CHAPTER 1: ST. LOUIS BI-STATE REGIONAL ITS CONCEPT OF OPERATIONS

Introduction

The St. Louis Bi-State region encompasses the City of St. Louis, four counties in the State of Missouri (Franklin, Jefferson, St. Charles and St. Louis) and three counties in the State of Illinois (Madison, Monroe, and St. Clair). Major highways in the St. Louis region include Routes I- 270 and I-255, which circles the region, and Routes I-44, I-55, I-64, I-170 and I-70, which bisect the area. Along with these major highways there are numerous municipalities with major arterials that compose the St. Louis Bi-State transportation network. The large number of agencies and jurisdictions in the Bi-State area require a complex and unique working relationship between the two neighboring states and many local governments.

To address the complex interjurisdictional transportation issues identified in the Early Deployment Plan (titled "Bi-State St. Louis Area Intelligent Vehicle Highway System Planning Study", April 1994) the major transportation agencies in the St. Louis Bi-State area created the Gateway Guide program. The Gateway Guide program, which is a partnership among the Missouri Department of Transportation (MoDOT), the Illinois Department of Transportation (IDOT), the Bi-State Development Agency (the regional transit operator) (BSDA) The East-West Gateway Coordinating Council (the Metropolitan Planning Organization for the region) (EWGCC) and other stakeholder agencies, is being implemented to provide the St. Louis Bi-State region with coordinated transportation operations and an advanced transportation management system. These partner agencies meet regularly as the Gateway Guide Regional Team to coordinate various issues such as incident management, geographical information systems (GIS), transit services and Intelligent Transportation Systems (ITS).

The Gateway Guide program will be implemented in several phases with priority placed on coordinated operations and the regional deployment of Intelligent Transportation Systems (ITS). This will allow the existing MoDOT Transportation Information Center (TIC), the IDOT District 8 communications facility, and several other future centers to receive information from field devices and disseminate travel information to the traveling public.

- The St. Louis Bi-State region's transportation goals include:

- Disseminate real time travel information

- Improve incident management.

- Improve the overall safety of the transportation network

- Improve traffic management

- Reduce non-recurring congestion

- Coordinate regional resources and databases, such as developing a regional GIS base system

- Reduce energy consumption

- Improve air quality

These goals can be achieved through the effective use and deployment of ITS technologies and better coordination among the transportation agencies and incident response agencies. With the different jurisdictions and agencies responding to incidents, the participating stakeholders have stated that communications tends to be the major issue hindering the ability to quickly and efficiently clear an incident and manage traffic. This Concept of Operations outlines the role of various centers in the St. Louis Bi-State region including the MoDOT Transportation Information Center, the IDOT Communications Room, the Emergency Operations Centers, the Transit Management Center, as well as other regional stakeholders and how each of these agencies working together will be able to share information vital to a seamless transportation management system.

Transportation Management Centers

MODOT TRANSPORTATION INFORMATION CENTER

The MoDOT Transportation Information Center (TIC) is operated and maintained by the St. Louis Metropolitan District of MoDOT. The construction of the TIC building was completed in 2000. Currently, MoDOT is in the process of linking existing field devices on the Interstate, which include Closed Circuit Television (CCTV) cameras, vehicle detectors, Highway Advisory Radios (HARs), and Dynamic Message Signs (DMSs), with the TIC. Future field devices will include additional CCTV cameras, ramp metering, lane control signs on the approaches to river crossing bridges, roadway weather information systems, vehicle detectors, HARs, and DMSs on freeways in the St. Louis area.

The TIC is a part of St. Louis's Gateway Guide program, which is a regional transportation management. The Gateway Guide system will allow various ITS components to be linked together in one network. The next construction phase for the MoDOT St. Louis District, which includes a portion of Routes I-270, and a link between the MoDOT TIC and the Missouri Highway Patrol offices, is under design. Future MoDOT ITS construction phases include field device deployments on other freeway and major arterial routes in the District. Additionally, communications connections will be developed to 911 dispatch centers and emergency operations centers throughout the District and to the IDOT Communications Center.

The existing communications infrastructure is composed of twisted pair copper cable, fiber optic cable, cellular, radio, and microwave communications media. The existing field devices are connected to fiber optic cable managed by Digital Teleport Inc. (DTI) on MoDOT right-of-way through a shared resource contract.

The TIC currently operates between the hours of 6:00 a.m. and 12:00 a.m. midnight Monday through Friday. There are plans for MoDOT to operate the TIC 24 hours a day 7 days a week in the near future. MoDOT's TIC is currently staffed by Metro Networks personnel under the direction of MoDOT.

Data received at the TIC from field devices will be displayed on an electronic map displaying real-time traffic conditions through color-coded links. CCTV images received from cameras

are displayed on monitors and a video wall. TIC operators have the ability to control pan, tilt, and zoom (P-T-Z) for any camera. Archived traffic and incident data will be stored on a MoDOT server to allow other agencies access for research and planning purposes through agreement with MoDOT. The electronic status map and video images will be linked to the Gateway Guide website so that real time travel information is disseminated to incident response agencies and the public.

Due to current limitations of software, communications connections and security MoDOT is not proposing to allow other agencies rights to control video surveillance camera's P-T-Z at this time. However, it is recommended that remote P-T-Z control be included as a feature of the control hardware and software systems so that it can be implemented in the future. Procedures will need to be reviewed and developed to broaden P-T-Z control with future integrated software and broadband communications connections in order to define the hierarchy of remote camera control that will allow TIC operators to regain control of a camera as needed.

MoDOT has a Motorist Assist program, which strives to improve coordination between towing companies, fire, and police as well as provide assistance to minor incidents. In the future, AVL will be implemented on the service patrol vehicles to provide vehicle tracking for more efficient response.

Operating agreements or memoranda of understanding (MOU) between MoDOT and other participating agencies should be discussed to define the role of each agency. The operating agreement could also include capital and operating cost sharing, hierarchy of system control and use of traffic and video data and information.

Functions of the MoDOT TIC may include:

- Incident management

- Detection on freeways

- Surveillance on freeways

- Freeway lane control

- Development and implementation of freeway control strategies

- Road weather detection

- Real time video control (based on control hierarchy)

- Traffic prediction capability

- Traffic data archive and data management/warehousing capabilities

- Traffic, incident and construction information dissemination capability, including DMS, HAR, cable TV, Internet web site, 511

- Real time communication to emergency operations and transit centers

- Real time communications to interactive traveler information network (kiosks, media, Metro Networks, and websites)

- Real time regional data sharing capability

- Middleware that enables integration among all participating agencies

- ITS maintenance management and information tools

- Transportation system performance measuring tools

- Motorist Assist dispatch

- Motorist Assist vehicle tracking (AVL)

- Real time detection on freeways and arterials using vehicle probe data from AVL systems (buses, Motorist Assist vehicles)

IDOT COMMUNICATIONS ROOM

The Illinois Department of Transportation (IDOT) District 8 manages the freeway network on the eastern portion of the St. Louis Bi-State region. IDOT operates and maintains a number of ITS-related devices from the District 8 communications room. These include Autoscope video detectors along Route I-270, a surveillance camera on Routes I-270 and IL 203, 40 interconnected closed-loop arterial systems and 13 railroad interconnects with signal preemptions in District 8, call boxes (77 miles of coverage), HARs, and seven portable DMS signs in District 8. IDOT continuously updates traffic counts, volume, and speed. There are plans to lease T-1 lines for CCTV cameras and telephone lines for detector and DMSs.

IDOT District 8 ITS projects, which are currently being planned or under construction include 11 additional video detectors on Poplar Street (completion October 2001), eight video detectors on Route I-270 from the river to Route IL 3 (completion March 2002), 10 surveillance cameras (completion May 2002), three DMS signs and seven more surveillance cameras (June 2002). Additional funding is available for seven cameras and more detectors to be implemented in the next year. Also an analysis of communications options for linking local traffic operations and emergency operations centers as well as field devices along 125 miles of freeways in the District will be underway soon. Future projects include software integration with the Gateway Guide program, provision of direct real time communications with the MoDOT TIC and upgrading the ITS communications room to a Transportation Operations Center.

IDOT staff indicates that heavy congestion occurs during AM and PM peak periods on I-55/70, I-64, and I-270. IDOT staff also states that the lack of coordination and communication between agencies, especially during incident response is a major problem. After an incident occurs there is little delegation of tasks, which, in turn, slows down the incident removal process. IDOT has implemented a new intra-agency database to promote communications between bureaus.

IDOT has a service patrol program, Emergency Patrol Vehicles (EPV), which is similar to MoDOT Motorist Assist in District 8 and is modeled after IDOT's Minute Man program in the Chicago area.

IDOT's TOC functions may include:

- Incident management

- Detection on freeways

- Surveillance on freeways

- Development and implementation of freeway control strategies

- Road weather detection

- Highway-Rail Interface

- Real time video control (based on control hierarchy)

- Traffic prediction capability

- Traffic data archive and data management/warehousing capabilities

- Traffic, incident and construction information dissemination capability, including DMS, HAR, cable TV, Internet web site, 511

- Real time communication to emergency operations and transit centers

- Real time communications to interactive traveler information network (kiosks, media, and websites)

- Real time regional data sharing capability

- Middleware that enables integration among all participating agencies

- ITS maintenance management and information tools

- Transportation system performance measuring tools

- Service patrol dispatch (EPV)

- Service patrol vehicle tracking

At this time IDOT does not have any formal agreement with other agencies but does have a working relationship with MoDOT. They exchange information regarding incidents, special events, and construction and maintenance activities. IDOT is a part of the Gateway Guide program, which provides coordination of freeway management issues such as traffic flow, incidents, special events, traveler information, and planning and operation of transportation systems. Operating agreements or memoranda of understanding (MOU) between IDOT and other participating agencies are required to specifically define the role of each agency. The operating agreement will include discussions on capital and operating costs, hierarchy of system control and use of traffic and video data and information. Both IDOT and MoDOT indicate that a communications link between the two centers will be developed in the future.

Sharing of video control and other operating functions must be discussed and roles and responsibilities defined before the systems are fully integrated.

Emergency Operations Centers

Incident response plays a major role in transportation management. In the St. Louis Bi-State region there are numerous agencies that may respond to incidents on the freeway system. These responding agencies include: The Missouri Highway Patrol, the Illinois State Police, the 911 dispatch center in each of the seven counties, and city police and fire dispatch centers in cities adjacent to freeways. At this time there is concern about agency cooperation due to communication issues. Police mostly use radio communications but different jurisdictions are not compatible. MoDOT and IDOT will use radio dispatchers to coordinate incident response but they still have communication issues when dealing with an incident involving different jurisdictions. Most traffic related calls are received by local 911 centers, the Missouri Highway Patrol or Illinois State Police. These centers maintain a coordination list of responding agencies and will pass the call to the appropriate police, fire, or EMS agency, if needed. MoDOT and IDOT desire to receive traffic related information directly from the first responder agency and will, in turn, provide the coordination with the appropriate local traffic operations agency.

A solution is to link the 911 centers in the St. Louis Bi-State area to the MoDOT TIC and the IDOT District 8 TOC. Later the Gateway Guide program should be connected to the major public safety agencies, which include police, fire, and EMS dispatch centers in both Illinois and Missouri. Access to the Gateway Guide system will allow public safety agencies to receive real-time traffic data as well as CCTV images. In turn the public safety agencies can send real time traffic incident data back to the MoDOT and IDOT centers. It is acknowledged that there will be some difficulty integrating some of the existing Computer Aided Dispatch systems used by the response agencies since there are so many different system types in use. Partnerships and memorandums of understanding will need to be developed to define roles of each participating agency as well as determining operating costs, hierarchy of system control and use of traffic and video data and information.

After the Gateway Guide system is implemented, functions of the Emergency Operations Center may include:

- Real time communications to MoDOT TIC, IDOT TOC, other public safety agencies, and transit center

- Real time video display

- Real time video control (based on control hierarchy)

- Incident management

    o Detection on freeways

    o Surveillance on freeways

- Vehicle tracking for emergency vehicles

- Signal preemption for emergency vehicles (*done at intersections*)

- Dispatch for emergency vehicles

- Dispatch for towing providers

There have also been institutional issues when responding to an incident regarding delegation of tasks. Another process to better facilitate incident response is to develop a continuing joint training program among participating incident management agencies in Illinois and Missouri and to conduct debriefings of major incidents with the responding agencies. This will allow agencies to become familiar with each other's procedures and allow better coordination.

Transit Management Center

The Bi-State Development Agency (BSDA) is St. Louis Bi-State Region's Transit Agency, which consists of buses known as Metrobus, light rail known as MetroLink, and Call-a-Ride para-transit. They are able to collect ridership information by electronic fare boxes and by hand on MetroLink. Automatic passenger counters are being installed on 35 buses and 65 rail vehicles, which will allow electronic counts and speed related data. Two additional jurisdictions in the Bi-State region have developed transit systems. In St. Clair County, IL, the county manages a bus system and has contracted with BSDA to operate that system. Madison County, IL has developed a separate bus system.

BSDA would like to coordinate regional transit management issues such as traffic flow, incidents, special events, traveler information, and park and ride facilities. Funds have been ear-marked for AVL on express buses in 2002. With AVL, BSDA would be able to track vehicles and provide real time scheduling.

BSDA would like to receive real-time traffic data from MoDOT's TIC and IDOT's TOC to allow better coordination with real-time scheduling and to enable Internet trip itinerary planning for travelers. In the future, BSDA would also like to have transit signal priority for buses. Once the BSDA transit center has a link to the Gateway Guide system their functions may include:

- Transit vehicle tracking

- Fixed route operation and management

- Demand responsive operation and management

- Detection on freeways

- Surveillance on freeways

- Real time video display

- Real time video camera control (based on control hierarchy)

- Highway/rail intersection controls

- Automated transit passenger counting

- Transit fare management

- Transit maintenance and fleet management

- Transit security

- Parking management

- Traveler information dissemination, 511

- Real time communications to transportation management and emergency operations centers

The memorandum of understanding (MOU) between BSDA and MoDOT should include capital and operating costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data information.

Local Traffic Operations Centers

ST. LOUIS COUNTY

St. Louis County has the largest population of any jurisdiction in the St. Louis Bi-State area. The County Department of Highways and Traffic is responsible for the installation, operation and maintenance of all county owned traffic signals and most municipal signals under contracts with their respective city. The County dispatches Highway and Traffic Department staff and vehicles for maintenance and emergencies. The County Police Department is responsible for dispatching towing vehicles.

The County operates and maintains seventeen closed loop systems. Many of the signal systems are interconnected with copper or fiber optic cable. They are currently in the process of upgrading their system with fiber optic cable and installing several CCTV cameras on major arterials. In the future they plan to connect to MoDOT's TIC and their own traffic control center with fiber optic cable. In addition there are plans to add DMSs on major arterials to allow information to be disseminated to travelers.

Functions that the County traffic control center may include are:

- Incident management

    o Traffic signal control

    o Detection on arterials

    o Surveillance on freeways

    o Surveillance on arterials

    o Highway/rail intersection controls

- Real time video display

- Real time video camera control (based on control hierarchy)

- Road weather detection

- Traffic prediction capability

- Traffic data archive and data management/warehousing capabilities

- Traffic, incident and construction information dissemination capability, including DMS, HAR, cable TV, Internet web site, 511

- Real time communication to emergency operations and transit centers

- Real time communications to interactive traveler information network (kiosks, media and websites)

    o Real time regional data sharing capability

    o Middleware that enables integration among all participating agencies

    o ITS maintenance management and information tools

    o Transportation system performance measuring tools

A MOU is being developed between the County and MoDOT to define the roles and responsibilities each agency will have. The County has working relationships with the Highway Patrol and MoDOT. They would like to receive more information on lane and road closures and incidents affecting traffic flow.

CITY OF ST. PETERS

The City of St. Peters is located west of St. Louis in St. Charles County. Route I-70 runs through St. Peters and is the major link to Route I-270.

St. Peters' ITS network consists of traffic signal control, CCTVs, and speed detectors. Data is collected every fifteen minutes and transmitted through a fiber network, which is owned by the City. Future plans entail DMSs for City arterials leading to expressways (Routes I-70, I-370, Page Avenue, I-64) and additional centralized signal systems.

When an incident occurs on Route I-70, traffic is diverted onto Mexico Road in St. Peters, which parallels Route I-70. Unfortunately, the City of St. Peters does not often receive notice when traffic is diverted. Timely notification of a diversion would enable them to change timing plans on Mexico Road from the central traffic signal system. This lack of appropriate signal timing, in turn, causes additional delays on Mexico Road. St. Peters desires to receive video feed from the Routes I-70/I-370 camera and any additional cameras operated by MoDOT on routes that impact traffic conditions in the City of St. Peters.

Functions that the City of St. Peters may want included in a traffic control center are:

- Incident management

- Traffic signal control

- Detection on arterials

- Surveillance on freeways

- Surveillance on arterials

- Highway/rail intersection controls

- Real time video display

- Real time video camera control (based on control hierarchy)

- Road weather detection

- Traffic prediction capability

- Traffic data archive and data management/warehousing capabilities

- Traffic, incident and construction information dissemination capability, including DMS, HAR, cable TV, Internet web site

- Real time communication to emergency operations and transit centers

- Real time communications to interactive traveler information network (kiosks, media and websites)

- Real time regional data sharing capability

- Middleware that enables integration among all participating agencies

- ITS maintenance management and information tools

- Transportation system performance measuring tools

At this time the City of St. Peters has working relationships with the local police and MoDOT. A MOU exists between St. Peters and MoDOT for the joint signal system operations on Route I-70 with cameras. MoDOT and the City would also like to coordinate regional arterial management issues, such as traffic flows, incidents, special events, traveler information, and planning and operation of transportation systems.

Information Service Providers

An information service provider (ISP) is an entity that receives data and information from the traffic management, transit management and emergency operations centers and distributes it 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). 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.

MoDOT will supply basic traveler information to the Gateway Guide web site, local agencies, the public, the media and private vendors through various communications media, such as DMS, HAR, kiosks, Internet, 511 and electronic data communications. IDOT also plans to supply basic traveler information to the Gateway Guide web site, a 511 system, local agencies, the public, the media and private vendors through various means.

Metro Networks, an ISP, through an agreement with MoDOT will receive traveler information from the MoDOT TIC and enhance its dissemination. Information could be distributed by a variety of means such as radio and television broadcast, telephone/cellular service, Internet and pager. Metro Networks will use compatible hardware/software for communications with the TIC. Any other center may contract directly with a private ISP by agreement with MoDOT or IDOT in order to disseminate locally specific traveler information to the traveling public.

Metro Networks will operate the TIC under direction by MoDOT and disseminate traffic data in Tele-Atlas data format to its national websites.

Additional Regional Stakeholders

EAST-WEST GATEWAY COORDINATING COUNCIL

The East-West Gateway Coordinating Council (EWGCC) is the metropolitan planning organization (MPO) for the St. Louis Bi-State region. The organization helps fund and coordinate projects for all of the major municipalities in the seven county, St. Louis Bi-State region. The agency acquires traffic volume, speed data, and roadway condition information regularly. They would like to receive information on commercial vehicle data including volume of freight.

The East-West Gateway Coordinating Council has memorandums of understanding with all major municipalities and is currently developing one with MoDOT for pilot ITS projects. In one project EWGCC would receive information on incidents, travel times, and traffic data from MoDOT's TIC.

MoDOT and IDOT will coordinate transportation planning activities with the East-West Gateway Coordinating Council in order to improve communications among state DOTs and local municipalities dealing with real-time traffic data.

RESEARCH UNIVERSITIES

It is also anticipated that major research universities in the region such as the University of Missouri – Columbia, University of Missouri – Rolla, University of Illinois – Champaign and Washington University –St. Louis will want to obtain data for traffic and incident research. A regional data warehouse for transportation data should be developed to provide access to real time data.
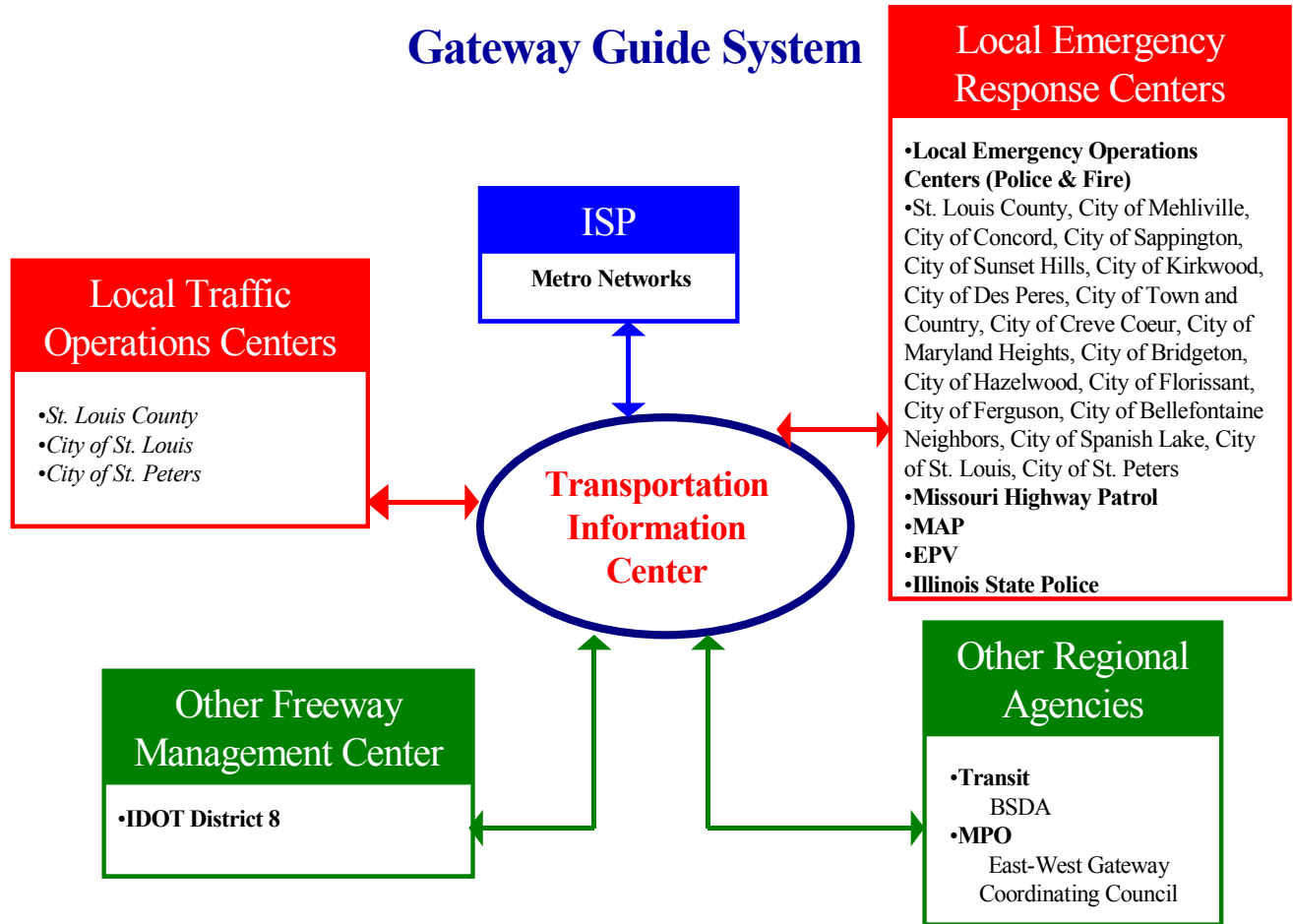
Jurisdictional Responsibilities

The major responsibilities for the implementation of the ITS technologies on freeway systems including design, construction, management, operations and maintenance will be MoDOT's responsibility in Missouri and IDOT's in Illinois. ITS technologies implemented on the arterials will be operated and maintained by the respective city or county jurisdiction. The transit agency (BSDA) will be responsible for design, construction, operations, management, and maintenance of transit facilities. The Gateway Guide program and the Gateway Guide Regional Team will be the coordination point for the Bi-State region's transportation and incident management activities.

The stakeholder involvement process used as input to the St. Louis Regional Concept of Operations resulted in development of the regional concept of operations. The concept is summarized in a the center-to-center ITS diagram shown in Figure 1. Figure 1 depicts the participating agencies, their responsibilities and the relationship between these agencies. The central concept revolves around a regional network, the Gateway Guide system, which includes counties in Missouri and Illinois. Through close communication among participating agencies, each agency is able to share data with all other participating agencies.

St. Louis Regional Concept of Operations

Gateway Guide System

ISP

Metro Networks

Local Emergency Response Centers

- **Local Emergency Operations Centers (Police & Fire)**
- St. Louis County, City of Mehliville, City of Concord, City of Sappington, City of Sunset Hills, City of Kirkwood, City of Des Peres, City of Town and Country, City of Creve Coeur, City of Maryland Heights, City of Bridgeton, City of Hazelwood, City of Florissant, City of Ferguson, City of Bellefontaine Neighbors, City of Spanish Lake, City of St. Louis, City of St. Peters
- **Missouri Highway Patrol**
- **MAP**
- **EPV**
- **Illinois State Police**

Local Traffic Operations Centers

- *St. Louis County*
- *City of St. Louis*
- *City of St. Peters*

Transportation Information Center

Other Freeway Management Center

- **IDOT District 8**

Other Regional Agencies

- **Transit**
  BSDA
- **MPO**
  East-West Gateway Coordinating Council

* Italicized text indicates future entities.

Figure 1: St. Louis Regional Concept of Operations – Center-to-Center Diagram

An Operations and Maintenance (O&M) Plan is needed to further delineate the responsibilities of each party for the initial installation. In general, each city/county should maintain the devices, traffic signal control equipment, and communication components located on city and non-state right-of-way. MoDOT and IDOT should maintain the infrastructure that supports the electrical equipment and communications within the interstate rights-of-way and on state rights-of-way.