Status Report

Implementation of the Advanced Transportation Management System (ATMS)

April 22, 2009

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Office of the County Auditor
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County Auditor
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Executive Summary

Broward County’s Advanced Transportation Management System (ATMS) capital project was initiated in June 2000 to reduce traffic congestion, improve incident response time and decrease operations and maintenance costs.\(^1\) ATMS is principally characterized by the deployment of advanced traffic management technologies throughout Broward County, including a fiber optic traffic signal communication network and Ethernet based communication concept. According to planning documents, ATMS deployment will allow the Broward County Traffic Engineering Division (BCTED) to more efficiently use its resources to manage County-wide traffic flows and respond to traffic signal maintenance concerns.

Broward County’s ATMS deployment plan, finalized in July 2003, includes a six-phase sequential construction schedule. During the construction period, the existing traffic signal system would continue to operate until it was replaced one segment at a time. The total cost of ATMS Phases I thru VI (design and construction) was estimated at $85.6 million, with initial funding provided through two FDOT “Local Area Participation” agreements (hereafter referred to as “grants”) totaling $21.4 million. The first construction project (“Phase I”) of Broward County ATMS was to be fully deployed by the end of July 2005, and the last construction project (“Phase VI”) was proposed to be completed by the end of 2008.

Our review found that the design of Phases I & II and a significant portion of Phase I construction have been completed. However, no phase of the ATMS project has been fully completed as of April 2009. BCTED, the agency charged with ATMS project management, cites several reasons for ATMS deployment delays. These include: difficulty fine tuning and testing the prototype Ethernet signal communication concept, consultant design errors, additional reporting requirements imposed by the U.S. Federal Highway Administration after project design, negotiations with federal authorities to allow Broward County’s Enterprise Technology Services Division (ETS) to co-locate fiber optic cable within the same conduit used for ATMS fiber optic cable deployment, waiting for ETS to complete its design plan, and Hurricane Wilma.

During our review, we interviewed BCTED, Florida Department of Transportation (FDOT) and ETS officials to determine the consequences of ATMS project delays. These stakeholders indicated the following:

- **All ATMS grant funding not used prior to the two grants’ expiration on June 30, 2009 will be reprogrammed for an alternative ATMS project managed by FDOT.** These grants, initially awarded in July 2000 and June 2005, have a combined value of $21.4 million and will both expire in June 2009. As of March 2009, approximately $10 million (47%) of ATMS Phase I & II grant funding has been utilized by BCTED.\(^2\) According to FDOT, the alternative ATMS project is not expected to be completed until

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1. The Broward County Board of County Commissioners appointed a Selection/Negotiation Committee in June 2000 to select an ATMS master plan design consultant.
2. After the conclusion of our fieldwork in April 2009, BCTED advised that approximately $1.75 million of additional ATMS grant eligible expenditures were made in April 2009. Due to time constraints, we did not review supporting documentation for these expenditures, and therefore they are not included in our expenditure analysis.
2012, and will be smaller in scope than the six-phase County-wide ATMS deployment project managed by BCTED.

- **BCTED remains relatively limited in its ability to reduce traffic congestion, improve incident response time, and more efficiently use its resources due to ATMS deployment delays.** For example, as part of Phase I, BCTED purchased and installed new signal controller technology that is capable of providing adaptive signal control. Adaptive signal control is the ability for traffic signal systems to continuously adjust and coordinate signal timing cycles to correspond with prevailing traffic conditions. However, as of April 2009 the Division has yet to procure and install the required software necessary to realize this advanced signal controller functionality.

- **Broward County must continue to lease telephone lines from a private provider (i.e. AT&T) at substantial cost.** One touted benefit of ATMS deployment was the opportunity to replace the existing copper wire communication network and leased telephone lines from AT&T with a County owned fiber optic signal communication network. According to ATMS planning documents, eliminating the need for leased telephone lines has an estimated return on investment of more than $600,000 annually once all six phases are completed. As FDOT grants would have presumably funded all procurement and installation of the proposed fiber optic traffic signal communication network, the County was required to make no capital investment to achieve this cost savings.

- **ETS’s migration to a County-wide fiber optic voice and data communication infrastructure may be slowed and/or more costly in the future.** Like BCTED, ETS has initiated a strategy of migrating from leased communication infrastructure to a County owned and managed fiber optic communication network in an effort to reduce costs. According to ETS, the sharing of fiber optic conduit with BCTED during ATMS Phase I construction allowed for the connection of 17 County buildings to a fiber optic communication network at a cost of $2.8 million. ETS estimates that the cost to connect these buildings to a fiber optic network would have been tripled ($8.4 million) if ETS had independently trenched and installed underground conduit rather than “piggyback” on BCTED’s effort. While FDOT’s alternative ATMS project will continue the deployment of fiber optic conduit runs throughout Broward County, it is not initially expected to be a County-wide deployment similar to the project managed by BCTED. Therefore, the opportunity for ETS to share conduit and reduce cost may be initially limited.

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3 ETS reports an estimated monthly cost savings of more than $35,000 due to the migration from leased telecom infrastructure to a County owned and managed fiber optic voice and data communication network at affected locations.
Purpose and Scope

This report presents the status of implementation of Broward County’s Advanced Transportation Management System (ATMS) capital project. The purpose of our review was to describe the history and objectives of Broward County ATMS. Additionally, we sought to determine if the ATMS project has been completed in accordance with the proposed schedule, and if not, to identify the causes and consequences of delays. To accomplish our objectives, we:

- Conducted interviews with staff from the Broward County Traffic Engineering Division, the Broward County Enterprise Technology Services Division and the Florida Department of Transportation
- Reviewed ATMS master plan and design documents
- Reviewed and categorized ATMS expenditure data
- Reviewed applicable traffic engineering system design literature, including performance reports

Section 1: Introduction to Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS) can be used to optimize traffic signal efficiency and improve mobility

Intelligent Transportation Systems (ITS) integrate advanced information and communication technologies with transportation infrastructure to improve traffic mobility and safety. Common ITS deployments include electronic tolling (e.g. Florida’s Sun-Pass) and electronic roadside message signs providing motorists with real-time traffic information. Other advanced ITS deployments include fiber optic cable runs capable of providing video monitoring of intersections and Global Position System (GPS) traffic signal pre-emption devices that allow for improved mobility of emergency response and transit vehicles.

Since the 1990s the federal government has supported the deployment of ITS technologies by state and local governments to decrease vehicular travel times. For example, the 1998 Transportation Equity Act for the 21st Century authorized $1.3 billion for the continued research and deployment of ITS technologies on America’s roadways. National studies indicate that ITS deployments, often considered a cost-effective alternative to expensive road widening, provide several significant travel benefits to all citizens including:

- Reducing crashes, delays and travel times
- Improving travel time reliability

4 “Travel time reliability” refers to a driver experiencing consistency in travel time from point A to B on repeated occasions. Commutes that do not have high travel time reliability often frustrate motorists because it is difficult to budget the appropriate amount of travel time necessary for these trips.
• Providing AMBER alerts on dynamic message signs\(^5\)
• Supporting emergency evacuation operations
• Reducing air pollution emissions and fuel consumption, and
• Improving incident response and clearance

ITS technologies can be used to optimize the efficiency of traffic signal systems in several ways. For example, traffic signals have historically operated on “time-of-day” patterns. This means at scheduled intervals throughout the day signal timing patterns shift to accommodate expected traffic volumes (e.g. rush hour traffic). However, signal systems utilizing ITS technologies, such as “adaptive signal control,” have the ability to continuously adjust and synchronize signal timing cycles in response to real-time traffic conditions. Adaptive signal control systems not only respond to rush hour traffic volumes, but also automatically adjust signal timing configurations to relieve traffic overflows created by unanticipated events, such as vehicle crashes.breakdowns and inclement weather. Additionally, the deployment of closed circuit monitoring systems provides traffic management entities with the ability to visually monitor traffic conditions and signal functionality from a remote location; when necessary, technicians can manually override signal sequences to temporarily divert traffic and clear backed-up intersections. The Florida Department of Transportation (FDOT) reports that for every dollar invested in ITS, an economic benefit of eight dollars is realized in terms of travel time savings.\(^6\)

The Broward County Traffic Engineering Division (BCTED) is charged with traffic signal system management in Broward County. Although Section 316.006, Florida Statutes grants cities with original jurisdiction of traffic management within their boundaries, BCTED has assumed responsibility for almost all roadways in Broward County.\(^7\) Specifically, BCTED has agreements with 27 of Broward County’s 31 cities to provide complete traffic engineering services, and agreements with two cities (Plantation and Wilton Manors) to provide modified traffic engineering services.\(^8\) BCTED services generally include the planning, design, engineering, construction and maintenance of all traffic control devices for County maintained roads, and the installation and replacement of street signs and pavement markings. BCTED provides traffic engineering services at no cost to Broward County cities. Additionally, BCTED provides traffic signal engineering services on all State roadways, such as University Drive and US-1/Federal Highway, via intersection maintenance agreements with FDOT.

The traffic signal system managed by BCTED, often referred to as the arterial system, is estimated to carry more than 50% of Broward County’s daily traffic volume. Arterial roadways are generally characterized by their lack of residential entrances; rather these roadways are designed to quickly move traffic between neighborhoods and to link with expressways, freeways and interstates. Within Broward County, Commercial Boulevard is an example of a major arterial roadway. As arterial roadways often intersect with local streets, traffic signals are

\(^5\) An AMBER alert is a child abduction alert system used in the United States and Canada.
\(^6\) This return-on-investment analysis is based on the initial year of FDOT’s ITS program in Broward County, which includes ITS deployments on I-95 and I-595.
\(^7\) Major exclusions include I-95, I-595 and Florida’s Turnpike.
\(^8\) Southwest Ranches and Hillsboro Beach are the two Broward cities that do not have agreements with BCTED as of March 2009; “modified traffic engineering services” means BCTED provides services for only designated roadways within a municipal boundary.
typically necessary to control the flow of traffic. For Fiscal Year 2009, BCTED maintains 1,350 traffic signals on Broward County’s roadway network.

**ITS upgrades were recommended for Broward County’s traffic signal system in the late 1990s**

BCTED’s ITS deployment goals for Broward County’s arterial roadway system and adjacent feeder streets have generally been in place since the late 1990s. Specifically, a consultant was retained in 1998 to evaluate the physical characteristics of Broward County’s traffic control infrastructure, and to determine ITS system configurations that would be most appropriate for County-wide implementation. The consultant’s study was conducted under the direction of a project review committee that included BCTED, FDOT and the Broward County Metropolitan Planning Organization (MPO) staff. A final report, called the “Broward County Signal System Master Plan,” was delivered to the project committee in September 1998.

The 1998 study concluded that many critical elements of Broward County’s existing traffic infrastructure were rapidly obsolescing or increasingly incapable of accommodating system expansion. These system deficiencies were seen as limiting BCTED’s ability to relieve growing traffic congestion in Broward County. Three of the study’s most salient findings were:

- Most of Broward County’s signal controllers (i.e. the hardware located in a metal cabinet at each signalized intersection) were determined to be beyond their service life or no longer supported by the manufacturer. Further, only 1% of Broward County’s signal controllers was still in production or expected to remain in production beyond a few years. As signal controllers manage the signal timing at each intersection, their proper operation is critical to an efficient traffic system; a malfunction at only one intersection can have disruptive effects to an entire corridor (e.g. Broward Boulevard). Without signal controller replacement, the study concluded that Broward County would soon be forced to buy scrap or salvage material from other jurisdictions because replacement parts for existing controllers were no longer produced by manufacturers.

- The existing underground copper wire communication infrastructure limited BCTED’s ability to coordinate traffic signals and remotely manage traffic overflows. A coordinated signal system is a group of signals that operate on a common cycle length and change in relation to each other allowing cars to move through the system with few or no stops. However, the consultant noted that 450 of the County’s approximately 1,300 signalized intersections (35%) were not controlled by the central computer system and therefore could not be coordinated. Without central coordination of these signals, BCTED’s ability was seen as limited to ensure a smooth traffic flow through several non-connected intersections. Although non-connected signals may be appropriate for some remote areas or residential streets, the consultant noted that dedicated interconnects between the central computer system and local intersections offers the most accuracy and flexibility for maintenance purposes.

- BCTED had not kept up with the maintenance and replacement of its inductive loop detectors (ILDs). ILDs are loops of wire embedded within the pavement and hardwired
to a signal controller that provide vehicle count, presence, occupancy and passage data to the signal system. When a vehicle passes over the ILD detection path, an actuation is sent to the signal controller which either extends the green light for that vehicle or brings the green light to it at the earliest opportunity. ILDs can be easily damaged during street reconstruction, utility repair and other construction. Without properly functioning ILDs, a system loses its ability to make adjustments in response to real-time traffic conditions. One consequence is a light turning green despite no vehicles present at the corresponding intersection. The consultant noted over 100 intersections that required some type of ILD repair at the time of the study (September 1998).

Due to Broward County’s rapidly obsolescencing and/or damaged traffic control infrastructure, the consultant of the 1998 study and project review committee recommended an accelerated infrastructure replacement program. Specific recommendations include:

- Replacing the approximately 1,300 rapidly obsolescencing signal controllers with new technology capable of providing adaptive control (when paired with appropriate software)

- Converting from a partially leased signal communications network to a County owned fiber optic grid capable of providing closed circuit video feeds of selected intersections and other critical data uploads from field equipment to a remote control center

- Upgrading the central traffic control software to a sophisticated solution capable of providing advanced traffic control functionalities, which were deemed not possible with BCTED’s existing 25 year old software

- Repairing and/or replacing underground ILDs to ensure that each signal in a desired coordination loop is operating at optimal efficiency

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**Section 2: Purpose, Funding and Deployment Schedule of Broward County ATMS**

In July 2000, FDOT awarded Broward County a $17 million grant for the design and deployment of ITS technologies, collectively known as “ATMS”

The completion of the consultant study in September 1998 and subsequent approval of the study’s proposed recommendations by the U.S. Federal Highway Administration made Broward County eligible for federal/state aid participation. Accordingly, in July 2000, Broward County entered into a “Local Area Participation” agreement (hereafter referred to as “grant”) with FDOT which provided $17 million in funding for the design, construction and contract administration for the first set of a series of ITS upgrades to the traffic signal system. These ITS upgrades

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9 Adaptive signal control is the ability of traffic signal systems to continuously adjust and coordinate signal timing cycles to correspond with prevailing traffic conditions
collectively were known as the “Advanced Transportation Management System” (ATMS). Pursuant to terms of the grant agreement, Broward County was responsible for the development of the first phase of ATMS contract plans and design specifications, as well as construction. BCTED was assigned as the managing agency for the ATMS project.

**A six-phase ITS deployment plan was completed in July 2003 estimating full ATMS implementation by the end of 2008**

In December 2001, the Board of County Commissioners awarded a contract for ATMS design services in the amount of $1.4 million to Kimley-Horn and Associates, Inc (“the Consultant”).

This contract included the development of a system-wide ATMS deployment plan, as well as design and construction plans for the first phase of an Ethernet based fiber optic communications network.

In October 2003, BCTED accepted the Consultant’s system-wide ATMS deployment plan. Due to the size of the system, multiple project phases were deemed necessary for successful completion. Specifically, the plan proposed six-phases of ATMS deployment over a five-year period. Many factors were taken into consideration during the development of deployment phases, including input from BCTED. For example, BCTED requested that Fort Lauderdale’s Central Business District and government center area be considered for inclusion in the first deployment phase due to this area’s high level of traffic congestion. Another factor in determining the deployment phases was an emphasis on minimizing disruptive traffic impacts associated with system deployment. Accordingly, the deployment plan indicates that existing system infrastructure would continue to operate until it was replaced one segment at a time to minimize construction impact and efficiently focus limited resources.

We have summarized the primary objectives of the ATMS deployment plan into the following:

- **Upgrading the traffic signal communication from a copper wire network to a fiber optic network.** Fiber optic connection provides capabilities not possible with copper wire, including the ability to remotely communicate with all field devices via an Ethernet network for signal monitoring, control configuration and data collection. Additionally, a fiber optic network can be installed with redundancies that allow the system to remain operational even if a line is cut during street reconstruction, which frequently happens. It was estimated that 85% of the existing underground conduit supporting copper wire could be reused for fiber optic cable installation, thus reducing cost. Once completed, the County would own the entire communication network, as opposed to the current operation of leasing telephone line drops from AT&T. The cost savings of owning the extensive communication infrastructure was estimated to be in excess of $600,000 annually.

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10 The award of the ATMS design services contract to Kimley-Horn was delayed from the period October 2000 to March 2001 due to an award protest by the second ranked firm. The protest claim was rejected by a Hearing Officer in March 2001 and the Selection/Negotiation Committee approved an agreement with Kimley-Horn in October 2001. Thereafter, the agreement was submitted to the Board of County Commissioners in December 2001.

11 The system-wide deployment plan is considered a planning and pre-engineering document.
• **Upgrading approximately 1,300 signal controllers and cabinets.** The new signal controllers, when paired with advanced software, would be capable of adaptive signal control and enhanced data collection abilities.

• **Deploying dynamic message signs (DMS) throughout the County for disseminating traffic information to motorists.** Examples include: destination travel times, construction delays, and AMBER and vehicle incident alerts.

• **Converting from inductive loop detectors (ILDs) to video image detection devices.** BCTED historically used ILDs for vehicle detection at selected intersections. However, due to its underground location, this technology was often vulnerable to damage during street resurfacing. Therefore, the deployment plan called for the replacement of ILDs with video detection devices, which could be placed above ground on existing structures, such as poles or mast arms. Video image detection devices also have enhanced functionalities, such as the ability to collect vehicle volume, speed and occupancy data.

• **Integrating closed-circuit television cameras to visually monitor traffic, high accident areas and DMS messages.** With the ability to remotely monitor traffic signal functionality BCTED could proactively detect system failures rather than rely on citizens and/or local police departments for notification of improperly functioning traffic signals.

• **Implementing an enhanced traffic signal system software solution compatible with upgraded field equipment to fully leverage system capabilities.**

Each ATMS phase included the deployment of ITS technologies to approximately 200 intersections, including 50 closed-circuit monitoring cameras and 15 dynamic message signs (DMS). Exhibit 1 on the next page pairs the Broward County ATMS phases with associated geographic boundaries. Appendix A on page 19 of this report also provides an overlay of each ATMS phase onto a map of Broward County.
Exhibit 1: Broward County’s six-phase ATMS deployment plan was developed to minimize disruptive constructions impacts

<table>
<thead>
<tr>
<th>Phase</th>
<th>Geographic Limits</th>
<th>Affected Municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North</td>
<td>South</td>
</tr>
<tr>
<td>I</td>
<td>Commercial Blvd</td>
<td>I-595 / SR-84</td>
</tr>
<tr>
<td>II</td>
<td>Commercial Blvd</td>
<td>I-595</td>
</tr>
<tr>
<td>III</td>
<td>County-Line (North)</td>
<td>Commercial Blvd</td>
</tr>
<tr>
<td>IV</td>
<td>I-595 / Eller Dr</td>
<td>County-Line (South)</td>
</tr>
<tr>
<td>V</td>
<td>County-Line (North)</td>
<td>Commercial Blvd</td>
</tr>
<tr>
<td>VI</td>
<td>I-595</td>
<td>County-Line (South)</td>
</tr>
</tbody>
</table>

Source: Broward County ATMS Communication Design and Deployment Project, July 2003

According to the deployment plan, the first ATMS construction phase was to be fully deployed by the end of July 2005, and the last construction phase was scheduled to be completed by the end of 2008. All phases of the ATMS project were expected to be fully deployed and operational by the first quarter of year 2009. Exhibit 2 below indicates the proposed construction schedule and estimated cost of each deployment phase of the ATMS project, as found in the ATMS deployment plan developed by Kimley-Horn in July 2003.

Exhibit 2: The deployment schedule indicated that all ATMS construction was to be completed by calendar year 2008.

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>$13,065,656</td>
</tr>
<tr>
<td>Phase I</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase II</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>$15,980,555</td>
</tr>
<tr>
<td>Phase III</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>$14,045,829</td>
</tr>
<tr>
<td>Phase IV</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>$13,799,007</td>
</tr>
<tr>
<td>Phase V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>$12,780,376</td>
</tr>
<tr>
<td>Phase VI</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>$15,893,202</td>
</tr>
<tr>
<td>ATMS TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$85,564,625</td>
</tr>
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Source: Broward County ATMS Communication Design and Deployment Project, July 2003
Section 3: Implementation Status of Broward County ATMS as of April 2009

In this section of the report, we review the implementation status of Broward County ATMS. This includes a summary of ATMS design and construction work completed (by phase) as of April 2009, as well as an analysis of actual project expenditures. We also analyze the utilization of the two FDOT grants totaling $21.4 million which have been used to fund Broward County ATMS deployment. This section concludes with a description of ATMS deployment delays and a recently agreed upon reassignment of ATMS project management responsibility from BCTED to FDOT.

No phase of the ATMS project has been completed as of April 2009

To determine the status of ATMS implementation as of April 2009, we interviewed BCTED staff and reviewed historical project expenditure data. We found that no phase of ATMS has been completed as of April 2009. While design work has been completed for both Phases I and II, construction has only been performed for Phase I; construction for Phase I began in late 2007. BCTED states that no design and/or construction work has been initiated for Phases III thru VI. In total, $10 million has been collectively expended on Phase I ($9.7 million) and Phase II ($340,000). BCTED reports that all ATMS expenditures to date have been supported by two FDOT grants totaling $21.4 million, awarded in July 2000 and June 2005.

We categorized ATMS expenditure data to determine the types and amount of ATMS work that has been completed as of March 26, 2009. We found that of the $10 million ATMS expenditures for Phases I & II, $3.7 million (37%) has been for the purchase and installation of 15.3 miles of fiber optic cable and underground conduit. Other significant expenditures include $3.1 million (31%) for the purchase and installation of 995 signal controllers, and $2.4 million (24%) for Phase I and II design. Exhibit 3 on the next page provides a summary of categorized ATMS expenditures.

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12 The ATMS project has been exclusively funded by two FDOT grants. The first grant, awarded in July 2000, provides $17 million of funding for ATMS Phase I. The second grant, awarded in June 2005, provides $4.5 million for ATMS Phase II.

13 After the conclusion of our fieldwork, BCTED advised that approximately $1.75 million of additional ATMS grant eligible expenditures were made in April 2009. Due to time constraints, we did not review supporting documentation for these expenditures, and therefore they are not included in our expenditure analysis.
Exhibit 3: Most ATMS expenditures have been for Phase I construction and the procurement and installation of signal controllers

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Amount</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Construction</td>
<td>Purchase and installation of 15.3 miles of underground fiber optic cable and conduit</td>
<td>$3,660,902</td>
<td>37%</td>
</tr>
<tr>
<td>2. Signal Controllers</td>
<td>Purchase and installation of 995 signal controller field devices and associated County-wide software license</td>
<td>$3,134,870</td>
<td>31%</td>
</tr>
<tr>
<td>3. ATMS Design</td>
<td>Purchase of ATMS Phase I &amp; II system design and deployment plan</td>
<td>$2,449,224</td>
<td>24%</td>
</tr>
<tr>
<td>4. Miscellaneous</td>
<td>Includes various services and supplies, such as hardware and software solutions for video, voice and data communication devices</td>
<td>$392,001</td>
<td>4%</td>
</tr>
<tr>
<td>5. Computer Devices</td>
<td>Purchase and installation of servers, routers, switches, etc.</td>
<td>$322,952</td>
<td>3%</td>
</tr>
<tr>
<td>6. Training</td>
<td>Staff training for the Network Plus application</td>
<td>$50,470</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$10,010,419</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: Office of the County Auditor Analysis

In response to our request to identify what remains to be completed for ATMS Phase I, BCTED provided a comprehensive listing of significant tasks. These tasks include:

- Installing approximately 12 miles of remaining conduit and fiber optic cable
- Applying for six Florida East Coast (FEC) railroad crossing permits and installing conduit under railroad tracks
- Purchasing and installing 58 Pan Tilt Zoom (PTZ) cameras and video encoders
- Installing conduit and poles for PTZ cameras
- Purchasing and installing 289 fiber splice closures
- Purchasing and installing 10 dynamic message signs (DMS)
- Installing conduit and support structures for DMS
- Purchasing and installing 265 Ethernet switches
- Establishing a database to document all materials/devices installed in the field
- Testing and programming all field equipment prior to full-deployment
- Testing and verifying network connectivity and operational integrity of field equipment
- Providing applicable training to BCTED personnel

We also noted during our fieldwork that BCTED has not yet procured the recommended traffic signal control software upgrade. Additionally, ATMS Phase II remains substantially incomplete; no construction has been initiated for this phase as of April 2009.
Significant components of Phase I have been completed as of April 2009

According to BCTED, significant components of ATMS Phase I have been completed and are in use as of April 2009. These include:

- Model 2070 signal controllers have been installed at all signalized intersections that provide enhanced controller capability and allow for fire-rescue signal pre-emption capability throughout the County. Model 2070 signal controllers represent the critical foundation for all future ATMS operations and provide the remote intelligence necessary for the future ATMS software platform to operate efficiently.

- The fiber optic ring installed for ETS as incorporated into ATMS Phase I now serves as the communications backbone for the County’s critical services. This ring provides redundant and independent Ethernet communications between 17 County buildings and serves as an important Homeland Security feature. Apart from installation savings estimated at $5.6 million, by co-locating with BCTED in ATMS Phase I, ETS will realize an additional annual saving of $420,000 over previously less-secure leased communication lines.

- Approximately 28 miles of underground conduit have been installed to support almost 200 intersections once splicing is completed. Supporting devices, routers, switches, etc. have been purchased and installed. This will facilitate communications via Ethernet to the County’s Transportation Management Center for testing and refinement for the future ATMS software platform.

BCTED cites several causes of ATMS deployment delay

According to BCTED management the ATMS project has not been completed in accordance with the Consultant’s proposed deployment schedule for the following reasons:

- After the Consultant completed the deployment plan in July 2003, BCTED worked with the Consultant to fine tune the proposed Ethernet communications concept and test prototype. BCTED states that the use of an Ethernet traffic communication concept was considered a cutting-edge approach not typically used in the traffic engineering industry and therefore took extra revisions. The development of the Ethernet concept was concurrent with ATMS Phase I design. The test prototype, deployed on Commercial Boulevard, was completed in 2007.

- In July 2004, Broward County’s Enterprise Technology Services Division (ETS) was investigating installing fiber for the County’s intra-communication network. ETS expressed interest to BCTED in co-locating fiber optic cable within the same conduit that would be used for ATMS fiber optic deployment. Some of the benefits of conduit sharing included significant reduction in labor and material costs during installation, minimal disruption to the motoring public during installation and the elimination of any potential utility conflicts within limited public-right-of-way. However, because ETS’s proposal was not transportation related and not contemplated within the FDOT grant
agreements, BCTED had to seek approval from FDOT and the U.S. Federal Highway Administration. This approval process took approximately five months when ETS was authorized to co-locate its fiber within U.S. Federal Highway Administration funded conduit. Associated ETS fiber optic design was finalized in August 2007.

- In January 2006, the BCTED employee designated as ATMS project manager resigned. Subsequently, in March 2006, a new project manager was assigned to oversee the project. When the new project manager reviewed the project, this engineer noticed design inconsistencies that needed to be addressed. BCTED states that no penalties were levied against the design consultant (Kimley-Horn) for these errors because the plans were revised at no cost to the County. Per BCTED, the design inconsistencies created a delay of approximately three months.

- In July 2006, the U.S. Federal Highway Administration required BCTED to design a System Engineering Management Plan (SEMP) for ATMS prior to proceeding with construction. According to the Federal Highway Administration’s website, a SEMP “focuses on the technical plan of the project and the systems engineering processes to be used for the project. Its purpose is to detail out those engineering tasks; especially to provide detailed information on the processes to be used. Preparation of a SEMP is most important if the project involves development of custom software.” To meet this requirement, BCTED authorized a consultant to perform the SEMP in January 2007. The SEMP was completed in April 2007, with final approval by the U.S. Federal Highway Administration in August 2007.

- Hurricane Wilma is identified as having caused ATMS deployment delays from the period October 2005 to December 2006.

**The FDOT grants funding Broward County’s ATMS project will expire on June 30, 2009; only 47% of available grant funding has been utilized as of March 2009**

The ATMS project has been exclusively funded by two FDOT grants. The first grant, awarded in July 2000, provided $17 million of funding for ATMS Phase I. Originally scheduled to expire on June 30, 2007, this grant was extended by FDOT at the request of BCTED due to Phase I delays. Additionally, FDOT awarded BCTED a second grant in June 2005 for $4.5 million. This grant was earmarked to provide design and partial construction funding for ATMS Phase II. Originally scheduled to expire on December 28, 2007, this grant was also extended by FDOT at the request of BCTED due to project delays. As of April 2009, both FDOT grants are scheduled to expire on June 30, 2009.

Our review of project expenditure data indicates that 47% of available grant money has been expended as of March 2009. Specifically, $9.7 million of the available $17 million (57%) for Phase I has been expended, and $339,753 of the available $4.5 million (8%) for Phase II has been expended. Exhibit 4 on the next page illustrates grant funding utilization. Additionally, Exhibit 5 on the next page provides a breakdown of grant utilization by fiscal year.
Exhibit 4: Only 47% of available ATMS grant funding has been utilized as of March 2009

<table>
<thead>
<tr>
<th></th>
<th>Amount Awarded</th>
<th>Amount Expended</th>
<th>Amount Remaining</th>
<th>% Expended</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMS Phase I</td>
<td>$16,988,868</td>
<td>$9,670,666(^{14})</td>
<td>$7,318,202</td>
<td>57%</td>
</tr>
<tr>
<td>ATMS Phase II</td>
<td>$4,450,000</td>
<td>$339,753</td>
<td>$4,110,247</td>
<td>8%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$21,438,868</td>
<td>$10,010,419</td>
<td>$11,428,449</td>
<td>47%</td>
</tr>
</tbody>
</table>

Source: Broward County Traffic Engineering Division

Exhibit 5: BCTED has averaged $1.3 million of annual ATMS grant expenditures during the past eight fiscal years

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>ATMS Phase I</th>
<th>ATMS Phase II</th>
<th>Total ATMS Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>$0</td>
<td>N/A</td>
<td>$0</td>
</tr>
<tr>
<td>2002</td>
<td>$173,232</td>
<td>N/A</td>
<td>$173,232</td>
</tr>
<tr>
<td>2003</td>
<td>$1,496,894</td>
<td>N/A</td>
<td>$1,496,894</td>
</tr>
<tr>
<td>2004</td>
<td>$2,325,689</td>
<td>N/A</td>
<td>$2,325,689</td>
</tr>
<tr>
<td>2005</td>
<td>$1,291,246</td>
<td>$0</td>
<td>$1,291,246</td>
</tr>
<tr>
<td>2006</td>
<td>$576,258</td>
<td>$0</td>
<td>$576,258</td>
</tr>
<tr>
<td>2007</td>
<td>$106,800</td>
<td>$135,820</td>
<td>$242,620</td>
</tr>
<tr>
<td>2008</td>
<td>$1,771,844</td>
<td>$203,933</td>
<td>$1,975,777</td>
</tr>
<tr>
<td>2009</td>
<td>$1,928,702(^{15})</td>
<td>$0</td>
<td>$1,928,702</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$9,670,666</strong></td>
<td><strong>$339,753</strong></td>
<td><strong>$10,010,419</strong></td>
</tr>
</tbody>
</table>

Source: Broward County Traffic Engineering Division

**BCTED and FDOT will reprogram unused grant funding for the design and construction of an alternative ATMS project in Broward County**

As both FDOT grants are scheduled to expire on June 30, 2009, Broward County would return any remaining funding under the terms of these agreements. Expenditure data provided by BCTED indicates that, as of March 2009, $11.4 million (53% of the total $21.4 million available) of awarded FDOT grant funding has not been utilized for Phases I & II. In an effort to obtain extensions for the expiring ATMS grants, BCTED and FDOT conducted a series of meetings in 2008 and 2009. By January 2009, it was determined that it would be in the best interest of both parties for FDOT to assume project management responsibility of ATMS. Accordingly, FDOT agreed to dedicate all unused funding from the two existing grants to a new project, tentatively called “ATMS 1.1.” ATMS 1.1, which will be budgeted during Fiscal Year 2010-11, will focus on the deployment of various ITS technologies on selected high-volume corridors throughout Broward County (as opposed to the phased geographic deployment strategy initiated by BCTED). Despite FDOT assuming project management responsibility for ATMS

\(^{14}\) Includes $580,147 of eligible grant expenditures not yet reimbursed by FDOT as of April 3, 2009.

\(^{15}\) Includes $580,147 of eligible grant expenditures not yet reimbursed by FDOT as of April 3, 2009.
deployment, FDOT officials indicate that BCTED will have a level of input and involvement in ATMS 1.1 through monthly workgroup meetings.

ATMS 1.1 will not be as large in scope as the six-phase ATMS deployment managed by BCTED. However, FDOT anticipates seeking additional funding for ATMS deployment in Broward County after the completion of ATMS 1.1 in 2012. According to FDOT, BCTED’s underutilization of ATMS grant funding and the relinquishing of project management responsibility are not seen as jeopardizing BCTED’s or FDOT’s ability to obtain federal funding for future ATMS deployments in Broward County.

We identified three significant consequences of ATMS deployment delay and the proposed redesign of ATMS by FDOT

ATMS 1.1 should provide for the continued, limited deployment of ITS technologies on Broward County’s arterial roads. However, stakeholders we interviewed during our fieldwork noted three significant consequences of ATMS deployment delay. Specifically:

(1) **BCTED remains relatively limited in its ability to reduce traffic congestion, improve incident response time, and more efficiently use its resources due ATMS deployment delays.** For example, as part of Phase I, BCTED purchased and installed new signal controller technology that is capable of providing adaptive signal control. Adaptive signal control is the ability for traffic signal systems to continuously adjust and coordinate signal timing cycles to correspond with prevailing traffic conditions. However, as of April 2009 the Division has yet to procure and install the required software necessary to realize this advanced signal controller functionality.

(2) **Broward County must continue to lease telephone lines from a private provider (i.e. AT&T) at substantial cost.** One touted benefit of ATMS deployment was the opportunity to replace the existing copper wire communication network and leased telephone lines from AT&T with a County owned fiber optic signal communication network. According to ATMS planning documents, eliminating the need for leased telephone lines has an estimated return on investment of more than $600,000 annually once all six phases are completed. As FDOT grants would have presumably funded all procurement and installation of the proposed fiber optic traffic signal communication network, the County was required to make no capital investment to achieve this cost savings.

(3) **ETS’s migration to a County-wide fiber optic voice and data communication infrastructure may be slowed and/or more costly in the future.** Like BCTED, ETS has initiated a strategy of migrating from leased communication infrastructure to a County owned and managed fiber optic communication network in an effort to reduce costs. According to ETS, the sharing of fiber optic conduit with BCTED during ATMS Phase I construction allowed for the connection of 17 County buildings to a fiber optic...
communication network at a cost of $2.8 million. ETS estimates that the cost to connect these buildings to a fiber optic network would have been tripled ($8.4 million) if ETS had independently trenched and installed underground conduit rather than “piggyback” on BCTED’s effort. While FDOT’s alternative ATMS project will continue the deployment of fiber optic conduit runs throughout Broward County, it is not initially expected to be a County-wide deployment similar to the project managed by BCTED. Therefore, the opportunity for ETS to share conduit and reduce cost may be initially limited.

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10 ETS reports an estimated monthly cost savings of more than $35,000 due to the migration from leased telecom infrastructure to a County owned and managed fiber optic voice and data communication network at affected locations.
Appendix A

According to its July 2003 deployment plan, Broward County’s ATMS project consists of six phases to be completed over a five-year period.

Source: Broward County ATMS Communication Design and Deployment Project, July 2003 – Map Design by Broward County Planning & Redevelopment Division