Transit Security: The Life Cycle Costs of Onboard CCTV

The Real Cost of the Lowest Bid

A MARCH NETWORKS WHITE PAPER

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Printed in Canada. 060-3014-00-A.

Executive Summary

The true cost of video surveillance technology is considerably more than the initial procurement costs. Operating, maintaining and replacing a system adds significantly to the total life cycle cost, and ultimately determines whether an investment is a sound one or not. System performance and reliability, which are generally reflected in the initial cost, directly impact life cycle costs. This paper will help decision-makers evaluate on-board CCTV systems objectively, and make recommendations to public authorities supported by cost-benefit comparisons of different products over the duration of their planned use.

Introduction

Public transit authorities are under mounting pressure to provide a safe and secure environment for passengers and staff on their bus, light rail and subway systems. Compounding these demands is the public nature of transit system funding accountability and the need for ever more efficient operations. Leading transit authorities are embracing video surveillance as a tool to address this challenge, especially on their public vehicles. A fully monitored transit environment helps maintain and even increase ridership. It deters crime and vandalism, speeds incident response, and protects against fraud or false liability claims – all lowering maintenance and operations costs.

Such costs are not always readily quantifiable, however, they are an integral part of life cycle costing. Therefore a systematic approach[1,2] to their calculation leads to a sound basis for comparison of different video surveillance systems.

What are Life Cycle Costs?

To drive down costs while maintaining a high level of service and safety, transit authorities need integrated, reliable video technology with highly automated features such as wireless access, high-speed video extraction, vehicle data integration, powerful management software and more.

Life cycle costing often shows that a project with a higher initial cost may be more financially beneficial in the long run.

Managing a surveillance system reliably across multiple stations and platforms, plus hundreds or even thousands of vehicles, is a tall order, especially when those systems are exposed to the knocks, dirt and temperature extremes of road and rail networks.

This white paper examines the four key operational factors affecting the life cycle costs of mobile video surveillance systems: procurement, operation, maintenance and replacement. It also examines different scenarios complete with associated life cycle cost calculations.

A life cycle cost analysis is important when evaluating capital investment options, because it helps determine the option that is most cost effective. In deciding to purchase a product or service, a timetable of life cycle costs shows all the costs that need to be allocated to a product so an organization can allocate budget accordingly. Depending on the product or service being purchased, such calculations may extend to cost recovery and/or ROI (Return on Investment). These may in turn depend on values taken from other reliability analyses like failure rate, cost of spares, repair times and component costs.

A typical quantitative analysis would involve a side-by-side cost comparison analyzing the different products under consideration. Life cycle costing often shows that a project with a higher initial cost may be more financially beneficial in the long run (Figure 1).

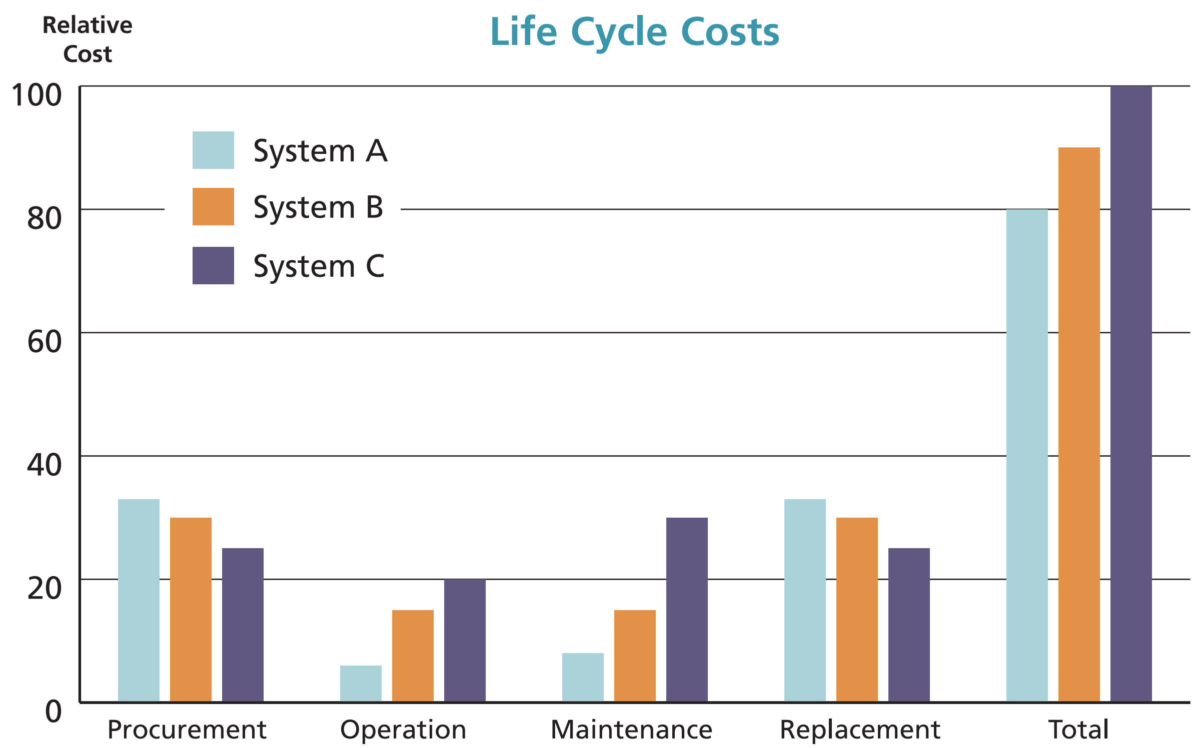

Figure 1: Comparison of Life Cycle Costs for three systems. System A has the highest procurement cost but the lowest life cycle cost.

Initial Procurement

Initial procurement in nearly all public tenders is done through an RFP (Request For Proposal) bid process, many of which are awarded on the basis of lowest cost. When the emphasis is on the short-term cost versus the long-term value of the project, suppliers are forced to focus on immediate financial parameters as opposed to innovative solutions that may make a project more cost-effective in the long-term. Low-cost bidding encourages the replication of older, less expensive technologies, which may actually cost more over the life cycle of a project.

Rather than evaluating projects solely on the basis of initial cost, life cycle costing looks at the total cost of ownership, including operation, maintenance and replacement requirements.

While economics should play a role in the bidding process, innovation, competitiveness and long-term sustainability should be of equal or greater importance.

Qualifications-Based Selection (QBS) is an increasingly recognized competitive procurement process that includes public announcement of projects, and careful review of firms' capabilities, experience, technical skills and ability to deliver excellent post-sales support. More importantly, points are awarded based upon proven long-term product reliability, strict compliance with recognized industry standards, and adherence to international guidelines for corporate procedures and manufacturing, such as those embodied in ISO 9000.

While economics should play a role in the bidding process, innovation, competitiveness and long-term sustainability should be of equal or greater importance.

Operational Costs

All video surveillance systems have associated operational costs that are an important part of a QBS calculation.

The top three operational costs are:
- The collection and archiving of video evidence
- Ongoing system management including upgrades
- Preventative maintenance programs to keep systems operational in harsh environments

Costs are considerably lower in each of these areas with the use of wireless technology (Figure 2). Wireless communication permits significant savings through:
- Automated health monitoring – preventative maintenance programs can be scaled back
- Automated upgrades / changes – buses remain in service
- Automated data retrieval – fewer staff required to collect and archive video

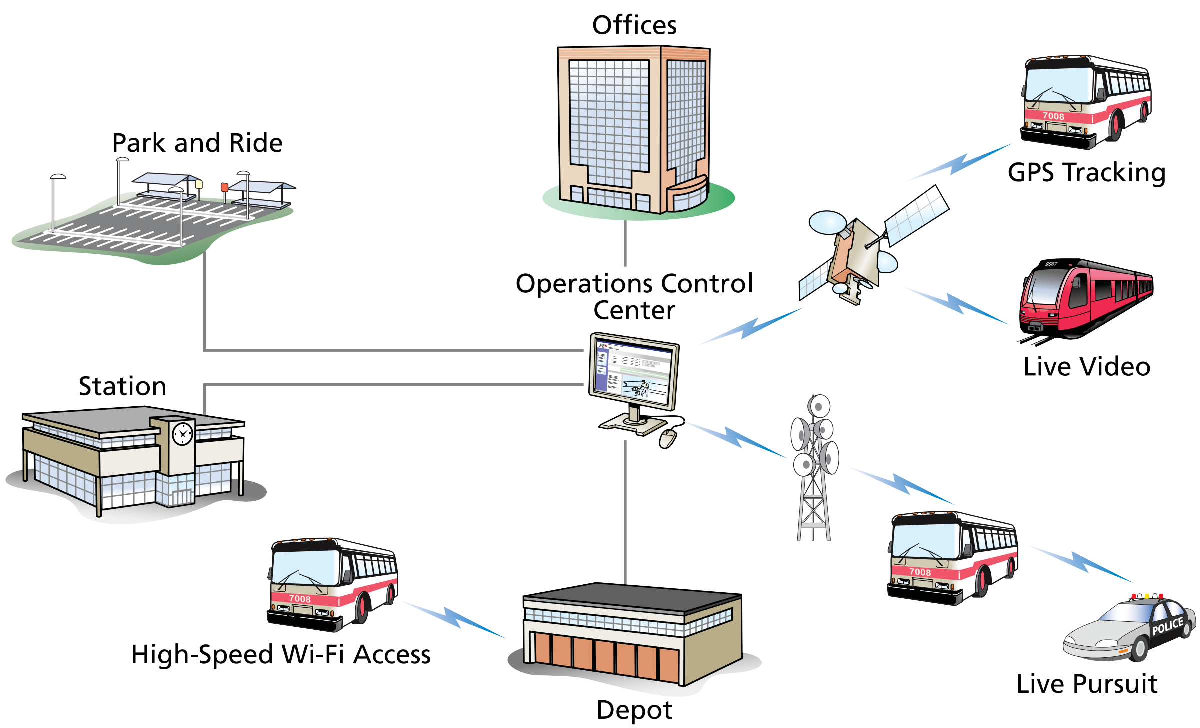

Figure 2: Wireless communication enables transit authorities to manage and operate mobile video surveillance systems much more efficiently.

System Maintenance

CCTV systems require some preventative maintenance, however, the use of high performance technology helps reduce the resources required, and enables malfunctions to be detected long before they otherwise would be through regular inspections.

For example, comprehensive health checks that monitor every key element of the networked video system ensure that alerts will be transmitted to the administrator in a timely manner and allow corrective actions to be taken before critical video is lost. Automatic Field of View monitoring ensure that cameras are correctly aligned, in focus and unobstructed, meaning that only periodic lens cleaning will necessitate an actual visit to each vehicle.

For a transit authority operating a fleet of 400 buses over five years, average costs are typically:
- **$50 per extraction to pull hard drives from incident related requests**
- **$50 per month per bus for preventative maintenance**
- **$5,000 per month in replacement equipment and hard drives for the fleet**

Total costs for parts and labor are, on average, $18 million over the 5-year period. By adding wireless communications and comprehensive management software such costs are drastically reduced, and further reductions in maintenance staff and time taken to administer the system are possible. In this example, the savings in labor and equipment could amount to approximately $6 million or 30%.

More powerful system software will even send warnings of a pending hard-drive failure through predictive analysis of a number of attributes, including hours of operation, temperature, spin-up time and spare sectors.

Maintenance costs are significantly reduced through high unit reliability. Robust units are built to withstand shock and vibration, extreme temperatures, moisture and humidity, dust and water, power fluctuations and electro-magnetic interference. High-quality, ruggedized platforms significantly lower life-cycle costs.

Life Cycle Cost Calculations

Life cycle cost calculations help reveal the true cost of a video surveillance system by factoring in all elements of initial procurement, operation, maintenance and replacement, as well as the effects of inflation. In the first example in Table 1, the lower life cycle costs of the advanced system result in a saving of more than $2.2 million for the same projected useful life. In the second example, the single largest factor to consider is the system replacement cost given that the proposed advanced system offers nearly twice the useful life of the standard system. This results in a saving of greater than 50% or $5.24 million over the 10-year operating period.

Surveillance System*	Standard System (per vehicle)	Advanced System (per vehicle)
Capital Procurement Cost (MDVR, Cameras and Installation)	$6,000	$8,000
Annual Operating Costs: Video Retrieval Preventative Maintenance	 $1200 (manual) $600	 $120 (automatic) $300
Repairs and Parts [2-Year Manufacturer's Warranty]	$500	$300
Calculation for same life times**		
Operating Period	6 years	6 years
Life Time	6 years	6 years
Discount Factor @ a rate of 5% per annum	0.846 (Annual Costs)	0.846 (Annual Costs)
Life Cycle Cost per Vehicle	$16,829	$11,147
For a Fleet of 400 Vehicles	**$6,731,600**	**$4,458,800** **Potential saving of $2.27 million**
Calculation for different life times**		
Operating Period	10 years	10 years
Life Time	6 years (with full replacement in 7th year)	10 years
Discount Factor @ a rate of 5% per annum	0.772 (Annual Costs) 0.711 (Capital Replacement)	0.772 (Annual Costs)
Life Cycle Cost per Vehicle	$26,478	$13,095
For a Fleet of 400 Vehicles	**$10,591,200**	**$5,238,000** **Potential saving of >50% = $5.24 million**

* See Appendix A
** See Appendix B

Table 1: Life Cycle Cost Calculations Comparing Two Onboard Video Surveillance Systems.

Conclusions

Life cycle cost considerations should play a critical role in the procurement of an onboard video surveillance system. Capital budgeting analysis often indicates that while initial procurement costs may be higher, the total system cost over its planned life can be much less than that of an inexpensive solution.

Reduced life cycle costs will also factor into a faster ROI because the positive benefits of improved risk management, enhanced asset protection and rapid incident response will be amortized over a shorter period of time.

Glossary

Discount Factor - The number by which a future cash flow to be paid must be multiplied in order to obtain the present value (see Appendix B).
Discount Rate – The annual percentage by which costs are discounted based upon rates of return and inflation rates. Used to calculate the Discount Factor.
Life Cycle – The time interval between a product's procurement and its disposal.
Life Cycle Cost (LCC) - Cumulative cost of a product over its life cycle.
Life Cycle Costing - Economic analysis to assess the cost of a product over its life cycle or part of it.
MTBF – Mean Time Between Failures
Qualifications-Based Selection (QBS) – a method of selecting a product or service based upon its relative merits in a number of weighted categories.

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About March Networks

March Networks™ (TSX:MN; AIM:MNW) is a leading provider of intelligent IP video and business analysis applications that enable organizations to reduce losses, mitigate risks and improve security and operational efficiency. The company's advanced software suite includes enterprise-class video management, powerful analytics and comprehensive managed and professional services. Our software and systems are used by leading financial institutions, retailers, transportation authorities and other organizations in more than 50 countries. For more information, please visit www.marchnetworks.com.

APPENDIX A – LIFE CYCLE COST FACTORS

Important System Characteristics that directly affect reliability, durability and ease of use and therefore influence Life Cycle Costs

	Standard System	Advanced System
Ingress protection against dust, water and salt	IP30	IP65[3]
Shock and vibration protection	Tested to 5G	Tested to 30G. Rugged design with built-in hard drive protection.
EMC hardened, including high-level surge protection	To national standards only	Meeting or exceeding all international standards for rubber and steel wheel environments
Conformal coating against moisture and condensation	No	Yes, all components
Remote health monitoring and management	None	Yes, entire system including predictive monitoring[4]
Wireless video extraction	None	Yes, cellular, high-speed broadband and mesh[5]

APPENDIX B – LIFE CYCLE COST FORMULAS

Explanation and Assumptions Made	Standard System	Advanced System
Annual Operating Costs: Video Retrieval	About $50 per manual retrieval of video from a vehicle versus $5 for wireless extraction.	
Preventative Maintenance	Includes cleaning cameras and checking operation[6]. Advanced systems permit effective remote monitoring so that fewer physical checks are required. Approximately $50 per check.	
Repairs and Parts [2-Year Manufacturer's Warranty]	Hard drives may need replacing every 3 years. With predictive monitoring[6] such costs can be reduced.	
Life Time	Projected useful life of the system. This could be derived from manufacturer's MTBF data.	
Discount Factors **A** is applied to the capital replacement cost in the 7th year, and **B** to the annual operating costs.	Formulas: **A.** $\frac{1}{(1+r)^T}$ where r is the discount rate* expressed as a decimal and T is the time to a given future year for which a fixed amount is to be discounted.	
	B. $\left[1- \frac{1}{(1+r)^P}\right] \div rP$ where r is the discount rate* expressed as a decimal and P is the period of years over which a fixed annual amount is to be discounted.	
Calculation for same life times	Capital Cost + [(Operating Costs x Period) + (Repair Costs x (Life – Warranty)] x Factor	
Calculation for different life times	Initial Capital Cost + [(Operating Costs x Period) + (Repair Costs x (Period – 2xWarranty)] x Factor Plus Capital Replacement Cost in 7th year Note: In this example, there are two warranty periods of 2 years each	Capital Cost + [(Operating Costs x Life) + (Replacement Costs x (Life – Warranty)] x Factor Note: There is only one warranty period for the more durable, advanced system

*Discount Rate[7]

Definition: The annual percentage by which costs are discounted based upon rates of return and inflation rates. Used to calculate the Discount Factor.

The discount rate selected for an LCC analysis has a large effect on the final results. It should reflect the potential earnings rate of the system owner. Whether the owner is a national government, transit authority, or an individual, money spent on a project could have been invested elsewhere and earned a certain rate of return. The nominal investment rate, however, is not an investor's real rate of return on money invested. Inflation, the tendency of prices to rise over time, will make future earnings worth less. Thus, inflation must be subtracted from an investor's nominal rate of return to get the net discount rate (or real opportunity cost of capital). For example, if the nominal investment rate was 7 percent, and general inflation was assumed to be 2 percent over the LCC period, the net discount rate that should be used would be 5 percent.

References

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