



# TRAFFIC MANAGEMENT VEHICLE PILOT PROJECT



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## Introduction

In June of 2004, Florida's Turnpike Enterprise initiated one of the most proactive and innovative programs to further their traffic management efforts: the Traffic Management Vehicle (TMV) Pilot Project. This pilot project represents a public-public-private partnership between the Turnpike Enterprise, the Center for Urban Transportation Research at the University of South Florida (CUTR/USF), and Eye In The Sky (EITS).

The Turnpike initiated a contract with CUTR/USF for the mobile traffic management vehicle service, and CUTR/USF engaged the services of EITS to develop and provide the TMV. The TMV service provided by EITS utilizes state-of-the-art digital satellite video technology to transmit live video images to the Turnpike's Traffic Management Centers (TMC) in Pompano and Turkey Creek. This allows the TMC operators to closely monitor traffic conditions and allows for decision makers to make better-informed decisions.

The TMV is a full-sized van equipped with a camera, computer, satellite dish, generator, and other equipment necessary to collect and transmit live video images in real time to the Turnpike's two traffic management centers. Figure 1 shows the TMV in operation at the Southern entrance to the Homestead Extension of Florida's Turnpike near Florida City. The TMV camera is mounted on a telescoping 45 foot boom to allow for distance viewing. The camera features full pan, tilt, and zoom capabilities. This allows the TMV to be positioned in a safe location where it is not impeding traffic flow, and then the camera angle and view can be adjusted to provide the best coverage of the area of interest. Figure 2 shows a view from the ground of the TMV's mast in an up and operational position. The TMV operator sits in a captain's chair in the rear of the vehicle, where he is able to control and monitor all of the TMV operations. The operator controls the raising and lowering of the boom and the pan-tilt-zoom of the camera from this position. The operator has monitors and where he can monitor the signal coming in from the camera, and can also monitor local news reports in the event of major incidents or weather events. Figure 3 shows the inside of the TMV.



Figure 1 – Traffic Management Vehicle



Figure 2 – View of TMV Boom



Figure 3 – Interior View of TMV

## Purpose of the TMV Program

The purpose of the TMV program is to assist the Turnpike Enterprise by providing real-time video monitoring capability in any and all areas of interest. Presently, many areas of the Turnpike system are not covered by Intelligent Transportation Systems (ITS) deployments. This means that in those areas, the TMC operators are operating somewhat in the dark when there is an incident or reports of traffic congestion. The operators would have to rely on reports that come in from the Florida Highway Patrol, 511, or other traffic information outlets. In many cases, the information provided by these outlets proves to be less than real-time and in some cases is inaccurate. In order to provide reliable travel information to Turnpike patrons, the TMC must have reliable traffic data. By using the TMV, the TMC operators have a first-hand view in real time of what is happening out in the roadway. The TMV is designed to go to any area of interest, and transmit video images back to the TMC so that the operators can then relay accurate real-time information to patrons via the Dynamic Message Signs (DMS) or the Highway Advisory Radio (HAR) systems.

A very significant part of the TMV purpose is to assist in traffic incident management efforts. The Turnpike is recognized across the state as one of the leaders in traffic incident management. Whenever an incident occurs on a high-speed limited access facility, there is a risk of secondary collisions due to high-speed traffic suddenly running up on traffic that is backed up from an incident. In many cases secondary collisions end up being worse than the primary incident that caused them. In addition to the safety and operational concerns related to incident management, to the Turnpike Enterprise, delays or traffic diversion due to major traffic incidents can present a significant loss in revenue.

In the past year, the Turnpike has also implemented the Roadway Incident Scene Clearance (RISC) program. This program utilizes a very select group of tow and recovery operators that are specially trained and equipped to handle major incident clearance. The RISC program provides financial incentives to the towing contractor for meeting certain clearance time criteria, and assesses liquidated damages if the scene is

not cleared in a timely manner. The TMV has been used on several occasions to assist in monitoring and tracking the timeline of events within RISC incidents to insure and/or document compliance with the stated clearance time goals of the RISC program.

As mentioned above, another key benefit of the TMV program is that it allows monitoring in areas where gaps exist in ITS deployment. Even after all of the planned ITS deployments are in place, there will continue to be portions of the Turnpike system that will not have adequate video coverage. Also, in some areas where there may be deployments, there will be situations where the fixed camera locations will not provide adequate views of the particular scene of interest. In many instances, horizontal or vertical curves, bridges and overpasses, as well as utility poles and buildings provide challenges to being able to see every area of the roadway from a relatively small number of camera locations.

The TMV has also proven useful in monitoring heavy traffic due to special events. The TMV has been deployed to monitor traffic before and after Miami Dolphin and Florida Marlin home games at ProPlayer Stadium, concerts and events at the Sound Advice Amphitheatre, races at Homestead Motor Speedway, and other events at several venues throughout Southeast Florida. In many of these locations, events are relatively rare, so a permanent camera installation would not be a cost-effective ITS deployment. By using the TMV for these events, the Turnpike has a camera where it is needed when it is needed.

In addition to deployments for incidents and special events, the TMV is routinely sent to areas of known recurring congestion. This allows the TMC operators to monitor traffic in the vicinity and post appropriate messages to alert approaching motorists of the congestion ahead of them.

The TMV is a self-contained traffic management center, so it can operate in adverse conditions when there is no power or communications. The power to run the TMV comes from the onboard generator, and the digital satellite communications do not

require any connection to any hardwired or ground-based wireless communication system. The robustness of the communication system of the TMV was displayed in the aftermath of the 2004 hurricane season. The TMV was deployed to several locations that had been hit hard by the various hurricanes. Even though there was no power, and the cellular and microwave wireless networks were down, the TMV was able to transmit video back to the TMC.

One of the significant improvements to the TMV operation that came out of the hurricane deployments was improvement to the redundancy of the voice communications between the TMV and the TMC. Typically, the TMV operators stay in contact with the TMC operators via Nextel phones. However, in the aftermath of a hurricane or other disaster, the cellular networks are not always operational as towers are either damaged or are without power. When this first occurred, the TMV and TMC operators were able to communicate by instant messaging via the internet. Since the TMV had satellite internet connectivity, it was able to transmit/receive messages to/from the TMC even when other communication networks in the area were completely shut down. For subsequent hurricane deployments, the TMV and TMC were issued satellite telephones so that real-time voice communications could be maintained even in adverse situations.

## Routine Deployments of the TMV

The TMV is scheduled for normally 40-hours of deployments per week. The Turnpike TMC staff releases the schedule each week of the upcoming week's routine scheduled deployments. The normal hours of TMV deployment are Monday through Friday from 6:00 to 10:00 AM and from 4:00 to 8:00 PM. These hours were picked to coincide with the Road Rangers, and to ensure coverage of the peak-hour travel periods. Figure 4 shows a TMV video image from a routine monitoring deployment. The TMV has typically been deployed at known congested areas in an effort to capture real-time video in areas of recurring congestion. The video obtained from these locations assists the Turnpike Traffic Operations Office in analyzing the operation of the area in question to determine what countermeasures might best address the congestion being experienced. Traffic Operations has requested several TMV deployments to monitor areas where congestion frequently occurs such as Commercial Boulevard, Sample Road, and PGA Boulevard.

Many of these locations are places where the traffic backup from the ramp terminal intersections back up onto the mainline through lanes. This presents a particularly tenuous situation where high-speed rear-end collisions are more likely to occur. In some cases, the Turnpike will temporarily suspend toll collection in an effort to clear out this congestion and improve the safety of the system. By being able to better monitor and understand what is occurring at these intersections, the Turnpike can expect to minimize the amount of time when tolls are suspended. Thus, having active traffic monitoring of these congested locations can be expected to have a net positive effect on toll revenues.

Other locations that are typically monitored in the routine operation are some of the more heavily congested toll plaza locations, where long queues form that result in large delays to the Turnpike patrons. These backups also sometimes obstruct access to the SunPass only lanes, which also can be a safety concern, as the SunPass customers are used to driving through the toll plazas unimpeded and may not be expecting to stop. Figure 5 shows the TMV video image from monitoring of the Golden Glades toll plaza.



Figure 4 – Routine Traffic Monitoring



Figure 5 – TMV Image from Golden Glades Toll Plaza

Other non-event/incident uses of the TMV include the monitoring of traffic in some of the major work zones on the Turnpike. The Turnpike Roadway Design and Construction units have periodically requested the TMV be used to monitor some of the ongoing construction projects, especially during periods of very high traffic.

The TMV can also be utilized to monitor critical bridges or other infrastructure with respect to homeland security (see Figure 6). When there are elevated alert levels or specific threats, the TMV can be deployed to monitor the areas and identify potential threats.



Figure 6 – Monitoring of Key Transportation Infrastructure

## Special Deployments of the TMV

In addition to the routine scheduled deployments, the TMV is often called into special service for incidents, holiday weekends, sporting events, concerts, and other things that result in increased traffic and congestion on the Turnpike. Shortly after the start of the program, the TMV was pressed into service to monitor traffic and roadway conditions as South Florida experienced severe brushfires in early July 2004. Figure 7 shows an image from the TMV video taken near Milepost 33 on July 11, when the brush fires were immediately adjacent to the Turnpike right-of-way with flames and smoke billowing hundreds of feet into the air. Figure 8 shows the TMV set up safely off of the roadway monitoring traffic during the fires. Figures 9 and 10 show the reduced visibility that the area experienced as a result of the fires. Later that day, the Turnpike was shut down at Milepost 26 (SR 836) due to the reduced visibility. The TMV was sent down to this area to monitor traffic conditions at the point where the roadway was closed. Figure 11 shows an image from the TMV taken as it was monitoring the roadway closure. The TMV was extremely beneficial to the Turnpike in this incident as well by verifying conflicting reports regarding the current roadway status. Media reports and Florida Highway Patrol (FHP) dispatch was reporting that the Turnpike was closed. By having the TMV on the scene, the TMV operators were able to confirm to the TMC operators that the road was open. The TMC operators could then relay this status information to patrons via the DMS or HAR system and send updated information to media outlets.



Figure 7 – TMV Video of Brushfires



Figure 8 – TMV Monitoring Traffic during Brushfires



Figure 9 – Limited Visibility from Brushfires



Figure 10 Reduced Visibility from Smoke



Figure 11 – Milepost 26 Turnpike Closure

Several other events over the course of the year resulted in special deployments of the TMV. Throughout August and September, the TMV was involved in hurricane evacuation and recovery efforts as Florida endured the most active hurricane season in recent history. As a part of the recovery efforts after Hurricane Charlie, the TMV was requested by the Turnpike Roadway Group to record images of areas damaged by the hurricane and identify areas where signs were blown down.

The TMV was also used to monitor several special events at ProPlayer Stadium including Miami Dolphin and Florida Marlin home games. Figure 12 shows video from one of the special event deployments at ProPlayer Stadium. In addition, the TMV was used to assist with traffic monitoring for major golf tournaments at PGA, events at the Office Depot Center, and NASCAR events at Homestead Motor Speedway.



Figure 12 – Video Image from ProPlayer Stadium

As mentioned above, the TMV is often called in to help monitor RISC incidents, where there are significant financial incentives for the contracted tow/recovery operators to complete their work in a very efficient and expedient manner. The TMV's capabilities are used to monitor and document the RISC clearance, so that if there are any questions of how timely the response and clearance were handled they can be reviewed and addressed. The video images from the TMV also help in the after-action debriefings that the Turnpike does after the RISC incidents. This helps all of the incident responders see what things can be improved on next time to further improve the incident management efforts and clear the roadway quicker. Figure 13 shows an image from one of the RISC incidents where a dump truck overturned in the median.



Figure 13 - Image from RISC Incident

## Demonstration Deployments of the TMV

The TMV represents a truly innovative approach in the aggressive pursuit of improved traffic management. Wherever it is shown, the TMV demonstrates the Turnpike's commitment to innovation. Shortly after the beginning of the pilot project, the TMV was shown to other ITS practitioners at the FDOT ITS Working Group Meeting in Daytona Beach in July 2004. Many of those in attendance took the time to check out the TMV and learn more about its capabilities. The TMV was also showcased and highlighted at Transpo 2004 in Jacksonville in December. Representatives from agencies throughout Florida and Georgia were able to see first-hand what the TMV could do. A presentation was made at that conference about the TMV and the successes that it had enjoyed to date. It was also prominently featured at the roll-over recovery demonstration held in conjunction with Transpo. In this demo, a semi-truck and trailer combination that were overturned were up-righted to demonstrate proper scene management at the site of a major highway incident.

The TMV was also sent to the ITS America Annual Meeting in Phoenix, Arizona in May 2005. It was displayed as a prominent part of the Florida DOT's ITS booth at the exhibit. It generated a lot of interest and discussion among those present. ITS America President Neil Schuster was being interviewed one morning by a local TV station, and the TMV was chosen as the backdrop and one of the centerpieces of the TV segment.

## Benefits of the TMV

It is difficult to assess the benefits of something like the TMV since it is but one small element of the Turnpike Advanced Traffic Management System (ATMS). It would be somewhat like trying to determine benefits of a single fixed camera installation. The camera installation, like the TMV, is of no significant benefit in and of itself. It is only beneficial as a part of a larger integrated system, when that video image is relayed back to a TMC, where operators can use the information to make informed traffic management decisions. However, to try to assess the benefits of the TMV, it will be compared with a series of fixed camera locations.

In the first year of operation, the TMV was deployed for requested viewing at 161 sites; deployed for 75 incidents; and deployed for 43 special events. These deployments represent the TMV being deployed at 77 unique locations on the Turnpike Mainline, the Sawgrass Expressway, and the Beeline. It is important to note that these numbers do not represent all of the routine TMV deployments, but just a portion of them. However, these represent the deployments where the TMV was utilized in response to specific requests and needs, and represent locations where the need for video information was more crucial than in some of the other routine deployments.

The Federal Highway Administration (FHWA) ITS deployment cost database reports that the cost of a CCTV installation is between \$9,000 and \$19,000 in capital cost and between \$1,000 and \$2,300 per year of O&M cost (2004 dollars). The expected life of a CCTV installation is estimated at 10 years. For this analysis, a capital cost of \$15,000 and an annual O&M cost of \$1,500 will be utilized. Using these numbers, the estimated capital cost is \$1,155,000 to have cameras at these 77 locations. If the capital cost is annualized over the estimated ten-year life, using an interest rate of 7%, the annualized capital cost is approximately \$164,500. Based on the \$1,500 per location cost, the total estimated operating cost would be \$115,500 per year. Thus to have had camera coverage at these 77 locations would have an expected annual cost (capital plus O&M) of \$280,000.

By comparison, the first year cost of the TMV service was \$328,424 which represents a 17% greater cost than having 77 fixed cameras. Again, the benefits of the live video image can really be assessed only as a part of the whole ITS deployment. Typically, ATMS deployments report benefit/cost ratios that range between 5 and 20 (sometimes even greater). Using a conservative estimate that the overall Turnpike ATMS is operating with a benefit/cost ratio of 10, and assuming that the benefit/cost ratio can be uniformly applied to all of the elements of the integrated system, the benefit/cost ratio for the TMV could then be estimated as 8.5 (benefit/cost ratio of 10 divided by 1.17 due to 17% higher cost than fixed cameras).

However, the greatest weakness in this analysis is that it presumes that the 77 camera locations could all have been forecast in advance. While some of them could have been, in the case of deployments for special events at large venues like ProPlayer Stadium, many of the deployments were to incident locations that were scattered throughout the area. To have the same coverage capability as the TMV, the Turnpike would need to have camera coverage for every mile of roadway, thus the comparative costs for the fixed-camera system could arguably be considered much greater. Even in the ultimate ITS configuration currently planned by Turnpike Traffic Operations, this will not be achieved. Additionally, the TMV offers other benefits that are not included in this analysis. Most notable in this is that the TMV has much greater on-scene intelligence due to the operator in the truck at the site. Therefore, the real benefit/cost ratio for the TMV would be expected to be significantly greater than the 8.5 value computed above.

## Conclusions

The TMV Pilot Program has proven itself to be an incredible success story for the Turnpike. It continues to receive very positive reviews from FHP and other partners in incident management, and has received a great deal of publicity and positive feedback. The program has helped the Turnpike to reduce the impact of incidents, analyze recurring and non-recurring congestion, and monitor special events. Presently, the TMV service is primarily used in the tri-county area in Southeast Florida (Broward, Dade, and Palm Beach Counties). It is recommended that the Turnpike strongly consider expanding the TMV program to deploy a second TMV routinely in the Orlando metro area of the Turnpike. By having a second TMV in the Orlando vicinity, the vehicle could also reasonably respond to incidents or events that would affect the Polk County Parkway, the Veterans' Expressway, or the Suncoast Parkway.

The TMV has become a fully-integrated part of the Turnpike Traffic Management Center's daily operation (Figure 14). The TMC operators know where the TMV is deployed, and move it around in response to situations as they arise in real time. The TMV has proven itself to be a valuable tool in the Turnpike's efforts to monitor and respond to congestion and traffic incidents. The TMV represents another element of the Turnpike's efforts to provide premium service to the Turnpike patrons.

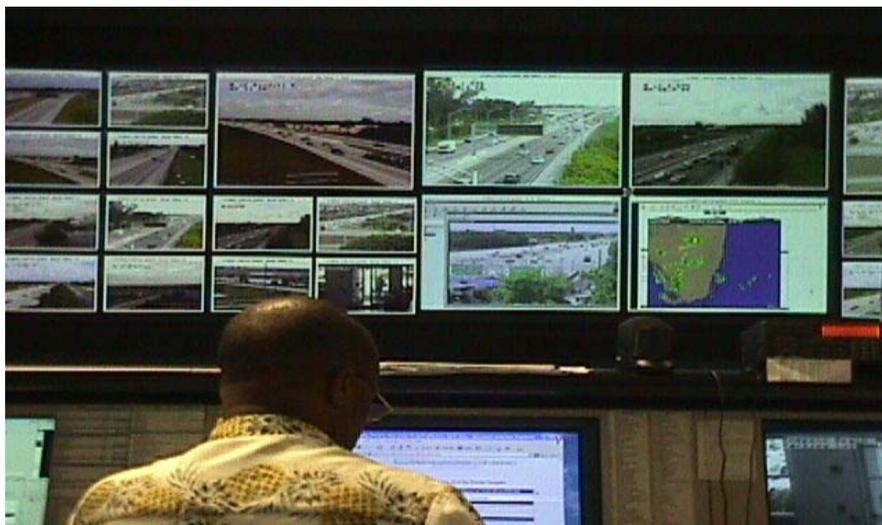


Figure 14 – Turnpike Traffic Management Center