Oklahoma
Statewide Intelligent Transportation Systems (ITS) Strategic Plan

Oklahoma Department of Transportation

In Coordination With:

U.S. Department of Transportation

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Oklahoma Statewide Intelligent Transportation Systems Strategic Plan

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1.0 OKLAHOMA STATEWIDE ITS STRATEGIC PLAN EXECUTIVE SUMMARY

The Oklahoma Statewide ITS Plan identifies how intelligent transportation systems will advance the goal of the Oklahoma Department of Transportation and the other ITS stakeholders. The ITS Strategic Plan presents the ITS vision and concept of operation for Oklahoma. An assessment of the existing ITS inventory and communications was made to establish a baseline for moving forward with the plan.

The three primary goals of the Oklahoma Statewide ITS System are based on the key transportation needs of the state as defined by the ITS stakeholders. The ITS Vision goals are as follows:

1) Improve Safety And Mobility. Manage traffic during times of congestion, roadway incidents, construction activity, weather events, and emergencies to reduce the number and severity of crashes, improve the travel time on the surface transportation network, and reduce delay to travelers.

2) Enhance Security. The Oklahoma surface transportation system represents strategic infrastructure both to the nation and the state. Monitor critical infrastructure to prevent incidents from occurring and greatly assist in the response and recovery when incidents do occur.

3) Increase Agency Efficiency. All agencies are challenged to be more productive with constrained resources. ITS systems should assist staff in all Oklahoma transportation agencies to be more efficient in completing their job duties. Efficiency may be gained by being able to do existing task in less time or allowing individual staff to do more in less time.

To meet the goals of the Oklahoma Statewide ITS System, ITS infrastructure (i.e., cameras, dynamic message signs, detectors, weather sensors, and telecommunication as well as the structural support hardware and cabinets) will be deployed throughout the state. The infrastructure will gather data, process the data to create useful information, and disseminate the information to operators, responders, managers, and users of the system. The ITS Vision revolves around the six key ITS themes: incident management, work zone traffic management, weather monitoring, commercial vehicle operations, critical infrastructure monitoring, and traveler information.

1) Incident Management. Incident detection and verification information will be seamlessly shared with all response agencies. Information on incident location, incident type, emergency vehicle location, and response routes will aid

dispatchers and responders in getting to the scene of an incident and clearing the incident from the roadway.

2) Work Zone Traffic Management/Monitoring. Traffic volume, speed, and queue information will be communicated back to operators monitoring the traffic conditions in construction work zones. Cameras will allow for real-time video and images to be shared with division staff and managers to monitor, inspect, and supervise construction activities. The same visual information will be available at ODOT headquarters for senior management to monitor the state highway system.

3) Weather Information Systems. Weather and pavement sensors installed along the roadside will measure ambient air temperature, wind speed, and relative humidity. The same sensors installed in the pavement will measure the pavement temperature and help monitor the amount of ice-fighting chemicals needed on the road surface or activate automatic anti-icing systems. In addition, sharing of information through partnerships with weather agencies (i.e., National Weather Service) will improve weather related information for transportation management and traveler information.

4) Critical Infrastructure Monitoring. Critical transportation infrastructure such as airports, water ports, highway interchanges, and bridges will be monitored for early detection of emergencies and/or failures.

5) Commercial Vehicle Operations. Commercial vehicle operations will be made paperless as ODOT, Department of Public Safety (DPS), Tax Commission, and other supporting agencies install advanced internal systems.

6) Traveler Information. This information gathered by ITS systems ultimately should benefit the traveling public. When provided with accurate, real-time information, individuals can make informed decisions about travel mode, travel routes, and travel times. The information should be made available through multiple media outlets including, television, radio, telephone, Internet, and personnel handheld devices.

The Statewide ITS Strategic Plan builds on a hierarchy of transportation management and operation. This report highlights how different agencies will use and gain from a state and regional ITS systems. Local municipal governments and ODOT divisions outside the urban areas may develop transportation operations centers. The urban areas will develop regional transportation management centers. The great majority of the management and operation will be done by these centers. The local and regional centers will communicate real-time data (i.e., camera images, traffic speed and volumes, incident information, construction information, weather information, etc.) to the statewide transportation information center. The statewide center will serve as an information clearinghouse to allow all transportation agencies in the state to operate the system more effectively and efficiently. The statewide center will also be developed with redundancy to support the regional and local centers in their operation.

This document is the first in a series that provides for development of intelligent transportation systems in Oklahoma. The other documents that follow this document are:

- Oklahoma Statewide ITS Architecture
- Oklahoma Statewide ITS Implementation Plan
- OCARTS ITS Architecture (published by ACOG)
- OCARTS ITS Implementation Plan
- Tulsa ITS Plan and Architecture
- Tulsa ITS Implementation Plan
- Commercial Vehicle Operation (CVO) Business Plan
- Commercial Vehicle Information System Network Design

2.0 OKLAHOMA STATEWIDE ITS VISION

This report documents the first steps in the development of an ITS Plan and Architecture for the State of Oklahoma. Stakeholder meetings were held with the various agencies interested or affected by ITS. The ITS needs identified in these stakeholder meetings are outlined, and a Statewide ITS Vision is described from each of the major stakeholder's perspective.

2.1 Statewide ITS Goals

The goals of the Oklahoma Statewide ITS System are based on the key transportation needs of the state. The three primary goals are as follows:

1) Improve Safety And Mobility. Manage traffic during times of congestion, roadway incidents, construction activity, weather events, and emergencies to reduce the number and severity of crashes, improve the travel time on the surface transportation network, and reduce delay to travelers.

2) Enhance Security. The Oklahoma surface transportation system represents strategic infrastructure both to the nation and the state. Monitor critical infrastructure to prevent incidents from occurring and greatly assist in the response and recovery when incidents do occur.

3) Increase Agency Efficiency. All agencies are challenged to be more productive with constrained resources. ITS systems should assist staff in all Oklahoma transportation agencies to be more efficient in completing their job duties. Efficiency may be gained by being able to do existing task in less time or allowing individual staff to do more in less time.

The goals for the Oklahoma ITS System support the national ITS goals identified by the US DOT.

2.2 Statewide ITS Vision

To meet the goals of the Oklahoma Statewide ITS System, ITS infrastructure will be deployed throughout the state. The infrastructure will gather data, process the data to create useful information, and disseminate the information to operators, responders, managers, and users of the system. The ITS Vision revolves around the needs of six key areas as shown in Figure 2.1.

2.2.1 Incident Management

Incident detection and verification information will be seamlessly shared with all response agencies. Information on incident location, incident type, emergency vehicle location, and response routes will aid dispatchers and responders in getting to the scene of an incident and clearing the incident from the roadway. The same information will allow state and local agencies responsible for traffic control to support the response and clearance of incidents and inform motorists through dynamic message signs on the roadway system. Incident information will be shared with media and disseminated to the public via television, radio, Internet, and personal devices to inform motorists of incidents for more effective travel planning.

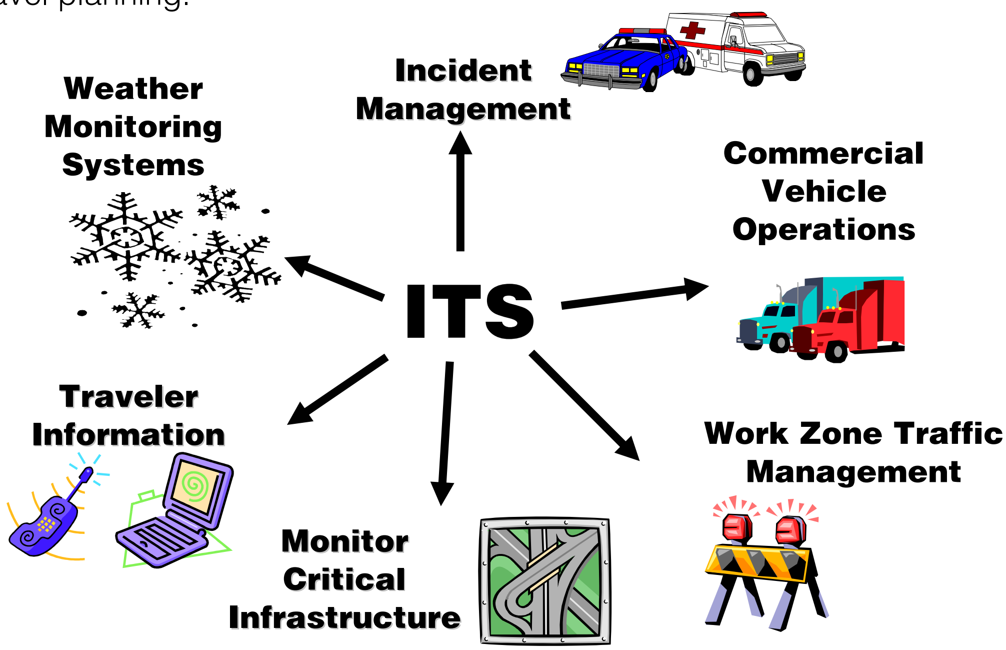


Figure 2.1 ITS Vision Key Areas

2.2.2 Work Zone Traffic Management / Monitoring
Traffic volume, speed, and queue information will be communicated back to operators monitoring the traffic conditions in construction work zones. Cameras will allow for real-time video and images to be shared with Division staff and managers to monitor, inspect, and supervise construction activities. The same visual information will be available at ODOT headquarters for senior management to monitor the state highway system. The camera images will also be shared with other agencies and the media to assist those agencies and the traveling public.

2.2.3 Weather Information Systems
Weather and pavement sensors installed along the roadside will measure ambient air temperature, wind speed, and relative humidity. Sensors installed in the pavement will measure the pavement temperature and help monitor the amount of ice-fighting chemicals needed on the road surface. Improved weather information will be achieved by sharing of weather data between regional Division staff. This helps the planning of equipment and materials needed to address a particular storm event. Reliable, up-to-the minute weather and road conditions information will be disseminated to the public and media for better travel planning.

2.2.4 Critical Infrastructure Monitoring

Critical transportation infrastructure such as airports, water ports, highway interchanges, and bridges will be monitored for early detection of emergencies and/or failures. Strategic monitoring will assist in detection of and response to problems, ultimately reducing the impacts to the stakeholders in Oklahoma.

2.2.5 Commercial Vehicle Operations

Commercial vehicle operations will be made paperless as ODOT, DPS, Tax Commission, and other supporting agencies install advanced internal systems. The ports of entry and weigh stations will support this paperless operation and will be upgraded and instrumented to allow trucks to process paperwork and be weighed without stopping. In addition, handheld computers will enable staff to perform more safety inspections, and to gather historical safety information on commercial vehicles.

2.2.6 Traveler Information. This information gathered by ITS systems ultimately should benefit the traveling public. When provided with accurate, real-time information, individuals can make informed decisions about travel mode, travel routes, and travel times. The information should be made available through multiple media outlets including, television, radio, telephone, Internet, and personnel handheld devices.

2.3 Oklahoma ITS Perspectives

Oklahoma will have a comprehensive and coordinated approach to managing the statewide transportation network. The following perspectives illustrate what the ITS system will look like to the following agencies.

2.3.1 Oklahoma DOT Perspective

Traffic engineering and maintenance staff in the Regional Divisions responsible for the day-to-day operation of the highway system will be able to log onto a workstation and get the real-time conditions for the roadways in their area. The type of information will include traffic conditions, incident data, weather data, construction activities, and status of field device. Field devices will include:

- Cameras for surveillance of traffic conditions, incidents, weather, and construction activities
- Dynamic message signs to post real-time traveler information
- Roadway weather systems to detect environmental conditions
- Roadway detectors to collect speed, volume, and occupancy data

This information will allow staff to plan, operate, and maintain the State's Highway System more effectively.

Construction staff will be able to monitor and inspect highway construction sites where cameras are installed as part of the ITS system.

Greater use of video teleconferencing operating on the telecommunication system installed as part of the ITS system will reduce staff's need to travel for activities such as inter-department meetings, construction letting/bid conferences, and training sessions. This capability will also allow quick incident management and emergency management conferences.

ODOT Planning staff will be able to access a database of archived traffic data collected by the ITS system. These data will help automate state and federal data reporting requirements. The data will be linked to graphic information systems to further report information about the state's transportation system.

Senior management will be able to view the operation and status of key elements of the transportation network from their offices at ODOT headquarters.

ODOT will also be able to share information with other key stakeholders such as

- Oklahoma Department of Civil Emergency Management
- Oklahoma Transportation Authority
- Traffic, police, and fire departments of local cities
- Airport Authorities
- Port Authorities

Real-time traffic and roadway conditions collected by detectors and cameras can be shared to assist coordinated, regional transportation management. ODOT will be able to use the dynamic message signs to inform travelers of conditions near or at airports, ports, and tollways.

<u>2.3.2 Oklahoma Highway Patrol / Department of Public Safety Perspective</u>

In addition to E-911 calls, an OHP dispatcher will get a notification about an event from the ITS system. The dispatcher will be able to verify the traffic-related incident via the camera images being brought from the field. The dispatcher will have accurate location information of the incident location as well as real-time locations of emergency response vehicles in the field. The dispatcher will be assess the severity of an incident and be able to dispatch the incident information to the officer in the field along with the "quickest" response route information. The responding office will be in coordination with ODOT and local agencies on what traffic control is needed to improve safety and mobility through and around the incident scene.

<u>2.3.3 MPO Perspective</u>

The ITS system will be able to archive transportation data for use in transportation planning, regional traffic and air quality modeling, as well as mobility and congestion system management. Vehicle detection systems will collect hourly and daily traffic count information. Toll tag reader systems will sample travel time and origin-destination data. Automatic passenger counter systems on transit vehicles will provide public transportation data. The incident management data will be logged to provide crash and incident trends by section of roadway. Weigh-in-motion stations installed for commercial vehicle operations will record the truck volume and weight data on many roadway segments. All of this data will be continually archived in order to produce historical trends over several years.

2.3.4 Local City Perspective

Local city fire and police are many times the primary responding agencies to incidents. Fire and police agencies will have access to shared video and real-time traffic data to assist in incident and emergency response. The traffic departments of these same local agencies will also be informed of traffic conditions and incidents on the State Highway System to help improve operation on their local system. If an incident occurs on a state highway, for example, the city can proactively manage traffic demand by adjusting signal timing on approved alternate routes. At the same time, the city can inform the state to warn of conditions on those streets. While working at a city workstation, a city operator will be able to get traffic conditions, status of equipment, incident information, and camera images on other parts of the transportation network. The local agency staff will have greater interaction with the regional ITS system, but still have access to information on the statewide system.

2.3.5 Other Users of the System

The state highway system supports the mobility and economic vitality in Oklahoma. Better incident management and availability of real-time traffic and weather information will provide users, such as the general public and commercial vehicle operators, with tools to better use the highway system.

In addition, development of ITS in Oklahoma will provide real-time traffic information to the media outlets that provide transportation information to these other uses. Television and radio stations will be able to provide more up-to-date and accurate information to users that will in turn allow better travel decisions.

2.3.6 Summary

The ITS Vision describes what can be achieved by the Oklahoma ITS stakeholders over the next 20 years. Cooperative ITS planning, design, deployment, and operation of individual systems will create an integrated statewide ITS system to improve safety, mobility, security, and efficiency for Oklahoma.

3.0 Oklahoma Statewide ITS Concept of Operations

3.1 Introduction

This Concept of Operations defines the role of the Oklahoma Statewide ITS System and how it will operate. This document also outlines the plan for a Statewide Transportation Information Center (STIC), Regional Transportation Management Centers (RTMCs), local Traffic Operations Centers (TOCs), Emergency Operations Centers (EOCs), as well as how each of the agencies working together (through operating agreements) will be able to share information necessary to create a seamless transportation management system.

The key concept for a statewide Intelligent Transportation System (ITS) is to share vital transportation information between the state's transportation agencies to manage and operate the transportation system more effectively. This will be accomplished through establishing the STIC with a communications infrastructure for real-time traffic information processing, dissemination and display. This Concept of Operations envisions a STIC operated by the Oklahoma Department of Transportation (ODOT). The STIC will share information on critical statewide transportation infrastructure. This information will be gathered through communication with the RTMCs, local TOCs, emergency operations centers, rural transit systems, Oklahoma Transportation Authority, Oklahoma airports, and Inland Waterway facilities. The information will be made available to agencies and the public through real-time data and video displays over the state's communications network. The following represents the goals that the state is trying to achieve:

- Improve the safety and mobility on the State's Transportation System
- Enhance security of the transportation network
- Increase agency efficiency

These goals can be achieved through the effective use and deployment of ITS technologies. The Concept of Operations outlines what information should be shared, what systems are needed, and what systems need to interface. This concept will serve as the basis for developing the statewide ITS architecture as defined by the Federal Highway Administration.

3.2 Stakeholder Involvement

The Oklahoma Statewide ITS Vision and Concept of Operations are based on a series of stakeholder meetings held in the December 2001 and January 2002. The following agencies were interviewed to determine their interests in ITS and their role in deploying a statewide ITS:

- Oklahoma DOT (Planning and Research Division, Traffic Engineering Division, Division 4 Maintenance, Division 8 Traffic, Division 8 Maintenance, Division 3)

- Oklahoma Transportation Authority (OTA)
- Oklahoma Highway Patrol / Department of Public Safety (DPS)
- City of Oklahoma City
- City of Tulsa
- Association of Central Oklahoma Governments (ACOG)
- Indian Nations Council of Governments (INCOG)
- University of Oklahoma
- Oklahoma Department of Civil Emergency Management

The summary of meeting notes for each of the stakeholder interviews is shown in Appendix A.

3.3 Definition of the Region

The definition of the region for the Statewide ITS Plan is the area encompassed by the Oklahoma state boundaries. Included within this area are the Indian Nation Reservations.

There are several regions external to the State of Oklahoma developing ITS systems. Traffic demand, construction, and incidents in these regions have an impact on transportation within the state of Oklahoma. These regions are:

- Amarillo, Texas
- Dallas/Fort Worth, Texas
- Wichita Falls, Texas
- Little Rock, Arkansas
- Fort Smith, Arkansas
- Springfield, Missouri
- Wichita, Kansas

These regions are defined as external interfaces with high potential for sharing information with Oklahoma.

3.4 Existing ITS Related Systems

ODOT working with fellow stakeholders have built a foundation to support the future deployment of the state's ITS system. ODOT currently has over 900 miles of fiber optic backbone already in place for ITS deployment initiatives to build upon.

Because Oklahoma is just beginning it's ITS program, there are relatively few ITS deployments that constitute existing or legacy systems. The key systems that ODOT currently has deployed are CCTV and DMS signs in the Oklahoma City area. There is also a deployment of an automated de-icing system on the I-35/I-40 interchange (i.e., Fort Smith Interchange).

Telecommunication systems may also impact future ITS deployments. ODOT currently operates a 155.2 Mhz radio system statewide. This system is for voice only, and will not have to interface with any of the initial deployment projects. Future ITS projects needing radio communication will need to evaluate this system for its ability to handle project requirements.

The ITS systems of interest owned or deployed by other key stakeholders are as follows:

- DPS - *55 call-in system
- DPS – 800 Mhz radio system
- OTA – fiber telecommunication system
- OTA – PikePass System
- OTA – video detection at toll plazas
- OTA – toll plaza de-icing systems
- City of OKC – two central traffic signal control systems (both systems are the same vendor)
- Cities of Oklahoma City, Tulsa, Edmond, Norman, Chickasha, Midwest City, Enid, and El Reno all have some video detection for their traffic signal actuation.
- Cities of Oklahoma City, Edmond, and Norman have emergency pre-emption on their traffic signal system.

3.5 Statewide Transportation Information Center

The Statewide Transportation Information Center (STIC) will be responsible for coordination of ITS information throughout the state of Oklahoma. The STIC will be the central location for ODOT to share data and information collected by regional and local transportation management centers among the ITS stakeholders throughout the state. The STIC will focus on collecting and disseminating transportation information critical to statewide safety, incident management, travel, security, and emergency management. These facilities include:

- Interstate highway system
- Oklahoma state highways on the National Highway System
- OTA Turnpike system
- Oklahoma airports
- Oklahoma Inland Waterway system

The STIC will be located in Oklahoma City, but may not be located with the regional Oklahoma City Area Regional Transportation Study (OCARTS) ITS System. Space requirements for housing the STIC will be minimal because the primary operation and management will take place at the regional transportation management centers. The STIC will likely consist of a few computer servers and monitors to access and view data; it will not need significant space for work stations or video displays. Operating staff requirements will also be minimal.

A key aspect of the STIC is to provide a network for the sharing of video and data. This ITS network should be a separate network from ODOT or other agencies to maintain the integrity of the system. Appropriate fire wall applications should be in place for sharing of data across the ITS network and other agency networks.

Functions of the Statewide Transportation Information Center should include:

- Sharing of real-time video on Interstate, turnpike, and National Highway System (NHS)
- Sharing of camera control for CCTV on Interstates, turnpikes, and NHS
- Sharing of incident information on Interstate, state turnpikes, and NHS
- Statewide traffic data archive and data management / warehousing capability
- Sharing of statewide construction information dissemination
- Sharing of statewide maintenance activities
- Real-time communication to commercial vehicle operations (CVO) weigh stations
- Support data and video sharing through statewide communications system
- Facilitate center-to-center communications via software
- ITS maintenance and information tools
- Limited back-up operations for regional and local transportation management centers

The STIC will receive considerable information from the Regional Transportation Management Centers. The functions of the STIC should be integrated as the regional ITS systems mature. The initial functions should focus on video sharing, incident information sharing, and construction activity sharing.

3.6 Regional Transportation Management Centers

The Regional Transportation Management Centers (RTMCs) are the foundation for transportation management and operation in Oklahoma. These centers will be responsible for the daily operation of the majority of the state's transportation infrastructure. These centers will coordinate incident management response, coordinate corridor management, lead information sharing, and communicate with local traffic operations centers (TOCs).

An RTMC essentially gathers information about the transportation network and other operations centers, processes and fuses this information with other operational and control data, and provides information to partner agencies and travelers. This information is then used to monitor incidents and the operations of the transportation network and implement traveler information and real-time control strategies to improve safety and efficiency. By having multiple agencies present in the RTMC or coordinating through real-time communications via a virtual center, local traffic, emergency and transit agencies can improve their operations, and form relationships among the participating agencies by sharing resources and information previously unknown to each other. The RTMC can also be a focal point for drawing the positive attention of the public, elected officials and the media towards transportation management.

Functions of a Regional Transportation Management Center may include:

- Incident detection on freeways
- Incident management coordination
- Development and implementation of freeway control strategies (i.e., what DMS messages, traffic control, traveler information will be implemented for different freeway conditions)
- Surveillance on freeways and major arterials (in coordination with local agencies)
- Real time video display
- Real time video control (based on a camera control hierarchy for multiple users)
- Traffic data archive and data management/warehousing capabilities
- Traffic, incident and construction information dissemination capability, including DMS, HAR, Internet web site
- Operations of dynamic message signs and CCTV on freeways under emergency evacuation procedures (i.e. – tornados, floods, hazardous materials incidents, etc.)
- Real time communications to local TOCs and transit centers
- Real time communications to information service providers and media
- Real time communications to interactive traveler information network (kiosks and web site)
- Real time regional data sharing capability
- Road weather detection
- Dispatch for service patrol vehicles
- Incident log for service patrol operators
- Vehicle tracking for service patrol vehicles
- Integration that enables integration among all participating agencies
- ITS maintenance management and information tools
- Maintenance vehicle tracking (ODOT or maintenance contractor vehicles)
- Winter maintenance
- Roadway maintenance and construction
- Work zone management
- Maintenance and construction activity coordination

Operating agreements among the local agencies are required to specifically define agency roles in the management of a RTMC. The operating agreements should include negotiations on capital, operating and maintenance costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information.

3.7 Local Traffic Operation Centers

Local transportation operation centers may be city, county, or ODOT division offices not associated with a RTMC. Local city public works departments will continue to operate and maintain surface street signal control in their jurisdictions. Coordination with the RTMC and other local traffic operation centers (TOCs) will be conducted by use of real time surveillance and detection, data sharing, and sharing information on operating plans. The TOCs may have all management functions available in the transportation management center except for freeway control (except for ODOT Divisions). A TOC may choose to implement only a few of the functions listed below and delay the implementation of some functions until later phases.

Functions of the local TOCs may include:

- Traffic signal control
- Signal preemption for emergency vehicles
- Signal preemption for buses
- Highway/rail intersection controls
- Real time communications to the RTMC, other local TOCs, emergency operation centers (EOCs) and transit centers
- Real time regional data sharing capability
- Incident management coordination
- Road weather detection
- Parking management (City of Tulsa and Tulsa International Airport)
- Traffic data archive capability
- Real time video display
- Real time video control (based on control hierarchy)
- Traffic, incident and construction information dissemination capability, including VMS, highway advisory radio (HAR), Internet web site
- Real time communications to information service providers, media and public facilities
- Operations of signals, DMS and CCTV under emergency evacuation procedures
- Maintenance and construction activity coordination

The local TOCs will share information with the RTMCs, which will in turn, share the information with the statewide transportation information center. Operating agreements between the RTMC Board and local agencies are required to specifically define agency roles. An operating agreement should include negotiations on capital, operating and maintenance costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information.

3.8 Information Service Providers

An information service provider (ISP) is an entity that receives data and information from the traffic management, transit management and emergency operation centers and distributes information to the traveling public. The information can be disseminated by wide area broadcast (radio or television) or through interactive services (telephone, pager, personal computer or kiosk). The service provider can be a public agency such as ODOT or a city. Private (for profit) companies can also acquire public data, add value and resell it to the public through subscriptions or by broadcast with advertising. The services to be provided include broadcast and interactive traveler services.

Typically, a government agency supplies basic traveler information to a web site, local agencies, the public, the media and private vendors through various communications media, such as dynamic message signs, highway advisory radio, kiosks and linked data communications. These roles and responsibilities must be defined in a partnering agreement. Initially, ODOT will provide the role of ISP for the statewide system.

Private vendors may receive and add value to traveler information received from the freeway management, traffic management and transit centers. Information dissemination may be by a variety of means such as radio and television broadcast, telephone/cellular service, Internet and pager. Private vendors will use compatible hardware/software for communications with the RTMC. The local agencies may contract directly with a private ISP by agreement with the RTMC Board in order to disseminate locally specific traveler information to the traveling public.

3.9 Commercial Vehicle Operations (CVO)

The mission for Oklahoma's CVO element is to use cost-effective methods and technology to improve the efficiency and effectiveness of Oklahoma's state regulatory, enforcement, and motor carrier practices, while increasing safety, security and productivity for state agencies, motor carriers and general traffic. The overall objective is to improve commercial vehicle safety, security and productivity, while lowering the costs of doing business for both motor carriers and the state of Oklahoma. To successfully meet this charge, the state is seeking to enable enforcement officers to focus their efforts on potentially higher risk carriers, drivers and vehicles; and to enable safe and legal motor carriers to apply for, pay for and receive their credentials electronically. This implies capabilities to:

- Develop an effective ITS / CVO institutional framework;

- Provide for electronic filing of credentials applications and fuel tax payments; electronic verification of applications and supporting information; electronic payment; and electronic processing / issuance capabilities;
- Electronically exchange information among agencies and other states;
- Electronically access credential and safety status information (snapshots) from the roadside;
- Electronically screen carriers and vehicles for safety and credential compliance at mainline speeds.

The development and deployment of the CVO Program will require CVO system enhancements, new interfaces, new systems development, communications upgrades and new linkages, business process revisions and a coordinated structure for decision-making among the affected stakeholders.

3.9.1 Effective ITS / CVO Institutional Framework

Oklahoma has developed a Commercial Vehicle Information Systems and Networks (CVISN) Team, which serves as the day-to-day planning and coordinating mechanism for development and deployment of the state's ITS/CVO program. The Oklahoma Department of Transportation (ODOT) is the lead agency. Team members include the Oklahoma Tax Commission (OTC), Oklahoma Corporation Commission (OCC), Department of Public Safety (DPS), Oklahoma Trucking Association (OTA) and the state offices of the FHWA and Federal Motor Carrier Safety Administration (FMCSA). An Executive Committee, including the Secretaries, Administrators or Commissioners of each agency, and a Steering Committee, including the managers of each of the affected functional areas, have been established to support program deployment.

3.9.2 Automated Credentials Capabilities

The OTC, OCC and DPS will modify their credentialing and permitting systems to provide for web-based application, verification, processing, payment and issuance of motor carrier and vehicle credentials and permits. Web-based filing and payment for quarterly fuel taxes will also be provided. Because Oklahoma credentials a number of large carriers with very large fleets, the OTC will develop a module for the International Registration Plan (IRP) web-based system, used for interstate vehicle registrations, which will enable carriers to download application data directly from their fleet management systems to the web-based application. Carriers will thus have two options for IRP filings – data entering application information to the web-based system (which will suit the needs of smaller carriers), or downloading from carrier records to the web-based system (to meet the needs of larger carriers).

3.9.3 Electronic Information Exchange

Oklahoma will undertake a variety of information exchange activities to support both enforcement and credentialing activities. Results of compliance reviews and driver and vehicle inspections are already captured electronically at the source using aspen field units. Inspection results are currently uploaded to the national Safety and Fitness Electronic Record (SAFER) at the end of shift.

A state Commercial Vehicle Information Exchange Window (CVIEW) will be developed. The CVIEW is a database management system which will house safety and credential status information on both interstate and intrastate motor carriers and vehicles. Oklahoma has installed xCVIEW, a CVIEW developed by the state of Washington, and will modify the xCVIEW database as required to meet state needs. OTC, OCC and DPS credentialing and permitting legacy systems will be interfaced to the Oklahoma CVIEW, using interface standards developed by the national SAFER Options Working Group (SOWG).

The Oklahoma CVIEW will routinely transmit interstate credential status information to SAFER system to enable enforcement officers in other states to access these data. The Oklahoma CVIEW will routinely receive downloads from the national SAFER database, ensuring that Oklahoma agencies have access to the most recent credential and safety status information for all interstate commercial motor carriers and vehicles, regardless of their base state.

The Oklahoma CVIEW will accommodate manual and automated queries. Officers at fixed scales (and mobile sites) will be able to query the CVIEW to assist in safety and compliance inspection selection decisions. The OTC will modify its IRP legacy system to query the CVIEW for carrier safety status prior to issuing a commercial vehicle registration.

3.9.4 Electronically Access Information from the Roadside

Communications systems at Oklahoma's fixed scales will be upgraded to enable scale officers to tie into the appropriate state networks to access CVIEW and other central databases. The Oklahoma Highway Patrol, Troop S, is pilot testing a satellite system which will enable officers to upload inspection results to the national SAFER system from mobile units, to query SAFER and other national databases, and to query CVIEW and other state databases from the roadside. The possibility of expanding satellite communications capabilities to mobile units operated by other CVO agencies with compliance verification responsibilities (OTC and OCC) will be explored.

Oklahoma is evaluating the potential to target mobile enforcement efforts on potentially higher risk carriers and vehicles, using upstream closed circuit TV (CCTV) cameras and satellite communications to capture and transmit tag and / or DOT numbers to officers involved in mobile screening operations. The tag /

DOT number would then be run against the Oklahoma CVIEW to assist the officer in safety and compliance inspection selection decisions.

<u>3.9.5 Electronically Screen Vehicles at Mainline Speeds</u>

Oklahoma has installed HELP, Inc.'s PrePass system at seven interstate scale sites. Under the PrePass program, HELP, Inc. issues transponders and assigns a unique transponder ID number to enrolled vehicles. Only carriers who meet specific compliance and safety requirements are eligible for enrollment. Vehicles equipped with PrePass transponders can legally bypass PrePass-equipped scales.

Oklahoma is planning to install weigh-in-motion (WIM) scales, CCTV and dynamic message signs (DMS) at one interstate scale location. The DMS would be used to notify mainline traffic of scale closings to prevent peak period back-up. The DMS could also be used for peak-period weight-only screening to reduce total volumes into the weigh station when back-up is a possibility. WIM scales would be integrated with the PrePass clearance system. Cameras would be used to assist scale house staff in manual query/sorting capabilities. Operational effects of these installations will be evaluated to determine the desirability of implementing similar improvements at other scales.

Oklahoma is evaluating mechanisms to expand PrePass functionality, including a PrePass host server / SAFER interface to increase the frequency with which the PrePass database is updated; and an interface between the Oklahoma CVIEW and the PrePass host server to accommodate intrastate information, potentially expanding PrePass enrollment to intrastate vehicles.

3.10 Other Oklahoma Stakeholders

There are four other strategic stakeholders

<u>3.10.1 Oklahoma Transportation Authority</u>

The Oklahoma Transportation Authority (OTA) owns, maintains, and operates Oklahoma's Turnpike System. OTA is beginning to deploy field devices (i.e., closed circuit television (CCTV) cameras, dynamic message signs, etc.) to help monitor and manage traffic on the state's turnpikes. Because of the importance of the turnpike system to interstate and intrastate travel, the OTA transportation management system should share information directly with the STIC. The type of information shared should include:

- Traffic conditions (including travel time information)
- Incident information
- Roadway conditions (e.g., ice and snow conditions)
- Construction information
- Lane closures

This seamless information would be valuable to Oklahoma travelers. Turnpike information available at the STIC would be in turn made available to the RTMCs. As part of the revenue collection system, OTA maintains the PikePass system consisting of transponders (i.e., toll tags) issued to individuals and tag readers deployed at the turnpike toll plazas. This system of electronic toll collection is an efficient means of collecting tolls and providing a high level-of-service to the OTA customers. In addition to toll collection, the tags provide data on origin and destination of trips as well as travel time. Tag readers installed on the state highway system could benefit from this type of data. The tag population is already sufficient to generate meaningful information on real-time travel conditions. Additional tag readers would need to be installed on non-turnpike facilities to monitor traffic conditions beyond the turnpikes. A memorandum of understanding would be needed between OTA and ODOT to share data on the tags while maintaining privacy on individuals, vehicles, and OTA payment accounts.

3.10.2 Oklahoma Department of Civil Emergency Management

The Oklahoma Department of Civil Emergency Management agency will benefit from deployment of ITS in the Oklahoma City area as well as access to statewide transportation data. The Oklahoma Department of Civil Emergency Management is activated for emergencies ranging from natural disasters to homeland security threats. The system of cameras monitoring the transportation infrastructure will provide real-time surveillance on these corridors. Real-time traffic data will also provide information on conditions of routes needed to respond to emergencies. The Department of Civil Emergency Management should have a workstation available to access both statewide and regional information from the Oklahoma ITS systems.

3.10.3 Airports

The major commercial airports in Oklahoma are Will Rodgers World Airport in Oklahoma City and the Tulsa International airport. In addition there are several other commercial, general aviation, and military airports that impact transportation in Oklahoma. An airport will interface with the RTMC. The data of interest to the airport is real-time traffic conditions and incident data as well as access to the video cameras, especially on the roadways leading to the airport. The airport should receive a RTMC remote workstation that will allow video display for any camera on the network and current roadway condition status.

The airports have information that would be of interest to state and regional travelers. This information consists of flight data from the airport's flight information display system (FIDS) and parking information for the on-airport parking garages and lots. In addition, if there is an incident at an airport that will delay flight operations, this information should be shared with the RTMC. This information will be in turn shared with the STIC.

An operating agreement will be required to specifically define the role of the airport and the other participating agencies. The operating agreement will include negotiations on capital, operating and maintenance costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information.

3.10.4 Oklahoma Inland Waterway System

The Oklahoma Inland Waterway system is considered strategic transportation infrastructure to the state. The users of the port facilities throughout the state would benefit from participation in the statewide ITS system and in turn receiving information on port operations will assist with commercial vehicle operations and rail operation with the ports. This information should be shared between the port authorities and the regional transportation management systems. Any port facility not associated with a RTMC should share data directly with the statewide ITS system. At the same time, traffic management and security will benefit from the ports sharing incident information with the RTMCs or STIC. If an incident occurs at a port that affects port operations, that information can be disseminated to users (i.e., commercial vehicles and rail operators) and agencies responsible for traffic control. Travelers can be alerted to alternate routes, access closures, and/or delays associated with any waterway incident. An operating agreement will be required to specifically define the role of each port facility and the other participating agencies. The operating agreement will include negotiations on capital, operating and maintenance costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information.

4.0 Inventory of Existing ITS Systems

4.1 Agencies

There are several agencies involved in ITS currently within the State of Oklahoma. The two largest cities, Tulsa and Oklahoma City, have a variety of ITS systems in the field. Many smaller cities, mostly within the larger metropolitan areas, also have one or more ITS systems. At the statewide level, three agencies have deployed ITS systems. These are the Oklahoma Department of Transportation (ODOT), the Department of Public Safety (DPS) and Oklahoma Transportation Authority (OTA). For purposes of documenting the existing ITS systems, each of the three agencies are listed with a summary of deployed systems. This is then followed by a listing of specific ITS systems and the cities which have deployment. [1]

4.1.1 Oklahoma Department of Transportation

The Oklahoma Department of Transportation (ODOT) has taken the lead on ITS deployment. The major areas of emphasis are to provide motorist information for non-reoccurring incidents (with the exception of the fiber backbone) and to help provide traffic control in construction and maintenance zones. All deployment to date has been in the Oklahoma City metropolitan area. Division 4 of ODOT has responsibility for most of the metropolitan area of Oklahoma City. ODOT has installed dynamic message signs on the major freeway segments in Oklahoma City. Figure 4.1 shows the locations. These signs are controlled by dial-up from a P.C. located at the Division 4 annex. The signs are designed to accept monitoring cameras. The signs are placed strategically to divert incoming interstate traffic.

ODOT has approximately seven acres of land at the Division 4 annex reserved for a future Traffic Management Center. This would most likely serve as the regional transportation management center. The land is located close to the I-35/I-235/I-40 interchange in Oklahoma City.

ODOT through a cooperative agreement with the University of Oklahoma (OU) has a research lab on the North Base Campus of OU. Software interfaces are being developed and tested in the lab to control DMS and camera locations.

ODOT has deployed ice control system on two bridges with good results. The bridges are the Fort Smith Junction (located at the I-40/I-35 interchange) and the Belle Island bridges. The ice control system is controlled by weather sensors in the pavement.

[1] The Federal Highway Administration (FHWA) conducted a survey of ITS deployment within the State of Oklahoma in 2000. FHWA is in the process of updating the survey. The 2000 results are summarized on a web at www.itsdeployment.gov/its2000/.

ODOT and OTA own an extensive fiber backbone network as part of an agreement with the installing Telco Companies. Figure 4.2 shows the network and ownership. Generally, the fiber along the turnpike system is owned by OTA. The fiber along the non-toll interstate is owned by ODOT. Divisions 1, 4 & 8 will have the initial connections to the fiber network. To date, none of the fiber is lit for ODOT. ODOT is in the process of purchasing equipment that is needed to light the fiber.

ODOT has a 155.25 MHz radio system with statewide coverage. It consists of four unique licenses. It is a voice only system, and OTA also uses this system.

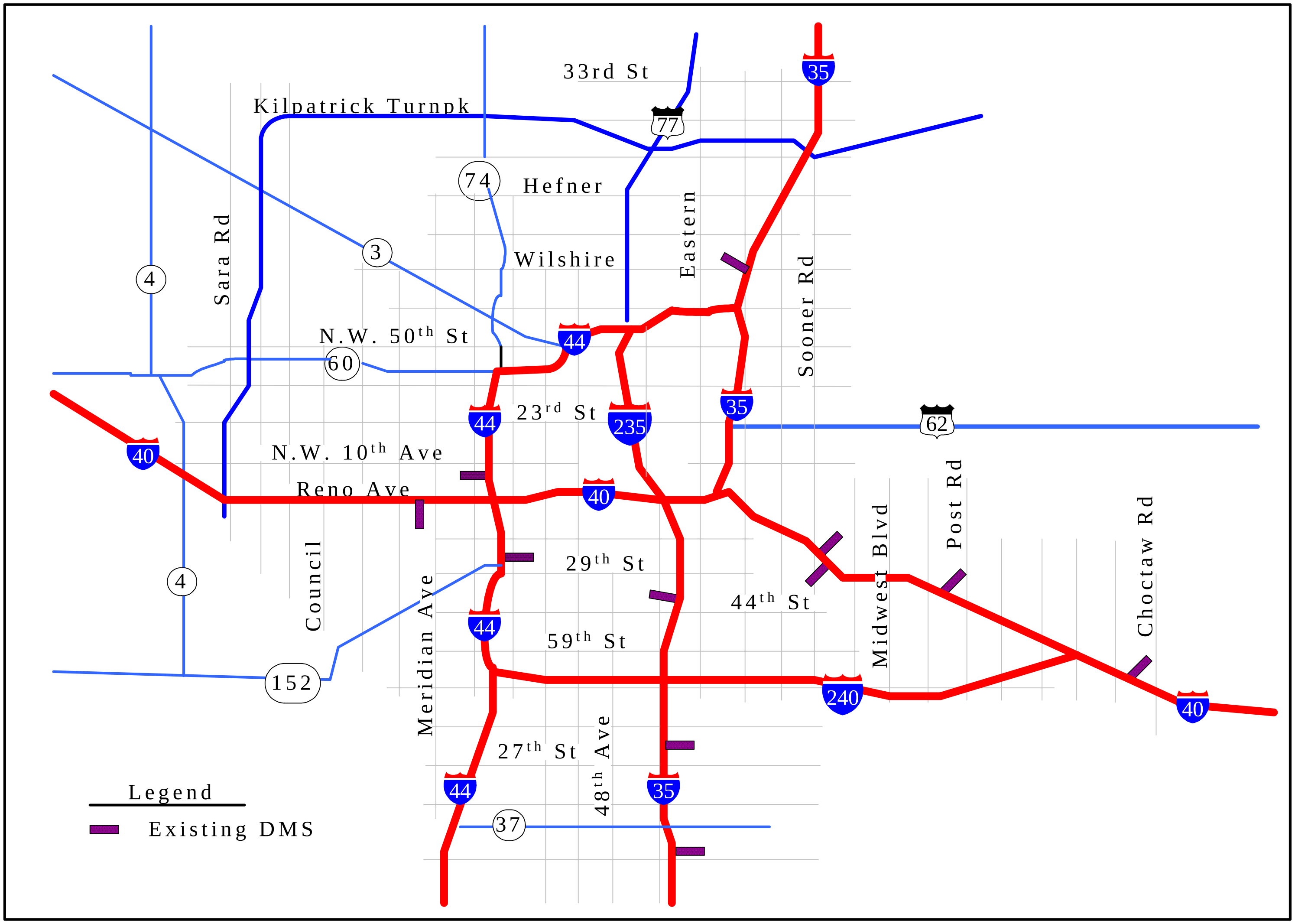


Figure 4.1 Oklahoma City Dynamic Message Sign Locations

Figure 4.2 Statewide Fiber Backbone

4.1.2 Department of Public Safety

The Department of Public Safety (DPS) is the statewide roadway enforcement agency. DPS has 13 troops or divisions statewide. One troop is dedicated solely to the statewide turnpike system.

The DPS currently has an 800 MHz radio system. They are seeking funding to upgrade the system to a trunked digital system that would be capable of voice and data transmission. There would be available capacity on the system for other agencies. The system would also be capable of vehicle tracking.

DPS has a *55 call system statewide for motorists. It is a direct link system for cell phone users to DPS dispatch centers.

4.1.3 Oklahoma Transportation Authority

As stated above, the Oklahoma Turnpike Authority (OTA) owns the part of the fiber backbone system along the turnpike system. The fiber network is part of the statewide system.

OTA operates an extensive electronic toll collector system. The “Pikepass” system uses a 2-way transponder. Every toll gate in Oklahoma is equipped with readers and most have bypass lanes. There are over 500,000 Pikepass holders using the system. The system is currently a stand alone system.

Toll collection enforcement is conducted through a video detection system. Currently, there are 65 cameras in place. There are additional cameras in place at toll plazas for security purposes.

Many of the newer toll plaza facilities have built-in automatic de-icing equipment. The equipment is operated by pavement and weather sensors.

4.2 Deployed Equipment

There are several types of ITS equipment being used by multiple agencies. For each type of equipment a list of the agencies that utilize it with a brief description is presented below.

4.2.1 Central Traffic Signal Control Systems

The City of Tulsa recently replaced a UTS signal system with a Bitrans system that controls 95 intersections in the downtown area. The system is controlled from a computer located in City Hall. Tulsa also has three closed loop systems.

The City of Oklahoma City maintains two central control systems. Both are Multisonics VMS systems. One controls 143 signals in the downtown and medical center area. It is controlled by a computer at the Transportation Division. The second system controls 36 signals along the Northwest Highway and 39th Street. The computer is housed at a dedicated control center building located at N.W. 63rd and the N.W. Highway. The City of Oklahoma City also has ten closed loop systems. The total number of signalized intersections in Oklahoma City is approximately 600. The total number within a system is 290 signals. Table 4.1 is a summary of all known traffic signal systems within the State of Oklahoma. It contains both central control systems as well as closed loop systems.

Table 4.1 Statewide Signal System Summary

CITY	LOCATION	TYPE OF SYSTEM	NUMBER OF SIGNALS UNDER CONTROL
Ada	Main Street	Closed Loop System	7
Altus	U.S. 283	Closed Loop System	6
Ardmore	Downtown/U.S. 77	Closed Loop System	15
Bartlesville	S.H. 60	Closed Loop System	8
Claremore	S.H. 66	Closed Loop System	6
Duncan	Downtown/U.S. 81	Closed Loop System	4
Edmond	2nd St/Bdwy	Closed Loop System	19
	S. Blvd.	Closed Loop System	7
	Danforth	Closed Loop System	11
	Kelley Ave.	Closed Loop System	7
	Bryant Ave.	Closed Loop System	9
Midwest City	29th Street	Closed Loop System	8
	Reno	Closed Loop System	8
	Air Depot	Closed Loop System	9
Moore	12th Street	Closed Loop System	4
	19th Street	Closed Loop System	
Muskogee	Main Street	Closed Loop System	6
Norman	S.H. 9	Closed Loop System	10
	Gray	Closed Loop System	6
	Robinson Ave	Closed Loop System	13
	Main Street	Closed Loop System	16
	Lindsey	Closed Loop System	16

Oklahoma City	Downtown & Med. Ctr.	Central Control - VMS	143
	N.W. Hwy, 39th, Penn	Central Control - VMS	36
	Memorial & Western	Closed Loop System	2
	S. Meridian	Closed Loop System	3
	N. May	Closed Loop System	17
	N. Penn & Reno	Closed Loop System	19
	N. Walker	Closed Loop System	12
	MLK	Closed Loop System	14
	Shields Blvd.	Closed Loop System	11
	S. Penn	Closed Loop System	12
	S. Walker	Closed Loop System	11
	S. Western	Closed Loop System	10
Ponca City	City Wide	Closed Loop System	36
Tahlequah	U.S. 82	Closed Loop System	5
Tulsa	Downtown	Central Control - Bitrans	95
	N. Memorial	Closed Loop System	24
	S. Yale	Closed Loop System	4
Stillwater	S.H. 51/Main	Closed Loop System	16
Warr Acres	MacArthur	Closed Loop System	7
Yukon	S.H. 94	Closed Loop System	5

4.2.2 Video Detection

Video detection has the capability to provide some monitoring of intersections with a fixed camera location. Table 4.2 provides a list of cities and locations where video detection is installed.

Table 4.2 Video Detection Summary

CITY	LOCATION
Chickasha	I-44 South Ramp
	I-44 North Ramp
Edmond	33rd & Broadway
El Reno	Bickford & Wade
	Rock Island & Wade
Enid	U.S. 412 & Monroe
Midwest City	S.E. 15th & Air Depot
	Sooner & Reno
Norman	Lindsey & I-35 East
	Lindsey & I-35 West
Oklahoma City	MLK & Reno
	S.W. 89th & Penn
Tulsa	129th E. Ave. & E. State Farm
	E. 19th & Utica

4.2.3 Emergency Pre-Emption

Emergency pre-emption is used in several cities in varying degrees throughout the state. The City of Oklahoma City uses it on Fire and Rescue vehicles. The City of Tulsa is testing two locations in an effort to determine its application. The City of Edmond has emergency pre-empt at 72 of its signal locations. The City of Norman has emergency pre-empt at 46 of its 105 signalized locations. The following cities have emergency pre-emption at one or more intersections. Tables 4.3 and 4.4 show the cities and type of emergency pre-emption used.

4.2.4 Emergency Management

The summary information provided is a combination of information gathered through one on one interviews and from the FHWA 2000 survey data. The data is from survey information from six fire departments, three Emergency

Management Services, six police departments and three county sheriff departments. All departments are within the Tulsa and Oklahoma City metropolitan areas. Table 4.3 summarizes the data from the police and sheriff departments. Table 4.4 is a summary of data from the fire, rescue and EMS agencies.

For the reporting police and sheriff departments, there are a total of 1875 police vehicles in service. There is expected to be an increase of 17% in vehicles by 2005. Eighty one percent of the vehicles are dispatched with a CAD system. Two communities, Edmond and Broken Arrow, allow police vehicles to pre-empt traffic signals.

For the reporting fire and EMS departments, there are a total of 247 vehicles in service. The fleet is expected to increase 11% by 2005. There are 17 vehicles currently with an on-board navigation system within the Oklahoma City Fire Department. The Norman Fire Department, Tulsa EMS, and Norman EMS plan on installing on-board navigation systems on a limited number of vehicles by 2005. Sixty-six percent of the vehicles are dispatched using a CAD system. This is expected to increase to 93% of the fleet by 2005.

All of the reporting fire departments have signal pre-empt capability. None of the EMS agencies have it. Thirty-four percent of the total fleet will have pre-empt capabilities by 2005. The Midwest City EMS expects to have some pre-empt capabilities. The overall fleet capability to pre-empt traffic signals is expected to increase to 63% by 2005.

Table 4.3 Police Department Inventory

City	No. of Vehicles		On-Board Nav.		CAD Dispatch		Pre-Empt Capabilities	
	2000	2005	2000	2005	2000	2005	2000	2005
Broken Arrow PD	77	120	0	0	0	120	70	120
Canadian County Sheriff	32	38	0	0	0	0	0	0
Edmond PD	75	85	0	0	0	85	9	12
Midwest City PD	77	82	0	0	77	82	0	0
Norman PD	86	105	0	0	86	105	0	0
Oklahoma City PD	620	620	0	0	571	571	0	0
Oklahoma County Sheriff	180	300	0	0	60	300	0	0
Tulsa County Sheriff	128	150	0	0	128	150	0	0
Tulsa PD	600	700	0	250	600	700	0	0
Totals	1875	2200	0	250	1522	2113	79	132

Table 4.4 Fire, Rescue And EMS Inventory

City	No. of Vehicles		On-Board Nav.		CAD Dispatch		Pre-Empt Capabilities	
	2000	2005	2000	2005	2000	2005	2000	2005
Tulsa FD	54	NA	0	0	54	NA	8	NA
Broken Arrow FD	21	24	0	0	0	24	21	24
Oklahoma City FD	91	95	17	NA	91	95	25	50
Edmond FD	10	12	0	0	0	12	10	12
Midwest City FD	21	27	0	8	8	10	12	14
Norman FD	26	29	0	8	0	12	9	12
Tulsa EMS	5	5	0	1	5	5	0	0
Midwest City EMS	14	16	0	8	0	16	0	10
Norman EMS	5	6	0	0	5	6	0	0
Totals	247	214	17	25	163	180	85	122

4.2.5 Transit Management

There are two major agencies which manage large transit fleets in Oklahoma; the Metropolitan Tulsa Transit Authority (MTTA) in Tulsa and Central Oklahoma Transit and Parking Authority (COTPA) in Oklahoma City. A summary of the important ITS function for each agency is shown in Table 4.5. COTPA currently has full deployment of an Automated Traveler Information System (ATIS). COTPA has sixteen vehicles available for on demand service. It has an analogue radio system that is being upgraded to a digital trunk system.

MTTA currently has 30 vehicles dedicated to demand responsive. MTTA provides public information through a website. Its radio system is a digital trunk system.

Table 4.5 Transit Inventory

	Oklahoma City		**Tulsa**	
	2000	**2005**	**2000**	**2005**
Number of Vehicles Demand Responsive	16	18	30	30
Vehicles Equipped with AVL	0	12	0	0
ATIS Deployment	100%	100%	0%	0%
Public Information Audible Enunciators				
In-Vehicle VMS	N	Y	N	N
Automated Cell Phone	N	Y	N	N
Kiosks	N	Y	N	N
Internet	N	Y	Y	Y
Dynamic Displays at Stops	0	102		
In Vehicle Navigational Aids	0	18	0	0
Type of Radio System	Analogue	Digital Trunk	Digital Trunk	Digital Trunk

5.0 TELECOMMUNICATIONS ASSESSMENT

5.1 Introduction

Telecommunications infrastructure is a vital part of any ITS deployment and can play a significant role in affecting the overall cost of implementation. A thorough assessment of existing telecommunications resources is important for ensuring that these resources can be maximally leveraged in strategic ITS planning. In this chapter, currently existing statewide telecommunications assets are identified for the State of Oklahoma. The data throughput, or bandwidth, requirements of existing plus proposed ITS assets are estimated. These requirements are then compared against the capacity of existing telecommunications assets to determine how much additional telecommunications infrastructure will be required to support statewide ITS implementation.

5.2 Current Telecommunications Assets – Statewide

Existing state-owned telecommunications assets available to support statewide ITS implementation fall into two categories: fiber optic cable and radio infrastructure. The following discussions identify assets in each category. In order to assess current and future bandwidth requirements, it will also be necessary in this chapter to examine planned deployments of field equipment including web cameras, pan-tilt- zoom full motion video cameras, weather sensing stations, dynamic message signs (DMS – both portable and fixed), and radio frequency traffic detectors.

5.2.1 Fiber Optic Cable

ODOT is fortunate to have under its control a significant amount of fiber optic infrastructure in both the Oklahoma City and Tulsa metropolitan areas. Figure 4.2 shows all of the state-owned fiber optic cable currently deployed in Oklahoma. Fiber cable exists along the entire length of both I-35 and I-44 in Oklahoma. The fiber is predominantly carrier-grade single- mode, capable of supporting high data rates over relatively long spans. Most of this fiber is dark (unused) at the present time. Lighting the fiber to make it usable for ITS requires the procurement and installation of fiber optic multiplexers and switches that enable information to be transmitted and received through the fiber cables. It should be noted in Figure 4.2 that there is an absence of fiber optic cable along I-40.

Appendix B enumerates and details all of the state-owned fiber optic cable currently available in Oklahoma. A detailed map showing state-owned fiber links appears in Appendix C. Some of these fiber optic cables belong to other state agencies; in some of those cases a memorandum of understanding (MOU) is already in place to make the cables available to ODOT for ITS use while in other cases MOU's would need to be negotiated in the future.

5.2.2 Statewide Radio Network

ODOT presently owns a radio network that provides total coverage of the state. The network is predominantly used for two-way voice communications regarding roadway maintenance. The low bandwidth links provide little opportunity to support bandwidth intensive ITS applications. However, a small number of low bandwidth rural ITS applications (e.g., remote weather stations, RTMS sensors located at rural work zones) may be supportable by this radio network. This network provides full coverage of the entire state.

5.3 ITS Assets

In the following subsections, current, in- work, and proposed ITS assets for statewide ITS implementation are examined. Enumerating these assets and their communications requirements is important for estimating the expected bandwidth requirements needed to deploy ITS in the State. This chapter considers only those assets that are specifically designated for ITS use. It should be noted that other assets including RTMS microwave traffic sensors, weather stations, weigh- in- motion sensors, *etc.*, have been deployed in the state for, *e.g.*, planning but not ITS. Such assets are not considered here.

5.3.1 Current ITS Assets – Oklahoma City

To date, deployed ITS assets in Oklahoma are limited to the Oklahoma City metropolitan area. Eleven (11) Dynamic Message Signs (DMS) are installed and operational at strategic points along interstate highways, as shown in previously Figure 4.1. Existing DMS are shown in green while in-work DMS are shown in red. Data communications to and from these DMS's is currently via leased- line dialup telephony service. Future plans call for all fixed-location DMS's in metropolitan areas in the State to eventually be connected to an ITS private network via fiber optic cables.

In addition, the ITS Lab at the University of Oklahoma maintains an array of ITS assets for the purpose of investigating and ensuring seamless hardware integration and also for supporting ITS software development efforts. Communications infrastructure connecting the lab to the outside world is currently limited to Internet connectivity.

5.3.2 In-Work Assets – Oklahoma City

A first- year ITS deployment project is presently underway in Oklahoma City where I-40 skirts the northern boundary of Tinker AFB. This segment of roadway has been the site of many crashes and truck-rollovers in the past. In addition, when Tinker AFB heightens security alert status, traffic attempting to enter the northern gates of the base can back up onto I-40. To provide ODOT and Tinker personnel a more effective means of monitoring incidents and traffic conditions, two DMS, four Closed-Circuit Television (CCTV) cameras, and 14 Internet Protocol (IP) based web cameras will be installed in 2003. The CCTV cameras will provide full-motion video images with pan-tilt-zoom (PTZ) camera control.

A 24-strand dedicated fiber optic cable will be installed to support the I-40 Tinker AFB project. Each fiber in the cable will be used for either analog video or for packet switched IP data communications. This cable will connect all four full-motion PTZ CCTV cameras, all 14 web cameras, and associated communications equipment to an ITS operator control console that will be located on Tinker AFB. For the near term, communications to and from the two DMS's will be via leased- line telephony connections. Initially, this equipment will comprise a standalone system without external communication capabilities. On the 24-month future horizon, it is envisioned that a fiber optic cable will connect this system with a broadband ODOT communication backbone available at the Reno Avenue Division IV regional annex.

<u>5.3.3 In-Work Assets – Tulsa</u>
A first-year ITS deployment project is presently underway in Tulsa, where an array of ITS assets will be deployed at strategic locations across the metropolitan area. This early ITS deployment will give ODOT and the Department of Public Safety (DPS) personnel a base-level capability to monitor incidents and traffic conditions. In addition to providing ODOT and DPS with a small-scale Traffic Management Center (TMC) capability, the following ITS assets will be deployed in 2003: seven DMS's, seven CCTV cameras, and 16 web cameras. The locations of these assets are shown in Figure 5.4.

All of the backbone communications for this project will be IP-based, including video communications. The network will be implemented over fiber optic cables some of which are owned by the Oklahoma Transportation Authority (OTA) and some of which are owned by ODOT. A MOU currently in place between ODOT and OTA stipulates that, for the OTA owned fiber links, 300 Mbps of bandwidth will be available for ITS use. Video from the analog CCTV cameras will be digitally encoded for transmission over the IP network.

The green rectangles are DMS's, circles with green fill and central black dot are CCTV cameras, and pentagons with green fill are web cameras.

<u>5.3.4 Proposed Assets – Oklahoma City</u>
Appendix D tabulates bandwidth requirements necessary to support ITS equipment that is expected to be deployed in the Oklahoma City metropolitan area on the ten-year horizon. This equipment includes:

- 74 full-motion CCTV Cameras with PTZ
- 20 fixed-location DMS's
- 296 IP-based Web Cameras
- 37 vehicle detectors, which may be of various types

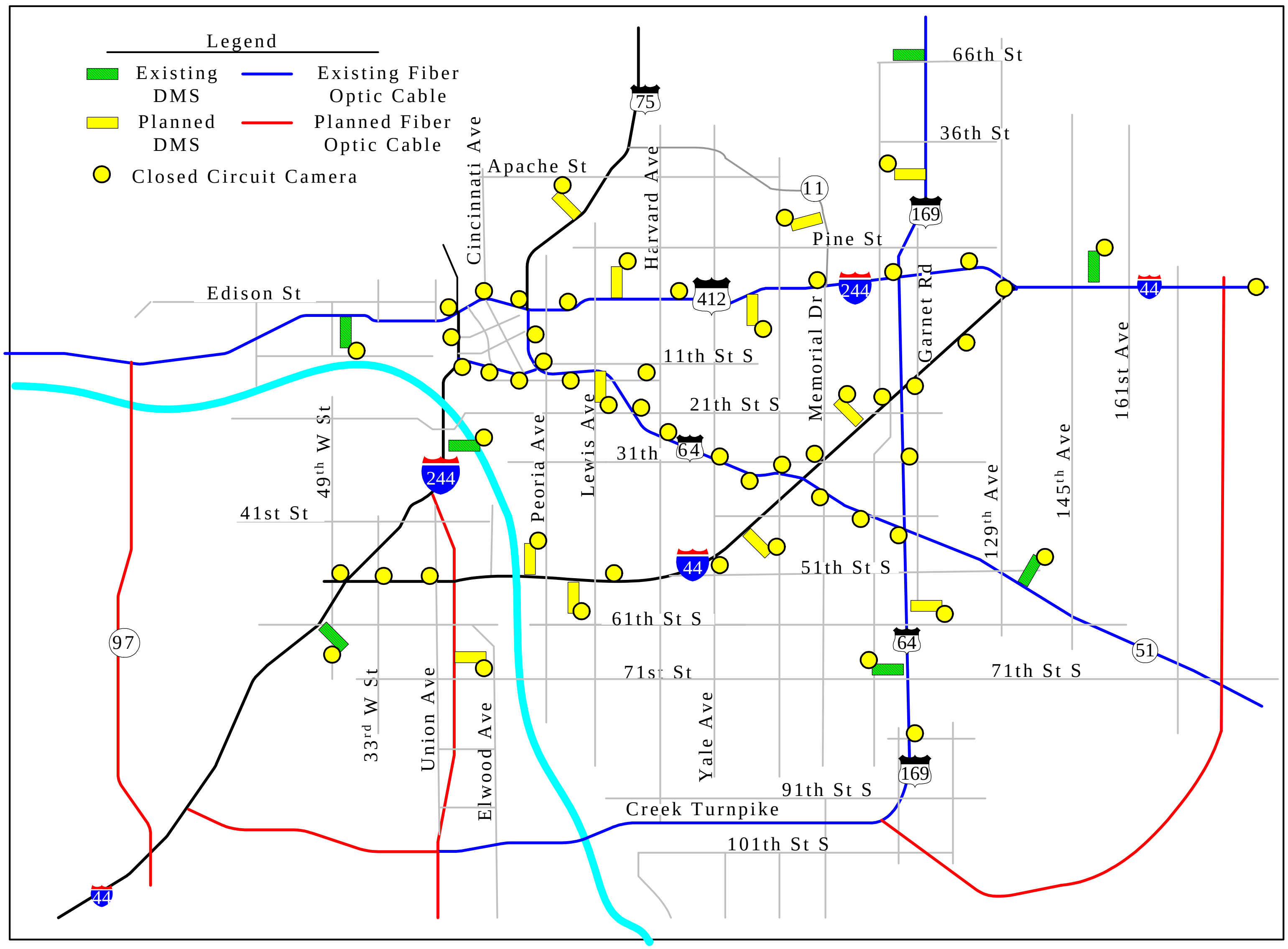


Figure 5.1 In-Work ITS Assets in the Tulsa metropolitan Area

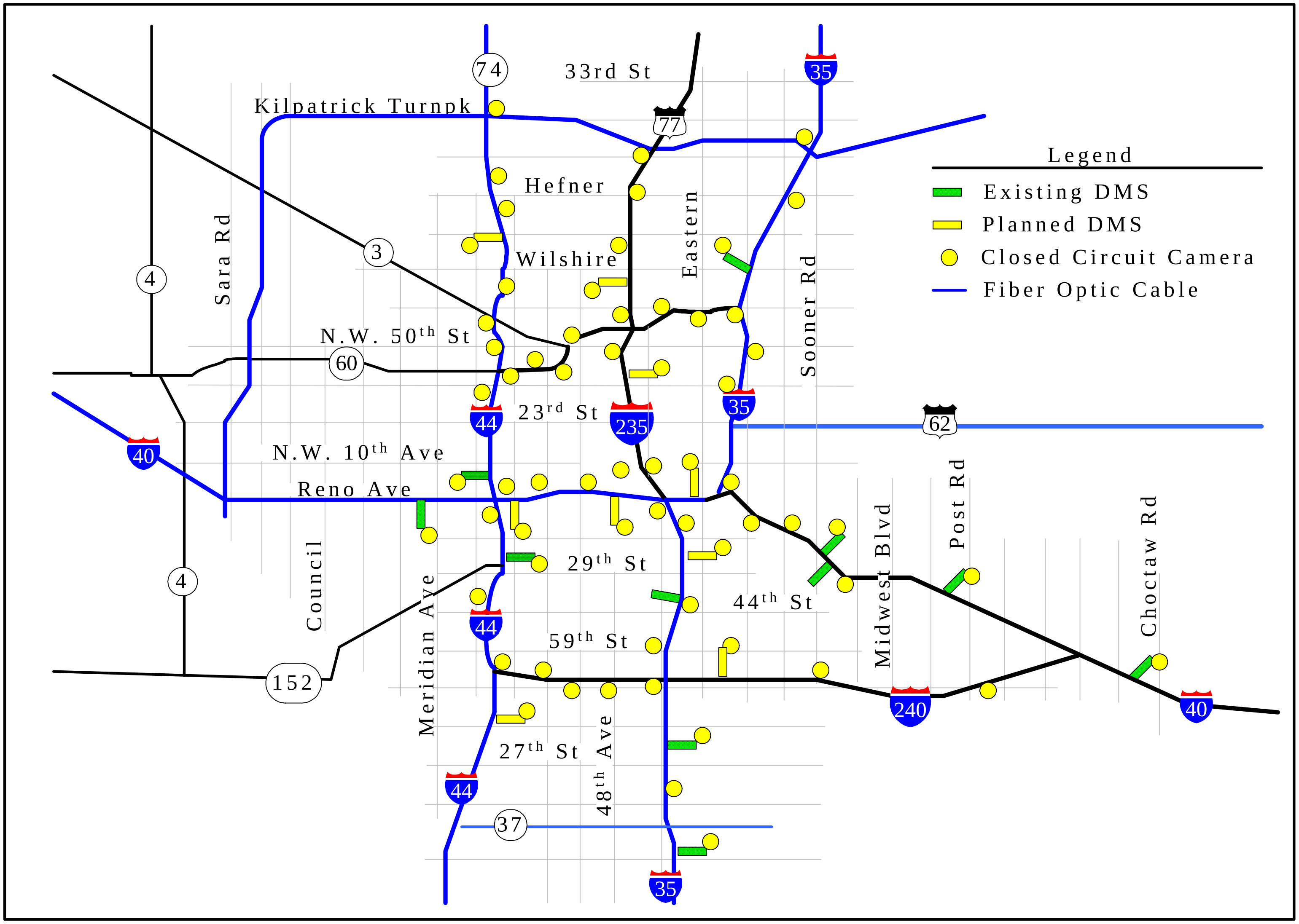


Figure 5.2 Proposed ITS Assets for Oklahoma City

None of the expected types requires bandwidth in excess of 19.2 kbps; this figure was therefore used in the bandwidth calculations.

The expected locations for deployment of these assets are shown in Figure 5.5 below. As shown in Appendix D, the total bandwidth required for these expected deployments is 875 Mbps.

5.3.5 Proposed Assets – Moore / Norman Area

Appendix D tabulates bandwidth requirements necessary to support ITS equipment that is expected to be deployed in the Moore / Norman area on the ten- year horizon. This equipment includes

- 12 full-motion CCTV Cameras with PTZ
- 3 fixed-location DMS's
- 48 IP-based Web Cameras
- 8 vehicle detectors, which may be of various types.

None of the expected types requires bandwidth in excess of 19.2 kbps; this figure was therefore used in the bandwidth calculations.

The expected locations for deployment of these assets are shown in Figure 5.6 below. As shown in Appendix D, the total bandwidth required for these expected deployments is 125 Mbps.

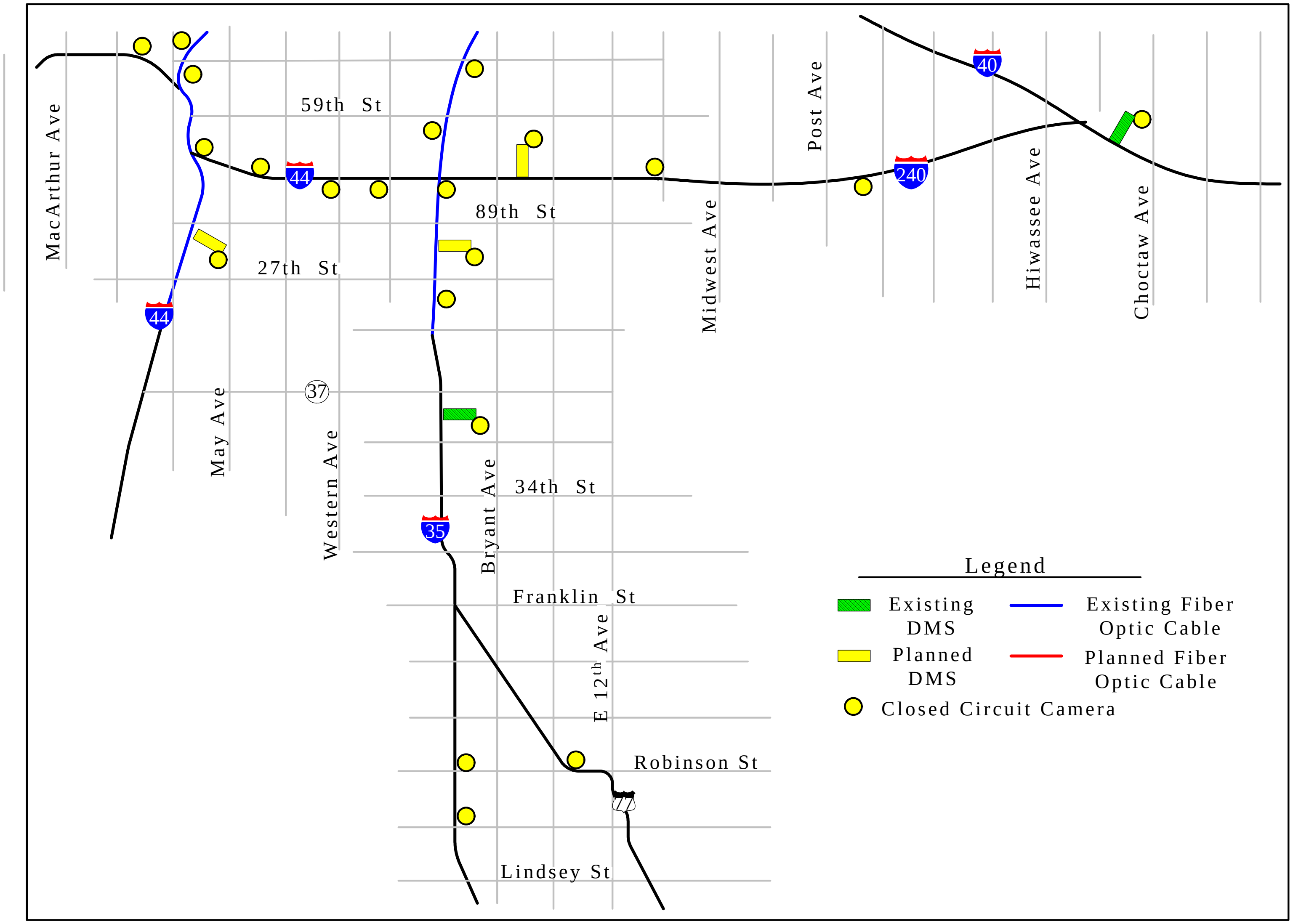


Figure 5.3 Proposed ITS Assets for the Moore / Norman Area

5.3.6 Proposed Assets –Tulsa Metropolitan Area
Appendix D tabulates bandwidth requirements necessary to support ITS equipment that is expected to be deployed in the Tulsa metropolitan area on the ten-year horizon. This equipment includes:

- 63 full-motion CCTV Cameras with PTZ
- 20 fixed-location DMS's
- 252 IP-based Web Cameras
- 35 vehicle detectors, which may be of various types

None of the expected types requires bandwidth in excess of 19.2 kbps; this figure was therefore used in the bandwidth calculations.

The expected locations for CCTV and DMS deployment were shown in Figure 5.4. As shown in Appendix D, the total bandwidth required for these expected deployments is 775 Mbps.

5.3.7 Proposed Assets – Lawton
Appendix D tabulates bandwidth requirements necessary to support ITS equipment that is expected to be deployed in the Lawton area on the ten- year horizon. This equipment includes:

- 2 full-motion CCTV Cameras with PTZ
- 0 fixed-location DMS's
- 16 IP-based Web Cameras
- 2 vehicle detectors, which may be of various types

None of the expected types requires bandwidth in excess of 19.2 kbps; this figure was therefore used in the bandwidth calculations. The locations for deployment of these assets have not yet been established. As shown in Appendix D, the total bandwidth required for these expected deployments is 50 Mbps.

5.3.8 Proposed Assets – Rural
Appendix E tabulates bandwidth requirements necessary to support ITS equipment that is expected to be deployed on a twenty-year horizon in areas other than those treated in Sections 5.3.1 through 5.3.7 above. This equipment includes:

- 350 IP-based Web cameras with opposite- facing pairs placed at ten-mile intervals, and
- 175 Weather Remote Processing Units placed at ten- mile intervals coincident with the Web camera deployments.

The locations for deployment of these assets have not yet been established. As shown in Appendix E, the total bandwidth required for these expected deployments is 550 Mbps. It is envisioned that future fiber optic cable deployments (discussed below in Section 5.4.2) will enable all of this equipment to communicate with the STIC.

5.4 Capability Assessment

5.4.1 Ten-Year Horizon

Currently deployed optical fiber assets are not sufficient to support the metropolitan area ITS deployments enumerated above in Sections 5.3.1 through 5.3.7 above. The following additional optical fiber deployments are recommended:

- I-40 from the Texas border to Webber's Falls,
- US 69 from I-44 to the Texas border,
- US 412 from I-35 to Enid,
- I-240 from I-44 to I-40, and
- I-35 from SH 9 West to I-40.

The accompanying switching equipment should support link bandwidths of 100 Mbps for rural links and 1 Gbps for urban links. While these figures are higher than the bandwidth requirements calculated in the Appendices, they will provide growth capability to accommodate unforeseen future sensor types and communications needs.

The proposed routes of new fiber optic cable support statewide ITS implementation, both urban and rural. With the addition of these optical fiber links, all of the planned metropolitan area deployments described in Sections 5.3.1 through 5.3.7 can be supported. In Tulsa, where bandwidth on the OTA-owned packet switched network is a concern, it should be noted that the bandwidth figure of 775 Mbps shown in Section 5.3.6 above represents the total bandwidth requirement. This total bandwidth for the network can be accommodated without exceeding the limit of 300 Mbps on any *individual* fiber optic link, as imposed by the current MOU between ODOT and OTA. Although rural ITS deployments are not planned on the ten- year horizon, the currently deployed communications infrastructure could support low-bandwidth ITS services in rural areas by utilizing ODOT's statewide radio network. While full motion video would not be possible over this network, reduced rate video, snapshot images from web cameras, and most types of traffic and weather sensor data could be transmitted. Thus, it would be feasible to bring some ITS services to rural areas on the ten- year horizon if this were deemed advantageous.

5.4.2 Twenty-Year Horizon

To support the deployment of the rural ITS assets enumerated in Section 5.3.8, additional fiber is needed. These needed fiber links are shown in blue in Figure 5.8 above. Specifically, they are along

- US 412 from Enid to the New Mexico border,
- US 81 from IH-40 (west of Oklahoma City) to Enid, and
- US 75 from the Kansas border to the Texas border.

It may also be desirable to consider deploying a grid of radio frequency transponders to support enhanced ITS capabilities along major roadways, both rural and urban. For example, such a network could provide the capability for DPS officers and ODOT maintenance personnel including, *e.g.*, snowplow operators, to obtain video, weather, and other ITS system data directly in their vehicles. A comparative cost study of the possible equipment tradeoffs would need to be undertaken to design such a radio network. High power, licensed radio transponders could easily provide sufficient bandwidth coverage omni-directionally with a radio spacing of 10 miles. Note that broadband communications infrastructure is already proposed to be available at ten- mile intervals to support the web cameras and Weather Remote Processing Units discussed in Section 5.3.8 above. Design alternatives to establish a radio network of this type using a more dense grid of lower power unlicensed transponders should also be investigated.

Appendix A Summary of Stakeholder Interviews

Interview: 12/19/01, 10:30AM
Location: Association of Central Oklahoma Governments (ACOG) Office
In Attendance: Linda Koenig Doug Rex Steve Hofener
Erin Ehlinger Vickie Morris

Existing:
They have set up an ITS Steering committee. This committee is split into three sub-committees: incident management, traveler information, technology and operations. The incident management sub-committee is currently meeting regularly and has been working towards getting quick clearance legislation passed.

Training has been held at the ACOG offices involving incident management and ITS architecture.

They are currently finishing up the ITS architecture for the region.

Future Needs/Wants:
They have considered being the data warehouse for the region. This was mentioned in the ITS architecture meetings. If they are not the ultimate data warehouse, they want a direct line to the data.

They could host a website with information concerning construction and maintenance closures with information from all regional agencies. It was mentioned that Tim Callahan at ODOT is already creating a map with this information for ODOT.

In the incident management meetings, the possibility of Pike Pass being used for congestion monitoring has been mentioned. This information will benefit all agencies.

Issues:
- Trouble getting some important stakeholders to steering committee meetings.
- Need for better records of accident locations, clearance times, etc.
- There is very little support for ITS from the middle to high level management. They think this is the major stumbling block for ITS.
- One key for selling ITS is to convince the rural commissioners that it is not just beneficial to urban areas.
- There is an overall perception that they do not have a traffic congestion problem in the area.

Interview: 12/18/01, 2:00PM
Location: ODOT Division III Office

In Attendance:			
	Jessie Fullingim	Rick Bond	Gary Chaffin
	Ralph Nguyen	Steve Hofener	Erin Ehlinger
	Vickie Morris		

Background:

Division III has been involved with the new maintenance contract with VMS, and Cleveland county in their district is covered in the contract.

They have attended ACOG ITS meetings regularly

They have sent representatives on the trip to Seattle and Portland to view what others are doing in ITS.

Existing:

Hand held sensors for measuring pavement surface temperature

Radios are currently Kenwood 155.25 MHz. This is the statewide ODOT system and supports voice only. They also have cell phones to supplement the radio system. The currently cannot communicate directly with Highway patrol until they are on the scene.

There is one high accident rail crossing location that they are interested in trying new technology to improve.

They have the DTN weather service, and 2 NOAA radios in the District (one in Norman, one at Mc Alister).

Six portable DMS (Winkomatic brand)

Future Needs/Wants:

More NOAA Weather Radios, connection to the weather system at OU, or any system that will provide better weather information.

RWIS on bridges, and other locations to support improved snow and ice response.

They would like to eliminate the use of “watch for ice on bridge” signs. These signs are currently mandatory according to their state MUTCD.

They are interested in becoming more involved in the I40 coalition. Trucking is a big issue in their division.

Service patrol of some type may be useful. Perhaps one of the employees could be trained in traffic control at incidents and provided with a special rig.

They hope to have a speed detection system installed soon.

Issues:

- Alternative routing around incidents and HAZMAT spills is a big issue in the division. This is in part due to the fact that they are not allowed to route traffic onto any roads except designated State Highways. If they do, the county asks for money to pay for road wear and damages. Coordination with counties for rerouting purposes is challenging as the Counties are always concerned about the damage to their roads. Also, re-routing signing can take hours to set up which is not feasible for short-term detours.
- They do not have good communication with the Oklahoma Highway patrol in that area. They typically are not contacted about incidents, unless the officer needs their equipment.
- It is hard to justify the use of ITS, when they do not even have shoulders on some of their roads.

Interview: 12/18/01, 9:00AM
Location: ODOT Reno Annex

In Attendance:			
	Ron Curb	Brett McIntyre	Randy Lee
	Rick Lowry	Christopher Poe	Steve Hofener
	Erin Ehlinger	Vickie Morris	

Background:
Recurrent congestion is not a huge issue in Oklahoma City at this time. Non-recurrent congestion is an issue. Peak periods have the most incidents, but these tend to be smaller incidents. Nighttime periods have the most severe incidents that can take several hours to clear. There are limited routes for diversion during freeway incidents.

Approximately 4 years ago ODOT became interested in dynamic message signs as a result of it taking so long to dispatch portable signs to incidents. This was the first interest in ITS. Most permanent DMS now installed are focused on traffic entering the region.

Construction projects have pushed ITS. First, there had been a history of incidents due to construction, such as during the I-40/Choctaw project. Second, DMS could be procured that supported construction traffic management which could be used post-construction for regional traffic management.

Upper management did not see the benefit of ITS, except in the areas of incident management. They feel that the needs of the many out weigh the few and that ITS focuses too much on urban areas. For ITS to work, it must show benefit in rural areas too.

Existing:
Automated sprayers on one bridge for ice control.

Approximately seven acres of land has been purchased near the Reno Annex for a future TMC site.

There are several DMS signs currently in place in the region. The signs are placed to divert primarily inbound Interstate traffic to other Interstates in the event of an incident. All are dial-up, and can be accessed from essentially anywhere using a PC with the sign software. These signs will remain dark unless pertinent accident information is available. They will not provide weather information. However, ODOT Division IV would like to gather weather data at the signs including pavement temperatures.

Incident management is handled by the contracted maintenance, VMS, Inc. VMS must respond with traffic control in place within 45 minutes during peak hours. VMS must respond with traffic control in place within 75 minutes during off-peak hours. VMS must contact ODOT Division when incident is expected to last over 1 hour. ODOT Division retains operation of the DMS. Coordinating the use of DMS during incident management could be improved. HAZMAT is controlled by the Fire department. HAZMAT typically causes lengthy delays.

Working with the I-40 coalition (TX, NM, AZ, others) to develop means to post advanced information for truckers before they enter or leave each state.

Future Needs/Wants:
Real-time map of region (possibly state) posted on the internet that provides the user with near real-time construction and maintenance information. A color-coded congestion map posted on the Internet. If there is a way to post this map on a colored DMS, there may be interest to do so. More freeway management functions and devices and telecommunications need to be implemented to create this map and to use the DMS more effectively for incident management. There is a need to develop an operator's manual for the DMS.

Service patrol would be a good idea, but not sure how it would work with the current maintenance contract with VMS.

They want RWIS, including sensors for pavement temperatures for maintenance purposes, and telecommunications to the devices. Roadway weather information system would aid in asset management during inclement weather.

Would like to consider modifying the current VMS contract. A hybrid maintenance contract in the future that splits operating responsibility between ODOT and contracted maintenance. It would also define functions of incident management and ITS in more detail.

Truck rollover detection is needed at several locations. (Portsmouth Jct., perhaps the EB exit to Morgan road, although the reconstruction appears to have corrected this issue). Over height detection is also needed, especially at the 63rd Street Bridge at the Broadway exit. It's been hit 3 times already this year.

Would like to have a Division TMC, with the potential to co-locate with DPS.

Peer to Peer visits with similar states

Ramp metering should be put in the plan for the long-term future.

Would like more information on "zipper" lanes, like in DC. These might be useful in the region on I-44.

There are no Highway-Rail intersection issues in the District.

Issues:
Privatization of maintenance started this year in the Oklahoma City region and surrounding counties. The contract is for "routine" maintenance. ODOT Division still retains operation of the DMS signs. This contract is renewed annually with a total of 5 years.

There is a need to separate out operations from maintenance duties for contracted maintenance. Another strategy is to have performance based goals for operation and maintenance. This strategy will help monitor how private contractor is performing.

Divided Crash Investigation responsibilities with the City of Oklahoma City Police Department on major freeway routes and seemingly different goals about clearing the incident. The City Police do not have the same training on handling incidents on high-speed facilities, such as the OSP do. This can cause problems and long delays on city-owned facilities when there are incidents. These delays affect ODOT's facilities as well. Total Stations might be useful to the City to help speed incident clearance.

Interview: 12/19/01, 2:00PM
Location: Department of Public Safety
In Attendance: Gene Thaxton Vickie Morris Ron Curb
Steve Hofener Erin Ehlinger

Background:
Gene Thaxton serves as the manager of communications for the DPS statewide. This includes computer systems, software, dispatch, radio, etc. He is also the chair of the Oklahoma Traffic Records committee.

Existing:
There are thirteen troops in the state and each has it's own communications center. One troop is dedicated to the turnpikes specifically.

The currently have a low band (+/-145) radio system that is being converted to an 800mHz system. Currently, both systems are in operation. The current 800MHz system is now analog. It will be upgraded to trunked digital. The DPS uses their radio system only for voice, not for data. Currently, they plan to use satellite communications for data. This system is currently under test in Oklahoma and several other rural states.

They have no association with 911. They have a *55 call-in systems for emergencies.

The have a good wrecker rotation system currently in place.

The current budget includes funding for 900 Mobile Data Terminals (MDTs) – essentially the entire DPS fleet.

Future Needs/Wants:
They are taking the lead on testing out the use of satellite for statewide data communications. The system can pull up records on a tag within 10 seconds. It can also be used for trucking permits, accident records, officer location, etc.

They are willing to share satellite communications system with other agencies to assist in coordination. They are hoping that other police agencies will piggyback onto this system.

They are working with OTA and ODOT on the implementation of 8 dynamic message signs. hey would like the use of cameras for 24/7 monitoring at each dispatch center, as cameras are added to ODOT's system.

Incident clearance would be expedited by providing better communications with the responding ambulance. (e.g. Providing information on the best route to the scene)

Issues:

- Officers have expressed reluctance to use the satellite system for tracking DPS vehicles. This should be resolved by implementing a switch that the officers can use to turn the tracking portion of the system on or off.
- DPS would be willing to discuss sharing filtered CAD data with ODOT to help in incident management.
- The use of outside contractors (maintenance) has been an issue. The relationships have not been built between outside contractors that were already established between DPS and ODOT.
- He is not aware of anyone in his agency that is looking into the use of total stations or other technology for accident investigation. They have a special team that handles accident investigation.

Interview: 12/18/01, 11:00AM
Location: City of Oklahoma City
In Attendance: Sheila Dees, Stuart Chai (unable to attend), Ron Curb, Christopher Poe, Steve Hofener, Erin Ehlinger, Vickie Morris

Existing:
The city operates approximately 600 signals. They have nine closed loop systems with phone drops, and two closed loop systems that are directly wired into the central office. In addition there are two Multisonic VMS systems controlling all downtown signals and approximately 23 signals along N.W. Expressway and 39th Street.

They have video detection cameras at two locations. The locations are MLK and Reno and S.W. 89th and Penn. The set of cameras at MLK and Reno comes back to the central office.

Heavy involvement in incident management for area disasters such as tornadoes. For freeway incidents they usually get a call once the signals are already congested. They are regularly in contact with VMS (contracted maintenance for the state) concerning incidents. They provide barricades, and portable DMS and other resources for traffic control.

Six portable changeable message signs, no permanent locations.

Agreements with other cities for control of their signals

They have regular communication with COTPA concerning road closures and construction. COTPA will alert the city of to roadway issues that hinder their bus routes.

The city has a website that contains static information

Future Needs/Wants:
Cameras for interstate routing onto city streets that are used for alternate routes.

Better communication between agencies concerning incident management, specifically ODOT

Sharing of camera images, not necessarily control, to and from other agencies

Interconnects on all arterials running parallel to the interstates.

When ODOT develops the regional TMC, it may be useful to have a city employee located at the center.

Need to have railroad pre-emption at signals.

Need to settle on how to respond to incidents. Everyone does things differently and this causes conflicts and problems.

Would like to be able to change signal timing to respond to detours and incidents.

<u>Issues:</u>

- Staffing shortage
- Alternate route decisions need to be made, but the City is not likely to designate alternate routes without some resources to apply to those roads.
- Ramp metering would be difficult at some locations because there is not enough queueing distance on some ramps.
- No consistency between agencies of how they handle emergency or incident management.

Interview: 12/19/01, 9:00AM
Location: Oklahoma Transportation Authority Office
In Attendance: Gary Brown, Ron Curb, Steve Hofener, Erin Ehlinger, Vickie Morris

Background:
OTA/ODOT owns the majority of fiber in Oklahoma.

They are working on a partnership with Southwestern Bell for usage of the fiber they own across the state.

Existing:
The Pike Pass is an active (2-way) transponder. They have prototypes of smaller (credit card size) transponders.

They have between 8 to 124 strands on most of the interstates in Oklahoma. OTA has management responsibilities and are leasing to ODOT. This contract is currently under negotiation.

The majority of the information they send on the fiber is toll revenue related.

Over 65 cameras in place for violation processing as well as road loops for toll classification. These cameras are currently not used for incident management.

They have 8 portable Variable Message Signs.

They have a maintenance contract with VMS. This is the same contractor that ODOT is using in some counties. It is only for a small portion of the urban turnpike (Kilpatrick Turnpike) in Oklahoma City from approximately Macarthur Boulevard to I-40.

They looked into weather systems 3 or 4 years ago and did not find them cost effective.

They have automated de-icing at toll plazas.

Website in operation, which does not contain road information.

Future Needs/Wants:
They are in the process of partnering with ODOT to implement 8 dynamic message signs. These signs will be operated by DPS. These will be shoulder-mount (ADDCO Brick). They will deploy 2 near Oklahoma City, 2 near Stroud, 2 near Tulsa, and 2 elsewhere. The locations in Oklahoma City and Tulsa are at the ends of the Turner Turnpike and also at Stroud (the half way interchange).

They would like to install an over height warning system at toll plazas.

They are interested in providing traveler information via kiosks/internet at rest areas and truck stops.

<u>Issues:</u>

- They have studied HAR, and do not believe it to be effective.
- There was some concern about ODOT using the Pike Pass for congestion detection. Their concern is possible battery deterioration. However, this is a possibility.
- They have tried to work with other states on sharing transponder information. This has been unsuccessful.

Appendix B State-Owned Fiber Inventory

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
a)	**OTA FIBERS**							**41.68**	**159.08**	**12**
		I-44 and Missouri State Line to Craig County Line and I-44	Will Rogers TPK	OTA	44-58-01	0	31.34	0	31.34	12
		I-44 and Ottawa County Line to I-44 and Mayes County	Will Rogers TPK	OTA	44-18-01	0	20.43	0	20.43	12
		I-44 and Craig County Line to I-44 and Rogers county line	Will Rogers TPK	OTA	44-49-41	0	13	0	13	12
		Mayes County Line and I-44 to I-44 and US 412	Will Rogers TPK	OTA	44-66-30	0	23.41	0	23.41	12
		I-44 and US 412 to I-44 and Tulsa County Line	I-44	ODOT	44-66-36	0	3.76	3.76	0	12
		I44 and Rogers County Line to I-244 and I-44	I-44	ODOT	44-72-78	0	14.47	14.47	0	12
		I-44 and I-244 to I-44 and Creek County Line	I-44	ODOT	44-72-08	0	1.1	1.1	0	12
		I-44 and Tulsa County Line to I-44 and Lincoln County Line	Will Rogers TPK	OTA	44-19-37	0	39.35	0	39.35	12
		I-44 and Creek County Line to I-44 and Oklahoma County Line	Will Rogers TPK	OTA	44-41-34	0	30.55	0	30.55	12

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
	-	I-44 and Lincoln County Line to I-44 and I-35	I-44	ODOT	44-55-76	0	16.45	16.45	0	12
	-	I-35 and I-44 to I-35 and NE 36 st.	I-35	ODOT	35-55-09	0	2.36	2.36	0	12
	-	I-35 and NE 36 Street to OTA HDQTS.	City Street	OTHER	City Street	0	1	0.5	0.5	12
	-	I-35 and NE 36 st. to I-35 and 4th st.	I-35	ODOT	35-55-15	7.64	10.18	2.54	0	12
	-	I-35 and 4th st. to IXC Junction Site	City Street	OTHER	City Street	0	1	0.5	0.5	12
b)	**<u>ODOT System</u>**	I-35 and 4th to Oklahoma-Texas State Line						**130.65**	**0**	**12**
	-	I-35 and 4th st. to I-35 and Cleveland County Line	I-35	ODOT	35-55-15	0	9.84	9.84	0	12
	-	I-35 and Oklahoma County Line to I-35 and McClain County Line	I-35	ODOT	35-14-06	0	13.4	13.4	0	12
	-	I-35 and Cleveland County Line to I-35 and Garvin County Line	I-35	ODOT	35-44-05	0	25.73	25.73	0	12
	-	I-35 and McClain Count Line to I-35 and Murray County Line	I-35	ODOT	35-25-46	0	25.89	25.89	0	12
	-	I-35 and Garvin Count Line to I-35 and Carter County Line	I-35	ODOT	35-50-32	0	9.89	9.89	0	12
	-	I-35 and Murray Count Line to	I-35	ODOT	35-10-36	0	21.43	21.43	0	12

Contract Description		**Location Description**	**Highway**	**Who's it is**	**Control Section**	**Begin Mileage**	**Ending Mileage**	**ODOT Total Mileage**	**OTA Total Mileage**	**# of Strands**
		I-35 and Love County Line								
	-	I-35 and Carter Count Line to I-35 and Texas State Line	I-35	ODOT	35-43-17	0	24.47	24.47	0	12
c)	**OTA OSF GRANT**	From the fiber optics telecommunications equipment room, Vinita, Oklahoma Turnpike maintenance building to a location ending at the OTA fiber access hand hole, Miami, Oklahoma Turnpike exit.								
	-							**0.75**	**25.29**	**2**
	-	Fiber optics Telecommunications equipment room to SH-69 and I-44	City Street	OTHER	City Street	0	1.5	0.75	0.75	2
	-	From SH-69 and I-44 to Ottawa County Line	Will Rogers TPK	OTA	44-18-01	11.48	20.4	0	8.92	2
	-	Ottawa Count Line and I-44 to SH10 and I-44	Will Rogers TPK	OTA	44-58-01	**0**	**15.62**	0	15.62	2
	-									
	-	**TOTAL**						**173.08**	**184.37**	
		TOTAL TOGETHER						**357.45**		

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
a)	**OTA-Cimarron Fibers**	From the Oklahoma State University, Stillwater, Oklahoma to the University Center at Tulsa						**30.5**	**48.7**	**4**
		Campus to US-177	City Street	OTHER	City Street	0	3.5	1.75	1.75	4
		City Street & US-177 Jct. To OTA Ent.	US-177	ODOT	177-60-31	5.01	6.01	1	0	4
		OTA Ent. To Jct. US-412	Cimarron OTA	OTA	TR-60-35	0	7.8	0	7.8	4
		TR & US-412 Jct. To Pawnee Co. Line	US-412 OTA	OTA	412-60-34	2	9.01	0	7.01	4
		Pawnee & Payne Co. Line To E. End of OTA	US-412 OTA	OTA	412-59-31	0	24.01	0	24.01	4
		Cimarron OTA End To Tulsa Co. Line	US-64	ODOT	064-59-06	14.3	22.15	7.85	0	4
		Tulsa Co. Line To Jct. I-244	US-64	ODOT	064-72-86	0	15.35	15.35	0	4
		I-244 & US-64 Jct. To Elgin Ave.	I-244	ODOT	244-72-09	5.69	6.57	0.88	0	4
		Elgin Exit To OSU Tele	City Street	OTHER	City Street	0	0.5	0.25	0.25	4
		TR & US-412 Jct. To US-412 & US-64 Jct.	US-412 OTA	OTA	412-52-39	6.84	2.9	0	3.94	4
		US-412 & US-64 Jct. To Morrison	US-64	ODOT	064-52-04	16.66	14.95	1.71	0	4
		Morrison To US-412 & US-64 Jct.	US-64	ODOT	064-52-04	14.95	16.66	1.71	0	4
		US-412 & US-64 Jct. To TR & US-412 Jct.	US-412 OTA	OTA	412-52-39	2.9	6.84	0	3.94	4

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
b)	**OSF-Cimarron Fibers**	From the Oklahoma State University, Stillwater, Oklahoma to the University Center at Tulsa						**30.5**	**48.7**	**4**
		Campus to US-177	City Street	OTHER	City Street	0	3.5	1.75	1.75	4
		City Street & US-177 Jct. To OTA Ent.	US-177	ODOT	177-60-31	5.01	6.01	1	0	4
		OTA Ent. To Jct. US-412	Cimarron OTA	OTA	TR-60-35	0	7.8	0	7.8	4
		TR & US-412 Jct. To Pawnee Co. Line	US-412 OTA	OTA	412-60-34	2	9.01	0	7.01	4
		Pawnee & Payne Co. Line To E. End of OTA	US-412 OTA	OTA	412-59-31	0	24.01	0	24.01	4
		Cimarron OTA End To Tulsa Co. Line	US-64	ODOT	064-59-06	14.3	22.15	7.85	0	4
		Tulsa Co. Line To Jct. I-244	US-64	ODOT	064-72-86	0	15.35	15.35	0	4
		I-244 & US-64 Jct. To Elgin Ave.	I-244	ODOT	244-72-09	5.69	6.57	0.88	0	4
		Elgin Exit To OSU Tele	City Street	OTHER	City Street	0	0.5	0.25	0.25	4
		TR & US-412 Jct. To US-412 & US-64 Jct.	US-412 OTA	OTA	412-52-39	6.84	2.9	0	3.94	4
		US-412 & US-64 Jct. To Morrison	US-64	ODOT	064-52-04	16.66	14.95	1.71	0	4
		Morrison To US-412 & US-64 Jct.	US-64	ODOT	064-52-04	14.95	16.66	1.71	0	4
		US-412 & US-64 Jct. To TR & US-412 Jct.	US-412 OTA	OTA	412-52-39	2.9	6.84	0	3.94	4

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
c)	**Morrison Fibers**	Looped from OTA-Cimarron Fibers to the Cimarron Turnpike Maintenance Facility, Morrison, Oklahoma And returning to the OTA-Cimarron Fibers.						**1.71**	**6**	**8**
		I-412 and Payne County Line to I-412 and Noble County Line	Cimarron TPK	OTA	412-59-30	0	2.06	0	2.06	8
		Payne County Line and Cimarron TPK to Cimarron TPK and I-64	Cimarron TPK	OTA	412-52-39	0	3.94	0	3.94	8
		I-64 and Cimarron TPK to Cimarron Turnpike Maintenance Facility, Morrison, Oklahoma	I-64	ODOT	64-52-04	14.95	16.66	1.71	0	8
d)	**Morrison Extra Fibers**	From the Oklahoma State University, Stillwater, Oklahoma to the Cimarron Turnpike Maintenance Facility, Morrison, Oklahoma.								
								8.32	**6**	**2**
		I-177 and SH-51 to I-177 and Cimarron Turnpike	I-177	ODOT	177-60-31	0	6.61	6.61	0	2
		I-412 and Payne County Line to I-412 and Noble County Line	Cimarron TPK	OTA	412-59-30	0	2.06	0	2.06	2

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Payne County Line and Cimarron TPK to Cimarron TPK and I-64	Cimarron TPK	OTA	412-52-39	0	3.94	0	3.94	2
e)	**OTA-Muskogee Fibers**	I-64 and Cimarron TPK to Cimarron Turnpike Maintenance Facility, Morrison, Oklahoma	I-64	ODOT	64-52-04	14.95	16.66	1.71	0	2
		From the University Center at Tulsa, Oklahoma to Conners State College, Muskogee, Oklahoma (located at the Highway 62 exit in Muskogee) via the Muskogee Turnpike.								
								17.52	**33.98**	**4**
		OSU Tele To Elgin int. at I-244	City Street	OTHER	City Street	0	0.5	0.25	0.25	4
		Elgin & I-244 To I-244 & I-444 Jct.	I-244	ODOT	244-72-09	6.57	6.85	0.28	0	4
		I-444 & I-244 Jct. To SH-51 & I-444 Jct.	I-444	ODOT	444-72-92	1.19	0	1.19	0	4
		SH-51 & I-444 Jct. To Wagoner Co. Line	SH-51	ODOT	051-72-80	0	14.44	14.44	0	4
		Wagoner / Tulsa Co. Line To Muskogee TPK. Ent.	SH-51	ODOT	051-73-12	0	0.36	0.36	0	4
		Muskogee TPK Ent. To TPK. & US-69 Jct.	Muskogee TPK.	OTA	TR-73-29	0	26.38	0	26.38	4
		Muskogee TPK & US-69 Jct. TO Muskogee Co. Line	Muskogee TPK.	OTA	TR-73-33	4.99	0	0	4.99	4

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Muskogee Co. Line To .96 mile N. of US-62	Muskogee TPK.	OTA	TR-51-62	2.16	0	0	2.16	4
		.96 mile N. of US-62 To .10 mile N. of US-62	SH-165	ODOT	165-51-60	0.96	0.16	0.8	0	4
		.10 mile N. of US-62 To Connors State College	City Street	OTHER	City Street	0	0.4	0.2	0.2	4
f)	**<u>OSF-Muskogee Fibers</u>**	From the University Center at Tulsa, Oklahoma to Conners State College, Muskogee, Oklahoma (located at the Highway 62 exit in Muskogee) VIA I-244 in Tulsa, Oklahoma and via the Muskogee Turnpike.	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
								23.83	**33.98**	**4**
		University Center at Tulsa, Oklahoma to I-444	I-244	ODOT	244-72-09	0.25	3.48	3.23	0	4
		I-444 TO SH-51	I-444	ODOT	444-72-92	0	1.19	1.19	0	4
		INTERSECTION AT I-444 AND SH 51 TO THE MUSKOGEE TURNPIKE	SH-51	ODOT	51-72-80	0	14.44	14.44	0	4
		MUSKOGEE TURNPIKE AND SH 51 TO THE INTERSECTION AT MUSKOGEE TURNPIKE AND SH 69	Muskogee TPK.	OTA	TR-73-29	0	26.83	0	26.83	4
		MUSKOGEE TURNPIKE AND SH69 TO THE COUNTY LINE	Muskogee TPK.	OTA	TR-73-33	0	4.99	0	4.99	4

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		MUSKOGEE COUNTY LINE TO SH 165	Muskogee TPK.	OTA	TR-51-62	0	2.16	0	2.16	4
		SH-165 TO SH 62	SH165	ODOT	165-51-60	0	0.96	0.96	0	4
		INTERSECTION AT SH-165 AND SH 62 TO SH62 AND SH 16	SH 62	ODOT	62-51-06	0	1.49	1.49	0	4
		INTERSECTION AT SH 62 AND SH 16 TO SH 62 AND SH 62B	SH 62	ODOT	62-51-47	0	1.01	1.01	0	4
		INTERSECTION AT SH 62 AND SH 62B TO COURT STREET	SH 62	ODOT	62B-51-51	0	1.51	1.51	0	4
g)	**Creek Fibers Loop**	From the OTA-Muskogee Fibers located along Broken Arrow Expressway, Tulsa, Oklahoma to U.S. highway 75, Tulsa, Oklahoma and returning to the OTA-Muskogee Fibers.								
								18.2	**14.84**	**8**
		From the intersection of Broken Arrow Exp. and HWY 169 to the Creek Turnpike.	US 169	ODOT	169-72-83	0	9.1	9.1	0	8
		US 169 and Creek Turnpike to US 75	Creek TPK.	OTA	TR-72-98	0	7.42	0	7.42	8
		US 75 to US 169 and Creek Turnpike	Creek TPK.	OTA	TR-72-98	0	7.42	0	7.42	8
		From the Creek Turnpike to the intersection of	US 169	ODOT	169-72-83	0	9.1	9.1	0	8

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Broken Arrow Exp. and HWY 169								
h)	**Norman Transmission Capacity**	From the regents for Higher Education Headquarters Building Oklahoma City, Oklahoma to the Telecommunications Center in the University of Oklahoma, Norman, Oklahoma.								
								19.15	**1.25**	**4**
		13 th and Phillips to I-235	City Street	OTHER	City Street	0	1	0.5	0.5	4
		13th and I-235 to I-235 and I-35	I-235	ODOT	235-55-42	0	1.84	1.84	0	4
		I-35 and I-235 to County Line	I-35	ODOT	35-55-15	0	6.01	6.01	0	4
		I-35 and the County Line to I-35 and Robinson St. Norman OK.	I-35	ODOT	35-14-06	0	10.05	10.05	0	4
		I-35 and Robinson to the Telecommunications Center in the University of Oklahoma, Norman, Oklahoma.	City Street	OTHER	City Street	0	1.5	0.75	0.75	4
l)	**Highway 75 Fibers**	From U.S. Highway 75, and Creek Turnpike to Highway 412 and U.S. Highway 75,Tulsa Oklahoma						**11.78**	**0**	**4**

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		US 75 and Creek Turnpike to US 75 and I-244	US 75	ODOT	75-72-18	0	7.34	7.34	0	4
		US 75 and I-244 to I-244 and US 412	I-244	ODOT	244-72-09	2.31	6.75	4.44	0	4
J	**<u>MBO-Muskogee I-40 Extension</u>**									
	<u>OTA-Muskogee-South Fibers</u>	From Muskogee, Oklahoma to the Muskogee TPK/Interstate 40 Intersection via the Muskogee TPK						**0**	**19.57**	**12**
	-	From Muskogee, Oklahoma to the Muskogee TPK/Interstate 40 Intersection via the Muskogee TPK	Muskogee TPK	OTA	TR-51-63	0	19.57	0	19.57	12
k)	**<u>ODOT-I40 Fibers</u>**	From Muskogee Turnpike/Interstate 40 intersection east to the Arkansas State Line via Interstate 40.						**44.2**	**0**	**12**
		I-40 and Muskogee Turnpike to Sequoyah County Line	I-40	ODOT	40-51-15	10.2	13.76	3.56	0	12
		Muskogee County Line and I-40 to I-40 and US-59	I-40	ODOT	40-68-22	0	17.62	17.62	0	12
		I-40 and US-59 to the Arkansas State Line	I-40	ODOT	40-68-23	0	23.02	23.02	0	12
l)	**<u>ODOT-Tulsa-Division Fibers Looped</u>**	From OTA-Muskogee Fibers located at the nearest handhold to the								

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		ODOT Division 8 Headquarters, 4002 North Mingo Valley Expressway, Tulsa Oklahoma, and returning to the OTA-Muskogee Fibers.								
								7.76	**0.25**	**16**
		SH-51 & US-169 To I-44 & US-169	US-169	ODOT	169-72-83	6.25	9.1	2.85	0	16
		I-44 & US-169 To 36th St. N.	US-169	ODOT	169-72-81	0	4.66	4.66	0	16
		36th St. N. To Div. 8 head.	City Street	OTHER	City Street	0	0.5	0.25	0.25	16
m)	**<u>ODOT-Muskogee-Division Fibers Looped</u>**	From OTA-Muskogee Fibers located at the nearest hand hole to the ODOT Division 1 Headquarters, 2800 South 32nd Street, Muskogee, Oklahoma, and returning to the OTA-Muskogee Fibers.								
								0.5	**0.5**	**8**
		From 2800 S. 32nd st. to OTA-Muskogee Fibers	City Street	OTHER	City Street	0	1	0.5	0.5	8
n)	**<u>ODOT-Sallisaw-Residency Fibers</u>**	From ODOT-I-40 Fibers to the ODOT Residency Office, Sallisaw, Oklahoma, and returning to the ODOT-I-40 Fibers.								

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
								3.56	**0**	**8**
		I-40 and Muskogee TPK to I-40 and Sequoyah County Line	I-40	ODOT	40-51-15	10.2	13.76	3.56	0	8
		TOTAL						**217.53**	**213.77**	
		TOTAL TOGETHER						**431.3**		

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
-	**ARTICLE 3 SECTION 3.1**	-	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
a)	**OTA-OKC CHICKASHA FIBERS**	13th and Phillips, down I-235 to I-40, east to I-44 & I-40 Interchange, south on I-44 to OTA - H.E. Bailey Turnpike Entrance.						**19.13**	**0.5**	**12**
		13th & Phillip To I-235	City Street	OTHER	City Street	0	1	0.5	0.5	12
		I-235 & 4th St. To I-235 & I-40	I-235	ODOT	235-55-42	0.84	0	0.84	0	12
		I-40 & I-235 To I-40 & I-44	I-40	ODOT	040-55-69	10.45	5.34	5.11	0	12
		I-44 & I-40 To I-44 & I-240	I-44	ODOT	044-55-05	4.88	0	4.88	0	12
		I-44 & I-240 To Cleveland Co. Line	I-44	ODOT	044-55-70	1.35	0	1.35	0	12
		Cleveland Co. Line To McClain Co. Line	I-44	ODOT	044-14-34	5.01	0	5.01	0	12
		McClain Co. Line To OTA Ent.	I-44	ODOT	044-44-03	1.44	0	1.44	0	12
b)	**OTA-CHICKASHA-LAWTON FIBERS**	OTA-CHICKASHA-LAWTON (CHICKASHA GATE TO LAWTON)						**0**	**61.04**	**12**
		OTA Ent. To Grady Co. Line	I-44	OTA	044-44-54	5.14	0	0	5.14	12
		Grady Co. Line To Caddo Co. Line	I-44	OTA	044-26-42	34.62	0	0	34.62	12
	?? Part of Lawton and Chickasha is ODOT R/W	Caddo Co. Line To Comanche Co. Line	I-44	OTA	044-08-53	4.69	0	0	4.69	12
		Comanche Co. Line To	I-44	OTA	044-16-	16.59	0	0	16.59	12

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Jct. I-44 & US-62			24					
c)	**OTA-LAWTON-TEXAS FIBERS**	OTA-LAWTON-TEXAS (LAWTON TO TEXAS STATE LINE)						**21.54**	**24.38**	**12**
		Jct. I-44 & US-62 To OTA Ent.	I-44	ODOT	044-16-49	15.89	0	15.89	0	12
		OTA Ent. To Cotton Co. Line	I-44	OTA	044-16-50	4.04	0	0	4.04	12
		Cotton Co. Line To Jct. US-70	I-44	OTA	044-17-37	20.34	0	0	20.34	12
		Jct. US-70 To Texas State Line	I-44	ODOT	044-17-06	5.65	0	5.65	0	12
d)	**OTA-JKT Fibers**	OTA-JKT (KILPATRICK TURNPIKE FROM STATE HWY 74 JCT TO I-35 JCT)						**0**	**8.99**	**16**
		SH-74 and John Kilpatrick Turnpike to I-35 and John Kilpatrick Turnpike	Kilpatrick OTA	OTA	TR-55-86	8.99	0	0	8.99	16
e)	**OTA-NEW-JKT Fibers**	New John Kilpatrick Turnpike from SH-74 and JKT west and south to SW 15th Street						**0**	**15.98**	**24**
		New JKT from SH-74 and JKT west to the Canadian County line and County line rd	Kilpatrick OTA	OTA	TR-55-86P	4.98	0	0	4.98	24
		New JKT from JKT and County Line Rd (Canadain County Line) going south to JKT and SW 15th Street	Kilpatrick OTA	OTA	TR-55-87P	11	0	0	11	24
f)	**ODOT-ETN-NE4 FIBERS**	EducationTelevision Network Building 13th and Philips to NE 4th						**0.53**	**0.53**	**24**

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		and I-235								
	-	EducationTelevision Network Building 13th and Philips to NE 4th and I-236	City Street	OTHER	City Street	0	1.05	0.53	0.53	24
g)	**ODOT-NE4-RenoHub Fibers**	NE 4th St. and I-235 to ODOT Reno Hub Site along I-235						**1.25**	**0**	**120**
	-	NE 4th St. and I-235 to ODOT Reno Hub Site along I-235	I-235	ODOT	ODOT	0	1.25	1.25	0	120
h)	**ODOT-RenoHub-I40 Fibers**	.3 miles West of I-40 and I-235 to I-40 and I-44 along I-40						**4.88**	**0**	**48**
	-	.3 miles West of I-40 and I-235 to I-40 and I-44 along I-40	I-40	ODOT	044-55-69	5.34	10.22	4.88	0	48
	-									
i)	**ODOT-I40-MacArthur Fibers**	ODOT I-40 MAC (I-40 FROM MACARTHUR TO I-44 JCT						**4.88**	**0**	**24**
	-	ODOT I-40 MAC (I-40 FROM MACARTHUR TO I-44 JCT	I-40	ODOT	044-55-69	5.34	10.22	4.88	0	24
j)	**ODOT-MACARTHUR-Sara Fibers**	ODOT SARA-MAC (I-40 FROM SARA RD TO MACARTHUR						**4.93**	**0**	**12**
	-	Sara Rd. To Okla. Co. Line	I-40	ODOT	040-09-05	35.37	37.35	1.98	0	12
	-	Okla. Co. Line To MACARTHUR	I-40	ODOT	040-55-69	0	2.95	2.95	0	12
k)	**ODOT-I40-I240 Fibers**	I-44 FROM I-40 JCT TO I-240 JCT						**4.88**	**0**	**24**
	-	I-44 FROM I-40 JCT TO	I-40	ODOT	044-55-	5.34	10.22	4.88	0	24

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		I-240 JCT			69					
l)	**ODOT-I240-SW89 Fibers**	I-44 and I-240 TO SW 89TH ST and I-44						**1.35**	**0**	**12**
	-	I-44 and I-240 TO SW 89TH ST and I-44	I-44	ODOT	044-55-70	1.35	0	1.35	0	12
m)	**ODOT-I40-SH66 Fibers**	I-40 and I-44 to SH-66 and I-44 along I-44						**3.45**	**0**	**24**
	-	I-40 and I-44 to SH-66 and I-44 along I-44	I-44	ODOT	044-55-07	0	3.45	3.45	0	24
n)	**ODOT-SH74 Fibers**	SH-74 and SH-66 to SH-74 and Kilpatrick Turnpike along SH-74						**7.72**	**0**	**12**
	-	SH-74 and SH-66 to SH-74 and Kilpatrick Turnpike along SH-74	SH-74	ODOT	074-55-63	0	7.72	7.72	0	12
o)	**ODOT-Stillwater Fibers**	I-35 FROM KIL OTA JCT TO SH-51 JCT; THEN SH-51 TO OSU						**51.68**	**0.25**	**12**
	-	OTA Jct. To Logan Co. Line	I-35	ODOT	035-55-09	4.8	13.37	8.57	0	12
	-	Okla. & Logan Co. Line To Payne Co. Line	I-35	ODOT	035-42-30	0	18.93	18.93	0	12
	-	Logan & Payne Co. Line To SH-51 Jct.	I-35	ODOT	035-60-29	0	8.97	8.97	0	12
	-	SH-51 & I-35 Jct.To Western Ave.	SH-51	ODOT	051-60-18	0.49	15.45	14.96	0	12
	-	SH-51 & Western Ave. To OSU	City Street	OTHER	Western Ave.	0	0.5	0.25	0.25	12
		TOTAL						**126.22**	**111.67**	
		TOTAL TOGETHER						**237.88**		

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
			D	E	F	G	H	I	J	K
a)	**I-40 FIBERS**	From the Arkansas State Line and I-40 going west on I-40 to the intersection of the Muskogee Turnpike and I- 40.						**44.5**	**0**	**16**
		I-40 and the Muskogee Turnpike Jct. to Sequoyah County Line	I-40	ODOT	040-51-15	10.2	14.06	3.86	0	16
		Muskogee & Sequoyah Co. Line and I-40 to I-40 & US-59 Jct.	I-40	ODOT	040-68-22	0	17.62	17.62	0	16
		I-40 and US-59 to I-40 and Arkansas State Line	I-40	ODOT	040-68-23	0	23.02	23.02	0	16
b)	**Muskogee Fibers**	From the OSU Telecommunications Facility in Tulsa to the I-40 and Muskogee Turnpike JCT						**20.29**	**53.35**	**16**
		OSU Telecommunications Facility to Elgin St. and I-244	City Street	OTHER	City Street	0	0.5	0.25	0.25	16
		Elgin St. and I-244 to I-244 and I-444 Jct.	I-244	ODOT	244-72-09	6.57	6.85	0.28	0	16
		I-444 & I-244 Jct. to SH-51 & I-444 Jct.	I-444	ODOT	444-72-92	1.19	0	1.19	0	16
		SH-51 & I-444 Jct. to Wagoner and Tulsa Co. Line	SH-51	ODOT	051-72-80	0	14.44	14.44	0	16
		Wagoner and Tulsa Co. Line to Muskogee Turnpike Entrance.	SH-51	ODOT	051-73-12	0	0.36	0.36	0	16

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Muskogee Turnpike Entrance to Muskogee Turnpike and US-69 Jct.	Muskogee OTA	OTA	TR-73-29	0	26.38	0	26.38	16
		Muskogee Turnpike and US-69 Jct. to Wagoner and Muskogee Co. Line	Muskogee OTA	OTA	TR-73-33	4.99	0	0	4.99	16
		Muskogee Co. Line and Muskogee Turnpike to 0.96 mile N. of Muskogee Turnpike and US-62	Muskogee OTA	OTA	TR-51-61	2.16	0	0	2.16	16
		0.96 mile North of US-62 and Muskogee Turnpike to Jct. US-62 and Muskogee Turnpike	SH-165	ODOT	165-51-60	0.96	0	0.96	0	16
		Jct. US-62 and SH-165 to Jct. SH-165 and Muskogee Turnpike	SH-165	ODOT	165-51-64	2.81	0	2.81	0	16
		Jct. SH-165 and Muskogee Turnpike to Jct. Muskogee Turnpike and I-40	Muskogee OTA	OTA	TR-51-63	19.57	0	0	19.57	16
c)	**<u>BA-Expwy Fibers</u>**	From the intersection of Broken Arrow Expressway and Highway 169 to the intersection of Highway 75 and Denver Ave.						**8.39**	**0**	**36**
		SH-51 & US-169 Jct. to SH-51 & I-444 Jct.	SH-51	ODOT	051-72-80	7.86	0	7.86	0	36
		I-444 & SH-51 Jct. to Denver Ave. and US-75	I-444	ODOT	444-72-94	1.32	0.79	0.53	0	36
d)	**<u>H75-I244 Fibers</u>**	US-75 and the Broken Arrow Expressway to the intersection of						**2.08**	**0**	**54**

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Interstate 244 and Highway 64								
	-	I-444 and the Broken Arrow Expressway Jct. to I-444 and I-244 Jct.	I-444	ODOT	444-72-94	1.32	0	1.32	0	54
	-	I-244 & I-444 Jct. to I-244 & US-64 Jct.	I-244	ODOT	244-72-09	4.99	5.75	0.76	0	54
e)	**H412 Fibers**	From the Oklahoma State University telecommunications facility in Tulsa to the east end of the Cimarron Turnpike at mile marker 59.31						**24.33**	**0.25**	**24**
	-	Cimarron Turnpike east end at mile marker 59.31 to the Tulsa Co. Line	US-64	ODOT	064-59-06	14.3	22.15	7.85	0	24
	-	Tulsa County Line and the Cimarron Turnpike to the Jct. I-244 and the Cimarron Turnpike	US-64	ODOT	064-72-86	0	15.35	15.35	0	24
	-	I-244 and US-64 Jct. to Elgin Ave. and I-244	I-244	ODOT	244-72-09	5.69	6.57	0.88	0	24
	-	Elgin Exit to OSU Tele	City Street	OTHER	City Street	0	0.5	0.25	0.25	24
f)	**Cimarron Fibers**	From the east end of the Cimarron Turnpike at mile marker 59.31 to the Oklahoma State University telecommunications facility in Stillwater						**7.59**	**40.57**	**24**
		Campus to US-177	City Street	OTHER	City Street	0	3.5	1.75	1.75	24

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		Hall Of Fame Ave. and US-177 Jct. to Cimarron Turnpike Entrance and US-177	US-177	ODOT	177-60-31	0.77	6.61	5.84	0	24
		Cimarron Turnpike Entrance and US-177 to US-412 and the Cimarron Turnpike	Cimarron Turnpike	OTA	TR-60-35	0	7.8	0	7.8	24
		Cimarron Turnpike and US-412 Jct. to the Pawnee Co. Line	US-412	OTA	412-60-34	2	9.01	0	7.01	24
		Pawnee and Payne County Line and US-412 to US-412 and US-64	US-412	OTA	412-59-31	0	24.01	0	24.01	24
		TOTAL						**107.18**	**94.17**	
		TOTAL TOGETHER						**201.35**		

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
3.1	**ODOT Fibers**	Oklahoma-Kansas Border and I-35 to I-40 and E.K. Gaylord Avenue to the Reno Regenerator Site.								
3.1.1	**ODOT-SH300 Fibers**	Oklahoma-Kansas border going south on 44th Street to State Line Rd 300, then west on State Line Rd 300 to the intersection of State Road 300 and Interstate 35 ("ODOT-SH300")						**1.5**	**1.5**	**24**
	-	Oklahoma-Kansas border going south on 44th Street to State Line Rd 300, then west on State Line Rd 300 to the intersection of State Road 300 and Interstate 35 ("ODOT-SH300")	City Street	OTHER	City Street	0	3	1.5	1.5	24
3.1.2	**ODOT-I-35 FIBERS**	Along ODOT-I-35 in its entirety from the Oklahoma-Kansas border to I-35 and John Kilpatrick Turnpike						**102.61**	**0**	**16**
		I-35 and Oklahoma-Kansas border to Tonkawa Repeater Hut	I-35	ODOT	35-36-25	28.05	0	28.05	0	16
		I-35 and Noble County Line to Payne County Line	I-35	ODOT	35-52-33	30.15	0	30.15	0	16
		I-35 and Payne County Line to I-35 and Logan County Line	I-35	ODOT	35-60-29	12.11	0	12.11	0	16

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
		I-35 and Logan County Line to I-35 and Oklahoma County Line	I-35	ODOT	35-42-30	18.93	0	18.93	0	16
		I-35 and Oklahoma County Line to SH66 and I-35	I-35	ODOT	35-55-09	13.37	7.94	5.43	0	16
		SH66 and I-35 to I-35 and John Kilpatrick Turnpike	I-35	ODOT	35-55-09	7.94	0	7.94	0	16
3.1.3	**ODOT-Edmond Fibers**	From the intersection of I-35 and 2nd Street going south on I-35 to the intersection of I-35 and the John Kilpatrick Turnpike						**7.94**	**0**	**40**
		I-35 and 2nd St. to I-35 and John Kilpatrick Turnpike	I-35	ODOT	35-55-09	7.94	0	7.94	0	40
3.1.4	**OTA-KILPATRICK FIBERS**	Kilpatrick Turnpike and I-35 to the intersection of the Hefner Parkway and the Kilpatrick Turnpike						**0**	**8.99**	**40**
		Kilpatrick Turnpike and I-35 to the intersection of the Hefner Parkway and the Kilpatrick Turnpike	Kilpatrick Turnpike	OTA	TR-55-86	0	8.99	0	8.99	40
3.1.5	**ODOT-SH74 Fibers**	Hefner Parkway and the Kilpatrick Turnpike to I-44 and Hefner Parkway						**7.43**	**0**	**40**
		Hefner Parkway and the Kilpatrick Turnpike to I-44 and Hefner Parkway	SH-74	ODOT	74-55-63	7.43	0	7.43	0	40

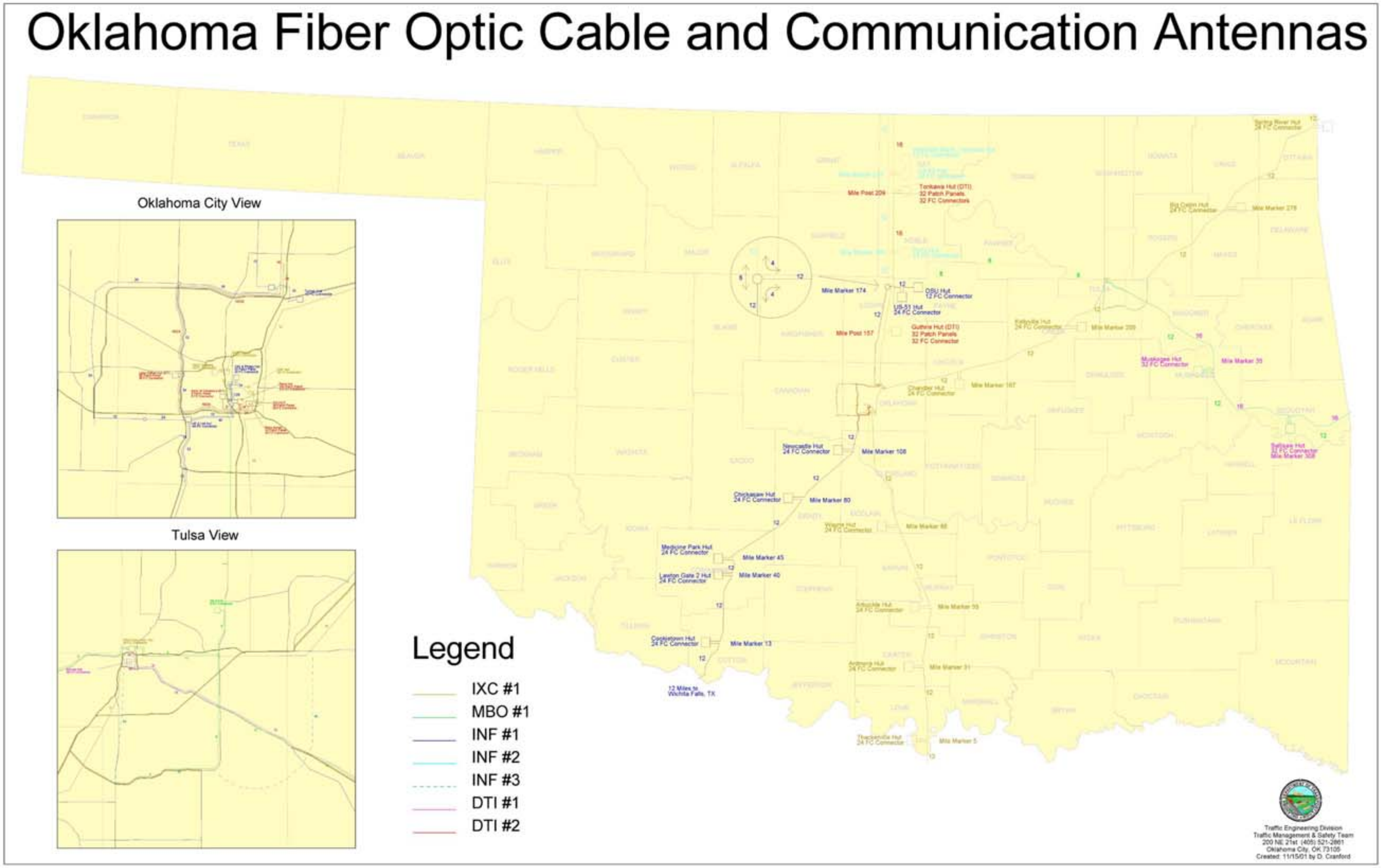
Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
3.1.6	**ODOT-144 Fibers**	I-44 and Hefner Parkway to I-44 and I-40						**3.73**	**0**	**40**
	-	I-44 and Hefner Parkway to I-44 and I-40	I-44	ODOT	44-55-07	3.73	0	3.73	0	40
3.1.7	**Odot-I40 Fibers**	Along ODOT-I40 in its entirety to I-40, I-235, and Reno Ave. Regeneration Hut						**13.2**	**1.75**	**40**
	-	I-40 and I-44 to I-40, I-235, and Reno Ave. Regeneration Hut	I-40	ODOT	40-55-69	0	11.45	11.45	0	40
	-	I-40, I-235, and Reno Ave. Regeneration Hut to 201 Robert S. Kerr Bank of Oklahoma Plaza	City Street	OTHER	City Street	0	1.75	0.88	0.88	8
	-	I-40, I-235, and Reno Ave. Regeneration Building east to ODOT Reno Annex Building on Reno Ave.	City Street	OTHER	City Street	0	0.25	0.13	0.13	36
	-	I-40, I-235, and Reno Ave. Regeneration Building east to IXC Regeneration Building near Martin Luther King and Reno Ave.	City Street	OTHER	City Street	0	1.5	0.75	0.75	24
		TOTAL						**136.41**	**12.24**	
		TOTAL TOGETHER						**148.65**		

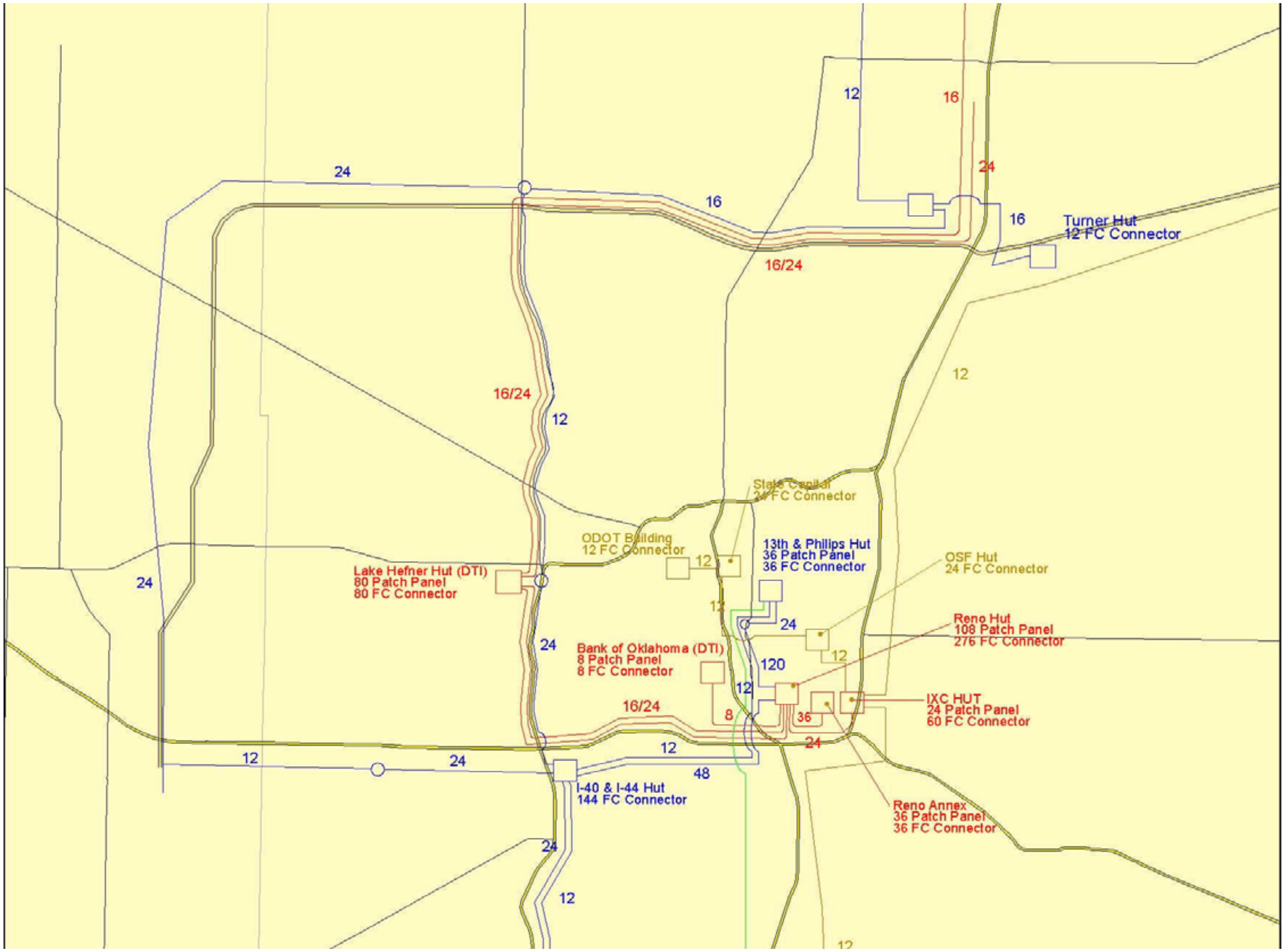
Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	ODOT Total Mileage	OTA Total Mileage	# of Strands
			D	E	F	G	H	I	J	K
INF AGREEMENT #2 ARTICLE 3								**62.97**	**0**	**12**
3.1	**ODOT I-35 FIBERS**	I-35 and the Kansas Oklahoma State Line to I-35 and Noble, Kay County Line	I-35	ODOT	35-36-25	28.05	0	28.05	0	12
		I-35 and Noble Kay County Line to I-35 and Payne County Line	I-35	ODOT	35-52-33	30.15	0	30.15	0	12
		I-35 and Payne County Line to I-35 and SH-51	I-35	ODOT	35-60-29	12.11	8.87	3.24	0	12
3.2	**ODOT Perry Fibers**	SH-77 & I-35 TO ODOT DIVISION OFFICE, PERRY	SH-77	ODOT	77-52-06	9.95	11.48	1.53	0	12
		TOTAL						**62.97**	**0**	
		TOTAL TOGETHER						**62.97**		

Contract Description		Location Description	Highway	Who's it is	Control Section	Begin Mileage	Ending Mileage	EQUIPMENT IN BUILDING	EQUIPMENT IN BUILDING $ VALUE	# of Strands ENTERING BUILDING
		NEWPORT AND NW 38th ST.	I-44	DTI	44-55-07					
		I-35 AND HWY 60	I-35	INF	35-36-25					
		I-35 AND MEMORAL RD.	I-35	INF	35-55-09					
		I-40 AND I-44	I40	ODOT	40-55-69					
		I-35 AND COLLEGE STREET	I-35	DTI	35-42-30					
		I-35 AND COUNTY ROAD E0270	I-35	DTI	35-55-15					
		RENO AND I-235	I-235	DTI	35-55-15					

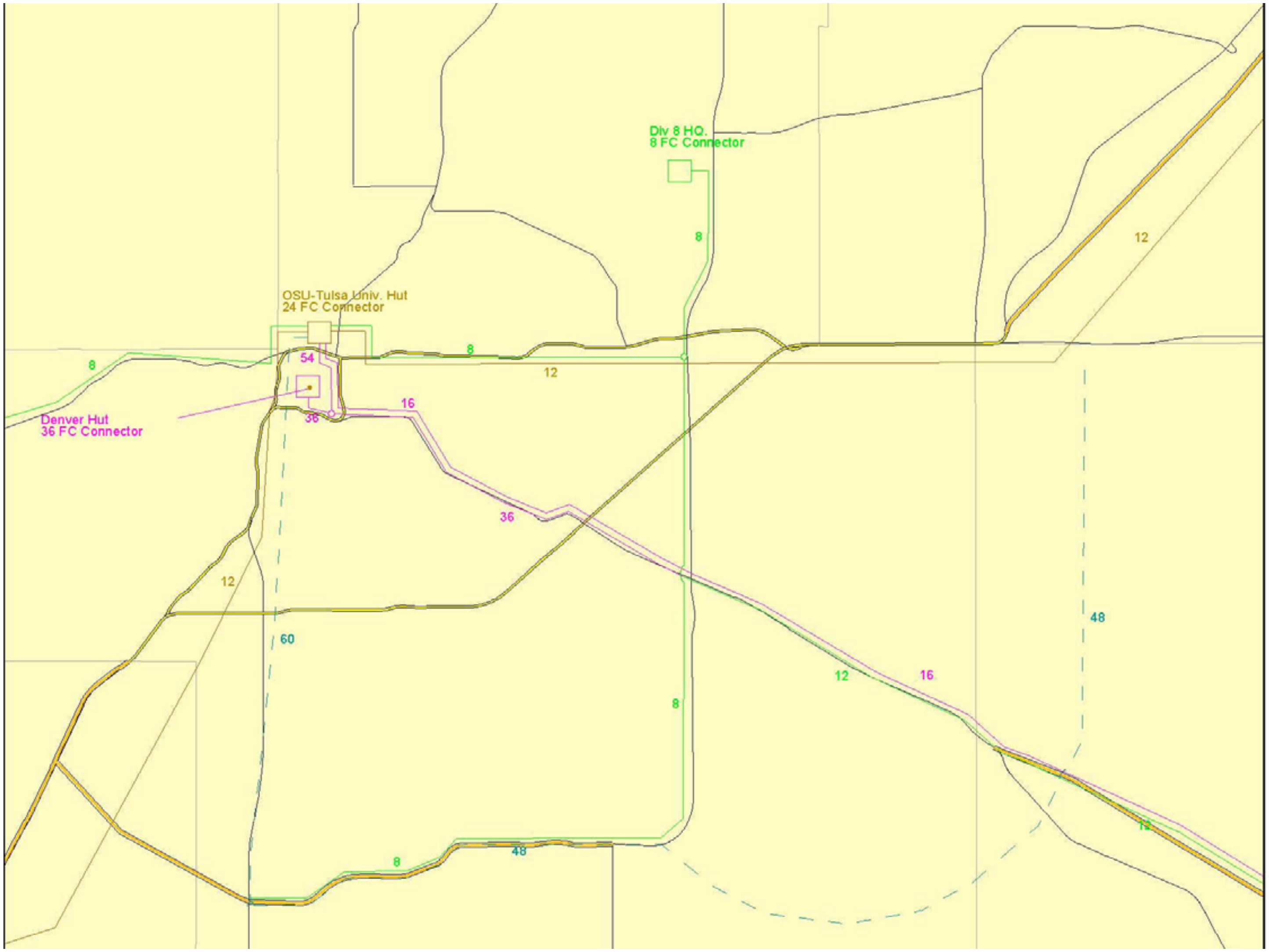
	ODOT Total Mileage	OTA Total Mileage	# Fiber
TOTAL	823.39	616.22	
TOTAL TOGETHER	1439.6		

Appendix C Detail State-Owned Fiber Map





Oklahoma City View


Div 8 HQ.
8 FC Connector
OSU-Tulsa Univ. Hut
24 FC Connector
Denver Hut
36 FC Connector
8
12
54
16
36
60
48

Tulsa View

Appendix D Planned Urban ITS Assets & Bandwidth Calculations

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
Existing Urban ITS Equipment									
Oklahoma City									
I-40 & Meridian			1						
I-40 & Sooner Rd.			1						
I-40 & Choctaw Rd.			1						
I-44 & SW 59th			1						
I-44 & S. of NW 10th			1						
I-35 N. of Wilshire			1						
Moore / Norman									
I-35 & Robinson St. - Norman	1		1		3				
I-35 & 12th St. - Moore	1		7		3				
Proposed Urban ITS Equipment									
Oklahoma City									
I-240 West to East									
I-240									
I-240 & I-44	1	6		0	1	0.02	4	6	
I-240 & Penn. Ave	1	6		0	1	0.02	4	6	
I-240 & Western	1	6		0		0	4	6	
I-240 & Santa Fe	1	6		0	1	0.02	4	6	
I-240 & I-35	1	6		0	1	0.02	4	6	
I-240 & Eastern	1	6	1	0.02	1	0.02	4	6	

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
I-240 & Sooner Rd.	1	6		0	1	0.02	4	6	
I-240 & Douglas Blvd.	1	6		0	1	0.02	4	6	
I-240 just W. of I-40		0		0	1	0.02		0	
	8	48	1	0.02	8	0.16	32	48	96.18
I-40 West to TMC									
I-40 & Meridian	1	6			1	0.02	4	6	
I-40 & May Ave.	1	6	1	0.02	1	0.02	4	6	
I-40 & Penn. Ave.	1	6			1	0.02	4	6	
I-40 & Western	1	6			1	0.02	4	6	
I-40 & Walker	1	6	1	0.02	1	0.02	4	6	
I-40 & Shields	1	6			1	0.02	4	6	
I-40 & Shields (New alignment)	1	6	1	0.02	1	0.02	4	6	
I-40 & I-35 Dallas Junction	1	6			1	0.02	4	6	
	8	48	3	0.06	8	0.16	32	48	96.22
TMC to I-40 East									
I-40 & Eastern	1	6	1	0.02	1	0.02	4	6	
I-40 & I-35 Ft. Smith Junction	1	6				0	4	6	
I-40 & Bryant	1	6			1	0.02	4	6	
I-40 & Sunnylane	1	6				0	4	6	
I-40 & Tinker AFB Approaches	4	24				0	16	24	
I-40 & Sooner Rd.	1	6	1	0.02	1	0.02	4	6	
I-40 & Air Depot	1	6				0	4	6	
I-40 & Douglas Blvd.	1	6			1	0.02	4	6	
I-40 & Post Rd.		0	1	0.02		0		0	
I-40 & Choctaw Rd.	1	6			1	0.02	4	6	

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
	12	72	3	0.06	5	0.1	48	72	144.16
I-44 Between I-240 & I-40									
I-44 & Airport Rd.	1	6					4	6	
Airport Rd. & Meridian	1	6					4	6	
I-44 & SW 44th	1	6			1	0.02	4	6	
I-44 & SW 59th	1	6			1	0.02	4	6	
I-44 & I-40	1	6					4	6	
	5	30	0	0	2	0.04	20	30	60.04
I-44 Between I-40 & HW66									
I-44 & Reno	1	6					4	6	
I-44 & S. of NW 10th	1	6			1	0.02	4	6	
I-44 & S. of NW 23rd	1	6	1	0.02	1	0.02	4	6	
I-44 & NW 23rd	1	6					4	6	
I-44 & NW 36th	1	6					4	6	
	5	30	1	0.02	2	0.04	20	30	60.06
I-44 Between HW66 & I-235									
I-44 & HW66	1	6			1	0.02	4	6	
I-44 & May Ave.	1	6			1	0.02	4	6	
I-44 & Penn. Ave.	1	6					4	6	
I-44 & NW Expressway	1	6			1	0.02	4	6	
	4	24	0	0	3	0.06	16	24	48.06
I-44 Between I-235 & I-35									
I-44 & Kelley	1	6			1	0.02	4	6	
I-44 & M. L. King, Jr.	1	6					4	6	

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
I-44 & I-35	1	6			1	0.02	4	6	
	3	18	0	0	5	0.1	12	18	36.1
Hefner Parkway									
Hefner & NW 50th	1	6			1	0.02	4	6	
Hefner & NW Expressway	1	6			1	0.02	4	6	
Hefner & Wilshire	1	6					4	6	
Hefner & Britton Rd.	1	6	1	0.02	1	0.02	4	6	
Hefner & Hefner Rd.	1	6					4	6	
Hefner & 122nd	1	6			1	0.02	4	6	
Hefner & Kilpatrick Tpk.	1	6	1	0.02	4	0.08	4	6	
	7	42	2	0.04	6	0.12	28	42	84.16
I-235									
I-235 & Sheridan	1	6					4	6	
I-235 & N 10th	1	6	1	0.02	1	0.02	4	6	
I-235 & N 36th	1	6	1	0.02	1	0.02	4	6	
I-235 & N 50th	1	6					4	6	
	4	24	2	0.04	2	0.04	16	24	48.08
Broadway Extension									
Broadway & I-44	1	6					4	6	
Broadway & N 63rd	1	6	1	0.02	1	0.02	4	6	
Broadway & Britton Rd.	1	6			1	0.02	4	6	
Broadway & Hefner Rd.	1	6					4	6	
Broadway & N 122nd	1	6			1	0.02	4	6	
	5	30	1	0.02	3	0.06	20	30	60.08

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
I-35 Between I-240 & I-40									
I-35 & SE 59th	1	6			1	0.02	4	6	
I-35 & SE 44th	1	6					4	6	
I-35 N. of SE 29th	1	6	1	0.02	1	0.02	4	6	
I-35 & SE 15th	1	6			1	0.02	4	6	
	4	24	1	0.02	3	0.06	16	24	48.08
I-35 N. of I-40									
I-35 & NE 23rd	1	6	1	0.02	1	0.02	4	6	
I-35 & NE 36th	4	24			1	0.02	4	6	
I-35 & NE 50th	1	6					4	6	
I-35 N. of Wilshire	1	6			1	0.02	4	6	
I-35 & Hefner Rd.	1	6			1	0.02	4	6	
I-35 & NE 122nd	1	6					4	6	
	9	54	1	0.02	4	0.08	24	36	90.1
Moore / Norman									
HW77 & Robinson St. - Norman	1	6					4	6	
I-35 & Main St. - Norman	1	6					4	6	
I-35 & 12th St. - Moore	1	6			1	0.02	4	6	
I-35 & Shields - Moore	1	6					4	6	
I-35 & N. 27th St. - Moore (S. OKC)	1	6	1	0.02	1	0.02	4	6	
I-44 & SW 89th - Moore (S. OKC)	1	6	1	0.02	1	0.02	4	6	
	6	36	2	0.04	3	0.06	24	36	72.1

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
Tulsa									
I-44 West to East									
I-44 & S. 61st	1	6	1	0.02	1	0.02	4	6	
I-44 / I-244 Western Junction	1	6					4	6	
I-44 & W. 33rd Ave.	1	6			1	0.02	4	6	
I-44 & Union Ave.	1	6					4	6	
I-44 & HW75	1	6					4	6	
I-44 W. of Peoria	1	6	1	0.02	1	0.02	4	6	
I-44 E. of Peoria	1	6	1	0.02	1	0.02	4	6	
I-44 E. of Lewis	1	6			1	0.02	4	6	
I-44 & Harvard	1	6			1	0.02	4	6	
I-44 & Yale	1	6			1	0.02	4	6	
I-44 W. of S. 41st	1	6	1	0.02	1	0.02	4	6	
I-44 & S. 31st	1	6					4	6	
I-44 between S. 31st & S. 21st	1	6	1	0.02	1	0.02	4	6	
I-44 & S. 21st	1	6					4	6	
I-44 between S. 21st & S. 11th	1	6			1	0.02	4	6	
I-44 & S. 11th	1	6					4	6	
I-44 E. of E. 129th Ave.	1	6			1	0.02	4	6	
I-44 / I-244 Eastern Junction	1	6					4	6	
I-44 W. of E. 161st Ave.	1	6	1	0.02	1	0.02	4	6	
I-44 E. of E. 193rd Ave.	1	6			1	0.02	4	6	
	20	120	6	0.12	13	0.26	80	120	240.38
I-244 West to East									
I-244 & Union Ave.	1	6			1	0.02	4	6	
I-244 W. of S. 21st	1	6	1	0.02	1	0.02	4	6	

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
I-244 & HW51	1	6					4	6	
I-244 & 2nd St.	1	6			1	0.02	4	6	
1-244 N. of 2nd St.	1	6					4	6	
I-244 & Denver	1	6					4	6	
I-244 & Cincinnati	1	6			1	0.02	4	6	
I-244 & HW75	1	6					4	6	
I-244 W. of Lewis	1	6					4	6	
I-244 E. of Lewis	1	6	1	0.02	1	0.02	4	6	
I-244 E. of Harvard	1	6			1	0.02	4	6	
I-244 E. of Yale	1	6	1	0.02	1	0.02	4	6	
I-244 & Sheridan	1	6			1	0.02	4	6	
I-244 & Memorial	1	6					4	6	
I-244 & HW169	1	6					4	6	
I-244 W. of E. 129th Ave.	1	6			1	0.02	4	6	
	16	96	3	0.06	9	0.18	64	96	192.24
HW51 West to East									
HW51 W. of I-244	1	6	1	0.02	1	0.02	4	6	
HW51 & Denver	1	6			1	0.02	4	6	
HW51 & S. 11th	1	6					4	6	
HW51 & Cincinnati	1	6					4	6	
HW51 & HW75 Junction	1	6					4	6	
HW51 W. of Lewis	1	6			1	0.02	4	6	
HW51 & Lewis	1	6	1	0.02	1	0.02	4	6	
HW51 & S. 21st	1	6					4	6	
HW51 & Harvard	1	6			1	0.02	4	6	
HW51 & Yale	1	6			1	0.02	4	6	
HW51 E. of Yale	1	6					4	6	

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
HW51 & Sheridan	1	6			1	0.02	4	6	
HW51 & Memorial	1	6			1	0.02	4	6	
HW51 & S. 41st	1	6					4	6	
HW51 & Mingo	1	6					4	6	
HW51 & HW159 Junction	1	6			1	0.02	4	6	
HW51 E. of E. 129th Ave.	1	6	1	0.02	1	0.02	4	6	
	17	102	3	0.06	10	0.2	68	102	204.26
HW75 South to North									
HW75 S. of S. 61st	1	6	1	0.02	1	0.02	4	6	
HW75 & S. 11th	1	6					4	6	
HW75 & 7th	1	6					4	6	
HW75 & 2nd	1	6			1	0.02	4	6	
HW75 S. of Apache St.	1	6	1	0.02	1	0.02	4	6	
	5	30	2	0.04	3	0.06	20	30	60.1
HW169 South to North									
HW169 & S. 81st	1	6			1	0.02	4	6	
HW169 N. of S. 61st	1	6	1	0.02	1	0.02	4	6	
HW169 & S. 31st	1	6			1	0.02	4	6	
HW169 & Apache St.	1	6	1	0.02	1	0.02	4	6	
	4	24	2	0.04	4	0.08	16	24	48.12
Memorial N. of I -244	1	6	1	0.02	1	0.02	4	6	
	1	6	1	0.02	1	0.02	4	6	12.04
Lawton									
I-44 and two gates at Fort	2	12					8	12	

Location	CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
Sill									
	2	12	0	0	0	0	8	12	24
	140	**840**	**33**	**0.7**	**92**	**1.84**	**548**	**822**	
								Grand Total	**1725**

CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
Oklahoma City								
8	48	1	0.02	8	0.16	32	48	96.18
8	48	3	0.06	8	0.16	32	48	96.22
12	72	3	0.06	5	0.1	48	72	144.16
5	30	0	0	2	0.04	20	30	60.04
5	30	1	0.02	2	0.04	20	30	60.06
4	24	0	0	3	0.06	16	24	48.06
3	18	0	0	5	0.1	12	18	36.1
7	42	2	0.04	6	0.12	28	42	84.16
4	24	2	0.04	2	0.04	16	24	48.08
5	30	1	0.02	3	0.06	20	30	60.08
4	24	1	0.02	3	0.06	16	24	48.08
9	54	1	0.02	4	0.08	24	36	90.1
74	444	15	0.3	51	1.02	284	426	871.32
Moore/Norman								
6	36	2	0.04	3	0.06	24	36	72.1

CCTV	CCTV BW	DMS	DMS BW	Vehicle Detectors	Detector BW	Webcams	Webcam BW	
Tulsa								
20	120	6	0.12	13	0.26	80	120	240.38
16	96	3	0.06	9	0.18	64	96	192.24
17	102	3	0.06	10	0.2	68	102	204.26
5	30	2	0.04	3	0.06	20	30	60.1
4	24	2	0.04	4	0.08	16	24	48.12
1	6	1	0.02	1	0.02	4	6	12.04
63	378	17	0.34	40	0.8	252	378	757.14
Lawton								
2	12	0	0	0	0	8	12	24

Appendix E Planned Rural ITS Assets & Bandwidth Calculations

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
I-35 South 1	Yes	2	1.5	3	0.02	3.02
I-35 South 2	Yes	2	1.5	3	0.02	3.02
I-35 South 3	Yes	2	1.5	3	0.02	3.02
I-35 South 4	Yes	2	1.5	3	0.02	3.02
I-35 South 5	Yes	2	1.5	3	0.02	3.02
I-35 South 6	Yes	2	1.5	3	0.02	3.02
I-35 South 7	Yes	2	1.5	3	0.02	3.02
I-35 South 8	Yes	2	1.5	3	0.02	3.02
I-35 South 9	Yes	2	1.5	3	0.02	3.02
I-35 South 10	Yes	2	1.5	3	0.02	3.02
I-35 South 11	Yes	2	1.5	3	0.02	3.02
I-35 South 12	Yes	2	1.5	3	0.02	3.02
I-35 South 13	Yes	2	1.5	3	0.02	3.02
I-35 South 14	Yes	2	1.5	3	0.02	3.02
I-35 South 15	Yes	2	1.5	3	0.02	3.02
					Total	**45.3**
I-35 North 1	Yes	2	1.5	3	0.02	3.02
I-35 North 2	Yes	2	1.5	3	0.02	3.02
I-35 North 3	Yes	2	1.5	3	0.02	3.02
I-35 North 4	Yes	2	1.5	3	0.02	3.02
I-35 North 5	Yes	2	1.5	3	0.02	3.02
I-35 North 6	Yes	2	1.5	3	0.02	3.02
I-35 North 7	Yes	2	1.5	3	0.02	3.02
I-35 North 8	Yes	2	1.5	3	0.02	3.02

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
I-35 North 9	Yes	2	1.5	3	0.02	3.02
I-35 North 10	Yes	2	1.5	3	0.02	3.02
I-35 North 11	Yes	2	1.5	3	0.02	3.02
					Total	**33.22**
I-44 South West 1	Yes	2	1.5	3	0.02	3.02
I-44 South West 2	Yes	2	1.5	3	0.02	3.02
I-44 South West 3	Yes	2	1.5	3	0.02	3.02
I-44 South West 4	Yes	2	1.5	3	0.02	3.02
I-44 South West 5	Yes	2	1.5	3	0.02	3.02
I-44 South West 6	Yes	2	1.5	3	0.02	3.02
I-44 South West 7	Yes	2	1.5	3	0.02	3.02
I-44 South West 8	Yes	2	1.5	3	0.02	3.02
I-44 South West 9	Yes	2	1.5	3	0.02	3.02
I-44 South West 10	Yes	2	1.5	3	0.02	3.02
I-44 South West 11	Yes	2	1.5	3	0.02	3.02
I-44 South West 12	Yes	2	1.5	3	0.02	3.02
I-44 South West 13	Yes	2	1.5	3	0.02	3.02
I-44 South West 14	Yes	2	1.5	3	0.02	3.02
					Total	**42.28**
I-44 North East 1	Yes	2	1.5	3	0.02	3.02
I-44 North East 2	Yes	2	1.5	3	0.02	3.02
I-44 North East 3	Yes	2	1.5	3	0.02	3.02
I-44 North East 4	Yes	2	1.5	3	0.02	3.02
I-44 North East 5	Yes	2	1.5	3	0.02	3.02
I-44 North East 6	Yes	2	1.5	3	0.02	3.02

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
I-44 North East 7	Yes	2	1.5	3	0.02	3.02
I-44 North East 8	Yes	2	1.5	3	0.02	3.02
I-44 North East 9	Yes	2	1.5	3	0.02	3.02
I-44 North East 10	Yes	2	1.5	3	0.02	3.02
I-44 North East 11	Yes	2	1.5	3	0.02	3.02
I-44 North East 12	Yes	2	1.5	3	0.02	3.02
I-44 North East 13	Yes	2	1.5	3	0.02	3.02
I-44 North East 14	Yes	2	1.5	3	0.02	3.02
I-44 North East 15	Yes	2	1.5	3	0.02	3.02
I-44 North East 16	Yes	2	1.5	3	0.02	3.02
I-44 North East 17	Yes	2	1.5	3	0.02	3.02
I-44 North East 18	Yes	2	1.5	3	0.02	3.02
I-44 North East 19	Yes	2	1.5	3	0.02	3.02
I-44 North East 20	Yes	2	1.5	3	0.02	3.02
I-44 North East 21	Yes	2	1.5	3	0.02	3.02
I-44 North East 22	Yes	2	1.5	3	0.02	3.02
I-44 North East 23	Yes	2	1.5	3	0.02	3.02
					Total	**69.46**
I-40 West 1	Yes	2	1.5	3	0.02	3.02
I-40 West 2	Yes	2	1.5	3	0.02	3.02
I-40 West 3	Yes	2	1.5	3	0.02	3.02
I-40 West 4	Yes	2	1.5	3	0.02	3.02
I-40 West 5	Yes	2	1.5	3	0.02	3.02
I-40 West 6	Yes	2	1.5	3	0.02	3.02
I-40 West 7	Yes	2	1.5	3	0.02	3.02
I-40 West 8	Yes	2	1.5	3	0.02	3.02

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
I-40 West 9	Yes	2	1.5	3	0.02	3.02
I-40 West 10	Yes	2	1.5	3	0.02	3.02
I-40 West 11	Yes	2	1.5	3	0.02	3.02
I-40 West 12	Yes	2	1.5	3	0.02	3.02
I-40 West 13	Yes	2	1.5	3	0.02	3.02
I-40 West 14	Yes	2	1.5	3	0.02	3.02
I-40 West 15	Yes	2	1.5	3	0.02	3.02
I-40 West 16	Yes	2	1.5	3	0.02	3.02
					Total	**48.32**
I-40 East 1	Yes	2	1.5	3	0.02	3.02
I-40 East 2	Yes	2	1.5	3	0.02	3.02
I-40 East 3	Yes	2	1.5	3	0.02	3.02
I-40 East 4	Yes	2	1.5	3	0.02	3.02
I-40 East 5	Yes	2	1.5	3	0.02	3.02
I-40 East 6	Yes	2	1.5	3	0.02	3.02
I-40 East 7	Yes	2	1.5	3	0.02	3.02
I-40 East 8	Yes	2	1.5	3	0.02	3.02
I-40 East 9	Yes	2	1.5	3	0.02	3.02
I-40 East 10	Yes	2	1.5	3	0.02	3.02
I-40 East 11	Yes	2	1.5	3	0.02	3.02
I-40 East 12	Yes	2	1.5	3	0.02	3.02
I-40 East 13	Yes	2	1.5	3	0.02	3.02
I-40 East 14	Yes	2	1.5	3	0.02	3.02
I-40 East 15	Yes	2	1.5	3	0.02	3.02
I-40 East 16	Yes	2	1.5	3	0.02	3.02
I-40 East 17	Yes	2	1.5	3	0.02	3.02

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
I-40 East 18	Yes	2	1.5	3	0.02	3.02
I-40 East 19	Yes	2	1.5	3	0.02	3.02
I-40 East 20	Yes	2	1.5	3	0.02	3.02
I-40 East 21	Yes	2	1.5	3	0.02	3.02
I-40 East 22	Yes	2	1.5	3	0.02	3.02
I-40 East 23	Yes	2	1.5	3	0.02	3.02
					Total	**69.46**
SH 69 1	Yes	2	1.5	3	0.02	3.02
SH 69 2	Yes	2	1.5	3	0.02	3.02
SH 69 3	Yes	2	1.5	3	0.02	3.02
SH 69 4	Yes	2	1.5	3	0.02	3.02
SH 69 5	Yes	2	1.5	3	0.02	3.02
SH 69 6	Yes	2	1.5	3	0.02	3.02
SH 69 7	Yes	2	1.5	3	0.02	3.02
SH 69 8	Yes	2	1.5	3	0.02	3.02
SH 69 9	Yes	2	1.5	3	0.02	3.02
SH 69 10	Yes	2	1.5	3	0.02	3.02
SH 69 11	Yes	2	1.5	3	0.02	3.02
SH 69 12	Yes	2	1.5	3	0.02	3.02
SH 69 13	Yes	2	1.5	3	0.02	3.02
SH 69 14	Yes	2	1.5	3	0.02	3.02
SH 69 15	Yes	2	1.5	3	0.02	3.02
SH 69 16	Yes	2	1.5	3	0.02	3.02
SH 69 17	Yes	2	1.5	3	0.02	3.02
SH 69 18	Yes	2	1.5	3	0.02	3.02
SH 69 19	Yes	2	1.5	3	0.02	3.02

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
SH 69 20	Yes	2	1.5	3	0.02	3.02
SH 69 21	Yes	2	1.5	3	0.02	3.02
					Total	**63.42**
INTP 1	Yes	2	1.5	3	0.02	3.02
INTP 2	Yes	2	1.5	3	0.02	3.02
INTP 3	Yes	2	1.5	3	0.02	3.02
INTP 4	Yes	2	1.5	3	0.02	3.02
INTP 5	Yes	2	1.5	3	0.02	3.02
INTP 6	Yes	2	1.5	3	0.02	3.02
INTP 7	Yes	2	1.5	3	0.02	3.02
INTP 8	Yes	2	1.5	3	0.02	3.02
INTP 9	Yes	2	1.5	3	0.02	3.02
INTP 10	Yes	2	1.5	3	0.02	3.02
INTP 11	Yes	2	1.5	3	0.02	3.02
INTP 12	Yes	2	1.5	3	0.02	3.02
					Total	**36.24**
MTP 1	Yes	2	1.5	3	0.02	3.02
MTP 2	Yes	2	1.5	3	0.02	3.02
MTP 3	Yes	2	1.5	3	0.02	3.02
MTP 4	Yes	2	1.5	3	0.02	3.02
MTP 5	Yes	2	1.5	3	0.02	3.02
MTP 6	Yes	2	1.5	3	0.02	3.02
MTP 7	Yes	2	1.5	3	0.02	3.02
					Total	**21.14**

Web Camera Location	Weather Station	Number of Web Cams	Band Width per Web Cam (Mb)	Total Web Cam Band Width (Mb)	Weather Station Band Width (Mb)	Total Band Width for Location (Mb)
SH 412 1	Yes	2	1.5	3	0.02	3.02
SH 412 2	Yes	2	1.5	3	0.02	3.02
SH 412 3	Yes	2	1.5	3	0.02	3.02
SH 412 4	Yes	2	1.5	3	0.02	3.02
SH 412 5	Yes	2	1.5	3	0.02	3.02
SH 412 6	Yes	2	1.5	3	0.02	3.02
SH 412 7	Yes	2	1.5	3	0.02	3.02
SH 412 8	Yes	2	1.5	3	0.02	3.02
SH 412 9	Yes	2	1.5	3	0.02	3.02
SH 412 10	Yes	2	1.5	3	0.02	3.02
SH 412 11	Yes	2	1.5	3	0.02	3.02
SH 412 12	Yes	2	1.5	3	0.02	3.02
SH 412 13	Yes	2	1.5	3	0.02	3.02
SH 412 14	Yes	2	1.5	3	0.02	3.02
					Total	**42.28**
		312			**Grand Total**	**471.12**