

**REDUCING CRIME THROUGH PHYSICAL
MODIFICATION: EVALUATING THE USE OF
SITUATIONAL CRIME PREVENTION STRATEGIES IN A
RAPID TRANSIT ENVIRONMENT IN BRITISH COLUMBIA**

by

Courtney Laurence
Bachelor of Arts, Saint Mary's University, 2007

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

In the
School of Criminology

© Courtney Laurence 2010
SIMON FRASER UNIVERSITY
Summer 2010

All rights reserved. However, in accordance with the *Copyright Act of Canada*, this work may be reproduced, without authorization, under the conditions for *Fair Dealing*. Therefore, limited reproduction of this work for the purposes of private study, research, criticism, review and news reporting is likely to be in accordance with the law, particularly if cited appropriately.

APPROVAL

Name: Courtney Laurence
Degree: Master of Arts
Title of Thesis: Reducing Crime Through Physical Modification:
Evaluating the Use of Situational Crime Prevention
Strategies in a Rapid Transit Environment in British
Columbia

Examining Committee:

Chair: Neil Boyd LL.M.
Professor and Graduate Program Chair

Dr Bryan Kinney
Senior Supervisor
Assistant Professor

Dr Martin Andresen
Supervisor
Assistant Professor

Dr Greg Jenion
External Examiner
Instructor, Criminology
Kwantlen Polytechnic University

Date Defended/Approved: June 11, 2010



SIMON FRASER UNIVERSITY
LIBRARY

Declaration of Partial Copyright Licence

The author, whose copyright is declared on the title page of this work, has granted to Simon Fraser University the right to lend this thesis, project or extended essay to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users.

The author has further granted permission to Simon Fraser University to keep or make a digital copy for use in its circulating collection (currently available to the public at the "Institutional Repository" link of the SFU Library website <www.lib.sfu.ca> at: <<http://ir.lib.sfu.ca/handle/1892/112>>) and, without changing the content, to translate the thesis/project or extended essays, if technically possible, to any medium or format for the purpose of preservation of the digital work.

The author has further agreed that permission for multiple copying of this work for scholarly purposes may be granted by either the author or the Dean of Graduate Studies.

It is understood that copying or publication of this work for financial gain shall not be allowed without the author's written permission.

Permission for public performance, or limited permission for private scholarly use, of any multimedia materials forming part of this work, may have been granted by the author. This information may be found on the separately catalogued multimedia material and in the signed Partial Copyright Licence.

While licensing SFU to permit the above uses, the author retains copyright in the thesis, project or extended essays, including the right to change the work for subsequent purposes, including editing and publishing the work in whole or in part, and licensing other parties, as the author may desire.

The original Partial Copyright Licence attesting to these terms, and signed by this author, may be found in the original bound copy of this work, retained in the Simon Fraser University Archive.

Simon Fraser University Library
Burnaby, BC, Canada

STATEMENT OF ETHICS APPROVAL

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

(a) Human research ethics approval from the Simon Fraser University Office of Research Ethics,

or

(b) Advance approval of the animal care protocol from the University Animal Care Committee of Simon Fraser University;

or has conducted the research

(c) as a co-investigator, collaborator or research assistant in a research project approved in advance,

or

(d) as a member of a course approved in advance for minimal risk human research, by the Office of Research Ethics.

A copy of the approval letter has been filed at the Theses Office of the University Library at the time of submission of this thesis or project.

The original application for approval and letter of approval are filed with the relevant offices. Inquiries may be directed to those authorities.

Simon Fraser University Library
Simon Fraser University
Burnaby, BC, Canada

ABSTRACT

Situational crime prevention and crime prevention through environmental design are strategies that reduce criminal opportunities through modification of the physical environment. Although limited, evidence suggests that these strategies are successful at reducing crime that occurs in transit environments. The rapid transit system in Vancouver, British Columbia provides a unique opportunity for evaluation of situational prevention strategies as both control and experimental groups are available for examination. 2008 crime rates at stations were used to determine if there were differences in crimes between two SkyTrain lines. Bivariate analyses found that crime rates at stations that were not designed with crime prevention techniques were not significantly related to crime rates within a 100m buffer of the station suggesting that factors outside of neighbourhood crime trends affect station crime. Multiple regression was then employed to determine if particular design characteristics are predictive of crime. Implications and areas for future research are also discussed.

Keywords: Situational Crime Prevention; Crime Prevention through Environmental Design; Evaluation Research; Mass Transit Systems

ACKNOWLEDGEMENTS

This Masters thesis could not have been successfully completed without the support and encouragement from many people. I would like to thank my senior supervisor, Dr. Bryan Kinney, and my second supervisor, Dr. Martin Andresen who both provided me with much needed support for the past two years. I would also like to thank my external committee member, Dr. Greg Jenion, whose expertise in crime prevention was an additional benefit to my thesis. Thank you to Professor Neil Boyd who took the time to chair my defence. I would also like to thank Dr. Margaret Jackson who took the time to review my evaluation chapter and provide suggestions. Special thanks to the Transit Police crime analysts and to ICURS. I would like to thank my friends on both the West and East coasts for their continuous encouragement. Finally, I would like to thank my family for their unwavering support.

TABLE OF CONTENTS

Approval.....	ii
Abstract.....	iii
Acknowledgements.....	iv
Table of Contents.....	v
List of Tables	vii
1: Chapter 1 – Introduction.....	1
2: Chapter 2 – Theory	5
2.1 Introduction	5
2.2 Environmental Criminology	6
2.3 Opportunity Theories	9
2.3.1 Routine Activities Theory.....	10
2.3.2 Rational Choice Theory	12
2.3.3 Pattern Theory.....	15
2.4 Crime Prevention Strategies	19
2.4.1 History.....	19
2.4.2 Crime Prevention.....	21
2.4.2.1 Crime Prevention Through Environmental Design	21
2.4.2.2 Situational Crime Prevention.....	28
2.5 Criticisms of Crime Prevention	29
2.5.1 Displacement and Diffusion of Benefits	30
2.5.1.1 Displacement.....	30
2.5.1.2 Diffusion of Benefits	33
2.5.2 Root Causes	35
2.5.3 Financial Costs.....	35
2.6 Conclusion	36
3: Chapter 3 – Transit Crime	37
3.1 Introduction	37
3.2 Transit Crime	37
3.2.1 Fare Evasion	38
3.2.2 Graffiti and Vandalism	40
3.2.3 Crimes Against the Person	41
3.3 Crime Prevention Approaches	44
3.3.1 Fare Evasion	45
3.3.2 Graffiti and Vandalism	46
3.3.3 Crimes Against the Person	47
3.3.4 Additional Safety Measures	49
3.4 Case Studies	50

3.5 Conclusion	56
4: Chapter 4 – Evaluation Research	57
4.1 Introduction	57
4.2 Evidence-Based Policy	58
4.3 Evaluation Research	59
4.3.1 Types of Program Evaluations	62
4.3.2 Research Designs	64
4.3.3 Maryland Scientific Methods Scale	65
4.3.4 Program Failure	68
4.3.5 Realistic Evaluation	69
4.4 Evaluating Crime Prevention Programs	71
4.5 Political Context	74
4.6 Conclusion	76
5: Chapter 5 – Methodology	77
5.1 Introduction	77
5.2 Hypothesis	78
5.3 Sample	78
5.4 Variables	79
5.5 Research Strategy	81
5.6 Conclusion	82
6: Chapter 6 – Results	84
6.1 Introduction	84
6.2 Descriptive Statistics	84
6.3 Bivariate Analyses	85
6.4 Multiple Regression	87
7: Chapter 7 – Discussion	90
7.1 Introduction	90
7.2 Current Study	90
7.3 Transit and the Built Environment	95
7.4 Policy Implications	98
7.5 Limitations	101
7.6 Future Research	102
8: Chapter 8 – Conclusion	105
Appendix 1 – 25 Techniques of Situational Crime Prevention.....	107
Reference List	109

LIST OF TABLES

Table 1 - Descriptive Statistics of Variables	85
Table 2 - Regression Results for Design Characteristics and Station Crime	89

1: CHAPTER 1 – INTRODUCTION

For some people, using public transportation is one part of their daily activities and they do not give it a second thought. Others, however, fear for their personal safety when in a transit environment, avoid it all together and instead, use personal vehicles as their means of transportation. In order for any major town or city to function efficiently, public transportation is relied upon to transport residents and visitors throughout the city safely and effectively. As city populations grow, modes of rapid public transportation become a necessity. Although criminal incidences on transit systems are relatively low, compared to city crime rates, fear for one's safety while using mass transit has been cited as a reason for not using the system (Shellow, Romualdi, and Bartel, 1974; Schultz and Gilbert, 2001). Because concern for one's personal safety can affect whether an individual will use public transportation, it is important to study the occurrence of crime within transit systems and determine approaches that can be used to remedy actual and perceived crime on the system.

Factors that lead to increased fear while using public transportation creates a cyclical relationship where one's fear of crime will reduce the number of passengers on the system as people avoid using public transportation, reducing the effect of safety in numbers, which lowers the actual level of safety and increases fear (Carr and Spring, 1993). This can also be integrated into a financial model where one's fear is created or increased by the design and

appearance of the public transportation system. Lack of cleanliness or care within the system increases fear, while decreasing the number of passengers and overall revenue for the system. The transit environment continues to degrade, as there is inadequate funding for maintenance of the system, which again increases the fears of transit passengers (Clarke, 1996).

Because passengers' concerns for their personal safety can result in an immediate decision to travel on the system or not, immediate responses to the problem become especially important. Situational crime prevention and crime prevention through environmental design are responses that focus on the criminal event rather than the criminal. These types of responses modify and alter the physical environment in order to block criminal opportunities. Several of these techniques have been adapted and implemented in different public spaces such as neighbourhoods, bars and pubs, schools, etc., and have been found to be effective at reducing crime (Clarke, 1997).

Although limited in scope, these strategies have also been applied to public transit environments. However, previous examinations of the applications of situational crime prevention and crime prevention through environmental design to transit environments have been hindered by the lack of adequate control groups. One of the first rapid transit systems designed and built using crime as a consideration was in Washington, DC. In La Vigne's (1996) examination of the effectiveness of these techniques, she compared crime rates from the Washington system to rapid transit systems in other cities with differing populations, policing strategies, and crime patterns. La Vigne controlled for

extraneous variables as best as possible and was able to make general conclusions about the effectiveness of using crime as a design consideration in rapid transit systems.

Because these types of crime prevention and crime reduction responses target the criminal event rather than the criminal, the effects of the application can be seen soon after the implementation. It is then possible to evaluate the specific program or intervention, using appropriate study designs, to determine its effectiveness. Rigorous evaluations provide evidence that helps to inform relevant criminal policy. Evaluations are able to offer insight on what programs work or do not work. Following an evidence-based approach, programs that have been found to be effective can be implemented in other environments, decreasing the amount of time and money spent on programs that are not successful in achieving their goals of reducing and preventing crime, while increasing programs that have been found to be successful.

The aim of the present study was to advance and add to La Vigne's conclusions on the application of crime prevention strategies to transit system design. Vancouver's rapid transit system is different than systems in other cities, as one of the SkyTrain lines was built without using crime as a design consideration, while a second line, built several years later, utilized situational crime prevention and crime prevention through environmental design concepts. Although an exploratory study was utilized to gain more insight on the application of these types of techniques to transit environments, this study had the advantage of a control group that is similar to the experimental group as the two

lines that were examined in this study are located in the same regional area. The use of situational prevention techniques was evaluated to determine if there were any differences in crime between the SkyTrain line that incorporated these techniques into the design and the SkyTrain line built earlier that did not.

The first three chapters will outline the theoretical framework, the current problem with crime in transit environments, and the use of evaluation research to develop evidence-based policy. The theoretical framework will help explain why crime occurs within a transit environment, based on the movement and decision-making processes of potential offenders and non-offenders. Situational crime prevention and crime prevention through environmental design will be presented to provide a background on these techniques and their application in transit environments to reduce and prevent crime. The importance of using evaluation research to support the use of implementing successful programs based on evidence of what works will also be explained. The final chapters describe the study design and results, and offer inferences based on the results obtained. Finally, future areas for research are identified.

2: CHAPTER 2 – THEORY

2.1 Introduction

Prior to the 1970s, a majority of criminological research focused on examining offender characteristics and individual predispositions to identify commonalities that would help explain why crime occurred. As theories continued to develop and expand, criminological research branched into an area that considered crime as a product of a particular environment rather than as a result of an individual's predispositions (Jeffery, 1978). The movement of people through a specific environment provides criminal opportunities that can be blocked, and reduced, through the modification and manipulation of the physical environment. Some environments are more conducive to crime than others, requiring a crime prevention response that is specific to the particular situation.

The approaches to criminology that examined offender characteristics were primarily divided into two schools, classical and positive. The classical approach to crime utilized the legal system as a means to provide punishment and deter and control crime, while the positive school focused on the treatment and rehabilitation of the offender (Jeffery, 1978). The two schools offered differing views towards criminology, but both approaches were reactive responses as the focus was on preventing future criminal events, but lacked consideration of the initial criminal event and actual criminal behaviour. Jeffery (1978:159) recognized that "behaviour is the product of two sets of variables: a

physical environment and a physical organism in interaction” and that this interaction should be examined to develop a proactive response to crime through prevention. By understanding how elements in a particular environment can influence behaviour, the physical environment can be modified to reduce the reinforcement that one may receive for engaging in criminal and deviant behaviour (Jeffery, 1969, 1971, 1977, 1990).

2.2 Environmental Criminology

In the early 1970s, through the development of environmental criminology, the criminological research began to expand to the physical environment and the criminal event rather than the individual criminal. Instead of considering crime as a result of an offender’s predispositions, it is possible to explain how crimes can occur due to opportunities provided by a particular environment (Brantingham and Brantingham, 1984). It is hypothesized that by blocking the opportunities provided by an environment it is possible to completely eliminate some criminal events or reduce it to an acceptable level.

Several theories, commonly known as opportunity theories, explain how particular characteristics of an environment can increase the likelihood of criminal acts being committed. Although reducing criminal opportunities through the manipulation of the built environment is not a new concept, opportunity theories explain why these methods are effective. Officially known as crime prevention through environmental design and situational crime prevention, these techniques take a more proactive approach to crime prevention. Building on the core

concepts of opportunity theories, these two strategies reduce criminal opportunities through modification of the built environment.

Brantingham and Brantingham (1993) noted that criminal events were the end products of a conscious decision making process. The key concept that is put forth by environmental criminology is that crime does not occur randomly. Instead, there are four major dimensions that describe when crime is likely to occur. The first theme is based on the normal movement of an individual. People are more likely to become victims, and offenders are more likely to commit crimes in locations where they spend the most time (Brantingham and Brantingham, 1991). This stream of environmental criminology provides support for routine activities theory developed by Cohen and Felson (1979).

The second theme describes how the occurrence of crime at a particular location is a product of the decision-making processes and choices made by offenders and victims (Brantingham and Brantingham, 1991). Indicators provided by the environment influence this process and help offenders determine safe and dangerous opportunities. Numerous studies provide support for relationships between crime and one's decision-making process and this has led the formation of rational choice theory by Cornish and Clarke (1986).

The final two themes of environmental criminology differ slightly from the first two dimensions. The physical conditions of some neighbourhoods cause people to view them negatively and therefore relate them to crime. These labels increase fear of crime associated with particular areas, but the fear may not necessarily reflect the actual occurrence of crime (Brantingham and

Brantingham, 1991). Finally, environmental criminology measures crime spatially, which provides a different approach to previous measures of crime rates and victimization surveys (Brantingham and Brantingham, 1991). All four approaches aim to understand and explain why crimes occur at some locations and not others.

Previous to the development of the environmental criminology perspective, most criminological research focused on the motivation of offenders (Brantingham and Brantingham, 1991). There are several approaches that aim to explain offenders' motivations. Sociological, biological and psychological theories, among others, attempt to explain an individual's motivation to engage in criminal and deviant behaviour. Brantingham and Brantingham (1993:260) noted that, previous theories that have focused on individual dynamics of a criminal behaviour have tended "to equate criminality with crime when criminality is but one of the elements contributing to a criminal event." Past experiences and personal history that leads an individual to develop criminal tendencies can be described as criminality whereas the actual behaviour of engaging in a criminal event is considered crime (Lilly, Cullen and Ball, 2007). Although crime and criminality go hand in hand, environmental criminology and opportunity theories are less focused on the past history of a potential offender, and instead are concentrated on the actual criminal act. Environmental criminology moves away from the examination of criminal motivations. Instead, these motivations are assumed to exist in some individuals and the focus turns to the location of crimes and the criminal event (Brantingham and Brantingham, 1991).

2.3 Opportunity Theories

By moving away from the examination of criminal motivations, and instead focusing on the location of crimes, opportunities for crime that the physical environment provides, become apparent. Following this approach several theories have emerged. Routine activities theory (Cohen and Felson, 1979) describes how the normal daily activities of people affect crime, while rational choice theory (Cornish and Clarke, 1986) explains how the choice to commit a crime results from a rational decision-making process conducted by the potential offender prior to committing a crime. Through careful examination of the locations of criminal activities, Brantingham and Brantingham (1984) developed pattern theory, which posits that crime does not occur randomly across space and time, but instead occurs in a pattern depending on the location.

Although these three theories are similar to each other as they describe why crime occurs in certain situations, the intention of each theory operates on a different level. Routine activities theory is focused on the combination of different factors, capable guardians and suitable targets, in the general public, that converge to create opportunities for crime, which makes it a macro theory, whereas rational choice theory is interested in an individual's decision making process, categorizing it as a micro theory (Clarke, 2005). Pattern theory on the other hand, a meso theory, is concentrated on the community and the daily activities that bring individuals into contact with each other (Clarke, 2005). The unit of interest for each of these three theories range from the individual, to a

specific environment and to the general public, but all three theories help to explain why some locations are more conducive to crime than others.

2.3.1 Routine Activities Theory

Post World War II, violent crime rates for robbery, burglary, and vehicle theft in the United States, dramatically increased even though the previously observed indicators related to these crimes did not appear to worsen (Cohen and Felson, 1979). Unemployment rates dropped, while the number of people completing high school and the median family income increased. After World War II, more people, especially women, were leaving their home for several “routine” activities including, employment, education, and leisure. The increased number of people engaging in these routine activities left homes unattended for extended periods during the day and because people were no longer isolated in their home, from a potential offender, the likelihood of victimization increased. The number of unattended homes and amount of people who were no longer secluded in their homes increased the availability of targets for a motivated offender.

Routine activities theory hypothesizes that crime will result when there is a convergence in time and space of three specific factors: a motivated offender, a suitable target, and the absence of a capable guardian (Cohen and Felson, 1979). If one of these components is missing, the chances of a crime being committed are reduced. In this situation a suitable target can refer to individuals or physical property and a suitable guardian is not limited to official police officers (Felson, 2008). Instead, a suitable guardian is any individual who engages in

behaviours to protect friends, family, strangers and physical property (Cohen and Felson, 1979). Because people do not remain in their residences completely isolated from others and go about their daily activities, which can include going to and from the workplace, attending educational institutions, and engaging in leisure and recreational activities, there is a high likelihood that these three factors will converge.

Environmental criminology assumes that the motivated offender exists, which makes it necessary to examine what factors increases the risks of an individual becoming a victim, or what makes a specific target appealing to a motivated offender. Felson and Cohen (1980) proposed four characteristics that are likely to increase the appeal of certain targets. The first characteristic is the target's value, whether it is financial or figurative. An item that is expensive is more attractive to a motivated offender, which increases the likelihood of the item becoming a suitable target (White, 2006). A second component is the target's visibility (Felson and Cohen, 1980). If a particular item can be clearly seen by others, it is likely that a motivated offender will notice it. Items that are more accessible than others are also likely to become a target because there are lower risks associated since less effort or skill is necessary (White, 2006). Finally, inertia refers to any characteristics that increase the difficulty of obtaining the desired item (White, 2006). Heavy items, as well as those that are physically locked down, are more complicated to steal, which makes them less desirable to a motivated offender (Felson and Cohen, 1980). It can be concluded that items

that are not visible, have a lower value, are not accessible, and are difficult to remove have a lower risk of becoming a suitable target.

It is highly probable that the combination of these three factors will occur in a transit environment. One characteristic of mass transit systems is that they bring people together who would normally not come in contact with each other (Brantingham and Brantingham, 1998). Because of this characteristic, there are increased numbers of suitable targets available for a motivated offender. Also, because transit systems operate not only during peak hours when people are travelling to and from work, there are extended periods of time in the early morning and late evening when fewer people are using on the system. With lower passenger levels during these time periods there is a lack of an appropriate guardian, which provide opportunities for a motivated offender to commit a crime. It should not be surprising then that crime occurs in and around this environment. However, it is possible to block these opportunities through the removal of suitable targets and by increasing the number of capable guardians.

2.3.2 Rational Choice Theory

Rational choice theory explains the occurrence of crime as a result of an offender's decision-making process (Cornish and Clarke, 1986). The costs and benefits of committing a particular crime are weighed before the offender engages in criminal behaviour. If the risks and efforts of committing a crime are much higher than the perceived benefits or rewards of that crime, it is plausible that the potential offender will desist from committing the criminal act or will commit a crime that requires less effort (Clarke and Cornish, 2001). A crime that

requires effort that is greater than the reward can result in complete reduction of the actual crime, or the offender will engage in a crime that is easier to commit, possibly reducing the level of victimization.

There are several assumptions of the rational choice perspective. The first assumption is that criminal behaviour is purposive and individuals engage in this behaviour in order to achieve or obtain some goal, which can include: material goods, money, excitement, and control, to satisfy their needs (Cornish and Clarke, 2008). The second assumption is that criminal behaviour is rational and offenders much like any other individual, attempt to achieve their desired goals through an existing method that is the most efficient (Cornish and Clarke, 2008). Another supposition of rational choice is that the decision-making process involved is crime specific and different crimes require different thought processes. The purposes, motives, and goals vary between crimes making the decision-making process specific to the particular crime (Cornish and Clarke, 2008). In order to develop appropriate crime prevention programs it is necessary to understand the thought processes involved for each particular crime (Linden, 2007).

The final three elements of rational choice include identifying the compositions of criminal involvement and crime event decisions, and the differences between the two (Cornish and Clarke, 2008). Crime event decisions are based on considerations that must be made prior to, during, and after committing a crime, while involvement decisions refer to one's criminal career. The three stages of involvement include initiation, habituation, and desistance. It

is likely that an offender's decision to initially engage in committing a crime is dependent on past criminal experience while habituation and desistence are related to previous successes and failures (Cornish and Clarke, 2008). The involvement process is comparable to behavioural reinforcement. If an individual successfully steals a car during their first attempt of this crime, it is likely they will continue with this behaviour since it was positively reinforced. However, if during the initial attempt the offender is detected or is unable to successfully steal the car, it is probable that they will desist from committing this crime in the future since they were not rewarded for their behaviour. Habituation can occur in two situations. Individuals who are always successful will continue to steal cars until they are no longer rewarded for doing so, while individuals who are intermittently successful will likely continue until a succession of offences do not result in reinforcement.

Characteristics of transit environments provide opportunities for certain types of crimes to be committed. Motivated offenders come to locations having already engaged in the criminal decision-making process (Cornish and Clarke, 2008). An individual who is motivated to steal a car, for example, will enter a transit environment looking for opportunities. Transit station parking lots tend to lack adequate security and there is an awareness that most vehicles are parked for several hours unattended throughout the day as people use the transit system to go to work. Individuals will also target transit environments for graffiti knowing that this environment provides an opportune location to display their work. Using materials that are resistant to graffiti will increase the effort required to engage in

this behaviour and reducing the reward of a reaching a large audience.

Increasing the efforts and reducing the rewards that transit environments provide for criminal opportunities can result in a lower number of criminal offences committed.

2.3.3 Pattern Theory

Pattern theory hypothesizes that “crimes do not occur randomly or uniformly in time or space or society” (Brantingham and Brantingham, 2008:79). Instead, certain areas are more or less likely to experience crime depending on the activities that make up that environment. Each separate environment has a backcloth that is continuously changing based on the individuals and activities that are located in the environment (Brantingham and Brantingham, 1993). “The likelihood of a criminal event transpiring depends on the backcloth, the site, the situation, an individual’s criminal readiness, routine activity patterns, and the distribution of targets” (Brantingham and Brantingham, 1993:266). Individuals develop routines creating patterned behaviour as they engage in their daily activities that take them from their home to work and leisure activities. Both offenders and non-offenders have developed activity spaces and when the spaces of these two individuals intersect, opportunities are created for engaging in criminal behaviour (Brantingham and Brantingham, 2008).

There are several elements needed that interact with each other and vary depending on the type of crime being committed. These components include: readiness, structural backcloth, activity backcloth, event process, expected crime pattern, and the relationship of elements (Brantingham and Brantingham, 1993).

The level of one's readiness to commit a certain crime will vary depending on the seriousness of engaging in the criminal behaviour. The more serious crimes, such as rape and murder, require a higher level of readiness and willingness as compared to less violent crimes, such as shoplifting. The structural and activity backcloths are formed by an individual's routine activities and vary by site, situation, and offender (Brantingham and Brantingham, 1993). The event process of each criminal act differs based on the potential offender's goals and what they hope to achieve or gain by engaging in the behaviour. As each criminal act has a different goal, the expected crime pattern will change spatially and temporally, in order to generate the best possible circumstances to achieve these goals. Household burglaries will tend to occur in residential areas, possibly during a weekday as homes are more likely to be empty during that time, while bar fights will increase during the nights on the weekend (Brantingham and Brantingham, 1993). Finally, these elements adapt to the criminal event as the relationship changes between them. It is important to acknowledge that none of these conditions is static, but instead are dynamic, and the importance of one element versus another element varies depending on the specific criminal event (Brantingham and Brantingham, 1993).

Transit systems are unique environments that provide fixed areas where it is likely that these two activity spaces of offenders and non-offenders will intersect. One's routine activities that involve employment, education, and leisure activities, also include modes of transportation. Because of this, many offenders' and non-offenders' awareness spaces will include public

transportation. Also, transit environments are not limited to one specific type of crime, but provide opportunities for several types including, crimes against a person, property crimes, and fraud or fare evasion. With several opportunities for different types of crime and the probability of offenders' and non-offenders' backcloths intersecting, there is an increased likelihood of criminal events occurring in a transit environment.

Many environments that have high activity and movement of individuals can be described as crime generators and crime attractors. Crime generators are environments, such as shopping centres, that bring people, with no underlying criminal motivations, together in large groups (Brantingham and Brantingham, 1995). Crime generators can also bring potential offenders into a particular environment without an underlying motivation to commit a crime, but who may subsequently do so (Brantingham and Brantingham, 2008). Because these individuals have no underlying motivation, crimes that are committed are as a result of the opportunities provided by the environment. After implementation of situational crime prevention strategies, crimes that occur in these environments are not likely to displace because they are opportunistic in nature (Brantingham and Brantingham, 2003). Most displacement is dependent on motivation so by eliminating opportunities in crime generator environments, there will be a reduction in crime without displacement. By examining displacement, or lack of displacement, it is possible to determine whether the location of the situational prevention strategy was a crime generator.

Mass transit systems can serve as crime generators since they are environments that bring people together for pro-social purposes. Most individuals travel on transit systems without engaging in criminal behaviour and have no motivation to do so. However, these environments can provide opportunities for crime. Within transit systems this is most likely to occur with fare evasion. Individuals will plan to purchase a fare upon entering a transit station, but because of other factors (running late, transit officials are not present, line-ups at ticket machines, etc.), they may instead opt to use the system without purchasing a fare. Transit systems can also generate crime that leads to individual victimization. Passengers in a hurry may leave valuable items exposed or behind on the train as they leave the environment, which increases the likelihood of theft.

Crime attractors, on the other hand, are environments in which individuals are drawn to for a criminogenic purpose. These environments provide opportunities for crime and are well known to potential offenders, which also enables repeat offending (Brantingham and Brantingham, 1995). Transit environments are attractive for thieves who steal cars as many transit stations provide parking lots for passengers to leave their vehicle for extended periods of time and use public transit. Thieves are aware that the parking lots are relatively insecure and are drawn to transit stations to engage in this behaviour. It is also likely that a motivated offender will travel for longer distances to find a suitable target and because public transit provides opportunities for an offender to gain access to a suitable target this increases the likelihood of theft from a transit

station parking lot (Barclay, Buckley, Brantingham, Brantingham, and Whinn-Yates, 1996).

2.4 Crime Prevention Strategies

Opportunity theories, such as rational choice theory and pattern theory, approached criminal events in a different manner than previous, offender-based theories by looking at how crime and the environment are related, it becomes possible to identify problems and risks that would increase the likelihood of a crime being committed, and modify the environment to decrease this risk. As opportunity theories became more accepted in criminology, the focus turned to how these criminal opportunities could be reduced with methods that would take a proactive rather than reactive approach.

2.4.1 History

Many individuals engage in activities that reduce criminal opportunities without any knowledge of the formal theoretical concepts. Target hardening strategies are in effect when people install alarms to protect their homes, and lock their car doors when leaving it unattended. These types of protective strategies have been in use for several centuries and were not necessarily new concepts when the official terms and theoretical frameworks began to emerge. Concepts that can be explained as similar to Newman's (1972) defensible space are observed through the construction of cities in several countries where walls were built to defend and protect cities against invasions.

As construction of citadels and castles evolved, techniques were sought out that would further protect these areas from invasion. Situating castles and citadels on higher grounds allowed the residents to have a clear sightline of anyone approaching the area (Schneider and Kitchen, 2002). This type of design also enabled the defenders to differentiate between legitimate and illegitimate users entering the area, which is similar to key concepts of defensible space and CPTED (Schneider and Kitchen, 2002).

While cities and empires continued to develop, the focus moved from defending the city from outsiders, to protecting residents from each other and preventing crime within the city. Over 700 years ago statutes were created and issued by the governing parties that required modification of the physical environment to reduce the likelihood of victimization. In 1285, Edward I

“commanded that the highways from market towns to other market towns be widened where there are woods or hedges or ditches, so that there may be no ditch, underwood or bushes where one could hide with evil intent within two hundred feet of the road on one side or the other, provided that this statute extends not to oaks or large trees so long as it is clear underneath. And if by the default of the lord, who will not fill up a ditch or level underwood or bushes in the manner aforesaid, robberies are committed, the lord shall be answerable: and if murder is committed, the lord shall be condemned to make fine at the king’s pleasure” (Rothwell, 1975:461).

This illustrates that the modification of the physical environment, resulting from concerns for the safety of residents and travellers, is not a new approach for preventing crime and has been in use for over 700 years (LeBeau, 1987).

2.4.2 Crime Prevention

The three main types of crime prevention programs include: primary (addresses factors that influence everyone), secondary (programs are specific to a person, place or situation), and tertiary (programs address preventing repeat offenses) (Brantingham, Brantingham and Taylor, 2005). Because perceptions of crime within a transit system are possibly as important or more so, than actual crime for influencing ridership, it is necessary to use approaches that target both issues (Shellow, et al., 1974). Building upon the development and expansion of opportunity theories, strategies that aim to reduce criminal opportunities have grown. Two specific techniques include: situational crime prevention, which was introduced by Clarke in 1980, and crime prevention through environmental design (CPTED), the terminology, which was first presented by Jeffery in 1971. These techniques can be utilized to modify and change negative behaviour that occurs because of opportunities produced by the environment (Brantingham and Brantingham, 1988). Although these techniques are similar, the one main difference is that situational crime prevention (secondary) attempts to address a problem that already exists, while CPTED (primary) is used in anticipation of future issues (Clarke, 2008). Both methods can be used in a transit context to prevent future crime and remedy existing crime.

2.4.2.1 Crime Prevention Through Environmental Design

Crime prevention through environmental design is a collection of techniques that posit that, “the proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime, and to an

improvement in the quality of life” (Crowe, 2000:46). In 1971, Jeffery was the first to officially term these techniques as crime prevention through environmental design, but there were several key works that emerged throughout the 1960s to 1970s that aided in the development and expansion of these approaches.

Jacobs (1961) was one of the first authors to bring attention to the designs and physical environments of cities as means to generate crime. Through the examination of American cities she concluded that streets that were full of activity appeared to be the safest streets, while those that were deserted had problems with crime. Her main contribution was the concept of “eyes on the street”. By studying and observing her own city sidewalks she determined that the safest streets had three main characteristics. It was found that the differences between public and private spaces must be clear to strangers, there needs to be eyes on the street, and continuous activity on the sidewalks that encourages residents to watch the activity in the streets, and therefore increasing awareness of suspicious behaviour (Jacobs, 1961).

Jacobs observed that as a city developed into focused sections (industrial, commercial, residential, etc.), these types of locations only required individuals to visit them with a specific purpose and at a particular time of the day. Because of the decrease of multiple land uses some locations were abandoned during certain times of the day leaving the areas vulnerable to crime as there was less activity and there were fewer individuals providing eyes on the street. By increasing the mixed use of land for different purposes it would be possible to

encourage continuous surveillance, as people would be attracted to the locations for multiple purposes (Jacobs, 1961).

Building on Jacobs' work, Shlomo Angel was interested in the connections between crime and urban planning. Following Jacobs' conclusions on the benefits of individual surveillance at deterring crime, Angel (1968) was concerned with examining exactly how one's presence could affect crime. He hypothesized that when the intensity of people's presence was low there would be limited targets or victims for a motivated offender resulting in lower crime rates. There would also be lower crime rates when there was a high presence of people as there would be too many capable guardians and witnesses. However, as the amount of people increase from a low intensity to a high intensity there is a period when the number of individuals provide enough suitable targets for a motivated offender, but there are not enough individuals to provide adequate surveillance. This point, called the critical intensity zone, is when most crimes are likely to occur (Angel, 1968)¹. Angel proposed that through the modification of the environment, the activity of individuals as they travel through particular settings could be manipulated so that critical intensity zones would be avoided. Although not empirically evaluated at the time, both Jacobs and Angel can be credited with providing valuable inferences on the relationships between crime and the planning and development of cities.

Jeffery outlined that criminal behaviour involved four elements, which included, the reinforcement available from the criminal act, the risk involved in

¹ It is important to note that at the time of this hypothesis there were no formal definitions outlining the boundaries of the critical zone.

the commission of the crime, the past conditioning history of the individual involved, and the opportunity structure to commit the act. Supporting the newer, differing, criminological stream emerging in the 1970s, Jeffery believed that, "There are no criminals, only environmental circumstances which result in criminal behaviour. Given the proper environmental structure, anyone will be a criminal or a noncriminal" (1971:177). Therefore, behaviour can be recognized as a product of the environment and through physical modification of the environment, behaviour can be positively manipulated as well.

Newman (1972) described the concept of defensible space as increasing the sense of ownership one feels, as well as using design to differentiate between public and private space. Defensible space is guided by four strategies: territoriality (developing perceived areas of public and private space), natural surveillance (increasing opportunities for visibility), image (using design to influence perceptions), and milieu (influence of geographical areas on each other) (Newman, 1972).

Territoriality can be defined as the physical boundaries or zones that delineate private property from public property (Newman, 1972). The use of specific and obvious boundaries between private and public space provides residents with a sense of ownership, which increases feelings of responsibility and concern residents have towards the private space. This is especially important in apartment buildings and high-density residences where private space is harder to define as compared to single-family homes. By creating definitive boundaries for public, private and semi-private areas residents will

engage in territorial actions and control outsider access of private and semi-private spaces (Newman, 1972).

The second strategy of defensible space is natural surveillance. Natural surveillance requires two core elements. The first element is that individuals are physically able to view public areas within their residence and the second element involves the continuous feeling that one's behaviour is being monitored (Newman, 1972). However, Newman observes that in order to effectively improve safety in an environment, through surveillance, it is necessary that the observer also take action in response to a particular event. He also further states that one's willingness to react is dependent on the extent to which the individual is invested in the specific location. Therefore, the efficiency of natural surveillance strategies increases when individuals demonstrate strong feelings of ownership towards their residences and surrounding areas (Newman, 1972).

The final two strategies of defensible space, image and milieu, aim to create positive and pro-social spaces by using design to influence perceptions. Certain environments, such as public housing, carry negative stigmas and are easily identifiable, which attracts deviant behaviours and makes them vulnerable to crime (Newman, 1972). Milieu refers to activities that occur in specific locations. Generally, some areas have a reputation for being safe because of the types of activities that occur there, the spaces have high levels of public movement, and they are formally monitored (Newman, 1972). Designing environments that encourage positive behaviours can help alter negative perceptions that are attached to some environments.

The original CPTED techniques include: territorial reinforcement, natural surveillance and natural access control (Cozens, 2008). Territorial reinforcement resembles defensible space as it aims to create a sense of ownership using symbolic barriers such as signs, or physical barriers, such as fences, while natural surveillance employs techniques that provide opportunities for self-surveillance by residents (Cozens, 2008). Finally, natural access control uses an approach that limits access to particular areas through locks, and security personnel (Cozens, 2002). All three of these measures can be applied to a transit context by the placement of signs and locked gates that inform and limit passenger access. Station design can also include wide, open platforms with good visibility to and from neighbouring residences.

Three techniques that were not included in the initial CPTED model, but were later added, consist of: activity support, image/space management and target hardening (Cozens, 2008). Activity support, comparable to Newman's strategy of milieu, involves using legitimate activities in particular areas to promote positive behaviour (Cozens, 2002). Image/space management involves the continuous maintenance of spaces to dissuade criminal behaviour from commencing (Cozens, 2008). This technique is beneficial for discouraging graffiti and vandalism. The last addition to the CPTED model is a target hardening approach that aims to increase the effort required by an offender to engage in deviant behaviour (Cozens, 2008). All six CPTED strategies can be applied to a transit context as a way of preventing anticipated criminal and deviant behaviour.

While Newman's (1972) work was one of the key foundations leading to the development of CPTED, it is important to recognize some differences between Newman's crime prevention through urban design (CPTUD) and Jeffery's (1971) crime prevention through environmental design. Both terms are sometimes used interchangeably with CPTED being the most commonly recognized and referenced. Newman's *Defensible Space* is grounded in the understanding that physical design and lack of differentiation between private and public spaces have resulted in the breakdown of informal social controls and led to increases in crime. The movement from single-family households to multiple family dwellings have created environments where people do not feel the need to invest in their community and instead become autonomous individuals, accountable only to themselves and their families. As Newman states, "when people begin to protect themselves as individuals and not as a community, the battle against crime is effectively lost" (1972:3).

Some components of CPTED have a similar intention to those of CPTUD, but the focus of CPTED is the modification of physical environment to alter and influence one's behaviour. Jeffery (1971) believed that behaviour, both potential offenders and victims, are products of the physical environment and result from reinforcement or punishment created by one's environment. As Jacobs (1961) proposed, multi-use environments encourage movement of people and "eyes on the street". Some environments, however, have been built for singular purposes and create locations where there is limited movement of the public (Jeffery, 1971). These types of environments are blocked off from public view creating

criminal opportunities. The main focus of CPTUD is that physical design of an environment can lead to social isolation while CPTED is concerned with physical isolation. Still, both concepts overlap with each other and reducing crime through modification of the physical environment cannot be achieved without the consideration of decreasing both social and physical isolation.

2.4.2.2 Situational Crime Prevention

Situational crime prevention developed throughout the 1970s as a concept that could encompass a wide range of strategies (Clarke, 1980). It has been described as a “variety of techniques and individual measures that attempt to change the person-situation interaction in a way that makes the crime less likely to occur” (Smith, 2008:124). Situational crime prevention is a broad concept that can be used to prevent different types of crime, but to be effective its use involves application to a specific type of crime (Clarke, 2008). Through research, application, and evaluation of these techniques to different types of crime in multiple environments, they continue to evolve, becoming more effective and specific to each particular situation (Brantingham, et al., 2005).

The initial situational crime prevention model consisted of 12 groups, which expanded to contain 16 groups and the current model contains 25 categories (Tilley, 2005). There are currently five main categories of this type of prevention and within each category there are five sub-groups that practitioners can employ to prevent crime. The five main groups include techniques that: increase the effort required to commit a crime, increase the risks of committing crime, reduce the reward derived from crime, reduce provocation, and remove

excuses for doing crime (Brantingham, et al., 2005). Although the categories and sub-groups remain constant throughout multiple applications, the actual responses and modifications vary depending on the environment and types of crime being targeted.

Smith (2008) applied the 25 techniques² of situational crime prevention to a transit system context. Increasing the effort involved in committing a criminal act while using public transit can be achieved through target hardening, which includes using graffiti resistant materials and easy to clean surfaces while increasing the risks can be accomplished with improved lighting and designs with open sightlines (Smith, 2008). Reducing the rewards and provocations are obtainable by denying the benefits of graffiti through the quick removal and reducing stress and frustration by playing classical music in the stations (Brantingham, et al., 2005). Finally, placing adequate garbage bins throughout stations will remove excuses for engaging in this particular deviant behaviour (Smith, 2008).

2.5 Criticisms of Crime Prevention

As with other crime prevention and reduction techniques, the use of situational prevention strategies does not come without some criticisms. Because these techniques are based on the premise of reducing crime by blocking criminal opportunities, people unfamiliar with this framework may perceive these types of responses as not being effective in reducing crime. Also, inadequate application of these techniques, which have lead to failures,

² Note Appendix 1

decreases the confidence one may have in situational prevention strategies (Clarke, 2005).

2.5.1 Displacement and Diffusion of Benefits

One of the most commonly expressed criticisms of these techniques is that it does not eliminate or reduce crime, but instead displaces it to another location that has not implemented the prevention strategy. However, research indicates that crime displacement does not occur often and when it does, it is very rarely displaced completely (Eck, 1993). Some view these crime reduction and prevention strategies in a negative way due to the possibility of crime moving, or displacing, from the original location, where the program is implemented, to another area that does not have the same, or any, crime reduction strategy in place. On the other hand, diffusion of benefits refers to the effectiveness of the program spreading to locations outside of the targeted area.

2.5.1.1 Displacement

There are several types of displacement, with the most common form being temporal displacement, where crime occurs at a different time of day (Hamilton-Smith, 2002). One study that examined the effectiveness of bike patrols in a transit station parking lot found no temporal displacement as the time period of car thefts remained the same (Barclay, et al, 1996). This study also found that there was no spatial displacement. It did not appear that potential offenders changed locations because there was no increase in car thefts in the surrounding areas. Tactical displacement involves the use of a different method

to commit the same crime (Hamilton-Smith, 2002). This could occur in a transit environment in the form of fare evasion. In some rapid transit systems, turnstiles are installed to reduce the amount of fare evasion. Before the installation of turnstiles, individuals who avoid paying fare could use the system without any difficulty. However, after the installation of turnstiles, if these individuals are motivated to avoid paying fares, they may choose to jump the turnstiles or use slugs to evade paying. Crime type/functional/offence displacement results when a completely different offence is committed while target displacement entails selecting a different target (Hamilton-Smith, 2002). The final type of displacement, perpetrator displacement, occurs when new offenders begin to commit crimes after other offenders have desisted, possibly due to the arrest of the previous offender (Eck, 1993).

It could be argued that some types of displacement would be acceptable outcomes of a crime reduction strategy. If the strategy used involved a target hardening approach, where it would become more difficult for an offender to commit a crime, they would either desist or resort to other means that would be less difficult and could therefore reduce the overall impact the crime has. Target displacement could result when a motivated offender attempts to steal a car, but upon breaking into the car they realize there is an anti-theft device installed and instead steal a cell phone. Although the target hardening strategy did not eliminate the intent to steal, it did reduce the impact of the crime as the offender chose to steal the cell phone rather than the car, which lowers the actual costs to society.

The likelihood of displacement occurring “depends on the spatial and temporal reach of the intervention, the type of crime involved, the strength of the offender’s motivation, and the attractiveness of alternative targets at various distances in space and time” (Brantingham and Brantingham, 2003:126). Hamilton-Smith (2002) observed that although there are four specifications concerning the probability of displacement, the strength of an offender’s motivation is very influential as to whether crime will be displaced. He further states that an offender’s willingness to adopt and change their criminal behaviours is dependent on their motivation and those with well-developed criminal careers are more likely to relocate. Displacement, after the implementation of a crime reduction strategy, is not inevitable and when it does occur there is little evidence of total displacement (Hamilton-Smith, 2002; Lab, 2007). However, if some displacement does occur, the benefits gained from the crime prevention initiative permeate the costs of the displaced crime (Ratcliffe, 2002). This is also supported by an examination by Guerette and Bowers (2009) of 102 studies that empirically measured displacement. They concluded that displacement is not a normal product of a situational crime prevention measure, and when it does occur it does not outweigh the benefits attained from the intervention.

One limitation of previous research on displacement is that the specific studies were not directly assessing displacement. Instead, any evidence produced resulted from an examination of the crime reduction intervention. Because the methodologies for the studies were developed to observe the

intervention's effects, any evidence of displacement, or lack thereof, was a secondary result to the original study. However, the first study to specifically assess displacement found little evidence of displacement for prostitution and drug related crimes (Weisburd, Wyckoff, Ready, Eck, Hinkle, and Gajewski, 2006) providing empirical support for previous research. Examining displacement directly requires a unique approach where the goals of the crime reduction intervention are not to produce the most beneficial crime prevention results, but instead provide the best means to measure displacement (Weisburd, et al., 2006).

2.5.1.2 Diffusion of Benefits

Diffusion of benefits is a concept opposite to that of displacement, but like displacement can occur in several forms (Barclay, et al., 1996). Diffusion of benefits occurs when the positive effects of a situational prevention strategy spread from the target location to neighbouring or similar areas (Eck, 1993). Newton, Johnson and Bowers (2003) examined a transit initiative that involved intensifying the number of appropriate guardians, including, police, security, and transit officials, on a bus route that experienced high levels of crime. These guardians were concentrated along the bus route and therefore, it was not expected that there would be any effect of this initiative outside an immediate 200m buffer zone. The researchers found that a reduction in recorded assaults and theft from car extended 400m beyond the bus route demonstrating the possibility of diffusion of benefits. However, because there was no concrete boundary for coverage by police officials along the bus route Newton, et al.

(2003) were unable to determine if the reduction in crime outside the original buffer zone resulted solely from diffusion of benefits or directly from the initiative.

While studying the effects of bike patrols in commuter parking lots Barclay, et al. (1996) found an 87.5% reduction in car thefts following the commencement of the program and this rate was maintained for some time after, demonstrating some diffusion of benefits. Weisburd, et al. (2006) also found evidence of diffusion of benefits where crime decreased in the areas beside the intervention locations. They attributed this to media coverage, public awareness of the intervention, and visibility of the intervention, such as observations by offenders in changes to police presence in particular areas. Some offenders were unaware of the physical boundaries of the targeted area, which resulted in incorrect assumptions that some locations were part of the intervention when they were not (Weisburd, et al., 2006).

It is necessary to anticipate possible displacement and diffusion of benefits before the implementation of crime reduction programs. By doing so, criminal behaviours that occur in the targeted environment can be analyzed to predict how they will change after implementation and appropriate responses can be identified (Hamilton-Smith, 2002). However, actual measurement of displacement and diffusion of benefits can be difficult. Because one environment can produce multiple criminal opportunities, it can be complicated to determine the type of displacement that will occur (Hamilton-Smith, 2002). In some situations where the crime reduction strategy results in a reduction in crime in both the target and control areas, diffusion of benefits may go unnoticed (Eck,

1993). Instead, the successful program will appear to have little to no effect and may be terminated as a result.

2.5.2 Root Causes

Some individuals believe that these responses that involve blocking criminal opportunities are only temporary and that the root causes of crime (poverty, lack of education, poor upbringing, etc.) are ignored and need to be the focus in order for there to be a reduction in crime (Linden, 2007). Because addressing criminal opportunities as a way to reduce crime has only emerged in the past 40 years, there is an abundance of research on root causes of crime and the focus has been placed on attending to these social issues. However, techniques that are implemented to block criminal opportunities have immediate results, which provide more time to develop appropriate strategies that target social issues or factors that increase the likelihood of an individual engaging in criminal behaviour (Clarke, 1980; Clarke, 2008). Situational prevention techniques can be specifically applied to a criminal opportunity and are designed to have a direct, rather than gradual, impact so the effectiveness can be immediately determined (Clarke, 2005).

2.5.3 Financial Costs

An additional criticism is in regards to the actual cost of these techniques and strategies. There is limited research that shows whether the costs associated with situational crime prevention and CPTED are less than the actual benefits that would be obtained (Mills, 1996). A financial assessment or cost

benefit analysis should be undertaken when these techniques are being considered for a crime prevention strategy to determine if the implementation will be worthwhile (Clarke, 2008). While the most cost effective use of these crime prevention and reduction strategies is during the design stage (Crowe, 2000), it does not devalue application on existing structures.

2.6 Conclusion

The development and expansion of environmental criminology has increased the understanding of how certain environments produce crime. This understanding allows for the formation of appropriate crime prevention responses. Both situational crime prevention and CPTED methods can be used to prevent crime that is an occurring problem, and crime that is anticipated to occur in the future. They can be directly applied to the design of transit systems as these types of strategies “allow for effective monitoring and implementation of effective program modifications as the original program’s effectiveness wanes” (Brantingham, et al., 2005: 287). The two techniques are a unique approach to crime prevention as they can be manipulated and implemented depending on the type of crime that is being targeted increasing applicability and effectiveness (Rondeau, Brantingham and Brantingham, 2005). Through modification of the physical environment, crimes can be completely eliminated, or reduced, in a transit environment.

3: CHAPTER 3 – TRANSIT CRIME

3.1 Introduction

Crime that occurs on mass transit systems, as well as public perceptions of crime, are problems that can affect the number of passengers that travel on public transit. Although the number of crimes that occur on transit systems are generally lower than the overall crime rates for the city where the system is located, public insecurities can reduce the number of passengers using the system (Smith, 1986; Kenney, 1987). Because the public's perceptions of crime influence ridership, steps need to be taken to increase feelings of security. Through the use of situational crime prevention and crime prevention through environmental design (CPTED) techniques, the physical environment can be manipulated in order to modify behaviour. These techniques can be used in a transit environment to block opportunities for crime, which reduces actual crime within the system, while increasing passengers' feelings of security.

3.2 Transit Crime

By developing an understanding of the opportunities that transit systems provide for crime, it is possible to take steps that will block the potential opportunities. However, it is important to understand which crimes are actually being committed in order to develop an appropriate response. Generally, the occurrence of crime in transit environments has been found to be related to two

situational characteristics: lack of supervision, and overcrowding and peak travel (Smith and Clarke, 2000). More specifically, there are three categories of criminal behaviours that can be a product of environmental circumstances, which include fare evasion, graffiti and vandalism, and crimes against the person (Easteal and Wilson, 1991). Most crimes occur when there is a lack of supervision, while some crimes against the person, such as indecent exposure and pick pocketing, occur when there is overcrowding on the system and there are increased opportunities for physical contact (Jochelson, 1994). It is necessary to determine when each crime is likely to occur in order to apply approaches that are best suited for each specific crime.

3.2.1 Fare Evasion

There are three broad categories of fare evasion, which consist of vaulting turnstiles, buying an inappropriate fare, and fare fraud (Weidner, 1996). Fare fraud can include using counterfeit slugs, not validating the fare card or not purchasing a fare on honour-based transit systems. Because of the nature of this type of crime, there are difficulties in gaining an understanding of how often this type of deviant behaviour occurs. A fare evasion audit conducted in 1989 in Vancouver found that over 50% of the total fare evasion was a result of insufficient fare (DesChamps, Brantingham, and Brantingham, 1991). Van Andel (1989) found that as fare procedures changed, the responsibility of regulating fare purchases changed from primarily bus drivers checking passenger fares upon boarding buses, to the responsibility of each passenger. The increased

responsibility placed on passengers to purchase tickets resulted in a higher frequency of fare evasion.

There is also evidence that the more complicated a fare system is, the increased likelihood a person will engage in fare evasion (Smith and Clarke, 2000). Not only can the actual fare vending machine create problems, but also the fare system as a whole becomes more complex in cities that are serviced by multiple forms of public transportation. Due to the geographical nature of some cities, such as Vancouver, British Columbia, these regions require several different systems, including a combination of buses, ferries, and rapid transit, in order to provide the most efficient and effective service to the public. This system also utilizes passes, such as student, employee, and monthly, that cover all zones and are valid for a specific amount of time depending on the type of pass. The multiple modes of public transportation, and the differences in ticket prices depending on the zones travelled, times of the day, and days of the week travelled add to the confusion when an individual tries to purchase adequate fare.

One survey that examined passengers' perceptions of fare evasion, found that the public generally thought fare evasion was okay in certain situations, such as families with lower incomes (Van Andel, 1989). The survey also determined that those individuals who thought it was okay to evade fare in some circumstances were also more likely to engage in fare evasion by not purchasing a fare.

3.2.2 Graffiti and Vandalism

Although one act of graffiti or vandalism may seem inconsequential and not produce any physical harm to individuals, collective acts of graffiti or vandalism have much more severe consequences. Areas that are prone to these deviant behaviours demonstrate to the public and potential offenders a perceived lack of care or control of the location. A single incident of vandalism or graffiti, that is not remedied immediately, can result in an escalation of these types of deviant behaviours, as there does not appear to be any formal or informal control of the environment (Wilson and Kelling, 1989). This amplifies feelings of insecurity and increases the likelihood that the deviant behaviour will repeatedly occur in that particular location (Smith and Cornish, 2006). This type of behaviour is especially necessary to curb as areas with high levels of graffiti and vandalism promote feelings of insecurity leading to decreased ridership (Smith, 2008). Although this behaviour occurs at a higher rate in areas that are prone to graffiti and vandalism, broken windows theory demonstrates that once the initial deviant act is committed, similar acts will follow if there is no immediate response to fix the problem, even in locations that appear to have control over the environment (Wilson and Kelling, 1989).

Graffiti and vandalism are deviant behaviours that are usually committed by youth during off-peak hours when fewer passengers are using the system and there are fewer appropriate guardians (Easteal and Wilson, 1991). It is also likely that youths who target public transit for vandalism are not limited to that particular environment, but also engage in other deviant activities, in different locations (Morgan and Smith, 2006). One study conducted on the New York

subway system found that 40% of the individuals arrested for graffiti also committed robberies and burglaries (Sloan-Howitt and Kelling, 1990). Smith and Cornish (2006) found that vandalism is most likely to occur on public property, rather than private property, increasing the likelihood that transit environments will be targeted. Acts of graffiti and vandalism result in reduced ridership, but there can also be dangerous outcomes for the offender. Eastel and Wilson (1991) observed that a number of deaths resulted from graffiti artists taking more risks by finding increasingly difficult areas to reach, such as in the tunnels or train tracks.

3.2.3 Crimes Against the Person

Crimes that are specifically targeted toward passengers have a direct impact on the fear of crime experienced by individuals. Crimes against the person usually include assaults, robberies, sexual offences, and pick pocketing. However, it is necessary to separate these offences as assaults and robberies tend to occur during a different time period than sexual offences and pick pocketing (Smith and Clarke, 2000).

The time period with the highest risk of victimization for assaults and robberies occurs between midnight and 6 am (Jochelson, 1994). Smith (1986) also found that the risk of assaults or robberies increased during the midnight to 4 am time period on weekends demonstrating an increased risk when there is lack of appropriate guardians from fellow passengers or transit officials. Angel's robbery/density hypothesis posits that robberies occur during levels of medium density and not at high or low levels (Clarke, Belanger, and Eastman, 1996).

This is a result of too few suitable targets at a low density of individuals, and too many appropriate guardians at a higher density of individuals, supporting routine activities theory (Clarke, et al., 1996). Testing this hypothesis in a transit environment, Clarke, et al. (1996) found that robberies usually occurred when there were lower levels of passengers. It is possible, that the likelihood of the robbery occurring not only depends on the density of the individuals in an environment, but also the type of robbery being committed (Clarke, et al., 1996). However, most studies show that as the number of passengers travelling on the system decreases, risk of victimization increases (Shellow, et al., 1974; Block and Davis, 1996).

On the other hand, certain crimes are more likely to occur when ridership is higher. Sexual offences, such as indecent exposure and inappropriate touching, and pick pocketing usually occur during peak periods on transit as there are increased opportunities for physical contact (Smith and Clarke, 2000). However, one study conducted on an Australia railway system found that sexual offences was the only category of criminal offences to occur more on the train than in the station (Jochelson, 1994). Morgan and Smith (2006) suggest that this is because of the restricted passenger movement and crowding on trains that inhibits an individual's ability to remove him or herself from the confined space on the train. Although, the highest number of sexual offences occurs during peak hours, the highest risk of victimization was found to be during the midnight to 6 am time period (Jochelson, 1994).

Different studies have examined several transit systems to determine which specific areas have higher incident rates, as compared to other locations within the stations. Much like the time period that crimes are likely to occur within, locations of crime are also dependent on the specific type of crime. Smith (1986) found that half of the reported robberies occurred on station platforms and in stairwells, while less than one third occurred on the actual train. Because crimes like pick pocketing, occur during peak travel periods when there are increased opportunities for physical contact it follows that these crimes are more likely to occur not only on crowded trains and busy platforms, but also in locations where passengers congregate, such as elevators and escalators (Morgan and Smith, 2006). If the design of transit stations and trains are conducive for criminal opportunities, it is likely that these crimes will occur.

Crime rates at stations were also found to generally be reflective of the crime rates in the local neighbourhood (Falanga, 1988; La Vigne, 1996; Smith and Cornish, 2006). An analysis of a transit system in California found that transit stations that were below ground had higher crime rates than those above ground, and the five stations with the highest crime rates had limited visibility from the surrounding residences (Liggett, Loukaitou-Sideris and Iseki, 2004). By gaining an understanding of which type of crimes are more likely to occur during certain time periods and at particular locations, it is possible to develop specific approaches that can better target and prevent each type of crime.

3.3 Crime Prevention Approaches

Although, actual crime that occurs within a transit system context is relatively lower than the rate for the whole city, and the likelihood of victimization is low, the public generally feels insecure when using transit (Shellow, et al., 1974; Smith, 1986; Kenney, 1987; Schultz and Gilbert, 2001). This sense of insecurity is usually because of the physical structures of the stations, as many passengers feel trapped in the dark, isolated areas. Public perceptions are also influenced by a heightened awareness of crime occurring on public transit because of media sensationalization (Kiersh, 1980). One survey conducted by Shellow, et al. (1974) found that 25% of transit non-users revealed that concern for their personal safety was the reason for not using public transit. Furthermore, Schultz and Gilbert (2001) found that women have higher fears of travelling on public transit, than men, and therefore limit their use of this form of transportation.

Fear of crime and actual crime on public transit produces a cyclical relationship. The increased feelings of insecurity reduces the number of individuals who use public transit, which in turn increases victimization as crimes on transit usually occur when there are reduced numbers of passengers travelling on the system (Shellow, et al., 1974; Block and Davis, 1996). Increased levels of crime reduce ridership even further, decreasing revenue generated by the system. A lack of revenue does not allow for adequate maintenance and upkeep of stations and trains or provide funding for transit

officers to patrol the system, which again increases feelings of insecurity (Clarke, 1996).

3.3.1 Fare Evasion

Since there are three different means for one to engage in fare evasion, different approaches to inhibit these behaviours are necessary. Turnstile vaulting can be conducted in two ways. An individual can either physically jump over a waist high turnstile, or pass through immediately following another passenger. One method that was used to prevent this behaviour involved the installation of floor to ceiling turnstiles, which did not allow one to jump over the turnstile (Weidner, 1996).

Also, turnstiles that required tickets at both entry and exit points decreased the likelihood of an individual buying a fare for shorter distances than the trip involved, reducing this type of fare evasion by about 65% (Weidner, 1996). Using tickets at both entry and exit of the system also increases the likelihood of an individual being detected for not purchasing a fare, or purchasing an inadequate amount. If an individual is able to evade the fare at the entry point, having an appropriate ticket at the exit point increases one's risks in engaging in this deviant behaviour. Following a rational choice perspective of increasing the efforts involved in fare evasion, a target-hardening approach in London was used to make it more difficult for one to use counterfeit slugs (Weidner, 1996; Smith and Clarke, 2000). The designs of a new rapid transit line in Paris included ticket seller booths that were centrally located in the lobby in view of the turnstiles to deter tampering and the use of counterfeit tickets (Myhre

and Rosso, 1996). In Vancouver, British Columbia, fare tickets were easy to alter and modify, and could be made to look authentic, even to transit officials (DesChamps, et al., 1991). To reduce the tampering of fare tickets, they were redesigned to make them more difficult to alter, and additional training for officials to recognize counterfeit tickets was provided (DesChamps, et al., 1991).

3.3.2 Graffiti and Vandalism

Using design techniques to manipulate the physical environment in combination with other strategies can limit the occurrence of these types of deviant behaviours. One of the most common responses is to ensure that areas, which have been vandalized, are cleaned or fixed immediately (Easteal and Wilson, 1991; La Vigne, 1996). The rapid transit system in Washington, DC uses a policy of cleaning or repairing problematic areas within 24 hours (La Vigne, 1996). One approach taken by a transit system in Melbourne, Australia, involved completely cleaning and repairing one station and maintaining the cleanliness of that station before continuing to the next one (Easteal and Wilson, 1991). Eventually the whole line, including each station, was free of graffiti and vandalism and the high maintenance effort reduced the problem significantly. The policy for this system also included cleaning and repairing each train immediately and if it was not possible, the train was removed from service and vandalized trains were not placed in service with clean trains (Easteal and Wilson, 1991).

A second approach that targets graffiti and vandalism involves increasing the effort required and reducing rewards. This includes the use of materials,

such as concrete, brick, granite and bronze, that are easy to clean and resistant to graffiti and vandalism (Easteal and Wilson, 1991; La Vigne, 1996; Myhre and Rosso, 1996). The use of recessed walls or placement of rails in front of walls separates the public from accessing walls in stations. Some systems have taken advantage of graffiti by providing spaces for legitimate artwork by graffiti artists (Easteal and Wilson, 1991). Arched walls and vaulted ceilings were also used in the design of the Paris line to reduce opportunities for graffiti and vandalism (Myhre and Rosso, 1996).

3.3.3 Crimes Against the Person

Measures that are taken to reduce opportunities for crimes that occur against a person also help to increase feelings of safety within the transit environment. Some of the specific designs that have been used at transit stations include eliminating dead end hallways and negative space that provide opportunities for criminal behaviours (Easteal and Wilson, 1991; Gaylord and Galliher, 1991; Felson, et al., 1996). Increased lighting and use of materials that are lighter in colour, or can better reflect light to create brighter stations and trains, have also been implemented in some systems (Falanga, 1988). Each separate light in the Washington system covers at least two square feet and is recessed so as not to cause shadows. Indented walls that reflect the lighting were also used, creating a brighter atmosphere in the stations (La Vigne, 1996).

Visibility and natural surveillance can also be increased to provide opportunities for passengers and individuals outside the transit environment to view passengers using the transit system. One approach that has been used to

increase visibility is to limit advertising between the tracks of opposite platforms so passengers on one side of the track can view other passengers opposite them (Easteal and Wilson, 1991; La Vigne, 1996). The transit system in Hong Kong placed escalators at the ends of the platforms, rather than in the middle of the platform, so new passengers arriving could view the passengers who are already waiting for a train (Gaylord and Galliher, 1991). Stations that are designed with a large and open concept with wide platforms provide better observation opportunities, and trains that are built with a straight through format with a slight raise in the middle offer a beneficial observation point for transit officials who can stand in the middle and view the whole train (Gaylord and Galliher, 1991). In Paris, glass barriers have been used to prevent access to the track while still allowing for observation of the opposite track (Myhre and Rosso, 1996).

Other strategies that have been employed involve limiting the number of entrances and exits and using design to manage passenger flow. Falanga (1988) found that areas with a greater number of entrances and exits provided escape routes for offenders and were usually areas that had high incidences of crime. In addition, by managing the flow of passengers, individuals going against this flow, potentially for illegitimate reasons, become obvious to the crowd (Falanga, 1988; La Vigne, 1996; Myhre and Rosso, 1996). Transfer tunnels at the mezzanine level are preferred over those below ground as above ground tunnels reduce loitering in the stations and longer stairs and escalators are favoured to winding stairs as a way to avoid blind spots (La Vigne, 1996).

3.3.4 Additional Safety Measures

Although the design of transit systems can help to reduce opportunities for crime, the physical modification does not eliminate the need for formal surveillance through the use of CCTV. CCTV can be used in areas where natural surveillance is difficult or impossible and it can also be used as a form of surveillance in addition to that provided by transit officials or transit police. This use would be especially beneficial when located in the back of long buses or on the upper level of double decker buses as the only person able to provide formal surveillance would be the driver (Poyner, 1983). The most effective use of CCTV is to have the cameras directed to one console station where an attendant monitors the screen and communicates to transit officials about problem situations (Kiersh, 1980; Eastal and Wilson, 1991; La Vigne, 1996). Posted signs informing passengers about monitoring of the stations and trains by CCTV help as a deterrent and provide a sense of security for passengers (La Vigne, 1996).

One of the most common responses for creating safer transit systems is to increase the number of transit officials (Kiersh, 1980; Translink, 2008). However, if an increase in police officers patrolling transit systems is the only measure implemented, this measure is not likely to reduce the actual number of crimes committed and because the transit environment is so vast, it is not possible to have the entire system monitored by officials (Kiersh, 1980; Smith and Cornish, 2006). While visibility of transit officials reduces levels of fear experienced by passengers, undercover officials have been found to have a greater impact on reducing crime within the system and have been employed in several transit

systems in conjunction with uniformed officials (Kiersh, 1980; Pearlstein and Wachs, 1982; Easteal and Wilson, 1991).

It is also necessary for effective communication systems between consol stations, police officers, transit attendants, and transit passengers. Alarm systems and direct telephone lines and intercoms between transit stations and trains, and transit officials that enable officials to be alerted quickly to problematic and dangerous situations also help increase feelings of safety (Shellow, et al., 1974; La Vigne, 1996; Myhre and Rosso, 1996). Public address systems can be used to inform passengers and transit attendants about delays and situations arising within the system, which helps to reduce one's frustrations (Myhre and Rosso, 1996).

3.4 Case Studies

Situational crime prevention techniques and CPTED are becoming more accepted by urban planners and architects and usage of these methods increase as they become recognized as effective measures to reduce crime. These techniques have been utilized in several transit systems, in both pre-construction and post-construction of the transit lines. The cities of Washington, DC and Hong Kong have used these techniques to guide the design of their respective transit lines as a way to reduce incidences of crime by eliminating opportunities for criminal activity. Chicago and New York City are examples of how these design measures can be used to reduce opportunities post-construction of the transit line and stations. It is important to recognize that the general techniques can be utilized by all cities, but implementation depends on the specific

environment. What works in one city or at one station may not necessarily work at other stations. The design of each station needs to take into consideration the population it serves, the neighbourhood it is situated in and the type of crime that exists (Falanga, 1988). This type of approach follows a system-based perspective. Each station may have multiple factors that can interact to influence crime, but these factors may differ at every station. It is necessary to examine each station as a system itself and determine different relationships that exist in order to apply crime prevention strategies that are best suited for each separate station (Stewart and Ayres, 2001).

Chicago

The Chicago subway system was constructed before crime was a consideration for design (Falanga, 1988). One study that examined this subway system compared two high-risk stations that differed in crime type, victims, and offenders, as well as station characteristics. There were 12 high incidence sites identified from this comparison, some of which included: platform to mezzanine level escalator, platform train wait area, area beneath the mezzanine level stairs, and lower transfer tunnel (Falanga, 1988). Falanga (1988) also found that non-violent crimes usually occurred when the density of passengers was higher, such as during rush hour. Violent crimes usually occurred when passengers were isolated, and graffiti and vandalism occurred when there were no passengers around. From this analysis of high incidence sites Falanga was able to determine several characteristics that needed to be considered during the design of stations. One of his recommendations was to minimize the number of

entrances and exits as it was noted that stations with multiple escape routes had a higher number of crimes. It was also found that passenger movement should be controlled so that when a person is going against the flow it would be more conspicuous to the other passengers. With multiple entrances and exits it is difficult for one to develop an awareness of who the legitimate users are and separate them from illegitimate individuals.

Washington, DC

The Washington Metro system, on the other hand, was designed using crime prevention techniques. The Metro system began operating in 1976 and is considered one of the safer subway systems in the world (La Vigne, 1996). Safety was an important consideration when designing this specific system because at the time of design and implementation, Washington, DC had the tenth highest crime rate in the United States. La Vigne (1996) conducted a study to distinguish if the lower crime rates were in fact due to the design of the station. It has been established that crime rates at a particular station are generally reflective of the crime in the surrounding neighbourhood (Falanga, 1988) so one approach to determine if a reduction in crime on the system was in fact a direct result of the design, was to examine crime rates both above and below ground. La Vigne (1996) found that above and below ground crime rates were not related except for assaults, which is a type of crime that is more situational related than other crimes, since assaults are more likely to be committed in the offender's neighbourhood.

The Washington subway system was also compared to three other systems that used differing design characteristics. Atlanta and Washington's systems were both implemented during the same time period and past system designs were taken into consideration while Chicago and Boston's systems were much older and built before crime was a design consideration. Crime on Washington's subway system on average was found to be significantly lower than the other three systems (La Vigne, 1996).

Washington's subway stations were designed uniformly for ease of ridership, which is important as the unfamiliarity of stations can increase one's fear (Pearlstein and Wachs, 1982). Transfer stations that connected multiple lines used overhead tunnels at the mezzanine level to avoid dark, underground tunnels, which also prevented people from lingering in the long passageways.

Hong Kong

Similar to the Washington, DC transit system, the subway system in Hong Kong has been perceived as one of the safest subway systems in the world (Gaylord and Galliher, 1991). The pre-design of this system though is unlike any other system due to the different demands that would be placed on it as Hong Kong contains one of the highest population densities in the world. From early on it was recognized that private cars would not be an efficient way for the city to operate, which increased the necessity for functional public transportation (Gaylord and Galliher, 1991). The three main factors that contribute to the low crime rate on Hong Kong's subway system include: the overall low crime rate in Hong Kong, the efforts of the transit police, who have the highest proportion of

officers to passengers in the world, and the physical design of the system (Gaylord and Galliher, 1991). The stations were designed to increase visibility and natural surveillance by building large, open platforms, wide tunnels, and trains were built with a straight through format enabling a passenger to see from one end of the train to the other end. Escalators were placed at the end of platforms so new passengers arriving could observe the passengers that were waiting for a train.

New York City

An examination of one station in New York City presents an example of using crime prevention designs to reduce crime opportunities post-construction of the station. The Port Authority Bus Terminal is located in the heart of Manhattan and is one of the busiest stations in New York City as it handles a majority of passengers who travel from New Jersey every day for work (Felson, Belanger, Bichler, Bruzinski, Campbell, Fried, et al., 1996). There were six levels that were designed and added at different times making it difficult for passengers to get around the station. By being located close to Times Square, which was known for prostitution and pornography stores, the Port Authority terminal was in a centralized location and provided easier access for clients in the sex industry (Felson, et al., 1996). An increase in homelessness and crack cocaine in the 1980s resulted in transients moving into the Port Authority terminal and engaging in behaviours such as, injection drug use, having sexual intercourse, giving birth, and some transients died in the terminal building (Felson, et al., 1996). Laws

prevented eviction of transients from public places and the poor design did not allow for traditional surveillance to have any effect.

Because of costs and the size of the station, it could not be reconstructed so modifications were made instead. Opportunities that were available for illegal activities were eliminated by closing up spaces and knocking down walls to remove alcoves and areas where these activities were taking place (Felson, et al., 1996). Familiar chain stores were brought into a renovated food court, which was a different technique from the design of Washington's system as no commercial stores were built at the stations. However, one of the main reasons for this difference is that the public did not feel secure in the Port Authority terminal so their confidence needed to be increased through the use of familiar stores. In Washington, it was a completely new system so encouraging passengers to return to the stations was not necessary and one of the reasons for not having commercial establishments is to prevent loitering. This exemplifies that although the design of a station attempts to reduce crime, methods that are implemented need to be specific to the goals of each individual system. Also, the physical design of the restrooms in the Port Authority bus terminal presented numerous opportunities for illegal behaviours, such as drug dealing and prostitution. Several steps, such as mirrors to increase visibility and the placement of attendants at the entrances of the restrooms, were taken to decrease illegitimate use (Felson, et al., 1996).

Through examination of the different subway systems, it is clear that there are several similar and different approaches taken, but all the systems address

the same goal of reducing opportunities for crime. It is apparent that the physical design of stations and trains affect not only the perceptions of fear of passengers, but also impacts the level of crime within the transit system.

3.5 Conclusion

Transit systems are very diverse environments with numerous opportunities for the generation of crime (Brantingham and Brantingham, 1998). An objective to decrease the occurrence of crime by reducing opportunities is one that is easier to attain rather than one of completely eliminating crime. Careful examination of the transit environment and crime patterns is necessary before implementation, to ensure the problems at each station are targeted appropriately. The design of the physical environment using situational crime prevention and CPTED strategies can help to diminish potential opportunities for crime. In addition, designs that are used to reduce criminal opportunities have also been found to reduce fear of crime experienced by passengers using public transit.

4: CHAPTER 4 – EVALUATION RESEARCH

4.1 Introduction

When developing and implementing a specific policy it is important to consider what is and is not effective in certain situations. This type of policy development is known as evidence-based policy and it relies on past experiences and research to provide scientific evidence to determine what programs or methods have positive effects. However, in order for evidence-based policies to be successful, the supportive evidence needs to result from rigorous evaluations that determine the successfulness of particular programs.

There are several types of evaluations that can be utilized to assess the effect a program may have, but the specific type of evaluation that should be employed is dependent on the particular goals of the evaluation. There is much debate on how thorough an evaluation needs to be in order to consider the results as providing evidence for a crime prevention program. The Maryland Scientific Methods Scale was created to provide guidelines and exact standards for studies for the consideration of each study's respective findings (Farrington, Gottfredson, Sherman, and Welsh, 2002). Through the use of accepted standards, applicable programs are examined to establish what effects the programs have. Those programs with beneficial outcomes should be utilized when developing crime policy.

4.2 Evidence-Based Policy

Using an evidence-based approach to crime policy is similar to the scientific approach taken by health and medicine policy (Welsh and Farrington, 2001; Mears, 2007). The findings from empirical research on specific issues are utilized to implement policies that have been demonstrated to be beneficial. Although limited, the amount of rigorous evaluations conducted on crime prevention programs is increasing (Chemers and Reed, 2005; Welsh and Farrington, 2005). However, due to the complex and multifaceted nature of crime and delinquency issues, using an evidence-based approach to policy development may not always appear to be a realistic response to a problem. The length of time and amount of effort that is required to thoroughly evaluate a crime prevention program in order to determine its effectiveness fails to appease the public when an immediate response is demanded due to increased awareness and concern of a public safety issue.

More often than not, crime policy is powered by political ideology, public demands, and the current issues at hand while empirical evidence becomes a secondary consideration (Welsh and Farrington, 2001). Also, because of the pressure the public places on governments for an immediate response to a crime issue, the governing body is likely to implement a policy that will provide immediate results and garner support from the public, independent of whether or not the program has evidentiary support (Welsh and Farrington, 2001). This type of response from the government tends to produce policies that promote a “tough

on crime” ideology, demonstrating to the public that the governing body is reacting to the particular safety issue, thus satisfying the public’s concerns.

Although immediate reaction by the government to a particular issue may please the general public, the policies that are developed and implemented may not necessarily be empirically supported or found to be effective. The implementation of programs and policies that have not been found to be successful can result in wasting valuable resources, such as time and money, and possibly do nothing to remedy the issue. Because of the likelihood of these programs having no positive effects, or possibly even harmful outcomes, it is necessary to promote and encourage the use of programs and policies that have been empirically found to be worthwhile and successful (Welsh and Farrington, 2001). Some states, including Washington and Oregon, have legislated that funding will only be provided for programs after sufficient evidence of the effectiveness of the program has been produced (Chemers and Reed, 2005). Determining what type of program works and does not work in a particular situation, based on previous findings, increases the ability to successfully target and remedy issues that cause concern for public safety.

4.3 Evaluation Research

The use of evaluations to assess the effectiveness of programs allows one to provide governing bodies and stakeholders with accurate findings on the benefits, or lack thereof, of individual programs. Evaluations can be used in multiple circumstances, depending on what the governing bodies or stakeholders’ goals are. The most common function of an evaluation is to

provide findings on a program that would then be used to inform policy (Weiss, 1998). This type of use, instrumental use, allows one to determine whether a program should be continued or if modifications are necessary to produce successful outcomes. A thorough evaluation enables policy makers to make informed decisions in regards to the individual program based on the findings of the evaluation (Weiss, 1998). Policies and programs that result from informed decisions, founded on empirical evidence, are more likely to be effective than those that are implemented due to rash decisions made by the governing bodies and stakeholders as a way to placate the general public.

Not only can the results of evaluations be used immediately after completion to make informed decisions regarding policies and programs, but also evaluations are helpful in multiple ways following the original evaluation. A second type of use, conceptual use, is by those individuals who are exclusively involved in the targeted program (Weiss, 1998). Even if an evaluation's results are not used following commencement of the evaluation, individuals involved with the program are still able to benefit and use the information gained. Although changes may not be possible at that point in time, understanding of the strengths and weaknesses of that particular program increases one's knowledge of the functionality of the program and when there is an opportunity to do so, these individuals are better able to modify the program (Weiss, 1998). Evaluations can be used as a means of persuasion as the managers of a program can also use evaluation findings to substantiate problems that they know to already exist and provide support for changes. Finally, the outcomes of an evaluation can be used

outside of the targeted program to build a knowledge base that can be utilized by external parties to develop and implement similar programs and policies (Weiss, 1998).

It is important to be aware that an evaluation's outcomes can differ significantly depending upon the mechanisms of an evaluation. Even though one specific program is being examined, the type of data obtained, measures used, and analyses employed can produce varying results (Weiss, 1998). Before generalizations can be made about the program, based on the outcomes, these factors need to be considered. Because of the effects the design components can have on an evaluation's results, it is necessary that governing bodies are aware of these potential effects when developing policy to avoid developing overarching policies that are ineffective.

The main objective of program evaluations is to verify whether the "program is doing what is supposed to be doing" (Pal, 2006:285). Evaluations can be used to determine the effectiveness of implemented crime prevention programs. Results from these evaluations allow governing bodies to establish whether or not the specific programs are successful in obtaining the desired goals. If the results from the evaluation show that the interventions are not reaching the predetermined goals, the program can be eliminated, or modified, reducing the amount of time and valuable resources that would be wasted on ineffective programs (Rossi, Lipsey, and Freeman, 2004).

4.3.1 Types of Program Evaluations

There are five key categories of program evaluation, which include: needs, theory, implementation (process), impact, and efficiency (Rossi, et al., 2004).

The selection of the evaluation to be conducted is dependent on the purpose of the evaluation and the goals it aims to achieve. For example, a process evaluation examines what was done during the implementation of the program to determine if the initial goals of the program are the same as the end results of the program (Lab, 2007). Because of the nature of this type of evaluation, it is impossible for it to be unsuccessful as it is used to examine the whole implementation progression. Conversely, impact evaluations are used to identify the outcomes a program had and whether or not its goals were accomplished. These types of evaluations can fail for multiple reasons including, theory, implementation, and measurement, because of the precise detail that is required to reach specific conclusions regarding the program (Sherman, Gottfredson, MacKenzie, Eck, Reuter, and Bushway, 1997). Careful consideration of the program's goals and the goals of the evaluation is necessary to choose an evaluation that is capable of accomplishing those goals.

The first type of evaluation is a needs evaluation where the situation is assessed to determine if the social problem that currently exists would benefit from the implementation of a program (Rossi, et al., 2004). This type of assessment is beneficial when it is utilized as the first step as it can provide information whether a particular program would be useful and it can identify the specific tools and services a program needs to provide to be successful (Rossi, et al., 2004). If a proper needs assessment is not conducted prior to the

implementation of the program it will be difficult to assess the validity of any outcomes as it is possible the program failed at the implementation stage because it was not designed to fit the needs specific to the particular social problem.

Theory evaluation, the second type of evaluation, is concerned with assessing how the program intends to obtain its particular objectives identified by the current social problem (Rossi, et al., 2004). The goals and objectives of the program, as well as how these are to be obtained, need to be clearly defined before the program is implemented. Each program should be founded on reputable theories that support the how and why the desired objectives can be obtained based on the design of the program (Rossi, et al., 2004).

Performance evaluations, or process evaluations, ensure that the program is implemented as originally planned (Rossi, et al., 2004). Performance evaluations are executed on an on-going basis (Welsh and Harris, 2004) and because the program is being continuously monitored this evaluation is able to provide feedback throughout the whole period the program is implemented for (English, Cummings, and Straton, 2002). These evaluations help ensure that the program, that is designed to obtain specific goals, is implemented and carried out as planned to attain the previously identified objectives.

The fourth category of evaluation types is impact evaluations and they are used to establish whether the actual outcomes of the program are similar to the desired outcomes and predetermined goals (Pal, 2006). Conclusions based on impact evaluations result from examining the findings at one specific point in time

(Welsh and Harris, 2004). This type of evaluation is useful for crime prevention programs as measures of crime can be examined to identify if the program was effective at reducing crime. Although the results from an impact evaluation cannot be assumed to be completely accurate, there is increased confidence when a strong research design is used that maximizes internal validity (Rossi, et al., 2004).

The final category is an efficiency evaluation where cost-benefit analyses and cost-effectiveness analyses are used to determine how efficient a specific program is (Welsh and Harris, 2004). Even though a program may be successful in obtaining the desired goals, it might not be worthwhile to implement the program if the costs are exorbitant. This type of evaluation usually requires both impact and performance evaluations to gain a full understanding of the costs and benefits of a particular program (Lab, 2007).

4.3.2 Research Designs

The evaluation of crime prevention programs originated in the 1970s and usually involved one of the two research designs that were popular at the time (Ekblom and Pease, 1995). These two designs included a before and after design with a comparison group or a time series with multiple pretests and posttests (National Research Council, 2005). Currently, there are several research designs available to determine the effects of an intervention. The actual design that is chosen is dependent on the resources and information that is available to the evaluator. These research designs include, but are not limited to: posttest only, pretest-posttest, pretest-posttest with control group, and pretest-

posttest with random assignment to control and experimental groups (Tilley, 2009).

The more thoroughly the research design controls for outside influences, the higher the resulting internal validity will be allowing for a higher level of confidence in concluding that the findings were because of the intervention. However, the level of control that is required to increase the internal validity lowers the external validity, which is problematic when generalizing the results (Sherman, et al., 1997). The difficulty in generalizing the results to other areas causes problems in demonstrating the potential a program may have because the results are specific to the particular situation. Weak external validity also increases the difficulty when trying to garner support for the intervention. If one cannot be sure of the potential success a program may have in a different environment, separate from the one evaluated, success of the program may be questioned by the governing bodies resulting in a lower amount of successful programs being implemented or funded. However, the only scientific method to increase the external validity without lowering internal validity is through replication of the evaluation in multiple environments (Sherman, et al., 1997). Replication can increase the level of external validity while providing further support for the intervention.

4.3.3 Maryland Scientific Methods Scale

The Maryland Scientific Methods Scale (SMS) was developed to provide a standardized set of criteria that could be used to assess the methodological quality of studies (Farrington, 2003). By assessing crime prevention evaluations

based on this scale, a certain level of confidence in the program results can be obtained depending on the level on the scale that each particular study reaches. This scale is especially useful because there is not a direct focus on the effects of the program, but rather the focus of the scale is on the amount and depth of evidence of the effects of the program (Cozens, 2005). Examining studies based on this scale allows for the development of effective evidence-based policy.

A study can be placed on a particular level ranging from one to five, with a level one study having the lowest strength of internal validity and a level five study having the highest (Farrington, 2003). A level one study is one that only examines the relationship between an intervention, such as an implemented crime prevention program, and the outcome variable, while a level two study examines the change in the outcome variable previous to the intervention and following the intervention without a control group (Cozens, 2005). Level one studies do not have a proper design to determine causality and both level one and level two studies are not able to eliminate issues that are likely to cause problems with internal validity (Farrington, 2003). According to Cook and Campbell (1979), a study needs be rated as a level three in order for the results to be considered for concluding what programs work and do not work.

Studies that reach level three on the Maryland Scientific Methods Scale have, at the minimum, used a research design that utilizes a comparison of the effects of the program between an experimental and control group, limiting potential threats to internal validity (Cozens, 2005). A level four study uses several experimental and control group comparisons and a level five study,

reaches the highest level of internal validity as units are randomly assigned to the control and experimental groups (Farrington, 2003).

Although a level five study is desired, these types of studies are infrequent as there can be great difficulty with random assignment and implementation (Farrington, 2003). In studies examining situational based programs, it is especially difficult to utilize random assignment to the experimental and control groups as the units of study are places such as neighbourhoods, schools, and streets, and are large units compared to individuals (Welsh and Farrington, 2005; Lab, 2007). It is easier, cost and time wise, to obtain information and randomly assign 200 individuals to control and experimental groups than it is to obtain the same information for 200 neighbourhoods. If only true experimental studies were considered it is likely that a majority of situational based studies would be omitted due to the difficulty of random assignment (Farrington, 2001). Several quasi-experimental evaluations, with similar results, can help increase confidence in a program's results when there is a lack of a sufficient number of studies with criteria suitable for reaching level five on the Scientific Methods Scale.

The Maryland Scientific Methods Scale is beneficial as it provides accepted guidelines for considering the results of evaluation studies, but there are also several criticisms. Although, there are standardized criteria for each level of the scale, it is possible for a study to be downgraded a level because of implementation failure, which causes unreliability within the scale (Farrington, et al., 2002). Farrington (2003), also notes that there are several research designs that are not included in the scale, but actually have designs that are stronger and

better able to control threats to internal validity and therefore, are better than the research designs comprising levels one and two on the scale. A third criticism is that the scale is used for all types of units, such as individuals, schools, neighbourhoods, etc., and it may be necessary to modify the scale depending on the unit of study (Farrington, et al., 2002). While there are several criticisms of the SMS, it is a simplistic tool that offers an accepted standard for the methodological quality of evaluation studies, which increases the quality of evidence for the effects of programs. Awareness of the limitations of the scale allows one to make better-informed decisions when developing evidence-based policies.

4.3.4 Program Failure

Policies that are based on theory are better able to explain why a particular intervention works or does not work in a specific environment. Mears (2007) notes that programs lacking a strong theoretical base tend to be unsuccessful at accomplishing the predetermined goals of the program. He asserts that although a majority of crime policy is based on theory, the theoretical foundation is often weak or flawed. Understanding the “why” a program should work allows for successful future implementation of the program in other areas (Lab, 2007). Having a strong theoretical foundation for programs prevents implementing programs that are most likely to fail immediately as the program itself invalidates assumptions of the theory (Lab, 2007). Knowledge of these assumptions helps explain the outcomes of the evaluation and provides an understanding of what specific characteristics of the program need to be modified

to be effective in a different environmental context (English, et al., 2002).

Awareness of the theoretical foundation allows for development of programs that have a better opportunity to be successful than those that are based on incorrect assumptions.

Another problem with some programs is that while they may be based on a theoretical foundation, the theoretical components are difficult to implement and therefore cannot transfer to a successful program (Mears, 2007). The disconnection between theory and program implementation frequently results in programs that fail to achieve their goals. To be successful programs need to “be implemented in the way they were intended to be carried out” in a particular environment (Rossi, et al., 1999:170). To ensure that this occurs a process evaluation needs to be conducted, but this is not often initiated or considered a significant part of the evaluation progression (Mears, 2007). One criticism of program evaluation is that, because each program is situational, it is difficult to generalize results to programs outside the local context. However, using theory during the development and implementation of the program enables one to generalize how the program could work outside areas based on the underlying assumptions of the theory (Lab, 2007).

4.3.5 Realistic Evaluation

The most common, desired form of evaluation, and most widely accepted, is the randomized experimental design (Cook and Campbell, 1979). Although achieving this high standard of research design is difficult outside of a controlled environment, this type of design has the highest level of internal validity,

increasing confidence that the program or intervention used can be credited for the results obtained (Farrington, 2003). Realistic evaluation, as described by Pawson and Tilley (1994), continues to emerge and develop as an approach to evaluation research, different from the widely accepted experimental designs. The goals of realistic evaluation are, not only to determine what works, but why the particular program works and in what situations it may work (Pawson and Tilley, 1994).

This type of evaluation is founded and driven by theory (Guerette, 2009; Tilley, 2009). Programs that are based on solid theoretical frameworks are more likely to succeed and as realistic evaluation emphasizes, allows one to determine why the program should work (Pawson and Tilley, 1994, Guerette, 2009). This is especially useful as crime prevention programs are designed for the specific environment where it is to be implemented in order to target the needs of the environment and obtain the predetermined goals. If the programs are not based on valid theory it is probable the program will fail because it may contradict assumptions of the theory (Lab, 2007). Realistic evaluation avoids this as it commences with a theory that describes why the program should work (Pawson and Tilley, 1994).

Achieving a high level of internal validity results in losing external validity, which makes it difficult to generalize the results of an evaluation to other environments (Sherman, et al., 1997). Realistic evaluation also shares this problem with experimental design since the intervention is context specific. The lack of external validity is generally overcome through replication of the programs

in several environments. However, strategies, such as situational crime prevention and CPTED, are effective because they are context specific and are designed to target the needs of each individual environment. Reliance on replication as a way to increase the ability to generalize results to other environments could lead to misleading assumptions about the value of these strategies (Guerette, 2009).

The use of realistic evaluation to assess situational crime prevention and CPTED strategies could be more appropriate and beneficial than the use of traditional experimental designs as this approach examines the context to determine how and why the intervention works. The understanding of what strategies work in what circumstances provides opportunities for applied use by crime prevention officers (Gill and Turbin, 1999). The knowledge produced enables one to anticipate future problems and identify solutions to prevent them from occurring (Hope, 1991). The evaluation approaches of experimental research designs and realistic evaluations tend to be viewed as opposing methods (Guerette, 2009), but in the end the type of approach utilized should be determined by the situation and chosen based on which would be more successful in obtaining the most accurate results.

4.4 Evaluating Crime Prevention Programs

While it is difficult to reach level five on the SMS for situational based crime prevention programs, these programs are less likely to fail because the strategies are theoretically based. Also, situational programs that are based on theory can produce results that can be interpreted even though strong internal

validity may be lacking (Lavrakas, 1979). Although the study may not eliminate all threats to internal validity, it is possible to interpret the results from a program with a strong theoretical foundation. Before implementation, one is able to determine why the particular program should work and knowing the “why” increases the likelihood of a successful program (Lab, 2007).

Through the identification of actual crime issues and transit passengers’ perceived safety issues, the problems could be targeted and addressed through modification of the physical design and implementation of other situational crime prevention techniques and CPTED strategies or other methods. These crime prevention strategies, through “using the appropriate techniques, provides the potential for measuring the impact of interventions” (Brantingham, et al., 2005:287).

Situational crime prevention and CPTED evaluations, although limited, have been increasing in the past several years. Appropriately designed evaluations of successfully implemented programs provide evidence for programs that work or do not work. Separate from determining what type of evaluation to utilize there are three key goals when obtaining evidence for a particular program. Eck identifies the need for evidence that demonstrates that “for a specific crime problem an intervention is the appropriate choice; the application of this intervention resulted in the prevention of the type of crime we are interested in; and if we applied the intervention again we will obtain similar results” 2005:700). This evidence-based approach promotes the implementation of situational crime prevention programs that have demonstrated an ability to

reduce crime (Farrington, 2001). Many of the transit systems that have been designed, using crime as a consideration, can attribute the success of a reduction in crime to not only the physical design, but also the use of evidence on what has worked in the past. The designers for the systems, which considered crime as a design concern, spent time examining existing systems and consulting with previous designers, police officers, and transit staff. These consultations not only provided designers with ideas of what specific physical modifications worked, but also what the designers of the existing transit systems would “do over” if they had an opportunity to do so (Gaylord and Galliher, 1996; La Vigne, 1996; Myhre and Rosso, 1996). Quality evaluation research has the ability to identify “best practices” that can be utilized in crime prevention strategies (Guerette, 2009).

A recent review of evaluations of situational crime prevention techniques from the past 30 years uncovered 261 studies (Guerette, 2009). After a more detailed examination, studies that evaluated techniques that could be classified under Cornish and Clarke’s (2003) list of 25 techniques, used some form of quantitative analysis, and presented the original findings were included, which reduced the number of studies to 206 (Guerette, 2009). The situational crime prevention techniques used were found to be effective in 75% of these studies while only 12% were found to be not effective. The remaining studies produced either mixed results or inconclusive findings. Although only six studies (3%) used a randomized experimental design, all six of these studies were found to be

effective in obtaining their respective objectives and reducing crime (Guerette, 2009).

4.5 Political Context

The application and utilization of results obtained, even from the most rigorous evaluations, are dependent on the current political context. Even with valid results of a program's effectiveness or ineffectiveness, it does not necessarily mean that the decision-making process, in regards to the particular social problem, will be altered (Weiss, 1993). To increase the likelihood of the utilization of an evaluation's results, the evaluation should be sensitive to the present political context (Weiss, 1993).

Depending on the political environment it is possible that successful programs are not implemented while ineffective programs continue to be funded and supported. There are several reasons why the results of even the most well founded evaluations may not be considered during the decision-making process. These can vary from an individual politician's priorities, to a governing body's values, and the general public's opinions. "A considerable amount of ineffectiveness may be tolerated if a program fits well with prevailing values, if it satisfies voters, or if it pays off political debts" (Weiss, 1993:98).

Although the majority of politicians believe that policy decisions should be based on evidence of what works, the politician's tenure and the insecurity of employment dominates priorities (Weiss, 1993). To facilitate re-election, the focus tends to be on demonstrating to the public that something is being done,

rather than on the actual effectiveness of the program (Weiss, 1993; Welsh and Farrington, 2001). Also, the use of the evaluation results in the decision-making process can be affected by the values of the actual decision-maker. The more closely a program's objectives mirrors the decision-maker's values, there is an increased likelihood that the evaluation's results will be critically considered (Weiss, 1993).

Another issue that affects the use of evaluations is the actual selection of what programs are to be evaluated. Weiss (1993) has noted that the programs selected for evaluation tend to be those that are new and take an original approach to addressing the specific social problem, while the programs that have been in place for several years avoid being examined and continue to be funded and supported despite no, or limited, knowledge of effectiveness.

One of the main assumptions of evaluation research is that the results are utilized to inform public policy. However, this is not always the situation. It is very rare that the results obtained from evaluations are used in the decision-making process of policy and it may actually take several years before the collection of evidence is considered by decision-makers (Weiss, 1993). This can occur when there is a political window "in which institutionalized procedural events dictate predictable window openings" (Howlett and Ramesh, 2003:137), where changes in the governing body or overall expectations provide opportunities to make use of the collection of credible evidence. Eventually, a political window will open and the years of credible evidence will accumulate to the point where the public becomes aware of the failures of ineffective programs

and demand increased support of programs found to be successful (Weiss, 1993).

4.6 Conclusion

Establishing the impact a program has not only can reduce the amount of time and resources wasted, but the results can also inform relevant criminal policy. Much of the current criminal policy lacks support or evidence, but with increases in efficient evaluations, these policies can become more effective (Mears, 2007). Environmental modifications are especially useful because they are situational in nature, making them easily adaptable for multiple locations. There is likely to be increased success when implemented programs are theory-driven. Because the political context plays a very influential role in the consideration of evidence from evaluation studies, it is important to acknowledge the influence and to remain sensitive to the values and expectations of the decision-makers (Weiss, 1993).

5: CHAPTER 5 – METHODOLOGY

5.1 Introduction

The Greater Vancouver Regional District (GVRD) in British Columbia is made up of several cities within the Lower Mainland. Because of the diverse physical environments and expansive spread of the cities, it is necessary to use several modes of public transportation including, buses, express buses, rapid transit systems, and ferries in order to best meet the needs placed on the system by the public. The rapid transit system, SkyTrain, is a mostly elevated rapid transit system that connects several cities to downtown Vancouver. The safety of passengers and employees is a priority of any public transportation system. The Translink system in Vancouver, which includes the SkyTrain system, buses, and ferries, is “committed to providing a service that is efficient, safe, reliable and comfortable” (Translink, 2010). As the Greater Vancouver Regional District continues to grow in population and area, an efficient mode of public transportation becomes even more important.

A quasi-experiment was used to evaluate the situational crime prevention and CPTED strategies already implemented in the GVRD rapid transit system. Because random assignment and pretests and posttests of the implemented measures were not possible, this research design can only reach a maximum of a level three on the Scientific Methods Scale. However, based on the outline provided by Cook and Campbell (1979), the results produced from a level three

study can still be assessed for determining what programs work or do not work. By closely examining the occurrence of crime within the transit system it is possible to identify problems and solutions to reduce crime and increase passenger and employee safety while providing efficient means of transportation.

5.2 Hypothesis

The aim of the current research was to examine the design of the rapid transit system to determine if any particular design characteristics were related to the occurrence of crimes at the stations. Because several situational crime prevention and CPTED characteristics were assessed there is not a specific hypothesis. Instead, based on the assumptions of routine activities theory, rational choice theory, and pattern theory, the general hypothesis is that stations that were designed with crime as a consideration should have a lower occurrence of crime compared to stations that did not consider crime in the design. Therefore, stations on the Millennium Line should experience less crime than stations on the Expo Line³.

5.3 Sample

Currently, the Greater Vancouver Regional District is serviced by three SkyTrain lines, with the newest line, Canada line, having opened in the summer of 2009 in anticipation of the 2010 Winter Olympics. The oldest SkyTrain line, Expo line, opened in 1986 and connects the City of Surrey, New Westminister,

³ Although the Expo line services the downtown core where there is a higher volume of people and therefore a higher volume of crime, the dependent variable used for the purposes of these analyses is specifically crimes that occur at the transit station, which helps to reduce the possibility of extraneous factors influencing crime rates at Expo line stations.

and Southern Burnaby to downtown Vancouver, while the Millennium line opened in 2002 and connects Northern Burnaby to the downtown core. The Expo and Millennium lines service a combined total of 33 stations. Both lines share the same route from New Westminster to downtown Vancouver. The Expo line services 4 stations in Surrey and the Millennium line services 13 stations in Northern Burnaby. One of the main transfer stations is between Broadway Station and Commercial Drive Station where the two lines are connected by an overhead passageway. The second transfer point is at Columbia Station where the Expo line continues to Surrey and the Millennium line continues to North Burnaby. Although both lines follow the same route in Southern Burnaby, those stations will be considered as Expo line stations as that was the time they were initially implemented and designed. For the purposes of this research 19 stations were designated as part of the Expo line while 12 stations were considered part of the Millennium line⁴. The data was collected on January 22 and 23, 2010 and involved riding both lines and visiting all stations, during the off peak travel period in the day.

5.4 Variables

Each station, on both lines, was examined to establish if predetermined characteristics of situational crime prevention and CPTED strategies were utilized in the design of the station. The design characteristics were either

⁴ Although the Broadway and Commercial SkyTrain stations are two separate stations, designed at different times, the crime data obtained for the SkyTrain stations grouped them as a single entity because of their proximity to each other and the total number of crimes occurring at one station or the other could not be differentiated. This resulted in an examination of 31 stations rather than 33 stations.

observed as present or not present. The variables were then analyzed to establish if the presence of particular characteristics were related to the 2008 crime rates at the stations. Some situational crime prevention and CPTED characteristics were in place at all stations and therefore were not analyzed.

The independent variables that were examined contained features that could present opportunities for crime and inhibited the use of appropriate guardians. Other design characteristics that were assessed included those that reduced the risks and efforts involved with committing an offence while increasing the rewards. These design characteristics are identified by routine activities theory and rational choice theory as elements that can increase the likelihood of a criminal offence occurring when combined with a motivated offender.

Specifically, the features examined were the presence of ATMs and payphones in the station, the location of commercial franchises in and around the station, the visibility of the platforms to and from neighbouring buildings, whether one platform serviced two directions, sightlines in the walkways, controlled entrances and exits, the use of transparent materials for elevators, and whether the station was part of a major transit hub and was serviced by more than one bus route in addition to the SkyTrain. The ability to view one platform from the other was assessed, but because the responses for the presence of this characteristic contained 6.5% (2 stations) of the cases, the variable was excluded from the analyses. The independent variables were dichotomous

variables and were coded as 1 for presence of indicator and 0 for indicator not present.

The dependent variable was crimes against the person per 100 000 passengers at the station. To obtain the 2008 crime rate for each station, the total number of crimes at each station was divided by the total number of passengers that entered the station. The station crime rate was not normally distributed so therefore it was transformed by natural logarithm in order to obtain a normally distributed dependent variable.⁵ The crime rate at 100m buffer areas was examined in some of the analyses and this rate was formed by dividing the total number of crimes in the buffer zone by the 2008 population of the municipality that the station was located in⁶. This variable was also not normally distributed and was therefore transformed with a natural logarithm.

5.5 Research Strategy

Several different analyses were employed to examine crime on the Greater Vancouver Regional District rapid transit system. Because transit systems are unique environments creating an appropriate research design can be difficult. Public transportation systems are designed to operate for many years when implemented and the nature of this structure does not allow for

⁵ Although some stations did not report any crime, it was not necessary to modify the variable before completing the natural logarithm transformation. See Greene, (2000) for further explanation.

⁶ The buffer zone is a 100m zone immediately surrounding the transit station. Although the city population may not be completely representative of the individuals located in this area, and therefore at risk of becoming a victim, using the city population in this situation is a better measure than passenger total at the station. The population is representative of residents who could be at a higher risk of victimization than individuals utilizing public transport, as passengers spend shorter periods of time in a transit environment.

random assignment of stations to control and experimental groups and it is impossible to conduct pretests and posttests. Instead, these limitations were acknowledged beforehand and several analyses were conducted in order to overcome these limitations as best as possible to provide strong support for the overall results and conclusions.

Crime occurring at the stations and crime within 100m buffer zones were examined to develop a general representation of the crime occurring on both SkyTrain lines. Design characteristics were then entered into regression models to determine if any of the indicators were predictive of crime occurring at the stations. Bivariate and multiple regression models were utilized because they are statistical techniques that use independent variables to predict the level of a continuous dependent variable (Meyers, Gamst, and Guarino, 2006). Bivariate regression models were used initially to understand how each design characteristic interacted with the dependent variable. From there, the indicators that were significant at the 0.1 level were included in a multiple regression model. A standard multiple regression was employed, as there was no theoretical reason to enter the variables at different blocks of the model. The assumptions of multiple regression were assessed and problems were remedied before performing any further analyses.

5.6 Conclusion

The Greater Vancouver Regional District encompasses a large surface area that contains several highly populated cities. Therefore, the GVRD requires efficient modes of rapid public transportation to service the growing population.

Employee and passenger safety is one of the main priorities of any public transportation system. Two SkyTrain lines were evaluated in this specific study to assess the overall safety of employees and passengers based on the crimes occurring at the stations. Previous research suggests that crime prevention programs that use situational crime prevention and CPTED strategies are more successful at reducing crime as criminal opportunities are blocked. The purpose of this research was to determine if there were differences in crime on the two lines and whether crime was affected by the physical characteristics of the stations.

6: CHAPTER 6 – RESULTS

6.1 Introduction

Transit environments are multifaceted units to examine, as the continuous movement of individuals throughout the system produces a dynamic setting. The use of transit stations within a transit system, as cases, for the sample requires that multiple statistical techniques be utilized in order to provide sufficient information for conclusions. Several steps were taken to gain an understanding of the presence of crime within a public transit environment.

6.2 Descriptive Statistics

Initially, there were eleven variables that were examined throughout the analyses. The ability to view one platform from the other was discarded at the beginning because only two stations (6.5%) did not have the ability to view one platform from the other. Almost half, 41.9% (13), of the stations had elevators that were designed with transparent materials and had one platform servicing both directions. There were structures creating hidden recesses and nooks in 4 of the stations (12.9%) and 4 stations also had multiple entrances and exits. A majority of the stations, 74.2% (23), were part of a major transit hub and were serviced by more than one bus, in addition to the SkyTrain. It was possible to view neighbouring residences from the platforms of 12 stations (38.7%). Only 8 stations (25.8%) had retail services located directly in them while 20 stations (64.5%) had retail services located around them. Finally, 26 stations (83.9%)

had payphones and 14 stations (45.2%) had ATMs present within the station. The average crime rate on the Expo line was 1.90 crimes per 100 000 passengers with a standard deviation of 1.78, while the Millennium line had a mean of 0.77 crimes per 100 000 (SD=0.74) in 2008.

Table 1 - Descriptive Statistics of Variables

Variables		Variables	
ATMs Present	Yes 45.2% (14)	Controlled Entrances/Exits	Yes 87.1% (27)
Payphones Present	Yes 83.9% (26)	Recesses/Nooks In Passageways	Yes 12.9% (4)
Retail Shops IN Station	Yes 25.8% (8)	View One Platform From Other	Yes 93.5% (2)
Retail Shops AROUND Station	Yes 64.5% (20)	Glass Elevators	Yes 41.9% (13)
Neighbour View Platform	Yes 38.7% (12)	Crime Rates 2008	
Transit Hub	Yes 74.3% (23)	Millennium Line	Mean 0.77 (SD 0.74)
One Platform	Yes 41.9% (13)	Expo Line	Mean 1.90 (SD 1.78)

6.3 Bivariate Analyses

The first analysis that was performed was an independent samples t-test to determine if the average number of crimes at the stations differed significantly between the Expo line and Millennium line. With 19 stations on the Expo line and 12 stations on the Millennium line equal variances were assumed ($F=0.310$, $p=0.582$) and the results were significant with $t=2.562$ ($p<0.05$). The Expo line had significantly more crime with a mean difference of 0.437 crimes per 100 000 passengers between the two lines.

The next step involved examining each SkyTrain line separately and comparing the stations to the neighbourhoods they were located in to see if there was a relationship between crime within 100m buffer and crime at the station. Generally, crime at a station is reflective of crime in the neighbourhood because high crime stations tend to be located in high crime neighbourhoods (Shellow, et al, 1974; Falanga, 1988). Pearson correlations were used to examine these relationships and a positive, significant relationship was found between the station crime rate and buffer crime rate on the Millennium line ($r=0.657$, $p<0.05$) while the relationship between the stations and buffers on the Expo line, although positive, was not significant and Pearson's r was close to be unreported ($r=0.290$, $p=0.228$).

After the SkyTrain lines were analyzed individually, the design characteristics were independently explored in several bivariate regressions with the crime rate at the stations as the dependent variable. The presence of both ATMs and payphones located in the stations were not significant predictors of crime at the stations, respectively $t=0.751$, $p=0.458$, and $t=0.562$, $p=0.579$. However, both showed a positive relationship with station crime. Retail services located within the station was not a significant predictor ($t=0.390$, $p=0.700$), but retail services located around the stations was a negative, significant predictor of station crime at an alpha level of 0.10 ($t=-1.844$, $p=0.075$). Stations that were transit hubs, servicing more than one bus route or other mode of transportation, were positively and significantly related to crime at stations ($t=2.312$, $p=0.028$). Station platforms that were visible to neighbouring residents was also a

significant predictor ($t=-2.562$, $p=0.016$) demonstrating lower crime rates at stations with opportunities for natural surveillance. Controlled entrances and exits and recesses and nooks in stations were not significant predictors, but both relationships were supportive of previous research. Controlled entrances and exits had a negative relationship with station crime ($t=-0.673$, $p=0.597$) and recesses and nooks had a positive relationship ($t=1.482$, $p=0.149$). Elevators built with transparent materials was also not significantly related, but supported the literature with a negative relationship with station crime ($t=-1.358$, $p=0.185$). Finally, stations that used one platform to service both directions as compared to using two platforms, was a positive, significant predictor ($t=2.298$, $p=0.029$).

6.4 Multiple Regression

After examining the bivariate relationships between the design indicators and the crime rates at the stations, the predictors that were significant at the 0.10 level were included in the multiple regression analyses. The four independent variables that were found to be significant predictors of station crime were retail services located around the station, visibility of the platform to and from neighbouring residences, station is a transit hub, and the number of platforms the station is serviced by.

A standard multiple regression was used and all four variables were entered in the analysis at the same time. The model was significantly better than no model ($F=6.453$, $p=0.001$). The R^2 for the model was 0.498 demonstrating that the four variables accounted for 49.8% of variance in the dependent variable. Although in a bivariate regression visibility of the platform was

significantly related ($p=0.016$), with the inclusion of the three other variables in the multiple regression model this variable became less significant ($t=-0.989$, $p=0.332$) while retail around the station ($t=-2.935$, $p=0.007$), transit hub ($t=2.728$, $p=0.011$), and single platform ($t=2.222$, $p=0.035$) remained significant at an alpha of 0.05.

The final regression model included three variables: transit hub, retail around station, and single platform servicing station. Again, this model was significantly better than no model ($F=8.285$, $p=0.000$) with an R^2 of 0.479. Almost 50% of the dependent variable can be explained by the three variables. Although the removal of the visibility characteristic from this model resulted in a slight decrease in the R^2 (0.498 to 0.479), the three remaining variables increased in significance. Stations with one platform servicing both directions have significantly more crime ($t=2.906$, $p=0.007$) and stations that are part of a major transit hub have significantly more crime as well ($t=3.196$, $p=0.004$). Finally, stations with retail services located around the station have significantly less crime ($t=-3.099$, $p=0.004$).

Table 2 - Regression Results for Design Characteristics and Station Crime

	<i>Model 1</i>			<i>Model 2</i>		
	<i>Coefficient</i>	<i>Standard Error</i>	<i>t-statistic</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t-statistic</i>
One platform serving two directions	0.344	0.155	2.222*	0.408	0.140	2.906**
Retail shops located AROUND station	-0.435	0.148	-2.935**	-0.455	0.147	-3.099**
Station part of major transit hub	0.460	0.169	2.728*	0.512	0.160	3.196**
Neighbouring res view platform	-0.162	0.164	-0.989			
R ²	0.498			0.479		

* Significant at 0.05 level

** Significant at 0.01 level

7: CHAPTER 7 – DISCUSSION

7.1 Introduction

Safe and efficient public transportation systems are necessary in any major city. Thorough examination of transit environments helps to identify problems that exist or have the potential to develop. Knowledge of these issues facilitates the creation of programs or responses that are able to directly target the problem at hand. Using evidence of what has worked in the past leads to the implementation of successful programs, which eliminates or lessens the impact of the particular issue.

7.2 Current Study

Studies in the past that have analyzed rapid transit systems and the relationships between the built environment and crime have been limited by the actual transit systems being studied. Each study generally focused on the transit system within the city, which was either built with crime as a consideration or designed without using situational crime prevention or CPTED concepts. The entire rapid transit system in Washington, DC, was built using strategies that reduce opportunities for crime (La Vigne, 1996), while the transit system in Chicago was designed without considering these concepts. One study on the Chicago rapid transit system identified several areas where crimes were occurring most often (Falanga, 1988) and these locations could have been

eliminated if situational crime prevention or CPTED strategies had been considered during the design of the system.

To be able to provide support that the design of the physical environment lowers the rate of crimes occurring within a transit system, systems designed with and without crime as a consideration need to be compared. However, a system designed with and without these characteristics is very rare, which makes it necessary to compare systems from different cities. While this can provide a general idea of the differences between the systems, it is very likely that other factors are affecting the crime rates, which lowers the confidence one can place in the results. The Greater Vancouver Regional District SkyTrain system differs from a majority of other cities' systems as it contains stations built with and without situational crime prevention and CPTED strategies. This enables one to place more confidence in the results as confounding factors that may cause problems when examining systems in two cities, can be reduced or eliminated. The SkyTrain system in Vancouver, British Columbia provides an uncommon opportunity to examine the impact these strategies may have on reducing crime.

A comparison of the Expo line and Millennium line found higher crime rates at stations on the Expo line, which was built without situational crime prevention and CPTED concepts. A closer examination of crime at the stations and surrounding neighbourhood found that there was not a significant relationship between crime at the stations on the Expo line and crime within a 100m buffer. Buckley (1996) found that there was higher criminal activity located within 750m of the SkyTrain stations in Vancouver and that the highest crime

occurred within 50m of the station. It was expected that there would be a relationship between the stations and the neighbourhoods as high crime neighbourhoods usually have high crime stations. Because this was not the case at the stations on the Expo line it provides support that there are other factors affecting the occurrence of crime at the stations that were not designed with crime as a consideration.

A closer examination of individual characteristics found that stations that were part of a transit hub had significantly higher crimes rates independent of the SkyTrain line the station was located on. Previous research has identified that transit hubs can be considered as crime attractors and crime generators (Brantingham and Brantingham, 1995). Transit hubs provide the opportunities for individuals to come into contact with each other, who may not necessarily have come into contact otherwise. This increases the likelihood that a motivated offender will cross paths with a suitable target and will engage in criminal activities. The increased number of passengers using not only the SkyTrain system, but also other modes of public transportation, in one particular location, increases criminal opportunities, as there are more suitable targets for a motivated offender.

Stations that were serviced by one platform experienced more crime than those with two platforms. Stations that have one platform usually experience more passenger traffic, such as stations that service major shopping centres or universities. Because passengers are not separated depending on the direction of their travel, the number of passengers on one platform is doubled, which

again, increases the number of suitable targets. Also, because passengers are restricted to one platform, with overcrowding and an increased likelihood of physical contact, it is probable that stations with one platform will experience more crimes, such as pick pocketing and inappropriate sexual contact. Stations with one platform may be more efficient for those that experience higher levels of passenger traffic, but it makes it more difficult for passengers to identify individuals who may be loitering, potentially for illegitimate reasons. Stations with two platforms decreases the number of suitable targets for a motivated offender while increasing appropriate guardians as passengers waiting on one platform can view the passengers waiting on the opposite platform, whereas individuals waiting on a single platform, generally do not face each other. However, one problem with the double platform design is that transit officials who are responding to a situation may access the wrong platform, which can delay the response.

The platform waiting area has been identified as an area where passengers will experience a higher likelihood of victimization as compared to other areas within the station (Kenney, 1987; Falanga, 1988). Depending on the train schedule, passengers potentially spend long periods waiting for a train to arrive, which increases the likelihood that the passenger's path will intersect with a motivated offender's path. During peak travel platforms are overcrowded increasing the possibility of pick pocketing, and during off peak hours, platforms can be deserted, which can provide criminal opportunities as there is a lack of an appropriate guardian and there are decreased risks of being detected. Because

there is an increased risk of victimization on platforms, additional consideration for the design of this area is required.

The presence of retail services around the station was the third characteristic that was significantly related to crime. Stations that had retail services located nearby, experienced lower crime rates. Jacobs (1961) found that multi-use neighbourhoods experienced less crime, as there were more eyes on the street. Single use neighbourhoods attract individuals for a specific purpose, which can depend on the time of the day, but neighbourhoods that have several purposes, such as residences, transit services, and retail services, promote the continuous flow of individuals throughout the day and increases surveillance by those utilizing the neighbourhood. The location of retail services around transit stations provides appropriate guardians, which can increase the likelihood of detection.

Although there were only three design characteristics that were significantly related to crime at transit stations, the remaining characteristics were related to crime in the expected direction. It is probable that because the sample size was small with only 19 cases in the control group and 12 cases in the experimental group, there was not enough statistical power to detect a significant effect size (Rossi, et al., 2004). This is evident in the relationship between station crime and visibility of the platform from neighbouring residences. At the bivariate level, the visibility of the platform is significantly related to less crime at the station, but becomes non-significant when included in the multiple regression model. In order to detect significant relationships with a small effect size, while

maintaining the alpha level at 0.05 and the statistical power at 0.80 (Cohen, 1988), a sample size of 26 cases in the control group and 16 cases in the experimental group would be necessary. It is possible that because there was such a small sample size, the effect sizes of the characteristics may have been too small for detection. Based on the theoretical framework it was expected that stations on the Expo line would have more crime than stations on the Millennium line. This study proposed a one-sided hypothesis with an alpha of 0.05, resulting in the study achieving a statistical power of 0.7833, which is just below the accepted standard of 0.80.

7.3 Transit and the Built Environment

There is evidence that physical modifications of the transit environment, that follow situational crime prevention and CPTED techniques, can help block criminal opportunities and reduce the impact of crime (Falanga, 1988; Felson, et al., 1996; Gaylord and Galliher, 1996; La Vigne, 1996). However, it is important to acknowledge and be conscious that not all techniques work in every context. While the designs of transit systems are aimed at reducing crime, the methods that are implemented need to be specific to the goals of each individual system. Some systems may have different goals and environments that need a particular focus, which may be dissimilar to other systems.

One strategy, employed by the Washington, D.C. transit system to eliminate opportunities, involved only installing fare machines and newspaper vending machines in the stations (La Vigne, 1996). On the other hand, the Port Authority bus terminal used well-known fast food restaurants to encourage

passengers to feel safe in the station (Felson, et al., 1996). Although this strategy used by the Port Authority bus terminal appears to be contradictory to reducing opportunities for crime, this particular station had developed a negative public image, which needed to be remedied by establishing familiar businesses that would encourage the use of the station. The Port Authority bus terminal needed to alter the negative image that was associated with the terminal and by doing so a multi-use station was created. People were not only accessing the terminal for travel purposes, but were drawn to it for other reasons, such as dining and shopping, which increased the number of appropriate guardians.

To increase the likelihood of success, the goals of not only the transit system as a whole, but also each individual station need to be identified and assessed. This approach can be used to determine a strategy that has been successfully implemented in the past and one that is specific to the individual transit system. To be able to develop an effective strategy, it is essential to have an understanding of the type of crimes that are occurring at the local context. Some situational crime prevention and CPTED techniques are general and can be used to decrease the likelihood of several types of crimes, but because there are two situations when crime is likely to occur in a transit environment, lack of supervision, and overcrowding and peak travel (Smith and Clarke, 2000), implemented techniques need to be appropriately applied to the identified problem. This is only possible when there is information that describes the types of crime occurring, where and when these crimes are occurring, and who the victims and offenders are.

Opportunity reduction strategies can be implemented on different transit systems, but each individual station also needs to be considered separately. Stations should be designed uniformly as unfamiliarity of the station can increase one's fear (Pearlstein and Wachs, 1982). Still, crime patterns at each separate station need to be considered so that the design and crime prevention techniques that are implemented target the actual crime issues that exist at each station on the transit line, while maintaining a consistent appearance. Also, although crime at a particular station is usually reflective of crime in that neighbourhood, there are some instances when this is not the case (Jochelson, 1994). The stations that are found to have the lowest risk of victimization, independent of the neighbourhood, need to be examined to determine which factors are affecting the levels of crime at these stations (Smith, 1986). An increase is needed in "transit managers and security officials' awareness about the types of crime that are committed on their systems, as well as the spatial and temporal patterns of criminal activity" (Pearlstein and Wachs, 1982:282).

Another approach for transit system design, that has been utilized by several cities, involves meeting with police officers, transit officials and architects of existing systems to determine which strategies have and have not worked in that particular city, as well as what transit officials would 'do over' if possible (Gaylord and Galliher, 1996; La Vigne, 1996; Myhre and Rosso, 1996). This type of strategy can be very effective as it follows an evidence-based approach. Knowing what techniques have worked in what situations allows for the transit system design to be tailored for the local context.

Overall, the crime rate at SkyTrain stations is relatively low considering the number of passengers who travel on the system each day. The highest rate for 2008, on both lines, was 7.38 crimes against a person per 100 000 passengers with the average station crime rate being 1.46 per 100 000 passengers. Some stations did not experience any recorded crimes against the person at the station⁷. Because passengers spend a short amount of time on the actual system, as it is used to travel from one location to another, there is limited time for one to become victimized. It is more likely that transit officials, transit police, bus drivers, and individuals who work within the transit system have an increased risk of victimization as they spend longer periods of time within the transit environment. By identifying who the victims are, it will be possible to generate effective responses that target the problem. Bus drivers in Washington, DC, were continuously being robbed and assaulted because of their access to money obtained from passengers' fares. The fare system was altered to create an exact fare process where the bus drivers did not handle or have access to the money, and robberies and assaults subsequently decreased (Poyner, 1983).

7.4 Policy Implications

As more rigorous evaluations are conducted that demonstrate the effectiveness of the application of situational prevention strategies to reduce and prevent crime, their use continues to increase. Consistently, situational prevention programs, when implemented appropriately, produce results

⁷ It is possible that crime did occur at these stations, but the incidents were not reported to the Transit Police.

supporting the successfulness of the program (Farrington, 2001). Place based crime prevention targets the specific criminal event that is occurring at the particular location. By using the results of evaluations it is possible for policy makers to implement programs that have been found to be successful while eliminating programs that are not effective, reducing the amount of resources wasted on ineffective programs.

Although limited, a few studies have examined the effects the built environment can have on crime rates in a transit environment (Falanga, 1988; Gaylord and Galliher, 1991; Felson, et al., 1996; La Vigne, 1996; Myhre and Rosso 1996). Based on these studies, and others that have implemented situational prevention strategies, modifying the physical environment as a means of reducing and eliminating certain types of crimes appears to be a practical response. When implemented appropriately the effects of these strategies are apparent immediately. Not only do these types of prevention programs target the actual criminal event, which increases the successfulness of the programs, but also the immediate effects demonstrate to the public that the governing body has taken steps to reduce or eliminate the problem. The increased use of evaluations to determine the outcomes of a specific program increases the actual implementation of successful programs based on evidence.

The results of this study found that there were differences in crime rates between stations that utilized situational prevention strategies and those that did not. Stations designed with situational crime prevention and CPTED techniques had lower rates of crime occurring at the station irrespective of the crime

occurring within the station neighbourhood. A usual response to a crime problem on a transit system is to increase police presence (Kiersh, 1980). Because both lines were located in the same region, there is increased confidence that station design, rather than policing strategies, affected the crime rates.

Increased police presence in a transit environment helps to dissuade passengers' concerns for their safety, while also deterring motivated offenders to engage in criminal behaviour. However, increased police presence is not an efficient or cost effective means for reducing crime. Because transit systems are so expansive, it would be impossible to employ an adequate number of transit officials to saturate the system that would make increased police presence a worthwhile response to prevent and reduce crime. Even with increased resources, the funding is rarely long term or permanent. Therefore, governing bodies need to examine alternative options that are successful and cost effective.

Physical environments, once built, are rarely modified. It is more cost effective for a governing body to invest in a strategy that designs an environment conducive to natural surveillance, as less funding is then required for police officials. Also, the inclusion of techniques in the design of the built environment, that reduce criminal opportunities, are permanent means of preventing crime as they are not dependent on funding. Physical modification of the environment can prevent actual crime while lowering perceptions of crime. Through Jacobs' (1961) observations, she found that people fear dark, confined spaces. The wide, open concepts of situational prevention strategies that increase the

opportunities for natural surveillance, helps reduce passengers' fears of becoming a victim while using public transportation.

Situational crime prevention and CPTED strategies are theoretically founded increasing the likelihood of success if implemented appropriately (Lavrakas, 1979). They are cost-effective methods of reducing and preventing crime and because they are context specific the crime problem at each location can be identified and directly targeted, increasing the effectiveness of the strategy. Because these strategies can function independent of fluctuations of government funding, they are appealing means of reducing crime that can be successful and produce immediate results.

7.5 Limitations

Examining transit systems and generating conclusions can be difficult due to environmental characteristics. Public transportation is used to move passengers from one location to another, which can make data collection difficult and produce misleading results. An individual may be the victim of pick-pocketing at one station, but not realize until they exit the transit environment at another station. Therefore, the crime would have actually occurred at a different station compared to the station where the crime may be reported. However, steps can be taken to gain an understanding of the crime that occurs at each specific station, which allows inferences to be made if this potential problem is acknowledged.

The dependent variable in this study, crime rate at the station, is an official total of crimes against the person occurring at the stations. However, this measure of crime does not allow one to establish the type of crime, location in the station, or time the crime occurred, which makes it difficult to generate specific conclusions. Nonetheless, the crime totals were obtained from the SkyTrain Transit Police, providing a more accurate representation of the crimes that occur at SkyTrain stations compared to calls for service obtained from police services outside of the SkyTrain system.

7.6 Future Research

Previous research has shown that crime is not limited to the transit station itself, but extends to the local area surrounding the station. Block and Davis (1996) found that in two neighbourhoods of North East Chicago, robberies were less likely to occur at the transit station, but instead were concentrated one block from the stations. Through the examination of areas that extend for 750m around transit stations, calls for service were consistently high within 50m of each of the selected nine SkyTrain stations in Vancouver and while the “station areas account for only 14% of the total city areas, [they] account for 49% of the police calls for service” (Buckley, 1996:72). Within a small radius of transit stations there are still suitable targets, but also a lack of appropriate guardians increasing the likelihood of victimization (Liggett, Loukaitou-Sideris, and Iseki, 2002). Because of this, there has been some, although limited, research, which has focused on a ‘whole journey approach’ for transit crime. This includes examination of the environment beginning when an individual leaves their house

lasting until they reach their destination, rather than only examining crime that occurs on trains and at transit stations. Passengers have been found to experience varying levels of stress depending upon the point of their trip, making it necessary to recognize and separate each stage of a passenger trip (Smith, 2008). By identifying patterns that occur during the whole journey between home and the final destination, opportunity reduction strategies can be implemented outside of the primary transit environment.

Modifications of the physical environment, that block potential criminal opportunities, also help lessen the fear of one's personal safety when using transit as the modifications usually employ strategies of open sightlines, increased visibility, and increased lighting. Feelings of security and safety can be dependent on the gender of passengers. Fear of crime experienced by women is significantly higher than fear experienced by men (Smith and Clarke, 2000; Smith, 2008). Smith (2008) also found that women tend to feel threatened by a single man and fear rape or sexual assault, while men feel at risk around groups of other men and fear violent crime. One study conducted in Toronto found that women modified their routine activities to limit their use of public transit (Schultz and Gilbert, 2001). Specifically, fear of crime experienced by women needs to be further examined as studies have shown that most women are 'transit captive' and do not have access to alternate modes of transportation (Schultz and Gilbert, 2001).

Additional research is also needed to determine how much of an impact fear of crime, in a transit environment, has on overall ridership. Public

perceptions of crime on transit are usually not reflective of the actual crime that occurs. One survey conducted by Translink (2008) in Vancouver, found that passengers viewed the Waterfront station as one of the safest stations even though it had one of the higher crime rates compared to the other SkyTrain stations, while the Metrotown station was viewed as one of the most and least safe station. It is apparent that perceptions of crime, in a transit context, differ than the actual crime rate, but the overall impact this has on ridership is not clear. Some surveys have shown that concerns for safety have reduced the number of individuals that use public transit (Shellow, et al., 1974) whereas other studies have found that passengers are aware of crime on transit, but it is not an issue worrying the public (Kenney, 1987). Because of the ambiguity of the potential impact fear of crime has on ridership and revenue generated by transit systems, further development is needed.

8: CHAPTER 8 – CONCLUSION

Efficient and safe means of public transportation are necessary for any major city. Transit environments bring together both offenders and non-offenders who otherwise may not come into contact with each other. Because of the unique environment there are several types of crime that occur within a transit system. Through the identification of the different types of crime that do occur, appropriate responses can be developed and implemented. One response is the modification of the built environment to block opportunities for crime. Situational crime prevention and crime prevention through environmental design use techniques that alter the physical environment to reduce the rewards and increase the risks of committing a crime.

The aim of this study was to determine if there were differences in crime rates between transit stations that were built with crime as a consideration and those that were not. Because of the context specific nature of these strategies, they have been found to be effective in reducing criminal opportunities. Although limited, evaluations of the application of situational prevention techniques to transit environments have produced successful results, especially when used during the design stage rather than after implementation. The use of programs that have been shown to be successful based on evidence produced from evaluations decreases the use of programs that are not effective and instead may be harmful and waste resources. Situational crime prevention and CPTED

strategies are successful, cost effective means to prevent and reduce crime in a transit environment.

APPENDIX 1 – 25 TECHNIQUES OF SITUATIONAL CRIME PREVENTION

<i>Increase the effort</i>	<i>Increase the risks</i>	<i>Reduce the rewards</i>	<i>Reduce provocations</i>	<i>Remove excuses</i>
1. Target harden	6. Extend guardianship	11. Conceal targets	16. Reduce frustrations and street	21. Set rules
- Interior screens for bus drivers	- Travel with a friend	- Encourage passengers to conceal their valuables	- Staff informed of disruptions in operations	- By-laws applicable to transport setting posted
- Graffiti-resistant surfaces	- Know routes and help points		- Design and light for calm atmosphere	
2. Control access to facilities	7. Assist natural surveillance	12. Remove targets	17. Avoid disputes	22. Post instructions
- Restrict access to fare-payers	- Good lighting and sightlines	- Rechargeable smartcards instead of disposable passes	- Simple fare structures and exact-fare systems	- Signs drawing attention to important rules posted
- Automatic train doors	- Shelters with glass sides, well-lit, located near shops	- Real-time arrival indicators		
3. Screen exits	8. Reduce anonymity	13. Identify property	18. Reduce emotional arousal	23. Alert conscience
- Require tickets for exiting	- Staff with name tags	- Security mark "hot property" (cell phones/ipods)	- Employees trained to handle difficult confrontations	- Use of CCTV posted

			- Avoid public disputes with passengers	- Use posters noting the unacceptability of these crimes, the potential harms, and the long-term consequences
4. Deflect offenders	9. Utilize place managers	14. Disrupt markets	19. Neutralize peer pressure	24. Assist compliance
- Separate waiting passengers from non-passengers	- CCTV use in unsupervised areas, designated waiting areas and high-crime areas, and with public address systems	- Licensed buskers	- Credible role models for good behaviour	- Litter bins
- Separation of rival sports supports			- Student dispersal via a variety of routes and at different times	- Safety zones for passengers designated with painted lines
5. Control tools/weapons	10. Strengthen formal surveillance	15. Deny benefits	20. Discourage imitation	25. Control drugs and alcohol
- No benches	- Truancy patrols, special units and constables	- Classical music over public address systems at train and bus stations	- Rapid removal of graffiti	- Special "dry" trains during sporting events
- Limit pay phones	- Train captains, transport wardens, bus monitors		- Media attention to details of anti-social acts discouraged	- Public transport settings designated as "alcohol-free" zones

(Based on Smith, M. J. 'Addressing the Security Needs of Women Passengers in Public Transport' in Security Journal, 21 (1-2), (2008) 117-133 - reproduced with permission of Palgrave Macmillan. This material may not be copied or reproduced without permission from Palgrave Macmillan.)

REFERENCE LIST

- Angel, S. (1968). Discouraging crime through city planning. Working Paper, #75. Berkeley, CA: Centre for Planning and Development Research.
- Barclay, P., Buckley, J., Brantingham, P. J., Brantingham, P. L., & Whinn-Yates, T. (1996). Preventing auto theft in suburban Vancouver. In R. Clarke (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Block, R., & Davis, S. (1996). Environs of rapid transit stations: A focus for street crime or just another risky place? In R. Clarke (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Brantingham, P. J., & Brantingham, P. L. (1984). *Patterns in crime*. New York, NY: Macmillan
- Brantingham, P. J., & Brantingham, P. L. (1991). *Environmental Criminology* (2nd ed). Prospect Heights, IL: Waveland.
- Brantingham, P. J., & Brantingham, P. L. (1998). Environmental criminology: from theory to urban planning practice. *Studies on Crime and Crime Prevention*, 7(1), 31-60.
- Brantingham, P. J., & Brantingham, P. L. (2003). Anticipating the displacement of crime using the principles of environmental criminology. In M. Smith and D. Cornish (Eds.), *Theory for Practice in Situational Crime Prevention*, 119-148. Monsey, NY: Criminal Justice Press.
- Brantingham, P. J., & Brantingham, P.L. (2008). Crime pattern theory. In R. Wortley and L. Mazerolle (Eds.), *Environmental Criminology and Crime Analysis*. Portland, Oregon: Willan Publishing.
- Brantingham, P. L., & Brantingham, P. J. (1988). Situational crime prevention in British Columbia. *Journal of Security Administration*, 11(2), 17-27.
- Brantingham, P. L., & Brantingham, P. J. (1993). Environment, routine and situation: toward a pattern theory of crime. In R. Clarke and M. Felson (Eds.), *Routine Activity and Rational Choice: Advances in Criminological Theory*. New Brunswick, NJ: Transaction Publishers.
- Brantingham, P. L., & Brantingham, P. J. (1995). Criminology of place: crime generators and crime attractors. *European Journal on Criminal Policy and Research*, 3(3), 1-26.

- Brantingham, P. L., Brantingham, P. J., & Taylor, W. (2005). Situational crime prevention as a key component in embedded crime prevention. *Canadian Journal of Criminology and Criminal Justice*, 47(2), 271-292.
- Buckley, J. B. (1996). *Public transit and crime: routine activities/ecological approach*. Burnaby, BC: Simon Fraser University.
- Carr, K. & Spring, G. (1993). Public transport safety: a community right and a communal responsibility. In R. Clarke (Ed.), *Crime Prevention Studies*, Vol. 1. Monsey, NY: Criminal Justice Press.
- Chemers, B., & Reed, W. (2005). Increasing evidence-based programs in criminal and juvenile justice: a report from the front lines. *European Journal on Criminal Policy and Research*, 11(3-4), 259-274.
- Clarke, R. V. (1980). Situational crime prevention: theory and practice. *British Journal of Criminology*, 20(2), 136-147.
- Clarke, R. V. (1996). Crime and the economics of mass transit. In R. Clarke (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Clarke, R. V. (Ed.). (1997). *Situational Crime Prevention: Successful Case Studies*. Albany, NY: Harrow and Heston
- Clarke, R. V. (2005). Seven misconceptions of situational crime prevention. In N. Tilley (Ed.), *Handbook of Crime Prevention and Community Safety*. Portland, OR: Willan Publishing.
- Clarke, R. V. (2008). Situational crime prevention. In R. Wortley and L. Mazerolle (Eds.), *Environmental Criminology and Crime Analysis*. Portland, OR: Willan Publishing.
- Clarke, R. V., Belanger, M., & Eastman, J. A. (1996). Where Angel fears to tread: a test in the New York City subway of the robbery/density hypothesis. In R. Clarke, (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Clarke, R. V. & Cornish, D. B. (2001). Rational Choice. In R. Paternoster & R. Bachman (Eds.), *Explaining Criminals and Crime: Essays in Contemporary Criminological Theory*. Canberra, ACT: Australian Institute of Criminology.
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*, 44(4), 588-608.
- Cook, T. D., & Campbell, D. T. (1979). *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. Chicago, IL: Rand McNally.

- Cornish, D. B., & Clarke, R. V. (1986). *The Reasoning Criminal: Rational Choice Perspectives on Offending*. New York, NY: Springer-Verlag.
- Cornish, D. B., & Clarke, R. V. (2003). Opportunities, precipitators and criminal decisions: A reply to Wortley's critique of situational crime prevention. In M. Smith and D. B. Cornish (Eds.), *Theory for Situational Crime Prevention*. Monsey, NY: Criminal Justice Press.
- Cornish, D. B., & Clarke, R. V. (2008). The rational choice perspective. In R. Wortley and L. Mazerolle (Eds.), *Environmental Criminology and Crime Analysis*. Portland, OR: Willan Publishing.
- Cozens, P. M. (2002). Sustainable urban development and crime prevention through environmental design for the British city. Towards an effective urban environmentalism for the 21st century. *Cities*, 19(2), 129-137.
- Cozens, P. M. (2005). Designing out crime - from evidence to action. Paper presented at Delivering Crime Prevention: Making the Evidence Work, Carlton Crest Hotel, Sydney, 21-22 November.
- Cozens, P. M. (2008). Crime prevention through environmental design. In R. Wortley and L. Mazerolle (Eds.), *Environmental Criminology and Crime Analysis*. Portland, OR: Willan Publishing.
- Crowe, T. (2000). *Crime Prevention Through Environmental Design: Applications of Architectural Design and Space Management Concepts* (2nd ed.). Woburn, MA: Butterworth-Heinemann.
- DesChamps, S., Brantingham, P. L., & Brantingham, P. J. (1992). The British Columbia transit fare audit: a description of a situational crime prevention process. In R. V. Clarke (Ed.), *Situational crime prevention: Successful case studies* (1st ed.). Albany, NY: Harrow and Heston.
- Easteal, P. W. & Wilson, P. R. (1991). *Preventing crime on transport: rail, buses, taxis, planes*. Canberra, ACT: Australian Institute of Criminology.
- Eck, J. E. (1993). The threat of crime displacement. *Criminal Justice Abstracts*, 25(3), 527-546.
- Ekblom, P. & Pease, K. (1995). Evaluating crime prevention. In M. Tonry and D. Farrington (Eds.), *Building a Safer Society: Strategic Approaches to Crime Prevention, Crime and Justice*. Chicago, IL: University of Chicago Press.
- English, B. J., Cummings, R., & Straton, R. G. (2002). Choosing a crime prevention model for community crime prevention programs. In N. Tilley (Ed.), *Evaluation for Crime Prevention*. Monsey, NY: Criminal Justice Press.
- Falanga, M. (1988). *Reducing crime through design in the Chicago subway system*. Ann Arbor, MI: Bell & Howell Information & Learning.

- Farrington, D. P. (2001). Evidence-Based Policy on Crime and Justice. Third International, Inter-Disciplinary Evidence-based Policies and Indicator Systems Conference, CEM Centre, University of Durham.
- Farrington, D. P. (2003). Methodological quality standards for evaluation research. *The ANNALS of the American Academy of Political and Social Science Research*, 587(1), 49-68.
- Farrington, D. P., Gottfredson, D. C., Sherman, L. W., & Welsh, B. C. (2002). Maryland Scientific Methods Scale. In L. W. Sherman, D. P. Farrington, et al. (eds.), *Evidence-Based Crime Prevention*. New York, NY: Routledge.
- Felson, M. (2008). The routine activity approach. . In R. Wortley and L. Mazerolle (eds.), *Environmental Criminology and Crime Analysis*. Portland, OR: Willan Publishing.
- Felson, M., Belanger, M. E., Bichler, G. M., Bruzinski, C. D., Campbell, G. S., Fried, C. L., et al. (1996). Redesigning hell: Preventing crime and disorder at the port authority bus terminal. In R. Clarke (ed.) *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Felson, M., & Cohen, L. E. (1980). Human ecology and crime: a routine activities approach. *Human Ecology*, 8(4), 389-406.
- Gaylord, M. S., & Galliher, J. F. (1991). Riding the underground dragon. *British Journal of Criminology*, 31(1), 15-26.
- Gill, M., & Turbin, V. (1999). Evaluating "realistic evaluation": evidence from a study of CCTV. In K. Painter and N. Tilley (Eds.), *Surveillance of Public Space: CCTV, Street Lighting and Crime Prevention*. Monsey, NY: Criminal Justice Press.
- Greene, W. H. (2000). *Econometric Analysis* (4th ed.). Upper Saddle River, NJ: Prentice Hall.
- Guerette, R. T. (2009). The pull, push, and expansion of situational crime prevention evaluation: an appraisal of thirty-seven years of research. In J. Knutsson and N. Tilley (Eds.), *Evaluating Crime Reduction Initiatives*. Monsey, NY: Criminal Justice Press.
- Guerette, R. T., & Bowers, K. J. (2009). Assessing the extent of crime displacement and diffusion of benefits: a review of situational crime prevention evaluations. *Criminology*, 47(4), 1331-1368.
- Hamilton-Smith, N. (2002). Anticipated consequences: developing a strategy for the target measurement of displacement and diffusion of benefits. In N. Tilley (ed.), *Evaluation for Crime Prevention*. Monsey, NY: Criminal Justice Press.
- Hope, T. (1991). Crime information in retailing: prevention through analysis. *Security Journal*, 2(4), 240-245.

- Howlett, M., & Ramesh, M. (2003). Agenda-setting: policy determinants, policy ideas, and policy windows. In D. Mills (Ed.), *Studying Public Policy*. Ontario: Oxford University Press.
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York, NY: Random House.
- Jeffery, C. R. (1969). Crime prevention and control through environmental engineering. *Criminologica*, 7(3), 35-58.
- Jeffery, C. R. (1971). *Crime Prevention Through Environmental Design*. Beverly Hills, CA: Sage Publications, Inc.
- Jeffery, C. R. (1976). Criminal behaviour and the physical environment: a perspective. *American Behavioural Scientist*, 20(2), 149-174.
- Jeffery, C. R. (1977). *Crime Prevention Through Environmental Design*. (2nd ed.). Beverly Hills, CA: Sage Publications, Inc.
- Jeffery, C. R. (1978). Criminology as interdisciplinary behavioural science. *Criminology*, 16(2), 149-169.
- Jeffery, C. R. (1990). *Criminology: An Interdisciplinary Approach*. Eaglewoodcliffs, NJ: Prentice Hall.
- Jochelson, R. (1994). *Crime on the rail system*. Sydney, Australia: New South Wales Bureau of Crime Statistics and Research.
- Kenney, D. J. (1987). *Crime, Fear, and the New York City Subways: The Role of Citizen Action*. New York, NY: Praeger Publishers.
- Kiersh, E. (1980). Protecting the commuter. *Police Magazine*, 3(5), 36-43.
- Lab, S. P. (2007). *Crime Prevention: Approaches, Practices and Evaluations* (6th ed.). Cincinnati, OH: Anderson Publishing Co.
- Lavrakas, P. J. (1979). Theory-based evaluation planning: a CPTED example. *The Bellringer: A Periodic Review of Criminal Justice Evaluation*, 9/10, 15-18.
- La Vigne, N. G. (1996). Safe transport: Security by design on the Washington metro. In R. Clarke (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- LeBeau, J. L. (1987). Environmental design as a rationale for prevention. In E. H. Johnson (ed.), *Handbook on Crime and Delinquency Prevention*. Westport, CT: Greenwood Press, Inc.
- Liggett, R., Loukaitou-Sideris, A., & Iseki, H. (2002). Journeys to crime: assessing the effects of a light rail line on crime in the neighbourhoods. *Transportation Research Board*, 1-25.

- Liggett, R., Loukaitou-Sideris, A., & Iseki, H. (2004). Protecting against transit crime: the importance of the built environment. UCLA School of Public Affairs, California Policy Options, 139-156.
- Lilly, R. J., Cullen, F. T., & Ball, R. A. (2007). *Criminological Theory: Context and Consequences*. Thousand Oaks, CA: Sage Publications.
- Linden, R. (2007). Situational crime prevention: its role in comprehensive prevention initiatives. *Review De l'IPC*, 1, 139-159.
- Mears, D. P. (2007). Towards rational and evidence-based crime policy. *Journal of Criminal Justice*, 35(6), 667-682.
- Mills, K. M. (1996). Crime prevention through environmental design: public facilities applications and strategies. *Security Journal*, 7(2), 109-115.
- Morgan, R., & Smith, M. J. (2006). Crime against passengers – theft, robbery, assault and indecent assault. In M. J. Smith, and D. B. Cornish (Eds.), *Secure and Tranquil Travel: Preventing Crime and Disorder on Public Transport*. London, UK: UCL Jill Dando Institute of Crime Science.
- Myhre, M. L., & Rosso, F. (1996). Designing for security in meteor: A projected new metro line in Paris. In R. Clarke (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Myers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied Multivariate Research: design and interpretation*. Thousand Oaks, CA: Sage Publications, Inc.
- National Research Council. (2005). *Improving Evaluation of Anticrime programs. Committee on Improving Evaluation of Anti-Crime Programs. Committee on Law and Justice, Division of Behavioural and Social Sciences and Education*. Washington, DC: The National Academies Press.
- Newman, O. (1972). *Crime Prevention Through Urban Design: Defensible Space*. New York, NY: The Macmillan Company.
- Newton, A. D., Johnson, S. D., & Bowers, K. J. (2004). Crime on bus routes: an evaluation of a safer travel initiative. *Policing: An International Journal of Police Strategies & Management*, 27(3), 302-319.
- Pal, L. (2006). *Beyond Policy Analysis: Public Issue Management in Turbulent Times* (3rd ed.). Toronto, ON: Thompson Canada Limited.
- Pawson, R., & Tilley, N. (1994). What works in evaluation research? *British Journal of Criminology*, 34(3), 291-306.
- Pearlstein, A., & Wachs, M. (1982). Crime in public transit systems: an environmental design perspective. *Transportation*, 11(3), 277-297.

- Poyner, B. (1983). *Design Against Crime – Beyond Defensible Space*. London, England: University Press, Cambridge.
- Ratcliffe, J. (2002). Burglary reduction and the myth of displacement. *Trends and Issues in Crime and Criminal Justice*. Canberra, ACT: Australian Institute of Criminology.
- Rondeau, M. B., Brantingham, P. L., & Brantingham, P. J. (2005). The value of environmental criminology for the design professions of architecture, urban design, landscape architecture, and planning. *Journal of Architectural and Planning Research*, 22(4), 294-304.
- Rossi, P. H., Freeman, H. E., & Lipsey, M. W. (1999). *Evaluation: A Systematic Approach* (6th ed.). Thousand Oaks, CA: Sage Publications Inc.
- Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2004). *Evaluation: A Systematic Approach* (7th ed.). Thousand Oaks, CA: Sage Publications Inc.
- Rothwell, H. (Ed.). (1975). *English Historical Documents 1189-1327*. New York, NY: Oxford University Press.
- Schneider, R. H., & Kitchen, T. (2002). *Planning For Crime Prevention: A TransAtlantic Perspective*. London, England: Routledge.
- Schultz, D. M., & Gilbert, S. (2001). Detering crime fears on public transportation. *Crime and Justice International*, 17(5), 28-30.
- Shellow, R., Romualdi, J. P., & Bartel, E. W. (1974). Crime in rapid transit systems: an analysis and a recommended security and surveillance system. *Transportation and Research Record*, 487, 1-12.
- Sherman, L. W., Gottfredson, D., MacKenzie, D. L., Eck, J., Reuter, P., & Bushway, S. (1997). *Preventing Crime: What Works, What Doesn't, What's Promising*. Report to the U.S. Congress. Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.
- Sloan-Howitt, M., & Kelling, G. (1990). Subway graffiti in New York City: 'Gettin' Up' vs. 'Meanin' It and Cleanin' It.' *Security Journal* 1, 131-136.
- Smith, M. J. (1986). *Transit crime study, volume 1 – summary of findings and policy recommendations*. New York, NY: New York City Criminal Justice Agency, Inc.
- Smith, M. J. (2008). Addressing the security needs of women passengers on public transport. *Security Journal*, 21(1), 117-133.
- Smith, M. J., & Clarke, R. V. (2000). Crime and Public Transport. In M. Tonry (Ed.), *Crime and Justice: A Review of Research*. Chicago, IL: The University of Chicago Press.

- Smith, M. J., & Cornish, R. V. (2006). *Secure and Tranquil Travel: Preventing Crime and Disorder on Public Transport*. London, England: Willan Publishing.
- Stewart, S., & Ayres, R. (2001). Systems theory and policy practice: an exploration. *Policy Science*, 34(1), 79-94.
- Tilley, N. (2009). *Crime Prevention*. Portland, OR: Willan Publishing.
- Translink. (2008). SkyTrain Security: Analysis, Clarity and Action. Retrieved on February 6, 2009 from <http://www.translink.ca/files/pdf/2008-12-02SkyTrainSecurityAnalysis.pdf>.
- Translink. (2010). About Translink. Retrieved on June 16, 2010 from <http://www.translink.ca/en/About-TransLink.aspx>.
- Van Andel, H. (1989). Crime prevention that works: the care of public transport in the Netherlands. *British Journal of Criminology*, 29(1), 47-56.
- Weidner, R. R. (1996). Target hardening at a New York City subway station: decreased fare evasion – at what price? In R. Clarke (Ed.), *Preventing Mass Transit Crime*. Monsey, NY: Criminal Justice Press.
- Weisburd, D., Wyckoff, L. A., Ready, J., Eck, J., Hinkle, J. C., & Gajewski, F. (2006). Does crime just move around the corner? A controlled study of spatial displacement and diffusion of crime control benefits. *Criminology*, 44(3), 549-592.
- Weiss, C. H. (1993). Where politics and evaluation research meet. *Evaluation Practice*, 14(1), 93-106.
- Weiss, C. H. (1998). Have we learned anything new about the use of evaluation? *American Journal of Evaluation*, 19(1), 21-33.
- Welsh, B. C., & Farrington, D. P. (2001). Toward an evidence-based approach to preventing crime. *The ANNALS of the American Academy of Political and Social Science*, 578(1), 158-173.
- Welsh, B. C., & Farrington, D. P. (2005). Evidence-based crime prevention: conclusions and directions for a safer society. *The Canadian Journal of Criminology and Criminal Justice*, 47(2), 337-354.
- Welsh, W., & Harris, P. (2004). *Criminal Justice Policy and Planning* (2nd ed.). Cincinnati, OH: Anderson Publishing.
- Wilson, J. Q. & Kelling, G. L. (1989). Broken Windows. In R. G. Dunham and G. P. Alpert (Eds.), *Critical Issues in Policing: Contemporary Readings*. Prospect Heights, IL: Waveland Press.

White, G. (2006). *Crime Prevention Through Environmental Design: How Investing in Physical and Social Capital Makes Communities Safer*. Queenston, ON: The Edwin Mellen Press.