PREVENTING AUTO THEFT IN SUBURBAN VANCOUVER COMMUTER LOTS: EFFECTS OF A BIKE PATROL

by

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Abstract; *During April 1995, a bicycle-mounted security patrol was introduced into a vehicle-theft "hot spot," the largest park-and-ride commuter vehicle park in British Columbia. Vehicle thefts dropped substantially in the vehicle park during the bicycle patrol, and remained low for an extended period of time after the bike patrol was withdrawn. Vehicle thefts did not appear to displace to adjacent areas or to another nearby hot spot on the transit system. Some vehicle thefts may have been displaced to a more distant hot spot, but the overall result for the city as a whole was a small net reduction in vehicle thefts.*

INTRODUCTION

Motor vehicle theft has become a major crime during the past half century. In North America, rates of vehicle theft have tripled over the past 30 years (Maguire and Pastore, 1995). Motor vehicle thefts and thefts from vehicles accounted for 28% of all recorded crimes in England and Wales in 1990 (Webb and Laycock, 1992). Similarly, in British Columbia, CAN in 1994, motor vehicle thefts and thefts from motor vehicles together accounted for 57% of all recorded thefts and almost a quarter (23%) of all recorded criminal code offenses of any kind (Police Services Division,

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1995). Motor vehicle thefts result in average direct financial losses of $3,500 (CAN) per stolen vehicle in British Columbia (Fleming et al., 1994). Such theft also has the potential to cause injury to the thieves, police and others. As a result, prevention of vehicle theft reduces substantial amounts of criminal injury and economic harm.

Public policy in British Columbia, as in other developed and urbanized jurisdictions, has in recent years placed strong emphasis on reducing the flow of automobiles into city centers. This has been accomplished by improving public transit in ways that will make it attract commuters out of their cars and onto mass transit vehicles. One feature of this policy has been the introduction of free "park-and-ride" parking lots for commuters at suburban transit nodes. Commuters from the dispersed bedroom communities of the "divergent metropolis" (Felson, 1994) can drive to these suburban transit nodes, park their cars for free and ride high-speed transit the rest of the way into the city center (Mancini and Jain, 1987; Webb et al., 1992). British Columbia Transit (BC Transit) is the Crown corporation[1] responsible for operation of the public transit system in greater Vancouver. Vancouver's mass transit system is, at present, essentially a bus system with one high-speed, elevated automated rail transit line (SkyTrain) and one high-speed commuter ferry (SeaBus) (DesChamps et al., 1991). Park-and-ride lots are associated with suburban SkyTrain stops and a number of major suburban bus interchanges. The park-and-ride lots create concentrations of parked, unattended cars at most hours of the day and night.

Contemporary theoretical work in environmental criminology (Brantingham and Brantingham, 1991) and in routine activities theory (Felson, 1994) suggests that such concentrations of unattended vehicles should also create "hot spots" of vehicle crime. And indeed, such commuter parking lots seem to generate disproportionate shares of suburban auto theft in the U.S. (Mancini and Jain, 1987), in Australia (Geason and Wilson, 1990) and in England and Wales (Webb et al., 1992).

Automobile theft is a high-volume crime in British Columbia generally and in the greater Vancouver area in particular. Within greater Vancouver, automobile theft seems to concentrate near major activity centers and along major transit routes (Fleming et al., 1994; Weigman and Hu, 1992; Brantingham et al., 1991). Studies of this crime in Vancouver strongly support the rational choice theory of offending (Cornish and Clarke, 1986), routine activity theory (Felson, 1994; Cohen and Felson, 1979) and pattern theory (Brantingham and Brantingham, 1993). In particular, there appears to be a strong relationship between auto theft and place (Eck and Weisburd, 1996; Fleming et al., 1994). The majority of British Columbia auto thieves appear to be juveniles who steal for joyriding and transport

purposes, and who are attracted to malls, large parking lots and other easily accessible locations that feature concentrations of older vehicle makes and models that are technically easy to steal (Fleming, 1993; Fleming etal., 1994).

BC Transit operates park-and-ride commuter parking lots in association with many of its bus interchanges and SkyTrain stations. The largest of its park-and-ride facilities is located at the Scott Road SkyTrain station in the suburban city of Surrey. The Scott Road facility is comprised of four separate parking lots with a rated capacity of 2,411 parking stalls. This is an enormous concentration of parked cars. The second largest park-and-ride facility in the BC Transit system has a capacity of 400 cars. The Scott Road facility is more than eight times larger than the commuter car park studied by Laycock and Austin (1992), more than ten times larger than the average of the 19 suburban London commuter car parks studied by Webb et al. (1992), and more than 30 times larger than the average of 72 Connecticut commuter car parks studied by Mancini and Jain (1987).

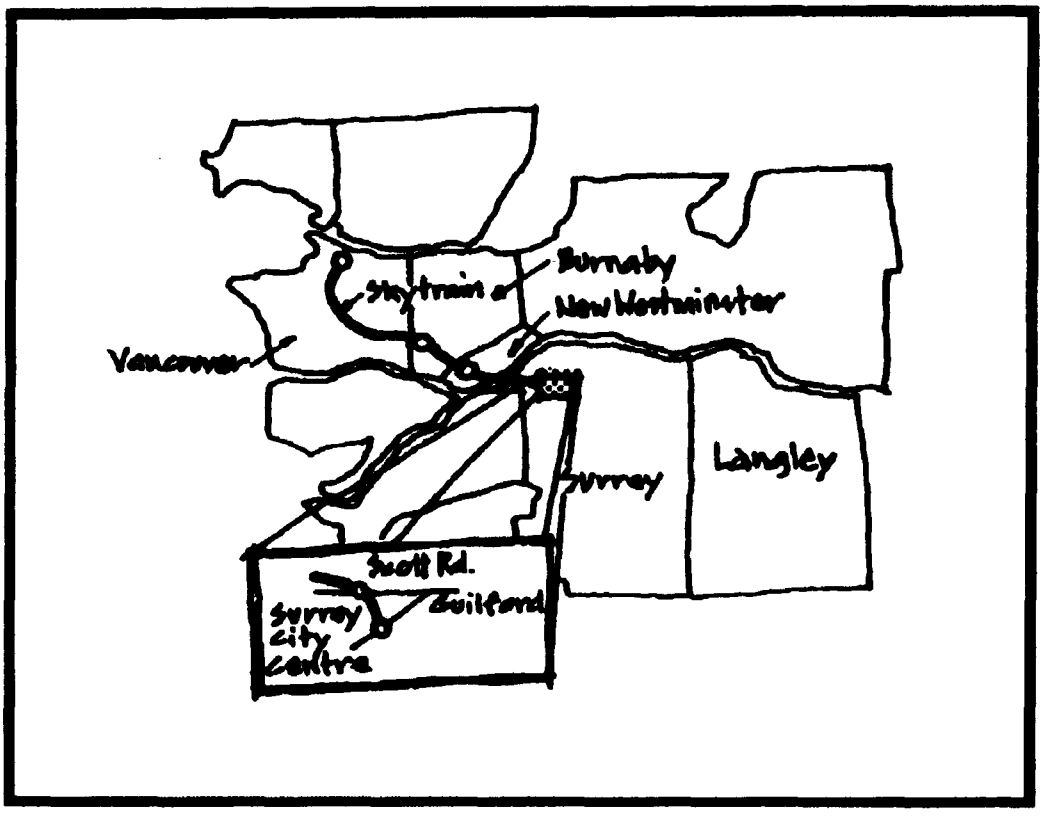
Figure 1, a schematic map of Greater Vancouver, shows the location of major municipalities, the approximate route of SkyTrain between downtown Vancouver and suburban Surrey, the approximate location of the Scott Road SkyTrain station and the approximate location of two probable displacement sites. Such a massive park-and-ride facility should, theoretically, constitute a major crime generator (Brantingham and Brantingham, 1995). By the fall of 1994, the Scott Road facility had developed both a public and a police reputation as one of greater Vancouver's crime hot spots. Auto theft was seen to be one of its major problems.

This chapter presents results of a limited natural experiment in which formal surveillance in the form of a security bicycle patrol was introduced into the Scott Road park-and-ride facility for the single month of April 1995. After completing this experiment, we were asked by BC Transit Security to help assess the crime prevention impact of the bicycle patrol.

THE STUDY

BC Transit is the Crown corporation (government-owned, independently incorporated operating authority) responsible for operation of the public transit system in greater Vancouver. The Insurance Corporation of British Columbia (ICBC) is the Crown corporation holding a monopoly over issuance of mandatory motor vehicle liability insurance. It also writes most of the comprehensive vehicle insurance policies that provide theft coverage. The two Crown corporations have a mutual interest in reduction of auto theft. BC Transit must make park-and-ride facilities safe places

Figure 1: Greater Vancouver Regional District Sky Train* Scott Road, Surrey City Centre and Guildford Locations

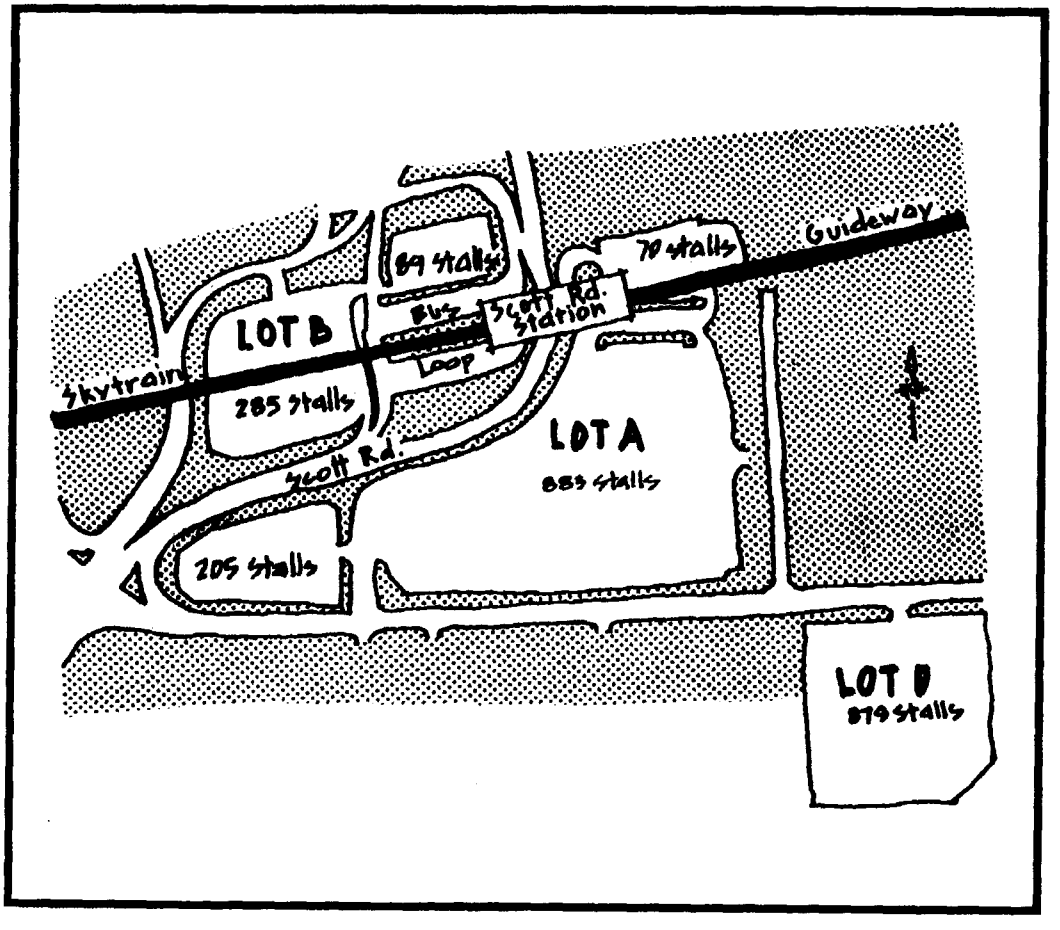


for transit customers to park if it wishes to increase transit ridership, and ICBC must typically pay out about $3,500 per stolen vehicle to repair damage done during the course of the theft (Fleming et al., 1994)

The Scott Road SkyTrain Park-and-Ride is accessible 24 hours a day and experiences high traffic, except during the early-morning hours. It is unfenced, and most of the lots have multiple entries and exits (see Figure 2). There are no shops in the Scott Road facility, and visibility from the

SkyTrain station into the parking lots is poor. In terms of the correlates of high-crime car parks identified by Webb et al. (1992), the Scott Road park-and-ride facility would appear to be an ideal location for vehicle theft. Moreover, its location near major roadways, with easy transit access and an absence of formal guardians, has been shown to be strongly associated with high crime rates at other suburban locations in greater Vancouver (Brantingham and Brantingham, 1995). It is, however, in an open, flat area. An official guardian, if elevated, would have a broad viewing range across the park-and-ride lots. Actual formal surveillance is possible.

Figure 2: Scott Road Station Park-and-Ride



By late 1994, the Scott Road Station and park-and-ride lot had developed a reputation as a crime hot spot (Spinks et al., 1995; Zyartuk, 1994). In September 1994, BC Transit Security proposed a comprehensive prevention plan for Scott Road. The plan was consistent with recommendations found in the limited literature on car park security {e.g., Mancini and Jain, 1987; Geason and Wilson, 1990; Poyner, 1991; Eck and Spelman, 1992; Laycock and Austin. 1992; Webb et al., 1992) and in line with recommendations made by Seattle Transit security on the basis of Seattle's experience with problems in commuter park-and-ride lots. This plan included: fencing the perimeter of the parking lots and limiting access through a single main entrance/exit for each lot; upgrading lighting, trimming shrubs that were blocking sightlines and introducing a closed camera television surveillance system; installing emergency phones throughout the lots; introducing a mobile security guard patrol from 9 a.m. to midnight each day, 7 days a week; and instituting a pay parking system coupled with a staffed collection kiosk at the single entry/exit to each lot.

The proposal received conceptual support within BC Transit. However, the large start-up costs required for implementation, together with issues ranging from jurisdictional questions to the relative contributions that might be reasonably expected from other agencies, delayed implementation of any part of the plan until well into 1995. Such implementation problems are not unusual. For instance, there was some discussion as to whether the Surrey detachment of the Royal Canadian Mounted Police (RCMP) would increase the frequency of its patrol in the vicinity of the Scott Road park-and-ride lots in lieu of the introduction of a BC Transit-controlled mobile security patrol in the lots. The introduction of pay parking at the site was delayed while a public opinion poll was commissioned to gauge ridership support or resistance. As Laycock and Austin (1992:157) have observed with respect to the introduction of "crime prevention attendants" in the Meadowvale commuter lot in England, even with goodwill on all sides the "implementation phase of a project is frequently prone to problems."

As events unfolded, only the mobile security patrol recommendation was implemented during 1995. And that implementation was temporary, operating for the single month of April 1995. At the completion of the test month, the program was closed while BC Transit looked for some way to assess its impact.

The mobile security patrol "experiment" was designed by BC Transit security. The ICBC, which was averaging insurance payouts in excess of $40,000 per month as a result of Scott Road vehicle thefts, provided $15,000 to support a one-month test implementation, A private security

firm was retained to supply the security personnel utilized in the test. The mobile security patrol took the form of a bicycle patrol that circulated through the Scott Road park-and-ride lots. Four security guards, dressed in bright yellow jackets, helmets, and other gear very similar to that worn by *police* bicycle patrol constables in greater Vancouver, patrolled in pairs and in irregular patterns during the hours of 7 a.m. to 7 p.m., Monday through Friday.

Mobile security by bicycle has good surveillance potential at the Scott Road park-and-ride lot. The elevation of bicycle riders is sufficient to allow security personnel a much better view of the lots than would be possible from a vehicle or on foot. Bicycle-mounted security personnel were also highly visible to people using the park-and-ride lot. Bicycles offer another advantage as well. Access to different points in the very large area covered by the park-and-ride lots is quicker by bicycle than by motor vehicle or by foot. Patrol on bicycle, in a high visibility lot with few points of refuge (Nasar and Fisher, 1992, 1993), has the potential of increasing perceived risk on the part of potential offenders.

While the limited and post hoc nature of this study did not make it possible to observe the bicycle patrol or to interview people using the Scott Road SkyTrain station, it is reasonable to note that such a patrol is more like a security guard at an entrance to a building than it is to a mobile police patrol. Everyone using the SkyTrain station during the hours the bicycle patrol operated would be likely to see the guards on their bicycles, even when they were in a different lot.

The introduction of the bicycle patrol was preceded by a media campaign that resulted in extensive coverage in local newspapers and in the major regional daily newspapers starting March 11, 1995. Headlines such as "Bike squad gears up to squelch car break-ins" and "Yellowjackets invade SkyTrain station" capture the flavor of this coverage (Spinks et al., 1995). The Scott Road bike patrol was given coverage on local television news shows on April 1, the day it started. There were also several follow-up stories about the bike patrol in the local press during mid-April.

In late April, as the test project was coming to a close, one of the authors[2] was contacted by BC Transit security and asked whether it would be possible to have a team of students from a Simon Fraser University crime prevention course attempt to assess the impact of the bicycle patrol on the auto theft problem at Scott Road, despite its short duration and limited availability of comparison data.

The initial student study of the bicycle patrol (Spinks et al., 1995) focused on changes in the average number of vehicles stolen from the Scott Road park-and-ride lots for short periods before, during and after the bicycle-patrol test, utilizing Scott Road park-and-ride vehicle-theft data

obtained from the Surrey RCMP detachment.[3] In addition, the students conducted interviews with RCMP personnel working in the Scott Road area, with BC Transit security personnel, and with the private security guards who had patrolled the park-and-ride lots during the text month. Field observations of the Scott Road park-and-ride lots were conducted on different days of the week and at different times of the day and night. A qualitative evaluation of the media coverage given to the bicycle-patrol experiment was also undertaken. Finally, a small snowball survey of four Surrey auto-theft offenders was completed.

The results of the student project indicated that there was a large reduction in vehicle thefts at the Scott Road park-and-ride lots during the test month. A total of 192 cars were reported stolen during the eight-month pretest phase, an average of 24 cars per month. During the test month (April), only three cars were reported stolen. Theft of autos remained lower than average during the post-experimental phase, with only three cars reported stolen during May and 13 stolen reported in June, indicating a possible diffusion of benefits (Spinks et al., 1995) .

The student project focused on the Scott Road site alone. As a result, the question was left open of whether there had been any diffusion of benefits from the bicycle-patrol intervention or any displacement of vehicle thefts to other locations within Surrey. In addition, it appeared that the media coverage accompanying the introduction of the bicycle patrol at Scott Road might have enhanced its effect (see Laycock, 1992, and Poyner, 1988, on the interaction of crime prevention initiatives and media coverage). This research attempts to explore both the preventive impact of the bicycle patrol and its attendant media coverage, and the displacement and diffusion of benefits effects in more detail using police data on vehicle theft for all parts of Surrey.

Motor vehicle theft data used for this study were obtained from the Surrey RCMP detachment. A differently constructed experiment conducted over a longer time span and situated in a jurisdiction where geographically coded crime data were available for a longer pre-experiment time period would have been better from a scientific point of view. However, the Scott Road park-and-ride bicycle patrol test was run at a crime hot spot by an operating agency that is subject to the pressures and constraints that always limit courses of action outside the laboratory. The police data covered a 13-month period, from August 1994 through August 1995. Thefts were recorded by date and for a small spatial unit called an atom.[4] It was impossible to conduct analyses on data for the period prior to August 1994 because the city of Surrey was not divided into small-area atoms for purposes of police record-keeping until then. The test period

extended for only a single month. Follow-up data were collected for a period of four months following the experiment.

Analysis

Reported motor vehicle thefts were analyzed several ways. First, temporally ordered counts of motor vehicle theft were explored to ascertain the amount of crime reduction at the Scott Road park-and-ride, the target intervention site. These temporally ordered counts were also used to look for indications of displacement or diffusion of benefits in adjacent and other attractor locations in Surrey. Monthly three-dimensional vehicle-theft maps were created to help identify motor-vehicle-theft hot spots (Block, 1990), and to visualize the impact of the bicycle patrol. This was followed by a statistical times-series analysis of reported motor vehicle thefts at Scott Road, the area surrounding the Scott Road park-and-ride lots and other hot-spot locations in Surrey, as well as for Surrey as a whole.

To provide a context for the motor vehicle thefts, these small-area patterns were also compared to trends in several greater Vancouver municipalities and to trends in British Columbia as a whole. The analysis was done using time-series statistical methods. Details of these techniques and the results are presented in Appendix 1. The overall patterns and the results of the time-series analysis are presented in the main text.

Results

The Local Backcloth: Broader Trends Around the Intervention Site

Regional Trends. Although the vehicle theft trends in British Columbia as a whole appeared to be headed downward in 1995 following an extended period of increase (Fleming et al., 1994), the general trend in Surrey and adjacent municipalities appeared to be upward from 1994 or leveling off.

Table 1 compares reported motor vehicle thefts for the first eight months of 1994 and 1995 for Surrey and four adjacent municipalities.[5] Motor vehicle theft was increasing or leveling off in all of these municipalities over the time frame of this study. While there was a downward trend in the province as a whole, there was no general downward trend in the large municipalities that form the Vancouver suburbs in and around Surrey. Any decrease in vehicle thefts at the Scott Road park-and-ride occurred against this general local trend.

Table 1: Municipal Motor Vehicle Thefts- Eight Month Comparisons, 1994 and 1995

Municipality	Total Vehicle Thefts January-August, 1994	Total Vehicle Thefts January-August, 1995
Burnaby	1,419	2,329
Langley City	205	212
Langley District	307	314
New Westminster	563	664
Surrey	2,567	3,151
British Columbia Totals	17,238	14,943

The Scott Road experiment was played out against this general backcloth, but requires a more-detailed spatial and temporal analysis to provide a basis for estimating the impact of the natural experiment.

A Site-Specific Analysis

We examined the more specific context of the Scott Road park-and-ride bicycle patrol test and vehicle-theft changes at other Surrey motor vehicle theft hot spots. Two of these hot spots (Block, 1990), Surrey City Centre and Guildford, stood out both because they appeared to be likely displacement locations on theoretical grounds, and because, together with the Scott Road park-and-ride facility, these atoms accounted for about 16% of all motor vehicle thefts occurring across the 113 Surrey police atoms in the period before the bicycle patrol test took place. Table 2 focuses on the crimes occurring at these four locations before, during and after the bicycle-patrol test.

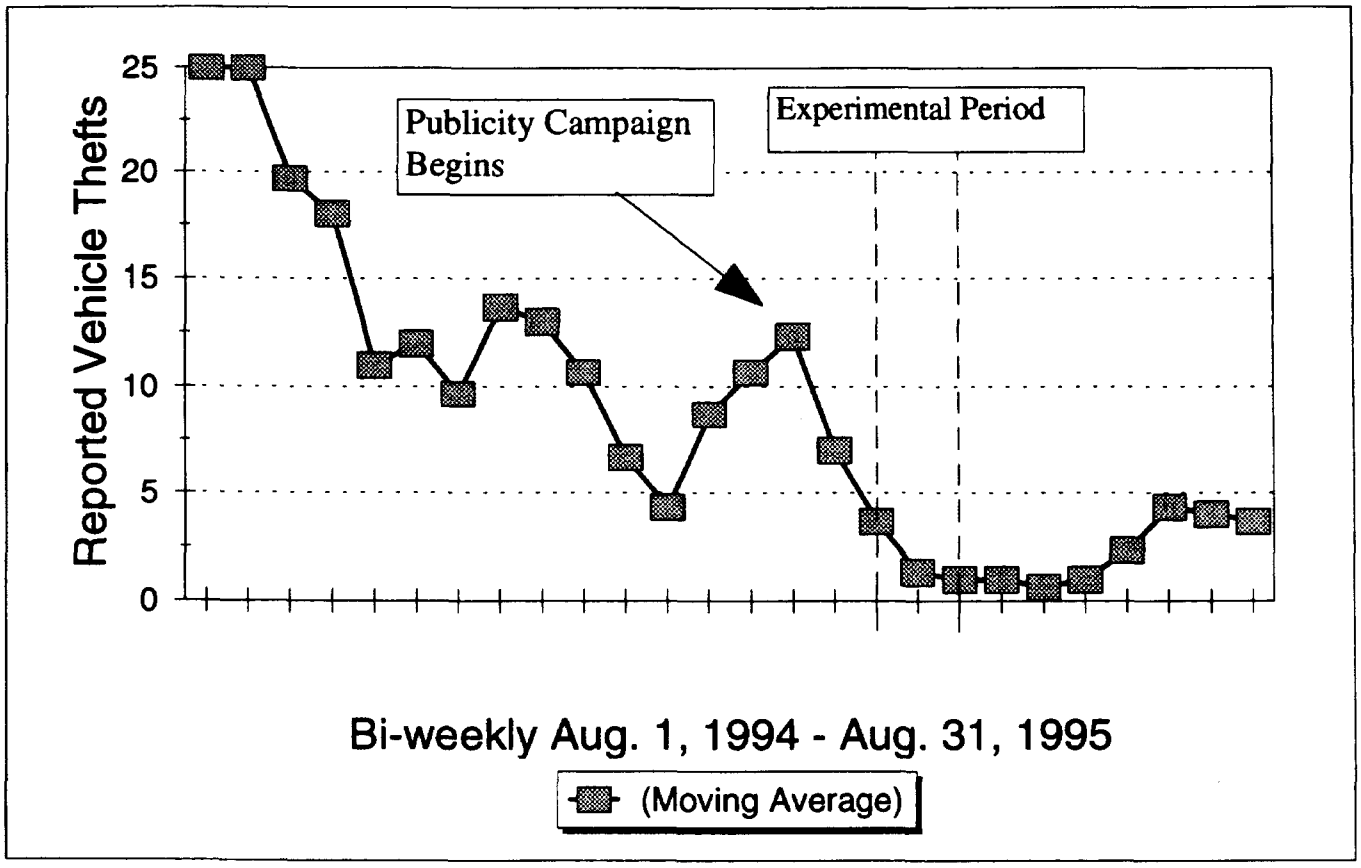
As is apparent from Table 2, the Scott Road park-and-ride site dropped from a position as the single hottest vehicle-theft hot spot in Surrey in the pre-test period to a position as a cold spot during the test. In the eight months preceding the test, Scott Road averaged 24 vehicle thefts per month. During the test month and the month immediately after, Scott Road averaged three vehicle thefts per month. In the three months following that, vehicle thefts at Scott Road climbed back to an average of 11.3 per month.

Table 2: Vehicle Theft Totals and Proportional Share of Vehicle Thefts Before, During, and After the Scott Road Park-and-Ride Bicycle-Patrol Test

	Before		During		After	
Police Small Area	**Total**	**Column**	**Total**	**Column**	**Total**	**Column**
Area Surrounding Scott Road	82	13.2%	12	8.2%	47	18.2%
Scott Road	192	30.0%	6	4.1%	34	13.2%
Guildford	159	25.8%	69	47.3%	88	34.1%
Surrey City Centre	189	30.4%	59	40.4%	89	34.5%
Surrey Total	3,116		686		1,056	

Time-series analysis (see Appendix 1) on vehicle-theft data aggregated into weekly counts established that, except for the reduction at Scott Road, there was no significant trend in the level of motor vehicle theft in Surrey during the test period.[7] The Scott Road vehicle-theft reduction is so large that if it is included in the analysis, there is a mild (but not statistically significant, $p = .09$) downward trend in auto thefts for Surrey as a whole across the test period. The Scott Road reduction cannot be attributed to seasonal effects. Although there are very strong seasonal effects on vehicle theft in the northern parts of British Columbia (Fleming, 1993), the mild and stable climate of Greater Vancouver does not appear to impose climatic fluctuations on vehicle theft in Surrey. A standard seasonal decomposition run on six years of monthly Surrey vehicle theft counts collected for an earlier project (Fleming et al., 1994) found no seasonal effects in the data in the Greater Vancouver area.

Figure 3: Scott Road Auto Theft Trends



The magnitude and timing of the impact of the introduction of the bicycle patrol at the Scott Road park-and-ride lot is tracked in Figure 3, using reported vehicle-theft counts. The data have been aggregated into two-week units for the purposes of this figure. The curve has been smoothed using a moving-average procedure to accentuate trends.

Three things are apparent in Figure 3. First, the publicity campaign that preceded the actual introduction of the bicycle patrol at Scott Road appears to have had a substantial impact almost immediately. A short upward trend in reported vehicle thefts was reversed, and counts dropped sharply. Second, the actual introduction of the bicycle patrol accelerated the reduction in reported vehicle thefts. Third, the reduced levels of reported vehicle thefts continued at Scott Road for many weeks and were still relatively low at the end of the study period. Note that both the publicity campaign and the bicycle patrol appeared to contribute to this reduction. This combined effect appears to be consistent with similar interactive crime prevention effects reported in crime prevention interventions in England (Laycock, 1992; Poyner, 1988). It reinforces the notion that multiple types of situational interventions can have a cumulative impact in reducing crime at a particular intervention point.

While we have no actual counts, we have been told by BC Transit that there were many telephone complaints about motor vehicle theft at Scott Road prior to the introduction of the bicycle patrol, and an inordinate number of complimentary calls after its introduction. The bicycle patrol appears to have had a positive impact on transit riders in general, as well as a crime prevention impact. While this cannot be studied because of the post hoc nature of the research, it seems reasonable that the high visibility of private security on bicycles (putting the riders at a level from which they could be seen from a distance) may have had a general fear-reduction impact.

The introduction of the bicycle patrol at Scott Road appears to have reduced the average motor vehicle theft counts at that park-and-ride facility by some 87.5%, a reduction that was maintained for some time following termination of the experiment. This is a clear example of situational crime prevention at an established hot spot, and an example of a diffusion of benefits over time at that location.

Displacement and Diffusion of Benefits

Displacement of crime can take a variety of forms (P.L. Brantingham and P.J. Brantingham, 1984; Barr and Pease, 1990). Spatial displacement might move offenders into adjacent areas or to more distant crime generators or crime attractors {Brantingham and Brantingham, 1995).

Temporal displacement might move offenders into different time periods at the same location. The Scott Road bicycle patrol operated from 7 a.m. to 7 p.m., Monday through Friday. A functional displacement might cause offenders to take up some other crime. We are not currently in a position to address the latter possibility, but we can say something about spatial and temporal displacement of motor vehicle thefts.

Diffusion of benefits from a situational crime prevention intervention can similarly take several forms (Clarke and Weisburd, 1994). Benefits can diffuse spatially to other areas, preventing crime at locations that have not experienced the intervention. Such a diffusion is likely when a prevention program is widely advertised, but its spatial boundaries are not made clear. Potential offenders are likely to avoid the general area where the prevention program is implemented rather than just the specifically protected location. Moreover, because much crime is a spatial by-product of travel to some specific destination point, if the destination point is protected and therefore avoided by potential offenders, the nearby areas into which crime might spill over from the destination end up protected as well (Brantingham and Brantingham, 1991, 1995; Langworthy and LeBeau, 1992a, 1992b).

Benefits can diffuse in time, preventing crime during hours when an intervention such as the bicycle patrol is not actually operating, and continuing for at least a while after a program stops (Clarke and Weisburd. 1994). This sort of diffusion of benefits in time has been documented as a "residual deterrence" effect from small-area police "crackdowns" by Sherman (1990) and by Kohfeld and Sprague (1990). Short-term, small-area concentrations of police patrol and arrest activity not only suppress crime in the target area during the police action, but appear to continue for a time after the police concentration is withdrawn. A similar effect ought, in principle, to be seen in places where a private security "crackdown" raises the risk of offending. This appears to have happened at Scott Road.

Benefits can also diffuse functionally, preventing other types of crime than those specifically targeted by the situational intervention (Kohfeld and Sprague, 1990). In principle, increasing the risks of committing one type of crime at a specific location could increase the risks of committing other types of crime (Clarke and Weisburd, 1994). In practice, techniques that work well in preventing vehicle thefts do not necessarily work well in preventing thefts from vehicles. At present we do not have sufficient data on the incidence of other types of crime at Scott Road and other parts of Surrey to address this issue.

No Temporal Displacement at Scott Road

We undertook a temporal displacement analysis at Scott Road, exploring times at which motor vehicle thefts were reported to the police and, therefore, presumably to determine whether the times at which the thefts occurred had changed in any substantial way. [8] No change appears to have occurred. Prior to the introduction of the bicycle patrol, 39.6% of all motor vehicle thefts were reported to the police between the hours of 6:00 a.m. and 9:00 a.m. In the period after the experiment started, 41.7% of all Scott Road motor vehicle thefts were reported between the hours of 6:00 a.m. and 9:00 a.m. No temporal displacement had occurred.

This is particularly interesting because a substantial proportion of the Scott Road motor vehicle thefts occurred outside the hours during which the bicycle patrol was actually operating. Yet car thieves did not change their temporal patterns to adapt, they reduced their activities instead. This may suggest another diffusion of benefits in diurnal time. If so, then it also suggests that publicity campaigns should be imprecise about the exact hours when a preventive intervention might operate. A crime attractor such as a large parking lot with no surrounding activities requires an affirmative decision to go there to look for a target. While this was not part of the research, it is possible that most of the motor vehicle thieves going to the Scott Road park-and-ride were persons looking for low-risk opportunities. British Columbia motor vehicle thefts are a youth crime aimed at older vehicles (Fleming, 1993). The Scott Road park-and-ride is deserted at night after the trains stop running. The vehicles parked there overnight are exposed without guardianship. Their owners are somewhere else, without their vehicles. Thieves who went to Scott Road at night would probably expect to see no guardians (either official or unofficial) at all. They may have been the ones who keyed on low-risk opportunities in selecting suitable targets (Felson, 1994; Clarke, 1992). They must have traveled to Scott Road by car (also common in British Columbia for even the theft of old cars (Fleming, 1993)) and, with an expectation of a bicycle patrol, may have been easily deterred. The remaining motor vehicle thieves were probably persons, caught at Scott Road station when the SkyTrain and buses stopped for the night, who stole a vehicle to get home. We have found similar late-night thefts of motor vehicles near bars in another municipality. Bar closing hours are close to bus stopping hours, and bar patrons often miss the last bus home.

We now look at three additional displacement and diffusion areas: the area surrounding Scott Road; Surrey City Centre; and Guildford.

The Areas Described

The area immediately surrounding the Scott Road park-and-ride atom is mixed industrial and residential. Adjacent atoms are largely lower-income, single-family residential.

Surrey City Centre is a regional shopping center. There is a large grocery store, a library, a few retail stores, a public recreation center, a SkyTrain stop and a bus interchange—all located next to an anchor mall. East of the Surrey City Centre mall are located high-density lower- and middle-income residential areas. This mall is also located along an arterial highway that runs parallel to the SkyTrain route.

Guildford is a very busy retail-commercial area made up of numerous fast-food restaurants, video-rental businesses and other "chain" retail shops. Directly adjacent to the area's anchor, Guildford Mall (and directly across the street from some of the parking lots), is a high-density, low-income, older residential area. The residential area comprises mostly low-rise apartment buildings and has a palpable "run-down" ambiance.

The Scott Road Surrounds

We explored the trends in reported motor vehicle thefts at four police atoms that generally surround the Scott Road park-and-ride. The average number of cars stolen per month in this group of atoms was 38. The number of vehicles reported stolen in these atoms during April 1995, the experimental month, was 12.

The atom immediately surrounding the Scott Road SkyTrain Park-and-Ride may have been directly affected by the bicycle patrol at the park-and-ride. While the total number of thefts for this area for March 1995 was 23, during April the number of reported auto thefts dropped to four, and in May only eight thefts were reported. By June the number of reported motor vehicle thefts rose to 17, perhaps indicating the temporal limit of a diffusion of benefits in time and space from a short-term intervention such as the Scott Road bicycle patrol. The numbers were small, however. The limited time for the study precluded the showing of a statistical increase or decrease in the nearest atom during the test period. There was a decrease in the weeks following the test period, perhaps a slow diffusion of benefits.

The other three atoms adjacent to Scott Road had a consistent combined pattern of nine or fewer offenses per month, and, because of the small numbers of crimes, analysis of a possible displacement effect was difficult. However, a consistent pattern was apparent in all of these atoms,

which were comprised of a mix of both residential and commercial land use: the number of reported auto thefts in April 1995 was near the lowest observed during the 13-month study period.

Surrey City Centre

An average of 26 stolen vehicles was reported at Surrey City Centre each month over the 13-month study period. The average number of reported vehicle thefts for the months preceding April 1995 was 24, while the average for the months following was 29. The number of vehicles reported stolen at Surrey City Centre during the month in which the bicycle patrol was operating at Scott Road was 34. While at first glance this seemingly high number may seem to indicate a displacement effect, a closer examination of the actual pattern of offenses for the 13-month period reveals that this is probably not the case. A detailed time-series analysis reported in Appendix 1 indicates that there was no measurable displacement to Surrey City Centre.

Temporal displacement analysis was conducted to see whether there was any appreciable change in the times at which Surrey City Centre motor vehicle thefts were reported to the police. Displacement from Scott Road would presumably be reflected in a rise in the proportion of offenses reported at Surrey City Centre during the key reporting times at Scott Road. There was no change in the proportion of offenses reported at Surrey City Centre during the early-morning hours. There was some modification in the pattern of reporting during the early afternoon, but it seems unlikely that Scott Road auto thieves displaced both spatially and temporally. All indications are that the bulk of Scott Road park-and-ride thefts probably involved late-night joyriding or theft for transportation purposes after the SkyTrain and buses stopped running. It seems unlikely that joyriders and thieves trying to get home after a night out on the town would alter their activity patterns to steal cars from Surrey City Centre at midday.

Guildford

The average monthly number of reported motor vehicle thefts for the 13-month study period was 24. The average number of thefts for the months preceding April was 20, while the average number for the following months was 30. The number of thefts of auto at Guildford for the test month of April was 38.

The time-series analysis (see Appendix 1) suggested that there was a partial displacement of Scott Road vehicle thefts to Guildford. This finding is tempered by the temporal displacement data, which showed no sub-

stantial modification in the times at which Guildford motor vehicle thefts were reported to the police during and after the Scott Road experiment. This suggests that there was some displacement of opportunistic vehicle theft to Guildford, but little or no displacement of planned vehicle theft.

This is consistent with police perceptions: the Surrey constables who were interviewed informally indicated a belief that a substantial proportion of the vehicle thefts at Scott Road had been opportunistic joyriding or transportation-related thefts by residents of the Guildford area. To the extent that this perception is true, it would explain why some displaced vehicle thefts would occur at Guildford, but not at Surrey City Centre. The geometry of home location (Brantingham and Brantingham, 1991) and routine activities (Felson, 1994) would dictate this particular displacement. Offenders look for things to steal either relatively near to home, or at crime generators such as transportation nodes or crime attractors such as very large concentrations of unguarded targets (Brantingham and Brantingham, 1995). If police perceptions are correct, Guildford would be a displacement area for Scott Road because it would be close to offenders' homes. Surrey City Centre would not be a displacement area because it would require a trip outside the offenders' normal activity spaces.

Summary of Results

Table 3 contains a summary of the results of the time-series analysis. Appendix 1 contains the details of the statistical analysis.

As can be seen from Table 3, the time-series analysis found that Scott Road had an overall decrease during the study period and showed a sharp drop during the bicycle-patrol period. There was also a decrease from the overall trend that continued after the bicycle-patrol experiment ended, but compared to the experimental period this constituted a small increase. Vehicle thefts still remained well below the pre-bike-patrol period during the post-experimental period.

In the area adjacent to Scott Road there was no statistical upward trend over the entire study period, during the experiment or during the period following the experiment. This indicates that there probably was no major spatial displacement to the areas adjacent to the Scott Road park-and-ride, but also indicates that the thefts in the surrounding areas were low enough that there was no possibility of any strong diffusion of benefits into the surrounding neighborhood.

At Surrey City Centre there was no statistical upward trend over the entire study period, during the bike patrol experiment or following the experiment. Surrey City Centre is the next large node on the SkyTrain

Table 3: Vehicle Theft Trends at Selected Sites in Surrey

Time Frame	Scott Road	Scott Road Surrounds	Surrey City Surrounds	Guildford Centre	Surrey as a Whole
Full study period	decrease	no trend	no trend	no trend	no trend
During experiment	sharp decrease	no trend	no trend	increase	borderline decrease
After experiment	small increase	small decrease	no trend	increase	no trend

system. This suggests that there was no spatial displacement to the next similar cluster of criminal opportunities, and indicates that something besides riding the SkyTrain contributes to target selection by the offenders who steal vehicles at Scott Road.

In contrast, there was an increase at the Guildford shopping center both during and after the Scott Road bicycle-patrol experiment, suggesting some displacement to this alternative high-activity center. This is consistent with the idea that at least some of the Scott Road park-and-ride vehicle thieves live in or use the Guildford area.

Most importantly, Surrey as a whole reflected the bicycle-patrol reductions at the Scott Road park-and-ride. While borderline ($p = .09$), there was a clear drop in the weekly totals for Surrey during the bicycle patrol. Such displacement as did occur was not substantial enough to negate the positive impact at the park-and-ride. The net effect of the park-and-ride bicycle patrol was a reduction in the total auto thefts experienced in the city.

Overall, the time-series analysis supports the idea that there was a strong reduction in vehicle theft at Scott Road both during and after the experiment, and that there was little or no displacement into contiguous neighborhoods or to the next nearest crime-generator site. It suggests that there was some displacement, but not complete displacement, to an alternative crime-generator site.

CONCLUSION

It is always impossible to determine conclusively the exact amount of displacement of a crime. Crime is a dynamic behavior, and while there are definite patterns to any criminal behavior, rarely if ever is crime predictable with a 100% degree of accuracy. Given the preceding analysis, it is apparent that the bicycle patrol that was implemented for a one-month period at the Scott Road park-and-ride did, indeed, prevent some thefts of motor vehicles. It would also seem that there were some displacement effects from this location to one other well-known problem area in the city of Surrey, but not to another established problem spot. The evident diffusion of benefits in temporal form at Scott Road, and the positive impact for Surrey overall, further strengthens the idea that there was only partial displacement of the offenses actually prevented at the park-and-ride by the bicycle patrol. As is stated by Hesseling (1995), to fully understand displacement more needs to be studied than just the areas adjacent to where the program was implemented. In addition, a variety of data sources must be used.

It would be interesting to analyze the results of a longer period of patrolling. This would likely give a clearer picture of what exactly the effects of formal guardianship on auto theft in a specific location such as the park-and-ride would be, as well as the locations surrounding such a place. A longer study period of a few years would also have been advantageous. An exploration of data for other types of crime would also be very useful, but was not possible in this particular post hoc study.

The Future

From an operational perspective, the results of the initial student study (Spinks et al., 1995) were sufficient to permit BC Transit to plan to initiate a more extensive bicycle patrol at the Scott Road park-and-ride lots, new park-and-ride lots serving a commuter train service and other smaller park-and-ride lots. We hope that there will be a follow-up study looking at the impact of this expanded bicycle-patrol program.

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NOTES

1. A Crown corporation is a government-owned, independently incorporated operating authority. Similar British Columbia Crown corporations provide all basic auto insurance, provide all electric power, and operate the provincial ferry system.

2. Paul Brantingham.

3. The Surrey RCMP had begun keeping crime data by small geographic areas in August 1994. The way in which crime data are kept in the more general RCMP PIRS data system made it impossible to retrieve data for Scott Road or any other small geographic area prior to that date. Moreover, both the retrieval process and the data re-entry process were cumbersome. An RCMP constable had to retrieve and print data one 40-line screen at a time. These printouts then had to be scanned into a computer at the university, converted into machine-readable characters with an OCR program, then imported into Excel, SPSS, and other programs for analysis. For the student project, which looked only at Scott Road data, this process took several weeks before the data were available for analysis. The larger study reported in this article expanded the analysis to all of Surrey's small geographic areas and took much longer to retrieve and prepare data for analysis.

4. An atom is a small, clearly defined neighborhood-type area. An atom may be classified as either commercial or residential, depending on what exists within the area.

5. At this writing, municipal crime-count data for the final four months of 1995 are not yet available. We therefore present year-to-date comparisons for comparable eight-month periods in 1994 and 1995. The data presented here were supplied by Police Services, Ministry of Attorney General of British Columbia, through a special data retrieval.

6. The "before" period shown in Table 2 comprises August 1994 when police atom indicators were first added to Surrey police data through March 1995.

The "during" period comprises the months of April and May 1995. The "after" period comprises the months of June through August 1995.

7. When doing a post hoc study on information that is made available by other actors, one has to infer some relationships with missing data. Table 1, based on available monthly data, shows a total increase in Surrey from part of 1994 to part of 1995. Time-series analysis for the time period where more-detailed weekly data were available shows Surrey leveling off. It may be that auto theft in Surrey has reached a saturation level. Demographically, teenagers are proportionately being concentrated farther away from Vancouver. In British Columbia, motor vehicle theft is primarily a youth crime (Fleming, 1993; Fleming et al., 1994). Rapid growth in this offense may move to other municipalities. However, even if the growth rate is lessened or stops, there will still be areas of concentration of crime.

8. We are aware that there is normally some time lag between the time at which a vehicle theft occurs and the time the theft is discovered and reported to the police. Vehicle theft is one of those offenses in which the time of the crime must typically be stated as having occurred in a broad band sometime between when the driver left the car parked and returned to find it gone. Nevertheless, these time bands are typically constrained by routine work rhythms in commuter lots. A major temporal displacement should be reflected in a movement in reporting times that is consistent with the organization of shift work over the course of the day.

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APPENDIX 1

The analysis of time-series data requires techniques that take into account the time-ordering of variables. Time-series analysis is a search for crime trends, seasonality and other factors influencing change (see P. J. Brantingham and P.L. Brantingham, 1984, for an overview of time-series analysis in criminology).

Time-series analysis may be done in many ways. One common way is using a statistical technique called AutoRegressive Integrated Moving Averages (ARIMA), sometimes called the Box-Jenkins Method. ARIMA modeling is frequently used to explore the impact of a change on an experiment.

In ARIMA modeling, current values are based on past values in one of three ways:

(1) Each value in a time series is dependent on a prior value or values. That is, each value in the series is correlated with prior values. This is called autoregression.

(2) Sometimes the value in a time series reflects a cumulative effect, that is, there is a continuing growth or decrease in the series. This type of cumulative change is called an integrative change. When a time series reflects such a change, it is studied by looking at the changes themselves instead of the values. This involves looking at differences between the values at different points in time.

(3) Finally, sometimes what happens in a time series really reflects a change at a specific point in time, and one or more prior changes. That is, the value in the time series reflects the averaging of the current disturbance and one or more prior disturbances. This means that the value at any given point in time is influenced by prior values for a fixed time period.

ARIMA analysis requires several steps, including determining whether the time series being studied is autoregressive or integrative or is best represented by a moving average. This is done by calculating autocorrelations and partial autocorrelations. The results indicate which lags and interrelationships to use in the actual time-series analysis.

It is possible to include a test period in an ARIMA model. This can be done by first creating a time-dependent dummy variable and then including it in the analysis. This time-dependent "test" variable will have the

value 1 during the test and 0 otherwise. Using such a time-dependent "test" variable is sometimes called intervention analysis.

The Scott Road Park-and-Ride Analysis

The impact of the natural experiment at the Scott Road park-and-ride was explored using the ARIMA techniques just described. The reported motor vehicle thefts were examined by weekly totals. Autocorrelation and partial autocorrelation analyses were performed to determine whether the time-series motor vehicle data were best analyzed using an autoregressive technique, differences, moving averages or some combination. Some additional seasonality tests were done as well to verify results. The reported crime totals in the time series were found to be consistent with using a moving-averages model.

A variable was created to identify when publicity started for the bicycle patrol, together with the weekly totals during the patrol. A second variable was created to identify the time series totals that came after the bicycle patrol stopped. The use of the "during-and-after" variables is sometimes called a pulse technique. Such a technique is particularly important in natural experiments in crime prevention because it makes it possible to calculate a statistical estimation of deterrent and displacement effects.

In reading the tables that follow there are three variables worth considering. First, there is a variable for the moving average (MAI). There is a variable (DURING), used to identify the natural-experiment period, and there is a third variable (AFTER), used for the weeks following the DURING period. There is also a constant value (CONSTANT) that indicates what the initial estimated motor vehicle theft value weekly totals were.

We were working with all reported motor vehicle thefts. These totals represent a sample only when one considers non-reported thefts. Motor vehicle thefts are reported at very high levels, both for insurance purposes and because vehicle theft seems to upset people more than other crimes. British Columbia has a high stolen-vehicle recovery rate (Fleming et al., 1994). T tests and associated statistical significance levels were calculated for the different variables, but. in this case, should be considered only as indicators of the relative importance of the different variables.

Together, these variables made it possible to explore whether the weekly totals of motor vehicle theft, while varying week to week, were best described from a CONSTANT value, whether there was a moving-averages trend (or seasonality) and whether there was a clear decrease or increase during or after the operation of the bicycle patrol.

Models were developed for:

(1) Surrey as a whole (Table A1);

(2) The Scott Road park-and-ride hot spot (Table A2);

(3) The police area that surrounds Scott Road (Table A3); and

(4) The two other hot spots, Surrey City Centre (Table A4) and Guilford (Table A5).

In interpreting the tables, it is helpful to consider the "B" values, the T values (T RATIOs) and the probability (Approximate Probability). The T values can be positive or negative.

When the probability meets or exceeds the conventional .05 significance level, it is noted with an "*." Because of the limits imposed by this post hoc study of a natural experiment, the symbol "+" is used to indicate when the probability suggests that future studies should explore a specific type of relationship, even when the conventional level of significance was not reached.

Table A1: The District of Surrey as a Whole

Analysis of Variance:

	Degrees of Freedom	Adjusted Sum of Squares	Residual Variance
Residuals	48	17614.35	366.95

Variables in the Model:

	B	Standard Error B	T-RATIO	Approximate Probability
MA1	-.042	.14	-.29	.77
DURING	-13.45	7.84	-1.72	.09+
AFTER	.82	6.74	.12	.90
CONSTANT	102.55	3.52	29.10	.00*

Table A2: Scott Road Park-and-Ride

Analysis of Variance:

	Degrees of Freedom	Adjusted Sum of Squares	Residual Variance	
Residuals	47	516.09	10.96	

Variables in the Model:

	B	Standard Error B	T-RATIO	Approximate Probability
MA1	-.33	.14	-2.39	.02*
DURING	-5.37	1.66	-3.23	.00*
AFTER	-2.86	1.51	-1.90	.06+
CONSTANT	5.99	.77	7.77	.00*

Table A3: Area around Scott Road Park-and-Ride

Analysis of Variance

	Degrees of Freedom	Adjusted Sum of Squares	Residual Variance
Residuals	53	202.83797	3.8267747

Variables in the Model:

	B	Standard Error B	T-RATIO	Approximate Probability
MA1	-.07	.14	-.53	.60
DURING	-.94	.81	-1.16	.25
AFTER	1.57	.69	2.27	.03*
CONSTANT	2.40	.34	6.97	.00*

Table A4: Surrey City Centre

Analysis of Variance

	Degrees of Freedom	Adjusted Sum of Squares	Residual Variance
Residuals	47	382.80	8.14

Variables in the Model:

	B	Standard Error B	T-RATIO	Approximate Probability
MA1	-.04	.15	-.25	.80
DURING	1.26	1.17	1.08	.29
AFTER	1.32	1.00	1.32	.19
CONSTANT	6.10	.53	11.49	.00*

Table A5: Guildford

Analysis of Variance

	Degrees of Freedom	Adjusted Sum of Squares	Residual Variance
Residuals	47	394.03	8.38

Variables in the Model:

	B	Standard Error B	T-RATIO	Approximate Probability
MA1	.00	.15	.00	.99
DURING	3.50	1.15	3.04	.00*
AFTER	2.20	.98	2.24	.03*
CONSTANT	5.13	.52	9.86	.00*