CHAPTER 8

OPERATIONAL IMPROVEMENTS

Operational improvements enable the existing transportation system to move traffic more quickly and more safely. Approaches for improving operations range from the traditional – including signal coordination, intersection widening, and access management – to the use of intelligent transportation system (ITS) technologies. This plan’s recommendations for operational improvements are focused on the most congested segments of the county’s major roadways and on increased application of ITS technologies on freeways and major arterials.

Operational improvements enhance the transportation system’s performance and optimize the enormous investment represented by the existing system. Their implementation contributes to the preservation and maintenance of existing infrastructure, which is a high priority at all levels of government. Compared to expansion projects, operational improvements are generally faster and less expensive to implement.

This plan recommends operational improvements such as improved signalization, the addition of turn lanes, and other traditional approaches, and it also recommends the greater use of intelligent transportation system (ITS) technologies. Both the traditional and ITS approaches for improving system operation help to reduce congestion, improve safety, lower pollutant emissions, improve system efficiency and performance, and reduce the need for expansion projects.

TRADITIONAL APPROACH FOR IMPROVING SYSTEM OPERATION

The traditional approach for improving system operation is focused on facilitating traffic turns, merging, and other traffic movements. This approach involves traffic signal coordination, the addition of turn lanes at intersections, removal of parking, synchronization of traffic signals with an areawide signal system, and access management. Traditional operational improvements are especially effective on arterials, such as Dixie Highway.

Arterials, as a critical component of the roadway system, account for about 35% of vehicle miles traveled at the regional level. As an area becomes more developed, the arterials become more congested, less efficient, and more hazardous. The addition of curb cuts (driveways) and cross streets results in more traffic signals. Every signalized intersection reduces arterial capacity – the reduction may be 50% or more.
where signals are frequent and poorly spaced. Intersections and access points increase the potential for accidents – more than half of all accidents typically occur at intersections or are access-related.

For corridors where curb cuts, cross streets, and traffic signals are already in place, such as Dixie Highway, traditional operational improvements can mitigate traffic problems. For highways where development is pending or just beginning, such as recently completed KY-17, roadway capacity can be preserved and mobility problems mitigated by a preventative approach that applies access management.

Access management controls the design and operation of driveway and street connections onto a highway. For major roadways in developing areas, access management is fundamental for minimizing curb cuts and signalization in order to preserve travel capacity and functional integrity. For major roadways in developed areas, access management is sometimes suitable for addressing new access points or for retrofitting existing roadways.

The responsibility for improving operations belongs to local governments for local roads and to the KYTC for state roads. As part of this plan, five of Kenton County’s most congested roadway segments are recommended for studies to determine the optimal combination of operational improvements. These studies will enable the recommended projects to be eligible for federal funding. The areas to be studied (described in Chapter 5) are:

- Dixie Highway (U.S. 25) from Florence in Boone County to I-75 in Covington,
- KY-17 and intersections from Kyles Lane to Dudley Pike and west to Horsebranch and Orphanage Roads, including the I-275 ramps,
- Turkeyfoot Road (KY-1303) between Dixie Highway (U.S. 25) and Dudley Pike (county road),
- Madison Avenue/Scott Street and Greenup Streets (KY-17) between 3rd and 26th Streets, and
- Madison/James/Decoursey (KY-16/KY-177) between 26th Street and Grand Avenue.

In addition to the areas recommended for study, this plan also recommends two projects for implementation of operational improvements (see Chapter 5).

- On 4th and 5th Streets in Covington (including some inter-connecting streets, the I-75 approach lane, and the Clay Wade Bailey Bridge southbound exit ramp), a variety of improvements to traffic operations are recommended consistent with recommendations in the Central Area Loop Study.
- On Madison Avenue between Latonia Avenue and 26th Street, recommendations are for the removal of parking to create an additional lane (includes the need to add signs and pavement markings and build off-site parking).
INTELLIGENT TRANSPORTATION SYSTEM (ITS) TECHNOLOGIES

Metropolitan areas throughout the country are using or deploying intelligent transportation systems to manage traffic. These systems merge computer, telecommunication, and electronic technologies into an integrated operation. The ITS components support each other to reduce congestion and delay, increase travel speed and traffic throughput, reduce the frequency and severity of accidents, and optimize transportation system efficiency.

ITS technologies were initially focused on the freeway system, but they are also being applied to arterials, transit systems, and other transportation elements. They are being used increasingly to facilitate inter-agency communication and coordination so that agencies in different jurisdictions can work together in responding to incidents and managing traffic. ITS applications will continue to expand as new technologies are developed.

Federal policy promotes the application of ITS technologies for their effectiveness and -- given the realization that expansion projects cannot keep pace with congestion -- for their potential. Whereas ITS applications focus on transportation operations within metropolitan areas, federal requirements seek to insure that these systems are developed so they can be integrated nationally. As a basis for funding eligibility, metropolitan areas are required to develop ITS plans that include a “Regional Architecture” in conformity with the “National Architecture.” For this metropolitan area, OKI developed an ITS plan in 2001.

For Kenton County, ITS technologies are currently used to monitor freeways for congestion and accidents; reduce the time needed to detect, respond to, and clear incidents; provide real-time traffic information to help motorists avoid congestion; and improve bus performance and security for transit users. The benefits of ITS for improving Kenton County transportation are expected to grow in the future as ITS continues to evolve.

The Regional ITS: ARTIMIS

In the Cincinnati-Northern Kentucky area, the regional ITS is called “ARTIMIS” (Advanced Regional Traffic Interactive Management and Information System). ARTIMIS covers 88 miles of the region’s most heavily traveled freeways. In Kenton County, ARTIMIS covers I-275 and the northern part of I-75/I-71, as indicated in Figure 8-1.

The major goals of ARTIMIS are to improve motorist safety, travel time, and air quality. ARTIMIS works to achieve these goals by reducing congestion on freeways, which is mostly due to incidents. Extensive studies show that more than 50% of
congestion in metropolitan areas is due to incidents such as accidents, disabled vehicles, spilled loads, special events, and adverse weather conditions.

A primary function of ARTIMIS is to manage incidents. Electronic devices detect and transmit data on traffic conditions to the ARTIMIS centralized control center, which then makes information available to motorists (directly and through the media) and to emergency response agencies and transit operators. Major components of the ARTIMIS system include the following.

- **Vehicle Detection Technologies** - More than 1100 detectors are embedded in the freeway pavement to identify traffic conditions (vehicle count, occupancy, and speed). Data that indicates slow or stopped traffic represents the potential occurrence of an incident. Radar detectors are installed along I-71 in Hamilton County.

- **Closed-Circuit Television Cameras** - ARTIMIS has more than 80 cameras. Sixty of these are full-motion color video cameras that provide clear images of traffic conditions. These cameras are connected to fiber-optic cable. Slow-scan color cameras, which produce a moving video image, are used where telephone lines are the communication medium. Fixed black and white cameras are used for tunnels and poorly lit environments where high resolution is needed.

- **Communications Infrastructure** - Dedicated fiber-optic cable (see Figure 8-1) is the preferred communications medium because it can transmit multiple video images, in addition to advantages related to stability (relatively immune to cross-talk), operating costs, and immunity to lighting damage. Where fiber-optic cable has not been installed, telephone (leased service) or microwave (wireless transmission for one camera) are used.

- **Dynamic Message Signs** - Forty over-head mounted signs are located near major interchanges to advise motorists of traffic problems and potential alternate routes.

- **Highway Advisory Radio** - The HAR makes traffic advisories and construction information available 24 hours a day via broadcasts on a dedicated channel (530 AM).

- **511 Traveler Advisory Telephone Service** - This system provides up-to-the-minute, route-specific traffic and construction information 24 hours a day. It is accessible from both landline and wireless phones via one three-digit number (511). ARTIMIS receives more than 75,000 calls per month.

- **Reference and Ramp Markers** - Blue and white signs are posted along the median every 0.1 mile and at entrance and exit ramps with information on the direction of travel, interstate route number, and location (based on the freeway milepost system). The markers have helped expedite incident response by
enabling motorists to report and emergency responders to locate incident sites accurately.

- **Freeway Service Patrol Vans** - Five vans assist motorists with temporary repairs, provide fuel, call for assistance, remove road debris, and provide other services that speed up the removal of disabled vehicles and reduce traffic congestion and delay.

The benefits of ARTIMIS were evaluated in a recent study conducted by OKI. In a conservative assessment of ARTIMIS impacts, the study estimated that delay from incidents has been reduced by 19,000 hours per day, which together with improvement in safety, travel time, and environmental quality translates into an ARTIMIS benefit/cost ratio of 12 to 1. In a survey of emergency responders, it is estimated that ARTIMIS has reduced response time by about 30% (related to the speed and accuracy with which information is provided to dispatchers and emergency responders). These benefits clarify the value of applying advanced technologies to the transportation system.

**ITS Applications to Transit**

ITS technologies deployed by the Transit Authority of Northern Kentucky (TANK) for fleet management (December, 2002) are intended to improve transit operations and efficiency and attract new riders.

TANK has deployed Computer Aided Dispatch (CAD), Automatic Vehicle Location (AVL), and Mobile Data Terminal (MDT) systems for its entire fleet of fixed route, demand response, and support vehicles. These systems involve the use of satellites and computers for tracking vehicle real-time locations, which in turn improve schedule adherence and reduce passenger wait time. TANK installed the same systems as Metro (transit operator in the City of Cincinnati and Hamilton County in Ohio) to enable the two operators to share scheduling information and integrate various operations.

Transit operations are further improved by additional ITS applications and improvements in TANK and Metro inter-operability. TANK is sharing Metro’s 800 MHZ radio infrastructure and using the same type of electronic equipment as Metro. In addition, both transit agencies have tied in with ARTIMIS. A fiber optic cable connects Metro dispatch to ARTIMIS, and a broadband telephone line connects Metro with TANK.

TANK’s ITS system also includes portable radios for support staff, a Digital Voice Recording System, and an interface with the ADEPT paratransit scheduling software to expedite driver communication with the operator. Each of TANK’s buses is equipped with a silent alarm button and passive listening system for expediting response to medical or other emergencies and improving passenger and driver safety.
The Brio report tool provides data valuable to the operations, scheduling, and planning departments.

TANK’s new on-board technologies automate many functions previously carried out via voice over radio. They provide direct voice communication between dispatchers and operators, recorded data useful for management and operation, and automatic transmission of real-time location and vehicle status into text and map formats for view by a dispatcher. AVL, which uses Differential Global Positioning System technology, can locate a vehicle with an accuracy of ten meters and enable operations to adhere more closely to schedule.

**State ITS Initiatives**

The KYTC has been aggressive in applying ITS technologies across the state. In Kenton County, the KYTC has taken the initiative to install and operate a roadway weather information system (RWIS), automated vehicle location (AVL) on snowplows, and traffic signal systems.

An RWIS provides on-line weather information relative to surface conditions on the interstate system to assist with the application and timing of de-icing chemicals. Kenton County currently has an RWIS station at the interchange of I-275 and KY-17, and another one is planned for I-275 near the Indiana state line in Boone County.

KYTC has deployed ten AVL-equipped snowplows in Northern Kentucky to test the potential benefits of equipping all snowplows in the state with AVL. This capability enables the state to track the location of snowplows and their efficient distribution and utilization in the area.

**RECOMMENDATIONS: ITS STRATEGIC PLAN**

Federal legislation (Section 5206-e of TEA-21) requires that ITS projects conform to the National ITS Architecture and Standards. This requirement, which is intended to insure the “inter-operability” of ITS projects and systems nationwide, basically means that each metropolitan area develop an ITS Plan and Architecture as a prerequisite for federal funding eligibility for future ITS projects. The “architecture” describes how systems will be interconnected in the region, including system interface and data flows.

OKI completed a *Regional Intelligent Transportation System Plan*, inclusive of a regional architecture, that was adopted by the OKI policy board in April 2002. The recommendations are estimated to cost $45.4 million for Northern Kentucky, of which Kenton County’s share is an estimated $17.1 million. When added to its share of the cost of ARTIMIS operation and maintenance, Kenton County’s total cost for ARTIMIS through 2030 is an estimated $31.3 million. The State of Kentucky has taken responsibility for financing ITS throughout the state, which is assumed to include the cost associated with ARTIMIS.
The OKI regional ITS plan’s recommendations are presented in three tracks, with overlapping implementation, as summarized below:

- **Track 1: Optimize the existing ITS,**
- **Track 2: Integrate systems and agencies,** and
- **Track 3: Expand ITS coverage and services.**

### Optimize the Existing ITS

Recommendations, which are to be implemented in the next six years, will enhance the ITS infrastructure that is already in place. Major recommendations that affect Kenton County are the following.

- Add fiber optic cable to I-275 to upgrade communications (which involves the addition of more field devices).
- Improve signal operations, responsive and adaptive signal control, and other non-ITS approaches along Dixie Highway.
- Increase the number of freeway service patrol vans from two to four in Northern Kentucky.
- Purchase four vehicles for the purpose of removing disabled vehicles from interstates in Northern Kentucky.

Additional recommendations include improving public education of ARTIMIS, supporting the regional forum for incident management, and implementing additional travel information dissemination methods (may include cable TV station, personalized traveler information on a subscription basis delivered to cell phones, pagers, and personal computing devices).

### Integrate Systems and Agencies

These recommendations, which are to be implemented in the next six years, apply to the technical and institutional integration of ITS applications. They will expand ARTIMIS usage and capabilities.

Agencies will be integrated into ARTIMIS at one of three levels of membership. These levels are differentiated by the levels at which an agency chooses to receive data, provide data, and control field devices. As an example of the fullest level of integration, a 911 emergency dispatch agency could view an incident through ARTIMIS or an ARTIMIS member agency’s video cameras (obtain real-time data direct from the source) in order to determine the type of emergency response needed and then control the camera to monitor emergency response and determine additional needs.

The plan recommendations support ITS integration, which in turn provide for the following capabilities:

- Emergency dispatch, emergency response, transit, and other agencies will be electronically integrated with ARTIMIS. In Kenton County, candidates include
the Kenton County, Covington, and Erlanger-Elsmere computer-aided-dispatch systems.

- Member agencies will be able to control video cameras, Dynamic Message Signs, and Highway Advisory Radio.
- Member agencies will be able to share data and video images, including real-time information on incidents, travel time on arterials and freeways, and other data.
- Centralized traffic signal systems will be connected to ARTIMIS, and incident detection capabilities will be expanded to arterials.

**Expand ITS Coverage and Services**

These recommendations focus on expanding the geographic coverage of existing systems along the freeways and key arterials and adding new ITS functions and services. In Kenton County, this includes the addition of ARTIMIS field devices and communications along I-275, which overlaps with recommendations in Track 1 for optimizing the existing ITS. In addition, service improvements, which are recommended for implementation in the next ten years, include the following:

- install advanced highway-rail safety systems at key crossings,
- implement transit signal priority on traffic signals based on study results of key corridors,
- implement specialized truck-oriented traveler information via ARTIMIS and at weigh stations approaching the region (provide information flow to freight automated dispatch),
- install snow and ice detection (Road Weather Information System) on key bridges, and
- test an electronic crash mitigation/speed control system on northbound I-71/I-75 downhill in Covington as a demonstration project.