Sevier County Tourist Corridor

Intelligent Transportation Systems Master Plan

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SEVIER COUNTY TOURIST CORRIDOR ITS MASTER PLAN

APTS	Advanced Public Transportation System
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
CCTV	Closed Circuit Television
DMS	Dynamic Message Sign
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAR	Highway Advisory Radio
ITS	Intelligent Transportation System
NEPA	National Environmental Policy Act
ROM	Rough Order of Magnitude
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users
SEA	Systems Engineering Analysis
TDOT	Tennessee Department of Transportation
TEA-21	Transportation Equity Act for the 21st Century
THP	Tennessee Highway Patrol
TPO	Transportation Planning Organization
TSIS	TDOT SmartWay Information System
TRIP	Travel and Recreation Information Program

1. INTRODUCTION

1.1 Project Overview

In October 2011, the Knoxville Regional Transportation Planning Organization (TPO), in coordination with the Tennessee Department of Transportation (TDOT), began the update of the Knoxville Regional Intelligent Transportation System (ITS) Architecture with the goal of completing the update in 2012. A regional ITS architecture provides a framework for implementing ITS projects, encourages interoperability and resource sharing among agencies, identifies applicable standards to apply to projects, and allows for cohesive long-range planning among regional stakeholders. ITS architectures allow stakeholders to plan for what they want their system to look like in the long-term and then break out the system into smaller pieces that can be implemented as funding permits. Typical ITS projects that might be considered in an ITS architecture include advanced arterial traffic management systems, traveler information dissemination, incident management, and public transit monitoring systems that provide real-time information to operators and transit users.

Given some of the unique transportation challenges that exist along the Sevier County Tourist Corridor, the Knoxville Regional TPO placed additional emphasis on identifying possible ITS projects that might be needed along the corridor. The Sevier County Tourist Corridor includes the Cities of Sevierville, Pigeon Forge, and Gatlinburg and is one of the most heavily used and congested tourist corridors in the State of Tennessee. The Knoxville Regional TPO worked closely with the Sevier Transportation Board to define the ITS Master Plan project and identify stakeholders to invite to participate and provide input regarding transportation challenges and potential ITS solutions in the corridor.

A series of four regional workshops were held to develop the Knoxville Regional ITS Architecture and included stakeholders from throughout the Region. In order to gather additional input from stakeholders along the Sevier County Tourist Corridor, two additional workshops were help in Pigeon Forge in the first half of 2012. Stakeholders from local, state, and federal agencies along the corridor were invited to provide input along with several representatives from the tourist industry, such as the Chambers of Commerce and Dollywood theme park. This ITS master plan reflects the input and discussions from those two workshops held with the stakeholders from the Sevier County Tourist Corridor.

The projects that are identified as part of the Sevier County Tourist Corridor ITS Master Plan will also be incorporated into the Knoxville Regional ITS Architecture. The Knoxville Regional ITS Architecture was first developed in 2000 and was updated in 2003. Regional ITS architectures are living documents and need to be continuously updated in order for them to accurately reflect the ITS needs, plans, and visions within a region. A regional ITS architecture is also necessary to satisfy the ITS conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) bill passed in 2005. In response to Section 5206(e) of TEA-21, the Federal Highway Administration (FHWA) issued a final rule and the Federal Transit Administration (FTA) issued a final policy that required regions implementing any ITS project to have an ITS architecture in place by April 2005. After this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. In order to show this conformance, it is important that any region deploying ITS have an updated regional ITS architecture in place.

The Knoxville Regional ITS Architecture update includes the same geographic boundaries as the Knoxville Regional TPO as well as all of Anderson, Blount, Knox, Loudon and Sevier Counties. The

entire Sevier County Tourist Corridor is included within the boundaries of the Knoxville Regional ITS Architecture.

1.2 Sevier County Tourist Corridor

The Sevier County Tourist Corridor is defined in this study as the route comprised of SR 66 and US 441, extending from I-40 Exit 407 on the northern end to the entrance to the Great Smoky Mountains National Park at the southern end. The corridor is shown in blue in **Figure 1**. The corridor passes through the Cities of Sevierville, Pigeon Forge, and Gatlinburg and draws an extremely high number of tourists throughout the year. Attractions along the corridor include the Dollywood Theme Park, Ripley's Aquarium of the Smoky's, Titanic Museum, and Ober Gatlinburg. There are a very large number of hotels, shopping destinations, restaurants, and entertainment venues. Special events are held throughout the year that can place additional stresses on the transportation system beyond the normal tourist traffic. The corridor also serves as the gateway into the Great Smoky Mountains National Park, which adds additional traffic.

There are two routes which could serve as bypass routes along the Tourist Corridor: Veterans Boulevard located to the east of the Tourist Corridor and the Gatlinburg Bypass located west of Gatlinburg.

Veterans Boulevard begins approximately 1.5 miles east of downtown Sevierville and ties back into the Tourist Corridor in Pigeon Forge near the Dollywood theme park. This corridor is not generally utilized as a bypass and primarily serves the needs of local residents. Some of the challenges noted by stakeholders were that travelers need to travel over a mile east of downtown Sevierville to access the corridor, there is limited signage directing motorist to Veterans Boulevard, and the number of lanes is restricted on Veterans Boulevard on the south end. There are no detection devices or closed circuit television (CCTV) cameras located along Veterans Boulevard to allow real-time monitoring. Routing traffic onto Veterans Boulevard may also be objectionable to business owners along the Tourist Corridor due to concerns about loss of potential customers. Use of Veterans Boulevard as a bypass will likely require a public outreach effort and consensus building among business owners before it could become a feasible option.

The Gatlinburg Bypass provides a convenient alternative to bypass the City of Gatlinburg and enter the Great Smoky Mountains National Park. The bypass is generally well signed and provides adequate capacity. The challenge is that many of the tourists in the area are either going to Gatlinburg as their destination or are choosing to drive through Gatlinburg to sight-see through downtown. Although the Bypass was considered a valuable route by stakeholders, the popularity of Gatlinburg as both a destination and scenic route to drive through limits the number of people that use the bypass.

In addition to the Tourist Corridor, tourists traveling to the area do have several other choices. Travelers coming from Knoxville can access the area using US 441. This is a well-used route by many people traveling from Knoxville, but those from outside the Knoxville Region will typically stay on I-40 and travel to SR 66 when traveling to the corridor. Tourists traveling from North Carolina along I-40 can access the area using US 411 or SR 329 to US 321. In general these routes are not that heavily utilized.

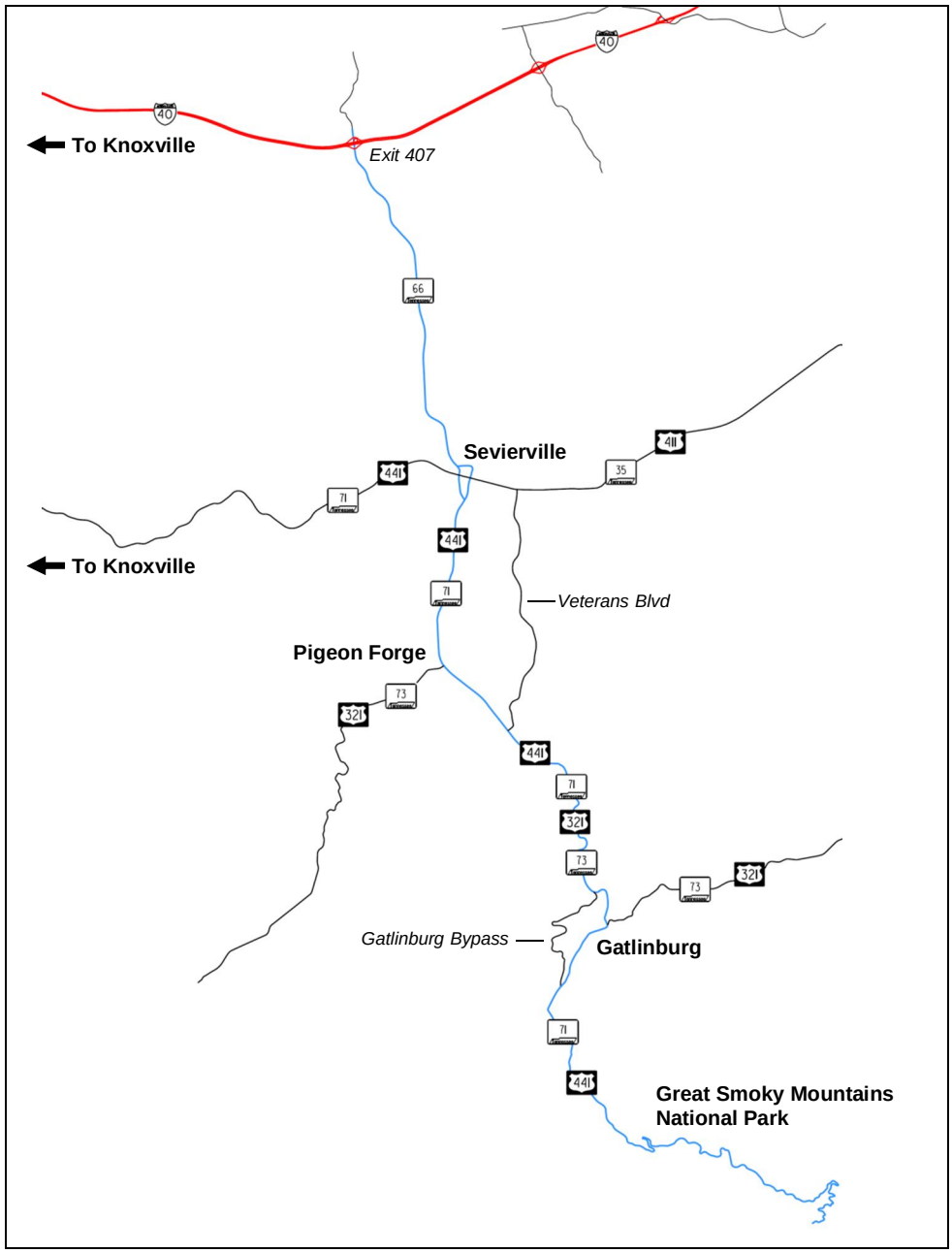

Figure 1 – Sevier County Tourist Corridor ITS Master Plan Study Area

1.3 Stakeholders

The Knoxville Regional TPO and the Sevier Transportation Board identified a large group of stakeholders to invite to participate in the development of the Sevier Country Tourist Corridor ITS Master Plan. These included representatives from local agencies including public works, transit, fire, and police, representatives from state agencies such as the Tennessee Department of Transportation, and representatives from federal agencies such as the Great Smoky Mountains National Park and the Federal Highway Administration. Given the importance of tourism to area, representatives of the

Chambers of Commerce and several of the largest tourism generators, such as Dollywood and Ober Gatlinburg, were also invited.

Stakeholders were provided an opportunity to provide input into the process at two separate workshops held on February 15, 2012 and April 17, 2012 in Pigeon Forge at City Hall. In the first workshop held in February, an overview of the project was provided and stakeholders were asked for input on transportation challenges and needs in the corridor. Potential ITS solutions to those challenges and needs were also discussed.

In the second workshop held in April, project concepts were presented to stakeholders for additional input and discussion. Stakeholders were also asked to provide any other ideas for project concepts to include in the ITS Master Plan.

In addition to the workshops, several conversations and meetings were conducted with officials from local and state agencies to better understand their needs and identify projects in more detail. These meetings were primarily to help define project concepts in more detail, and also to present project ideas to determine their feasibility for those agencies might be tasked with the operations and maintenance of such systems. It is important to consider the long term implications of any ITS deployment. Systems must be properly maintained in order to operate effectively and in some cases, the systems must be continuously monitored. Input from stakeholders that are responsible for these systems is very important so that anything that is implemented has the support of the agencies responsible for operations and maintenance.

In **Table 1**, all of the agencies that attended the first, second workshop, or both workshops have been identified.

Table 1 – Participating Stakeholder Agencies

Stakeholder Agencies	Workshop 1 Participant *February 15, 2012*	Workshop 2 Participant *April 17, 2012*
City of Gatlinburg		
City Manager's Office	✓	
Mass Transit (Gatlinburg Trolley)	✓	✓
Planning Department	✓	✓
Police Department		✓
City of Pigeon Forge		
City Manager's Office	✓	✓
Community Planning	✓	
Fire Department	✓	✓
Fun Time Trolley	✓	✓
Police Department		✓
Public Works Department		✓
City of Sevierville		
Administration Department	✓	✓
Engineering Department	✓	✓
Planning and Development	✓	✓
Police Department	✓	✓
Public Works Department	✓	✓
CDM Smith	✓	✓
Dollywood	✓	✓
East Tennessee South RPO	✓	✓
Federal Highway Administration	✓	✓
Gatlinburg Chamber of Commerce	✓	
Great Smoky Mountains National Park	✓	✓
Knoxville Regional TPO	✓	✓
Ober Gatlinburg	✓	
Sevier County		
Emergency Management Agency	✓	
Highway Department	✓	
Mayor's Office	✓	✓
Tennessee Department of Transportation		
Division of Multimodal Transp. Resources	✓	✓
Region 1	✓	

1.4 Document Overview

The Sevier County Tourist Corridor ITS Master Plan report is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the Sevier County Tourist Corridor ITS Master Plan project and the relationship to Regional ITS Architecture update. A description of the corridor and stakeholders involved in the project is also provided.

Section 2 – Corridor Challenges and Needs

This section provides an overview of the challenges and needs identified by stakeholders for the Tourist Corridor.

Section 3 – Existing Systems

This section provides an overview of the existing ITS systems that currently exist in the region, including traffic signal systems, monitoring systems, transit traveler information systems. An overview of TDOT's SmartWay deployments in the Region is also provided.

Section 4 – Project Recommendations

This section provides a description of the project recommendations for the Sevier County Tourist Corridor ITS Master Plan. Project descriptions include an overview of the recommended project elements, benefits of the program, cost range, and phasing opportunities for project implementation.

Section 5 – Regional ITS Architecture Conformance

This section demonstrates the conformity of the recommended projects with the Knoxville Regional ITS Architecture that is being updated concurrently with the Sevier Tourist Corridor ITS Master Plan.

2. CORRIDOR CHALLENGES AND NEEDS

On February 15, 2012, the first of two stakeholder workshops was conducted with stakeholders from the Sevier County Tourist Corridor. The three-hour workshop was conducted in the Pigeon Forge City Hall and included stakeholders representing both public and private sector entities with a vested interest in the Sevier County Tourist Corridor. Approximately 35 stakeholders were in attendance at the workshop.

Stakeholders were asked to identify the key challenges that they saw regarding transportation in the corridor. Challenges did not necessarily have to be able to be addressed through ITS deployment, for the purposes of the workshop the focus was to simply identify all of the transportation challenges in the area. The project team stated that challenges identified for the corridor would then be reviewed against potential ITS concepts for the Corridor, and at the next workshop possible ITS solutions would be presented and discussed.

In addition to the project challenges that were identified, several specific needs were also noted by stakeholders in attendance. Both the project challenges and the needs that were identified are presented in this chapter.

2.1 Sevier County Tourist Corridor Challenges

The primary challenge with the Sevier County Tourist Corridor is the heavy traffic volume that is experienced along the corridor during peak tourists' travel. This volume, which causes most intersections to operate over capacity, isn't limited to a few times per year. It occurs nearly every weekend throughout the year, and during peak tourist months in the summer and around the holidays the heavy volumes can occur throughout the entire week. The stakeholders identified the period between July and October as the peak tourist periods that cause severe congestion on the Corridor. The Tourist Corridor also experiences extremely high volumes during the Christmas holidays.

The Stakeholders identified several specific challenges related to the Sevier County Tourist Corridor:

Traffic exiting off of I-40 at the SR 66 exit queues onto I-40: The primary route tourists use to access the corridor is I-40 from Knoxville to the exit at SR 66. This heavy right-turn movement off of eastbound I-40 can cause long queues to build onto the freeway on I-40. This can occur during any period with heavy volumes, but is most common on Fridays during the peak tourists' months. Improvements are planned for the traffic signal at the I-40 exit ramp which may improve this concern.

Tourists leaving the area on Sundays can create severe congestion: Throughout the year there are always a very large number of people who leave the Sevier County Tourist Corridor area near the same time. This creates severe congestion along the Corridor regardless if it is a peak tourist month or not. Traffic backs up at the Sevierville/Pigeon Forge city line due in part to a lack of coordination between the two cities traffic signal system. Traffic also backs up at the I-40 ramps. There is a lack of coordination at this location between the City of Sevierville main traffic control system and the signals at this location. Improvements to SR 66 and a TDOT planned diverging diamond interchange should improve this congestion.

Veterans Boulevard is underutilized: Veterans Boulevard can provide a bypass for motorists traveling south on SR 66 going to Dollywood, Gatlinburg, or the Great Smoky Mountains National Park. Stakeholders noted several reasons why Veterans Boulevard may be underutilized:

- Lack of prominent signing of the corridor as a by-pass;
- Dog-leg at the northern end requires the motorist to travel approximately 1.5 miles to the east to access the corridor;
- South end of the corridor is reduced to a two-lane road which creates a choke point; and

- Due to the lack of real-time traveler information on the corridor, motorists do not know if using the Veterans Boulevard will save them time.

As noted earlier, routing traffic onto Veterans Boulevard may be objectionable to local businesses on the Tourist Corridor. Also, the limited number of lanes on the south end and the potential conflict of traffic movements on the north end with US 441 all create additional concerns that must be addressed before considering routing traffic onto Veterans Boulevard.

A large majority of travelers access the Tourist Corridor at the same point at I-40 and SR 66: Although alternate routes exist to travel from Knoxville to the cities along the corridor, a large majority of the traffic will travel east on I-40 to the SR 66 exit. Travelers coming from the east will also most commonly access the corridor at the SR 66 exit from I-40 as well.

The corridor experiences unusual or unanticipated peak demands which severely impact operations: Examples of such demand include special events such as car shows which add additional vehicles cruising on the roads, and unanticipated demand such as severe storms may require that Dollywood closes unexpectedly, which sends a large amount of traffic onto the corridor. The signal system, even if it is timed well, is often not able to accommodate the unusual or unanticipated demand.

Incidents with extended closures along the corridor severely impact traffic: Since the Tourist Corridor often operates at capacity or over capacity, incidents and other impacts to traffic can have severe impacts on traffic conditions. Stakeholders noted that CCTV cameras may help to route emergency vehicles to the scene faster by allowing dispatchers to monitor traffic conditions and provide routing instructions to emergency responders. By getting emergency vehicles to the incident scene sooner, the expectation is that incidents can be cleared sooner and have less of an impact on traffic.

There is not a consistent travel pattern in any of the three cities: Stakeholders noted that each of the three cities experience very different traffic patterns. Each has unique tourist attractions and traffic demands. Although the cities are all located along the same corridor, the unique needs and traffic patterns of each must be carefully considered as the same approach may not work in every city.

2.2 Sevier County Tourist Corridor Needs

Potential ITS solutions were discussed with the stakeholders and possible ITS solutions were identified. Stakeholders identified the following potential ITS needs to consider when developing the ITS Master Plan for the Sevier County Tourist Corridor.

- Provide improved traffic signal coordination along the Sevier County Tourist Corridor that can account for unanticipated and fluctuating demand
- Provide alerts regarding severe congestion to travelers entering and leaving the area. These types of alerts will most likely be located on the road side to alert traveler just as they approach or enter the Tourist Corridor.
- Provide advanced traveler information to travelers prior to them entering and leaving the area. This type of information should be available from home or other mobile devices to allow access to the information well in advance of entering the Tourist Corridor.
- Provide emergency vehicle signal pre-emption to emergency vehicles in the Pigeon Forge area.

This list is by no means conclusive. The project team reviewed both the list of corridor challenges as well as the list of needs and used these as the basis for developing a set of project concepts to consider along the Sevier County Tourist Corridor.

3. EXISTING ITS SYSTEMS

3.1 Sevier County Tourist Corridor Existing Systems

In the Sevier County Tourist Corridor, the primary infrastructure that would be considered ITS infrastructure includes:

- Arterial traffic signal systems (Includes vehicle detection and emergency vehicle signal preemption);
- Closed circuit television (CCTV) cameras;
- Dynamic message signs; and
- Transit vehicle traveler information systems.

Arterial Traffic Signal Systems – Arterial traffic signal systems are operated by the City of Sevierville, City of Pigeon Forge, and the City of Gatlinburg. The location of existing signals in each city is shown in **Figures 2, 3, 4, and 5**. Each of these systems operates on a closed loop signal system. The City of Sevierville is in the process of implementing PEEK IQCentral software and placing several intersections on a fiber communications network that should improve operations along the Tourist Corridor. Stakeholders noted that police will often take control of certain intersections during periods of heavy congestion to manually control the traffic signals. Emergency vehicle signal preemption exists on the signals but transit priority does not.

CCTV Cameras – There are six existing CCTV cameras along the SR 66 segment of the Tourist Corridor from I-40 to the intersection with US 441 and 411. These cameras were originally installed to monitor traffic during a construction project along the corridor and are operated by the City of Sevierville. Although stakeholders indicated that CCTV cameras would be useful to monitor traffic conditions along the corridor, the lack of staff to monitor the cameras reduces the usefulness of the cameras.

Dynamic Message Sign (DMS) – There is only one DMS currently in operation along the corridor. This sign is located at the entrance to the Great Smoky Mountains National Park for motorists traveling southbound on the Tourist Corridor once they have left the City of Gatlinburg. The DMS location is shown in **Figure 5**.

Transit Traveler Information Systems – Gatlinburg Mass Transit and the Pigeon Forge/Sevierville Fun Time Trolley both operate trolley systems. Ridership is very high, with Gatlinburg ranking as the fifth largest transit system and Pigeon Forge/Sevierville Fun Time Trolley as the sixth largest transit system in the State of Tennessee. Both systems have GPS enabled on their trolleys to track trolley locations on the web. At the time of this report, Gatlinburg provided locations on their transit website and Pigeon Forge/Sevierville was working to improve accuracy of the maps with plans to make them public soon. Both agencies were planning to provide additional methods for the public to access real-time bus location, including the ability to scan a code at stops and determine the next trolley arrival with a Smart phone and deployment of monitors to show the trolley locations in hotel lobbies and other areas where tourists have access to the information. The transit routes are shown in **Figures 2, 3, 4 and 5**.

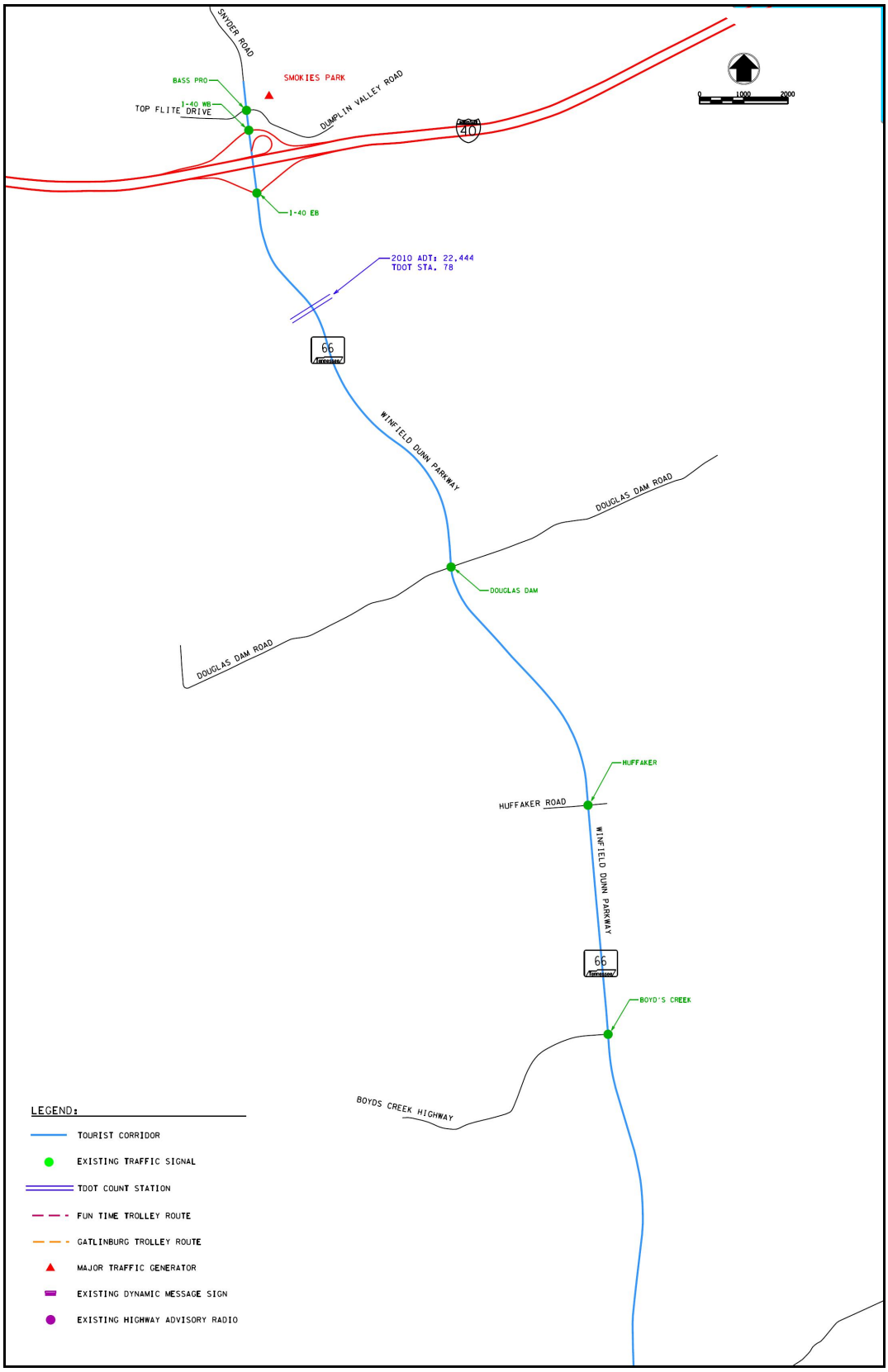

Figure 2 – City of Sevierville Existing ITS Infratructure (North)

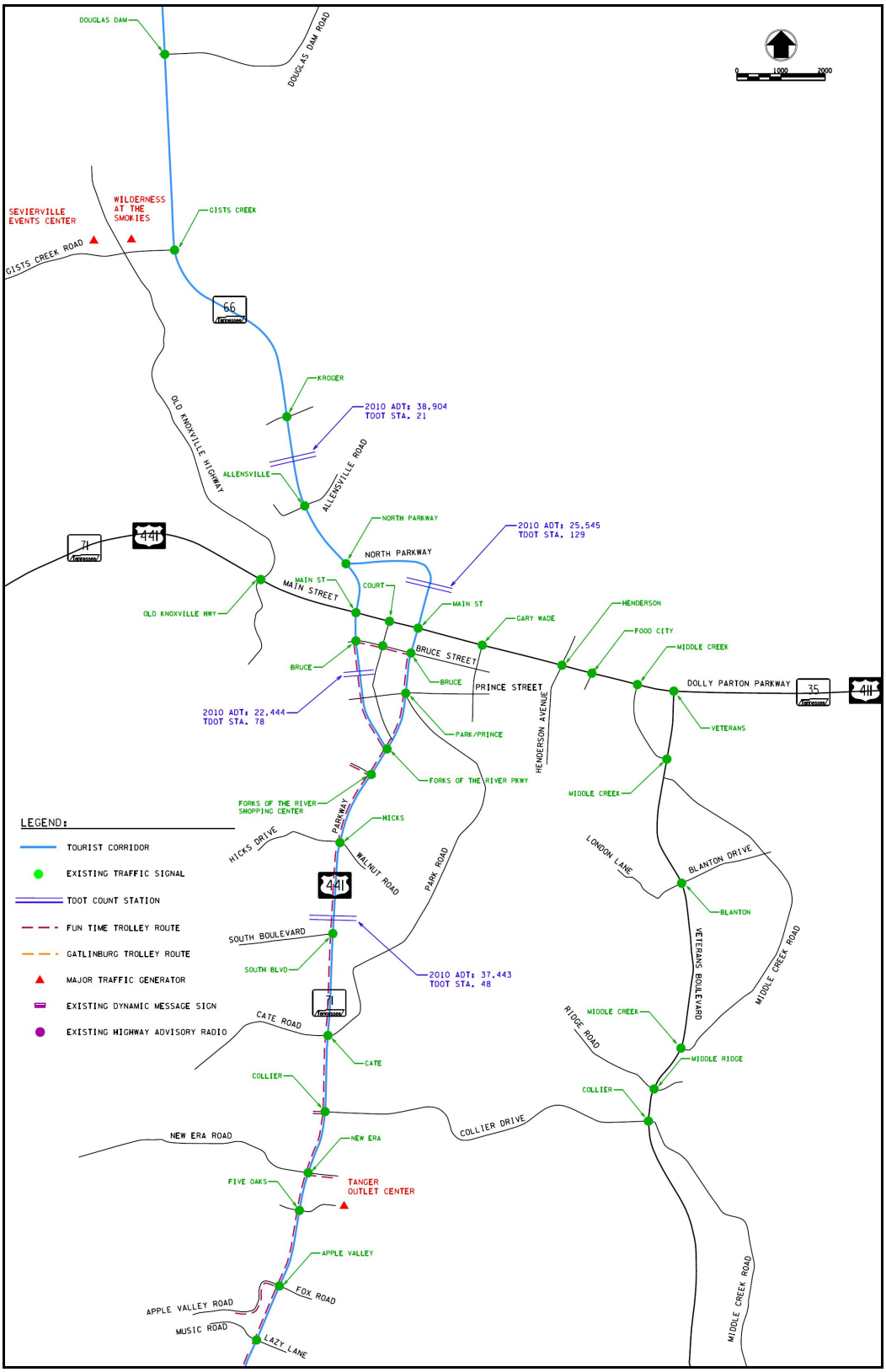

Figure 3 – City of Sevierville Existing ITS Infratructure (South)

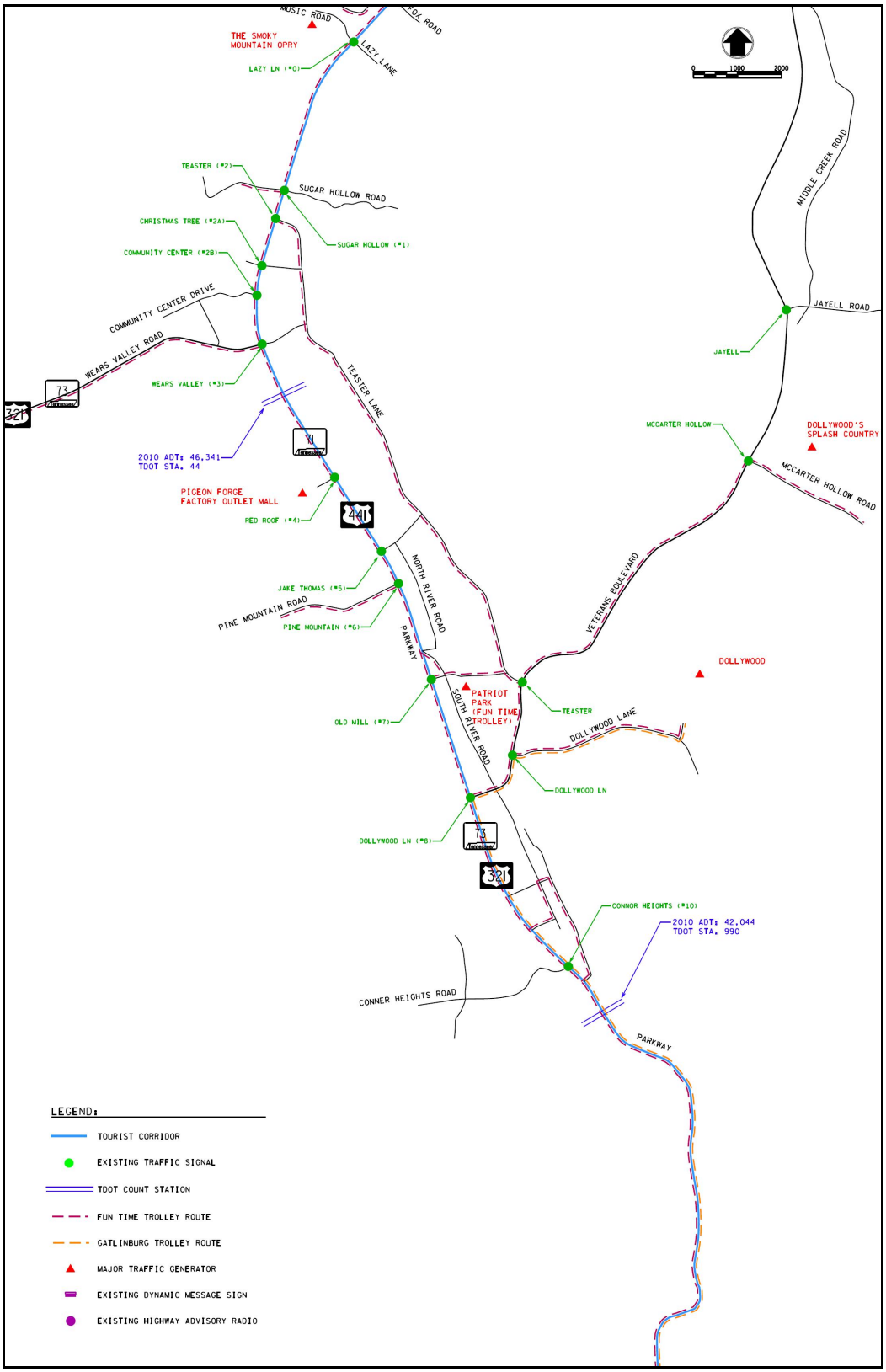

Figure 4 – City of Pigeon Forge Existing ITS Infratructure

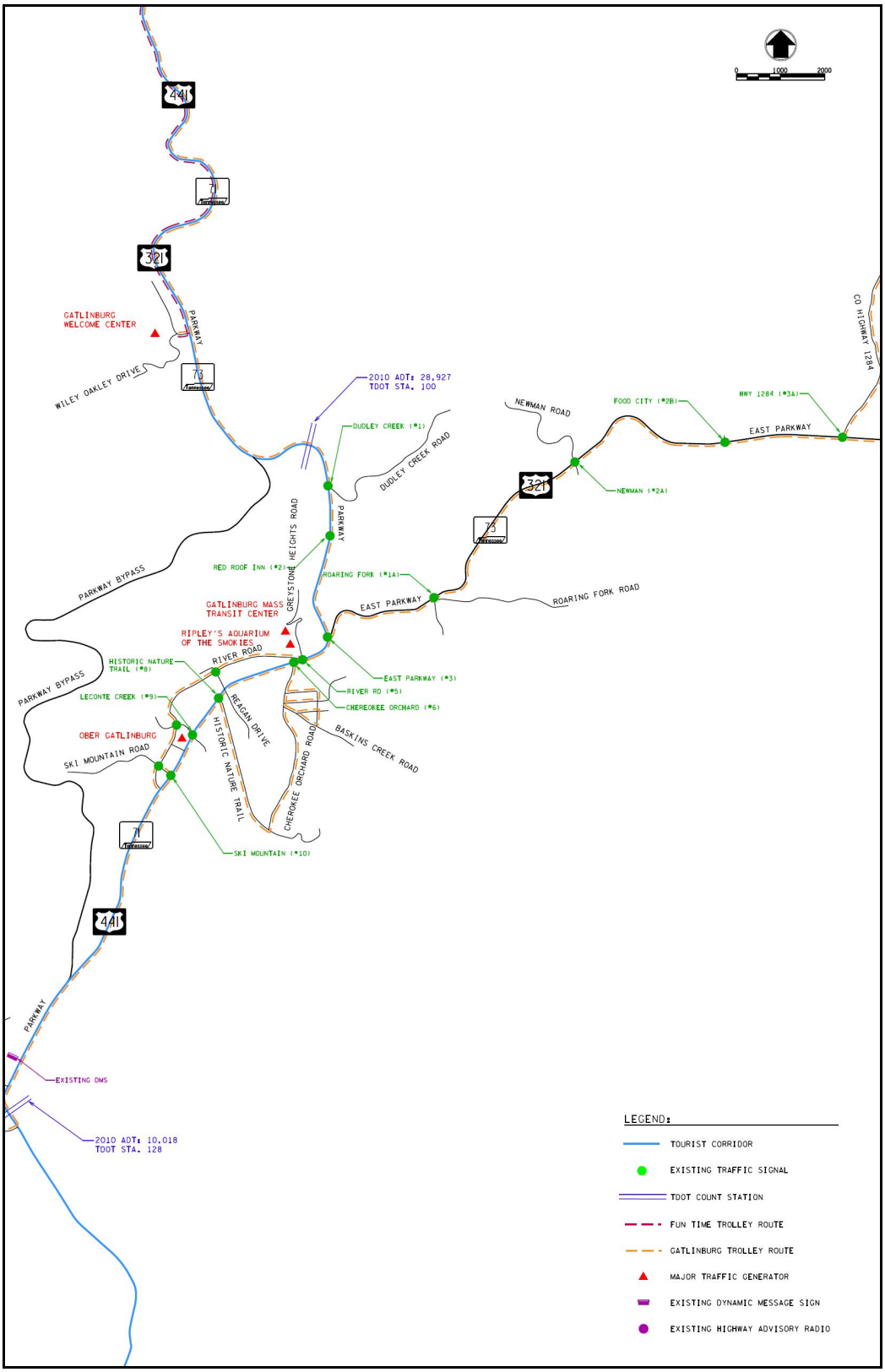

Figure 5 – City of Gatlinburg Existing ITS Infratructure

3.2 Knoxville Regional Existing Systems

Within the Knoxville Region there are a number of significant ITS deployments and programs that have been implemented. Several of these deployments can be utilized by the Sevier County Tourist Corridor to assist with meeting the goals of the corridor for traffic management. For example, the TDOT SmartWay 511 traveler information phone number can be used for providing alerts regarding travel conditions on the corridor for motorists that are traveling to the area. A summary of the existing regional systems in the area, and the benefit they may provide to the corridor, is included below.

TDOT SmartWay ITS Program – The TDOT SmartWay ITS Program has been operational since 2005 and provides coverage to approximately 45 miles of freeway. A majority of the urban freeway system in Knoxville is covered by SmartWay ITS. It includes a Traffic Operations Center that is staffed every day of the year for 24 hours per day, freeway detection systems, CCTV cameras, DMS, and highway advisory radios (HAR) connected by a Gigabit Ethernet fiber optic communication network. TDOT does not currently include ramp metering or integration with adjacent local signal systems along parallel arterial networks but it has been considered and could possibly be added at some point in the future. The SmartWay TMC staff work closely with the TDOT HELP Service Patrol operators as well as public safety officials to manage incidents, special events, severe weather events, and construction closures. Information about traffic conditions, including travel times, is included on the DMS and HAR at the roadside as well as through the SmartWay website and 511 traveler information system to alert motorist as early as possible.

In **Figure 6**, the existing SmartWay traveler information components of DMS and HAR are shown. Under the existing deployments, there are no DMS located near the SR 66 exit from I-40, which serves as the primary route to the Tourist Corridor. There are HAR stations located approximately 12 miles to the west and 8 miles to the east of the SR 66 exit. These HAR stations could be utilized for broadcasting messages regarding travel conditions on the Tourist Corridor if there was severe congestion or an incident. Future expansion of the TDOT SmartWay system on the freeway may also add additional DMS and HAR stations closer to the SR 66 exit which would allow additional use of the SmartWay system for providing traveler information about the Tourist Corridor.

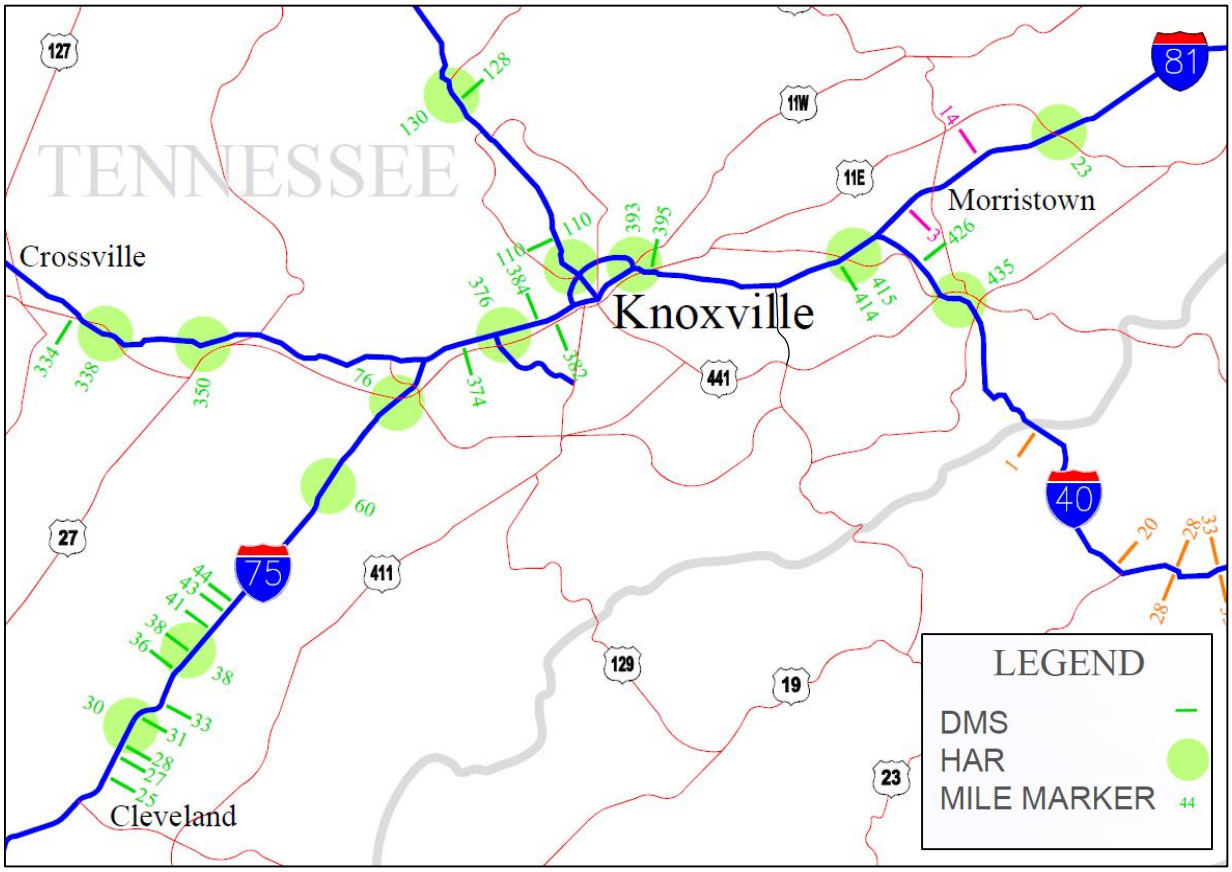

Figure 6 – TDOT Existing ITS Infrastructure

511 Traveler Information Number – TDOT currently operates a statewide traveler information number that provides real-time traveler information throughout the state. Information is put into 511 through the TDOT SmartWay Information System (TSIS), which is updated by the TDOT SmartWay TMC operators and the Tennessee Highway Patrol (THP) dispatchers. 511 information can also be accessed through a 511 website and several social media sites such as Twitter and Facebook.

TDOT has indicated that 511 can be used for providing traveler alerts and information about the Tourist Corridor. TDOT does not currently have any CCTV cameras or detection devices located on the Tourist Corridor, so they have no way to determine travel conditions along the corridor. Any travel condition information that is posed on 511 about the Tourist Corridor will need to be provided by local Sevier County agencies, such as Sevier County or any of the cities located along the corridor. While collecting this real-time information will be challenging, the TDOT 511 system offers an established system for providing this information to travelers statewide.

TDOT HELP Service Patrol – The TDOT HELP Service Patrol Program has been in operation in the Knoxville Region since the year 2000. The HELP Service Patrol Program trucks patrol freeways including I-40, I-75, I-640, I-275 I-140, and US 129 (SR 115) to assist motorists with minor repairs such as flat tire changes, fuel, and push services to move disabled vehicles out of the through lanes. HELP operators also assist with traffic control and detours during major incidents.

The HELP Service Patrol currently only operates on segments of freeway where TDOT has deployed the SmartWay freeway management system components. The HELP Service Patrol vehicles do not currently operate in the vicinity of the Sevier County Tourist Corridor. However, future expansion of

the system may provide additional service patrol capabilities along I-40 near the exit for SR 66, which would provide better incident management near the Tourist Corridor.

TDOT/TPO Incident Management Task Force – TDOT and the Knoxville TPO are leading an Incident Management Task Force that focuses on issued related to the management of crashes on freeways. The Task Force is made up of representatives from police and fire departments, emergency medical series, state and local transportation departments, towing and recovery companies, environmental agencies, and hazardous spill and containment companies. The Incident Management Task Force provides a forum for these agencies to review responses to incidents and promote better communication and cooperation has recently established an Incident Management Task Force. This group includes public safety and traffic agencies in the Knoxville Region that are involved in incident management. The group is meeting at regular intervals to discuss how incident management can be improved in the region, ensure continued coordination between agencies involved in incident management, and review responses to major incident.

Emergency responders along the Sevier County Tourist corridor may want to participate in this Task Force. Improved incident management along the freeways leading to the Tourist Corridor could help eliminate some of the challenges associated with travel in the area.

4. PROJECT CONCEPT RECOMMENDATIONS

Recommendation for project concepts were discussed with project stakeholders at the second project workshop, conducted on April 17, 2012. This workshop included the participation of approximately 22 stakeholders from the Sevier County Tourist Corridor.

Additionally, input was sought from many of the stakeholders in discussions with those agencies that would be responsible for deployment, operations, and maintenance of systems. A primary concern by stakeholders was the implementation of systems that could be operated with minimal staff involvement. On-going costs for operations can be challenging for many smaller municipalities and counties with limited staff. This was noted in the discussions and the number of projects and concepts was generally scaled back in consideration of minimizing operations and maintenance costs.

Improvements to traffic signal systems were generally seen as the projects that might provide the greatest cost benefit. In Sevierville and Pigeon Forge, which have wide open corridors and less pedestrian traffic, an adaptive signal system was recommended as a project concept. Enhanced traffic responsive or adaptive signal systems should assist in dealing with unpredictable flow. Adaptive systems reduce the need for frequent corridor-wide timing but do require detection on all approaches to a traffic signal and rely on accurate detection in order to be effective.

In Gatlinburg, the ability to address congestion by ITS was somewhat constrained by a limited number of though lanes and frequent pedestrian crossings. The investment required for an adaptive signal system was not considered cost effective because the limited number of through lanes and heavy pedestrian volumes would still limit any improvements to congestion that an adaptive system might offer. Instead, it was recommended that the existing closed loop signal system be improved.

Stakeholders noted the need for improved traveler information in the Region. One of the largest challenges, and highest cost items, is in monitoring the system to collect real-time information to provide to travelers. Rather than deploy a series of detection systems throughout the corridor (including by-pass routes), it was recommended that a third party traffic data provider be used. Although this data may not be as accurate, in general it is often of a high enough quality to provide general traveler information and alerts to motorists. It can also be used to determine if potential alternate routes, such as Veterans Boulevard, are operating at a level of service high enough that traffic can be routed to the alternate routes. A second challenge with deployment of a traveler information system is determining an agency that will take ownership of the system to provide on-going system operations and maintenance. Sevierville and Pigeon Forge have considered a joint operations center for their signal system, and if such a center were implemented this may be the best location to serve as the operation center for traveler information.

Finally, on-going transit traveler information systems by the Gatlinburg Trolley and Pigeon Forge/Sevierville Fun Time Trolley are providing an effective method to encourage transit ridership. Both agencies have plans to deploy devices in areas that are accessible to tourists, such as hotel lobbies, and should further encourage the use of transit by displaying all trolley locations and providing tourists with estimates of the next trolley arrival time.

4.1 Signal System Upgrades and Joint Traffic Operations Center (Sevierville and Pigeon Forge)

Project Concept: Signal System Upgrades (Sevierville and Pigeon Forge)

Elements: The City of Sevierville is currently in the process of upgrading their traffic signal system controllers and communications system, including the communications to their existing traffic signals. The City would like to improve traffic signal timing along the Sevier Tourist Corridor either through the implementation of an upgraded traffic responsive signal system with improved signal timing, or through the implementation of an adaptive traffic signal control system. As a first step in moving forward, a feasibility study should be performed to determine the best option for the City of Sevierville. If possible, the study will be performed in coordination with the City of Pigeon Forge so that a joint deployment of the traffic signal system upgrades in both cities is considered. A joint deployment of the traffic signal system and a combined traffic operations center (TOC) would allow seamless coordination of traffic signals at the Sevierville/Pigeon Forge border and could provide cost savings by combining the operations of the system into a single center.

Traffic Signal System – Regardless of which type of signal system is implemented, communication upgrades will be necessary to support real-time second by second communications between field controllers and the TOC. Wireless IP communication links, which can be implemented as an extension of the City of Sevierville IT network, provide the most cost effective delivery option. In order to support IP communications, traffic signal controller communications interface modules will need to be upgraded as a minimum. However, traffic signal controllers are approaching end-of-life vendor support and will be facing wholesale replacement in the near to intermediate time frame. Acquisition of new equipment for either Sevierville or Pigeon Forge should be coordinated with the other City if possible to ensure the signal systems of both cities are compatible and can be operated in a coordinated fashion along the Tourist Corridor.

If an adaptive signal control system is selected, system detection will need to be expanded to support adaptive control. All approach lanes will need individual detection established. This is already the case for most approaches. Additionally, mid-block or departure lane detection will be needed on the major movements which will need to be added from scratch.

Central software licensing, database setup, and field integration services will also be needed to complete the migration from the current closed loop system.

Joint Traffic Operations Center – The cities have discussed the possibility of a joint TOC to monitor and control the traffic signal system. It is recommended that a single TOC be established, but that both cities still retain the ability to monitor and operate their respective cities. The joint TOC is a critical piece to the successful operations of the traffic signal system. Coordination of traffic between the two cities will be needed to provide seamless traffic flow along the Tourist Corridor. A joint TOC could also serve as the primary center for operations of a corridor wide traveler information

Existing traffic signal system in Sevierville

system.

Benefits: The upgraded traffic responsive signal system would provide improved signal timing and allow the cities to monitor traffic conditions and implement new timing plans remotely to address special events, incidents, or changes in travel patterns. The adaptive traffic signal control program would provide improved signal timing that adapts to the unpredictable flow conditions associated with special trip generators within the corridor, reduces the frequency for high cost system wide signal retiming modeling, and improves performance verification via historical documentation.

Rough Order of Magnitude (ROM) Cost Range: Before advancing with a signal system upgrade, there will need to be a signal system feasibility study in the range of $75,000-100,000. The major deployment ROM cost elements associated with this program are estimated in the range of $150,000-200,000 for communication connectivity, $20,000-25,000 to upgrade existing controller communication interfaces, $125,000-150,000 to upgrade controller platform, and $125,000-250,000 to expand system detection (adaptive traffic signal control system only). Portions of these communication and controller upgrades are already underway but most of the system upgrades are not fully funded. Central software and overall system setup and integration are estimated at $400,000-500,000 to cover an adaptive operation or $50,000 – 100,000 to upgrade to an enhanced traffic responsive system. If the participating agencies go the route of a traffic responsive system rather than an adaptive system, then they should expect to expend between $200,000-250,000 every 3-5 years to keep timing patterns and traffic responsive flow signatures current. For either option, an approximate estimate of $100,000 has been made to cover the cost of preliminary engineering, including design, systems engineering analysis (SEA), and NEPA work.

Approximately $50,000 should be estimated for the establishment of a joint TOC at one of the cities and the addition of software to allow the other city the capability to monitor and control the signal system from within their city. The joint TOC will use existing office space and be comprised primarily of a workstation, additional monitors, and communications equipment for support. Additional cost should be considered to staff the TOC, although generally existing staff could be used to monitor the TOC during critical periods and it is not anticipated that the TOC will have dedicated staff for operations.

The total estimated program ROM cost is estimated at approximately $1,400,000 over the next 10-12 years for an adaptive system, and approximately $1,500,000 over the next 10-12 years for an enhanced traffic responsive system when periodic signal retiming efforts are included on a 3 to 5 year basis.

Phasing Opportunities: The communication and controller interface upgrade would be a minimum first step to conduct a system upgrade feasibility study while maintaining current closed loop operation. The second step would be the transition to enhanced traffic responsive closed loop system or adaptive control by updating the hardware platform, adding additional flow detection, and central setup and integration. The cost for both approaches would be very similar over the 10-12 year system life, but the costs for the enhanced traffic responsive signal system would more evenly distributed over the life of the system. The TOC could also be added as part of the second step. The system could continue to grow from that base platform later through the addition of auxiliary functions such as video and dynamic message signs on a location by location basis. Video and DMS would likely be implemented if a corridor wide traveler information system were implemented.

Challenges: Special integration requirements of non-traditional traffic signal communication platform.

Benefit-to-Cost Studies: A large number of studies have been performed to determine the benefits of improving signal timing. Benefits vary quite widely depending on volumes, traffic patterns, and quality of current signal timing in relation to traffic conditions. In general signal timing has been

shown to be a very cost effective improvement for reducing delay and improving throughput with minimal disruption to the traveling public.

Studies of adaptive control systems also vary, but in general show a benefit-to-cost ratio in the range of approximately 20:1 and have been shown to reduce travel time by as much as 10 to 40 percent. Some specific examples of adaptive control system benefits that have been measured are included below.

- In Atlanta, adaptive signal control combined with transit signal priority showed a benefit-to-cost ration of 23:1 to 28:1. (June 2010)
- In California, the estimated benefit-to-cost ratio for optimized sign timing plans, coordinating traffic signals, and implementing adaptive signal control was found to be 17:1. (January 2001)
- In Los Angeles, adaptive signed control system were show to improve travel time by 13 percent, decrease stops by 31 percent, and reduce delay by 21 percent. (July 2001)
- In a USDOT study of ITS benefits, it was found that adaptive signal control systems in five metropolitan areas reduced delay by 19 to 44 percent. (December 2000)

Sponsors: Cities of Sevierville and Pigeon Forge

4.2 Closed Loop Signal System Improvements (Gatlinburg)

Project Concept: Closed Loop Signal System Improvements (Gatlinburg)

Elements: The existing closed loop system operates with an aging hardware platform that is a generation older than the devices currently in use in Pigeon Forge and Sevierville. The hardware platform should be upgraded to a more modern system. There are elements of an old twisted pair copper communication network that would be sufficient for closed loop operation, but portions are in disrepair. The communications network should be extended to match a reasonable system coverage limits and repairs made to the twisted pair copper communications network where needed. No recent timing plans have been developed for the current system and are significantly dated, where available at all. New timing plans should be developed so that the system is more responsive to current traffic conditions. Finally, the system should have the capability to be monitored and controlled from a single location. This central site will act as the TOC, but does not have to be an elaborate system beyond a workstation and possibly multiple monitors.

Benefits: The signals in this area currently operate essentially uncoordinated due to the state of the current closed loop signal system. Upgrading and restoring this closed loop system would reduce stops and associated grid lock conditions that frequently occur along the tourist corridor, particularly during peak turnover periods.

Adaptive signal systems were considered for the Gatlinburg area, but given the limited number of lanes and heavy volume of pedestrians, it was decided that the benefit of such adaptive systems would not outweigh the cost of implementation. Rather, a strong focus on improving the traditional closed loop signal system currently in use in Gatlinburg is recommended as the most cost effective method of ITS to improve traffic flow through the City.

Rough Order of Magnitude (ROM) Cost Range: The major ROM cost elements associated with this program are estimated in the range of $125,000-150,000 for communication repairs and expansion, $50,000-75,000 to upgrade the controller platform, and $175,000-200,000 to cover central software and overall system and system retiming. Approximately $10,000-$25,000 is estimated for a TOC located within an existing office space to provide a single workstation and capability to monitor and control the signal system. Approximately $50,000 is estimated for preliminary engineering, including design, SEA, and NEPA. The total estimated program ROM cost is approximately $500,000.

Existing traffic signal system in Gatlinburg

Phasing Opportunities: The hardware platform upgrade (ROM approximately $60,000) could be delayed to a later date but it would be beneficial to keep the entire program together to take advantage of economies of scale and the age of the current equipment.

Challenges: Special attention in the development of timing plans that not only maximizes traditional vehicular flow conditions but also incorporates the unique aspects of the tourist corridor.

Benefit-to-Cost Studies: Traffic signal system improvements, such as signal coordination and updated traffic signal timing plans, provide some of the highest cost benefit ratios of any ITS improvements. These types of projects are usually relatively low cost improvements that can be implemented quickly with little or no construction. The benefit-to-cost ratio of these projects can exceed 50:1 and reductions in delay can be measure at 20 percent or higher. Examples of the benefit-to-cost studies for traffic signal system improvement projects are included below.

- The Institute of Transportation Engineers (ITE) Journal has published research showing the retiming of traffic signals and signal synchronization as part of the Texas Traffic Light Synchronization Program provided a benefit-to-cost ratio of 62:1. (August 2005)
- A recent study in Allegheny County, Pennsylvania showed a benefit cost ration of 57:1. (August 2011)
- The Texas Traffic Light Synchronization Program also showed that retiming of traffic signal and signal synchronization reduced delays by 24.6 percent. (August 2005)
- The Public Road Journal published a report showing across the nation traffic signal retiming programs have resulted in travel time and delay reductions of 5 to 20 percent and fuel savings of 10 to 15 percent. (December 2004)

Sponsor: City of Gatlinburg

4.3 Corridor Wide Traveler Information System

Project Concept: Corridor Wide Traveler Information System

Elements: A data source with real-time information on the Sevier County Tourist Corridor and alternate routes will be needed. Alternate routes could include Veterans Boulevard, the Gatlinburg By-pass, and US 441 to Knoxville. Real-time information can be disseminated through the existing TDOT SmartWay Traveler Information System, which includes the 511 traveler information number and the SmartWay website. SmartWay also operates Twitter sites for various corridors in the State and it may be possible to add a site for the Sevier County Tourist Corridor. For major incidents, TDOT could also use their existing DMS and HAR to broadcast messages along I-40. Arterial DMS could also be added at key decision points and to provide general information on the Tourist Corridor. This may include DMS located southbound on the Tourist Corridor just south of I-40, southbound just north of the intersection of the Tourist Corridor with US 441 and US 411 to direct traffic to Veterans Boulevard, and southbound on the Tourist Corridor north of the Gatlinburg Bypass. Northbound DMS Tourist Corridor locations may include a DMS south of the Gatlinburg Bypass, DMS south of the Veterans Boulevard intersection in Pigeon Forge, and a DMS south of the intersection with US 441 and US 411 to provide information on the US 441 corridor for motorists traveling to Knoxville. A DMS in Gatlinburg to provide traveler information on conditions along US 321 for motorist traveling to North Carolina and Virginia may also be considered.

Stakeholders discussed the use of a limited number of CCTV cameras to verify traffic conditions at critical locations. CCTV cameras could be deployed at critical intersections and along portions of the Tourist Corridor and alternate routes to verify traffic conditions. Camera feeds can also be made available to the public for viewing.

In the Great Smoky Mountains ITS Strategic Plan, a project was identified to upgrade or replace existing AM radio highway advisory radio (HAR) to allow more automated operations. An automated HAR system could be used to broadcast messages regarding travel conditions along the tourist corridor, and the corridor wide traveler information system could be used to provide information about travel conditions within the Great Smoky Mountains National Park.

In order to operate the system, an expansion of an existing TOC should be considered. This could include the possibility of using a joint Sevierville/Pigeon Forge TOC or Gatlinburg TOC recommended in Sections 4.1 and 4.2 of this report, or use of TDOT's Region 1 SmartWay TMC.

Benefits: The availability of real-time data along key corridors in the Region will allow travelers to access information about the Tourist Corridor in advance and perhaps use alternate routes to access the Tourist Corridor or determine a better time to travel into the area. The real-time travel information can be distributed at no cost through coordination with the existing SmartWay system. With the addition of DMS (up to seven locations), roadside traveler information can also be

Existing traveler information provided by TDOT on I-40

provided to promote alternate routes and reduce driver frustration by providing them with real-time information on travel conditions.

The Great Smoky Mountains ITS Strategic Plan (2007) also noted the need to provide improved real-time information regarding travel conditions within the park. The addition of the corridor wide traveler information system would allow the Great Smoky Mountains National Park a means to provide information on park conditions to travelers while they are en-route to the park.

Rough Order of Magnitude (ROM) Cost Range: In general, the deployment of detection systems throughout the Region are considered cost prohibiitive. Through the use of a private data provider, such as INRIX, it is expected that data costs for real-time data of multible corridors throughout the Region may cost approxiately $100,000 per year. This would include real-time data on approximately 90 miles of roads, including the Sevier Tourist Corridor, Veterans Boulevard, Gatlinburg Bypass, US 441/411 to Knoxville, US 411 to I-40 near Chestnut Hill, and US 321. The deployment of arterial DMS can vary depending on size and availability of communications system. In general, $125,000-150,000 should be used to provide a ROM that includes the DMS and communications at each site. This would allow the implementation of larger DMS, possibly on structures to span the roadway, which will allow the signs to stand out amoung the many other signs and buildings on the corridor. CCTV camera cost can range from $10,000-30,000 depending on communications and use of existing poles. Stakeholders discussed using a cost estimate of $10,000 with the assumption that existing traffic signal poles would be used and the communicaiton system that may be deployed as part of the adaptive signal control system would be utilized. Upgrades and central software for a TMC to monitor and control the traveler information system are estimated using a ROM cost of $25,000-50,000. Total program ROM costs would be approximately $1,300,000 of capital funding with recurring costs of roughly $100,000 per year for real-time data if the operations were folded into an existing operations center such as the TDOT Region 1 SmartWay TMC that is already staffed. If a local TOC is prefered to manage this program the annual recurring costs would increase accordingly for additional staff.

Phasing Opportunities: Acquisition of real-time data would be the first step towards providing a real-time traveler information system, followed by addition of the data to the SmartWay Traveler Information System. The deployment of DMS could be phased in over time to determine their effectiveness, and finally CCTV cameras could be added if needed by the operating agency.

Challenge: The primary challenge will be with data accuracy along some of the by-pass routes and possible alternate routes such as US 411 and US 321. Third party data providers typically rely on a high saturation rate of vehicles that transmit data to them. On the routes that have limited traffic there will be a lower saturation rate and real-time data accuracy may be lower. Generally the levels of accuracy of real-time travel data has been improving over time, however an evaluation of the data accuracy along selected routes needed for the corridor wide traveler information system should be completed prior to implementing the system.

Monitoring of the flow data and posting real-time messages will also be a challenge without a dedicated group of operators. The system may be able to be set to provide some types of standard messages once a certain volume or set speed threshold has been reached. Unlike other ITS projects identified for the Sevier County tourist corridor, this program requires a significant annual recurring cost funding commitment in addition to the front end capital cost commitment.

Benefit-to-Cost Studies: There is a limited amount of data showing benefit-to-cost ratios of traveler information systems, particularly on arterial routes. It is often difficult to determine the true impact of providing travel information to travelers because it is hard to determine which users changed their trips or chose to take an alternate route, and if their choices were the result of the traveler information system. Through surveys it has generally been shown that travelers do have a strong desire for real-

time information and will often change their trips due to that information. Some examples of benefit studies for real-time travel information systems are summarized below.

- Users of the Branson TRIP (Travel and Recreation Information Program) traveler information system found the information to be useful when the system was fully functional. A survey of users found that between 50 and 65 percent of respondents indicated that the information provided by the system saved them travel time. (July 2005)
- Studies of the 511 telephone traveler information system in Arizona and Virginia found that 70 percent of the users in Arizona were satisfied with the content provided, and in Virginia 90 percent of callers found the service useful and nearly half adjusted their travel plans based on the information they received. (Arizona: September 2005, Virginia: January 2004)

Sponsor(s): A program sponsor has not been formally identified, although the possibility of joint operations center for the signal system in Pigeon Forge and Sevierville was discussed. If such a center is established, this would be a likely location for the corridor wide traveler information system program. The program would most likely need to be supported by each of the three cities along the corridor as it would provide benefits to travelers to all three of the cities.

4.4 Trolley Information System (Gatlinburg and Pigeon Forge/Sevierville)

Project Concept: Trolley Information System (Gatlinburg and Pigeon Forge/Sevierville)

Overview: The trolley information system was in place prior to the development of the Sevier County Tourist Corridor ITS Master Plan, however it is noted here because of the significant benefits the program can provide. Both Gatlinburg Mass Transit and the Pigeon Forge/Sevierville Fun Time Trolley systems track trolley locations in real-time and can display trolley locations on web-sites. The agencies are exploring expanding the systems to add monitors at hotels and other locations where tourists will have access to the real-time trolley information. This will provide them with an estimate of the next trolley arrival time to make transit use a better experience and encourage additional ridership. Monitors could also be used in the future to provide tourists information about events and attractions that are accessible by trolley, which could encourage additional ridership.

The two trolley programs currently have such a high ridership that they are ranked as the fifth and sixth largest transit systems in the State of Tennessee. Continued growth in ridership should assist in alleviating some of the vehicular traffic that currently uses the Tourist Corridor.

The importance of trolley vehicle location was also emphasized in the Great Smoky Mountains ITS Strategic Plan. That plan recommended the use of transit automated vehicle location and that information on trolley locations be made available through the web or at trolley stops to enhance non-auto access to the park facilities.

Benefit-to-Cost Studies: Transit users that experience real-time information systems very commonly report the information enhances their experience, makes transit easier to use, and increases the frequency with which they use transit. Examples of some studies of real-time transit information are included below.

- San Luis Obispo Transit in California found that the addition of automated vehicle location (AVL), real-time passenger information, and electronic fare media on their buses resulted in a minimum of a 3.9:1 benefit-to-cost ratio. (July 2009)
- A study of the Chattanooga Area Regional Transportation Authority's SmartBus Project found that two thirds of the bus tracking website users said they used transit more frequently because of the availability of real-time information. (December 2009)
- A survey of visitors to the Acadia National Park in Maine found that over 80 percent of transit users that experience the real-time bus departure signs and on-board next-stop announcements felt these technologies made using transit easier and saved them time. (June 2003)

Sponsors: Gatlinburg Mass Transit and Pigeon Forge/Sevierville Fun Time Trolley

Pigeon Forge/Sevierville Fun Time Trolley

4.5 Project Concepts Summary

A summary of the project concepts and costs has been included in **Table 2**. Project costs are generally estimated using the high end of the rough order of magnitude cost range. The scale of deployment and current market conditions will vary and can impact the overall costs of the projects. Element costs that are provided should be used for planning purposes only and a more detailed project budget will need to be prepared prior to moving forward with implementation of any projects.

Project phasing has been established to prioritize deployment of projects if total funding for deployment is not available.

Projects for providing traveler information for the Gatlinburg and Pigeon Forge/Sevierville Fun Time Trolley are currently in progress by those agencies and have not been included in the summary of project concept recommendations.

Table 2 – Project Concepts Summary

Project Concept and Phases	Rough Order of Magnitude Cost
Pigeon Forge/Sevierville Signal System Upgrades and Joint TOC	
Pre-Implementation Feasibility Study	***$100,000***
Phase 1 – Communication and Controller Upgrade	
Upgrade communication connectivity to existing traffic signal controllers	*$200,000*
Upgrade existing traffic signal controller communication interface module to support IP communication	*$25,000*
Phase 1 Total	***$225,000***
Phase 2 – Upgraded Traffic Responsive System or Transition to Adaptive Control System	
Upgrade traffic signal controller platform	*$150,000 (Both Systems)*
Expand traffic signal system detection	*$250,000 (Adaptive Only)*
Procure and implement central software, including system set up and integration	*$500,000 (Adaptive)* *$100,000 (Traffic Responsive)*
Signal Timing Improvements (Recurring cost approximately every 3-5 years)	*$250,000 (Traffic Responsive Only)*
Implement joint TOC for monitoring and control of system	*$50,000 (Both Systems)*
Phase 2 Total	***$950,000 (Adaptive)*** ***$550,000 (Traffic Responsive)***
Preliminary Engineering (Design, Systems Engineering Analysis, and NEPA)	***$100,000***
Total Project Cost *(Total project costs have been rounded up to the nearest $100,000. Traffic responsive option will have a recurring cost for signal timing of $250,000 every 3-5 years)*	***$1,400,000 (Adaptive)*** ***$1,000,000 (Traffic Responsive)***
Gatlinburg Closed Loop Signal System Improvements	
Phase 1 – Communications, Software and Timing Plans	
Repair and expand communication connectivity to existing traffic signal controllers	*$150,000*
Procure and implement central software system and updated signal timing plans	*$200,000*
Phase 1 Total	***$350,000***
Phase 2 – Controller Platform and TOC	
Upgrade existing traffic signal controller platforms	*$75,000*
Implement TOC for monitoring and control of system	*$25,000*
Phase 2 Total	***$100,000***
Preliminary Engineering (Design, Systems Engineering Analysis, and NEPA)	***$50,000***
Total Project Cost	***$500,000***
Corridor Wide Traveler Information System	
Phase 1 – Real Time Data Acquisition	
Procure real-time data for the Tourist Corridor and alternate routes (Recurring annual cost)	*$100,000*
Integrate data with existing SmartWay Traveler Information System *(Integration is expected to be accomplished primarily through use of TxDOT and City staff)*	*$0*
Phase 1 Total	***$100,000***
Phase 2 – Roadside Traveler Information	
Implement DMS at decision points on the corridor (Assume 7 DMS)	*$1,050,000*
Implement CCTV cameras for verification of real-time data (Assume 10 cameras)	*$100,000*
Upgrade existing TOC for monitoring and control of the system	*$50,000*
Phase 2 Total	***$1,200,000***
Total Project Cost	***$1,300,000 Initial Cost and*** ***$100,000 Annual Cost for Data***

5. REGIONAL ITS ARCHITECTURE CONFORMANCE

The Sevier County Tourist Corridor ITS Master Plan was developed in coordination with the update of the Knoxville Regional ITS Architecture. This allowed all of the project concepts to be incorporated into the Knoxville Regional ITS Architecture to ensure project conformance to the Regional ITS Architecture.

The project concepts recommended in the Sevier County Tourist Corridor Master Plan correspond to the several of the service packages identified in the Knoxville Regional ITS Architecture and are identified in **Table 2**. Service packages represent the services that ITS can provide in the Region, and a separate service package is generally developed for each stakeholder that is implementing a particular service.

Table 3 – Knoxville Regional ITS Architecture Service Packages

Project Concept	ITS Service Package from the Knoxville Regional ITS Architecture
Adaptive Signal System Improvements (Pigeon Forge/Sevierville)	ATMS01 – Network Surveillance ATMS03 – Surface Street Control ATMS07 – Regional Traffic Management
Closed Loop Signal System Improvements (Gatlinburg)	ATMS01 – Network Surveillance ATMS03 – Surface Street Control ATMS07 – Regional Traffic Management
Corridor Wide Traveler Information System	ATMS01 – Network Surveillance ATMS06 – Traffic Information Dissemination ATMS08 – Traffic Incident Management ATIS01 – Broadcast Traveler Information
Trolley Information System (Gatlinburg and Pigeon Forge/Sevierville)	APTS01 – Transit Vehicle Tracking APTS02 – Transit Fixed-Route Operations APTS08 – Transit Traveler Information

Each of the projects above will be represented in the Knoxville Regional ITS Architecture Update document. The Knoxville Regional ITS Architecture includes an Appendix with the ITS Service Packages represented for appropriate stakeholders that display one or more elements of a project. For example, for the Adaptive Signal System Improvements the ATMS01 – Network Surveillance service package demonstrates the ability to monitor traffic flow at each traffic signal. ATMS03 – Surface Street Control demonstrates the ability of the City of Pigeon Forge or City of Sevierville to monitor traffic signals and implement control plans. Finally, ATMS07 – Regional Traffic Management demonstrates the ability of cities to communicate and coordinate traffic signal information, such as communication between the Cities of Pigeon Forge and Sevierville.