



OFFICE OF THE
City Auditor

Automated Photo Enforcement Review

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The Office of the City Auditor conducted
this project in accordance with the
*International Standards for the
Professional Practice of Internal Auditing*

Automated Photo Enforcement Review

Table of Contents

1. Introduction	1
2. Background	1
3. Project Objective, Criteria, Scope and Methodology	3
4. Observations	4
4.1. Cost Savings	4
4.1.1. Operational trends	6
4.2. Flexibility	8
4.3. Synergy	9
4.4. System Replacement	9
4.5. Technology	10
4.6. Data Retention	11
4.7. Accountability	11
4.8. Information	12
5. Conclusion	14

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Automated Photo Enforcement Review

1. Introduction

On September 18, 2013 Council made a request to have the Office of the City Auditor (OCA) perform an audit of the effectiveness and efficiency of the City's role in administering the Automated Photo Enforcement program, and whether the expected outcomes are being achieved by the City as outlined in the June 21, 2007 report to City Council entitled *Automated Traffic Enforcement: A recommended Delivery Model for the City of Edmonton*.

2. Background

2007 Council Direction

At its January 16, 2007 meeting, City Council passed a motion directing the City Manager, in collaboration with the Edmonton Police Commission, to consider program delivery alternatives for automated photo enforcement. Administration assembled a Steering Committee and Project Team to consider alternatives and make a recommendation to Council.

The Steering Committee's stated purpose was to recommend a delivery model for automated photo enforcement that would best combine the attributes of:

- Potential for increased traffic safety
- Cost effectiveness
- Accountability and transparency, and
- Employing appropriate and optimal technology

After reviewing the existing delivery model in 2007 and alternative models, technologies, suppliers, and estimated costs, Administration recommended that the City take over operation of the program from the contractor. The recommendation included purchasing the equipment and software to enable the City to operate the entire program without relying on a contractor to capture violation images and process them into tickets.

Changes to the Automated Photo Enforcement Program

The following notable events associated with the Automated Photo Enforcement program occurred following Council's decision to transition to a new delivery model:

- **2007** – Through the Edmonton Police Service (EPS), the City retained control of the program. A third-party vendor continued to provide violation review and ticket processing services.
- **2008** – The agreement with the vendor was extended for violation reviews and ticket processing until the City could assume responsibility for the entire program. Finance and Treasury began planning the development of violation review software.
- **2009** – The Office of Traffic Safety (OTS) was assigned the role of addressing the program's equipment requirements including purchasing, installation, and maintenance functions.

In April, Provincial legislation allowed for the use of intersection safety devices to enforce both red light and speed-on-green violations. Previously only red light violations were enforced.

- **2012** – In April, a Memorandum of Understanding between the OTS and EPS formalized and clarified roles, and assigned the OTS the responsibility to fully conduct and manage the program under the oversight of EPS.

In August, the first version of the Photo Enforcement Ticket System was implemented. The City began to review all violations and issue tickets relating to intersection safety devices as well as mobile photo radar. In November, Dragon Cam photo laser technology was implemented by the OTS with the third-party vendor providing violation review and ticket printing services.

- **2013** – In May, the vendor was no longer used to process violations on behalf of the City. A new version of the Photo Enforcement Ticket System was implemented that allowed the City to begin reviewing violations and printing tickets stemming from photo laser violations.

The OTS is one of the functional areas of the Transportation Operations Branch, which is part of the City's Transportation Services Department. The OTS' responsibilities include managing and administering the Automated Photo Enforcement program, processing violations and tickets, and testing and maintaining equipment.

Appendix A to our report provides a listing of the various types of automated photo enforcement equipment currently used by the City.

3. Project Objective, Criteria, Scope and Methodology

Our objective was to evaluate the degree to which the City has achieved the expected outcomes described in Administration's recommendation to Council in 2007.

The expected outcomes of a fully self-sufficient delivery model for the City were:

1. **Cost savings** – an enforcement program that would be delivered at a reduced cost.
2. **Flexibility** – the ability to develop a tailored program that would best meet the City's traffic safety objectives.
3. **Synergy** – the ability to share resources and processes with existing bylaw offence ticket production.
4. **System replacement** – the plan to develop a new system that combined bylaw ticket and automated enforcement ticket processing and production.
5. **Technology** – implementing technological improvements including moving from wet film to the latest digital technology and potentially using non-invasive intersection technology for intersection safety devices.
6. **Data retention** – in-house information storage and retention of staff knowledge and expertise.
7. **Accountability** – to improve control over automated enforcement equipment and information as well as ticket processes and production.
8. **Information** – enhanced tracking of financial and traffic data to improve traffic safety programs.

We assessed the degree of achievement of the expected outcomes against the following criteria:

1. The City's Administration is achieving the anticipated cost savings and is continuing to improve its efficiency in processing violations.
2. The City's Administration is achieving the anticipated operational outcomes that were forecast in the 2007 recommendation.

During the planning stage of the audit, we worked with the OTS to develop an understanding of the history of the Automated Photo Enforcement program including its governance. We reviewed the 2007 report to Council entitled *Automated Traffic Enforcement – A Recommended Delivery Model for the City of Edmonton* in order to develop a work plan that would allow us to assess the degree of achievement of the expected outcomes. We also reviewed a consultant's 2006 report to the Edmonton Police Commission entitled *Program Delivery Review – Photo Enforcement Traffic Safety*.

All operations of the Automated Photo Enforcement program were in scope, including intersection safety devices (speed-on-green and red light) and mobile speed enforcement vehicles (photo radar and laser cameras). We reviewed the program operating costs for the period from January 1, 2007 to December 31, 2013.

4. Observations

Our review of Automated Photo Enforcement operations found that the City has achieved the majority of outcomes anticipated in 2007. Improvements in operations now allow for development of Traffic Safety programs tailored to specific sites, implementation of effective new technologies and techniques, and implementation of effective controls over violation data. However the expected outcomes of *Cost Savings*, *System Replacement*, and *Synergy* between the Automated Photo Enforcement operations and Bylaw ticketing operations identified in the 2007 report have not been achieved.

4.1. Cost Savings

The realization of *Cost Savings* was the first expected outcome of the 2007 Council report, *Automated Traffic Enforcement – A Recommended Delivery Model for the City of Edmonton*. To assess achievement of the outcome, we compared the forecasted analysis in the 2007 report to actual figures and we also considered general improvements that had been made in the areas of cost reduction and operational enhancements.

The report identified three scenarios, which were based on varying annual ticket volumes of 150,000, 187,500, and 112,500. In the report, Administration identified Scenario 1 (i.e., 150,000 tickets annually) as the most realistic scenario. Therefore, we used this Scenario for comparison, which estimated five-year cumulative savings of \$7.3 million.

As shown in Table 1, it was assumed that over a five-year period (i.e., 2008 – 2012) 750,000 tickets would be generated using 29 units of automated photo enforcement equipment (with a capital cost of \$2.9 million). It was also anticipated that the software development costs for the combined ticketing system¹ would be \$1.0 million and the City would no longer rely on a third-party vendor for ticket processing.

Table 2 shows the five-year actuals from 2008-2012. During this five-year period 1,173,000 tickets were generated using 67 units of automated photo enforcement

¹ The 2007 Council Report anticipated that a system combining both the Automated Photo Enforcement and Bylaw ticketing processes would be developed (i.e., as reflected in outcome three, “*System Replacement*”). To date however, only a system for the Automated Photo Enforcement process (known as the Photo Enforcement Ticket System) has been developed. Thus, software costs reflected in this report only pertain to this system. Please refer to section 4.4 for further discussion.

equipment. By the end of 2012, approximately \$1.4 million² had been spent developing the combined ticketing system and more than \$19.2 million had been incurred in third-party vendor costs which were not phased out as early as planned.

Table 1: Scenario 1 – As per 2007 Council Report

2007 Report Expectations	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)	Totals
Ticket Volume	150,000	150,000	150,000	150,000	150,000	750,000
Available Photo Enforcement equipment	29 units	29 units	29 units	29 units	29 units	29 units
Vendor Costs	\$0	\$0	\$0	\$0	\$0	\$0
Capital Costs - Equipment	\$2,900,000	\$0	\$0	\$0	\$0	\$2,900,000
Capital Costs - Software	\$1,000,000	0	0	0	0	\$1,000,000
Operating Costs	\$555,000	\$555,000	\$555,000	\$555,000	\$555,000	\$2,775,000
Total Expected Costs	\$4,455,000	\$555,000	\$555,000	\$555,000	\$555,000	\$6,675,000

Table 2: Actual Results

Actual Results	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)	Totals
Ticket Volume	219,286	166,956	355,774	190,685	240,299	1,173,000
Available Photo Enforcement equipment	29 units	24 units	60 units	63 units	67 units	67 units³
Vendor Costs	\$2,798,000	\$3,723,774	\$5,818,012	\$3,047,992	\$3,765,124	\$19,152,902
Capital Costs - Equipment	\$613,030	\$4,209,692	\$2,867,461	\$1,792,566	\$1,256,403	\$10,739,152
Capital Costs - Software	\$0	0	0	\$755,000	\$621,718	\$1,376,718
Operating Costs	\$4,318,000	\$3,878,488	\$5,639,667	\$4,400,128	\$4,124,760	\$22,361,043
Total Actual Costs	\$7,729,030	\$11,811,954	\$14,325,140	\$9,995,686	\$9,768,005	\$53,629,815

As shown in Table 1, in 2007 the total program costs were estimated at \$6.7 million over five years (Scenario 1). From 2008 to 2012 actual costs were \$53.6 million. (According to Management, the program cost overruns were fully covered by program revenues, so there was no draw from the tax levy). Factors contributing to the difference between the projected figures in the 2007 Council report and the actual results include

² In 2013, an additional \$510K was spent on the system with another \$68K being spent by July 2014. To date, approximately \$2.1M has been spent on the system in total.

³ As at July 2014, there are 77 units of automated photo enforcement equipment on hand (see Appendix A).

the introduction of speed-on-green enforcement legislation in 2009 as well as the increase of 38 units in automated photo enforcement equipment (see Appendix A and Section 4.5). This increased the actual ticket volume by 423,000 tickets above the projected volume of 750,000 for the five-year period.

The difference in five-year costs is primarily due to continuing vendor costs for processing violations and the discrepancy in operating costs. The original forecasts assumed that vendor costs would stop prior to 2008, but the actual costs were over \$19 million due to the delay in implementing the Photo Enforcement Ticket System. Similarly, the total projected operating costs over the five-year period were estimated at under \$3 million, but in the first year alone, they were over \$4 million. Annual operating costs have been reasonably constant since 2008. The total operating costs for five years exceeded the 2007 estimate by nearly \$20 million. Vendor and Operating Cost line items account for about 83 percent of the cost overruns from the 2007 estimates.

Therefore, we concluded that the projected total cost savings of \$7.3 million that was forecast in the 2007 report (Scenario 1) was not achieved.

At the cost-per-unit level, however, we did observe improvements to cost efficiency in operations since 2008, which are discussed in following section.

4.1.1. Operational trends

Total Operating Costs

Table 3 displays the financial operating results for the City's Automated Photo Enforcement program since 2009. As shown in Table 3, total operational costs have been declining since 2010.

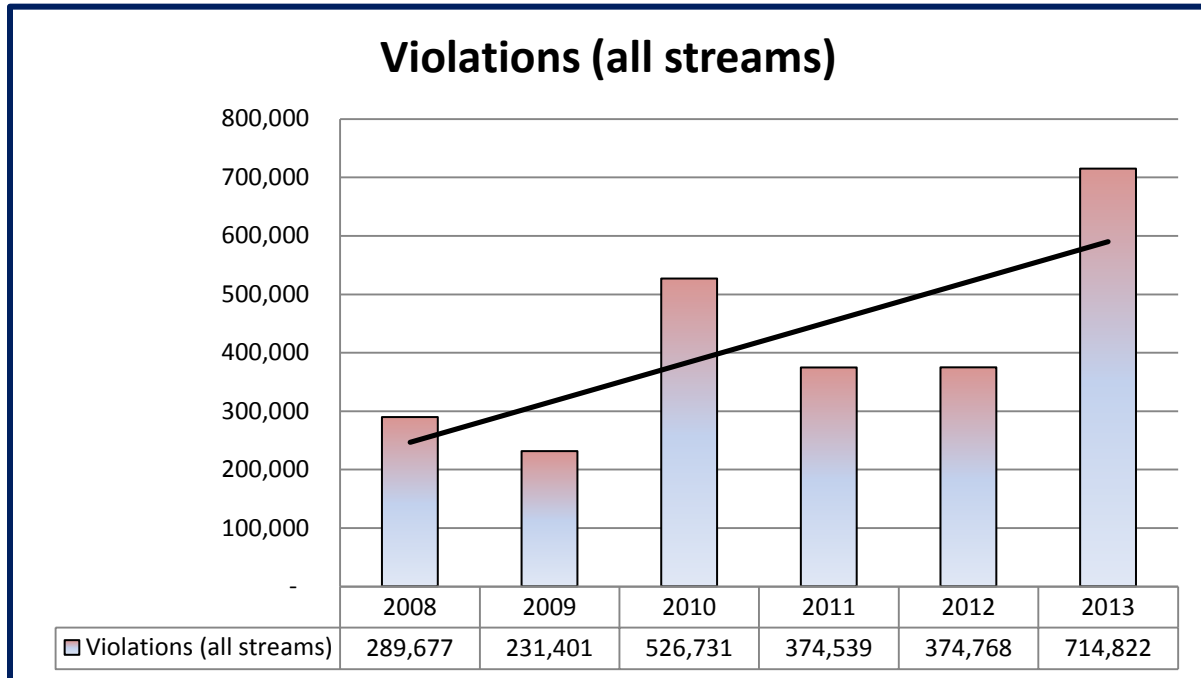
Table 3: Automated Photo Enforcement Financial Operating Details (In thousands of dollars)

	2009 Actual	2010 Actual	2011 Actual	2012 Actual	2013 Actual	2014 Budget
Automated Enforcement Revenue	\$16,837	\$22,043	\$15,937	\$20,684	\$41,263	\$30,100
Automated enforcement operations	3,879	5,534	4,292	4,014	5,956	6,249
Ticket processing - Vendor contract	3,724	5,818	3,048	3,765	1,536	-
Ticket processing - Reviews (Finance)	-	739	325	302	-	-
Ticket processing - IT support	-	106	108	111	111	222
Ticket processing - Printing	-	-	-	-	54	54
Total Operational Expenses	(\$7,603)	(\$12,197)	(\$7,773)	(\$8,192)	(\$7,657)	(\$6,525)
Total Revenue over Expenses	\$9,234	\$9,846	\$8,164	\$12,492	\$33,606	\$23,575
Note: For 2014, 25 FTEs support the delivery of the City's Automated Photo Enforcement program (22 FTEs within the Office of Traffic Safety and 3 from the Information Technology and Materials Management Branches of the Corporate Services Department).						

Violations Observed and Reviewed

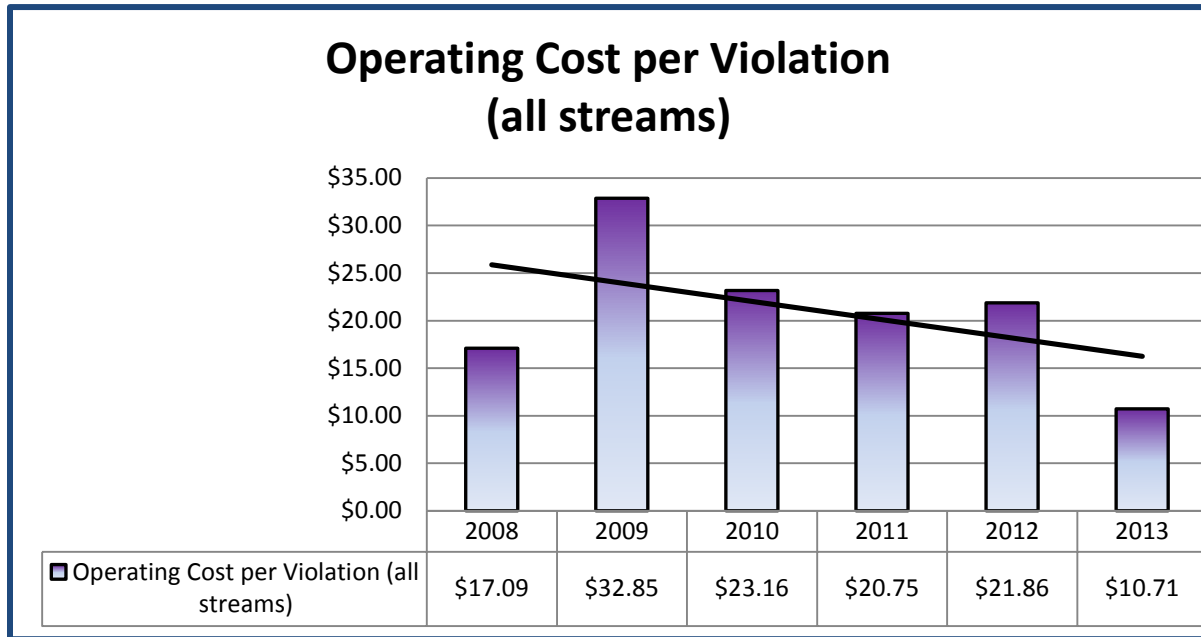
Violation reviews drive the operational costs at the OTS. Reviewers determine whether a violation meets defined criteria to be processed further into a ticket. As Chart 1 shows, the number of violations being reviewed has increased by 147 percent from 289,677 in 2008 to 714,822 in 2013. The introduction of speed-on-green violations in 2009 and mobile photo laser equipment in 2012 contributed to this increase.

Chart 1: Violations Reviewed – 2008-2013



In terms of cost reduction per unit level, Chart 2 demonstrates that the City is decreasing the per unit violation processing cost. The cost declined from \$17.09 per violation in 2008 to \$10.71 in 2013.

Chart 2: Operating Cost per Violation 2008-2013



4.2. Flexibility

Flexibility was the second expected outcome of the 2007 report to Council. Specifically, the report anticipated that the recommended model would provide the City with the flexibility to design and develop a program that would best meet the City’s traffic safety objectives.

To assess this outcome, we considered improvements that have been made in the areas of strategy and program development with respect to safety.

We observed that since 2007, the OTS has enhanced its safety strategy by developing, implementing, and enhancing the *Speed Management Continuum*. This Continuum provides the OTS with a methodological approach to address traffic safety issues based on observed circumstances. For example, mobile enforcement may be chosen as a Continuum-based solution to a speeding issue in a specific area within the City.

Using the Speed Management Continuum, the OTS has developed and administers a variety of traffic safety-related programs. They include:

- **Community awareness signs** – Customized signage where community members, City Councilors, and schools have identified speeding as an issue.

- **Speed display dollies & trailers** – Portable and mobile speed displays designed to inform drivers of their current driving speed compared to the posted limit.
- **Community programs & education** – Public education activities that include brochures, flyers, media advertisements, and school-based education opportunities.
- **Safe driving pamphlets** – Pamphlets about safe driving sent to traffic violators along with tickets.

4.3. Synergy

Synergy of resources and processes between the City's Bylaw ticketing production and the recommended automated photo enforcement model was the third expected outcome of the 2007 Council report. To assess this outcome, we considered the extent to which processes between Automated Photo Enforcement and Bylaw ticket processes have been combined or shared.

We observed that this outcome has not yet been achieved. Following Council's approval of the 2007 report, the Treasury Management section of the Finance Department⁴ was directed to assist with violation reviews since this area was also processing Bylaw tickets. A dedicated group of violation reviewers for the Automated Photo Enforcement process were assigned to work with Bylaw violation reviewers in Treasury Management. However, violation review tasks for the two processes were kept separate. Automated Photo Enforcement violation reviewers in Treasury Management did not perform any Bylaw-related functions. Bylaw staff did, however, manage the Automated Photo Enforcement information phone line from August 2012 to October 2013.

4.4. System Replacement

System Replacement was the fourth expected outcome of the 2007 Council report. Specifically, it entailed the development of a combined Bylaw and Automated Photo Enforcement ticketing process (i.e., a combined system). To assess this outcome, we reviewed the progress made to date to develop a system that could process violations and tickets from both processes.

We observed that the City has not achieved this outcome. The 2007 report to Council estimated that the City could implement a combined system for a capital cost of \$1.0 million. As of July 2014, the City has spent approximately \$2.1 million developing the Photo Enforcement Ticket System (PETS), which currently does not include Bylaw Ticketing functions.

⁴ Now named the Financial Services and Utilities Department.

The City did take steps to investigate the plausibility of a combined system. A work project in 2008 designed to determine the extent of similarities and differences between the operations found that eight distinct processes between them ranged from “different” to “very different.” Additionally, a Request for Proposal to acquire a commercial-off-the-shelf software solution proved unsuccessful as vendors could not demonstrate that they could deliver the required functionality. Finally, the City determined that its enterprise software could not be customized for this purpose.

Legislative privacy requirements also prohibited developing a system that shared a single data warehouse between the two processes. As a result, the City subsequently decided to develop the systems separately, which resulted in developing PETS in 2012 for the Automated Photo Enforcement operation only.

In 2013, the City began considering whether PETS could be used as a parking ticket management solution that would apply automated photo enforcement to parking violations. This would allow violation photos from both processes to be captured by PETS. In July 2014, Council approved the implementation of electronic parking meters and Administration is currently planning changes to PETS to allow parking violations from this technology to be processed as part of a combined system.

4.5. Technology

The use of current *Technology* was the fifth expected outcome from the 2007 Council report, specifically in the use of digital photography and the potential use of non-invasive⁵ enforcement technologies. We also considered general improvements that the City has made in the areas of equipment acquisition, testing, evaluations, and research.

We observed that following Council’s approval of the 2007 Recommendation, the City acquired digital-based mobile photo radar, photo laser, as well as intersection safety device technologies. These are automated enforcement methods that use digital photography technology. The OTS has also acquired and implemented the following technological improvements:

- **The introduction of Dragon Cam mobile photo laser technology in 2012**
In 2013, tickets stemming from Dragon Cam technology accounted for 46 percent of all tickets from the City’s automated enforcement operations.
- **The implementation of “wire frame technology” in 2013**
The PETS software was upgraded to include “wire frame technology” that assists reviewers in clearly identifying violations.

⁵ Current installations of intersection safety devices require cutting the pavement to embed two antenna loops for each lane monitored.

- **The implementation of GPS in mobile enforcement vehicles in 2014**
Global Positioning System tracking devices were installed in mobile enforcement vehicles to ensure that operators are at the right locations at the right time. The use of GPS tracking also promotes accountability over the use of the City's assets.

We determined that non-invasive intersection enforcement technology has not been employed by the City to date. According to the OTS, internal testing results found that non-invasive intersection technology is less accurate than the current equipment being used.

We also observed that the OTS routinely evaluates and tests any new equipment it considers implementing in operations. As well, the OTS actively stays abreast of current enforcement technologies through its research practices.

4.6. Data Retention

Data Retention was the sixth outcome of the 2007 Council report and it referred to information storage and retention of staff knowledge and expertise. To assess this outcome, we considered improvements that the City has made in the controls over photo enforcement systems and retention of staff knowledge and expertise.

Our 2013 audit of the Automated Photo Enforcement program found that information and images are captured, stored, and controlled in-house at the OTS. Records of equipment testing and maintenance are also retained at the OTS.

In terms of retention of staff knowledge and expertise, the OTS has a diverse set of highly skilled individuals experienced with traffic enforcement and safety. We also observed that the OTS works closely with the *City of Edmonton Assistant Professor of Urban Traffic Safety* who works out of the University of Alberta. The Professor's research tasks include analyzing the City's traffic data to assess how well the City is meeting its traffic safety objectives.

4.7. Accountability

Accountability was the seventh outcome of the 2007 Council report and it concerned the improvement over the control of automated enforcement equipment and information as well as ticket processing and production.

During our 2013 audit, we observed that adequate access controls exist to safeguard the OTS' automated enforcement equipment. We also reviewed the controls over the PETS system and determined that appropriate management and access controls exist to safeguard the integrity and privacy of the data. These controls enable the OTS to

retain key violation data which, in turn, enables it to be accountable for printed and issued tickets.

4.8. Information

The final expected outcome from the 2007 report to Council was enhanced *Information*. The intent was to have a model that would provide enhanced tracking of financial and traffic data that would ultimately lead to improvement in traffic safety programs.

We observed that the Financial Services and Utilities Department tracks financial data (revenues and expenses) for the Automated Photo Enforcement program. The City then receives ticket revenue information from Alberta Justice once tickets are paid. While the PETS system can determine expected ticket revenues based on processed tickets, actual figures will always remain unknown until they are paid. Hence, the current system is useful for forecasting approximate revenues and other forms of financial analyses.

In terms of gathering traffic data, we observed that Speed Surveys are used as the primary method to gather traffic data at the OTS. Speed Surveys assess the traffic behaviour on a given roadway by using recording devices placed on the surface of the pavement. They are typically initiated following a concern or complaint from a citizen, the EPS, or Council and provide evidence to support whether a traffic speed issue exists. Once the data is analyzed, the OTS can determine an appropriate solution to address a confirmed traffic issue in accordance with the Speed Management Continuum (see Section 4.2).

PETS is used by the OTS to enable it to gather and track key violation data such as the Rate of Acceptance (i.e., tickets issued versus violations observed) and the number of vehicles monitored for any given month by equipment type and location. Together, this information provides the OTS with another source of driving behaviour from which it can adapt its operational programs to achieve the City's safety objectives.

As an example, we obtained and reviewed the OTS data files that contained a listing of all violating and non-violating vehicles (Monitored Driving Events⁶) for the 20-month period beginning August 1, 2012 to March 31, 2014. The purpose of our analysis was to understand the rate of violations committed (i.e., driving behaviour) and the rate of tickets issued (i.e., OTS' output) for the 20-month period. As shown in Table 4, 360 million monitored driving events resulted in approximately 0.19 percent of violations and 0.13 percent of issued tickets. For the given period, 13 tickets were issued for every 10,000 driving events captured by the OTS' automated photo enforcement equipment.

⁶ Monitored Driving Events are vehicles that are captured by the OTS' intersection safety device and mobile photo radar camera units on any given day, month and year. "Events" include both non-violating and violating vehicles. The "Events" are stored daily in data files, which are maintained by the OTS.

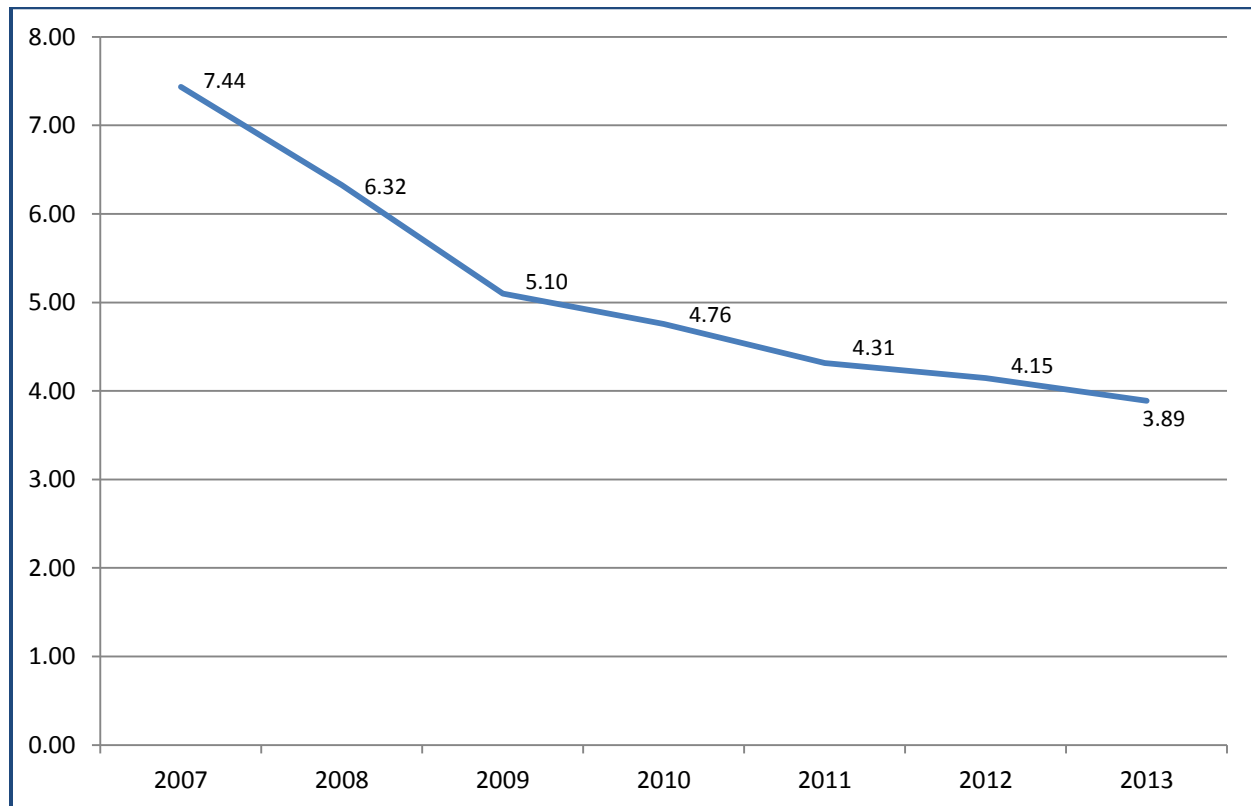
Table 4: Monitored Driving Event Activity: August 1, 2012 - March 31, 2014

	Numbers Observed	Percentage
Total Monitored Driving Events	360,422,483	100%
Total Violations Committed	691,077	0.19%
Total Tickets Issued	476,160	0.13%

With respect to reporting, we observed that the OTS reports on traffic safety information and trends using a variety of mediums, including the City’s website, social media, and most notably through its annual *Motor Vehicle Collisions Summary Report*. This report summarizes the incidence of fatal, injury, and property damage collisions for a given year as a result of motor vehicle accidents.

The OCA reviewed the OTS’ collision reports for the period from 2007 to 2013 in order to assess the incidence of collisions on Edmonton’s roads during the period. As illustrated in Chart 3, the incidence of collisions that resulted in fatalities and injuries per 1,000 of population declined steadily during the period.

Chart 3: Fatal and Injury Collisions per 1000 Population



5. Conclusion

This review assessed the effectiveness and efficiency of the City's operation of the Automated Photo Enforcement program and whether or not the expected outcomes are being realized.

We reviewed the 2007 Council report, *Automated Traffic Enforcement – A Recommended Delivery Model for the City of Edmonton* to develop a work plan that would allow us to assess the degree of achievement of the eight expected outcomes.

Our review of financial and violation data found that the City's Automated Photo Enforcement program has shown improvement trends in operations since 2010 (Table 3). The total annual operating cost as well as the cost per violation has decreased since 2010 (Chart 2), which demonstrates an improvement in operating efficiency.

We also found that improvements in operations now allow for better data collection, development of Traffic Safety programs tailored to specific sites, implementation of effective new technologies and techniques, and effective controls over violation data.

We found that the City has achieved the majority of outcomes anticipated in the 2007 Council report. However the expected outcomes of *Cost Savings*, *System Replacement*, and *Synergy* between the Automated Photo Enforcement operations and Bylaw ticketing operations have not been achieved.

We have not issued any recommendations as part of this project.

We thank the management and staff of the Office of Traffic Safety, Information Technology Branch, and Financial Services and Utilities Department for their cooperation and assistance during this review.

Appendix A

Type of Equipment	Type of Violations Generated	Where Equipment is Deployed ⁷	Total Number in 2013
Mobile photo radar – uses radar beams to detect the speed of vehicles.	Speed violations only	Strategically placed throughout the City at select locations.	14 units
Mobile photo laser – uses laser beams to detect the speed of vehicles.	Speed violations only	Strategically placed throughout the City at select locations.	13 units ⁸
Intersection safety devices – uses “loops” placed under the pavement surface to detect speeding and/or red light violations.	Both speed-on-green & red light violations	50 cameras placed at 29 high collision intersections within the City.	50 units

⁷ All sites are approved by the Edmonton Police Service.

⁸ On average, 4 or 5 units of the 13 units are used each day. Operators will use either photo radar or photo laser equipment at one location depending upon which would be most effective due to circumstances such as available daylight.