# MIAMI VALLEY ITS
# Early Deployment Plan

# Final ITS Strategic Deployment Plan

**NOTE TO READER:**

**THIS IS A LARGE DOCUMENT**

Due to its large size, this document has been segmented into multiple files. All files separate from this main document file are accessible from links (blue type) in the table of contents or the body of the document.

# MIAMI VALLEY ITS

## Early Deployment Plan

## Final ITS Strategic Deployment Plan

September 1997

# MIAMI VALLEY ITS

# Final
# ITS Strategic Deployment Plan

**Prepared by:**

**BRW, INC.**

**in association with:**

**Battelle**
**CH2M Hill**
**LJB, Inc.**
**TEC Engineering, Inc.**

**Prepared for:**

**Miami Valley Regional Planning Commission**
**40 West Fourth Street, Suite 400**
**Dayton, Ohio 45402**

***September 1997***

# ITS STRATEGIC DEPLOYMENT PLAN TEAM

The Miami Valley ITS Strategic Deployment Plan Team was led by the Miami Valley Regional Planning Commission and consisted of a Policy Committee, Technical Committee and Consultant Team. The Policy Committee set the strategic direction for and coordinated all activities of the Strategic Deployment Plan development effort. The Technical Committee participated in all major planning activities and reviewed all major work products of the Strategic Deployment Plan. The Consultant Team, under supervision of the Policy and Technical Committees, prepared the Strategic Deployment Plan and all associated documents.

## POLICY COMMITTEE

**Ms. Nora E. Lake**
Miami Valley Regional Planning Commission

**Ms. Anne Hassoun**
Miami Valley Regional Planning Commission

**Mr. Scott Glum**
Miami Valley Regional Planning Commission

**Mr. Don Spang**
Miami Valley Regional Planning Commission

**Mr. Jim Buckson**
FHWA - Ohio Division

**Mr. Larry Himes**
Clark County-Springfield Transportation
Coordinating Committee

**Mr. Kerry Lawson**
City of Dayton

**Mr. Dexter McMillan**
City of Kettering

**Mr. Michael Morris**
Ohio Department of Transportation, District 8

**Mr. George Saylor**
Ohio Department of Transportation, Central

**Mr. Phil Stormer**
Ohio Department of Transportation, District 7

## TECHNICAL COMMITTEE

Butler Township
City of Beavercreek
City of Centerville
Clark County
City of Englewood
City of Fairborn
Greene County
Harrison Township
City of Huber Heights
Jet Express
League of Women Voters
Miami County
Miami County Community Action Council
Miami-Liberty Cab Company
Miami Township
Miami Valley Regional Transit Authority
Montgomery County
Ohio Bicycle Federation
City of Piqua
City of Springfield
Springfield Bus Company
City of Troy
City of Vandalia
Washington Township
City of West Carrollton
City of Xenia

## CONSULTANT TEAM

BRW, Inc. (prime consultant)
Battelle Memorial Institute
CH2M Hill
Lockwood, Jones & Beals, Inc.
TEC Engineering, Inc.

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# MIAMI VALLEY ITS

## EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

This report presents the Strategic Deployment Plan for Intelligent Transportation Systems (ITS) in Clark, Greene, Miami and Montgomery Counties, Ohio (the "Miami Valley"). The report summarizes the steps that were performed in preparing the Strategic Deployment Plan and presents the plan recommendations, including projects, a system architecture, costs, schedule and program benefits. This summary highlights the plan process, recommended projects, costs and benefits.

## PLAN DEVELOPMENT PROCESS

Preparation of the SDP was led by the Miami Valley Regional Planning Commission and project Policy and Technical Committees. The Policy Committee set the strategic direction for and coordinated all activities of the SDP development effort. The Technical Committee was formed in order to assure broad jurisdictional and multimodal participation in the development of the SDP. The members of these committees are identified in the inside front cover of this report.

Development of the Miami Valley ITS EDP began in June 1996 and followed the ten step ITS Planning Process developed by the Federal Highway Administration (see Section 1.3). Early activities included development of an overall project vision, goals and objectives.

The ITS Vision for the Miami Valley is one of enhanced *transportation Productivity mobility efficiency and safety within the region with a reduction in energy use and improvement in the environment through the use of cost effective ITS technologies and systems* Goals of the Strategic Deployment Plan include to create a state-of-the-art ITS transportation system; enhance productivity; improve safety; reduce energy consumption and improve the environment; enhance mobility and accessibility; and increase efficiency.

## PROGRAMS AND PROJECTS

The Strategic Deployment Plan includes projects organized into the following six Program Areas:

1: Freeway/Incident Management Systems
2: Advanced Traffic Signal Control Systems
3: Public Transportation Systems
4: Multi-Modal Traveler Information Systems
5: Public-Private Partnerships
6: Technical and Planning Support

The first program area implements a system to monitor freeway traffic conditions and to improve incident response. Program Area 2 includes projects which will improve the flow of traffic on arterial streets by making traffic signals more responsive to changing traffic conditions. Program Area 3 implements systems which make transit more responsive and efficient, including technology to speed fare payment and to inform riders of expected bus arrival times. Program Area 4 will provide travelers information about traffic conditions and transit, such as traffic accidents and bus schedules. Program Area 5 identifies specific opportunities for involving the private sector in ITS deployment. Program Area 6 lays out the management and administrative structure to guide implementation and to implement a public education and outreach program.

Figure S-l summarizes the recommended projects of the Miami Valley ITS Strategic Deployment Plan.

## PROGRAM BENEFITS

Throughout the United States, many of the ITS programs and projects similar to those included in this Strategic Deployment Plan have demonstrated significant improvements in transportation efficiency and safety, including the following (Intelligent Transportation Infrastructure Benefits: Expected and Experienced, FHWA, January 1996):

***Freeway Management Systems***

- 20 to 40 percent reductions in travel times
- 17 to 25 percent increases in freeway capacity
- 15 to 50 percent reductions in accidents
- reductions in fuel consumption and emissions

***Traffic Signal Control Systems***

- 8 to 15 percent reductions in travel time
- 6 to 12 percent reductions in fuel consumption
- 4 to 13 percent reductions in emissions

***Incident Management Programs***

- 10 to 42 percent reductions in travel time
- reductions in incident clearance times of up to 8 minutes

***Traveler Information Systems***

- reductions in travel times of up to 17 minutes under incident conditions
- 6 to 12 percent reductions in fuel consumption
- reductions in emissions of up to 25 percent

***Transit Management Systems***

- 15 to 18 percent reductions in travel times
- 12 to 23 percent increases in service reliability

# SUMMARY OF RECOMMENDATIONS

## FREEWAY/INCIDENT MANAGEMENT SYSTEM PROJECTS

**Regional Freeway/Incident Management System:**

- Initial system
- Expanded system
- Ultimate system

**Other Regional Projects/Activities:**

- Service Patrols
- Major Generator Traveler information Systems
- Portable Traffic Management System
- Hotline Incident Reporting System
- Changeable Message Signs
- Closed-Circuit Television Cameras
- Vehicle Detectors
- Highway Advisory Radio
- Enhanced Reference Markers
- Ramp Metering Feasibility Study

## ADVANCED TRAFFIC SIGNAL CONTROL SYSTEM PROJECTS

**Coordinated Traffic Signal System Improvements:**

- Years 1-2 (Phase 1)
- Years 3-5 (Phase 2)
- Years 6-10 (Phase 3)
- To be determined Years 11-20 (Phase 4)

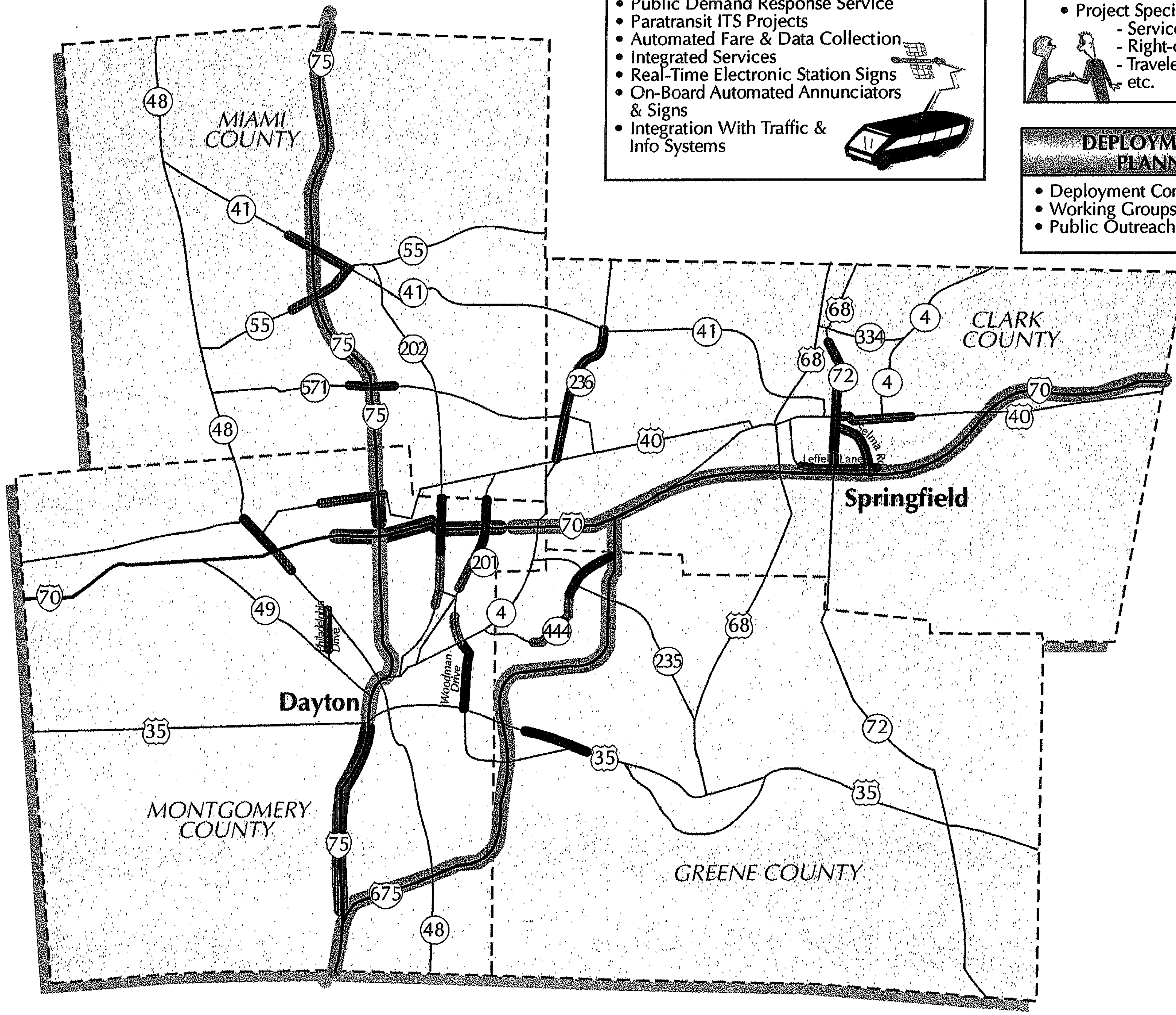
- Interjurisdictional Cooperation
- Remote Monitoring/ Optimization Capabilities

**Other Regional Traffic Signal Projects/Activities:**

- Timing Plan Updates
- Microprocessor Controller Conversions
- Highway/Railroad Intersection Improvements
- Emergency Vehicle Preemption Feasibility Study
- Freeway Traffic Diversion Timing Plans
- Special Event Timing Plans & Procedures

## MULTI-MODAL TRAVELER INFORMATION SYSTEM PROJECTS

- Central Information Processing System
- Enhanced Media Coordination
- Automated Telephone Info Line
- Cable Television
- Internet Site
- In-Vehicle Devices
- Kiosks
- Pagers
- Pavement & Weather Sensing System




## PUBLIC TRANSIT PROJECTS

- Automatic Vehicle Location
- Transfer Coordination
- Public Demand Response Service
- Paratransit ITS Projects
- Automated Fare & Data Collection
- Integrated Services
- Real-Time Electronic Station Signs
- On-Board Automated Annunciators & Signs
- Integration With Traffic & Info Systems

## PUBLIC-PRIVATE PARTNERSHIP OPPORTUNITIES

- Requests for Partnership Proposals
- Education & Outreach Program
- Project Specific Partnerships:
  - Service Patrols
  - Right-of-Way Leases
  - Traveler Information Systems
  - etc.

## DEPLOYMENT TECHNICAL & PLANNING SUPPORT

- Deployment Committees
- Working Groups
- Public Outreach & Education

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EARLY DEPLOYMENT PLAN

MVRPC
Miami Valley Regional Planning Commission

BRW, Inc.,
October, 1997

BRW

Using these and other data from ITS deployments throughout the world, the potential benefits of implementing the first five years of the Miami Valley ITS Strategic Deployment Plan were estimated in terms of benefit-cost ratios for the four "'project-oriented" program areas (Program Areas 1 through 4) and for the overall ITS program. As shown in Table S. 1, the recommended ITS program will generate over $400 million in benefits over the first five years by reducing travel delay, fuel usage, vehicle emissions and accidents, nearly eight times the cost of the program.

**TABLE S.l**
**SUMMARY OF OVERALL PROGRAM COSTS AND BENEFITS**
**(YEARS 1-5)**

| | Years l-5 | | |
|---|---|---|---|
| **Program Area** | Total **Benefit ($000)** | **Total Cost ($000)** | **B/C** Ratio |
| Freeway/Incident Management | $99,519 | $17,205 | 5.8: 1 |
| Advanced Traffic Signal Control | $23 1,723 | $6,05 1 | 383:l |
| Public Transportation System | $28,637 | $22,26 1 | 1.3:l |
| Multi-Modal Traveler Information | $76,154 | $4,347 | 17.5:1 |
| **Total ITS Program:** | $436,033 | $49,864 | 8.7:1 |

Source: BRW, Inc., July 1997

## SHORT TERM IMPLEMENTATION COSTS

Implementation, operating and maintenance and staffing costs were estimated for the first five years of the recommended regional ITS deployment. The cost estimates assume no private sector contributions, although there are a number of opportunities for private sector involvement and cost sharing arrangements, as discussed in Program Area 5.

As shown on Table S.2, the recommended program will cost approximately $49 million over the first five years. Public sector staffing requirements will increase over the first five years from approximately seven full-time equivalent positions in year 1 to approximately 2 1 positionsin year 5. These labor requirements reflect all agency participation in the regional ITS program, including operations, project management and participation in regional deployment committees, as described below.

## MOVING TOWARD IMPLEMENTATION

Development of the Miami Valley ITS Strategic Deployment Plan has required significant cooperation and coordination between all agencies within the region. These strong institutional relationships will need to continue as the program plan proceeds into the deployment stage.

## TABLE S.2
### Summary of Year 1 - 5 Miami Valley ITS - Conceptual Implementation Costs by Program Area

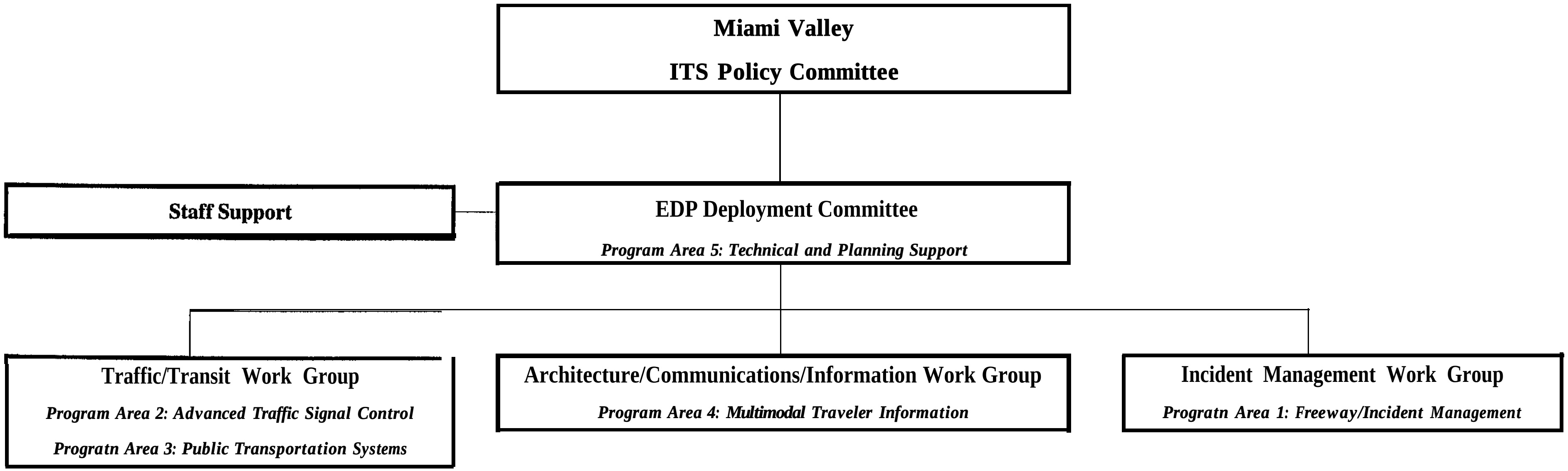
| Program Area & Projects | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|
| **Program Area 1.0 Freeway/Incident Management Systems** | | | | | | |
| Design/Study & Construction | $934,400 | $3,177,000 | $2,465,000 | $2,975,000 | $4,6 10,000 | $14,161,400 |
| Operations and Maintenance | $15,000 | $40,400 | $261,800 | $361,900 | $519,900 | $1,199,000 |
| *Total Costs* | $949,400 | $3,217,400 | $2,726,800 | $3,336,900 | $5,129,900 | $15,360,400 |
| **Program Area 2.0 Advanced Traffic Signal Control Systems** | | | | | | |
| Design/Study & Construction | $1,082,500 | $1,132,500 | $1,245,000 | $1,120,000 | $1,133,000 | $5,713,000 |
| Operations and Maintenance | $0 | $0 | $0 | $0 | $0 | $0 |
| *Total Costs* | $1,082,500 | $1,132,500 | $1,245,000 | $1,120,000 | $1.133,000 | $5,7 13,000 |
| **Program Area 3.0 Public Transportation Systems** | | | | | | |
| Design/Study & Construction | $1,006,250 | $2,381,250 | $5,815,800 | $5,515,800 | $4,457,550 | $19,176,650 |
| Operations and Maintenance | $0 | $95,625 | $315,000 | $871,580 | $1,410,660 | $2,692,865 |
| *Total Costs* | *$1,006,250* | $2,476,875 | $6,130,800 | $6,387,380 | $5,868,210 | $21,869,515 |
| **Program Area 4.0 Multimodal Traveler Information System** | | | | | | |
| Design/Study & Construction | $600,000 | $595,000 | $854,000 | $948,000 | $538,000 | $3,535,000 |
| Operations and Maintenance | $47,760 | $53,940 | $74,040 | $99,840 | $99,840 | $375,420 |
| *Total Costs* | $647,760 | $648,940 | $928,040 | $1,047,840 | $637,840 | $3,910,420 |
| **Program Area 5.0 Public - Private Partnerships** | | | | | | |
| *Total Costs* | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $350,000 |
| *Note: All costs shown for Program Area 5 are for Study/Design* | | | | | | |
| **Program Area 6.0 Technical and Planning Support** | | | | | | |
| *Total Costs* | $250,000 | $375,000 | $350,000 | $350,000 | $350,000 | $1,675,000 |
| *Note: All costs shown for Program Area 6 are for Study/Design* | | | | | | |
| **PLAN TOTAL** | | | | | | |
| Design/Study & Construction | $3,623,150 | $7,285,750 | $10,379,800 | $10,558,800 | $10,738,550 | $42,586,050 |
| Operations and Maintenance | $62,760 | $189,965 | $650,840 | $1,333,320 | $2,030,400 | $4,267,285 |
| *Total Costs* | $4,005,910 | $7,920,715 | $11,450,640 | $12,312,120 | $13,188,950 | $48,878,335 |

Source: BRW, Inc., September 1997

All Costs Assume 100% Public Funding (Assumes No Private Sector Contributions)

Figure S-2

## Proposed ITS Program Management Structure



# MIAMI VALLEY ITS

## INTRODUCTION

# 1.0 INTRODICTION

The problems of urban traffic congestion and air quality are of national concern. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 established national goals for the development and implementation of advanced technologies to address these problems through coordinated programs. The term IVHS has since been renamed to Intelligent Transportation Systems (ITS) to reflect the multi-modal nature of the program. This report presents an integrated, multi-modal, phased strategic deployment plan to address the surface transportation needs and problems of Clark, Greene, Miami and Montgomery Counties, Ohio, through the use of Intelligent Transportation Systems. A map of the study area is presented in Figure l-l.

## 1.1 ORIGIN OF THE PLAN

The process which has culminated in the publication of this ITS Strategic Deployment Plan (SDP) began March 9, 1993 with the Federal Register publication of the Federal Highway Administration (FHWA) announcement of procedures for implementing the Strategic Deployment Program. In July 1994, the Miami Valley Regional Planning Commission (MVRPC) submitted to the FHWA an "Expression of Interest in the FHWA IVHS Strategic Deployment Program for the Dayton/Springfield Area," a request for funding under the FHWA IVHS Strategic Deployment Program.

The request for funding was approved by the FHWA. On January 12,1996 the MVRPC issued a Request for Proposals (RFP) to conduct the Dayton/Springfield Area ITS Strategic Deployment Program study. Proposals to conduct the study were submitted from several teams of private planning and engineering consultants on February 13, 1996. The most qualified consultants, as determined by the written proposals, were identified and in person interviews were conducted on April 10, 1996.

The BRW, Inc. project team was selected to conduct the study and a contract was executed in May, 1996. The study formally began in June 1997. Shortly after the beginning of the study, the working name of the project was changed from "Dayton-Springfield Area" to "Miami Valley" ITS Strategic Deployment Plan, in recognition of the broader scope of the study.

## 1.2 SDP TEAM

The Miami Valley Regional Planning Commission led the Miami Valley ITS Strategic Deployment Plan team. The team included the following groups:

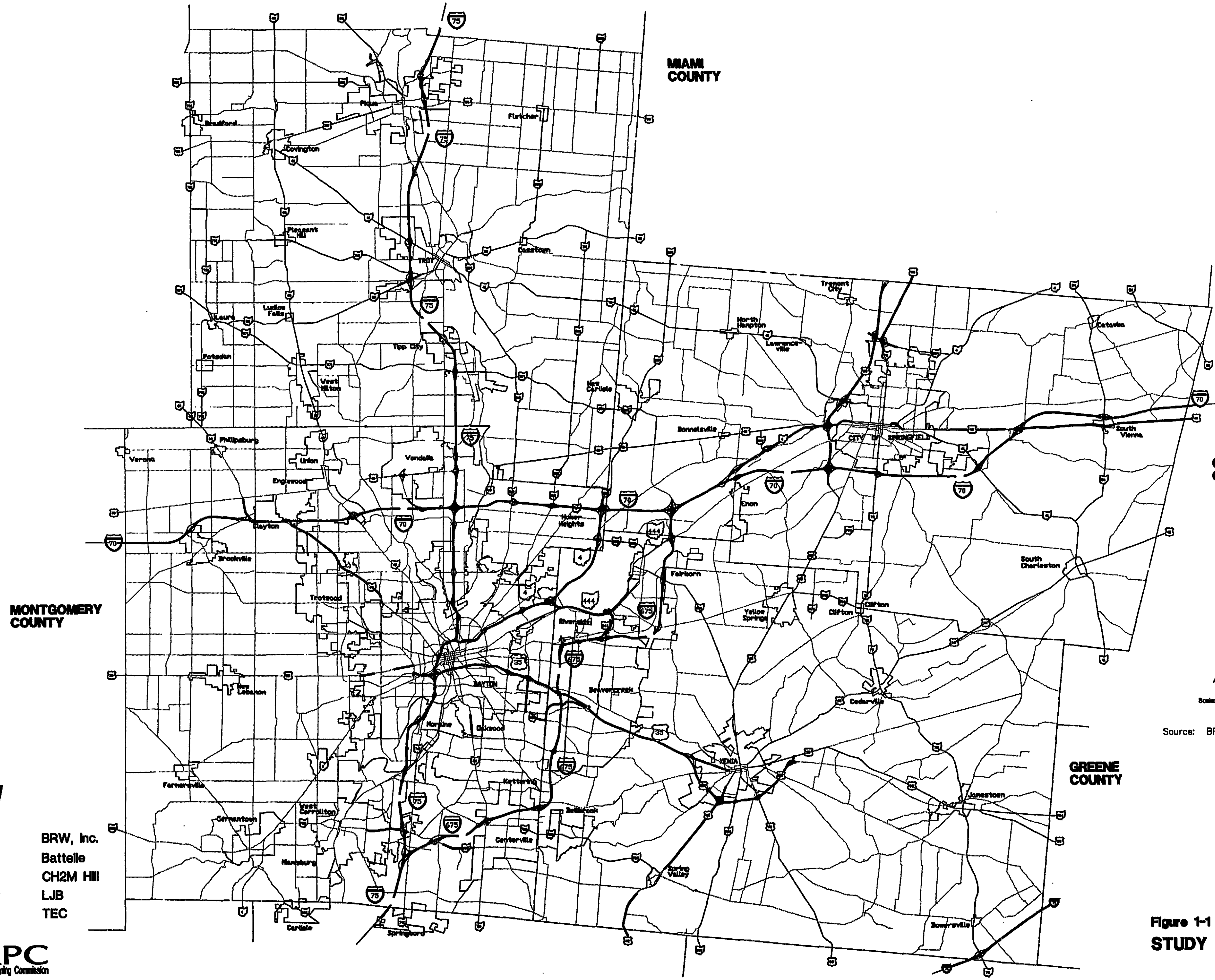
1. Policy Committee
2. Technical Committee
3. Consultant Team

The Policy Committee set the strategic direction for and coordinated all activities of the SDP development effort. The Policy Committee was composed of 11 individuals representing the following organizations:

- Miami Valley Regional Planning Commission
- Clark County-Springfield Transportation Coordinating Committee
- Federal Highway Administration - Ohio Division
- Ohio Department of Transportation - Central Office
- Ohio Department of Transportation - District 7
- Ohio Department of Transportation - District 8
- City of Dayton
- City of Kettering
- City of Moraine

The Technical Committee was formed in order to assure broad jurisdictional and multimodal participation in the development of the SDP. The Technical Committee participated in all major SDP planning activities and reviewed all major work products. The Technical Cornmittee included all of the members of the Policy Committee plus 32 additional individuals representing the following organizations:

- Butler Township
- City of Beavercreek
- City of Centerville
- Clark County
- City of Englewood
- City of Fairbom
- Greene County
- Harrison Township
- City of Huber Heights
- Jet Express
- League of Women Voters
- Miami County
- Miami County Community Action Council
- Miami-Liberty Cab Company
- Miami Township
- Miami Valley Regional Transit Authority
- Montgomery County
- Ohio Bicycle Federation
- City of Piqua
- City of Springfield
- Springfield Bus Company
- City of Troy
- City of Vandalia
- Washington Township
- City of West Carrollton
- City of Xenia




NORTH
Scale: 1" = 25,000'

Source: BRW, Inc. May 1997

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BRW, Inc.
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TEC

MVRPC
Miami Valley Regional Planning Commission

**Figure 1-1**
**STUDY AREA**

study.dwg 8-7-97

The private consulting team employed by MVRPC to assist in the preparation of the SDP consisted of:

- BRW, Inc. (prime consultant)
- Battelle Memorial Institute
- CH2M Hill
- Lockwood, Jones & Beals, Inc.
- TEC Engineering, Inc.

## 1.3 FHWA ITS DEPLOYMENT PROCESS

Intelligent Transportation Systems represent an approach to serving transportation needs and resolving transportation problems through an inter-modal, strategic approach which applies advanced and emerging technologies. Preparation of the Miami Valley ITS SDP has followed the ten step ITS Planning Process developed by the Federal Highway Administration. This process is illustrated in Figure 1-2.

The federal ITS planning and deployment process emphasizes the significance of a strategic approach, a user-needs perspective and a strong institutional coalition. The deployment of ITS should be structured and strategic in order to protect against the inefficient allocation of resources and to ensure that ITS potential can be fully realized. Deployment should be based upon solving local user needs rather than simply looking for opportunities to utilize new technologies. Finally, successful deployment depends upon the development of an institutional framework and coalition of transportation agencies and other stakeholders. Such a coalition and the cooperation it fosters help ensure that each agency's needs, constraints, opportunities and responsibilities are addressed and that the resulting system meets the needs and expectations of each agency and the public.

## 1.4 DEVELOPMENT OF THE SDP

The development of the Miami Valley SDP closely followed the ten step FHWA deployment planning process. The major activities of the planning effort are summarized in the sections which follow.

### 1.4.1 Agency and Stakeholder Coordination and Outreach

The Policy and Technical Committees developed the Miami Valley ITS SDP in a coordinated manner with multi-jurisdictional and multimodal involvement. During the course of the SDP study, the two committees met 11 times to develop goals and objectives, review needs and problems, discuss proposed program areas and priorities, and approve the SDP.

A broad range of transportation stakeholders in the region were kept informed of and involved in the SDP development through workshops and newsletters. Workshops were held to inform and solicit input and workshop participants were provided an opportunity to review draft SDP products and identify and-discuss information specific to their concerns.

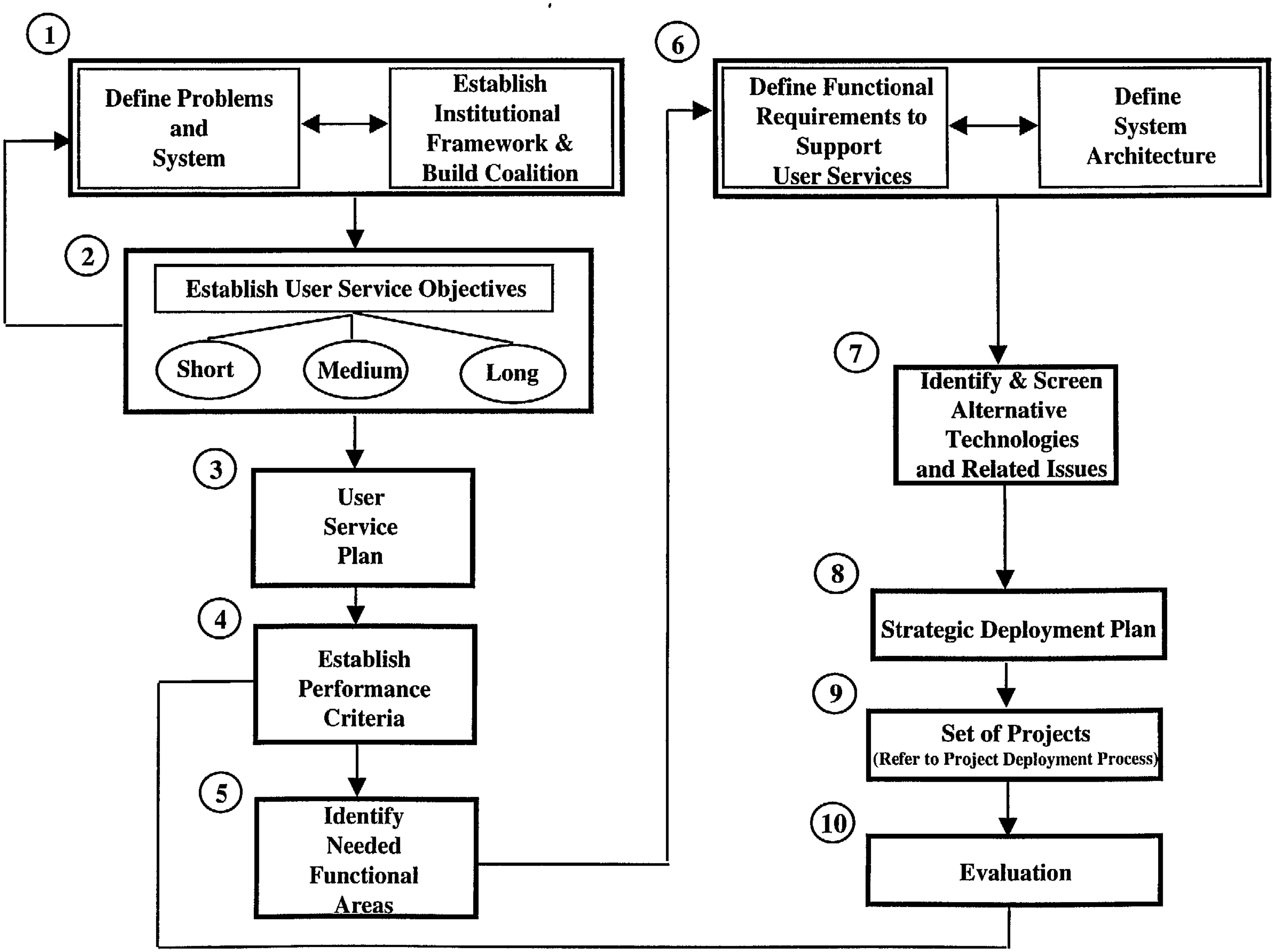



**Figure 1-2**

# FHWA ITS Planning Process

Source: "IVHS Planning and Project Deployment Process", FHWA, April 1993

Two outreach workshops were held, one on November 7,1996 and one on May 1, 1997. The first workshop described the study to participants and elicited their comments on needs, problems and potential solutions. The second workshop focused on the draft projects developed by the consultant team in conjunction with the Policy and Technical Committees. Both workshops were held at the MVRPC in Dayton.

Three newsletters were published during the course of the study. The first newsletter was published in October 1996. It announced the study, a schedule of activities, and provided a brief introduction to ITS services. The second newsletter was published in April of 1997. This newsletter summarized the conclusions of the needs assessment and user service prioritization activities and presented the draft program areas which have been used to organize specific projects.

The third newsletter was published in August of 1997. This newsletter provided an executive summary of the report and an outline of the next steps for Miami Valley ITS deployment. Five hundred copies of each newsletter were printed and distributed using a list of area transportation stakeholders as identified by the MVRPC. Invitations to the outreach workshops were distributed via the newsletters.

### 1.4.2 Transportation Systems and Facilities Inventory

Prior to the assessment of specific transportation needs and deficiencies and the identification of ITS opportunities, an inventory was made of the elements of the transportation system that are most relevant to ITS, including existing methods of traveler information dissemination, incident management, traffic signal control and freeway management. This inventory focused on identifying existing technological components and architectures which can form the foundation for regional ITS deployment. The results of the inventory are presented in the ***User Service Plan*** (July 1997).

### 1.4.3 Opportunities and Deficiencies Assessment

The opportunities and deficiencies identification process was two-pronged, featuring both qualitative and quantitative activities. The qualitative assessment of regional problems, issues and perspectives included a widely distributed project newsletter, interviews with local transportation agency staff, a regional survey of transportation stakeholders, and a public Outreach Workshop. The quantitative assessment of regional transportation conditions centered on the development of maps and tables summarizing area freeway/interstate and major arterial street deficiencies and issues. The following data was collected and mapped for all area freeway segments and important arterial streets:

- existing congestion (daily level of service);
- forecasted congestion;
- safety (accident rates); and
- roadway design deficiencies.

Each type of data was added as a layer to a single map, yielding a composite map where the magnitude of deficiencies was established based on the presence or absence of the various layers. The deficiencies assessment process is summarized in Section 2.0 of this report and presented in detail in the *User Service Plan* (July 1997).

### 1.4.4 Assessment of Technologies and Development of a System Architecture

Separate Working Papers were prepared which assessed ITS technologies and developed a system architecture for the recommended Miami Valley ITS. The technology assessment identified candidate technologies to perform required ITS functions and compared the technologies in terms of cost and performance. The technology assessment is presented in detail in the *Technologies Analysis Working Paper* (March 1997). The system architecture is summarized in Section 5.0 of this report and is documented in detail in the *Functional Needs, Requirements and Preliminary System Architecture Working Paper* (January 1997) and in *the Recommended System Architecture and Technologies Working Paper* (August 1997).

### 1.4.5 Development of Projects

The central element of the Miami Valley ITS Strategic Deployment Plan is the programs and projects that will be deployed to deliver ITS user services. An iterative and interactive approach was used to identify and develop programs and projects for the SDP.

The first step in the development of specific program areas and projects began with a special two-day workshop with the Policy and Technical Committees. The purpose of the workshop was to identify and prioritize the specific user services appropriate for early deployment in the Miami Valley and to preliminarily rank the effectiveness/attractiveness of specific ITS projects and applications. This prioritization was based upon the results of the qualitative and quantitative opportunities and deficiencies assessment process. The workshop included many presentations and interactive voting and discussion activities. These activities yielded the following:

- a prioritized list of the most significant transportation problems in the Miami Valley;
- a prioritized ranking of the ITS user services most appropriate to address those problems;
- a list of overriding factors to guide the development of all of the specific programs and projects included in the SDP; and
- a prioritized list of potential ITS projects/strategies for further investigation and development.

In the months following the workshop, several drafts of potential projects were developed and refined based on Policy and Technical Committee input, resulting in the program area and project descriptions presented in Section 6.0 of this report.

### 1.4.6 Development of the Strategic Depoyment Plan

The final step in the development of the Strategic Deployment Plan was the production of this final report and the elements necessary to move the plan into the deployment stages. In the fmal stages of the study, strategies were established for the implementation of the plan, including a recommended ITS program management structure, roles and responsibilities (Section 9.0 of this report).

## 1.5 ACCOMPANYING DOCUMENTS

Several documents were produced which support this ITS Strategic Deployment Plan. These documents consist of the following:

- *Functional Needs, Requirements and Preliminary System Architecture Working Paper* (January 1997)
- *Technologies Analysis Working Paper* (March 1997)
- *Recommended System Architecture and Technologies Working Paper* (August 1997)

## 1.6 VISION, GOALS AND OBJECTIVES

One of the initial steps in the development of the Miami Valley ITS Strategic Deployment Plan was to identify a vision of eventual ITS deployment, a destination to be reached via the road map represented by the Strategic Deployment Plan. Along with the development of this vision a list of goals and associated objectives were developed to help guide the preparation of the plan.

### 1.6.1 Vision Statement

*The vision for the Miami Valley is one of enhanced transportation productivity, mobility, efficiency and safety within the region with a reduction in energy use and improvement in the environment through the use of cost effective ITS technologies and systems.*

The vision starts with mutual cooperation between agencies and jurisdictions within the region to plan and implement advanced ITS technologies. The vision is an integrated approach to solve transportation problems. The vision seeks to improve the use of existing infrastructure and the choices of users and operators. The vision approaches problems that can be effectively addressed with the resources available within the region.

The vision for the Miami Valley applies to all single and multimodal users who travel within and those who travel through the area. The vision is also for transportation operators and agencies, and the surrounding community. The vision for the region includes the following elements:

- **Evolution**
  The implementation of ITS technologies within the Miami Valley will occur in an evolutionary manner. They will be introduced gradually as the costs and benefits of the technologies are demonstrated and justified for the region.

- **Travel Information**
  Information regarding the transportation system within the Miami Valley will be immediately available to users and operators through a variety of devices such as television, radio, personal computers at home and at work, public kiosks, handheld mobile devices, roadway signage and other interactive communication devices. Users and operators will be able to inquire and receive information about current and expected traffic conditions, travel times, incidents and alternative routes. Users and operators will be also able to inquire and receive information about transit status and schedules. This information will allow users to make informed decisions about when to leave, how to travel, and what route to take.

- **Traffic Management**
  The traffic on selected Miami Valley routes will be monitored and controlled through an integrated system. Integrated systems will control arterial and freeway operations, monitor and make adjustments to lane usage, speed limits, ramp access and traffic signals. The goal of an area-wide system is to maximize the efficiency of the overall network based on actual conditions. In cooperation with travel information systems, traffic control operators can notify users of current or changing conditions and thereby redirect traffic or set drivers' expectations for safer more efficient flow. An incident management system will identify incidents, dispatch the appropriate response services, and serve to remove and mitigate the effects of incidents throughout the area.

- **Commercial Operations**
  In coordination with national and regional initiatives, commercial carriers will be able to drive through the region with minimal delays. Commercial carriers will have access to traveler information systems that can assist with routing, scheduling and dispatching optimization.

- **Electronic Payment Services**
  Devices will allow users to electronically pay fares and fees with a minimum amount of delay. Payment systems will collect fares and fees from users and operators in an integrated manner with other collection systems.

- **Travel Demand**
  Users who wish to ride share can immediately determine potential candidates and dynamically create car pools. Devices such as smart cards, public kiosks and personal digital assistants will allow users to communicate with each other and work together to reduce the number of vehicles on the roadway. ITS technologies will allow for detailed traffic data collection and analysis. This information can support demand management techniques such as congestion pricing and large employer travel management.

- **Transit Systems**
  Public transportation will be more attractive by offering faster service resulting from traffic signal priority at selected locations and control of special ramps or lanes. Service will also be improved through the use of technology to track vehicles, accurately maintain schedules, predict demand and operate fleets more efficiently with a minimum of downtime and delay. Users of transit systems can be informed immediately on the status of their chosen route using a variety of devices such as telephones with services such as audiotext, public kiosks, personal computers and personal digital assistants. Users will be encouraged to use transit systems through improved information and easier access to information. Fare collection will be made easier and more accessible through addressing policies and barriers.

- **Vehicle Tracking**
  Systems will monitor and track the status of commercial carriers, transit operators, emergency and service vehicles, and hazardous material carriers. These systems will allow operators to efficiently schedule their services, monitor on-time performance, and quickly respond to user needs.

- **Emergency Management**
  Devices will notify authorities of the need for dispatching emergency vehicles to the site of a collision or incident. Systems will coordinate the response from fire, police and medical agencies resulting in fast response in the most appropriate manner. Other systems will coordinate the removal of incidents to promote the timely return of the travel network to peak performance.

- **Navigation**
  Systems and on-board devices will assist drivers with planning and following safe and efficient routes throughout the Miami Valley. These devices will also provide local information such as services and attractions.

- **Pollution**
  Air pollution will be reduced through improved efficiency and use of transportation systems including demand management strategies. Dynamic ride-sharing systems will encourage the use of high occupancy vehicles. Traveler information systems will decrease the number of vehicle miles traveled through better planning. Public transportation systems will improve information available to users which will increase the use of public transit services. . Traffic management systems will improve the flow of vehicles and reduce the level of pollution. Detection systems will monitor vehicle emissions and support enforcement efforts.

- **Cooperation**
  The future of transportation in the Miami Valley starts with the mutual cooperation among transportation agencies within the region. All agencies from the Ohio Department of Transportation (ODOT) to city traffic agencies to local fire, police and medical service providers will work together to promote and encourage the most productive and safest operation of the transportation network. These agencies will work together to plan, design, implement and operate ITS systems in a cooperative and mutual manner.

- **Institutional Issues and Barriers**
  Barriers to deploying ITS technologies and arrangements will be researched and identified. Legislative initiatives will be developed and submitted where appropriate to reduce barriers, resolve privacy concerns and encourage arrangements such as public/private partnerships.

## 1.6.2 Goals and Objectives

Table 1.l presents the goals and associated objectives for the Miami Valley ITS Strategic Deployment Plan.

**TABLE 1.1**
**GOALS AND OBJECTIVES**

| Goal | Objectives |
|---|---|
| 1. To create a state-of-the-art ITS transportation system | • To establish an ITS architecture that:<br>- Is open, receptive and adaptable to meet future area architecture and field test needs.<br>- Is consistent to the maximum degree possible with developing national standards.<br>• To develop and integrate the following systems throughout the area as appropriate:<br>- Travel and Traffic Management<br>- Public Transportation Management<br>- Electronic Payment Services<br>- Commercial Vehicle Operations<br>- Emergency Management |
| 2. To enhance productivity | • To reduce the travel delay and increase the reliability and predictability of moving people and goods for all transportation users.<br>• To improve the ability of users and operators to perform travel planning using real-time travel information.<br>• To reduce the operational costs to operators incurred from poorly operating transportation facilities.<br>• To reduce the scheduling and processing delays and costs to users and operators associated with the regulation of vehicles.<br>• To reduce the costs and improve the quality of data collection for transportation system planning, use, operations, maintenance and installations. |
| 3. To improve safety | • To reduce the number and severity of motor vehicle collisions and associated injuries and fatalities.<br>• To improve the average response time of emergency services.<br>• To improve the ability to identify, respond, remove and/or mitigate the effects of incidents.<br>• To improve the tracking of hazardous material movements, and the response to and mitigation of the effects due to loss of containment situations.<br>• To enhance personal security on all modes of transportation. |

| Goal | Objectives |
|---|---|
| 4. To reduce energy consumption and improve the environment | • To increase the use of public transit and other shared ride alternatives.<br>• To reduce harmful emissions per unit of travel for all transportation modes.<br>• To maintain and improve air quality standards.<br>• To reduce the energy consumption per unit of travel for all transportation modes.<br>• To reduce the need for new right-of-way requirements and related community disruption associated with transportation facility improvements. |
| 5. To enhance mobility and accessibility | • To improve the accessibility and availability of travel options information to users of all transportation facilities.<br>• To reduce the variability and to simplify the use of public transportation.<br>• To improve the predictability of travel time for all transportation modes.<br>• To reduce the complexity of scheduling and fee collection procedures for operators and users of intermodal facilities. |
| 6. To increase efficiency | • To reduce congestion and associated costs.<br>• To optimize the operational efficiency of goods and people movement on existing facilities.<br>• To increase average vehicle occupancy.<br>• To reduce time lost in intermodal interchange.<br>• To increase capacity of existing infrastructure through ITS Deployment. |

- Source: BRW, Inc., May 1997

# MIAMI VALLEY ITS

## Opportunities and Deficiencies

# 2.0 OPPORTUNITIES AND DEFICIENCIES ASSESSMENT

## 2.1 OVERVIEW

This section summarizes the results of the Opportunities and Deficiencies Assessment. Detailed results are presented in the *User Service Plan* (July 1997).

The opportunities and deficiencies identification process was two-pronged, featuring both qualitative and quantitative activities. The qualitative assessment of regional problems, issues and perspectives included a widely distributed project newsletter, interviews with local transportation agency staff, a regional survey of transportation stakeholders, and a public Outreach Workshop. The quantitative assessment of regional transportation conditions centered on the development of maps and tables summarizing area freeway/interstate and major arterial street deficiencies and issues.

## 2.2 QUALITATIVE ASSESSMENT ACTIVITIES

### 2.2.1 Newsletters

Three project newsletters were mailed to approximately 400 study area transportation stakeholders representing a wide range of interests. The newsletters educate and solicit input and represent one of the tools of the qualitative deficiencies assessment. In October 1996 the first Miami Valley ITS Newsletter was sent out to inform potential stakeholders of the ITS Strategic Deployment Plan development process and to invite them to the first of two Outreach Workshops, described below. A second newsletter was distributed in April 1997 which included updates on the status of the project and summaries of recommended program areas. The final project newsletter was distributed in October 1997 and summarized this Strategic Deployment Plan.

### 2.2.2 User Needs Survey

Over 200 surveys were distributed to transportation systems users and operators. Individuals receiving the survey represent motorized modes of transportation including transit, highways, trucking, aviation, and intercity bus. Thirty-seven (37) returned surveys resulted in a 19 percent response rate.

The survey addressed problem areas, problem area suggestions, user needs, and ITS project ideas. Survey results are presented in Tables 2.1 through 2.4. Table 2.1 shows the results of the problem area ranking exercise. As shown in Table 2.1, when asked to rank a pre-defined list of potential problems, highway congestion, highway safety and commercial vehicle hazardous materials routing were ranked as the most significant.

Table 2.2 shows the results of the "fill in the blank" problem identification portion of the survey. As indicated, highway congestion, inadequate/unsafe roadway design, and lack of signal timing coordination were the most frequently reported problems. Lack of traveler information was also identified as a problem.

Table 2.3 shows the results of the user needs portion of the survey, where respondents were asked to rate the priority of the 30 ITS User Services identified by the United States Department of Transportation. As shown in Table 2.3, hazardous materials incident response, traffic control and incident management scored highest.

Table 2.4 lists the ITS project suggestions which were identified by survey respondents. As indicated, the suggestions covered a wide range of ITS services and include many of the specific applications which are being deployed successfully nationally.

### 2.2.3 Stakeholder Interviews

Representatives of the following 23 area public and private transportation organizations were interviewed between October 2, 1996 and October 30, 1996:

- City of Beavercreek
- Clark County Engineering
- CCSTCC
- Dayton International Airport
- City of Dayton Fire Department
- City of Dayton Police Department
- City of Dayton Traffic Engineering
- Federal Highway Administration
- Greene County Engineering
- Jet Express
- City of Kettering
- Miami Valley Regional Transit
- Authority
- Montgomery County
- City of Moraine
- ODOT (Central)
- ODOT (District 7)
- ODOT (District 8)
- ODOT (CVO)
- Ohio Trucking Association
- Ohio Public Utilities Commission
- City of Springfield
- Springfield Bus Company
- Wright State University

The purpose of the interviews was to identify agency goals and responsibilities, transportation problems in the Miami Valley, ITS technologies already in use, ITS funded projects, and to-discuss projects or suggestions that might improve the Miami Valley transportation system. Interviews provided an opportunity to solicit detailed comments from agency representatives that might not be expressed through the other outreach efforts such as the surveys and workshops.

**TABLE 2.1**
**USER NEEDS SURVEY**
**PROBLEM AREA RATINGS**

| Problem Area | Problem | Average Rating | Number of Responses |
|---|---|---|---|
| Highway | ***Safety*** | 2.9 | 34 |
| Highway | Congestion | 2.9 | 34 |
| Commercial Vehicles | Hazardous Material Routing | 2.8 | 19 |
| Local Bus Systems | Status Information | 2.7 | 11 |
| Commercial Vehicles | Hazardous Material Response | 2.6 | 19 |
| Intercity Bus/Rail | Safety/Security | 2.6 | 7 |
| Highway | Air Pollution | 2.5 | 32 |
| Highway | Access | 2.5 | 33 |
| Local Bus Systems | Travel Time | 2.5 | 11 |
| Commercial Vehicles | Weight Checking | 2.5 | 15 |
| Commercial Vehicles | Regulations | 2.4 | 16 |
| Commercial Vehicles | Safety Inspections | 2.4 | 16 |
| Highway | Emergency Response | 2.4 | 28 |
| Local Bus Systems | Safety/Security | 2.4 | 10 |
| Intercity Bus/Rail | Travel Time | 2.4 | 7 |
| Local Bus Systems | Scheduling and Route Information | 2.3 | 12 |
| Highway | Road and Weather Condition Info. | 2.3 | 32 |
| Highway | Travel Time Information | 2.3 | 31 |
| Highway | Travel Time | 2.2 | 33 |
| Local Bus Systems | Scheduling | 2.2 | 12 |
| Intercity Bus/Rail | Status Information | 2.2 | 6 |
| Intercity Bus/Rail | Scheduling | 2.2 | 5 |
| Highway | Car Pooling Coordination | 2.1 | 25 |
| Commercial Vehicles | Fleet Routing | 2.1 | 15 |
| Intercity Bus/Rail | Schedule and Route Information | 2.1 | 8 |
| Highway | Personal Security | 1.9 | 27 |
| Highway | Noise | 1.9 | 31 |
| Intercity Bus/Rail | Operations | 1.8 | 4 |
| Intercity Bus/Rail | Fleet Management | 1.8 | 4 |
| Local Bus Systems | Operations | 1.6 | 8 |
| Local Bus Systems | Fleet Management | 1.5 | 8 |
| Local Bus Systems | Fare Collection | 1.2 | 10 |

**1 Out of 37 surveys returned**

**Rating Categories:**
1 = Not a Problem
2 = Occasional Problem
3 = General Problem
4 = Significant Problem
5 = Very Significant Problem

***Source: BRW; Inc., May 1997***

**TABLE 2.2**
**USER NEEDS SURVEY**
**TOP FIVE PROBLEMS FREQUENCY OF RESPONSE**

| Area | Problem | Frequency |
|---|---|---|
| Highway | Congestion | 20 |
| Highway | Inadequate/Unsafe Roadway Design | 12 |
| Highway | Lack of Signal Timing Coordination | 7 |
| Highway | Traveler Information | 6 |
| Highway | Incident Management/Emergency Response | 6 |
| Highway | Access Control | 5 |
| Transit | Insufficient Transit Service | 5 |
| Highway | Excessive Speed | 4 |
| Highway | Road Construction Management/Coordination | 3 |
| Highway | Additional Width/Lanes Needed | 3 |
| Highway | Inadequate Snow Removal | 2 |
| Highway | No Park and Ride Options | 2 |
| Institution | Overdependence on Automobiles, Subsidized Automobile Use | 2 |
| Highway | Construction Caused Congestion and Accidents | 2 |
| Transit | Alternative Transportation Option (foot, Bicycle or Transit) | 2 |
| Institution | Licensing Standards for Drivers Are Too Low, More Education Needed | 2 |
| Highway | Capacity Constraints | 2 |
| Highway | Lack of Alternative Routes | 2 |
| Commercial | Truck Traffic | 2 |
| Highway | Interchange Needed | 1 |
| Highway | Lack of Traffic Signals | 1 |
| Transit | Lack of Options for Intercity Commercial Aviation Service | 1 |
| Highway | Lack of Protected Left Turns | 1 |
| Transit | Lack of Light Rail to Airport | 1 |
| Highway | Lack of Routes to West Dayton | 1 |
| Commercial | Safe and Efficient Movement of Trucks | 1 |
| Highway | Too Many Traffic Signals | 1 |
| Highway | Police Pursuits, Technology to shut Engines of fleeing Cars | 1 |
| Highway | Weather Advisory for Motorist | 1 |
| Highway | Varying Speed Limits | 1 |
| Highway | Cruising on Main Street | 1 |
| Transit | Alternative Transportation Information | 1 |
| Institution | Intermodal Coordination | 1 |
| Highway | Manintaining Ozone Attainment Status | 1 |
| Highway | Frequent Lane Changes Required to Go Downtown | 1 |
| Highway | Identification of High Hazard Crash Locations | 1 |
| Institution | Need to Plan Ahead of Development | 1 |
| Highway | Maintaining Existing Infrastructure | 1 |
| Highway | Lack of emergency (Incident) Information System | 1 |
| Transit | Lack of Public Transit Ridership, Need a Safer Transit Environment | 1 |
| Transit | Intercity Rail | 1 |
| Highway | congestion Pricing | 1 |
| Highway | Problem Areas on Interstate 75 | 1 |

*Source: BRW, Inc., May 1997*

## TABLE 2.3
## USER NEEDS SURVEY
## USER NEED PRIORITIES

| User Need Area | User Need | Average Priority | Number of Responses [1] |
|---|---|---|---|
| Commercial Vehicle Services | Hazardous Material Incident Response | 4.3 | 32 |
| Travel and Traffic Management | Traflic Control | 4.2 | 33 |
| Travel and Traffic Management | Incident Management | 4.1 | 33 |
| Emergency Management Services | Emergency Vehicle Management | 4.0 | 34 |
| Emergency Management Services | Emergency Notification and Personal Security | 3.9 | 35 |
| Advanced Vehicle Safety Systems | Intersection Collision Avoidance | 3.5 | 29 |
| Advanced Vehicle Safety Systems | Vision Enhancement for Crash Avoidance | 3.5 | 30 |
| Advanced Vehicle Safety Systems | Longitudinal Collision Avoidance | 3.4 | 29 |
| Advanced Vehicle Safety Systems | Safety Readiness | 3.4 | 30 |
| Travel and Traffic Management | Travel Demand Management | 3.3 | 35 |
| Public Transportation Management | Public Travel Safety | 3.3 | 33 |
| Advanced Vehicle Safety Systems | Pre-Crash Restraint Deployment | 3.3 | 29 |
| Advanced Vehicle Safety Systems | Lateral Collision Avoidance | 3.3 | 29 |
| Commercial Vehicle Services | On-Board Safety Monitoring | 3.1 | 27 |
| Travel and Traflic Management | Route Guidance | 3.1 | 33 |
| Travel and Traffic Management | En-Route Driver Information | 3.0 | 33 |
| Public Transportation Management | Public Transportation Management | 3.0 | 31 |
| | Highway-Railroad Intersection | 3.0 | 26 |
| Travel and Traffic Management | Emissions Testing and Mitigation | 2.9 | 34 |
| Public Transportation Management | Personalized Public Transit | 2.9 | 32 |
| Commercial Vehicle Services | Automated Roadside Safety Inspections | 2.9 | 28 |
| Commercial Vehicle Services | Freight Mobility | 2.9 | 27 |
| Travel and Traffic Management | Pre-Trip Travel Information | 2.7 | 34 |
| Travel and Traffic Management | Ride Matching and Reservation | 2.6 | 34 |
| Public Transportation Management | En-Route Transit Information | 2.5 | 31 |
| Commercial Vehicle Services | Commercial Vehicle Administrative Processes | 2.5 | 27 |
| Travel and Traflic Management | Traveler Services Information | 2.3 | 34 |
| Commercial Vehicle Services | Commercial Vehicle Electronic Clearance | 2.3 | 27 |
| Electronic Payment Services | Electronic Payment Services | 2.2 | 28 |
| Advanced Vehicle Safety Systems | Automated Vehicle Operations | 2.1 | 30 |

**Out of 37 surveys returned**

**Rating Categories:**
1 = Very Low Priority
2 = Low Priority
3 = Average Priority
4 = High Priority
5 = Very High Priority

*Source: BRW, Inc., May 1997*

**TABLE 2.4**
**USER NEEDS SURVEY**
**ITS PROJECT/PROGRAM IDEAS**

| Category | Idea/Suggestion |
|---|---|
| System Congestion | Traffic Signal Coordination |
| | Freeway Management System |
| | Motorist Information |
| | Freeway Surveillance |
| | Variable Message Signs |
| | Alternate Route Messages |
| | Congestion Management |
| | Establish Park and Ride |
| | En-route Incident Information |
| | Highway Advisory Radio-Real Time Information |
| | Closed Circuit Television and Vehicle Detection Equipment |
| | Additional Lanes |
| | Remote Monitoring of Traffic Signal Operation |
| Incident Management | Incident Management System |
| | Accident Avoidance Systems in Vehicles |
| | Video Surveillance (Photo radar) at Frequent Crash Areas |
| | More Emergency Response Staff Training |
| | Freeway Incident Information System |
| | Cellular Caller Identification |
| | Enhance Area-Wide Snow Removal Capability |
| Transit | Develop Suburban Transit |
| | Expand Transit to out of County Suburbs |
| | Exploration of Commuter Rail System |
| | ITS Transit Projects |
| | ITS Demand-Responsive Transit Projects |
| | Improve Multi-Modalism |
| | Safer Transit Environment |
| Aviation | Expand/Market Dayton Airport Operations |
| Highway Engineering | Additional protected left turn lanes |
| | Improve I-75/SR 4 Intersection |
| | Access Management |
| | Reconstruction of Accident Prone Sections of Highway |
| | Bridge Deicing System |
| Commercial Vehicle Operations | Use ITS for CVO Management |
| | Hazardous Material Identification |
| Trip Planning | Traveler Information via Radio and Computer |
| | Road Construction Information |
| Standards | Adopt State Standards for Location Identification |
| | Ensure Connectability with other State/Local Systems |

*Source: BRW, Inc., May 1997*

As shown in Table 2.5, the three (3) most frequently reported problems included traffic congestion, accidents/incidents and inadequate/poor roadway design. Funding and Interagency/ inter-jurisdictional issues were also identified as important. Table 2.6 identifies the transportation solutions proposed by interviewees.

### 2.2.4 Outreach Workshop #1

Thirty-eight (38) people attended the Outreach Workshop held on November 7, 1996. Workshop attendees included the members of the project Policy and Technical Committees as well as interested area transportation stakeholders. Over 20 different organizations were represented at the workshop, including state, regional and local governments as well as several private sector organizations, including trucking, taxi cab and real estate firms. The purpose of the workshop was to explain the Strategic Deployment Plan project and to solicit input on transportation problems and potential ITS solutions.

In an effort to identity problems and potential solutions, workshop attendees were divided into four discussion groups based on their transportation interests and backgrounds: Transit, Highway, Incident Management/Institutional Issues and Commercial Vehicle Operations. In the breakout session the groups listed obstacles, problems, and trends interfering with the Miami Valley ITS vision and proposed solutions to overcome those obstacles. A high level summary of the problems and potential solutions identified at the workshop are shown in Tables 2.7 and 2.8.

## 2.3 QUANTITATIVE ASSESSMENT ACTIVITIES

The quantitative assessment of regional transportation conditions centered on the development of maps and tables summarizing area freeway/interstate and major arterial street deficiencies and issues. Issues in non-highway areas, such as traveler information and transit, were addressed through the qualitative activities described in Section 2.2. The quantitative roadway assessment described in this section was used in conjunction with the results of the qualitative assessment activities described in Section 2.2 to guide the development of recommended projects.

### 2.3.1 Freeway/Interstate Issues

The freeway/interstate facilities that were considered in this analysis are shown in Figure 2-l. The following data was collected and mapped for each facility:

- existing congestion (daily level of service);
- forecasted congestion;
- safety (accident rates); and
- roadway design deficiencies.

**TABLE 2.5**
**AGENCY INTERVIEWS**
**REPORTED PROBLEM AREAS**

| Frequency Cited | Problem Area |
|---|---|
| 11 | Traffic Congestion |
| 8 | Accidents/Incidents |
| 7 | Inadequate/poor Roadway Design |
| 5 | Funding |
| 4 | Inadequate Signage/Traveler Information |
| 4 | Conflicting Agency/Jurisdictional Priorities & "Turf" Isssues |
| 4 | Lack of Detour/Rerouting Traffic |
| 4 | Impacts of Detouring Traffic |
| 2 | Low Transit Ridership |
| 2 | Driver Behavior |
| 2 | Railroad Crossing Delays |
| 2 | Access to Incidents/Emergency Vehicle Regulatory & Enforcement Agencies |
| 2 | Transit Not Suburb-Oriented |
| 2 | Coordination Among Commercial Vehicle Regulatory & Enforcement Agencies |
| 1 | Coordination on Construction/Detours |
| 1 | Road Construction |
| 1 | Inadequate Rest Trop/Sleeping Locations for Commercial Vehicle Drivers |
| 1 | Commercial Vehicle Safety Inspections (Delays, Inadequate Facilities) |
| 1 | Accidents |
| 1 | Interstate On-Ramps/Merging & Weaving Areas |
| 1 | Inadequate Staff Resources |
| 1 | Access Control (too many driveways) |
| 1 | Inadequate Commercial Vehicle airport Access |
| 1 | Heavy Volume and Unrealibility of Cellular Incident Phone Calls |
| 1 | Work Zone Safety |
| 1 | Abundant Parking (Deterrent to Transit) |
| 1 | Room for Bicycles Packages, Etc. on Transit Vehicles |
| 1 | Transit Equipment Procurement (Dwindling Number of Suppliers) |
| 1 | Difficulty in Implementing Non-Mandated Commercial Vehicle Programs |
| 1 | Inadequate Regional Coordination/Cooperation of Traffic Signal Efforts |
| 1 | Institutional Issues in Integrating ODOT Interstate Signals into Local Systems |
| 1 | Lack of Support for Fixed Route Transit in Greene County |
| 1 | Lack of Enthusiasm Among Commercial Vehicle Participants |
| 1 | Lack of Qualified Commercial Vehicle Operators |
| 1 | High Commercial Vehicle Fuel Taxes |
| 1 | Size and Complexity of Commercial Vehicle Regulatory Databases |

*Source: BRW, Inc., May 1997*

**TABLE 2.6**
**AGENCY INTERVIEWS**
**SUGGESTED SOLUTIONS**

**Commercial Vehicle Operations**

- Separate, grade-separated facilities for commercial vehicles
- Coordination of commercial vehicle databases
- Automated hazardous materials enforcement
- Tie-ins with the Advantage I-75 project

**Traveler Information**

- Highway advisory radio
- Traffic information on existing agency Internet sites
- Traveler information for construction and detours
- Traveler information at park-n-ride lots
- Improved s&age/traveler information for the Nutter Center
- Changeable message signs

**Freeway Management**

- Pre-arranged incident detour plans
- Dedicated incident reporting hotline
- A regional traffic management center
- Regional emergency communications center and common communications system
- Pavement/weather sensing stations

**Traffic Signal Systems**

- Improve traffic flow along arterial street detour routes
- Regional traffic signal coordination/cooperation efforts

**Transit**

- "Smart" transit to better serve suburban/neighborhood trips
- Automatic vehicle location for transit vehicles
- Active transit station signs

**Other**

- Advanced warning for the presence of trains at at-grade rail crossings
- Automation of existing permanent traffic counters
- Transponders on taxi cabs to allow automating counting and billing for airport use
- Electronic debit card system for airport parking

*Source: BRW, Inc., May 1997*

**TABLE 2.7**
**OUTREACH WORKSHOP**
**REPORTED PROBLEM AREAS**

| | |
|---|---|
| *Highest Frequency* | • Inadequate Cooperation and Coordination (among modes, organizations and services) |
| | • Legal/Institutional Issues (liability, legislated responsibilities, etc.) |
| *Medium Frequency* | • Inadequate Information (travelers and operators) |
| | • Funding |
| | • Congestion |
| | • Incidents |
| | • Standardization/Compatibility |
| | • Private Sector Costs |
| *Low Frequency* | • Driver Resistance |
| | • Inefficiency |
| | • Senior/Disabled Access |
| | • Emergency Vehicle Access |

*Source: BRW, Inc., May 1997*

**TABLE 2.8**
**OUTREACH WORKSHOP**
**SUGGESTED SOLUTIONS**

| | |
|---|---|
| **Incidents** | • **Incident Response**<br>• **Advanced Work Zone Traffic Control**<br>• **Freeway Management** |
| ***Coordination/Cooperation*** | • **Training**<br>• **Education**<br>• **Political/Legislative Action** |
| ***Traveler Information*** | • **Kiosks**<br>• **Automated Phone Systems**<br>• **Real-Time Data** |
| ***Funding*** | • **Identify Dedicated Source(s)**<br>• **State Participation** |

*Source: BRW, Inc., May 1997*

Each type of data was added as a layer to a single map, yielding a composite map where the magnitude of deficiencies was established based on the presence or absence of the various layers. The methodology for each type of data and the resulting deficiencies and priorities summary maps are briefly described below.

### *Congestion*

Freeway/interstate roadway segments with existing and forecasted average daily Levels of Service E or F were identified. This information was taken from the Ohio Department of Transportation's 1990 and 2020 "Existing Plus Committed Roadway Projects" regional travel forecasts.

### *Safety*

Freeway/interstate accident data was obtained from the Ohio Department of Transportation for the 1993 to 1995 time period for each of the freeway/interstate segments within the four county Miami Valley ITS study area. Some of the segments included accident rates and some did not. For those segments that did not include accident rates, accident rates were calculated based on the segment length and a generalized segment average daily traffic volume. The freeway segments within the study area and the documented accident rates are shown in Table 2.9. The data indicate that accident rates on the various segments range from 0.6 accidents per million vehicle miles (Acc/MVM) to 1.6 Acc/MVM.

The accident rates for each of the freeway segments were compared to a typical average urban freeway accident rate (1.7 accidents per million vehicle miles) to identify problem areas, based on the assumption that Miami Valley freeway/ interstate segments with rates above the typical average rate represent problem areas. As shown in Table 2.9, none of the segments analyzed have accident rates above the typical average rate.

Although the accident rates analysis does not indicate higher accident rates than are typical, the relative accident rates of different freeway/interstate segments are useful in identifying the appropriate geographic phasing of ITS projects which address accidents or their effects. For mapping purposes, the accident rates were stratified into high, medium and low categories corresponding to the upper, middle and lower thirds of the accident rate distribution. Segments within the two highest categories were mapped.

### *Design Deficiencies*

The following six regional freeway/interstate segments were assessed for design deficiencies based on a subjective "windshield survey":

- I-75 from I-675 to I-70
- I-70 from the Airport Access Road to I-675
- I-675 from I-75 to I-70
- US 35 from Third Street to Xenia
- SR 4 from I-75 to I-70
- SR 444 from SR 4 to I-675.

The assessment considered the following design features:

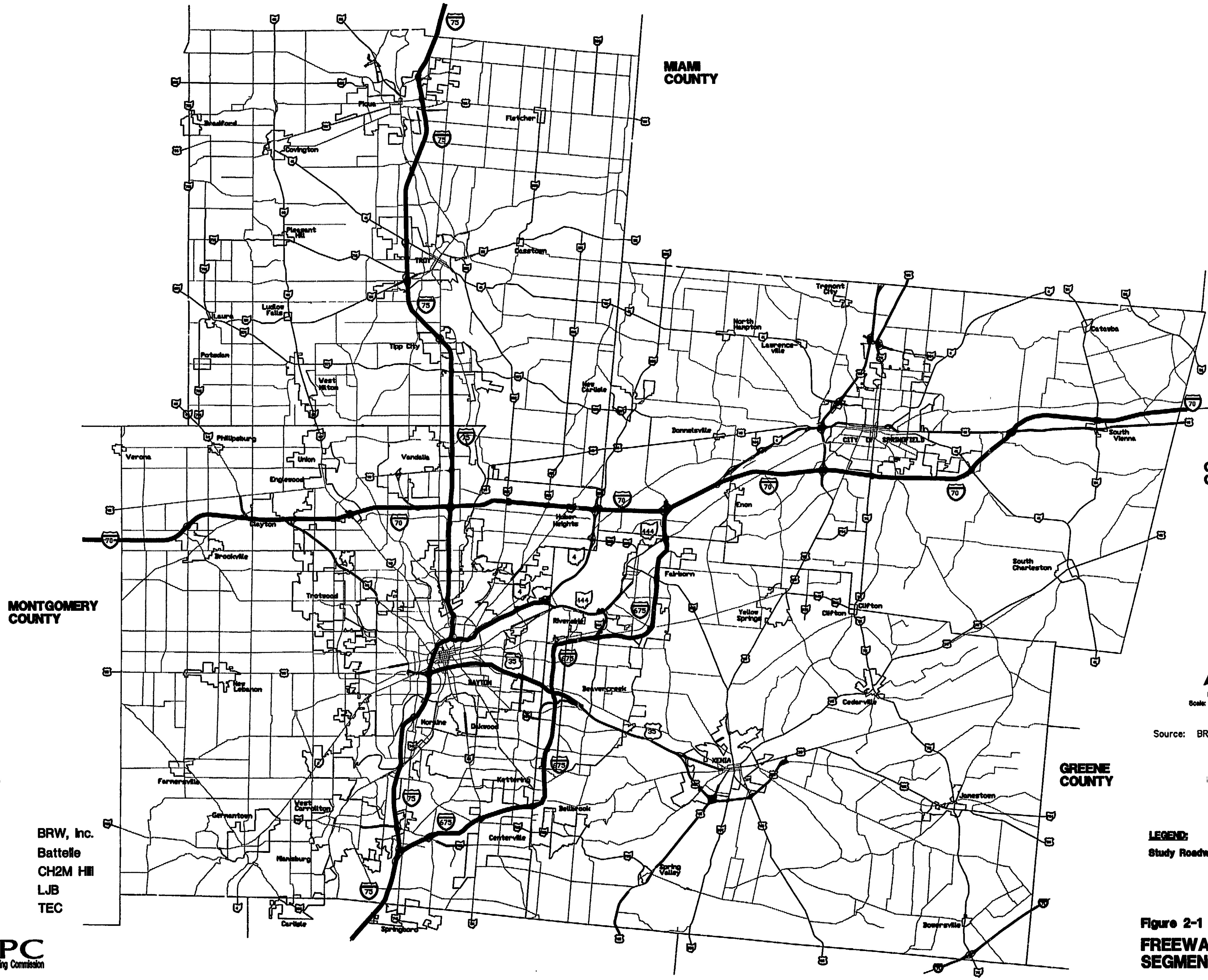
- Substandard Horizontal and Vertical Curvature
- Short or Difficult Weaves
- Short Merge Areas
- Left Side On/Off Ramps
- Loop Ramps
- Features which Limit Capacity During Peaks

# MIAMI VALLEY ITS

EARLY DEPLOYMENT PLAN

MVRPC
Miami Valley Regional Planning Commission

BRW, Inc.
Battelle
CH2M Hill
LJB
TEC




Source: BRW, Inc. May 1997

**LEGEND:**
Study Roadway

**Figure 2-1**
**FREEWAY / INTERSTATE SEGMENTS ANALYZED**

freeanal.dwg 8-7-97

## TABLE 2.9
## FREEWAY/INTERSTATE ACCIDENT ANALYSIS

| Segment | Average Daily Volume (2) | Length (mi.) | Avg. # Acc./Yr. (1) | Acc. Rate (Acc./mvm) | Avg. Rate (Acc./mvm) | Is Rate > Avg. Rate |
|---|---|---|---|---|---|---|
| Montgomery County | | | | | | |
| I-75 (I-70 to US 35) | 91,000 | 9 | 480 | 1.6 | 1.7 | No |
| I-75 (I-70 to Miami County) | 63,000 | 4 | 130 | 1.4 | 1.7 | No |
| I-75 (US 35 to Warren County) | 78,000 | 11.4 | 451 | 1.4 | 1.7 | No |
| I-70 (I-75 to Clark County) | 43,000 | 11 | 187 | 1.1 | 1.7 | No |
| I-70 (I-75 to Preble County) | 34,000 | 12.6 | 157 | 1.0 | 1.7 | No |
| I-675 (I-75 to Greene County) | 43,000 | 7.4 | 128 | 1.1 | 1.7 | No |
| Clark County | | | | | | |
| I-70 | 40,000 | 29.3 | 404 | 1.0 | 1.7 | No |
| Greene County | | | | | | |
| I-71 | 26,000 | 4.1 | 22 | 0.6 | 1.7 | No |
| I-675 (Montgomery County to SR 444) | 54,000 | 7.7 | 150 | 1.0 | 1.7 | No |
| I-675 (SR 444 to I-70) | 41,000 | 10 | 131 | 0.9 | 1.7 | No |
| Miami County | | | | | | |
| I-75 | 45,000 | 20 | 361 | 1.1 | 1.7 | No |

(1) Ohio Department of Transportation (1990)
(2) Ohio Department of Public Safety (1995)
(3) Daily Volumes were averaged over entire segment length.

Source: BRW, Inc., April 1997

For the most part, the detrimental impact of each of these characteristics on capacity and safety are self evident. Curves that are too tight and roads with abrupt crests and valleys reduce sight distances, slow traffic and create safety problems. Merge and weave sections that are too short do not provide adequate gaps for safe lane changes. Relative to diamond interchanges, loop ramps create slower and more difficult merges. Left side on/off ramps, which are generally much less common than right side ramps, conflict with driver expectations and compound the negative impact of merging traffic on through lane capacity by introducing merging vehicles directly into what **is** normally the fastest moving lane.

For each segment, any specific relevant design deficiencies were identified. Based on these deficiencies, the segment was given an overall numeric rating from 1 (very poor) to 5 (very good). Table 2.10 presents this information. Segments with a rating of 3 or below were mapped.

### *Summary of Freeway/Interstate Issues*

The information described above was mapped as layers on maps for the four county study area. These maps are shown as Figures 2-2 through 2-5. This information is presented in tabular form in Table 2.11.

## Arterial Street Issues

A deficiencies data collection and mapping effort similar to the one performed for freeways/interstates was conducted for major arterial streets. This exercise considered all major arterial roadways as well as other roadways which parallel freeways and which represent potential reliever routes. A map of the roadways which were considered in this analysis is shown in Figure 6-6.

### *Congestion*

Like the freeway/interstate deficiencies analysis, the analysis of regional major arterial streets mapped existing and forecasted Levels of Service of E or worse. Data was not available for Clark County, which is currently preparing an update to their regional traffic forecasting model. Congestion data for Greene, Miami and Montgomery Counties was supplied by the Miami Valley Regional Planning Commission.

## TABLE 2.10
## SUMMARY OF REGIONAL FREEWAY/INTERSTATE DESIGN DEFICIENCIES ASSESSMENT

| Route | Segment | Design Deficiencies | Overall Rating (l=very poor; 5=very good) |
|---|---|---|---|
| I-75 (south to north) | Montgomery County Line thru US 35 interchange | None notable | 4 |
| | Thru SR 4 interchange | Substandard Horizontal Curvature<br>Short or Difficult Weaves<br>Short Merge Areas<br>Left Side On/Off Ramps<br>Capacity Limiting During Peaks | 2 |
| | Thru Needmore Road interchange | Substandard Vertical Curvature<br>Short or Difficult Weaves<br>Short Merge Areas<br>Capacity Limiting During Peaks | 3 |
| | Little York Road thru I-70 interchange | Short or Difficult Weaves<br>Short Merge Areas<br>Loop Ramps<br>Capacity Limiting During Peaks | 2 |
| | Thru Miami County | None notable | 4-5 |
| l-70 (west to east) | Montgomery County Line to I-70 | Capacity Limiting During Peaks | |
| | I-75 interchange | Short or Difficult Weaves<br>Short Merge Areas<br>Loop Ramps<br>Capacity Limiting During Peaks | 2 |
| | Thru SR 210 | Short Merge Areas<br>Loop Ramps<br>'Capacity Limiting During Peaks | 3 |
| | Thru Greene and Clark Counties | None notable | 4-5 |
| L-675 (south to north) | I-75 to I-70 | Minor Difficulties at Fairfield Road | 4-5 |
| US 35 (west **to** east) | I-75 to Smithville Road | Left Side On/Off Ramps | 3-4 |
| | Thrn I-675 | | 3-4 |
| SR 4 (south to north) | I-75 to SR 444 | Includes At Grade Access | 3 |

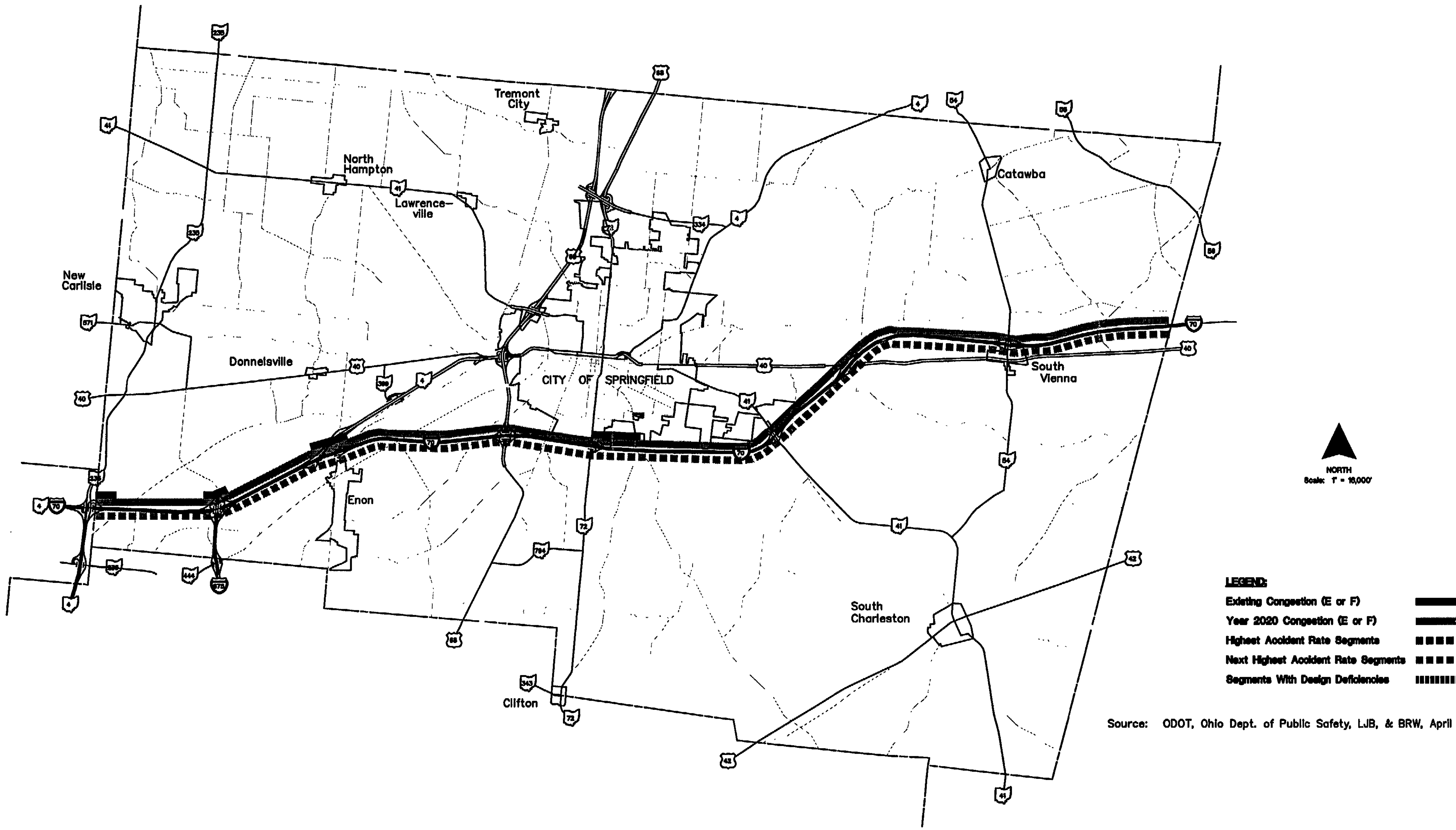
Source: LJB & BRW, Inc., April 1997.

**TABLE 2.11**
**SUMMARY OF FREEWAY/INTERSTATE ISSUES**

| County | Roadway | Segment (1) | Existing Congestion (2) | Forecasted Congestion (3) | "High" Accident Rate (4) | "Moderate" Accident Rate (5) | Design Deficiencies (6) |
|---|---|---|---|---|---|---|---|
| Clark | I-70 (west to east) | Montgomery County line to SR 235 interchange (or Mud Creek crossing) | X | X | | X | |
| | | SR 235 overpass to I-675 interchange | | X | | X | |
| | | I-675 interchange | X | X | | X | |
| | | I-675 interchange to SR 4 interchange | | X | | X | |
| | | SR 4 interchange through Enon Road overpass | X | X | | X | |
| | | Enon Road overpass to SR 72 | | X | | X | |
| | | SR 72 to Old Selma Road | X | X | | X | |
| | | Old Selma Road to east Clark County line | | X | | X | |
| Greene | I-675 (south to north) | Montgomery County line to US 35 | | X | | X | |
| | | US 35 to Grange Hall Road | | | | X | |
| | | Grange Hall Road to Beavercreek border | | X | | X | |
| | | Beavercreek Corporate Limit to North Fairfield Road | | X | | X | X |
| | | North Fairfield Road to west of Beaver Valley Road | | X | | | X |
| | | West of Beaver Valley Road to Dayton-Yellow Springs Road | | X | | | |
| Miami | I-75 (south to north) | Montgomery County line to SR 571 | | X | | X | |
| | | SR 571 through Tipp City border north crossing . | | X | | | |
| | | Tipp City border north crossing to north Miami County line | | X | | X | |
| Montgomery | I-75 (south to north) | Montgomery County Line through US 35 interchange | X | X | X | | |
| | | US 35 interchange through Needmore Road interchange | X | X | X | | X |
| | | Needmore Road interchange through Little York Road | X | X | X | | |
| | | Little York Road through I-70 interchange | X | X | X | | X |
| | | I-70 interchange through US 40 interchange | X | X | X | | |
| | | US 40 interchange through Vandalia border north crossing | | X | X | | |
| | | Vandalia border north crossing to south Miami County line | | | X | | |
| | I-70 (west to east) | Montgomery County Line through SR 49 west interchange | | | | X | |
| | | SR 49 west interchange to SR 49 east crossing | | X | | X | |
| | | SR 49 east crossinn tn SR AR | | | | X | |
| | | SR 48 to I-75 | X | X | | X | |
| | | I-75 interchange to SR 201 | | X | | X | X |
| | | SR 201 to CI& fhmtv I ine | | X | | X | |
| | I-675 (west to east) | I-75 to Greene County line | | | | X | |

(1) All locations are approximate
(2) 1990 Daily Level of Service E or F
(3) 2020 Daily Level of Service E or F
(4) Locations with accident rates within the upper one-third of all segments analyzed
(5) Locations with accident rates within the middle one-third of all segments analyzed
(6) A subjective assessment based on a field review considering factors such as weaving/merging distances, interchange spacing, horizontal and vertical curvature, left side on/off ramps and loop ramps

Source: BRW, Inc., May 1997.




Source: ODOT, Ohio Dept. of Public Safety, LJB, & BRW, April 1997.

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**Figure 2-2**
**FREEWAY / INTERSTATE ISSUES**
**CLARK COUNTY**

clark-fo.dwg 8-7-97

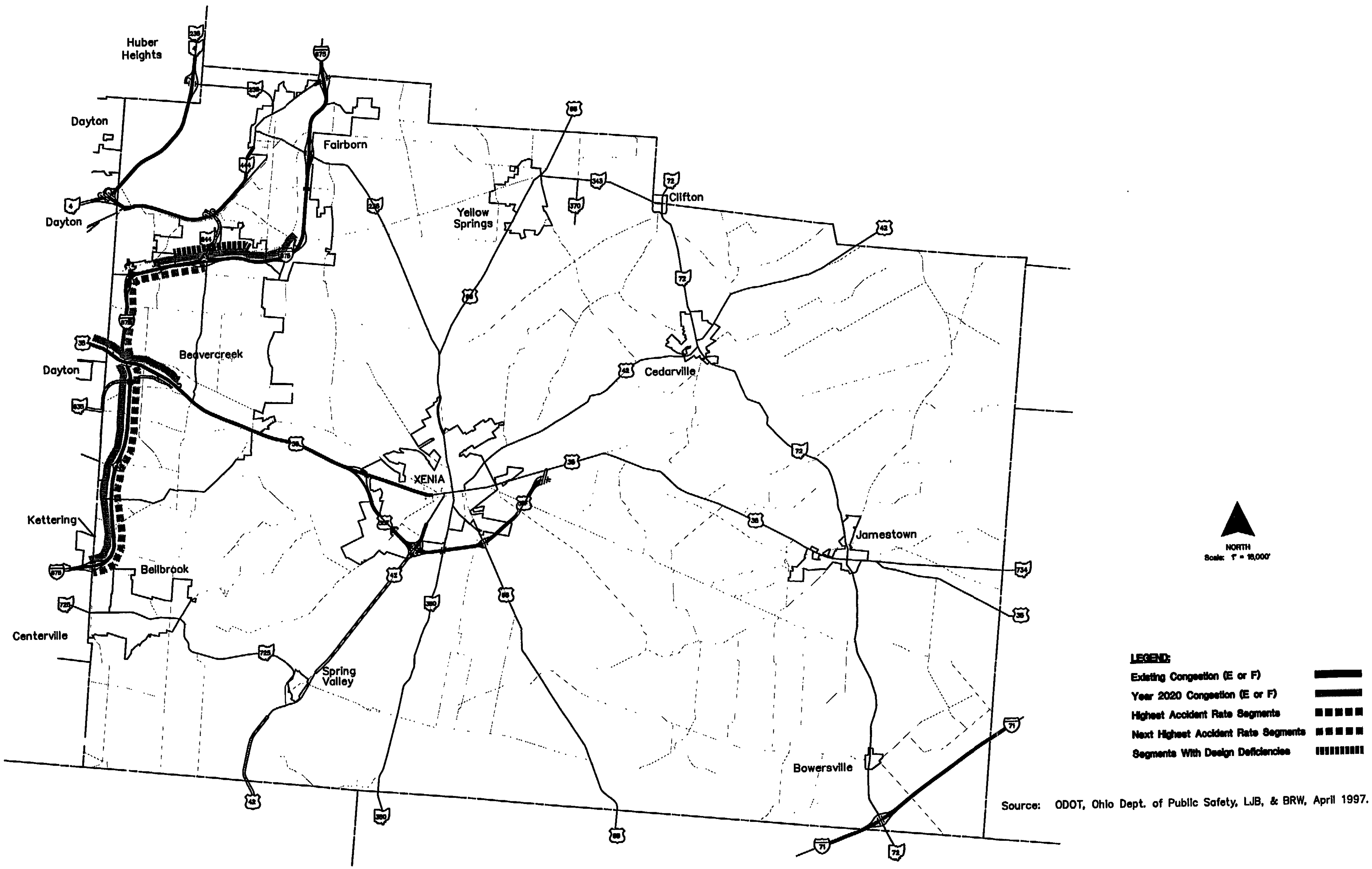


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**Figure 2-3**
**FREEWAY / INTERSTATE ISSUES**
**GREENE COUNTY**

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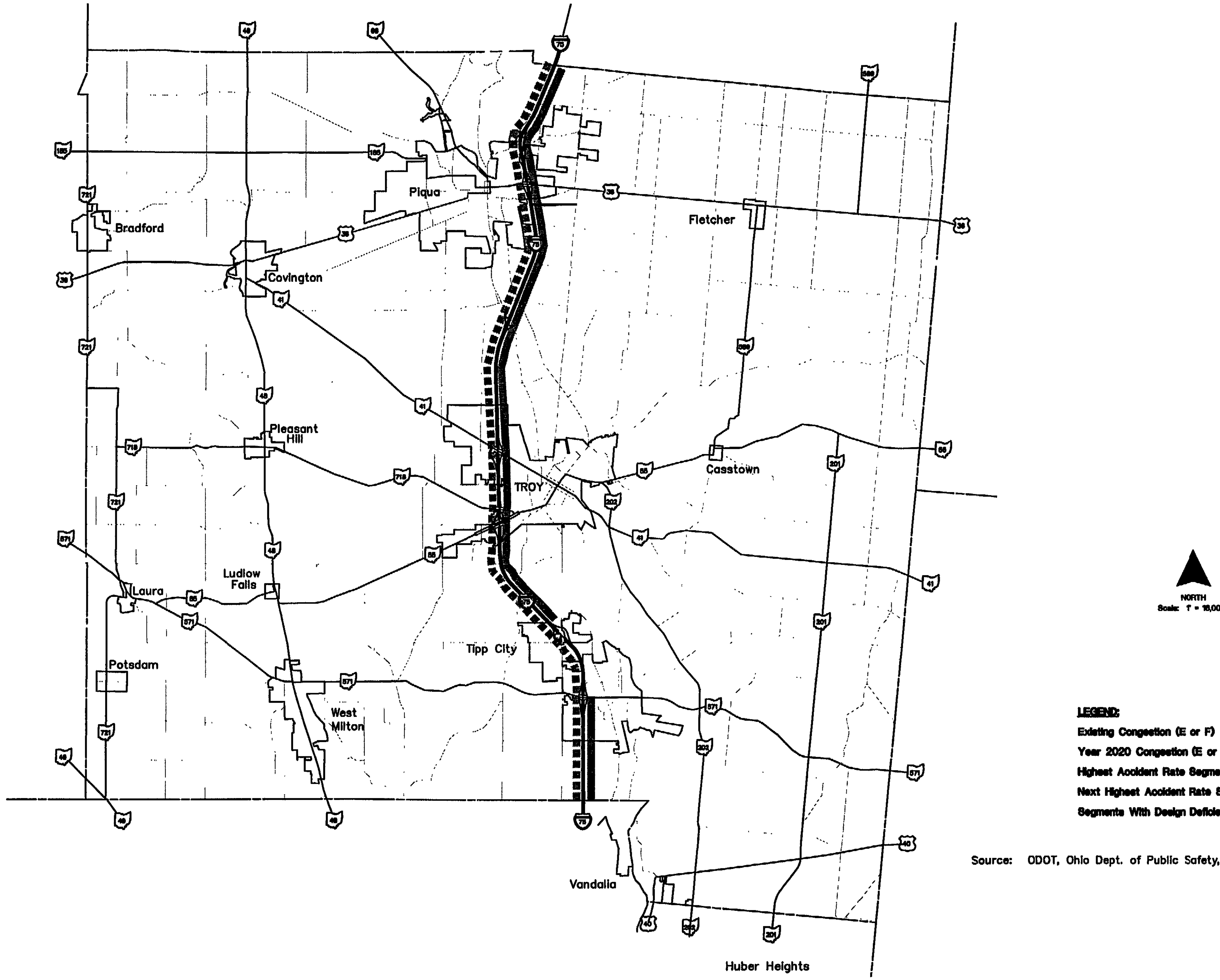


**LEGEND:**

- Existing Congestion (E or F)
- Year 2020 Congestion (E or F)
- Highest Accident Rate Segments
- Next Highest Accident Rate Segments
- Segments With Design Deficiencies

Source: ODOT, Ohio Dept. of Public Safety, LJB, & BRW, April 1997.

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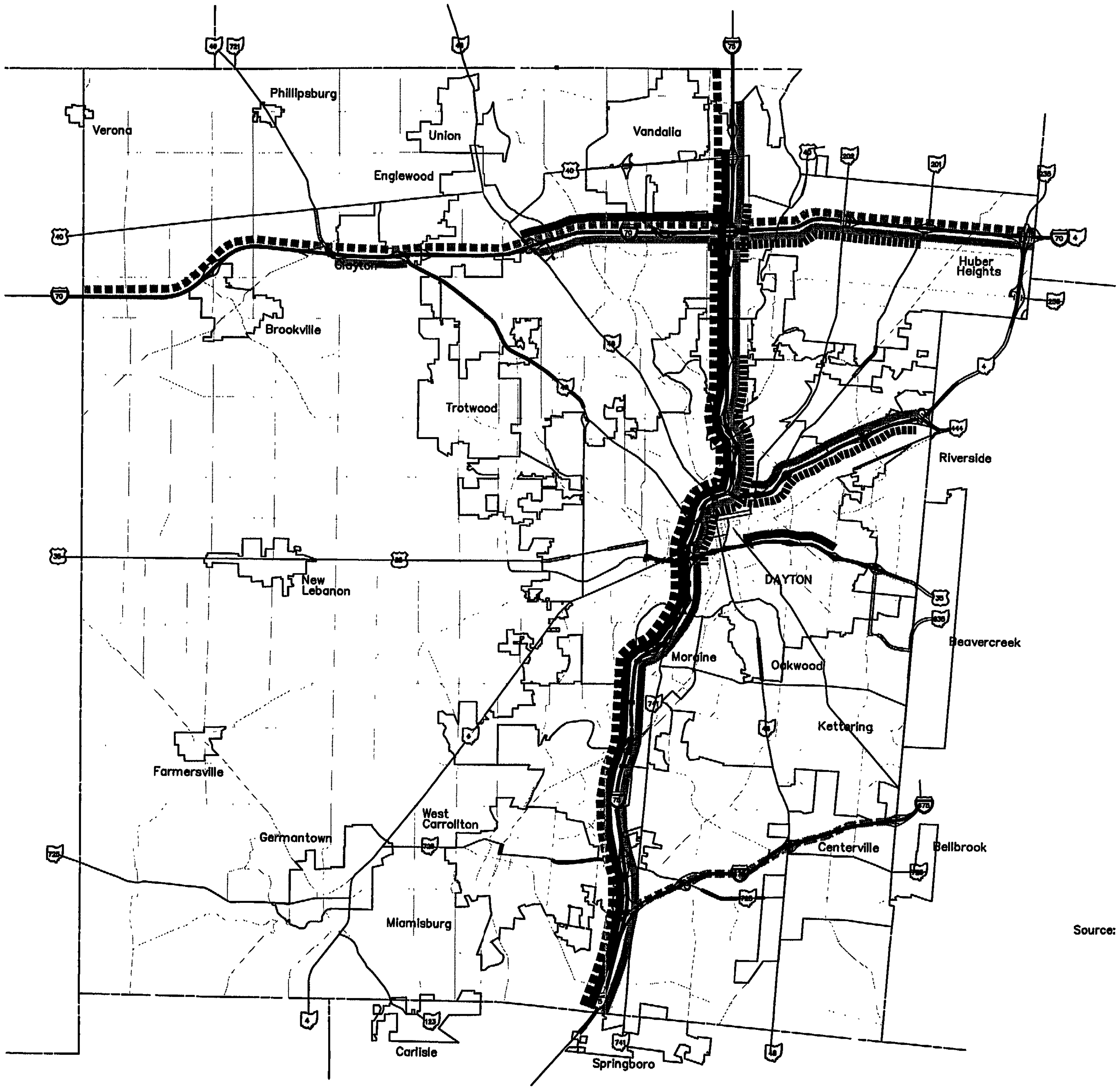
**Figure 2-4**
**FREEWAY / INTERSTATE ISSUES**
**MIAMI COUNTY**

miami-fo.dwg 8-7-97




**LEGEND:**

- Existing Congestion (E or F)
- Year 2020 Congestion (E or F)
- Highest Accident Rate Segments
- Next Highest Accident Rate Segments
- Segments With Design Deficiencies

Source: ODOT, Ohio Dept. of Public Safety, LJB, & BRW, April 1997.

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**Figure 2-5**
**FREEWAY / INTERSTATE ISSUES**
**MONTGOMERY COUNTY**

montg-fo.dwg 8-7-97

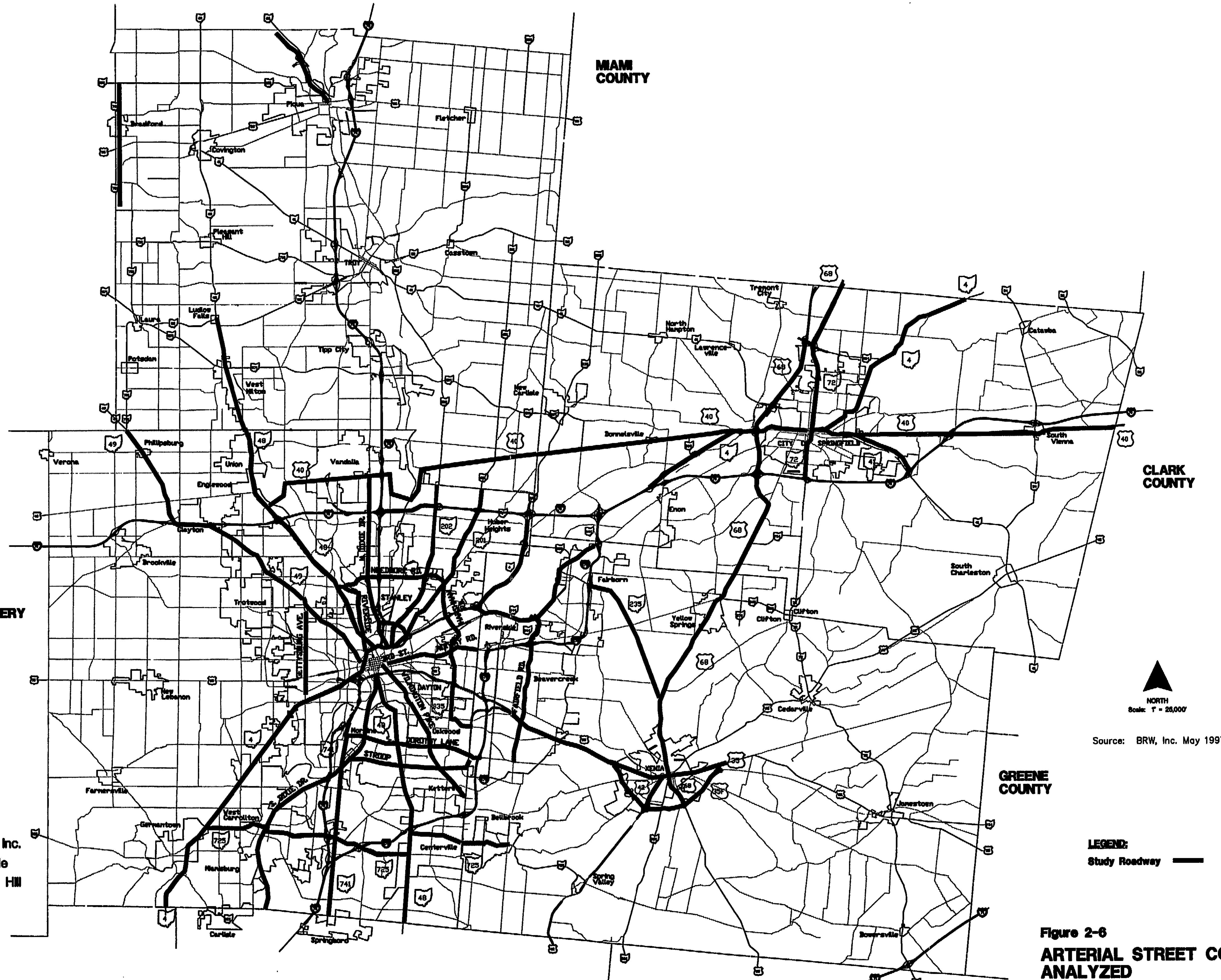


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**Figure 2-6**
**ARTERIAL STREET CORRIDORS ANALYZED**

artanal.dwg 8-7-97

### *Safety*

Traffic accident rates were calculated for a sampling of 20 area arterial street intersections. The sample was selected based two "most dangerous intersection" news articles published in the Dayton Daily News, as well as information collected from the Cities of Dayton, Kettering and Springfield and the Ohio Department of Public Safety (1995 Highway Accidents by County).

The "critical rate" accident analysis methodology was used. This approach identifies problem locations based on the difference between site specific accident rates and areawide average rates for similar locations. Some variation from the average is expected and does not necessarily suggest a localized safety problem. However, if a rate sufficiently exceeds the average, i.e., exceeds a "critical rate", the difference is statistically valid and suggests that there may be a localized safety problem.

An average accident rate was calculated using a sample of ten intersections considered to be representative of Miami Valley urban arterial street intersections in terms of traffic volumes, design and traffic control. Using a typical average accident rate of 1.5 accidents per million entering vehicles for urban signalized intersections, a critical rate was calculated at each of the 20 "problem" locations. The accident rates at each locations were then compared to their respective critical rates.

As shown in Table 2.12, sixteen (16) of the "problem" locations exceeded their critical rates, indicating that localized safety problems may be present. Additionally, although not reflected in Table 2.12, two of the "typical" intersections also exceeded their critical rates. The roadways that include at least one of the sixteen (16) problem locations were identified and mapped. These roadways are:

- Gettysburg Avenue
- Dorothy Lane
- Brandt Pike
- SR 725
- Woodman Drive
- Spring Street

### *Local Priorities*

A meeting was held with agency traffic engineering staff throughout the four county study area, including municipal, county and Ohio Department of Transportation personnel. The purpose of the meeting was to identify arterial street segments which are considered high priorities for ITS projects from the perspectives of the traffic engineers responsible for these facilities. The meeting generated a list of priority locations for each of the four counties, shown in Table 2.13.

### *Summary of Arterial Issues*

The information data described above was mapped as layers on individual county maps. These maps are shown as Figures 2-7 through 2-10. This information is presented in tabular form in Table 2.14.

## TABLE 2.12
## ARTERIAL STREET INTERSECTION ACCIDENT A L Y S I S

| Intersection | Existing Traffic Control | (1994) Entering Daily Volume"' | Average # Accidents/Yr. | Accident Rate | Average Areawide Rate | Critical Rate | Is Rate > Critical Rate |
|---|---|---|---|---|---|---|---|
| 1) Brandt Pike/Chambersburg Rd. | Signal | 39,600 | 49 | 3.39 | 1.5 | 2.0 | Yes |
| 2) Gettysburg/Hoover Ave. | Signal | 37,300 | 43 | 3.16 | 1.5 | 2.0 | Yes |
| 3) Brandt Pike/Fishburg Rd. | Signal | 37,100 | 38 | 2.81 | 1.5 | 2.0 | Yes |
| 4) Gettysburg Ave./3rd St. | Signal | 38,950 | 36 | 2.53 | 1.5 | 2.0 | Yes |
| 5) Old Troy Pike/Taylorsville Rd. | Signal | 36,750 | 36 | 2.68 | 1.5 | 2.0 | Yes |
| 6) Col. Glenn Hwy./National Rd. | Signal | 41,350 | 34 | 2.25 | 1.5 | 2.0 | Yes |
| 7) Dayton-Xenia/North Fairfield | Signal | 33,750 | 33 | 2.68 | 1.5 | 2.0 | Yes |
| 8) Gettysburg Ave./James McGee Blvd. | Signal | 37,100 | 33 | 2.44 | 1.5 | 2.0 | Yes |
| 9) Dorothy Lane/Wilmington Pike | Signal | 65,800 | 32 | 2.03 | 1.5 | 1.89 | Yes |
| 10) Helena St./Riverside Dr. | Signal | 33,700 | 31 | 2.52 | 1.5 | 2.0 | Yes |
| 11) Keowee St./3rd St. | Signal | 50,150 | 31 | 1.69 | 1.5 | 1.94 | No |
| 12) Needmore Rd./N. Dixie Dr. | Signal | 49,250 | 31 | 1.72 | 1.5 | 1.95 | No |
| 13) Dorothy Lane/Woodman Dr. | Signal | 47,400 | 45 | 2.27(1) | 1.5 | 1.96 | Yes |
| 14) Ohio 725/Ohio 741 | Signal | 72,350 | 42 | 1.60 | 1.5 | 1.87 | No |
| 15) Ohio 725/Byers Rd. | Signal | 55,800 | 35 | 1.72 | 1.5 | 1.92 | No |
| 16) Patterson/Woodman | Signal | 37,900 | 36 | 2.64(1) | 1.5 | 2.0 | Yes |
| 17) Forrer/Smithville | Signal | 31,750 | 27 | 2.32(1) | 1.5 | 2.0 | Yes |
| 18) N. Spring St./E. North St. | Signal | 28,700 | 32 | 3.09 | 1.5 | 2.08 | Yes |
| 19) S. Spring St./E. High St. | Signal | 17,800 | 26 | 4.00 | 1.5 | 2.21 | Yes |
| 20) E. Main St./N. Burnett Rd. | Signal | 21,700 | 26 | 3.32 | 1.5 | 2.15 | Yes |

(1) "High Accident Locations," City of Kettering (1995)
(2) Daily Entering Volumes Obtained from Traffic Flow Maps.
Source: BRW, Inc., April 1997

#24542

**TABLE 2.13**
**LOCAL TRAFFIC ENGINEERING ARTERIAL STREET PRIORITIES**

Montgomery County

- SR 202 in Huber Heights from south to north corporation line
- SR 201 in Huber Heights from south to north corporation line
- Woodman Drive US 35 to SR 201
- National Road (US 40) from Brown School House Road to Dogleg Road
- SR 48 from US 40 to Garver Road
- Philadelphia Drive from Siebenthaler to Turner

Greene County

- Dayton-Yellow Springs Road in Fairborn from Southlawn Drive to Trebein Road
- SR 444 from SR 844 to I-675
- Dayton-Xenia Road in Beavercreek from west corporation line to Fairfield Road
- US 35 from Fairfield Road to Valley Road

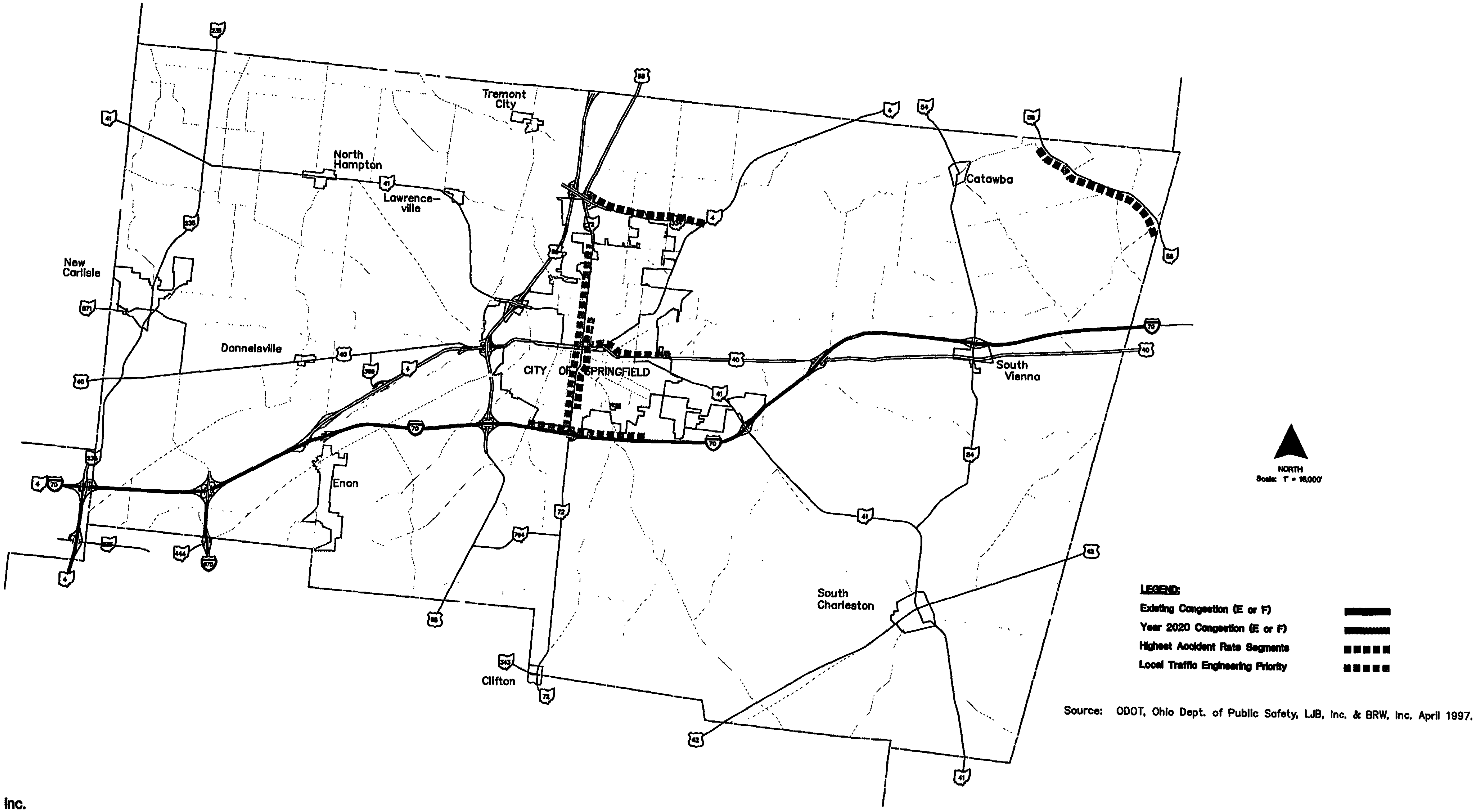
Miami County

- SR 41 from Washington Road to Market Street
- South Market Street from Main Street to West Market Street
- SR 571 from just west of I-75 to Hyattsville Road
- SR 55 from I-75 to Nashville Road
- SR 55 from SR 718 to South Market Street

Clark County

- SR 72 North from North Street to Eagle City Road
- SR 72 South from Main South to Leffel Lane
- East Main Street/US 40 East from Limestone Street to East Corporate Line
- SR 235 between SR 41 and US 40
- Selma Road from SR 72 to Leffel Lane
- Leffel Lane: Springfield - Xenia Road to Burnett Road

***Source: Local, County and State Traffic Engineering Staff, April 21, 1997 Meeting***




Source: ODOT, Ohio Dept. of Public Safety, LJB, Inc. & BRW, Inc. April 1997.

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**Figure 2-7**
**ARTERIAL STREET ISSUES**
**CLARK COUNTY**

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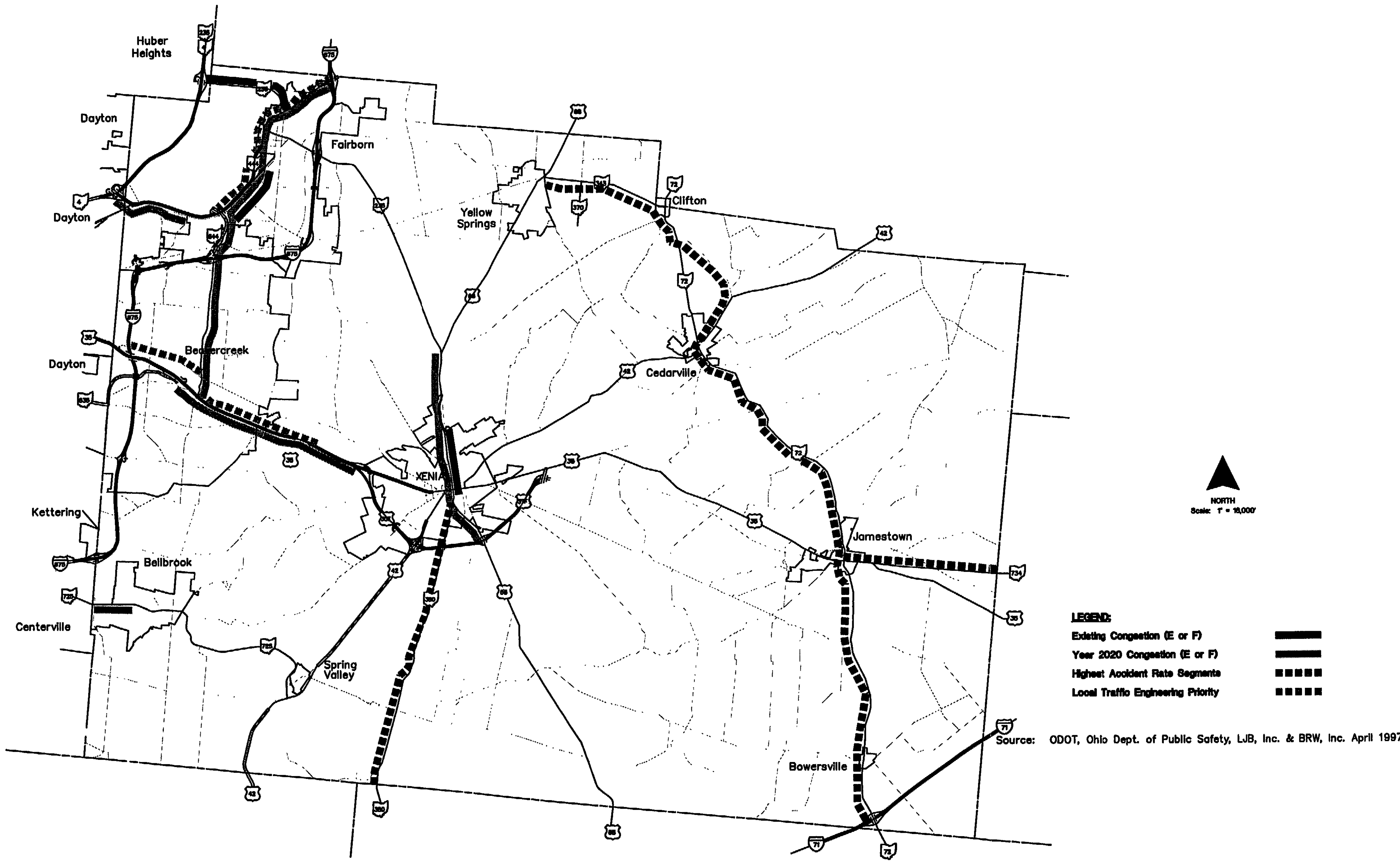


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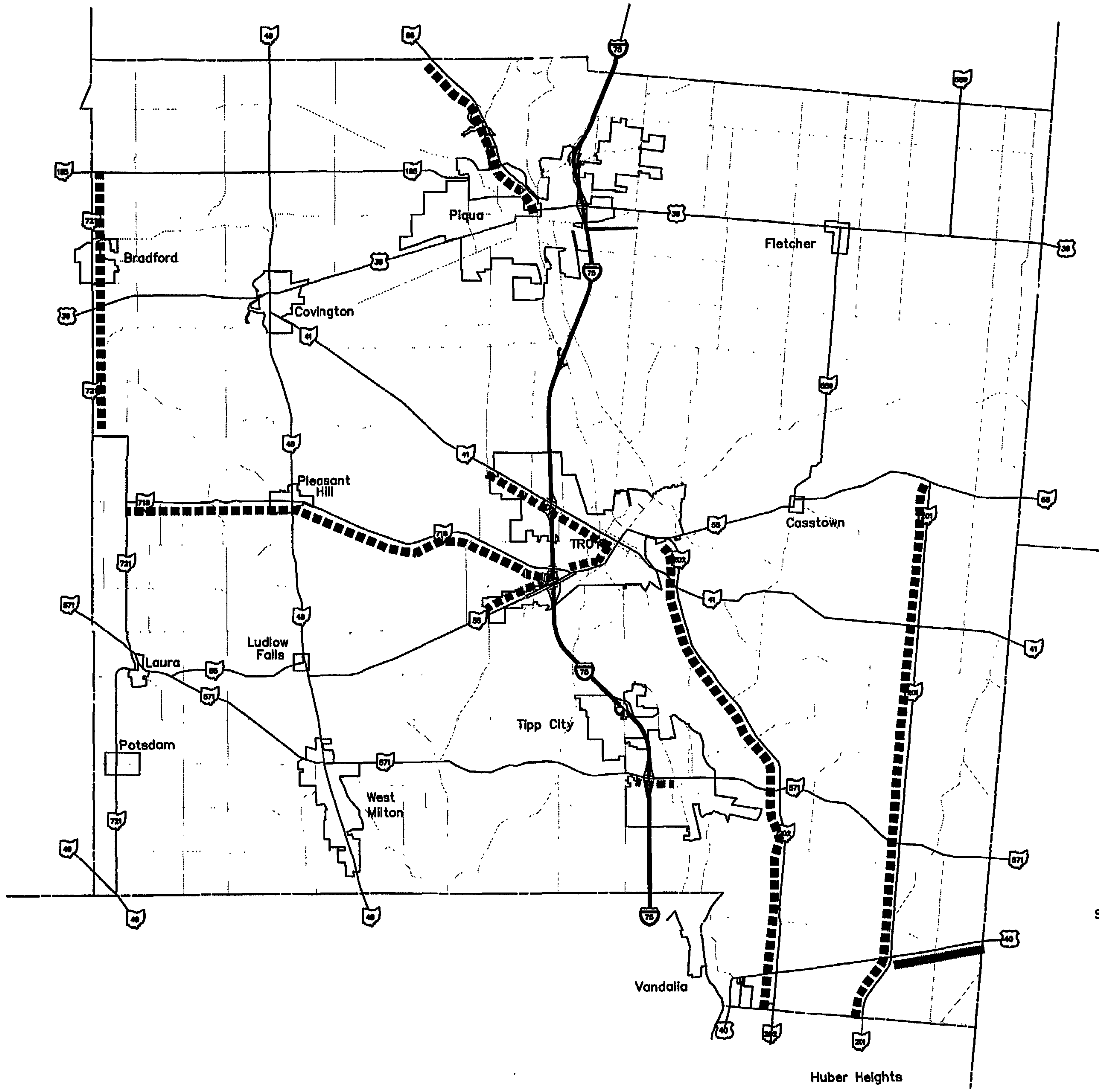
Figure 2-8
**ARTERIAL STREET ISSUES GREENE COUNTY**

green-ao.dwg 8-7-97




NORTH
Scale: 1" = 16,000'

**LEGEND:**

- Existing Congestion (E or F)
- Year 2020 Congestion (E or F)
- Highest Accident Rate Segments
- Local Traffic Engineering Priority

Source: ODOT, Ohio Dept. of Public Safety, LJB, Inc. & BRW, Inc. April 1997.

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**Figure 2-9**
**ARTERIAL STREET ISSUES**
**MIAMI COUNTY**

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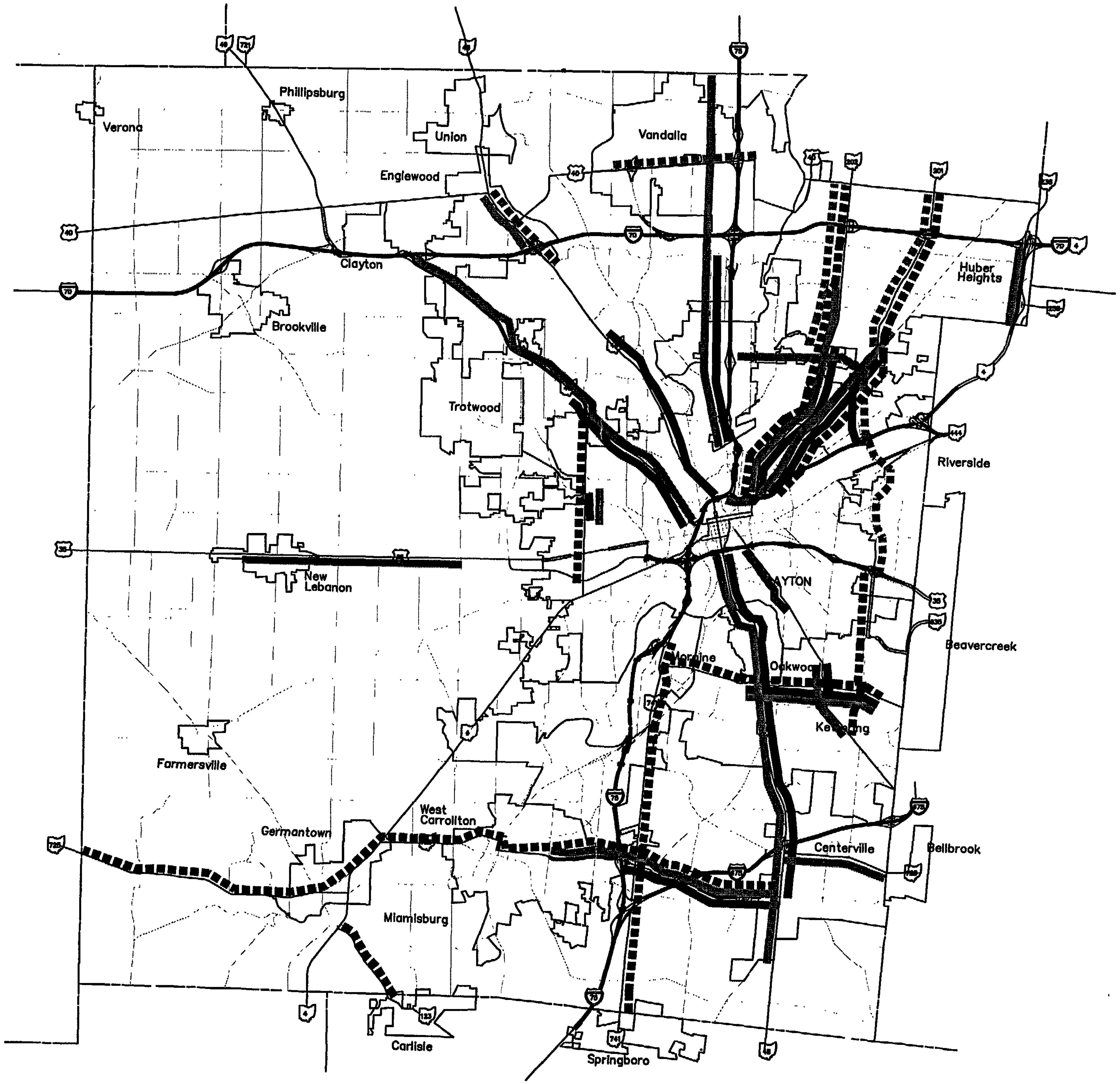


**LEGEND:**

- Existing Congestion (E or F)
- Year 2020 Congestion (E or F)
- Highest Accident Rate Segments
- Local Traffic Engineering Priority

Source: ODOT, Ohio Dept. of Public Safety, LJB, Inc. & BRW, Inc. April 1997.

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**Figure 2-10**

**ARTERIAL STREET ISSUES MONTGOMERY COUNTY**

montg-ao.dwg 8-7-97

## TABLE 2.14
## SUMMARY OF ARTERIAL STREET ISSUES

| County | Roadway | Segment (1) | Existing Congestion (2) | Forecasted Congestion (3) | "Critical" Accident Rate Intersection(s) (4) | Local Priority (5) |
|---|---|---|---|---|---|---|
| Clark | US 40 (west to east) | Miami County Line to SR 235 | | X | | |
| | SR 334 (west to east) | US 68 to SR 4 | | | X | |
| | SR 72 (south to north) | Leffell Lane to John Street | | | | X |
| | | John Street to Main Street | | | X | X |
| | | North Street to McCreight Avenue | | | X | X |
| | | McCreight Avenue to Eagle City Road | | | | |
| | US 40/East Main Street (west to east) | Limestone Street to East Corporate Line | | | | X |
| | SR 235 (south to north) | US 40 to SR 41 | | | | X |
| | Selma Road (south to north) | Leffel Lane to SR 72 | | | | X |
| | Leffel Lane (west to east) | Springfield-Xenia Road to Burnett Road | | | | X |
| | SR 56 | Through Clark County | | | X | |
| Greene | SR 444 (west to east) | Montgomery County Line to Zink Road | | X | | |
| | | SR 844 to Schuster Road/Oak Street | X | X | | X |
| | | Schuster Road/Oak Street to I-675 | | X | | X |
| | SR 235 (west to east) | Montgomery County Line to SR 444 | X | | | |
| | SR 844 (south to north) | I-675 to SR 444 | | X | | |
| | North Fairfield Road (south to north) | US 35 to I-675 | | X | | |
| | US 35 (west to east) | Montgomery County Line to North Fairfield Road | | X | | |
| | | North Fairfield Road to Valley Road | | X | | X |
| | | Valley Road to Xenia Bypass | | X | | |
| | SR 725 (west to east) | Montgomery County Line to Regent Park Drive | | X | | |
| | SR 380 (south to north) | South Greene County Line to US 68 | | | X | |
| | US 68 (south to north) | Xenia Bypass to SR 380 | | X | | |
| | | SR 380 to Xenia North Corporate Line | X | X | | |
| | | Xenia North Corporate Line to SR 235 | | X | | |
| | | Yellow Springs South Corporate Line to Clark County Line | | X | | |
| | SR 72 (south to north) | I-71 interchange to Clifton South Corporate Line | | | X | |
| | SR 343 (west to east) | Entire length | | | X | |
| | SR 734 (west to east) | SR 72 to east Greene County Line | | | X | |

## TABLE 2.14
## SUMMARY OF ARTERIAL STREET ISSUES

| County | Roadway | Segment (1) | Existing Congestion (2) | Forecasted Congestion (3) | "Critical" Accident Rate Intersection(s) (4) | Local Priority (5) |
|---|---|---|---|---|---|---|
| Miami | SR 721 (south to north) | Just north of right angle turn to SR 185 | | | X | |
| | SR 66 (south to north) | Piqua North Corporate Line to Miami County North Line | | | X | |
| | SR 718 (west to east) | SR 721 to SR 55 | | | X | |
| | SR 202 (south to north) | Montgomery County Line to SR 55 | | | X | |
| | SR 201 (south to north) | Montgomery County Line to SR 55 | | | X | |
| | SR 41 (south to north) | Market Street to Washington Pike | | | | X |
| | South Market Street (south to north) | West Market Street to Main Street | | | | X |
| | SR 571 (west to east) | Just west of I-75 to Hyattsville Road | | | | X |
| | SR 55 (west to east) | Nashville Road to I-75 | | | | X |
| | | SR 718 to South Market Street | | | | X |
| | US 40 (west to east) | SR 201 to Miami County East Line | | X | | |
| Montgomery | SR 725 (west to east) | SR 4 to Heincke Road | | | X | |
| | | Heincke Road to I-75 interchange | | X | X | |
| | | I-75 interchange to SR 48 | X | X | X | |
| | | SR 48 to Greene County Line | | X | | |
| | SR 123 (south to north) | Warren County Line to SR 4 | | | X | |
| | SR 741(south to north) | Warren County Line to SR 725 | | X | X | |
| | | SR 725 to I-75 | | | X | |
| | SR 48 (south to north) | Centerville South Corporate Line to SR 725 | | X | | |
| | | SR 725 to US 35 | X | X | | |
| | | I-75 to Burgess Avenue | X | X | | |
| | | Burgess Avenue to Woolery Lane | | X | | |
| | | Garber Road to I-70 | | | | X |
| | | I-70 to divergence from US 40 | | X | | X |
| | SR 49 (south to north) | I-75 to Wolf Road | X | X | | |
| | | Wolf Road to I-70 | | X | | |
| | Gettysburg Avenue (south to north) | Home Avenue to Oakridge Drive | | | X | |
| | | Oakridge Drive to Hoover Avenue | | X | X | |
| | | Hoover Avenue to Wolf Creek Pike | X | X | X | |
| | | Wolf Creek Pike to Little Richmond Road | | X | X | |
| | | Little Richmond Road to SR 49 | | | X | |
| | US 35 (west to east) | Western part of New Lebanon to Union Road | | X | | |
| | | Wilmington Pike to Smithville Road | X | | | |
| | North Dixie Drive (south to north) | Great Miami River Crossing to Little York Road | X | X | | |
| | | Line | | X | | |

**TABLE 2.14**
**SUMMARY OF ARTERIAL STREET ISSUES**

| County | Roadway | Segment (1) | Existing Congestion (2) | Forecasted Congestion (3) | "Critical" Accident Rate Intersection(s) (4) | Local Priority (5) |
|---|---|---|---|---|---|---|
| | Needmore Road (west to east) | I-75 to SR 201 | | X | | |
| | SR 202 (south to north) | SR 4 to Huber Heights South Corporate Limits | X | X | X | |
| | | Huber Heights South Corporate Limits to Chambersburg Road | | X | X | X |
| | | Chambersburg Road to Miami County Line | | | X | X |
| | SR 201 (south to north) | SR 4 to Kitridge Road | x | X | X | |
| | | Kitridge Road/ Huber Heights South Corporate Limits to Powell Road | | X | X | X |
| | | Powell Road/ Huber Heights South Corporate Limits to Miami County Line | | | X | X |
| | Woodman Drive/ Harshman Road (south to north) | Linden Avenue to SR 4 | | X | | X |
| | | SR 4 to SR 201 | X | X | | X |
| | Woodman Drive (south to north) | Wilminton Pike to US 35 | | | X | |
| | Wilmington Pike (south to north) | Woodman Drive to Dorothy Lane | | X | | |
| | | Dorothv Lane to Smithville Road | X | X | | |
| | | Irving Avenue to Dayton CBD | | X | | |
| | Dorothy Lane (west to east) | SR 741 to Patterson Blvd. | | | X | |
| | | Patterson Blvd. to La Plata Drive | X | X | X | |
| | National Road/US 40 (west to east) | Dogleg Road to Brown School House Road | | | | X |
| | Philadelphia Drive (south to north) | Siebenthaler Avenue to Turner Road | | | | x |
| | SR 4 (south to north) | I-75 through SR 444 interchange | | X | | |
| | | Greene County Line to I-70 | | X | | |

(1) All locations are approximate
(2) 1990 Daily Level of Service E or F
(3) 2020 Daily Level of Service
(4) Roadway segment includes at least one intersection with a "critical" accident rate (a rate significantly higher, statistically, than the area average rate)
(5) Identified as high priority locations by city, county and/or state traffic engineering staff

Source: BRW, Inc., May 1997.

# MIAMI VALLEY ITS

## USER SERVICES

# 3.0 USER SERVICE PRIORITIZATION

## 3.1 OVERVIEW

The final prioritization of Miami Valley transportation problems and ITS User Services occurred at the Workshop Intensive held on January 28 and 29, 1997. The workshop represented the culmination of the qualitative portion of the deficiencies assessment. The Workshop was attended by the project Policy and Technical Committees. The results of all of the previous qualitative assessment activities were summarized and a number of interactive activities were conducted to identify a final, subjective assessment of regional problems and ITS priorities.

The final activities of the Workshop Intensive focused on the discussion and preliminary prioritization of potential ITS projects/strategies. This exercise was based upon the problems and User Services prioritization and provided critical direction to the development of the program areas and projects presented in Section 6.0 of this report.

Thirty-five (35) people attended one or both days of the two-day workshop. Organizations represented at the workshop include the following:

- City of Beavercreek
- Butler Township
- City of Centerville
- Clark County Transportation Coordinating Committee
- City of Dayton
- City of Fairbom
- City of Huber Heights
- City of Kettering
- Federal Highway Administration
- Miami Valley Regional Planning Commission
- Miami County
- Montgomery County
- Ohio Department of Transportation - Central Office
- Ohio Department of Transportation - District 7
- Miami Valley Regional Transit Authority
- City of Springfield
- City of Troy
- City Xenia
- The project consulting team:
  - BRW,Inc.
  - Battelle Memorial Institute
  - CH2MHill
  - LJB

- TEC
- Dick Braun (Expert Panelist)
- Ron Fisher (Expert Panelist)
- Jerry Pittenger (Expert Panelist)

## 3.2 PROBLEM PRIORITIES

Utilizing the same list of predefined problem areas that was included in the User Needs Survey, Workshop participants individually scored area transportation problems. The individual scores were reviewed and a second round of voting was conducted. Table 3.1 presents the results of both votes.

## 3.3 USER SERVICE PRIORITIZATION

Workshop attendees performed a similar ranking of the 30 ITS User Services. The results are shown in Table 3.2.

## 3.4 OVERRIDING FACTORS

Before turning to the consideration of potential ITS projects to address identified problems and to implement the high priority user services, workshop participants developed a list of Overriding Factors. These factors loosely define the characteristics of preferred projects and will help guide all subsequent project development activities. The following working list was identified:

- Reflects a Region-Wide Perspective
- Addresses Safety
- Funding/Sponsorship Available
- Serves Many
- Highly Visibility
- "Early Winner"
- Accepted by Users
- Acceptable Risk-to-Benefit Ratio
- Ease of Deployment
- Maximizes Resources
- Acceptable Operating/Maintenance Costs
- Marketable
- Recognizes and Takes Advantage of the Unique Features of the Region

**TABLE 3.1**
**PROBLEM PRIORITIES**
**WORKSHOP INTENSIVE: JANUARY 28 - 29,1997**

| Final Score | Problem | First Score |
|---|---|---|
| 27 | Highway Congestion | 144 |
| 21 | Highway Safety | 81 |
| 21 | Cooperation & Coordination | 66 |
| 16 | Highway Emergency Response | 53 |
| 14 | Funding | 59 |
| 13 | Highway Road & Weather Info. | 58 |
| 10 | Highway Access | 41 |
| 6 | Highway Travel Time | 63 |
| 6 | Local Bus Intersystem Connections | 45 |
| 3 | Legal/Institutional | 32 |
| 2 | Highway Special Events | 36 |
| 2 | Local Bus Status Info. | 28 |
| 1 | Highway Air Pollution | 42 |
| 1 | Highway Lack of Bypass (Alternate Rolutes) | 51 |
| 1 | CVO Safety Inspection | 39 |
| 1 | Railroad Crossings | 18 |
| 1 | Transit Operations | 8 |
| | Local Bus Travel Times | 41 |
| | CVO HAZMAT Response | 37 |
| | Local Bus Scheduling | 34 |
| | Local Bus Safety/Security | 33 |
| | CVO HAZMAT Routing | 28 |
| | Intercity Bus/Rail Connections | 25 |
| | Highway Travel Time Info. | 24 |
| | CVO Weight Checking | 24 |
| | Intercity Bus Scheduling/Route Info. | 19 |
| | CVO Regulations | 15 |
| | CVO Fleet Routing | 11 |
| | Highway Noise | 8 |
| | Intercity Bus/Rail Travel Time | 7 |
| | Car-pooling Coordination | 6 |
| | Personal Security | 6 |
| | CVO CDL Licensing | 5 |
| | ADA Compliance/Special Populations | 4 |
| | Intercity Bus/Rail Safety/Security | 4 |
| | Local Bus Fleet Management | 3 |
| | Intercity Bus Operations | 1 |
| | Local Bus Fare Collection | 0 |
| | Intercity Bus Status Info. | 0 |
| | Intercity Bus Scheduling | 0 |
| | Intercity Bus Fleet Management | 0 |
| | Intercity Bus ADA Compliance | 0 |

*Source: BRW Inc.. May 1997*

**TABLE 3.2**
**USER SERVICE PRIORITIES**
**WORKSHOP INTENSIVE: JANUARY 28 - 29, 1997**

| Service | Service Bundle | Score |
|---|---|---|
| 1. Traffic Control | Travel & Transportation Management | 146 |
| 2. Incident Management | Travel & Transportation Management | 101 |
| 3. En-Route Driver Information | Travel & Transportation Management | 71 |
| 4. Route Guidance | Travel & Transportation Management | 67 |
| 5. Traveler Services Info. | Travel & Transportation Management | 52 |
| 6. Public Transportation Management | Public Transportation Operations | 49 |
| 7. Pre-Trip Travel Information | Travel Demand Management | 43 |
| 8. Highway-Railroad Intersection | (Not yet assigned) | 38 |
| 9. HAZMAT Incident Response | Commercial Vehicle Operations | 36 |
| 10. Emergency Vehicle Notification & Personal Security | Emergency Management | 35 |
| 11. Emergency Vehicle Management | Emergency Management | 35 |
| 12. On-Board Safety Monitoring | Commercial Vehicle Operations | 34 |
| 13. Demand Management & Operations | Travel Demand Management | 34 |
| 14. En-Route Transit Information | Public Transportation Operations | 23 |
| 15. Pre-Crash Restraint Deployment | Advanced Vehicle Control | 18 |
| 16. Safety Readiness | Advanced Vehicle Control | 17 |
| 17. Intersection Collision Avoidance | Advanced Vehicle Control | 16 |
| 18. Automated Roadside Safety Inspection | Commercial Vehicle Operations | 14 |
| 19. Personalized Public Transit | Public Transportation Management | 14 |
| 20. Automated Highway System | Advanced Vehicle Control | 13 |
| 21. Freight Mobility | Commercial Vehicle Operations | 11 |
| 22. Electronic Payment Services | Electronic Payment Services | 11 |
| 23. Public Travel Security | Public Transportation Operations | 10 |
| 24. Emissions Testing & Mitigation | Travel & Transportation Management | 10 |
| 25. CV Electronic Clearance | Commercial Vehicle Operations | 9 |
| 26. CV Administrative Processes | Commercial Vehicle Operations | 8 |
| 27. Ride Matching & Reservation | Travel Demand Management | 6 |
| 28. Vision Enhancement for Crash Avoidance | Advanced Vehicle Control | 6 |
| 29. Longitudinal Collision Avoidance | Advanced Vehicle Control | 4 |
| 30. Lateral Collision Avoidance | Advanced Vehicle Control | 0 |

*Source: BRW, Inc., May 1997*

## 3.5 ITS STRATEGIES/PROJECT CONCEPTS

Potential ITS strategies were discussed in each of the following four areas:

- Freeway/Incident Management
- Advanced Traffic Signal Control
- Public Transportation Management
- Commercial Vehicle Operations

In terms of specificity, "strategies" fall between User Services and individual projects. For example, "changeable message signs" is an example of an ITS strategy within the User Service "En-Route Driver Information". Each discussion centered around a comparison of suggested ITS solutions from the outreach process (User Needs Survey, Local Agency Interviews and the November 1996 Outreach Workshop) with a "master list" of potential strategies. Potential strategies, their benefits and their relationship to suggested ITS solutions were discussed. Traveler information strategies were not discussed separately but were included throughout the other strategy areas.

Following the discussion, participants rated the strategies based on their ability to address high priority transportation problems, implement high priority User Services and address Overriding Factors. The results of that rating are shown in Table 6.3.

## TABLE 3.3
## ITS STRATEGIES/PROJECT CONCEPTS PRIORITIZATION
## WORKSHOP INTENSIVE: JANUARY 28-29,1997

| Rank | Strategy/Proiect Concept | Area | Score |
|---|---|---|---|
| 1 | Changeable Message Signs | Freeway Management | 84 |
| 2 | Multi-Jurisdictional Signal System Coordination | Traffic Control | 73 |
| 3 | Advanced Traffic Control System<br>● Closed Loop<br>● Central Systems<br>● Adaptive Signal Control (SCOOT) | Traffic Control | 71 |
| 4 | Detection System | Freeway Management | 67 |
| 5 | Signal Timing and Synchronization Programs | Traffic Control | 63 |
| 6 | Highway Advisory Radio Broadcasts | Freeway Management | 41 |
| 7 | Special Event Traffic Control Plans | Traffic Control | 36 |
| 8 | Advanced Work Zone Traffic Control | CVO, Incident Management and HAZMAT | 33 |
| 9 | Emergency Vehicle Pre-Empt (EVP) | Traffic Control | 26 |
| 9 | Railroad Grade Crossing Advanced Safety Systems | Traffic Control | 26 |
| 9 | Mobility Management System - a central phone number provides access to integrated transit information, including personalized public transit | Transit | 26 |
| 12 | Surveillance Cameras | Freeway Management | 25 |
| 13 | Service Patrols | CVO, Incident Management and HAZMAT | 22 |
| 14 | Surveillance:<br>● Vehicle Detection<br>● Visual, Manual<br>● Visual Automated | Traffic Control | 20 |
| 15 | Integrated Freeway Ramp Signals | Traffic Control | 19 |
| 16 | Traffic Signal Preemption | Transit | 16 |
| 17 | Interactive Traveler Information Kiosks at Travel Information Centers and Other Major Transfer Points | Transit | 14 |
| 17 | Transit Incident Alerts | Transit | 14 |
| 17 | Response and Clearance Procedures/Protocol | CVO, Incident Management and HAZMAT | 14 |
| 20 | Traffic Management Center | Freeway Management | 13 |

# TABLE 3.3
# ITS STRATEGIES/PROJECT CONCEPTS PRIORITIZATION
# WORKSHOP INTENSIVE: JANUARY 28-29,1997

| Rank | Strategy/project Concept | Area | Score |
|---|---|---|---|
| 20 | Smart Card Fare collection/Passenger Counting System | Transit | 13 |
| 22 | En-route Driver-Base Communications to Correct for Schedule Problems (AVL required) | Transit | 12 |
| 22 | Coordination of Enforcement Databases (Weight, Licensing, Driver Inspections) | CVO, Incident Management and HAZMAT | 12 |
| 24 | Automated Transfer Coordinator Connection Protection (AVL required) | Transit | 11 |
| 24 | High Speed Weigh-In-Motion | CVO, Incident Management and HAZMAT | 11 |
| 26 | Ramp Meters | Freeway Management | 10 |
| 27 | Automated Collection of Bus Passenger Loading, Run-Time, and Mileage Data | Transit | 9 |
| 27 | Interactive Traveler Information Kiosks at Travel Information Centers and Other Major Transfer Points | Transit | 9 |
| 27 | Electronic Clearance for Safety and Operations Inspection | CVO, Incident Management and HAZMAT | 9 |
| 27 | l/10 Mile Route Markers | CVO, Incident Management and HAZMAT | 9 |
| 31 | Diversionary Timing Plans and Procedures for Alternative Arterial Routes | CVO, Incident Management and HAZMAT | 8 |
| 32 | Automated Schedule Adherence Monitoring (AVL required) | Transit | 7 |
| 32 | Incident Recording System/Database | CVO, Incident Management and HAZMAT | 7 |
| 32 | Regional Emergency Communications Center and Common Communications System | CVO, Incident Management and HAZMAT | 7 |
| 32 | Database of Scheduled Incidents (Maintenance, Construction and Events) | CVO, Incident Management and HAZMAT | 7 |
| 36 | Traffic Signal Priority | Traffic Control | 6 |
| 37 | Provide real-time traffic condition information to dispatch centers of public transit agencies from TOCs | Transit | 5 |
| 37 | On-Board HAZMAT Incident Response Information | CVO, Incident Management and HAZMAT | 5 |

**TABLE 3.3**
**ITS STRATEGIES/PROJECT CONCEPTS PRIORITIZATION**
**WORKSHOP INTENSIVE: JANUARY 28-29,1997**

| Rank | Strategy/Project Concept | Area | Score |
|---|---|---|---|
| 39 | Express Bus/Park and Ride | Freeway Management | 4 |
| 39 | HOV Bypass | Freeway Management | 4 |
| 39 | Computer Record Keeping of Telephone Customer Service Unserved Trips | Transit | 4 |
| 39 | Active Transit Station Signs | Transit | 4 |
| 39 | Random-Route (Dial-A-Ride) Transit | Transit | 4 |
| 39 | Integrated Operations Between Arterial, Ramp Terminals and Ramp Meters | CVO, Incident Management and HAZMAT | 4 |
| 39 | Towing Rotational List | CVO, Incident Management and HAZMAT | 4 |
| 46 | Automated Updating of Telephone Customer Service Schedule Database | Transit | 3 |
| 46 | Automated Origin-Destination Driven Telephone Customer Service Database | Transit | 3 |
| 46 | Evaluation of Driver Fitness for Duty (OOS Determinations) | CVO, Incident Management and HAZMAT | 3 |
| 46 | Special Access Points for Maintenance and Emergency Vehicles | CVO, Incident Management and HAZMAT | 3 |
| 50 | Automated Identification and Billing System (AIBS) for Paratransit | Transit | 2 |
| 50 | Single Trip Ridesharing (using both advance and real-time reservations) | Transit | 2 |
| 50 | Use of Remote Sensors and Cameras | Transit | 2 |
| 50 | Innovative Measures to respond to Incidents | Transit | 2 |
| 50 | On-Board Safety System Monitoring | CVO, Incident Management and HAZMAT | 2 |
| 50 | Total Stationing Equipment | CVO, Incident Management and HAZMAT | 2 |
| 50 | List of Key Equipment in Region | CVO, Incident Management and HAZMAT | 2 |
| 57 | Enhanced Computerized Driver Scheduling (Run Cutting) System | Transit | 1 |

## TABLE 3.3
## ITS STRATEGIES/PROJECT CONCEPTS PRIORITIZATION
## WORKSHOP INTENSIVE: JANUARY 28-29,1997

| Rank | **Strategy/Project concept** | **Area** | **Score** |
|---|---|---|---|
| 57 | On-Board Electronic Destination Signs | Transit | 1 |
| 57 | On-Board Automated Bus Stop Annunciators | Transit | 1 |
| 57 | Post Incident Debrief Sessions | CVO, Incident Management and HAZMAT | 1 |
| 61 | Central DB for HAZMAT Incident Response | CVO, Incident Management and HAZMAT | 1 |

Source: *BRW, Inc., May 1997*

# MIAMI VALLEY ITS

## TECHNOLOGY ASSESSMENT

Technology Assessment

# 4.0 TECHNOLOGY ASSESSMENT

## 4.1 OVERVIEW

Current technologies available to perform the functions associated with the highest priority ITS User Services for the Miami Valley were assessed in terms of a number of criteria, including cost and performance. The results of the assessment are presented in the ***Technologies Analysis Working Paper*** (March 1997).

Given the evolutionary nature of ITS technologies and the long, twenty year time frame considered in this plan, specific technologies were not recommended for each specific projects. Rather, the technology assessment focused on providing the descriptive and comparative information necessary to support the selection of specific technologies during the design phase of recommended projects.

## 4.2 SUMMARY OF SELECTED FINDINGS

The ***Technologies Analysis Working Paper*** (March 1997) includes findings regarding the relative cost and performance of a number of technologies. Selected findings for key technologies are presented here in Tables 4.1 through 4.6.

# SUMMARY OF INFORMATION FOR NON-INTRUSIVE TRAFFIC DETECTION TECHNOLOGIES

| TECHNOLOGY | VENDOR/PRODUCT | STATED CAPABILITIES | APPROXIMATE COST | ADDITIONAL EQUIPMENT(2) |
|---|---|---|---|---|
| Active Infrared | Schwartz Electro-Optics, Inc.<br>Autosense I | volume, occupancy, density, speed<br>classification, presence | $6,500 | PC, mounting bracket |
| Active Infrared | Santa Fe Technologies/Tital<br>SmartLOOK | volume, presence, classification,<br>acceleration, speed | $8,000 | PC |
| Passive Infrared | Eltec Instruments, Inc.<br>833/842 | 833: volume, occupancy, speed, presence<br>842: volume (up to 45 mph),<br>occupancy, presence | 833: $820<br>842: $1,210 | |
| Passive Infrared | Grumman Corporation<br>Grumman Traffic Sensor | volume, occupancy, density, speed | $1 | |
| Passive Infrared | ASIM Engineering Ltd.<br>(Switzerland)<br>IR224 | volume, occupancy, presence | $1,400 | PC with Interface Box and display software to receive serial data (optional) |
| Passive Magnetic | 3M<br>Microloop | volume, occupancy, presence,<br>speed (with two sensors) | $500-800 (1) | |
| Passive Magnetic | Nu-Metrics<br>NC-40, NC-90A | NC-40: volume, occupancy, presence<br>NC-90A: same plus speed, class, length<br>G-l: volume, occupancy,presence, temp.<br>G-2: same plus speed, class, length | NC-40: $550<br>NC-90A: $895<br>G-1: $975<br>G-2: $1,695 | PC, computer interface ($450), software ($745) and protective cover ($158-NCs only) |
| Passive Magnetic | Safetran Traffic Systems, Inc.<br>232 E/231E | volume, occupancy, speed, presence,<br>(232 is the counter) (231 is the probe) | 232E: $700<br>231E: $90 each | PC |
| Radar | EIS, Inc.<br>RTMS XI | volume, occupancy, speed, presence,<br>turning movements, classification | $3,500 | PC for setup (required) and for serial data (optional) |
| Doppler Microwave | Microwave Sensors, Inc.<br>TC-20/TC 26B | volume, occupancy<br>(20 is short range) (26B is long range) | TC-20: $630<br>TC-26B: $735 | |
| Doppler Microwave | Peek Traffic, Inc.<br>PODD | volume, occupancy | $650 | Mounting hardware |
| Doppler Microwave | Whelen Engineering Co.<br>TDW 10/TD 30 | volume, occupancy, speed<br>(TOW is wide beam) (TDN is narrow beam) | $995 | PC for serial data (optional) |
| Passive Acoustic | AT&T I IRD<br>SmartSonic TSS-1 | volume, occupancy, speed | $1,450 | Mounting brackets<br>PC for serial data (optional) |
| Pulse Ultrasonic | Microwave Sensors, Inc.<br>TC-30C | volume, occupancy, presence | $560 | |
| Pulse Ultrasonic | Sumitomo Electric USA, Inc.<br>SDU 420 | volume, occupancy, presence | $1 | |
| Video Tracking | CRS, Inc.<br>TAS 2 | volume, occupancy, density, headway speed, classification, dwell, presence, queue length, incidentdetection | $15,000-$18,000 | Camera |
| Video Tracking | Condition Monitoring Systems<br>Mobilizer (VME, Wide Area, and PC systems) | volume, occupancy, density, presence, speed classification, delay, turn moves, headway acceleration, O/D studies, ped/bike detection | VME: $10,000-$30,000<br>WAS: $7,000-$25,000<br>PC: $5,000 | VME: cameras<br>WAS: (includes cameras)<br>PC: 586 PC, cameras |
| Video Tracking | EM<br>Cruise | | $1 | Camera |
| Video Tracking | ELIOP Trafico S.A. (Spain)<br>Eva 2000 S | volume, occupancy, density, presence, speed, classification,headway<br>(Price varies with features) | $7,000-$17,000 | 386 PC, camera, software |
| Video Tripline | Econolite<br>Autoscope 2004 | volume, occupancy, density, presence, speed, classifications, headway, turning movements | $17,000(1 camera unit)<br>$24,000(4camera unit) | 486 PC (cameras included) |
| Video Tracking | Peek Transyt<br>Video Trak-900 | volume, occupancy, density, presence, speed, classifications, headway, turning movements, incidentdetection | $18,000(4 camera unit) | 486 PC, cameras |
| Video Tripline | RockwellInternational<br>TraffiCam | volume, occupancy, speed, presence | $3,800 | 386 PC (camera included) |
| Video | Sumitomo Electric USA, Inc.<br>IDET 100 | volume, occupancy, speed, classification, presence | $15,000(1) | |
| Video | Eagle Signal/Odetics<br>VTDS | volume, occupancy, speed, presence, headway | $1 | |

(1) Price is estimated or was not available.
(2) Collection of relay data requires additional equipment.
(3) Contact vendors for a full description of all device features, cost and additional equipment. Table updated February, 1996.

SOURCE: Minnesota DOT/FHWA

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## TABLE 4.2

## DETECTOR TYPES, PRIMARY DATA TYPES AND MOUNTING OPTIONS

| DETECTOR TYPE | PRIMARY DATA TYPE | MOUNTING OPTIONS |
|---|---|---|
| Inductive Loop | Presence | In Roadway (Per Lane) |
| Piezoelectric Strip | Axle Count, Weight | In Roadway (Per Lane) |
| Radar (Continuous Wave) | Speed | Overhead (Per Lane) |
| Radar (Multi-Zone) | Presence | Overhead or Side-Fired (Multi-Lane) |
| Active infrared (Non-Image) | Presence | Overhead (Per Lane) |
| Passive Infrared (Non-Image) | Presence | Overhead (Per Lane) |
| Passive Infrared (Image) | Presence | Overhead or Side-Fired (Multi-Lane) |
| Acoustic (Passive) | Presence | Overhead (Per Lane) |
| Ultrasonic (Pulsed) | Presence | Overhead (Per Lane) |
| Ultrasonic (Continuous Wave) | Presence | Overhead (Per Lane) |
| Magnetometer or Microloop | Presence | In Roadway (Per Lane) |
| Video Image Detection | Tracking | Overhead or Side-Fired (Multi-Lane) |

## TABLE 4.3

## COMPARISON OF DETECTOR TECHNOLOGIES ANALYZED

| | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| Loops | 1, 2, 5, 14 | 3, 10, 11, 16 |
| Magnetometers | 9 | 5, 10, 11, 16 |
| Axle Counters | 1, 2, 5, 14 | 10, 11, 16 |
| Radar (Wide Beam) | 4, 14, 15, 17 | 12 |
| Radar (Narrow Beam) Overhead | 4, 5, 14 | 2, 8 |
| Microwave Overhead | 4 | 2, 8 |
| Microwave Doppler Side-Fire | 4, 14, 15,17 | I,12 |
| Infrared Passive (Non-Image): | 4 | 1, 2, 8, 16 |
| Infrared Active (Non-Image): | 4 | 1, 12, 8, 16 |
| Infrared Passive (Image): | 7 (side-fire), 17 | 8 (overhead) |
| Acoustic Passive | 15 | 2, 8, 14, 16 |
| Ultrasonic Pulse | 7 (SF), 14, 4, 7 (side-fire), 14 | 8 (overhead) |
| Video | 7 (side-fire), 15 | 8 (overhead), 17 |

1 History
2 Initial Cost (including support)
3 Life Cycle Cost
4 Calibration (ease)
5 Accuracy
6 Ability To Send Data
7 Pole Support
8 Structure Support or Mast Arm
9 Bridge Intrusive
10 Lane Closure for Installation
11 Lane Closure for Maintenance
12 Occlusion
13 Initial Cost
14 Enviorionmental Performance
15 Ease of Installation
16 Single Lane Detection
17 Multi Lane Detection

TABLE 4.4

SUMMARY OF CABLE TYPE COMMUNICATIONS SYSTEMS

| System Ownership | Technology | Communications: Max Bandwidth or Data Rate Per Circuit | Communications: Applicable Information | Maximum Transmisslon Distances | Applicable Services | Total Cost Per Basis Including Supporting Hardware & Equipment |
|---|---|---|---|---|---|---|
| Telephone Company Facilities | Voice Grade Channel | 9600 bps | Data, Voice and Slow Scan TV (SSTV) | up to 10 miles | Traffic Control Systems | $80 to $1 00/month per circuit or channel |
| | Digital Channel | 1.54 mbps | Data, Voice and Slow Scan TV (SST) | up to 10 miles | Traffic Control Systems and ITS Systems using SSTV | up to $300/month per circuit or channel |
| Agency Owned Facilities | Twisted Pair Cable | 9600 bps Analog | Data, Voice and Slow Scan TV (SST) | 2 to 3 miles | Traffic Signal and Traffic Control System | $15 to $25 per foot |
| | | Digital 30 kbps | | up to 15 miles with reamplifications | Capillary Cabling only in ITS | |
| | Coaxial Cable | 350 MHz | Data, Voice and CCTV | up to 2000' without reamplifications, up to 4 to 5 miles with reamplifications | Traffic Control Systems Particularly CCTV and ITS | $20 to $30 per foot |
| | Fiber Optic Cable | 2.5 GHz | Data, Voice and CCTV | up to 5 miles multimode fiber up to 25 miles singlemode fiber | Traffic Control and ITS Backbone Systems | $20 to $25 per foot |

Notes: All cable types can be installed in any conduit including underground can be already buried which usually requires special cable jackening or can be installed along an overhead cable line (I.e. supporting messenger cable) between poles. Maintenance requirements are generally none, except if the cable and any connections have been disturbed or cut by utility excavations.

TABLE 4.5

## VARIABLE MESSAGE SIGN
## PRODUCT - COST COMPARISON

| | HISTORY | PERFORMANCE | COST |
|---|---|---|---|
| Flip Disk | Reliable | Limited visibility under some lighting conditions.<br>Fading of colors.<br>Mechanical failures (dots stick). | 3 row -21 character<br>$50,000 - $100,000<br>3 row - 8 character<br>$25,000 - $50,000 |
| Bulb Matrix | Unreliable | High power consumption.<br>High temperature output. | Not Applicable |
| Light emitting - Diode | Reliable | Early problems of brightness during daylight, variance in brightness, poor brightness degeneration curve and color.<br>Problems have been resolved but only 4 years of history available. | 3 row - 21 character<br>$60,000 - $130,000<br>3 row - 8 character<br>$40,000 - $60,000 |
| Fiber Optic | Reliable | Early problems of halo effect have been resolved.<br>Scored very high in side-by-side tests in the areas of brightness under all lighting conditions, visibility and legibility. | 3 row - 21 character<br>$50,000 - $110,000<br>3 row - 8 character<br>$30,000 - $50,000 |
| Hybrid | Reliable | Two hybrids presently in use, LED and Fiber Optic. Each delivers a brighter message. The Fiber Optic is capable of delivering a dot much brighter than that delivered by LED. | Add 15% - 20%<br>above basic LED or<br>Fiber Optic sign. |

## TABLE 4.6

## CATV COMMUNICATIONS OPTION - COMMERCIALLY OWNED FACILITIES ADVANTAGES / DISADVANTAGES

| **CATV as a communications option has some advantages. These are summarized as follows:** | **There are also some disadvantages in using CATV. These are summarized as follows:** |
|---|---|
| 1. Their cable network is already in place | 1. Most CATV networks are designed with emphasis on downstream transmission of video signals to cable subscribers. |
| 2. The design effort and initial installation costs are much lower than an agency owned system. | 2. Video channels take up most of the available bandwidth. The bandwidth available for traffic control may be very narrow ranging from a single 6 MHz channel to 4 or 5 channels. |
| 3. A franchise agreement may provide government use of CATV cable at either reduced rates or free of charge. | 3. Frequencies of available channels are often the least desirable and susceptible to noise and interference. |
| 4. A second separate cable, referred to as an institutional network (I-Net), may exist for the purpose of providing services to government and commercial subscribers. | 4. CATV facilities are often concentrated in residential areas. Services near freeways and in central business districts are few or nonexistent. |

# MIAMI VALLEY ITS

## SYSTEM ARCHITECTURE

# 5.0 *SYSTEM ARCHITECTURE AND COMMUNICATIONS CONCEPT PLAN*

## 5.1 OVERVIEW

This section summarizes portions of the recommended system architecture that was developed to support the ITS program areas and projects presented in Section 6.0 of this report. The effort to develop the system architecture included two reports, the ***Functional Needs, Requirements and Preliminary System Architecture Working Paper*** (January 1997) and the ***Recommended System Architecture and Technologies Working Paper*** (August 1997). The latter report includes the final recommendations for system architecture, including high-level architecture diagrams for program areas 1 through 4 of the recommended ITS (program areas are discussed in Section 6.0 of this report), and summary architectures for each of the implementation time frames: Immediate Term (years l-2), Short Term (years 3-5), Mid-Term (years 6-10) and Long-Term (years 1 l-20). The summary presented here includes only the summary architectures.

## 5.2 BACKGROUND CONCEPTS

Architecture, as it pertains to Intelligent Transportation Systems (ITS), refers to the technical blueprint by which integrated systems are designed, built, and deployed. Typically, an architecture comprises three major components: the processing system, the communications, and a data architecture. The architecture is the strategy, not the applications or services built within that architecture. It defines "what" components and systems must talk to each other but not necessarily "how" they communicate. These "how" decisions are typically defined on the project or process level.

For ITS deployment in the Miami Valley, some architectural components are already in place. Whether by design or not, agencies and organizations around the Miami Valley region have deployed systems that will become a part (either in part or in their entirety) of the overall ITS deployment in the region. The challenge facing those involved in guiding ITS deployment in the area is to implement an architecture that is flexible enough to respond to changing needs and technologies but robust enough to handle the volume of data and information that must be processed and distributed throughout the region.

## 5.3 COMMUNICATION PROFILES

One of the most important components of an architecture is the communications infrastructure. The type of communication methods and technologies selected must support the collection and dissemination of transportation information throughout the ***Miami*** Valley Area. The ***Recommended System Architecture and Technologies Working Paper*** (August 1997) identifies candidate communication technologies that are applicable for the various program areas but does not recommend specific types of communications for a specific interface.

Each program area can be successfully implemented with a variety of communications methodologies. The type of communication ultimately selected will depend on many factors such as existing communication infrastructure, resources available, data communication requirements, and the long-range plan for the systems involved. In order to simplify the multitude of communications options available for each program area, “profiles” have been identified that represent the type of communications and data transmission requirements necessary in each program area rather than a particular communication medium. These profiles (A, B, and C) vary depending on the amount of data (which could be voice, video, or electronic data) that must be transmitted (volume) and how often this transmission takes place (frequency). The three profiles are defined below and are used in the architecture diagrams in Section 5.3.

### 5.3.1 Profile A

- Low volume data
- Manual data
- Updates only when required

Systems using this profile of communications typically do not have large amounts of data to transfer to the central data server, which receives raw data and processes it for dissemination to various independent service providers and traveler information systems. The data to be transferred typically is not available electronically and most data is manually processed through hardcopy, voice, facsimile, or pager networks. Typical sources of this information would be transit agencies that have static schedules or special event information. Some examples of communication technologies that fall under this category are public switched networks, cellular networks, pager networks, etc.

### 5.3.2 Profile B

- Electronic data
- Low and high volumes of data
- Static and dynamic data
- Updated regularly, but not real-time

Systems using this profile of communications typically have large amounts of data to transfer that are available electronically. The data is not updated frequently and could be either static or dynamic in nature. The frequency of data received and transmitted using these profile ranges from one update daily to more than one update (usually if updates occur during peak morning and evening hours). A transit agency would be a typical source of this type of information where they have their route schedules in an electronic format that can be transmitted to a central data server. While not static, this transit information is not frequently updated and thus does not require a real-time communications link to the central data server. This profile could also be used to disseminate information out to changeable message signs, highway advisory radio, and electronic station signs. Some examples of communication technologies that fall under this category are analog telephone lines, digital modem lines, packet radio networks, etc.

### 5.3.3 Profile C

- Low and high volume data
- Continuous update of information - real-time
- Primarily dynamic information

Systems using this profile typically have large amounts of data that are available by electronic media and/or updated frequently or almost continuously. Typically, the data is dynamic, supplemented by some static information. The frequency of data received and transmitted in this category is in real-tune. While this may not constitute a continuous open communication link between two systems, it is necessary that this profile support frequent updating of the information. Sources of such information include real-tune incident detection, speed data, CCTV images, and video detection systems. Types of dissemination techniques which use this type of communications are traveler information services like the Internet, Cable TV, in-vehicle navigation devices, and planning organization like Emergency Management, Incident Rescue Operations, etc. Some examples of communication technologies that fall under this category are fiber optic network, FM Subcarrier systems, coaxial cable systems, etc.

## 5.4 RECOMMENDED ARCHITECTURES BY TIME FRAME

The architectures described below relate to specific projects described in detail in Section 6.0 of this report. For the purposes of system architecture, the Mid- and Long-Term time frames have been combined.

The architectures presented on *the* next *several* pages reflect a *distributed* architecture for the Miami Valley. A distributed architecture relies heavily on local storing and processing of data and then communicating that data between systems using the various communications means discussed in Section 5.3. In a distributed architecture, each site receives separate data inputs, then processes the data into the appropriate information content and stores it for retrieval. Each user (or data terminal) makes a request of the “system” for information. The type of information requested will determine which “server” or processor will respond to the request.

The primary disadvantage of a distributed architecture is that data is not resident in a single “location,” which generally makes maintenance, consistency and standardization of data format easier. However, a strong advantage of distributed architectures is that it can be more easily expanded incrementally and control can be maintained at the local level.

### 5.4.1 Immediate Time Frame Near l-2 Projects

Projects recommended for immediate implementation focus on establishing “early winners.” These projects are relatively autonomous systems that can be useful to travelers even if there is not a large, installed base of traffic detection and reporting devices. In later phases, as more traffic data and surveillance systems become available, more data intensive projects are recommended for implementation.

For the Freeway/Incident Management Systems program area, projects recommended for deployment in the immediate time frame include vehicle detection, changeable message signs and closed-circuit television surveillance. These systems can provide immediate benefits to agencies responsible for monitoring freeway flow and responding to incidents on the freeway system.

The projects recommended for implementation in the Advanced Traffic Control Systems program area are scheduled timing updates, microprocessor controller conversions, and phase 1 of the coordinated traffic signal system improvements.

For the Public Transportation Systems program area, the immediate time frame includes projects in the automatic vehicle location systems for MVRTA buses, automated on-board fare and data collection, and transit traveler information through electronic displays on MVRTA buses.

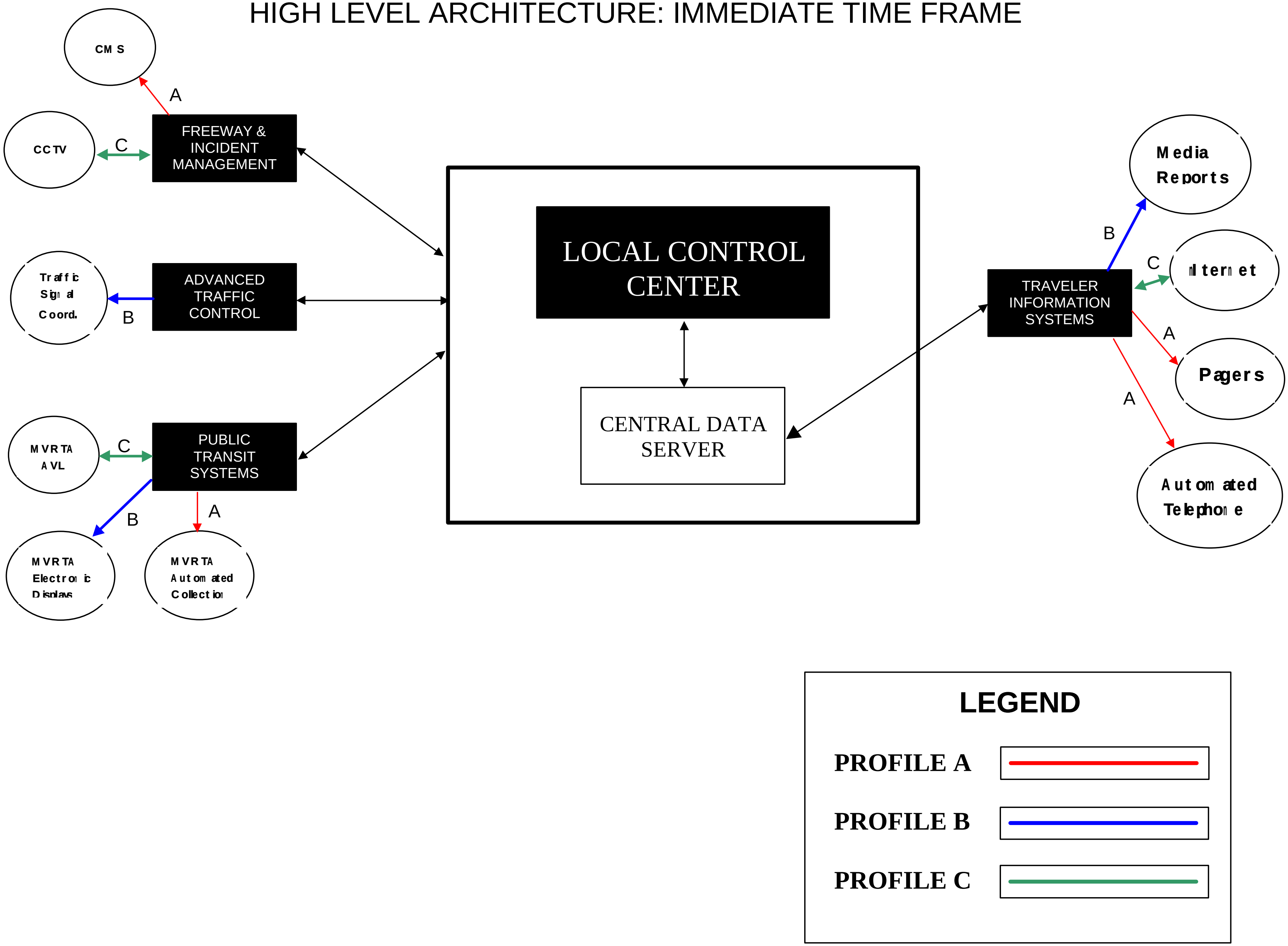
The five projects recommended for implementation in the Multimodal Traveler Information Systems program area during this time frame include media reports, Internet, pagers, automated telephone, and the central data server. The central data server is the most complex of these projects and is implemented in the immediate time frame to establish a foundation on which future projects can be implemented. Without the central data server, many of these systems would not be able to take advantage of traffic information that will be collected.

The remaining four projects in the Multimodal Traveler Information Systems program area can be established as autonomous systems, not necessarily connected into the central data server. Their deployment can parallel the development and deployment of the central data server. While these systems can provide functionality without connection to the central data server, it is highly recommended that this connection be designed into each system so when the central data server comes “on line,” each system can take advantage of the extended information that is available.

Figure 5-1 presents the recommended high level system architecture for the Immediate (years l-2) deployment time frame.

FIGURE 5-1

# HIGH LEVEL ARCHITECTURE: IMMEDIATE TIME FRAME



## 5.4.2 Short Term Time Frame Near 3-5 Projects

Projects recommended for the short term time frame typically, though not always, rely more on an established infrastructure and are more complex with respect to the implementation and deployment requirements.

For the Freeway/Incident Management Systems program area, it is recommended that a cellular hotline be established for callers to use from their vehicles to report traffic incidents and other freeway problems as well as gain information regarding current traffic situations. Highway Advisory Radio is the second project in this area to be deployed in the short time frame. This project allows broadcast of traffic and travel related information to all motorists.

Deployment of ITS technologies at highway rail intersections, and phase 2 of the coordinated traffic signal system improvements are the projects recommended in the Advanced Traffic Control Systems program area for this time frame.

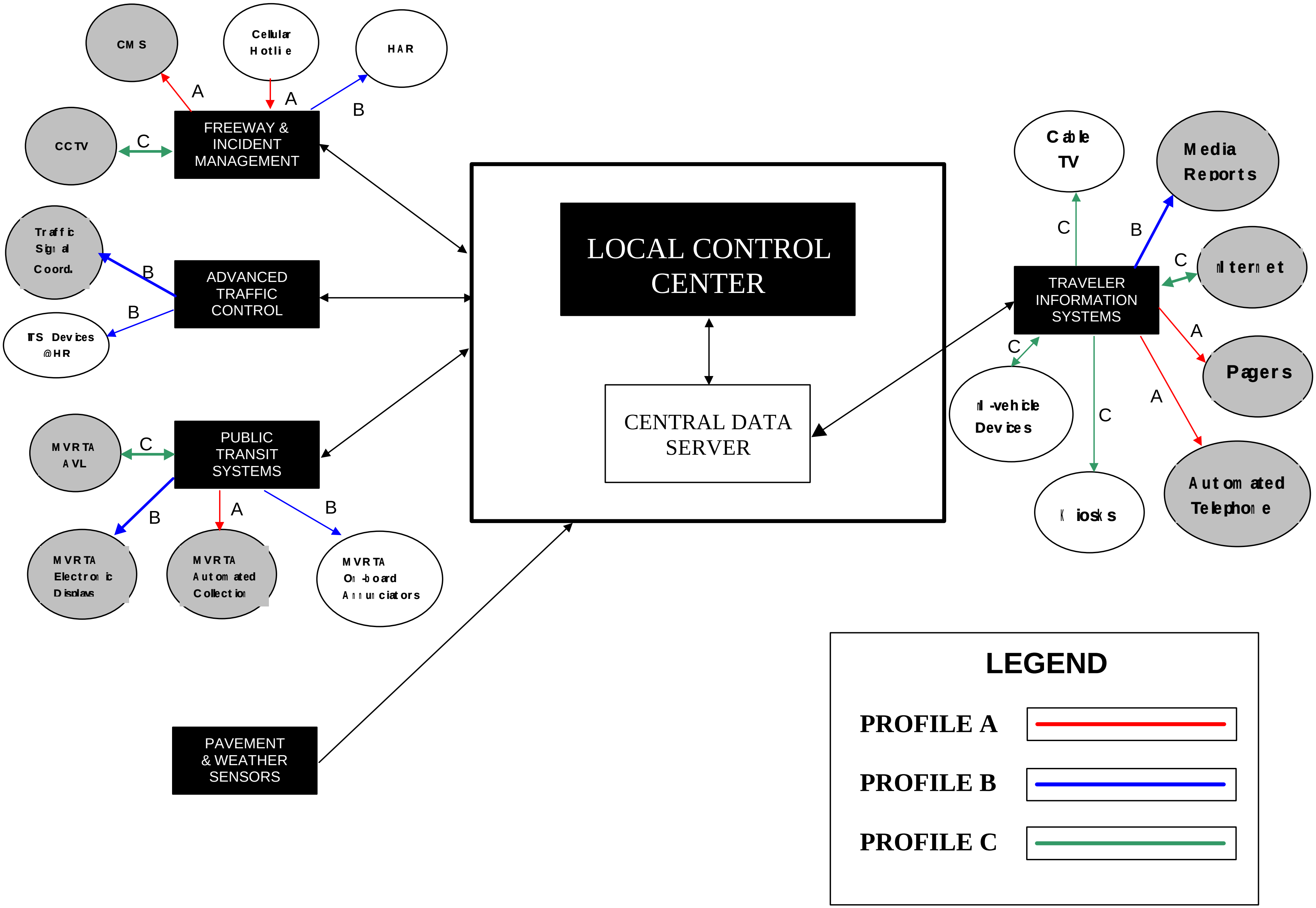
For the Public Transportation Systems program area, inclusion of on-board annunciators, announcing critical bus stops and major intersections is the project recommended for implementation in the short time frame.

Multimodal Traveler Information Systems program area has three projects recommended for implementation in this time frame. These are a cable television traffic system, traveler information kiosks, and in-vehicle devices. These projects typically rely more heavily on receipt of data and are dependent on the previous development and deployment of the central data server. Continued updating of the central data server would also be required as additional systems are brought "on-* line."

Figure 5-2 presents the recommended high-level system architecture for the Short Term (years 3-5) deployment time frame.

FIGURE 5-2

# HIGH LEVEL ARCHITECTURE: SHORT-TERM TIME FRAME



### 5.4.3 Mid-Term/Low-Term Time Frame Near 6-20 Projects

Projects recommended for implementation in the mid- to long-term time frames are typically heavily dependent on established infrastructure or are recommended based on anticipated growth in the previous 5-10 years that would then make these additional systems a necessity.

Ramp Metering is the only project in the Freeway/Incident Management Systems program area implemented in this area. It was felt that ramp metering was not needed in the immediate or short term periods and a study would be initiated to determine the feasibility and necessity of ramp metering before any implementation.

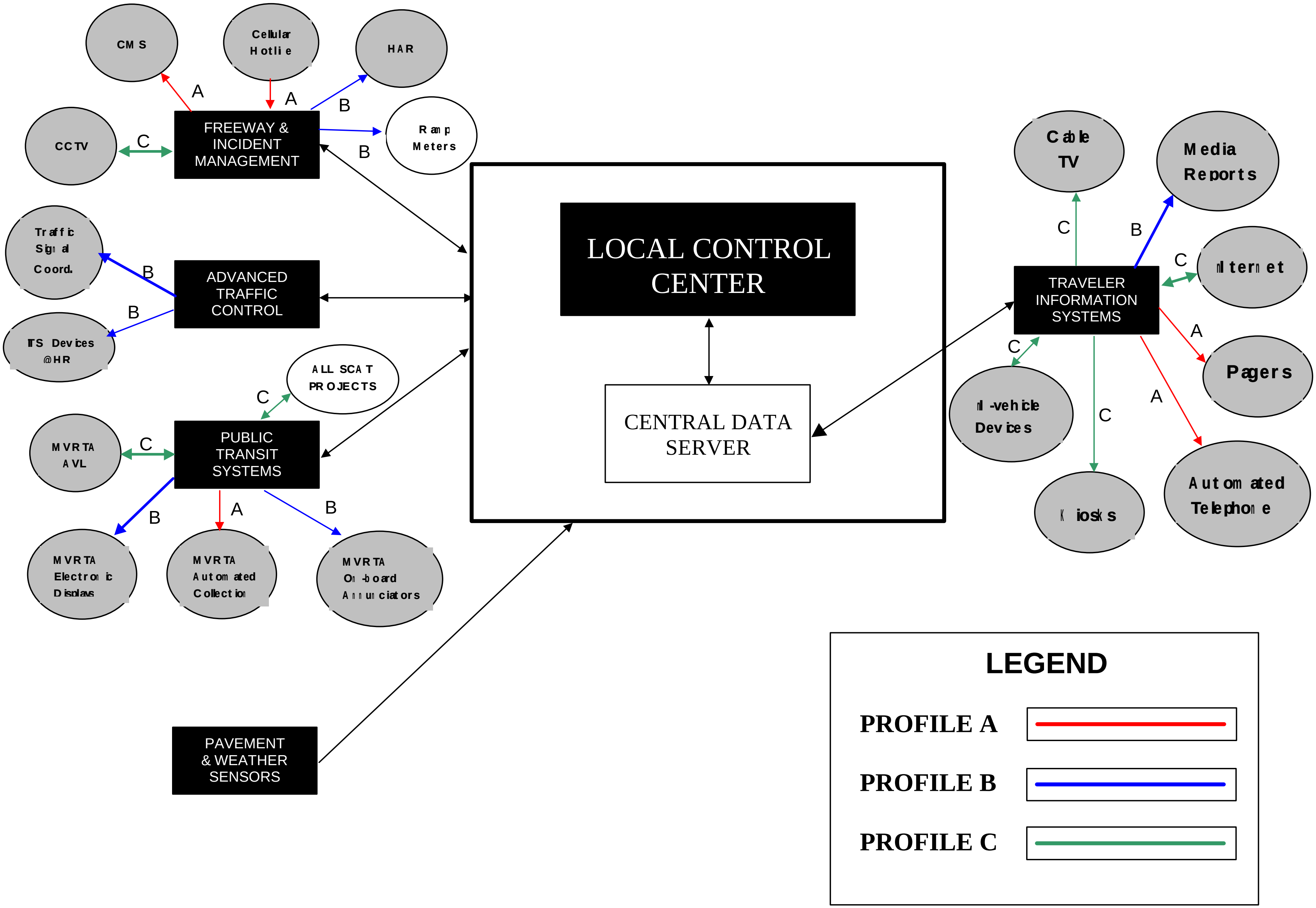
In the Advanced Traffic Signal Control Systems program area, projects include phase 3 & 4 of the coordinated traffic signal system improvements, and ITS strategies at Highway/Railroad Intersections.

In the Public Transportation Systems program area, projects include implementation of AVL, electronic display, and automated fare collection on SCAT buses.

Figure 5-3 presents the recommended high-level system architecture for the combined Mid- and Long-Term (years 6-20) deployment time frames.

FIGURE 5-3

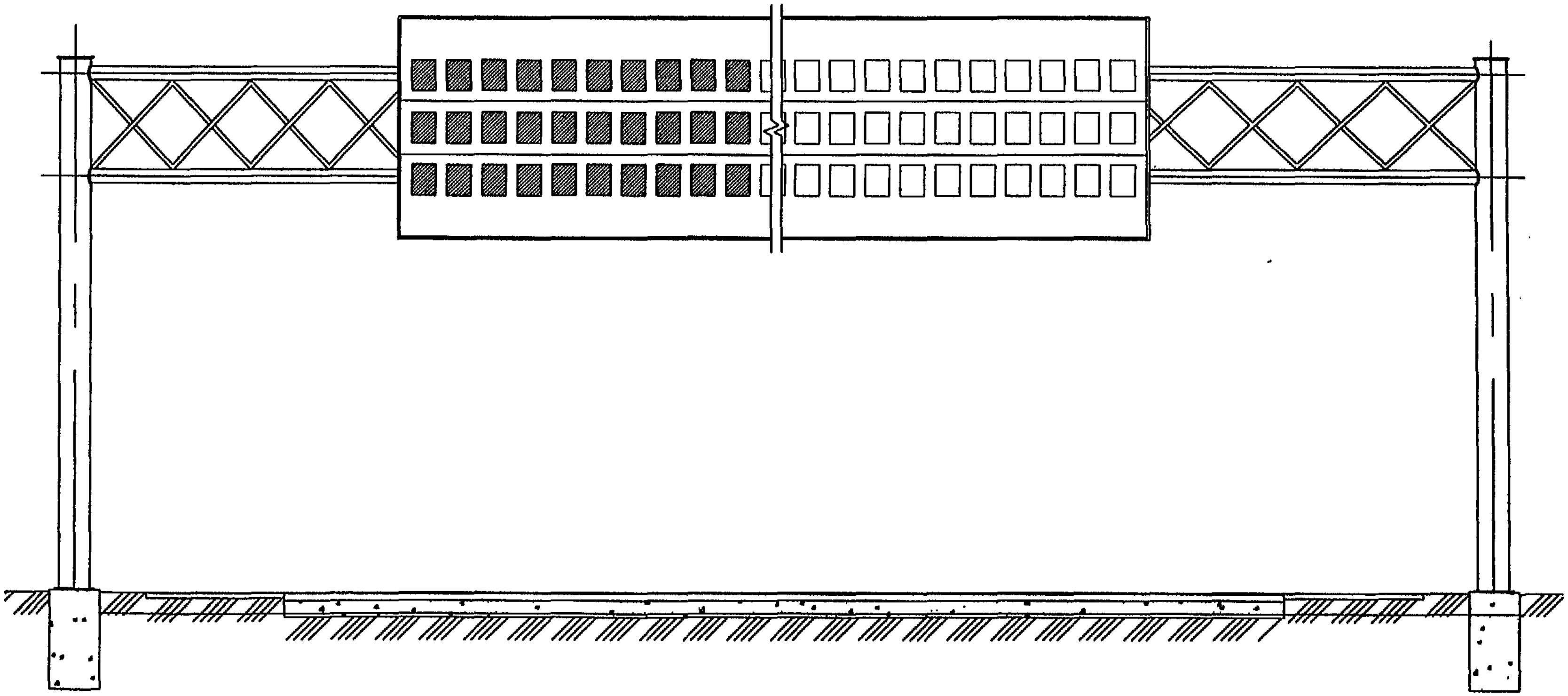
HIGH LEVEL ARCHITECTURE: MID-LONG TERM TIME FRAME



# MIAMI VALLEY ITS

## APPENDIX

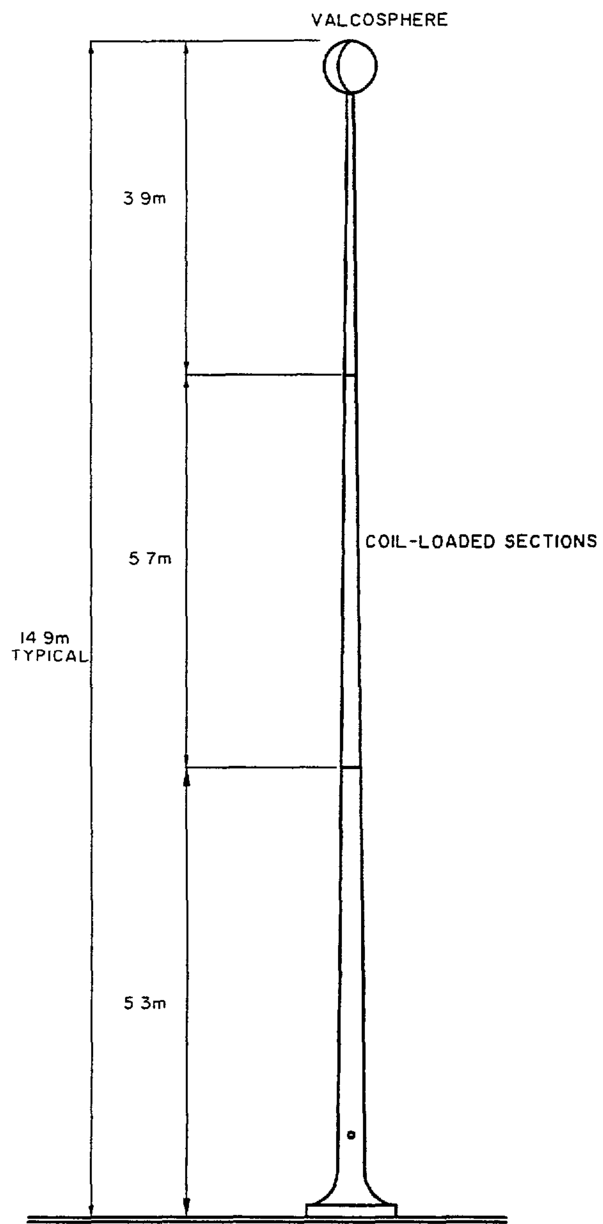
# *APPENDIX*
# *TYPICAL ITS SYSTEM FEATURE*



FIBEROPTIC
CHANGEABLE MESSAGE SIGN

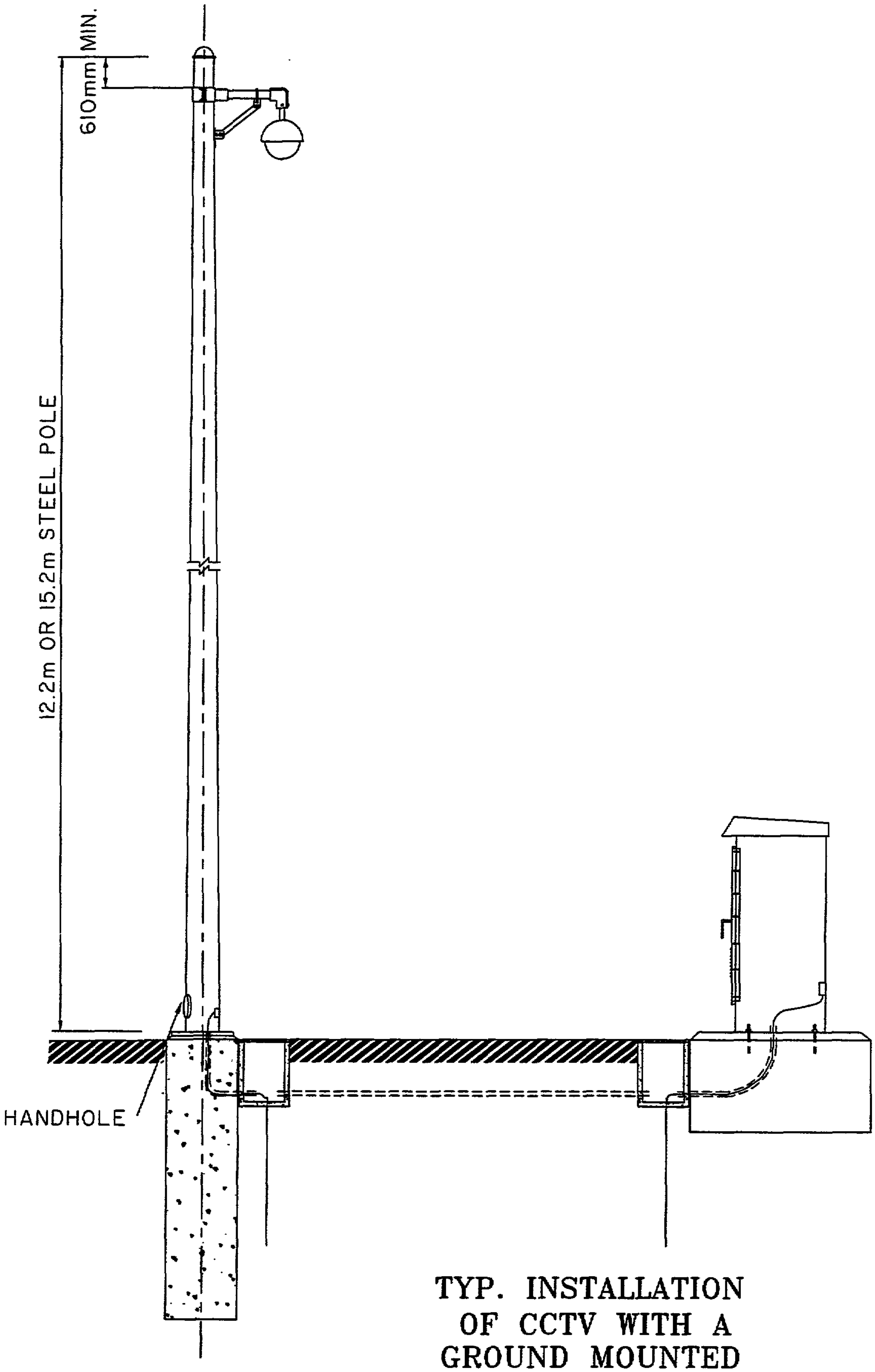
ARTIMIS SYSTEM-CINCINNATI AREA

9652\CMSDET DWG | VGDR 05/18/94 | PLOT SCALE NONE, VIEW PLOT1



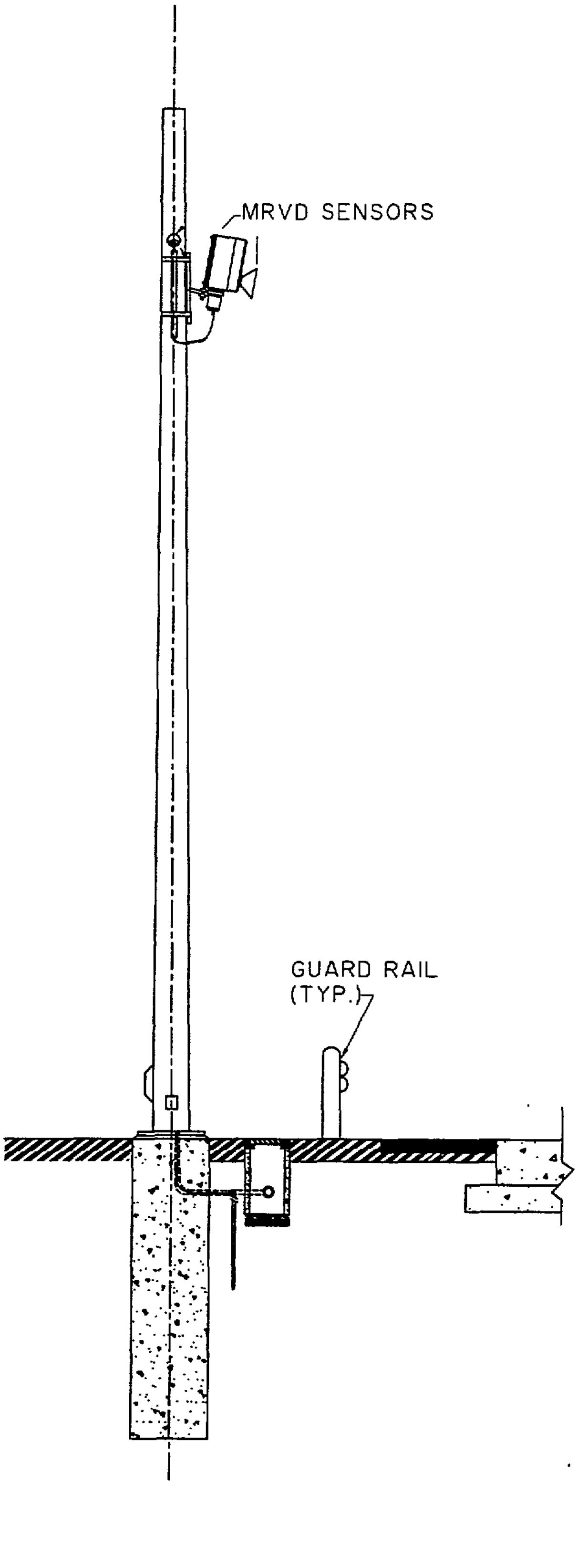

TYP HAR ANTENNA SPEC.

ARTIMIS SYSTEM–CINCINNATI AREA




TYP. INSTALLATION OF CCTV WITH A GROUND MOUNTED CABINET

ARTIMIS SYSTEM-CINCINNATI AREA




**TYP.**

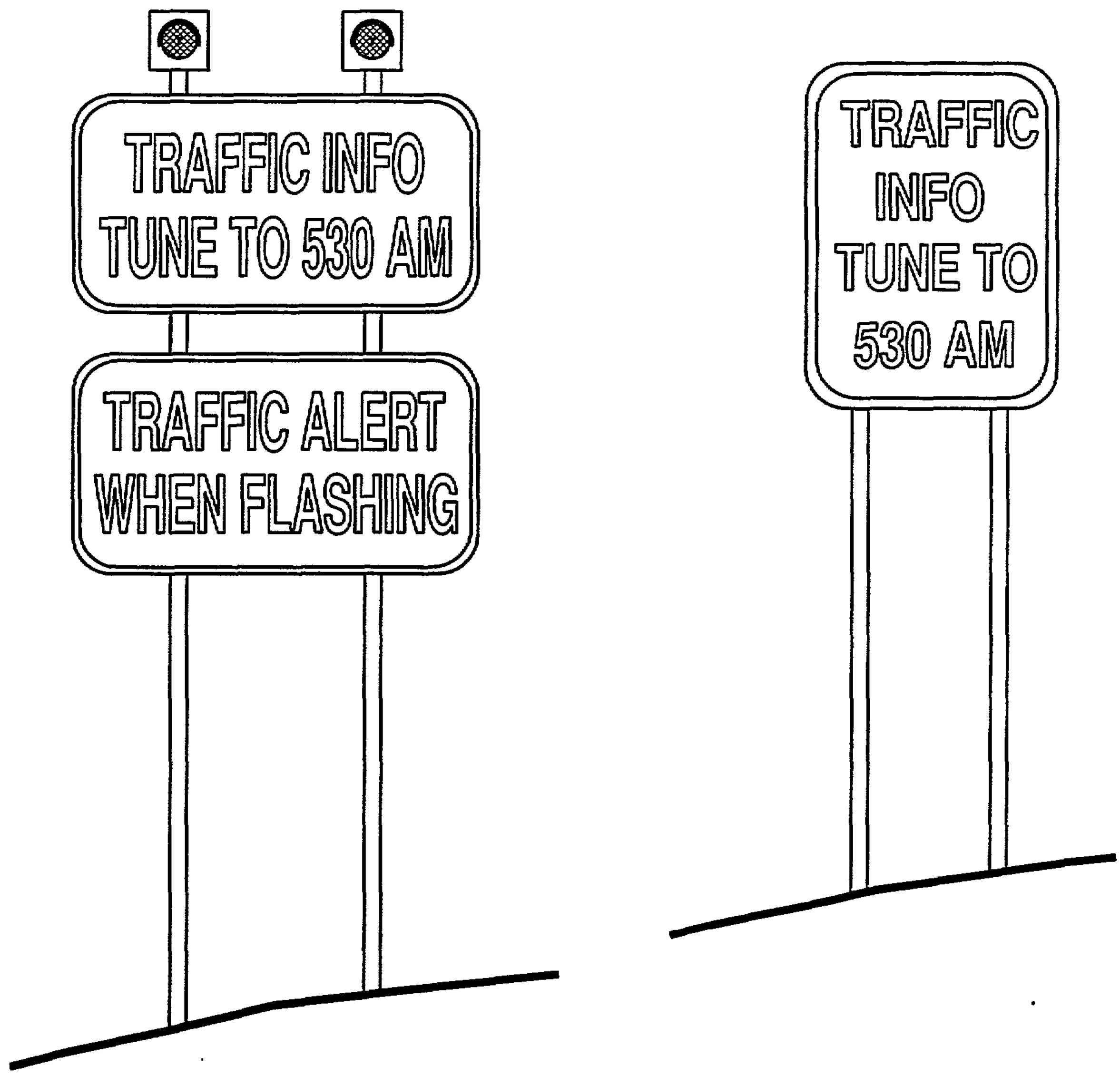
**STEEL POLE**

**INSTALLATION**

**WITH SIDE FIRE**

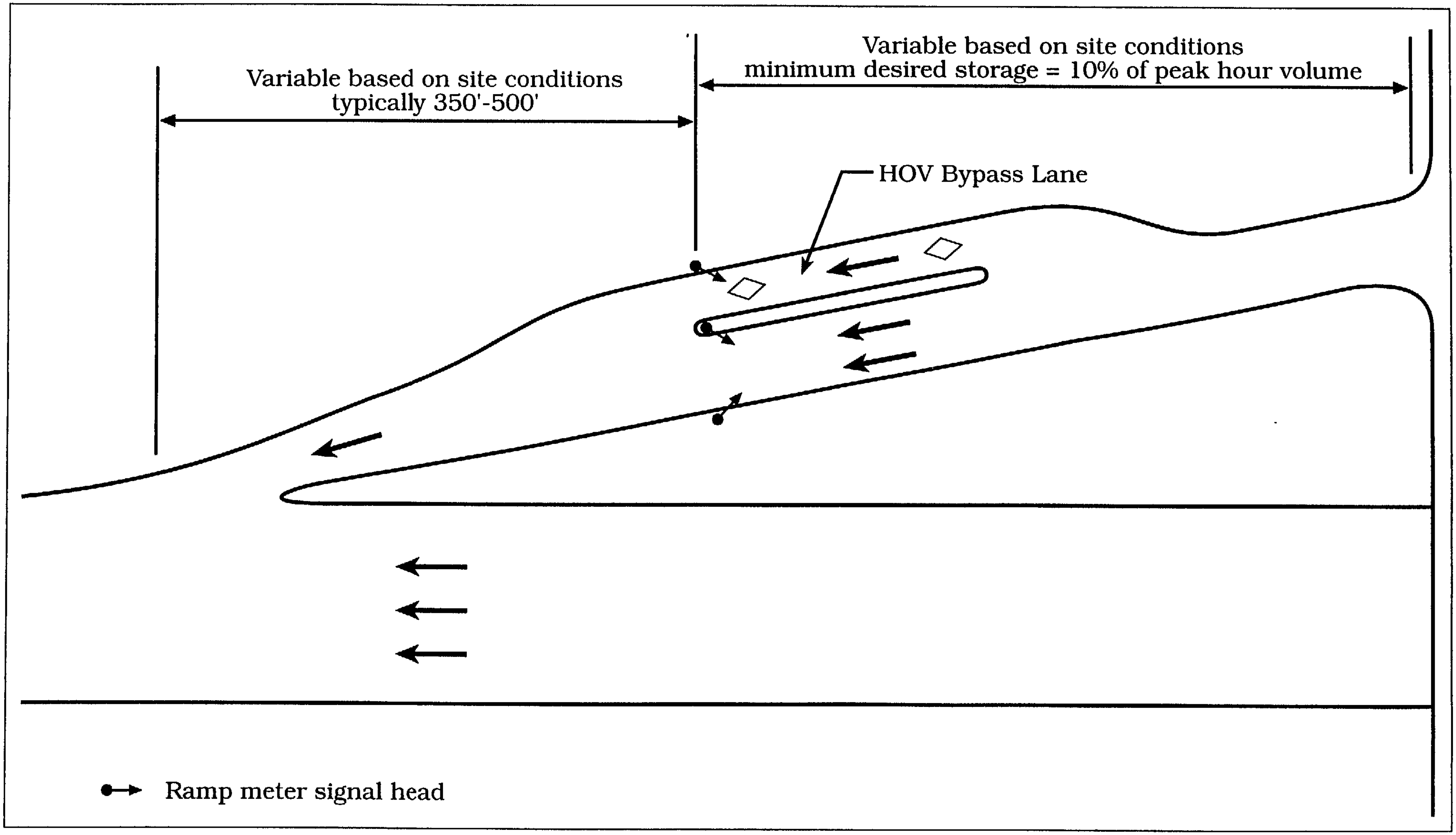
**DETECTOR**

ARTIMIS SYSTEM-CINCINNATI AREA



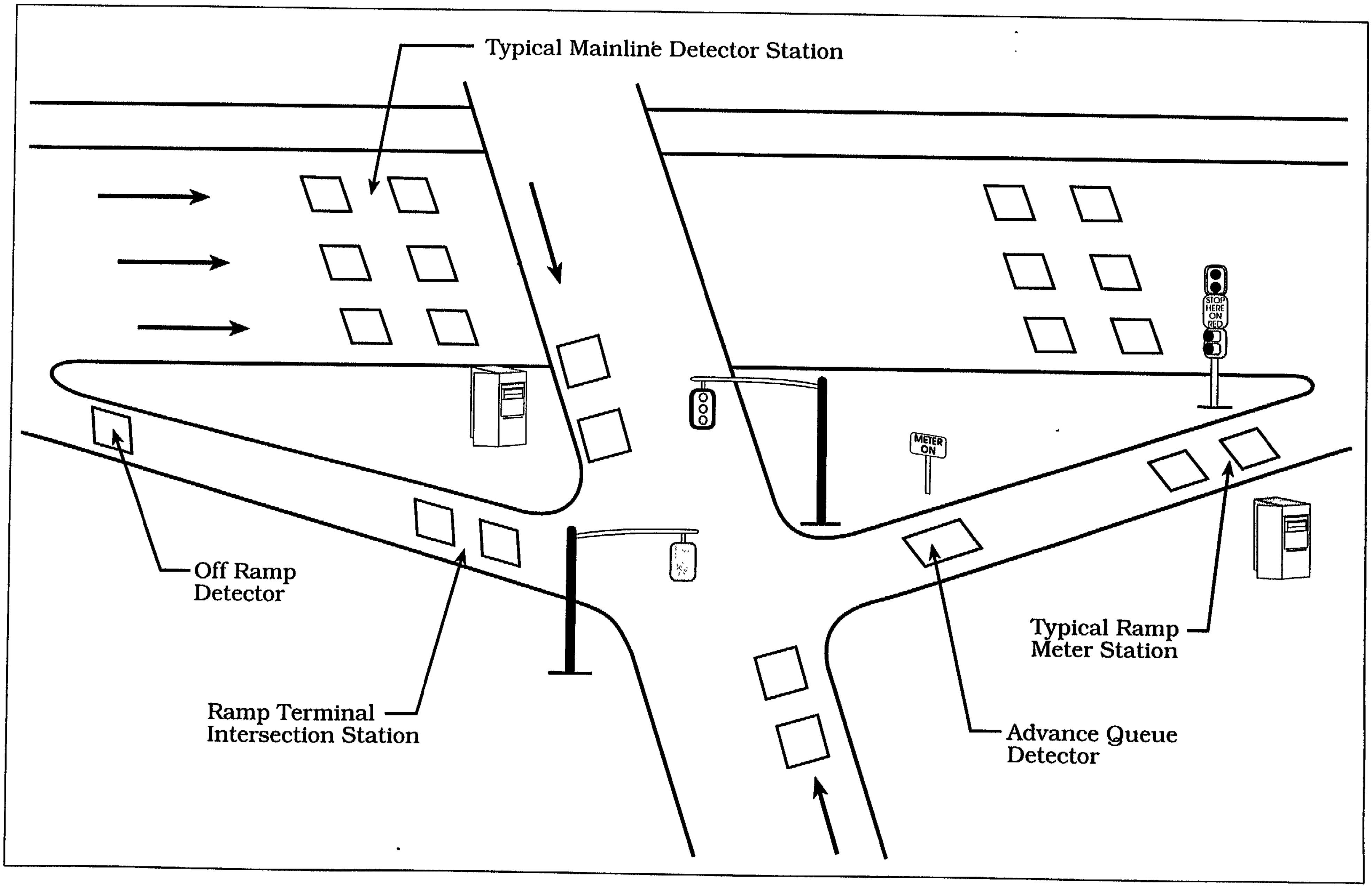

HIGHWAY ADVISORY RADIO
FIXED SIGNAGE

ARTIMIS SYSTEM-CINCINNATI AREA



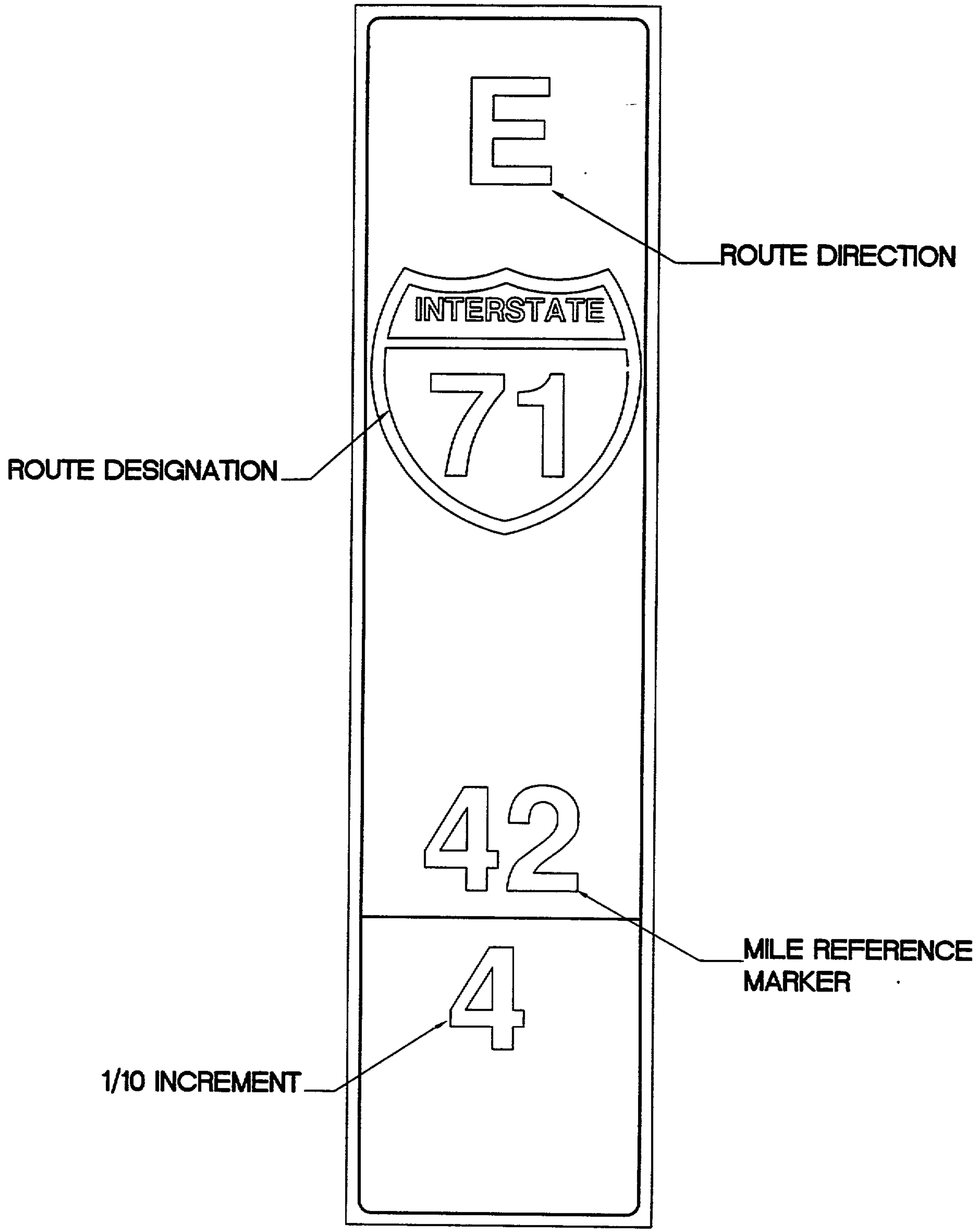

Source: BRW Inc., based on Minnesota Department of Transportation Standards, May 1997

*Typical Ramp Metering Configuration with Dual Lanes and H[redacted]V Bypass*



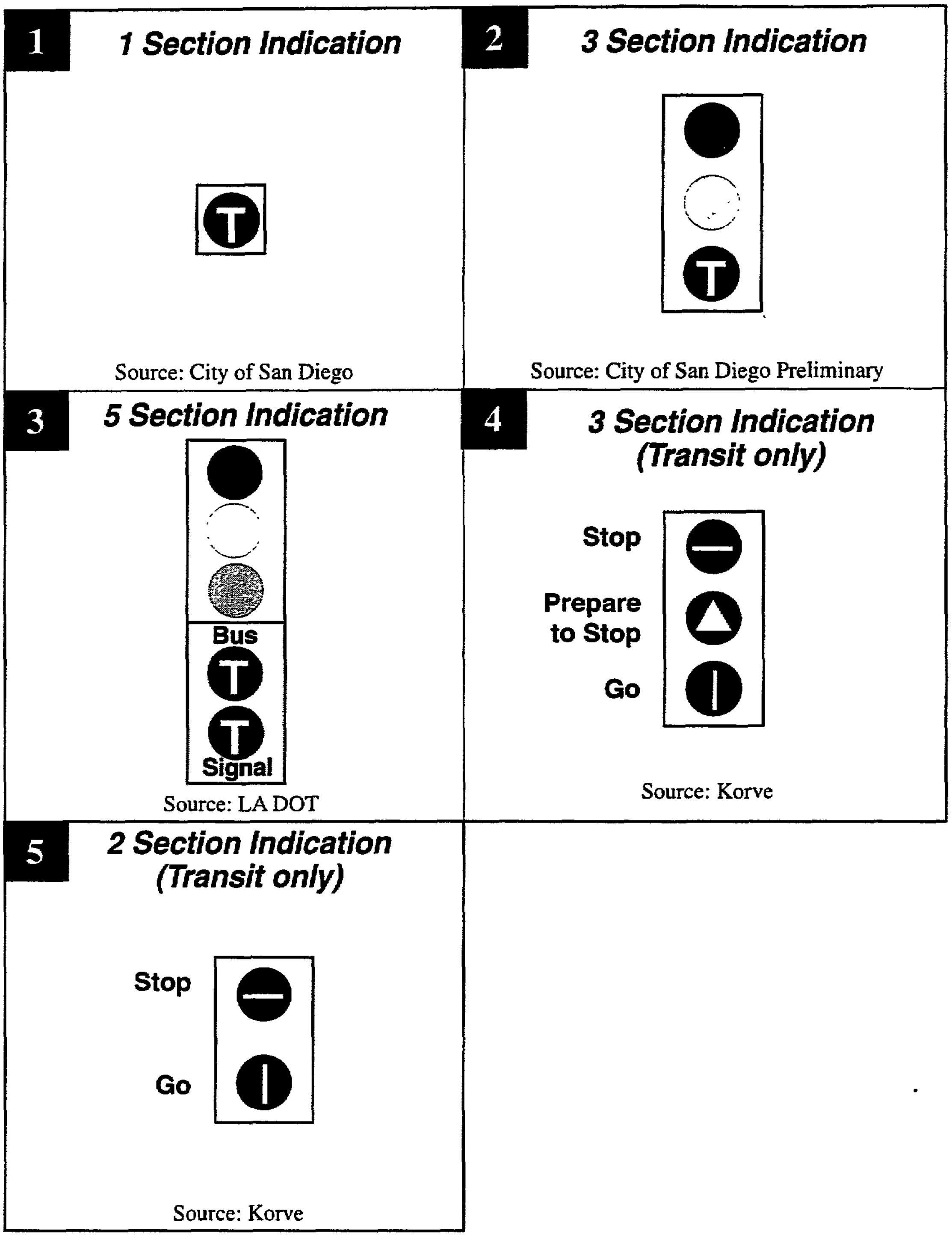

Source: BRW Inc., May 1997

*Typical Detection Systems for Freeway Interchange*



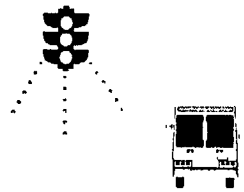
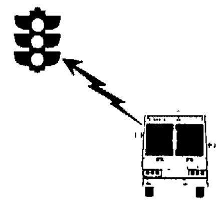
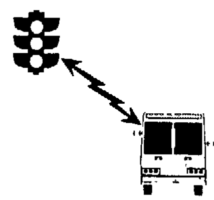
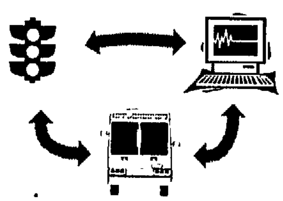

TYPICAL REFERENCE MARKER

ARTIMIS SYSTEM-CINCINNATI AREA




Source: BRW Inc., March 1996

*Potential Signal Indications for Transit Priority*

| Strategy | | Traffic Signal Control Elements | Transit Vehicle Control Elements |
|---|---|---|---|
| 1. Independent Action |  | a) ▪ Controller capable of providing priority by phase thru external actuation<br>b) ▪ Localized operation only | a) ▪ Requires activation system:<br>—video —smart tags<br>—infrared —radio<br>b) ▪ Manual or automatic initiation<br>c) ▪ No schedule correlation or central system interface |
| 2. Passive Bus/ Active Signal |  | [a) + b), plus:]<br>c) ▪ Schedule for bus route & direction resident in controller memory<br>d) ▪ Schedule changes require local update<br>e) ▪ Reliable & accurate time base required<br>f) ▪ Decision to provide priority made by controller based on route/ direction of arrival compared to schedule event recording possible | [a) + b), plus:]<br>d) ▪ Activation system on bus must provide route/direction coding |
| 3. Active Bus/ Active Signal |  | a) + b) + c) + d)<br>▪ Decision models can be enhanced by considering additional data (passenger counts)<br>▪ Event recording possible<br>▪ 2-way communication capability (status to schedule, time update, priority verification) | [b) + c) plus:]<br>▪ 2-way transponder required for activation/data exchange<br>▪ Linkage to on-board passenger counting<br>▪ On-board annunciators |
| 4. Full System Integration |  | a) + c) + e)<br>▪ Integrated system insures accurate time base & full communications<br>▪ Remote real-time monitoring/ database update<br>▪ Linked to central offices:<br>—signal operations<br>—transit operations | ▪ On the fly database updates to bus<br>▪ AVL system<br>▪ Mayday system<br>▪ On-board annunciators |

Source: BRW Inc., March 1997