



APPENDIX 2G – Preliminary Evaluation of the Bait Car Pilot Project

A PRELIMINARY ASSESSMENT OF THE IMPACT OF ICBC'S BAIT CAR PROGRAM

SPRING 2004

INTRODUCTION

This evaluation is a preliminary assessment of the impact of ICBC's Bait Car program on the crime rate in BC for auto theft. The Bait Car program was implemented in Vancouver in September of 2002 with the aim of decreasing motor vehicle theft in areas exposed to the program, and therefore reducing comprehensive claim costs for the corporation.

Results from previous studies have demonstrated that the success of theft prevention programs depends on many factors including: overall crime rates, population size, and the socio-economic characteristics of the areas targeted by these programs. Similarly, the influence of co-existing anti-crime initiatives (i.e. community based anti-theft programs, police initiatives etc.) have been studied and shown to impact theft rates. However, these factors were **not considered** in the evaluation which is the subject of this report. Instead, attention was focused solely on **describing the patterns of auto crime rates** (based on ICBC claims and Police theft data) before and after the implementation of the Bait Car program. Various locations in the Vancouver Lower Mainland were studied along with the city of Kelowna in the Southern Interior of the province. Kelowna was chosen as a frame of reference in which to interpret the changes seen in the Lower Mainland.

While an attempt is made to assess the "change" in Lower Mainland Auto theft rates in the time period following the implementation of the program, it is important to be mindful of the fact that no effort was made to control for the myriad of other factors (see above) which may have influenced these rates. Owing to this limitation in the design of this evaluation, it would be inappropriate at this time to infer a causal relationship between the existence of the Bait Car program and any subsequent changes in auto crime rates in affected areas based on the findings contained in this report. The findings contained herein are put forth as a means of encouraging a future, more all-encompassing study which carefully examines "Bait Car" related changes in auto theft patterns in a larger context.

EVALUATION METHOD AND RATIONALE

Data Sources:

Two types of auto theft data were analyzed for this report:

1. ICBC claims data, where the claim in question had an associated KOL = 11 and the theft took place in British Columbia, was obtained for the period January 1st 1998 through November 30th 2003.
2. City of Vancouver motor vehicle theft data was obtained from the Vancouver City Police as well; however, data was available for the period Jan 1st 1998 through December 31st 2002 only.

A data series of monthly theft totals was constructed for each location based on the raw data provided by the corporation and the police.

Program Time Period:

The initial media campaign publicizing the Bait Car program kicked off in the last 2 weeks of September of 2002. While other media coverage, both print and radio, has occurred since the program's inception, the effect of these various, and the initial, media campaigns were not studied separately. For the purposes of conducting this preliminary assessment of the impact of the program the program start date was set at October 1st 2002 (with some exceptions - see table 1), and the program was assumed to have been continuously in place through to November of 2003. This end date was in some cases limited by the latest available and reliable data (see table 1).

Locations Studied:

While the Bait Car program was implemented in Vancouver, it was not reasonable to assume the program would impact Vancouver only given the existence of a wider reaching media campaign, word of mouth etc.. With this in mind, data analyses were conducted for 11 locations, 10 in the Lower Mainland:

- | | |
|--------------------|-----------------|
| 1. Vancouver | 6. Delta |
| 2. North Vancouver | 7. Richmond |
| 3. West Vancouver | 8. Surrey |
| 4. Burnaby | 9. Langley |
| 5. Coquitlam | 10. Abbotsford, |

and 1 in the Southern Interior:

11. Kelowna

EVALUATION METHOD AND RATIONALE CONT'D

Data Modeling Techniques:

Each location's monthly series of theft counts was subjected to a statistical modeling process which involved choosing the "best" model from a set of possible choices which included the following types of models:

1. random walk
2. linear trend
3. quadratic trend
4. exponential trend
5. S-curve
6. moving average
7. exponential smoothing (simple, Holt's linear, quadratic, Winter's)
8. ARIMA (time series)

The "best" model for each location was determined based on its performance in terms of the following statistics:

- (1) the root mean squared error (RMSE)
- (2) the mean absolute error (MAE)
- (3) the mean absolute percentage error (MAPE)
- (4) the mean error (ME)
- (5) the mean percentage error (MPE)

Each of these statistics is based on the one-ahead forecast errors, which are the differences between the data value at time t and the forecast of that value made at time $t-1$. In simple terms this means that theft counts for a given month were estimated by inputting the counts for the previous month into the model equation.

The first three statistics measure the **size of the errors**: the discrepancy between the actual theft counts and those predicted by the model. A better model will give a smaller value.

The last two statistics measure the bias. **Bias** is a measure of whether a model has a tendency to either under or over predict. A good model will not have this tendency and will give a value close to 0.0.

Forecasting Future Monthly Theft Counts:

Once the "best" model was chosen for a location, that model was used to predict or "forecast" the number of monthly thefts that would have been observed following the inception of the program if the program had no impact. The rationale being if the program has no impact, the forecasts, which are based on the historic patterns inherent in the monthly series prior to the program starting, will accurately predict the theft counts observed when the program was in place. Simply put, if the pattern of theft counts observed during the time the program was in place did not stray significantly from that observed in the time period prior to the program, there would be no evidence that theft rates were changing in conjunction with the timing of the program implementation.

EVALUATION METHOD AND RATIONALE CONT'D

Model Forecasts vs. Observed Monthly Theft Counts:

The actual auto theft counts observed prior to the start of the Bait Car program were compared with those predicted by the model. This was done to ensure that the model fit the "pre-program" data well.

Once it was established the model fit the "pre-program" data series, the same statistical test (two-tailed paired difference t-test) was used to assess the fit of the monthly auto theft counts observed once the program was in place relative to the forecasts generated by the model. This test of "during -program" fit was the basis on which the evaluation of the changes in theft patterns following the implementation of Bait Car was made. If the post-program implementation fit, which was based on comparing model forecasts with observed data, was "good" (based on the results of a test of statistical significance), the conclusion was that there had been no change in the pattern of monthly theft claim rates during the period of the programs existence. Conversely, if the pattern in the post-program implementation data forecasts marked a statistically significant departure from the pattern observed in the pre-program data, the conclusion was that theft rates had changed during the period of the programs existence.

EVALUATION FINDINGS

Model Forecasts vs. Observed Monthly Theft Counts:

The actual auto theft counts observed prior to the start of the Bait Car program were compared, via a two-tailed paired differences t-test (alpha = .05), with those predicted by the model. In all locations studied the pre-program fit of the model to the observed data series was found to be acceptable. This finding may be expressed in statistical terminology by stating that there was no evidence to support a difference between observed pre-program theft rates and those given by the model.

The results of the “during-program” fit of the model are presented in Table 1. Only those locations where the findings for either the police or the claims data were significant are included in the table.

TABLE 1. Trends In “During Program” Theft Rates Relative To “Pre-Program” Patterns

<u>LOCATION STUDIED</u>	<u>DATA SOURCE/ TIME PERIOD</u>	<u>T-TEST FINDINGS</u>		<u>CONCLUSION REGARDING “DURING PROGRAM” THEFT RATES</u>
		<u>T-VALUE</u>	<u>P-VALUE</u>	
Abbotsford	ICBC ²	5.998	0.000	evidence supports a DECREASE in theft rates
Abbotsford	POLICE ¹	2.830	0.012	evidence supports a DECREASE in theft rates
Delta	ICBC ²	5.257	0.000	evidence supports a DECREASE in theft rates
Delta	POLICE ¹	2.213	0.042	evidence supports a DECREASE in theft rates
Langley	ICBC ²	4.591	0.000	evidence supports a DECREASE in theft rates
Richmond	ICBC ²	2.690	0.016	evidence supports a DECREASE in theft rates
Vancouver	ICBC ³	2.267	0.038	evidence supports a DECREASE in theft rates
Burnaby	ICBC ³	2.267	0.038	evidence supports an INCREASE in theft rates
Kelowna	ICBC ²	2.879	0.011	evidence supports an INCREASE in theft rates
New Westminster	ICBC ²	2.391	0.029	evidence supports an INCREASE in theft rates
North Vancouver	POLICE ¹	2.943	0.010	evidence supports an INCREASE in theft rates
Surrey	ICBC ³	2.462	0.026	evidence supports an INCREASE in theft rates
Surrey	POLICE ¹	5.453	0.000	evidence supports an INCREASE in theft rates
West Vancouver	ICBC ²	4.233	0.001	evidence supports an INCREASE in theft rates
West Vancouver	POLICE ¹	3.263	0.005	evidence supports an INCREASE in theft rates

1 Pre-program time period set at Jan 1998 – Jul 2002, During-program time period set at Aug 2002 – Nov 2002
2 Pre-program time period set at Jan 1998 – Jul 2002, During-program time period set at Aug 2002 – Nov 2003
3 Pre-program time period set at Jan 1998 – Sep 2002, During-program time period set at Oct 2002 – Nov 2003

NOTE: Pre- and during- program time period settings were affected by data availability and by the best fitting model for the data series in question. Models were all initially based on a during-program time period beginning in August of 2002. This was a very conservative choice and it had a big impact on the forecasts calculated for models which had a time series component. In those cases, the during-program start date was reset to begin in October of 2002 – a date which was more in-line with the media campaign start to the Bait Car program. It was decided that findings in all other cases would be similar regardless of whether the during-program start date was set to August or October of 2002 and in those cases no resetting of the during-program start date was done.

EVALUATION FINDINGS CONT'D

Changes Observed In Theft Claim Rates – Observed “During-Program Rates” Vs. Model Forecasts:

The changes in monthly theft claim counts for locations where the “during-program” rates represented a statistically significant departure from the pattern seen in the “pre-program” rates are given in Table 2.

The right-most column of Table 2 provides estimates of the magnitude of the discrepancies in forecasted vs. observed theft claim rates during the time Bait Car has been in place. Any interpretation of the percentages in this column must be made with caution. For example, while estimates in the table suggests that claims rates observed in Abbotsford during the time the Bait Car Program was in existence were markedly lower than forecasted: down 252 percent, it is not appropriate to credit this apparent “decrease” directly to the impact of the Bait Car Program. Instead, Table 2 should be used a guide to interpreting the trends observed in the distribution of theft claims throughout the Lower Mainland during the time that Bait Car was in existence.

TABLE 2. Discrepancies in Forecasted Vs. Observed “During Program” Theft Claim Rates

LOCATION	DATA SOURCE/ TIME PERIOD	THEFT CLAIM RATES		
		(A) average monthly observed “pre-program” theft claims	(B) monthly (forecast – observed) average in “during-program” time period	Magnitude of Discrepancy Estimates in Forecasted Vs. Observed “During Program” Theft Claim Rates = (B ÷ A) X 100
Abbotsford	ICBC ²	49.8	-125.5	-252%
Langley	ICBC ²	59.4	-46.7	-79%
Delta	ICBC ²	24.2	-11	-45%
Richmond	ICBC ²	50.44	-7.3	-14%
Vancouver	ICBC ³	381.8	-34.3	-9%
West Vancouver	ICBC ²	3.56	3.6	101%
Kelowna	ICBC ²	30.3	7.7	25%
New Westminster	ICBC ²	49.6	6.8	14%
Surrey	ICBC ³	335.4	36.4	11%
Burnaby	ICBC ³	160.9	11.6	7%

1 Pre-program time period set at Jan 1998 – Jul 2002, During-program time period set at Aug 2002 – Nov 2002
 2 Pre-program time period set at Jan 1998 – Jul 2002, During-program time period set at Aug 2002 – Nov 2003
 3 Pre-program time period set at Jan 1998 – Sep 2002, During-program time period set at Oct 2002 – Nov 2003

NOTE: Pre- and during- program time period settings were affected by data availability and by the best fitting model for the data series in question. Models were all initially based on a during-program time period beginning in August of 2002. This was a very conservative choice and it had a big impact on the forecasts calculated for models which had a time series component. In those cases, the during-program start date was reset to begin in October of 2002 – a date which was more in-line with the media campaign start to the Bait Car program. It was decided that findings in all other cases would be similar regardless of whether the during-program start date was set to August or October of 2002 and in those cases no resetting of the during-program start date was done.

CONCLUSIONS

1. There is statistical evidence that theft claim rates have changed in some locations which may logically have been impacted by the implementation of the Bait Car program.

Areas showing an overall increase in theft claim rates during the existence of the Bait Car program include:

- West Vancouver
- New Westminster
- Surrey
- Burnaby

Areas showing an overall decrease in theft claim rates during the existence of the Bait Car program include:

- Abbotsford
- Langley
- Delta
- Richmond
- Vancouver

2. There is statistical evidence that theft claim rates have increased in Kelowna during the existence of the Bait Car program.
3. While a “magnitude of effect” has been calculated for those areas whose theft claim rates have changed since the inception of Bait Car, program managers should be cautious in crediting these changes directly to the impact of the program. In the absence of a thorough statistical analysis of the impact of related anti-crime initiatives and other factors influencing crime rates, any assumptions regarding the absolute effectiveness of the program would be premature.
4. Logical next steps include:
 - carefully considering the changes documented in this report and interpreting them in the context of the auto crime situation in the Lower Mainland as it is understood by program managers and;
 - planning for a more detailed evaluation of this program based on this careful consideration of the finding of this preliminary assessment of the impact of the Bait Car program.