Best Practices for Vehicle Operations:
Digital Recording Systems on Fleet Vehicles

WSTIP recommends:

1. Install digital recording systems as part of any new fixed route and paratransit vehicles purchase.

2. Existing fleet vehicles, assuming at least two more years of service, should be retrofitted with digital recording systems starting with fixed route and then paratransit.

3. Contracted service vehicles are included in this recommendation if WSTIP provides coverage for the auto liability of the vehicle and the vehicle is owned by the member.

4. Members should consider implementing appropriate technology for their vanpool fleet after fulfilling the first three recommendations.

WSTIP has developed the following resources to assist with this Best Practice:

- Generic business case presentation – The Business Case for Vehicle Technology by Steven M. Clancy, Geneva Financial Services (attached) … additional working spreadsheets are available on the Transit Portal
  - A gathering place to document member’s actual experiences with digital recording systems (gathering place is located at http://www.watransitportal.org/WSTIP/Pages/DigitalRecording.aspx).
  - Check the database for current information.
- Basic technical specifications for the design and configuration of a digital recording system – Technical specifications for the design and configuration of a digital recording system on buses and paratransit vehicles by Robert Kecham, TruSys (attached)
- Basic policy template for maintenance – Digital Recording Systems Maintenance Guidelines by Robert Kecham, TruSys (attached)
- Reference guide for working with your union – Labor Law Implications regarding Implementation and Use of Digital Recording Systems by Bruce Schroeder, Summit Law Group (attached)

WSTIP is still planning on developing these resources:

- A list of intergovernmental contracts members can utilize for purchase
  - Current contract is King County Metro for Apollo Systems

Best Practice accepted by WSTIP Board March 2010
The Business Case for Vehicle Technology

Steven M. Clancy CPA, CITP, CFF, CRISC
Geneva Financial Services, Inc.
12/1/2010
THE BUSINESS CASE FOR ON-BOARD VIDEO SURVEILLANCE AND EVENT DATA RECORDERS IN PUBLIC TRANSPORTATION

A SYNOPSIS

Executive Summary

For many years transit has been in the forefront of adopting appropriate technology to enhance operations as well as provide for a reliable, safe and secure experience for the public. Technology-assisted surveillance and event data recording devices have become a critical cornerstone in public transit’s efforts to address security, safety, trust and transparency.

This study assembles and attempts to summarize much of what is currently understood about this technology through a review of relevant literature and interviews with vendors and transit agencies operating event data recording (EDR) and on-board surveillance systems.

Critical to the efforts of public transit to further leverage the use of on-board technologies is the ability to express in concise understandable terms the operational and public benefits derived from making these significant expenditures. We believe that a model that expresses expenditures within the context of social benefits is the best approach. We further believe that the Balanced Score Card model is currently the best approach for this effort.

This report attempts to place in the hands of interested transit agencies a “Business Model” that speaks to the commonly held objectives found in all transit agencies: financial sustainability, trust (transparency), efficiency, the safety and security of employees and public and learning and growth principals within the transit enterprise. Accordingly, we apply a “Balanced Score Card” approach that allocates capital and operational expenditures associated with EDR and surveillance technologies across the above social objectives to arrive at targeted key performance indicators (KPI’s) and a “return on social benefits.”

Although it is difficult to project the precise effect that the use of surveillance technology will have on efficiency and cost saving, information obtained during this project indicates the following “lessons learned:”

- Cost savings due to fraud reduction can be significant. It has been estimated that the use of video cameras on routes in which fraudulent claims are a serious financial problem have contributed to an approximately 25% reduction of claims payouts. (Transit Cooperative Research Program Synthesis 38, 2001)
• The capital cost of implementation is the lesser of the total cost for surveillance technology. In all cases interviewees indicated that new adopters should consider the additional management, Information Technology and Maintenance expenditures required to keep this complex technology available. The example of the financial model in this document addresses this concern.

• That the surveillance program needs to be well publicized and be the central element in a larger campaign that would focus on troubled areas or areas of the route system where higher risk exists.

• One of the critical lessons learned is the need to include organized labor in the initial planning and deployment of EDR and surveillance technology. In all interviews with properties currently utilizing this technology, it was conveyed that if early positive experiences can be obtained, labor will become a willing participant.

• The use of EDR devices with limited video surveillance is primarily designed for extending management’s responsibility for policy and procedural compliance to the daily operations of the vehicle. Any desire on the part of agencies using EDR technology for additional on-board surveillance to address safety and security concerns usually results in the installation of additional purpose designed surveillance systems. The capital costs associated with the implementation of stand-alone EDR is significantly less; however, the ongoing operational costs of vehicle communications can be formidable in those cases where cellular data is retrieved.

Overall we determined that agencies found both surveillance systems and EDR systems to be beneficial in their own right. Responses to questions did not point to one particular area that individuals felt were of benefit over any other. Presumably, the effectiveness of the combination of reduction in fraudulent claims, fare evasion, crime deterrence, speed with which known liabilities can be settled, safety and security and legal evidence in criminal cases all lead to a perception that the benefits far outweighed the financial expenditures.

One surprising result of the interviews was the level and extent agencies felt that the surveillance systems built trust within the community in general and the riding public specifically. The worry and perception of safety and security is as real as the reality of the event itself. (Richards, 1980)
Introduction

On a typical weekday, as many as 13 million people in the United States ride public transit. Passengers use the nation’s fleet of buses, demand response vehicles, ferry boats, and other vehicles. Transit agencies operating these vehicles are charged with ensuring, to the extent feasible, that the public transportation environment is secure and safe.

Design and operational solutions over the past years have been implemented in varying degrees of success to safeguard the security of the passengers, transit employees and property. Some transit properties have had the financial ability to rely upon resource intensive patrol solutions to address both crime and the perception of crime. Such an operational model is not feasible for most transit properties in the U.S. Fewer than 10% of agencies maintain full-time, in-house security or police presence. Others increasingly are relying upon technology to increase management’s operational and situational awareness. This technology is primarily associated with vehicle telemetry in two broad categories: 1) Event data recording devices, and 2) surveillance technologies.

Event Data Recording (EDR) is primarily associated with monitoring driver behavior as well as recording specific data anomalies during an event. Surveillance technologies are primarily “instruments of truth,” providing accurate and clear evidence of the conditions preceding, during and after an event.

Passengers often perceive that their personal mobility is limited on board transit vehicles, because of this, large deployment of security and police personnel are not practical. Although most serious security issues occur in transit facilities or transit-related facilities such as stations or park-and-ride lots, rather than in vehicles, patrons often do not perceive vehicles to be secure. (Transit Cooperative Research Program Synthesis 38, 2001). On-board vehicle surveillance systems provide the patrons with the perspective that the vehicles are safe and secure and that the appropriate behavior of the riding public can be expected. These expectations are obtained without the need for expenditures for additional transit security personnel on-board vehicles.

Until recently, surveillance technology could not be used in a mobile environment to support the provision of security and safety on vehicles. This is no longer the case. Both DVR and surveillance technologies can have direct communications to the dispatch and supervision and is both possible and affordable.
Table 1:

<table>
<thead>
<tr>
<th>CRIME</th>
<th>IN VEHICLE</th>
<th>NOT IN VEHICLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicide</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Forcible rape</td>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td>Robbery</td>
<td>540</td>
<td>3144</td>
</tr>
<tr>
<td>Aggravated assault</td>
<td>1040</td>
<td>1274</td>
</tr>
<tr>
<td>Larceny/theft</td>
<td>2167</td>
<td>9213</td>
</tr>
<tr>
<td>Motor vehicle theft</td>
<td>N/A</td>
<td>2167</td>
</tr>
<tr>
<td>Burglary</td>
<td>24</td>
<td>467</td>
</tr>
<tr>
<td>Arson</td>
<td>17</td>
<td>43</td>
</tr>
</tbody>
</table>

Source: FTA, National Transit Database

As a result, transit systems are now evaluating and vehicle manufacturers now offer audio, event and video telemetries for in-vehicle deployment. Although results are not generally quantified, electronic vehicle surveillance and event data recording devices are generally thought by many agencies making use of the equipment to be both beneficial and cost-effective. In discussions with transit properties and literature review, reports have indicated passengers have been highly supportive of the technology. Signage indicating the presence of video and audio surveillance was met with an overwhelmingly positive response from the riding public. Interestingly, in addition to their safety benefits, the surveillance systems have also led to dramatically improved vehicle cleanliness.

Transit properties have reported that operators were initially hesitant about surveillance installations that captured their actions on videotape. As the intent of the systems became clearer during use, most operators became more accepting. For example: The front camera on each vehicle, which is positioned above the driver’s head, is also equipped with a microphone. This has helped managers adjudicate fare disputes between drivers and passengers.

The objectives of this report are to establish a “business model” that transit agencies may use to “make the case” for the provision of on-board vehicle surveillance and event data recording technology.
Project Approach

The approach to this project involved substantial literature search including previous work accomplished by the Washington State Transit Insurance Pool. In addition, we conducted interviews with Maintenance, Operation and IT employees at various transit properties currently utilizing on-board surveillance and event data recording devices.

Even though most literature segregates telemetry technology into video surveillance, audio recording and event data recording, for purposes of this business case development we will combine video and audio surveillance into one mode of technology.

Nationally, transit properties utilizing telemetry technology are equally divided between video/audio surveillance and event data recording devices. Far fewer utilize audio recording alone. Because most transit properties are local entities they operate in relative isolation and have not collaborated in describing their experiences. Consequently most rely upon vendor information or the experience of a vendor supplies reference in their decision making.

Definition

In order to proceed we will need to have some common definitions for on-board vehicle telemetry systems. These will be summarized as follows:

1. **Video Surveillance Technologies:**

   A typical system is digital technology that will begin recording automatically from 30 to 60 seconds after the vehicle is powered up, allowing vehicle power stabilization. The recording device either goes directly to “record mode” or is in “ready mode” waiting for an external “trigger” to start the recording. Current technologies for video recording systems provide limited event telemetry such as GPS location, date, time and speed imbedded within the video. This information is “compressed” and stored for later retrieval or transmitted via cellular, WIFI or WIMAX to transit operations. Environmental factors tend to shorten the life of surveillance equipment and many agencies have implemented features to protect their investment. Most house the equipment in a vandal proof enclosure. Consistent filtered power is often a problem and many provide power conditioning features to protect the equipment.

2. **Event Data Recorders:**

   The digital event recorder, a second type of digital recording device, is becoming more widely used on vehicles among transit agencies nationally. Such devices are able to record visual images as well as signals from an array of vehicles systems such as accelerometers, vehicle engine management systems, GPS heading, time and distance. These systems are configurable such that the operator can “trigger” a recording event or it can be “triggered” by an event that “jumps” pre-set parameters
such as a G-force parameter. As with the stand alone video surveillance technology data can be stored in an on-board hard drive and retrieved at a later date or transported via a common communications infrastructure either upon arrival at a particular “hot spot” location of via cellular in a “real time” basis. Significant compression and communication band width is necessary for “real time” transport. Event recorders may include limited video recording just prior, during and after an event.

3. **Audio Recording:**

Audio recording can be implemented on a stand-alone basis, or as part of the video recording system. Most systems that utilize audio recording do so as part of the video recording system. There are legal issues associated with the use of audio recording which will be discussed in a later section. We will not address audio recording as a separate system.

**BENEFITS OF SURVEILLANCE TECHNOLOGY**

Surveillance systems and event data recording devices have been installed in transit vehicles for a number of reasons. Most notable reasons specified in literature research and transit agency interviews were to improve passenger and employee safety, reduce fraudulent injury claims, mitigate accident and liability claims and enhance overall security. Most often, video surveillance systems were selected when the transit operations management leadership where the primary driving force in the selection of on-board technology. We believe the primary motivation in the operations arena is to have a tool available to adjudicate and resolve complaints and incidents that take place during transit operations. Specifically, the following applications were cited during the literature search along with follow-up interviews with transit properties. We will address each of these individually.

- Crime prevention and response
- Fraud risk management
- Legal evidence
- Customer service
- Employee security and other employee-related issues
- Financial considerations

In a 2001 National Center for Transit Research report: Cops, Cameras and Enclosures: A synthesis on the Effectiveness of Methods to Provide Enhanced Security to Bus Operators, video cameras on-board were rated along with other methods of providing on-board security and posted an effectiveness rating of 3.2 out of a possible 4 points and an overall effectiveness/cost ratio of 1.3 compared to all other effective measures.
Table 2

<table>
<thead>
<tr>
<th>METHODS</th>
<th>Effectiveness</th>
<th>Cost</th>
<th>Effectiveness Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 to 4</td>
<td>1 to 3</td>
<td></td>
</tr>
<tr>
<td>2-Way Radio</td>
<td>3.10</td>
<td>2.20</td>
<td>1.40</td>
</tr>
<tr>
<td>Panic Button Dispatch</td>
<td>3.00</td>
<td>2.30</td>
<td>1.30</td>
</tr>
<tr>
<td>Panic Button headsign</td>
<td>2.70</td>
<td>1.70</td>
<td>1.60</td>
</tr>
<tr>
<td>CAD AVL</td>
<td>3.00</td>
<td>3.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Video Cameras On-Board</td>
<td>3.20</td>
<td>2.50</td>
<td>1.30</td>
</tr>
<tr>
<td>Security in-house</td>
<td>3.80</td>
<td>2.00</td>
<td>1.90</td>
</tr>
<tr>
<td>Security uniformed</td>
<td>3.00</td>
<td>2.10</td>
<td>1.40</td>
</tr>
<tr>
<td>Security plainclothes</td>
<td>3.00</td>
<td>1.70</td>
<td>1.80</td>
</tr>
<tr>
<td>Contracted</td>
<td>2.70</td>
<td>2.30</td>
<td>1.20</td>
</tr>
<tr>
<td>Security (On-board)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security uniformed</td>
<td>3.30</td>
<td>2.30</td>
<td>1.40</td>
</tr>
<tr>
<td>Security plainclothes</td>
<td>3.30</td>
<td>2.20</td>
<td>1.50</td>
</tr>
<tr>
<td>Sworn Police in-house</td>
<td>3.40</td>
<td>2.20</td>
<td>1.50</td>
</tr>
<tr>
<td>Sworn Police uniformed</td>
<td>3.30</td>
<td>2.20</td>
<td>1.50</td>
</tr>
<tr>
<td>Sworn Police plainclothes</td>
<td>3.60</td>
<td>2.20</td>
<td>1.60</td>
</tr>
<tr>
<td>Specialized Self Defense</td>
<td>2.80</td>
<td>2.00</td>
<td>1.40</td>
</tr>
<tr>
<td>Operator Training Prevention</td>
<td>2.90</td>
<td>1.40</td>
<td>2.10</td>
</tr>
<tr>
<td>Structure to retrofit</td>
<td>3.50</td>
<td>2.50</td>
<td>1.40</td>
</tr>
<tr>
<td>Protect Operator new specs</td>
<td>3.70</td>
<td>2.50</td>
<td>1.50</td>
</tr>
</tbody>
</table>
Crime Prevention and Response:

By far, the majority of those transit properties who have installed surveillance systems did so with the goal of reducing incidents of crime and responding to those that do occur (Transit Cooperative Research Program Synthesis 38, 2001). In the various questionnaires, agencies were asked to rate the overall effectiveness of surveillance systems at reducing crime. The 20 agencies responding to this question felt their surveillance systems performed better than average at reducing crime. Ten of 19 respondents reported a measurable reduction in the number of assaults experienced at their facilities. Beyond crime prevention, surveillance records can be very useful as evidentiary material in obtaining convictions for those that commit crimes on vehicles and especially good at addressing public disorder issues. Most importantly evidence in the literature indicates that the presence of a video record is very effective in facilitating plea bargaining or caused individuals to drop frivolous claims.

Studies have shown that crimes do not occur on transit vehicles any more often than in the community at large. Crime parallels that of the surrounding community. Accordingly, transit properties often install surveillance systems with the goal of mitigating passenger fear of using the systems. (Transit Cooperative Research Program Synthesis 38, 2001). As reported by Richards and Hoel, “perceived security, not actual security, is what influences ridership and transit use patterns”. (Richards, 1980)

Fraud Risk Management:

Fraud has become a serious issue for many transit properties. Industry experts at several agencies assert that a single fraudulent claim can yield $5,000 to $10,000
(Transit Cooperative Research Program Synthesis 38, 2001). Intentionally promoted accidents are a major problem throughout the country. Video systems on-board vehicles are a key component in the fight against fraudulent claims. One property estimated that annual claims related savings were in the range of $2.2 million (2001 dollars)

**Legal Evidence:**

For those systems that have on-board video and event data recording the output from these systems becomes a critical component to the legal discovery process. For those events for which the data indicates that liability rests with the agency, settlement negotiations may begin early leading to a more fair and just outcome for both plaintiff and defendant.

With regard to general legal challenges, the legal implications of surveillance on transit vehicles are a significant issue. Federal and local laws define the rights of entities to observe activity on a transit vehicle and, in particular, to record images and audio from these observations that may be used later as evidence in court for other purposes. Conversely, the Fourth Amendment to the U.S. Constitution states that “the right of the people to be secure in their persons, houses, papers and effects, against unreasonable searches and seizures shall not be violated” and is most often cited in opposition to surveillance programs.

This area of law is new and unresolved, limitations are predominantly identified and addressed on a state-by-state basis, and accordingly neither clarity nor conformity is present at this time.

Transit agencies performing surveillance have encountered legal concerns in another area in particular – signs accompanying surveillance equipment. The legal standard is that the gathering and recording of information via surveillance systems be performed precisely in the manner that the surveillance is understood by the public and, above all, that the surveillance is “advertised” to the public. As a result, if signs are presented to assert that surveillance is being used, this constitutes a legal obligation by the transit agency to the public (in some instances) to perform such surveillance. Again, the existence and nature of this obligation differs from state to state.

Within the state of Washington it is generally agreed that there is not a presumption of privacy accorded those riding public transportation. With adequate notice of the use of video surveillance aboard vehicles legal issues are addressed.

**Customer Service:**

As indicated earlier, passengers are generally supportive of video surveillance systems aboard transit vehicles. Although not typically installed to address customer service needs they are increasing being utilized for this purpose. The area of service most impacted by the use of surveillance is in the area of fare dispute resolution and complaint resolution. Audio or video information can be used following or during a fare
dispute to support an operator in resolving a situation where a patron has not paid the appropriate fare. As well, surveillance video has the capability of proving or disproving criticisms made by passengers about system equipment of employees. Additionally early intervention by supervisors to unruly individuals can lead to a more pleasant future riding environment.

**Employee Security and Other Employee Related Issues:**

The use of surveillance technologies to monitor the conduct of employees is a controversial application as well as a potentially valuable tool. Surveillance provides information applicable to three areas of benefit relating to transit agency employees: (1) protection of employees through monitoring, (2) risk management through observation and efforts at accident avoidance and (3) working to resolve passenger complaints. Interviews with member transit agencies that are using on-board surveillance yielded information to suggest that almost all were utilizing historical information for driver interaction training as well as policy and procedure development. The potential cost savings from utilizing real video in real situations rather than needing to “purchase” training footage can be substantial. With regard to policy compliance, some properties are “mining the data” through the use of “sampling techniques” to randomly evaluate driver conditions and adherence to policies.

Employees can be victims of serious crimes on-board vehicles as seen in table 4. Significantly more robberies and aggravated assaults, both crimes that include force or the threat of force, occur against employees while they are on board transit vehicles than at other locations within the transit environment. Integrating the video surveillance system with the silent alarm or “panic” button available to drivers is a formidable safety and security measure when “linked” to the operations facility via cellular or WIMAX communication systems.

**Table 3**

<table>
<thead>
<tr>
<th>CRIME OCCURRING IN TRANSIT ENVIRONMENT</th>
<th>Occuring in Vehicle</th>
<th>Not Occuring in Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicide</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Forcible rape</td>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td>Robbery</td>
<td>540</td>
<td>3144</td>
</tr>
<tr>
<td>Aggravated assault</td>
<td>1040</td>
<td>1274</td>
</tr>
<tr>
<td>Larceny/theft</td>
<td>2167</td>
<td>9213</td>
</tr>
<tr>
<td>Motor Vehicle theft</td>
<td>N/A</td>
<td>2197</td>
</tr>
<tr>
<td>Burglary</td>
<td>24</td>
<td>467</td>
</tr>
<tr>
<td>Arson</td>
<td>17</td>
<td>43</td>
</tr>
</tbody>
</table>

Source: FTA 1988 National Transit Database
According to the Department of Justice’s National Crime Victimization Survey, the most common type of workplace violent crime is simple assault, with an average of 1.5 million a year (Warschol, 1998). The risk rate (per 1000) for various occupations was as follows (health, 1996).

**Table 4**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Risk Rate (per 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Safety Officers</td>
<td>306</td>
</tr>
<tr>
<td>Private security guards</td>
<td>218</td>
</tr>
<tr>
<td>Taxi drivers</td>
<td>184</td>
</tr>
<tr>
<td>Prison guards</td>
<td>117</td>
</tr>
<tr>
<td>Bartenders</td>
<td>91</td>
</tr>
<tr>
<td>Mental health professionals</td>
<td>80</td>
</tr>
<tr>
<td>Gas station attendants</td>
<td>79</td>
</tr>
<tr>
<td>Convenience store clerks</td>
<td>68</td>
</tr>
<tr>
<td>Mental health custodial</td>
<td>63</td>
</tr>
<tr>
<td>Junior high middle school teachers</td>
<td>57</td>
</tr>
<tr>
<td><strong>Bus drivers</strong></td>
<td><strong>45</strong></td>
</tr>
<tr>
<td>Special Education teachers</td>
<td>41</td>
</tr>
<tr>
<td>High School teachers</td>
<td>29</td>
</tr>
</tbody>
</table>

**Financial Considerations**

Initial financial considerations involve funding strategies. The second consideration involves decisions relative to retrofitting vehicles. The primary funding source for the installation of telemetries is the federal government via grants provided through the Federal Transit Administration (FTA). Significantly, all FTA capital grant funds are associated with funding for new vehicles. As a result very little funding is available for retrofitting the existing fleet with telemetries. Accordingly there is a fairly long lead time to fund implementation fleet wide. This issue has lead most transit properties to include video surveillance and event data recording only with new vehicle orders. Transit agencies are required to allocate 1% of their annual federal grant towards security equipment or programs.
Current pricing for on-board surveillance systems are as follows:

**Capital Expenditures:**

30 foot vehicle; $7,500 this would include the following:
- Six cameras
- Eight track DVR
- Vehicle information module (audio, GPS, event switch)
- Wireless Access Point. Add $1,500

35-40 Foot; $10,400
- Information module
- Audio
- GPS
- Event switch
- 2-wireless access points and internet switch
- Minibus is available on State bid at an approximate cost of $7,500 for a four camera system. Additional modules as per above (access point etc.).
- Retrofit costs of existing vehicles is approximately $10,000 per vehicle with additional modules (WIFI etc.) extra as per above.

**Annual Operating Expenditures:** (assume fleet of 45 FR and 45 PT vehicles)

- .33 FTE for Subject Mater Experts. This usually is someone located in the operations department and performs operations, retrieval and coordination with maintenance and IT departments.
- Spare parts. Usually 10% of capital costs annually for parts replacement.
- .15 FTE in maintenance
- .25 FTE in IT

**Stand-alone Event Data Recording Devices:**

Event data recorders come in many sizes and price. Most are connected to or associated with limited video and are primarily designed to address transit operator compliance to policy and/or procedures. Typically these systems include the following:

- Telematics:
  - GPS based location
  - Speed and heading information related to the ‘triggered” event
  - On-line mapping, video event recording
  - Accelerometer information
  - Management reporting
  - Cellular event reporting
- Pricing: (per vehicle)
  - Hardware: $500-$1,500; installation $200-$500
  - Communication service subscription: $40-$50 per month
Agency Operational Issues:

As one can see, the least of the expenditures for on-board surveillance equipment is the capital expenditure.

Reports from transit systems seem to indicate that surveillance equipment is sensitive electronic equipment that is prone to vibration and the affects of non-optimal power requirements within the vehicles. One of the most cost effective approaches an agency can take is to install power conditioning equipment between the vehicle power and the DVR equipment. Unfortunately when the DVR equipment is down, the bus is also out of service within the maintenance shop for evaluation.

Transit agencies interviewed for this study as well as those described in the literature have consistently documented both the actual and perceived “value” of a deterrent effect resulting from the installation of surveillance equipment on vehicles. It has been said that the very presence of the equipment on board vehicles and notification of same no matter what evidence they provide is sometimes described as their greatest advantage in addressing crime and unruly behavior. (Transit Cooperative Research Program Synthesis 38, 2001)
**To “network” or not to “network”:**

Within the last few years considerable work on the national communications infrastructure has taken place. Specifically this has been the case in the technology areas of WIMAX and WIFI. This work has allowed transit properties to experiment (with limited success) the provision of full duplex high speed communications between vehicles and the central dispatch or operating facility. Vendors have been working with these transit properties in the design of equipment to allow this “linkage” with the vehicle. More importantly, however, is the advancement that has taken place with the nation-wide cellular providers. The move to 3-G and 4-G data service at reasonable cost has provided the opportunity for transit properties to have access to the necessary band-width required in order to have direct full-duplex communication with the on-board technology including video surveillance equipment. Adoption of this communication technology would add anywhere from $20 to $30 per month per vehicle plus equipment, However, the benefits in labor saving and speed of response to on-board vehicle emergencies has lead many agencies to consider this option. EDR systems can leverage this communication technology as well with considerably lower band-width and time-delay requirements than that required by video surveillance equipment.

The most common approach to implementation seems to be a staged or phased approach whereby cellular or WIFI/WIMAX is tested on a sample group of vehicles.
Model Business Case Analysis

Comparisons and cost benefit analysis is usually attempted to divine a means of expressing the relationship that might exist between the expenditure of tax-payer funds and the direct or indirect benefits that the citizens may derive from such an expenditure. Most often, with respect to on-board telemetry technology, it is difficult to quantify this relationship into the traditional return-on-investment (ROI) format. History notwithstanding, we believe that there is an appropriate approach that considers the social benefits of this type of expenditure. This recommended approach is the “Balanced Scorecard” methodology. In the most technical sense, the Balanced Scorecard is a strategic planning and management system used to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organizational performance against strategic goals. In the context of this report we will utilize this methodology to align the business activities and expenditures of on-board telemetry to a “vision and strategy” of safety, security, truth (i.e. transparency), accuracy and community trust. Even though these “core values” may not be overtly stated, they exist in all transit properties. An example of these “linked” core values might look like the following Table 5:
### Table 5

#### Balanced Score Card

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial</strong></td>
<td>Trust</td>
</tr>
<tr>
<td></td>
<td>Efficiency</td>
</tr>
<tr>
<td></td>
<td>Security</td>
</tr>
<tr>
<td><strong>Customer</strong></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Security</td>
</tr>
<tr>
<td></td>
<td>Learning</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
</tr>
<tr>
<td><strong>Agency (operations)</strong></td>
<td>Learning</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Efficiency</td>
</tr>
<tr>
<td></td>
<td>Security</td>
</tr>
<tr>
<td><strong>Risk Management</strong></td>
<td>Financial Efficiency</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Security</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
</tr>
</tbody>
</table>

#### Balanced Score Card

<table>
<thead>
<tr>
<th>Value Management</th>
<th>Financial</th>
<th>Customer</th>
<th>Agency</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Efficiency</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Security</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Safety</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Learning</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Growth</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
You will note that the categories of Financial, Customer, Agency and Risk Management represent the “stakeholders”. Customer, of course, is also representative of taxpayer in this context. Note that the values of Trust, Efficiency, Security, Safety, Learning and Growth are in most cases representative in all of the Stakeholders.

**Trust:**

The results of literature search and interviews with transit agencies show that on-board video systems are an “instrument of truth”. They lend clarity and accuracy to events and conditions in question. As a result, when these systems are in use, trust develops within the community. Employees are more trusting of how events and situations will be addressed. The customer is more trusting that their concerns will be addressed and that other members of the community will be consistent in their behavior. Those responsible for financial expenditures utilize the “digital memory” of on-board telemetry to reduce the specter of unknown “contingent” liabilities (i.e. the potential of unknown liability claims).

**Efficiency:**

In this context, efficiency represents the value of “time” and “resources.” For the customer on-board video and telemetries represent the speed with which the supervisor may be able to address their complaint. Prior to video it may have taken a few days or a few weeks before the supervisor was able to interview the driver and other witnesses to determine the “truth” of the complainants’ story. Sometimes the case was never clear enough to be resolved. Now it might take a few hours. From the agency’s perspective, the elimination of frivolous lawsuits and complaints allows all individuals from the driver to the supervisor to focus on the more important tasks at hand. From the risk management perspective on-board video telemetries allow the quick resolution of an accident when it is clear that liability rests with the transit property. The settlement amount may be the same but the expenditure for legal counsel is considerably less. Financial efficiency is obtained with the ability of on-board video and telemetry systems to reduce and eliminate fare evasion and the cost of passenger counting.

**Safety and Security:**

In recent years, agencies have concentrated on improving the actual and perceived security of transit facilities such as subway stations and bus depots. This initiative is based on the theory that through the proper design and operations of facilities and equipment, officials can produce a climate of security by creating a physical environment that positively influences human behavior. The assurance of both actual and perceived security on transit vehicles, however, is complicated by several factors, which are present to a lesser degree in facilities. Generally speaking, individuals perceived feeling of safety and security is as important as their actual safety and security. If the transit property can increase the public’s perception of safety through on-board video technology, the impact upon the public’s trust of the community around them is enhanced. Safety and security surveillance equipment are two of the main features that transit agencies need to market to the perspective clients.
Learning and Growth:

A major indicator of an agency's ability to leverage technology value is represented in the ability to utilize the technology for learning and growth. Within the context of on-board video and telemetry, this construct equates to utilizing the video and event data recording for driver and employee training purposes. The reviewing of incidents and accidents as a basis to evaluate and revise policies or establish revised approaches to solving problems is a core component to this concept.

Growth in this context is associated with building trust between employees, community and leadership. On-board video assists in this regard with not only its impact upon safety, security and accident reduction but also in its use in passenger counting, asset (vehicle) deployment and maintenance.
The Development of the Business Case:

The Path to Success:

Step one

- Define the expected results from implementation of EDR and Surveillance
  - **Trust:**
    - Reduction of frivolous complaints
    - Increased driver adherence to policy
    - Accident/incident investigation
    - Reduction in vandalism (increase in conviction)
    - Mitigation of passenger fear
  - **Efficiency:**
    - Increased speed of complaint resolution
    - Quicker resolution of claims
    - Better support to the driver in the field
    - Greater oversight of driver compliance
    - Quicker management response to good things
  - **Safety and Security:**
    - Quicker response to incidents
    - Greater conviction of wrong-doers
    - Reduction of fraudulent claims
    - Reduction of trip and fall accidents
  - **Learning and Growth:**
    - Training in ADA passenger transport
    - Passenger/stop load analysis
    - Compliance with stop announcement

- Assign weighted values to categories and subcomponents:

Step Two:

- Build the annual operating budget for this decision package
  - **Expected Capital expenditures**
  - **Expected annual depreciation**
  - **Expected parts and warehouse**
  - **Expected labor and overhead**
    - Direct equipment with installation per vehicle
    - Parts cost for ongoing operations
    - Labor cost for SME in operations
    - Labor cost for maintenance technician
    - Labor cost for IT
    - Overhead allocation for labor
    - Communication costs
      - Cellular costs (annual)
      - IT equipment costs
    - Training costs
    - Procurement expenditures
  - **Expected Grant reimbursement**

Step Three:

- Assign the total annual expected operating expenditures to the weighted values for each category
- Estimate the expected expense reduction from obtaining success in each of the weighted categories. This becomes your Key Performance Indicator or KPI
Balanced Scorecard Example:

<table>
<thead>
<tr>
<th></th>
<th>Trust</th>
<th>Efficiency</th>
<th>Safety and Security</th>
<th>Learning and Growth</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of frivolous complaints</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Increased Driver Adherence</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Accident/incident investigation</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Reduction in vandalism</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Mitigation of passenger fear</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Increased speed of complaint resolution</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Quicker resolution of claims</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Better support to the driver in the field</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Greater oversight of driver compliance</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Quicker management response to good things</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Quicker response to incidents</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>greater conviction of wrong-doers</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Reduction of fraudulent claims</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Reduction of trip and Fall</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Training in ADA passenger transport</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Passenger/stop load analysis</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Compliance with stop announcement</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>27</td>
<td>25</td>
<td>23</td>
<td>19</td>
<td>94</td>
</tr>
<tr>
<td><strong>Percentage of Total</strong></td>
<td>29%</td>
<td>27%</td>
<td>24</td>
<td>20</td>
<td>94%</td>
</tr>
<tr>
<td>Annual Operating Expenditures</td>
<td>$71,091.31</td>
<td>$65,825.28</td>
<td>$60,559.26</td>
<td>$50,027.22</td>
<td>$247,503.07</td>
</tr>
<tr>
<td>Targeted expense reduction from implementation of value</td>
<td>$50,000.00</td>
<td>$37,000.00</td>
<td>$40,000.00</td>
<td>$10,000.00</td>
<td>$137,000.00</td>
</tr>
<tr>
<td>Net expenditures</td>
<td>$21,091.31</td>
<td>$28,825.28</td>
<td>$20,559.26</td>
<td>$40,027.22</td>
<td>$110,503.07</td>
</tr>
</tbody>
</table>
### Projected Costs:

<table>
<thead>
<tr>
<th>Input Table</th>
<th>Per-vehicle</th>
<th>Depreciable Life 5-years</th>
<th>Number of Vehicles</th>
<th>Total Acquisition</th>
<th>Depreciation Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDR New</td>
<td>$500.00</td>
<td>$100.00</td>
<td>80</td>
<td>$40,000.00</td>
<td>$8,000.00</td>
</tr>
<tr>
<td>EDR Retro</td>
<td>$1,500.00</td>
<td>$300.00</td>
<td>27</td>
<td>$40,500.00</td>
<td>$8,100.00</td>
</tr>
<tr>
<td>EDR new Install</td>
<td>$450.00</td>
<td>$90.00</td>
<td>80</td>
<td>$36,000.00</td>
<td>$7,200.00</td>
</tr>
<tr>
<td>EDR Retro Install</td>
<td>$750.00</td>
<td>$150.00</td>
<td>27</td>
<td>$20,250.00</td>
<td>$4,050.00</td>
</tr>
<tr>
<td>Video Surveillance (new)</td>
<td>$8,500.00</td>
<td>$1,700.00</td>
<td>80</td>
<td>$680,000.00</td>
<td>$136,000.00</td>
</tr>
<tr>
<td>Video Surveillance (retro)</td>
<td>$9,000.00</td>
<td>$1,800.00</td>
<td>27</td>
<td>$243,000.00</td>
<td>$48,600.00</td>
</tr>
<tr>
<td>New Video install costs</td>
<td>$1,800.00</td>
<td>$360.00</td>
<td>80</td>
<td>$144,000.00</td>
<td>$28,800.00</td>
</tr>
<tr>
<td>Retrofit Video install costs</td>
<td>$3,500.00</td>
<td>$700.00</td>
<td>27</td>
<td>$94,500.00</td>
<td>$18,900.00</td>
</tr>
<tr>
<td>Shipping freight</td>
<td>$15,000.00</td>
<td>$3,000.00</td>
<td>1</td>
<td>$15,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td></td>
<td>$41,000.00</td>
<td>$8,200.00</td>
<td></td>
<td>$1,313,250.00</td>
<td>$262,650.00</td>
</tr>
</tbody>
</table>

Less FTA 80% Grant

|                                                   | $1,050,600.00 | $210,120.00 |
|                                                   | $262,650.00   | $52,530.00  |

Annual Parts

<p>|                                                   | $13,132.50    |</p>
<table>
<thead>
<tr>
<th>Number of vehicles:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apollo New:</strong></td>
<td></td>
</tr>
<tr>
<td>30 Foot</td>
<td>25</td>
</tr>
<tr>
<td>35 Foot</td>
<td>15</td>
</tr>
<tr>
<td>40 Foot</td>
<td>40</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>80</td>
</tr>
<tr>
<td><strong>Apollo Retrofit</strong></td>
<td></td>
</tr>
<tr>
<td>30 Foot</td>
<td>5</td>
</tr>
<tr>
<td>35 Foot</td>
<td>10</td>
</tr>
<tr>
<td>40 Foot</td>
<td>12</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>27</td>
</tr>
<tr>
<td><strong>EDR new</strong></td>
<td></td>
</tr>
<tr>
<td>30 Foot</td>
<td>25</td>
</tr>
<tr>
<td>35 Foot</td>
<td>15</td>
</tr>
<tr>
<td>40 Foot</td>
<td>40</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>80</td>
</tr>
<tr>
<td><strong>EDR retrofit</strong></td>
<td></td>
</tr>
<tr>
<td>30 Foot</td>
<td>5</td>
</tr>
<tr>
<td>35 Foot</td>
<td>10</td>
</tr>
<tr>
<td>40 Foot</td>
<td>12</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>27</td>
</tr>
</tbody>
</table>
**Key Performance Indicators:**

As you can see by the above example, the outcome of the process of applying the Balanced Scorecard approach leads to the creation of “Key Performance Indicators” (KPI). In this example, they are Trust, Efficiency, Safety and Security and Learning and Growth. Of course, each agency would utilize those values (or KPI’s) that were relevant to their environment. In each category, the reader will note that we utilized estimates or “targets” of expense reduction that would be expected from implementation of the “value,” or KPI. This “target” will be the goal to aspire to for the period and would become a part of the KPI management and monitoring environment.

In presenting this format to the leadership of the agency the project manager would pose the question: *Can we gain value through the implementation of this technology within the performance indicator of “Trust”? Can we through building greater trust relationship and transparency within our community save the funds we have indicated? Would we will be able to reduce frivolous complaints and incidents, increase driver adherence to policy and procedures, provide for better accident/incident investigation, reduce vandalism and mitigate passenger fear and save the targeted $50,000?*

Likewise similar questions would be asked with respect to the performance categories of Efficiency, Safety and Security and Learning and Growth. To the extent the agency governing board and leadership say “yes” to these KPI questions, the agency would move forward with the project.
Closing

It is clear that further research needs to take place regarding what affect increases in feelings of trust and safety on the part of the community and riding public will have upon the actual use of public transportation and specifically the use of technology to enhance these feelings. There is also a need for further research regarding the protection of the public’s right to privacy visa-a-vi the use of on-board technology and to what extent violations of this right would damage the trust relationship and therefore propensity to ride and utilize public transportation.

What is clear, however, is that through the use of a business model that expresses technology expenditures within the context of social and operational benefits, leadership and decision makers will have clarity within which to make critical internal resource allocation decisions.

The Federal Transit Administration has included on-board telemetries as part of their Intelligent Transportation Systems initiative. This requires a structured engineering approach to the specification, implementation and decision making. The Balanced Score Card approach would address one of the structured engineering components.

Prices continue to stabilize while the capabilities of on-board telemetry systems continue to rise providing a viable option for even the smallest of transit systems. Agencies face a far greater variety of choices when making a purchasing decision on such equipment than they ever have had before.

The question for those transit agencies who have not adopted a vehicle telemetry strategy is not “if” but “when.” It is hoped that this report will help address this question.
The Washington State Transit Insurance Pool wishes to thank the following people for their contributions to this Best Practice resource document:

Steven M. Clancy, Geneva Financial Services

The contributions of the Whatcom Transportation Authority (Bellingham) while in the research phase. Notably the following individuals shared their thoughts and experiences:

- Geoff Beaumont, Operations Supervisor, Whatcom Transportation Authority
- Robert Muzzy, Safety and Security Officer, Whatcom Transportation Authority
- Paul Schrager, Operations Director, Whatcom Transportation Authority
- Pete Stark, Fleet and Facilities Director, Whatcom Transportation Authority

Our Review Team – Thanks for giving time to review this document and sharing your experience:

- Terence Artz, Risk Manager, Pierce Transit (Lakewood)
- Lyle Bland, Operations Manager, Link Transit (Wenatchee)
- Emmett Heath, Director of Administration, Community Transit (Everett/Snohomish County)
- Ken Mehin, Transit Manager, Yakima Transit (Yakima)
- Robert Muzzy, Safety and Security Officer, Whatcom Transportation Authority (Bellingham)
- Allen Walch, Administrative Services Manager, Ben Franklin Transit (Richland)
WSTIP Technical Standards Document:
Recommended Practice for
the Selection of Cameras and Digital Recording
Systems

Consultant:

True System Designers Limited (TRUSYS)

www.trusys.com

1916 Eastlake Avenue East
Seattle, WA
(800) 905-6810
Abstract: This document provides guidelines for the selection of digital cameras and recording devices for WSTIP member agencies. This document addresses camera specifications, placement, recording systems and ancillary equipment such as GPS and microphones.
# TABLE OF CONTENTS

INTRODUCTION ............................................................................................................................. 4  
ACKNOWLEDGEMENT .................................................................................................................. 5  
SYSTEM DESIGN .......................................................................................................................... 6  
  1. OVERVIEW .............................................................................................................................. 6  
  1.1 Scope: .................................................................................................................................. 6  
  1.2 Purpose: .............................................................................................................................. 7  
  2. CAMERA SPECIFICATIONS ................................................................................................... 7  
  2.1 Functional Requirements: ............................................................................................... 7  
  2.2 Exposure Control ............................................................................................................ 7  
  2.3 Resolution ....................................................................................................................... 8  
  2.4 Frame Rate ..................................................................................................................... 8  
  2.5 Infrared ............................................................................................................................ 8  
  2.6 Wired Vs. Wireless .......................................................................................................... 8  
  2.7 Interface Tools ................................................................................................................ 9  
  3. CAMERA PLACEMENT ........................................................................................................ 9  
  4. MICROPHONES .................................................................................................................. 10  
  5. GPS ..................................................................................................................................... 11  
  6. RECORDING SYSTEMS ....................................................................................................... 11  
  6.1 Camera Resolution ....................................................................................................... 12  
  6.2 Output Devices .............................................................................................................. 12  
  7. SUGGESTED LAYOUT ......................................................................................................... 13  
  7.1 Suggested Four Camera Configuration ........................................................................ 13  
  7.2 Suggested Eight Camera Configuration ...................................................................... 13  
  7.3 Suggested Twelve Camera Configuration .................................................................... 14  
  8. DEFINITIONS ..................................................................................................................... 15  
  9. REFERENCES .................................................................................................................... 17
INTRODUCTION

This Recommended Practice is designed to provide participating WSTIP members a set of minimum specifications for the selection and implementation of on-board cameras, microphones and digital storage solutions for use in fixed route and paratransit buses.

The hardware items, methods, and procedures listed in this report are based on interviews with WSTIP members and video surveillance industry leaders. While these recommendations are based on best practices and industry standards, they are only intended as guidelines and recommendations. Individual fixed route and paratransit buses may require unique configuration(s) that may vary from the suggested layout provided in this report however the principals and guidelines still apply.
ACKNOWLEDGEMENT

WSTIP greatly appreciates the assistance and contributions of the following individuals, who provided the appropriate technical information found within this document:

**Rick White**, Operations Manager, Valley Transit (Walla Walla)
**Jim Merrill**, Operations Manager, Intercity Transit (Olympia)
**George Baxter**, Operations Manager, Everett Transit (Everett)

**Adele Robinson**, Seon Systems Corporation
**Don Eaton**, Apollo Video Technology
**Jack Meltzer**, Axis Communications

WSTIP also wishes to express their gratitude for the hard work of the TRUSYS team in developing this document:

**John Ketchum**, TRUSYS
**John Gargett**, TRUSYS
SYSTEM DESIGN

1. OVERVIEW

This document establishes a set of minimum criteria for the selection of Video Surveillance Systems (VSS) for use in fixed route and paratransit buses. Both attended and stationary are discussed in this report. This includes fixed cameras and Pan Tilt Zoom (PTZ) cameras, digital storage solutions, and video management software. The intent of this document is to ensure that the technical capabilities of cameras and recording systems are consistent and that they provide optimized image quality.

It is essential to any system that it be 'designed for purpose' rather than attempting to provide a 'one size fits all' approach to the system design. The system needs to be designed for every day safety and security requirements where identification of people and objects within images must be captured. The systems need to be designed to meet four industry-accepted categories - Detect, Monitor, Identify, and Recognize.

This report is based on the use of color cameras with a minimum of VGA resolution. Interviews with WSTIP members show that frame rates are being used between 10 fps in low traffic and low motion areas and up to 30 fps in high traffic areas. Where cameras are observing motor vehicles or external images of mobile platforms, 30 fps is used. Compression methods should be configured MJPEG and H.264. It is essential that WSTIP members strike a balance between resolution and recording duration, especially in high traffic and high motion areas, principally due to the large amount of data storage required:

<table>
<thead>
<tr>
<th>Camera Type</th>
<th>Codec</th>
<th>Compression (%)</th>
<th>Storage (days)</th>
<th>Day/Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic/Bus Islands</td>
<td>MJPEG/H.264</td>
<td>&lt;40%</td>
<td>&gt;7 Days</td>
<td>Yes</td>
</tr>
<tr>
<td>Bus – Fare Station</td>
<td>MJPEG/H.264</td>
<td>&lt;10%</td>
<td>&gt;7 Days</td>
<td>Yes</td>
</tr>
<tr>
<td>Bus – Handicap Platform</td>
<td>H.264</td>
<td>&lt;10%</td>
<td>&gt;7 Days</td>
<td>Yes</td>
</tr>
<tr>
<td>Bus – Aisle way</td>
<td>H.264</td>
<td>&lt;40%</td>
<td>&gt;7 Days</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Any VSS should be such to allow for local recording of images and contain a digital signature to allow for chain of evidence. It is recommended that IP-based networks, based on the Fast Ethernet 100Base TX standard, be used over structured wiring, Cat6 cabling, or fiber optic cabling, and utilize Power over Ethernet (PoE).

1.1 Scope:

This document provides guidelines for the selection and specification of cameras and recording systems for use within WISTIP fixed route and paratransit buses. This document applies to mobile camera systems on buses and does not cover recommendations or requirements for fixed site cameras in specific locations. This document does apply to any camera used within a fixed route or paratransit VSS system so that WSTIP members have a consistent technical recommended practice across the state.
1.2 Purpose:
The purpose of this document is to ensure that WSTIP members have a set of minimum specifications to be used when defining the performance and capabilities of VSS to be used within fixed route and paratransit systems. This document ensures the quality of imagery obtained from direct camera feeds, recordings, and network systems are of consistent and acceptable levels that enable the system to be used effectively.

2. CAMERA SPECIFICATIONS

2.1 Functional Requirements:
These specifications are indented to provide a base line for the collection and dissemination of quality imagery that can be used in both static and real-time situations. Quality data ensures that the agency can be used in daily and post-event analysis, ensuring the best possible outcome for operators, security and law enforcement officials.

Quality data is a direct result of quality hardware and optimum coverage. The primary goals of any VSS system are to capture detail of riders, associated individuals and traffic incidents. Systems need to be designed to capture details such as shape of the eyes, ears, nose, mouth, and chin. In order to identify a person there are other individual distinguishing features that should be considered when designing a system such as moles, scars, tattoos, and freckle patterns. It is also beneficial to be able to derive measurements of these features, is possible. Likewise, identifying a vehicle requires that the license plate numbers or other identifying characteristics be distinguished.

These recommendations will ensure that the WSTIP members can collect data in all lighting situations in a secure format while enabling the end user ease of access to the data. As cameras are at the heart of the design the following sections will address the design parameters via:

- Exposure Control
- Resolution
- Frame Rate
- Infrared
- Wired vs. Wireless
- Interface tools

2.2 Exposure Control
Most cameras today are equipped with automatic features to guarantee correct exposure under varying lighting conditions which include, but are not limited to, automatic gain, day/night switching and automatic iris controls. Automatic iris control, or electronic shuttering, is required in fixed route and paratransit buses.

In fixed route and paratransit buses, it is also desirable to capture the state of traffic signals and dashboard mounted status indicators for forensic purposes. There has been a recent transition from incandescent lamps to the use of LED’s for traffic control signals, and some of these are pulse width modulated to reduce the total amount of power used as well as to increase the life of
the bulbs. Likewise, LED status indicators on dashboards are often pulse width modulated. This means that, although the human eye sees them in a state of constant illumination, they are actually dark at times. It is important in these applications to select a camera that supports an exposure mode that compensates for this and always captures the true state of the signal or indicator.

2.3 Resolution

Resolution is the ability to resolve or see small details in an image. Resolution for VSS cameras (as well as for TV monitors and recorders) is a monochrome specification that specifies how many black and white lines can be seen in a given area and is specified in terms of lines of horizontal resolution. For images with 4:3 aspect ratios, horizontal resolution is defined as the number of vertical black and white lines you can discern in \( \frac{3}{4} \) of the picture width. VSS cameras range from 200 to more than 1,000 lines of horizontal resolution. Care must be taken to preserve the aspect ratio between camera and display so as to avoid the loss of image in display transition. The output resolution of any camera used by a WSTIP member must meet the requirements of at least VGA level of resolution. Any camera-based compression architectures must enable the playback resolution requirements to be met. It is strongly recommend that, wherever possible, all cameras should have as high resolution as possible above the minimum requirements of VGA.

2.4 Frame Rate

Frame rate is most often expressed in frames per second (fps). The frame rate is not a measure of the quality of the image, which is achieved by resolution, but a measure of how any given scene is captured in terms of motion. The more frames per second that are used, the more information is available regarding motion. Full motion video begins at approximately 22 – 24 fps for the human eye, and most VSS equipment will easily capture at rates up to 30 fps. It is recommended that a minimum of 10 fps be used in low traffic areas where limited motion is anticipated and 15 fps where fast moving objects need to be observed. Where motor vehicles or external images from vehicles are recorded, 30 fps should be specified.

2.5 Infrared

The image sensors used in video cameras may be sensitive to a part of the infrared (IR) spectrum that is outside the normal range of human visual perception. This can greatly improve the ability of the camera to record in low-light situations. Due to the fact that images acquired by infrared-sensitive cameras can make some dark clothing and other objects appear lighter than they actually are, it is recommended that infrared-sensitive cameras not be used to record scenes that are well illuminated. Infrared-sensitive cameras are cameras specifically selected to operate at the near infrared end of the light spectrum. These cameras may also require additional infrared lighting to be installed. It is essential that lighting be installed such that it operates in a manner that is safe for the eyes of humans and animals since the eye’s iris will only adjust to the intensity of visible light.

2.6 Wired Vs. Wireless

Internet Protocol Camera technology is very different from "closed circuit television" (CCTV)
technology. Based on the Internet Protocol the cameras can send and receive data via a computer network (WAN/LAN) and the Internet, CCTV (analog) cameras cannot. IP cameras now represent the fastest growing product segment in the video surveillance market. What is driving the market shift away from CCTV technologies is the higher resolutions offered by IP based video devices. Internet Protocol (IP) cameras support mega pixel resolution and output a digital signal over a network, such as Ethernet, and typically contain a compression algorithm within the camera. This output can be transmitted over a wired or wireless network.

Caution must be exercised when considering Wireless IP-based cameras in that the resolution and compression architectures must meet the system design requirements for that location. Wireless IP cameras are useful for remote locations however, unless you are using a high bandwidth and encrypted radio wireless link, care must be taken to record the output of the camera locally in high resolution and that imagery is optimized for the exiting communications network. Interference and capacity issues on the radio network may well restrict its transmission capability and possibly cause corruption of the image file. Public unlicensed frequencies are prone to capacity issues as well as potential loss of signal. For this reason, images that originate from wireless camera locations and have no local recording may only be useful for ‘observation’ or ‘situation awareness’, and may not be admissible in court due to ‘chain of evidence’ requirements and use of a public frequency. Due to this uncertainty it is therefore recommended to install wired cameras wherever possible.

2.7 Interface Tools

Interface tools are the products used to collect, record, store and process the collected data produced by the cameras. In some cases hardware and software solutions are provided for use on board fixed route and paratransit buses such as thin-client tablet PCs. These tools need to provide the WSTIP member the ability to interact with the data in the most reasonable amount of time since many WSTIP members have limited personnel and are only capable of devoting part-time status to data handling and processing. Any interface tool should require a minimum amount of training. These systems, at minimum, need to enable the user to view, edit, catalog and store the data all within the chain-of-evidence framework. Most manufactures provide digital signature marking capabilities.

3. Camera placement

It is important that the vehicles be not only equipped with quality hardware but well placed hardware. The most common configurations are four and eight camera arrangements although smaller vehicles (vans) use between four and six cameras and the larger buses from eight and up. It should be noted that as the cost of cameras and supporting hardware prices come down transit agencies are moving towards comprehensive twelve camera configurations (see suggested layout).

Camera placement is tied directly to the operations of the vehicle and the safety of the operators and passengers. Imagery needs to be collected at several common points, regardless of the vehicle. Minimum coverage areas are down the aisle front-to-rear, front outward, driver/stairwell (fare box) and the exit door/stairwell. Secondary views are up the aisle middle-to-front, up aisle

---

2 American Public Transportation Association IT-RP-001-08 V2.0
rear-to-front, exterior front-to-rear passenger side and increasingly exterior front-to-rear driver’s side.

Typical Eight-Camera Configuration

<table>
<thead>
<tr>
<th>Camera</th>
<th>Angle</th>
<th>Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front outward</td>
<td>6.0 or 8.0mm</td>
</tr>
<tr>
<td>2</td>
<td>Down aisle front to rear</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>3</td>
<td>Driver/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>4</td>
<td>Up aisle middle-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>5</td>
<td>Exit door/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>6</td>
<td>Up aisle rear-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>7</td>
<td>Exterior front-to-rear driver’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
<tr>
<td>8</td>
<td>Exterior front-to-rear passenger’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
</tbody>
</table>

Cameras should be configured to the specific view and associated lightning expectations. It is common to add additional IR lighting to cameras (either built in IR or separate IR emitter) to the camera responsible for the driver and stairwell. It should also be noted that all on-board cameras should be hard wired, not wireless. It enables the most effective security and hardening of the device for security and longevity and in most cases new vehicles are pre-configured for ease of installation, if not installed at the factory.

4. Microphones

In most cases the WSTIP members will want to collect associated audio with some of the cameras. Audio can be provided via embedded microphones in the cameras or independently placed microphones. Independent placement is preferred as it enables the directed recording where cameras/microphone combinations may pick up unwanted ambient noise. Audio collection is important in customer services incidents and paramount in any event where the safety of the
operator or passengers is question. Some jurisdictions debate the legality of audio collection throughout the vehicle, however many agencies consider it standard practice to place microphones in the front of the vehicle to capture the driver’s interactions with the riders as well as record significant events. WSTIP members should verify any legal questions with their own counsel.

5. GPS

Global Positioning Satellite (GPS) data has become a mainstay in the hardware/software offerings by the equipment vendors. GPS data enables the data collection and evaluations systems to tie a location to the collected data and can be integrated into cameras. This function allows the participating agencies to view the collected data in both time and location but also enables the real-time monitoring of the vehicles location. This real time data can then tied to the dispatching function of the agency.

GPS signals can be affected by surrounding terrain that can often “shadow” the signal, leaving gaps in the data. It is therefore important that the GPS antenna be properly positioned. The hardware vendors offer many different GPS solutions for both inside and outside the vehicle. In areas where participating agencies may be affected by surrounding terrain it is recommended that the GPS antenna be placed on the outside of the vehicle giving it the best possible “view” to the overhead satellites.

6. Recording Systems

Transit designed -digital storage solutions are common to all vendor offerings. They come in a variety of sizes and usually designed to support a certain number of cameras (usually hardware limitations due to processing power and/or storage). The digital data streams from each camera are recorded onto a hard drive located securely within the storage appliance itself.

Recording capacity is a major issue when designing any VSS system. System design needs to ensure that the recording requirements are sufficient for general operational needs plus a reasonable percentage of spare capacity (25%+). For instance, a modern network camera using a minimum of VGA resolution (640x480), with low compression, and an acceptable frame rate may well output the following (see table below):

<table>
<thead>
<tr>
<th>Frame rate</th>
<th>Bit rate</th>
<th>Storage/minute</th>
<th>Storage/hour</th>
<th>Storage/day (24 hours)</th>
<th>4 Cameras</th>
<th>8 Cameras</th>
<th>12 Cameras</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 fps</td>
<td>1.5 mbps</td>
<td>15 MB</td>
<td>900 MB</td>
<td>2.16 GB</td>
<td>8.64 GB</td>
<td>17.28 GB</td>
<td>25.92 GB</td>
</tr>
<tr>
<td>10 fps</td>
<td></td>
<td></td>
<td></td>
<td>5.4 GB</td>
<td>21.6 GB</td>
<td>43.2 GB</td>
<td>64.8 GB</td>
</tr>
<tr>
<td>20 fps</td>
<td></td>
<td></td>
<td></td>
<td>9 GB</td>
<td>36 GB</td>
<td>72 GB</td>
<td>108 GB</td>
</tr>
</tbody>
</table>

It is therefore recommended that a minimum of 750GB of on-board storage be used for each vehicle to allow for at least one week of data collection. Additionally, some recorders have a redundant drive for back-up and this is also a recommended practice.

In all cases, the operational procedures for the handling of VSS storage media must ensure that appropriate processes are in place. It should be noted that in all cases, a digital signature or
hashing method of marking frames outside of the data area MUST be used.

6.1 Camera Resolution

Transit digital storage solutions must record each frame at an appropriate resolution so that the end-to-end playback capability of the recorded image can achieve not less than the original resolution that the camera produced.

NOTE: Transcoding of images to improve storage capacity may invalidate the ability to present the recorded images as evidence in a court of law.

A clear understanding of the compression methods used must be made so that artifacts from the compression algorithm do not compromise the resolution of the cameras image. Failure to choose the correct codec and image compression may render any post-event analysis task difficult. Particular care must be taken when considering a compression codec that is recording based on 'motion', as different compression methods perform differently.

6.2 Output Devices

6.2.1 Mass Long-term Storage

Digital recording solutions must be capable of exporting exact duplicates of the recorded images to removable media, either from the on-board video recorder by pulling the hard drive, by using a portable memory stick, using a laptop with a wired or wireless connection, and/or by transferring data directly to a central storage via a Wireless Local Area Network (WLAN) or a 3G/4G data connection from a major telecommunication carrier. This is necessary so that transit operators, security agencies, and law enforcement agencies can obtain copies of the recorded digital files that are a bit-for-bit copy of the files stored on the system.

6.2.2 Incident Data Files

It is recommended that these systems have the ability to output usable video recordings to be played back on a laptop or personal computer using Microsoft Windows or Macintosh Apple applications. The ability to export the recorded images to portable storage such as DVD (Digital Versatile Disk) or Blue Ray DVDs from a central processing (docking) station should be provided. The greater storage capability of DVDs will reduce the number of disks needed to store the recording on removable media. Systems designed to output to DVD should be capable of making bit-for-bit copies of files recorded on the system hard drive(s) which will also preserve the digital signature or hashing.
7. SUGGESTED LAYOUT

7.1 Suggested Four Camera Configuration

<table>
<thead>
<tr>
<th>Camera</th>
<th>Angle</th>
<th>Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front outward</td>
<td>6.0 or 8.0mm</td>
</tr>
<tr>
<td>2</td>
<td>Down aisle front to rear</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>3</td>
<td>Driver/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>4</td>
<td>Up aisle middle-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
</tbody>
</table>

7.2 Suggested Eight Camera Configuration

<table>
<thead>
<tr>
<th>Camera</th>
<th>Angle</th>
<th>Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front outward</td>
<td>6.0 or 8.0mm</td>
</tr>
<tr>
<td>2</td>
<td>Down aisle front to rear</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>3</td>
<td>Driver/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>4</td>
<td>Up aisle middle-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>5</td>
<td>Exit door/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>6</td>
<td>Up aisle rear-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>7</td>
<td>Exterior front-to-rear driver’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
<tr>
<td>8</td>
<td>Exterior front-to-rear passenger’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
</tbody>
</table>
### 7.3 Suggested Twelve Camera Configuration

<table>
<thead>
<tr>
<th>Camera</th>
<th>Angle</th>
<th>Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front outward</td>
<td>6.0 or 8.0mm</td>
</tr>
<tr>
<td>2</td>
<td>Down aisle front to rear</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>3</td>
<td>Driver/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>4</td>
<td>Up aisle middle-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>5</td>
<td>Exit door/stairwell</td>
<td>3.6mm</td>
</tr>
<tr>
<td>6</td>
<td>Up aisle rear-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>7</td>
<td>Center Up aisle rear-to-front</td>
<td>2.5 – 4.0mm</td>
</tr>
<tr>
<td>8</td>
<td>Exterior front-to-rear driver’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
<tr>
<td>9</td>
<td>Exterior front-to-rear passenger’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
<tr>
<td>10</td>
<td>Exterior rear-to-front driver’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
<tr>
<td>11</td>
<td>Exterior rear-to-front passenger’s side</td>
<td>6.0 – 8.0mm</td>
</tr>
<tr>
<td>12</td>
<td>Exterior rear back-up</td>
<td>6.0 – 8.0mm</td>
</tr>
</tbody>
</table>
8. DEFINITIONS

Pixel  
A pixel (short for picture element, using the common abbreviation "pix" for "picture") is a single point in a graphic image.

CIF  
Pixel resolution of a video image - for PAL video, CIF is 352X288 pixels; for NTSC video, CIF is 352X240 pixels

2CIF  
For PAL video, 2CIF is 704X288 pixels; for NTSC video, 2CIF is 704X240 pixels

4CIF  
For PAL video, 4CIF is 704X576 pixels; for NTSC video, 4CIF is 704X480 pixels

Codec  
A codec is a device or program capable of performing encoding and decoding on a digital data stream or signal. The word codec may be a combination of any of the following: 'Compressor-De-compressor', 'Coder-Decoder', or 'Compression/Decompression algorithm'.

D1 resolution standard. In the NTSC system, "Full D1" means 720x480 pixels, and in the PAL and SECAM systems full D1 is 720x576. You also see "cropped D1", which is 704xNN, which is useful because the 8 pixels on either edge of the video frame aren't supposed to contain useful information. Therefore, some programs will prefer the cropped D1 resolution to save bandwidth. Other popular resolutions are often described in terms of D1: the SVCD resolution is 2/3 D1 (480xNN) and 352xNN is 1/2 D1. Occasionally you see SIF somewhat inaccurately described as 1/4 D1.

Frames  
In film, video production, animation, and related fields, a frame is one of the many still images which compose the complete moving picture.

H.264  
H.264, also known as MPEG-4 AVC (Advanced Video Coding), is a video compression standard that offers significantly greater compression than its predecessors. The standard is expected to offer up to twice the compression of the current MPEG-4 ASP (Advanced Simple Profile), in addition to improvements in perceptual quality. The H.264 standard can provide DVD-quality video at under 1 Mbps, and is considered promising for full-motion video over wireless, satellite, and ADSL Internet connections

Cat6  
Category 6 cable includes four twisted pairs in a single cable jacket. This use of balanced lines helps preserve a high signal-to-noise ratio despite interference from both external sources and other pairs (this latter form of interference is called cross talk). It is most commonly used for 100 Mbit/s networks, such as 100BASE-TX Ethernet.

I Frames  
I-frames are used for random access and as references for the decoding of other pictures. Intra refresh periods of one-half second are common on applications such as digital television broadcast and DVD storage.
P Frame  Older standard designs (such as MPEG-2) use only one previously decoded picture as a reference during decoding, and require that picture to also precede the P picture in display order. However, H.264 uses multiple previously decoded pictures as references during decoding, can have any arbitrary display-order relationship relative to the picture(s) used for its prediction and typically requires fewer bits for encoding than do I pictures.

FOV  The 'field of view' is the area of a scene, observed by a camera and lens combination and measured both horizontally and vertically, that can be seen through the camera. Differing lenses can be configured for wide angle FOV or narrow FOV, depending on the requirements and whether it is measured as a ratio of the min and max ranges of the FOV in either degrees (angular) or mms (linear).

NVR  A network video recorder (NVR) is a device that records video in a digital format to a network storage device, typically a disk drive.

VGA  Video graphics array (640x480): a standard-resolution standard for displaying text, graphics, and colors on computer monitors.

SVGA  Super video graphics array (800x600): a high-resolution standard for displaying text, graphics, and colors on computer monitors, a higher standard than VGA.

10. ABBREVIATIONS AND ACRONYMS

APTA  American Public Transportation Association
CD  Compact Disc
CIF  Common Intermediate Format
DVD  Digital Versatile Disk
DVR  Digital Video Recorder
FOV  Field of View
FPS  Frames per Second
IP  Internet Protocol
JPEG  Joint Photographic Experts Group
LAN  Local Area Network
LED  Light Emitting Diode
MPEG  Moving Picture Experts Group
NTSC  National Television Standards Committee
PAL  Phase Alternating Line
PM  Preventative Maintenance
PTZ  Pan Tilt Zoom
VHS  Victor Hitachi Sharp (tape-based video recording) - also referred to as Vertical Helical Scanning and Video Home System
VSS  Video Surveillance Systems
WAN  Wide Area Network
WLAN  Wireless Local Area Network
9. REFERENCES

This document has taken input from the following publications and interviews:

SWGIT document on recommended guidelines for the use of cameras and recording systems in law enforcement applications.

APTA VSS Placement Standard for Transit Applications; APTA S-FS 002-07 (June 07)

Intercity interview (June 2010)

Valley Transit interview (June 2010)

Everett Transit (June 2010)

Apollo Technologies interview (June 2010)

SEON Technologies (June 2010)

AXIS interview (July 2010)
A. Introduction

With the rapid development of technology, certain resources have recently become available for tracking of vehicles and surveillance in the vicinity of the vehicles. These new technologies provide significant enhancements for risk management. However, some unions representing operators or vehicle maintenance employees of vehicles equipped with Digital Recording Systems (“DRS”) may portray the introduction of these technologies as risking the inappropriate use of the video for expanded disciplinary surveillance and an infringement on personal privacy rights.

These materials are intended as a general guide concerning the labor law implications stemming from the implementation and use of DRS on buses or on agency premises. These guidelines are general in nature and do not take into consideration the specific contract or policy language you might already have in place. After covering the general legal foundation covering the introduction of new technology into the workplace, I will address pointers on how to introduce the topic with affected unions and successfully bargain the right to use the results of the new technology. This general guide will end with examples of good and bad contract or memorandum of understanding language related to DRS use.
B. Legal Overview

Public transit agencies in Washington State are covered under the Public Employee Collective Bargaining Act, RCW 41.56. Private subcontractors to these public transit agencies are in turn covered by the National Labor Relations Act. Given the overwhelming proportion of service provided by public agencies, these materials will primarily focus on the law under RCW 41.56.1

In order to determine what, if anything, must be bargained with the union concerning the introduction of cameras or other related technology, it is important to understand the scope of the bargaining obligation. The Public Employment Relations Commission (“PERC”) divides possible topics for bargaining into three categories: 1) mandatory subjects; 2) permissive subjects; and 3) illegal subjects. Matters falling into the first category must be bargained with a union if they demand bargaining, absent some form of a waiver. Matters falling in the permissive category can be bargained with a union but that decision is discretionary with the employer. Also, for permissive subjects, even when an employer agrees to address the topic with the union, an employer is free to cut off bargaining at some pre-impasse point in the process. Matters involving permissive subjects cannot be submitted to interest arbitration if the parties are unable to reach agreement. On the other hand, mandatory subjects of bargaining can be submitted to interest arbitration, absent an agreement by the parties.

Illegal subjects of bargaining rarely emerge and are not relevant to the discussions involving this technology topic.

What constitutes a mandatory subject of bargaining?

Mandatory subjects of bargaining involve those that relate to wages, hours and working conditions. Certain topics, such as wages, insurance benefits and uniforms, clearly constitute a mandatory subject of bargaining. For topics that are not so clear-cut there are two principal considerations weighed: (1) the extent to which managerial action impacts the wages, hours and working conditions of employees; and (2) the extent to which managerial decisions are deemed essential managerial prerogatives. International Association of Firefighters, Local 1052 v. PERC (Richland), 113 Wn.2d 197, 200 (1989). The Supreme Court held in Richland, “[t]he scope of mandatory bargaining is limited to matters of direct concern to employees.” The Richland court also stated that “managerial decisions that only remotely affect ‘personnel matters’ and decisions that are predominantly ‘managerial prerogatives,’ are classified as non-mandatory subjects.” Richland, 113 Wn.2d at 200. This is often referred to as the “balancing test.”

---

1 The National Labor Relations Board, the federal agency governing private sector labor law, has ruled consistent with the Public Employment Relations Commission regarding use of cameras in the workplace. If employers want to install cameras to document actions for disciplinary purposes, that is a mandatory subject of bargaining. Colgate-Palmolive Co., 323 NLRB 82 (1997).
The PERC has recently explained how it applies these legal standards to technological change. *King County*, Decision 9495-A (PECB, 2008). The PERC explained as follows:

When a subject such as a technological change relates to both conditions of employment and managerial prerogatives, the Commission applies a balancing test on a case-by-case basis to determine whether an issue is a mandatory subject of bargaining. The inquiry focuses on which characteristic predominates. While management decisions concerning permissive subjects need not be bargained to impasse, an employer still may have an obligation to bargain the impacts/effects that such decision has on employee wages, hours, and working conditions. A union that fails to timely request bargaining over a decision, or the effects of that decision, after receiving adequate advance notice from the employer waives its right to bargain.

*Id.*

The PERC has applied this balancing test to the introduction of cameras in a variety of contexts. In *King County* the issue involved installation of cameras at solid waste transfer stations. Since at least 1994, video cameras had been used in a limited capacity at some of King County’s worksites. These cameras were primarily installed in the “scale houses” and were pointed at the cashier’s location and the gates to the property. Up through 2004, there was no indication that these cameras were used to discipline truck drivers or transfer station operators who worked at the transfer sites.

In 2004, King County wanted to expand the use of cameras at transfer stations. The first expansion focused on portions of the premises for security purposes, and was not motivated by a desire to uncover evidence of employee misconduct for disciplinary purposes. The second expansion was directed towards the employees, and, the PERC concluded, was in part for the purpose of uncovering misconduct that could lead to discipline. The PERC concluded that because the first expansion was primarily for security purposes, the County had no obligation to bargain the decision to install the cameras.

As for the second expansion, the PERC concluded that the purpose was substantially different from the security focus of the initial set of cameras. In the second expansion, the results of the camera systems could be used for disciplinary purposes. In such a circumstance, the County had to notify the union of its intent to use the cameras for employee discipline and, upon request, bargain with the union both the decision to use those cameras for discipline and the effects of that decision.

In another decision involving the use of video recordings in the workplace, the Commission grappled with use of video from cameras in the Snohomish County Jail. *Snohomish County*, Decision No. 9678 (PECB, 2007). The Commission concluded that
the cameras in the Snohomish County Jail were primarily for security purposes and to preserve evidence relevant to possible inmate lawsuits. Then the County received a report of a security lapse by certain jail personnel. As part of the investigation into that security lapse, the County reviewed the video recording. The Commission found that the review was appropriate since the County acted upon information obtained independently from the video recording and the recording was merely corroborative, circumstantial evidence in the investigation.

C. Application of PERC Precedent to Transit Camera/DVR Installation

Based on the balancing test set forth above, it is critical for transit agencies desiring to install camera systems on their buses to emphasize the intended purposes other than discipline as much as possible. This would include the focus on video that could be used to deter misconduct, investigate accidents, and defend against claims and false accusations. It would also focus on the use of video to investigate customer complaints and to protect operators from spurious complaints or assaults by passengers. If the focus is on the use of video cameras as a tool to uncover employee misconduct, it is likely that the PERC would conclude both the decision and the effects of the decision to install video cameras on buses would be mandatory subjects of bargaining. In such a situation, the agency could not proceed with installation and use of the DRS system until the dispute is resolved through interest arbitration.

Even if the agency is successful in casting the decision as primarily a managerial prerogative to address accidents and other security issues, the agency will still have a duty to bargain, upon a union’s request, the impact of such cameras on employees. This impact bargaining would focus primarily on when, if ever, the agency could use the results from the DVR as the basis for discipline against an operator. In the next section of this general guide I will suggest certain approaches to an agreement on the use of video camera results.

In a situation where the decision to introduce new technology, such as a camera system, is a permissive subject of bargaining, but a duty to impact bargain exists, an employer may proceed with the installation of the new technology even though impact bargaining is not complete. Stated another way, if the union attempts to block the installation of systems on the buses until the completion of impact bargaining, an employer need not agree.

D. Suggestions for Bargaining Regarding Use of Video Cameras

Given the likelihood that your represented employees may demand to bargain over the allowable uses of the video cameras, and that the PERC would find an obligation to engage in impact bargaining on this topic, I want to furnish a few practical suggestions on approaches to such impact bargaining.
As you approach impact bargaining you should think from the union’s perspective. What likely is the real concern they have? The most common concern is for employers doing random searches through the video camera results to uncover evidence of misconduct that could be the basis for discipline. Almost all agencies have no interest in doing such random searching, even if they have the resources to do so. Therefore, one of the early responses to union concerns is to reassure them that this is not the agency’s intent.

Second, it is helpful for the agency to focus on the benefits of the video system for operators. There is significant evidence that agencies which have used video cameras for several years have been able to use the results of the cameras to exonerate operators who have received bogus customer complaints. They have also been useful in exonerating operators from fault in accidents. Video can also be a useful tool to address fare evasion. The presence of video cameras hopefully can provide a deterrent to assaults on operators. Video can help identify passengers who do assault operators. Digital recording systems are far more beneficial to operators’ interest than not.

Third, the recording can be a robust review and training tool. Coaches have long used the “replay” button to help athletes improve their game. Likewise, operators are able to review the recording of an incident or accident and carefully analyze the circumstances and learn from that review.

What are examples of agreements to avoid? First, do not agree to a blanket prohibition on the use of video cameras for discipline. If you have egregious misconduct such as a criminal matter or a sexual assault of a developmentally disabled passenger, the results of the video camera may be prime evidence in proving or disproving that misconduct. An employer may be placed in an untenable position of knowing of criminal conduct through review of video, but having contract language precluding action based on such video.

Second, don’t limit the allowable use to training only. Review of video to highlight recurring unsafe driving practices may be a very valuable tool for focusing training, but it should be available for at least some categories of discipline above and beyond remedial training.

Third, don’t limit the use of video review to accidents only. Although this is a very important piece in the reason for introducing cameras, use in other contexts, such as investigating customer complaints, and third party assistance such as to law enforcement is also very important.

Fourth, avoid agreements which preclude a camera focused on the driving compartment. There are many reasons, including new legislation precluding the use of cell phones while driving, to have some video record of what is actually happening in the driving compartment. Video capture of the operating compartment also completes the left front view of the vehicle. This information can be critical in accident analysis and claims.
mitigation. WSTIP reports that recent serious accidents have involved buses turning left into occupied crosswalks.

Fifth, be careful about defining a narrow span of time around the precipitating event for review. This is particularly problematic for customer complaints. It may be important for you to understand what preceded the actual incident that led to the complaint in order to understand the entire context. Some agreements limit the span to 30 seconds on either side of the precipitating event. This is too narrow. Also, customers routinely furnish the wrong time of an incident when they complain. In such situations it is necessary to expand the scope of the video review to find the actual incident.

What are hallmarks of good agreements regarding use of cameras? I have attached a number of sections from collective bargaining agreements and letters of agreement as examples of what other agencies have already put in place. The agreement from the Whatcom Transit contract underscores a number of beneficial provisions. First, the agreement recognizes that video can be used as part of previously-announced ride checks. This would allow a trainer or supervisor to focus on certain driving practices revealed in a review of the operator’s video. Second, the agreement allows the use of camera and audio recordings for the investigation of complaints, accidents, or other precipitating causes. The precipitating-cause trigger is also reflected in the letter of agreement at Spokane Transit and in the collective bargaining agreement at Community Transit. Notice that the precipitating cause language is not limited to accidents only. The agreements at Whatcom Transit and Spokane Transit expressly allow the agency to take action for misconduct uncovered in a legitimate review, even if unrelated to the original precipitating cause.

The Whatcom Transit agreement further allows the use of cameras as part of previously-announced surveys regarding safety, security, customer service and regulatory compliance. A prime example in this area would be use to check about ADA callouts.

You should also consider language that would allow routine review of digital video recording to determine remedial training needs. Such remedial training would be disconnected from any discipline. The Whatcom Transit contract includes such language.

A final hallmark of a good agreement is a recognition that evidence of criminal activity or traffic violations that rise to a level that could precipitate a charge or citation may be acted on in all situations.

E. Checklist for Approaching Labor with Camera Installation Issue

1. Consider involving union/operators in the design of the camera system. In many situations, the involvement of employees and their labor representatives during the phase of developing the specifications for new technology
generates greater buy-in by those employees without aggressive demands to bargain.

2. Notify union of intent to install camera systems. Once the agency has made the decision to move forward with camera installation, it is best to give written notice to the affected unions of such decision. This written notice is also a prime opportunity to emphasize the non-disciplinary purposes for installing cameras. The notice should also give the union a defined time period to respond if they believe there are any issues to impact bargain. I’ve attached a sample letter from Intercity Transit providing such notice. If a union fails to respond within the allotted time, you have set up a waiver-by-inaction defense if they demand to bargain at a later point.

3. Engage in impact bargaining. If a union responds to your notice of intent and seeks impact bargaining, set up meetings to commence such bargaining. Be prepared with examples of agreements from other agencies that can provide a starting point for your agreement. Be prepared to listen to your union’s concerns and don’t make assumptions that you understand their concerns.

4. Invoke mediation to provide third-party perspective. If face-to-face discussions are not fruitful, it may be helpful to call for a mediator to assist the parties. Under RCW 41.56, either party may ask for the appointment of a PERC mediator. Unlike an arbitrator, a mediator does not charge for their service. However, unlike an interest arbitrator, a mediator has no power to force either party to agree. If the mediator is unsuccessful, the remaining disagreement can be certified for resolution in an interest arbitration. As discussed above, if the decision is a permissive subject, an agency may proceed with the installation of the camera system even though it is preceding interest arbitration regarding impact bargaining.

5. Interest arbitration. For all represented employees in Washington State public transit agencies, interest arbitration is available to resolve disagreements. This includes disagreements over impact bargaining.

F. Conclusion

The introduction of new technologies such as cameras and GPS tracking systems involves unique challenges under Washington’s labor law. With adequate preparation and a problem-solving approach with the unions, proper agreements can be reached to reflect both the agencies’ and the unions’ interests.
The Washington State Transit Insurance Pool wishes to thank the following people for their contributions to this Best Practice resource document:

Our Legal Team from Summit Law Group – Thank you for your leadership, legal and communication expertise:

- **Bruce Schroeder**, Summit Law Group

Our Review Team – Thanks for giving time to review this document and sharing your experience:

- **Lynn Bourton**, Administrative Services Manager, Link Transit (Wenatchee)
- **Emmett Heath**, Director of Administration, Community Transit (Everett)
- **Ed Ruttledge**, Human Resources Director, Intercity Transit (Olympia)
- **Kimberly Somers**, Human Resources Specialist, Whatcom Transportation Authority (Bellingham)
to re-establish wage scales based upon the type of service for which Operator duties are performed (i.e., fixed-route service, paratransit service or flexible-route service) and separate collective bargaining agreements for those service divisions are re-implemented.

D. The WTA maintains its rights to determine appropriate staffing levels and to create shift assignments in accordance with the parameters established in Article 9 and Article 15 of this collective bargaining agreement.

E. In the event the WTA determines it is in its best interest to utilize service vehicles whose length is in excess of 40 feet, skin to skin, the parties will meet to discuss wage rates for Operators driving these vehicles.

F. No Operator in fixed-route or paratransit service employed on May 24, 2004, shall be required to cross-train.

G. Cross-training will be made available at least once each calendar year.

Section 22: On-Board Camera and Data Systems
The purpose of WTA's on-board camera and data system is to enhance safety, security and customer service. On-board camera and audio recordings may be used for the following reasons:

a) Previously announced ride checks. Information gathered would be used in the same way as information obtained by personnel assigned to complete a ride-check.

b) Investigations of complaint, accident or other precipitating cause. Information obtained in such a review, even if unrelated to the original precipitating cause, may initiate corrective action taken in accordance with progressive discipline provisions of this contract.

c) Previously announced surveys regarding safety, security, customer service and regulatory compliance.

If criminal activity or traffic violations that rise to a level that could precipitate a charge or citation or violations of safety-related policies are discovered in any of these reviews, corrective action may be taken in accordance with progressive discipline provisions of this contract.

In addition to a) through c) above, routine reviews of digital video recording may be made to determine remedial training needs. If criminal activity or traffic violations that rise to a level that could precipitate a charge or citation are discovered in such reviews, corrective action may be taken in accordance with progressive discipline provisions of this contract.
LETTER OF AGREEMENT
between
AFSCME LOCAL 3939
and
SPOKANE TRANSIT AUTHORITY
On-Board Digital Recording Devices

Spokane Transit Authority and AFSCME Local 3939 agree to the following:

1. STA desires to use on-board digital recording devices ("Equipment") on its revenue vehicle fleet to increase public and operator safety, manage risk, provide additional training opportunities and maximize service to the public. AFSCME members are encouraged to inform their supervisors of recorded events that may have value for training purposes.

2. STA and the Union acknowledge that the primary purpose of the Equipment is to increase public and operator safety. Therefore, the parties agree that video and audio information recorded by the Equipment shall not be randomly or routinely reviewed for performance reasons. This is referred to by the parties as "targeted surveillance" or "fishing." Such targeted surveillance or fishing is not allowed. STA, its managers or supervisors and/or the Union, however, may review the video and/or audio recordings of the Equipment when there is a precipitating event or articulable reason warranting the review (the "Precipitating Event"). The Precipitating Event may include, but is not limited to: (1) a customer or operator complaint, (2) an accident or incident, (3) a claim filed against STA, (4) investigations of misconduct, or (5) police requests. In the event the Union identifies a Precipitating Event it would like to review, the Union shall make its request to review the information to the ________ and provide a description of the Precipitating Event warranting the review.

3. When reviewing information recorded by the Equipment, STA managers/supervisors will fast forward until five minutes before the Precipitating Event and five minutes after the Precipitating Event. For purposes of this MOU, the duration of the Precipitating Event for purposes of calculating the beginning and ending of the permissible review will include any act or omission that is related to the Precipitating Event. For example, the duration of a Precipitating Event relating to a customer or driver complaint will include the entire route on which the subject customer was a passenger. The duration of a Precipitating Event relating to an accident will include the period of impact through the time period in which the driver is released from the scene. Information obtained in such a review, even if unrelated to the precipitating cause, may be considered by STA in making an appropriate response or initiating discipline.

4. The Equipment shall not be used to record protected Union speech. The Union agrees to caution its stewards, officers, agents and members to exercise its due diligence in discussing Union protected speech in private.

5. Except as set forth herein, the remaining terms and condition of the parties’ collective bargaining agreement remain in full force and effect.

SPOKANE TRANSIT AUTHORITY

Steve Doolittle
Human Resources Manager

AFSCME LOCAL 3939

Dean Vercruysse
President/Business Agent
Appendix A

ATU-CT 2009-2012 Agreement

- Make necessary announcements to customers,
- Announce transfer point, and
- Identify your route at multi-routed zones.

Discipline for ADA announcement infractions:
First Offense = counseling and verbal reprimand
Second Offense = counseling and written reprimand
Third Offense = counseling and 3-day unpaid suspension
Fourth Offense = Hearing for Discharge

2. Minor Infractions
   Step 1: First infraction = counseling
   Step 2: Second infraction = counseling and written reprimand
   Step 3: Third infraction = counseling and 1-day unpaid suspension
   Step 4: Fourth infraction = counseling and 3-day unpaid suspension
   Step 5: Fifth infraction = hearing for discharge

3. Major Infractions
   Step 1: First infraction = counseling and written reprimand
   Step 2: Second infraction = counseling and 1-day unpaid suspension
   Step 3: Third infraction = counseling and 3-day unpaid suspension
   Step 4: Fourth infraction = hearing for discharge

4. Severe Infractions
   One offense will usually result in a hearing for discharge. However,
   consideration of mitigating circumstances may warrant a suspension without
   pay up to 30-days.

B. Audio and Video. The Employer and the Union believe it is important to maintain
   the safety and security of employees and the public. The company will not randomly
   review audio or video data nor review it for the purpose of discovering policy
   violations in the absence of an observation or incident.

   Review initiated by an observation or incident will be for the purpose of determining
   what actually happened and an employee may be subject to coaching, counseling or
   more serious discipline as a result. Any discipline resulting from review of audio or
   video recording must be related to the initial purpose of the review; however,
   discipline may also be issued if review of the data reveals commission of a severe
   infraction unrelated to the original purpose.

C. Removing Infractions. A minor infraction that is one year old shall be crossed off
   the employee’s record. Future discipline will be based on the number of infractions
   that remain. Provided the employee has not received a three-day unpaid suspension
   for the infraction, major or ADA infractions shall also be crossed off the employee’s
   record 12 months after that infraction. For example, if an employee commits a minor
March 23, 2007

Ms. Rita Dilenno, Business Agent

ATU Local 1984
629 12th Avenue, SE #10
Olympia, Washington 98501

Re: On-Board Video Recording

Dear Rita:

Per our conversation on March 21, 2007, Intercity Transit intends to install video recording equipment throughout the revenue vehicle fleet. The primary purposes for installing this equipment are to address safety, security and risk mitigation issues.

As you may be aware, bargaining unit members have been involved in the preliminary work leading to the acquisition of the video equipment. Intercity Transit has received valuable input from employees represented by the Local on the design goals and functionality of the proposed on-board video recording equipment. Intercity Transit employees have also had the opportunity to travel to another property that has a video recording system in place and confer with professional colleagues who are also represented by an ATU Local. The issue has also been the subject of community interest and area media. As a result, I expect this formal notice comes as no surprise to the Local.

Intercity Transit respectfully asserts that the installation of video recording equipment will have, at most, a de minimus impact on the conditions of employment. No “automatic” obligation to bargain in a separate agreement is precipitated by this issue. Nevertheless, this notice is provided to the Local as a matter of courtesy. In the event the Local believes that Intercity Transit has an obligation to engage in “impact bargaining,” the Local is invited to submit a timely demand to bargain. Intercity Transit suggests that a “timely” demand to bargain would be submitted within thirty (30) calendar days of receipt of this notice and certainly no later than May 1, 2007.

Any demand to bargain that may be submitted by the Local will, of course, be considered by Intercity Transit. In the event the Local submits a demand to bargain, it would likely be helpful to the process if the Local identifies what conditions of employment it believes would be changed, why the identified changes have a more than de minimus impact as well as rationale as to why the alleged changes in the conditions of employment override Intercity Transit’s concern for safety, security and risk mitigation.

Sincerely,

Ed Rutledge
Human Resources Director

Cc: Mike Harbour
    Jim Merrill

526 Patterson SE - PO Box 659 - Olympia, WA 98507-0659 • 360-786-8585 • fax: 360-357-4184 • intercitytransit.com
Memorandum of Agreement  
Intercity Transit and ATU Local 1765  
December 1, 2008

Pursuant to a demand to bargain submitted by the Union on April 11, 2007, the parties entered into “impact negotiations” on the effects of implementing a comprehensive on-board digital video recording system throughout the revenue fleet on May 14 and June 25, 2007.

The parties have agreed no recording shall be used by any manager against any ATU member for the purpose of finding misconduct or issuing discipline, referred to by the parties as “targeted surveillance” or “fishing,” except where there is an initiating event such as a complaint, accident, incident or infraction and as referenced in Article IX, Section B of the Labor Agreement.

In cases where the incident is reported by the Operator, the recording of the incident will be reviewed to determine the facts of the incident. If review of the incident reveals a Category C violation, the Operator will be counseled and a report of the incident will be placed in the Operator’s file for a one-year period. This violation will not count toward progressive discipline track for Category C violations. A second self-reported incident that reveals a Category C violation within the same 12-month period will be treated as a regular Category C violation. If review of a recording based on a self-reported incident reveals a Category B or Category A violation, appropriate discipline will take place.

If management determines to review a recording under such circumstances, management will first review the recording to determine if there appears to be a basis for potential discipline. If management determines there may be a basis for discipline, they will notify the Union President/Business Agent and provide a copy of any initiating documentation and permit the Union President/Business Agent or designee to independently review the recording. Following this review, management and the Union President/Business Agent or designee may jointly review and discuss the recording.

Any finding of misconduct or discipline based on such a review must be related to the specific incident which was the subject of the complaint, accident or infraction.

To implement this agreement, the policy and procedures adopted by the Intercity Transit Authority on June 6, 2006 resolve the Union’s concerns regarding “targeted surveillance,” “fishing,” and records maintenance. For example, the adopted policy and procedures permits viewing of recorded material to that which is associated with an “incident.” As a result, “fishing” is not within the adopted policy and procedures.
These June 2007 policies and procedures included the following:
POLICY-OP-5507
PROCEDURE-OP-5507-A
PROCEDURE-OP-5505-B
TASK-OP-5507-A
TASK-OP5507-B
FORM-OP-5507

The parties further agree that any audio record of a "protected" Union conversation shall not be used by any manager in a manner that would be contrary to the interest of a member of the bargaining unit.¹ The Union agrees to caution its stewards, officers, agents and members to exercise due diligence in protecting the Local’s interests and the interests of its members.

In the event Intercity Transit plans to amend the above reference policy and procedures, it shall notify the Union so the Union may submit a timely demand to bargain the impact of any such amendments. This provision includes any additional audio input device outside of the "fare box area" or a video input device that is focused on the "operator's compartments."

[Signatures]
For Intercity Transit
For ATU Local 1765

Date: 1/30/09      Date: 2-2-09

¹ The term, "protected" means that the conversation is member to member or member to officer or vice versa regarding issues of representation or lawful union business.
To: All Supervisors
From: Andrew Overhauser, Frank Bezemer
Date: April 28, 2010
Re: Real Time GPS – Supervisor Vehicles

We determined a need for the Dispatcher to be able to quickly locate Supervisor Road assets throughout the service day by other means than radio transmissions. This will enable the Dispatcher to determine the location of a Road Supervisor instantly before attempting radio contact, identifying the closest Road Supervisor to a needed response. There are also times when hailing a Road Supervisor has had no response. This can be for many reasons; however of paramount concern is the Road Supervisor’s safety should no response be given.

For reasons stated, STA purchased a real time GPS tracking device and installed it on one Supervisor vehicle for testing purposes. Several vendors were considered until LiveView GPS was chosen for the test. LiveView GPS offers comprehensive reports such as historical travel playback, boundary alerts, start/stop durations, and options such as panic alerts and vehicle lock out access.

The testing phase should last about two weeks. The unit was installed on Monday, April 26. All Supervisor road vehicles are scheduled for GPS installation.

As we all know, Supervisor vehicles are for official business only. Because the information is so easy to obtain, it would be embarrassing if you had to explain why you were out of the service area or at Lowe’s to pickup mulch for your garden.

Thank you
Memorandum of Agreement

City of Pullman/Pullman Transit and ATU Local 1015

Pursuant to a request from ATU Local 1015 to bargain the use of video recording, GPS/AVL and other recording devices installed in Pullman Transit vehicles and facilities. The parties agree that no recording devise or GPS reports will be used by any manager, supervisor, or employee against any ATU member for the purpose of finding misconduct or issuing of discipline, referred to by both parties as “targeted surveillance” or “fishing”, except where there is an initiating event such as a complaint, accident, incident, or infraction which occurs. The Employer will fast forward through the recording until the triggering complaint/incident, and will then retain the recording 30 seconds prior to the incident through 30 seconds after the completion of the incident. For accidents, the Employer will fast forward through the recording until the accident, and will retain the recording one minute prior to the accident through 30 seconds after the driver is released from the scene.

Staff considers all materials generated by the DVR system as confidential. Staff will review materials under certain situations, such as, but not limited to:

- Accidents
- Incidents
- Investigations of misconduct
- Operator requests
- Passenger complaints
- Processing a public records request
- Police requests

The parties further agree that any audio record of a “protected”, Union Member, conversation shall not be used by any manager in a manner that would be construed to be “targeted surveillance” or “fishing” except where there is an initiating event such as a complaint, accident, incident, or infraction which occurs.

The Union agrees to caution its stewards, officers, agents, and members to exercise due diligence in protecting the Local’s interest and the interests of its members.

It is further understood by both parties that the installation of the above mentioned equipment is designed as a safety measure to protect the interest of the City, Union, employees and clients of Pullman Transit. It is not being installed for the explicit desire to cause undue harm to the Union or its members, or for any other reason. However, these enhancements may at times be used to
determine what exactly did happen in the event of an incident such as but not limited to a complaint, accident, assault, or injury while in the performance of their duties.

The parties agree that this memorandum shall run for a trial period through the end of the 2009-2010 school year and either party, during the life of this agreement, may sit down and negotiate any complaints or concerns regarding this agreement.

[Signature]
For the City of Pullman/Pullman Transit
Date: 10/21/09

[Signature]
For ATU Local 1015
Date: 10-2-09
Video Surveillance System Technical Recommendations Practice Policy

Purpose

To establish control procedures for the on-board camera system for use in fixed route and paratransit buses that consists of the following components:

- Network cameras
- Network cabling infrastructure
- Digital storage solution
- On board and backup power systems
- Communication system used for data transfer
- GPS systems
- Audio systems used in conjunction with on-board cameras

Policy Statements

Installation Quality

- Create baseline of system installation quality by performing a User Acceptance Testing (UAT) process to ensure that the system components are installed to specifications.
- Implement a change management practice in order to maintain system design documentation.

System Design

1. The system design information is used to provide installation specifications and support the lifecycle maintenance program. Maintaining this documentation is critical to the success of the system and important for legal reasons.

2. The system design documents shall consist of the following:
   a. System Drawings
      i. Device layout on busses
         1. Camera
         2. Microphone
         3. GPS receiver
      ii. Cable path information
      iii. Intended views of camera
iv. Intended listening area of audio

v. Location of digital storage solution, network communications, power systems, and other communication equipment

vi. Document system connection diagrams (e.g. One-line diagram)

vii. Installation details

b. Specifications

i. Maintain record of original specifications

c. Pictures

i. Document key areas with pictures and keep on file with system design information

General Maintenance

• Software and Firmware

  o Software and firmware should be kept up to date. Contact system vendor for updates on when firmware and updates are made available by the manufacturer(s).

• Data management

  o All incident data should be archived at least monthly and kept for three (3) years.

Ongoing Testing Procedures

• The on-board camera system investment is used to support the Transit Agency in the documentation of incidents and events that occur onboard. In order to realize the benefit associated with this system during post-incident analysis, the system must be tested regularly and demonstrate proper performance.

• The following table provides the testing procedures for the on-board camera system.
<table>
<thead>
<tr>
<th>Technology</th>
<th>Life Expectancy</th>
<th>Potential Maintenance Issues</th>
<th>Service Steps</th>
<th>Service Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera</td>
<td>5-7 years</td>
<td>Scratches, dust, smear: i.e. blurry image</td>
<td>Inspect camera and housing for surface damage. Clean or replace polycarbonate cover, or entire camera as required.</td>
<td>Include in daily bus cleaning cycle</td>
</tr>
<tr>
<td>Loose screws</td>
<td></td>
<td></td>
<td>Inspect camera for loose mounting and determine reason for wear. Secure camera with new screws and ensure it is fastened properly.</td>
<td>3 mo.</td>
</tr>
<tr>
<td>Damaged housing</td>
<td></td>
<td>Broken, removed from wall/bus</td>
<td>Replace damaged housing, polycarbonate cover, or entire camera as required.</td>
<td>As required</td>
</tr>
<tr>
<td>Cables</td>
<td>15 years</td>
<td>Loose connections; intermittent signal; Interference from cable abrasions (constant rubbing on rough surface)</td>
<td>Troubleshoot intermittent problem and replace cable as required.</td>
<td>Cameras should be removed and cable terminations inspected every 3 years or when camera is replaced.</td>
</tr>
<tr>
<td>Disconnected, Cable termination failed</td>
<td></td>
<td></td>
<td>Check cable ends for faulty connection and replace termination.</td>
<td>As required</td>
</tr>
<tr>
<td>Power source</td>
<td>3-7 years</td>
<td>Failed batteries, batteries do not provide adequate reserve power</td>
<td>Test battery for charge capacity.</td>
<td>Replace defective batteries as required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power loss, surge, short circuit, intermittent</td>
<td>Test for grounds fault, short circuit, and cable continuity.</td>
<td>Replace cable or components as required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dust free environment</td>
<td>Inspect for dust and dirt that may affect circuitry</td>
<td>Clean power source every 3 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overheat due to environment</td>
<td>Check temperature of component enclosures during bus operation</td>
<td>Replace as required or move power source to cooler area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Service voltages</td>
<td>Test for power supply specification voltage output</td>
<td>Test every 5 years</td>
</tr>
<tr>
<td>Technology</td>
<td>Life Expectancy</td>
<td>Potential Maintenance Issues</td>
<td>Service Steps</td>
<td>Service Frequency</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Digital storage solution</td>
<td>3-5 years</td>
<td>Retention periods</td>
<td>Review recorded video timeframe. Check earliest and latest video data by date and calculate difference. If under 7 days, consult your technical specialist.</td>
<td>Check retention period every month</td>
</tr>
<tr>
<td>MTBF for Hard Drive (HDD)</td>
<td></td>
<td>Indication of HDD wear will come in the form of intermittent or corrupt access to the data.</td>
<td>Replace HDD in the event of failure or every 3 years</td>
<td></td>
</tr>
<tr>
<td>Playback and export of all cameras</td>
<td></td>
<td>Playback all camera feeds on video player, this may require exporting the video data. If audio is connected also check for sound quality.</td>
<td>Review recorded video every 6 mo.</td>
<td></td>
</tr>
<tr>
<td>Live video of all cameras</td>
<td></td>
<td>Inspect each camera video signal by cycling or showing all cameras on the screen. If GPS is connected also check for time stamp and GPS data overlay.</td>
<td>At the beginning of every bus shift</td>
<td></td>
</tr>
<tr>
<td>Sync with central data storage (if applicable)</td>
<td></td>
<td>Review logs and files by date. Ensure the dates for all blocks of data match the bus service schedule.</td>
<td>Review recorded video every 6 mo.</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>7-10 years</td>
<td>Unable to connect to network</td>
<td>Contact IT department to implement standard network troubleshooting steps.</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unable to export data via computer, memory stick, other media</td>
<td>Test the export process by using the main data export methods. Contact IT department to implement standard data transport troubleshooting steps.</td>
<td>6 mo.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not communicating with camera, audio device</td>
<td>Contact system vendor to troubleshoot hardware specific problems. Hardware problems may be caused by configuration issues or failed components.</td>
<td>As required</td>
</tr>
<tr>
<td>Technology (if applicable)</td>
<td>Life Expectancy</td>
<td>Potential Maintenance Issues</td>
<td>Service Steps</td>
<td>Service Frequency</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------</td>
<td>------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GPS Systems</td>
<td>5-7 years</td>
<td>GPS data not recording or displaying to onboard camera system</td>
<td>Contact system vendor to troubleshoot hardware specific problems. Hardware problems may be caused by configuration issues or failed components. Inspect for time and date stamp on camera images.</td>
<td>At the beginning of every bus shift (see digital storage solution section)</td>
</tr>
<tr>
<td>Antenna/receiver unable to locate satellite</td>
<td></td>
<td></td>
<td>Contact system vendor to troubleshoot hardware specific problems. Hardware problems may be caused by configuration issues or failed components. Inspect antenna for damage.</td>
<td>6 mo.</td>
</tr>
<tr>
<td>Audio (If applicable)</td>
<td>5-7 years</td>
<td>Poor sound quality; static, background noise, humming, noise from electrical systems</td>
<td>Contact audio specialist to troubleshoot noise interference problems. Noise may be the result of many things and requires specialized knowledge to isolate the issues.</td>
<td>(see digital storage solution section)</td>
</tr>
<tr>
<td>Loss of audio, Not recording</td>
<td></td>
<td></td>
<td>Contact system vendor to troubleshoot hardware specific problems. Hardware problems may be caused by configuration issues or failed components.</td>
<td>(see digital storage solution section)</td>
</tr>
<tr>
<td>Not synchronized with video</td>
<td></td>
<td></td>
<td>Contact system vendor to troubleshoot hardware specific problems. Hardware problems may be caused by configuration issues or failed components.</td>
<td>(see digital storage solution section)</td>
</tr>
</tbody>
</table>