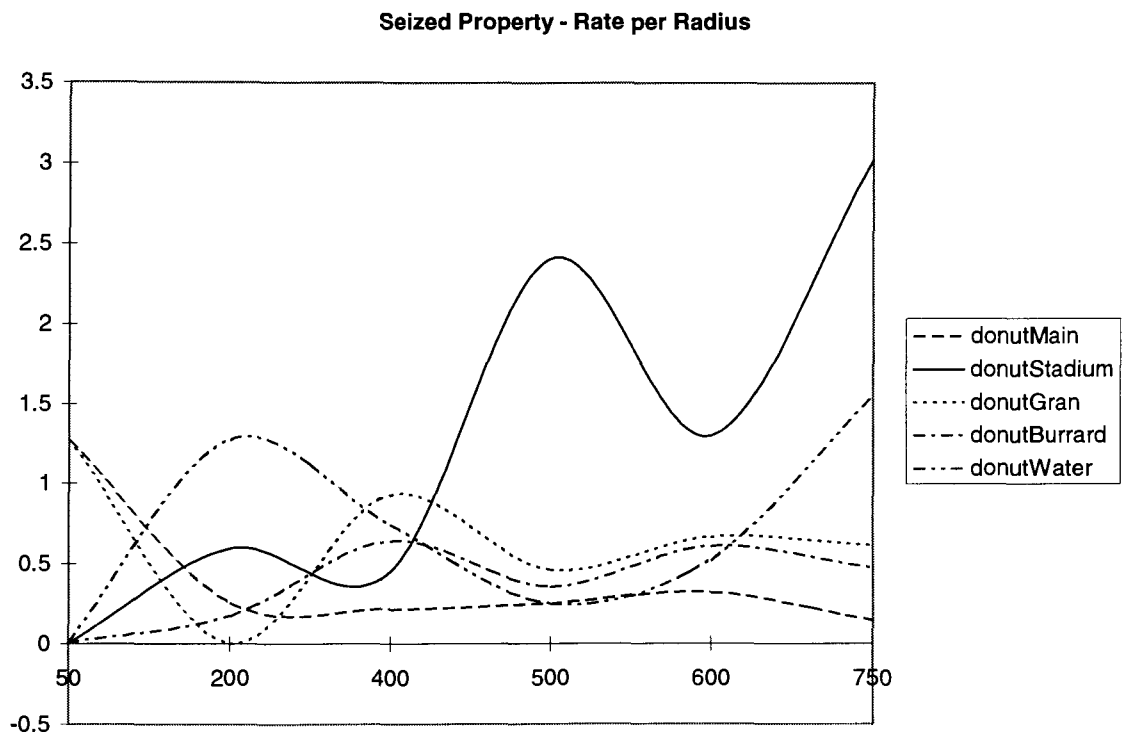


Figure 13: Seized Property: Rate per Radius

Granville, Burrard and Main Street station areas all show a distance-decay pattern for this call for service. Both Waterfront and Stadium station areas do not show the distance-decay, however this can probably be explained by the overlap between the downtown station areas as well as by the influence of Hastings Street on the Waterfront station area. The location of the Stadium station area is also

probably influential upon the existence of a distance-decay pattern for the calls for service recorded within its boundaries. Stadium station is located at the periphery of the downtown core of Vancouver. As the distance away from the Stadium Skytrain station increases, in the direction of the downtown core, the number of bars and recreational liquor establishments, movie theatres and restaurants increases. These are all types of land usages associated with higher rates of crime.

Persons with a Knife

Table 17: Rate of persons with a knife calls for service per radius area

<i>KNIFE</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	0	0.254648	0	0.106103	0.028937	0.031438
Stadium	1.273241	0.084883	0.106103	0.601253	0.434059	0.345818
Granville	1.273241	0.254648	0.132629	0	0.173624	0.110033
Burrard	0	0.169765	0.079578	0.141471	0.173624	0.015719
Waterfront	0	0	0.026526	0.282942	0.144686	0.330099

Person with a Knife - Rate per Radius

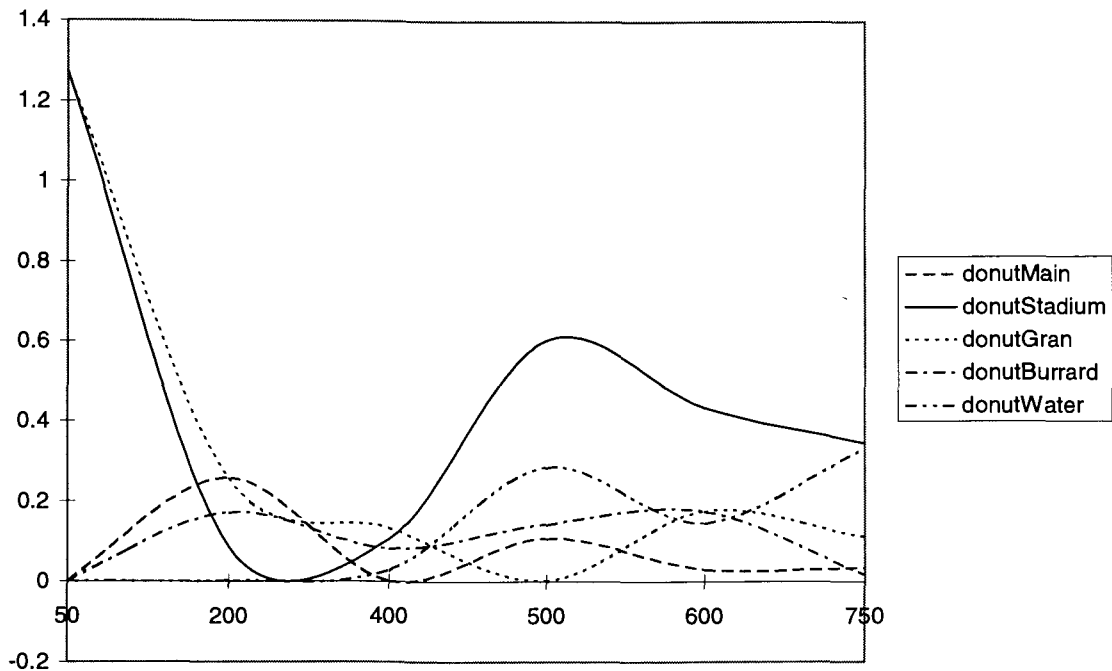


Figure 14: Person with a Knife : Rate per Radius

Two of the station areas (Stadium and Granville) record high rates of calls for service for persons with a knife within the first 50 m radius. The Burrard station area follows its usual pattern of calls for service and subsequently records a higher rate of persons with a knife within the next concentric circle of analysis. With the exception of the Granville station area, all of the station areas record a fairly high rate of persons with a knife at the 500 m radius as well. A distance-decay pattern is fairly evident for this call for service for all of the station areas with the exception of the Waterfront station area. It would seem that the attracting effect of a public transit station is also evident for this type of call.

Stabbing

Table 18: Rate of stabbing calls for service per radius area

<i>STAB</i>	50m	200m	400m	500m	600m	750m
Main	1.273241	0	0	0.070736	0.028937	0
Stadium	0	0	0.106103	0.565885	0.31831	0.251504
Granville	1.273241	0	0.053052	0.035368	0.057875	0.078595
Burrard	0	0	0.079578	0.035368	0.028937	0.047157
Waterfront	1.273241	0	0.106103	0.035368	0.086812	0.251504

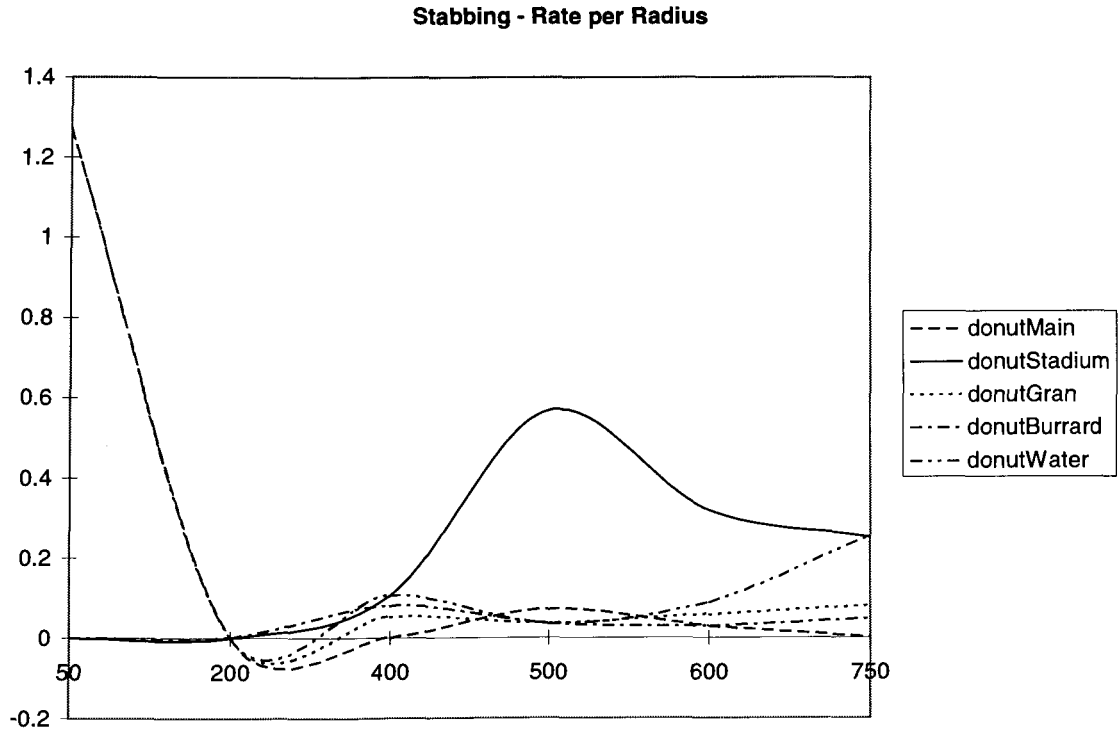


Figure 15: Stabbing: Rate per Radius

Main Street, Granville and Waterfront station areas all record high rates of stabbing calls within 50 m of the Skytrain station. The Burrard station area shows an uncharacteristically late peak of calls for service for stabbing incidents at the 400

m radius. Stadium station records a peak of stabbing incidents at the 500 m radius. All of the station areas show a distance-decay pattern for stabbing calls for service with the exception of the Waterfront station area. This data would seem to show a close relationship between stabbing calls for service and the location of at least three of the Skytrain stations (Main, Granville and Waterfront).

Drug Arrest

Table 19: Rate of drug arrest calls for service per radius area

<i>DRUGAR</i>	<i>50m</i>	<i>200m</i>	<i>400m</i>	<i>500m</i>	<i>600m</i>	<i>750m</i>
Main	1.273241	0	0	0.035368	0	0.047157
Stadium	0	0.084883	0.132629	0.990298	0.347247	1.100331
Granville	0	0.169765	0.981456	0.212207	0.115749	0.235785
Burrard	0	0.084883	0.742724	0.424414	0.115749	0.220066
Waterfront	0	0	0.026526	0.070736	0.115749	0.911703

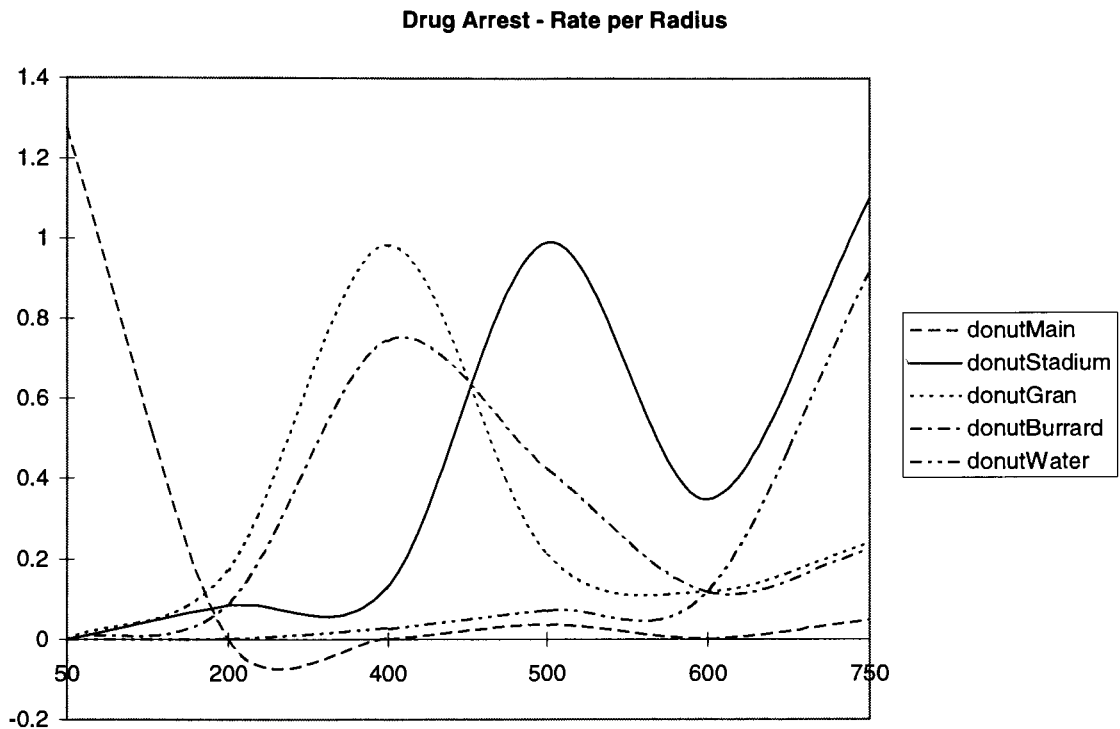


Figure 16: Drug Arrest: Rate per Radius

A high rate of drug arrests was recorded within 50 m of only the Main Street Skytrain station. Both Granville and Burrard recorded high rates of drug arrests within the next 150 m concentric circle. Stadium station area records a high rate of drug arrests within the 400 m to 500 m concentric circle. A distance-decay pattern is not evident for this type of call for service after the 600 m radius. While this may seem to contra-indicate an overall distance-decay pattern, this is probably not the case. The actual numbers of drug arrest calls for service is quite low within each station area. A small change in the numbers could strongly influence the rate of drug arrests per concentric circle. The overlap of station

areas might account for the apparent rise in rates of drug arrests within the last 150 m of each station area radius. In the case of the Waterfront station area the influence of the high crime area of Hastings Street upon the drug arrest rate at the 750 m radius must not be overlooked.

Overall Station Area Observations

Upon analysis of the individual calls for service important patterns regarding individual station areas became apparent. These station area patterns may have been obscured within the call-by-call analysis and should be clarified. The Burrard, Stadium and Waterfront station areas all demonstrate unique call for service patterns that hold true for the majority of the calls for service within each station area. These patterns are probably influenced by the land zonings and usages particular to the respective station area.

A unique and consistent pattern exists within the Burrard station area. Few, if any, calls for service are recorded within the first 50 m radius of the station. The result is a low or non-existent rate of crimes within this first concentric circle. Burrard Street station area, however, usually records a rate of calls for service at the 200 m radius that is equivalent to or higher than the rates of the other commercial station areas. These findings can probably be explained by the relative absence of potential targets for criminal opportunity within a 50 m radius of the Burrard Street station. As one progresses in distance from the

station, however, a proportionately similar amount of potential targets exists in the Burrard station area as for any of the other downtown / commercial station areas.

Stadium station area usually records high rates of calls for service within the first 50 m of the station, but also consistently records a high secondary peak of offences at the 500 m or 600 m radius level. This is consistent for all types of calls for service analysed in this study. The distance of this secondary peak is consistent with the distance from the Skytrain station of the sports stadiums and unattended, above ground parking lots on one side of the station as well as the location of many and recreational liquor establishments on another side of the Stadium Skytrain station.

Distance-decay is a fairly consistent pattern for both the residential and commercial station areas. The Waterfront station area is, however, a consistent exception to this pattern. It is felt that the reason for this unique pattern within the Waterfront station area is due to the high crime area of Hastings Street, in Vancouver that overlaps at the periphery of the 750 m radius area of the Waterfront station. The careful observer will notice, however, that a distance-decay pattern is apparent for most offences included within the present analysis until the last 150 m of the Waterfront station area. For some of the offences Stadium station area also shows the influence of Hastings Street at the 750 m periphery with a non-conforming pattern.

Many of the station areas in both the residential and commercial sections, overlapped with at least one other station area at the periphery of the 750 m

radius. While this overlap was slight (occurring within the last 50 m to 100 m), it probably affected many of the call for service patterns especially with regards to a distance-decay phenomenon. A majority of the calls for service included within the present analysis demonstrated a distance-decay until the 600 m radius (while some continued even to the 750 m radius). It is felt that this is sufficient support for a statement supporting a distance-decay pattern of calls for service with regards to the nine Skytrain stations. Support for a pattern of distance-decay from the Skytrain stations also provides support for the hypothesis of this study.

Summary

This chapter has delved into the spatial patterns of criminal activity around nine Skytrain stations as recorded by the Vancouver Police Department for the period of May, 1995 to August, 1995. Many methods were used for the analysis including spatial mapping of the station areas, the calculation of a location quotient of crime for each call for service, an analysis of the raw numbers of calls on a call for service basis and an analysis of the patterns of criminal activity surrounding the Skytrain stations on the basis of the size of area contained within various radii of the stations.

Chapter Four: Conclusion and Final Remarks

Conclusion

The power of an attracting land use in concert with agglomeration and multiplier effects upon crime rates cannot be overlooked. This study has lent support to the notion that transit terminals are indeed attracting land uses that exert strong influence upon the rates of crime in the areas surrounding the terminals. Skytrain stations are nodes of activity that draw large numbers of people to a limited number of spaces. These large numbers of people naturally take advantage of the opportunities that surround them, both legitimate and criminal, through the course of their routine activities.

Another important factor associated with the use of the Skytrain system as a means of transportation is the limited awareness space created by the individuals who use the system. The Skytrain stations become nodes of daily activity for the BC Transit customers.

Zipf's principle of least effort states that people will take the shortest path or the path of least resistance to reach their goals. Individuals using the Skytrain system will naturally make use of the services and opportunities that they observe along their travels to and from the Skytrain station. Few individuals will stray very far from their natural travel paths to explore unknown areas for potential opportunities. Opportunities and services will be observed and incorporated into

an individual's mental template of an area. This mental template may be reinforced by personal action upon what is observed through the course of daily travel to and from work and school, or even through the course of travel to places of recreation. As the distance increases from the Skytrain station, the number of people who will be able to incorporate these areas into their mental templates will decrease. The opportunities in these areas (legitimate and criminal) will not be noticed or acted upon with as great a frequency as the areas closer to the attracting land use, in this case, the Skytrain station. Variation in the distance travelled to search for opportunity will occur individually, but as this study has shown through findings of consistently high rates of calls for service within 50 m of the Skytrain stations and a distance-decay pattern to the calls for service, relatively few individuals appear to venture farther than 750 m from a public transit station in search of a criminal target. It is more likely that the target became obvious to the potential offender through the course of his or her daily activities, close to his or her home, work or places of recreation.

This research has shown that high rates of criminal activity are situated within 50 m of Skytrain stations. Brantingham and Brantingham (1993) state that a criminal follows a decision process in locating suitable targets and 'good crime situations'. A search for targets involves looking near one's usual travel paths between major activity nodes, such as work, school and places of recreation. Brantingham, Brantingham and Wong (1990) state that individual criminal activity patterns seem to focus on the end points or 'nodes' of routine daily travel.

Movement about a city can affect the likelihood of offending as higher numbers of people in an area increases levels of anonymity. This is supported by the routine activities approach that stresses the importance of the environment as a necessary component of criminal interactions between potential offenders and victims (Roncek, Bell and Francik, 1981; Roncek and Maier, 1991; Roncek and Pravatiner, 1989).

Crime and fear of crime concentrate in certain areas. These areas have been termed 'hot spots' (Block, 1979; Nasar and Fisher, 1993; Sherman, Gartin and Buerger, 1989). Knowledge about hot spots develops through ongoing direct experience with the environment, and the development of mental maps or templates of the physical and social surroundings. This research has shown that the Skytrain stations and their surrounding areas are hot spots of criminal activity in the City of Vancouver. The location quotients of crime for each of the station areas show a higher than normal ratio of crimes located within a 750 m radius of each station.

Of importance to the crime pattern associated with each Skytrain area was the types of land use and zoning in that each station was located. Very different crime patterns were found in areas that were primarily residential as opposed to commercial in nature. The influence of specific land uses such as parks, stadiums and recreational liquor establishments also proved to be of importance. It is these types of land use that serve to draw large numbers of individuals (both potential criminals and potential targets) to areas characterised by lower levels of

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guardianship and surveillance. This research has shown that certain types of land use associated with Skytrain station areas probably contribute to agglomeration and multiplier effects upon rates of criminal activity.

Examples of these phenomena are numerous. A clear relationship exists, for example, between the rate of break and enters and the amount of residential land directly (within 50 m) around the Skytrain station. At both the Joyce and Nanaimo Skytrain stations, housing is located directly adjacent to the station. Both of these stations exhibit unusually high rates of break and enters within 50 m of the Skytrain stations. The relationship of higher break and enter calls for service was modified at the 29th Avenue station (another highly residential area) where the presence of a large park adjacent to the station decreased the rate of break and enters within the immediate vicinity of the station. The park, however, was associated with higher rates of assault.

The Stadium station is also located within a unique area. This uniqueness is reflected in the types of crimes associated with the station area, and where the highest rates of these crimes were recorded within the station area. The presence of the two large sport stadiums within walking distance of the Stadium station is probably the largest influence on the patterns of criminal activity for this station area. The stadiums are large attracting land usages to a large number and variety of individuals, and so are the large, unprotected, unsupervised parking lots associated with the stadiums. The parking lots offer numerous unprotected targets for potential offenders who may be walking by on their way to or from the

Stadium Skytrain station. Also within easy walking distance from the Stadium station are numerous recreational liquor establishments that offer a sport-like atmosphere.

Burrard Skytrain station is another unique location. Virtually no crimes were associated with the first 50 m radius of this station. Of the downtown / commercial station areas included within this analysis, the Burrard station area recorded the lowest rates of calls for service within the first 50 m of the station. Like the unique crime patterns associated with the Stadium station area, the crime patterns for the Burrard station area can also probably be explained by the land uses that are located immediately adjacent to the station. There is very little of interest, either criminally or legitimately, within 50 m of the Burrard Skytrain station. Most of the buildings close by the station are office buildings. While there is some shopping close by the station, located underneath one of the adjoining hotels, the stores are only open during normal business hours. The majority of the stores cater to a higher than average income. The large majority of users of this station are professionals on their way to and from work.

There is very little parking located close by the Burrard Skytrain station. The station is located on a one-way street, not at a busy intersection. As previously stated in the description of the Burrard station, this station is not very busy after business hours. Most of the downtown entertainment locales are more easily accessible through the Waterfront and Granville Skytrain stations.

✂

Factors that seemed to strongly influence the patterns of the various rates of calls for service around the Skytrain stations include types and variety of users, size (measured by pedestrian and traffic flow) of the intersection at that the station is located, types of businesses and retail shops located within 50 m of the station (including recreational liquor establishments), the presence of a park, and the presence of parking within easy walking distance from the station.

Stemming from the analysis of the different crime patterns associated with the Skytrain station areas in the City of Vancouver was a distinction between a 'residential' type station area and a 'commercial / downtown' station area. Higher LQCs for break and enter, suspicious circumstances, suspicious persons, screams, stolen autos, breach of probation, harassment and prowlers were associated with the residential station areas. Theft from auto, theft, annoyance, mischief, fight, drug arrest, seized property, impaired driving, warrant calls, wagon calls, persons with a knife and stabbing incidents were all recorded with higher LQCs in the commercial / downtown station areas. The three types of calls for service that had higher LQCs in both station areas were robbery, assault and mental cases. The four types of calls for service that did not have higher than normal LQCs for either type of station area were audible alarms, noise calls, disturbances and arrests.

The findings of high rates of offences occurring within the first 50 m of the Skytrain stations, combined with a distance-decay phenomenon evident at many of the station areas for a majority of the calls for service, offer support for the hypothesis of this study that the areas contained within 750 m of the Skytrain

X

stations in the City of Vancouver would exhibit higher ratios and rates of calls for service than the rest of the city. While this hypothesis has been supported, it was also discovered that distinct patterns of calls for service are associated with different types of land usage, and, with various locations of the Skytrain stations. It would seem that patterns of calls to police are directly affected by the presence or absence of a Skytrain station. While it is not possible from the present analysis to determine the *exact number* of individuals who may become aware of criminal opportunities because of the use of the Skytrain or the rate of offenders who use the Skytrain in the commission of offences, analysis of the data does *strongly suggest that these phenomenon do occur*. The importance of movement to crime is among the original themes of routine activities theory. Brantingham, Brantingham and Wong (1991) suggest that transit contributes to patterns of crime by shaping the criminal opportunity and getaway potential of high risk populations.

This research has practical implications for environmental design purposes. Definite relationships between the presence of transit and certain types of land use have been revealed. Unique locations, such as the Burrard, Broadway and Stadium station areas can be used as case studies and examples of what works and what does not work with regards to lowering crime rates within the immediate vicinity of public transit stations. The relationships between station location and land use that have been revealed through the present analysis also have implications for the allocation of police resources and crime prevention initiatives.

Crime prevention specialists will be able to use the findings from this study to help design areas around future Skytrain stations as well as other public transit stations.

The goal of the present analysis was to contribute to an expansion of knowledge within the field of environmental criminology. While this research explored how transit shapes and affects crime patterns in the urban environment, more research needs to be done. The effects of time and seasonal fluctuation in the use of the Skytrain system upon crime rates in the station areas are just two examples of areas that could benefit from further analysis. For unique station areas, such as the Stadium area, it would be interesting to further explore a possible relationship between the scheduling of special events and sporting events with crime patterns. Further clarification is also needed with regard to possible use of the Skytrain system as a tool in the commission of criminal offences outside the official boundaries of the transit commission.

2

Appendix 1 - Location Quotients

	JOYCE	29TH	NANAI	BROAD	MAIN	STADIUM	GRAN	BURRARD	WATER
AUDIBL	0.79	0.76	0.78	0.56	0.86	0.54	0.65	0.58	0.59
TFAUTO	0.91	1.02	0.85	0.8	1.35	1.92	2.33	2.19	2.09
BNE	1.31	1.92	2.07	1.2	0.72	0.63	0.58	0.55	0.68
THEFT	0.86	0.51	0.59	0.95	0.97	1.17	1.71	1.8	1.63
ANNOY	0.88	0.62	0.95	1.16	1.44	1.06	1.22	1.32	1.45
NOISE	0.95	1.17	0.93	1.07	0.44	0.48	0.6	0.79	0.43
SUSCIR	1.36	1.28	1.56	1.16	0.7	0.69	0.69	0.69	0.68
SUSPER	1.29	1.37	1.45	1.36	0.82	0.73	0.89	0.85	0.8
MSCHF	0.96	1.18	1.37	1.04	0.99	1.03	1.25	1.22	1.09
DIST	1.12	0.88	1.13	1.18	1	1.05	1.07	1.03	1.07
FIGHT	0.98	0.7	0.42	1.16	0.92	1.73	1.32	1.36	1.53
ROBBRY	1.95	0.83		2.19	1.24	2.09	1.59	1.65	1.98
DRUGAR			1.26	0.61	0.51	2.92	1.89	2.04	2.17
SCREAM			2.26	0.91		0.27	0.42	0.68	0.24
STAUTO	1.62	1.72	1.51	1.15	0.85	0.52	0.66	0.67	0.52
ASLT	1.4	1.54	0.96	1.39	0.8	1.36	1.12	1.04	1.32
SEIZED	0.6	0.87	1.61	0.98	1.28	2.65	1.05	0.96	1.77
IMP	0.72	0.47	0.77	0.35	2.27	0.89	0.84	0.72	0.67
BREACH	0.47	2.14	1.96	1.3	0.37	2.05	0.93	0.87	1.25
MENTAL	1.82		0.78	1.53	0.9	1.06	1.37	1.43	1.11
WARRANT	0.66	0.53	0.73	1.34	0.83	2.21	1.02	0.93	1.26
WAGON	0.53	0.36	0.49	0.94	1.5	2.32	1.08	0.97	1.82
KNIFE				1.71	1.19	1.95	0.84	0.71	1.51
STAB						3.41	0.93	0.79	2.4
HARASS	1.02	1.42	2.07	1.17	0.25	0.58	0.85	0.96	0.88
PROWL	1.68			1.65			0.17	0.19	
ARREST	0.64	0.6	0.91	1.34	1.41	0.99	0.75	0.71	0.75

Appendix 2 - City of Vancouver Zone Definitions

Official definitions of City of Vancouver Land Zonings Relevant to this Analysis

-taken from the City of Vancouver Zoning Districts Map

C

C-1

Commercial District - The intent is to provide for small-scale convenience commercial establishments, catering typically to the needs of a local neighbourhood and consisting primarily of retail sales and certain limited service functions, and to provide for dwelling uses designed compatibly with commercial uses.

C-2

Commercial District - The intent is to provide for a wide range of goods and services, to maintain commercial activities and personal services that require central locations to serve larger neighbourhoods, and to provide for dwelling uses designed compatibly with commercial uses.

C-2C

Commercial District - The intent is to provides for a wide range of goods and services, to maintain commercial activities and personal services that require central locations to serve larger neighbourhoods, districts or communities and to encourage creation of a pedestrian oriented district shopping area by increasing the residential component and limiting the amount of office use.

C-3A

Commercial District - The intent is to provides for a wide range of goods and services, to maintain commercial activities, specialized services and some light manufacturing enterprises while preserving the character and general amenity of the area and its immediate surroundings, and to provide for dwelling uses designed compatibly with commercial uses.

FC-1

Commercial District (False Creek) - The intent is to permit and encourage the development of a high density mixed commercial use neighbourhood, including some residential and compatible industrial uses. For commercial development, a variety of small scale retail and service uses are encouraged. Larger, more regional-oriented office and retail commercial uses are limited in size and extent for individual sites.

CD

CD-1

Comprehensive Development District - A separate CD-1 bylaw exists for each area or site zoned CD-1, tailor made to the intended form of development.

BCPED

Comprehensive Development District (False Creek-North Side) - The intent of this district and its two accompanying official development plans (False Creek North and Southeast Granville Slopes) is to achieve a high standard of design and development within a number of residential neighbourhoods, parks, public facilities and commercial areas on the north side of False Creek.

CWD

Comprehensive Development District (Central Waterfront) - The intention of this District and its two accompanying official development plans (Central Waterfront and Coal Harbour) is to encourage the development of commercial, recreational, cultural and public uses throughout the waterfront area as well as residential uses west of Burrard Street. The Coal Harbour redevelopment is in this area, between Cardero and Burrard Streets.

DD

Comprehensive Development District (Downtown) - The intent of this district and accompanying official development plan is to ensure that all buildings and developments in the Downtown District meet the highest standards of design and amenity for the benefit of all users who live, work, shop or visit the Downtown.

HA

HA-1 and HA-1A

Historic Area Districts (Chinatown) - The intent is to encourage the preservation and rehabilitation of the significant early buildings of Chinatown, while recognizing that the evolving activities that make this district an asset to the City need to be accommodated contextually. The Schedule may permit a range of uses provided that reasonable, but not rigorous, concerns for compatibility are met. To achieve this intent, this schedule provides the basic development controls that regulate land uses and building forms. There are two Districts: HA-1 corresponds to the boundaries of the Provincially designated site; HA-1A is the remainder of Chinatown.

MI

I-1

Industrial District - The primary intent is to permit light industrial uses that are generally compatible with one another and with adjoining residential or commercial districts. It is also the intent to permit advanced technology industry, and industry with a significant amount of research and development activity. Service commercial uses compatible with and complementing light industrial uses are also permitted but not offices or retail stores.

IC-1 and IC-2

Industrial Districts - The primary intent is to permit light industrial uses that are generally compatible with one another and with adjoining residential or commercial districts. It is also the intent to permit advanced technology industry, industry with a significant amount of research and development activity, and commercial uses compatible with and complementing light industrial uses. The general intent of external design regulations in the IC-2 District is to achieve a form of development compatible with the function of abutting major streets.

M-1

Industrial District - The intent is to permit industrial and other uses that are generally incompatible with residential land use but are beneficial in that they provide industrial employment opportunities or serve a useful or necessary function in the city. It is not the intent, however, to permit uses that are potentially dangerous or environmentally incompatible when situated near residential districts.

M-2

Industrial District - The intent to permit industrial and other uses that are generally incompatible or potentially dangerous or environmentally incompatible when situated in or near residential districts but that are beneficial in that they provide industrial employment opportunities or serve a useful or necessary function in the city.

RM

RM-4 and RM-4N

Multiple Dwelling Districts - The intent is to permit medium density residential development, including a variety of multiple dwelling types, to encourage the retention of existing buildings and good design, and to achieve a number of community and social objectives through permitted increases in floor area. The RM-4N District requires evidence of noise mitigation for residential development.

RM-5, RM-5A, RM-5B and RM-5C

Multiple Dwelling Districts (West End) - The intent is to permit a variety of residential developments and some compatible retail, office, service and institutional uses. Emphasis is placed on achieving development which is compatible with neighbouring development with respect to streetscape character, open spaces, view retention, sunlight access and privacy. The RM-5A, RM-5B and RM-5C districts permit greater densities than RM-5. The additional intent of the RM-5 district is to require developments suited to families with children. The additional intent of the RM-5C district is to permit a greater range of uses.

RM-6

Multiple Dwelling District - The intent is to permit high density residential development and some compatible retail, cultural, recreational, service and institutional uses. Emphasis is placed on achieving development which recognizes the formal character of Georgia Street and is compatible with the West End residential character along Alberni Street.

RS

RS-1 and RS-1S

One Family Dwelling Districts - The intent is to maintain the single family residential character of the RS-1 district and, in the RS-1S district, to conditionally permit two family dwellings and encourage new development that is similar in character to development in the RS-1 district.

RS-2

One Family Dwelling District - The intent is primarily to maintain the single family residential character of the district, but also to conditionally permit in some instances the conversion of large homes to contain additional accommodation, and some two family and multiple family dwellings.

RT

RT-2

Two Family Dwelling District - The intent is to permit two family dwellings and to conditionally permit, in some instances, low density multiple-family housing.

RT-4, RT-4N and RT-7 Districts

Two family Dwelling districts - The intent is to encourage the retention of existing residential structures and to encourage and maintain a family emphasis. The RT-4N district requires evidence of noise mitigation for residential development.

RT-5, RT-5N and RT-8

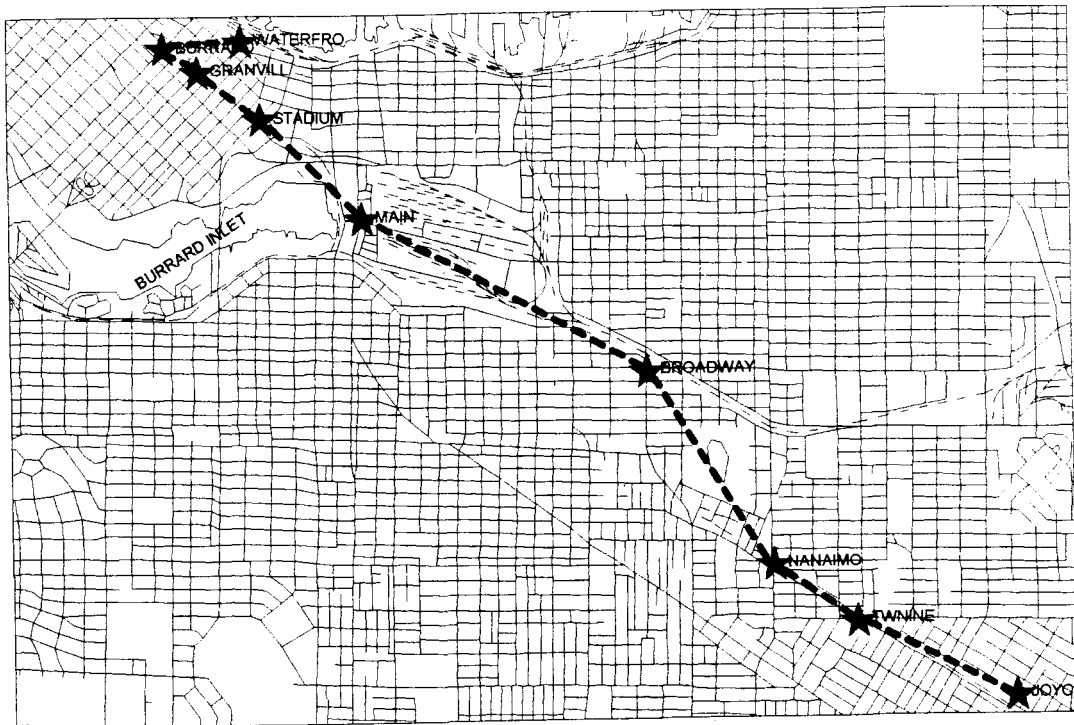
Two family Dwelling districts - The intent is to encourage retention of the existing residential buildings and to ensure that redevelopment is at a scale that is in keeping with the existing character of the neighbourhood. The RT-5N district requires evidence of noise mitigation for residential development.

RT-9

Two family Dwelling district - the intent is to encourage new development with a diversity of character and neighbourly building scale and placement. The retention and renovation of existing buildings is also permitted on sites where buildings have historical or architectural merit.

Appendix 3 - Skytrain Route Map

-The nine stations along the Skytrain route through the City of Vancouver.



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