



Economic Impact Group, LLC

Case Study: A Cost-Benefit Analysis of the digiTICKET Implementation for the Sand Springs Police Department

Prepared By:
Economic Impact Group, LLC
17912 Barrington Drive
Edmond, OK 73012

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Executive Summary

The Sand Springs Police Department implemented the digiTICKET automated citation delivery system in partnership with Saltus Technologies, LLC beginning in March of 2009. The costs and benefits of this implementation are discussed in detail within the body of this document. A summary of results is given below.

- The City of Sand Springs police department acquired 23 digiTICKET units and related software over a 9-month period beginning in March 2009 at a total cost of \$109,600 with an additional annual fee of \$4,815 for annual maintenance
- Saltus Technologies is a Tulsa, Oklahoma based automated citation systems provider offering services to public safety agencies throughout the United States
- The Sand Springs police department experienced a 63% increase in citation and court revenue
- The City of Sand Springs enjoyed an \$8,500 annual reduction in administrative costs
- Residents experienced a 67% reduction in traffic accidents resulting in an estimated saving of \$2 million in societal costs, including damage to person and property
- In total, the net present value of net benefits is estimated to be over \$471 thousand over a period of 5 years – not including the additional societal benefits related to decreased traffic accidents

Economic Impact Group, LLC.

Economic Impact Group (EIG) is a consulting firm dedicated to providing technical economic analysis to private and public sectors. EIG has provided consulting services since 2005 to a wide variety of industries, trade associations and local governments.

Our competencies include impact analysis, policy analysis, non-market valuation, business modeling, damages calculation and many more. We deliver clarity in an ambiguous world.

Our Economists

Kyle Dean, PhD

Dr. Dean specializes in regional economic modeling, cost-benefit analysis, impact analysis and fiscal analysis. His models have provided insight into complex local and state issues including the impacts of statewide immigration legislation and state and local development policies.

In addition to his duties with EIG, Dr. Dean has also served as the Associate Director of the Center for Applied Economic Research at Oklahoma State University and currently serves as the Associate Director of the Economic Research and Policy Institute at Oklahoma City University.

Russell Evans

Mr. Evans specializes in public policy, pricing and non-market valuation, antitrust and regulation, tort evaluation and macroeconomic forecasting. He has worked to help groups, including businesses, tribes and development agencies understand the economic impact of their operations. In addition, the more prominent cities throughout the state rely upon his annual economic forecasts to plan their yearly activities.

Mr. Evans also served as the Director of the Center for Applied Economic Research at Oklahoma State University and is currently the Director for the Economic Research and Policy Institute at Oklahoma City University.

Introduction

The traffic citation process for many law enforcement agencies can be inefficient and may pose personal risks for officers. The traditional method of writing, handling, processing and inputting the citations into the police RMS and court system is fraught with opportunities for loss. Many departments require officers to write a separate citation for each individual offense. A traffic stop where several offenses occurred requires the shepherding of several citations through the process of writing, entry and final dispensation. This manual process required multiple personnel to handle each citation, yielding repeated opportunities for mistakes, or worse, loss of citations altogether.

As police departments look for ways to become safer and more efficient, digital systems that automate and simplify the ticket delivery process become attractive options. One such department is the Police Department in Sand Springs, OK. This report serves to estimate the costs and benefits to the Sand Springs Police Department from the implementation of an automated system by Saltus Technologies in Tulsa, OK.

digiTICKET

Saltus Technologies provides digital ticketing solutions to police departments throughout the U.S. The company was spun from Tulsa, OK based mobile technology provider MacroSolve in 2010 to focus on their automated citation product digiTICKET. The first digiTICKET solution was implemented in 2009 in a joint development effort between then MacroSolve and the City of Sand Springs Oklahoma Police Department. To date, digiTICKET has been implemented in law enforcement agencies in Oklahoma, Kansas, Missouri, Arizona and California.

Sand Springs PD

Prior to 2009, the Sand Springs PD, like most departments around the country, used a manual system of citation delivery. The process required officers to write one ticket per offense for every traffic stop or other encounter. Tickets were

turned into their central administrative assistant at the end of each shift, then manually entered into the police RMS and court systems.

The department agreed to implement the digiTICKET solution in partnership with Saltus Technologies in March 2009. The first 7 officers were outfitted with handheld units in May 2009. The successful implementation led the department to request 8 more units each in October and December of 2009 leading to a total of 23 units, 21 operational and 2 spare. A list of equipment and purchase value is detailed in the next section.

Methodology

Cost Benefit Analysis

To appropriately address the value provided by any public expenditure, one must incorporate the stream of costs and benefits that occur in different time periods due to the expenditure. CB Analysis has a long tradition of use in the Public Finance Literature by a variety of economists throughout the years. This study follows the methodology outlined in Gramlich (1990).

The net benefits for any public expenditure are the sum of all benefits less the sum of all costs discounted by the appropriate cost of capital. In each period, the total benefits less costs are discounted at the appropriate discount rate. The sum of these discounted cash flows provide the Net Present Value of Net Benefits (NPVNB) for the project. A positive NPVNB is a strong indicator of a project worthy of public expenditure whereas a negative NPVNB provides appropriate impetus to decline the implementation of the public project.

The annual costs and benefits are discounted and summed over all time periods in accordance with Equation 1. This equation was used to calculate the Present Value of Benefits and the Present Value of Costs separately.

$$(1) PV = \sum_{t=0}^n \frac{FV_t}{(1+i)^t}$$

where

PV = Present value of all future costs/benefits

n = Number of time periods in the analysis

t = Time period in which the cash flow occurs

FV = Value of the cash flow in time period in which it occurs (Future Value)

i = Discount rate

Finally, the Net Present Value of Net Benefits (NPVNB) is calculated as the Net Present Value of Benefits (NPVB) less the Net Present Value of Costs (NPVC).

$$(2) NPVNB = NPVB - NPVC$$

Parameters

There aren't many parameters in a model such as this. The important parameters for discussion include the appropriate number of time periods and discount rate. The choice of each is somewhat a subjective exercise, however, there are accepted ways to address each.

The number of time periods logically follows from the estimated life of the given project. For example, selecting a length of project for public road expenditure requires an estimate of the average life of public roads. This allows the inclusion of all possible expenditures and revenues that accrue due to the existence of the original road. There would be a design phase followed by implementation, maintenance and final replacement. Any discussion of expenditure should take into account all of these phases.

For the automated ticketing system, the logical number of periods is tied to the initial design and implementation as well as the initial maintenance expenditures. One could include expenditures on additional equipment and maintenance in subsequent years, however, that would distract from the value of the initial expenditure, which at its core is the expenditure of interest. Thus, this

analysis will include a five-year discount period in conjunction with the initial purchase equipment and maintenance.

The choice of discount rate is the most critical factor in determining the outcome of the analysis. In analyses that cover longer periods of time this choice is magnified as payments that occur farther into the future receive greater discounting and thus provide less impact on the analysis. In cases where most of the costs occur early and benefits accrue in later years, higher discount rates magnify the costs more than the benefits. Therefore, it is important to choose a discount rate that accurately approximates the actual opportunity cost of forgone returns to dollars used in the investment.

Due to the fact that the purchase of police equipment is a public expenditure, we chose to follow the federal government guidelines and practices for assigning the appropriate discount rate. In OMB Circular A-94, federal agencies are instructed to use a 7% real discount rate for all base case analyses. However, in practice, the Congressional Budget Office (CBO), General Accounting Office (GAO) and other agencies use a variety of discount rates that are more germane to particular projects under study. For detailed discussion of the use of discount rates by various federal agencies see Kohyama (2006).

For the purpose of this analysis where nominal cash flows cover short periods of time, the Government Accounting Office (GAO) approach to discounting seems appropriate. According to Kohyama, since 1991 the GAO uses "the interest rate for marketable Treasury debt with maturity comparable to the program being evaluated' for cost benefit analysis." Under the GAO policy, "nominal rates may be used to discount nominal benefits and costs." As such, the discount rate used for this analysis is the yield on the 5-year Treasury note as reported by CNBC.com on February 1, 2011. The reported rate was 2.0082%.

Data

Data for this analysis was obtained directly from the Sand Springs Police Department and Saltus Technologies, LLC. Due to the nature of this initial deployment, Saltus provided the software and implementation services at no cost requiring the department to pay for the hardware and ongoing maintenance. For the

case study calculations, we used retail value as the basis for all purchases. The equipment provided as well as the delivery timeline is summarized in Table 1 below.

Table 1: Equipment Value and Implementation Schedule

Description	Year of Delivery (FY)	Delivery Month	Dollar Value of Equipment
7 Units and Accessories	2009	March	\$45,400.00
8 Units and Accessories	2009	October	\$32,100.00
8 Units and Accessories	2009	December	\$32,100.00

Source: Saltus Technologies, LLC.

In any case study, researchers would prefer to have multiple years worth of pre-implementation data to set baseline levels for comparison. The SSPD provided Citation data for the years 2008, 2009 and 2010. This included the total number and value of citations, the value of uncollectable citations and the value of all court costs and uncollectable citations in the court system. Due to the lack of additional multi-year data, we made the assumption that 2008 was typical of citation activity and set it to the baseline year for comparison. The citation and court costs data for the years under study is summarized in Tables 2 – 5.

Table 2: Citations by Fiscal Year

Fiscal Year	Total Number	Monthly Average	Value of Citations	Avg. Monthly Value
2008	6,434.00	536.17	\$273,941.90	\$22,828.49
2009	5,031.00	419.25	\$212,042.50	\$17,670.21
2010	10,029.00	835.75	\$531,513.86	\$44,292.82

Source: Sand Springs Police Department

Table 3: Net Value of Citations by Fiscal Year

Fiscal Year	Total Value	Uncollectable	Percent Uncollectable	Net Value	%Change from Prev. Year
2008	\$273,941.90	\$76,264.68	27.84%	\$197,677.22	
2009	\$212,042.50	\$53,853.02	25.40%	\$158,189.48	-19.98%
2010	\$531,513.86	\$256,231.91	48.21%	\$275,281.96	74.02%

Source: Sand Springs Police Department

Table 4: Court Costs¹ by Fiscal Year

Fiscal Year	Total Value	Uncollectable	Percent Uncollectable	Net Value	%Change from Prev. Year
2008	\$158,584.46	\$24,481.00	15.44%	\$134,103.46	
2009	\$140,681.32	\$19,224.93	13.67%	\$121,456.39	-9.43%
2010	\$260,385.61	\$79,020.04	30.35%	\$181,365.57	49.33%

Source: Sand Springs Police Department

Table 5: Total Fines and Court Costs by Fiscal Year

Fiscal Year	Total Value	Uncollectable	Percent Uncollectable	Net Value	%Change from Prev. Year
2008	\$432,526.36	\$100,745.68	23.29%	\$331,780.68	
2009	\$352,723.82	\$73,077.95	20.72%	\$279,645.87	-15.71%
2010	\$791,899.47	\$335,251.94	42.34%	\$456,647.53	63.29%

Source: Sand Springs Police Department

¹ Court costs include all costs required for adjudication and assessments for state crime-fighting programs.

Results

The costs for this project came primarily from the initial capital investment in equipment. Because the Sand Springs implementation occurred in three phases, their primary costs transpired over two years. The estimated costs of equipment, implementation and maintenance were outlined in Table 1 in the previous section. The discounted sum of those costs is detailed in Table 6 below. The Present Value of all costs is over \$126 thousand in current year dollars.

Table 6: Present Value of Total Costs

Year	Purchase and Implement	Annual Maintenance & Hosting	Additional Equipment Purchases	Total Costs	Net Present Value of Costs
2009	\$45,400.00	\$900.00		\$46,300.00	\$46,300.00
2010		\$4,815.00	\$64,200.00	\$69,015.00	\$67,656.33
2011		\$4,815.00		\$4,815.00	\$4,627.28
2012		\$4,815.00		\$4,815.00	\$4,536.19
2013		\$4,815.00		\$4,815.00	\$4,446.89
2014		\$1,203.75		\$1,203.75	\$1,089.84
Total	\$45,400.00	\$21,363.75	\$64,200.00	\$130,963.75	\$128,656.52

In interviews with police department personnel, we discovered that the digiTICKET system improved not only the number of total tickets written but that the public reporting of tickets per officer increased the productivity of each officer. It is difficult to determine specifically how much of the increase is directly due to the implementation of digiTICKET, however, police department officials indicate that the increase is significantly related to the new system and its ease of use.

According to the SSPD tracking data, the number of citations written increased significantly post digiTICKET implementation (see Figure 1 below). The first handheld units were delivered in May 2009 as indicated by the first light gray bar with subsequent deliveries in October and December 2009 (FY-10). From the initial implementation forward, citations and net revenues increased consistently. By the end of FY-10, net citation and court cost revenues were up by 63% over FY-09 (Figure 2) while net citation revenues alone were up 74%.

Figure 1: Monthly Citations

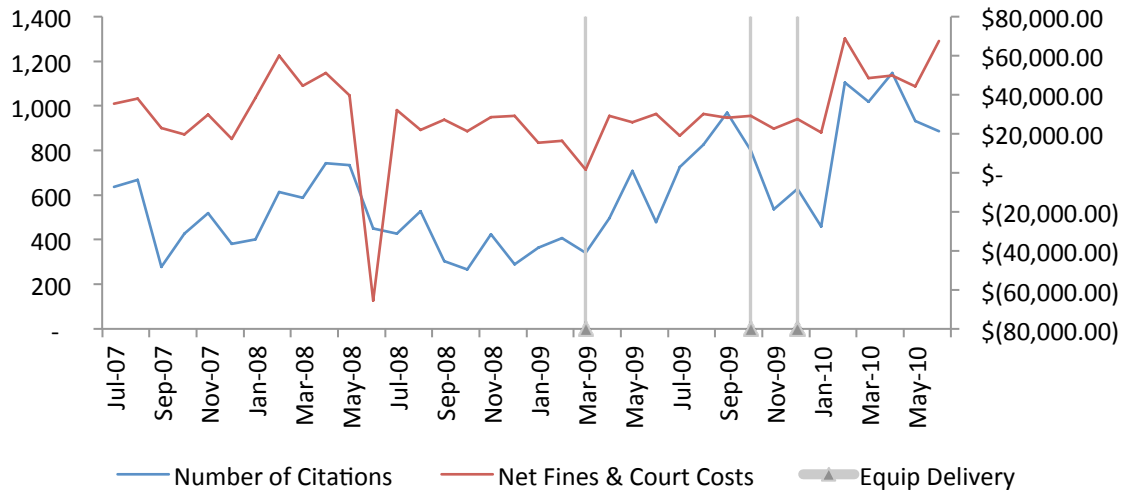
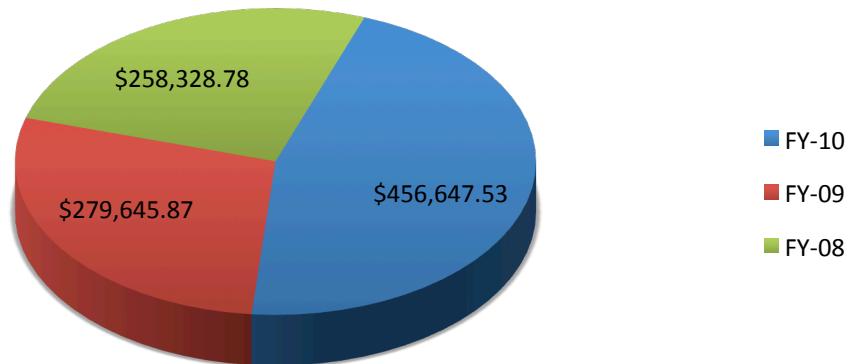


Figure 2: Annual Net Revenue from Fines and Court Costs



The benefits associated with the project derive primarily from four sources: Revenue from additional citations, revenue due to reduction in lost citations, revenue from additional court costs and reduction in administrative overhead due to manual ticket entry into the court system². Table 7 details the discounted benefits from these sources. The revenues from citations and court costs include the reduction in lost citations.

Table 7: Present Value of Total Benefits

Year	Net Revenue from Additional Citations	Cost Saving from Reduction in Citation Data Entry	Net Court Revenue from Additional Citations	Total Benefits	Net Present Value of Benefits
2009	\$17,459.08	\$2,094.00	\$(463.48)	\$19,089.60	\$19,089.60
2010	\$77,604.74	\$8,766.32	\$47,262.11	\$133,633.17	\$131,002.38
2011	\$78,225.13	\$9,174.83	\$47,639.94	\$135,039.91	\$129,775.28
2012	\$78,850.49	\$9,602.38	\$48,020.79	\$136,473.66	\$128,571.17
2013	\$79,480.85	\$10,049.85	\$48,404.69	\$137,935.38	\$127,390.00
2014	\$20,029.06	\$2,629.54	\$48,791.65	\$71,450.25	\$64,688.69
Total	\$351,649.35	\$42,316.93	\$239,655.70	\$633,621.97	\$600,517.12

The Net Present Value of Net Benefits (NPVB) is the sum of all discounted benefits less the sum of all discounted costs. Table 8 details the NPVB for the digiTICKET implementation in Sand Springs.

Table 8: Net Present Value of Net Benefits

Year	Net Present Value of Costs	Net Present Value of Benefits	NPVNB
2009	\$46,300.00	\$19,089.60	\$(27,210.40)
2010	\$67,656.33	\$131,002.38	\$63,346.05
2011	\$4,627.28	\$129,775.28	\$125,147.99
2012	\$4,536.19	\$128,571.17	\$124,034.98
2013	\$4,446.89	\$127,390.00	\$122,943.12
2014	\$1,089.84	\$64,688.69	\$63,598.85
Total	\$128,656.52	\$600,517.12	\$471,860.60

² We estimated salary expenses to be 20% of median annual compensation for local government executive assistants. According to the Bureau of Labor Statistics, annual earnings for executive assistants in this category were \$41,880 in 2008. For more information see “Occupational Outlook Handbook, 2010-11 Edition.”

As expected, the first year of implementation is costly due to the large up-front capital expenditure. However, even though significant capital expenditure occurs in the second year, FY-10 still shows net benefits of over \$63 thousand in base year dollars. Indeed, this project pays for itself within the second year of implementation. The remaining years show even greater net benefits bringing the total NPVNB for the project to \$471,861.

Property Damage and Loss from Injury

In addition to the benefits mentioned in the previous section and included in the NPVNB calculation, traffic accidents resulting in property damage and injury costs generate significant economic losses and the reduction of these accidents create additional, yet difficult to quantify and attribute directly to the digiTICKET system, benefits. These economic losses are the result of the initial property damage plus the associated costs of injury treatment and rehabilitation. The Federal Highway Administration identifies 11 areas of emphasis in estimating the comprehensive costs of motor vehicle accidents. They are: property damage, lost earnings, lost household production, medical costs, emergency services, travel delay, vocational rehabilitation, workplace costs, administrative, legal, and pain and lost quality of life.³ Table 9 updates the values from the 1994 U.S. Department of Transportation report to reflect 2009 market prices. Economic losses stemming from motor vehicle accidents increase from \$6,892 for minor injury accidents to over \$3.5 million in fatality accidents.

³ U.S. Department of Transportation, Federal Highway Administration, *Motor Vehicle Accident Costs*, October 1994

Table 9: Comprehensive Dollar Cost per Injury Accident⁴

Accident Type	Cost per Injury (\$ 2009)
Minor	\$ 6,862.00
Moderate	\$ 54,895.00
Serious	\$ 205,857.00
Severe	\$ 672,468.00
Critical	\$ 2,717,319.00
Fatal	\$ 3,568,197.00

Table 10 provides an estimated breakdown of the share of accidents in each reporting category. Notice that property damage only accidents and minor injury accidents account for nearly 91% of all crashes.

Table 10: Distribution of Motor Vehicle Crashes⁵

Accident Type	People in Injury Crashes	% Share
MAIS 0 - Property Damage Only	2,548,458	0.3243
MAIS 1 - Minor	4,659,585	0.5930
MAIS 2 - Moderate	436,007	0.0555
MAIS 3 - Serious	125,903	0.0160
MAIS 4 - Severe	36,509	0.0046
MAIS 5 - Critical	9,463	0.0012
MAIS 6 - Fatal	41,821	0.0053
Total	7,857,746	1.00

Combining the data from the tables above yields an expected economic loss of \$35,801 (\$ 2010) per motor vehicle crash. The Oklahoma Highway Safety Office 2001 Crash Fact Book reports an estimated 77,148 statewide crashes. Using the expected economic loss per accident cited above (and adjusted to 2001 market prices) produces an estimated economic loss due to motor vehicle crashes of just under \$2.3 billion for the state. This number is consistent with the estimates of economic losses by state presented in the report cited in footnote 3.

⁴ Re-created from the referenced report; all values updated to 2010 dollars using the appropriate GDP Implicit Price Deflators

⁵ Data are taken from *The Economic Impact of Motor Vehicle Crashes 2000*, May 2002, Department of Transportation Report No. DOT HS 889 446; Authors: L. Blincoe, A. Seay, E. Zalashnja, E. Romano, S. Luchter, R. Spicer

Using the expected economic loss per crash value allows a quick estimate of the economic losses averted due to increased productivity and efficiency gains in policing traffic. The City of Sand Springs data report a reduction in the number of motor vehicle crashes from 83 in 2008 to 27 in 2010, or a reduction of 67 percent. This reduction in accidents is then estimated to have avoided just over \$2 million in economic losses annually.

Finally, it should be noted that in cost-benefit analysis, the economic loss avoided value is likely to understate the true value of the improvement as it fails to capture the entirety of the community's willingness to pay for reduced incidence of crashes.

Conclusion

In concluding, it should be noted that cost-benefit analysis is by definition a comparison of a two-state situation. In the context of this report, the two states represent the Sand Springs police department before and after the acquisition and implementation of the digiTICKET solution. The returns to the department are overwhelmingly positive. This is not at all unexpected as competition in this market combined with technological improvements serves to keep initial costs low while maintaining benefits from increased officer productivity and reduced incidents of personal injury and property damage. This is indeed the key to the large net present value. The digiTICKET solution offers a path to significantly increase officer productivity at a relatively low initial cost. Continual advancements in both the hardware/software space and strong customer support would seem to position the digiTICKET citation system nicely for future expansion.

The implementation of the digiTICKET automated citation system was a significant step for the City of Sand Springs. Following a graduated implementation schedule, the entire delivery and setup phase was completed from March through December of 2009. Outfitting a total of 21 officers, the system increased the average productivity of the officers and the efficiency of citation processing. Over a two year period, the city saw an increase in net citation and court cost revenue of over 63%. It also benefited from the reduction in direct salary attributable to administrative entry of nearly \$8.5 thousand per year. During this same time, we estimate that the reduction in traffic accidents led to an additional \$2 million in reduced societal costs. While it's difficult to attribute the total reduction in traffic accidents to the implementation of the digiTICKET system, it is likely that some of this reduction is due to the increased enforcement of traffic laws from officers using the digiTICKET system. However, this reduction isn't necessary to demonstrate that the digiTICKET system provided significant value to the city as we estimated the Net Present Value of Net Benefits for the system to total close to \$500,000.

References

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