Automated Traffic Enforcement – Program Review

Summary Report

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INTRODUCTION

MNP was engaged by Alberta Transportation to conduct a review of Automated Traffic Enforcement (ATE) in the province. As part of this review, MNP completed six deliverables, which will be referenced throughout this summary report:

- Jurisdictional Scan
- Municipal Attitudes Review
- Guidelines Review
- Collision Data Analysis
- Literature Review
- Public Engagement Survey

These six deliverables are included as individual appendices. The detailed methodology and analysis for each is listed by section.

The ATE program review sought to answer three main questions:

1. Does ATE contribute to traffic safety in Alberta?
2. How much revenue is generated from ATE programs?
    a. Where is the revenue allocated?
    b. How is the revenue spent?
3. Are Alberta municipalities who operate an ATE program compliant with the ATE Technology and Training Guidelines, and are the Guidelines effective?

None of the individual deliverables could answer all three main questions fulsomely. Each question actually draws upon the research results of two or more of the deliverables. Therefore, this summary section addresses the three main questions and draws from applicable elements of the program review to present evidence, findings and conclusions in response to each of the them

TRAFFIC SAFETY

How does ATE contribute to traffic safety in Alberta?

ATE has had a small contribution to traffic safety in the province, but is generally not being used in a way that maximizes traffic safety. Regression analysis isolated a direct contribution of ATE on the observed reduction in collision rates. While overall collision rates have per 10,000 residents declined by 29.35% over the 10-year period, findings from this analysis showed that 1.4% of this reduction in collision rates, and 5.3% of the observed reduction in the proportion of severe collisions, could be attributed to the use of ATE.

ATE Contribution to Traffic Safety in Alberta

Albertans have mixed perceptions on whether ATE has made the roads safer. They agree that ATE improves intersection safety where it is present, and that the threat of receiving ATE fines contributes to improvements in their driving behaviour.

Alberta, like many Canadian jurisdictions, has seen a steady decrease over time in collision rates. There are a wide range of potential reasons for this decline, some of which may include improved vehicle safety and collision avoidance technology, education and awareness campaigns, demographic changes, improved road design, and enhanced enforcement, among many others.

This study isolates the contribution of ATE enforcement to Alberta's traffic safety. It has shown statistically sound evidence that ATE is directly attributable to 1.4% of the overall reduction of traffic collisions in the province and to a 5.3% reduction in the proportion of severe (fatal) collisions.

While the observed effects were small compared to many other existing studies, the methodologies and scope of this study differed greatly. These new results were observed at a municipal level, which highlight a change in Albertan's overall driving behaviour, in all driving scenarios, due to the use of ATE. This is a new contribution to existing literature, as many existing studies have focused on driving behaviour and collision results in areas very close to ATE cameras. It is important to note, that previous studies have been conducted in Alberta that also show a contribution from ATE on traffic safety.

A number of national and international studies have indicated that the introduction or use of ATE does contribute to traffic safety, though the consensus is stronger for speed-enforcement, as intersection safety devices often have varying results and are associated with a higher number of rear-end and property damage collisions. While the methodologies of these studies, and the observed scale of contribution of ATE to traffic safety varies, there is a consistent observable pattern of ATE positively contributing to traffic safety.

Is ATE being used to maximize traffic safety outcomes?

While ATE has had some effect on traffic safety, this effect has likely not been as large as it could have been. Limited reporting requirements have made it impossible to trace the level of overall reinvestment of fine revenue into traffic safety initiatives, though, anecdotally, we know this occurs. The reason for device placement has no statistical link to reductions in collisions. This can be attributed to the open nature of provincial program guidelines.

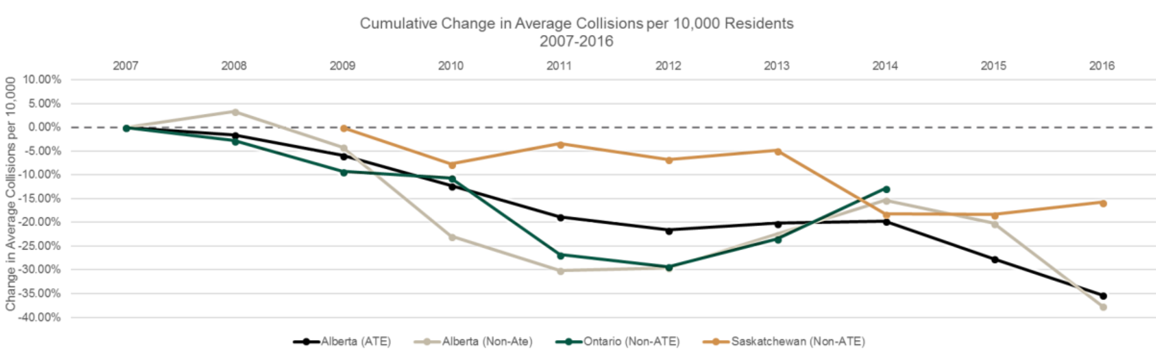
PROVINCIAL COMPARISON

When compared with other Canadian jurisdictions, Alberta is a leader in the use of ATE in terms of the breadth of use across province's municipalities and in the variety of device types used. Alberta also has a long history of using ATE, with photo radar units first introduced in 1988.

Finally, compared to other provinces, Alberta has the greatest "intensity" of ATE use with the highest number of ATE devices per capita. Alberta's ATE device per capita ratio is over three times higher than British Columbia and Manitoba, which are tied for the second highest.

Despite this high intensity of use, collision rates in Alberta have decreased at similar levels to other jurisdictions. Collision rates for Alberta municipalities using ATE have decreased at similar levels for non-ATE jurisdictions (including non-ATE Alberta municipalities), as shown in Figure 1.

***Figure 1**: Cumulative Change in Average Collisions (per 10,00 Residents)*



There is not enough data available to account for the wide range of potential factors that could affect collision rates in any given jurisdiction to draw meaningful conclusions about the data above. However, given the high intensity of ATE use in Alberta's municipalities, it is reasonable to question why ATE use has not translated into higher levels of collision reduction, and what improvements could be made to Alberta's ATE program to maximize traffic safety outcomes

GUIDELINES CONTRIBUTION TO SAFETY

Regression analyses were conducted to test the effectiveness of different location criteria that must be selected by municipalities to justify ATE use. Analyses were conducted for the types of criteria selected (grouped into three categories: Historical reasons, Subjective reasons, and Situational reasons) and the number of criteria selected (up to three location criteria can be selected for each ATE instance) compared to traffic safety outcomes (collision rates, collision severity, collision types). The results of the analysis found no meaningful relationships between the location criteria (type or numbers) selected by municipalities to justify ATE and any traffic safety outcomes. That is, the reason selected for placement and the existence of the device has an essentially random connection with the resulting collision statistics. This result provides additional evidence that the current provincial guidelines do not necessarily mandate ATE use in a way that maximizes traffic safety outcomes, even in cases of full municipal compliance.

How has ATE contributed to traffic safety in the province?

In order to test and isolate exactly how ATE has contributed to traffic safety in the province, regression analyses were conducted on the use of ATE (and the intensity of ATE use in terms of active camera hours) compared to a range of traffic safety outcomes, including collision rates, the proportion of severe (or fatal) collisions, and the proportions of types of collision (i.e. rear-end vs. side-angle, which tend to be more serious in nature). The results yielded modest, but observable effects of ATE contributing to reduced traffic collisions and reduced proportion of severe collisions.

Notably, a regression analysis of traffic collision rate change between 2008 and 2016, for municipalities that used ATE and a control group of comparable municipalities with no ATE, showed that 1.4% of the observed reduction in collision rates could be directly and solely attributable to ATE use. A similar regression analysis of severe (fatal) traffic collisions, showed that 5.3% of the observed reduction in the proportion of severe collisions could be attributed to the use of ATE. This analysis used a smaller sample of municipalities to remove some smaller municipalities that had not experienced any severe collisions.

It is important to note that this is not necessarily the full effect of ATE on traffic collisions. Regression analyses are intended to isolate the statistical relationship between predictor variables (in this case the use of ATE) and response variables (traffic collision rates, or the proportion of severe traffic collisions). The regression analysis calculates the part of the relationship between ATE use and collisions rates that can be directly explained but does not exclude the potential for a larger indirect contribution.

The analysis was not able to assess the contribution of these other potential traffic safety factors to a reduction in overall collision rates. In addition to being out of the scope of the study, there is not existing data to properly assess and isolate all of the potential factors that could affect traffic safety. There is an important opportunity for additional research, data collection and analysis to be conducted to assess the contribution of other traffic safety measures have on reducing collision rates, in order to be able to compare and contrast to ATE use.

Therefore, it could be reasonably expected that ATE had some contributory effect to the other 98.6% of collision reduction (or 94.7% of severe collision proportion reduction). It can also be expected that other traffic safety factors (such as collision avoidance systems, other vehicle technology, awareness and education campaigns, engineering and road design, traffic calming measures, climate changes, road maintenance and clearing improvements, etc.), or some combination thereof, had contributory effects as well.

How do this study's findings compare to existing studies?

METHODOLOGY COMPARISON

The regression analyses conducted in this study are a unique addition to the current body of research regarding ATE's effect on traffic safety, as they isolate the direct effect of ATE on collisions rates at an overall municipal level. This better shows the ATE effect on overall changes in driver behaviour in all driving scenarios and locations, not just in specific locations where ATE is used.

Other studies have generally been focused on collisions in specific areas at or around ATE installations. As shown above, these location-based analyses have often shown higher levels of contribution in localized test areas. This is usually done by calculating an expected "baseline" rate of collisions in a particular location based on collision rates at comparable locations in other jurisdictions, or by measuring other comparable "control" locations without ATE. Some more robust studies have taken measures to control for various factors in their comparisons, or have measured a comprehensive set of control sites to gain a better sense of overall driver behaviour changes.

Several other issues have been identified in other location-based studies that the methodology was hoping to overcome:

- Regression to the mean (RTM) – which suggests that in some cases ATE will be implemented in areas or intersections where collisions have recently occurred in high numbers, though due to random statistical chance versus any sort of casual factors. In these cases, when collisions levels naturally revert back to normal, ATE may be incorrectly credited with the reduction.
- Crash migration – occurs when drivers change their behaviour because they know where ATE is present, effectively displacing collisions and dangerous driving. This could include slowing down for particular intersections or stretches of road, but then speeding up again once they are away from the location they know has ATE. Drivers could also avoid certain roads with ATE, which would displace traffic volume. In all cases of crash mitigation, the effect of ATE would be overestimated as traffic volume and speeding drivers would be displaced to other locations.

The study avoids the above issues by looking at driver behaviour at a municipal level, rather than in a particular road-section where ATE is used to remove the potential to wrongfully overestimate the effect of ATE.

COLLISION RESULTS COMPARISON

As noted, there is a broad consensus in research studies on the effectiveness of ATE, particularly for speed-only mobile photo radar devices. The research consensus on intersection safety devices is less clear as they tend to increase rear-end and lower-severity collisions, while reducing high-severity collisions, which can result in an overall increase in total collisions.

The supplemental Literature Review (Appendix E) highlights a wide range of national and international studies for speed-only enforcement and intersection safety devices. The results vary but generally align with this study's findings. Overall, the literature tends to show fairly high contribution for speed cameras contribution traffic safety, but lower for red light cameras and intersection devices. However, some studies have shown smaller effects of ATE. Studies that have attempted to factor in a range of other potential traffic safety factors, and studies that observed non-ATE control locations tended to show lower overall contribution effects.

In terms of Canadian results, a number of studies across British Columbia, Manitoba and Quebec are highlighted in the Literature Review report and Jurisdictional Scan report (Appendix A). The results of these studies vary but generally range from approximately 15%-30% stated contribution, though with varying methodologies. However, one more recent Manitoba study using a time-series methodology did not ultimately yield statistically significant results for ATE reducing most collision severities, showing modest and mixed results. The research results have mostly shown higher-levels of ATE contribution, with more effect on traffic collisions than we observed in the regression analysis.

Most of these studies that showed high effect levels were focused on very isolated locations directly where ATE cameras were present. In contrast, the analysis conducted for this review included collisions across all areas of a municipality, isolating the effect of ATE on overall driver behaviour, which showed more modest results.

COMPARISON TO OTHER ALBERTA STUDIES

A number of international and national studies were highlighted in the previous section, though there have also been a range of studies conducted in Alberta. These studies tend to resemble the location-specific studies seen in other jurisdictions. Overall, these studies show slightly lower levels of ATE effectiveness in Alberta than many studies referenced above, though still tend to show ATE contributing to overall traffic safety.

The earliest Alberta study referenced in the Literature Review report was from 2009 by Sayed and de Leur which evaluated 25 camera intersection sites to 47 control sites in Edmonton. The study found that site results varied significantly, with typical collision rate decreases anywhere from approximately 1% up to approximately 45%, though decreases were not universal. This study used a large number of control sites to better isolate the effect of ATE. The next study was conducted by AECOM which compared projected collision rates with observed collision rates for 46 intersections with ATE in Edmonton and Calgary. The study saw all collisions decline by 8.4%, with a higher reduction in severe collisions (32.4%). The most recent study was conducted in 2017 which looked at a relationship between key enforcement measures and speed related collision rates in Edmonton. The study estimated approximately 2-7% reduction in speed related collision from those enforcement indicators.

Overall, the results showed somewhat modest results when compared to earlier studies, but with a much broader scope in terms of device type and location.

RESULTS COMPARISON FOR OTHER TRAFFIC SAFETY OUTCOMES

The study also looked at the effect of ATE on other areas of traffic safety, including collision types and differences in terms of device type. There are similar challenges based on methodology differences of the study. However similarly to collision rates, while the observed ATE contributions are more modest, they are generally aligned with the findings of other studies. The findings compare in the following ways:

- Collision types – many studies focusing on intersection safety devices in the Literature Review report observed an increase in rear-end collisions and a decrease in side-angle (right-angle) collisions (when included in the analysis), which are often more severe collisions. The findings aligned with the research in that we observed that ATE is directly attributable to 11.3% of observed increases in the proportion of rear-end collisions, using a similar regression analysis to the prior analyses mentioned above. However, the analysis did not highlight any meaningful contribution for ATE on the change in proportion of side-angle collisions. This is a different result than what was observed in the Cochrane Review study looking at red-light cameras (Perkins et al 2017), which saw a decrease in side-angle collisions of 28% with the use of ATE. It is unclear what factors could be contributing to this difference in finding.
- Device types – In general, the Literature highlighted a difference in observed results between intersection devices, and in particular red-light cameras, and non-intersection speed-enforcement cameras. The intersection cameras showed increases in rear-end collisions and mixed results for overall collision rates. The study conducted regression analyses for the use of intersection devices and mobile photo radar

devices, compared to traffic safety collision outcomes (total collisions, collision severity, collision type). We observed results that aligned with the research findings for collision types: intersection devices were shown to contribute to increases in the proportion of rear-end collisions (13.1%), while mobile devices actually contributed to a 3.9% reduction in the proportion of rear-end collisions. Similarly, the regression analyses showed that mobile, speed-only devices had a stronger contribution to the reduction of overall collision rates (4.2%) compared to intersection safety devices or ATE as a whole. This pattern was also seen in the Literature Review where intersection safety devices, or red-light cameras, had mixed results on affecting collision rates compared to a strong consensus on mobile speed-enforcement devices contributing to reducing collision rates.

STUDY LIMITATIONS

The regression analyses used existing data from reported traffic collisions to determine the jurisdiction of the collisions, the severity of the collision and the type of collision, using the reported eCollision data from Alberta Transportation, which includes all reported collisions in the province. The data set covered 2007-2016. While this data set is very large, which is important for statistical reliability, there are some challenges with the cleanliness of the data, particularly regarding the locations of collisions. Data is inputted by reporting agencies, so errors in spelling and specific addresses are common. Data was cleansed for spelling at a municipal level, but it was not practical to clean and interpret specific address, coordinate or other location-related attributes of the reported collisions. It is unclear at this time what additional effects or contributions might be highlighted if more specific location or road section information were available. It is reasonable to expect that additional relationships between ATE and traffic safety could be explored with a cleaner data set with usable location data.

More details on the specific data, calculations and methodologies used can be seen in the supplemental Collision Data Analysis (Appendix D).

How do Albertans feel ATE has impacted traffic safety?

Albertans have mixed perceptions about whether ATE has made the roads safer, though they agree that ATE improves intersection safety where it is present, and that ATE fines contribute to improvements in their driving behaviour.

Albertan's perceptions can be divided into two main categories: perceptions on ATE's contribution to road safety and perceptions on ATE's impact on driver behavior.

PERCEPTIONS ON ATE'S CONTRIBUTION TO ROAD SAFETY

Public perception was nearly evenly split for whether photo radar or intersection safety devices (otherwise known as Intersection Safety Cameras [ISCs]) have contributed to improved overall safety outcomes in the last five years. This question was asked about road safety outcomes in general, as well as for reduced collisions in their municipality. Each question had similar split results, with a slightly larger number of Albertans "disagreeing" with the sentiments. Overall summary results from the supplemental Public Engagement Survey (Appendix F) are included below for each question:

Figure 2: *To what degree do you believe that photo radar/Intersection Safety Cameras have contributed to improved safety outcomes (reduced speeding, fewer collisions, better driver attention/behaviours) in the last five years.*

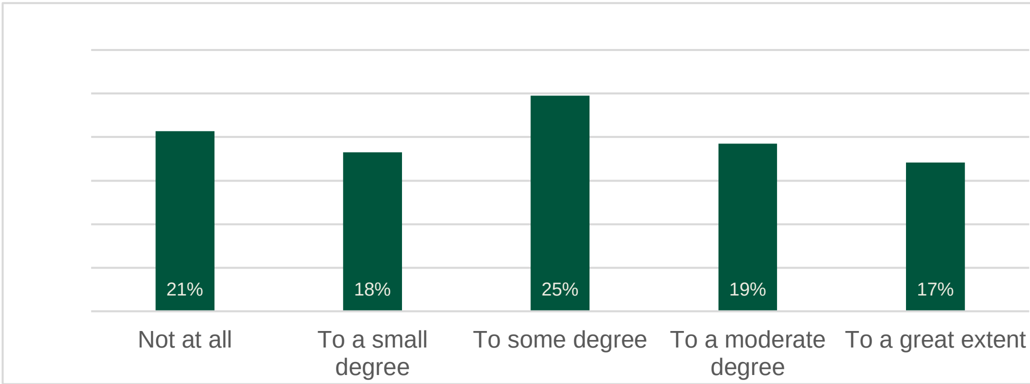
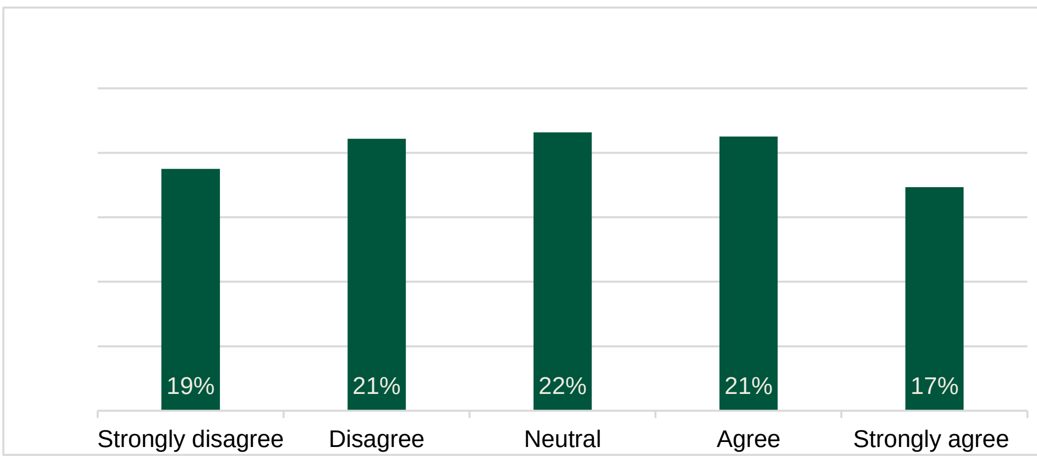
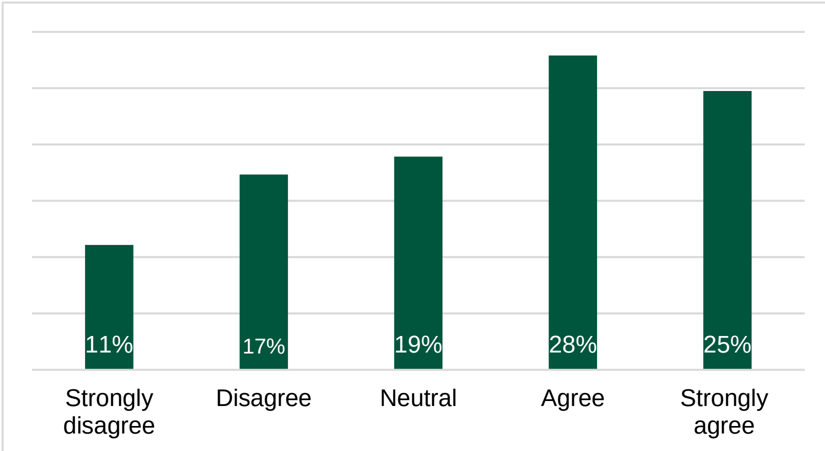


Figure 3: *In the past five years, photo radar/Intersection Safety Cameras have reduced collisions in my municipality in Alberta.*



Public perception was much more favourable to the effectiveness of intersection cameras making intersections safer, with a majority of respondents agreeing that ISCs that detect speeding make intersections safer.

__Figure 4:__ Intersection Safety Cameras (ISCs) that detect speeding make intersections safer.



PERCEPTIONS ON ATE CONTRIBUTION TO DRIVING BEHAVIOUR

Public perception was also more favourable to the idea that ATE altered their driving behaviour, with half of respondents agreeing that knowing they could receive an ATE violation, and that actually having received an ATE violation, has improved their personal driving behaviour.

__Figure 5:__ Knowing that I could receive an Automated Enforcement violation/fine has improved my own driving behaviour (reducing speeding, running red lights, etc.).

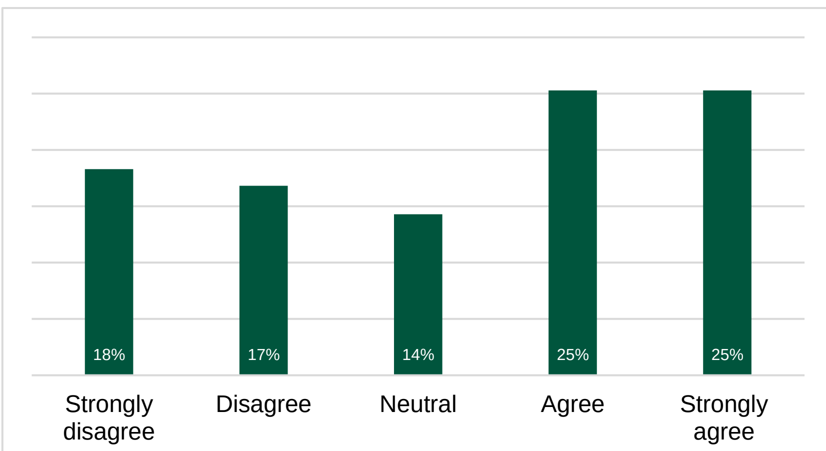
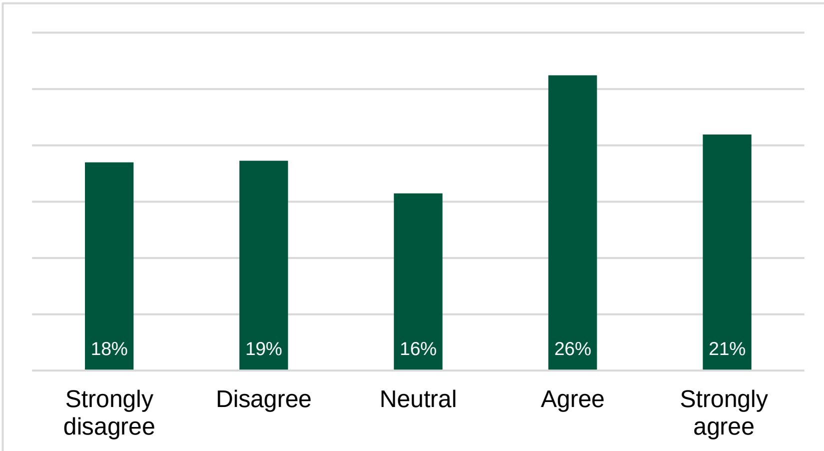


Figure 6: *Having received an Automated Enforcement violation/paid an ATE fine has improved my own driving behaviour (reducing speeding, running red lights, etc.).*



Traffic Safety Conclusions

On the whole, the data shows that ATE programs have an effect on traffic safety. As discussed, ATE has had a small contribution to traffic safety in the province, but is generally not being used in a way that maximizes traffic safety. Alberta is a leader in the use of ATE in terms of the breadth of use across municipalities of all sizes, the variety of device types used, and the intensity of use in terms of devices per capita. However, despite this high level of use, collision rates in Alberta have decreased at similar levels to other jurisdictions. Given the high level of ATE use in Alberta municipalities, it is reasonable to question why ATE use has not translated into higher levels of collision reduction, and what improvements could be made to Alberta's ATE program to maximize traffic safety outcomes.

Further, the analyses found no meaningful relationships between the location criteria (type or numbers) selected by municipalities to justify ATE and any traffic safety outcomes. This result provides additional evidence that the current provincial guidelines are not established in a manner that promotes ATE use to maximize traffic safety outcomes, even in cases of full municipal compliance.

In terms of the other safety findings of the ATE program review, the regression analysis isolated a direct contribution of ATE on the observed reduction in collision rates. The findings from this analysis showed that a 1.4% contribution to a reduction in collision rates, and a 5.3% of the observed reduction in the proportion of severe collisions, could be attributed to the use of ATE. These results are more modest than what is typically seen in other existing studies, though, as noted, the methodology and intent of the analysis was different than the intent of many other studies. The analysis was intended to isolate the effect of ATE on overall driving behaviour, compared to other studies which have generally examined collision rates and driving behaviour in a defined area where ATE is located.

As noted, there are several opportunities to enhance the current analysis to gain a better understanding of ATE's contributions to traffic safety. Additional research, data collection and analysis would be required to identify and isolate the wide range of potential traffic safety variables asides from ATE. Being able to isolate the relative contribution of all potential variables would provide additional insight on the relative value of ATE compared to other traffic safety investments and may highlight particularly effective combinations of traffic safety variables.

There is also an opportunity to enhance and clean the current eCollision data set to improve location information. There may be additional insights into driving behaviour around ATE in particular road types, intersection types, speeds, conditions, radius of driver change, and other potential factors that would provide insight to improving the safety effect of ATE enforcement and inform ATE location selection for municipalities to maximize safety outcomes.

More details on the data, calculations and methodologies used in the current analysis can be seen in the supplemental Collision Data Analysis (Appendix D).

REVENUE GENERATION

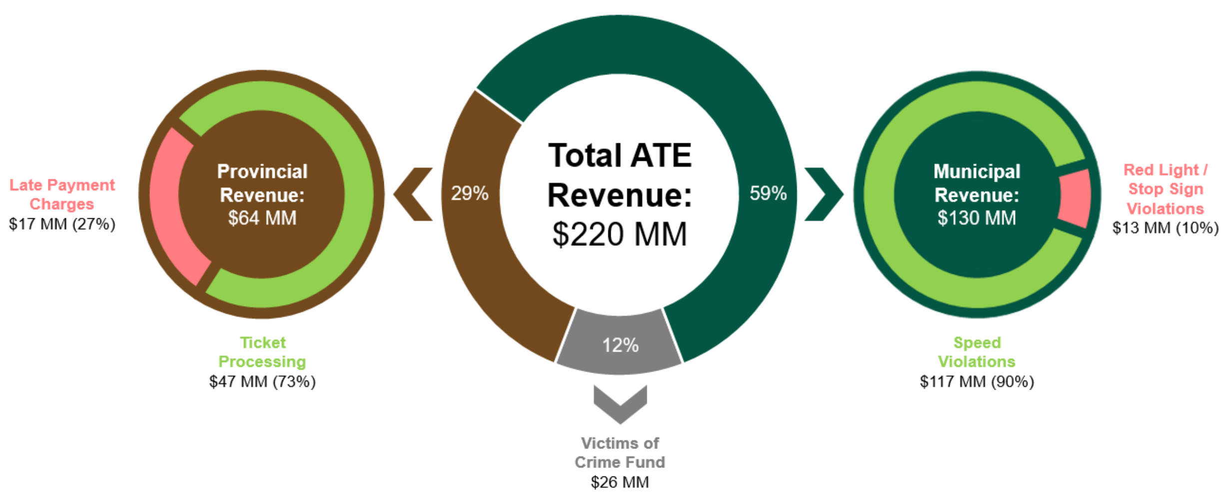
How much revenue is generated by each ATE program? Where is the revenue allocated? How is the revenue spent?

In total in the 2016-2017 calendar year, ATE programs in Alberta generated $220 million. Revenue is distributed into three streams: Victims of Crime Fund ($26M), municipal revenues ($130M), and provincial revenues ($64M). Municipalities receive ATE revenue into their general revenue fund. Municipalities have Traffic Safety Initiative expenditures over the same time period in which they have ATE revenue. Municipal budgeting and reporting is not currently required to demonstrate any linkage between ATE revenues and Traffic Safety Initiative expenditures.

Revenue Generation, Allocation, and Expenditure

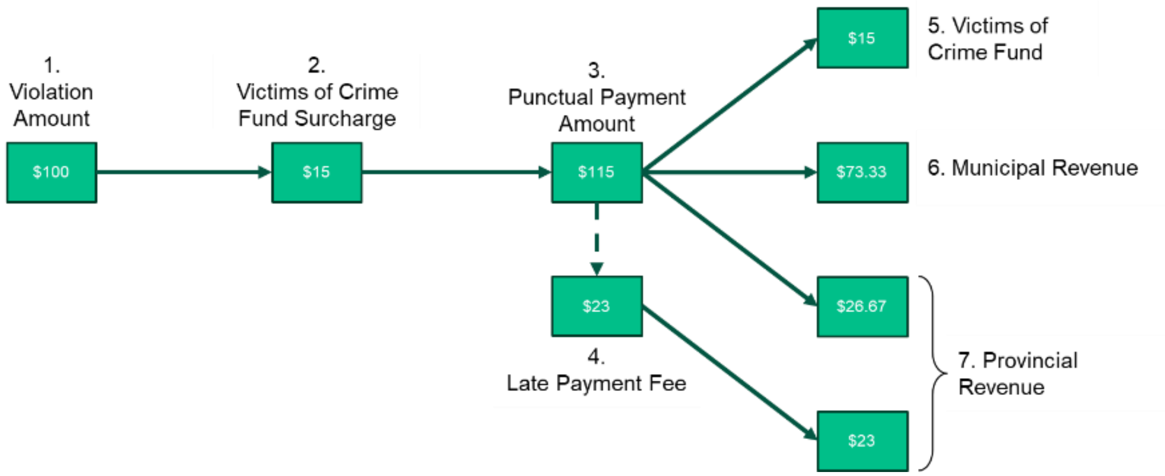
As part of the ATE program review, revenue data was collected from the Alberta Ministry of Justice and Solicitor General to gather insights into how much revenue is generated by each ATE program, where the revenue is allocated, and how the revenue is spent. In total in the 2016-2017 calendar year, ATE programs in Alberta generated $220 million. This revenue is allocated into three streams: Victims of Crime Fund (12%), municipal revenues (59%), and provincial revenues (29%). Of total ATE revenues, 90% were sourced from speed violations, with the remaining 10% coming from red light and stop sign violations. Provincial revenues were made up of ticket processing fees (73%) and late payment charges (27%), as denoted in Figure 7 below.

***Figure 7**: ATE Revenue Distribution*



In order to better understand how the above revenue is distributed, the following figure depicts how violation fines are calculated and distributed, based on a $100 violation ticket:

Figure 8: *ATE Violation Fine Disbursement Model ($100 Violation Ticket*)*



**Note: These values represent projected values, actual disbursement may vary based on limitations of data collection and accounting considerations.*

How ATE revenue is tracked and distributed within a municipality is not mandated by the Province. As a result, the majority of ATE revenues are received into general municipal revenues. Classifying municipalities into Metro, Urban, and Rural[1], ATE revenues make up 1.05%, 0.93%, and 2.02% of total municipal revenues, respectively.

At the municipal level, revenue generation was examined based on total revenue distributed to the municipality. It is important to note that this revenue represents only the amount distributed to the municipality (59%), not the total revenue generated from ATE devices in that municipality. Municipal revenues were compared with the amount and type of device in each municipality, and the total amount of ATE hours for each municipality. ATE hours were used as an equalizing measure between municipalities of significantly varying sizes in the data shown in Figure 9 below, as well as further calculations made throughout this review. On the whole, the average increase in revenues to municipalities from 2013-2016 was 11.5%.

[1]Where groupings are classified as the following: Metro (Edmonton and Calgary), Urban (Grande Prairie, Lethbridge, Lloydminster, Medicine Hat, and Red Deer), and Rural (all others, with the exception of the Regional Municipality of Wood Buffalo and Strathcona County, which were not included due to data anomalies).

Figure 9: *Revenue Distribution to Municipalities*

Municipality	Revenue	Number of Photo Radar Locations	Number of Red Light locations	Number of Speed on Green locations	Total ATE locations	Total ATE hours
Beaumont	$865,841.82	83	0	0	83	40,037.00
Calgary	$38,097,171.79	950	50	47	1047	2,686,043.00
Camrose	$554,982.69	78	0	n/a	78	53,490.00
Canmore	$632,057.00	56	0	0	56	43,374.00
Coaldale	$238,011.96	7	Not Available	Not Available	7	24,237.00
Cold Lake	$79,576.00	149	0	0	149	1,309.00
Devon	$1,123,193.60	47	0	0	47	60,333.00
Edmonton	$50,796,340.35	272	49	49	370	3,694,987.00
Edson	$1,597,479.92	32	0	0	32	107,477.00
Fort Saskatchewan	$2,210,740.50	39	7	7	53	190,516.00
Grande Prairie	$4,198,693.56	282	0	0	282	82,842.00
Hinton	$1,660,241.14	55	0	0	55	126,981.00
Leduc	$1,756,022.25	134	0	0	134	91,601.00
Lethbridge	$3,971,403.53	54	2	2	58	256,738.00
Lloydminster	$1,108,933.89	101	0	0	101	112,211.00
Medicine Hat	$2,367,039.39	162	0	0	162	317,100.00
Morinville	$443,355.20	51	0	0	51	9,245.00
Red Deer	$1,582,725.38	323	10	Not Available	333	185,558.00
Regional Municipality of Wood Buffalo	$2,219,253.22	138	8	Not Available	146	155,758.00
Slave Lake	$317,980.00	60	0	0	60	10,512.00
Spruce Grove	$5,157,458.56	115	0	0	115	272,805.00
St. Albert	$4,292,187.76	153	6	6	165	296,562.00
Stony Plain	$844,489.58	44	0	0	44	29,422.00
Strathcona County	Not Available	Not Available	10	10	Not Available	152,781.00
Taber	$444,650.32	5	Not Available	Not Available	5	29,749.00
Wainwright	$428,705.50	96	0	0	96	12,730.00
Wetaskiwin	$592,555.00	93	0	0	93	33,254.00
Whitecourt	$1,117,316.14	55	0	0	55	179,388.00

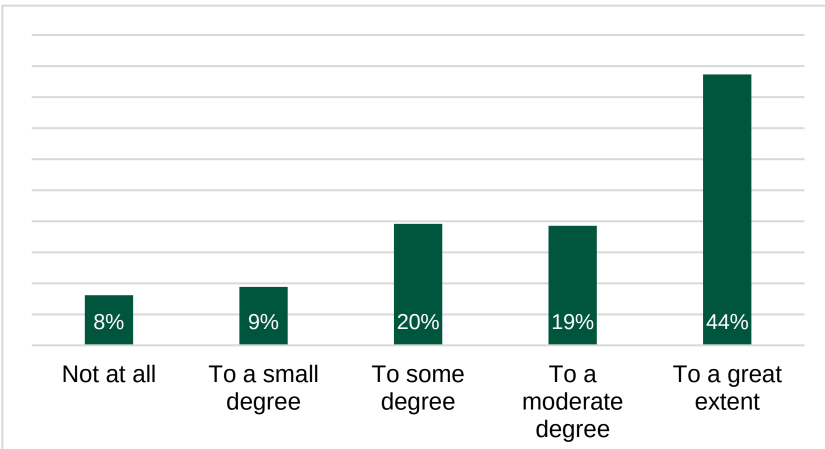
Perceptions of Revenue

In reviewing ATE programs as a revenue stream, in addition to provincial and municipal data, feedback from the public was collected and analyzed. Through a public opinion survey conducted of 1200 Albertans, 63% of respondents believed to a moderate or great extent that ATE is primarily focused on revenue generation as shown in Figure 10.

This, however, does not indicate that the public opposes the use of ATE to fine traffic violations, with the majority (>50%) of respondents agreeing or strongly agreeing to the statements:

1. Photo radar should be used to ticket drivers who are speeding on public roads in municipalities.
2. Intersection Safety Cameras (ISCs) should be used to ticket drivers who speed through intersections.
3. Intersection Safety Cameras (ISCs) should be used to ticket drivers who run red lights.

Figure 10: *To what degree do you believe that ATE is primarily focused on revenue generation?*



According to studies conducted in British Columbia (Chen 2000/2002/2005[2]), which completed a systematic review of photo radar across the province, public support of an ATE program can be garnered through fair site selection (where historically high collision rates have occurred), reasonable violation fines, and the allocation of ATE revenues to Traffic Safety Initiatives (TSIs[3]).

A common theme of the recommended program components is an ATE program that is perceived to be fair. The National Highway Traffic Safety Association guidelines – to be discussed in further detail further on in this document – recommend extensive communications efforts to inform the public as to where and why ATE is being

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[2]Chen, Greg. 2005. "Safety and Economic Impacts of Photo Radar Program". *Traffic Injury Prevention* 6(4): 299-307

Chen, Greg, Jean Wilson, Wayne Meckle, P. Cooper. 2000. "Evaluation of BC Photo Radar Program in British Columbia". *Accident Analysis and Prevention* 32(4): 517-526.

Chen, Greg, Wayne Meckle, Jean Wilson. 2002. "Speed and Safety Effect of Photo Radar Enforcement on a Highway Corridor in British Columbia". *Accident Analysis and Prevention* 34(2): 129-138.

[3]Where TSIs for this analysis are defined as: Traffic Enforcement, Staff Training, Signage, Traffic Calming Measures, and Public Education.

[4]National Highway Traffic Safety Administration. 2008. Speed Enforcement Camera Systems Operational Guidelines 15.

used[4]. In Alberta, the clarity of ATE programs to the public remains reportedly low, with 46% of Albertans disagreeing or strongly disagreeing that information is readily available to them on where ATE is or will be operated.

Reinvestment

Chen (2000/2002/2005) suggests that policy makers may overcome opposition to ATE programs more easily should revenues generated from ATE programs be used for TSIs, rather than general municipal or police revenues. When Albertans were asked in the public opinion survey what ATE revenues should be spent on, the majority (84%) of respondents selected various TSIs.

As there are no established revenue-tracking requirements for municipalities operating ATE programs, it is not possible to directly link the ATE revenue received by a municipality to its TSI expenditures. In addition to there being no framework to track ATE revenues, there is also no definition for what constitutes a TSI, making comparison across municipalities problematic. Expenditure information for this analysis was self-declared by municipalities, who have no specific criteria for reporting TSI expenditures. As a result, taking information from any one period in time does not accurately reflect a municipality's overall TSI investment. When comparing revenues and expenditures, the data available does not necessarily consider other reporting and accounting complexities, such as late or disputed ticket adjustments, capital expenditure reporting, and depreciation/amortization, making any analysis completed over a select period of time further limited in its reliability. Based on the data available, it can only be stated with certainty that municipalities generating ATE revenue also invested in TSIs within the same period.

Revenue Conclusions

When answering the question of revenue, the total in the 2016-2017 calendar year, ATE programs in Alberta generated $220 million, distributed to Victims of Crime Fund ($26 million), municipal revenues ($130 million), and provincial revenues ($64 million). The revenue data reported was inconsistent and did not allow for analysis to connect ATE revenues to TSI expenditures. As there are not current guidelines or policies in place to mandate how ATE revenue must be tracked or allocated, this analysis can only conclude that municipalities that received ATE revenue into their general revenue fund also had Traffic Safety Initiative investments over the same time.

In order to gain better insights into how ATE revenue is spent by municipalities, clear policy accepted by all parties outlining how ATE revenues must be tracked in a municipal budget and where the revenues are spent would be required. Additionally, this same policy, if the goal is to connect ATE revenue to TSI expenditure, must define what constitutes a TSI, and how it is to be reported, including but not limited to type of expenditure and capital investment financing. A clearly defined policy for ATE revenue tracking and TSI expenditure reporting would provide future researchers and analysts with the ability to more accurately link ATE revenues to TSI expenditures and compare between municipalities.

GUIDELINES REVIEW

Are Alberta municipalities which operate an ATE program compliant with the ATE Technology and Training Guidelines, and are the Guidelines effective?

The conclusion of the review is that all of the Alberta ATE Municipalities are compliant with the current Guidelines, and there are opportunities for improvement to the effectiveness of the Guidelines.

Guidelines Context

Unlike many of the Provinces and Territories in Canada, Alberta municipalities are supported by guidelines which govern their ATE programs. ATE has been used in varying capacities in Alberta for the past 30 years; it is legislated under the *Traffic Safety Act*, and photo radar guidelines were first established following legislative approval of photo radar and red-light camera use in 1999, with intersection speed cameras that measured speed on green following in 2009. In 2015, the percentage of revenue retained by the Province was increased, however, the revenue amount to municipalities did not decrease, as this change coincided with a 35% increase in violation amounts. As discussed in the previous section, the guidelines do not outline which type of account the municipalities must receive the revenue from the Province, nor the revenue distribution between the Victims of Crime Fund, the municipalities, and the Province.

The U.S. National Highway Traffic Safety Administration (NHTSA) has developed a set of operational guidelines for speed enforcement cameras and is considered leading practice. The NHTSA guidelines provide sound advice to governments: ensuring that red light cameras are used at high-risk intersections, being part of a broad and well-publicized road safety strategy, and ensuring they are constantly being evaluated will help to make roads safer. NHTSA also conducted a national survey of all jurisdictions using speed enforcement to measure the degree to which these principles have been followed.

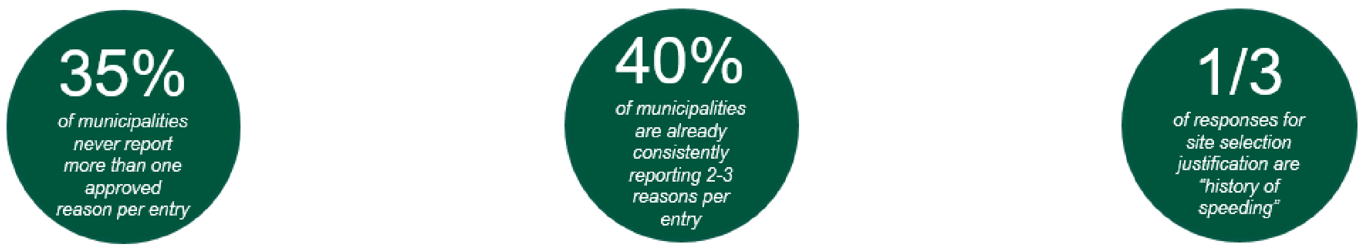
Audits

All Alberta municipalities that operate an ATE program are audited. The guidelines state that the Public Security Division, at the direction of the Minister of Justice and Solicitor General, may conduct audits to ensure compliance with the guidelines. As a majority of municipalities utilize peace officers, there may be additional related audits which are completed under the *Peace Officer Act*. Under the current guidelines there have been two audit cycles, the first completed in 2013/14 and the second completed in 2016/17. The audit reports have found areas for improvement in some municipalities, but through both audit cycles, all of the municipalities have been found to be compliant with the minimum requirements of the current guidelines.

Location Justification

It is important that safety remains the top priority of the ATE program. Sites should be those with the highest risk of collisions, injuries, and fatalities related to speed or red-light violations. Municipalities are required to submit quarterly reports according to Appendix A of the Technology Guidelines, which includes providing justification for each ATE device location. Justification options include Historical reasons (History of speeding, History of collisions, History of red lights violations), Subjective reasons (Areas of public concern, Conventional enforcement unsafe), and Situational reasons (School/playground zone, Construction zone, High speed multilane arteries). Analysis of the collision data and Municipal reports has shown that device deployment does not have any statistically significant link between the reason for device deployment (historical, subjective, or situational) and change in collision rate. Additionally, municipalities may report up to three choices although only one justification option selection is required. The number of choices selected also does not have any statistically significant link to the change in collision rates or the total collisions per capita. Findings of location justification in municipalities are highlighted below in Figure 11.

***Figure 11**: Location Justification Results*



Guidelines Conclusions

The Guidelines should inform Municipalities of revenue reporting requirements, to enable more definite future analysis. Defining and standardizing how municipalities report on their traffic safety investments would create a uniform understanding of what does and does not constitute a traffic safety investment. This along with standardized reporting requirements would enable accurate and comparable financial data amongst municipalities that operate ATE programs in Alberta. One mechanism to enact a new requirement could be to update Appendix A of Technology Guidelines for direction to municipalities on reporting requirements. All of the Alberta ATE Municipalities were asked if the current Guidelines create any barriers or issues – a common response was that increased clarity regarding specific expectations would be beneficial for governance and operation of the ATE programs.

More high-quality data would enable an increased ability to publish information for public consumption and awareness. Data entry should be improved to ensure cleaner eCollision data, with a focus on location data (i.e. address and GPS coordinates). This would allow for future analysis that includes ATE device deployment locations vs. collision locations in isolation and in aggregate to make a more definitive assessment of the effectiveness of ATE in real time and in the future. As seen in other jurisdictions with ATE programs that have been in existence for a longer period of time than Alberta's ATE program, there is opportunity in Alberta to enhance public awareness requirements on site locations, reason for site selection, and publishing traffic safety improvement results. Using improved data to create a baseline, and measuring and reporting differences over time would also contribute to both data-driven decision-making as well as evidence of desired outcomes that can be communicated to the public.

OPPORTUNITIES FOR IMPROVEMENT

Overall, this program review found that the ATE programs in operation in Alberta both generate revenue and have a measurable positive effect on traffic safety. While Alberta is a leader in program development and execution, there remains opportunity for improvement that would allow for future policy makers and/or reviewers to conduct more extensive analyses of the ATE program in Alberta.

Traffic Safety

Additional research, data collection and analysis would be required to identify and isolate the wide range of potential traffic safety variables asides from ATE. Being able to isolate the relative contribution of all potential variables would provide additional insight on the relative value of ATE compared to other traffic safety investments and may highlight particularly effective combinations of traffic safety variables.

There is also an opportunity to enhance and clean the current eCollision data set to improve location information. There may be additional insights into driving behaviour around ATE in particular road types, intersection types, speeds, conditions, radius of driver change, and other potential factors that would provide insight to improving the safety effect of ATE enforcement and inform ATE location selection for municipalities to maximize safety outcomes.

Revenue

In order to gain better insights into how revenue is spent by municipalities, clear policy outlining how ATE revenues must be tracked in a municipal budget and where the revenues are spent is required. Additionally, this same policy, if the goal is to connect ATE revenue to TSI expenditure, must define what constitutes a TSI, and how it is to be reported, including but not limited to type of expenditure and capital investment financing. A clearly defined policy for ATE revenue tracking and TSI expenditure reporting would enable future research and analysis the ability to more accurately link ATE revenues to TSI expenditures and compare amongst Alberta municipalities.

Guidelines

Defining and standardizing how municipalities report on their traffic safety investments would create a uniform understanding of what does and does not constitute a traffic safety investment. This along with standardized reporting requirements would enable accurate and comparable financial data amongst municipalities that operate ATE programs in Alberta. One mechanism to enact a new requirement could be to update Appendix A of Technology Guidelines for direction to municipalities on reporting requirements.

As seen in other jurisdictions with ATE programs that have been in existence longer, there is opportunity in Alberta to enhance public awareness requirements on site locations, reason for site selection, and publishing traffic safety improvement results. Using improved data to create a baseline and measuring and reporting differences over time also contributes to both data-driven decision-making as well as evidence of desired outcomes that can be communicated to the public.

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EXECUTIVE SUMMARY

MNP was engaged by Alberta Transportation to conduct a jurisdictional scan of Automated Traffic Enforcement (ATE) in Canada, and a select number of foreign jurisdictions. This jurisdictional scan covers the provinces and territories within Canada, as well as Australia, Hong Kong, New Zealand, Sweden, and the United Kingdom. The content in this report is focused on the types and amount of ATE devices used, and any notable ATE technology or practices used within these jurisdictions. This document summarizes the findings of this engagement.

When compared against other Canadian jurisdictions, Alberta is a leader in Automated Traffic Enforcement, both in breadth of use across province's municipalities and in variety of device types operated. Alberta municipalities are supported by the Automated Traffic Enforcement Technology Guidelines which permits the use of mobile photo radar units, as well as Intersection Safety Cameras (ISCs) equipped with Red Light Cameras (RLCs) and Speed on Green capabilities, unlike many of the provinces and territories in Canada[(5)]. Alberta has the highest per capita rate of ATE devices compared to other jurisdictions in Canada. There are, however, an increasing number of pilot programs, such as those in Saskatchewan, Manitoba, and Quebec, legislative reviews, such as the upcoming ATE revisions in Ontario, and installations of ATE technology in many provinces throughout Canada.

The international jurisdictions examined in this scan – Australia, New Zealand, Hong Kong, Sweden, and the United Kingdom – have common technologies, using mobile and fixed speed enforcement, as well as Red Light Cameras, Speed on Green Cameras, and other technology not used in Canada, discussed directly following. Australia has the highest number of ATE devices per capita, with approximately 31 devices per 100,000. Sweden (11), has the second highest rates, followed by the United Kingdom (4), Canada (3), Hong Kong (3), and New Zealand (2).

There are many automated methods and technologies being employed successfully throughout the world, acting as extensions, compliments, and alternatives to the operation of ATE:

- Fixed speed cameras are most often used as point-to-point cameras, which use two cameras to measure the average travelling speed of a car between two fixed points. The use of fixed speed enforcement, currently only in use within Canada in the province of Quebec, has proven effective in reducing speed and collisions in countries such as Australia, Hong Kong, New Zealand, Sweden, and the United Kingdom.
- Specifically for heavy trucking, Safe-T-Cams are used in Australia to monitor the speed, break and travel times, and check points of long-haul drivers[(64)].
- Intelligent Speed Adaptation technology, used and/or tested in varying capacities in Australia, Hong Kong, Sweden, the United Kingdom, and other countries, is a built-in system that transmits a vehicle's relative position against the speed limit where it is travelling, and either alerts the driver that he or she is speeding, or, in some cases, automatically lowers the speed of the vehicle.

Many Canadian provinces, including Alberta, publicly list online where mobile and ISC sites are located within the municipality; however, the nature and level of detail presented online varies by province. Moreover, there are varying levels for information available on why the ATE sites have been selected. In Saskatchewan, intersection choice is specified online, alongside statistics of historical collisions. British Columbia lists an average crashes per year per Red Light Camera location statistic (as photo radar is not operated in the province)[59]. Quebec reports violation statistics per location, alongside infraction data per location or device[42].

Of the Australian states examined, speed and RLC device locations are posted by the state governments, identifying the specific location and device type, and depending on the state, on a day to day basis for mobile speed enforcement[70].In the United Kingdom, this information is also posted, by municipality.

When compared to other jurisdictions, many Alberta municipalities do not have robust platforms for sharing ATE.

INTRODUCTION

Methodology and Scope

MNP was engaged by Alberta Transportation to conduct a jurisdictional scan of Automated Traffic Enforcement (ATE) in Canadian provinces and territories, and a select number of foreign jurisdictions. The purpose of this engagement was to research and report findings on the types and amounts of ATE devices, and any associated practices or technologies, within the specified jurisdictions. Tables 1 through 3 of this report represent the agreed upon jurisdictions to report ATE information and statistics.

Online research, electronic, and telephone communication were used to acquire the report findings. The following information includes the extent of publicly available information on ATE and related content for the respective jurisdictions.

Appendix I, following the body of this report, states the municipalities included in the data presented in the "Alberta" categories of Tables 1 and 2. Appendix II lists a summary of the findings in this report, inclusive of statistics, legislation, and other notable information. Appendix III provides the references and sources for this report.

Devices to Be Discussed

As shown below in Table 1, there are four primary devices examined in this report. For consistency, the term "photo radar" will be used to include speed detection and enforcement devices using photo radar, as well as other forms of similar technology (e.g. LIDAR etc.). Therefore, devices are defined as the following:

- **Mobile Photo Radar**: A photo radar (or equivalent purpose) device that can be moved and can operate in multiple locations and is used for speed enforcement.
- **Fixed Photo Radar**: A photo radar (or equivalent purpose) device that is permanent placed and operated in one location and is used for speed enforcement.
- **Red Light Camera**: A fixed Intersection Safety Camera that records vehicle offence information for drivers that pass through an intersection on a red light.
- **Speed on Green Camera**: A fixed Intersection Safety Camera that records vehicle offence information drivers that pass through an intersection at a speed above the posted limit.

The following report findings address the number of devices in each jurisdiction, unless otherwise specified. Therefore, a jurisdiction is listed to have "15 Mobile Photo Radar" indicates that the jurisdiction owns and/or operates 15 devices. These 15 units can be operated at multiple sites or locations, specific to the municipality, which is not focused on in this report.

Summary of Findings

Table 1 presents a visual summary of report findings, and is discussed in detail later in this report.

TABLE 1: SUMMARY OF JURISDICTIONAL FINDINGS - DEVICES

CANADA	Photo Radar*		Intersection Safety Cameras		Other Notable Technology or Methods
	Number of Fixed Devices	Number of Mobile Devices	Number of Red Light Devices	Number of Speed on Green Devices	
British Columbia	○	○	◕	◕	
Alberta	○	◑	●	●	Highway Air Patrol
Saskatchewan	○	◔	◔	○	
Manitoba	○	◔	◑	◑	
Ontario	○	○	●	○	Highway Air Patrol
Quebec	◔	◔	◔	◔	

New Brunswick, Nova Scotia, PEI, Newfoundland and Labrador, Yukon, Northwest Territories, and Nunavut do not use any form of Automated Traffic Enforcement.

INTERNATIONAL	Photo Radar*		Intersection Safety Cameras		Other Notable Technology or Methods
	Number of Fixed Devices	Number of Mobile Devices	Number of Red Light Devices	Number of Speed on Green Devices	
Australia	●	●	●	●	STCs, ASC, & ISA**
Hong Kong	◔	◔	●	●	
New Zealand	◔	◔	◔	◔	
Sweden	●	●	○	●	ASC & ISA
United Kingdom	●	●	●	●	ASC & ISA
Canada	◔	●	●	●	Highway Air Patrol

**Or equivalent speed enforcement devices, as defined.*
***STC: Safe-T-Cam (long-haul trucking compliance network), ASC: Average Speed Cameras, ISA: Intelligent Speed Adaptation*

Legend: ○ No ATE; ◔ 0-49; ◑ 50-99; ◕ 100-149; ● 150+

When compared against other Canadian jurisdictions, Alberta is a leader in Automated Traffic Enforcement, both in breadth of use across province's municipalities and in variety of device types operated. Alberta municipalities are supported by the Automated Traffic Enforcement Technology Guidelines which permits the use of mobile photo radar units, as well as Intersection Safety Cameras (ISCs) equipped with Red Light Cameras (RLCs) and Speed on Green capabilities, unlike many of the provinces and territories in Canada(5). Alberta has the highest per capita rate of ATE devices compared to the rest of Canada. There are, however, an increasing number of pilot programs, such as those in Saskatchewan, Manitoba, and Quebec, legislative reviews, such as the upcoming ATE revisions in Ontario, and installations of ATE technology in many provinces throughout Canada.

Internationally, within the scope of the jurisdictional scan, Australia, Sweden, and the United Kingdom have implemented extensive and advanced traffic safety technology including long-haul driver monitoring systems, responsible traffic design, and federally funded partnerships with local authorities, respectively. Please see "Summary of International Scan Data" and "Notable Practices and Technology" for further details.

There are many methods and technologies being employed successfully throughout the world, acting as extensions, compliments, and alternatives to the operation of ATE. These methods and technologies will be discussed further, by jurisdiction, throughout this report.

TABLE 2: CANADIAN JURISDICTIONAL SCAN DATA

CANADA	Years in Operation	Photo Radar		Intersection Safety Devices		Number of ATE Devices per Capita (per 100,000)****
		Number of Fixed Devices	Number of Mobile Devices	Number of Red Light Devices	Number of Speed on Green Devices	
British Columbia	22	N/A	N/A	140	140	3.0
Alberta*	30**	N/A	80	161	161	10.0
Saskatchewan	19	N/A	11	7	N/A	1.6
Manitoba	15	N/A	10	51	51	3.0
Ontario	25	N/A	N/A	246***	N/A	1.8
Quebec	9	23	12	19	10	0.7
New Brunswick, Nova Scotia, PEI, Newfoundland and Labrador, Yukon, Northwest Territories, and Nunavut do not use any form of Automated Traffic Enforcement.						
Total	**(Avg.): 20**	**23**	**113**	**624**	**362**	**(Avg.): 3.4**

**Inclusive of municipalities listed in Appendix I.*
***Information provided from the Calgary Police Service.*
***Inclusive of: Toronto, York, Peel, Halton, Ottawa, Hamilton, and Waterloo regions.*
****Population data based on 2018 Q1 Statistics Canada reports.*

SUMMARY OF CANADIAN JURISDICTIONAL SCAN

British Columbia

British Columbia implemented a photo radar program in 1996, lasting until 2001, when it was disbanded in favour of traditional enforcement methods after a change in provincial leadership[(33)]. The province currently operates exclusively RLCs, with 140 cameras in 26 communities since their implementation in 1999[(38)]. The types of red light devices permitted within the province are specified in the Motor Vehicle Act, under Division 41: Speed Monitoring and Traffic Light Safety[(37).] RLCs are operated jointly between RCMP, ICBC, and the Ministry of Public Safety and Solicitor General of British Columbia[(18)].

Alberta

ATE has been used in varying capacities in Alberta for the past 30 years, with legal guidelines in place for the past 19 years[(46)]. Photo radar guidelines were first established following legislative approval of photo radar and RLC use in 1999, with ISCs that measured Speed on Green following in 2009[(28)]. ATE in Alberta is legislated under the *Traffic Safety Act*[(80)]. The types and number of ATE devices in Alberta municipalities are widely varied and include mobile photo radar, Red Light and Speed on Green ISCs. A study conducted by AECOM on behalf of Alberta Transportation in 2014 evaluated the effects of ISCs on intersection safety. This study found that "ISCs have a statistically significant impact on the frequency, severity, property damage only, angle, and rear end collisions"[(28)].

Many smaller municipalities have used or currently use third party contractors operating mobile radar devices to enforce speed limits, often with a set schedule of active photo radar hours. Alberta does not use ATE on provincial highways[(5)]. These technologies are governed by the Automated Traffic Enforcement Technology Guidelines, published by Alberta Justice and Solicitor General, which specifies their conditions of use based on Traffic Safety Criteria. While not a finite list, the guidelines state that use of ATE should be determined by high-risk, high-frequency, high collision, or high-pedestrian volume locations[(5)]. The Guidelines also specify public notice requirements such as signage, advertisements with local media, a "familiarization" period, and ongoing notification of existing sites[(5)].

Per capita, Alberta has the highest usage of ATE devices in Canada, as presented in Table 2. Against international jurisdictions, Alberta is comparable with Sweden, a world leader in traffic safety, both with approximately 10 devices per 100,000 people. Alberta is only surpassed by Australia, which has an average of over 31 ATE devices per 100,000 people.

Saskatchewan

Saskatchewan began a pilot program on photo speed enforcement in 2014, with the first camera site beginning operation in November 2014, in Moose Jaw[(45)]. Active ticketing for the pilot began in March, 2015[(45)]. Photo speed enforcement sites were selected based on high speed, high traffic volume, and high risk locations, such as school zones, construction zones, and major intersections[(45)]. Photo radar use is limited to mobile devices, which are rotated through a set number of specified locations. RLCs are implemented at the municipal level, and are currently operated in Regina[(79)] and Saskatoon[(50)], with four in each city. RLCs have been used in the province since 1999[(12)].

The focus of Saskatchewan's pilot program is on improving road safety and reducing collision deaths. As a result, photo radar locations are marked with signage, as mandated by provincial regulations, and posted online, where Saskatchewan Government Insurance posts a comprehensive breakdown of all site locations, alongside details and results of the pilot program[(73,45)]. The three high-speed locations of the pilot have seen a decrease in speed violations between 47 and 79 percent between January 2015 and

January 2018[65,66]. While the pilot program was specified to last two years, the program has since been extended and speed enforcement remains classified as the "Speed Enforcement Pilot"[65]

Speed is enforced separately on provincial highways, though both municipal and provincial ATE use is regulated by the Chapter T-18.1 under the *Traffic Safety Act* (The Traffic Safety [Speed Monitoring] Regulations)[73].

Manitoba

Under the current *Highway Traffic Act,* only the City of Winnipeg is permitted to use ATE in Manitoba. Photo radar use is limited to ten mobile devices that enforce speed in playground, construction, and school zones[25]. ISCs are also permitted for use within the City of Winnipeg[25]. The specifics ISCs that enforce running red lights and speeding on green violations at 51 sites throughout the city, with any 33 active at a given time[44]. In an evaluation of the program from 2008-2011, The Traffic Injury Research Foundation found that at sites where ISCs had been installed, there was a 24 percent decrease in injury crashes and a 13 percent decrease in property damage crashes[19]. The location of active cameras is posted on the Winnipeg Police Service website. The City of Winnipeg Photo Enforcement Safety Program has been in effect since 2003[44].

Ontario

Ontario began a pilot program for photo radar in 1993, but the program was removed from provincial legislation in 1995[1]. RLCs are permitted in only select municipalities in Ontario, with approximately 230 locations throughout the Toronto[51], York[53], Peel[22], Halton[54], Ottawa[49], Hamilton[48], and Waterloo[52] regions, legislated under Bill 20 of the *Red Light Camera Act*, 1998 (An Amendment to the *Highway Traffic Act*)[7]. The Act legislates the use of ATE in the designated municipalities mentioned, with locations determined by the municipalities themselves. Under the Red Light Camera Processing Centre Agreement, the above municipalities have agreed, in accordance with the Ministry of Transportation, to post signage at each leg of the an intersection controlled by a RLC[29].

The *Safer Schools Act, 2017 (Bill 65)* has since been passed in 2017, and will come into force upon proclamation by the Lieutenant Governor[8]. This act amends the use of "photo radar" within the Act, replacing it with the broader wording "Automated Traffic Enforcement". The Act then sanctions the use of ATE by municipalities, subject to the constraints that the speed limit of a road system is less than 80km/h or considered a school zone[8].

Quebec

Quebec implemented ATE in the province in two phases. The first acquisition phase was in 2009, consisting of three mobile speed devices, five exclusively red-light cameras, one red light and Speed on Green combined, and six fixed speed devices[15]. Directly following in 2010, a pilot program was launched in three areas of Quebec (Montréal, Montérégie, and Chaudière-Appalaches) that reflected major volume and traffic concerns[47]. The evaluation of the pilot project, conducted by Transports Quebec, reported "[a 20-30 percent reduction in collisions for all ATE device types]"[47]. At intersections with RLCs, there was a net decrease of total collisions, with a particular decrease of side angle collisions[46]. However, these same intersections also saw an increase in rear-end collisions[47]. After the evaluation of the pilot program, the second acquisition phase took place in 2015, adding an additional six fixed speed devices, 13 red-light devices, nine of which are combined with Speed on Green devices, and 21 mobile speed devices[15]. These totals are current as of April 2018[15].

Usage of ATE devices in Quebec are ultimately overseen by Transports Quebec, and are specified by the legislation "Projet de loi no 57 Loi modifiant l'encadrement de l'utilisation des cinémomètres photographiques et des systèmes photographiques de contrôle de circulation aux feux rouges et d'autres dispositions législatives''[1], under the *Code de la sécurité routière*[32,13]. This legislation requires that all public roads equipped with ATE must be accurately signed with the device type active in the area[13].

All Other Provinces/Territories:

The provinces of New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador, as well as the Northwest Territories, Yukon, and Nunavut do not currently use any form of ATE.

SUMMARY OF INTERNATIONAL JURISDICTIONAL SCAN

TABLE 3: INTERNATIONAL JURISDICTIONAL SCAN DATA

INTERNATIONAL	Years in Operation	Number of ATE Devices	Total Devices per Capita (per 100,000)**
Australia	~33	7,585*	31.4
Hong Kong	25	236	2.7
New Zealand	25	60	1.9
Sweden	28	1,100	11.1
United Kingdom	27	2,838	4.3
Canada	30	1,122	3.1

**Total number is approximate and inclusive of: Western Australia, South Australia, New South Wales, Queensland, and Victoria.*
***Population data based on World Bank 2017 Statistics.*

Australia

RLCs have been used in Australia since the 1980s, with speed enforcement beginning in the late 1990s. The data represented in Table 3 is inclusive of five of the six Australian states, which make up the mainland territory: New South Wales[14], South Australia[6,75], Western Australia[6], Queensland[16], and Victoria[10]. Australian ATE is governed at the state level, with state police implementing their own operating practices and compliance regulations (i.e. New South Wales - *The Road Transport Act 2018* No. 18)[17]. On a per capita basis, Australia has three times the rate of ATE enforcement than Sweden, the next most-enforced jurisdiction.

Hong Kong

Hong Kong has used ATE for 25 years. RLCs were implemented in 1993, with speed enforcement following in 1999[81]. Following installation, rates of excessive speeding and red light offences were reduced substantially[81]. In 2003, Hong Kong introduced digital technology for all 195 RLCs, and as of 2016, Hong Kong had 125 digital speed camera sites in operation[81]. As seen in Table 1, Hong Kong

[1] Approximate translation: Bill 57: Law modifying the framework of the usage of photo radar devices and Intersection Safety Camera devices, and other legislative provisions.

employs all forms of automated traffic enforcement, and presently operates 39 speed enforcement devices and 197 RLCs. The Hong Kong Department of Transport reported that “for speed enforcement camera systems… there was a 50 percent reduction in the number of vehicles in excess of the speed limit by 15 kilometres per hours, and a 40 percent reduction in the number of traffic accidents involving injuries”[(81)].

The operational guidelines and technology specifications of ATE in Hong Kong are included in Chapter 2 of the Administration of Road Safety Measures, published jointly by the Transport and Housing Bureau, the Transport Department, Hong Kong Police Force, and the Information Services Department[(2)].

New Zealand

New Zealand’s ATE program is run by the New Zealand Police, and has been in effect since 1993[(41)]. New Zealand operates RLCs, as well as fixed and mobile speed cameras[(41)]. Under the 2016-2020 Road Policing Action Plan, aligned with the national Safer Journeys road safety programme, enforcement of speed is defined as “use of automated cameras, hand held cameras, enforcement demerits, and driving to the road conditions”[(58)]. The associated legislation is included in the *Land Transport Act 1998* (Approved Vehicle Surveillance Equipment Notice 2017)[(30)]. Regulations of this legislation state that any additions of ATE must be published in the New Zealand *Gazette* to notify the public, and that mobile enforcement units are required to be parked legally, and in plain site[(30)].

Since implementation of ATE, New Zealand has seen a 23 percent decrease in road fatalities/serious injuries in urban areas, and an 11 percent decrease in rural areas[(63)].

Sweden

Sweden began trial use of ATE for the first time in 1990[(39)]. As of 2014, Sweden had 1,100 speed enforcement cameras operating throughout the country as shown in Table 3, with plans to add 2,000 more by 2025[(71).] There are no RLCs in Sweden[(20)]. Speeding violations in Sweden are tied directly to the driver, as cameras not only photograph the vehicle, but the driver as well, comparing the captured image to government records[(71)]. Public approval of ATE use in Sweden as of 2014 was between 75 and 80 percent[(71)]. This, combined with high compliance rates, indicate that drivers are aware and influenced by ATE.

ATE is regulated by the Trafikverket (Swedish Transport Administration) which oversees the Automatic Traffic Control system (ATK), administered by the Swedish Transport Administration and the Swedish Police[(4)].

United Kingdom

The United Kingdom has used forms of ATE for 27 years, using mobile, fixed, and average speed cameras. There are approximately 2,800 ATE devices in the United Kingdom, as presented in Table 3[(23)]. ATE is regulated *Road Safety Act,* the *Road Traffic Act 1991* (Sections 23 and 40) and the *Highways Act 1980* and partially funded by grants to eligible municipalities by the Department for Transport[(60, 72)]. The Road Traffic Regulation Act requires that signage is posted in the area monitored by ATE devices, and that fixed device housings are painted yellow to ensure driver visibility[(60)].Enforcement of the United Kingdom’s National Safety Camera Programme is carried out in partnership with local police, government authorities, Magistrates’ Courts, and the Highways Agency[(24)]. According to a study conducted by the London School of Economics and Political Science "from 1992 to 2016, speed cameras reduced accidents by between 17 to 39 per cent and fatalities by between 58 to 68 percent within 500 metres of the cameras” in the United Kingdom[(68)].

NOTABLE PRACTICES AND TECHNOLOGY

Practices

Public Awareness

Many Canadian provinces, including Alberta, publicly list online where mobile and ISC sites are located within the municipality; however, the nature and level of detail presented online varies by province. Moreover, there are varying levels for information available on why the ATE sites have been selected.

In Saskatchewan, intersection choice is specified online, alongside statistics of historical collisions, as mentioned above(65,66). British Columbia lists an average crashes per year value per RLC location (as photo radar is not operated in the province)(59).

Quebec reports violation statistics per location, alongside infraction data per location or device(42). The province incorporated public acceptance of ATE as part of the its 2010 pilot program(47). The pilot discovered that over 80 percent of the surveyed public supported the use of ATE devices, should they be installed in locations with a history of accidents(47).

Of the Australian states examined, speed and RLC device locations are posted by the state governments, identifying the specific location and device type, and depending on the state, on a day to day basis for mobile speed enforcement(70). In the United Kingdom, this information is also posted, by municipality.

When compared to other jurisdictions, many of Alberta municipalities do not have robust platforms for sharing ATE information with the public.

Technology

Point-to-Point Cameras

Point-to-Point cameras are any two devices that measure some aspect traffic behaviour from one designated point to another. Average Speed Cameras, a type of Point-to-Point camera, measure and record the time a car passes across a certain point, until the time it passes a second point. These two indication points can use sensors, in addition to cameras, to track the vehicle from the start to the end of a set distance interval (Figure 1) or two sets of cameras that use the time-stamps of the two vehicle images (Figure 2) for speed calculations. The driver's time is then calculated between the two points, resulting in the determination of an average travelling speed. Every photograph taken of passing vehicles is run against a digital registration database. Should the average speed be higher than that of the posted limit, a ticket is issued. Average Speed Cameras are used in many parts of the world, including Australia, Sweden, and the United Kingdom.

Another form of Point-to-Point enforcement called Air Patrol is commonly used for speed enforcement on Alberta and Ontario highways. This system, not

FIGURE 1: DEPICTION OF SENSOR-BASED ASCs(47).

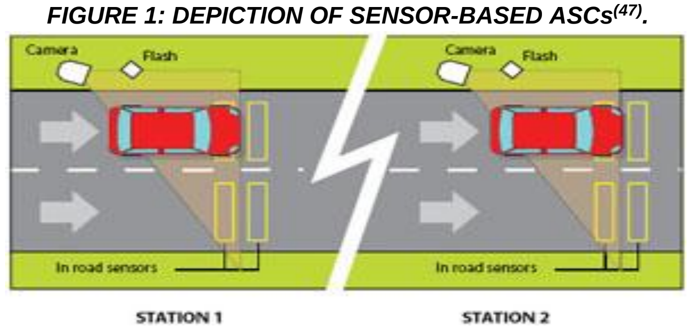
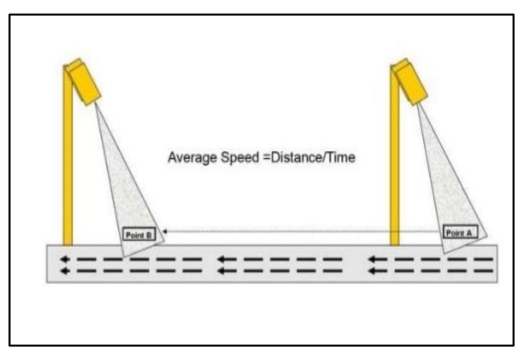


FIGURE 2: DEPICTION OF IMAGE-BASED ASCs(3).

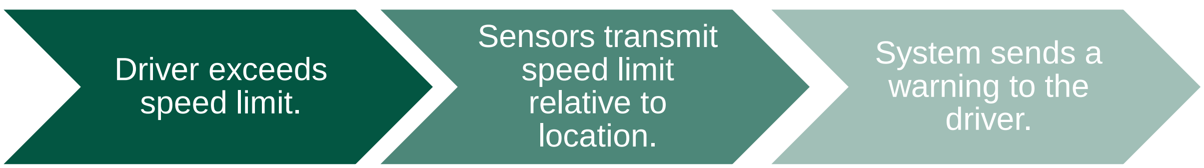


considered a form of automatic speed enforcement due to the necessity of accompanying manned ground enforcement, uses aircraft to calculate a vehicle's average speed between two marked points on the road. The calculated vehicle speed and information is then transmitted to a ground enforcement vehicle.

Intelligent Speed Adaptation

Intelligent Speed Adaptation (ISA), introduced in Australia, the United Kingdom, Sweden, and other countries, is an automated device used to either alert the driver that they are speeding, or forcibly lower the vehicle's speed[(56)]. These two types of devices fall into one of two categories: speed alerting or speed limiting[(56)]. Speed altering systems are designed to notify the driver that he/she is speeding using visual and auditory alerts, or through exerting upward pressure on the accelerator. Speed limiting devices prevent the driver from exceeding the speed limit[(56)]. Using transmitters or GPS, these devices continually monitor the vehicle's relative position, calculating a speed and comparing it to the speed limit for that position[(56)]. If the driver exceeds the speed limit, warnings, or other pre-set means of notification, alert the driver. ISA device systems can be downloaded to select GPS systems within a vehicle[(56)].

FIGURE 3: THE STAGES OF AN ISA SYSTEM.



Safe-T-Cameras

Safe-T-Cams are used in Australia to monitor heavy vehicle transport on major roadways. This digital camera network is used to detect unregistered or uninsured drivers, and to ensure that long-haul drivers take the required number of breaks and enter inspection areas[(64)]. Targeted at improving road safety and heavy vehicle driver compliance, this system has seen a 91 percent reduction in speeding offences and 57 percent decrease in fatal crashes against the previous year in New South Wales alone[(35)].

Violation Fine Alternatives

In the United Kingdom, one in three drivers are fined and over 12 million drivers receive penalty notices (fine and demerit points) annually[(40)]. Due to the prevalence of speeding, the National Speed Awareness Course (NSAC) was established as an alternative to receiving demerits and/or fines[(38,40)]. This program is a national scheme first implemented in 2007, having since reached 1.2 million course participants as of 2017[(26)]. The NSAC "was not designed to reduce the incidence of collisions" but rather "participation in the course may lead to indirect road safety benefits of this nature"[(26)]. Ipsos MORI and the Institute for Transport Studies with the University of Leeds published a study in May 2018 evaluating the impact of the NSAC that concluded the course had a greater effect on reducing speed reoffending than penalties that required a fine and demerit points ("for the types of drivers offered the course")[(26)].

APPENDICES

Appendix I: Alberta Municipalities Accounted for in ATE Data

Municipality	
Calgary	Lloydminster
Camrose	Medicine Hat
Canmore	Morinville
Coaldale	Red Deer
Devon	Regional Municipality of Wood Buffalo
Edmonton	Slave Lake
Edson	Spruce Grove
Fort Saskatchewan	St. Albert
Grande Prairie	Strathcona County
Hinton	Taber
Leduc	Wetaskawin
Lethbridge	Whitecourt

Appendix B: Summary of Data Table

Jurisdiction	Years in Operation	Photo Radar		Intersection Safety Cameras		Total ATE Devices	Operational Governing Body	Number of Municipalities using ATE	Highway Use	Legislation	Regulating Body	Public Awareness Requirements	Notable Technology/Practices	Reported Evaluations
		Fixed	Mobile	Red Light Camera	Speed on Green Camera									
British Columbia	22	0	0	140	140	280	Provincial	11	No	*Motor Vehicle Act* Division 41 - Speed Monitoring and Traffic Light Safety[37]	Policing and Security Branch's Road Safety Unit; Insurance Corporation of British Columbia[18]	Not Specified	N/A	N/A
Alberta	30	0	80	161	161	402	Municipal	28	No	*Traffic Safety Act* Revised Statutes of Alberta 2000 Chapter T-6[80]	Alberta Justice and Solicitor General[5]	Under the Automated Traffic Enforcement Technology Guidelines, the following are required: 1) Signage 2) Advertising in the local media advising of the new ATE program and a four-week "farmiliarizaition period" that isses "warning notices" to drivers 3) Existing ATE technology sites must be advertised on a monthly basis by "notifying the local media and posting on an established website, where possible".[5]	Highway Air Patrol (Non-ATE Speed Enforcement)	A study conducted by AECOM on behalf of Alberta Transportation in 2014 evaluated the effects of ISCs on intersection safety. This study found that "ISCs have a statistically significant impact on the frequency, severity, property damage only, angle, and rear end collisions"[28].
Saskatchewan	19	0	11	7	0	18	Provincial	3	Yes (Workzones)	*Traffic Safety Act* T-18.1 Reg 10 - The Traffic Safety (Speed Monitoring) Regulations[73].	Saskatchewan Government Insurance	The Regulations state that: "A speed monitored zone must have official signs in each direction of travel indicating that a speed monitoring device is being used to measure and recorded the speed of the vehicles"[73].	N/A	The three high-speed locations of the automated traffic enforcement pilot have seen a decrease in speed violations between 47 and 79 percent between January 2015 and January 2018[65,66].
Manitoba	15	0	10	51	51	112	Municipal	1	Yes (Workzones)	*Highway Traffic Act Image Capturing Enforcement Regulation 200/2002*[25].	Manitoba Justice	Not Specified	N/A	In an evaluation of the program from 2008-2011, it was found that at sites where ISCs had been installed, there was a 24 percent decrease in injury crashes and a 13 percent decrease in property damage crashes[19].
Ontario	25	0	0	246	0	246	Municipal	6	No	Bill 20, *Red Light Camera Act*, 1998 (An Amendment to the *Highway Traffic Act*); Ontario Regulation 277/99 Red Light Camera System Evidence[7]	Ontario Ministry of Transporation; Ministry of the Attorney General[29]	Under the Red Light Camera Processing Centre Agreement (with the Ministry of Transportation), approved municipalities are required to post signage at each leg of the intersection controlled by a Red Light Camera[29].	Highway Air Patrol (Non-ATE Speed Enforcement)	N/A
Quebec	9	23	12	19	10	64	Provincial	8	Yes	*Code de la sécurité routière* - Projet de loi No57: Loi modifiant l'encadrement de l'utilisation des cinemometres photographiques de controle de circulation aux feux rouges et d'autres dispositions legislatives**[13,32]	Transports Quebec	All public roads equipped with ATE have device-type-specific signage, as per section 294.1 of the Code de la sécurité routière[13].	N/A	The evaluation of the pilot project, conducted by Transports Quebec, reported "[a 20-30 percent reduction in collisions for all ATE device types]"[47].
Canada	25	23	113	624	362	1122	N/A	57	N/A	N/A	N/A	N/A	N/A	N/A

** *Approximate translation: Bill 57: Law modifying the framework of the usage of photo radar devices and Intersection Safety Camera devices, and other legislative provisions*

Jurisdiction	Years in Operation	Photo Radar		Intersection Safety Cameras		Total ATE Devices	Operational Governing Body	Number of Municipalities using ATE	Highway Use	Legislation	Regulating Body	Public Awareness Requirements	Notable Technology/Practices	Reported Evaluations
		Fixed	Mobile	Red Light Camera	Speed on Green Camera									
Australia	~33	Not Specified	Not Specified	Not Specified	Not Specified	7585*	State	N/A	Yes	Dependent on State. Sample legislation: New South Wales: *Road Transport Act 2013 No18* - Division 4: Approval of Traffic Enforcement Devices; South Australia: *Road Traffic Act 1961* - 30.4.2018 Division 7: Photographic Detection Devices; Western Australia: *Road Traffic (Administration) Act 2008; Road Safety (General) Regulation 2009*	Varies by state.	Varies by state. Following approval to use ATE devices from the Minister of Police, the body implementing the ATE device must publish a notice in the state Gazette (Western Australia)[81].	Average Speed Cameras; Safe-T-Cams; Intelligent Speed Adaptation	N/A
Hong Kong	25	24	15	197	Not Specified	236	Special Administrative Region	N/A	Yes	*Audit: Administration of Road Safety Measures* [2]	Transport Department	Not Specified	N/A	With regard to the success of ATE in Hong Kong, the Department of Transport reported that "for speed enforcements camera systems… there was a 50 percent reduction in the number of vehicles in excess of the speed limit by 15 kilometres per hours, and a 40 percent reduction in the number of traffic accidents involving injuries"[51].
New Zealand	25	5	46	9	Not Specified	60	National	N/A	Yes	Land Transport Act 1998 (Approved Vehicle Surveillance Equipment Notice 2017)[30]	Minister of Police	Following approval to use ATE devices from the Minister of Police, the body implementing the ATE device must publish a notice in the New Zealand Gazette. Mobile units are required to be parked legally and in plain site[30].	N/A	Since implementation, New Zealand has seen a 23 percent decrease in road fatalities/serious injuries in urban areas, and an 11 percent decrease in rural areas[63].
Sweden	28	Not Specified	Not Specified	Not Specified	Not Specified	1,100	National	N/A	Yes	N/A	Trafikverket (Swedish Transport Administration)	Not Specified	Average Speed Cameras; Intelligent Speed Adaptation	In a study conducted by Andersson and Larsson (2005), after the initial sinstallation of 225 fixed speed cameras on 30 routes fatal crashes were reduced by 50 percent and severe injuries were reduced by 25 percent in the short term[56].
United Kingdom	27	487	Not Specified	Not Specified	Not Specified	2,800	National/Municipal	N/A	Yes	*Road Traffic Regulation Act 1984; Road Traffic Act 1991 (Sections 23 and 40); Highways Act 1980* [60]	Department for Transport	Camera signs must be posted and visible to the driver. Fixed device housings must be painted with designated yellow paint. Mobile devices/enforcement must be "liveried and clearly identifiable"[60].	Average Speed Cameras; Intelligent Speed Adaptation; Violation Fine Alternatives.	According to a study conducted by the London School of Economics and Political Science "from 1992 to 2016, speed cameras reduced accidents by between 17 to 39 per cent and fatalities by between 58 to 68 percent within 500 metres of the cameras" in the United Kingdom[68].

**Total number is approximate and inclusive of: Western Australia, South Australia, New South Wales, Queensland, and Victoria*

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Appendix III: References

1) A Timeline of Photo Radar in Ontario. (2016, November 8). Toronto Sun. Retrieved May 03, 2018, from http://torontosun.com/2016/11/08/photo-radar-cheap-effective-safety-measure-or-cash-cow-that-wont-die/wcm/f2010719-3c72-4e48-9fa4-9f1759e916cd
2) Administration of Road Safety Measures. (2013, March 28). Transport and Housing Bureau et al. Retrieved May 10, 2018 from https://www.aud.gov.hk/pdf_e/e60ch02.pdf
3) Akpeokhai, E.O., Speed Detection of Moving Vehicles (Using Traffic Enforcement Camera) [Image]. (2015, May 23). Retrieved May 10 from https://www.slideshare.net/EmmanuelOshogweAkpeo/my-serminar-slide
4) ATK Annual Report 2016 Traffic Safety Cameras. (2016). Trafikverket. Retrieved May 15 2018 from https://trafikverket.ineko.se/Files/sv-SE/41199/Ineko.Product.RelatedFiles/2017_234_ATK_%C3%85rsrapport_2016_ENG_20171219.pdf.
5) Automated Traffic Enforcement Technology Guidelines. (2014 September). Province of Alberta. Retrieved May 15 from https://www.edmonton.ca/transportation/AutomatedTrafficEnforcementTechnologyGuidelinesSept20142.pdf
6) Average Speed Safety Camera. (n.d.). South Australia Government. Retrieved April 30, 2018, from https://www.dpti.sa.gov.au/towardszerotogether/safer_speeds/average_speed_safety_camera
7) Bill 20, Red Light Camera Act, 1998. (1998). Legislative Assembly of Ontario. Retrieved May 20, 2018 from https://www.ola.org/en/legislative-business/bills/parliament-36/session-2/bill-20
8) Bill 65, Safer School Zones Act, 2017. (2017). Legislative Assembly of Ontario. Retrieved May 10, 2018 from http://ontla.on.ca/web/bills/bills_detail.do?locale=en&Intranet=&BillID=4358
9) Camera Locations. (2018, April 29). Western Australia Police Force. Retrieved April 30, 2018, from https://www.police.wa.gov.au/Traffic/Cameras/Camera-locations
10) Camera Systems. (2018, March 28). Government of Victoria. Retrieved April 30, 2018, from https://www.camerassavelives.vic.gov.au/camera-locations/camera-systems\
11) City to Scrap Its Speed Cameras. (2010, December 29). Retrieved May 02, 2018, from https://www.portsmouth.co.uk/news/city-to-scrap-its-speed-cameras-1-2303434
12) City Spending $800k on Red Light Program Update. (2017, March 21). Regina Leader-Post. Retrieved May 04 from http://leaderpost.com/news/local-news/city-spending-800k-on-red-light-program-upgrade
13) Code de la securite routiere (Chapitre C-24.2). (2018 March 01). Publications Quebec – Legis Quebec. Retrieved May 20, 2018 from http://www.legisquebec.gouv.qc.ca/en/ShowDoc/cs/C-24.2?langcont=fr.
14) Current Location. (2017, May 10). New South Wales Government – Centre for Road Safety. Retrieved April 30 from http://roadsafety.transport.nsw.gov.au/speeding/speedcameras/current-locations.html
15) D. Normandeau, personal communication, April 25, 2018.
16) Department of Transport. (2014, November 14). Speed and Red Light Camera Types | Transport and motoring. Retrieved May 01, 2018, from https://www.qld.gov.au/transport/safety/fines/speed/cameras#mobile

17) Division 5 of The Road Transport Act 2018 No 18. (2018). New South Wales Government. Retrieved May 10, 2018 from https://www.legislation.nsw.gov.au/#/view/act/2013/18

18) Enhanced Traffic Enforcement Program – Annual Report. (2014). British Columbia Ministry of Public Safety and Solicitor General. Retrieved May 15, 2018 from https://www2.gov.bc.ca/assets/gov/law-crime-and-justice/criminal-justice/police/publications/road-safety/enhanced-traffic-enforce-prog-2014-annual-report.pdf.

19) Evaluation of the Photo Enforcement Safety Program of the City of Winnipeg – Final Report. (2011 July). Traffic Injury Research Foundation. Retrieved May 15 from http://tirf.ca/wp-content/uploads/2016/08/WinnipegPhotoEnf-FinalReport-12.pdf.

20) F. Eriksson, personal communication, May 15, 2018.

21) Flieter, J.J., Lewis, I., Watson, B. Promoting a more positive traffic safety culture in Australia: Lessons learnt and future directions (2013, November). Queensland University of Technology.

22) For Residents – Red Light Cameras. (n.d.). Region of Peel – Public Works, Transportation. Retrieved May 04, 2018 from, https://www.peelregion.ca/pw/transportation/residents/red-light.htm

23) Half of UK Road Speed Cameras Are Switched Off. (2017, November 04). Retrieved May 01, 2018, from http://www.bbc.com/news/uk-41869134

24) Handbook of Rules and Guidance for the National Safety Camera Programme for England and Wales for 2005/06. (2004, November). National Archives – Department of Transport. Retrieved May 07 from http://webarchive.nationalarchives.gov.uk/+/http:/www.dft.gov.uk/pgr/roadsafety/speedmanagement/nscp/bookofrulesandguidancefo4581.pdf.

25) Highway Traffic Act *(C. C. S. M. c. H60).* (2017). 1st Reading November 20, 2011. Retrieved from the Government of Manitoba website: https://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=220/2002

26) Impact Evaluation of the National Speed Awareness Course: Final Report. (2018). Ipsos MORI Social Research Institute; Department of Transport. Retrieved May 15, 2018 from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706208/national-speed-awareness-course-evaluation.pdf.

27) Intelligent Speed Adaptation. (2016, September 21). Transport for New South Wales. Retrieved May 15 from http://roadsafety.transport.nsw.gov.au/research/roadsafetytechnology/isa/index.html.

28) Intersection Safety Device Program – Intersection Speed Camera Analysis. (2014 March). AECOM. Retrieved May 15 from http://www.transportation.alberta.ca/Content/docType47/Production/isdspeedcameraanalysis.pdf.

29) J. Catlin. Personal Communication. May 25, 2018.

30) Land Transport (Approved Vehicle Surveillance Equipment) Notice 2017. (2017 November 30). New Zealand Legislation. Retrieved May 18, 2018 from http://www.legislation.govt.nz/regulation/public/2017/0289/latest/whole.html.

31) Legislative Council Panel on Transport (2008 April). Legislative Council of the Hong Kong Special Administrative Region of the Peoples Republic of China. Retrieved May 20, 2018 from http://www.legco.gov.hk/yr07-08/english/panels/tp/papers/tpcb1-1356-1-e.pdf.

32) Loi modifiant l'encadrement de l'utilisation des cinémomètres photographiques et des systèmes photographiques de contrôle de circulation aux feux rouges et d'autres dispositions législatives. (2012). Assemblee Nationale. Retreived May 15 from

https://www.transports.gouv.qc.ca/fr/securite-signalisation/securite/radars-photo-surveillance-feux-rouges/Documents/loi-57-cinemometre.pdf.

33) Lunman, K. (2018, April 12). B.C. scraps photo radar as cabinet debuts on TV. Retrieved April 23, 2018, from https://www.theglobeandmail.com/news/national/bc-scraps-photo-radar-as-cabinet-debuts-on-tv/article4150046/

34) M. De La Cour. Personal Communication. May 11, 2018.

35) Major Success in NSW Trucking Compliance Regime. (2014, July 17). Greenslips. Retrieved May 04 from https://www.greenslips.com.au/blog/366-major-success-in-nsw-trucking-compliance-regime.html

36) Ministry of Transport and Communications. (1997). En route to a society with safe road traffic. Selected extract from Memorandum prepared by the Swedish Ministry of Transport and Communications. Memorandum, DS 1997:13.

37) Motor Vehicle Act – Motor Vehicle Act Regulations, Division 41. (2018, May 15). Queen's Printer, British Columbia. Retrieved May 15, 2018 from http://www.bclaws.ca/civix/document/id/complete/statreg/26_58_13#division_d2e43397

38) National Speed Awareness Course. (2018). TTC Group. Retrieved May 10, 2018 from http://www.ttc-uk.com/police-referred-courses/national-speed-awareness-course/

39) New Concepts in Automatic Enforcement. (2000 June). Escape. Retrieved May 27, 2018 from http://virtual.vtt.fi/virtual/proj6/escape/escape_d6.pdf.

40) One in three British motorists fined every year, as experts say automation has created a 'cash cow'. (2017, October 25). The Telegraph. Retrieved May 10, 2018 from https://www.telegraph.co.uk/news/2017/10/25/one-three-british-motorists-fined-every-year-experts-say-automation/

41) Ontario Regulation 277/99 Red Light Camera System Evidence (under Highway Traffic Act, R.S.O. 1990, c. H.8. (2017 September 29). Province of Ontario. Retrieved May 20, 2018 from https://www.ontario.ca/laws/regulation/990277.

42) Overall Statistics. (2016, December 31). Ministère des Transports du Québec. Retreived May 10, 2018 from https://www.transports.gouv.qc.ca/en/radars-photo-surveillance-feux-rouges/Pages/statistiques-globales.aspx

43) Permanent Casualty Reduction Scheme [PDF]. (n.d.). Retrieved May 01, 2018 from, (http://www.speedcheck.co.uk/images/Nottingham_Case_study/pdf).

44) Photo Enforcement Safety Program Annual Report 2010: Just Slow Down [PDF]. (2010). Winnipeg: Winnipeg Police Service. Retrieved April 30, 2018 from http://www.winnipeg.ca/police/safestreets/docs/2016_photo_enforcement_ar.pdf

45) Photo Speed Enforcement FAQs. (n.d.). Saskatchewan Government Insurance. Retrieved April 30, 2018, from https://www.sgi.sk.ca/photo-speed-faqs

46) "Photo Radar Guidelines Issued to Police". (1999, December 16). Government of Alberta. Retrieved May 15 from https://www.alberta.ca/release.cfm?xID=8573.

47) Rapport d'Evaluation du Projet Pilote : Cinémomètres photographiques et systèmes photographiques de contrôle de circulation aux feu rouges. [PDF]. (2010). Montréal : Ministère des Transports du Québec.

48) Red Light Cameras (2014, December 18). City of Hamilton. Retrieved May 03, 2018 from, https://www.hamilton.ca/streets-transportation/driving-traffic/red-light-cameras

49) Red-light Cameras. (2018). City of Ottawa. Retrieved May 04, 2018 from, https://ottawa.ca/en/residents/transportation-and-parking/road-safety/safe-driving#red-light-cameras

50) Red Light Cameras. (2018, January 30).The City of Saskatoon. Retrieved from: https://www.saskatoon.ca/moving-around/driving-roadways/safe-driving/red-light-cameras.

51) Red Light Cameras. (n.d.). City of Toronto. Retrieved May 04, 2018 from, https://www.toronto.ca/services-payments/streets-parking-transportation/traffic-management/pavement-markings/red-light-cameras/

52) Red Light Cameras (2018). Region of Waterloo. Retrieved May 04, 2018 from, https://www.regionofwaterloo.ca/en/living-here/red-light-cameras.aspx

53) Red Light Cameras (2016, December 23). York Region. Retrieved May 3, 2018, from http://www.york.ca/wps/portal/yorkhome/transportation/yr/traffic/redlightcameras/!ut/p/a1/jZA_T8MwEMU_S4eMxFfTNhabFf44KVWy1fWCnOA4lhI7cgyR-PSYioEBWm670-_dvXdIII6Ele9Gy2CclcNXL3YvBX0qGNtDWW1IDhQqWuKMwEO9jcApAvBHUbimL_9xAPtDftBITDL0N8Z2DvHgZdeZFnGvXgej-9DKUXk5oyMS540Yb3ZsnUMJrCJQPGb19p6wNeDsCrDH38CFTNG0Hlxz_s-J2uaWRHdedcorn775OO5DmOa7BBJYliVtjNVp68YEfhP0bg6I_-TQNPKPZwamHo9kpqvVJ_KbDgs!/dl5/d5/L2dBISEvZ0FBIS9nQSEh/#.WuxpzeQzXyo

54) Red Light Camera Program. (n.d.). Halton Region. Retrieved May 04, 2018 from, http://www.halton.ca/cms/One.aspx?portalId=8310&pageId=71664

55) Red Light Camera Research Summary. (n.d.). City of Brantford. Retrieved May 20, 2018 from http://www.brantford.ca/pdfs/3.3%20Red%20Light%20Camera%20Summary%20.pdf

56) Regan, M. A., Young, K. Intelligent Speed Adaptation: A Review. (2002). Monash University Accident Research Centre. Retrieved April 30 from http://acrs.org.au/files/arsrpe/RS020049.PDF.

57) Regina Red Light Cameras 'Not Functioning', City Report Says | CBC News. (2014, August 18). Retrieved May 01, 2018 from http://www.cbc.ca/news/canada/saskatchewan/red-light-cameras-not-functioning-city-of-regina-report-says-1.2739501

58) Road Policing Action Plan 2016-2020 (2016). New Zealand Police. Retrieved May 10, 2018 from http://www.police.govt.nz/sites/default/files/publications/road-policing-action-plan-2016-2020.pdf

59) Road Safety – Red Light Cameras. (2018). Insurance Corporation of British Columbia. Retrieved May 04, 2018 from, http://www.icbc.com/road-safety/community/Pages/Red-light-cameras.aspx

60) Road Traffic Act 1991. (2018, May 10). The National Archives. Retrieved May 10, 2018 from https://www.legislation.gov.uk/ukpga/1991/40/section/23

61) Road Safety (General) Regulations 2009 S.R. No. 115/2009. (2012, July 21). Victoria Legislation and Parliamentary Documents. Retrieved May 20, 2018 from http://www.legislation.vic.gov.au/domino/web_notes/LDMS/LTObject_Store/LTObjSt7.nsf/d1a8d8a9bed958efca25761600042ef5/e5b912ca721de8ddca257a4c001ef84a/$FILE/09-115sr009bookmarked.pdf.

62) Roads: Speed Cameras [PDF]. (2013 April 15). House of Commons Library. Retrieved May 18, 2018.

63) Safe Speed Cameras. (n.d.). New Zealand Police. Retrieved April 30, 2018, from http://www.police.govt.nz/advice/driving-and-road-safety/speed-limits-cameras-and-enforcement/safe-speed-cameras

64) Safe-T-Camera. (n.d.). National Heavy Vehicle Regulator. Retrieved from: https://www.nhvr.gov.au/safety-accreditation-compliance/on-road-compliance-and-enforcement/safe-t-cam

65) SGI Photo Speed Enforcement Pilot Results – Speeding Violations for January 2018. (2018, January). Saskatchewan Government Insurance. Retrieved May 10, 2018 from https://www.sgi.sk.ca/documents/625510/627014/Photo-Speed-Enforcement-Pilot-Results-Jan-2018.pdf/f434bc73-0090-4090-9531-541331260099

66) SGI Photo Speed Enforcement Pilot Results – Speeding Violations for January 2015. (2015, January). Saskatchewan Government Insurance. Retrieved May 10, 2018 from https://www.sgi.sk.ca/documents/625510/627014/Photo-Speed-Enforcement-Pilot-Results-Jan-2018.pdf/f434bc73-0090-4090-9531-54133126009

67) Speed Camera FOI Data. (2012 July 10). RAC Foundation. Retrieved May 18, 2018 from https://www.racfoundation.org/media-centre/speed-camera-foi-data.

68) Speed cameras reduce road accidents and traffic deaths, according to new study. (2017 October 25). The London School of Economics and Political Science. Retrieved May 18, 2018 from http://www.lse.ac.uk/News/Latest-news-from-LSE/2017/10-October-2017/Speed-cameras-reduce-road-accidents-and-traffic-deaths-according-to-new-study.

69) Staples, D. (2017, May 19). Edmonton Journal. Retrieved May 03 from, http://edmontonjournal.com/news/politics/david-staples-how-the-alberta-government-can-fix-edmontons-photo-radar-abuse

70) Surveys of Community Attitudes to Road Safety. (2015, May 14). Government of Australia. Retreived May 10, 2018 from https://infrastructure.gov.au/roads/safety/community_attitudes_survey/index.aspx

71) Swedish Drivers Support Speed Cameras. (2014, January-February). Retrieved from: http://www.itsinternational.com/categories/enforcement/features/swedish-drivers-support-speed-cameras/

72) The Traffic Signs (Amendment) Regulations and General Directions 2008 No. 2177. (2008 September). Her Majesty's Stationary Office and Queen's Printer of Acts of Parliament. Retrieved May 18, 2018 from https://www.legislation.gov.uk/uksi/2008/2177/schedule/paragraph/7/made#text%3Dspeed%20camera

73) The Traffic Safety (Speed Monitoring) Regulations. (2013, May 15). Government of Saskatchewan. Retrieved May 15 2018 from http://www.publications.gov.sk.ca/freelaw/documents/English/Regulations/Regulations/T18-1R10.pdf.

74) The Effectiveness of Average Speed Cameras in Great Britain. (2016, September). Owen, Ursachi, and Allsop. Retrieved May 18 from https://www.racfoundation.org/wp-content/uploads/2017/11/Average_speed_camera_effectiveness_Owen_Ursachi_Allsop_September_2016.pdf.

75) Tingvall, C. (1998). The Swedish 'Vision Zero' and how parliamentary approval was obtained. Road Safety Research. Policing. Education Conference. 16-17 November 1998, Wellington, New Zealand. Proceedings: Volume 1. Land Transport Safety Authority. New Zealand Police. pp.6-8.

76) Toward Zero Together [Image]. (n.d.). Government of South Australia. Retrieved May 10, 2018 from https://www.dpti.sa.gov.au/towardszerotogether/safer_speeds/average_speed_safety_camera.

77) Traffic Branch Headquarters, Hong Kong Police Force. Personal Communication. May 9, 2018.

78) Traffic Camera Locations. (2018, April 20). South Australia Police. Retrieved April 30, 2018, from https://www.police.sa.gov.au/your-safety/road-safety/traffic-camera-locations#country

79) Traffic Safety Unit. (2015, June 04). Regina Police Department. Retrieved April 23, 2018, from http://reginapolice.ca/about-us/community-services-division/traffic-safety-unit/

80) *Traffic Safety Act* Revised Statutes of Alberta 2000 Chapter T-6. (2018, April 09). Alberta Queen's Printer. Retrieved May 10, 2018 from http://www.qp.alberta.ca/documents/Acts/t06.pdf.

81) Transport Department - Red Light Cameras and Speed Enforcement Cameras. (2017, January 05). Retrieved May 02, 2018, from http://www.td.gov.hk/en/transport_in_hong_kong/its/its_achievements/red_light_cameras_and_speed_enforcement_cameras/index.html

82) Western Australia Road Traffic (Administration) Act 2008. (2008). Australasian Legal Information Institute. Retrieved May 20, 2018 from http://www8.austlii.edu.au/cgi-bin/download.cgi/cgi-bin/download.cgi/download/au/legis/wa/consol_act/rta2008263.txt.

APPENDIX B – MUNICIPAL ATTITUDES

Automated Traffic Enforcement Review

Municipal Workbook Summary

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Introduction and Methodology

In order to facilitate data and information gathering for the automated traffic enforcement (ATE) program review, each municipality currently operating an ATE program in Alberta was asked to complete a Municipal Workbook. The Workbook is an excel spreadsheet with three sections, covering the following topics:

- Identification,
- Traffic Safety Investment, and
- Municipal ATE Governance.

The requested data items and questions within these pages were designed based on our understanding of tracked and available data, and in some cases, were presented with fairly vague wording, to allow for all municipalities to respond despite varying recording and reporting processes across the municipalities. The Workbooks were revised and validated with Alberta Transportation (AT) prior to sending to the municipalities, who had received correspondence regarding the existence and progress of the ATE program review, as well as the expectation of an upcoming Workbook for completion. Workbooks were sent to each municipality's Mayor, City Manager or CAO, and a high-level police or RCMP representative.

The 28 municipalities who operate ATE programs in Alberta and provided responses to the Workbook are listed below, and an overview of municipal responses are outlined within this report.

- Beaumont
- Calgary
- Camrose
- Canmore
- Coaldale
- Cold Lake
- Devon
- Edmonton
- Edson
- Fort Saskatchewan
- Grande Prairie
- Hinton
- Leduc
- Lethbridge
- Lloydminster
- Medicine Hat
- Morinville
- Red Deer
- Regional Municipality of Wood Buffalo
- Slave Lake
- Spruce Grove
- St. Albert
- Stony Plain
- Strathcona County
- Taber
- Wainwright
- Wetaskiwin
- Whitecourt

Executive Summary

- All 28 municipalities that currently operate an ATE program in Alberta completed and returned the municipal workbook. The workbook requested 5-10 years of historical data regarding traffic safety investment and municipal governance – the large majority of responses included at least 5 years of data.
- 13 / 28 municipalities outsource their ATE program operation through a contract with Global Traffic Group Ltd. Global provides a turn-key service for municipalities, which includes training of peace officers, public education campaigns, and signage. Other arrangements include contracting services through a neighbouring municipality, and contracting with another vendor, Conduent, for ticket processing activities.
- There is a broad range of what municipalities do in the conduct of public awareness campaigns (relative to ATE). This ranges from the minimum requirements through to extensive campaigns.
- Seven (7) municipalities conduct citizen surveys to gauge public opinion and satisfaction with traffic related enforcement practices.
- 75% (21/28) of municipalities reported that they implement traffic calming measures and a variety of other traffic safety initiatives as part of their overall traffic safety plan. These municipalities also reported that they use ATE revenues to help fund these traffic safety initiatives.
- A large majority of municipalities believe that the Training Guidelines do not create any barriers or negative effects for the municipalities. With regard to the Technology Guidelines, municipalities would appreciate increased direction and clarity regarding specific expectations as the current perceived ambiguity leads to challenges in the delivery of municipal ATE programs at times.

Identification

Alberta Transportation
Automated Traffic Enforcement

Participant Workbook - Identification
Please Select Your Municipality

Please select your municipality and provide contact information:

Municipality (drop down list):	Please Select Your Municipality
Contact Name:	
Contact Phone Number:	
Contact Email Address:	

A sample response for the subsequent pages is provided below:

Data Item	Description	Response			Name of File Supplied	Comments
		Complete Data	Partial Data	ata Not Capture		
Public Education campaigns (dollars spent, dates)	5-10 years of safety investment data re: public education campaigns	x			Campaigns2008_2018.xls	Complete data can be found on the "Public Education" tab
Staff training (dollars spent, dates)	5-10 years of safety investment data re: staff training for Automated Traffic Enforcement Device Operators, Intersection Safety Device Data Reviewers, or other roles as applicable.		x		Training.xlsx	Data collection and categorization practices have improved in recent years; partial or unclear data pre-2014

Municipalities were asked to provide contact details for one representative of the municipality, to facilitate the ongoing exchange of information.

Respondents were asked to provide:

- Name of Municipality
- Contact Name
- Contact Phone Number
- Contact Email Address

Two sample data entries were also provided to improve clarity for the individuals compiling the data, and to control the consistency of responses.

Traffic Safety Investment

MNP Tantus **Alberta Transportation** Automated Traffic Enforcement

Participant Workbook - Traffic Safety Investment
Please Select Your Municipality

As part of the Automated Traffic Enforcement (ATE) program review, an analysis of municipal investments in various traffic safety measures is being conducted. To facilitate this analysis, the following ATE data is requested (Rows 6 - 15).
In some cases, budget and spending data may not be segregated or easily attributable directly to traffic safety improvements - please specify in the comments if that is the case.
Preference is for data to be provided in .csv / .xls format. Please specify in comments if data is provided in a different format.
Please indicate the level of available data (Complete, Partial, or Not Captured) for each data item, the name of the file supplied, and additional comments regarding a description of the file or the contained data.

Data Item	Description	Response			Name of File Supplied	Comments
		Complete Data	Partial Data	ata Not Capture		
Public Education campaigns (dollars spent, dates)	5-10 years of safety investment data re: public education campaigns					
Staff training (dollars spent, dates)	5-10 years of safety investment data re: staff training for Automated Traffic Enforcement Device Operators, Intersection Safety Device Data Reviewers, or other roles directly related to traffic safety enforcement as applicable.					
Traffic calming measures (dollars spent, type of calming measure, locations, dates)	5-10 years of safety investment data re: traffic calming measures					
Signage (dollars spent, signage type, locations, dates)	5-10 years of safety investment data re: signage to notify/alert public of ATE presence					
ATE Enforcement staff (annual budget in $ for ATE enforcement staff only)	5-10 years of safety investment data re: ATE enforcement staff					
Total enforcement staff (annual budget in $ for all traffic enforcement staff - including ATE staff as part of the total)	5-10 years of safety investment data re: total enforcement staff					
Contracted enforcement resources (annual budget in $)	5-10 years of safety investment data re: contracted enforcement resources such as commissionaires, mobile photo radar operators, etc.					
Public satisfaction in traffic safety (% satisfied)	5-10 years of safety investment data re: public traffic safety satisfaction - measured via results of past surveys (please include)					
Other Traffic Safety investments (dollars spent, description, dates)	5-10 years of municipal investments in traffic safety improvements other than what is described above					
Overall Annual Municipal Operating budget (revenues and expenditures)	5-10 years of municipal operating budget (non capital budget)					

The second page focused on analysis of municipal investments in various traffic safety measures. In cases where budget or spending data is not recorded in such a way that it can be easily attributed to the categories provided, the municipalities specified their response further in the comments section. Rate of response (%) is included for each question on the following pages, and was expected to be less than 100%, as the workbook questions were not always possible to answer for each municipality.

The categories are:

- Public Education Campaigns
- Staff Training
- Traffic Calming Measures
- Signage
- ATE Enforcement Staff
- Total Enforcement Staff
- Contracted Enforcement Resources
- Public Satisfaction
- Other Traffic Safety Investments
- Overall Annual Municipal Operating Budget

A summary of aggregated responses for this section of the workbook is provided on the following pages.

Municipal Workbook Summary

Request	Response %	Outsourced Service	Details and Noteworthy Practices
Public Education Campaigns	**71.4%** (20/28)	**10.7%** (3/28)	• The guidelines state that a key element to the success of any enforcement practice is the implementation of a strong public awareness campaign. • Public Education Campaigns are utilized by the majority of municipalities surveyed, and are largely undertaken internally, rather than by contract. • These campaigns include a range of initiatives including newspaper ads or digital maps indicating ATE device locations, and funding police-led traffic education events. • Many municipalities pointed to cost savings through the utilization of social media, websites, and radio to keep citizens up to date on ATE activity. • CRISP (Capital Region Intersection Safety Partnership) is an initiative undertaken by Edmonton, St Albert, Strathcona County, Spruce Grove, Fort Saskatchewan, Leduc, Morinville, and Stony Plain, which provides members with access to educational information and research. Membership fees are $20,000 per year. Key CRISP research relating to ATE usage revolve around exploring the untapped potential of automated enforcement data. CRISP has completed two major studies to date, which have uncovered positive relationships between automated enforcement violations and other traffic-related behaviours, while reinforcing the role this data can play in the development of more effective intervention strategies that will make Alberta roadways and communities safer. • High variation in spending in this area. Some responses indicated no efforts were undertaken, some chose outlets that required minimal or zero cost, while the highest expenditures were $1.5m.
Staff Training	**89.3%** (25/28)	**57.1%** (16/28)	• This segment refers to the cost required for training ATE operators (police, RCMP, third-parties, etc) on correct usage of photo radar, red light, and/or intersection cameras. • Of the municipalities that do *not* contract this service out, only one provided specific ATE related training costs. • The majority of municipalities that contract out their ATE service do not contribute funds directly to staff training • By contracting out the service, municipalities did not have access to information regarding the allocation of expenses to ATE related training.
Traffic Calming Measures	**75%** (21/28)	**N/A**	• Traffic calming measures are implemented by municipalities to help improve traffic safety, reduce speeding, and deter dangerous driving. • For many municipalities surveyed revenues from ATE devices were put toward traffic calming measures including curb extensions, speed feedback signs, medians, crosswalk markings. • Municipalities have spent revenues on eco-friendly cross walk lights powered by solar energy in school zones and heavy traffic areas at around $40,000 per year.
Signage	**85.7%** (24/28)	**21.4%** (6/28)	• This segment includes costs related to the purchase, installation, and maintenance of ATE-related signage. • As signs are required by ATE guidelines, all 28 municipalities (including the four which did not provide a response) have ATE signage in place – and this is reflected in the Alberta Justice and Solicitor General audits. • Few municipalities indicated that revenues generate through ATE operation were used to fund signage directly.
ATE Enforcement Staff	**82.1%** (23/28)	**53.6%** (15/28)	• This segment was intended to capture the human capital costs associated with ATE device usage. • In some cases, ATE Enforcement Staff costs were calculated as a percentage of the total salaries paid to protective services staff based on the amount of time spent monitoring traffic or utilizing ATE devices. • For Global Traffic Group or other third-party contracts, a percentage of payment made from municipalities was allocated to fund staff payments.

Municipal Workbook Summary

Request	Response %	Outsourced Service	Details and Noteworthy Practices
Total Enforcement Staff	**82.1%** (23/28)	**14.3%** (4/28)	• Total Enforcement Staff costs included total salaries for all police, RCMP, peace officers, or any other enforcement officers within a municipality's protective services. • The outsourced service percentage in this case refers to municipalities that contract their policing exclusively to the RCMP. • The majority of municipalities provided combined costs of CPO, RCMP, and Peace Officers.
Contract Enforcement Staff	**100%** (28/28)	**N/A**	• The majority of smaller municipalities contract out to Global Traffic Group for ATE services including education, training, signage, call center, court attendance, equipment, human resources etc. Others use Conduent (formerly Xerox). • Larger cities used this category to account for expenses used to cover the costs of Commissionaires.
Public Satisfaction	**60.7%** (17/28)	**N/A**	• This segment focused on the identification of municipalities which perform public satisfaction surveys regarding traffic safety initiatives. • Only 7 municipalities completed surveys to gauge public opinion and satisfaction with traffic related enforcement practices.
Other Traffic Safety Investments	**75%** (21/28)	**N/A**	• A large portion of surveyed municipalities allocated additional ATE revenue to various traffic safety or community-enhancing initiatives. • Expenditures include infrastructure improvements, additional RCMP costs for smaller urban municipalities, contributions to community grants, safety reviews, etc. • Other miscellaneous expenditures that were identified in this segment were closely related to previous sections, such as costs for electronic signage, automotive-related safety campaigns, ATE expansion costs, and general public safety improvements.
Overall Annual Budget	**89.3%** (25/28)	**N/A**	• Many responses did not meet the requested criteria. ATE contract, single-year, or estimated budgets were common in lieu of providing the detailed overall annual budget. Due to wide variances in reporting, this segment may not provide reliable information for review. To resolve this, additional data was sourced from Alberta Justice and Solicitor General regarding revenues disbursed to municipalities.

Municipal ATE Governance

Alberta Transportation
Automated Traffic Enforcement

Participant Workbook - Municipal ATE Governance
Please Select Your Municipality

As part of the Automated Traffic Enforcement (ATE) program review, an analysis of how municipalities govern and operate their ATE program is being conducted. Please respond in Comments section. Please specify if any additional information is being provided in response to the question in the form of another file or document.

Data Item	Description	Response			Name of File Supplied	Comments
		Complete Data	Partial Data	ata Not Capture		
Traffic Safety Plan (TSP)	Traffic Safety Plan documentation - current plan and description of how long the current TSP has been / will be in place.					
Municipal Budget (Traffic Safety Initiatives)	Municipal budget documentation that specifies planned / actual spending on traffic safety initiatives for the past 5-10 years					
Municipal Oversight	How does your municipal Council maintain oversight of your ATE program?	Comment only. Please describe.				
ATE Operations	Please describe the operational structure of your ATE Program, including municipal departments, police, contractors, and others as applicable.	Comment only. Please describe.				
ATE information - publically available?	Do you make ATE program information (locations, revenue, traffic safety investments) available to the public? How/when/where?	Comment only. Please describe.				
Municipal view on ATE Guidelines	Do the Alberta Automated Traffic Enforcement **Technology Guidelines** create any barriers or issues with regard to current or desired ATE governance or operations in your municipality?	Comment only. Please describe.				
Municipal view on ATE Guidelines	Do the Alberta Automated Traffic Enforcement **Training Guidelines** create any barriers or issues with regard to current or desired ATE governance or operations in your municipality?	Comment only. Please describe.				

The final page of the workbook focused on analysis of how municipalities operate and govern their ATE programs.

The topics covered are:

- Traffic Safety Plans
- Municipal Budget for Traffic Safety Initiatives
- Municipal Oversight
- ATE Operations
- ATE Information
- Municipal View on Guidelines

A summary of the aggregated responses for the remaining questions in this section of the workbook is provided on the following page.

Municipal ATE Governance

Municipal Oversight How does your municipal Council maintain oversight of your ATE program?	**ATE Operations** Please describe the operational structure of your ATE Program, including municipal departments, police, contractors, and others as applicable.	**ATE Information** Do you make ATE program information (locations, revenue, traffic safety investments) available to the public? How/when/where?	**Municipal View on Guidelines** Do the Alberta Automated Traffic Enforcement **Technology Guidelines** create any barriers or issues with regard to current or desired ATE governance or operations in your municipality?	**Municipal View on Guidelines** Do the Alberta Automated Traffic Enforcement **Training Guidelines** create any barriers or issues with regard to current or desired ATE governance or operations in your municipality?
• The majority of municipalities provide annual reports to their Councils, who review ATE usage, approve budgets and funding, etc. In some cases, the reports are submitted by the ATE contract holder, or by local police/RCMP. • Other municipalities assign representatives from within the municipality, local police service, and/or RCMP to oversee the ATE program and provide final approval on ATE zones and operation.	• Approximately half of municipalities have contracted out the oversight of ATE devices to either Global Traffic Group Ltd or Conduent (formerly Xerox), who provide and operate all related services and resources required for ATE usage. • The remaining municipalities rely either on the RCMP or local protective services to operate and report ATE usage to the police/RCMP representative or Council.	• All municipalities make ATE locations available to the public, via any combination of newspaper, radio, social media, websites, email, and interactive maps. • Although some municipalities do share ATE revenues on their website, many responses were not clear regarding public transparency of ATE revenues and traffic safety investments.	• The municipalities take these Technology Guidelines very seriously, and would appreciate increased direction and clarity regarding specific expectations. • A common response is that the Technology Guidelines restrict municipalities from deploying new technology to combat issues including distracted driving, noise bylaw violations, pedestrian crossings, and school bus passing infractions, as the current Technology Guideline only allows for the use of ATE for speed and intersection offenses.	• The very large majority of responses stated that the Training Guidelines do not create any barriers or negative effects for the municipalities. • Clarification of training hours spent for qualification on specific equipment and technology types could be improved.

APPENDIX C – GUIDELINES REVIEW

Automated Traffic Enforcement Review

Guidelines Review

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Introduction and Methodology

Automated Traffic Enforcement (“ATE”) Technology and Training Guidelines are in place in Alberta to govern the use of ATE across the province. As part of the ATE program review, Alberta’s ATE Technology Guidelines and ATE Training Guidelines were reviewed to determine the effectiveness of the guidelines, as they relate to traffic safety improvements. These Guidelines were issued under Ministerial Order, as published by Alberta Justice and Solicitor General under Section 3.1 of the Alberta Police Act. The Guidelines provide the Solicitor General the ability to give guidance, and allow Alberta Justice to provide direction to the municipalities who operate ATE programs**.**

As part of the guidelines review, the processes for government audits, as well as the financial disbursement model were considered and investigated. Further detail regarding the audit process can be found on subsequent pages, and detail regarding the disbursement model is provided in Appendix I of this report.

This report includes what is currently working well, as well as opportunities for improvement in the future. In addition to information from interviews conducted with the Public Security Division whose responsibility it is to administer these guidelines, analysis was completed based on available data from the following sources:

- Results of 2013-14 and 2016-17 Solicitor General Audit Reports
- Provincial ATE Quarterly Reporting from 2009-2017
- Municipal Workbook responses from 28 Alberta municipalities that operate an ATE program
- Publicly available jurisdictional comparator information

Executive Summary

- The municipalities are compliant with regards to: organization, site selection, operational requirements and considerations, public awareness, testing, monitoring, peace officers engaged in ATE, policy, and training resources, as outlined in the ATE Technology and Training Guidelines.

- Alberta Justice and Solicitor General (AJSG) conducts audits of all municipalities that operate an ATE program in Alberta (“the municipalities”), under direction from both the ATE Technology Guidelines and the ATE Training Guidelines. No major issues have been discovered by AJSG as a result of the audits completed.

- Overall, the municipalities’ opinion of the guidelines is that clarity should be improved throughout both documents, the technology guidelines impose barriers related to implementation of new and emerging technology, and the training guidelines do not impose any barriers on operation of municipal ATE programs.

- The revenue disbursement model is effective in that the process is followed to distribute revenues to the Victim Services Fund, the municipalities, and the province. Each municipality is assigned a vendor number and the money is deposited from the province into the bank account the municipality designates.

Guidelines Overview

The following tables summarize successes and challenges that have emerged from reviewing the Technology and Training Guidelines. Each set of findings is categorized by the corresponding guidelines section and requirement that they relate to.

Section	Alberta Guideline Requirement	What is Working Well	Challenges
Organization	*Responsibility for the operation of the automated traffic enforcement program shall rest with the police service of each jurisdiction, including: ensuring enforcement is conducted in accordance with local Traffic Safety Plans, directing at which sites automated traffic enforcement is to be used, and setting periods of operation and duration of enforcement.*	AJSG validates Traffic Safety Plans and Site Assessments though interviews with each municipality's police service as part of the audit process. In the most recent audit cycle, all municipalities were found to be in accordance with the guidelines in this area.	In the opinion of some of the municipalities, the technology and training guidelines are lacking clarity throughout, and specifically regarding definitive descriptions on the approval of new equipment.
Site Selection Criteria	*Automated traffic enforcement technology sites will not be selected randomly – <u>one or more</u> of the [approved justifications] must exist before automated traffic enforcement is used at a specific site.*	In 2017, over 99% of quarterly reported entries included at least one of the approved reasons for using ATE at a specific site. Approximately 40% of municipalities consistently report 2-3 of the approved reasons per entry, which is above and beyond the requirement.	Approximately 35% of municipalities never report more than one of the approved reasons per entry. History of Speeding is the most used reason for deploying ATE at a specific site, and Construction Zone was very rarely used as a reason. There is slight misalignment between the guidelines and the reporting template: while high pedestrian volumes is listed under site selection criteria in the guidelines, it is not an option in the suggested quarterly reporting template.
Operational Requirements and Considerations	*Each automated traffic enforcement location must have a corresponding 'Site Assessment' document issued by the police service of the jurisdiction showing why the location was selected and how it relates to traffic safety.*	Findings within the most recent audits concluded for each municipality that the appropriate identified police service representative is maintaining review and approval of site assessments, every 3 years for speed locations and every 5 years for intersections where ISD is deployed.	There is a lack of clarity regarding requirements for Site Assessments. Municipalities have created documents with a wide range of justifications, level of detail, and complexity. Police Detachment Commanders are not always aware that they have the authority to change ATE locations, based on their municipality's TSP, collision data, or other relevant data. This issue is compounded in rural areas where there tends to be high turnover in the role. AJSG has been focused on education to resolve this issue, and it was addressed in the 2016-17 audit cycle.

Guidelines Overview

Section	Alberta Guidelines Requirement	What is Working Well	Challenges
Public Awareness	*A key element to the success of any enforcement practice, including the use of automated traffic enforcement technology, is the implementation of a strong public awareness campaign.* *All significantly new technology should be reviewed and accepted by Alberta Justice and Solicitor General before being implemented for use within a municipality.* *Existing automated traffic enforcement technology sites must be advertised on a monthly basis.*	Municipalities are compliant with the minimum standards of advertising and signage, according to the quarterly reports and audit results.	Some of the municipalities would appreciate more details on what is expected for advertising to the public, and clearer details on expectations of intersection signage. This section of the guidelines is organized in a confusing way – the requirements for new technology do not seem to fit under the Public Awareness section.
Testing for Intersection Safety Devices	*Intersection Safety Devices shall be tested at minimum every 30 days by a tester appointed under the Traffic Safety Act. A tester of an intersection safety device will not be considered for appointment under the Traffic Safety Act until he/she provides the appropriate Alberta Transportation employee suitable documentation from the device manufacturer demonstrating that the tester is competent in the inspection and testing of the intersection safety device.*	In cases where this requirement is not met, AJSG will suspend the municipality's ATE program pending proof of compliance. In each case, device manufacturer information is reviewed by AJSG, a Senior Crown Policy representative from a legal perspective. Consultations are completed with Alberta Transportation, Office of Traffic Safety, and engineers to ensure thorough review.	There are cases where the automatic computer testing could fail, leading to lower confidence in ISD accuracy than manual independent verification.
Monitoring	*Each enforcement agency shall collect data on the use of automated traffic enforcement technology. The data will be collected monthly on each site and reported quarterly to Alberta Justice and Solicitor General.* *At a minimum, the data collection shall provide information as outlined in Appendix 'A'.* *All traffic enforcement technology data generated by ATE will be retained by the enforcement agency for a minimum of ten (10) years.*	Municipalities monitor and collect data to align with the requirements as set out in the guidelines – data is reported quarterly and often summarized annually. In cases where reporting is not completed in a timely manner, Alberta Justice and Solicitor General have followed up and received the unsubmitted data. A reported 480 million vehicles were monitored in 2017 which lead to approximately 1.5 million speed or red light offenses (0.6% of monitored vehicles) Through the most recent audit cycle, all 28 municipalities were found to retain files for the required minimum of 10 years, relating to the categories of returned violation notices, convicted in absence, monthly stats, electronic stats, personnel files	Although quarterly reports are consistently submitted and collected, the format in which reporting is completed is not entirely consistent (some ATE technology does not allow for the transfer of data onto an Excel Spreadsheet). This leads to additional effort in compiling and analyzing data, and may lead to inconsistent data due to misunderstanding of what exactly is being requested.

Guidelines Overview

Section	Alberta Guidelines Requirement	What is Working Well	Challenges
Peace Officers Engaged in ATE	*The Public Security Division, at the direction of the Minister of Justice and Solicitor General, may conduct audits to ensure compliance with these guidelines.*	The decision to conduct audits increases the accountability of municipalities and ensures requirements outlined in the guidelines are being met.	There is room for improvement in organization and clarity of the guidelines. Some requirements, including this one, seem out of place which leads to confusion and misunderstanding. This hold true from a compliance perspective, as the audit process would benefit from concrete requirements and expectations on which to base the audits.
Policy and Instructor Qualification	*Automated traffic enforcement technology operators [must]:* *1. Successfully complete a minimum of 40 hours of training with qualified instructor covering the use and operation of automated traffic enforcement technology* *2. Under a qualified instructor, successfully complete a recognized Radar and/or Laser Operator's Course obtaining a certificate upon completion.* *3. In the event the enforcement agency changes the make/model of equipment in use, the operators must obtain updated training specific to the new make/model from a qualified instructor to an established standard.* *4. The operator must be aware of, and adhere to, existing Provincial guidelines governing the use of automated traffic enforcement in Alberta.*	Policy is reviewed as part of the AJSG audit process. All municipalities' policies were found to be in compliance with the guidelines, and few municipalities were suggested minor improvements to update policy sections based on provincial leading practices.	This section of the training guidelines may not provide enough detail regarding requirements of the municipalities. Clarification of training hours spent for qualification on specific equipment and technology types could be improved.
Training Resources	*There are private agencies as well as police services within this province that are able to deliver the standard level of training detailed in these guidelines.* *The Public Security Division [of AJSG] will review the submission by the employer to ensure that the curriculum meets provincial standards prior to any designations being issued under alternate or newly created training.*	Overall, the municipalities do not feel that there are any unreasonable barriers imposed on their ATE programs as a result of the training guidelines.	There has been at least one incident in which a municipality's ISD testers were not properly appointed. The program was suspended pending resolution, but situations similar to this can cause large potential risks for the province.

High-Level Jurisdiction Scan: Introduction

A jurisdictional scan was completed to compare and contrast Alberta's ATE governance and operations under the Guidelines to the neighboring provinces. Western provinces were researched based on the categories set out in Alberta's Guidelines. Findings were compiled for British Columbia, Saskatchewan, and Quebec, based on the following:

- ATE programs do not exist in the Eastern provinces or the Territories,
- Manitoba was excluded because ATE is only operated in Winnipeg,
- There was very limited publicly available information for Ontario's past ATE program governance.

The findings of this high-level jurisdictional scan can be found on the following pages.

High-Level Jurisdiction Scan

Section	Alberta	Saskatchewan	BC	Quebec
Organization	Communities policed by the RCMP under a municipal policing contract, or with their own police service have the ability to use ATE technologies within their municipal boundaries, while adhering to Alberta ATE guidelines. The municipality is responsible for the establishment and operation of an Automated Traffic Enforcement Program, which will ensure enforcement is conducted in accordance with local Traffic Safety plans, directing which sites ATE technology is used, and setting periods of operation and duration of enforcement.	The use of photo radar, red light cameras, and other ATE devices is governed by Saskatchewan Government Insurance (SGI), a provincial crown Corporation. SGI assumed responsibility from the province's Department of Highways in the mid-1980's for most road safety legislation, regulations, programs, and policies. In 2015, SGI implemented the Photo Speed Enforcement Pilot (PSEP), a two-year, $4.5 million contract to install and monitor the province's first ATE devices. The program continues to operate to this day.	In 2003, the Enhanced Traffic Enforcement Program (ETEP) was created as a partnership between Police Services Division, the Insurance Corporation of BC (ICBC), and the RCMP to augment existing traffic enforcement resources and target road safety issues within the province. To this end, ETEP agreed to provide funding to the operation of 140 automated red light camera sites through the Intersection Safety Program, and created the Integrated Traffic Camera Unit (ITCU) to oversee this initiative. Ticket revenue generated from this program is distributed among B.C. municipalities to enhance their policing and community-based public safety programs.	In August 2009, the commissioning of 9 photographic speedometers and 6 photographic traffic control systems marked the beginning of the Phase 1 deployment of automated control devices, overseen by the Ministry of Transportation. In October 2015, the deployment continued with Phase 2, corresponding to the commissioning of 36 new automated control devices, 17 speedometers and 19 photographic traffic control systems.
Site Selection	ATE guidelines provide a list of criteria, of which one or more must exist in order for ATE technology to be implemented at any given site. Many of these criteria require an identifiable, documented history of collisions, speeding problems, or offenses. Unless approved by the Government of Alberta on a case-by-case basis, the use of automated enforcement is limited to intersection and speed-related offenses.	Cameras exist on the Highway 1 and 9th Avenue intersection in Moose Jaw, Circle Drive in Saskatoon, Ring Road in Regina, and select school zones within each of these cities. The locations chosen are high speed, high traffic volume and high-risk locations, where having an enforcement officer on the side of the road is very dangerous. School zones are selected by municipalities and their police services.	Red light cameras are installed at B.C. intersections that experience a high rate of serious collisions. A team of experts, comprising of RCMP, local police services, ICBC, and engineering and traffic safety specialists, helped select B.C's highest-risk intersections. Site selection was based on where cameras would be the most effective in reducing serious crashes and fatalities. Site selection is based on type, severity, and frequency of collisions at a given location. The committee that determined these locations was recognized for creating an international best practice for red-light camera site selection criteria.	Potential photographic traffic control system sites are proposed by municipalities in partnership with their police departments. Municipalities present the sites to a panel including the Minister of Transport and Minister of Public Security. Sites selected can include public roads, school zones, or construction sites. Locations are chosen based on criteria including the number of collisions caused by speeding or red light violations, and the level of safety risk police have with traditional enforcement.
Operational Requirements	Outside of intersections, ATE technology must have a human operator on site – unless approved by the Government of Alberta for areas of special safety needs or for other exceptional circumstances. Additionally, each automated enforcement location must have a corresponding 'Site Assessment' document issued by the police service of jurisdiction showing why the location was selected and how it relates to traffic safety.	The photo speed enforcement pilot program uses automatic devices. The high-speed nature of the selected corridors are not conducive to having operators controlling the cameras. In order for a speed monitoring device to be used, official signs in each direction of travel must indicate the use of such a device to motorists.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.

High-Level Jurisdiction Scan

Section	Alberta	Saskatchewan	BC	Quebec
Operational Considerations for Intersectional Safety Devices	Due to a high percentage of deaths and serious injuries caused by collisions in urban intersections, Intersection Safety devices were implemented within Alberta to record evidence related to both speed and red light infractions in an effort to encourage safe driving habits.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.	The entirety of BC's 140 ATE devices are located in intersections as red light cameras (as part of the Intersection Safety Program).	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.
Public Awareness	Permanent signs shall be posted on primary access roads entering municipalities that use automated traffic enforcement technology, alerting the public that ATE technology is used as a speed and red light enforcement tool in the municipality. Any new ATE site will be advertised on local media for a period of three months prior to enforcement, and a four-week familiarization period will take place where 'warning notices' will be issued in place of fines. Existing ATE technology sites must be advertised on a monthly basis by notifying local media and posting on an established website, where possible.	During the first three months of PSEP, SGI issued warnings to offending drivers caught by ATE devices rather than fines. In addition, traffic signs that clearly indicate the use of photo speed enforcement are posted at ATE sites. Further information, including camera locations, ticketing statistics, ticket payment information, and a comprehensive FAQ are available to the public via the SGI website.	Camera locations across the province are detailed on an interactive map on the ICBC website, signs are posted at intersections advising drivers of red light cameras, and the Road Safety Unit of the ETEP measures public awareness and support of traffic enforcement through independent surveys.	During the implementation of Phase 2 deployment of photographic traffic control devices, the Ministry of Transport funded a campaign to inform the public through multi-media advertisement, a two minute video posted to the websites of the Ministry of Transportation, Quebec 511, Quebec Automobile Insurance Corporation, and municipal partners describing the operation of the technology, a press release indicating the location of each device, and the distribution of a digital toolbox containing advertising elements for partners to use on their websites. The Ministry of Transport also requires indication of usage via road signs, and provides interactive maps for red light cameras, stationary, and mobile photo radar locations.
Testing	Intersection Safety Devices are tested at minimum every 30 days by a tester appointed under the Traffic Safety Act. A tester of an intersection safety device will not be considered for appointment under the Traffic Safety Act until he/she provides to the appropriate Alberta Transportation employee suitable documentation from the device manufacturer demonstrating that the tester is competent in the inspection and testing of the intersection safety device.	ATE systems perform self diagnostics at start-up to ensure that they are operating correctly. They are tested and certified before leaving the factory to meet the standards of a speed instrument. The cameras are checked on a daily basis, to ensure they are functioning properly.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.

High-Level Jurisdiction Scan

Section	Alberta	Saskatchewan	BC	Quebec
Monitoring	Each enforcement agency shall collect data on the use of automated traffic enforcement technology. The data will be collected monthly at each site and reported quarterly to Alberta Justice and Solicitor General. All traffic enforcement technology data generated by Automated Traffic Enforcement will be retained by the enforcement agency for a minimum of ten (10) years.	As the ticketing and monitoring vendor contracted by SGI, Conduent Inc files and stores ticketing and camera data, and uploads offending documents to the applicable police service for review. During this process, monthly statistics are recorded and accessible by the public through the SGI website.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.
Peace Officers Engaged in ATE	Peace Officer Appointments allowing the use of Automated Traffic Enforcement Technology may contain, as a condition of that appointment, a clause requiring compliance with Provincial Automated Traffic Enforcement Guidelines and Provincial Automated Traffic Enforcement Training Guidelines.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.
Training	Alberta's ATE Guideline outlines training requirements for the use of ATE technologies by police, provides qualifications for instructors to deliver radar or laser training to operators, and regulates the availability of applicable training resources.	Police officers are highly trained in the use of Radar and Laser speed detection technology, and are equipped with the latest tools of the trade to effectively perform their duties.	The Road Safety Unit in partnership with the Justice Institute of BC ensures that officers have access to advanced traffic enforcement training.	No publicly available provincial equivalent to this section of the Alberta Guideline could be identified.

Audit Process

Alberta Justice and Solicitor General audits all municipalities that operate an ATE program. There have been two audit cycles, beginning in Q3 of 2013 – the first completed in 2013/14 and the second completed in 2016/17. It should be noted that because there is no provincial legislation for ATE, there is also no provincial legislation that outlines audit procedures for ATE. As the large majority of municipalities utilize peace officers, there may be additional related audits which are completed under the Peace Officer Act.

The audit process reviews the following for each municipality:

- Explanation of the municipal program's history
- Conventional vs. ATE enforcement statistics by tickets issued
- Program and equipment overviews
- Policy, Reporting, Training, Signage, File Retention, and Public Complaints review
- Interviews with key program management personnel and an ATE operator
- Examination of program documents such as policies, site assessments, traffic safety plans, and other administrative and operational documents
- Opportunities for improvement
- Conclusions and Recommendations to address opportunities

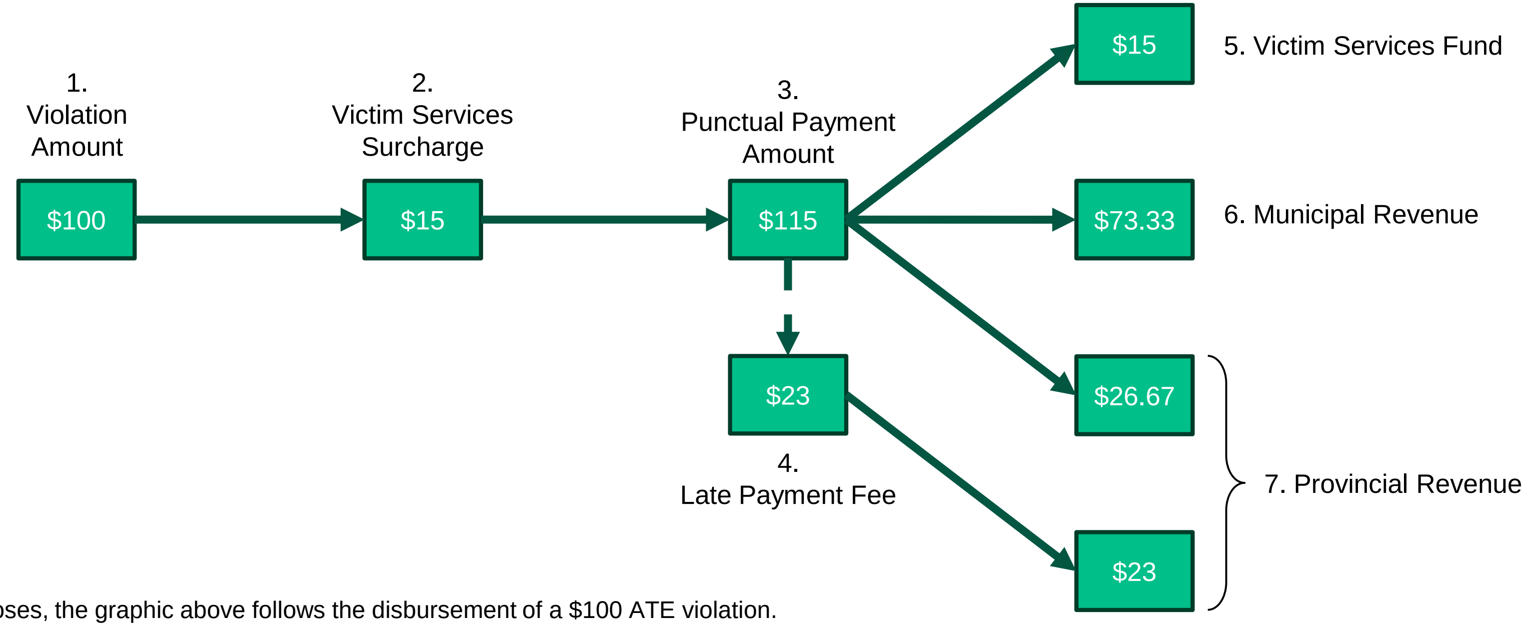
No major issues have been discovered by AJSG as a result of the audits completed since 2013.

Appendix I: Revenue Disbursement Model

There exists a level of complexity in the revenue disbursement model, as initial violation amounts – which are based on legislated fines dependant on the number of kilometers driven above the speed limit – could increase because of a penalty for late payment, or decrease if the fine is argued down with a prosecutor or in court.

To every ticket, a 15% victims services surcharge is applied, which goes directly to the Victim Services Fund. This fund compensates victims of crime, although not necessarily traffic-related crimes or collisions. The Justice division of AJSG administers the court process, the fine collection, and the fine revenue distribution processes. For this, the province retains 26.67% of the remaining revenues if the violation is paid on time. If the payment is late, an additional fee of $20 or 20% – whichever is greater – is applied to the violation amount, and the entire amount is retained by the province to cover additional administrative costs. The municipality that issued the violation receives 73.33% of the violation amount. This money is unrestricted, so the municipality has discretion regarding how it is spent, which may include ATE program costs, traffic safety investments, or unrelated expenditures. Disbursements and adjustments between the province and the municipalities are handled on a monthly basis by AJSG.

Appendix I: Revenue Disbursement Model



1. Violation Amount: For illustrative purposes, the graphic above follows the disbursement of a $100 ATE violation.
2. Victims Services Surcharge: 15% of the violation amount is added on to the violation amount, to be added to the Victim Services Fund.
3. Punctual Payment Amount: There is an allowed amount of time for payment of a violation, and after that period, the late payment amount is incurred.
4. Late Payment Fee: If the violation is not paid on time, a penalty of $20 or 20% (whichever is greater) is added to the initial violation amount. This fee covers processing costs which are incurred provincially, therefore the fee associated with late payments is retained by the province.
5. Victim Services Fund: This is a legislated, restricted account used to compensate victims of crime and fund victim rehabilitation programs, not necessarily directly related to traffic incidents.
6. Municipal Revenue: 73.33% of the remaining balance after payment to the Victim Services Fund is disbursed to the municipality that issued the violation, to pay for costs of operating the program. The destination account is not outlined in legislation, and is placed at the discretion of the municipality.
7. Provincial Revenue: 26.67% of the remaining balance after payment to the Victim Services Fund is retained by the Province, under legislation, and is directed to general revenues. These monies cover the costs of ticket processing, court proceedings, and collection of fine payments. The entire late payment fee (if applicable) is retained by the province to cover additional administrative costs.

APPENDIX D – COLLISION DATA ANALYSIS

Tantus

MNP LLP

Automated Traffic Enforcement Review

Data Analysis Final Presentation

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Date: July 6, 2018

Executive Summary

1. Methodology and Limitations
2. Study Findings
3. Study Recommendations

Executive Summary

Research Introduction & Overview

- The intent of this analysis was to test the effectiveness of ATE use in the province on collision rates and its overall effectiveness as a traffic safety tool compared to other forms of traffic safety investment and non-ATE enforcement. The analysis intended to map the overall traffic safety strategies and investments from municipalities (ATE users and non-ATE users) against the improvement they've seen in traffic safety. Overall, the analysis shows the use of ATE has impacted collision rates in the province. However, due to data limitations, primarily regarding municipal traffic safety investment, the comparison between the effectiveness of ATE compared to other forms of traffic safety remains unclear.

Methodology and Limitations

- We conducted basic analyses and regression analyses of collision rates in the province for the year-over-year changes in overall collision rates, collision severity and collision types
  - For all analyses we examined the overall use of ATE, the use of ISD's and the use of Mobile devices
  - For all investment analyses we looked at same year impacts on collision rates, as well as a 1-year lag
- Due to data limitations, the analysis did not indicate a comprehensive view of how municipalities are investing in traffic safety. The current analysis relies on self-reported results from municipalities. Some municipalities indicated that further refinement of their expenditures could be offered with more time. Some capital and operating expenditures are likely absent from the existing data, and some may include non-traffic safety expenditures that have not been removed.
- The location data form the eCollision data set was not usable, based on data input challenges. While the municipal name data was cleansed, we were unable to cleanse or use specific intersection location data. This meant the analysis was unable to determine collision rates at different intersections or road types, as was the initial goal. As such, all analysis was conducted at a municipal level.
- The analysis used several Ontario municipalities as comparators for larger municipalities who did not use ATE, which were not available for larger sized municipalities in Alberta. However, differences in collision data made comparison difficult and potentially impacted the results (There were significantly lower collision rates in Ontario and it appears that less serious collisions are less likely to be reported)

Executive Summary

Findings of the Data Analysis

- Our analysis is aligned with existing research in its finding that the use of ATE **does** have a meaningful statistical relationship with reducing collision rates, though its impact is relatively small (Approximately 1.4% of the observed reduction in provincial collision rates can be explained by the use of ATE)
- The analysis aligns with existing research that ATE **does** have a meaningful statistical relationship with reducing severe collisions
  - This relationship was observed with the limited sampling of larger municipalities, which excludes less populous municipalities that had no instance of fatal (severe) collisions within their boundaries.
- Given the data available, the analysis **does not definitively confirm or deny** other research findings that ATE can change collision patterns. We **did not** observe a statistically meaningful relationship regarding side angle collision patterns at a municipal level (other studies have generally focused on specific intersections or locations)
- The data **does** suggest a higher level of rear-end collisions occur with ATE. We observed a statistically meaningful relationship between the use of ATE and an increase in rear-end collisions.
  - This pattern was even stronger for the use of ISD's. The relationship of overall ATE use to increased rear-end collisions is likely due to the large use of ISD's, as Mobile devices actually showed a meaningful impact on reducing rear-end collisions at a municipal level
- Our analysis **did not confirm or deny** any meaningful relationship between the criteria selected by municipalities to justify ATE and traffic safety. The analysis examined the type of criteria selected, as well as the number of criteria selected (i.e. only 1, 2, 3)
- The case study analysis of municipal traffic expenditures generally indicated that studied municipalities are reasonably reinvesting ATE revenue, and that investment in traffic safety correlates to a reduction in collision rates. However, data issues limited the analysis of municipal traffic safety investment.

Executive Summary

Recommendations from the Data Analysis

- Conducting additional data analysis on municipal traffic safety investment would provide additional insight into how municipalities are investing ATE fine revenue and what areas of traffic safety investment have the largest impact on collision rates and collision severity.
  - The case studies identified municipalities are generally investing fine revenue in traffic safety and their investments are impacting traffic safety, however we had a limited sample with incomplete data.
  - Incorporating comprehensive municipal investment data into the study could identify meaningful insight into traffic safety investment programs and ATE enforcement programs to inform ATE guidelines.
- Incorporating more specific location data for individual intersections or road segments would provide additional insight into ATE's impact on collision rates, collision types and collision severities directly where it is being used. The current analysis examines changes in collisions at a municipal-level, which is useful for determining overall driver behaviour change, but a more targeted analysis of specific road locations could identify additional insights of ATE's direct impact on traffic safety where it is used.
  - Significant data cleansing of existing eCollision data would be required to conduct this analysis of historical collision rates. It may be more reasonable to conduct additional analysis that focuses on specific locations in the future, so cleansing past data would not be required
- A review of the selection criteria used for deployment reasons would be valuable, as the analysis found no significant impact between the deployment reasons used (or number of deployment reasons used) and collisions. Adjusting the deployment reasons available, or how they are selected may provide an opportunity to ensure deployment reasons have a more meaningful impact on traffic safety
- The analysis highlighted the difficulty of collecting municipal traffic safety investment information. AT should work with Municipal Affairs to explore how it can obtain standardized, consistent information from municipalities of their traffic safety investment as a part of their regular reporting
  - The collection of comprehensive traffic safety investment should include capital and operating investment in public education, staff training, signage, ATE enforcement, other enforcement staffing, other traffic calming measures, and any other traffic safety spending
- The analysis highlighted challenges with the current eCollision data quality, primarily regarding locations. The challenges appear to be during data entry from reporting agencies. AT should explore how it can work with those agencies to improve data entry to ensure cleaner eCollision data that would provide additional value for being able to focus in on specific location, as identified above.

Methodology Overview

1. General Methodology Overview
2. Limitations and Additional Notes

General Methodology Overview

Data Overview:

- Alberta Transportation eCollision data – Person and Object Files (2007-2016)
- Alberta Justice and Solicitor General ATE Audit Summary Analysis (MNP) with camera hours and criteria (2009-2017)
- Alberta Justice and Solicitor General ATE Audit Summary Analysis (MNP) & JOIN Revenue Reports
- Municipal Financial Information System (Alberta Municipal Affairs)
- Municipal ATE Expenditure collected Workbooks
- Municipal Non-ATE Expenditure collected Workbooks
- Ontario Ministry of Transportation Road Safety Reports (2010-2014)
- The eCollision data was cleansed by consolidating municipal name variations and consolidating collisions with multiple objects and persons into a single collision
- The AJSG ATE Audit Summary Analysis summarized all camera hours and identified likely ISD devices based on the reported characteristics of the device (i.e. devices that stayed in the same location for an entire day, or for multiple days were determined to be likely ISD devices)

Collision Data Analysis Calculations

- Basic Analysis of Collision trends including:
  - Year over Year change in Collision Rates
  - Year over Year change in Collision Severity Proportion
  - Year over Year change in Collision Type Proportion
- Regression Analysis of:
  - Use of ATE vs. Change in Collision Rates
  - Camera hours of ATE vs. Change in Collision Rates
  - Camera Hours of ATE vs. Collision Rates per 10,000
  - Change in Camera hours of ATE vs. Change in Severity Proportion
  - Camera Hours of ATE per 10,000 vs. Severity Proportion
  - Camera hours of ATE vs. Collision Type Proportion
- Regression Analysis has been run on all municipal groupings and on ISD and Mobile device hours in addition to Total Camera Hours of ATE

General Methodology Overview (2)

Revenue Study Analysis Calculations:

- Basic Financial Analysis of Revenue trends:
  - Avg Ticket Revenue received per year (all sizes)
  - Avg Ticket Revenue change per year (all sizes)
- Case Study Regression Analysis of:
  - Traffic Safety Spend vs. Collisions per 10,000
  - Traffic Safety Spend (1 year lag) vs. Collisions per 10,000
  - Ticket Revenue (1 year lag) vs. Traffic Safety Spend
  - Ticket Revenue (1 year lag) vs. Total ATE Spend
  - Ticket Revenue (1 year lag) vs. Total Expenses
  - Ticket Filings (1 year lag) vs. Total Expenses
  - Ticket filings 1 year lag vs. Total Traffic Safety Spend
  - Change in Ticket Revenue vs. Change in ATE Spend
  - Change in Ticket Filings vs ATE Spend
  - Change in Collision Rates vs. Change in ATE Spend

Site Selection Criteria Analysis: Regression analysis of:

  - Deployment Reasons vs. Collision rate per 10,000
  - Deployment Reasons vs. Change in Collision rates
  - Number of Deployment Reasons vs. Change in Collision rates
  - Number of Deployment Reasons vs. Collision rate per 10,000
- Deployment reasons were grouped into the following categories: Historical deployment reasons, Situational deployment reasons, Subjective deployment reasons, Blank deployment reasons, and Other deployment reasons

Limitations and Other Notes

Research Limitations:

- Limited Traffic safety spend data provided by ATE municipalities
- No Traffic safety data provided by Non-ATE Municipalities
- Ontario comparators skew comparison buckets(Significantly lower Collisions per 10,000)
- The control group for large cities (Ottawa) has significantly different collision statistics, and may be skewing results. Individual case studies on Edmonton, and Calgary have been included to show a micro-level relation between ATE usage and collisions
- Limited severe collisions in smaller Non-ATE jurisdictions skews analysis

Further Research Refinement:

- Enhanced data on municipal expenditures is required to analyze traffic safety investment – the current analysis relies on self-reported results from municipalities, supplemented with existing Municipal Financial Information & Statistics information through Alberta Municipal Affairs, where reasonable to do so. Some municipalities indicated that further refinement of their expenditures could be offered with more time. Some capital and operating expenditures are likely absent from the existing data, and some may include non-traffic safety expenditures that have not been removed.
- Enhanced data will allow for the analysis of what types of traffic safety investments impact traffic safety, providing guidelines for individual ATE programs

Additional Notes/Assumptions:

- Municipalities have been grouped to determine trends in varying sized jurisdictions: Large City (750,000 – 1,000,000), Mid-Large City (30,000 - 150,000), Small-Mid City (10,000 - 30,000), Small Town (0 – 10,000)
- Population (As listed from Municipal Affairs Alberta) has been used as a proxy for traffic growth
- All data has been included for analysis purposes unless otherwise identified
- Analysis where strong outlier data has been removed and a statistical significant correlation has been identified, are marked “Likely”.
- Analysis that does not have any statistical significance (P-Value <0.05) are marked “Unclear”

Safety - Collision Data Analysis

Structure of Deeper Analysis Questions

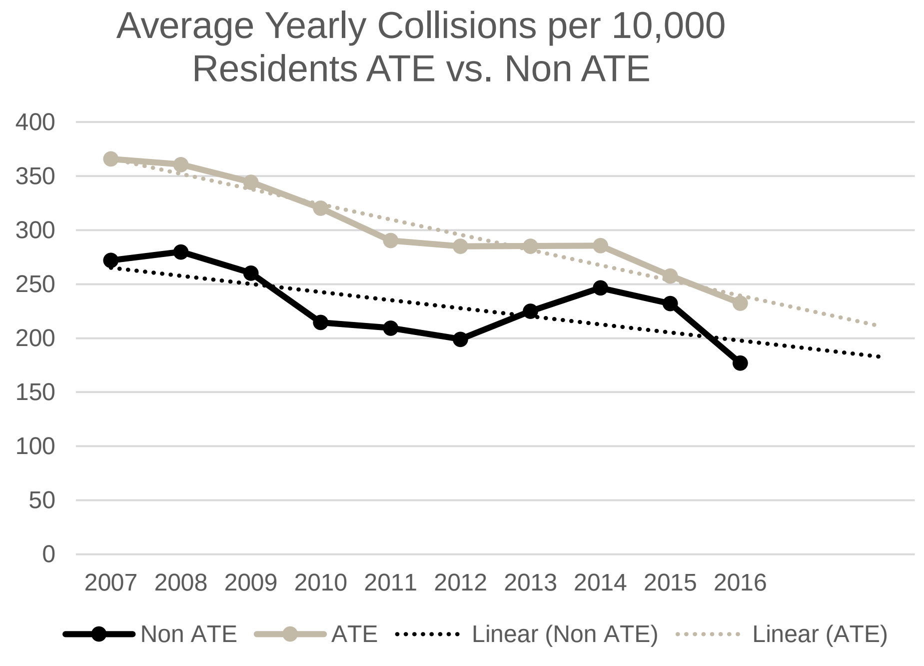
- As a supporting analysis of the ATE program review in Alberta asking: ***"Is Automated Traffic Enforcement ("ATE") being used effectively to affect traffic safety?",*** the study broke this question down into 4 sub-questions informed by the findings of the literature review:
  1. Has ATE decreased collision rates in the province?
  2. Has ATE reduced fatalities or impacted the severity of collisions?
  3. Has ATE changed the patterns of collisions in the province?
  4. Is there a difference between ISDs and mobile photo radar?

Safety: Collision Data

1. Has ATE decreased collision rates in the province?

Municipal Grouping	Use of ATE vs. Change in Collision Rate Or Intensity of ATE vs. Collision Rates	
	Correlation	Significant
Total	Yes (r^2 = -.014)	Yes (p-value = .027)
Large City	Unclear	No
Mid Large City	Yes (r^2 = -.084)	Yes (p = .011)
Small Mid City	Unclear	No
Small Town	Unclear	No

"Unclear" indicates that there is no statistical relationship; that is, any cause and effect relationship between the variables appears to be random.



Key Takeaways / Statistical Analysis:

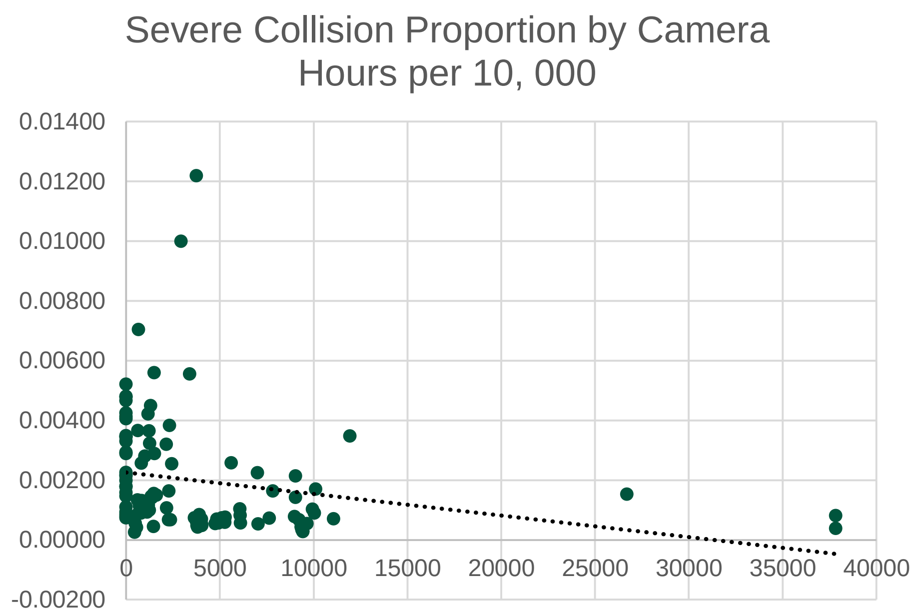
- Overall, the use of ATE does show an impact on collision rates, though the level of impact is somewhat limited. At a provincial level, the correlation between the use of ATE and collision rates declining is weak, but is statistically significant based on regression analysis.

Safety: Collision Data

2. Has ATE reduced fatalities or impacted the severity of collisions?

Municipal Grouping	Camera Hours vs. Severity Proportion		
	Fatality	Injury	Property Damage
Alberta	Likely (r^2=-.053) (p=.017)	Yes (r^2=.038) (p=.0004)	Yes (r^2=-.038) (p=.0004)
Large City (750,000 – 1,000,000)	Unclear	Unclear	Unclear
Mid Large City (30,000 -150,000)	Unclear	Unclear	Unclear
Small Mid City (10,000 - 30,000)	Unclear	Yes (r^2=.031) (p=.045)	Yes (r^2=-.030) (p=.049)
Small Town (0 – 10,000)	Unclear	Unclear	Unclear

"Unclear" indicates that there is no statistical relationship; that is, any cause and effect relationship between the variables appears to be random.



Key Takeaways / Statistical Analysis:

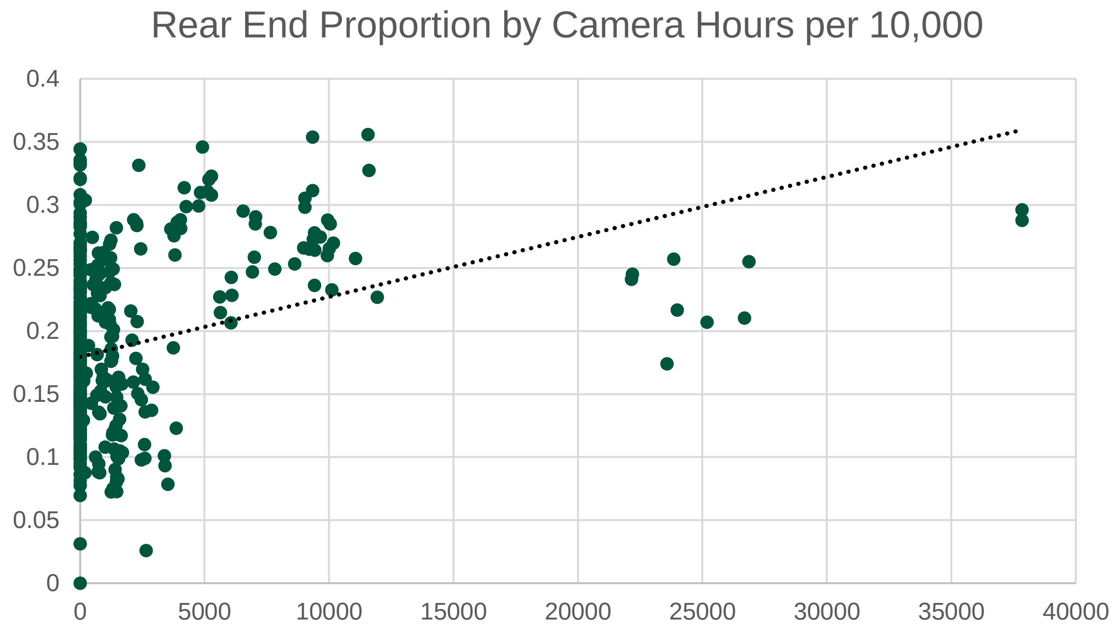
- The analysis uses the same ranking scale of collision severity as the eCollision object file data: Fatality collisions = Severe, Injury collisions = Moderate, Property Damage Only collisions = Minimal
- Despite reducing collisions, ATE does not appear to be impacting the proportion of severe (fatal) collisions
- Large number of small municipalities with zero severe (fatal) collisions, who also tend to not have ATE, may be skewing results. Adjusting by removing municipalities with no severe collisions, ATE does show a reduction in collision severity and is statistically significant at a provincial level.
- Low severity (Property Damage) collision proportions have been reduced with ATE and is statistically significant at a provincial level

Safety: Collision Data

3. Has ATE changed the patterns of collisions in the province?

Municipal Grouping	Camera Hours vs. Collision Type Proportion	
	Rear End	Side Angle
Alberta	Yes, (r^2=.113) (p=5.56E^{-12})	Unclear
Large City (750,000 – 1,000,000)	Unclear	Unclear
Mid Large City (30,000 -150,000)	Unclear	Unclear
Small Mid City (10,000 - 30,000)	Yes, (r^2=.077) (p=.0003)	Unclear
Small Town (0 – 10,000)	Unclear	Unclear

"Unclear" indicates that there is no statistical relationship; that is, any cause and effect relationship between the variables appears to be random.



Key Takeaways / Statistical Analysis:

- Rear end collision proportions do appear to increase with the use of ATE. At a provincial level there is a positive statistically significant correlation.
- There may be a small impact on side angle collisions, though only large cities show a reasonable correlation, and it is not statistically significant

Safety: Collision Data

4. Is there a difference between ISD's and mobile photo radar?

Area	Change Observed?	
	Intersection Devices	Mobile Devices
Overall Collision Rate	Some	Some
Collision Severity	Weak	Some
Collision Type	Limited (Some – for rear-end)	Limited (Some – for rear-end)

Some – Statistical significance and correlation in certain size categories but not overall.

Weak – Statistical significance and correlation in all size levels, but the correlation is weak.

Limited – No statistically significant correlation in any size level.

Key Takeaways / Statistical Analysis:

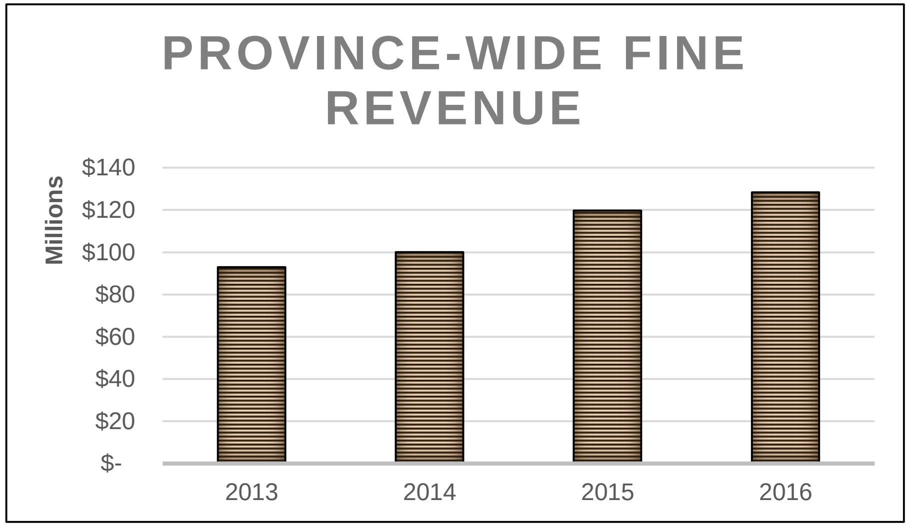
- The use of mobile devices and ISD devices both have "Limited" results for reduced collision rates at a Provincial level, but there is greater significance at different municipal size categories (hence the "Some" scoring)
- Mobile devices have some impact on collisions at a provincial level (r^2=-.042) (p=.0002)
- ISDs have an impact on moderate (injury) (r^2=.039) (p=.0003) and minimal (property damage) collisions (r^2=-.039)(p=.0003) at all size levels, but there is no identifiable relationship to severe (fatal) collisions
- ISDs have a slightly larger impact on increasing rear-end collisions than all camera hours (r^2=.131) (p=7.7E^{-14})
    - Mobile devices have a significant relationship reducing rear-end collisions (r^2=-.015) (p=.012) (though not observed for smaller municipalities)
- ISDs and mobile devices have an unclear impact on side angle collisions

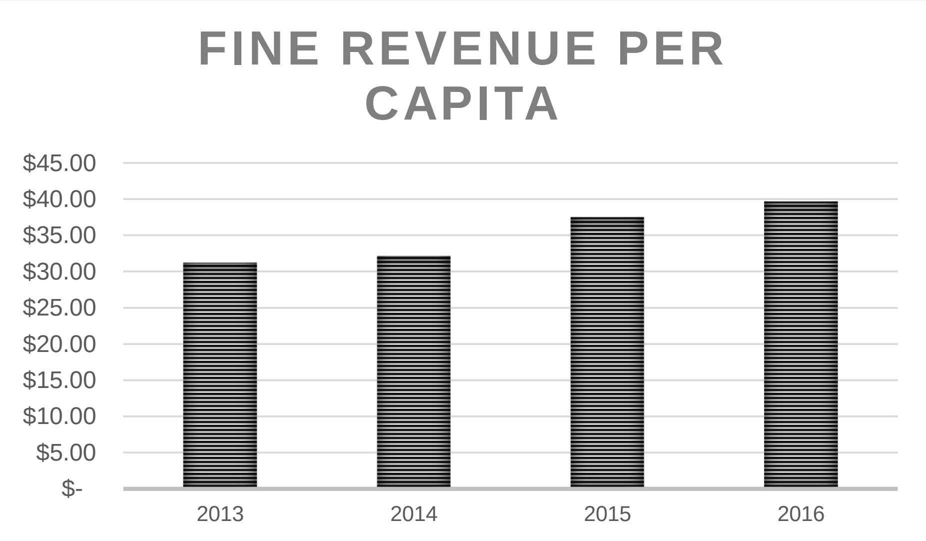
Revenue

1. Municipal Revenues Breakdown
2. How Revenues Are Spent – Municipal Case Studies

Revenue: $ to municipalities

Municipal Grouping	ISD Usage (% of Total Camera Hours)	AVG Revenue per municipality	AVG Revenue Increase (2013-2016)
Province	93.28%	$2.76 Million	11.52%
Large City (750,000 – 1,000,000)	96.05%	$39.1 Million	10.07%
Mid Large City (30,000 -150,000)	91.64%	$1.55 Million	24.18%
Small Mid City (10,000 - 30,000)	83.00%	$781 Thousand	5.93%
Small Town (0 – 10,000)	0%	$510 Thousand	19.72%





Key Takeaways / Statistical Analysis:

- There have been consistent increases in overall fine revenue collected (at all municipal size levels) as well as consistent increases in fine revenue collected per capita
- There does not appear to be significant differences in the fine revenue increases between municipalities that use more or less ISD's

Revenue Distribution: Methodology

- Revenue data was provided for each municipality by Alberta Justice and Solicitor General
  - The information provided reflects only what was reported by municipalities
  - Values listed as "Not Available" either indicate that the category did not have a reported value in the reports provided for the review, and therefore this information was not included in the analysis of any future data
- ATE camera hours were used as a measure of reporting in the table to follow, as well as throughout this review to equalize analysis done between municipalities of varying sizes
  - Note that Intersection Safety Devices (ISDs) (red light camera and/or speed on green) typically run 24 hours a day, leading to greater camera hours for municipalities with ISD programs

Revenue Distribution by Municipality (2016)

Summary of Revenue Distribution by Municipality and ATE Locations

Municipality	Revenue	Number of Photo Radar Locations	Number of Red Light locations	Number of Speed on Green locations	Total ATE locations	Total 2016 ATE hours
BEAUMONT	$865,841.82	83	0	0	83	40,037.00
CALGARY	$38,097,171.79	950	50	47	1047	2,686,043.00
CAMROSE	$554,982.69	78	0	n/a	78	53,490.00
CANMORE	$632,057.00	56	0	0	56	43,374.00
COALDALE	$238,011.96	7	Not Available	Not Available	7	24,237.00
COLD LAKE	$79,576.00	149	0	0	149	1,309.00
DEVON	$1,123,193.60	47	0	0	47	60,333.00
EDMONTON	$50,796,340.35	272	49	49	370	3,694,987.00
EDSON	$1,597,479.92	32	0	0	32	107,477.00
FORT SASKATCHEWAN	$2,210,740.50	39	7	7	53	190,516.00
GRANDE PRAIRIE	$4,198,693.56	282	0	0	282	82,842.00
HINTON	$1,660,241.14	55	0	0	55	126,981.00
LEDUC	$1,756,022.25	134	0	0	134	91,601.00

Revenue Distribution by Municipality (2016)

Municipality	Revenue	Number of Photo Radar Locations	Number of Red Light locations	Number of Speed on Green locations	Total ATE locations	Total ATE hours
LETHBRIDGE	$3,971,403.53	54	2	2	58	256,738.00
LLOYDMINSTER	$1,108,933.89	101	0	0	101	112,211.00
MEDICINE HAT	$2,367,039.39	162	0	0	162	317,100.00
MORINVILLE	$443,355.20	51	0	0	51	9,245.00
RED DEER	$1,582,725.38	323	10	Not Available	333	185,558.00
REGIONAL MUNICIPALITY OF WOOD BUFFALO	$2,219,253.22	138	8	Not Available	146	155,758.00
SLAVE LAKE	$317,980.00	60	0	0	60	10,512.00
SPRUCE GROVE	$5,157,458.56	115	0	0	115	272,805.00
ST. ALBERT	$4,292,187.76	153	6	6	165	296,562.00
STONY PLAIN	$844,489.58	44	0	0	44	29,422.00
STRATHCONA COUNTY	Not Available	Not Available	10	10	Not Available	152,781.00
TABER	$444,650.32	5	Not Available	Not Available	5	29,749.00
WAINWRIGHT	$428,705.50	96	0	0	96	12,730.00
WETASKIWIN	$592,555.00	93	0	0	93	33,254.00
WHITECOURT	$1,117,316.14	55	0	0	55	179,388.00

Structure of Deeper Analysis Questions

- In an attempt to answer the second analysis question, ***"Is the focus of the ATE program on revenue generation?",*** spending information was solicited from Alberta municipalities. This was a difficult exercise as municipalities are not required to report expenditure in the groupings that were requested.
- The analysis focused on the limited data provided by 5 of the 28 municipalities, five were selected of varying sizes and characteristics.

Appendix F: How fine $ are being spent

Case Study #1:

Financial Stats (2009 - 2016)	
% Change in Traffic Safety Spend (AVG)	8.02%
% Change in ATE Spend (AVG)	17.27%
% Change in Total Expenses (AVG)	4.96%
Fine Stats (2013 - 2016)	
% Change in Fine Revenue (AVG)	16.69%
% Change in Fines Issued ($ value) (AVG	26.77%
Ticket Revenue / Total Revenue (AVG %)	0.69%
Safety Stats (2009 - 2016)	
% Change in Collisions (AVG)	-0.89%
% Change in Severe Collisions (AVG)	10.03%
% Change in Rear End Collisions (AVG)	-0.13%
% Change in Side Angle Collisions (AVG)	-0.75%
ATE Use Stats (2009 - 2016)	
% Change in Camera Hours (AVG)	1.52%
Camera Hours / 10,000 (AVG)	3875.94
ISD % (AVG)	97.78%

Key Takeaways / Statistical Analysis:

- Ticket Revenue has a higher correlation to total operational expenses than traffic safety spend
- ATE use and Traffic Safety spend have impacted collision rates, but has less impact on severity of collisions
  - Strong statistical significance for increased camera hours impacting collision rates(same year r^2=-.778)
  - Strong statistical significance for increased traffic safety spending impacting collision rates (same year r^2=-.66) (1-year lag r^2=-.71) Stronger statistical significance for moderate severity collisions than severe
- ATE spending has increased more than other traffic safety spending (17.27% to 8.02%)
- ISD's have been a key strategic part of traffic safety for the City, but intent of reducing severe collisions has not been realized (increase of 5.48% in proportion of severe collisions)
- Change in ticket revenue has tracked closely with change in ATE spend (16.69% to 17.27%, respectively)

Appendix F: How fine $ are being spent

Case Study #2:

Financial Stats (2009 - 2016)	
% Change in Traffic Safety Spend (AVG)	12.42%
% Change in ATE Spend (AVG)	8.17%
% Change in Total Expenses (AVG)	5.91%
Fine Stats (2013 - 2016)	
% Change in Fine Revenue (AVG)	6.00%
% Change in Fines Issued ($ value) (AVG)	8.72%
Ticket Revenue / Total Revenue (AVG %)	1.40%
Safety Stats (2009 - 2016)	
% Change in Collisions (AVG)	-2.34%
% Change in Severe Collisions (AVG)	-1.23%
% Change in Rear End Collisions (AVG)	-1.41%
% Change in Side Angle Collisions (AVG)	-2.46%
ATE Use Stats (2009 - 2016)	
% Change in Camera Hours (AVG)	18.53%
Camera Hours / 10,000 (AVG)	4715.87
ISD % (AVG)	94.27%

Key Takeaways / Statistical Analysis:

- Ticket Revenue has a higher correlation to traffic safety spending than to overall operational expenses
- ATE use and Traffic Safety spend have impacted collision rates, but has less impact on severity of collisions
  - Strong statistical significance for increased camera hours impacting collision rates (same year r^2=-.639)
  - Strong statistical significance for increased traffic safety spending impacting collision rates (same year r^2=-.781 and 1-year lag r^2=-.834)
  - Stronger statistical significance for moderate severity collisions than severe
- Other traffic safety spending has increased more than ATE related spending (12.42% to 8.17%)
- Has adopted a Vision Zero strategy, with a focus on public education and engineering to reduce injury collisions – will expect to see greater education investment in the future (no cost data for traffic calming, but investments have been made
- Change in ticket revenue has tracked closely with change in ATE spend (6.00% to 8.17%, respectively)

Appendix F: How fine $ are being spent

Case Study #3:

Financial Stats (2009 - 2016)	
% Change in Traffic Safety Spend (AVG)	0.10%
% Change in ATE Spend (AVG)	0.00%
% Change in Total Expenses (AVG)	5.08%
Fine Stats (2013 - 2016)	
% Change in Fine Revenue (AVG)	14.43%
% Change in Fines Issued ($ value) (AVG)	21.18%
Ticket Revenue / Total Revenue (AVG %)	0.78%
Safety Stats (2009 - 2016)	
% Change in Collisions (AVG)	-2.39%
% Change in Severe Collisions (AVG)	44%
% Change in Rear End Collisions (AVG)	1.73%
% Change in Side Angle Collisions (AVG)	-3.97%
ATE Use Stats (2009 - 2016)	
% Change in Camera Hours (AVG)	60.11%
Camera Hours / 10,000 (AVG)	2317.05
ISD % (AVG)	63.40%

Key Takeaways / Statistical Analysis:

- Investment in ATE and Traffic Safety has been extremely consistent throughout the time period, with some one-off changes in capital expenditures
- As a result, there is no statistical relationship between ticket revenue and ATE or Traffic Safety spend, but there is between ticket revenue and general expenses
- Traffic Safety spend does not impact collision rates compared to other studies:
  - A fairly weak statistical relationship between traffic safety spending impacting collision rates (same year and 1-year lag)
  - Likely due to the low change in traffic safety spending
- Camera hours have only a medium (but not statistically significant) relationship to reduced collisions – this is weaker than other studies.
- ISD shows an impact on reducing the proportion of head-on collisions, and increasing the proportion of rear-end collisions – though no impact on side angle collisions was observed
- Investments have been largely for capital improvements for traffic calming and road markings / signage
- There is no discernable impact on severity for ATE use

Appendix F: How fine $ are being spent

Case Study #4:

Financial Stats (2009 - 2016)	
% Change in Traffic Safety Spend (AVG)	43.00%
% Change in ATE Spend (AVG)	37.80%
% Change in Total Expenses (AVG)	9.30%
Fine Stats (2013 - 2016)	
% Change in Fine Revenue (AVG)	32.61%
% Change in Fines Issued ($ value) (AVG)	64.04%
Ticket Revenue / Total Revenue (AVG %)	3.19%
Safety Stats (2009 - 2016)	
% Change in Collisions (AVG)	0.47%
% Change in Severe Collisions (AVG)	N/A
% Change in Rear End Collisions (AVG)	7.65%
% Change in Side Angle Collisions (AVG)	1.40%
ATE Use Stats (2009 - 2016)	
% Change in Camera Hours (AVG)	744.24%
Camera Hours / 10,000 (AVG)	12585
ISD % (AVG)	49.02%

Key Takeaways / Statistical Analysis:

- There is no statistical relationship between ticket revenue and expenditures of any kind
- Traffic Safety spend has impacted collision rates:
  - Strong statistical significance for increased traffic safety spending impacting collision rates (same year r^2=-.568 and 1-year lag r^2=-.740)
- The use of Mobile Photo Radar shows a strong statistical relationship with reduced collision rates in the community(r^2=-.734) , but not for ISD
- Invested Heavily in Traffic Calming in 2015 and 2016 according to data, also dramatically increased fines in 2015 (leading to high average increases in table)
- Side angle collisions decreased significantly (30%) 1 year after ISD use began, but increased significantly after that, and total collision rate decreases were not seen in years with ISD use

Appendix F: How fine $ are being spent

Case Study #5:

Financial Stats (2009 - 2016)	
% Change in Traffic Safety Spend (AVG)	14.15%
% Change in ATE Spend (AVG)	14.67%
% Change in Total Expenses (AVG)	4.62%
Fine Stats (2013 - 2016)	
% Change in Fine Revenue (AVG)	29.70%
% Change in Fines Issued ($ value) (AVG)	36.01%
Ticket Revenue / Total Revenue (AVG %)	4.72%
Safety Stats (2009 - 2016)	
% Change in Collisions (AVG)	-4.72%
% Change in Severe Collisions (AVG)	N/A
% Change in Rear End Collisions (AVG)	41.88%
% Change in Side Angle Collisions (AVG)	9.09%
ATE Use Stats (2009 - 2016)	
% Change in Camera Hours (AVG)	6.74%
Camera Hours / 10,000 (AVG)	2939
ISD % (AVG)	0.00%

Key Takeaways / Statistical Analysis:

- There is a strong statistical relationship between ticket revenue and Traffic Safety / ATE expenditures (r^2=-.987, r^2=-.995) , but limited relationship to General Expenses (Suggests good, targeted investment)
- The use of ATE and Traffic Safety spend have both impacted collision rates:
  - Strong statistical significance for increased camera hours impacting collision rates (r^2=-.652)
  - Strong statistical significance for increased traffic safety spending impacting collision rates in the same year (r^2=-.585) , but not for a 1-year lag
- Unclear impact on severity of collisions (the small number of severe collisions over the years makes it difficult to determine)
- Has adopted a Vision Zero strategy for new TSP. In the past most investment has gone to signage and visibility for traffic calming
- Unclear impact on collision types – no meaningful statistical relationships were observed

Revenue: How fine $ are being spent

Case Study Summary

Financial Stats (2009 - 2016)	1	2	3	4	5
% Change in Traffic Safety Spend (AVG)	9.08%	12.42%	0.10%	43.00%	14.15%
% Change in ATE Spend (AVG)	13.46%	8.17%	0.00%	37.80%	14.67%
% Change in Total Expenses (AVG)	3.02%	5.91%	5.08%	9.30%	4.62%
Fine Stats (2013 - 2016)					
% Change in Fine Revenue (AVG)	9.95%	6.00%	14.43%	32.61%	29.70%
% Change in Fines Issued ($ value) (AVG)	7.67%	8.72%	21.18%	64.04%	36.01%
Ticket Revenue / Total Revenue (AVG %)	0.80%	1.40%	0.78%	3.19%	4.72%
Safety Stats (2009 - 2016)					
% Change in Collisions (AVG)	-4.54%	-2.34%	-2.39%	0.47%	-4.72%
% Change in Severe Collisions (AVG)	10.03%	-1.23%	44%	N/A	N/A
% Change in Rear End Collisions (AVG)	-3.57%	-1.41%	1.73%	7.65%	41.88%
% Change in Side Angle Collisions (AVG)	-0.75%	-2.46%	-3.97%	1.40%	9.09%
ATE Use Stats (2009 - 2016)					
% Change in Camera Hours (AVG)	-3.28%	18.53%	60.11%	744.24%	6.74%
Camera Hours / 10,000 (AVG)	3644.41	4715.87	2317.05	12585	2938
ISD % (AVG)	95.97%	94.27%	63.40%	49.02%	0.00%

Key Takeaways / Statistical Analysis:

Revenue

- Allocation of revenue is not a reporting requirement, and the limited data received from collection process significantly limits the conclusions that can be made.
- This does not conclusively prove or disprove that ATE is being used for revenue generation based on the limited expenditure data received. However, the revenue that is being reinvested is having a real impact on traffic safety.
- In most cases, there has been a statistical relation between Fine Revenue received and Traffic Safety Investment, indicating fine revenue is being reinvested (though the data could not determine how completely it is being reinvested).

Safety

- The use of ATE has impacted collision rates in almost all case studies – highlighting ATE’s impact on traffic safety.
- Traffic Safety Investments are significantly related to a reduction in collision rates – highlighting the impact of other traffic safety measures on traffic safety results.
- In all case studies, there has been an unclear impact on collision severity.
- There is an unclear impact of ATE on changing collision types (though some examples where ISD’s have impacted an increase in rear-end collisions).
- Overall, the data does indicate that traffic safety investment (over and above ATE program investment) has a significantly positive impact on traffic safety.

Selection Criteria Analysis

Deployment Reasons – Data Analysis Support

Structure of Deeper Analysis Questions (Deployment)

- The second question of this review asked: “Has ATE been deployed appropriately across all Alberta municipalities?
- To answer the question reasons for ATE deployment were compared with collision statistics for ATE and comparator non-ATE jurisdictions.
- The analysis provided no significant correlation between the reasons for deployment (Historical, Subjective, Situational or Other) and impacts on collision occurrence.

Future: Guidelines - Criteria

Question: Is there a difference in collision rates based on the reason for device deployment?

Municipal Grouping	Criteria Type vs Collision Rates					Number of Choice Selections v. Collision Rate		
	Historical	Subjective	Situational	Other	Blank	One Choice	Two Choices	Three Choices
Province-wide	No	No	No	No	No	No	No	No

Key Takeaways / Statistical Analysis:

- Deployment reasons have been grouped into categories to identify high level relation between choices involving Historical reasons (History of speeding, History of collisions, History of red lights violations), Subjective reasons (Areas of public concern, Conventional enforcement unsafe), Situational/Locational reasons (School/playground zone, Construction zone, High speed multilane arteries). Other and Blank were left ungrouped.
- Device deployment does not have any statistically significant link between the reason for device deployment and change in collision rate
- The number of choices selected does not have any statistically significant link to the change in collision rates or the total collisions per 10,000 residents.

Study Discussion

What does the analysis tell us?
Where do we go from here?

Collision Data Conclusions

- Is Automated Traffic Enforcement (“ATE”) being used effectively to affect traffic safety?
  - Collision analysis suggests that 1.4% of the reductions of collisions in Alberta (5.3%) over the period of 2007-2016 can be attributable to the intensity of use of ATE.
  - Therefore, ATE appears to be effective in increasing traffic safety
- Is the focus of the ATE program on revenue generation?
  - Allocation of revenue is not a reporting requirement. Overall, revenue and spend data collected from select municipalities suggests that the spending over this period has had a significantly positive impact on traffic safety.
- Has ATE been deployed appropriately across all Alberta municipalities?
    - There is no statistical correlation between the reasons for deployment (Historical, Subjective, Situational or Other) and reductions in collisions.

Study Discussion

Findings

- Our analysis is aligned with existing research in its finding that the use of ATE **does** have a meaningful statistical relationship with reducing collision rates, though its impact is relatively small (Approximately 1.4% of the observed reduction in provincial collision rates can be explained by the use of ATE)
- The analysis aligns with existing research that ATE **does** have a meaningful statistical relationship with reducing severe collisions
  - This relationship was observed with the limited sampling of larger municipalities, which excludes less populous municipalities that had no instance of fatal (severe) collisions within their boundaries.
- Given the data available, the analysis **does not definitively confirm or deny** other research findings that ATE can change collision patterns. We **did not** observe a statistically meaningful relationship regarding side angle collision patterns
- The data **does** suggest a higher level of rear-end collisions occur with ATE. We observed a statistically meaningful relationship between the use of ATE and an increase in rear-end collisions.
  - This pattern was even stronger for the use of ISD's. The relationship of overall ATE use to increased rear-end collisions is likely due to the large use of ISD's, as Mobile devices actually showed a meaningful impact on reducing rear-end collisions
- Our analysis **did not confirm or deny** any meaningful relationship between the criteria selected by municipalities to justify ATE and traffic safety. The analysis examined the type of criteria selected, as well as the number of criteria selected (i.e. only 1, 2, 3)
- The case study analysis of municipal traffic expenditures generally indicated that the studied municipalities are reasonably reinvesting ATE revenue, and that investment in traffic safety correlates to a reduction in collision rates**.** However, data issues limited the analysis of municipal traffic safety investment.

Study Discussion

Study Limitations

- Since comprehensive municipal expenditure data was not available through the collection of workbooks, a case study methodology was used for a sampling of municipalities with relatively comprehensive information provided. The case study analysis of municipal traffic expenditures generally indicated that municipalities are reasonably reinvesting ATE revenue, and that investment in traffic safety correlates to a reduction in collision rates.
- Due to data limitations, the analysis did not indicate a comprehensive view of how municipalities are investing in traffic safety, or if the use of ATE is being used for revenue generation for the municipality. The analysis also did not indicate if any specific components of an ATE program or target areas of investment are better than others, or have a meaningful impact on traffic safety.
- Additional data and analysis would be required to more fully analyze the municipal reinvestment of fine revenue in traffic safety. The current analysis relies on self-reported results from municipalities, supplemented with existing Municipal Financial Information & Statistics information through Alberta Municipal Affairs, where reasonable to do so. Some municipalities indicated that further refinement of their expenditures could be offered with more time. Some capital and operating expenditures are likely absent from the existing data, and some may include non-traffic safety expenditures that have not been removed.
- The collection of comprehensive traffic safety investment should include capital and operating investment in public education, staff training, signage, ATE enforcement, other enforcement staffing, other traffic calming measures, other traffic safety spending
- The location data form the eCollision data set was not usable, based on data input challenges. While the municipal name data was cleansed, we were unable to cleanse or use specific intersection location data. This meant the analysis was unable to determine collision rates at different intersections or road types, as was the initial goal. As such, all analysis was conducted at a municipal level.
- The analysis used several Ontario municipalities as comparators for larger municipalities who did not use ATE, which were not available for larger sized municipalities in Alberta. However, differences in collision data made comparison difficult and potentially impacted the results (There were significantly lower collision rates in Ontario and it appears that less serious collisions are less likely to be reported)

Study Discussion

Recommendations from the Data Analysis

- Conducting additional data analysis on municipal traffic safety investment would provide additional insight into how municipalities are investing ATE fine revenue and what areas of traffic safety investment have the largest impact on collision rates and collision severity.
  - The case study identified municipalities are generally investing fine revenue in traffic safety and their investments are impacting traffic safety, however we had a limited sample size with incomplete data.
  - Incorporating comprehensive municipal investment data into the study could identify meaningful insight into traffic safety investment programs and ATE enforcement programs to inform ATE guidelines.
- Incorporating more specific location data for individual intersections or road segments would provide additional insight into ATE's impact on collision rates, collision types and collision severities directly where it is being used. The current analysis examines changes in collisions at a municipal-level, which is useful for determining overall driver behaviour change, but a more targeted analysis of specific road locations could identify additional insights of ATE's direct impact on traffic safety where it is used.
  - Significant data cleansing of existing eCollision data would be required to conduct this analysis of historical collision rates. It may be more reasonable to conduct additional analysis that focuses on specific locations in the future, so cleansing past data would not be required
- A review of the selection criteria used for deployment reasons would be valuable, as the analysis found no significant impact between the deployment reasons used (or number of deployment reasons used) and collisions. Adjusting the deployment reasons available, or how they are selected may provide an opportunity to ensure deployment reasons have a more meaningful impact on traffic safety
- The analysis highlighted the difficulty of collecting municipal traffic safety investment information. AT should work explore how it can obtain standardized, consistent information from municipalities of their traffic safety investment as a part of their regular ATE reporting
  - The collection of comprehensive traffic safety investment should include capital and operating investment in public education, staff training, signage, ATE enforcement, other enforcement staffing, other traffic calming measures, and any other traffic safety spending
- The analysis highlighted challenges with the current eCollision data quality, primarily regarding locations. The challenges appear to be during data entry from reporting agencies. AT should explore how it can work with those agencies to improve data entry to ensure cleaner eCollision data that would provide additional value for being able to focus in on specific location, as identified above.

APPENDIX E – LITERATURE REVIEW

Automated Traffic Enforcement – Program Review

Literature Review

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EXECUTIVE SUMMARY

Photo enforcement has been controversial. Proponents believe that photo enforcement can play an important role in increasing traffic safety by increasing the certainty of penalties for those who violate driving regulations, while opponents believe that its purpose is raising revenue for tax-averse governments. This report reviews the research on photo enforcement to determine its impact on road safety. The findings of this research are clear and consistent:

- Speed enforcement cameras reduce speeds and prevent non-injury crashes, injury crashes and fatal or serious injury crashes.
- Fixed cameras had a greater effect on total crashes and fatal or serious injury crashes, but there were no differences in speeding or in injury crashes.
- There were no differences between overt and covert cameras.

Speed Enforcement Cameras

Speed cameras can help to overcome the limitations of traditional enforcement. They offer a flexible way of enforcing speed limits, as they can be mounted in fixed locations or installed in mobile units that can cover a wide range of sites. Cameras can monitor speeds at specific locations or can cover corridors by measuring average speed over a particular section of highway. They can be hidden, or they can be open to public view and marked by signage. It is important to know whether or not speed cameras are effective in reducing death, serious injury, and property damage. However, there are methodological issues that make this assessment a complicated task so it is important to understand details of how the studies were conducted.

In preparing this report, we reviewed most of the evaluations that have been conducted assessing the effects of both speed cameras and red light cameras. The studies were completed between 1984 and 2015 and many have been summarized in the report and in the appendices. The research consistently shows that speed enforcement cameras reduce speeds and that they prevent non-injury crashes, injury crashes, and fatal or serious injury crashes. The most comprehensive piece of research available was a systematic review that included 51 studies (Steinbach et al, 2016). This review by Steinbach et al concluded that "Across all studies, the implementation of speed camera programmes was associated with a reduction in *average speed* of 7% (95% CI[1] 0-13%), in *percentage of vehicles exceeding the speed limit* of 57% (95% CI 50-64%), in *crashes* of 19% (95% CI 14-24%), in *injury crashes* of 18% (95% CI 13-23%) and *severe or fatal crashes* of 21% (95% CI 13-29%). Where there was enough data to generate comparisons across subgroups, we found only limited evidence that effects differed by type of speed camera (fixed or mobile), and no evidence for difference of effect between overt or covert cameras. There was no evidence that effects on percentage of speeding vehicles or injury crashes differed by whether the cameras were fixed or mobile. There was some evidence to suggest that fixed cameras had a greater effect on all road traffic collisions and those resulting in fatalities or severe injuries. We found no evidence that effects differed between urban and rural areas. There was some evidence that effects were greater within a short distance of camera sites compared to wider areas" (Steinbach, et al, 2016:45).

[1] CI stands for confidence interval. This means that the researchers are 95% certain that the reduction in average speed because of speed cameras lies between 0 and 13 mph with an average reduction of 7%.

For those interested in more detail about speed camera research, Appendix I presents several different types of studies. First, three additional systematic reviews are summarized and all concluded that speed enforcement cameras reduced collisions. The Appendix also provides summaries of speed camera studies conducted in Canada (two of which were done in Alberta) and several of the stronger studies carried out in other countries. With only one exception, these studies concluded that speed cameras had a positive impact on road safety. Appendix I also reviews several evaluations of section control (or point-to-point) cameras which allow for the measurement of average speeds as a vehicle moves past multiple camera locations. These section control studies also found that the cameras led to reduction in vehicle speeds and in collisions. Finally, Appendix I also summarizes a study showing that cameras were effective in reducing speed at highway work zones.

Red Light Cameras

The research on speed enforcement is clear and consistent – speed cameras are effective in reducing speeds and in reducing collisions, injuries and deaths. The evidence concerning red light cameras, is not as clear. The research shows three relatively common (though not always consistent) findings:

- Red light cameras reduce red light running.
- Red light cameras reduce side angle collisions.
- Red light cameras increase rear-end collisions.

The first two of these results are obviously positive for road safety. Running red lights can be dangerous and the resulting side angle collisions can cause serious injuries to the occupants of vehicles that are struck while proceeding through an intersection. However, the overall value of red light cameras is reduced because of the increase in rear end collisions. These collisions can be caused by drivers who brake quickly when they see an amber light because they want to avoid a photo enforcement ticket, and are then struck from behind by a vehicle whose driver was not able to react as quickly or who had decided to proceed through the amber light. Assessment of the success of red light cameras often hinges on a judgment about whether the harm caused by rear-end collisions is outweighed by the reduction in injuries and deaths caused by side angle crashes. In addition, there does appear to be real differences in the impact of red light cameras in different jurisdictions.

The difficulty in determining the net benefit of red light cameras is compounded by the fact that there are many threats to the validity of red light camera research. Some of the disagreements about the efficacy of the cameras involve methodology and particularly on researchers' judgments about the best way to control for the effects of regression to the mean and spillover in their research design and statistical analysis.

As with the speed cameras, the best way to summarize the research literature is to review the conclusions of the best of the systematic reviews which included 38 studies (Perkins et al 2017). The review's findings concerning the impact of red light cameras on *total crashes* were that the results were "highly heterogeneous" and "the direction of the estimated effects was also inconsistent" (2017:22). The overall reduction was calculated as 1% (95% CI 8% reduction to 6% increase) The results for *injury crashes* were also highly heterogeneous but more consistently positive. The pooled estimate of effect was a 20% reduction (95% CI 32%-5% reduction). The reverse was true of *property damage only* collisions with an estimated increase of 5% (95% CI 8% decrease - 20% increase). The overall estimate of *side angle* crashes showed a 21% reduction (95% CI 32% - 9% reduction). *Side angle crashes resulting in injury* had an overall estimated reduction of 28% (95% CI 39% - 14% reduction). The review also found a significant increase of 19% in *rear-end crashes* (95% CI 9% -31% increase). Finally, there was a 61% reduction in *red-light violations* (95% CI 64% - 56% decrease) though this finding was based on only three studies.

The remainder of the body of the report discusses several Canadian studies (two of which were conducted in Alberta). Appendix II first examines several other systematic reviews of red light camera research. These reviews come up with different conclusions about the utility of red light cameras. The four studies rated 'high quality' in the review conducted by Perkins et al (2017) are summarized. The lack of agreement among these four studies suggests that study quality is not the reason for the heterogeneity of the findings. The final studies summarized in Appendix II examine the impact of cancelling red light camera programs. Again, the results are ambiguous. Two of the studies – one looking at 14 cities that had cancelled their programs compared with 29 cities where cameras had not been turned off – concluded that the cameras had a positive impact on red light running and on collisions and that these increased when the cameras programs ended. However, the third study concluded that ending the program had almost no impact on collisions.

Given the debate over the evidence concerning red light cameras, what should jurisdictions do? Despite the ambiguity of the research, the preponderance of the evidence supports the use of red light cameras. However, the best way to do this is as part of an integrated traffic strategy. As noted in the speed enforcement section of this paper, the guidelines of the National Highway Traffic Safety Administration provide sound advice to governments. Ensuring that red light cameras are used at high-risk intersections (ideally this would be in locations that had relatively high numbers of side angle collisions and low numbers of rear-end crashes), that they are part of a broader, well-publicized road safety strategy, and that they are constantly evaluated will help to make roads safer. Garber et al (2007) have similar recommendations and also suggest that research be conducted on the best ways to reduce rear end collisions at camera intersections in order to overcome this negative feature of red light cameras. Among the measures that might accomplish this are better signs reminding motorists of photo enforcement, warning lights when approaching lights that are about to turn amber, and ensuring that the amber interval is long enough to reduce the likelihood of abrupt stops.

Finally, the inconsistent findings may be due to local circumstances. This suggests that local research is important and that programs should be regularly monitored to ensure they are having the desired effect. In this context it is important to note that both of the Alberta studies summarized in this report (Sayed and de Leur, 2009; AECOM, 2014a) found that red light cameras had a positive effect on collisions.

PART 1 – PHOTO SPEED ENFORCEMENT

Photo enforcement has been controversial. Proponents believe that photo enforcement can play an important role in increasing traffic safety, while opponents claim that its purpose is raising revenue for tax-averse governments. This paper reviews the research on photo enforcement to determine its impact on road safety.

There is some evidence that typical traffic enforcement methods are too inconsistent to have a lasting impact on the behaviour of drivers (Elliott and Broughton, 2005)[2], as drivers perceive that violating driving laws was not likely to result in a traffic ticket. Proponents of photo enforcement believe it will alter driving behaviour by increasing the certainty of sanctions for those who violate driving regulations.

Morain et al (2016) have noted several advantages of photo enforcement:

- Traditional enforcement is resource intensive and inconsistent;
- Photo enforcement systems can process large numbers of violators, so the certainty of penalties is increased;
- Photo enforcement can be used in locations where traditional methods would endanger police officers;
- Traditional enforcement methods can create traffic hazards due to congestion when vehicles are stopped;
- Some police departments have been accused of racially-biased traffic enforcement methods. Photo enforcement can eliminate this bias as long as enforcement sites are chosen objectively.

The National Highway Traffic Safety Administration has also noted limitations of photo enforcement:

- Cameras do not stop unsafe drivers who can continue to drive.
- There is no direct contact with violators, so no safety message can be delivered by traffic officers.
- There is a time lag between the violation and the violation notice, so there is no immediate feedback.

This paper will outline the research evidence concerning the effectiveness of photo enforcement, including speed cameras and red light cameras. While few studies explicitly compare traditional enforcement methods with photo enforcement, most of the evaluations are actually comparing automated traffic enforcement with traditional methods to see if photo enforcement results in less speeding and red light running than normal enforcement practices and if this leads to fewer collisions, injuries and deaths.

The Need for Speed Enforcement

Increased speeds lead to increased reaction and braking distances, which increases the likelihood of collisions (Willis et al, 2012). There is ample evidence that the higher the speed of vehicles involved in collisions, the greater the severity of the ensuing injuries. For example, in 2015 26% of Alberta drivers involved in fatal injury collisions had been driving at an unsafe speed compared with 8% of drivers involved in non-fatal injury collisions (Alberta Transportation, 2017). One way of reducing speeds is

[2] However, there is evidence that properly planned and implemented police patrols can be successful in reducing collisions (Newstead et al, 2001). A relatively new idea called the Data Driven Approach to Crime and Safety (DDACTS) has been successful in reducing both traffic collisions and some type of crime. Most traffic safety experts believe a combination of methods, including changes in road design, will have the greatest impact on motor vehicle collisions, injuries and deaths.

through enforcement of speed limits. However, resource limitations limit the ability of the police to increase the certainty of speeders being ticketed, so many jurisdictions around the world have turned to automated traffic enforcement to improve traffic safety.

Speed Cameras

Speed cameras can help to overcome the limitations of traditional enforcement. They offer a flexible way of enforcing speed limits, as they can be mounted in fixed locations or installed in mobile units that can cover a wide range of sites. Cameras can monitor speeds at specific locations or can cover corridors by measuring average speed over a particular section of highway. They can be hidden, or they can be open to public view and marked by signage.

It is important to know whether or not speed cameras are effective in reducing death, serious injury, and property damage. If photo enforcement is effective, two other questions arise which are addressed in some of the studies. First, do their effects extend beyond the camera sites? That is, do drivers also reduce their speeds in locations without cameras (referred to as 'spillover' or the 'halo effect')? Second, how long do the effects continue after the cameras are removed? This is particularly an issue with mobile cameras.

Methodological Issues in Assessing Speed Cameras

There are several threats to the validity of conclusions about the impact of photo enforcement. One is *regression to the mean* (RTM). Regression to the mean is a statistical problem that occurs when camera sites are selected because they have a high rate of collisions. These sites are more likely to revert to the mean on a subsequent measurement even if the intervention does not make a difference because the high rate of collisions may be due to random factors or to factors that are temporary. This would lead to a conclusion that **over**-estimates the impact of cameras, as some of the decline that might be attributed to photo enforcement is actually due to regression to the mean.

A second threat is the *spillover effect* where speeds and collisions are reduced at camera locations but, because drivers are aware of the risk of cameras, speeds and collisions also decline in non-camera areas. While this is desirable from a road safety perspective, it complicates research because if nearby non-camera areas are used as controls, the spillover effect would lead researchers to **under**-estimate the impact of photo enforcement.

Finally, there can also be *crash migration* when motorists slow down for cameras but drive at even higher speeds at non-camera locations to make up time, or when they avoid roads where they know cameras will be operating. This crash migration would lead to an **over**-estimation of the impact of cameras because the collisions are simply displaced to other locations.

Research on Speed Cameras

Over the past 20 years, researchers in many fields, particularly those involving health research, have assessed research by conducting systematic reviews. These reviews use a systematic process to gather as much of the published (and sometimes unpublished) research literature as possible on a particular topic. The author(s) of the review conduct a critical assessment of the methodology used in these studies in order to rule out studies in which the methodology is too weak to allow for valid conclusions. Systematic reviews may also entail a meta-analysis where the statistical results of several different studies are pooled to give an overall estimate of their results. Because many studies have been conducted on the impact of speed cameras and red light cameras, in this report we will present the results of systematic reviews on these topics as these provide the most valid conclusions about the impact of photo enforcement on traffic safety. To provide more detail, a number of studies will be discussed in the appendices to allow readers to assess the nature of the evidence. Many of the studies assessed in the systematic review are summarized in the report and in Appendix I.

Systematic Reviews on Speed Cameras

The Cochrane Reviews

The best source of systematic research reviews in the health field is the Cochrane Group. These reviews are comprehensive and methodologically rigorous and are widely considered to be the gold standard for facilitating evidence-based decision-making in health-related fields. Because traffic collisions are a major health issue, the Cochrane Group has conducted reviews of both speed cameras and red light cameras.

Wilson et al (2012)

Wilson et al conducted the first Cochrane review on speed cameras. 35 studies met the criteria for inclusion in the speed camera review. Ideally, the studies would have used a randomized controlled trial (RCT) design - which is considered the 'gold standard' for evaluation studies - but none met this criterion. Thus, all the studies selected for review were "before – after trials with control or comparison areas [29 studies] and interrupted time series studies [6 studies]" (2012:4).

The review concluded that speed cameras were successful: "**All** studies[3] reporting *speed outcomes* reported a reduction in average speeds post intervention with speed cameras" (2012:2). The reduction in the proportion of drivers who were driving faster than the speed limit "ranged from 8% to 70% with most countries reporting reductions in the 10 to 35% range" (2012:2). Most of the studies (28 of 35) also measured changes in the incidence of collisions following the introduction of speed cameras: "In the vicinity of camera sites, the reductions ranged from 8% to 49% for *all crashes*, with reductions for most studies in the 14% to 25% range. For *injury crashes* the decrease ranged between 8% to 50% and for crashes resulting in *fatalities or serious injuries* the reductions were in the range of 11% to 44%. Effects over wider areas showed reductions for *all crashes* ranging from 9% to 35%, with most studies reporting reductions in the 11% to 27% range. For crashes resulting in *death or serious injury* reductions ranged from 17% to 58%, with most studies reporting this result in the 30% to 40% reduction range. The studies of longer duration showed that these positive trends were either maintained or improved with time" (2012:2).

While the effect of speed cameras is consistently positive, the magnitude of their effect is quite variable. To some degree, the large differences among the studies of the impact of speed cameras are a function of the different conditions under which the cameras are used. For example, one would expect a greater reduction in serious injury and deaths when speeds are controlled on a roadway with a speed limit of 100 km/h than on a roadway with a speed limit of 40 km/h simply because the chances of serious injury and deaths are higher when collisions occur at higher speeds. Other differences may be a function of factors such as road design, local driving conditions and driver behavior.

The researchers noted that the quality of the research was moderate at best, but concluded that the findings were so consistent that they could conclude that speed cameras were an effective way of reducing death and serious injury on the roads. However, it was not possible to determine the overall size of this impact because of differences in the studies and weaknesses in their methodology.

[3] 20 of the 35 studies reported speed outcomes.

Steinbach et al (2016)

This work is an update of the earlier Cochrane review and was sponsored by the UK College of Policing. The researchers added another 16 studies to those in the 2012 Cochrane review and arrived at a very similar conclusion to that of the earlier work: "Across all studies, the implementation of speed camera programmes was associated with a reduction in *average speed* of 7% (95% CI[4] 0-13%), *percentage of vehicles exceeding the speed limit* of 57% (95% CI 50-64%), *crashes* of 19% (95% CI 14-24%), in *injury crashes* of 18% (95% CI 13-23%) and *severe or fatal crashes* of 21% (95% CI 13-29%). There was no evidence that effects on percentage of speeding vehicles or injury crashes differed by whether cameras were fixed or mobile. There was some evidence to suggest that fixed cameras had a greater effect on all road traffic crashes and those resulting in fatalities or severe injuries" (Steinbach, et al, 2016:45). In short, of the four outcome measures – percentage of vehicles speeding, injury crashes, total crashes, and fatal and severe injury crashes – no evidence was found that percentage of vehicles speeding, or injury crashes were impacted by camera type (mobile or fixed). However, there was some evidence to suggest that fixed cameras had a greater impact on total crashes as well as fatal and severe injuries. "We found no evidence that effects differed between urban and rural areas. There was some evidence that effects were greater within a short distance of camera sites compared to wider areas" (Steinbach, et al, 2016:45). There were also no differences between overt and covert camera installations.

While the findings of positive effects of speed cameras were consistent, the magnitude of those effects varied between studies. This implies that speed cameras are very likely to have a positive impact on traffic safety, but that the magnitude of this impact will vary by jurisdiction.

Conclusion

The research consistently shows that speed enforcement cameras reduce speeds and that they prevent crashes, injury crashes, and fatal or serious injury crashes. Even in the few studies that did not support the effectiveness of speed enforcement cameras, the results were positive, but the relationships were not statistically significant. Several studies cited in Appendix I show that speed cameras can be effective in reducing speed over large sections of highway (section control or point-to-point camera enforcement) and in construction work zones as well as at the fixed sites where cameras are most commonly used.

Speed enforcement cameras are much more popular in many European countries than they are in North America. For example, France uses a mixed deployment strategy with a combination of signed, fixed locations and mobile, hidden units. With the breadth of coverage across the country, this mixed system ensures both general and specific deterrence as it combines education and enforcement.

Despite its effectiveness, speed cameras are not allowed in several provinces, including B.C. and Ontario (though in 2017 Ontario announced plans to reintroduce it on a limited basis and B.C. may use red light cameras to ticket speeding violations in the near future (Daflos, 2018)), and its use is restricted in other provinces. Given the clear and consistent results supporting the value of speed enforcement cameras, we can ask why they are not more widely used.

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[4] CI stands for confidence interval. This means that the researchers are 95% certain that the reduction in average speed because of speed cameras lies between 0 and 13 mph with an average reduction of 7%.

If jurisdictions are to make use of speed camera enforcement as part of a comprehensive traffic safety program it is important to secure public support.

As Chen suggests, the best way to overcome this opposition is to ensure that programs are fair and that their goal is clearly road safety rather than raising money. This can be done in a number of ways. The sites of photo enforcement programs should be selected on the basis of data showing high rates of collisions. The public should be made aware of photo enforcement through educational programs and through clear and consistent signage. Perhaps most importantly, fines should not be excessive, and the money raised through photo enforcement should be used to promote road safety and should not go into police revenues or into the general government treasury. Using traffic violations as part of a police department or municipal government revenue stream creates perverse incentives for the police to use traffic enforcement to raise funds rather than to make the community safer.

Concerns about this have been raised in connection with many photo enforcement programs. Abuse of traffic enforcement programs has been most apparent in a number of U.S. jurisdictions where traffic fines represent a major part of municipal and/or state revenue. There is no question that some jurisdictions have abused photo enforcement. Sun (2011) provides the example of the City of Charlack, Missouri (population, 1360). A small section (.027 miles) of Interstate 170 lies within Charlack's boundaries. With no evidence of any specific traffic safety problem, the city set up an Automated Speed Enforcement system on I-170. This system contributed to the ability of Charlack to raise 29 percent of its total budget through traffic fines. Abuses in Charlack and in other communities such as Ferguson, MO, led the Missouri state government to pass legislation restricting the amount of money that St. Louis County communities can raise from traffic fines[5].

Not only are these practices unfair, but they also threaten the legitimacy of the police. The role of the police is to ensure public safety, not to act as tax collectors. The U.S. National Highway Traffic Safety Administration (2008) has published guidelines that will help to ensure that the public views photo enforcement as legitimate. The agency recommends that photo enforcement programs be limited to areas where speeding-related collisions are a problem. It also suggests that photo enforcement be used as "part of a comprehensive plan that includes engineering, education, and enforcement countermeasures tailored to address specific speed-related safety problems" (NHTSA, 2008:9). This will help to ensure public support for photo enforcement including both speed enforcement and red light cameras.

NHTSA guidelines also recommend an intensive communications campaign to ensure that the public are aware of the program and understand why photo enforcement is being used. Another vital element is providing ongoing monitoring and evaluation to ensure that photo enforcement programs are well-targeted, that they are contributing to road safety, and that they are being accepted by the public.

[5] The reputation of photo enforcement has also been tarnished by the behaviour of some vendors such as Redflex which was involved in a major bribery scandal in Chicago (Kidwell, 2017).

PART 2 – RED LIGHT CAMERAS

The research on speed enforcement is clear and consistent – speed cameras are effective in reducing speeds and in reducing collisions, injuries and deaths. The evidence concerning red light cameras, is not as clear. The research shows three relatively common (though not always consistent) findings:

- Red light cameras reduce red light running.
- Red light cameras reduce side angle collisions.
- Red light cameras increase rear-end collisions.

The first two of these results are obviously positive for road safety. Running red lights can be dangerous and the resulting side angle collisions can cause serious injuries to the occupants of vehicles that are struck while proceeding through an intersection. However, the overall value of red light cameras is reduced because of the increase in rear end collisions. These collisions can be caused by drivers who brake quickly when they see an amber light because they want to avoid a photo enforcement ticket, and are then struck from behind by a vehicle whose driver was not able to react as quickly or who had decided to proceed through the amber light. Assessment of the success of red light cameras often hinges on a judgment about whether the harm caused by rear-end collisions is outweighed by the reduction in injuries and deaths caused by side angle collisions. In addition, there does appear to be real differences in the impact of red light cameras in different jurisdictions.

The difficulty in determining the net benefit of red light cameras is compounded by the fact that there are many threats to the validity of red light camera research. Some of the disagreements about the efficacy of the cameras involve methodology and particularly on researchers' judgments about the best way to control for the effects of regression to the mean and spillover in their research design and statistical analysis.

The conflicting findings and the differences of opinions about the most appropriate statistical analysis techniques for red light camera evaluations allow both proponents and opponents of red light cameras to present research results that support their positions. This is not uncommon when discussing evidence-based policy (debates over the efficacy of mammograms and prostate cancer screening are examples from the field of medicine) but the level of disagreement over red light cameras is greater than in many other debates about evidence in the broad field of crime and public safety. While the bulk of the evidence does suggest that red light cameras are effective in reducing red light violations, collisions, injuries, and fatalities, there are grounds for disagreement.

Two figures from the updated Cochrane reviews conducted by the U.K. College of Policing illustrate why there is less confidence in the traffic safety benefits of red light cameras than in the benefits of speed cameras.

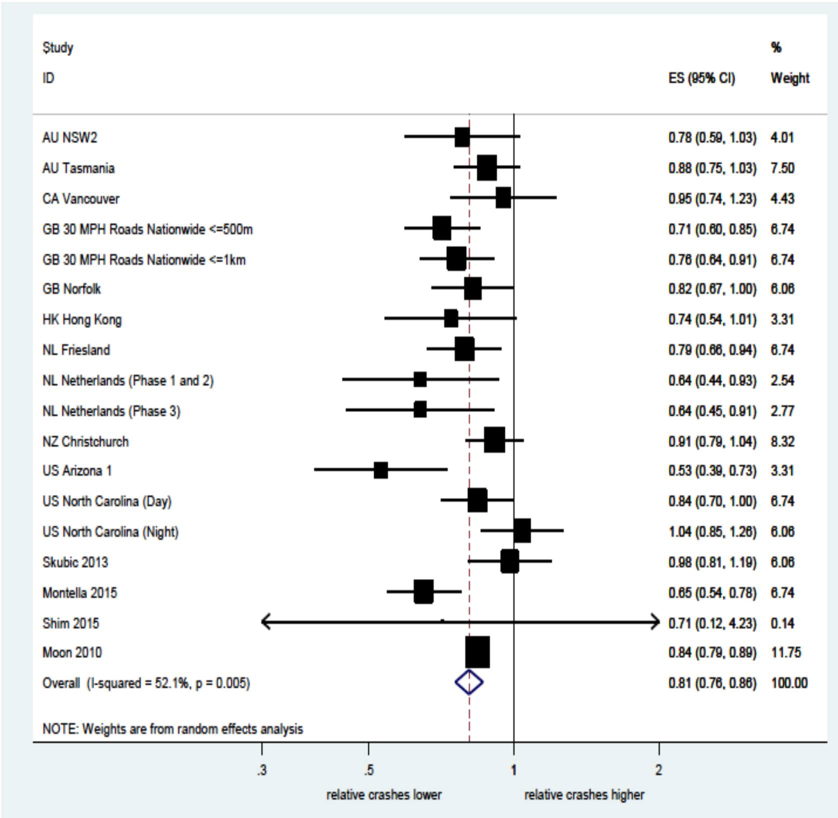

***Figure 1**: Effects of **Speed Cameras** on Total Crashes (Steinbach et al, 2016:29)*

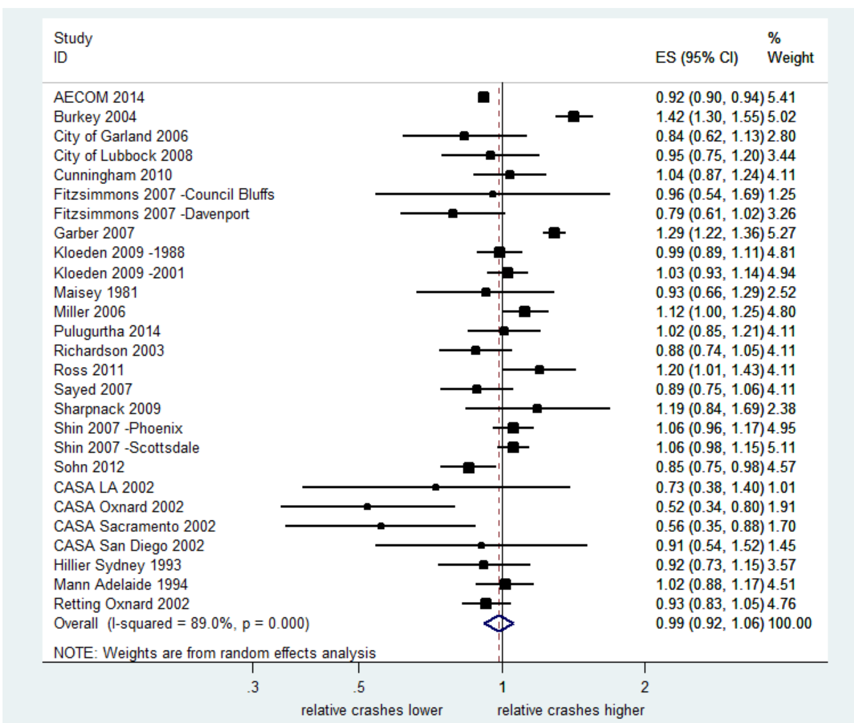

***Figure 2**: Effects of **Red Light Cameras** on Total Crashes (Perkins et al, 2017: 24)*

The solid black vertical line in these figures represents no change due to the treatment, while the dotted line represents an average result based on all the studies used in the systematic review. The boxes for each study represent the average change and the horizontal lines through the boxes represent the 95% confidence intervals.

Figure 1 shows that the combined speed camera studies show a reduction in total crashes - the dotted vertical line is on the 'lower' side of the solid 'no change' line. Also, only one of the studies (U.S. North Carolina – Night) shows an increased relative number of crashes. This indicates a strong consensus in the research that speed cameras reduce total crashes.

Figure 2 shows that there is only a slight overall reduction in total crashes that can be attributed to the presence of red light cameras. A number of studies show an **increase** in the relative number of crashes, indicating that there is less agreement among the studies about the direction of the effect of red light cameras than is the case for speed cameras. This does not mean there is a consensus that red light cameras are ineffective or that they actually reduce traffic safety as the most recent systematic reviews conclude they are effective. However, it does mean that there are differences among sites in the impact of these cameras and suggests that each jurisdiction should carefully assess the impact of their own red light camera programs[6].

In this section we will examine the conclusions of the Cochrane systematic review of red light camera research (Aeron-Thomas and Hess, 2005) and of the updated version (Perkins et al, 2017). Following this discussion, we will review Canadian studies of red light cameras. In Appendix II, we will present discussions of additional systematic reviews, descriptions of the four studies rated as being of high quality by Perkins et al, and a review of studies of the traffic safety implications of terminating photo radar programs.

Systematic Reviews

Several systematic reviews have examined the impact of red light cameras on red light running and on collisions. This section will discuss the Cochrane review and its 2017 update. Several other reviews will be presented in Appendix II.

As noted in the discussion of speed enforcement research, Cochrane reviews are usually considered to be the gold standard. In the case of red light cameras, the original Cochrane review was conducted in 2005, so it is badly out of date. Also, the studies were limited and the review's authors stated that 'larger and better controlled studies are needed' (Aeron-Thomas and Hess, 2005: n.p.). The review was recently updated (Perkins et al, 2017) and the authors found 38 studies – including the 10 studies used in the first review - and rated four of them of high quality.

The Cochrane Review

Aeron-Thomas and Hess (2005)

Aeron-Thomas and Hess identified only 10 studies that were methodologically sound enough to be assessed. They did not rate any of their studies as being of high quality and only two of the 10 were

[6] It should be noted here that Alberta evaluations discussed in Appendix II conclude that red light cameras do have a positive impact on traffic safety in Edmonton and several other municipalities.

assessed as 'moderate'. The 10 studies selected for the review were conducted in Australia (three studies), Singapore (one study), and the United States (six studies).

Because of the limitations of the original review, we will not discuss it other than stating that the conclusion was: "Red light cameras are effective in reducing total casualty crashes. The evidence is less conclusive on total collisions, specific casualty collision types and violations, where reductions achieved could be explained by the play of chance" (2005: n.p.).

Perkins et al (2017)

The Cochrane review was recently updated by a study sponsored by the U.K. College of Policing. This review was able to find 38 studies, including the 10 studies identified by Aeron-Thomas and Hess. The 28 new studies were conducted in the U.S. (20 studies), Australia (5 studies), Canada (2 studies) and Singapore (1 study).

As shown in Figure 2 above, the review's findings concerning the impact of red light cameras on *total crashes* were that the results were "highly heterogeneous" and "the direction of the estimated effects was also inconsistent" (2017:22). The overall reduction was calculated as 1% (95% CI 8% reduction to 6% increase) The results for *injury crashes* were also highly heterogeneous but more consistently positive. The pooled estimate of effect was a 20% reduction (95% CI 32%-5% reduction). The reverse was true of *property damage only* collisions with an estimated increase of 5% (95% CI 8% decrease - 20% increase). The overall estimate of *side angle* crashes showed a 21% reduction (95% CI 32% - 9% reduction). *Side angle crashes resulting in injury* had an overall estimated reduction of 28% (95% CI 39% - 14% reduction). The review also found a significant increase of 19% in *rear-end collisions* (95% CI 9% -31% increase). Finally, there was a 61% reduction in *red-light violations* (95% CI 64% - 56% decrease) though this finding was based on only three studies.

Canadian Studies

Six Ontario Municipalities (Synectics, 2003)

The Ontario government sponsored a two-year red light camera pilot project in the cities of Toronto, Hamilton and Ottawa and in the regions of Halton, Peel, and Waterloo. Ninety-five signalized intersections were selected in the six municipalities. Sixty-eight of these intersections had red light cameras and 27 had increased police enforcement. The sites were generally selected because they had high rates of crashes associated with red light running. The evaluation focused on 48 sites – 19 camera sites, 17 increased enforcement sites[7], and 12 comparison sites. The data were analyzed using the empirical Bayes technique. Unfortunately for purposes of this paper, the study examined the combined effect of red light cameras and increased enforcement (as well as a publicity campaign), so the impact of red light cameras alone cannot be determined[8].

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[7] The increased enforcement consisted of 20 hours of increased police deployment at each of the 17 sites in each of the 2 years of the project.

[8] The researchers did present tabular data showing that crashes at camera intersections increased by 2% while they decreased by 10.1% at increased enforcement intersections and by 12.7% at comparison intersections. Opponents of photo enforcement (i.e. Smimizu and Desrochers, 2015) use this as evidence that the cameras did not reduce crashes, but the study's authors would likely respond that the tabular data lack the controls used in the empirical Bayes analysis. This study illustrates the complexity of work in this area, as the same data can be interpreted in different ways.

The researchers found that the cameras, increased enforcement, and spillover to local comparison sites had "contributed to a 6.8 percent *decrease* in fatal and injury collisions; and contributed to an 18.5 percent *increase* in property damage only collisions" (2003: iii). The other results followed the pattern of most red light camera evaluations in that there was an increase in *rear-end collisions* and a decrease in *angle collisions*. For example, *fatal and injury angle collisions* declined by 25.3 percent while *fatal and injury rear-end collisions* increased by 4.9 percent. *Property damage angle collisions* declined by 17.9 percent while *property damage rear-end collisions* increased by 49.9 percent. A cost-benefit analysis concluded that the benefit-to-cost ratio was 1.57, meaning that the combined camera and increased enforcement program was a cost-effective road safety measure.

Edmonton (Sayed and de Leur, 2009)

Edmonton began to use intersection safety cameras in 1998. At the time of the evaluation by Sayed and de Leur, the program used 24 cameras deployed to 60 different locations. Each of these locations had a fixed sign warning of the cameras.

Sayed and de Leur compared 25 treatment sites (all of which were four-leg intersections with three or four lanes on each approach and with a posted speed of 50 kph) with 47 matched control sites. There were also 100 reference group sites which were used to generate predicted estimates of collisions based on traffic volume. They used collision and traffic volume data for three years prior to the implementation of the intersection safety camera program (ISC) and for two to three years following implementation.

The researchers found that the safety camera program was effective in reducing collisions in Edmonton. Twenty of the 25 treatment sites showed a reduction in *collisions* ranging from 3.7% to 41.4% following implementation of the ISC program. Seventeen of the sites showed reductions in *severe collisions* ranging from 3.5% to 51.4%. Nineteen of the sites showed reductions *in property damage only [PDO] collisions* ranging from 0.7% to 45.6%. There were reductions in *angle collisions* ranging from 1.7% to 85.2% at 18 sites. However, unlike most studies there were also reductions in *rear-end collisions*. These ranged from 8.2% to 55.2%.

Overall, "the reduction in total collisions is estimated to be 11.1% … severe collisions were reduced by 6.1% and PDO collisions were reduced by 14.3%. Angle type collisions were reduced by 17.2% and rear-end collisions were reduced by 12.4%" (2009: 202)[9].

Alberta (AECOM, 2014a)

AECOM conducted an evaluation of red light cameras in five Alberta cities. They collected data from 76 signalized intersections with red light cameras, 141 signalized intersections without red light cameras, and 37 intersections without signals. AECOM used an empirical Bayes approach in assessing the impact of red light cameras. The methodology used in this study allowed the researchers to control for spillover, regression to the mean, and changes in traffic volume.

The results of this evaluation showed that red light cameras had a positive effect on traffic safety. *Total collisions* declined by 8.4% and *severe collisions* decreased by 32.4%, while *property damage only* collisions increased by 1.4%. *Side angle collisions* were reduced by 37.7% *while rear-end collisions* increased by 7.7%. The researchers also concluded that there may have been a spillover effect of 10.7%. This means that there were reductions in collisions at intersections without red light cameras

[9] The researchers note that the results would have been slightly stronger if one intersection (37th Avenue at 127th street) had not seen a 44.8% increase in total collisions and an 86% increase in severe collisions after implementation.

because of the awareness of the cameras and the publicity concerning the program. However, AECOM notes that this may also be attributed to other factors influencing safe driving behaviour during the implementation period.

Winnipeg (Vanlaar et al, 2014)

Winnipeg has had an intersection camera program since 2003. The cameras are triggered by a red light violation or by excessive speed[10]. The program uses the 'violation on entrance' approach rather than the 'violation on exit' approach. This means that as long as the light is amber when the vehicle enters the intersection a ticket will not be issued if the signal turns red while the vehicle is still in the intersection.

Vanlaar et al conducted time series analyses (ARIMA time series modeling) to measure the cameras' impact. As the researchers point out, this type of analysis shows monthly trends over time rather than simply comparing totals for 'before' and 'after' the intervention. The dependent variables were red-light running crashes and speed-related crashes. Spillover effects were controlled by comparing the camera sites with all other signalized intersections in the city. The analysis of the 48 camera intersections compared the change in crashes with the first 12 cameras installed with each of the three subsequent installations of 12 cameras.

The researchers also conducted an experiment in which four camera sites were compared with eight comparison sites that did not have cameras. Data were collected three weeks before the cameras were operational and three weeks after. In weeks four and five after the cameras were operating photo enforcement warning signs were installed at the entrances to the intersections.

The results of the time series analyses were complex, as the researchers separately analyzed each of the four subsets of 12 cameras. They found that "the installation of the first set of cameras was associated with a non-significant increase in *side angle crashes* of 12.75%, followed by a highly significant decrease of 46.10% (p=.003) [for the second set of cameras]; a non-significant decrease of 10.68% [for the third set of cameras]; and a non-significant increase of 10.96%" [for the fourth set of cameras] (2014:242). There did not appear to be any spillover effects on side angle crashes, as "intersections without cameras in Winnipeg did not experience a comparable significant decrease in right-angle crashes, nor did they experience an increase" (2014: 242).

Rear-end crashes increased following the introduction of red light cameras: "the installation of cameras was associated with an initial significant 42.33% increase in crashes (p=.004). This was followed by a non-significant 18.86% decrease (p=.085). The effects associated with the installation of the third (+14.45%; p= .0139) and fourth set of cameras (-2.86%; p= .718) were not significant" (2014:242). The control intersections had an increase of 23.5%, which was just short of being significant (p= .053). The researchers suggest that this increase in rear-end crashes may have been the result of the spillover effect.

Over the four camera installation periods, the net change in *injury crashes* was an increase of 11.2%, but the changes were not statistically significant. There were no significant changes in injury crashes for the control intersections. There were also no changes in *property damage only* crashes (a net change of only 0.20%). The researchers also found that the installation of cameras had no impact on *speeding-related* crashes. They also reported that the cameras may have less impact on serious speeding violations (13

[10] This study was not considered in the Perkins et al (2017) review because the cameras were used for both red light and speed enforcement.

km/h or more over the limit) than on less-serious violations. The results of the experimental sub-study were complex and showed modest impacts on speeding violations and running red lights

The researchers conclude that “Overall, Winnipeg’s photo enforcement safety program had a positive net effect on traffic safety” (2014: 238). However, the results suggest that this impact was modest.

Conclusion

While the evidence clearly supports the use of photo speed enforcement, the research on red light cameras is not nearly as consistent[11]. In part, this is due to the fact that while most studies show that red light cameras reduce side angle collisions, they also show that red light cameras increase rear-end collisions. On balance, the evidence suggests that the cameras reduce deaths and injuries from crashes, but this conclusion is contradicted by some studies.

One of the problems is that many of the studies have methodological flaws. Given the ambiguity of the findings and the ideological debates over the use of photo enforcement, the methodological problems make it easy to for advocates of one side or the other to highlight findings that support one’s views. One important point needs to be made about this debate. The fact that a study has weaknesses does not necessarily mean that its findings are invalid – that conclusion would require replicating the study using a better research design. While stronger research design will enhance our confidence in a study’s findings, a weaker design does not necessarily mean that the findings are wrong – particularly when studies supporting the opposite position also have flawed designs.

Given the debate over the evidence concerning red light cameras, what should jurisdictions do? Despite the ambiguity of the research, the preponderance of the evidence supports the use of red light cameras. However, the best way to do this is as part of an integrated traffic strategy. As noted in the speed enforcement section of this paper, the guidelines of the National Highway Traffic Safety Administration provide sound advice to governments. Ensuring that that red light cameras are used at high-risk intersections (ideally this would be in locations that had relatively high numbers of side angle crashes and low numbers of rear-end crashes), that they are part of a broader, well-publicized road safety strategy, and that they are constantly evaluated will help to make roads safer. Garber et al (2007) have similar recommendations and also suggest that research be conducted on the best ways to reduce rear end crashes at camera intersections in order to overcome this negative feature of red light cameras. Among the measures that might accomplish this are better signs reminding motorists of photo enforcement, warning lights when approaching lights that are about to turn amber, and ensuring that the amber interval is long enough to reduce the likelihood of abrupt stops.

[11] The most consistent finding in this area is that the cameras alter driving behaviour. Studies have shown that cameras reduce red light running, a finding that is supported by data showing that the number of red light camera tickets issued typically declines over time.

APPENDIX I

OTHER STUDIES OF SPEED CAMERAS

In this Appendix, we will briefly describe the other systematic reviews conducted on the impact of speed cameras and then summarize some of the individual studies – many of which were used in the systematic reviews. Final sections of the appendix include reviews of section control (or point-to-point) cameras which are not extensively used in North America, but which are becoming increasingly common in Europe and other parts of the world, and of the use of cameras in construction work zones.

Systematic Reviews

Thomas et al, 2008

An early review by Thomas et al reviewed 90 studies and found 13 studies that met the review criteria. These studies were conducted in 8 countries. The studies included fixed and mobile cameras, and hidden and conspicuous camera sites.

The overall conclusion was that speed cameras were effective in reducing crashes and fatalities: "The best estimate of *injury crash* reductions attributable to fixed camera systems fall in the range of 20% to 25% at treated locations…. Effects on *fatal and other severity crashes* are less certain but also declined in general." (2008: 125).

While more difficult to assess because of the quality of the studies, results appeared to be similar for mobile camera systems: "…. An estimate of the range of expected improvement is less certain, but *daytime casualty (injury and fatal)* crash reductions reported by a statewide Australian study were around 20%, whereas *daytime speed-related collisions* were reduced by 25% in a province-wide Canadian study" (2008:125).

Elvik at al (2009)

Another systematic review (Elvik et al ,2009) examined 16 studies conducted in several European countries and in Australia and New Zealand. All of the studies utilized a comparison group. Elvik at al conducted a meta-analysis combining the results of the studies. They also introduced a statistical control for publication bias, which is the assumption that the results of successful projects are more likely to be published.

This analysis showed that fixed, visible speed cameras reduced the *total number of collisions* by 24% and *fatal collisions* by 39%. Doubling the level of enforcement reduced the crash rate by 35%, which was a larger effect than introducing a new program, which reduced the crash rate by 24%. Mobile, hidden cameras had smaller effects with a 10% reduction in *injury collisions* and a 16% reduction in *fatal collisions*.

The research concluded that photo speed enforcement was cost effective. Several studies included a benefit-cost analysis with reported benefit-cost ratios ranging from 2.3:1 to 26.7:1.

Hoye (2014)

Hoye's systematic review included 15 studies of speed cameras and 4 studies of the impact of section control cameras (section control refers to speed camera programs that measure average speed over a section of roadway rather than just at a single point). The dependent variables were crashes and fatal crashes. Hoye summarized the studies through a meta-analysis.

For speed cameras, Hoye found a 20% reduction in *crashes* and a 51% reduction in *fatal crashes*. Several threats to validity – including regression to mean (RTM) – were controlled for total crashes, but RTM was not controlled for fatal crashes. The effect of photo enforcement declined as the distance from the cameras increased. 0.5 km from the cameras the decline in crashes was 8% and 1 km and more away from the cameras it was only 4%.

The section control evaluations showed reductions of 30% for *total crashes* and 56% for *fatal crashes*. While the information available on section control was limited, two additional studies (Hoye, 2015 and De Pauw et al 2014b) are discussed below.

Hoye did not find sufficient information in the studies under review to be able to assess the degree to which the findings might be affected by spillover or crash migration.

Individual Studies

Summarizing the systematic reviews provides an overview of speed camera studies, but the summaries do not provide details of the individual studies and these details are helpful in understanding the research. Given the number of speed camera evaluations and the consistency of their findings, it is neither feasible nor necessary to review all of them in detail. Therefore, we will review selected studies based on their location (studies done in Canada will be highlighted) and we will also review the most recent studies since they will reflect the most current technology and have the advantage of being able to build upon previous work.

Canadian Studies

British Columbia (Chen et al, 2000, Chen et al, 2002, Chen, 2005)

Two British Columbia studies (Chen et al 2000; Chen et al, 2002) are among those included in most of the systematic reviews. In 1996, British Columbia introduced a province-wide, mobile photo radar program that was funded by the Insurance Corporation of British Columbia. The program had 30 photo radar units. It began with a 5-month period prior to implementation during which warning letters were issued to violators.

The first evaluation study was a province-wide study. Controlling for a number of variables including seasonality, amount of driving, alcohol consumption, and economic conditions (2005: 302), the study concluded that photo enforcement reduced speed and the number of collisions. The percentage of vehicles that were *speeding* at photo enforcement sites dropped from "more than 60 percent during the warning letter phase to 37 percent in the first year and to 30 percent in the second year of program operation" (2005: 302). Driving speeds also declined at non-camera sites, though these declines were much less than in the camera locations. The program also appeared to have reduced *injury collisions* by 14%, and *fatality collisions* by 26%.

The second study (Chen et al, 2002) was site-specific and looked at one selected 22 km. highway segment near Victoria. The segment is one where there are no alternate routes that would allow drivers to avoid the highway with photo enforcement.

The program was preceded by an extensive media campaign and there were warning signs posted. There were 12 possible camera locations along the segment, though not all were active at the same time, as the mobile units were rotated from one location to another. The study compared photo radar locations (1 km. in each direction from the camera sites) with the remaining segments of the highway for periods 2 years before and 2 years after the implementation of the photo radar program. Roadways in other nearby jurisdictions were also used as comparison sites.

The empirical Bayes analysis compared observed post-photo radar collision data with predicted collisions based on a statistically-generated collision model that adjusted for possible causal factors and used collision data from comparison locations. Empirical Bayes analysis allows researchers to compare the actual number of crashes with the estimated number that would have occurred without speed cameras by using the number of crashes at comparison sites similar to the camera sites. The empirical Bayes method can "account for regression to the mean, changes in traffic volume, and trends in crashes due to factors such as weather, crash reporting practices and driving habits" (Persaud, et al, 2008).

Traffic speeds declined in the warning phase of the program and remained at a level below the posted speed limit – a reduction of about 3 km/h. The *number of collisions* also declined at both the camera and non-camera locations. For the entire corridor the expected number of collisions decreased by 16% (+/-7%). Chen and his colleagues concluded that this supports the idea of a spillover effect in which the positive impact of photo radar impacts driving behavior on road segments that do not have cameras.

Alberta (AECOM, 2014b)

This appears to be the only study available that looks at the impact of adding a "Speed on Green" function to intersection safety cameras that have previously only been enforcing red light violations. Alberta has had a red light camera program since 1999 but did not start using the cameras to enforce speeding regulations until 2009. The study used an empirical Bayes approach analyze the data. The 'before' period extended from the time of activation of the red light cameras until the speed enforcement function was activated. The after period ran from this speed enforcement activation date until the time of data collection for the study. Because of the timing of the activation of the speed function, the study period varied from camera to camera. The data used for the study came from 46 intersections in Calgary, Fort Saskatchewan, Strathcona County, and St. Albert.

The study found that there was a 31.3% reduction in *angle collisions* and a 9.4% increase in *rear-end collisions*. There was also a 1% increase in *total collisions*, a 10.6% increase in *property damage only* collisions, and a 32.3% reduction in *severe collisions*.

While there was a very slight increase in overall collisions these collisions were less severe as there was a shift from angle collisions to rear-end collisions. Thus, there was a traffic safety gain from the activation of the speed on green function of intersection safety cameras.

Edmonton, (Li et al, 2017)

Li and his colleagues studied the impact of Edmonton's mobile camera enforcement program. They looked at the relationship between three enforcement performance indicators (EPIs) and speed-related collisions. The three EPIs examined in the study are: the number of enforced sites; the average check length (the amount of time spent on each visit to a site)[12]; and the number of tickets issued. The mobile units were deployed 20 hours a day between the hours of 6 a.m. and 2 a.m. and the researchers were able to vary the number of sites and the check lengths when determining the schedules for deployment of the mobile units. Data were collected for a period of 8 years (2005-2012). The dependent variable was the monthly number of speed-related collisions in the city.

The results of this study provide important guidance for jurisdictions seeking to maximize the effectiveness of their mobile speed enforcement programs. The analysis found that all three EPIs were significantly related to the number of speed-related crashes. The higher the number of enforced sites; the

[12] Note that there is an obvious trade-off between the number of sites visited and the time that can be spent at each site.

shorter the average check lengths; and the more tickets issued, the lower is the number of speed-related collisions. The researchers estimated that "the marginal effects of enforcing 100 enforced sites and issuing 10,000 tickets per month were estimated to be 47 and 140 fewer speed-related collisions, respectively" (2017:212)[13]. In an earlier paper using data for the same years, Li et al found that Edmonton's mobile camera program on arterial roads "showed consistent results in different collision severities, ranging from 14% to 20%, with the highest reductions observed for severe collisions" (2014:2).

While not specifically addressed in this study, the Edmonton data do suggest that mobile speed cameras should be more effective than fixed cameras. The fact that more sites with shorter average check lengths led to fewer speed-related collisions suggests there is a 'halo effect' where knowledge of photo enforcement persists even in circumstances where speed cameras are not currently active. Moving the mobile units on a frequent basis likely creates a perception that chances of receiving a fine are high enough to change driving behaviour.

Research in Other Countries

Scottsdale, AZ (Retting et al, 2008)

Retting et al assessed the impact of a 9-month fixed camera pilot program that was implemented on the Loop 101 freeway in Scottsdale in 2006. According to the authors, this was the first use of fixed speed cameras on a major highway in the U.S. The program involved the installation of 6 camera sites on an 8-mile section of the freeway. Motorists were ticketed if they exceeded the speed limit by 11 mph or more. The evaluation looked at the impact of the program on speeds compared to speeds on a control section of the highway 25 miles away near Glendale. Speed data were collected 2 months prior to implementation, at 3 periods during the program, and 6 weeks after the program ended. The researchers also received public input through a telephone survey.

The program had a significant impact on speeds. The posted speed limit was 65 mph and prior to the speed camera program the average speed was 70 mph. This declined to 63 mph shortly after program implementation and remained at about 65 mph during the remainder of the program. After the program ended[14] average speeds returned to 69 mph. One other important finding was that the percentage of vehicles exceeding 75 mph declined from 15% prior to the program to 1-2% while the cameras were operating. Once the cameras were removed, the percentage went back up to 12%. There was a spillover effect, as speeds at the Glendale control sites went down by 5 mph during the program and then went back up after the program ended.

Finally, the survey data indicated that there was strong public support for the camera enforcement program, though young drivers (the most likely to speed) were the least supportive.

Phoenix, AZ (Skubic et al, 2013)

This is one of the few studies that did not find that speed cameras reduced vehicle crashes. Speed cameras were installed at two-mile intervals along a 26-mile segment of the interstate highway running through Phoenix. There was also a control segment of 14 miles where there were no cameras.

[14] Because of the success of the pilot project, it was reinstated in 2007.

The cameras were installed in 2008 and were removed for political reasons in 2010. This allowed Skubic et al to compare the number of crashes before camera installation, during the period when cameras were installed, and then after the cameras were removed. The researchers compared data for 9-month periods before, during, and after the cameras. They found a 1.5% increase in crashes when the cameras were installed and a 28% increase when they were removed. In the road segment without cameras the comparable increases were 3.6% and 39%. The researchers believed that the crash numbers increased because of an increase in traffic in Phoenix. While the differences were not statistically significant, the data did show that the increase in crashes in the camera segment was less than the increase in the control segment[15].

Montgomery County, MD (Hu and McCartt, 2015)

Hu and McCartt evaluated an automated speed enforcement program in Maryland. The program was implemented in 2007 and was limited to residential streets with speed limits of 35 mph and to school zones. In 2009, a change in the law raised the threshold for photo enforcement from 11 mph over the speed limit to 12 mph over, and restricted the hours for school zone enforcement. In 2012, the county implemented a speed corridor approach where mobile cameras were moved to different locations along a roadway marked with signs reading “Speed Camera Corridor”. The program grew to 73 speed camera corridors and 61 additional speed camera sites.

The evaluation used data collected from 6 months prior to the initiation of the program to 7 ½ years after the program began. Data were also collected from two control sites in two nearby Virginia counties. Hu and McCartt measured the impact of the program on measured speeds and on speed-related crashes.

The initial phase of the program was evaluated using 20 camera sites, most of which were on residential streets with speed limits of 35 mph or below. Spillover was measured using 10 sites with similar characteristics as the camera sites. As controls, speeds were measured in similar sites in two nearby counties. From 2006 to 2014 *average speeds* declined in the camera sites by 13% compared with declines of 5% in the spillover sites and 4% in the Virginia control sites. The percentage of vehicles exceeding the speed limit by more than 10 mph declined by 64% in the camera sites compared with declines of 39% in the spillover sites and 43% in the control sites. Hu and McCartt also concluded that photo enforcement reduced crashes and injuries: “Camera enforcement was associated with a 19% reduction in the likelihood that a crash involved an **incapacitating/fatal injury** on camera eligible roads” (2016:57). The speed corridor approach was also successful with “a 30% reduction in the likelihood that a crash involved an incapacitating/fatal injury, over and above the reduction associated with speed camera enforcement” (2016: 58). There was also a favourable spillover effect of a “27% reduction in the likelihood that a crash involved an incapacitating/fatal injury (2016: 58).

Hu and McCartt also conducted a telephone survey in 2014 to measure citizens’ knowledge of, and attitudes toward, the automated enforcement program. According to the survey, the vast majority (95%) of respondents knew about the automated enforcement program and a majority (62%) favored the program. A higher number of respondents (82%) supported cameras in school zones. Support for speed cameras was highest among females and among older drivers. The scope of the program is shown by the finding that most of the respondents had either received a photo radar ticket themselves (59%), or knew someone who had received a ticket (75%). A substantial majority of respondents (76%) reported that the

[15] While it may not have affected the results, the researchers did not specify how drivers would have known that there were cameras along the 26-mile segment but not along the 14-mile segment of contiguous highway.

camera program had caused them to reduce their driving speeds. Respondents were also less likely to report that speeding was a safety problem in 2014 (56%) than prior to the program (71%)[16].

Belgium (De Pauw, et al, 2015)

DePauw et al addressed an interesting question about photo enforcement – whether cameras led to an improvement in compliance with speed limits, or if drivers simply slowed down before the camera locations and then sped up again afterward.

The researchers studied the effect of speed cameras on two roadways. One was two-lane in each direction and the other had three lanes. The speed limit for both was 120 km/h. They measured speeds at points 3 km ahead of the camera location and 3.8 km after the camera. Speeds were studied before and after the installation of cameras (13 months before and 10 months after at one location and 11 months before and 18 months after at the other location).

The analysis showed that the speed cameras had a strong effect on drivers' behaviour: "The driving speed reduced on average by 6.4 km/h, the odds of drivers exceeding the speed limit reduced on average by 80%, and the odds of drivers exceeding the speed limit by more than 10% reduced by 86%" (2015: 139). However, a graph of speeds approaching and following the cameras was distinctly V-shaped. This means that drivers slowed abruptly just before the cameras and returned to higher speeds within 1 km after passing the camera locations.

Norway (Hoye, 2015).

Hoye conducted an evaluation of the effect of fixed speed cameras in Norway. She used an empirical Bayes analysis to assess the impact of the 223 fixed speed cameras that were installed between 2000 and 2010. The cameras were visible and warning signs were posted prior to the camera locations. Cameras were installed at locations that had higher than average injury crashes and/or higher than average speeds. Because of this criterion for camera installation, it was necessary to control for regression to the mean along with the other controls (such as the overall trend in collisions) that were part of the empirical Bayes analysis.

Hoye concluded that speed cameras reduced "*injury crashes* by 22% on average on the medium road sections. The effects on KSI [*killed or seriously injured*] are larger but not statistically significant. On the long and short road sections the effects are smaller than on the medium sections and not statistically significant. …… Speed cameras that were installed in 2004 or later had more favorable effects than speed cameras from earlier years. They were found to reduce injury crashes and the number of KSI by 9% and 39% respectively on the long road sections and by 32% and 49% respectively on the medium road sections" (201:269).

Spain (Novoa et al, 2010)

Novoa and her colleagues studied the effectiveness of speed cameras in reducing crashes and injuries on arterial roads and on beltways in Barcelona. Warning signs were posted prior to the cameras and there was a publicity campaign prior to the implementation of the camera program.

On the arterial roads, the researchers compared rates of crashes within 500 metres before and after the speed cameras with the remaining portions of the road. There were no differences in *injury crashes*

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[16] A Canadian study also found support for photo enforcement. Vanlaar et al (2011) found that 95% of Winnipeg residents were aware of the photo enforcement program, 81% supported its continuation, and 71% felt the program improved road safety.

between the treatment and non-treatment road segments. On the beltway roads there were significant reductions in both the number of injuries (the monthly median number was reduced from 79 to 62 – a reduction of 21.5%) and injury collisions (the monthly median number was reduced from 48 to 38 – a reduction of 20.8%).

England (Li and Graham, 2016)

Li and Graham sought to determine the best sites for fixed speed cameras. The ability to be able to predict which sites would be the best places for cameras would help to make the program cost-effective and would ensure that the speed cameras would be placed where they would make the largest contribution to public safety.

The UK has set out guidelines for determining fixed camera sites. These are:

- Site length: Between 400 and 1500m
- Number of fatal and serious collisions (FSCs); at least 4 FSCs per km in the last three calendar years.
- Number of personal injury collisions (PICs); at least 8 PICs per km in the last three calendar years.
- 85th percentile speed at collision hot spots: 85th percentile speed at least 10% above speed limit.
- Percentage over the speed limit: at least 20% of the drivers are exceeding the speed limit.

The first three are the primary criteria, as speed data are not always available.

The researchers looked at 771 camera sites in eight administrative districts. Control sites which have not had cameras and which are at least 1.5 km from the camera sites were selected for each using a matching process. The sites had cameras mounted over the three-year period from 2002 – 2004 so the researchers used data from 1999 – 2007 to ensure they had coverage 3 years before and three years after camera installation.

Li and Graham found that "the reduction in personal injury collisions ranges from 10% to 40% whilst the average effect is 25.9% "(2016: 160). The reduction in crash rates varies by site characteristics – the camera sites that meet the criteria had better results than those that did not meet the criteria. This suggests that the positive impact of the cameras can be increased by careful site selection.

Korea (Shim et al, 2015)

Shim et al studied the impact of marked speed cameras on crashes on several Korean expressways. Korea has a large number of speed cameras – over 5200 when data were collected for this study. One component of their study involved collecting driving trajectory data from 259 taxis in the city of Daegu. These data showed that the drivers began reducing speed about 1000m prior to the camera site and resumed speeding after passing by the site. They found that total crashes were reduced by 7.6%, which was considerably lower than the reductions found in most earlier studies. They attributed this difference to an 11% increase in crashes from 1500m – 500m upstream of the camera location and conclude that these crashes are caused by variations in traffic speed caused by drivers who acted to avoid being caught speeding by a speed camera.

Studies on Section Control (or Point-to-Point) Cameras.

In recent years some jurisdictions, particularly in Europe, have begun using section control cameras (which are also referred to as point-to-point cameras or average speed cameras). One weakness of other camera systems is that when camera locations are known, motorists will slow down just before the camera sites and then resume speeding after passing the camera. The study by Shim et al (2015) cited in the previous section of this report found that crash reductions near the site of an enforcement location were also associated with an increase in crashes upstream of that location as cars began to slow down in anticipation of the presence of a speed camera. Section control systems allow enforcement officials to calculate average speeds by using cameras at multiple locations and computing the average time each vehicle takes to cover a given distance.

Belgium – Section Control (De Pauw et al, 2014b)

De Pauw et al studied the impact of automated section control on two sections of highway in Belgium. The sections are on a highway with 3 lanes in each direction and with a speed limit of 120 km/h. Speed data were collected both upstream and downstream of the photo enforcement section and speed information was collected over 2 one-week periods before and after system installation.

Section control cameras had an impact on speeds. The average speed decreased by 6 km/h, the odds of drivers exceeding the speed limit was reduced by 74%, and the odds that drivers would drive at more than 10% higher than the speed limit were reduced by 86%. The speed reductions were found to exist 6 km before and 6 km after the speed control sections. No crash data were provided.

Norway – Section Control (Hoye 2015a)

Hoye examined the impact of section control on crashes at 14 section control installations in Norway. The before period was 36 months and the follow-up period varied from 13 months to 36 months depending upon the date of camera installation. Unlike earlier section control studies that did not control for regression to the mean, Hoye conducted an empirical Bayes evaluation which enabled her to compare actual crash statistics with predicted crash statistics.

The roadways where section control was implemented either had very high crash rates or were in tunnels where alternate enforcement methods would have been difficult. Crash migration was limited by the lack of alternate routes.

Hoye concluded that section control photo enforcement had a positive impact on road safety: "When controlling for [regression to the mean] the number of *KSI [killed or seriously injured]* was … statistically significantly reduced by 49%. For *injury crashes* a non-significant reduction by 12% was found" (2015a: 177). There was no difference between tunnels and open roads in KSI, but injury crashes were reduced slightly more in tunnels than on open roads.

Finally, Hoye found that spillover effects [positive] on downstream sections of roadways were more likely to occur than was crash migration [negative].

Italy – Section Control (Montella, et al, 2012; Montella et al, 2015)

Montella and his colleagues evaluated the impact of a point-to-point camera system on speed and safety on an urban motorway in Naples. They found that the system had a positive impact on speeds and on crashes: "The P2P system yielded to a considerable reduction in all the calculated statistics: *the mean speed, the 85th percentile speed, the standard deviation of speed, and the proportion of drivers exceeding the speed limits.* …. The proportion of light and heavy vehicles exceeding the speed limits by more than 20 km/h was reduced respectively by 84 and 77%" (2015:177). These reductions in speeds led to a significant reduction in crashes with a 32% reduction in *total crashes*. They also found a spillover effect as there was a 21% reduction in total crashes on the section of the motorway where the system was not activated.

In an earlier paper, Montella et al (2012) reported a similar evaluation in which they found that the crash reductions diminished over time – from 39.4% in the first semester after activation to 18.7% in the fifth semester. They suggest that more intensive enforcement may be necessary to overcome this decline.

Speed Cameras in Work Zones

U.S.A. (Medina et al, 2009)

Medina et al used data from two highway work zones on Interstate highways in Illinois. They looked at the downstream effects (1.5 miles past the actual deployment location) of photo radar compared to several other speed control methods including police vehicles with lights on and off and speed feedback signs. They cite extensive research showing that several different methods, including photo radar, were successful in reducing speeds at the deployment location, but noted that there was limited information available concerning halo effects downstream from that location.

The findings were a bit complex because of separate analyses for the general stream of traffic and free-flowing vehicles (those where potential speeding was not impeded by vehicles in front of the vehicle) and for cars in the median and shoulder lanes. Overall, photo radar was the most effective way of reducing speeds. The combination of a speed feedback sign and a police vehicle with lights on had an effect on speeds in some, but not all, data sets and the other treatments had no effect.

APPENDIX II

OTHER STUDIES OF RED LIGHT CAMERAS

Systematic Reviews

Llau and Ahmed (2014)

This systematic review was limited to U.S. studies (Llau and Ahmed, 2014). The researchers concluded that red light cameras were effective: "All 9 studies reviewed showed significant reductions in the frequency/rate of violations, crashes, and injuries at intersections after RLC [red light camera] implementation. RLC interventions appear to decrease violations, crashes, and injuries at intersections" ((Llau and Ahmed, 2014: 542). Several of these studies were also part of the Cochrane review and another was too methodologically weak to have any validity, as it looked at only 1 intersection which was the 9th most dangerous in the U.S. A.

Erke (2009).

Erke conducted a meta-analysis that combined effect estimates from 21 different studies. The analysis showed "Significant accident reductions … for all types of crashes with unspecified severity, for all fatal crashes, and for right-angle collisions with unspecified severity" (2009: 900). There was no change for property damage only crashes and a significant increase in rear-end collisions.

While these results suggest that RLCs were effective, Erke concluded that "RLCs may reduce crashes under some circumstances under some conditions, but on the whole RLCs do not seem to be a successful safety measure" (2009:897). This conclusion was based on a further analysis that looked separately at: 1) studies that did not control for either regression to the mean (RTM) or spillover effects; 2) studies that controlled for spillover but not RTM; 3) studies that controlled for RTM but not spillover; and 4) studies that controlled for both spillover and RTM.

As noted by Lund et al (2009) Erke's conclusion is problematic because, unlike the Cochrane reviews, she did not limit her analysis to studies that were methodologically sound and many of the studies she used in her statistical analysis were of questionable validity. Lund and his colleagues note that five studies that controlled for both RTM and spillover were largely responsible for the conclusion that RLCs did not reduce crashes. Two of these studies (Garber et al, 2007 and Burkey and Obeng, 2004) were not published in peer-reviewed journals and have been the subject of papers critical of their methodology. Without the inclusion of these two studies, Erke's results would have been much more favorable to the efficacy of red light cameras. On the other hand, Langland-Orban et al (2016) said the Garber et al and Burkey and Obeng studies were the most valid among a number of RLC studies[17]. This debate reflects the lack of consensus about the most appropriate way of assessing the impact of red light cameras.

Elvik et al (2009)

The final systematic review that has been done was conducted by Elvik et al (2009) who reviewed 23 studies, most of which were conducted in the United States. As with the other reviews, Elvik et al noted the methodological weaknesses of many of the red light camera studies. Because of these weaknesses,

[17] Perkins et al (2017) agree with Langland-Orban and her colleagues, as they assess the Garber study as being of high quality and the Burkey and Obeng study as of moderate quality.

Elvik et al limited the studies to those that they felt had utilized proper controls. These studies were Burkey and Obeng (2004); Council et al. (2005); Garber et al., (2007); Retting and Krychenko, (2002); and Shin and Washington, (2007).

After reviewing the selected studies, Elvik et al concluded that "The *total number of accidents* seems to increase after the installation of red-light cameras" (2009: 904) but the effect is not statistically significant. *All collisions* increased by 15% and *all injury collisions* increased by 13%. While *side angle impacts* declined by 10%, *rear-end collisions* increased significantly with a 43% increase. Despite the fact that side angle impact collisions can be more serious than rear-end collisions, Elvik et al do not conclude that red-light cameras have a positive impact on road safety.

Studies Rated 'High Quality' By Perkins et al (2017)

Virginia (Garber et al, 2007).

Garber and his colleagues analyzed data from 6 Virginia jurisdictions – Alexandria, Arlington, Fairfax City, Fairfax County, Falls Church and Vienna. They used the empirical Bayes technique supplemented by other statistical tests.

Different locations produced varying results. The most consistent finding was that the cameras were associated with an increase in rear-end crashes. This increase was significant in 4 jurisdictions and positive but not significant in a 5th. This varied substantially from one jurisdiction to another, but the overall average increase was 27%.

Findings for other than rear-end crashes were inconsistent. Red light cameras were associated with increases in all 6 types of crashes measured in Arlington County, while in Fairfax there were significant decreases in 3 crash types and no significant increases. Even within jurisdictions there were differences, with some intersections showing increases in collisions and other intersections in the same jurisdiction showing decreases.

Overall, red light cameras were associated with an increase in *total crashes*. Two jurisdictions showed significant increases, two had nonsignificant increases, and one had a nonsignificant decrease. The cameras were also associated with an overall decrease of 42% in *red light running crashes* (though two jurisdictions showed an increase). There was an increase in *total crashes* in 4 jurisdictions and an increase in *injury crashes*. One interesting finding was that the incidence of *rear-end crashes* did not decline after the initial increase following the introduction of the cameras. This suggests that drivers did not become habituated to the cameras over time.

While the Garber et al study is often used to support the view that red light cameras do not improve road safety, their conclusion is more equivocal: "These results cannot be used to justify the widespread installation of cameras because they are not universally effective. These results also cannot be used to justify the abolition of cameras, as they have had a positive impact at some intersections and in some jurisdictions" (2007: n.p.).

Charlotte, NC (Pulugartha and Otturu, 2014)

Pulugartha and Otturu (2014) evaluated the impact of red light cameras installed at 32 intersections in Charlotte, N.C. These intersections were compared with 32 similar control intersections. The cameras were installed between 1998 and 2000 and the program was suspended in 2006. This enabled a comparison before[18] and after the red light cameras were installed and a second comparison between after - installation and program suspension.

The results of the study were complex. With the exception of *angle crashes*, the data did not show a statistically significant difference in the number of crashes at the signalized intersections: "The number of *rear-end crashes, left-turn crashes, right-turn and total crashes* decreased after the implementation of the RLC [red light camera] program, but also decreased substantially after the termination of the RLC enforcement program. On the other hand, *angle crashes* decreased after the implementation of the RLC enforcement program but increased marginally after the termination of the RLC enforcement program. The number of *sideswipe crashes* increased after the implementation of the RLC enforcement program but decreased after the termination of the RLC enforcement program" (Pulugartha and Otturu ,2014: 12).

It is interesting to note that the number of crashes declined by 4.6% from the 'before' to 'after' installation periods, but by 38.4% from the 'after installation' to 'after program termination' periods. One other interesting finding was that there were indications that the cameras were most effective in reducing crashes at intersections with less than 40,000 vehicle entries a day and at intersections with low numbers of rear-end crashes.

Miami-Dade County (Fla.) (Llau et al, 2015)

Llau et al examined 20 intersections with red light cameras and compared them with 40 comparison sites without cameras. The comparison sites were located at least 2 miles from the camera sites to minimize spillover effects. Intersection crash data were collected for a period of 3 years before camera installation and 2 years after. The researchers summarized their findings: "During the first year, RLC sites experienced a marginal decrease in *side angle/turn collisions* (−3%), a significant increase in *rear-end collisions* (+40%), and significant decreases in *all injury* (−19%) and [*red light running]-related injury* collisions (−24%). An increase in *side angle/turning* (+14%) and *rear-end* (+51%) collisions at the RLC sites was observed after 2 years despite camera enforcement. A significant reduction in [red light running]-related injury crashes (−17%), however, was still observed after 2 years. A nonsignificant decline in all *injury collisions* (−12%) was also noted" (2015:773). These findings are consistent with many other studies that have shown decreases in injury crashes but increases in rear-end crashes. The researchers concluded that overall the red light cameras provided safety benefits.

Orange County, Florida (Ahmed and Abdel-Aty, 2015)

Ahmed and Abdel-Aty used the empirical Bayes method to analyze collision data from 25 intersections with red light cameras. They also used data on 50 intersections with no cameras in order to control for spillover. All intersections had at least 3 years of before-camera and after-camera data.

The results were consistent with many earlier studies. *Angle and left-turn crashes* at target approaches decreased by 24% for crashes of all severity and by 26% for fatal and injury crashes. *Rear-end crashes* increased 32% for all severity crashes and 41% for fatal and injury crashes. The data showed a spillover effect as these all severity and fatal and injury crashes declined by 16% and 13% respectively for all approaches to camera-equipped intersections. There did not seem to be a spillover effect for rear-end crashes. The researchers also found there was a reduced frequency of angle and left-turn crashes throughout the county, not just on the travel corridors that had red light cameras installed.

[18] The length of the pre-installation period ranged from 1.5 to 3.5 years.

What Happens When the Cameras Stop?

Objections to red light cameras from politicians and from members of the public have led several jurisdictions to cancel camera programs. These cancellations provide obvious 'before and after' research opportunities. The final group of studies to be discussed in this paper examine the impact of the decision to turn off red light cameras on red light running and on crashes.

Virginia Beach – Turning off Red Light Cameras (Porter, et al, 2013).

Virginia Beach VA implemented a red light camera program in 2004. Martinez and Porter (2006) found that the incidence of red light running dropped 69% following the start of the program. However, the Virginia legislature ended their authorization for red light cameras in 2005, which provided Porter et al (2013) with the opportunity to see if red light running rates went back to their pre-camera level.

To control for spillover effects, Porter et al compared 4 photo intersections in Virginia Beach with 2 comparable intersections that did not have cameras. They also selected two control intersections in Newport News, a nearby city that did not have cameras.

The findings were consistent with previous research - turning off the cameras had a significant impact on drivers' behaviour. Within the first year, rates of *red light running* were 4 times higher than they were several months before the cameras were removed. This was close to the level of red light running prior to the installation of the cameras. They also found that the rate of increase was about the same for several different driver characteristics (i.e. age, race, and gender) that were predictive of running red lights.

It is important to note that while this study demonstrated the clear impact of red light cameras on red light violations, Porter et al did not examine its effect on collisions.

The Impact of Turning on and Turning off Red Light Cameras in the U.S. (Hu and Cicchino, 2017)

Hu and Cicchino studied the impact of adding and removing red light cameras on fatal crashes and on fatal red light running crashes. The study first compared vehicle crashes in 57 U.S. cities that had initiated red light camera programs between 1992 and 2014 with 33 cities that did not have RLC programs. The second part of the study compared 14 cities that removed cameras between 2010 and 2014 with 29 matched cities which had retained their programs.

The researchers controlled for several external factors including trends over time in fatal crash rates, population density, and unemployment rates. When they looked at the impact of initiating a red light camera program, the researchers found that cities in the camera group had high rates of *fatal crashes* in early years when their programs were getting started, but the crash rates declined for the rest of the study period. Rates in the control cities remained relatively constant during the entire period. The analysis showed that "the annual rate of fatal red light running crashes in cities with camera programs after cameras were turned on was 21.3% lower than what would have been expected without cameras. This difference was significant" (Hu and Cicchino, 2017:145). Further, the rate of *all fatal crashes* (not just red light running crashes) was 14.2% lower than the rate that would have been expected without cameras. Because red light running crashes make up only about 30% of all fatal crashes at signalized intersections, this means that the cameras appear to have an effect on driver behaviour at intersections that is not limited to reducing red light running. These results were consistent with those of an earlier study of 62 US cities – 14 with camera programs and 48 without - which found that fatal red light crashes declined by 24% and all fatal crashes at signalized intersections were reduced by 17 percent (Hu et al, 2011) compared with expected rates without the red light cameras.

What happened when red light camera programs were ended and the cameras were turned off? The rate of fatal red light running crashes was 30.1% higher than would have been expected with the cameras on and the rate of all fatal? crashes was 16.1% higher than expected. Based on these findings, the researchers conclude that "turning off cameras was associated with increases in citywide fatal crash rates at signalized intersections. Legislators and communities considering terminating camera programs should consider the impact to public safety as the programs end" (2017: 147).

Turning off Cameras in Houston and Dallas (Gallagher and Fisher, 2017)

A final study of the impact of ending a red light camera program examined collision rates in Houston and Dallas. Both cities had red light camera programs, but a referendum in 2010 led to the end of the use of red light cameras in Houston. If the cameras helped to reduce crashes, crashes at Houston intersections from which the cameras had been removed should have increased more than at intersections that never had cameras. Because the red light camera program continued in Dallas, crash rates at former red light camera intersections in Houston should have increased more than at similar red light camera intersections in Dallas.

Gallagher and Fisher concluded that there was "no evidence that red light cameras reduce the frequency of *vehicular accidents*" (2017: 6). They estimate that the Houston program – which covered 66 intersections – saved only "4 injury accidents per year" (2017:6). Thus, their work is not consistent with the view that red light cameras are effective in reducing crashes and injuries.

BIBLIOGRAPHY

AECOM. 2014a. Intersection Safety Device Program – Red-Light Camera Analysis. AECOM: Markham, ON.

AECOM. 2014b. Intersection Safety Device Program – Intersection Speed Camera Analysis. AECOM, Markham, ON.

Aeron-Thomas, Amy and Stephane Hess. 2005. Red-Light Cameras for the Prevention of Road Traffic Crashes. Wiley: Cochrane Database of Systematic Reviews.

Ahmed, M. and M. Abdel-Aty. 2015. "Evaluation and Spatial Analysis of Automated Red-Light Running Enforcement Cameras". *Transportation Research Part C* 50: 130-140.

Bailey, Melissa. 2012. "'No Taxation Through Citation'". *New Haven Independent*, 3 April.

Budd, Laurie, Jim Scully, and Stuart Newstead. 2011. *Evaluation of the Crash Effects of Victoria's Fixed Digital Speed and Red-light Cameras.* Melbourne: Monash University Accident Research Centre.

Burkey, M. and K. Obeng. 2004. "A Detailed Investigatin of Crash Risk Reduction Resulting From Red Light Cameras in Small Urban Areas." Greensboro: Urban Transportation Institute.

California State Auditor. 2002. "Red Light Camera Programs: Although They Have Contributed to a Reduction in Accidents, Operational Weaknesses Exist at the Local Level". Sacramento: California Bureau of State Audits.

Carnis, L. "Automated Speed Enforcement: What the French Experience Can Teach Us." *Joiurnal of Transportation Safety & Security* 3: 15-26.

Ceccarelli, Brian; Shovlin, Joseph. "Does the Multibillion-Dollar Red Light Camera Sector Owe Its Existence - and Profits - to Traffic Engineers' Misapplication of the Yellow Change Interval Formula?". Traffic Technology International, October/November 2013 pp. 56-62.

Chen, Greg. 2005. "Safety and Economic Impacts of Photo Radar Program". *Traffic Injury Prevention* 6(4): 299-307

Chen, Greg, Jean Wilson, Wayne Meckle, P. Cooper. 2000. "Evaluation of BC Photo Radar Program in British Columbia". *Accident Analysis and Prevention* 32(4): 517-526.

Chen, Greg, Wayne Meckle, Jean Wilson. 2002. "Speed and Safety Effect of Photo Radar Enforcement on a Highway Corridor in British Columbia". *Accident Analysis and Prevention* 34(2): 129-138.

Council, Forrest, Bhagwant Persaud, Kimberly Eccles, Craig Lyon, and Michael Griffith. 2005. Safety Evaluation of Red-Light Cameras. McLean, VA: Federal Highway Administration

Cunningham, Christopher and Joseph Hummer. 2010. "Evaluating the Effectiveness of Red-Light Running Camera Enforcement in Raleigh, North Carolina". *Journal of Transportation Safety & Security* 2: 312-324.

Daflos, Penny. 2018. "Photo Radar 2.0 coming to B.C., Aiming to Reduce ICBC Claims." CTV Vancouver News, March 8. https://bc.ctvnews.ca/photo-radar-2-0-coming-to-b-c-aiming-to-reduce-icbc-claims-1.3834857. Accessed 9 April 2018.

De Pauw, Ellen, Stijn Daniels, Tom Brijs, Elke Hermans, and Geert Wets. 2014a. "An Evaluation of the Traffic Safety Effect of Fixed Speed Cameras". *Safety Science* 62: 168-174.

De Pauw, Ellen, Stijn Daniels, Tom Brijs, Elke Hermans, and Geert Wets. 2014b. "Automated Section Speed Control on Motorways: An Evaluation of the Effect on Driving Speed". *Accident Analysis and Prevention* 73: 313-322.

De Pauw, Ellen, Stijn Daniels, Tom Brijs, Elke Hermans, and Geert Wets. 2015. "Behavioral Effects of Fixed Speed Cameras on Motorways: Overall Improved Speed Compliance or Kangaroo Jumps?" *Accident Analysis and Prevention* 73: 132-140.

Eccles, Kimberly, Rebecca Fiedler, Bhagwant Persuad, Craig Lyon, Glenn Hansen. 2012. Automated Enforcement for Speeding and Red Light Running. Washington: The National Academies Press.

Edwards, Phil. 2017. "Speed Cameras to Reduce Speeding Traffic and Road Traffic Injuries". http://whatworks.college.police.uk/Research/Research-Map/Pages/ResearchProject.aspx?projectid=427. Accessed 19 May 2017.

Elliott, M.A., and Broughton, J. 2005. How Methods and Levels of Policing Affect Road Casualty Rates (TRL Report 637) Wokingham: Transport Research Laboratory

Elvik, Rune, Alena Hoye, TrulsVaa, Michael Sorenson. 2009. Handbook of Road Safety Measures, 2nd Ed. Bingley UK: Emerald Publishing.

Erke, Alena. 2009. "Red Light for Red-Light Cameras? A Meta-Analysis of the Effects of Red-Light Cameras on Crashes". *Accident Analysis & Prevention* 41: 897-905.

Gallagher, Justin, and Paul J. Fisher. 2017. "Deterrence in a Setting with Multiple Risks: Traffic Cameras, Vehicular Accidents, and Public Safety." Available: https://docs.google.com/viewer?url=http%3A%2F%2Ffaculty.weatherhead.case.edu%2Fjpg75%2Fpdfs%2Fred_light_camera_14.pdf. Accessed: 5 June, 2017.

Garber, Nicholas, John Miller, Elizabeth Abel, Saeed Eslambolchi, and Santhosh Korukunda. 2007.The Impact of Red Light Cameras (Photo-Red Enforcement) on Crashes in Virginia. Charlottesville: Virginia Transportation Research Council.

Hallmark, Shauna, Massiel Orellana, Thomas McDonald, Eric Fitzsimmons, and David Matulac. 2010. "Red Light Running in Iowa". *Transportation Research Record* 2182: 48-54.

Hillier, W., J. Ronczka, and F. Schnerring. 1993. An Evaluation of Red Light Cameras in Sydney. Roseberry, NSW: Roads and Traffic Authority New South Wales.

Hoye, Alena. 2014. "Speed Cameras, Section Control, and Kangaroo Jumps – A meta-Analysis". *Accident Analysis and Prevention* 73: 200-208.

Hoye, Alena. 2015a. "Safety Effects of Section Control – An Empirical Bayes Evaluation". *Accident Analysis and Prevention* 74: 169-178.

Hoye, Alena. 2015b. "Safety Effects of Fixed Speed Cameras – An Empirical Bayes Evaluation". *Accident Analysis and Prevention* 82: 263-269.

Hu, Wen, Anne McCartt and Eric Teoh. 2011. "Effects of Red Light Camera Enforcement on Fatal Crashes in Large US Cities". *Journal of Safety Research* 42: 277-282.

Hu, Wen and Anne McCartt. 2016. "Effects of Automated Speed Enforcement in Montgomery County, Maryland, on Vehicle Speeds, Public Opinion, and Crashes". *Traffic Injury Prevention* 17:sup1: 53-58.

Hu, Wen and Jessica Cicchino. 2017. "Effects of Turning On and Off Red Light Cameras in Large U.S. Cities." *Journal of Safety Research* 61: 141-148.

Insurance Institute for Highway Safety. 2012. “Institute Responds to Criticism of Red Light Camera Research”. *Status Report* 47: n.p.

Kidwell, Dave. 2017. “Redflex to pay $20 million to Chicago to settle lawsuit over red-light camera bribery. *Chicago Tribune*, 6 Feb. http://www.chicagotribune.com/news/watchdog/redlight/ct-red-light-cameras-lawsuit-settled-met-20170206-story.html

Kyrychenko, Sergey and Richard Retting. 2004. “Review of ‘A Detailed Investigation of Crash Risk Reduction Resulting from Red Light Cameras in Small Urban Areas’ by M. Burkey and K. Obeng. Arlington: Insurance Industry for Highway Safety.

Langland-Orban, Barbara, Etienne Pracht, and John Large. 2008. “Red Light Running Cameras: Would Crashes, Injuries and Automobile Insurance Rates Increase if They are Used in Florida?”. *Florida Public Health Review* 5:1-7.

Langland-Orban, Barbara, John Large and Etienne Pracht. 2011. “An Update on Red Light Camera Research: The Need for Federal Standards in the Interest of Public Safety”. *Florida Public Health Review* 8:1-9.

Langland-Orban, Barbara, Etienne Pracht, and John Large. 2012. “Counterpoint: The Insurance Institute for Highway Safety Study Actually Found Cities Using Red Light Cameras Had Higher Red Light Running Fatality Rates.” *Florida Public Health Review* 9:1-8.

Langland-Orban, Barbara, Etienne Pracht, and John Large. 2014. “Red Light Cameras Unsuccessful in Reducing Fatal Crashes in Large US Cities”. *Health Behavior and Policy Review* 1: 72-81.

Langland-Orban, Barbara, Etienne Pracht, John Large, Nanhua Zhang, and Joseph Tepas. 2016. “Explaining Differences in Crash and Injury Outcomes in Red Light Camera Studies”. *Evaluation& the Health Professions* 39(2): 226-244.

Li, Hajoie, Daniel Graham, and Arnab Majumdar. 2013. “The Impacts of Speed Cameras on Road Accidents: An Application of Propensity Score Matching.” *Accident Analysis and Prevention* 60:148-157.

Li, Hajoie and Daniel Graham. 2016. “Heterogenous Treatment Effects of Speed Cameras on Road Safety”. *Accident Analysis and Prevention*. 97: 153-161.

Li, Ran, Karim El-Basyouny, and Amy Kim. 2014. “A Before and After Empirical Bayes Evaluation of Automated Mobile Speed Enforcement on Arterial Roads’. Paper presented at the 94th Annual Meeting of the Transportation Research Record, Washington, D.C.

Li, Ran, Karim El-Basyouny, Amy Kim, and Suliman Gargoum. 2017. “Relationship Between Road Safety and Mobile Photo Enforcement Performance Indicators: A Case Study of the City of Edmonton”. *Journal of Transportation Safety and Security* 9:2, 195-215.

Llau, Anthoni and Nasar Ahmed. 2014. “The Effectiveness of Red Light Cameras in the United States – A Literature Review.” *Traffic Injury Prevention* 15: 542-550.

Llau, Anthoni, Nasar Ahmed, Hafiz Khan, Fabian Cevallos, and Vukosa Pekovic. 2015. “The Impact of Red Light Cameras on Crashes Within Miami-Dade County, Florida”. *Traffic Injury Prevention* 16:773-780.

Lund, Adrian, Sergey Kyrychenko, and Richard Retting. 2009. “Caution: A Comment on Alena Erke’s Red Light for Red-light Cameras? A Meta-Analysis of the Effects of Red-Light Cameras on Crashes”. *Accident Analysis & Prevention* 41: 895-896.

Lunman, Kim. 2001. "B.C. Scraps Photo Radar as Cabinet Debuts on TV." *The Globe and Mail*, 28 June. https://www.theglobeandmail.com/news/national/bc-scraps-photo-radar-as-cabinet-debuts-on-tv/article4150046/. Accessed 9 April 2018.

Mann, T., S. Brown, and C. Coxon. 1994. Evaluation of the Effects of Installing Red Light Cameras at Selected Adelaide Intersections. Walkerville: South Australian Department of Transport Office of Road Safety.

Martinez, Kristie and Bryan Porter. 2006. "Characterizing Red Light Runners Following Implementation of a Photo Enforcement Program". *Accident Analysis & Prevention* 38: 862-870.

McCartt, Anne and Wen Hu. 2014. "Effects of Red Light Camera Enforcement on Red Light Violations in Arlington County, Virginia" 48: 57-62.

McGee, Hugh and Kimberly Eccles. 2003. "The Impact of Red-Light Camera Enforcement on Crash Experience". *ITE Journal* 73: 44-49.

Medina, Juan, Rahim Benekohal, Ali Hajbabaie, Ming-Heng Wang, Madhav Chitturi. 2009. "Downstream Effects of Speed Photo Enforement and Other Speed Reduction Treatments on Work Zones. *Transportation Research Record: Journal of the Transportation Research Board* 2107: 24-33.

Montella, Alfonso, Bhagwant Persaud, Mauro D'apuzzo and Lella Imbriani. 2012. "Safety Evaluation of Automated Section Speed Enforcement System". *Transportation Research Record;Journal of the Transportation Research Board.* 2281: 16-25.

Montella, Alfonso, Lella Imbriani, Vittorio Marzano, Filomena Mauriello. 2015. *Accident Analysis and Prevention* 75:164-178.

Morain, Stephanie, Andrea Gielen, and Kavi Bhalla. 2016. "Automated Speed Enforcement Systems to Reduce Traffic-Related Injuries: Closing the Policy Implementation Gap *Injury Prevention,* 22:79-83.

National Highway Traffic Safety Administration. 2008. Speed Enforcement Camera Systems Operational Guidelines 15.

Ng, C., Y. Wong, K. Lum. 1997. "The Impact of Red-light Surveillance Cameras on Road Safety in Singapore". *Road and Transport Research* 6: 9.

Novoa, Ana, Katherine Perez, Elena Santamarina-Rubio, Marc Mari-Dell'Olmo, and Aurelio Tobias. 2010. "The Effectiveness of Speed Enforcement Through Fixed Speed Cameras: A Time Series Studhy. *Injury Prevention* 16:12-16.

Perkins, Chloe, Rebecca Steinbach, Phil Edwards, Deirdre Beecher, Stephane Hess, Amy Aeron-Thomas, Ellen Kohn, and Suman Kakar. 2017. Red Light Enforcement Cameras to Reduce Traffic Violations and Road Traffic Injuries. London: London School of Hygiene and Tropical Medicine.

Persaud B, Council FM, Lyon C, Eccles K, Griffith M. 2005. "Multijurisdictional

Safety Evaluation of Red Light Cameras". *Transportation Research Record*

1922:29–37.

Persaud, Bhagwant, Richard Retting, Craig Lyon, and Anne McCartt. 2008. Review of "The Impact of Red Light Cameras (Photo-Red Enforcement) on Crashes in Virginia" by Nicholas J. Garber, John S. Miller, R. Elizabeth Abel, Saeed Eslambolchi, and Santosh K. Korokunda. Arlington, VA: Insurance Industry for Highway Safety.

Porter, Bryan and Thomas Berry. 2001. "A Nationwide Survey of Self-Reported Red Light Running: Measuring Prevalence, Predictors, and Perceived Consequences." *Accident Analysis & Prevention*. 33: 735-741.

Porter, Bryan, Kristie Johnson, and Johnnie Bland. 2013. "Turning Off the Cameras: Red Light Running Characteristics and Rates After Photo Enforcement Legislation Expired". *Accident Analysis & Prevention* 50(January): 1104-1111.

Pulugurtha, Srivinas, and Ramesh Otturu. 2014. "Effectiveness of Red Light Running Camera Enforcement Program in Reducing Crashes: Evaluation Using 'Before the Installation', 'After the Installation', and 'After the Termination' Data". *Accident Analysis and Prevention*. 64:9-17.

Retting, Richard., Allan Williams, Charles Farmer, and Amy Feldman. 1999. "Evaluation of Red Light Camera Enforcement in Fairfax, VA. *ITE Journal*. August: 30-34.

Retting, Richard and Charles Farmer. 2003. "Evaluation of Speed Camera Enforcement in the District of Columbia". *Transportation Research Record*. 1830:34-37.

Retting, Richard and S.Y. Krychenko. 2002. "Reductions in Injury Crashes Associated with Red Light Camera Enforcement in Oxnard, California". *American Journal of Public Health* 92: 1822-1825.

Retting, Richard, Sergey Kyrychenko, and Anne McCartt. 2008. "Evaluation of Automated Speed Enforcement on Loop 101 Freeway in Scottsdale Arizona". *Accident Analysis and Prevention* 4:1506-1512.

Rogers, J.,S.S. Dey, R. Retting, R. Jain, X. Liang, N. Askarzadeh 2016. Using Automated Enforcement Data to Achieve Vision Zero Goals: A Case Study. Paper Presented at 2016 IEEE International Conference on Big Data, Washington, D.C.

Sayed, Tarek and Paul de Leur. 2009. "Evaluation of Edmonton's Intersection Safety Camera Program." Pp. 191-204 in Al-Qadi, Imad, Tarek Sayed, Naser Alnuaimi, and Eyad Masad (eds.) *Efficient Transportation and Pavement Systems.* London: Taylor and Francis.

Schulz, Kathryn. 2015. "The Rabbit- Hole Rabbit Hole". *The New Yorker*. 4 June. Available: http://www.newyorker.com/culture/cultural-comment/the-rabbit-hole-rabbit-hole. Accessed 2 June, 2017.

Shim, Jisup, Shin Hyoung Park, Sungbong Chung and Kitae Jang. 2015. "Enforcement Avoidance Behavior Near Automated Speed Enforcement Areas in Korean Expressways". *Accident Analysis and Prevention* 80: 57-66.

Shimizu, Hiriko and Pierre Desrochers. 2015. "Speed or Greed: Does Automated Traffic Enforcement Improve Safety or Generate Revenue?" Winnipeg: Frontier Centre for Public Policy8.

Shin, Kangwon and Simon Washington. 2007. "The Impact of Red Light Cameras on Safety in Arizona". *Accident Analysis and Prevention* 39: 1212-1221.

Skubic, Jeffrey, Steven Johnson, and Chris Salvino, Steven Vanhoy, and Chengcheng Hu. 2013. "Do Speed Cameras Reduce Collisions?".*Annals of Advances in Automotive Medicine* 57:365-368.

South, David, Warren Harrison, Ingrid Portans, and Mark King. 1988. Evaluation of the Red Light Camera Program and the Owner Onus Legislation. Hawthorn, Victoria: Road Traffic Authority.

Steinbach, Rebecca, Chloe Perkins, Phil Edwards, Deirdre Beecher, and Ian Roberts. 2016. "Speed Cameras to Reduce Speeding Traffic and Road Traffic Injuries".

http://whatworks.college.police.uk/Research/Systematic_Review_Series/Pages/Speed_cameras.aspx. Accessed 8 April, 2018.

Sun, Carlos. 2011. Is Robocop a Cash Cow? Motivations for Automated Traffic Enforcement *Journal of Transportation, Law, Logistics and Policy* 78:11-35.

Synectics. 2003. Evaluation of the Red Light Camera Enforcement Pilot Project.

Tay, Richard. 2009. “The Effectiveness of Automated and Manned Traffic Enforcement”. *International Journal of Sustainable Transportation* 3: 176-186.

Thomas, Libby, Raghavan Srinivasan, Lawrence Decina, and Loren Staplin. 2008. “Safety Effects of Automated Speed Enforcement Programs: A Critical Review of International Literature”. *Transportation Research Record* 2078: 117-126.

Tomasino, Michael. 2015. “Police, Equity and Municipal Finance: A Comparison of St. Louis County, MO and New Jersey Traffic Enforcement”. *Rutgers CLiME* ,March 16. Available: http://www.clime.newark.rutgers.edu/publications/report/police-equity-and-municipal-finance-comparison-st-louis-county-mo-and-new-jersey. Accessed 25 May, 2017.

Vanlaar, Ward, Robybn Robertson, and Kyla Marcoux. 2011. Evaluation of the Photo Enforcement Safety Program of the City of Winnipeg: Final Report. Ottawa: Traffic Injury Research Foundation.

Vanlaar, Ward, Robybn Robertson, and Kyla Marcoux. 2014. “An Evaluation of Winnipeg’s Photo Enforcement Safety Program: Results of Time Series Analyses and an Intersection Camera Experiment”. *Accident Analysis and Prevention* 62: 238-247.

Wahl, Georgia, Tareq Islam, Bridget Gardner, and Alan Marr. 2010. “Red Light Cameras: Do They Change Driver Behavior and Reduce Accidents?”. *The Journal of Trauma, Injury, Infection, and Critical Care* 68: 515-518.

Walden, Troy ad Brian Bochner. 2011. “Effectiveness of Red Light Cameras – Texas Statewide Evaluation”. *ITE Journal* 81: 30-33.

Wilson, C., C. Willis, JK Hendrikz, R. LeBrocque and N. Bellamy. 2012. “Speed Cameras for the Prevention of Road Traffic Injuries and Deaths”. Cochrane Database of Systematic Reviews 11.

Wilmots, Brenda, Elke Hermans, Tom Brijs, and Geert Wets. 2017. “Evaluating Speed Enforcement Field Set-Ups Used by Regional Police in Belgium: An Analysis of Speed Outcome Indicators”. *Safety* 3.

APPENDIX F – PUBLIC ENGAGEMENT SURVEY

Tantus

MNP LLP

Automated Traffic Enforcement Review

Public Engagement Survey

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Executive Summary

- 1200 Albertans (18+) were asked 11 Questions
- 6 areas of question focus:
  - Safety
  - Public Engagement
  - Revenue Generation
  - Enforcement
  - Driver Behaviour
  - Revenue Allocation
- Overall trends observed:
  - The majority of Albertans agree or strongly agree that ATE should be used to ticket drivers who speed and/or run red lights.
  - The majority of Albertans disagree or strongly disagree that information on where ATE is/will be operated is readily available to them.
  - Female respondents - regardless of age, and Mature (55+) respondents - regardless of gender, believed to a moderate or great extent that receiving an ATE violation/fine, or knowing that they could receive an ATE violation/fine has improved their driving behaviour.
  - The majority of Albertans believe to a moderate or great extent that ATE is primarily focused on revenue generation.

Executive Summary

- Key Findings per Area of Focus:
  - **Safety (Questions 1-2, 8):**

    Overall, when asked if respondents believed that ATE had contributed to improved safety outcomes and if photo radar/Intersection Safety Cameras had reduced collisions in their municipalities over the past 5 years, Albertans had balanced responses:

    - Specifically, for improved safety outcomes, 36% of respondents agreed or strongly agreed and 39% disagreed or strongly disagreed (Q1).
    - For collision reduction, 38% of respondents agreed or strongly agreed and 40% disagreed or strongly disagreed (Q2).

    When asked if Intersection Safety Cameras make intersections safer, 53% of respondents agreed or strongly agreed, and 28% of respondents disagreed or strongly disagreed (Q8).

  - **Public Engagement (Question 3):**

    The majority of respondents (46%) disagreed or strongly disagreed that information on where ATE is/will be operated is readily available to them.

  - **Revenue Generation (Question 4):**

    The majority of respondents (63%) believed to a moderate or great extent that Automated Traffic Enforcement is primarily focused on revenue generation.

Executive Summary

- Key Findings per Area of Focus:
  - **Enforcement (Questions 5-7):**

    When respondents were asked if photo radar should be used to ticket drivers who speed (Q5), if red light cameras should be used to ticket drivers who run red lights (Q6), and if Intersection Safety Cameras should be used to ticket drivers who speed through intersections (Q7), 61%, 82%, and 68% agreed or strongly agreed, respectively.
  - **Driver Behaviour (Questions 9 & 10):**
    - When asked if knowing they could receive an Automated Enforcement violation/fine has improved their driving behaviour, 50% of respondents agreed or strongly agreed, and 35% disagreed or strongly disagreed (Q9).
    - When asked if receiving an Automated Enforcement violation/fine has improved their driving behaviour, 47% of respondents agreed or strongly agreed, and 37% disagreed or strongly disagreed (Q10).
  - **Revenue Allocation (Question 11):**

    The majority of respondents indicated that fine revenues should be allocated to various traffic safety initiatives.

Survey Introduction

- MNP and Tantus were engaged by Alberta Transportation to conduct a review of the Automated Traffic Enforcement Program in Alberta. As part of the program review, MNP partnered with Trend Research to conduct a public engagement survey to gather input from Albertans.
- The survey was completed as follows:
  - Period: April 3, 2018 – April 16, 2018
  - Length: 11 Questions
  - Delivery: 5-minute, Computer-Assisted Telephone Interview
- The survey focused on 6 key areas of engagement:
  - Safety (Questions 1-2, 8)
  - Public Engagement (Question 3)
  - Revenue Generation (Question 4)
  - Enforcement (Questions 5-7)
  - Driver Behaviour (Questions 9 & 10)
  - Revenue Allocation (Question 11)

Methodology

- Trend Research, in partnership with MNP, developed the respondent sample as follows:
  - A randomly-dialed, representative sample of phone numbers was selected to include 60% landline numbers and 40% mobile numbers.
  - All interviews were conducted from Trend Research's Edmonton call centre.
  - All interviews were supervised and monitored and the survey was registered with the Marketing Research & Intelligence Association (MRIA) to ensure best practices were being adhered to.
  - All interviewers were trained on the specific survey questions and a pretest of 20 interviews was conducted prior to commencing the full survey.

- Margin of error:
  - Overall results, at a sample size of 1,200, are reliable to within ±2.8 percentage points, 19 times out of 20.

For additional Methodology information, please see Appendix A.

Demographics (1/2)

- A randomized sample of 1,200 Albertans ages 18 years and older were surveyed.
- Respondent counts by region in Table 1 are based on Statistics Canada Alberta population distribution data.

Table 1: Survey Sample

Region	Respondents
Calgary Metro Area (CMA)	425
Edmonton Metro Area (EMA)	425
Small Cities - North	42
Small Cities - South	71
Rural - North	83
Rural - South	154
Total	**1,200**

The **Edmonton Metro Area** is defined as**:** City of Edmonton, Specialized Municipality of Strathcona County, City of St. Albert, City of Spruce Grove, Municipal District of Parkland County, City of Leduc, City of Fort Saskatchewan, Municipal District of Sturgeon County, Town of Beaumont, Town of Stony Plain, Municipal District of Leduc County, Town of Morinville, Town of Devon, Town of Gibbons, Town of Calmar, Town of Redwater, Stony Plain 135, Wabamun 133A, Town of Bon Accord, Town of Legal, Town of Bruderheim, Alexander 134, Village of Thorsby, Village of Warburg, Village of Spring Lake, Village of Wabamun, Summer Village of Seba Beach, Summer Village of Golden Days, Summer Village of Sundance Beach, Wabamun 133B, Summer Village of Lakeview, Summer Village of Itaska Beach, Summer Village of Betula Beach, Summer Village of Kapasiwin, Summer Village of Point Alison. [1]

The **Calgary Metro Area** is defined as**:** City of Calgary, Municipal District of Rocky View County, Town of Cochrane, City of Chestermere, Town of Crossfield, Tsuu T'ina Nation 145 (Sarcee 145), Town of Irricana, and Village of Beiseker.[1]

[1]Definition Retrieved May 16, 2018 from Statistics Canada 2016 Census.

Demographics (2/2)

- The following demographic information was collected from respondents:
  - Age (from age ranges)
  - Male/Female/Other
  - Valid Driver's licence (Y/N)
  - First 3 digits of postal code
  - Hours driven per day
  - Received an ATE Violation (Y/N)

Table 2: Key Survey Demographics

Category	Demographic	Respondents
Gender	Female	600
	Male	600
Age Range	18-34	343
	35-64	601
	65+	458
Hours Driven/Day	<1	388
	1-2	478
	2-5	195
	5+	74
	Other transport[1]	10
Received ATE Violation	Yes	691
	No	509
Valid Driver's License	Yes	1147
	No	53

[1]Indicates a respondent who uses a means of transportation other than driving.

Age Demographics (1/2)

- Survey respondents were asked to classify themselves into the following age categories (divided here by male and female):

Table 3: Age Demographics by Gender

Age Category	Female	Male	Total/Category	% of Total
18-20	30	18	48	4%
21-24	30	41	71	6%
25-34	113	111	224	19%
35-44	95	108	203	17%
45-54	96	100	196	16%
55-64	118	84	202	17%
65-69	54	51	105	9%
70-74	23	39	62	5%
75-79	22	26	48	4%
80+	19	22	41	3%

Age Demographics (2/2)

- For information display purposes, age ranges were grouped into the following age categories:
  - <35 years (343 respondents)
  - 35-64 years (601 respondents)
  - 65+ years (256 respondents)
- These groupings are reflective of significant age demographics within the Alberta population.

Survey Questions – Summary of Questions (1/2)

1. To what degree do you believe that photo radar/Intersection Cameras have contributed to improved safety outcomes (reduced speeding, fewer collisions, better driver attention/behaviours) in the last five years.[1]
2. In the past five years, photo radar/Intersection Cameras have reduced collisions in my municipality.[2]
3. Where I live, information is readily available to me on where Automated Traffic Enforcement is/will be operated.[2]
4. To what degree do you believe that Automated Traffic Enforcement is primarily focused on revenue generation.[1]
5. Photo radar should be used to ticket drivers who are speeding on public roads in municipalities.[2]
6. Intersection Safety Cameras should be used to ticket drivers who run red lights.[2]
7. Intersection Safety Cameras should be used to ticket drivers who speed through intersections.[2]
8. Intersection Safety Cameras that detect speeding make intersections safer.[2]
9. Knowing that I could receive an Automated Enforcement violation/fine has improved my own driving behaviour (reducing speeding, running red lights, etc.). [2]
10. Having received an Automated Traffic Enforcement violation/paid an ATE fine has improved my own driving behaviour (reducing speeding, running red lights, etc.).[2]

****Respondent data will be provided in a summary format. Where notable differences were observed, other demographic views are compared with the main question response.***

***Please note that Questions 1- 11 have been paraphrased in some instances on the following pages for conciseness.*

[1]On a scale of 1-5, where 1 means "Not at all" and 5 means "To a Great Extent".
[2]On a scale of 1-5, where 1 means "Strongly Disagree" and 5 means "Strongly Agree".

Survey Questions – Summary of Questions (2/2)

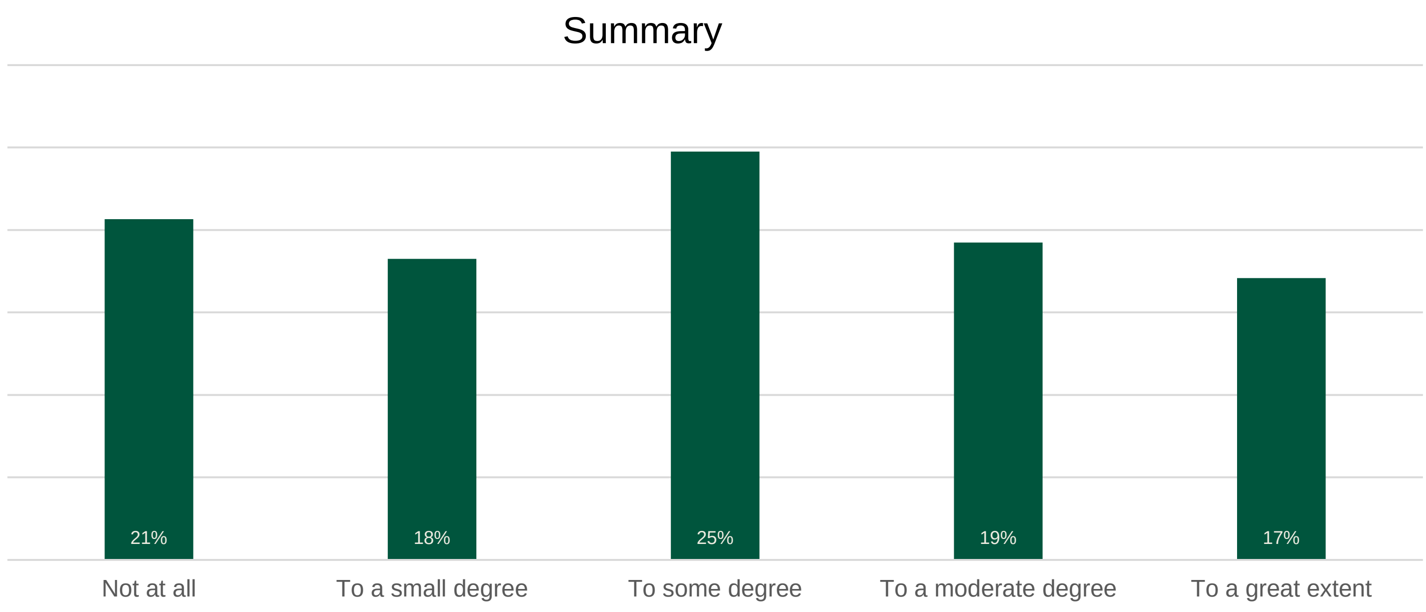
11. *Of the following, what do you think that Automated Traffic Enforcement violation fine revenues should be allocated to ("Yes" to any and all that apply):*
    1. *Nothing in particular, should be general revenues for municipal and provincial governments.*
    2. *Enhancing traditional policing resources (more police officers, crime prevention initiatives, community engagement initiatives).*
    3. *Invest in additional Police Officer traffic enforcement (officer operated radar/laser radar speed limit enforcement, school zone/playground zone officer enforcement).*
    4. *Specific and targeted traffic safety initiatives (public awareness campaigns, public service announcements, traffic calming structures, digital speed monitoring signs, public education initiatives).*
    5. *Research and development on how to improve traffic safety.*
    6. *Transportation infrastructure (roads, signals, signage, sensors, etc.).*
    7. *Helps offset court and justice administration costs associated with traffic violations.*
    8. *Victims services (i.e. services for victims and families of victims of injuries/deaths from traffic violations).*
    9. *Other (Please state).*

****Respondent data will be provided in a summary format. Where notable differences were observed, other demographic views are compared with the main question response.***

***Please note that Questions 1- 11 have been paraphrased in some instances on the following pages for conciseness.*

Question 1 (1/2):

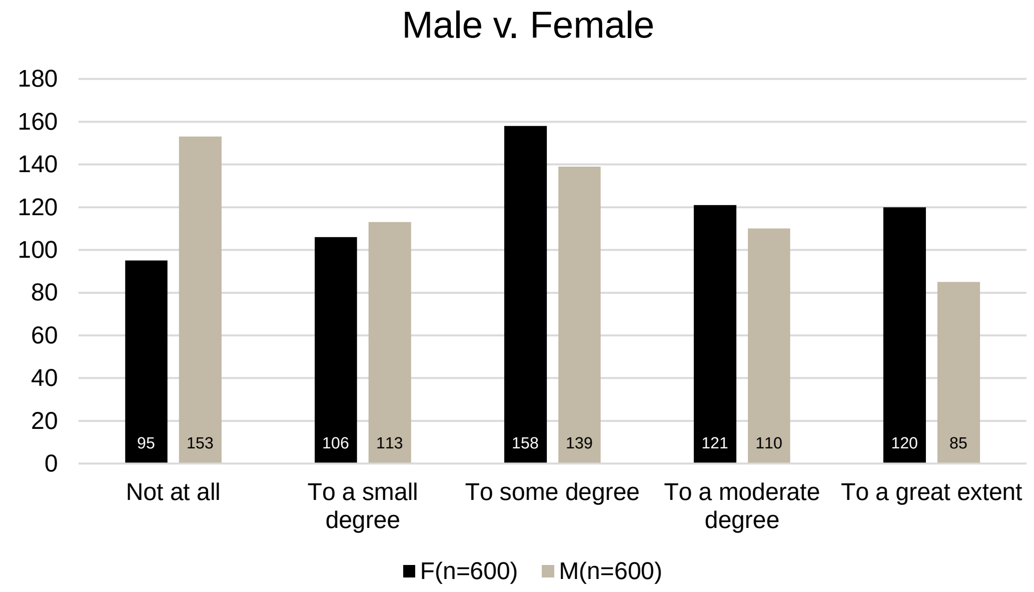
To what degree do you believe that photo radar/Intersection Cameras have contributed to improved safety outcomes (reduced speeding, fewer collisions, better driver attention/behaviours) in the last five years.



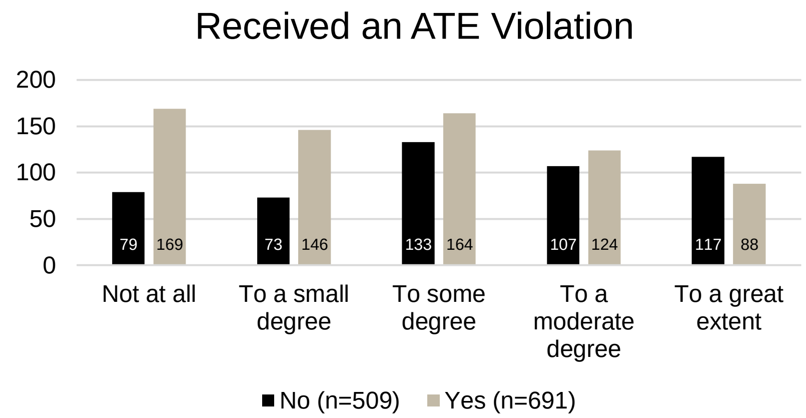
Responses were relatively evenly distributed on Question 1, with 36% of respondents believing to a moderate or great extent that photo radar/Intersection Cameras have contributed to improved safety outcomes in the last five years and, conversely, 39% believing to a small degree or not at all.

Question 1 (2/2):

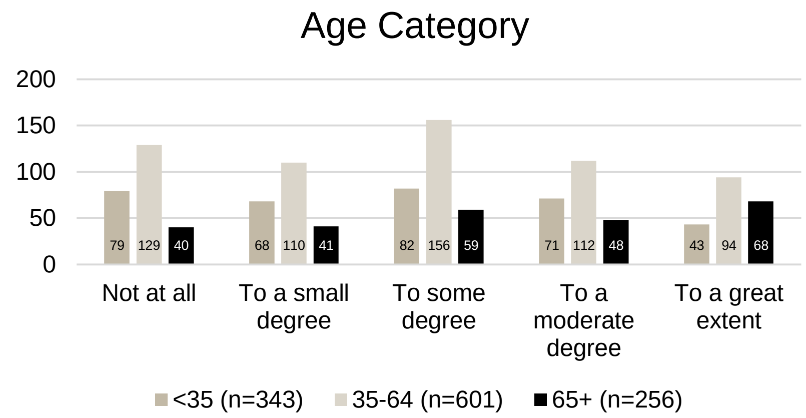
To what degree do you believe that photo radar/Intersection Cameras have contributed to improved safety outcomes (reduced speeding, fewer collisions, better driver attention/behaviours) in the last five years.



Female respondents were more likely to believe that photo radar/Intersection Cameras have contributed to improved safety outcomes, whereas male respondents were more likely to disagree.



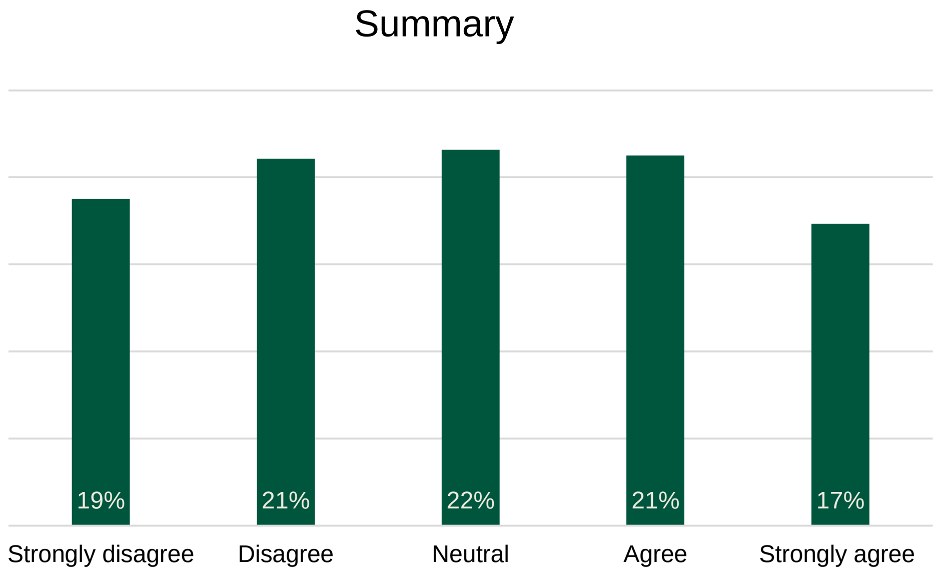
Those who have received an ATE violation were less likely to believe that photo radar/Intersection Cameras have contributed to improved safety outcomes than those who had not.



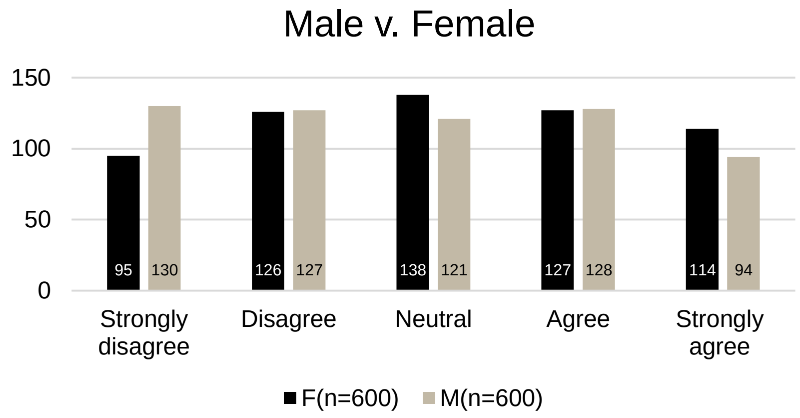
Respondents 65+ were the most likely to believe that photo radar/Intersection Cameras have contributed to improved outcomes. Those 35-64 were less likely to believe the statement, and those <35 were the least likely to believe the statement.

Question 2:

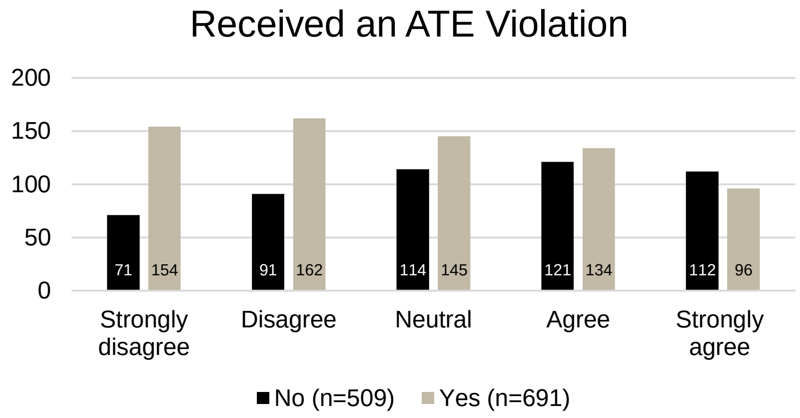
In the past five years, photo radar/Intersection Cameras have reduced collisions in my municipality in Alberta.



Responses were relatively evenly distributed on Question 2, with 38% of respondents agreeing or strongly agreeing that photo radar/Intersection Cameras have reduced collisions in their municipalities in the last 5 years. Conversely, 40% of respondents disagree or strongly disagree with the statement.



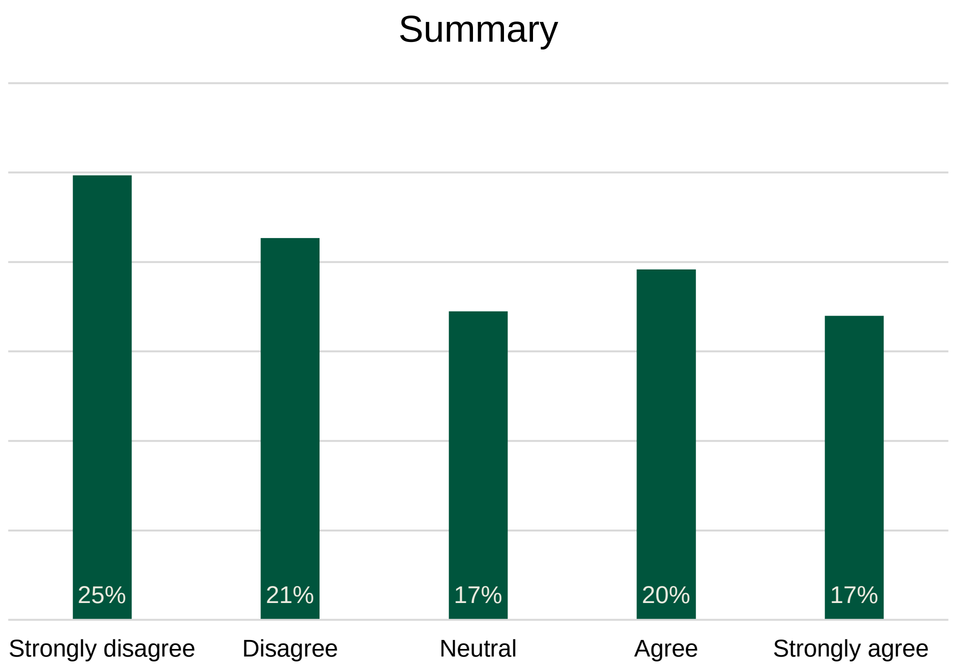
Female respondents were slightly more likely to agree that photo radar/Intersection Cameras have reduced collisions in their municipalities in the past 5 years, whereas male respondents were slightly more likely to disagree.



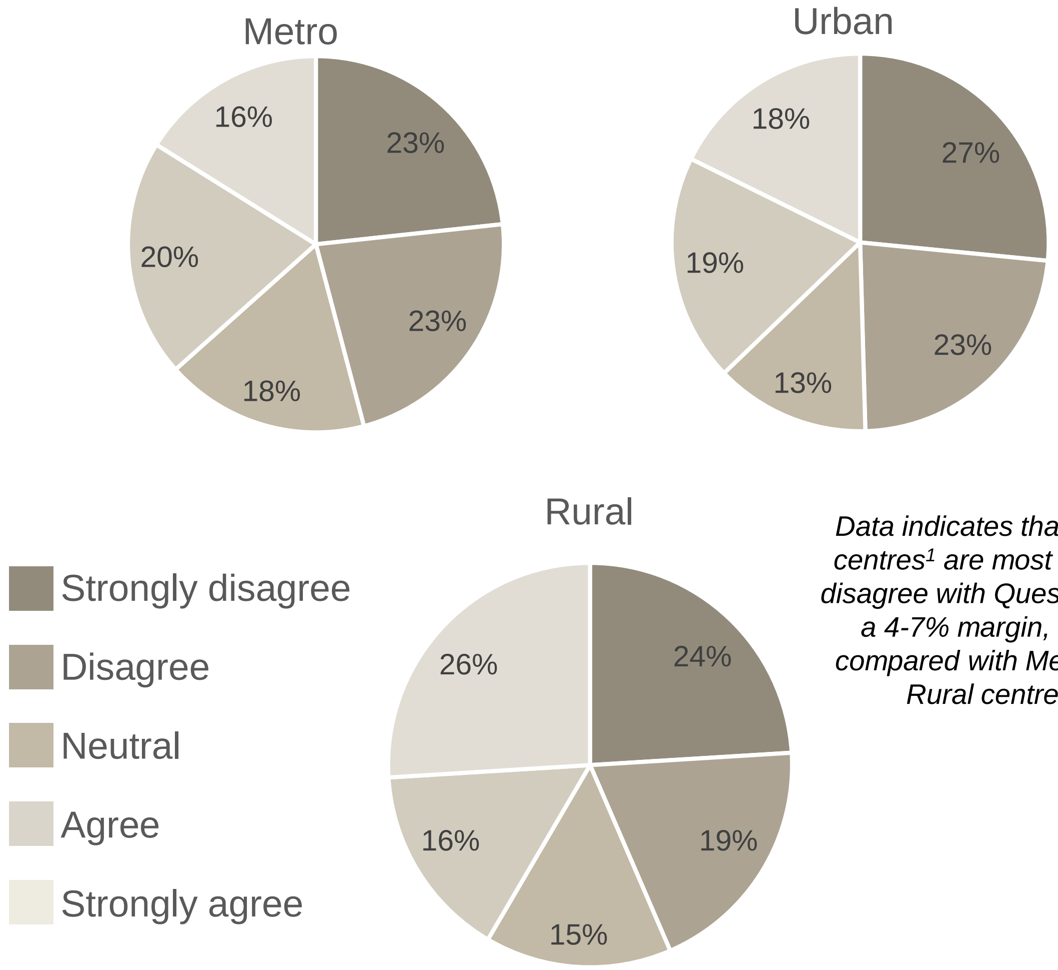
Respondents who had not received an ATE violation were more likely to agree that photo radar/Intersection Cameras reduced collisions. Previous violators were more likely to disagree with the statement.

Question 3:

Where I live, information is readily available to me on where Automated Traffic Enforcement is/will be operated.



46% of respondents disagreed or strongly disagreed that information on where Automated Traffic Enforcement is/will be operated is readily available.

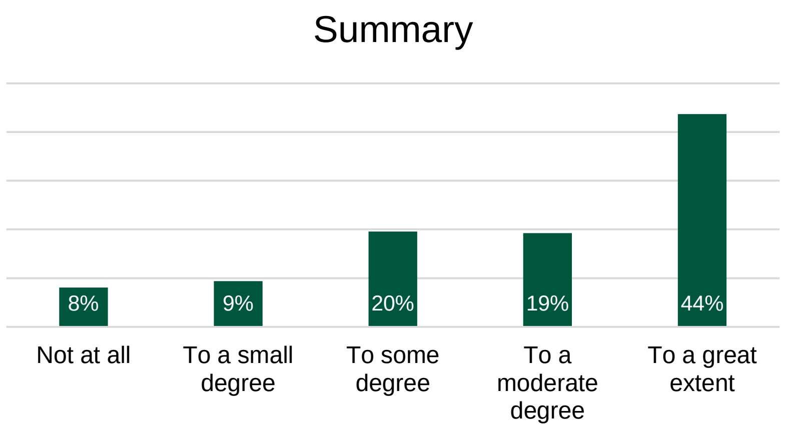


Data indicates that Urban centres[1] are most likely to disagree with Question 3 by a 4-7% margin, when compared with Metro and Rural centres.

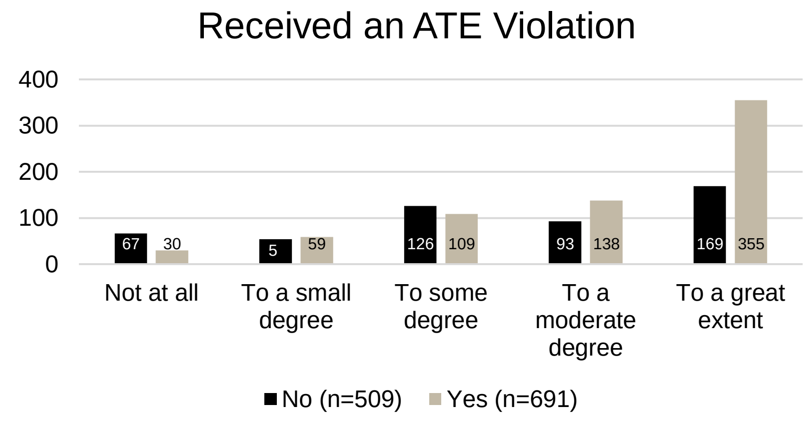
[1]Centres are classified as follows: Metro – Edmonton CMA & Calgary CMA; Urban – Fort McMurray, Grande Prairie, & Lloydminster, Lethbridge, Red Deer. & Medicine Hat; Rural – Rural North & Rural South

Question 4:

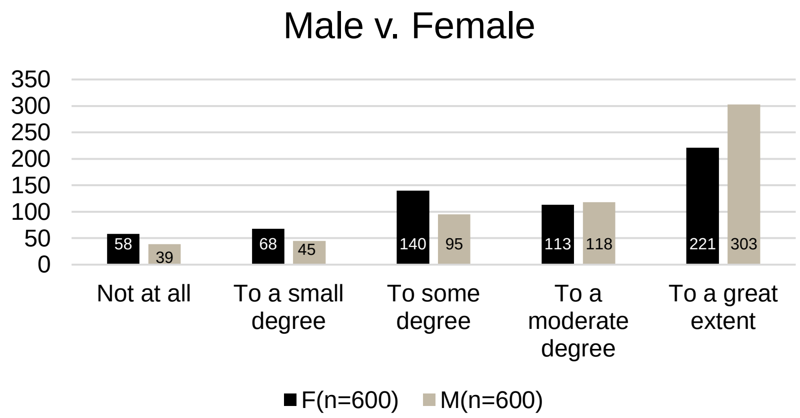
To what degree do you believe that Automated Traffic Enforcement is primarily focused on revenue generation?



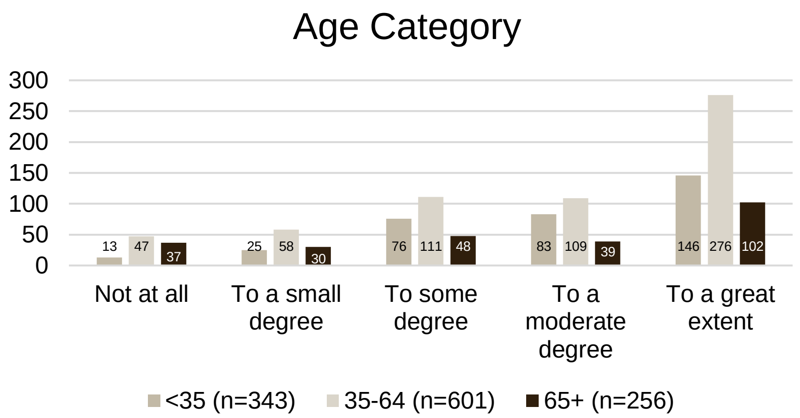
The majority (63%) of respondents believed to a moderate or great extent that Automated Traffic Enforcement is primarily focused on revenue generation.



Those who have received ATE violations in the past agreed to a greater extent that ATE is revenue-driven than those who had not received ATE violations.



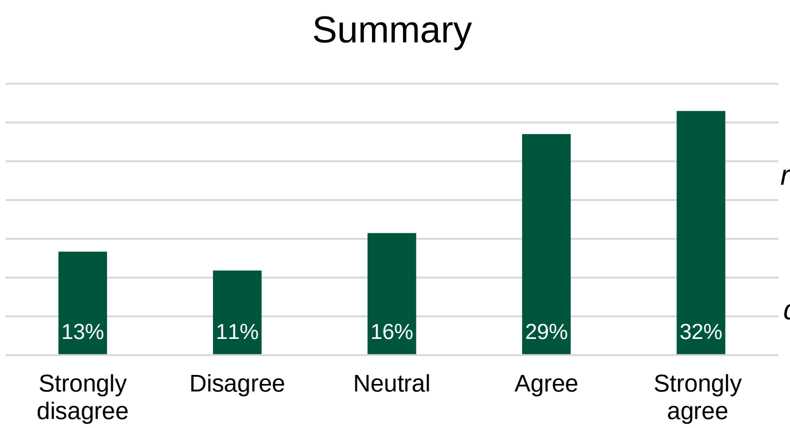
Male respondents agreed to a greater extent that ATE is primarily focused on revenue generation. Female respondents agreed to a lesser extent.



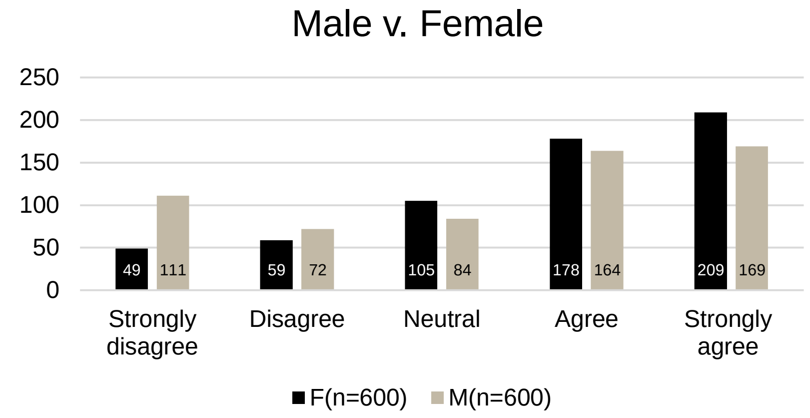
The majority of all age categories believe to a moderate or great extent with the statement. Those <35 and 35-64 believed that ATE is primarily focused on revenue generation to a greater extent than those 65+.

Question 5:

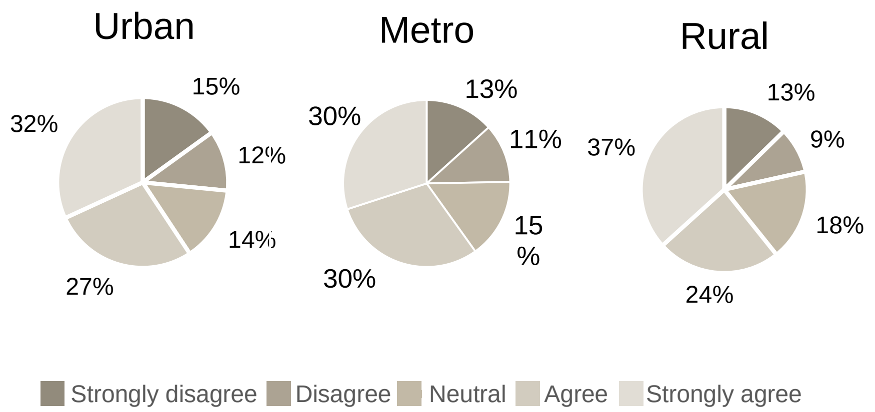
Photo radar should be used to ticket drivers who are speeding on public roads in municipalities.



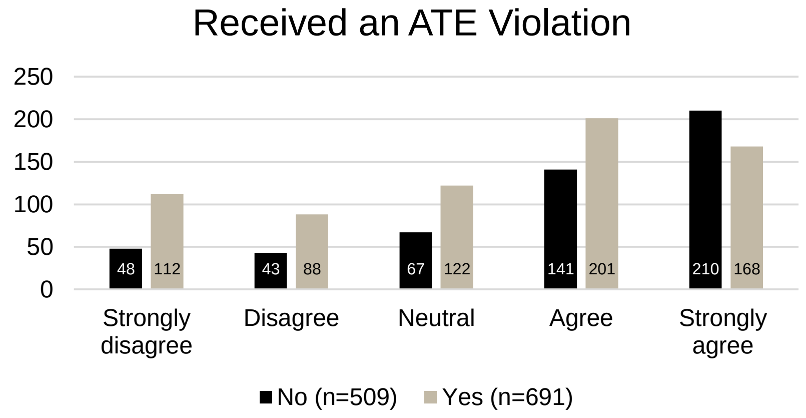
The majority of respondents (61%) agreed or strongly agreed that photo radar devices should be used to ticket drivers speeding on public roads in municipalities.



Female respondents were more likely to agree than male respondents that photo radar should be used to ticket drivers who are speeding on public roads in municipalities.



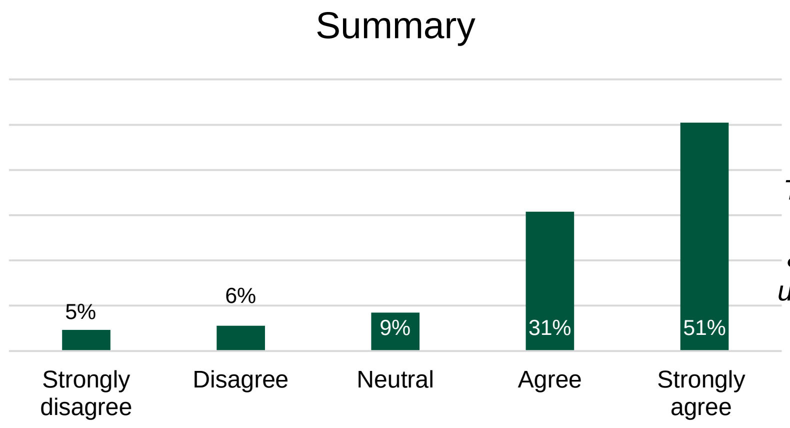
Respondents in Rural centres most strongly agreed with the use of photo radar to ticket drivers who are speeding.



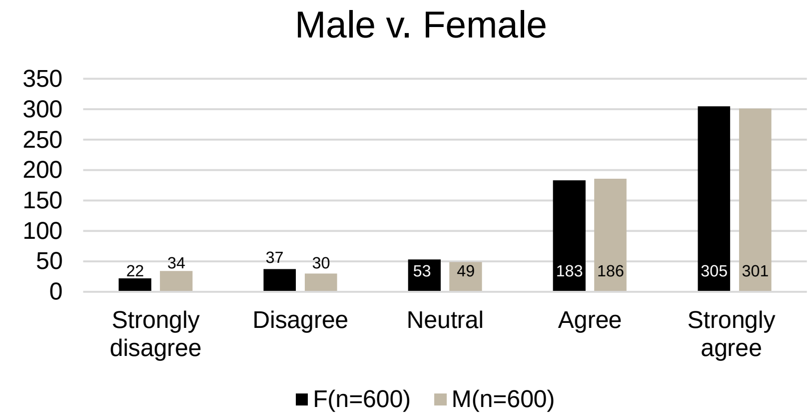
The majority of respondents agreed or strongly agreed that photo radar should be used to ticket drivers who are speeding. Those who have received an ATE violation in the past are more likely to disagree or strongly disagree than those who have not received one in the past.

Question 6:

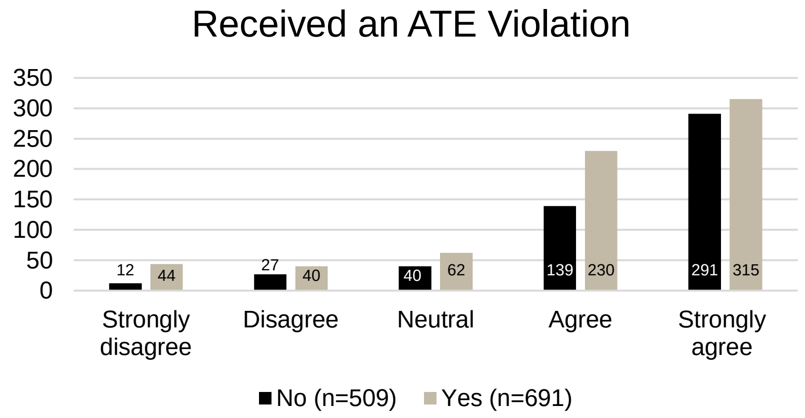
Intersection Safety Cameras (ISCs) should be used to ticket drivers who run red lights.



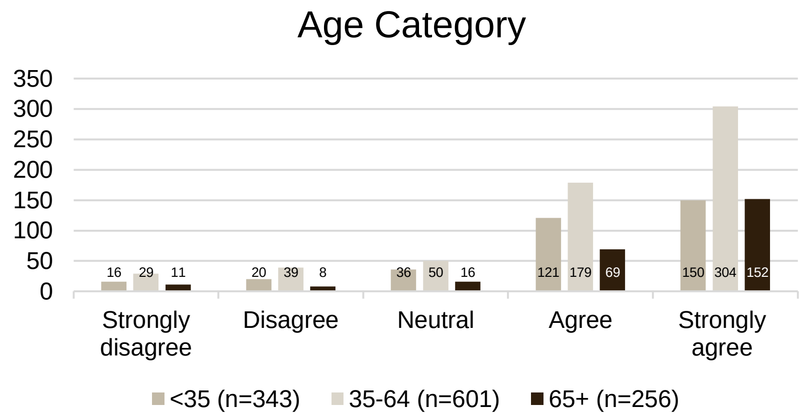
The majority of respondents (82%) agreed or strongly agreed that ISCs should be used to ticket drivers that run red lights.



The majority of both male and female respondents were likely to agree that ISCs should be used to ticket drivers who run red lights.



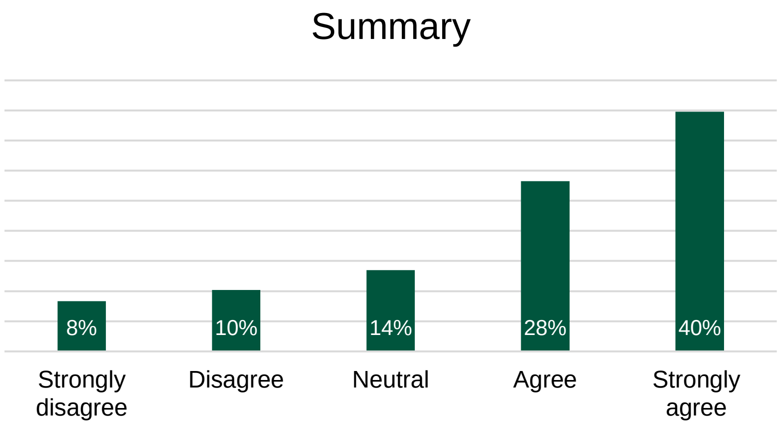
Both ATE violators and non-violators were likely to agree that ISCs should be used to ticket drivers who run red lights.



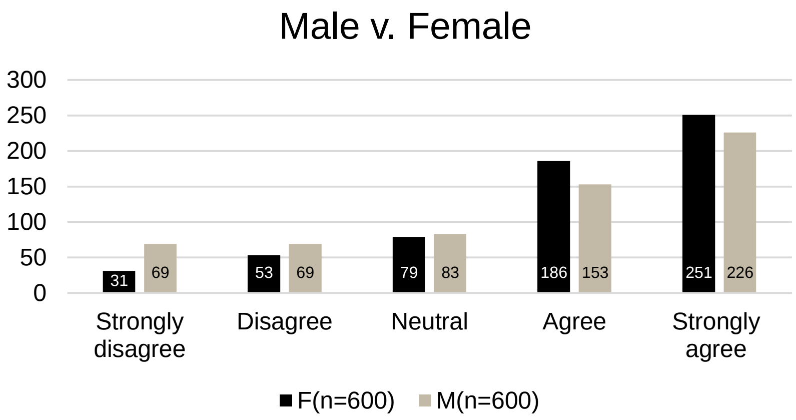
The majority of respondents in all age categories were likely to agree that ATE should be used to ticket drivers who run red lights.

Question 7:

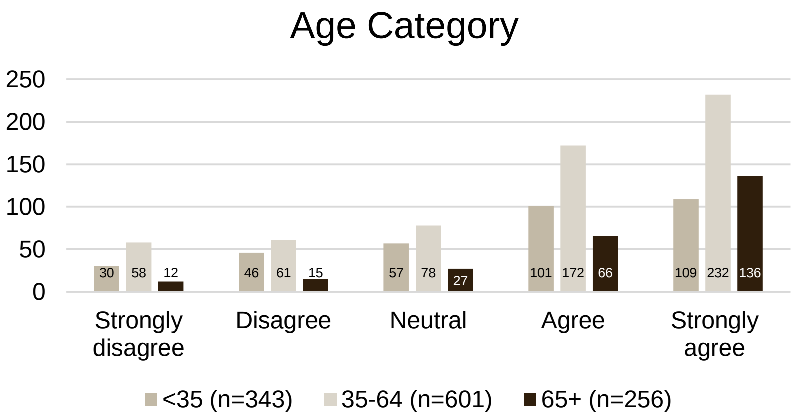
Intersection Safety Cameras (ISCs) should be used to ticket drivers who speed through intersections.



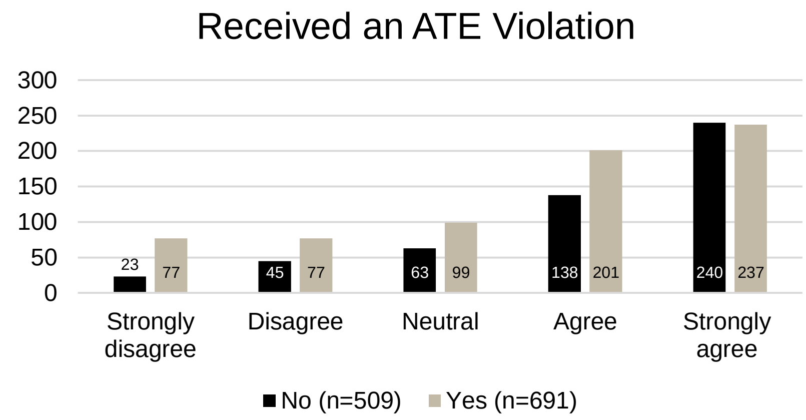
The majority of respondents (68%) agreed or strongly agreed that ISCs should be used to ticket drivers that speed through intersections.



Female respondents were more likely to agree than male respondents that ISCs should be used to ticket drivers who speed through intersections.



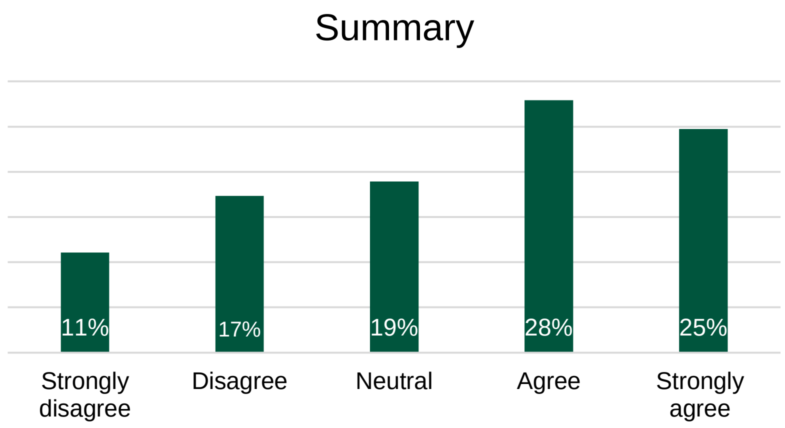
Respondents 35-64 and 65+ were most likely to agree with the statement, with respondents <35 slightly less likely to agree with the statement.



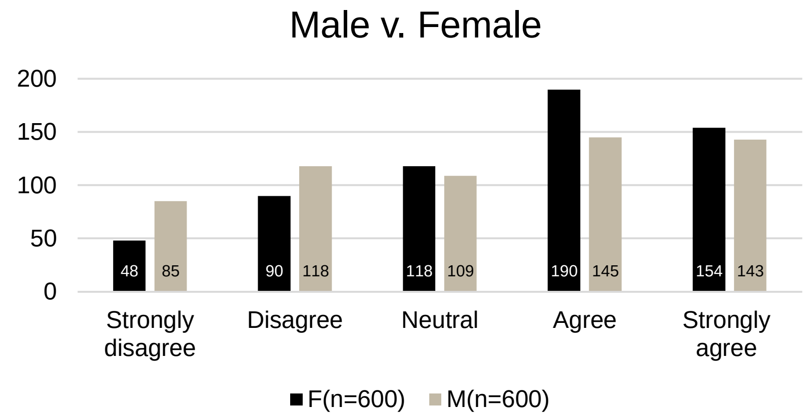
The majority of ATE violators and non-violators were likely to agree with the statement.

Question 8:

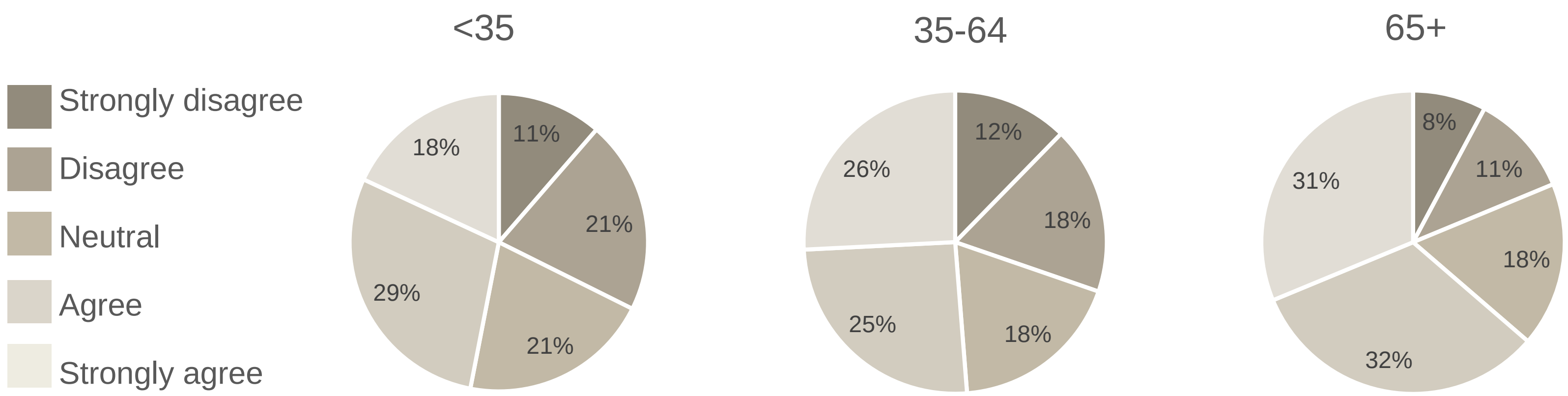
Intersection Safety Cameras (ISCs) that detect speeding make intersections safer.



The majority of respondents (53%) agreed or strongly agreed that ISCs that detect speeding make intersections safer.



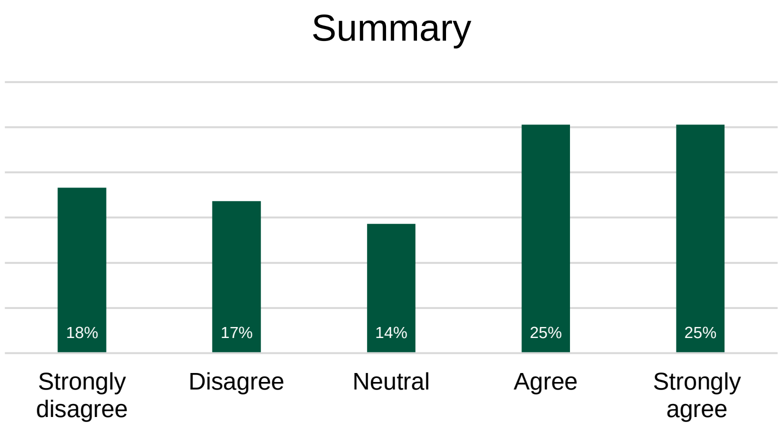
Both male and female respondents were likely to agree with the statement, with female respondents more likely to agree than male respondents.



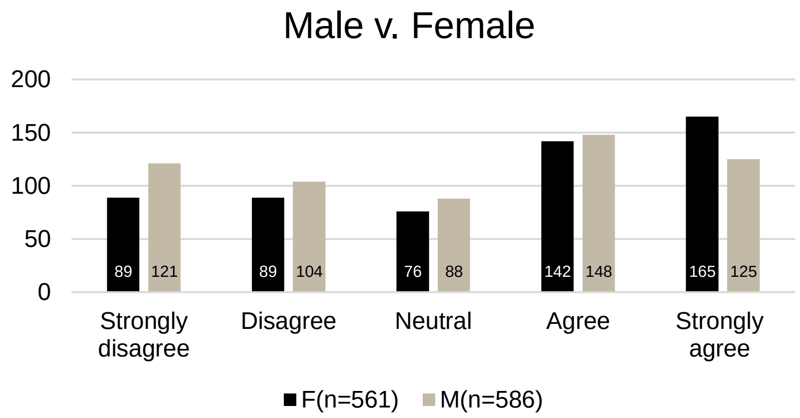
Respondents 65+ were the most likely to agree with the statement, followed by those 35-64, and <35, respectively.

Question 9 (n=1147[1]):

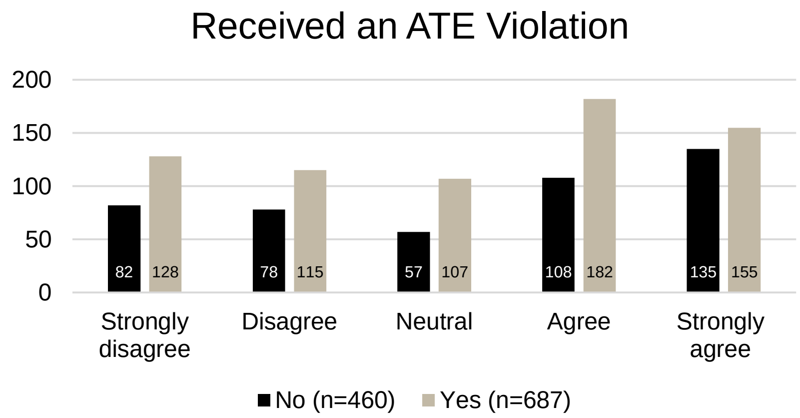
Knowing that I could receive an Automated Enforcement violation/fine has improved my own driving behaviour (reducing speeding, running red lights, etc.).



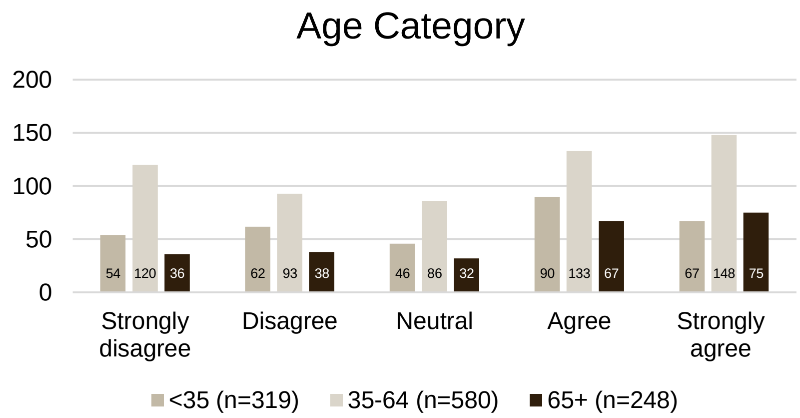
50% of respondents agreed or strongly agreed that knowing they could receive an ATE violation has improved their own driver behaviour, while 35% disagreed or strongly disagreed.



Both male and female respondents were likely to agree with the statement, with female respondents more likely to agree than male respondents.



The majority of respondents agreed or strongly agreed with Question 9. Respondents who have received an ATE violation were more likely to agree than those who have not received an ATE violation

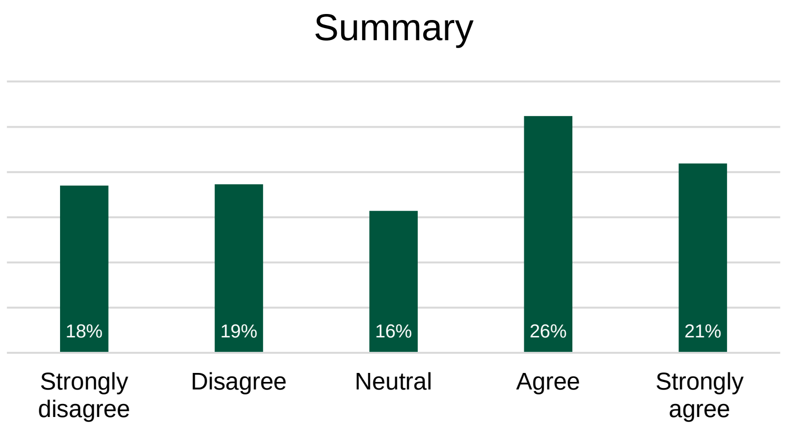


All age categories were likely to agree with the statement. Those 35-64 and 65+ were more likely to agree than respondents <35.

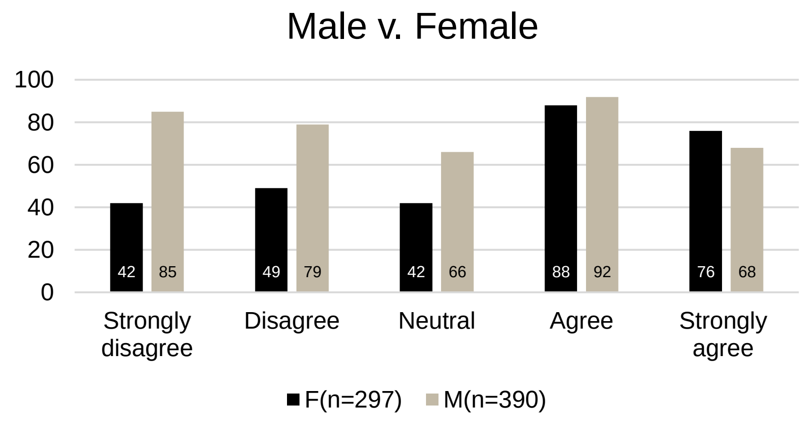
[1]53 individuals opted out of responding to this question.

Question 10 (n=687[1]):

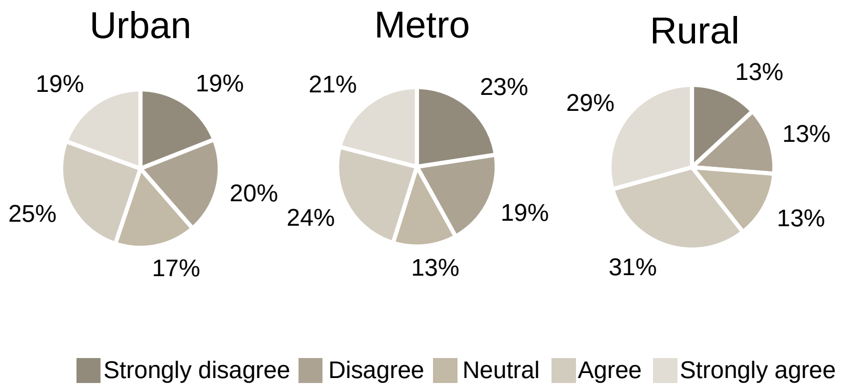
Having received an Automated Enforcement violation/paid an ATE fine has improved my own driving behaviour (reducing speeding, running red lights, etc.).



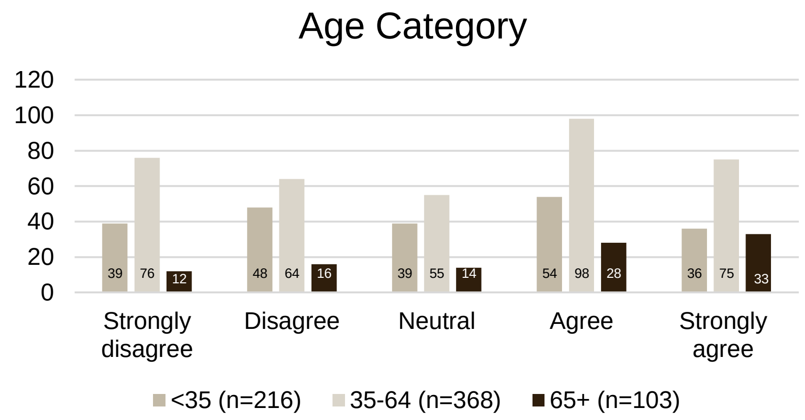
47% of respondents agreed or strongly agreed that receiving an ATE violation has improved their personal driving behaviour, while 37% disagreed or strongly disagreed.



Female respondents were more likely to agree that receiving an ATE violation has improved their driving behaviour. Male respondents were more likely to disagree.



Rural respondents were most likely to agree that receiving an ATE violation has improved their driving behaviour.

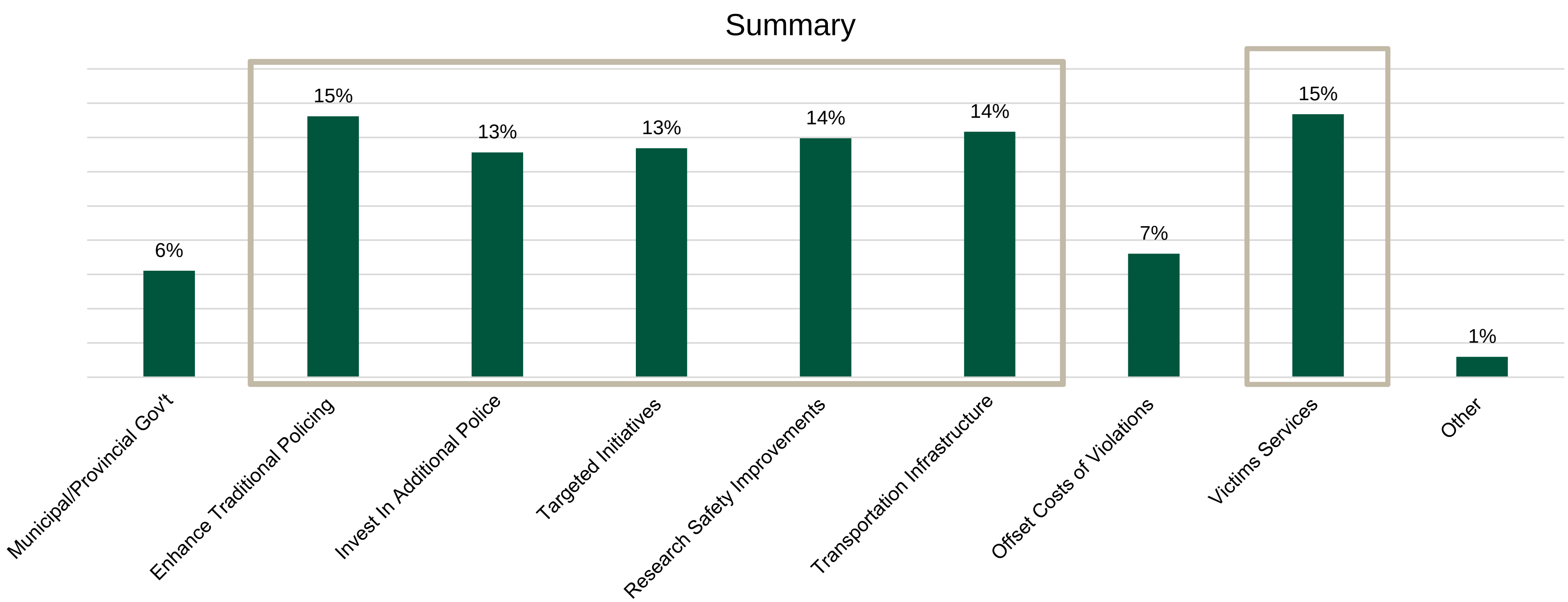


Respondents 65+ were the most likely to agree with Question 10, followed by respondents 35-64, and <35, respectively.

[1]*This question was only asked to individuals who had received an ATE violation in the past 5 years.*

Question 11:

Which of the following options should Automated Traffic Enforcement violation fine revenues be allocated to?



Albertans have a fairly distributed view of how ATE violation fine revenues should be allocated, focused mainly on a variety of traffic safety initiatives[1]

[1]Legend descriptions have been edited for conciseness. For full text please see Question Summary on page 8.

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APPENDICES

Appendix A:
Response Scale and Interpretation of the Data

- This survey used a 5-point response scale. Considerations for this metric include:
  - Studies in this field are most commonly conducted on a 5-point scale. While a 4-point “forced choice” scale may provide more decisive results, it would create a significant challenge in comparing and contrasting results against related studies.
  - On a 5-point scale, the “Middle” response cannot be clearly divided or joined with responses on the left or the right of the scale. Therefore, careful consideration has been given in the analysis of results to present objective observations accordingly.