AN EVALUATION OF CLOSED CIRCUIT TELEVISION AT THE SCOTT ROAD SKYTRAIN STATION PARK AND RIDE IN SURREY, BC

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Abstract

In August, 2009 a Closed Circuit Television (CCTV) pilot project commenced at the Scott Road Skytrain Station Park and Ride in Surrey, BC. The pilot project was implemented by the City of Surrey and scheduled for one year. This document reports on an evaluation of the CCTV system with respect to its ability to reduce auto-related crime and fear of crime at the pilot site. Using several sources of data including PRIME-BC crime incidents, ICBC insurance claim incidents, and results of victimization surveys, the evaluation considers the trends of auto-related crimes over several years in the City of Surrey and the northern district of the Corporation of Delta, BC. While the reductions in auto-related crime were large enough in magnitude to conclude that the CCTV system was effective, without further investigation it is difficult to quantify the decrease. Significant reductions in fear of crime were also identified.

Keywords: CCTV; auto crime; situational crime prevention; evaluation

Dedication

I would like to dedicate the completion of this degree to my father, Jim Reid and mother, Linda Reid. I am forever indebted to you both for the guidance and support you have given me throughout my life.

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1: Introduction

For many, *crime prevention* is a term that may be used interchangeably with similar expressions such as *crime reduction*, *public safety*, and *community safety*. While the latter terminology may be distinguished from each other on certain grounds, there is no doubt that the term *crime prevention* contains some level of ambiguity. From a criminal justice standpoint, for example, crime prevention may be achieved through the incapacitation of offenders or via specific and general deterrence measures. To a psychologist, on the other hand, it may have more to do with identifying and addressing individual risk factors associated with criminal or deviant behaviour. A sociologist may view crime prevention as having more to do with encouraging effective childhood rearing practices or establishing appropriate socialization techniques. From a policing perspective, it may involve foot patrols to provide guardianship over places and increase the likelihood that crimes will be detected. From just these few examples it is evident that crime prevention encapsulates a variety of approaches, strategies, programmes and techniques that are aimed to thwart criminal behaviour.

The "Primary, Secondary, and Tertiary" prevention model is a useful scheme that provides an organizational structure to the levels of intervention that exist in crime prevention. Primary prevention refers to interventions that target risk factors for criminal behaviour such as the broad social and economic conditions in society. Primary interventions, including those that involve the education and healthcare systems, are often focused on promoting pro-social behaviour rather than preventing criminal behaviour

directly. Secondary prevention strategies are interventions that target situations where crime is at an increased risk to occur. Secondary interventions, such as at-risk youth out-reach programmes and neighbourhood watch groups, focus more directly on preventing crimes that are known to be likely occurrences. Finally, tertiary prevention involves interventions that take place after a crime has occurred for the prevention of recidivism. Examples of tertiary interventions include drug treatment programs and custodial sentences.

Situational crime prevention is a specific approach within this broader framework that may be classified as a secondary intervention. This approach

> comprises opportunity-reducing measures that (1) are directed at highly specific forms of crime, (2) involve the management, design or manipulation of the immediate environment in as systematic and permanent way as possible, (3) make crime more difficult and risky, or less rewarding and excusable as judged by a wide range of offenders (Clarke, 1997).

Situational crime prevention focuses on reducing the physical opportunities for criminal events and increasing the risks associated with the commission of criminal acts. Its philosophy breaks from the general trajectory of criminological thought throughout the first half of the 20th century which was more concerned with the psychological, social and economic conditions that predispose individuals to crime (Clarke & Mayhew, 1980; Clarke, 1980).

Situational crime prevention surfaced in the United Kingdom (UK) during the 1960s and 1970s around the same time that two related strands of policy research– "defensible space" (Newman, 1972) and "crime prevention through environmental design" (Jeffery, 1971)–were materializing in the United States of America (USA). Originally developed by the Home Office Research Unit as an alternative mechanism to reduce institutional crime in correctional facilities, its potential for application in other

environments soon became recognized. This was, at least in part, due to related bodies of work that strengthened the theoretical basis for its potential utility. The “choice” model (Clarke, 1977; Clarke, 1980) and discoveries about factors that influence offender target selection decisions (Brantingham & Brantingham, 1975; Reppetto, 1974; Scarr, 1973; Waller & Okihiro, 1979), for example, suggested that criminal opportunities could be vulnerable to situational changes. Such findings led to the adoption of a situational crime prevention approach.

Over the past few decades, situational crime prevention has been developed into a well-structured and widely used approach to combat problems of crime and disorder. The key components of situational crime prevention include:

> 1) a theoretical foundation drawing principally upon routine activity and rational choice approaches, 2) a standard methodology based on the action research paradigm, 3) a set of opportunity-reducing techniques, and 4) a body of evaluated practice including studies of displacement (Clarke, 1997).

Over the past several decades a multitude of evaluative reports have amassed on situational crime prevention techniques employed around the world. Many have demonstrated the effectiveness of situational measures, some have shown minimal or short-lived reductions in crime, while others have resulted in unanticipated increases in crime. Of greatest importance, however, most have contributed to establishing a solid foundation of knowledge about which factors help to make a strategy successful and which factors hinder the ability of an approach to have a meaningful impact on crime. While this is not the appropriate forum for providing a detailed list of these important lessons, there are a few that merit some attention.

First, the measure being employed must target a specific type of offence. The situational approach may be used to prevent all types of crimes but since there are

particular environmental factors that provide opportunities for specific offence types, situational measures must target those precise opportunity characteristics. Measures must also be tailored to the specific settings in which they are implemented. Second, the environmental factors that provide opportunities for crime are different in every setting so expecting a situational tactic to impact crime in any given context would be problematic. Finally, relative costs and benefits must be considered when applying a situational crime prevention approach. Most tactics will not eliminate crime altogether but there is the potential for many to reduce crime if the necessary measures are taken *and* if such measures are deemed acceptable by users of the space.

A closed circuit television (CCTV) system is a specific type of situational crime prevention measure that attempts to increase the perceived risk of crime for potential offenders. CCTV has been used extensively in the UK in diverse settings for the prevention of a wide variety of crimes. In recent years, CCTV has also become a more frequent form of crime prevention in the USA, Canada, and other countries around the world. CCTV, for example, is commonly used in all sorts of retail stores to deter shoplifting and robbery, in airports and other transportation facilities to prevent various forms of crime including terrorism, and on private properties to deter trespassing and burglary. While this form of crime prevention is controversial for its potential violation of privacy (particularly when used in public spaces), its widespread use and acceptance have been hampered most seriously because evaluations of CCTV systems have failed to provide concrete evidence of effectiveness. For this reason, many have been hesitant to consider CCTV as a primary strategy for combating crime problems.

In the current study, a CCTV pilot project employed to reduce auto-related crime in a Park and Ride commuter parking lot adjacent to a major rapid transit hub in the City of Surrey, British Columbia (BC) is evaluated. Using several sources of data including local police crime incidents, insurance claim records, and a victimization survey, the impact of CCTV on two types of auto-related crime–theft from an automobile and theft of an automobile– are considered. A three year period leading up to the intervention was used to formulate a baseline of crime in the City of Surrey. The one year pilot project timeframe was then considered to evaluate the impact of the intervention. Specifically, this evaluation focuses on the broader trends of auto-related crime leading up to and through the intervention time period, changes in the amount and type of auto-related offences, fear of crime, as well as any displacement effects.

The theoretical foundation informing situational crime prevention, in general, and the crime prevention measure that is the focus of the current study, specifically, is the topic of the subsequent section. The methodology and a brief discussion of how it is informed by the action research paradigm are discussed in the "Methods" section. With respect to opportunity-reducing techniques, they are adaptive to changes in theory, practice and technology, and have been modified several times in recent history. Currently, there are 16 identified opportunity-reducing techniques that fall under the broad categories of increasing perceived effort, increasing perceived risks, reducing anticipated rewards, and removing excuses (Clarke & Homel, 1997).[1] The final component–"a body of evaluated practice"–is an ongoing process that feeds our

[1] For a complete list of the 16 opportunity-reducing techniques and examples of each please refer to (Clarke, 1997).

knowledge and understanding about the effectiveness (and ineffectiveness) of situational crime prevention measures.

2: Theoretical Literature Review

Situational crime prevention may be described as a theory in its own right–not merely a technique or set of techniques (Newman, 1997). Its concepts, however, are deeply informed by several perspectives well established within criminology theory. The theoretical foundation for situational crime prevention, and indeed the specific use of CCTV systems to reduce crime, are generally found in three bodies of criminological approaches. While routine activities theory and the rational choice perspective are two frameworks that have been established as inextricably linked to situational crime prevention approaches, the geometric theory of crime is also considered in this section because it provides the basis for the target selection behaviour of offenders –an important concept for a complete understanding of the situational crime prevention approach. Together, these three theoretical pieces provide a solid foundation for the assumptions we hold about human (non-)criminal behaviour as they apply to the utility of situational crime prevention. Routine activity theory is discussed first, followed by the geometric theory of crime and the rational choice perspective. A short discussion about how these elements combine to inform the current evaluation will conclude this section.

2.1 Routine Activities Theory

Routine activities theory was originally advanced to explain crime rate trends in relation to changes in social structure. The seminal work of Cohen and Felson (1979) offered a novel explanation for a bewildering paradox in post World War II North

America where crime rates rose dramatically despite recent advances in addressing many factors (e.g. unemployment, education and income) highly correlated with crime. Generally speaking, post war North America had changed the activity patterns of the continent's population by, for example, including women in the workforce, increasing the population of single adults, and making travel more accessible to a broader range of people. These changes, they argued, increased opportunities for crime by influencing the convergence of three necessary elements for occurrences of direct-contact predatory crimes[2]: 1) a motivated offender; 2) a suitable target; and 3) an absence of capable guardianship.

The theory put forth by Cohen and Felson (1979) focused on the spatial and temporal patterns of social movement and how they related to opportunity factors associated with criminal events. Although it had long been understood that an opportunity must be present in order for a crime to occur (see for example Hawley, 1950; Cloward, 1959), they identified the specific criteria that constituted an opportunity for crime and how these criteria may be influenced by people's routine activities. They argued it was the everyday routines that people engaged in that created opportunities for crime by allowing motivated offenders, suitable targets, and an absence of capable guardianship to converge in time and space (Cohen & Felson, 1979). In essence, removing anyone of these components would consequently remove the opportunity for a criminal event; thus, opening the way for a much broader array of crime prevention efforts.

[2] Direct-contact predatory crimes were defined by Cohen and Felson (1979) as those that occur outside the home, usually by strangers, and involve tangible victims and/or targets.

In addition to this concise model of criminal opportunity, Cohen and Felson (1979) provided a definition of target suitability. The suitability of a target from an offender's perspective was largely dependent upon its value, inertia, visibility, and accessibility. Value has a rather implied meaning in that any target that is desired by a potential offender possesses value. Inertia refers more specifically to material goods and how easily they may be moved based on their size, weight, and mobility. Visibility reflects whether the target is visible or known to a potential offender. Finally, accessibility defines whether an offender is able to gain access to the potential target. Similar to the impact of social structure changes in the years immediately following World War II, these factors were largely influenced by the evolving industrial, technological, and economic forces in North America at the time. Recent advances in technology and product design, for example, made many valuable items much more suitable targets because they were compact and easily concealed.

As an alternative approach to theories that had focused on offenders in order to understand the causes of crime, the routine activities model held the motivation of offenders as a given element and focused more specifically on the target and guardianship components. Specifically, they were concerned with the influence that people's legitimate routine activities had on targets and guardianship for creating opportunities for crime. Cohen and Felson (1979) attempted to explain crime rate trends over time by using household activity ratios (a measurement of the amount of time spent outside the home) in the USA. They hypothesised that increases in activities outside the home would explain increases in crime rates because direct-contact predatory crimes are more likely to occur outside the home where targets and victims are at greater risk. The

results of their time-series analysis revealed positive and statistically significant relationships between household activity ratios and each of the five crime rate categories considered. Since this initial test of the routine activities framework several other studies have gone on to further confirm its utility (see for example Cohen, 1981; Hough, 1987; Kennedy & Ford, 1990).

Routine activities theory is an important piece in the theoretical justification for situational crime prevention. With the understanding that our legitimate routine activities influence opportunities for crime by allowing likely offenders, suitable targets, and the absence of guardianship to come together in time and space, practitioners are empowered to use situational crime prevention approaches to thwart criminal events. By making targets less suitable for crime and increasing guardianship over them, many criminal events can be prevented. With respect to CCTV specifically, the routine activities approach would suggest that it has the potential to prevent crimes by affecting the degree of guardianship over targets that otherwise would be lacking such surveillance.

2.2 Geometric Theory of Crime

The geometry of crime literature (Brantingham & Brantingham, 1981) further informs the assumptions held by the situational crime prevention approach by describing the target selection behaviour of offenders. This framework focuses specifically on defining how offenders select locations and targets for crimes with less emphasis on any criminal motivations that they may hold. There are three ideas put forth in this framework that are of particular relevance to the use of CCTV as a situational crime prevention approach. First, crime locations are largely dependent upon where potential offenders reside and what their awareness space encompasses. Second, crime locations are also

dependent upon where potential targets are located and whether they are located within an offender's awareness space.[3] Third, target locations within an offender's awareness space must be recognized as "good" or suitable.

There are several factors that contribute to defining a person's activity and awareness spaces. Nodes and paths are two concepts that are particularly informative to the current discussion. In general, people move about from one activity to the next spending time at several locations throughout the day. Home, work, school, shopping centres, entertainment venues and recreation sites are common activity nodes that tend to consume the majority of peoples' daily lives. Paths are the spaces used to travel between activity nodes. Roadways and walkways are two examples of paths that connect people from one place to the next. It is the activity space of (non-)offenders that contributes to defining their awareness space–areas that they have knowledge about. As people spend time at different locations and move about from one place to the next, awareness spaces become defined via the development of cognitive maps.[4]

As noted above, targets located within an offender's awareness space constitute only the first two of three important concepts and serve to define a *potential* space for criminal activity. Target locations within an offender's awareness space must also be perceived as suitable. While there are several factors that contribute to defining what is suitable including the reasonable availability of targets, low perceived risk is arguably the most critical characteristic. Only in the most extraordinary circumstances will an offender

[3] This simple summary of the factors that determine the spatial patterning of crimes does not account for more complex target selection behaviour that is found with multiple (co-) offenders (See (Brantingham & Brantingham, 1981) for a more detailed discussion of the target selection behaviour of criminals).

[4] For further discussion about the development and use of cognitive maps for spatial perceptions of the physical environment please see Lynch, 1960; de Jonge, 1962; Gould and White, 1974; Beck and Wood, 1976.

select a target in a location that is interpreted as being unsafe. In the course of developing an awareness space, individuals receive cues from their environment which, in turn, contribute to their perceptions about the relative safety of an area.

There have been a number of empirical studies that support the link between the awareness spaces of individuals and target search areas. For example, investigations into the distances offenders travel to commit crimes have generally found a distance decay pattern where most crimes occur within close proximity to offenders' residences (LeBeau, 1987; Pyle et al., 1974; Wiles & Costello, 2000). Similarly, there has been a substantial body of research that lends support to the assertion about offenders' perceptions with respect to target selection behaviour for various types of crimes. Through interviews with burglars (Bennett, 1989; Rengert & Wasilchick, 1985), robbers (Feeney, 1986; Gabor et al., 1987), and shoplifters (Carroll & Weaver, 1986) the importance of environmental cues that define suitable targets has been well established. In fact, in several of these studies offenders pointed to specific decisions based on the perceived safety of a particular target location.

The awareness space of an individual is not something that is readily amenable to change through crime prevention measures as it is rooted in the activity patterns that define one's home, work, leisure, and recreational routines. Nor is the mere presence of targets within an individual's awareness space something that may be easily altered. It is the perception of target locations, rather, that is most relevant to the situational crime prevention approach. By causing a target location to be perceived as risky to potential offenders, crimes may be averted. Depending on the type of crime in question, a variety of measures may make a location seem less suitable. CCTV is one specific type of

measure that could influence offenders' perceptions about the safety of a location for the guardianship role that it is intended to provide.

2.3 Rational Choice Theory

The rational choice perspective (Clarke & Cornish, 1985; Cornish & Clarke, 1986) evolved out of the original "choice" model (Clarke, 1977; Clarke, 1980) that helped to establish the situational crime prevention approach. Based on concepts from economic theories of crime, among others, the rational choice perspective generally contends that crime is a purposeful act used to satisfy the needs and wants of offenders. In other words, offenders engage in a cost-benefit analysis whereby they make choices and decisions about engaging in criminal behaviour. While the statement that criminals are "rational" is a contentions one, the model proposed by Cornish and Clarke (1986) defines a "limited rationality" of offenders that fundamentally informs the situational crime prevention approach.

The various factors that may predispose a person to crime are not discounted in the model but the importance of free will in making rational decisions and choices is emphasized. Cornish and Clarke (1986) argue that criminal offending behaviour involves decisions and choices which are constrained by limits of time, ability and available information. An important distinction is made, however, between criminal involvement and criminal event participation. Criminal involvement consists of a set of stages in which an offender chooses to engage in crime, then to continue, and finally to desist. Each of these choices is based on a variety of factors and the decisions about them generally occur over time. Criminal event participation on the other hand, involves a separate set of decisions that are usually influenced by more immediate situational

factors. By treating each of these as discrete processes, the most suitable interventions may be selected for crime prevention approaches (Cornish & Clarke, 1998).

The importance of decision-making processes has been well documented in empirical literature. For several crime types including burglary (Bennett & Wright, 1984; Cromwell, Olson, & Avary, 1991; Decker, Wright, & Logie, 1993; Maguire, 1982; Nee & Taylor, 1988; Nee & Meenaghan, 2006; Walsh, 1980; Wright, Logie, & Decker, 1995), shoplifting (Carroll & Weaver, 1986; Walsh, 1978; Weaver & Carroll, 1985), theft of auto (Copes, 2003; Light, Nee, & Ingham, 1993), and robbery (Gabor et al., 1987), specific decision-making processes have been associated with various methods and motives related to criminal events. This body of research supports the assertions in rational choice theory that are inseparably linked to situational crime prevention.

It is the criminal event decisions and choices that most concern the situational crime prevention approach. Cornish and Clarke (1986) illustrate decision diagrams to reflect possible decision-making processes related to burglary. They claim, offenders will ask themselves questions about targets, guardianship, accessibility, and so on when making choices about specific opportunities for burglary. It is precisely this process that provides situational crime prevention with traction. By implementing preventative measures that make crimes more difficult or risky, offenders may weigh the relative costs and benefits and ultimately decide against participation in criminal events. With respect to CCTV, potential offenders may decide to refrain from taking advantage of a criminal opportunity after considering the various ways the measure could be used to detect their behaviour, direct a response or create evidence by monitoring their actions.

2.4 Theoretical Perspectives and CCTV

The three theoretical perspectives discussed in this section are all quite similar in orientation yet contribute to the situational crime prevention approach in unique ways. Routine activities theory suggests that crimes may be averted by affecting the opportunity structure–making targets less suitable and providing capable guardianship over them. The geometric theory of crime indicates that offenders will not select a target if its location is perceived as being risky or unsafe. Rational choice theory proposes a model of offender decision processes and choice making which identifies that crimes may be prevented if offenders interpret immediate situational factors as being difficult or risky. With respect to the use of CCTV systems in the context of preventing auto-related crimes, the technique appears to fit well within these theoretical principles by providing technology-assisted guardianship that may make targets less suitable, a location more risky, or the methods required by offenders to compromise the mechanism more difficult. It is the process of evaluation, however, which informs us about the utility of the approach.

3: Evaluation Design

Evaluation is a vital component in the process of crime prevention. In general, the purpose of an evaluation is to assess the causal connection between an intervention and an outcome. Through this process, evaluations can provide information about the effectiveness of a specific crime prevention measure, but more importantly, they can inform theory and effect policy decisions about future interventions. Unfortunately, few crime prevention measures are evaluated. In addition, many evaluations that are completed are not made publicly available. To further compound the problem, scores of evaluations do not meet basic requirements of reliable evaluative research (Ekblom and Pease, 1995; Sherman, Gottfredson, MacKenzie, Eck, Reuter and Bushway, 1997). Much of this problem may lie in the inherent nature of crime prevention research that, among other impediments, is limited with respect to evaluation design options and is often restricted by budgetary constraints. The following discussion describes the elements necessary for evaluative research, the criteria for judging effectiveness of an intervention, as well as the types of evaluations available for use in crime prevention research.

In general, there are four elements that necessitate consideration in evaluations: 1) interventions; 2) outcomes; 3) cases; and 4) settings (Shadish, Cook, and Campbell, 2002). Each of these should be described, in some fashion, by the supporting theory but in many cases the descriptions are quite vague. Together, the four elements constitute the most important features of an evaluation and each should be given careful attention when judging effectiveness and making generalizations.

Interventions are the measures that are assessed through the evaluation process. Eck (2005) notes that these are best thought of as packages since all interventions involve a variety of actions. In the current study, for example, CCTV is the focus of the evaluation but all of the decisions and processes that go into the design and implementation of the measure are broadly categorized as the intervention. With respect to what interventions may tell us, there are three important questions that may be answered: 1) if the intervention was applied again, would the same results occur?; 2) which components of the intervention are integral to obtaining the same results and which may vary?; and 3) if the intervention was applied again for a similar type of situation, would the same results be obtained (Eck, 2005)?

Outcomes refer to the changes in crime. It is important to note that changes are vulnerable to the method by which the outcomes are measured. Therefore, it is important to consider whether a change in the type of crime measurement would result in a change in the outcomes. Ultimately, the researcher would like to draw conclusions from one type of crime to other, similar types of crime. Once again, this is where the importance of theory and evidence are accentuated.

Cases, on the other hand, are the people or places that an intervention is geared towards. Cases vary considerably in different types of crime prevention studies. For example, in studies of a crime prevention technique that targets individual offenders, the offenders are the cases. In contrast, for a crime prevention strategy that targets a series of neighbourhoods, the neighbourhoods would be the cases. An evaluation that only considers one case (e.g., an evaluation of a bicycle patrol unit in a single parking facility) is called a case study.

Settings are the specific environments that interventions are applied within. Each setting has its own context that has an intimate connection with the intervention. Similar to the goals described for outcomes and cases, researchers are often interested in generalizing outcomes to other similar, or sometimes, different settings. Generally, it is difficult to gauge how vital the connection between the setting and intervention is. To understand this, however, other evaluations focusing on the same crime prevention technique but in different contexts may support the notion that the context is versatile. Conversely, if other evaluations reveal inconsistent outcomes for a single strategy in multiple settings, the context may be less versatile.

One of the main goals of evaluative research is to be able to generalize about the effect of an intervention. This means that general statements can be made about the effectiveness of a crime prevention technique based on specific examples. Since specific examples are often not representative of the broader context that is of interest, theory and evidence play a vital role. The process by which researchers are able to claim effectiveness for a crime prevention measure is based on the ability of theory and evidence to satisfy five criteria: 1) mechanism; 2) association; 3) temporal order; 4) rival causes; and 5) generalizing.

Mechanism is the process whereby an outcome is the result of an intervention. In order to satisfy this criterion, the specific process by which an intervention results in an outcome must be made clear. This is also referred to as “construct validity” (Shadish, et al., 2002). In evaluative research, mechanism serves several important purposes. First, it allows the intervention to be a plausible measure worth evaluating. In other words, if the intervention is grounded in good theory then it ought to be evaluated. Mechanism also

allows for the interpretation of results in relation to the theory and for the extension of conclusions about the intervention. If the evaluation produces results consistent with the grounding theory then broader conclusions may be made.

Association, also known as “statistical construct validity”, refers to whether there is sufficient evidence for the occurrence of the intervention and a reduction in crime (Shadish, et al., 2002). Generally, researchers should provide evidence that manipulations of the intervention are not attributable to random changes in crime. As alluded to in its alternative name, this criterion is typically satisfied through the use of statistics. Researchers must also be mindful of the ways in which a claim of association or a claim of no association could be in error. Inadequate measures of crime and poor implementation of the crime prevention technique are two examples that could result in the violation of this criterion.

To satisfy the condition of temporal order, the intervention must precede the outcome. This criterion is generally satisfied in evaluations that include measures before and after the intervention. Including both measures allows the researcher to compare the relative changes between groups. Accurate record-keeping is essential for understanding the timing of actions involved in the crime prevention strategy and is helpful for establishing temporal order (Tilley, 2009). It is also important to include measures in the period leading up to the intervention. By considering the trends in crime before the crime prevention technique is put into place, one can be more certain that the outcome is truly the result of the intervention and not that of a general downward trend in the study area.

Rival causes are perhaps the most difficult obstacles to overcome when judging the effectiveness of an intervention. This criterion requires the researcher to demonstrate

that no other plausible explanations could have caused the reduction in crime. Those rival causes that cannot be eliminated as plausible explanations for the outcome reduce the "internal validity" of the evaluation or, in other words, the certainty that the crime prevention measure caused the outcome change (Sadish et al., 2002). For decades now, researchers have identified rival explanations so that evaluators may be aware of them. For detailed lists of rival hypothesis classifications see Campbell and Stanley (1963) and Sadish et al. (2002).

Generalizing, or "external validity", is the final criterion that must be satisfied (Sadish et al., 2002). An evaluation is said to have high external validity if the results could be reliably replicated when applied to similar cases, settings, and outcomes. In order to achieve high external validity, the researcher must ensure that the cases, settings and outcomes involved in the evaluation are not uncharacteristic of those that the results would be generalized to. This is often very difficult to do but there are some telltale signs that cases, settings and outcomes are not typical. For example, an evaluation that is markedly intrusive, where people involved are aware of its existence, could call into question whether the outcomes would be the same in a context where people were not aware of the evaluation. Finally, Eck (2005) makes an important point about satisfying this criterion in evaluation research. Since external validity is based on induction, there is little rationale for generalizing. Instead, external validity should be used to understand when it is inappropriate to generalize (Eck, 2005).

There are a variety of evaluation design types, each with its own strengths and weaknesses. The selection of an evaluation design, however, is not usually an unbound choice for the researcher. The evaluation type is often determined by several factors

including the level of intrusion by both those implementing the evaluation and those affected by it, and how and when the evaluation process originates. Randomized experiments, quasi-experiments, non-experiments, and process evaluations are four general types of evaluations that may be conducted.

Randomized experiments are often considered the gold standard for evaluation design because they have the potential to eliminate virtually all rival causes (Sherman et al., 1997). In these types of experiments, two or more treatments are used to demonstrate their effect on the cases. One of the treatments is always a control, used to show what will happen if no intervention is offered. Further, when compared to the control, the impact of the other treatments can offer relative magnitudes of treatment effects. In these experiments, cases are randomly assigned to each of the treatments. Random assignment ensures that there are no differences between the groups so that any variations found in the outcomes must be attributable to the treatments.

There are certain conditions that must be met when randomized experiments are carried out. First, cases must be independent from each other. In other words, anytime the treatment of a case influences other cases in the evaluation, this condition is violated. In evaluations of crime prevention measures, the presence of displacement or diffusion of benefits are known to violate this condition so it is essential to ensure that cases are not affected by these phenomena. Randomized experiments also require that the implementation of the evaluation be carried out with precision. While this consequently elevates the level of intrusion, it is necessary to ensure that everything but the treatment is identical for the groups.

Generally, the only rival explanation that may be offered against the findings of a randomized experiment is that not all cases in each group received the same, equal treatment. This explanation is known as “attrition” (Eck, 2005). If this rival cause is eliminated the evaluation has very high internal validity. While this elevated internal validity is a significant strength because it provides more evidence for the specific effect of the intervention, it consequently reduces the external validity of the evaluation. The intensive managerial controls that are necessary to ensure that attrition does not occur create artificial conditions that are unlikely to be the same if the treatment was applied elsewhere.

Quasi-experiments are similar to randomized experiments in that they may also involve the use of multiple treatments. Unlike randomized experiments, however, quasi-experiments do not require the random assignment of treatments. While this reduces the internal validity of the evaluation because there is no assurance that the intervention group is statistically equivalent to the control group, it also provides considerably more leeway for research on interventions where random assignment is simply impractical or impossible.

Quasi-experiments vary with respect to the number of groups and treatments offered, type and intensity of measurement, degree of intrusiveness, and consequently the levels of internal and external validity. Experiments with the highest internal validity are those that use control groups that are similar to each other and include a series of measurements both before and after the interventions are introduced. These designs have higher internal validity because there is less room for rival explanations. Experiments with the lowest internal validity are those that do not use control groups and only have a

single point of measurement before, and a single point after, the intervention. Between these two extremes lies a variety of other quasi-experiment types with varying levels of internal and external validity.

Non-experiments are markedly different from both randomized experiments and quasi-experiments. In these evaluations there is no control group and no involvement with the application of an intervention. Instead, data for cases that had an intervention applied are compared to data for cases where no intervention was applied. These evaluations are useful for studies where the levels of intrusion inherent in quasi-experiments are not feasible. Statistical techniques are able to provide evidence for significant differences between the outcomes of groups in these types of evaluations, however, there is no certainty that the variations are due to differences between the cases or settings being compared. As a result, there are more rival explanations and therefore, non-experiment evaluations generally have low internal validity.

Finally, process evaluations serve the role of supporting the other experiment types. These evaluations offer a description about the implementation and functionality of an intervention rather than directly claiming effectiveness or non-effectiveness. Process evaluations are generally used to help build internal validity by explaining the mechanism involved in the intervention process.

While each of the evaluation types discussed above are options for crime prevention research, randomized experiments are rarely used because it is difficult to randomly assign cases to treatment groups in real world settings. As a result, quasi-experiments are by far the most commonly used design. There has, however, been a recent argument to move away from the quasi-experimental tradition. Some argue, the

quasi-experimental approach is ineffective in answering the all important question “what really works?”. Scientific realism takes a fresh approach to answering that question by changing the focus of the evaluation process. “Realism, as a philosophy of science, insists that the outcomes unearthed in empirical investigation are intelligible only if we understand the underlying *mechanisms* which give rise to them and the *contexts* which sustain them” (emphasis in the original) (Pawson and Tilley, 1994). In other words, evaluators of crime prevention measures should first consider why and how interventions affect potential cases before assessing whether they work.

The scientific realist approach has been met with some resistance in the realm of criminal justice research (see for example Pawson and Tilley, 1994; Bennett, 1996; Pawson and Tilley, 1997; and Tilley, 2000). It is, however, still being published in methods resources for interdisciplinary social science evaluation (see for example Vaessen and Leeuw, 2010). Although there has yet to be a paradigm shift in that direction, the scientific realist approach ought to be considered when designing an evaluation. The quasi-experimentation approach still remains the dominant study design in the field of crime prevention. This is also true of CCTV evaluations which have been largely dominated by quasi-experimental evaluation designs.

4: Literature Review: CCTV

CCTV has been used in many countries around the world in attempts to prevent and reduce crime in a variety of contexts. Since the 1980s, the use of CCTV has greatly expanded both in private and public spaces and continues to do so today. Despite its widespread application, there is a lack of reliable research that informs policy and practice with respect to its use in crime prevention and reduction programs. Part of the reason for the scarcity of reliable research is that many evaluations do not meet acceptable standards for producing conclusions about the effectiveness of CCTV initiatives. For example, in a recent meta-analysis of CCTV evaluations Welsh and Farrington (2009) set out basic inclusion criteria that required studies to: 1) have evaluated CCTV as the main intervention, 2) include an outcome measure of crime, 3) include before and after measures in experimental and comparable control areas, and 4) include at least 20 crimes in each area before the intervention was brought in. Out of the 93 studies that were obtained, only 44 met the inclusion criteria.

Another hurdle for informative research on the effectiveness of CCTV as a crime prevention measure is that programs and their evaluations vary considerably making it difficult to compare results and draw conclusions. For example, the size and scope of such strategies can be quite different. Some target very specific areas and have 100% surveillance of the locations while others may focus on broader areas with less comprehensive coverage. The research that is currently available, however, is a useful

starting point that begins to shed light on the overall effectiveness of CCTV as well as the specific effects it can have in a variety of contexts with different mechanisms used.

Generally, research on the effectiveness of public CCTV as a crime prevention measure has been focused on four general areas: 1) city and town centres, 2) public housing, 3) public transport, and 4) car parks. This section considers evaluations in each of these contexts and attempts to draw conclusions about the effectiveness of CCTV as a measure for preventing and reducing crime, and fear of crime. As a starting point, the most recent and comprehensive systematic review of CCTV evaluations conducted by Welsh and Farrington (2009) is referenced to provide a general overview about the effectiveness of public CCTV in each of the four major contexts. This can be a useful way of synthesizing the available research to produce the overall effectiveness of CCTV systems based on the pooled results of evaluations that met the criteria for inclusion. Subsequently, a variety of evaluation studies are considered under their own merit to reveal specific findings that may be concealed by the systematic review process.

4.1 City and Town Centres

A number of CCTV systems have been used as crime reduction strategies in city and town centres. These projects, most of which have taken place in the UK, usually involve a series of cameras set up in locations identified as hot spots for crime. Most of the schemes involve cameras that are actively monitored by security personnel. Generally, the CCTV systems are intended to serve multiple functions including the prevention of crime through deterrence, detection of crime through surveillance, intervention via security or police response, and collection of evidence that can be used in subsequent investigations and prosecutions.

In Welsh and Farrington's (2009) meta-analysis of the effectiveness of public CCTV to prevent crime, 22 of 44 studies evaluated CCTV systems in city and town centres (Welsh and Farrington, 2009). The average follow-up period was 18 months but ranged from 3 – 60 months. A few of the studies used multiple experimental areas and many used multiple controls. Six of the schemes involved other interventions in addition to the main CCTV system evaluated. Overall, Welsh and Farrington (2009) found a small but non-significant reduction in crime for the city and town centre evaluations. After pooling the effect sizes from those available in the included evaluations, an odds ratio of 1.08 translated to a 7% reduction of crime in experimental areas compared to control areas.

Although the total crime reduction effect across all city and town centre studies included in the meta-analysis was small and non-significant, the effect of CCTV appears to vary for different types of crime. In evaluations of Newcastle, Birmingham, and King's Lynn CCTV programs, for example, Brown (1995) found that CCTV systems did have an impact on crime but that the magnitude was different for various crime classifications. Property offences including burglary, and theft of and from vehicles experienced the greatest reductions while personal crimes such as assault and robbery experienced less pronounced reductions. In a different way, Armitage, Smyth, and Pease (1999) found reductions across a wide spectrum of offence types in their study of CCTV in Burnley, Lancashire (northwest England). There were, however, differences between crime types in the sequence that they declined. Burglary, vehicle crime, and other property crime were the first to experience significant reductions. Drug crimes, fraud, criminal damage, and violent offences experienced their declines somewhat later in the follow up period.

The effectiveness of CCTV also appears to vary over the course of some evaluations. In Brown's (1995) evaluations of three town centres the reductions were most apparent when the CCTV systems first came online. Sustained reductions were witnessed over the course of the evaluation time periods but were generally less prominent towards the tail ends of the study periods. Brown (1995) explains this finding by describing how the CCTV cameras likely had an initial deterrence effect through widespread publication of their presence and a sustained effect that was brought about by increased risk of arrest to offenders. Similar trends were also found in other studies (see for example Squires, 1998; Armitage et al., 1999).

Many evaluations of CCTV systems in city and town centres considered territorial displacement and the diffusion of crime prevention benefits.[5] Most, however, did not reveal clear evidence of such effects caused by CCTV. Although there were some indications that territorial displacement or diffusion of benefits could have been present, as was the case in Borough Town (UK) where displacement was detected, the effect of CCTV could not be disentangled from other interventions that coincided with the evaluation (Gill and Spriggs, 2005).

Some of the city and town centre CCTV studies also included evaluations to assess the effect of CCTV on public fear of crime. Generally, these evaluations involved surveys conducted before and after the intervention that asked participants about their feelings of fear and safety in the study area. Some studies reported a positive effect on the public's feelings of safety after CCTV cameras had been introduced into an area. In Brown's (1995) evaluation, for example, night time users of the space were found to have

[5] Diffusion of crime prevention benefits (or simply, diffusion of benefits) refers to an effect of crime prevention or reduction strategies whereby the positive effects of the measure extend beyond the intended area, time, crime type, type of offence, and/or methods used by offenders.

increased feelings of safety and in Squires' (1998) evaluation of the Ilford Town Centre (UK) CCTV scheme, both day and night time users reported increased feelings of safety. Another common finding among these two evaluations was that a disproportionate percentage of people who indicated that they felt unsafe in the area did not know that CCTV cameras were in use. This could suggest that feelings of safety may be associated with knowledge of the presence of CCTV in the area.

4.2 Public Housing

A number of CCTV systems have also been used as crime reduction strategies in public housing facilities. Once again, most of these programs have taken place in the UK. In these initiatives CCTV cameras are usually located inside or on public housing buildings and monitor various areas of housing complexes. As was the case for CCTV programs in city and town centres, most of the systems in public housing environments involve cameras that are actively monitored although in many cases it is the personal responsibility of residents to detect and report criminal activity.

In the Welsh and Farrington (2009) meta-analysis, 9 of 44 studies evaluated CCTV systems in public housing. The average follow-up period was 12 months and ranged from 3 – 18 months. Once again, Welsh and Farrington (2009) found there to be a small but non-significant reduction in crime for this context of CCTV use. Here an odds ratio of 1.07 translated to a 7% reduction of crime in experimental areas compared to control areas.

As was the case in the meta-analytic result for city and town centre CCTV evaluations, the overall effect of public housing CCTV systems on crime seems to mask variation between crime types. For example, in the Northern Estate (UK) evaluation

burglaries reduced by 47% in the experimental area while the control increased by 100% (Gill and Spriggs, 2005). The reduction in burglary accounted for the overall decline in crime that was experienced during the evaluation span so although CCTV had no effect on overall crime during the intervention period, it did have a meaningful impact on burglary, specifically. Other studies also revealed variations in reductions of specific types of crime even though overall reductions remained low (see for example Hood, 2003; Mucheno, Levine, and Palumbo, 1978).

In addition, several other evaluations of CCTV in public housing settings revealed increases in crime during intervention periods. In fact, in Dual Estate (UK) and Southcap Estate (UK) the increases in the experimental areas were greater than those in the control areas, indicating that CCTV could have caused increases in recorded crime (Gill and Spriggs, 2005). Gill and Springs (2005) explain that increases in recorded crime could have been likely results if more people reported crime because of the introduction of the surveillance system or if the police became more aware of crime in the experimental settings where CCTV had been used.

Evaluations of the effect of CCTV on fear of crime in public housing areas were also included in many of the studies. These produced mixed results. While some evaluations revealed reductions in people worrying about being a victim of crime that were greater than the control area, most did not or were not significant. To diminish the effect of CCTV on fear of crime further, the Gill and Spriggs (2005) report compared fear of crime levels with awareness about CCTV levels. Results from that analysis revealed that even in those areas where a significant reduction in fear of crime was experienced, it was not directly related to the public's awareness of CCTV in the area. This finding is

contrary to that found in both the Brown (1995) and Squires (1998) evaluations of town centres discussed above.

4.3 Public Transport

A third context in which CCTV systems have been implemented is public transport locations. Most of the evaluations of these systems have once again emerged from the UK. The general purpose of CCTV in this context, however, differs from that of city and town centres, and public housing. While the latter accommodate a variety of users of the space and therefore are susceptible to vast assortment of crime types, crime in public transport locations primarily consist of personal crimes such as assault, robbery, theft, fraud, vandalism, and more generally crimes that would be classified as "muggings". The CCTV systems were, however, intended to serve similar purposes to those in the city and town centre, and public housing schemes. The prevention of crime through deterrence, detection of crime through surveillance, intervention through direction of police response, and collection of evidence that could be used for investigative purposes were the primary purposes of installing the CCTV systems.

Once again, the Welsh and Farrington (2009) meta-analysis provides a good indication about the overall effectiveness of public transport CCTV systems to prevent and reduce crime. In the analysis four studies of CCTV programs in public transportation systems were included. The reported odds ratio weighted mean effect size was 1.30 which was equivalent to a non-significant 23% reduction in experimental versus control areas. Although far more encouraging than the magnitudes reported for either of the city and town centre or public housing settings, the greater overall reduction was largely

influenced by the program on the southern line of London's Underground system which experienced a 61% reduction (Webb and Laycock, 1992).

Once again, evaluations of CCTV used in public transportation systems reveal notable differences in the effects that systems have in reducing specific types of crime. In the studies concerning London's Underground, Webb and Laycock (1992) mention the ineffectiveness of CCTV use "in crowded environments to deal with more surreptitious behaviour such as pickpocketing or shoplifting". Instead, their evaluation reveals that CCTV may have had a meaningful impact on incidents of robbery although the use of multiple interventions precludes them from making any definitive conclusions.

Territorial displacement was accounted for in most of the evaluations but was not found to be present. For the most part, crime did not increase in neighbouring transport stations, nor in areas near stations that were the focus of an evaluation. Evaluation of fear of crime was also included in most of the studies but was not directly evaluated with respect to the effectiveness of CCTV.

4.4 Car Parks

Another context in which public CCTV systems have been evaluated, and a strand more directly related to the focus of the current study, is that of car parks. In these programs, CCTV systems are usually installed in large parking facilities with the primary purpose being to reduce auto-related crime. Of the programs evaluated, nearly all took place in the UK and involved cameras that were actively monitored by either security or police personnel.

While evaluations of CCTV systems used in the contexts discussed above reveal modest crime prevention and reduction benefits, those used in the context of car parks are

far more encouraging. In Welsh and Farrington's (2009) meta-analysis, a total of 6 studies met the evaluation criteria for inclusion. An overall odds ratio of 2.03 meant that crime decreased by 51% in experimental areas compared with control areas. This was marked by 5 of the 6 studies revealing a significant reduction in crime. The sixth study revealed an undesirable effect of CCTV yet Welsh and Farrington (2009) note that the small number of crimes measured meant that the odds ratio was non-significant.

Several of the evaluations in car parks revealed interesting effects of CCTV. In Poyner's (1992) evaluation of a CCTV system installed in the parking location at the University of Surrey, Guildford (UK), for example, a single camera was used to monitor 3 parking lots. Monitored by security personnel, the camera had nearly 100% coverage of the adjacent parking lots and was equipped with loudspeakers and infrared sensing capabilities. Analysis of three years of campus-wide crime data, including nine months following installation of the CCTV system, revealed an overall increase leading up to the intervention and an overall decrease after the intervention was put in place. A closer look at specific crime types showed that theft from automobiles was the most frequent type of auto-related crime and experienced the greatest reduction. More instructive, however, were the results found when comparing two parking lots with enough incidents to look at monthly trends. While only one of the lots was monitored by the camera, both experienced similar reduction trends. This pointed to a diffusion of benefits rather than any displacement effects, that Poyner (1992) attributed to the active response by security personnel for incidents detected through the CCTV system. Furthermore, the monthly trend analysis revealed that the lighting upgrade and landscape alterations brought in around the same time did not have a meaningful impact by themselves.

There is also further evidence to suggest that CCTV systems have a preventative effect independent of active monitoring and enforcement. In the Hawkeye (UK) case study a variety of implementation and operation difficulties precluded the deployment of police, yet a noticeable reduction in crime was experienced (Gill, Little, Spriggs, Allen, Argomaniz, and Waples, 2005). This finding is also consistent with the Bradford (UK) scheme evaluated by Tilley (1993). This evaluation revealed a 68% reduction in theft from cars and 48% reduction in theft of cars in the 12 months following the introduction of the CCTV intervention. Since there were no deployments or arrests made during this time, the apprehension of offenders could not be the mechanism driving the reductions.

Although it may be possible to achieve reductions in crime without active monitoring and enforcement, it is unclear whether these reductions can be maintained over long periods of time. Since the longest follow-up period was 24 months, it is unclear if the effects in the 5 schemes that witnessed reductions were upheld beyond the evaluation windows. The trends revealed in some studies indicated that this may not be the case. In the evaluation of Hartlepool (UK), for example, the reductions in car crime were short term and followed by an increase (Tilley, 1993).

Finally, the effect of CCTV on fear of crime was not included in studies at car park sites. This was probably because most car park CCTV systems were specifically designed to reduce incidents of auto-related crime and not fear of crime among users of the space. While most studies failed to mention the potential impact of CCTV on fear of crime at car park locations, some simply noted that it was not considered in the evaluation due to methodological reasons (see for example Gill et. al., 2005).

4.5 Future Directions in CCTV Research

The number of reliable evaluations of public CCTV systems should be considered deficient relative to the extensive use of this crime prevention and reduction measure. There is considerable difficulty in drawing conclusions about the effectiveness of public CCTV but it is hoped that this discussion has drawn attention to some of the most important discoveries to date.

Evaluations of public CCTV systems have largely been contained to four general settings: city and town centres, public housing, public transport, and car parks. In meta-analytic reviews the latter has been the only one to experience sizable and significant overall reductions in crime. This may be due to the design and implementation of such schemes which are often highly focused on specific types of crimes in highly contained areas. In fact, while the other settings may not have experienced significant overall reductions in crime, they each showed reductions in some specific crime categories. It is clear that further research is needed to identify the most suitable types of crime that public CCTV should target.

Evaluations have also yielded a debate about the importance that monitoring and responding to crime has on the effectiveness of CCTV. While the results of some studies indicated that reductions in crime could be achieved without monitoring or taking action towards criminal incidents, others revealed that monitoring cameras and deploying personnel to respond to incidents may have been contributing factors to maintaining reductions in crime.

Further, there are still many unanswered questions about the effect of CCTV on displacement of crime, diffusion of benefits, and fear of crime. While most evaluations

revealed no indications of displacement, diffusion of benefits or fear of crime, some did. That may indicate these phenomena are dependent on the design and implementation of the intervention or other contextual factors.

5: CCTV Pilot Project in Surrey, British Columbia

In August, 2009 a Closed Circuit Television (CCTV) pilot project commenced at the Park and Ride facility associated with the Scott Road Skytrain Station in Surrey, BC. The primary purpose of employing the use of CCTV at this location was to reduce crime and improve public safety in line with the recommendations set out in the City of Surrey's Crime Reduction Strategy (CRS). In addition to the design and implementation, funding was made available for evaluation of the pilot project so that the City could determine how best to use CCTV technology as a crime reduction tool, as well as establish best practices that could be shared with other municipalities. The pilot project was scheduled for a one year time span with a completion date of August 14th, 2010. This section outlines the design and implementation of the CCTV pilot project, the impact of auto-related crime, and a brief discussion about the general extent of auto-related crime.

5.1 Design and Implementation

The City of Surrey has the second largest population (approximately 447,000) in the province of BC and is continuing to grow rapidly (BCStats, 2010). In recent years it has transformed from a primarily residential suburb of Vancouver into an independent urban centre that is expected to surpass Vancouver's population within the next ten years (City of Surrey, n.d.). The City is divided into six Town Centres with most of its commercial development centred around two shopping malls – Guildford Town Centre and Central City Shopping Centre. For most growing urban centres, rapid development

brings about increases in crime. The City of Surrey is no exception in this facet. Between 1999 and 2003 the crime rate in Surrey rose steadily from 121 criminal code offences per 1,000 population to 128 criminal code offences per 1,000 population. Although this follows the general trend of the province during this time, Surrey's crime rate remained higher than the provincial average that rose from 115 criminal code offences per 1,000 population to 122 criminal code offences per 1,000 population during the same period (Police Services, n.d.).

In response to the rapid growth of the City, Surrey's CRS was adopted as a new approach to combat crime. The CRS is based on similar strategies implemented in the UK which have been recognized for significant reductions in crime. As its primary objectives, the strategy aims to:

1) reduce crime and increase community safety
2) increase public involvement in reducing crime
3) increase integration between all stakeholders involved in crime reduction
4) improve public awareness around the reality and perception of crime

(City of Surrey, 2007)

In order to tackle these objectives a series of actions are to be implemented along four major strands:

1) prevent and deter crime
2) apprehend and prosecute offenders
3) rehabilitate and reintegrate offenders
4) reality and perceptions of crime

(City of Surrey, 2007)

During the development of the CRS four Sub-Committees of the Mayor's Task Force created more than 100 recommendations under these categories. Along the "prevent and deter crime" strand are two recommendations of greatest relevance to this project. As one of its priorities, the Sub-Committee identified the development of a strategy for the application of CCTV in the City. Specifically, it was recommended that the City work with private sector partners and the Privacy Commissioner to develop a strategy for the introduction of CCTV pilot projects in areas identified as crime hot spots (City of Surrey, 2007). The Sub-Committee also recommended enhanced safety and security at Skytrain stations. In particular this would involve the City working closely with local police and transportation authorities to develop strategies to ensure that stations and adjacent parking lots were safe and secure for users (City of Surrey, 2007). Since its inception in 2007, a number of recommendations identified in the CRS have been implemented by the City. With respect to the two recommendations highlighted above, the City employed the use of CCTV in a pilot project at the Scott Road SkyTrain Park and Ride facility. The primary purpose of the CCTV pilot project was to address vehicle crime which was one of the priority crime types listed in the CRS.

The Scott Road Skytain Station parking lot was selected as the location for the current CCTV pilot project as Surrey RCMP crime data established it to have a high incidence of theft from and theft of automobiles. Through anecdotal information from those frequenting the area, the parking lot was also recognized as having an elevated risk for vehicle crime due to the lack of non-rush hour pedestrian traffic and the physical isolation of the location itself. Consequences of vehicle crime at this location have been noted to include damage to property, theft of property, increased fear of crime for transit

users, and hesitation by the public to use public transit for fear of victimization (Kerr & Bottril, 2009).

These problems are not new to this Park and Ride location. In fact, newspapers dating back to 1994 have reported on the high incidence of crimes at the Scott Road Park and Ride facility (Zyartuk, 1994). Other crime prevention strategies have also been attempted at this location. In 1995 a bicycle patrol was implemented at the Park and Ride lot as part of a single month pilot project. A preliminary evaluation found a reduction in vehicle crimes during and after the month long mobile patrol intervention (Spinks, Pittman, Singh, Barclay, and Jahn, 1995). A subsequent study indicated that although there had been partial territorial displacement, the displacement of crime did not impact nearby neighbourhoods or the next nearest crime generator location (Barclay, Buckley, Brantingham, Brantingham, and Whin-Yates, 1997). Although the Barclay et al., 1997 study noted that the results of the initial bicycle patrol evaluation had led to the expansion of the service at the location, it had been discontinued years prior to the commencement of the current CCTV pilot project.

The Scott Road Skytrain Station parking lot is located in the North-West corner of the City adjacent to the Scott Road Skytrain Station (Figure 1). This station is a convenient departure point for commuters travelling between Surrey and much of the lower mainland as it is the last point in Surrey before the rapid transit line crosses the Fraser River into New Westminster, Burnaby, and Vancouver. The lot is primarily used by commuters travelling out of Surrey to other municipalities in the lower mainland for work or school. This results in pedestrian and vehicle traffic peaking before and after the regular business hours of approximately 9:00am and 5:00pm, Monday to Friday. The lot

itself has more than 1500 parking spaces contained within a small number of distinct sections around the elevated platform of the Skytrain station (See Figure 2). All of the spaces are at ground level, uncovered, and within an area measuring approximately 350 metres by 250 metres.

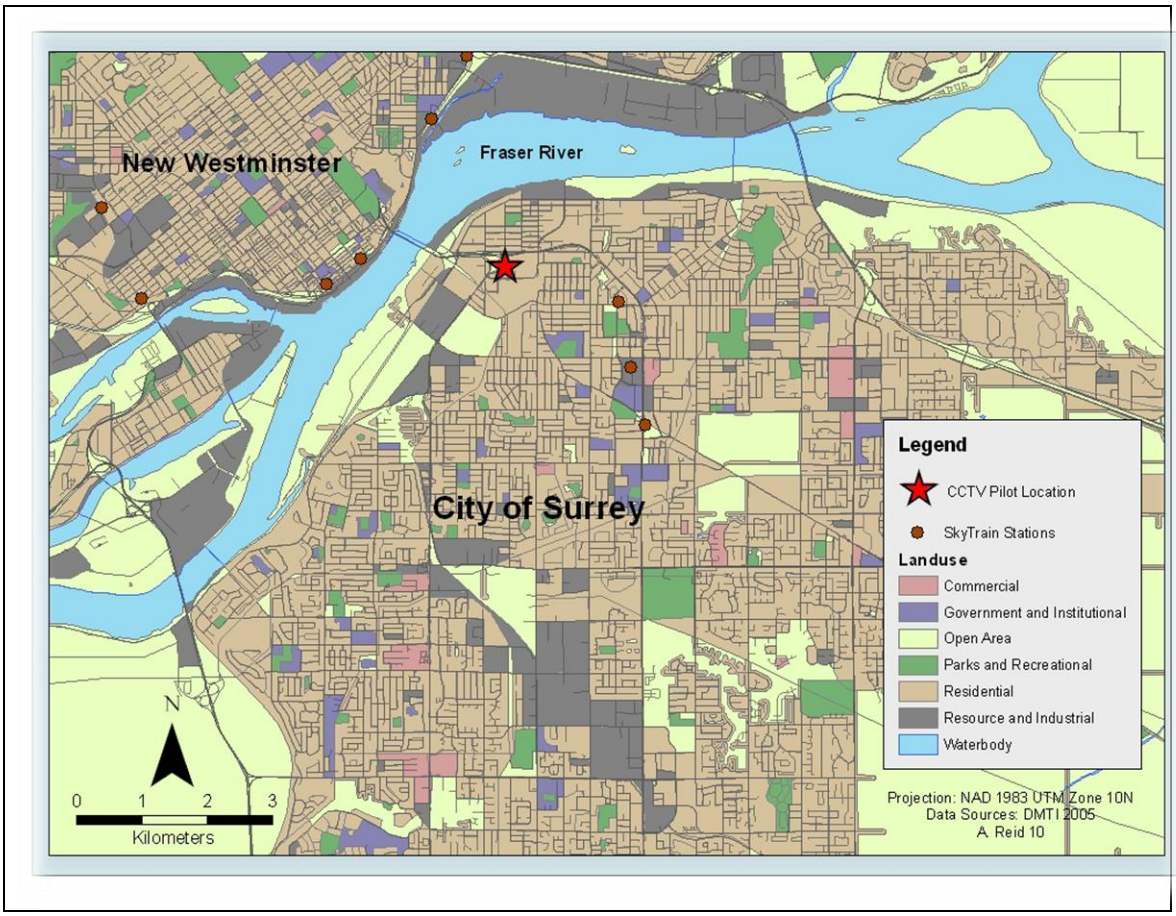


Figure 1. Map showing the location of the CCTV pilot site.

Twelve CCTV cameras have been installed at the Scott Road Skytrain Station parking lot to provide comprehensive coverage of the immediate area. Eleven fixed cameras and one adjustable via remote control record activity throughout the parking lot from a variety of angles. Recordings from the cameras are stored for a period of time and are available upon request to authorized agencies investigating criminal activity. A

lighting upgrade completed just prior to the start of the pilot project allows the cameras to capture improved quality images outside of daylight conditions. Seventeen signs informing the public about the use of CCTV in the area have also been posted around the parking lot in locations with high visibility. The system became operational on August 15, 2009.

Bing Maps Platform (2010). Image generated by (publicly available) Microsoft Virtual Earth Software.

Figure 2. Arial photo of Scott Road Skytrain Station.

5.3 The Importance and General Extent of Auto-related Crime

Auto-related crimes including theft of motor vehicle, theft from motor vehicle, and motor vehicle vandalism have been widely recognized as serious problems around the world. Results of the 2000 International Crime Victimization Survey reveal that car vandalism and theft from car were the two most prevalent crimes. For the 13 countries that participated in the survey, an average of 7% of the population were victims of vandalism while an average of 5% were victims of theft from an automobile (Besserer, 2002). While car and motorcycle theft were less prevalent than these other auto crimes,

they were considered more serious by respondents. In fact, car theft was viewed as the most serious crime with an average of 84% of victims from the 13 countries stating that their most recent incident over the past five years was very or fairly serious (Besserer, 2002).

Motor vehicles are attractive targets to offenders who recognize the opportunity for monetary gain through the theft of personal property contained within the vehicle, automotive parts or the vehicle itself. Others find vehicles attractive for "joyriding" or fulfilling their transportation needs (Fleming, Brantingham and Brantingham, 1994). In Canada specifically, auto crime is a major concern because of its impact on insurance costs. With respect to auto theft alone, the monetary cost to Canadian insurers is significant. The Insurance Bureau of Canada reported that in 2005 the cost of motor vehicle theft to insured Canadians was $540 million (Insurance Bureau of Canada, 2004). The cost to Canadians is even greater when considering this figure along with additional costs including non-insured vehicle theft, health care, court, and policing. The overall cost of motor vehicle theft exceeds $1 billion annually when considering the combined expense of these factors (Standard and Poor's DRI, 2000).

In addition to higher insurance premiums, auto-related crime impacts Canadians on other levels. Motor vehicle theft contributes to incidents of death and injury through motor vehicle theft collisions. Although it is difficult to capture precise figures about the human cost of motor vehicle theft due to the lack of a comprehensive reporting system in Canada, the National Committee to Reduce Auto Theft provides a glimpse into the problem. According to a review of newspaper articles published between 1999 and 2001,

81 persons were killed and 127 people injured as a result of auto theft (National Committee to Reduce Auto Theft, 2002).

Auto crime may also contribute to the generation of fear in Canadians. Those who have been victimized or believe crime in their community to be greater relative to other areas may alter their travel patterns and driving habits for fear of victimization. There is also some evidence to suggest that offenders who engage in auto crime early in their criminal career may continue on a prolonged offending career path. For example, a study based on longitudinal data from a registry of convicted criminals in Sweden revealed that vehicle theft best predicted an extended criminal career path when it was an offender's first criminal offence (Svensson, 2002).

The extent of auto crime in Canada is great. In fact, motor vehicle theft is one of the most frequently police-reported crimes across the country (Dauvergne, 2008) and the motor vehicle theft rate in 2004 was 498 per 100,000 population– 26% greater than the United States (Gannon, 2006). There is, however, considerable variation among provinces in Canada. In 2004, BC's motor vehicle theft rate was overrepresented with 818 per 100,000 population – second only to Manitoba (Gannon, 2006). It has, however, been on a steep decline for several years now. Incidents of vehicle theft reported to the Insurance Corporation of British Columbia (ICBC) have fallen by 55% in just the past six years (ICBC, 2010). This is similar to the rate of theft from motor vehicle which has declined by 52% in the past six years (ICBC, 2010).

There is also considerable variation among Canadian cities. In 2002 Surrey was declared the car theft capital of North America (CTV News Staff, 2002). Since then, it has followed the general trend of the province with a 52% reduction in incidents of

vehicle theft and a 44% decline in incidents of theft from motor vehicles (ICBC, 2010). There is still, however, room for considerable improvement. In 2007, Surrey was ranked 6th in Canada for cities with the highest vehicle theft rates (Maclean's news) and in 2009 had 85% more incidents of vehicle thefts than the City of Vancouver (ICBC, 2010).

6: Data

The evaluation of the CCTV system implemented at the Park and Ride location adjacent to Scott Road Skytrain Station incorporated data from a variety of sources. The results of two victimization surveys (one pre-intervention and one post-intervention) were used to assess changes in the number of incidents of auto-related crimes during the one year pilot project. In addition to reported victimization, the surveys included questions about participants' opinions with respect to the use of public CCTV and asked for responses to questions regarding personal feelings of safety at the pilot site. Themes from these elements of the victimization surveys are considered in the evaluation. Police crime data and insurance claim data are employed for the purposes of assessing statistically significant changes in the local trends of two categories of auto-related criminal offences: theft from motor vehicle and theft of motor vehicle were considered. These data were further used to assess statistically significant changes in the neighbourhood, community, city-wide, and area-wide trends to investigate possible displacement and diffusion of benefit effects.

6.1 Victimization Survey Data

Community engagement is increasingly becoming recognized as one of the key ingredients for successful crime reduction models (City of Surrey Crime Reduction Strategy, 2007; Given, 2008; Forrest, Myhill & Tilley, 2005). The importance of citizens' perceptions of crime has been gaining momentum in recent years and increasing public

involvement is, in fact, one of the stated objectives of Surrey's Crime Reduction Strategy (City of Surrey Crime Reduction Strategy, 2007, P. 9). This sentiment was echoed in a segment of the recent CBC special series "Neighbourhood 911" by Alan Given, Chief Executive of the Crime and Drugs Partnership in Nottingham City (UK). Given (2008) notes the importance of being responsive to community concerns which begins, he claims, by citizens articulating their concerns (Given, 2008). This is of further concern given that "complete information about citizens' perceptions of crime and their feelings of safety in the community is not available at this time in a statistically valid form" (City of Surrey Crime Reduction Strategy, 2007, P. 32).

Since the most recent Criminal Victimization Surveys in 2004 and 2009, little has been done to document the experiences of the public with respect to crime. There has been only one published study that has actively sought Surrey citizens' perceptions and satisfaction with criminal justice agencies in recent years. "Assessing the Performance and Policing Priorities of the Surrey RCMP: A Resident's Survey" was conducted by Kwantlen University College and the RCMP in 2007. This study focused on residents' satisfaction with the RCMP and the fear of crime in Surrey communities (Welsh, 2007). The study used a mail-out survey with 38 questions to measure residents' perceptions and obtain basic demographic information (Welsh, 2007).

The purpose for including victimization surveys in the current evaluation was not to collect general information on residents' perceptions of crime or their satisfaction with criminal justice agencies. Instead, victimization surveys were conducted to assess the impact of CCTV on the number of victimizations at the pilot site. The victimization surveys were also completed to collect the views and opinions of parking lot users with

respect to the use of public CCTV, and to allow for an assessment of the impact of CCTV on fear of crime for users of the Park and Ride facility. The surveys posed questions to participants about the frequency and reason for using the parking lot, their feelings of safety with respect to their person and property, personal incidents of victimization, attitudes towards the use of CCTV, as well as basic demographic information.

The first survey was conducted approximately four months prior to the date when the CCTV system became operational at the pilot site. The follow-up survey was conducted immediately following the one year intervention interval in August, 2010. Participants for the two surveys were recruited by a small team of research assistants[6] who approached users of the Park and Ride on weekday mornings as they parked their vehicles. Both male and female research assistants conducted the surveys with parking lot users. In both the pre-intervention and post-intervention collection, all surveys were completed within a two week interval.

Naturally, there were some difficulties in conducting the surveys with participants at the pilot site. The greatest challenge was convincing potential participants to complete the surveys. Initially, this proved difficult because the only times when parking lot users could be approached was either after they had parked their vehicles (on their way to the Skytrain station) or when they were returning to their vehicles (after they had left the Skytrain station). Since most people were trying to get to work or return home as quickly as possible, they did not want to be delayed to complete a survey.

This obstacle, however, did not present much of an issue once a strategy was developed by the team of research assistants. Potential participants were approached at

[6] The team of research assistants included Kathryn Wuschke, Monique Guterres, Jordana Gallison, Natasha Kwan and Kevin Lau.

their vehicles (on their way to the Skytrain station) and read the statement of consent that was printed on each survey. The research assistants then offered to read out and complete the surveys with parking lot users as they walked from their vehicle to the Skytrain station. Further, each participant was ensured that the survey would be completed by the time they reached the entrance to the station and, if not, they would not be required to stay to complete it. With these offers and guarantees, most parking lot users that were approached were willing to participate. In fact, once participants began to administer the surveys, many participants were keen to give responses and provide detailed information.

6.2 PRIME-BC Data

Crime incident data from the Police Records Information Management Environment for British Columbia (PRIME-BC) was provided by the Surrey RCMP detachment for the City of Surrey and covered the time period April, 2007 through August, 2010. Records for incidents of theft from motor vehicle under $5000, theft from motor vehicle over $5000, theft of motor vehicle under $5000, and theft of motor vehicle over $5000 were included in the data retrieval. For the purposes of the current study, these crime types were collapsed into two general categories: 1) theft from motor vehicle and 2) theft of motor vehicle.

PRIME-BC is a new police information system in British Columbia that serves all RCMP detachments and municipal police agencies in the province. The three main components that PRIME-BC integrates into one information system are Computer Assisted Dispatch (CAD) entries, the Records Management System (RMS), and the Mobile Work Station (MWS) (RCMP, 2007). The PRIME-BC system is seen by many as a major improvement in the management of police information and records. It alleviates

the impact of several problems that previous police information systems were unable to overcome including lengthy lag time between the time a crime occurs and when it is entered into the information system, and the duplication of logged events (Sherman, Garten, and Buerger, 1989).

Official crime measures can be used to understand criminal incidence reported to police, however, it is well known that there are major shortfalls in the ability of official measures to capture all crime that occurs (Sellin, 1931, 1957; Tibbits, 1932; Pittman & Handy, 1962; Boggs, 1965; Maltz, 1977; Skogan, 1975, 1977). According to the 2009 General Social Survey (GSS), about one third (31%) of criminal victimizations are reported to police (Statistics Canada, Juristat, 2006). As a result, any analyses that use police crime data should acknowledge this limitation. This is even true for the simple task of producing the crime rate for an area of interest. Allan Castle (2008), Officer in Charge of Criminal Analysis for the RCMP Pacific Region recognizes the limitations of police crime statistics and believes that an annual survey of criminal victimization should be adopted to produce more accurate measurements (Castle, 2008). Statistics Canada recognizes the need for more information and is currently in the process of assessing the effectiveness of carrying out an annual survey (Vancouver Board of Trade, 2008).

6.3 ICBC Data

ICBC insurance claim data from June, 2006 through August, 2010 was obtained for the City of Surrey and the Corporation of Delta. All insurance claims for incidents of theft from motor vehicle under $5000, theft from motor vehicle over $5000, theft of motor vehicle under $5000, and theft of motor vehicle over $5000 in the City of Surrey and the Corporation of Delta were included in the data retrieval. Once again, these crime

types were collapsed into the two general categories of theft from motor vehicle and theft of motor vehicle.

Although insurance claim data is a reasonable source for information about criminal occurrences related to automobiles, the data do have limitations. First, not all auto-related crimes are necessarily reported to insurance companies. For example, if an insured motor vehicle owner was victimized and the claim was thought to be less costly than the deductable that would have to be paid to the insurance company, the insured owner may decide against proceeding with a claim. In this type of case, the insured motor vehicle owner may decide to pay for the loss without processing a claim with the insurance company because it would be the cheaper option. Alternatively, a claimant may report a claim and sometime during the claims process the adjuster will discuss the remediation costs versus the deductable cost. If the claimant decides not to proceed with the claim because the deductable cost is more than the remediation costs, then the claim is closed without payment. These cases are included in the data included in this evaluation.

7: Methods

7.1 Victimization Survey Analysis

Total counts of victimization for incidents of theft of motor vehicle and theft from motor vehicle are calculated for the preliminary and follow-up surveys. Since the sample sizes were different between the two survey collections, counts of victimization adjusted for the approximate total population[7] are also calculated and reported. The figures from the preliminary and follow-up surveys are then compared to assess whether there had been any notable changes in the total incidents of auto-related crimes during the pilot project timeframe. Finally, a z-test was used to assess the presence of statistically significant changes from the before and after victimization counts for the two crime types.

Percentages of participant selections to each possible question response are calculated for the preliminary and follow-up surveys. These reported results allow for a general description of participants' opinions and attitudes surrounding crime and the use of CCTV at the pilot site. The results allow for an interpretation of whether there had been any notable changes in the degree of fear of crime as reported by participants. A z-test for difference in proportions is used to assess statistically significant changes in participant responses to questions regarding feelings of personal safety and the safety of personal property.

[7] The figures adjusted for the approximate total population were based on the 1532 stalls reported to be available for use at the Scott Road Park and Ride facility.

7.2 Geocoding Procedures

Both the PRIME-BC and ICBC datasets were geocoded to the Surrey and Delta road networks in preparation for spatial data analysis. Geocoding of spatial data introduces a potential source of error in spatial data analysis techniques so particular attention must be given when carrying out the procedure. Ratcliffe (2001) warned that, in addition to the inaccuracy of geocoding algorithms, there is the potential that not all street addresses or street intersections will be located. These geocoding errors could result in spatial bias. In order to proceed with confidence in spatial data analysis, Ratcliffe (2004) identified a minimum standard of 85% for geocoding success rates.

The requirement for a successfully geocoded event in the current evaluation was for the event to be matched to the exact address. The PRIME-BC and ICBC datasets were each geocoded with a success rate of 97 percent. Upon further inspection of the incidents that were not geocoded successfully, it appeared that the locations could not be matched interactively (manually) because the locations simply did not have specific street addresses. For example, a number of incidents had addresses that were documented as "King George Highway Off-ramp". The address locator used in this analysis was unable to recognize an off-ramp as a valid address and therefore, the incident was not geocoded to the street network. Since each of the 97% success rates exceeded the minimum standard identified by Ratcliffe (2004), and addresses and intersections that were not located by the geocoding procedure did not appear to have any distint spatial pattern, there was little concern for spatial bias when proceeding with the current analyses.

There are, however, a number of other potential problems in geocoding procedures that could impact the accuracy of spatial analyses: long streets can be

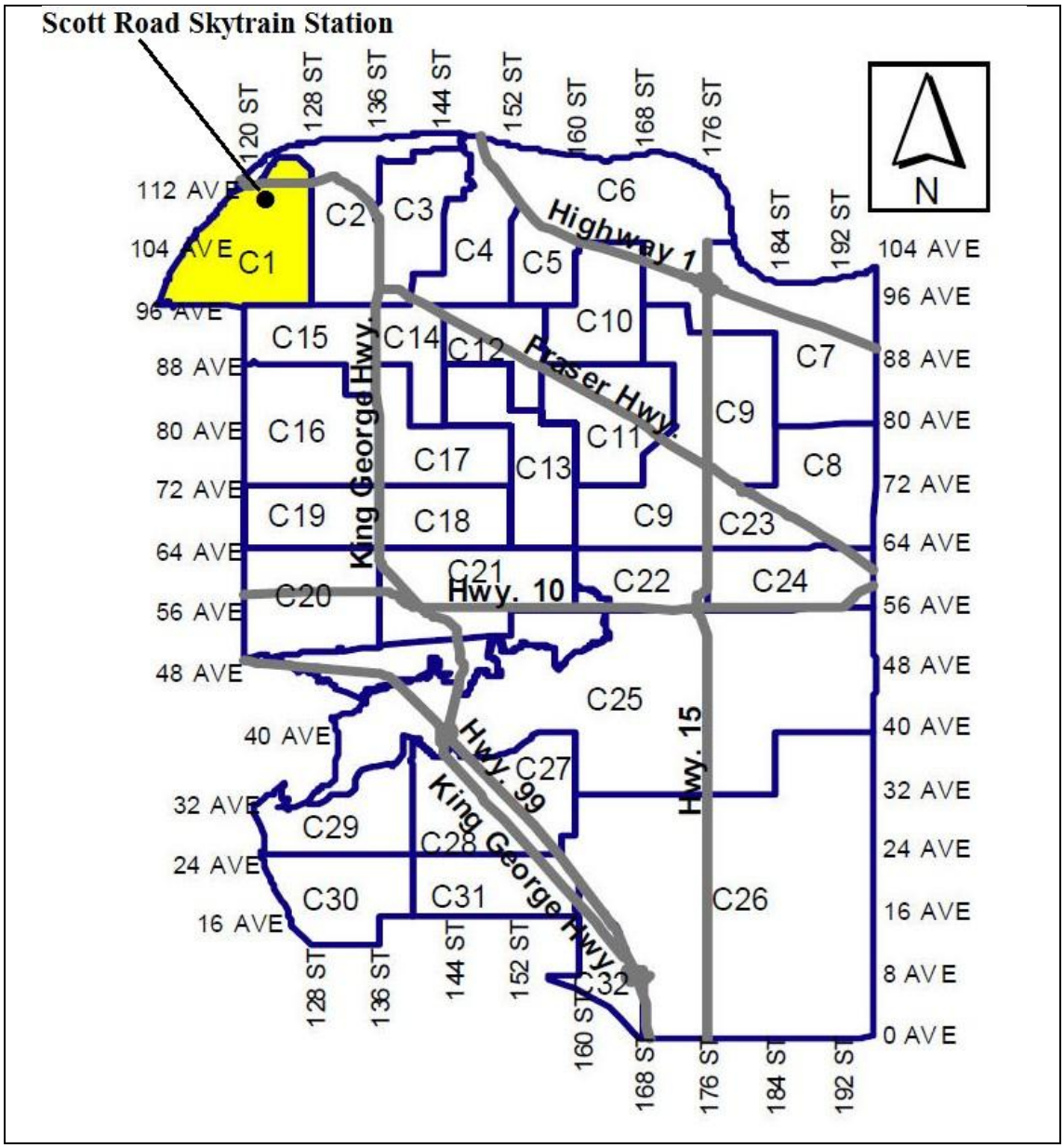
arbitrarily broken into street segments despite there being no intersections to substantiate a new end and beginning to a road; events are assigned to the street network using an interpolation process that could result in events being assigned to the wrong place on street segments; geocoding matches can be made on aerial units and subsequently misplaced on street segments; and variation in street segment length can skew analyses. Since the scope of the current evaluation did not require the consideration of spatial crime patterns at the street segment level of analysis, these issues did not present any concern.

7.3 Spatial Units of Analysis

All events that were successfully geocoded to the street network are subsequently aggregated to a variety of spatial units of analyses. The spatial units considered in the analysis of the PRIME-BC data include: 1) the CCTV pilot site; 2) the entire City of Surrey; 3) the six Communities of Surrey (these communities are a subset of the entire City of Surrey); and 4) the 32 areas of Surrey (these areas are a subset of the larger communities). Maps identifying the Communities of Surrey and Areas of Surrey are presented in Figure 3 and Figure 4[8], respectively. The spatial units considered in the analysis of the ICBC data included: 1) the CCTV pilot site; 2) the entire City of Surrey; 3) the six Communities of Surrey (these communities are a subset of the entire City of Surrey); 4) the northern region of the Corporation of Delta (located to the east of Surrey); and 5) the 32 areas of Surrey (these areas are a subset of the larger communities). By including several spatial units of analysis, potential displacement and diffusion of benefit effects are able to be considered in addition to the local trends of auto-related crimes at

[8] Figure 4 includes a seventh community named "City Centre", however, during the pilot project this community was still regarded by the City of Surrey as being part of "Whalley" and is therefore not considered as a distinct community.

the pilot site. These spatial units, specifically, were selected as they are the boundaries used by the cities to identify neighbourhoods, communities, and city limits.



Map provided by the City of Surrey, BC (2010).

Figure 3. Map of Surrey Areas with Corresponding Identification Numbers.

Map publicly available from the City of Surrey (2011) website: http://www.surrey.ca/plans-strategies/1322.aspx.

Figure 4. Map of Surrey Communities.

7.4 Test for Structural Break in Trends

In the current evaluation, a structural break test is used to assess the impact of the CCTV intervention on incidents of theft from motor vehicle and theft of motor vehicle at the Scott Road Skytrain Station Park and Ride. Structural break tests are commonly used with time-series data in economics and statistics to test for changes in trends over time. In the financial field, for example, such tests are often used in research on stock returns and exchange rates (see for example, Malik, 2003; Morana and Beltratti, 2004). Structural break tests may be applied in a variety of fields to address different research questions about time-series data.

In program evaluation, structural break tests may be used to test whether the independent variables have had different impacts on subgroups of the population. For example, Piehl, Cooper, Braga and Kennedy (2003) demonstrate the value of a structural break test in their evaluation of a youth homicide reduction program in Boston, MA (USA). In this evaluation, the researchers were faced with some difficult challenges. Specifically, there was no control (or comparison) group and the precise date that the intervention was implemented was unknown. By using a structural break test, the authors were able to identify a statistically significant reduction of youth homicide shortly after the estimated intervention date. By controlling for a variety of important variables, the authors were able to claim, with reasonable confidence, that the reduction was due to a program effect rather than an unrelated change in the outcome measure.

In the current evaluation, several structural break tests are employed via linear regression models. The models considered the association between three trends and the number of auto-related crime incidents in a variety of spatial units. Specifically, three

independent variables were introduced that represented the overall trend during the pre and post intervention periods, the impact at the intervention date, and the trend during the one year intervention pilot project, respectively. By considering these three trends, it was possible to identify the immediate impact of the intervention and the on-going impact of the intervention throughout the pilot project while also accounting for the effect of the general crime trend during the entire time-span of the study period.

8: Results

8.1 Victimization Surveys

This section presents results from the victimization surveys conducted at the Scott Road Park and Ride location. The first paragraph, below, summarizes information about the samples that were obtained for the two victimization surveys. The subsequent paragraphs summarize participants' responses to questions regarding their use of the parking lot, their perceptions of crime at the parking lot and their opinions about the use of public CCTV at the pilot site. Finally, responses to questions about participants' victimization and feelings of safety at the Scott Road Skytrain Station Park and Ride are summarized and discussed.

In total, 312 surveys were completed in the preliminary collection (before the installation of the CCTV cameras) and 302 more were completed during the follow-up collection (one year after the cameras became operational). These samples represented approximately 20% of the total spaces available for use in the parking facility although usage of the parking lot varied considerably by day of the week and season. The sex of participants that completed the victimization surveys were roughly split, with females making up slightly more than half of each sample population (55% for the preliminary survey and 53% for the follow-up survey). Approximately one third of participants were between the ages of 20 and 29 and a vast majority of each sample ranged from 20 to 49 years of age (79% of the preliminary survey and 77% of the follow-up survey). Please see

Table 1 for a detailed summary of survey responses to questions regarding this demographic information.

Most participants who completed a survey at the Scott Road Park and Ride were frequent users of the facility. The majority of parking lot users who were surveyed in both the preliminary and follow-up collections indicated that they used the parking lot on a daily basis, Monday to Friday (67% for the preliminary survey and 62% for the follow-up survey), and nearly 90% used the facility at least one day per week. The reason for using the parking facility that was most frequently selected by participants was travelling to work. 90% of participants who completed the pre-intervention survey and 85% of participants who completed the post-intervention survey identified this as the primary reason for parking their vehicle at the lot. Other respondents indicated that they parked at the Park and Ride location for the purpose of attending school (7% for the preliminary survey and 8% for the follow-up survey) while a very small number of participants indicated other reasons for using the facility.

Participants were also asked several questions about their attitudes, feelings, and opinions with respect to the use of public CCTV at the Scott Road Skytrain Station Park and Ride. When asked to rate the effectiveness of CCTV in reducing crime at the parking lot, respondents were generally more optimistic before the implementation of the CCTV system compared to after the cameras had been in operation for a year. 63% of respondents in the preliminary survey ranked the anticipated effectiveness of CCTV at the Park and Ride location as either 4 or 5 on a Likert Scale ranging from 1 to 5 (with 1 being very ineffective and 5 being very effective). In the follow-up survey, however, 33% of participants indicated one of these responses. The most frequently selected response in

the post-intervention survey was 3 (selected by 49% of respondents) indicating no distinguishable feelings about effectiveness or ineffectiveness.

Although opinions about the effectiveness of the CCTV system were quite varied, the vast majority of participants did not indicate any personal concerns about the use of public CCTV at the Park and Ride facility. 94% of respondents in the pre-intervention survey and 97% of respondents in the post-intervention survey responded “No” when asked if they had any concerns about the use of CCTV to reduce crime. Nearly all of those who did indicate some level of uneasiness about the use of a CCTV system specified personal privacy as their main concern.

The surveys also included questions regarding participants’ perceptions of crime. First, participants were asked to specify which, of three types of auto-related crime, were of most concern to them. Although participant responses did not reveal an overwhelming concern for a specific type of crime, the proportions of participant responses were relatively consistent between the two surveys. 41% in the preliminary survey and 40% in the follow-up survey identified vandalism as the crime that was of greatest concern. 35% and 32% selected theft of motor vehicle, and 24% and 28% selected theft from motor vehicle in the pre-intervention and post-intervention surveys, respectively.

Participants were also asked about their perceptions about the extent of crime at the pilot site over the past year. This meant that for participants in the pre-intervention survey, they were being asked about crime in the year leading up to the start of the CCTV intervention, and for the participants in the post-intervention survey, they were being asked about crime during the one year CCTV pilot study period. In both surveys, a majority of respondents indicated that crime had remained relatively unchanged over the

course of the previous year (61% in the preliminary survey and 66% in the follow-up survey). For those respondents that did identify a perceived change in crime during the previous year, the change in proportions seemed to indicate that more participants believed crime had been getting worse before the implementation of the CCTV system compared to after (19% in the pre-intervention survey and 6% in the post-intervention survey). Conversely, more participants perceived crime as getting better after the implementation of the CCTV system than did in the period leading up to the crime prevention strategy (20% in the pre-intervention survey and 28% in the post-intervention survey).

With respect to fear of crime, participants were asked to rate their feelings of personal safety at the Park and Ride location during daylight hours and also asked about their feelings of safety after daylight hours. In general, most participants indicated feelings of personal safety during the day (81% in the preliminary survey and 87% in the follow-up survey). The difference between the proportion of respondents who identified feelings of personal safety during the day in the preliminary survey and the corresponding proportion in the follow-up survey represented a significant improvement ($Z=1.913$, $p < .10$). There was also a slight improvement in the proportions of respondents' feelings of insecurity with 4% and 3% who indicated that they felt either fairly unsafe or very unsafe in the pre-intervention and post-intervention surveys, respectively.

There were fewer responses to questions about personal safety at night because some participants indicated that they were never present at the parking lot during the evening. Not surprisingly, the results of questions asking about night time use were

markedly different from those asked in the context of daytime use with many more respondents indicating feelings of insecurity. The differences between the pre-intervention and post-intervention surveys, however, did reveal an improvement both in the proportions of respondents that indicated feelings of insecurity and those that indicated feelings of safety. 41% of respondents in the preliminary survey identified as feeling either fairly unsafe or very unsafe during the evening while only 30% identified one of these responses in the follow-up survey. Similarly, 29% of respondents in the pre-intervention survey and 42% in the post-intervention collection identified as feeling either fairly safe or very safe during the evening hours. This difference in proportions represented a significant improvement in participants' feelings of personal safety at the pilot site during the evening ($Z=2.92$, $p < .01$).

Participants' feelings of safety with respect to their property were also asked in the same contexts of day and night-time parking lot use. When asked about the safety of their property during daylight hours, the results were similar to participants' feelings of personal daytime safety. More participants indicated that they felt either fairly safe or very safe (43% in the pre-intervention survey and 69% in the post-intervention survey) than did fairly unsafe or very unsafe (18% in the pre-intervention survey and 8% in the post-intervention survey). The difference between the proportion of respondents who identified feelings of safety for their property during the day in the preliminary survey and the corresponding proportion in the follow-up survey represented a significant improvement ($Z=6.35$, $p < .01$).

Participants' responses to the question regarding the safety of their property at night revealed similar results to the question about personal safety at night. A large

proportion of respondents indicated that they felt their property was either fairly unsafe or very unsafe (67% in the preliminary survey and 43% in the follow-up survey). Conversely, a much smaller proportion of participants selected fairly safe or very safe when asked about the safety of their property at night (10% in the pre-intervention survey and 33% in the post-intervention survey). Importantly, however, the proportion of respondents who indicated their property was either fairly safe or very safe in the preliminary survey was significantly improved when compared to the proportion of respondents who selected one of these options during the follow-up survey ($Z=2.74$, $p < .01$).

Perhaps most interestingly, there appears to have been a considerable drop in victimization since the installation of the CCTV system. In the pre-intervention survey, with approximately a 20% sample, there were 53 thefts from auto and 11 thefts of auto. When adjusted for the whole population of users at the pilot site, there were 260 thefts from auto and 54 thefts of auto. In the post-intervention survey, also with approximately a 20% sample, there were 25 thefts from auto and 2 thefts of auto. When adjusted for the whole population of users at the pilot site, there were 127 thefts from auto and 10 thefts of auto. The changes in both of these crime types were found to represent significant improvements (theft of motor vehicle: $Z=5.25$, $p < .01$; theft from motor vehicle: $Z=4.43$, $p < .01$)

The last response worthy of mention here is the proportion of the users that would be willing to pay $1 more for parking if the CCTV system was monitored. This is an important question because, as stated above, the evaluation research that shows the most

promise for CCTV includes those systems that are monitored. As shown in Table 1, only 27% of those surveyed would be willing to pay $1 more.

Table 1. Victimization Survey Results, Pre- and Post-intervention.

Survey question/issue	Response	Pre-intervention percent	Post-intervention percent
Frequency of use	Daily	67	62
	3-4 days per week	14	17
	1-2 days per week	9	9
	Infrequently	11	13
Reason for use	Shopping	0	1
	Work	90	85
	School	7	8
	Recreation	2	1
	Other	1	5
Personal safety (day)	Very Unsafe	2	1
	Fairly Unsafe	2	2
	Neither Safe nor Unsafe	15	9
	Fairly Safe	38	39
	Very Safe	43	48
Personal safety (night)	Very Unsafe	19	11
	Fairly Unsafe	22	19
	Neither Safe nor Unsafe	30	27
	Fairly Safe	20	28
	Very Safe	9	14
Victimization (counts)	Theft from auto	53 (260)	11 (54)
	Theft of auto	25 (127)	2 (10)
Crime of most concern	Theft of auto	35	32
	Theft from auto	24	28
	Vandalism	41	40
CCTV effectiveness	1	5	10
	2	6	9
	3	28	49
	4	32	19
	5	30	14
Concerned about CCTV	No	94	97
Crime trend (past year)	Worse	19	6
	Same	61	66
	Better	20	28
Vehicle safety (day)	Very Unsafe	6	3
	Fairly Unsafe	12	5
	Neither Safe nor Unsafe	40	23
	Fairly Safe	36	55
	Very Safe	7	14
Vehicle safety (night)	Very Unsafe	32	18
	Fairly Unsafe	35	26
	Neither Safe nor Unsafe	23	39
	Fairly Safe	9	14
	Very Safe	1	5
Willing to pay $1 for monitoring	Yes	n/a	27

8.2 PRIME-BC Data

Charts displaying the trends of theft of motor vehicle incidents and theft from motor vehicle incidents at the CCTV pilot site are presented in Figure 4 and Figure 5, respectively. Both charts show a downward trend of auto-related crime in the period leading up to the CCTV intervention with the lowest points occurring roughly at the time the CCTV cameras "went live". In the months following the CCTV intervention there is a marked increase in both theft of motor vehicle and theft from motor vehicle incidents. These increases are followed by prompt declines with auto-related crime incidents returning to some of the lowest levels over the course of the study time period.

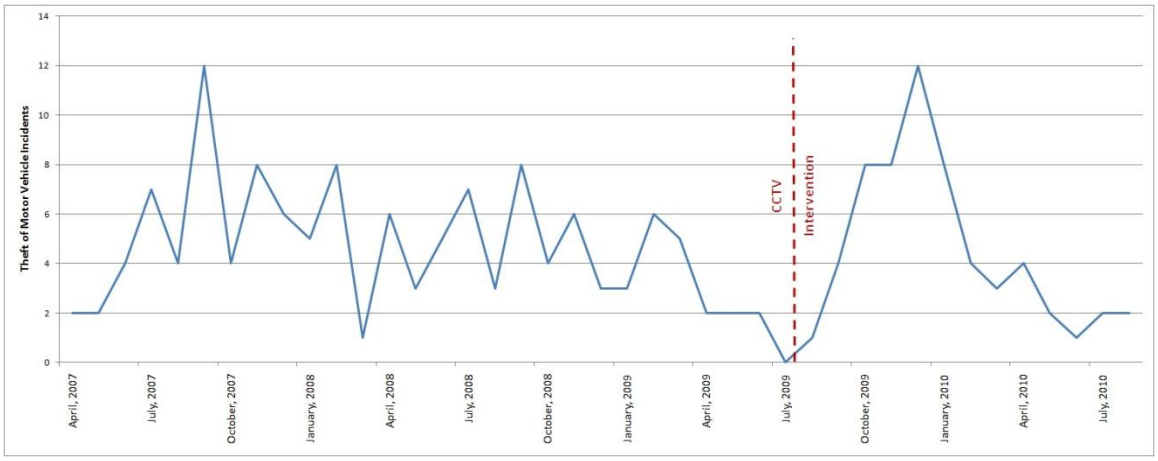


Figure 5. Chart of Incident Trend – PRIME-BC Data: CCTV Site (Theft of Motor Vehicle)

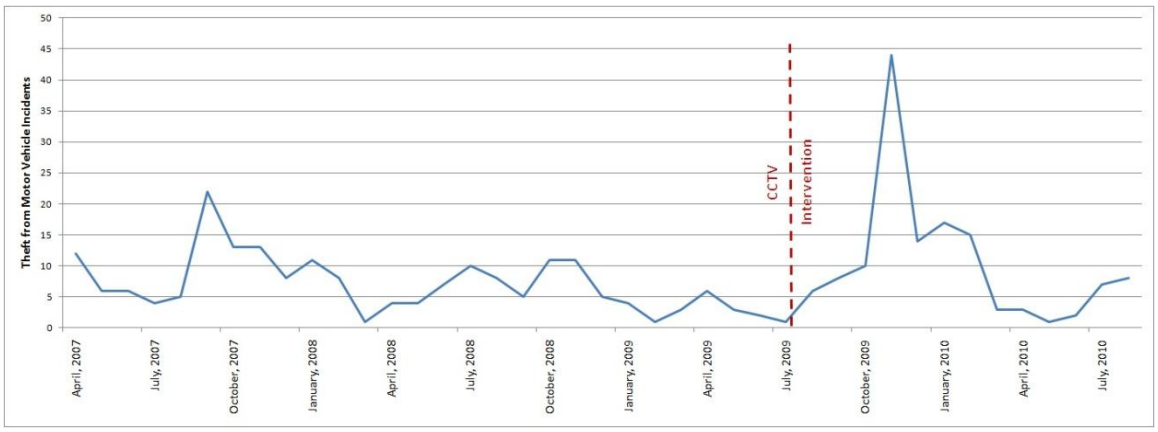


Figure 6. Chart of Incident Trend - PRIME-BC Data: CCTV Site (Theft from Motor Vehicle)

The results of the structural break test using the PRIME-BC data are reported in Tables 2 and 3 (theft of motor vehicle) and Tables 4 and 5 (theft from motor vehicle). The results for the City of Surrey, the CCTV site, and Surrey's Communities for theft of motor vehicle are presented in Table 2—the community of Whalley contains the CCTV site, but the CCTV site data are excluded from Whalley to investigate changes in the area not attributed to the CCTV site. The City of Surrey, as a whole, has an overall trend that is insignificantly different from zero over the time period: April 2007 to August 2010. There is no statistically significant change for the City during the evaluation period (15 August 2009 to 14 August 2010), but there is a statistically significant and negative estimated parameter value for CCTV Trend. This indicates that the City of Surrey, as a whole, experienced a decrease in theft of motor vehicle during this time period. As such, if the CCTV site experiences a similar change in trend it is not necessarily a result of the CCTV system, but part of a city-wide trend.

The results for the CCTV site, however, are statistically insignificant aside from a low magnitude negative overall trend. Consequently, based on the PRIME-BC data,

there is no statistical support for a decrease in theft of motor vehicle resulting from the CCTV system. Inspection of the parameter values for the Communities of Surrey reveals that there was very little change that occurred during the evaluation period. Newton has a statistically significant and negative estimated parameter for CCTV Trend, consistent with the city-wide CCTV Trend. South Surrey's overall trend is positive (increasing) and statistically significant. This increase in trend, however, is at a very modest level.

Table 2. Trend Results - PRIME-BC Data: Surrey, CCTV Site, and Communities (Theft of Motor Vehicle)

	Trend	CCTV	CCTV Trend	R^2
Surrey	0.01	3.93	**-6.88**	0.218
CCTV Site	**-0.09**	0.99	-0.11	0.196
Whalley	-0.28	1.26	-2.63	0.264
Guildford	-0.26	-1.41	0.19	0.112
Fleetwood	0.10	-2.52	-0.74	0.109
Newton	0.13	6.08	**-3.09**	0.157
Cloverdale	0.10	0.29	-0.20	0.009
South Surrey	**0.33**	-1.19	-0.32	0.219

Note. Bold indicates statistical significance at the 10 % level.

Locations of the 32 Areas of Surrey are identified in Figure 3. Turning to the analysis of the 32 Surrey Areas, Table 3, the results are quite similar to the broader Communities. Most often, the overall trend is negative. However, these estimated parameters are only statistically significant in 6 cases. Additionally, the magnitude of these parameters is always close to zero. The CCTV variable is always statistically insignificant, and the CCTV Trend variable is almost always negative, but only statistically significant in 2 Areas.

Overall, there is little to report from the analysis of the PRIME-BC data. Though there is no statistical evidence for a decrease in theft of motor vehicle at the CCTV site,

the analysis of the Communities and Areas shows no evidence of territorial displacement where crime had shifted to other areas.

The results from the PRIME-BC data for theft from motor vehicle exhibit much more statistically significant results. The City of Surrey has no statistically significant estimated parameters, pre- or post-CCTV installation. Curiously, the CCTV site has a statistically significant and positive estimated parameter for the CCTV variable. Such a result does not mean that theft from motor vehicle has increased because of the CCTV system; rather, it is likely due to an increased level of reporting to the police because the users of the Park and Ride know the CCTV system has been installed.

Table 3. Trend Results - PRIME-BC Data: Surrey Areas (Theft of Motor Vehicle)

Community	Area Number	Trend	CCTV	CCTV Trend	R^2
Whalley	1	**-0.20**	2.91	-0.44	0.238
	2	-0.11	6.06	**-1.26**	0.211
	3	-0.10	-3.79	0.32	0.126
	14	0.07	-1.34	-0.33	0.061
	15	0.05	-2.39	-0.85	0.160
Guildford	4	-0.08	1.05	-0.19	0.046
	5	-0.16	-2.51	0.22	0.231
	6	-0.01	-0.71	0.01	0.021
	7	-0.01	0.63	0.12	0.068
Fleetwood	10	0.06	-0.06	-0.22	0.058
	11	-0.04	0.76	-0.03	0.009
	12	0.08	-1.80	-0.22	0.080
	13	0.02	-1.80	-0.26	0.141
Newton	16	-0.11	6.78	**-1.75**	0.268
	17	0.12	0.19	-0.53	0.055
	18	0.05	2.93	-0.43	0.034
	19	0.00	-2.99	-0.12	0.084
	20	-0.04	0.55	-0.15	0.063
	21	**0.14**	-1.86	-0.17	0.086
Cloverdale	8	**0.16**	-2.25	0.03	0.167
	9	-0.04	0.62	-0.00	0.021
	22	0.09	0.19	-0.47	0.074
	23	-0.05	0.36	0.22	0.076
	24	-0.07	0.80	0.05	0.019
South Surrey	25	-0.03	0.69	0.12	0.041
	26	**0.16**	-0.55	-0.21	0.248
	27	0.03	0.39	-0.07	0.043
	28	**0.10**	-1.07	-0.08	0.114
	29	**-0.05**	1.21	-0.13	0.198
	30	0.02	0.67	-0.10	0.023
	31	0.07	-0.68	0.01	0.042
	32	-0.00	-0.44	0.11	0.053

Note. Bold indicates statistical significance at the 10 % level.

Cloverdale and South Surrey also have statistically significant estimated parameters for the CCTV variable, positive and negative, respectively. Due to the results for the CCTV site itself, there is no obvious interpretation of these findings. It is curious, however, that South Surrey reveals results that would be expected for the CCTV site

(negative CCTV and positive, but low magnitude CCTV Trend) when no known crime prevention initiative was implemented in that community.

Table 4. Trend Results - PRIME-BC Data: Surrey, CCTV Site, and Communities (Theft from Motor Vehicle)

	Trend	CCTV	CCTV Trend	R^2
Surrey	-0.72	23.46	-5.23	0.067
CCTV Site	**-0.24**	**5.98**	-0.23	0.163
Whalley	-0.70	32.19	-4.55	0.137
Guildford	-0.48	14.79	-0.65	0.094
Fleetwood	**-0.57**	4.03	0.61	0.112
Newton	0.09	-10.71	-1.69	0.197
Cloverdale	-0.26	**20.79**	-0.74	0.164
South Surrey	**1.44**	**-43.62**	**2.01**	0.468

Note. Bold indicates statistical significance at the 10 % level.

The results for theft from motor vehicle in the 32 Surrey Areas provide little insight into changes resulting from the CCTV system installation. The areas within the community of Whalley only show a statistically significant result for CCTV Trend in one of the Areas. Guildford, Cloverdale, and South Surrey each have one Area with a positive and statistically significant estimated parameter for CCTV. The areas in Cloverdale and South Surrey are distant from the CCTV site and are not expected to be places that would experience any crime displacement. The Area in Guildford, is a possibility for crime displacement because it contains many targets for theft from motor vehicle (the parking lot of a large shopping centre) but as stated above, the CCTV site also experienced an increase in theft from motor vehicle. Consequently, it is unlikely that the increase in Guildford is a result of the CCTV system installation. Lastly, similar to the results shown in Table 4, South Surrey had experienced notable decreases in theft from motor vehicle at the time the CCTV system was installed, with moderate increases in theft from motor vehicle thereafter.

Table 5. Trend Results - PRIME-BC Data: Surrey Areas (Theft From Motor Vehicle)

Community	Area Number	Trend	CCTV	CCTV Trend	R^2
Whalley	1	-0.09	1.68	-0.40	0.055
	2	-0.25	12.19	-1.61	0.096
	3	**-0.49**	11.99	-0.36	0.127
	14	0.07	5.74	-0.54	0.135
	15	0.05	-1.26	**-1.36**	0.241
Guildford	4	-0.15	**19.24**	**-1.56**	0.313
	5	-0.19	1.96	0.02	0.069
	6	-0.05	-1.69	0.30	0.029
	7	-0.04	-1.28	0.04	0.136
Fleetwood	10	-0.06	**-8.51**	**1.07**	0.196
	11	0.11	5.45	-0.25	0.278
	12	**-0.28**	0.59	-0.13	0.271
	13	**-0.36**	4.04	0.19	0.212
Newton	16	0.01	4.94	**-1.29**	0.369
	17	0.08	0.22	0.59	0.186
	18	-0.01	1.87	-0.24	0.007
	19	0.04	**-11.85**	0.14	0.238
	20	-0.04	5.45	**-0.81**	0.110
	21	0.01	-1.02	-0.07	0.018
Cloverdale	8	**0.15**	-0.24	**0.42**	0.59
	9	-0.06	1.13	0.02	0.029
	22	-0.04	2.73	-0.16	0.014
	23	-0.02	3.11	-0.32	0.039
	24	**-0.35**	**10.59**	-0.39	0.212
South Surrey	25	-0.05	**7.27**	**-0.55**	0.244
	26	**0.28**	-2.69	0.09	0.436
	27	**0.28**	**-9.21**	**0.83**	0.407
	28	**0.29**	**-6.47**	0.03	0.220
	29	0.11	**-6.67**	**0.56**	0.191
	30	0.14	-3.55	0.24	0.068
	31	**0.30**	**-14.17**	0.41	0.188
	32	**0.14**	**-4.12**	0.12	0.279

Note. Bold indicates statistical significance at the 10 % level.

8.3 ICBC Data

The results of the structural break test using the ICBC data are reported in Tables 6 and 7 (theft of motor vehicle) and Tables 8 and 9 (theft from motor vehicle). The results for the City of Surrey, the CCTV site, and Surrey's Communities are presented in Table

6—once again, the community of Whalley contains the CCTV site but the CCTV site data are excluded from Whalley to investigate changes in the area not attributed to the CCTV site. The results using the ICBC data are no more promising for the impact of the CCTV system at the Scott Road Skytrain Station Park and Ride, but do exhibit more consistent findings than the PRIME-BC data. The overall trend for the City of Surrey is negative, statistically significant, but moderate. There is no statistically significant increase in theft of motor vehicle at the time of the CCTV system installation (CCTV), but the parameter is a large positive magnitude. The trend after the CCTV system installation (CCTV Trend), however, is negative and statistically significant. The CCTV site experiences no statistically significant change in at the time of the CCTV system installation, but does have a statistically significant and positive trend thereafter that is low in magnitude.

Table 6. Trend Results - ICBC Data: Surrey, CCTV Site, and Communities (Theft of Motor Vehicle)

	Trend	CCTV	CCTV Trend	R^2
Surrey	**-0.99**	36.18	**-10.88**	0.425
CCTV Site	0.01	-1.02	**0.16**	0.080
North Delta	**-0.33**	6.47	-0.54	0.317
Whalley	-0.33	**-64.30**	**5.10**	0.543
Guildford	**-0.36**	**40.52**	**-4.40**	0.414
Fleetwood	0.02	**33.28**	**-4.84**	0.219
Newton	-0.19	**-24.29**	-1.54	0.480
Cloverdale	0.12	23.73	-2.61	0.072
South Surrey	**-0.25**	**28.27**	**-2.75**	0.328

Note. Bold indicates statistical significance at the 10 % level.

With regard to the possibility of crime displacement, the immediate area of North Delta shows no evidence of change for theft of motor vehicle. The rest of Whalley also exhibits no indication of crime displacement. In fact, Whalley has a larger in magnitude

decrease in theft of motor vehicle than the CCTV site itself that is also statistically significant. Though it is possible that there is a diffusion of benefits present here (offenders believe the entire area has increased enforcement), this is unlikely because the entire Community of Whalley is large. As such, it is more likely that the entire Community of Whalley (including the CCTV site) is experiencing a change in theft of motor vehicle that is independent from the CCTV system installation. The Community of Guildford experiences a statistically significant increase at the time of the CCTV system installation indicating the potential of crime displacement, but so does its neighbouring Community of Fleetwood. Therefore, a more obvious mechanism to explain this phenomenon is that there has been a more general shift in theft of motor vehicle in Surrey that has offenders searching for targets in Fleetwood and Guildford rather than Whalley that does not relate to the CCTV system installation. Lastly, the results for South Surrey indicate a statistically significant and large in magnitude increase in theft of motor vehicle, with a corresponding decreasing trend thereafter. Since the distance between South Surrey and the CCTV site is so great, however; this phenomenon is very likely not an incidence of crime displacement. Instead, this provides further support that there is another (unknown) mechanism at work regarding theft of motor vehicle in Surrey during the evaluation period.

The results from the ICBC data on theft of motor vehicle in Surrey Areas corroborate much of the previous discussion and show some variation within the larger communities. A few results are worthy of discussion here. First, essentially all areas of Whalley experience decreases in theft of motor vehicle in the CCTV and CCTV Trend variables. In fact, the Area that contains the CCTV site (Area 1) experiences a

statistically significant decrease in theft of motor vehicle at the time of the CCTV system installation, or thereafter. This indicates that the diffusion of crime prevention benefits may be occurring here, stated as a possibility above with regard to the results in Table 6.

With regard to the possibility of crime displacement, inspection of the Area results indicates that this is not likely. If crime displacement were to occur in the context of theft of motor vehicle to the Community of Guildford, that crime displacement would most likely occur in Area 4, the site of the large shopping centre and corresponding large parking lot. This does, in fact, occur. Additionally, Area 5, adjacent to Area 4, does not contain anywhere near the number of potential targets for theft of motor vehicle and experiences no such increase. Similar to the results in Table 6, however, the Areas within Fleetwood and South Surrey also experience these increases. Therefore, given that the CCTV site experienced no statistically significant change for theft of motor vehicle and increases in theft of motor vehicle occurred in many locations, the presence of any crime displacement from the installation of the CCTV system is unlikely.

Table 7. Trend Results - ICBC Data: Surrey Areas (Theft of Motor Vehicle)

Community	Area Number	Trend	CCTV	CCTV Trend	R^2
Whalley	1	-0.04	**-12.07**	**0.83**	0.365
	2	-0.05	**-20.03**	**2.14**	0.471
	3	**-0.12**	**-6.66**	**0.68**	0.290
	14	-0.04	**-7.02**	0.37	0.290
	15	-0.08	**-18.52**	**1.08**	0.404
Guildford	4	-0.19	**24.04**	**-2.98**	0.239
	5	**-0.13**	4.39	0.09	0.062
	6	-0.01	**10.02**	**-1.32**	0.256
	7	-0.02	2.06	-0.20	0.010
Fleetwood	10	0.04	4.39	-0.66	0.059
	11	-0.05	**17.16**	**-1.68**	0.109
	12	0.01	**4.99**	**-1.09**	0.199
	13	0.02	**6.73**	**-1.41**	0.312
Newton	16	**-0.17**	**-18.30**	0.99	0.451
	17	0.06	-0.17	**-1.05**	0.259
	18	-0.02	5.22	**-1.24**	0.192
	19	-0.01	**-13.57**	**0.69**	0.504
	20	**-0.05**	**-5.36**	0.27	0.412
	21	0.01	**7.89**	**-1.19**	0.202
Cloverdale	8	0.05	3.93	-0.22	0.057
	9	0.04	-0.78	-0.01	0.054
	22	0.04	7.21	-0.84	0.039
	23	-0.02	**5.64**	**-0.55**	0.085
	24	0.01	7.72	-0.99	0.050
South Surrey	25	-0.03	**3.48**	-0.08	0.103
	26	0.02	**5.03**	**-0.49**	0.153
	27	-0.01	**5.95**	**-0.73**	0.285
	28	-0.04	**3.04**	**-0.41**	0.145
	29	**-0.04**	0.42	-0.03	0.252
	30	**-0.05**	-0.58	0.05	0.273
	31	**-0.11**	**10.21**	**-1.06**	0.260
	32	-0.01	0.72	0.00	0.014

Note. Bold indicates statistical significance at the 10 % level.

Table 8. Trend Results - ICBC Data: Surrey, CCTV Site, and Communities (Theft from Motor Vehicle)

	Trend	CCTV	CCTV Trend	R^2
Surrey	**-1.37**	22.50	-3.16	0.174
CCTV Site	-0.01	-0.98	0.01	0.092
North Delta	**-0.24**	1.09	-0.06	0.179
Whalley	-0.17	**-61.57**	**11.64**	0.279
Guildford	**-0.78**	4.67	0.20	0.225
Fleetwood	-0.02	17.64	**-4.43**	0.209
Newton	-0.25	47.18	-4.84	0.078
Cloverdale	-0.03	**45.02**	**-7.31**	0.346
South Surrey	-0.12	**-29.46**	**4.58**	0.480

Note. Bold indicates statistical significance at the 10 % level.

Turning to the results for theft from motor vehicle using the ICBC data, the results are similar to those from the PRIME-BC data, Table 4. The City of Surrey, North Delta, and Guildford all have statistically significant and moderately decreasing overall trends in theft from motor vehicle. The City of Surrey, the CCTV site, and North Delta have no statistically significant changes resulting from the CCTV system installation—both CCTV and CCTV Trend are statistically insignificant in all cases. The Communities of Whalley and South Surrey have statistically significant and negative estimated parameter values for CCTV, and the Community of Cloverdale has a statistically significant and positive estimated parameter for CCTV. CCTV Trend is positive and statistically significant for the communities of Whalley and South Surrey, but negative and statistically significant for the Communities of Fleetwood and Cloverdale. As such, these results exhibit no evidence for a reduction or the presence of either crime displacement or the diffusion of crime prevention benefits.

Once again, the results for theft from motor vehicle concerning Surrey Areas (Table 9), only reinforce the discussion relating to the City of Surrey and its Communities (Table 8). For example, the negative estimated CCTV parameter for the

Community of Whalley is not present for Area 1, the Area that the CCTV site is contained within. The most statistically significant results are present for the Areas contained within the Communities of Cloverdale and South Surrey that are distant from the CCTV site.

Table 9. Trend Results - ICBC Data: Surrey Areas (Theft from Motor Vehicle)

Community	Area Number	Trend	CCTV	CCTV Trend	R^2
Whalley	1	0.03	-6.16	1.44	0.056
	2	-0.05	**-20.33**	**3.59**	0.127
	3	-0.11	**-25.34**	**4.57**	0.240
	14	0.02	-5.82	**1.24**	0.070
	15	-0.06	-3.92	0.79	0.007
Guildford	4	**-0.53**	5.38	0.51	0.225
	5	**-0.17**	-2.29	-0.07	0.201
	6	-0.09	-0.52	0.06	0.083
	7	-0.01	2.11	-0.30	0.019
Fleetwood	10	0.07	1.34	-0.60	0.053
	11	0.01	3.99	**-1.35**	0.214
	12	-0.03	3.96	**-1.09**	0.112
	13	-0.06	**8.35**	**-1.39**	0.224
Newton	16	-0.14	11.20	-0.87	0.023
	17	0.02	5.59	-0.35	0.025
	18	-0.04	4.92	-0.46	0.011
	19	-0.01	11.22	-1.42	0.043
	20	-0.07	**8.35**	-0.88	0.058
	21	-0.02	5.89	**-0.88**	0.063
Cloverdale	8	0.04	5.40	-0.96	0.297
	9	-0.01	**7.64**	**-1.03**	0.218
	22	-0.01	**12.69**	**-2.11**	0.191
	23	0.01	1.44	**-0.56**	0.165
	24	-0.07	**17.84**	**-2.65**	0.213
South Surrey	25	0.01	2.40	**-0.67**	0.162
	26	**0.05**	**-3.29**	-0.05	0.271
	27	-0.01	**-2.75**	0.01	0.201
	28	-0.01	**-6.18**	0.39	0.262
	29	-0.04	-2.44	**0.39**	0.115
	30	**-0.07**	**-6.39**	**1.22**	0.315
	31	-0.04	**-8.76**	0.27	0.483
	32	-0.01	**-2.04**	0.01	0.253

Note. Bold indicates statistical significance at the 10 % level.

9: Discussion

This study has evaluated the impact of a CCTV system that was introduced as part of a one year pilot project at the Scott Road Skytrain Station Park and Ride facility in Surrey, BC. The evaluation has several strengths that distinguish it from previous evaluations of CCTV systems and other situational crime prevention measures. Specifically, the evaluation used a comprehensive collection of data, structural break analysis, and included a community engagement component that involved users of the parking facility. The community engagement piece was comprehensive in its own right as the sample sizes obtained were large and the surveys incorporated measures of fear of crime, perceptions of crime, and opinions surrounding the surveillance system by having participants respond to a variety of thematic questions.

Three sources of data were collected and used to assess the impact of the intervention on two types of auto-related offences–theft of motor vehicle and theft from motor vehicle. In most previous studies, police-reported crime incidents were the sole source of information regarding the amount of crime and victimization at the area considered in the evaluation. As discussed in the "Data" section, this may be problematic since police-reported crime data are known to possess some notable deficiencies. By including three sources of incident data, the current evaluation was able to provide a more comprehensive interpretation of the changes in auto-related crimes. The fact that each data set revealed a different set of results, highlights the importance of including multiple sources of data. By incorporating a single data set in the evaluation, important

discoveries may have been missed. This further demonstrates the complex nature of evaluation research.

Structural break tests are used to evaluate the impact of the CCTV system for the police incident and insurance claim data sets. This should be viewed as a major improvement over many previous studies that have evaluated the impact of CCTV systems by using rather simple “before and after” type analyses. While pre- and post-intervention designs that incorporate statistical tests may be very reliable for determining whether there has been a significant change in the outcome measure since an intervention was introduced, they generally are unable to account for the broader trends in crime that lead up to, and through the intervention period. By employing structural break tests with the police and insurance claim data sets, these broader trends and the potential for any displacement or diffusion of benefits effects are able to be accounted for at a variety of spatial scales.

The inclusion of a community engagement component served several useful purposes in the current evaluation. First, participants’ perceptions of crime and opinions about the use of CCTV at the pilot site are able to be documented. These are important areas of investigation since situational crime prevention measures ought to be deemed acceptable, if not favourable, to users of the space they are implemented in. Completion of the surveys also allowed for an analysis of changes to participants’ levels of fear of crime at the pilot site. While some past evaluations of CCTV systems have included measures of fear of crime, these are particularly deficient in evaluations of CCTV systems that have been implemented in car parks. Finally, the surveys provided an

additional source of incident data that was able to be considered when evaluating the impact of the intervention on crime and victimization at the Park and Ride facility.

Results of the two victimization surveys revealed several interesting findings about peoples' perceptions of crime and the use of CCTV at the Park and Ride facility. First, although participants were less optimistic about the effectiveness of CCTV after the one year pilot project, responses indicated that more people felt crime had been getting better over the course of the year that the CCTV system was active than the year leading up to the implementation of the intervention. It should be noted, however, that a majority of participants in both the preliminary and follow-up survey indicated that the extent of crime at the pilot site had remained relatively unchanged over the past year. As a result, it is difficult to draw any firm conclusions about peoples' perceptions about the extent of crime in relation to their opinions about the effectiveness of the CCTV system.

While there was no single type of auto-related crime that stood out as being overwhelmingly of greatest concern to those who participated in one of the surveys, vandalism was the crime most frequently selected in this regard. This was particularly interesting since vandalism was not one of the crimes selected to be formally considered in the evaluation. In fact, theft of motor vehicle and theft from motor vehicle were the only two crimes targeted by the intervention. This indicated that the crime prevention strategy was not necessarily in line with the concerns of the public. If the concerns of the public were to be the focus of a future intervention, it is important to stress that the entire situational crime prevention strategy ought to be reviewed. As noted in the "Introduction" section, situational crime prevention measures must target a specific type of offence since

the opportunity characteristics related to a particular environment are different for every type of crime.

One of the most controversial issues associated with CCTV systems is that they inherently violate peoples' privacy. This is particularly true when CCTV systems are used in public spaces. The results from this evaluation, however, indicated that very few respondents had concerns about the use of CCTV for the purpose of preventing crime at the Scott Road Skytrain Station Park and Ride. Only 6% of respondents in the preliminary survey and 3% of respondents in the follow-up survey indicated that they had concerns about using CCTV to prevent crime. While there are a number of factors that are likely to influence peoples' concerns about the use of CCTV including the environment in which the cameras are installed, the extent of coverage by the cameras, and the way the images that are captured by the cameras will be used, it is instructive that in the current evaluation respondents overwhelmingly had few concerns.

With respect to fear of crime, results of the victimization surveys indicated that there were significant improvements in respondents' feelings of safety. In fact, this was true for personal feelings of safety and feelings of safety with respect to personal property for both day and night time parking lot users. Although difficult to quantify, the impact on fear of crime should not be ignored because most research on the costs of crime to society show that the psychological impacts of crime are most often far greater than the monetary losses (Brand and Price, 2000).

Finally, comparisons between the preliminary and follow-up surveys revealed promising results for a strong intervention effect by the CCTV system as there were significant decreases in both types of crimes considered. With respect to theft from motor

vehicle, reported victimization declined by more than half. With respect to theft of motor vehicle, an even larger reduction was identified with less than one fifth of reported incidents during the year following the installation of the CCTV system.

Though the results for theft from motor vehicle are plausible because reported crime to the police is significantly less than reported in the victimization survey, the results for theft of motor vehicle are not plausible. The number of thefts of motor vehicle in the year before the evaluation period is in order (54 in the victimization survey and 42 in the PRIME-BC data) because this difference may be attributed to having approximately a 20% sample with the victimization survey; however, the number of thefts of motor vehicle in the year of the evaluation period (10 in the victimization survey and 36 in the PRIME-BC data) clearly shows that the evaluation period sample is not representative of the population. Nevertheless, the drops in both theft of motor vehicle and theft from motor vehicle are large enough in magnitude to conclude that the CCTV system has been effective in reducing crime. Without further investigation, however; it is difficult to quantify this decrease.

These results seem to support the general framework of the situational crime prevention perspective. The results are indicative that the CCTV system may have contributed to a decrease in auto-related crime by increasing the perceived risks to offenders. Specifically, the CCTV system may have deterred offenders from committing auto-related crimes because they believed that they could be detected by the surveillance system, that there could be a response by security or police personnel, and/or that the images captured by the CCTV cameras could be used to identify and subsequently prosecute them.

While the results from the victimization surveys appeared promising for a meaningful impact by the CCTV system, the analyses using the police incident and insurance claim datasets yielded markedly different results. In all of the structural break tests that considered the CCTV pilot site, no statistically significant reduction in theft of motor vehicle or theft from motor vehicle was found at the time of the intervention or during the intervention period. There were also no meaningful indications of displacement or diffusion of benefits to any of the adjacent Communities or Areas.

These inconclusive, but generally negative results do not allow for any further discussion surrounding the theoretical implications of the findings. With no clear impact of the CCTV system on crime at the pilot site based on the police and insurance data, it would inappropriate to comment on behavioural change on the part of offenders in the area. Previous evaluations of CCTV systems, however, do provide some insight into the possible reasons for the absence of a meaningful impact that was found in the police and insurance data.

While the mere installation of a CCTV system may be able to have an initial preventative effect, deterring offenders from committing crimes in a particular environment, it is the monitoring and enforcement of laws that is likely to sustain a decrease in crime over time. This was found in several previous evaluations of CCTV systems (see for example Poyner, 1992) and arguably, ought to have been considered in the design and implementation of the current pilot project. There are also a variety of additional measures that should be considered when designing and implementing CCTV systems for the purpose of reducing auto-related crime in car parks. For example, some previous evaluations have shown the greatest success in reducing auto crime by CCTV

schemes that provided 100% coverage over the car park area. In addition, such CCTV systems included more advanced response programs and technology including loud speakers to communicate with offenders and infrared sensing capabilities for cameras (Poyner, 1992).

10: Conclusions

Considering the results from all three analyses, it appears as though the CCTV system installed at the Scott Road Skytrain Station Park and Ride has had an impact: decreased theft of motor vehicle and theft from motor vehicle. This statement is made primarily on the basis of the victimization survey analyses and lack of contrary evidence from the PRIME-BC and ICBC data. As a result of the nature of the statistical results from the police and insurance data, however, quantifying the decrease would be irresponsible. Although significant reductions in auto-related crimes are identified in the analysis of the victimization surveys, the lack of corroborating evidence in the analysis of the PRIME-BC and ICBC data sets suggests that further research should be conducted before continuing with the current CCTV scheme or adopting similar situational crime prevention measures.

As discussed above, most of the research that is able to show definite decreases in crime resulting from CCTV systems has been those systems that are monitored. As such it could be recommended that the CCTV system at the Scott Road Skytrain Station Park and Ride be monitored and evaluated again. Such monitoring would of course come with a cost, which is why a question regarding an increase in parking fees was asked of the survey respondents. The respondents were asked if they would be willing to pay an addition $1 per day for parking if the CCTV system had live monitoring. Of those asked, 27% said yes.

The value of $1 was used because it was thought to represent a small value to each individual, but when multiplied by all users over the entire year that $1 adds up quickly. Assuming that each individual that uses the Park and Ride has 8 weeks of holidays throughout the year, 220 days of parking (46 weeks at 5 days per week) would be a reasonable estimate of individual annual usage. Further assuming that there are consistently 1000 parking spaces used in the car park each and every day (this is a conservative estimate), $220 000 in revenues per year would be generated from that additional $1 fee. Even if the increase was based on the percentage of those willing to pay (27 percent), an increase in the parking fee of $0.25 would lead to $55 000 in revenues per year. Given that the Park and Ride is used primarily in the daytime hours, as indicated by the responses to the surveys, such revenues would very likely cover 12 hours of monitoring, 5 days per week. These revenues should be able to cover live monitoring or, perhaps, have security (on bicycles) on site for the hours and days that are of primary concern: Monday to Friday, 7am to 7pm.

It may also be concluded that the CCTV system has had an impact on fear of crime for users of the Park and Ride facility. This statement is made based on the differences in proportions for participant responses to questions on feelings of personal safety and the safety of personal property at the pilot site. In the context of both day and night-time parking lot use, the changes in proportions of responses from participants indicated significantly improved feelings of safety after the implementation of the CCTV system.

Appendices

Appendix A: Pre-intervention Victimization Survey

Consent Statement (3-4 minutes of your time)

The purpose of this study is to **evaluate the impact of installing CCTV** at Scott Road Skytrain Station's Park and Ride. You will be required to answer a few questions regarding their use of the car park, automotive theft victimization, and fear of victimization. The benefits of this study are to **identify the benefits of a CCTV system** and if these benefits are enough to **justify the costs in order to improve your safety** at this Park and Ride. Your name or any other **identifying information will not be gathered** and you will not be contacted for any future studies. If you would like to obtain research results further information is on this sheet (offer sheet on following page to participants).

Questions

1. How frequently do you use the Park and Ride at Scott Road Skytrain Station?

Daily 3-4 days per week 1-2 days per week Infrequently

2. When/why you use the Park and Ride what are the usual reasons for parking here?

Shopping Working School Recreation Other

3. In general, how safe do **you feel** you are at the Scott Road Station Park and Ride?

During the Day	**At Night**
5. Very Safe	5. Very Safe
4. Fairly Safe	4. Fairly Safe
3. Neither Safe nor Unsafe	3. Neither Safe nor Unsafe
2. Fairly Unsafe	2. Fairly Unsafe
1. Very Unsafe	1. Very Unsafe

4. During the last year have you been a victim of crime (i.e. automobile stolen, theft of property
from automobile, vandalism etc)

Example:

If theft from auto:

What was stolen: Value of goods:

If theft of auto:

Make: Model: Year:

5. What automotive crime most concerns you? Theft of Theft from Vandalism

6. On a scale of 1 (not effective) to 5 (extremely effective), On the following scale please indicate if you think that Closed Circuit Television (CCTV) is an effective way to reducing crime at the Scott Road Park and Ride.

1 2 3 4 5

7. Do you have any concerns about CCTV being used in this way?

YES NO

8. Do you believe in the last year criminal activity is getting worse, is the same, or better here at Scott Road Park and Ride.

Worse Same Better

9. In general, how safe do you feel **<u>your car or property in your car</u>** is here at the Scott Road
Station Park and Ride? (Fear of Crime)

During the Day	**At Night**
5. Very Safe	5. Very Safe
4. Fairly Safe	4. Fairly Safe
3. Neither Safe nor Unsafe	3. Neither Safe nor Unsafe
2. Fairly Unsafe	2. Fairly Unsafe
1. Very Unsafe	1. Very Unsafe

10. Sex and age range

MALE FEMALE

9-19	20-29	30-39	40-49	50-59	60-69	70+

Appendix B: Post-intervention Victimization Survey

Consent Statement (3-4 minutes of your time)

The purpose of this study is to **evaluate the impact of installing CCTV** at Scott Road Skytrain Station's Park and Ride. You will be required to answer a few questions regarding their use of the car park, automotive theft victimization, and fear of victimization. The benefits of this study are to **identify the benefits of a CCTV system** and if these benefits are enough to **justify the costs in order to improve your safety** at this Park and Ride. Your name or any other **identifying information will not be gathered** and you will not be contacted for any future studies. If you would like to obtain research results further information is on this sheet (offer sheet on following page to participants).

Questions

1. How frequently do you use the Park and Ride at Scott Road Skytrain Station?

Daily 3-4 days per week 1-2 days per week Infrequently

2. When/why you use the Park and Ride what are the usual reasons for parking here?

Shopping Working School Recreation Other

3. In general, how safe do **<u>you feel</u>** you are at the Scott Road Station Park and Ride with the presence of CTV?

During the Day	**At Night**
5. Very Safe	5. Very Safe
4. Fairly Safe	4. Fairly Safe
3. Neither Safe nor Unsafe	3. Neither Safe nor Unsafe
2. Fairly Unsafe	2. Fairly Unsafe
1. Very Unsafe	1. Very Unsafe

4. During the last 12 months have you been a victim of crime (i.e. automobile stolen, theft of property from automobile, vandalism etc)

Example:

If theft from auto:

What was stolen: Value of goods:

If theft of auto:

Make: Model: Year:

5. What automotive crime most concerns you? Theft of Theft from Vandalism

6. On a scale of 1 (not effective) to 5 (extremely effective), On the following scale please indicate if you think that CCTV has been an effective way to reducing crime at the Scott Road Park and Ride.

1 2 3 4 5

7. Do you have any concerns about CCTV being used in this way? YES NO

8. Do you believe in the last 12 months criminal activity is getting worse, is the same, or better here at Scott Road Park and Ride.

Worse Same Better

9. In general, how safe do you feel **<u>your car or property in your car</u>** is here at the Scott Road
Station Park and Ride with the presence of CCTV? (Fear of Crime)

During the Day	**At Night**
5. Very Safe	5. Very Safe
4. Fairly Safe	4. Fairly Safe
3. Neither Safe nor Unsafe	3. Neither Safe nor Unsafe
2. Fairly Unsafe	2. Fairly Unsafe
1. Very Unsafe	1. Very Unsafe

10. Would you be willing to pay an extra $1 for parking per day to have the CCTV monitored?

Yes No

11. Sex and age range

MALE FEMALE

9-19	20-29	30-39	40-49	50-59	60-69	70+

Appendix C: CCTV Camera Information, Locations, and Views

QTY	Model	
	NETWORK SYSTEM	
1	SRW 2008P	Cisco-Linksys 8 port POE switch
	CCTV	
1	WJND400P	64 Channel Network Video Recorder (1 TB)
1	WVASM100LP	Management Software for IP and Analog Recorders/Cameras
11	WVNP304P	1.3 Mega Pixel Fixed Body Camera, Progressive, Lens Option
11	POH1000HB	Camera Housing with Heater Blower
1	WVNW964P	Outdoor PTZ IP Camera 30x Optical Zoom Auto Tracking
11	PWM800	Steel Wall/Pole Mount Bracket, black, Medium Duty withou
11	PLZMP15-50	Lens, 1/3" Auto Iris, 5-50mm
12	WCS1-4	Camera Power Supply
1	PS1440RT2-120 UP	Liebert, 1500 VA UPS (Rackmount)
4	WD WD10EACS	1TB 16MB SATAII Western Digital Drives
	WIRELESS	
2	5440APC	AP OFDM Connectorized
12	5440SM	5.4 GHz OFDM Subscriber Modules
14	600SSC	Surge suppressor, RoHS compliant, universal ethernet
2	8514724E01	5.4 OFDM AP Receiver antennas
14	SMMB1A	Universal mounting bracket
2	ACPSSW-13B	29.5VDC; Fixed USA Blades
28		Heliax 3' Patch
14		POE Injectors

City of Surrey- Scott Road Skytrain CCTV Project

Schedule B Equipment Locations

Head End Equipment

- this equipment includes the wireless receiver antennas (2) on the building going back to a Cisco\Linksys network switch. This connects all of the 12 wireless cameras to the Panasonic Network Video Recorder (located in the first equipment rack at the bottom)down in the Skytrain Electronic Equipment Room in the Skytrain Station. The address for this station is **12515-110th Avenue, Surrey, BC.**

Camera Locations

-this includes 12 Panasonic cameras (11 fixed and 1 pan,tilt,zoom) with a wireless subscriber unit (transmitter) at various lighting poles located throughout the parking lot as depicted in the schedule B drawing.

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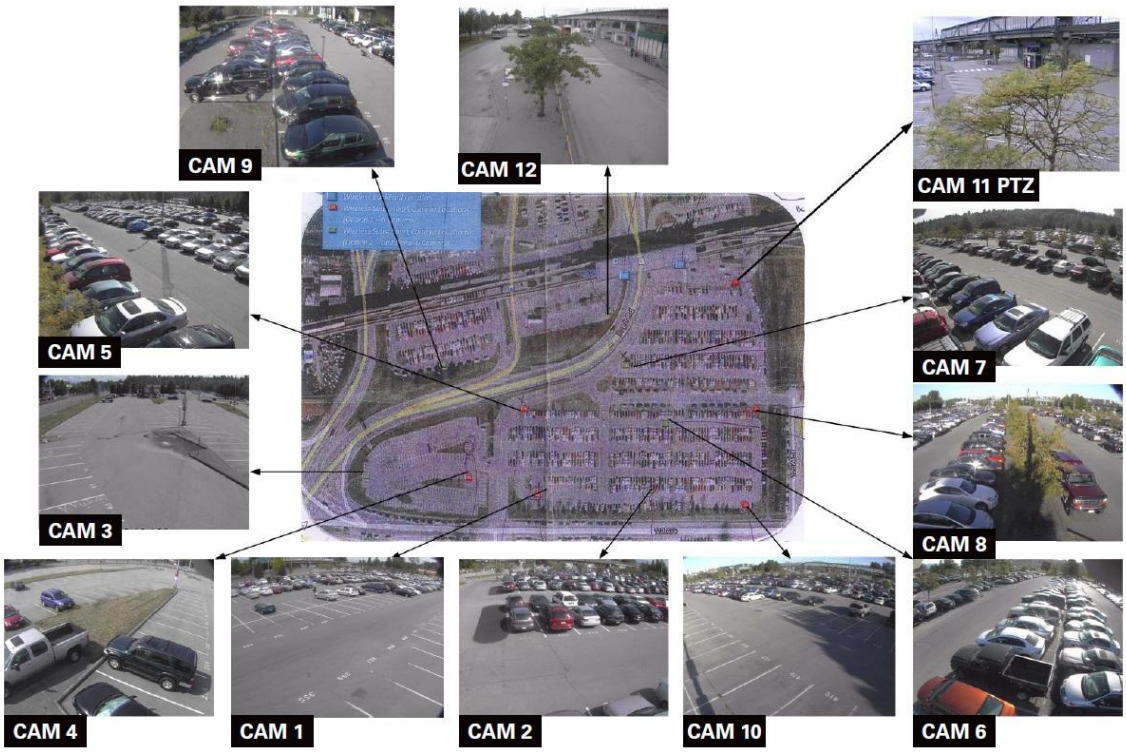

Document provided by BMS Integrated Services Inc.

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