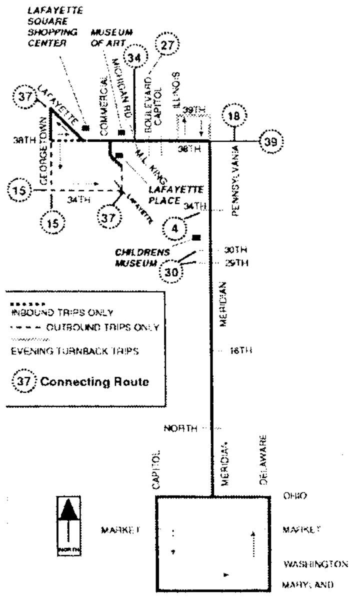
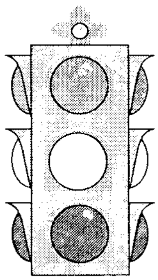
INDIANAPOLIS METROPOLITAN PLANNING ORGANIZATION





CONGESTION MANAGEMENT SYSTEM PROCESS REPORT

HNTB

in association with
JHK & Associates

March 1996

INDIANAPOLIS METROPOLITAN
PLANNING ORGANIZATION

INDIANAPOLIS CONGESTION
MANAGEMENT SYSTEM

THE CMS PROCESS

March 1996

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EXECUTIVE SUMMARY

In January 1995, the Indianapolis Metropolitan Planning Organization with the help of an interagency Study Review Committee began the process of developing a Congestion Management System (CMS) Plan. Aided by the consultant team of HNTB Corporation and JHK & Associates, the final product of this study is this CMS Process Report. This report documents the process of developing the CMS target network of congested corridors and identifies potential congestion management strategies for each targeted congested corridor.

The role of CMS is to provide relevant and technically sound strategic recommendations to the planning process. It is not intended to transcend the decision-making process of the Indianapolis Regional Transportation Plan (IRTP) and the Indianapolis Regional Transportation Improvement Program (IRTIP). The CMS serves a useful purpose in supporting and complementing the IRTP and IRTIP through the systematic provision of information on the system performance measures and the costs and benefits of alternative congestion management strategies.

The Indiana Department of Transportation is responsible for developing the Statewide CMS as well as integrating the individual Metropolitan Congestion Management Systems into the Statewide Plan. The Indianapolis CMS Plan have followed the guidelines in the Indiana Statewide Congestion Management System Work Plan which specifies that each CMS consist of the following nine elements:

1. Definition of targeted CMS network and components,
2. Establishment of suitable performance measures,
3. Establishment of performance objectives and standards,
4. Establishment of program data collections and system monitoring,
5. Identification of roadway and transit system deficiencies,
6. Analysis and evaluation of possible congestion mitigation strategies,
7. Implementation of strategies,
8. Evaluation of the effectiveness of implemented strategies, and
9. Establishment of a process to periodically update the CMS.

The Indianapolis CMS Process Report is organized and presented around these nine elements in details. Each chapter of this report covers one element of the CMS in Indianapolis. The Indianapolis CMS Target Network was selected based on performance measures determined by the Study Review Committee and the Indianapolis Regional Transportation Council.

The Target Network consists of key roadway segments, intersections, and multi-modal facilities that serve large numbers of trips and currently exhibit or are predicted to exhibit congestion. These components were selected for further analysis for possible implementation of congestion management strategies. The proposed Target Network includes 31 corridors consisting of approximately 100 miles of roadways, which meet the following performance criteria:

- Carry over 20,000 vehicles per day and are currently exhibiting congestion with Level of Service "E" or "F", and
- Predicted to be congested in the future after the improvements recommended in the Indianapolis Regional Transportation Plan are implemented, or
- Programmed as a capacity expansion in project the Indianapolis Regional Transportation Cost Feasible Plan.

The Study Review Committee has reviewed and provided additional refinements to the proposed Target Network. For analysis and programming purposes, some corridors were further divided into smaller segments. These projects were further prioritized for strategy implementation based upon traffic volume, congestion level and accident analysis. Figure S-1 shows the CMS Target Network with projects listed by priority ranking.

The Indianapolis CMS strategy screening process involved the systematic review of 64 potential strategies and detailed answers to 190 specific questions for each project. The screening process was organized into a tiered system consisting of 5 levels of CMS strategy categories.

- Level One includes strategies to eliminate vehicle trips;
- Level Two consists of strategies to shift trips from the automobile to other modes;
- Level Three contains strategies to shift trips from drive alone vehicles to carpool, vanpool and transit vehicles;
- Level Four comprises strategies to improve highway operations and increase capacity; and
- Level Five encompasses strategies to add capacity to accommodate travel demand.

Results of the preliminary strategy identification were distributed to the appropriate jurisdictional agents for review and comment. Review comments are incorporated into the final recommendations. The recommended strategies for each project are presented in Table S-1, listed by implementation priority ranking.

In general, transit and rideshare/vanpool program enhancements are the most common congestion management strategy recommendation representing one-third of all recommendations. These strategies reduce the total number of vehicles on the congested corridors and provide the greatest benefit in congestion relief. Intersection operation improvements, including intersection widening and signalization improvements, represent 18% of the recommended strategies. Intersection operations and design are a common cause for congestion in a corridor. Access management (recommended for sixteen corridors and 14% of all recommendations) is also a common recommended strategy. Many of the most heavily traveled facilities in the Indianapolis region have frequent uncontrolled driveways that slow travel speeds and increase conflict points. Other major recommendations include improvements in land use policies and growth management strategies. Many of the congested corridors are bordered by undeveloped land. Land use policies must recognize and respond to the existing or predicted congestion. Figure S-2 illustrates the frequency of certain strategy recommendations.

FIGURE S-1
INDIANAPOLIS METROPOLITAN PLANNING AREA
CMS TARGET NETWORK

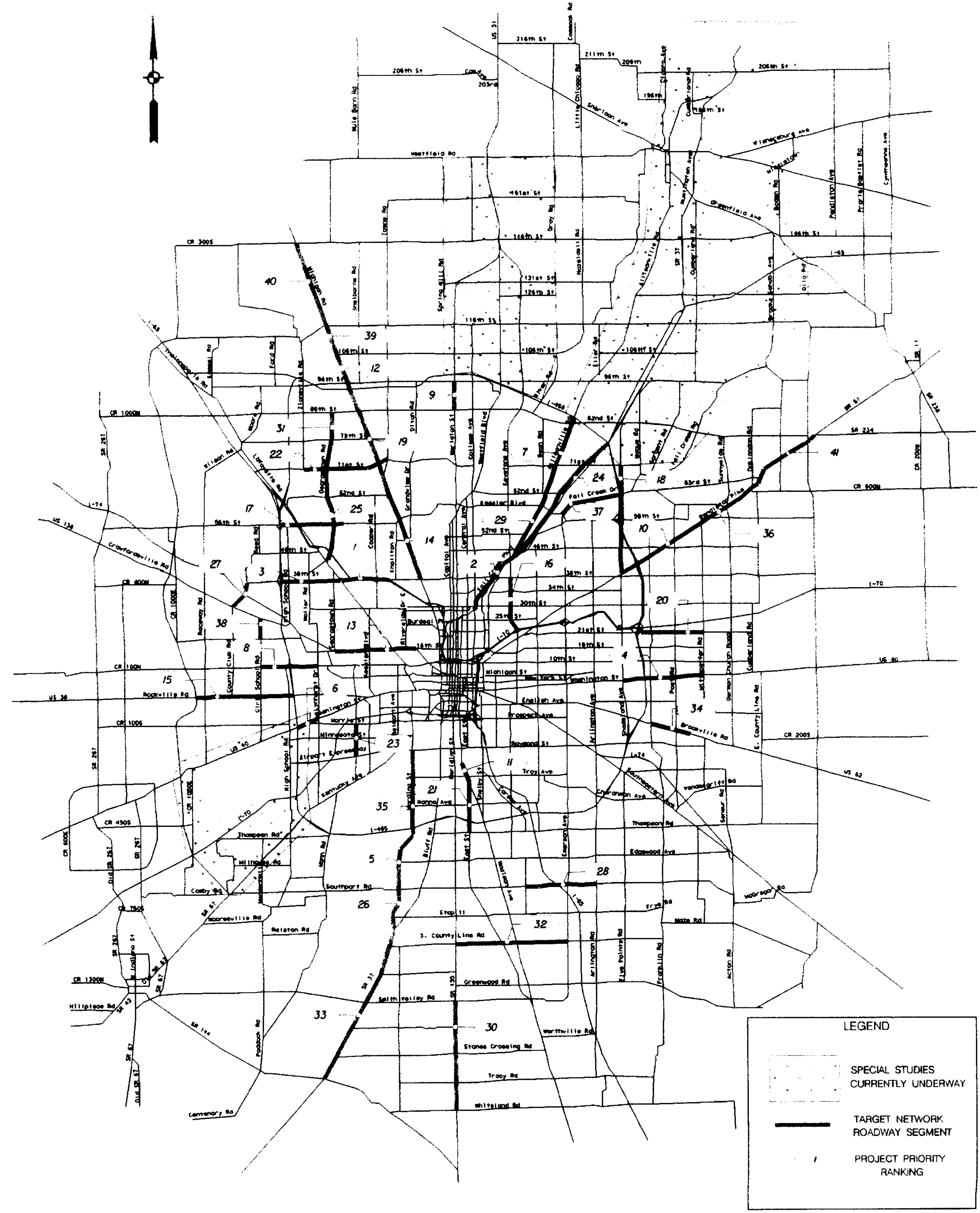
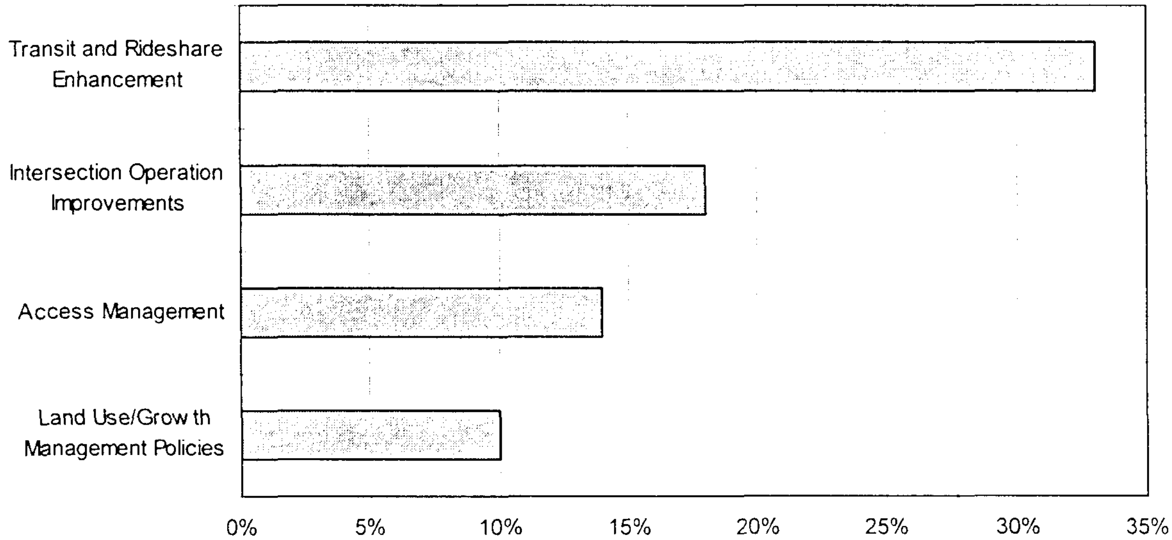


TABLE S-1
CMS TARGET NETWORK
PRIORITIZED CORRIDORS AND STRATEGIES

Rank	Dir	Street Name	From	To	Miles	ADT	LOS	Accident Rate	PROPOSED STRATEGIES 1	2	3
1	W	38th Street	Lafayette Rd	Cold Springs Rd	1.98	54,458	F	88.38	Incident Management	Transit Expansion	Rideshare/Vanpool
2		Fall Creek Prkwy	42nd St	College Ave	1.92	32,955	F	88.37	Turn Restrictions	Intersection Impr.	Excl. ROW - Bus/Rail
3	W	38th Street	I-465 (W)	Lafayette Rd	1.87	45,836	E	198.93	Intersection Impr.	Channelization	Access Management
4	E	Washington St	Shadeland Ave	Mitthoefer Rd	2.65	30,924	E	141.26	Transit Expansion	Access Management	Channelization
5	S	SR 37	I-465 (S)	Southport Rd	2.38	32,428	F	45.80	Commuter Transit	Rideshare/Vanpool	Intersection Widening
6	W	Washington St	High School Rd	Lynhurst Dr	1.11	30,038	E	122.82	Signalization Impr.	Transit Enhancement	Access Management
7		Allisonville Rd	I-465 (N)	62nd St	3.35	27,063	F	76.82	Access Management	Signalization Impr.	Median Control
8	W	10th Street	Lynhurst Dr	Girls School Rd	2.01	29,340	E	93.20	Transit Expansion	Channelization	Access Management
9	N	Meridian Street	96th St	86th St	0.98	29,750	E	86.73	Transit Expansion	Transit Fare Reduc	Rideshare/Vanpool
10		Pendleton Pike	Mitthoefer Rd	Shadeland Ave	2.18	25,286	F	74.46	Access Management	Signalization Impr.	Transit Expansion
11		Madison Ave	Southern Ave	East St	0.71	33,710	D	84.98	Rideshare/Vanpool	Transit Expansion	Channelization
12	N	Michigan Rd	106th St	79th St	3.19	26,537	F	29.47	Access Management	Signalization Impr.	Land Use Policies
13	W	16th Street	Georgetown Rd	Stadium Dr	3.41	26,273	E	82.21	Access Management	Transit Marketing	Intersection Impr.
14	N	Michigan Rd	60th St	38th St	2.94	23,336	F	45.35	Intersection Impr.	Transit Expansion	Driveway Control
15		Rockville Rd	N/S Corridor	I-465 (W)	3.67	29,138	E	47.87	Access Management	Growth Management	Rideshare/Vanpool
16	N	Keystone Ave	38th St	Bloyd Ave	1.91	26,246	D	108.90	Intersection Impr.	Access Management	Transit Expansion
17	W	56th Street	I-465 (W)	Guion Rd	2.32	18,996	F	58.05	Intersection Widening	Bicycle/Ped Facilities	Vanpool
18	N	Shadeland Ave	71st St	Pendleton Pike	3.83	22,681	F	37.68	Rideshare/Vanpool	Telecommuting	Bicycle/Ped Facilities
19	N	Michigan Rd	79th St	60th St	2.37	24,842	E	80.31	Additional Travel Lane	Access Management	Transit Expansion
20	E	21st Street	I-465 (E)	Mitthoeffer Rd	1.99	16,283	F	77.05	Intersection Widening	Signalization Impr.	Transit Marketing
21	S	East Street	Madison Ave	Thompson Rd	1.77	32,127	B	63.09	Transit Expansion	Transit Marketing	Bicycle/Ped Facilities
22	W	71st Street	Zionsville Rd	Michigan Rd	3.11	18,884	F	37.83	Signalization Impr.	Rideshare/Vanpool	Transit Expansion
23		Holt Rd	Morris St	Airport Expressway	1.10	22,665	F	20.30	Intersection Impr.	Access Management	Rideshare/Vanpool
24	N	SR 37	I-465 (N)	Fall Creek Prkwy	5.29	25,639	E	31.13	HOV Lanes	Rideshare/Vanpool	Clearance Time Impr.
25		Georgetown Rd	62nd St	Lafayette Rd	2.31	19,838	F	17.43	Land Use Policies	Transit Marketing	Transit Fare Reduc
26	S	SR 37	Southport Rd	South County Line Rd	2.10	28,218	D	23.33	Commuter Transit	Rideshare/Vanpool	Intersection Widening
27		Dandy Trail	38th St	Crawfordsville Rd	1.00	17,635	E	42.33	Land Use Policies	Transit Expansion	Intersection Widening
28	E	Southport Rd	Arlington Ave	Sherman Dr	2.99	21,129	C	40.91	Land Use Policies	Deceleration/Turn Lanes	Access Management
29		Allisonville Rd	62nd St	Fall Creek Prkwy	2.18	15,975	E	39.14	Access Management	Signalization Impr.	Deceleration/Turn Lanes
30	S	Meridian Street	Smith Valley Rd	Whiteland Rd	3.98	16,145	F	13.32	Transit Expansion	Rideshare/Vanpool	Bicycle/Ped Facilities
31		Georgetown Rd	86th St	62nd St	3.48	14,327	F	17.43	Land Use Policies	Transit Marketing	Transit Fare Reduc
32		South County Line Rd	Meridian St	Emerson Ave	4.77	20,985	E	17.40	Land Use Policies	Signalization Impr.	Access Management
33	S	SR 37	S. County Line Rd	SR 144	4.10	24,950	C	4.25	Commuter Transit	Intersection Widening	Rideshare/Vanpool
34		Brookville Rd	Franklin Rd	Davis Rd	2.07	15,520	E	22.38	Land Use Policies	Access Management	Frontage Roads
35		Harding Street	I-465 (S)	Raymond Ave	2.59	14,180	E	26.00	Design (RR Crossing)	Commercial Veh Oper	Intersection Widening
36		Pendleton Pike	Oaklandon Rd	Mitthoefer Rd	2.30	15,878	E	3.04	Access Management	Rideshare/Vanpool	Transit Expansion
37		Fall Creek Drive	Shadeland Ave	Kessler Blvd	2.45	8,922	A	31.16	Land Use Policies	Design Standards	Intersection Widening
38		Girls School Rd	Crawfordsville Rd	21st St	1.12	10,537	C	19.64	Land Use Policies	Telecommuting	Deceleration/Turn Lanes
39	N	Michigan Rd	126th St	106th St	2.16	12,964	A	17.14	Land Use Policies	Design Standards	
40	N	Michigan Rd	146th St	126th St	3.09	9,645	A	17.14	Land Use Policies	Design Standards	
41		Pendleton Pike	SR 234	Oaklandon Rd	2.80	8,768	A	3.04	Land Use Policies	Rideshare/Vanpool	Park and Ride

Figure S-2
Most Frequent Recommended Strategies



The congestion management strategies mentioned in this report have systemwide applicability and needs to be applied at a system level to avoid congestion spread throughout the region. These recommendations should be incorporated into the Regional Transportation Plan and Transportation Improvement Programs for the Indianapolis region. A monitoring plan is currently being developed by the Indianapolis MPO to further support and maintain the CMS process.

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INTRODUCTION

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) established a mandate for management systems with the intended effect of "improving the efficiency and safety of, and protecting the investment in, the nation's transportation infrastructure." According to the Interim Final Rule for Management and Monitoring Systems, a Congestion Management System (CMS) "means a systematic process that provides information on transportation system performance and alternative strategies to alleviate congestion and enhance the mobility of people and goods. A CMS includes methods to monitor and evaluate performance, identify alternative actions, assess and implement cost-effective actions, and evaluate the effectiveness of implemented actions."

In January 1995, the Indianapolis MPO began the process of developing a CMS Plan. Aided by the consultant team of HNTB Corporation and JHK & Associates, the final product of this undertaking is this CMS Process Report. This report documents the process of the development of the CMS and identifies specific potential congestion management strategies for each targeted congested corridor.

The role of this CMS is to provide relevant, technically sound information to the planning process. It is not intended to transcend the decision-making process of the Indianapolis Regional Transportation Plan (IRTP) and the Indianapolis Regional Transportation Improvement Program (IRTIP). The CMS, if properly applied, can serve a useful purpose in supporting and complementing the IRTP and IRTIP through the systematic provision of information on system status and the costs and benefits of alternative congestion management strategies.

The Indiana Department of Transportation is responsible for developing the Statewide CMS as well as integrating the individual Metropolitan Planning Organization Congestion Management Systems into the Statewide Plan. The development of the Indianapolis CMS followed guidelines documented in the Indiana Statewide Congestion Management System Work Plan.

Indiana Statewide Congestion Management System Work Plan

In July 1993, the Indiana Department of Transportation established an advisory committee to guide the development of guidelines for a Statewide CMS to assist MPOs in the development of regional area plans. The Statewide Indiana Congestion Management System Work Plan specifies that each CMS will consist of the following nine elements:

1. Definition of targeted CMS network and components,
2. Establishment of suitable performance measures,
3. Establishment of performance objectives and standards,
4. Establishment of program data collections and system monitoring,
5. Identification of roadway and transit system deficiencies,
6. Analysis and evaluation of possible congestion mitigation strategies,
7. Implementation of strategies,
8. Evaluation of the effectiveness of implemented strategies, and
9. Establishment of a process to periodically update the CMS.

Performance measures for strategy evaluation will depend on the type of strategies selected. The MPOs will be responsible for collecting the required data to derive the performance indicators.

The Statewide CMS recognizes a procedure to identify congested links at a macroscopic level using average daily traffic data. If a link is found to be congested, it is selected for further analysis at a microscopic level. If a link is found to be uncongested, it is eliminated from further analysis. This procedure reduces the analysis of a large amount of data, from several thousand links on a given network, to a manageable amount.

The mitigation of congestion will be addressed through the following five programs:

1. Trip reduction and travel demand management program,
2. Transportation systems management program,
3. Land use analysis program,
4. Capital improvement program, and
5. Transit program.

The CMS replaces the existing Transportation System Management Program (TSM) and provides information for the regional and Statewide transportation improvement programs (TIP and STIP). The emphasis of the CMS is on implementation with greater focus on transit and other multimodal alternatives.

The guidelines developed in the Statewide CMS Work Plan were followed in the development of the Indianapolis Congestion Management System Plan. This process report roughly follows in format with the nine elements required by the Statewide CMS Work Plan.

Consequently, in November 1995, the National Highway System Designation Act removed the penalties on states that did not implement the management systems, making the management systems optional. Nevertheless, this report strives to follow the intent and word of the original legislation.

I.

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CHAPTER 1: CMS PLAN DEVELOPMENT AND ORGANIZATION

CMS ORGANIZATION

In January 1995, staff of the Indianapolis MPO began the process of developing a CMS Plan aided by the consultant team of HNTB Corporation and JHK & Associates. The development of the Plan was guided by the CMS Study Review Committee (members listed below). Meetings were held monthly during the Plan development process.

TABLE 1-1
CMS STUDY REVIEW COMMITTEE MEMBERS

Mr. Sweson Yang Indianapolis MPO	Mr. Ron Griewe Indianapolis DCAM	Ms. Carrie Jefferies IDEM
Ms. Lori Miser Indianapolis MPO	Mr. John Nagle INDOT	Ms. Lisa Gion FHWA
Mr. Kevin Mayfield Indianapolis MPO	Ms. Joyce Newland IDEM	Mr. Ted Rieck IPTC (METRO)

The formal review agents for the CMS were the Indianapolis Regional Transportation Council (IRTC) Technical and Policy Committees. These organizations act as advisory agents for the Indianapolis Metropolitan Development Commission that is the formally designated Metropolitan Planning Organization. The IRTC is comprised of representatives of the transportation jurisdictions within the Metropolitan Planning Area. Updates on Plan progress were provided at the regularly scheduled quarterly meetings and through special mailings.

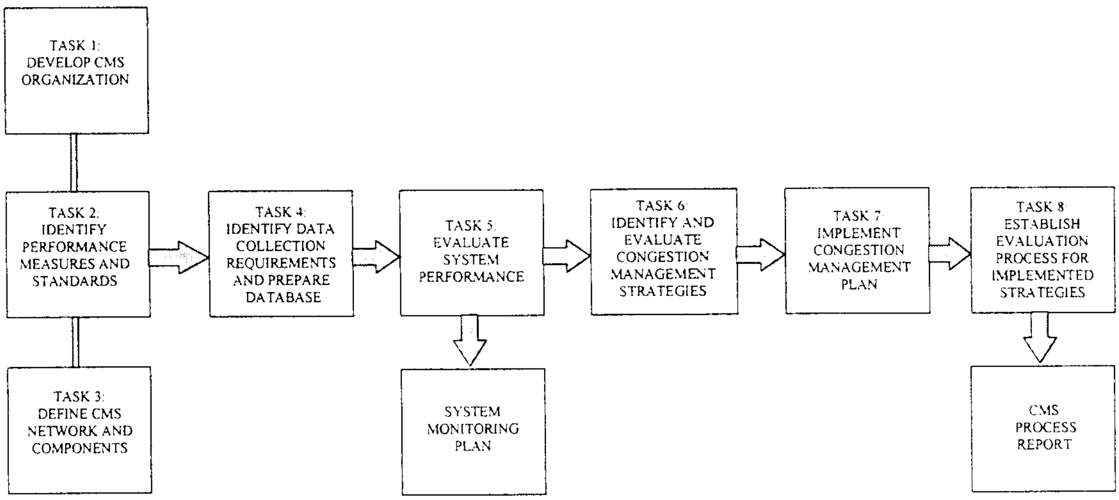
Public participation was provided through the Citizens Advisory Committee (CAC). The CAC, formed in 1994, is comprised of representatives from various jurisdictions, special interest groups, community organizations (including those that serve the disadvantaged), and interested individuals. Several presentations and mailings were made to the CAC during the CMS development process.

PLAN DEVELOPMENT

The purpose of the CMS was agreed to at an early stage in the development. The role of this CMS is to provide relevant, technically sound information to the planning process. It is not intended to transcend the decision-making process of the Indianapolis Regional Transportation Plan (IRTP) and the Indianapolis Regional Transportation Improvement Program (IRTIP). The CMS, should serve a useful purpose in supporting and complementing the IRTP and IRTIP through the systematic provision of information on system status and the costs and benefits of alternative congestion management strategies.

The development of the Indianapolis CMS followed guidelines documented in the Indiana Statewide Congestion Management System Work Plan developed by the Indiana Department of Transportation (INDOT). INDOT is ultimately responsible for developing the Statewide CMS as well as integrating the individual Metropolitan Planning Organizations Congestion Management Systems into the Statewide Plan. While still following the Statewide guidelines, the Indianapolis CMS was individualized to address the unique characteristics of the Indianapolis region. The flow diagram below illustrates the CMS Work Program followed.

CONGESTION MANAGEMENT SYSTEM WORK FLOW DIAGRAM



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II.

CHAPTER 2: IDENTIFICATION OF PERFORMANCE MEASURES AND STANDARDS

The CMS is performance-based system which is intended to effectively manage existing and new transportation facilities through the use of travel demand and operational management strategies where these actions are shown to be effective. The CMS is to monitor and analyze the magnitude of congestion on a multi-modal transportation system and to plan and implement actions, appropriate to the scope of the problem, that alleviate congestion and enhance the performance of the transportation system. One of the foundational issues for the development of the CMS is the identification of performance measures to identify congestion and monitor the effects of implemented strategies to reduce congestion.

FEDERAL RULES

The requirements for performance measures in the Federal Interim Final Rule for Management and Monitoring Systems are stated relatively simply. The basic statements concerning performance measures are that they:

- Must provide a measure of the extent of congestion.

- Must permit the evaluation of the effectiveness of congestion reduction and capacity enhancement strategies for the movement of people and goods. (Note that this would include evaluation both prior to implementation and following implementation.)

- Must be established cooperatively by the state and affected MPOs or local officials in consultation with the operators of major modes of transportation.

Note that the measures used to identify congestion do not have to be the same as the measures used to evaluate the effectiveness of congestion management strategies. The measurement of the extent of congestion implies a regional or area wide perspective. Identifying congestion problems and evaluation of strategy effectiveness imply a more localized perspective, involving problem identification and strategy evaluation. Variations in performance measures may be needed to address these two distinctly different purposes. There is no single performance measure that will satisfy all congestion management objectives.

In addition, the federal rules require the management systems to be considered as part of the metropolitan planning process. In response to questions about the relationship between the planning process and the management systems, the Federal Highway Administration (FHWA) described the relationship as a linkage between the Transportation Plan and the management systems. Furthermore, the FHWA identified that "that linkage can only be effective if the management systems and planning processes are developed and implemented in conjunction with each other and share, among other factors, consistent and complementary assumptions, goals and objectives, and data bases" (Source: 23 CFR 500 - Supplementary Information). Thus, when developing performance measures, the goals, objectives and data developed for the Transportation Plan were considered.

TYPES OF PERFORMANCE MEASURES

There are three broad classes into which most performance measures can be placed. These include:

- congestion measures;
- mobility measures; and
- accessibility measures.

One simple way to distinguish among these types are that **congestion measures** are generally location-based (i.e. measurements of conditions at or between intersections) and reflect the operating condition of a facility. Congestion measures could also be associated with a transit route, or route segment, in addition to a highway facility. **Mobility measures** are trip-based (i.e. consider the trip from origin to destination) and reflect the ability to complete the trip. **Accessibility measures** are activity-based (i.e. associated with a land use, activity center/area trip purpose) and reflect the potential for interaction between trip origins and destinations.

The most commonly recognized performance measures are those established for the measurement of congestion on roadway facilities. Examples include level of service, volume/capacity ratio, or speed on given facilities. Congestion can also be expressed, if desired, on the transit system using a load factor concept which is similar to the volume/capacity concept for roadways. Congestion measures provide the most direct measurement of operation on the transportation network. Mobility and accessibility measures can be used to express and evaluate the achievement of broader policies, including land use, demand management, and operational management initiatives. All the measures can be constructed to include multimodal concepts, if desired. In Indianapolis, the primary emphasis of the CMS was on congestion measures. These measures, which are used to describe performance on specific roadway links or intersections, can deal with both the macro level (i.e. system-wide or corridor level) as well as the micro level (i.e. individual links or intersections). They are used to identify specific congestion problems as well as express congestion trends at a more aggregate level. The Strategic Plan for Indianapolis Public Transportation focused mainly only mobility and accessibility measures. Table 2-1 summarizes a listing of performance measures that were considered for application in the Indianapolis CMS.

Table 2-1
Potential Performance Measures

Performance Measure	Highway or Transit	What is Measured		
		Congestion	Mobility	Accessibility
Level of Service	Highway	X		
Volume to Capacity	Highway	X		
Volume to Acceptable Flow Rate	Highway	X		
Vehicle Miles of Travel	Highway		X	X
Average Delay	Highway	X		
Accident Rates	Highway		X	
Average Travel Speed	Both	X	X	
Average Travel Rate	Both	X		
Load Factor	Transit	X		
Passengers per Hour	Transit	X		
Passengers per Revenue Mile	Transit		X	
Service Frequency	Transit		X	X
Average Travel Distance	Both		X	X
Average Travel Time	Both	X	X	
Population/ Employment Density	Transit			X
Person Miles of Travel	Both		X	X
Traffic Density	Highway	X		
Vehicle Occupancy	Both		X	
On Time Performance	Transit		X	X

CHARACTERISTICS OF GOOD PERFORMANCE MEASURES

The selection of performance measures presumes that one is able to identify strengths and weaknesses of one measure against another. The selection of performance measures for the CMS should be based on a set of criteria that will take into account the benefits, costs, and implications of the use of each. The criteria described below represent a basic list of considerations that can be used to select performance measures for the CMS.

- **Clearly understood** - One of reasons for existence of the performance measures is so that staff and elected officials can make assessments and decisions regarding future directions for the transportation system. The information should be readily understood by the public as well.

- **Sensitive to modes** - Because ISTEA and the management systems heavily emphasized multimodal solutions, the measures should be sensitive to the impact of the demand management strategies and programs as well as those that increase capacity and improve operations.

- **Sensitive to time** - The spreading of the peak period is very important phenomenon to be addressed in the CMS. It may appear that, during a single peak hour, demand remains constant while, in fact, congestion is growing significantly through the spreading of the peak period.

- **Not too difficult or costly to collect** - The most significant resource constraint in developing a system for performance monitoring is usually data collection. Where the explanatory power of two performance measures is similar, the one that costs less to collect would be favored. In addition, methods of sampling can be used to reduce the costs of data collection.

- **Can be forecast into the future** - The CMS must base its assessments not only on existing conditions but on predictions of the future. Therefore, the performance measures must be quantifiable in the existing condition as well as through modeling processes undertaken to predict future conditions.

- **Sensitive to the impact of congestion mitigation strategies** - If a congestion mitigation strategy is implemented, it should bring about an impact or change in the performance measures.

- **Current availability of data** - The availability of data to quantify the performance measures will reduce the initial cost of implementing a baseline system, and provide for a more efficient and effective full implementation of the CMS process. The minimization of resources for data collection will also allow for the application of these resources to the development and implementation of other elements of the CMS.

THE PERFORMANCE MEASURE COMPUTATION PROCESS

The process of computing a performance measure is relatively simple. There are two basic inputs: physical/operational data, such as number of lanes, and traffic data, volume and travel time. Congestion thresholds, such as severe/moderate/low/none, are used to distinguish the levels of congestion.

The type of data that typically needs to be compiled to compute performance measures include volume/capacity ratio (or level of service) and travel speed. The traffic and physical data could reside in a comprehensive database or GIS/CAD system. Some of the more fundamental data such as traffic volume could be maintained on a large sample basis. Other specialty data, such as bus and truck volume, auto occupancy and bus load factors could be collected on the basis of a much smaller sample.

Volume/Capacity vs. Speed

There are two principal approaches to the measurement of congestion, one based on volume, and another based on actual travel speed (travel time or travel rate). Traffic density can also be used to express congestion levels, but is not often considered due to its general unfamiliarity to many audiences and to the difficulty of data collection. In the past, the measurement of congestion has been based almost exclusively on volume. Although engineers have recognized the importance of speed, and have built speed/travel time into certain measures of level of service (e.g., arterial level of service in the Highway Capacity Manual is based on the estimated speed), the expense of data collection has prevented it from being a more prominent measure. In addition, forecasting travel time can be more difficult than forecasting volume.

In 1993, the MPO conducted a sample survey of approximately 700 miles of roadways with results documented in the Indianapolis Travel Time Survey. This survey, conducted over a four month period, was the first comprehensive study of travel time since 1965.

The implications of decisions to pursue either v/c or travel time-based measures are very important. A v/c-based definition will require traffic volume and physical (geometric) data, and is therefore easier and less expensive to develop. However, volume may not be as accurate a method to detect congestion, as a good estimate of capacity is often difficult. The capacity of a roadway is dependent upon the characteristics of the traffic traveling on it, such as the volume of turning traffic, the peaking characteristics, and the platooning of vehicles. Other variables which change, or are difficult to collect, are the actual traffic signal timings and the progression of traffic between signals. Typically, assumptions are made for the variables which determine capacity, resulting in generalized capacities which may, or may not, be accurate for any given application. An underestimate of capacity could lead to the conclusion that congestion does exist when in actuality it does not. The daily v/c ratio may also be deficient in detecting peak hour oversaturated conditions.

Actual travel time is a more accurate way to identify the location and magnitude of congestion. However, at the current time, travel time data are more expensive to collect. This is why a building-block approach, possibly beginning with a volume-based indictor, and transitioning to a travel time-based measure is a likely scenario for transitioning from the baseline CMS to the CMS "ultimate vision".

Developing Performance Measures

The development and application of system wide performance measures can be considered as a two-step process. The first step is the development of a mechanism to identify those elements of the transportation system that are considered congested. This is the **congestion measure**. The congestion measure is used to identify congestion problems and evaluate performance on individual elements of the transportation system, for example, roadway intersections or links, and transit vehicles or stops. The congestion measure can also be used to identify specific locations or time periods of congestion problems. Examples of roadway system congestion measures include the following:

- Level of service (LOS);
- Delay
- Travel rate (minutes per mile);
- Travel speed (miles per hour);
- Volume to capacity ratio (v/c); and,
- Traffic density.

Inherent in the use of a congestion measure is the establishment of a quantified level of the measure that indicates the onset of congestion or its severity, for example a v/c of greater than 0.95 (an example of a congestion threshold) or a travel rate of greater than 2.5 minutes per mile on a freeway to identify severe congestion. More than one congestion threshold may be defined to designate levels of the severity of congestion, for example, indicating congestion is moderate or severe.

The second step is the development of performance measures themselves. The performance measures are used to assess the extent and severity of congestion over the CMS geographic area and transportation system. In essence, the performance measures aggregate the individual congestion problems identified by the congestion measure to represent the extent and severity of congestion on a larger scale. The aggregation of the congestion problems can be for a corridor, a subarea, or for the entire geographic area included in the CMS. Performance measures can also be used to express the amount of travel that takes place on elements of the transportation system.

PERFORMANCE MEASUREMENT FOR THE INDIANAPOLIS CMS

The development of performance measures is a two step process. First, **congestion measures** are chosen to identify congestion problems and evaluate performance on individual elements of the transportation system. The second step is to develop the actual **performance measures** to access the extent and severity of congestion over the CMS geographic area and the transportation system.

Congestion Measures

A short list of candidate congestion measures was developed. These candidate congestion measures are the following:

- Roadway link v/c ratio;
- Link traffic density;
- Link travel rate (speed or travel time);
- Link delay per vehicle;
- Link level of service (LOS); and
- Trip travel time between origin-destination pairs.

Based on the assessment of the above congestion measures, it was recommended that the focus of congestion measures be narrowed to two candidates with significant potential for implementation in the CMS system. These two measures are the following:

- A v/c ratio (based on daily volume data with capacity being represented by basic link capacity); and,

- A travel time based measure that reflects the relationship of the actual travel time for a given time period of the day to the travel time under uncongested conditions taking into consideration roadway and traffic signal characteristics.

While using a travel time-based congestion measure has distinct advantages in descriptiveness, it is clear that the application of this type of measure over the entire CMS network is cost prohibitive given that data would require periodic updating to maintain a current assessment of congestion. Therefore, it was concluded that the v/c ratio be used to identify those elements of the network that have a potential to be considered congested, and the final assessment of the extent and severity of congestion could be based on the travel time (or speed) measure through follow up analysis, if needed. This two-tiered screening approach (i.e. the use of travel time) could be phased in over time and is one means of economizing on the types of data being collected.

Performance Measures

Recognizing FHWA's guidance for effectively incorporating the CMS within the metropolitan planning process, candidate performance measures were derived from the measures of effectiveness (MOE) which are considered for the development of the Transportation Plan and the TIP.

Based on an evaluation of the preliminary goals and objectives described in the Central Indiana Region Transportation Plan, the following MOEs were identified as potential performance measures for the congestion management system:

- Hours of delay time;
- Average travel time;
- Level of service by facility type, by system miles;
- Vehicle miles of travel;
- Accident rate;
- Average trip length;
- Air quality impacts;
- Average travel time to major travel and truck terminals; and ,
- Average travel time to major activity centers.

After discussions with the CMS Study Review Committee, it was determined that the initial CMS effort should concentrate on two of the above performance measures:

- Level of service by facility type, by system miles; and
- Average travel time (where available).

These measures are consistent with the recommended congestion measures and the measures of effectiveness for the Transportation Plan. Therefore, they will provide coordination and compatibility with other metropolitan planning efforts.

In addition, the following performance measures should be incorporated into the evaluation of the roadway network to be consistent with the Indiana Department of Transportation CMS requirements:

- Percentage of lane-miles (and number of lane-miles) that are congested (congestion determined through thresholds in volume/capacity ratio) by roadway functional class; and,

- Daily VMT (and percentage of daily VMT) operating under congested conditions.

Together, these congestion and performance measures will identify congested locations and define the extent of congestion throughout the urban area. They will also provide feedback as to the effectiveness of implemented strategies.

HNTB

III

CHAPTER 3: DEFINITION OF CMS NETWORK AND COMPONENTS

The Prototype Congestion Management System for the State of Indiana states that:

"The targeted urban CMS roadway network should consist of roadway components functionally classified as freeway, principal arterial and minor arterial. All State highways and principal arterials may be included in the CMS depending on how significant they are in the regional transportation network. The inclusion of local and collector streets is not recommended because these roadways in Indiana are rarely congested and costs associated with collecting data on all these facilities are prohibitively high. A nationwide survey of DOTs also showed that most systems that have been developed so far only included roadways functionally classified as freeway and principal arterial.

Once a highway or roadway is included in the congestion management system, it should not be removed from it. Key intersections should be included in the CMS. The boundaries of the urban CMS should extend to the MPO planning boundaries, or to the MPO planning boundaries, or to the boundaries of the non-attainment areas, whichever is larger.

The transit network in the CMS should include the entire fixed route system classified by route type (express, radial, connector or fixed stop). Transit performance evaluation should be limited to congested corridors as identified through the evaluation of the roadway network. A more detailed evaluation of the transit network will be addressed in the Public Transportation Management System (PTMS). Alternate modes analysis such as bicycles and pedestrians should be addressed primarily through the identification of specific improvement projects or programs."

The performance of the Indianapolis Transit System was thoroughly addressed in the Strategic Plan for Indianapolis Public Transportation performed for the MPO in 1994. For this reason, transit analysis will consist solely of strategy recommendations to increase service and ridership in targeted congested corridors.

The CMS has two purposes: to determine and monitor congestion and to develop strategies to alleviate congestion. This macro and micro analysis requires different scale network analysis zones. For this purpose, two specific roadway networks were designed by the Study Review Committee for the purposes of this project:

1. Areawide Monitoring Network
2. CMS Target Network.

Areawide Monitoring System

The Interim Final Rule states that "CMS efforts should be focused on those areas with existing congestion or with the likelihood that congestion will develop" and that "where it is determined that congestion does not exist and is not likely to occur, coverage can be limited to periodic verification of this determination". Whereas the best forecasting tool available is the regional transportation model and as a goal of the CMS is to be a component and supporting document for the regional transportation plan, the roadway network developed for the Central Indiana Regional Transportation Plan was adopted as the highway portion of the CMS Areawide Monitoring Network. The reasons for this are three-fold:

- Ease of compatibility between the Transportation Plan and the CMS.
- The Transportation Plan Network is comprehensive and includes the entire Metropolitan Planning Area.
- The modeling completed for the Transportation Plan is a proven valuable resource in determining future congestion patterns.

The CMS database provides information on the complete Areawide Monitoring System so that a Target Network was able to be selected.

Selection of the Target Network

The CMS target network consists of key roadway segments, intersections, and multi-modal facilities that serve large numbers of trips and currently exhibit or are predicted to exhibit congestion. These components will be analyzed for possible implementation of congestion management strategies. In addition, a comprehensive database has been compiled that includes detailed information for the entire regional transportation network as defined in the Indianapolis Regional Transportation Plan.

The Target Network, as displayed on the following pages, is a combined product of several alternatives reviewed by the Study Review Committee and the Indianapolis Regional Transportation Council. The alternatives considered several types of regional traffic information including: Average Daily Traffic (daily roadway traffic volumes), Level of Service (ranking system of roadways exhibiting breakdown or forced flow conditions), and congestion prediction from the Indianapolis Regional Transportation Plan.

The second phase of the study offered opportunities for research into roadway performance measures that will be used to identify congestion and decide what performance criteria are appropriate in defining a CMS Target Network for the Indianapolis region.

Performance measures and standards were used to assess the performance of roadway and transit systems. Examinations into Indianapolis regional planning issues, objectives, policies and practices along with the ongoing plans and programs at Federal, State, and local level were conducted to support selection of appropriate measures. Data were compiled to support the selection and development of performance measures, along with a short list of preferred candidate mobility and/or accessibility performance measures for roadway, transit and other modes of transportation. Advantages and disadvantages of candidate performance measures were reviewed. Finally, performance measures were selected for roadway, transit, and mobility analysis.

The proposed Target Network includes 31 corridors consisting of approximately 100 miles of roadways, which:

- carry over 20,000 vehicles per day and are currently exhibiting congestion, and
- are predicted to be congested in the future after the improvements recommended in the Indianapolis Regional Transportation Plan, or
- are programmed for capacity expansion in the Indianapolis Regional Transportation Plan.

The CMS Study Review Committee provided continuity refinements to the proposed Target Network in order to designate specific corridors for further study and to incorporate areas of congestion that may have been initially overlooked. For analysis purposes, the CMS Target Network was then divided into project corridors. Table 3-1 and Figure 3-1 shows the CMS Target Network project corridors.

TABLE 3-1
FINAL CMS TARGET
NETWORK PROJECT LIST

	DIR	Street Name	From	To	Miles	Reasoning
1	W	10th Street	Lynhurst Dr	Girls School Rd	2.01	High Volume Congested Network
2	W	16th Street	Georgetown Rd	Stadium Dr	3.41	High Volume Congested Network
3	E	21st Street	I-465 (E)	Mitthoeffer Rd	1.99	Future Congested Network
4	W	38th Street	I-465 (W)	Lafayette Rd	1.87	High Volume Congested Network
5	W	38th Street	Lafayette Rd	Cold Springs Rd	1.98	High Volume Congested Network
6	W	56th Street	I-465 (W)	Guion Rd	2.32	Moderate Volume Congested Network/Continuity
7	W	71st Street	Zionsville Rd	Michigan Rd	3.11	High & Moderate Volume Congested Networks/Continuity
8		Allisonville Rd	I-465 (N)	62nd St	3.35	Moderate & Future Congested Networks/Continuity
9		Allisonville Rd	62nd St	Fall Creek Prkwy	2.18	Moderate & Future Congested Networks/Continuity
10		Brookville Rd	Franklin Rd	Davis Rd	2.07	Future Congested Network/Continuity
11		South County Line Rd	Meridian St	Emerson Ave	4.77	Moderate Volume Congested Network/Continuity
12		Dandy Trail	34th St	Crawfordsville Rd	0.60	Future Congested Network
13	S	East Street	Sumner Ave	Thompson Rd	1.77	High Volume Congested Network/Continuity
14		Fall Creek Drive	Shadeland Ave	Kessler Blvd	2.45	Future Congested Network
15		Fall Creek Prkwy	42nd St	College Ave	1.92	Capacity Increase
16		Georgetown Rd	86th St	62nd St	3.48	Moderate & Future Congested Networks/Continuity
17		Georgetown Rd	62nd St	Lafayette Rd	2.31	Moderate & Future Congested Networks/Continuity
18		Girls School Rd	Crawfordsville Rd	21st St	1.12	Capacity Increase
19		Harding Street	I-465 (S)	Raymond Ave	2.59	Continuity
20		Holt Rd	Morris St	Airport Expresswy	1.10	Moderate Volume Network
21	N	Keystone Ave	38th St	Bloyd Ave	1.91	High Volume Congested Network/Continuity
22		Madison Ave	Southern Ave	Troy Ave	0.53	High Volume Congested Network
23	N	Meridian Street	96th St	82nd St	0.98	High Volume Congested Network
24	S	Meridian Street	Smith Valley Rd	Whiteland Rd	3.98	Capacity Increase
25	N	Michigan Rd	146th St	126th St	3.09	Moderate Volume Congested Network/Capacity Increase/Continuity
26	N	Michigan Rd	126th St	106th St	2.16	Moderate Volume Congested Network/Capacity Increase/Continuity
27	N	Michigan Rd	106th St	79th St	3.19	Moderate Volume Congested Network/Capacity Increase/Continuity
28	N	Michigan Rd	79th St	60th St	2.37	Moderate Volume Congested Network/Capacity Increase/Continuity
29	N	Michigan Rd	60th St	38th St	2.94	Moderate Volume Congested Network/Capacity Increase/Continuity
30		Pendleton Pike	SR 234	Oaklandon Rd	2.80	Capacity Increase/Continuity

TABLE 3-1
FINAL CMS TARGET
NETWORK PROJECT LIST

	DIR	Street Name	From	To	Miles	Reasoning
32		Pendleton Pike	Mitthoeffer Rd	Shadeland Ave	2.18	Capacity Increase/Continuity
33		Rockville Rd	N/S Corridor	I-465 (W)	3.67	High Volume Congested Network
34	N	Shadeland Ave	71st St	Pendleton Pike	3.83	Moderate & Future Congested Networks/Continuity
35	E	Southport Rd	Arlington Ave	Sherman Dr	2.99	High/Future Congested Networks/Continuity
36	N	SR 37	I-465 (N)	Fall Creek Prkwy	1.51	High/Moderate Vol Congested Networks/Capacity Increase/Continuity
37	S	SR 37	I-465 (S)	Southport Rd	2.38	High/Moderate Vol Congested Networks/Capacity Increase/Continuity
38	S	SR 37	Southport Rd	S. County Line Rd	2.10	High/Moderate Vol Congested Networks/Capacity Increase/Continuity
39	S	SR 37	S. County Line Rd	SR 144	4.10	High/Moderate Vol Congested Networks/Capacity Increase/Continuity
40	E	Washington St	Shadeland Ave	Mitthoefer Rd	2.65	High Volume Congested Network
41	W	Washington St	I-465 (W)	Morris St	0.35	High Volume Congested Network

High Volume Congested Network (Base Congested Network)
Planning Area Roadways demonstrating Level of Service E or F with an ADT of 25,000 or more.

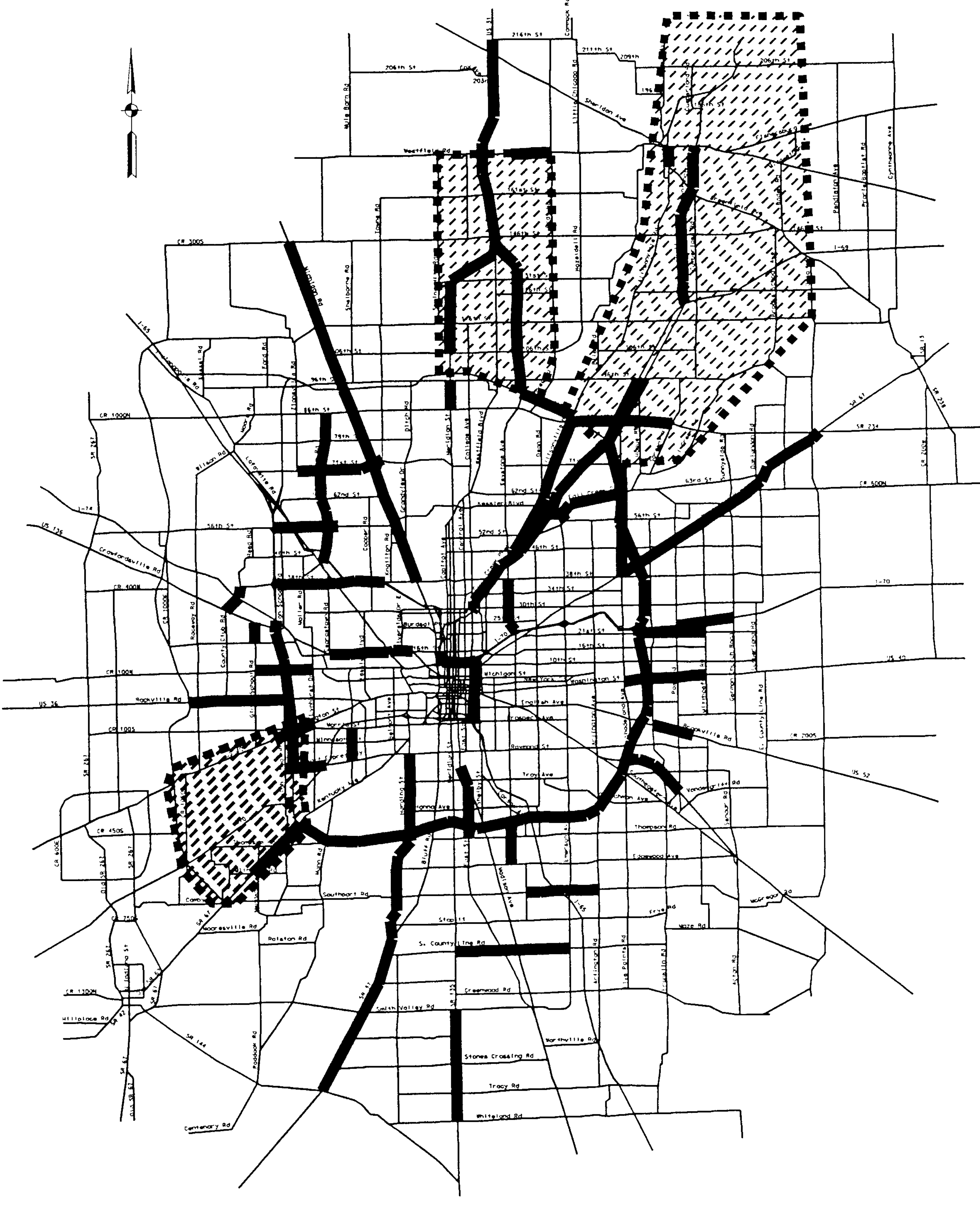
Moderate Volume Congested Network (Alternative Two)
An expanded Base Congested Network with lowering the ADT threshold to 20,000 or more.

Future Congested Network (Alternative Three)
Roadways predicted by Long Range Plan to exhibit congestion after Cost Feasible Plan is put in place.

Continuity
Changes made from Review Committee consultation and IRTC questionnaire responses in order to produce distinct corridors for study.

Capacity Increasing Projects
Capacity increasing projects committed to in the Indianapolis Regional Transportation Plan to phases 1995-2020.

FIGURE 3-1
INDIANAPOLIS METROPOLITAN PLANNING AREA
CMS TARGET NETWORK



IV.

CHAPTER 4: EVALUATION OF SYSTEM PERFORMANCE

Indianapolis is known as the "Crossroads of America" due to its central location and the number of major cross-country interstates that traverse the region. This freeway system serves as a central element of a transportation system that has served the expansion of this region for the last three decades with only localized areas of congestion. With regional population swelling over the 1.2 million mark, the system has started to show its age with ever increasing levels of congestion on area roadways.

The 1991 Highway Performance Monitoring System (HPMS) report documents 3,820 miles of roadways in the Indianapolis Urbanized Area. Breakdowns for the Urbanized Area by facility type, mileage and estimates of vehicle miles of travel are shown in Table 4-1 and Figure 4-2.

Figure 4-1
Indianapolis Regional Interstate System

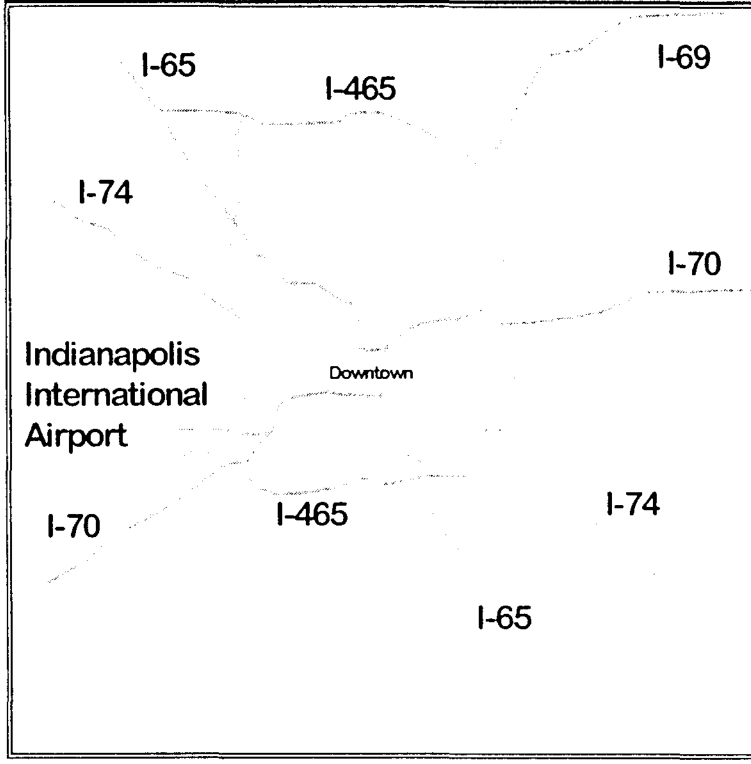
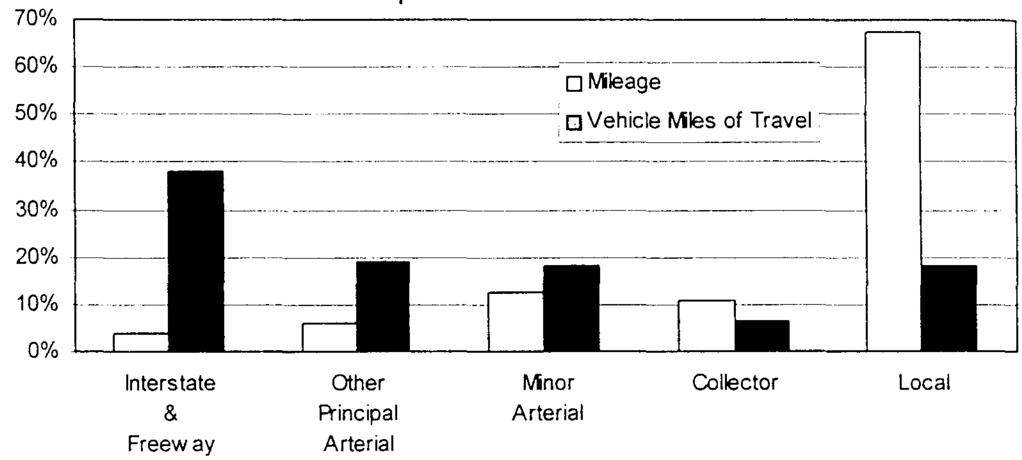


Table 4-1
Indianapolis Region
Highway Performance Monitoring System Statistics

Functional Classification	Miles	%	Vehicle Miles of Travel	%
Interstate	114	3.0%	7,467,068	35.9%
Other Freeway & Expressway	19	0.5%	507,433	2.4%
Other Principal Arterial	229	6.0%	3,961,728	19.0%
Minor Arterial	473	12.4%	3,786,166	18.2%
Collector	407	10.6%	1,322,058	6.3%
Local	2,587	67.5%	3,783,547	18.2%
Total HPMS	3,830	100%	20,828,000	100%

Figure 4-2
Indianapolis 1991 HPMS Statistics



The 1991 HPMS shows that while the roadways classified as Interstate or Freeway account for only slightly over 3% of the total mileage of the system, they accommodate nearly 38% of the total travel. A comparison of key HPMS data was conducted for a peer group of regions within the Midwest with the results documented in Table 4-2.

Table 4-2
Peer Region
Highway Performance Monitoring System Statistics

Region	Total HPMS Mileage	Total Freeway/ Expressway Miles	Freeway Miles Per 1,000,000 Capita	Daily Vehicle Miles Per Capita	% of Travel Served by Freeways
Columbus	3,214	141	149	22.4	45%
Indianapolis	3,830	133	145	22.8	38%
Memphis	3,208	85	99	22.3	27%
Louisville	3,371	135	171	27.7	37%

Source: "Our Nations' Highways" FHWA 1995

As seen in Table 4-2, the Indianapolis highway system statistically falls within the middle of all statistical categories when compared to the peer regions in the Midwest.

TRANSIT

The Indianapolis Public Transportation Corporation provides major transit service to the region. METRO currently operates 39 fixed-bus routes on a radial system around Downtown Indianapolis with a fleet of 219 active vehicles. Twenty six of the vehicles are lift equipped and the average vehicle age is 8 years. In 1994, METRO served 9,151,456 trips, up 2.5% from 1993. This increase in ridership came in spite of a 12% reduction in total vehicle miles and a trend in declining ridership over the last few years. In 1994, METRO operated with the highest farebox recovery rate of any fixed route system in Indiana. Performance measures of peer regions in the Midwest vary considerably, as shown by Table 4-3.

Table 4-3
Peer Region
1993 Transit System Comparison

Measure	Columbus	Indianapolis	Memphis	Louisville
1990 UZA Population	945,000	915,000	860,000	792,000
Peak # of Vehicles	252	128	165	248
Average Vehicle Age	6.20	8.20	9.40	9.50
Annual Passenger Trips (Millions)	16.69	11.10	12.65	22.20
Vehicle Revenue Miles (Millions)	8.30	5.92	6.70	10.05
Total Operating Cost (Millions)	$40.22	$22.05	$22.80	$35.30
Total Operating Cost/ Passenger Trip	$2.42	$2.00	$1.80	$1.61

Source: 1993 National Transit Database - Federal Transit Authority

The Open Door paratransit service run by METRO currently provides approximately 370 daily curb-to-curb trips that require advance reservations. Additionally, there are more than 30 social service agencies operating 250 vehicles, and more than 20 private transportation providers operating approximately 1,000 vehicles.

THE INDIANAPOLIS RIDESHARING PROGRAM

The Indianapolis Ridesharing Program (IRSP) was initiated in January, 1981. Operated by the Department of Capital Asset Management, it provides three primary services: 1) areawide ridematching service for commuters, including a specialized volunteer program matching senior citizens with rides; 2) the development of customized employer-based ridesharing programs; and 3) an effective ridesharing marketing program not only on a local level, but on a national level as well, through the Association for Commuter Transportation. As of August, 1995, these activities have resulted in a match file of approximately 750 prospective carpoolers. This translates into the elimination of an estimated 325 automobiles from the road every weekday. Ridesharing data for the first six months of 1995 indicates the substantial contributions made toward reducing the number of vehicles on the road and the subsequent reductions in areawide VMT and increased fuel savings.

OTHER RIDESHARING EFFORTS

In addition to efforts initiated by local government, the Indiana Department of Transportation (INDOT) has established a ridematching service for its employees through the use of a modem, which enables the on-site coordinator to dial in to IRSP's rideshare database and generate match lists. The on-site coordinator for INDOT is responsible for all internal marketing efforts which are guided by IRSP's coordinator. Since its initiation in April of 1995, many INDOT employees have indicated a willingness to share their ride into work. This is particularly true for those employees traveling from such places as Bloomington, Anderson, and Lafayette. Rideshare efforts have proven to be more effective with State employees than with City and County employees due to the longer commutes taken by some

State employees. Other large employer sites such as IUPUI, Methodist Hospital, St. Francis Hospital, the Children's Museum, and General Motors Truck and Bus have also promoted ridesharing internally to their employees.

AIR, RAIL, AND NON-MOTORIZED TRAVEL

Regional air travel needs are served by the Indianapolis International Airport, located in the southwest portion of Marion County, the Indianapolis Downtown Heliport, and several smaller airports (including Metropolitan Airport, Eagle Creek Airpark, Greenwood Airport, and Mount Comfort Airport). The Indianapolis International Airport served 6.5 million passengers in 1994. The airport is also a major cargo facility, ranked 19th in the world in cargo tonnage in 1993.

The Indianapolis regional rail system currently consists of approximately 190 miles of active tracks providing freight service within the Metropolitan Planning Area. The National Highway System has designated the Conrail Avon facility as a major multi-modal rail-to-truck facility.

At least six bicycle/pedestrian systems are currently in place or are being planned in the Indianapolis Region, including the Indianapolis Greenways Program with 175 miles of pathways under development in 14 corridors.

TRAVEL CHARACTERISTICS

Several recent studies have provided information on the existing and projected future travel characteristics of the Indianapolis regional system.

The IRTP projects that between 1990 and 2020 there will be a 48% increase in the number of person trips within the Indianapolis regional modeling area. This in turn will result in a 69% increase in the aggregate vehicle miles traveled in the modeling area and a 77% increase in the vehicle hours of travel. These robust increases in predicted travel will place a heavy demand on the region's transportation system.

Based on an analysis of the 1990 current day assignment, the highway system carried an average of 2.3 million vehicle trips per day. The average trip length was approximately 7.39 miles and travel time average 17.11 minutes per trip.

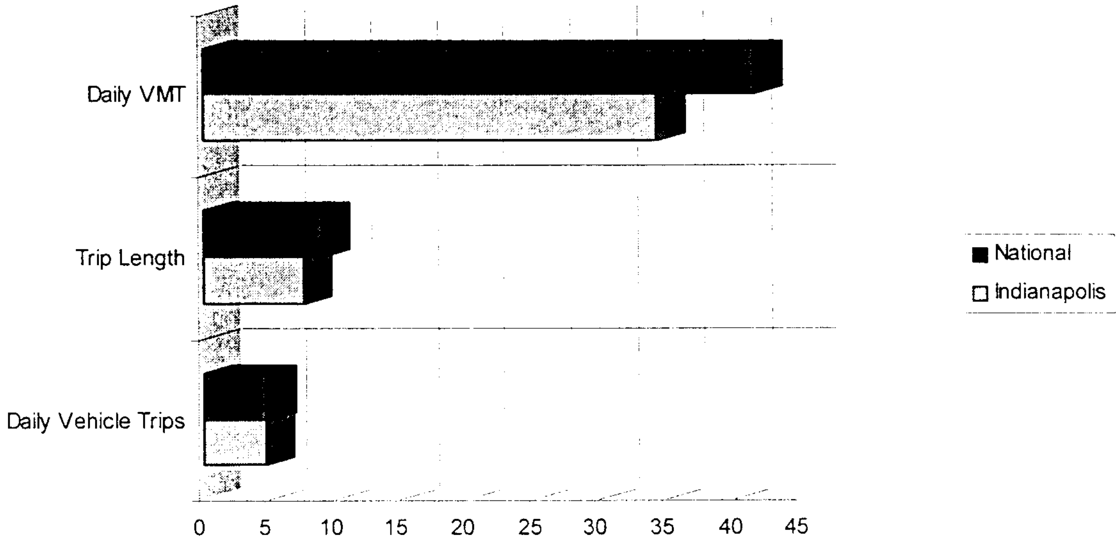
The following section presents some of the more important travel characteristics information documented in the Nationwide Personal Transportation Survey compiled by the Indianapolis MPO in 1992.

- Indianapolis average vehicle occupancy rate was approximately 1.53 persons per vehicle. This is lower than the national average of 1.60 persons per vehicle. The current work trip vehicle occupancy rate of 1.1 persons per vehicle is identical to the national average.

- The journey to work commuting trip distance of 9.28 miles in Indianapolis is shorter than the national average of 11 miles by 18.5%. For all purposes, the average vehicle trip length in Indianapolis is 7.53 miles, which is 19.5% shorter than the national average of 9 miles.

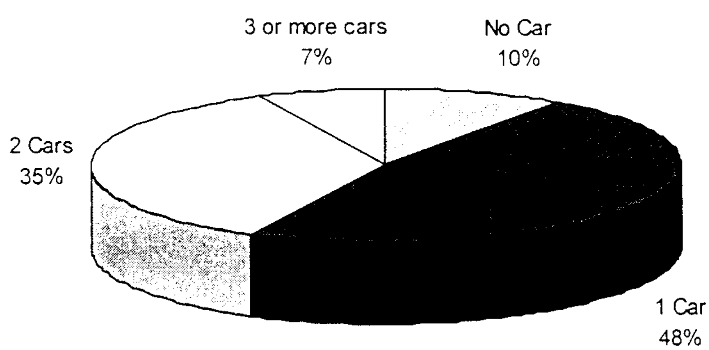
- Both the Indianapolis Average Daily Vehicle Trip Length and the Daily VMT per Household are lower than the national average.

FIGURE 4-3
Comparison with National Average



- In 1990, ten percent (10%) of Indianapolis households had no available vehicles compared to a national average of approximately 9%.

FIGURE 4-4
Households by Number of Vehicles

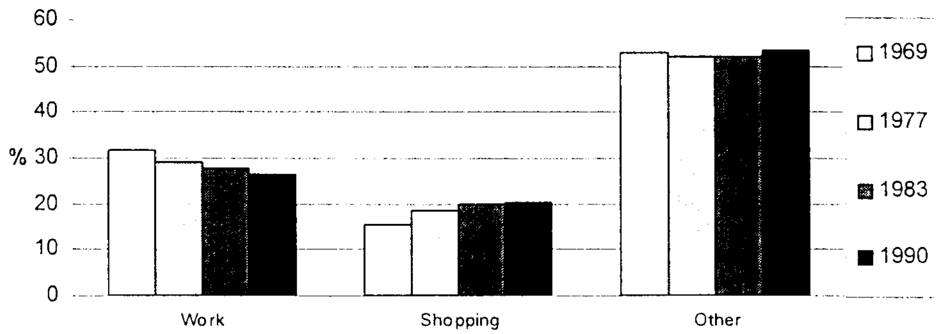


- Annual vehicle trips per household were 1,653 in 1990. This is slightly less than the national average of 1,702. Average annual Vehicle Miles of Travel (VMT) per household in Indianapolis (12,460) is less than the national annual average VMT of 15,000 by 21.2%.

- The primary mode of transportation to work in Indianapolis and the nation is the private vehicle (autos and trucks). The 1.5% of respondents who use public transit in Indianapolis is significantly lower than the national average of 5.5%. Walking and bicycling, by this report, have a higher percent of usage than public transit in Indianapolis.

- As automobiles have become more available, work trips have decreased as a percentage of total trips, being generally replaced by shopping trips.

FIGURE 4-5
Trip Purpose Trend

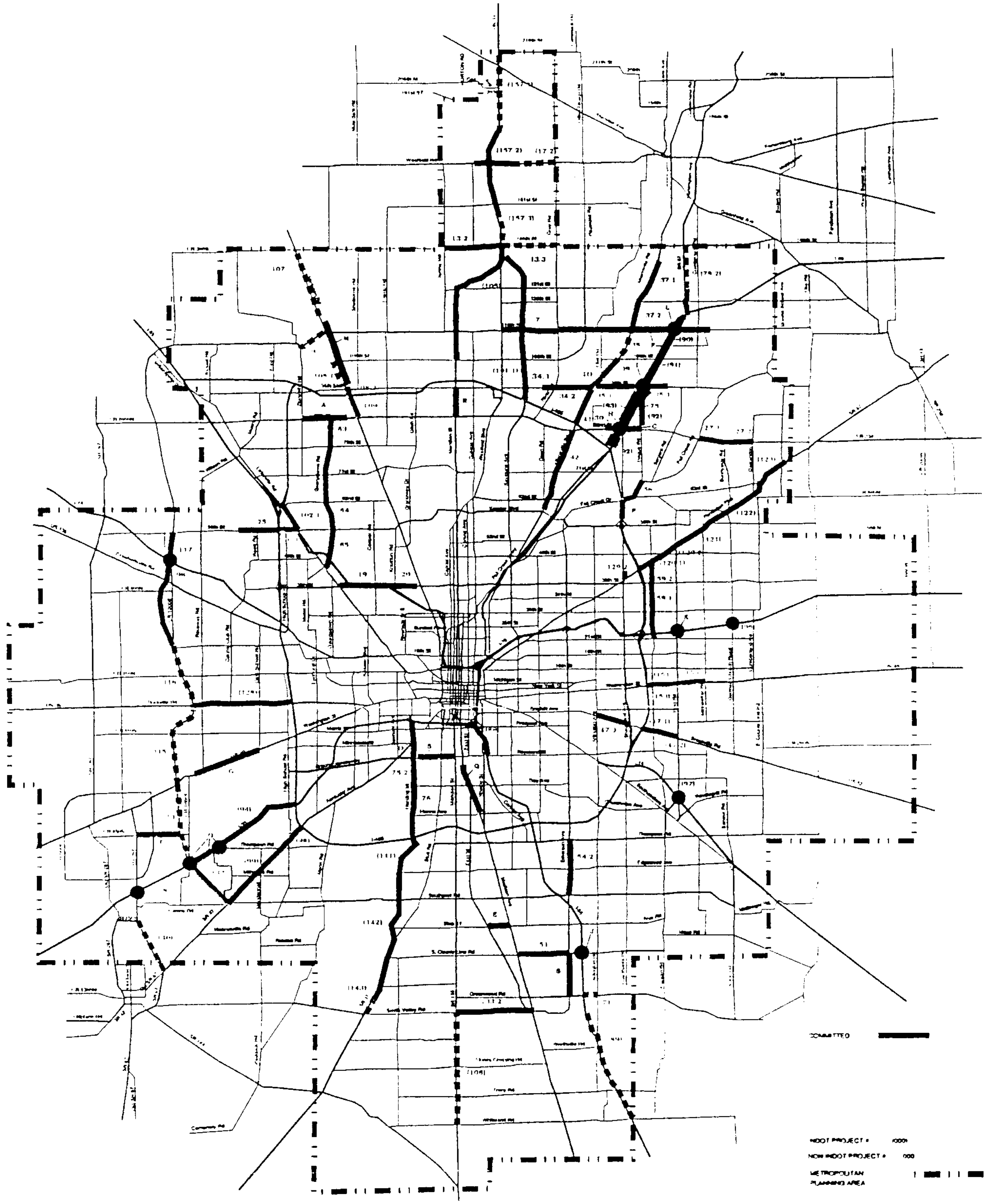


SYSTEM PERFORMANCE

Several measures are used to describe the performance of the roadway system in the Indianapolis region. They relate to the physical characteristics, travel demand, and operations under existing and forecasted conditions.

Indianapolis Regional Transportation Plan

The Indianapolis Regional Transportation Plan Update completed in 1995, provided a "cost feasible" plan for regional transportation expenditures through the year 2020. Over 2.25 billion dollars of local and state expansion, preservation, improvement, enhancement and transit projects are documented by the plan. Figure 4-6 illustrates the capacity increasing projects in the "cost feasible" plan. Table 4-4 shows systemwide performance characteristics predicted with full implementation of the plan.



MAP 4 - 6
ROADWAY EXPANSION PROJECTS

INDIANAPOLIS METROPOLITAN PLANNING AREA

NOTE: ALL ROADS ON BOUNDARY LINES ARE EXCLUDED EXCEPT MARION COUNTY'S EAST AND SOUTH COUNTY LINES

0 1 2 3 4 5 MILES

CITY OF INDIANAPOLIS
PLANNING DIVISION
DEPARTMENT OF METROPOLITAN DEVELOPMENT
APRIL 10, 1995

Table 4-4
Indianapolis Regional Transportation Plan
Systemwide Performance Characteristics
Average Weekday

Performance Characteristic	Year 1990 Existing Network	Year 2020 Cost Feasible Plan Network	1990-2020 % Change
Roadway Capacity Used	51%	74%	45%
Congested Speed (MPH)	41.4	40.1	-3%
Delay (in vehicle hours)*	30,903	115,899	275%
Accident Cost	$113,290	$197,880	75%
User Cost	$3,580,103	$6,095,422	70%

*The difference between actual trip travel time and unimpeded trip travel time.

Due to the limited funds available, the "cost feasible" plan cannot meet all of the forecasted travel demand placed on the year 2020 transportation system at the same level of service experienced currently. Table 4-4 shows a dramatic predicted increase in vehicle hours of delay and user cost.

Roadway Congestion Index Report

The Texas Transportation Institute reports annually on roadway congestion index values for the 50 largest urbanized areas in the United States. Urban roadway congestion levels are estimated using a formula that measures the density of traffic. Average travel volume per lane on freeways and principal arterial streets are computed using areawide estimates of vehicle-kilometers of travel and lane-kilometers of roadway. The resulting ratios are combined into one value using the amount of travel on each portion of the system. This variable weighing factor allows comparisons between areas such as Phoenix, where principal arterial streets carry twice the amount of travel of freeways, and Portland, where the ratio is reversed.

The traffic density is divided by a similar ratio that represents congestion for a system with the same mix of freeway and street volume. The resulting ratio indicates an undesirable level of areawide congestion if a value greater than or equal to 1.0 is obtained. In 1992 Draft figures, Indianapolis ranks as the 44th most congested area out of the top 50. The Indianapolis value of 0.85 is well below the nationwide average of 1.03 and the Midwestern average of 0.97. Table 4-5 and Figure 4-7 show the roadway congestion index values for the peer regions in the Midwest.

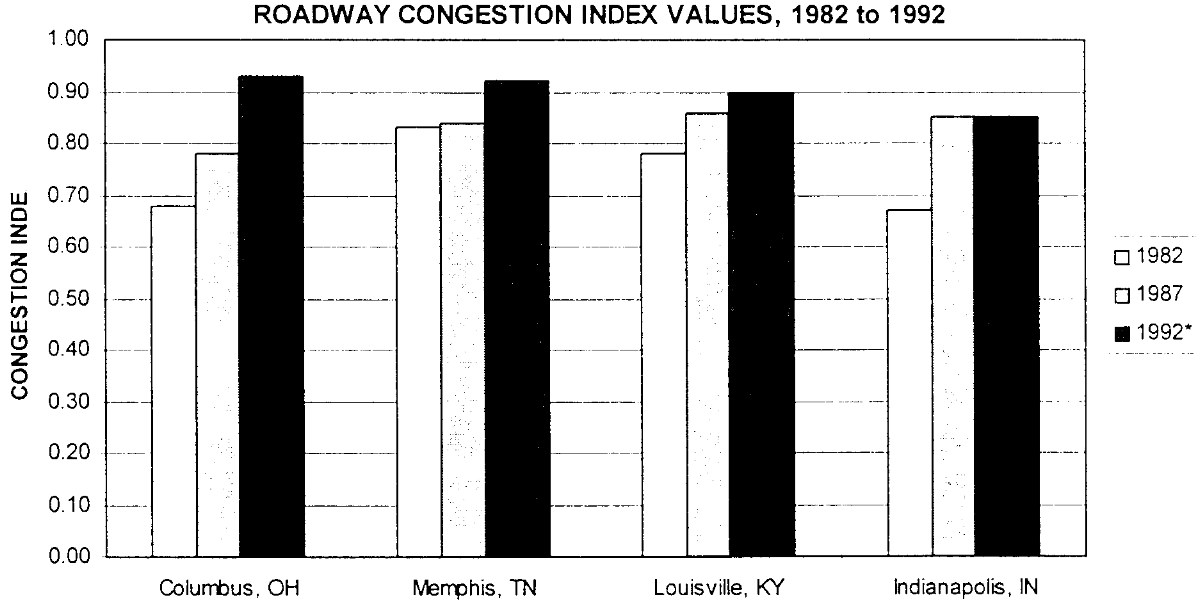
Table 4-5
Roadway Congestion Index Values
Peer Regions, 1982 to 1992

	1982	1987	1992*
Columbus, OH	0.68	0.78	0.93
Memphis, TN	0.83	0.84	0.92
Louisville, KY	0.78	0.86	0.90
Indianapolis, IN	0.67	0.85	0.85

* Draft

Source: Texas Transportation Institute, 1995

FIGURE 4-7
TEXAS TRANSPORTATION INSTITUTE
ROADWAY CONGESTION INDEX VALUES, 1982 to 1992



Congestion Management System Database

As part of the development of the Congestion Management System, a database was completed that includes detailed information on approximately 1,570 miles of roadways in the Indianapolis Metropolitan Planning Area. Based on the Streets Facility Inventory, developed by the Indianapolis MPO, this database contains characteristics on segments of roadways comprising the entire Metropolitan Modeling Area. Data from the Indianapolis Regional Transportation Plan and the 1993 Indianapolis Travel Time Study has been used to supplement information in the database. Included in the database for each segment are listed below:

- Road name
- Segment Boundaries
- Agency Jurisdiction
- Functional Classification
- HPMS Code
- Average Daily Traffic Volumes
- Month and Year of last count
- Segment Length
- Generalized right-of-way
- Generalized pavement width
- Number of continuous through lanes
- Capacity estimates
- Estimated Volume/Capacity ratio
- Level of Service

This database, and information from previous regional studies, will be continuously updated to monitor performance of the Indianapolis regional roadway network. The following figures illustrate regional roadway volume and operational characteristics documented in the CMS database.

Figure 4-8 illustrates Indianapolis regional roadways that carry in excess of 25,000 average daily vehicles. These 215 miles of roadways carry approximately half of the traffic in the region.

Figure 4-9 illustrates roadways identified by the CMS database as currently operating with a level of service "E" or "F" (at or beyond theoretical capacity). These two conditions account for over 150 miles of roadways and nearly 10% of the roadways cataloged in the database. Table 4-6 shows a breakdown by ADT and level of service.

Table 4-6
Indianapolis Regional Roadways 1995 Operations
Level of Service by Volume Group

	ROADWAY MILES	
ADT	**LOS "F"**	**LOS "E"**
50,000 +	3.93	15.98
30 - 50,000	14.57	10.02
20 - 30,000	19.2	11.65
10 - 20,000	37.28	40.15
TOTAL	74.98	77.8

source: CMS Database

FIGURE 4-8
HIGH VOLUME NETWORK
INDIANAPOLIS METROPOLITAN PLANNING AREA

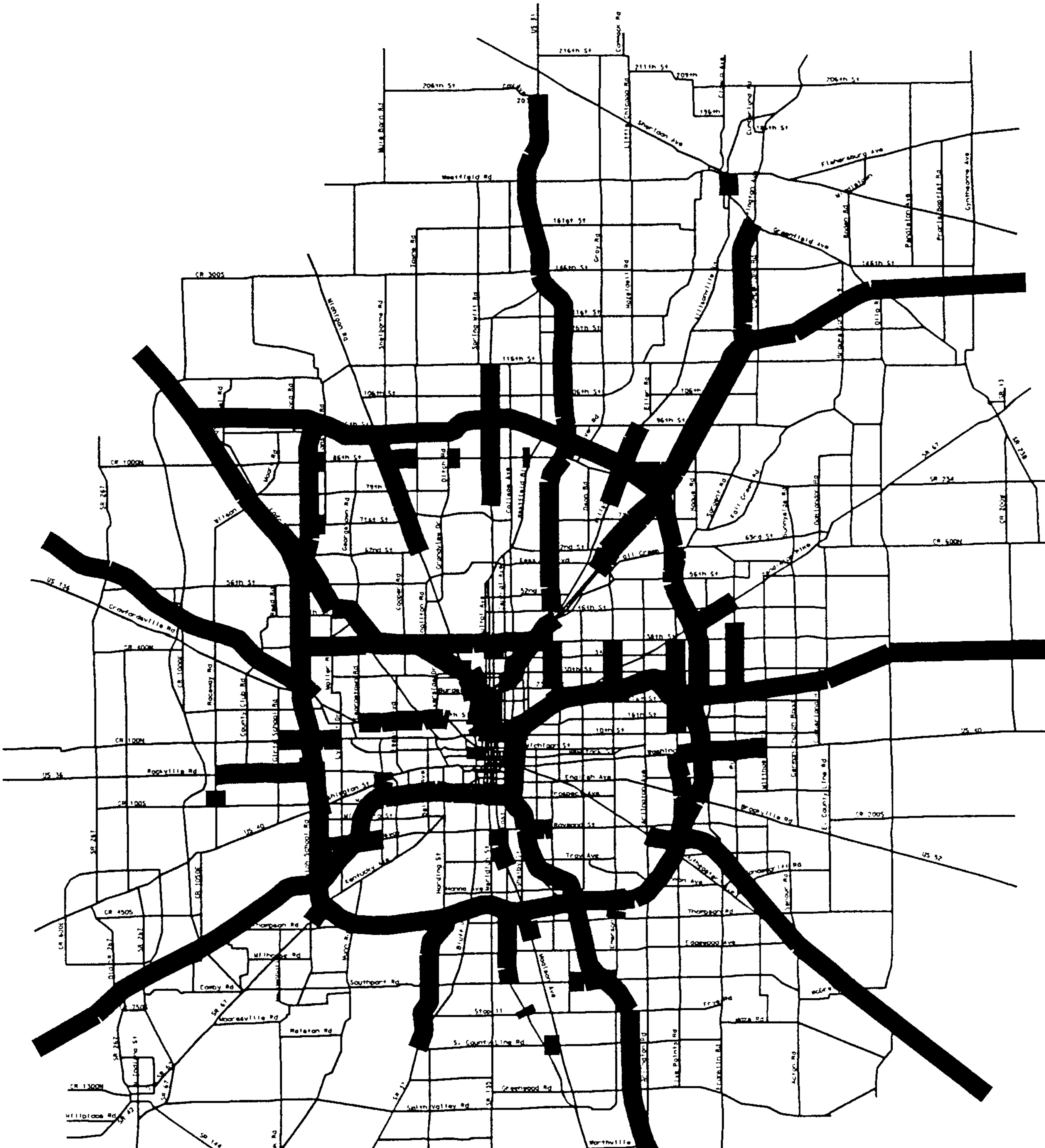
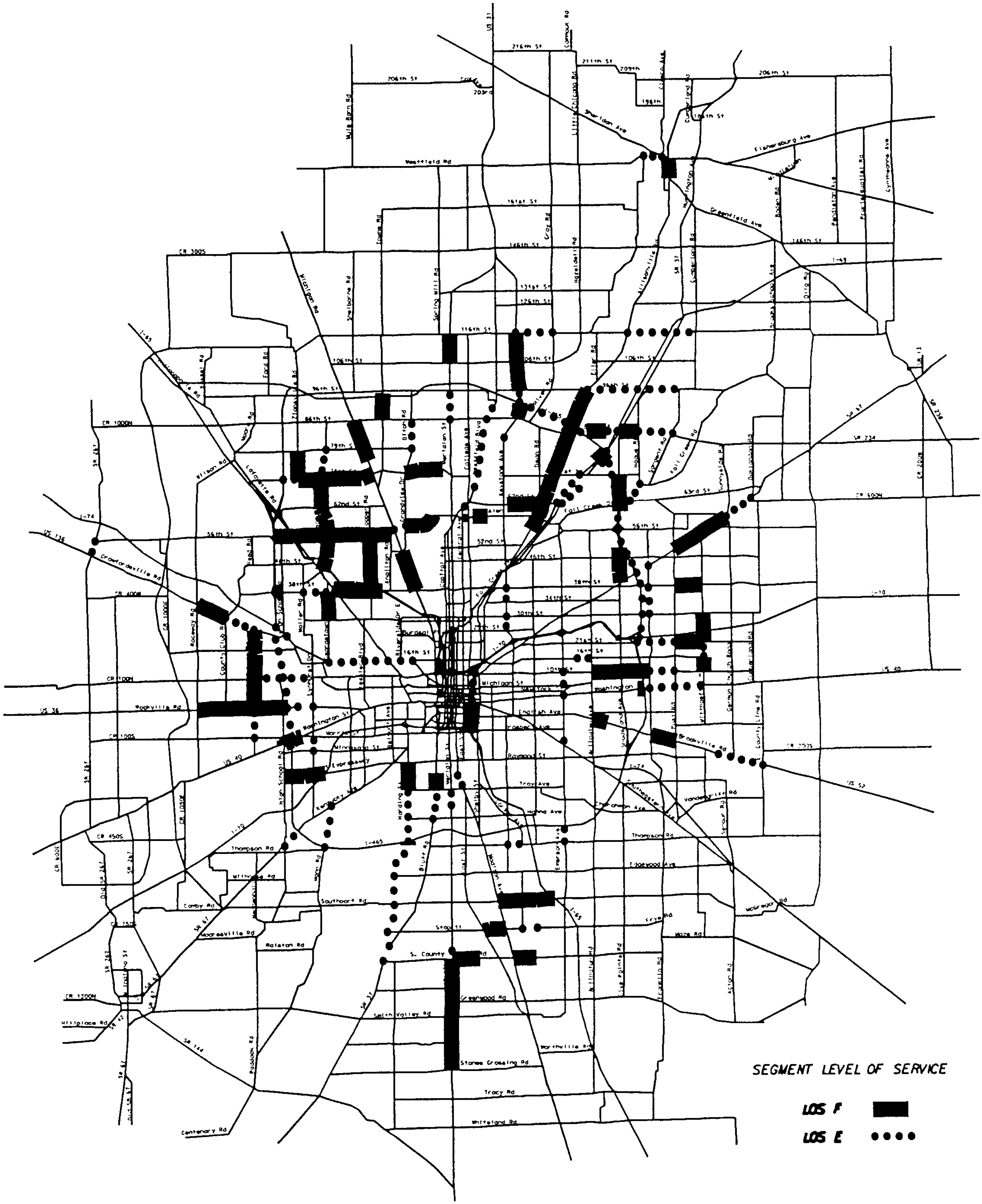


FIGURE 4-9

EXISTING CONGESTED ROADWAY SEGMENTS
INDIANAPOLIS METROPOLITAN PLANNING AREA



Intersection Performance

Delay at intersections are a major cause of congestion. Delay can occur through inadequate capacity, poor signal timing, or accidents. Every year the City of Indianapolis ranks local roadway intersection by accident rate. Table 4-7 and Figure 4-10 show of some of the most heavily traveled and congested intersections in the City of Indianapolis prioritized by accident rate.

TABLE 4-7
INDIANAPOLIS CONGESTED INTERSECTIONS PRIORITIZED BY ACCIDENT RATE
(Total Accidents Per Million Annual Entering Vehicles - 1994)

RANK	INTERSECTION	RATE	#	RANK	INTERSECTION	RATE	#
1	25th St./Pennsylvania St.	8.79	20	31	Sherman Dr./Washington St.(US 40)	1.88	22
2	Raymond St./Shelby St.	3.41	42	32	Girls School Rd./Rockville Rd.(US 36)	1.87	28
3	30th St./College Ave.	2.86	26	33	Post Rd./I-70	1.85	24
4	Keystone Ave./Fall Creek (SR 37)	2.56	50	34	38th St./High School Rd.	1.84	34
5	21St St./Post Rd.	2.56	45	35	82nd St./Allisonville Rd.	1.81	34
6	10th St./Lynhurst Dr.	2.55	34	36	38th St./Moller Rd.	1.79	32
7	I-465 EW Ramps/Allisonville Rd.	2.54	38	37	High School Rd./Wash. St.(US 40)	1.78	29
8	25th St./Post Rd.	2.52	32	38	38th St./Keystone Ave.	1.72	28
9	82nd St./Fall Creek Rd.	2.48	21	39	30th St./Shadeland Ave.	1.71	25
10	Belmont Ave./Washington St.(US 40)	2.46	20	40	86th St./Meridian St. (US 31)	1.62	27
11	11th St./Dr. MLK, Jr. St.	2.45	35	41	Holt Rd./Morris St.	1.62	20
12	82nd St./I-69/Shadeland Ave.	2.35	42	42	38th St./Lafayette Rd.	1.61	36
13	College Ave./Washington St. (US 40)	2.31	24	43	38th St./Shadeland Ave.	1.61	24
14	Stop 11 Rd./Madison Ave.	2.27	34	44	US 36/Pendleton Pike/Franklin Rd.	1.54	22
15	10th St./Shadeland Ave.	2.24	32	45	16th St./Illinois St.	1.54	21
16	10th St./Dr.MLK, Jr. St.	2.24	32	46	Madison Ave./Southport Rd.	1.51	20
17	10th St./Tibbs Ave.	2.23	21	47	38th St./Fall Creek Pkwy., NDr.	1.49	29
18	86th St./Allisonville Rd.	2.17	36	48	86th St./Ditch Rd.	1.44	22
19	52nd St./Keystone Ave.	2.15	30	49	16th St./Lafayette Rd.	1.35	21
20	Raymond St./Sherman Dr.	2.15	21	50	86th St./Westfield Blvd.	1.34	20
21	46th St./Meridian St.	2.15	21	51	38th St. /(SR37) Meridian St.	1.33	25
22	10th St./Country Club Rd.	2.12	20	52	82nd St./Bash Rd.	1.31	20
23	Post Rd./Washington St.	2.08	29	53	Holt Rd./Washington St. (US 40)	1.28	20
24	29th St./Meridian St.	2.05	22	54	16th St./Meridian St. (US 31)	1.26	20
25	Emerson Ave./Thompson Rd.	2.05	22	55	86th St./Michigan Rd.	1.25	22
26	34th St./Moller Rd.	2.05	20	56	21st St./Shadeland Ave.	1.18	20
27	38th St./Emerson Ave.	1.99	31	57	Crawfordsville Rd./High School Rd.	1.18	20
28	Stop 11 Rd./US 31	1.93	29	58	Madison Ave./Troy Ave.	1.14	20
29	High School Rd./Rockville Rd.(US 36)	1.91	28	59	East St. (US 31)/Thompson Rd.	1.04	21
30	Rural St./Washington St. (US 40)	1.88	22				

High accident rates are often an indicator of other congestion problems at intersections. These intersections require additional attention and detailed analysis to determine appropriate corrective measures.

At the system level, the Indianapolis Regional Transportation Plan predicts that costs due to accidents will increase 75% from 1990 to 2020. The City of Indianapolis has reviewed accident characteristics for its portion of the roadways in the region with the results shown in Table 4-8.

FIGURE 4-10

1994 HIGH ACCIDENT INTERSECTIONS

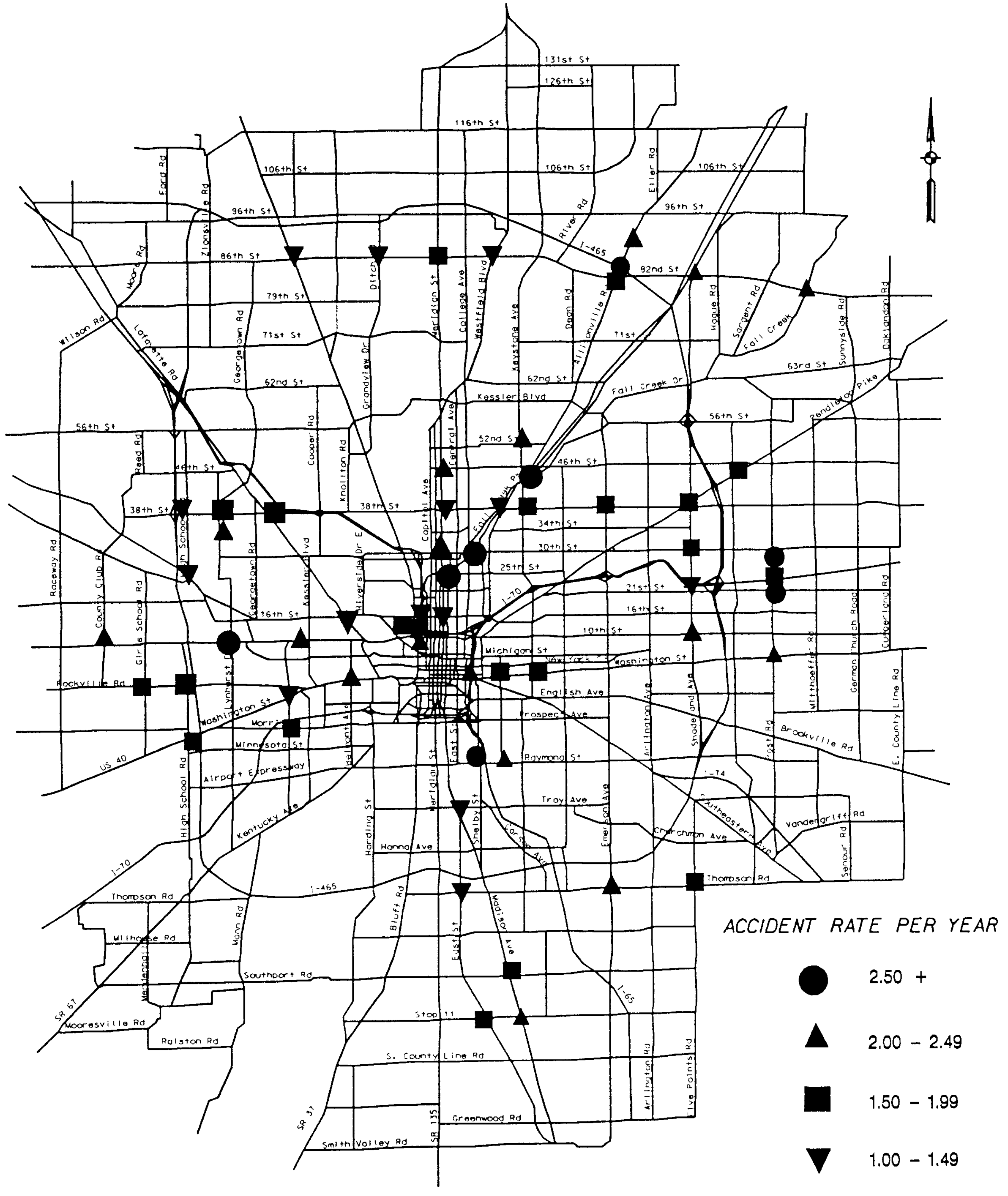
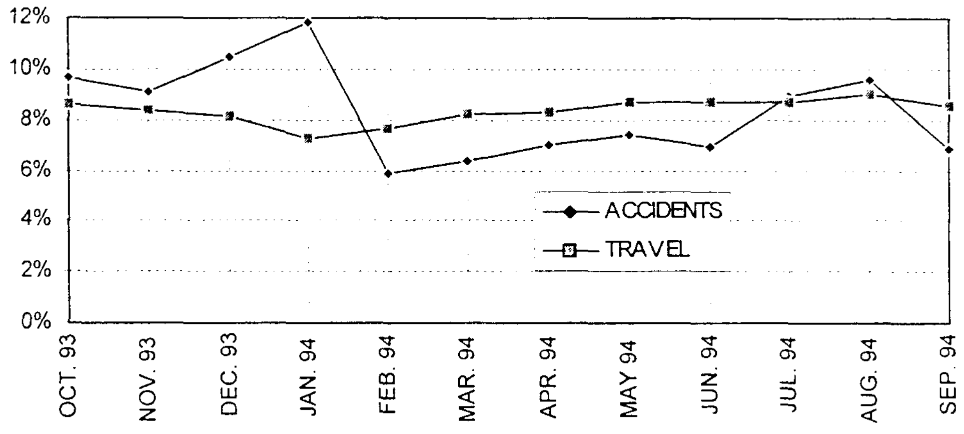


TABLE 4-8
INDIANAPOLIS / MARION COUNTY ACCIDENT SUMMARY

CRASH TYPE	OCT. 93	NOV. 93	DEC 93	JAN. 94	FEB. 94	MAR 94	APR. 94	MAY 94	JUN. 94	JUL. 94	AUG. 94	SEP. 94	YEAR TOTAL	% OF TOTAL
Property Damage	2435	2356	2721	3196	1430	1508	1586	1671	1589	2181	2401	1606	**24680**	73.7%
Personal Injury	798	696	782	765	535	609	754	793	730	808	805	683	**8758**	26.1%
Fatality	5	10	4	4	5	8	3	8	4	4	5	6	**66**	0.2%
TOTAL	**3238**	**3062**	**3507**	**3965**	**1970**	**2125**	**2343**	**2472**	**2323**	**2993**	**3211**	**2295**	33504	100%
CRASH TIME														
6:01am - 12:00pm	880	828	864	1362	618	604	547	608	513	679	796	592	**8891**	27%
12:01pm - 6:00pm	1433	1274	1568	1477	780	824	1089	1040	1060	1352	1472	999	**14368**	44%
6:01pm - 12:00am	611	632	753	720	384	507	508	595	536	648	642	488	**7024**	22%
12:01am - 6:00am	217	234	201	258	149	167	158	189	194	220	192	177	**2356**	7%
TOTAL	**3141**	**2968**	**3386**	**3817**	**1931**	**2102**	**2302**	**2432**	**2303**	**2899**	**3102**	**2256**	32639	100%
CRASH DAY														
MONDAY	354	324	296	251	196	166	165	276	254	292	281	210	**3065**	9%
TUESDAY	357	479	454	677	223	226	310	362	296	317	505	320	**4526**	14%
WEDNESDAY	439	460	499	525	301	317	344	404	268	389	515	284	**4745**	14%
THURSDAY	482	444	551	551	272	396	354	314	419	393	520	307	**5003**	15%
FRIDAY	375	375	568	570	394	447	329	320	385	433	485	394	**5075**	15%
SATURDAY	592	550	644	857	314	292	434	469	431	656	439	487	**6165**	18%
SUNDAY	639	430	495	534	270	281	407	327	270	513	466	293	**4925**	15%
TOTAL	**3238**	**3062**	**3507**	**3965**	**1970**	**2125**	**2343**	**2472**	**2323**	**2995**	**3211**	**2295**	**33504**	**100%**
% OF TOTAL	**10%**	**9%**	**10%**	**12%**	**6%**	**6%**	**7%**	**7%**	**7%**	**9%**	**10%**	**7%**	**100%**	

Table 4-8 indicates that accidents are most likely to occur during weekend afternoons during the months of October to January. Interestingly, only approximately 30% of the accidents occur at night (6:00 P.M. to 6:00 A.M), which is roughly equilavalent to the proportion of travel during the nightime hours. Figure 4-11 illustrates the relationship of annual proportions of estimated total travel to the number of accidents. A general trend can be read that accidents per vehicle miles of travel are less during the period of February to June.

FIGURE 4-11
MARION COUNTY ACCIDENT/TRAVEL TRENDS



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CHAPTER 5: REVIEW OF POTENTIAL CONGESTION MANAGEMENT STRATEGIES

An integral component of a Congestion Management System (CMS) is the identification and selection of congestion management strategies which warrant further evaluation. The key step of this component is the identification of reasonable alternatives for various applications. Conditions which are necessary for the various strategies to succeed are described and a list of screening and evaluation questions for determining their application was developed.

The next section provides a description of the regulations related to strategy identification, as outlined in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), and subsequent regulations on Statewide Planning, Metropolitan Planning and Management and Monitoring Systems. This section also includes a commentary on the meaning and intent of these regulations.

The third section provides a detailed discussion of alternative strategies, divided into five levels. Each strategy level is briefly defined, and a list of specific measures within each level is presented. The list of strategies is not all-inclusive, but is comprehensive and was used to initiate the identification of improvement alternatives. This section also describes the keys for successfully implementing the various strategies. These keys were considered when developing the questions for screening and evaluation to identifying those that are "reasonable".

The fourth section identifies screening and evaluation questions to determine the applicability of various strategies to address deficiencies.

ISTEA REGULATIONS

Two federal regulations, subsequent to the ISTEA, describe the CMS and its application within the planning process. An Interim Final Rule (23 CFR 500), Management and Monitoring Systems, describes the requirements of a CMS. A Final Rule (23 CFR 450), Statewide Planning and Metropolitan Planning, describes the planning processes, including how the CMS fits in.

A required component of the CMS is one that encompasses the Identification and Evaluation of Proposed Strategies. As stated in 23 CFR 500.507(c):

> *"The anticipated performance and expected benefits of traditional and nontraditional strategies that will contribute to the more efficient use of existing and future transportation systems shall be identified and evaluated based on the established performance measures."*

This section provides a list of strategies, or combinations of strategies, to be appropriately considered as part of the CMS. These may include, but are not limited to:

- transportation demand management (TDM) measures;
- traffic operations improvements;
- measures to encourage high occupancy vehicle (HOV) use;
- public transit capital improvements;
- public transit operational improvements;
- measures to encourage the use of non-traditional modes;
- congestion pricing;
- growth management;
- access management;
- incident management;
- Intelligent Transportation Systems (ITS); and
- addition of general purpose lanes.

The rule lists a number of sample measures within each of the strategy groups identified. Although the wording of the regulations indicates that the implementation of specific measures is not required, ISTEA mandates that consideration be given to strategies that reduce single occupancy vehicle (SOV) travel. However, "*the FHWA and FTA recognize, that in some cases, addition of general purpose lanes may be an appropriate congestion management strategy*" (23 CFR 450, Supplementary Information).

One of the questions raised in response to the proposed regulations was if a detailed analysis was required for every suggested strategy, and if an analysis of packages of strategies was appropriate. The legislation intended that "*the FHWA and FTA recognize, that in some cases, addition of general purpose lanes may be appropriate congestion management strategy*" (23 CFR 450, Supplementary Information).

> *"The FHWA and the FTA agree, particularly in areas with complex transportation systems, that congestion management should be analyzed in a comprehensive multimodal process that includes a logical packaging of appropriate travel demand reduction, operating, and capacity enhancement strategies."*

Similarly, regarding the list of strategies, the Supplementary Information states that:

> *"It was not intended that the list be all-inclusive or that every strategy on the list would be fully analyzed. The list was intended to be an illustrative sample of...strategies that should be considered."*

In other words, the Indianapolis MPO and the Indiana Department of Transportation, in cooperation with other agencies, were given the responsibility to determine the reasonableness of individual strategies (or combinations of strategies) and the extent to which they should be analyzed. Appropriate consideration may mean that some strategies are not applicable in certain areas, subareas, or corridors.

It should be noted that the CMS regulations include additional requirements for air quality non-attainment areas. These do not apply to Indianapolis at the time of the publication of this report, but are summarized in the following box for information purposes.

Air Quality Non-attainment Implications

In addition to the general statements, the regulation provides more specific guidance for the CMS in transportation management areas (TMAs) which are designated as air quality non-attainment areas. In the section describing the general requirements of a CMS, 23 CFR 500.505(e) states that:

> *"...in a TMA designated as non-attainment for carbon monoxide and/or ozone, the CMS shall provide an appropriate analysis of all reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in which a project that will result in a significant increase in capacity for SOVs (adding general purpose lanes to an existing highway or constructing a new highway) is proposed. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor and additional SOV capacity is warranted, then the CMS shall identify all reasonable strategies to manage the SOV facility effectively (or to facilitate its management in the future). Other travel demand reduction and operational management strategies appropriate for the corridor, but not appropriate for the SOV project itself shall also be identified. As required by 23 CFR 450.320(b), all identified reasonable travel demand reduction and operational management strategies shall be incorporated into the SOV project or committed to by the State and MPO for implementation."*

The reference to 23 CFR 450.320(b) is the regulation on metropolitan planning, which identifies the relationship of the metropolitan planning process to the management system. 23 CFR 450.320(b) states that:

> *"In TMAs designated as non-attainment for ozone or carbon monoxide, Federal funds may not be programmed for any project that will result in a significant increase in carrying capacity for single occupant vehicles (a new general purpose highway on a new location*

or adding general purpose lanes, with the exception of safety improvements or the elimination of bottlenecks) unless the project results from a congestion management system (CMS) meeting the requirements of 23 CFR Part 500, subpart E. Such projects shall incorporate all reasonably available strategies to manage the SOV facility effectively (or to facilitate its management in the future). Other travel demand reduction and operational management strategies identified under 23 CFR 500.505(e), as appropriate for the corridor, but not appropriate for incorporation into the SOV facility itself, shall be committed to by the State and the MPO for implementation in a timely manner, but no later than the completion date for the SOV project".

The implication of this is that in order to receive federal funding, projects that include significant increases in SOV capacity must be analyzed to consider the full range of demand reduction and operational management strategies as alternatives. Even if it is determined that mixed-flow lanes must be added, the alternative strategies still must be identified and implemented as appropriate. The added implication is that the strategy identification and evaluation process must not only look at alternative strategies, but also complementary strategies.

POTENTIAL STRATEGY IDENTIFICATION

After the performance of the transportation system had been measured and deficiencies identified, the CMS included steps to identify strategies that addressed the deficiencies. The requirements of the applicable regulations, combined with the instructions which accompanied the regulations, guided the identification of potential strategies for Indianapolis. These strategies include demand management, operational management, and capital intensive approaches. The CMS regulations require that appropriate consideration be given to all reasonable alternatives and, more specifically, that consideration be given to strategies that reduce SOV travel. The key was to identify those strategies that are reasonable for the particular location or deficiency.

The regulations include a comprehensive listing of strategies broken into 12 categories or groups. The boundaries between these groups are not distinct and individual measures may be included in more than one category. For example, park-and-ride lots are appropriate as a measure promoting HOV use and as transit capital improvements. For the purposes of this study, however, an attempt was made to separate potential strategies into a hierarchical order that considers first those actions which deal with the fundamental transportation and land use relationships which give rise to trip-making, and ultimately to congestion. Thus, if the reason for the trip can be eliminated, so can the trip and its congestion. In successive rounds, the residual trips not mitigated by previous levels of actions are successively dealt with using techniques aimed at the next higher level of concern. This process is described below:

- **Initial level:** Actions that decrease the need for trip making (i.e. growth management, activity centers, congestion pricing, and some TDM measures).

- **Second level:** Actions that place trips into transit or other non-auto modes (i.e. public transit capital and operating improvements, APTS, and parking management).

- **Third level:** Actions that put as many trips as possible into HOVs.

- **Fourth level:** Actions that optimize the highway system's operation for SOV trips, and for all other trips using highway facilities/modes (traffic signalization modification, ITS/IVHS, etc.).

- **Fifth and final level (the level of last resort):** Actions that increase the capacity of the highway system for SOVs by adding general purpose lanes.

This hierarchy responds to the letter and intent of the regulations. By following this preferential order of analysis, Indianapolis was assured of satisfying the regulations while efficiently considering congestion management strategies.

CMS STRATEGIES - LEVEL ONE

The first level includes actions that decrease the need for making the trip. This can be accomplished through growth management and the development of activity centers, congestion pricing and also certain types of transportation demand management. Table 5-1 summarizes this first tier of strategies, providing examples of strategies and the keys for successful implementation.

TABLE 5-1
LEVEL ONE STRATEGIES

Strategy Class	Strategy Examples	Keys to Success
Growth management/ Activity centers	Land use policies/regulations	Political support, public information and outreach
	Design standards	Provide good pedestrian and bicycle accessibility and transit-friendly designs.
	Locations of jobs and housing	Policies which promote affordable housing as well as commercial development.
Congestion pricing	Road user fees	Political support; technology; public education.
	Parking fees/taxes	Private sector cooperation; political support.
Transportation demand management	Telecommuting	Employer/employee support
	Trip reduction ordinances	Political support; employer/ employee support; policies which provide incentives for trip elimination or mode shift; enforcement

Growth Management/Activity Centers

Land use strategies seek to achieve concurrence between transportation infrastructure and land development. These strategies are often viewed as critical to the success of any regional transportation plan, and must be analyzed at the regional scale. Strategies for land use that can reduce the demand for SOV travel include locating residential or commercial development along transit corridors and mixed-use development. Mixed-use can be at a micro scale (i.e. individual building or parcel level), or at a macro scale. In addition, growth management practices and activity centers can even eliminate vehicular trips by matching trip productions with attractions at the same site, or by providing good pedestrian, transit and bicycle accessibility. Components of a growth management plan could include:

- Land use policies/regulations, including growth boundaries;
- Stricter design/zoning standards which promote this strategy (such as density bonuses), and
- Maintenance/development of a jobs/housing balance.

Typical keys to success include strong political support for growth management and the promotion of activity centers; good public information and outreach regarding the benefits of this strategy; an emphasis on providing good pedestrian and bicycle accessibility; and permitting mixed use/compact development.

Congestion Pricing

There has been limited practice of congestion pricing in the U.S., but this strategy may be implemented more often pending the outcome of several demonstration projects that are underway. Congestion pricing is generally used to charge roadway users at a time-differentiated rate to discourage trips during congested periods. At a minimum, it should be implemented throughout a corridor. Elements of a congestion pricing scheme could include:

- Road user fees;
- Parking fees;
- Graduated fares;
- Automated collection/billing systems, and
- Subsidies for low income commuters.

This strategy can be very controversial and requires an extensive public education and outreach effort, as well as strong political support to follow through on implementation and enforcement. If parking fees are used to implement the road pricing, cooperation and coordination with parking agencies and private sector providers will be necessary.

Political sensitivity regarding tolls must be addressed, and some practices, such as discounts for SOV commuters, may be counterproductive to reducing SOV travel. Pricing structures which promote HOV use and discouraging peak period SOV use are challenging to implement.

Transportation Demand Management

Some transportation demand management strategies are effective at eliminating vehicle trips, including telecommuting and trip reduction ordinances. With improvements in communication at a reasonably low cost, telecommuting is becoming more acceptable to both employers and employees. This trend is expected to continue with such recent technological capabilities as computer to computer teleconferencing becoming more common. Trip reduction ordinances can be used to eliminate trips, especially through telecommuting.

Keys to success include understanding of private sector operations and getting employers to recognize benefits of telecommuting, such as lower operating costs. Transportation Management Organizations can be effective in promoting telecommuting and other transportation demand management strategies.

CMS STRATEGIES - LEVEL TWO

The second level includes actions which attempt to place the trips not addressed in level 1 into transit or other non-auto modes. This can be accomplished through capital investments in public transit, public transit operational improvements, intelligent transportation systems, methods to encourage the use of non-traditional modes and certain types of transportation demand management. Table 5-2 summarizes this second tier of strategies, providing examples of strategies and the keys for successful implementation.

TABLE 5-2
LEVEL TWO STRATEGIES

Strategy Class	Strategy Examples	Keys to Success
Public Transit Capital Improvements	Exclusive r.o.w. (rail)	Dense development and/or feeder system; competitive travel times; good intermodal connections; system reliability; security; price.
	Exclusive r.o.w (busways)	Above keys plus enforcement
	Exclusive r.o.w. (bus lanes)	Effective design/operations
	Bus bypass ramps	Consistency with funding provider's goals and objectives; farebox recovery rate.
	Fleet expansion	Aggressive marketing by transit agency.
	Vehicle replacement/ upgrade	Location; security; cost.
	Park and ride facilities	Efficiency; coordination.

TABLE 5-2 (cont.)

Strategy Class	Strategy Examples	Keys to Success
Public Transit Capital Improvements	Other intermodal facilities	Coordination with other transit services.
	Paratransit services	Visibility, public information.
	Increased transit security	Studies to determine impact on ridership and financial implications.
	Service enhancement	Multi-agency coordination and support. Planning and impact studies.
Public Transit operational improvements	Service expansion	Studies to determine impact on ridership and financial implications
	Traffic signal preemption	Multi-agency coordination and support. Planning and impact studies.
	Fare reductions	Studies to determine impact on ridership and financial implications.
	Transit information systems	Technology; public education and outreach; Multi-agency coordination.
	Transit coordination	Multi-agency coordination.
	Transit marketing	Public and media education and outreach.
Advanced Public Transportation Systems	Intelligent bus stops	Technology; public education and outreach.
	Advanced mode choice system	Technology; public education and outreach; Multi-agency coordination.
Encourage the use of non-traditional modes	Bicycle facilities	Planning; public education and outreach; Multi-agency coordination.
	Bicycle storage systems	Planning; coordination with transit; public education and outreach.
	Pedestrian facilities	Planning; coordination with transit; public education and outreach.
	Ferry service	Multi-agency coordination.

TABLE 5-2 (cont.)

Strategy Class	Strategy Examples	Keys to Success
Transportation demand management	Parking management	Usage studies; Multi-agency/public coordination; public education and outreach; employee/ employer cooperation.

Public Transit Capital Improvements

Transit capital improvements are designed to increase ridership on transit lines by improving transit infrastructure or vehicles. These strategies are generally implemented to address regional or corridor transportation system deficiencies. Potential improvements could include:

- New rail lines, busways, or bus lanes (on exclusive right-of-way);
- Bus bypass ramps for preferential treatment of buses;
- Fleet expansion;
- Vehicle replacement/upgrades;
- Park-and-ride lots;
- New, expanded, or improved transit stations (intermodal facilities);
- Paratransit services; and
- Increased transit security.

The main key to success in implementing any of these strategies is a thorough study and understanding of the complicated issues which affect the use of non-automobile modes. It is also important to evaluate the entire trip, from origin to destination, when determining the appropriate strategy for shifting vehicle trips away from the personal vehicle. For example, land use densities affect the ability to provide competitive transit travel times at attractive costs. In turn, outside factors, such as parking costs, can determine what is considered an attractive cost for transit service. Good intermodal connections are crucial to providing competitive travel times. These transfers should be efficient and often require coordination between the various modes accessing intermodal facilities to minimize transfer times. It is also important to consider the pedestrian element of any trip to achieve the origin to destination evaluation of alternatives. The convenience of alternatives is important, such as the location of transfer points and the reliability of the system. Finally, transit security should not be overlooked (as required by ISTEA) as an important factor which has a direct impact on travelers' decisions to use alternative modes of travel. The 1994 Strategic Plan for Indianapolis Public Transportation, the Bicycle and Pedestrian Plan and the Comprehensive Rail Studies for the Indianapolis region were all used as reference studies for this report.

Public Transit Operational Improvements

Like capital improvements, operational improvements to transit systems can increase the demand for transit, which reduces the number of vehicles on the road. Operational improvements can be implemented on specific routes or transit corridors, although regional operational improvements are commonly developed. Some strategies are:

- Increases in service frequency;
- Longer operating hours;
- Improvements in service quality;
- Additional bus routes;
- Restructured or extended bus lines;
- Traffic signal preemption;
- Fare reductions;
- Improvements of coordination and transfers between systems and routes;
- Improved marketing of transit; and
- Transit passenger information systems.

Several of the operational improvements require a reallocation of resources to allow for increased service frequencies, hours of operation, additional routes, extensions of current routes, or even farebox reductions on routes. To ensure that the reallocation is justified, it is important to conduct studies to determine the impact on ridership and the financial implications of the changes. These studies should include the consideration and potential implementation of the keys to success identified for the various strategies.

As identified above, it is important for alternative modes to provide competitive travel times. One way to accomplish this is by providing preferential treatment to transit vehicles using traffic signal preemption. This strategy requires multi-agency coordination and support, as well as planning and impact studies required to build this support.

One of the biggest keys to success for any of the improvement strategies is effectively communicating the benefits to the public. This can take place through marketing, using public and media education and outreach. Another tool is the use of transit information systems to better communicate the services provided and increase the convenience of the user.

Advanced Public Transportation Systems

Advanced Public Transportation Systems (APTS) are a type of intelligent transportation systems (previously known as Intelligent Vehicle-Highway Systems, or IVHS), and include coordinated operational strategies implemented through technology. Intelligent bus stops and advanced mode choice systems can be used to provide up-to-date travel information to transit patrons.

As with any new technology, its effectiveness often hinges on public education and outreach to create user-friendly systems. To be effective, these information systems should provide data on multiple factors which affect the trip making decision. This typically requires multi-agency coordination to identify traffic conditions created by incidents, or just the current extent of congestion. Elements may include:

- *Travel Planning.* Pre-trip multi-modal travel information and ride-matching services can help travelers determine their optimal mode choice, departure time, and route before their trips.

- *Traveler Information.* Real-time information to guide travelers during trips includes advisory services (to warn of traffic or transit congestion or delays), route guidance systems, and traveler services information.

Encourage the Use of Non-Traditional Modes

In many areas, walking and bicycling are a viable alternative to vehicle use. In some cases, demand for these non-traditional modes can be increased by improving the transportation system to better accommodate pedestrians and bicyclists. These scale of these measures ranges from a regional approach (e.g., land use strategies) to facility-specific improvements (e.g., bicycle paths). Strategies that can be used include:

- New pedestrian and bicycle facilities;
- Improved facilities (safety, aesthetic, or travel time improvements); and
- Bicycle storage systems can be installed at transit terminals, on transit vehicles and at work sites.

The keys to these types of improvements include adequate planning to ensure the facilities are effectively implemented within the overall land use plan and transportation system, and public education and outreach to ensure the implemented improvements are consistent with public desires. Often, multi-agency coordination is required to achieve the level of planning needed to fully integrate these strategies within the highway and transit systems.

Transportation Demand Management

One aspect of transportation demand management which is effective in shifting automobile travel to other modes is parking management. These strategies can include establishing maximum limits on the total number of spaces in a given area or for each employer, and increased parking charges (which may be reduced or eliminated for carpool/vanpool users.)

This can be a very controversial subject and requires a thorough study of the full impacts and implications of alternative strategies. Public education and outreach are important to build consensus between property owner, business and employees. Multi-agency coordination is also required to implement, monitor and enforce the management strategies.

CMS STRATEGIES - LEVEL THREE

The third level includes actions which attempt to place the trips not addressed in levels 1 and 2 into high occupancy vehicles (HOVs). This can be accomplished through various strategies which encourage HOV use and certain types of transportation demand management. Table 5-3 summarizes this third tier of strategies, providing examples of strategies, providing examples of strategies and the keys for successful implementation.

Table 5-3
LEVEL THREE STRATEGIES
CMS STRATEGIES TO SHIFT TRIPS FROM SOV TO HOV

Strategy Class	Strategy Examples	Keys to Success
Encourage high occupancy vehicle use	HOV lanes	Extensive planning; Multi-agency cooperation, public education and marketing campaign, enforcement.
	HOV ramp bypass lanes	Engineering criteria; Multi-agency cooperation.
	HOV toll savings	Studies to determine financial implications.
	Park-and-ride lots	Location, security, costs.
	Guaranteed ride home programs	Public education and marketing campaign; employer support; reliable administration.
	Employer trip reduction ordinances	Appropriate coverage; flexibility of means; enforcement; oversight.
Transportation demand management	Ride share matching services	Public education and marketing campaign; employer support.
	Vanpooling programs	Public education and marketing campaign; employer support; seed agency.

As with transit, the key to success with HOV strategies is a holistic approach which considers how to aggregate HOV riders at the residential trip end, how to provide preferential treatment of the line-haul portion of the trip (in terms of time and/or cost savings), preferential treatment on the work trip end (i.e. parking availability, location and costs), as well as flexibility (i.e. guaranteed rides home). Thus, strategies in this level, if constructed into packages, will be more successful than if independently evaluated and implemented.

Encourage High Occupancy Vehicle Use

High occupancy vehicle (HOV) facilities are designed to increase person throughput by increasing vehicle occupancies on a facility or in a corridor. Incorporation of HOV elements has generally been encouraged in recent policy statements in the U.S., although conversion of mixed-flow facilities to HOV use is much less popular. Even though most HOV measures are applied to specific facilities, strategies to support HOV use must occur throughout a transportation corridor to be effective. Measures to encourage HOV use include:

- HOV lanes (lanes on a mixed flow roadway or a dedicated facility);
- HOV signal priority;
- HOV access priority (including queue bypasses at ramp meters, queue jump lanes at arterial signals);
- HOV toll savings;
- Park-and-ride lots;
- Guaranteed ride home programs, and
- Employer trip reduction ordinances.

The implementation of HOV lanes requires extensive planning on a regional level and at the corridor level. Multi-agency cooperation (e.g., IRTC municipalities, the Indianapolis MPO, the Indiana Department of Transportation, and transit providers) is typically beneficial. This helps to maximize the effectiveness of the system, by coordinating with transit service and incorporating transit within the HOV system. Public education and marketing campaigns are also effective in building public acceptance and support for HOV travel.

Technical strategies to complement and support HOV travel, such as priority treatments and park-and-ride lots, should be based on sound engineering criteria, and should incorporate multi-agency cooperation.

Guaranteed ride home programs are effective at eliminating barriers to carpooling and can be very effective in the public's acceptance of ridesharing. An effective program needs public education and marketing of the services. As with any strategy that affects employees, high level employer support is very beneficial. Efficient and reliable administration of the program is also critical.

Employer trip reduction ordinances can be used to shift trips from SOVs to higher occupancy vehicles. It is important that the appropriate areas are covered by the ordinances and that flexibility is provided in the ordinance to accomplish the intended purposes. This strategy also requires ongoing oversight and enforcement.

Transportation Demand Management

Transportation demand management strategies which are effective at shifting trips to higher occupancy vehicles include providing ride share matching services and implementing vanpooling programs. Both need effective public education and marketing campaigns to stir interest. In addition, a common characteristic of successful ride sharing and vanpooling programs is high level employer support. This typically includes effective communication of the programs to employees as well as preferential treatment for ridesharers, such as special parking spaces and/or rates. Vanpool programs typically require a seed agency to provide the initial financial support for the van purchase; however, they can be self supporting. One potential fatal flaw to avoid is to ensure there is adequate parking clearance for the vans -- many parking structures cannot accommodate larger vans.

CMS STRATEGIES - LEVEL FOUR

Despite the best possible results from strategies in the first three levels, a significant portion of trips in Indianapolis will likely remain via the automobile. Thus, the fourth level includes actions to optimize the existing highway system's operation for these residual automobile trips, whether HOV or SOV. This can be accomplished through traffic and freeway operational improvements and management, incident management, access management and intelligent transportation systems. Table 5-4 summarizes this fourth tier of strategies, providing examples of strategies and the keys for successful implementation.

Table 5-4
LEVEL FOUR STRATEGIES
CMS STRATEGIES TO IMPROVE HIGHWAY OPERATIONS

Strategy Class	CMS Strategy Examples	Keys to Success
Traffic operational improvements	Intersection widening	Studies; engineering criteria.
	Channelization	Studies; engineering criteria.
	Intersection turn restrictions	Public education and outreach.
	Signalization improvements (including maintenance)	Studies; engineering criteria; Multi-agency cooperation
	Traffic control centers	Technology; engineering criteria.
	Computerized signal systems	Technology; engineering criteria.
	Traffic surveillance & control systems	Technology; Multi-agency coordination; maintenance commitment.
	Roadway widening	Alternative studies; engineering criteria; incorporation of non-SOV strategies.
	Truck restrictions	Regulatory or legislative authority; Public education.

TABLE 5-4 (cont.)

Strategy Class	CMS Strategy Examples	Keys to Success
Freeway operations and management	Elimination of bottlenecks	Studies; engineering criteria; solve weak link-not move problem.
	Commercial vehicle lanes	Studies to justify; public education and outreach; Funding.
	Ramp metering	Detailed planning effort; commitment to maintenance and adjusting.
Incident management	Detection of incidents	Technology; Multi-agency coordination.
	Response time improvements	Multi-agency coordination; public education.
	Clearance time improvements	Planning; Multi-agency coordination and support; public education.
	Information distribution	Multi-agency coordination; public education and outreach.
	Alternative routing	Planning; communication technology; public education and support; Multi-agency coordination.
	Construction management	Planning for capacity; signal modifications; public education; public and media outreach.
Access management	Driveway control	Engineering criteria; application process; enforcement.
	Median control	Engineering criteria; studies to support modifications/approvals.
	Frontage roads	Engineering criteria; Multi-agency coordination; public outreach and education.

TABLE 5-4 (cont.)

Strategy Class	CMS Strategy Examples	Keys to Success
Intelligent Transportation Systems	Automated toll collection	Technology; public education.
	Advanced traveler information systems	Technology; public education; public and media outreach; Multi-agency coordination.
	Commercial Vehicle operations	Technology; Multi-agency coordination.
	Advanced Vehicle Control Systems	Technology; research and development (not currently available for implementation).

Traffic Operational Improvements

Improvements in traffic operations are designed to allow more effective management of the supply and use of the supply and use of existing roadway facilities. These improvements can increase effective capacity by optimizing traffic operations, especially in recurring congestion conditions (non-recurring congestion is discussed under Incident Management). Although some of these strategies may involve the construction of special purpose mixed-flow lanes, this category encompasses improvements intended to help "optimize" existing capacity on the road system, as opposed to "adding" new capacity. Depending on the specific strategy, traffic operations improvements can be appropriate for a region, corridor, or specific facility. Some strategies can include:

- Intersection geometric improvements include minor widening to increase turning movement capacity, restriping, and channelization;
- Intersection turn restrictions to eliminate conflicting movements;
- Traffic signal improvements, such as adjustments to signal timing and phasing, and the installation and maintenance of actuated system components (e.g., loops and controllers);
- Traffic control centers, including coordinated signal systems on arterials, and regional control centers with communication systems to interconnected signal systems;
- Advanced traffic surveillance and control centers allow monitoring, dynamic updates to signal/meter systems, and coordinated ramp metering and traffic signal control and can be used to support incident management and traveler information activities.
- Roadway widening including auxiliary lanes, passing lanes, truck climbing lanes, widened shoulders, and reversible lanes, and
- Truck restrictions to increase roadway capacity.

The main keys to success for each of these strategies is thorough engineering studies to identify the appropriate strategy, and the application of appropriate engineering criteria in the design of the improvements. Another important factor is adequate maintenance of traffic signals and loops to ensure the system operates efficiently. Some of these strategies, such as turn and truck restrictions, require public education and outreach.

Freeway Operations and Management

Freeway operations and management improvements are similar to traffic operation improvements and are designed to allow more effective management of the supply and use of existing freeway facilities. These improvements can increase effective capacity by optimizing traffic operations at ramps and other weaving and merge areas. As with traffic operation improvements, while some of these strategies may involve the construction of special purpose lanes, this category does not include the construction of general purpose lanes that provide for significant increases in SOV capacity. Some strategies can include:

- Roadway widening to eliminate bottlenecks, including freeway auxiliary lanes and commercial vehicle lanes, and
- Ramp metering, which can be set at or below demand rates, and include time-differentiated metering to maintain speeds on the freeway.

These types of strategies also require thorough engineering studies to identify appropriate strategies, and the application of appropriate engineering criteria in the design of the improvements. Special care should be taken to eliminate bottlenecks, and not just move them further downstream. It should be noted that the use of commercial vehicle lanes and ramp metering benefit from public education and outreach.

Incident Management

This class of strategies is used to deal with incident related non-recurring congestion. Incidents can include accidents, disabled vehicles, construction or road maintenance, and special events. Non-recurring congestion results because there is a temporary reduction in effective capacity. Because the congestion management strategies described above are generally ineffective for addressing non-recurring congestion, incident management strategies are needed to minimize the negative impacts of an incident. Incident management strategies can be generally classified as one of three actions needed to manage an incident: detection/verification, response (which includes managing traffic during incidents and dispatching emergency or other vehicles to the scene), and clearance. Some components of an incident management plan can be implemented on individual facilities, but a complete system would likely use a regional approach to incident detection, response, and clearance. Potential strategies are listed below:

- Incident detection/verification improvements can involve video cameras (CCTV), service patrols, motorist call boxes, and cellular telephone hotlines;
- Incident response time improvement strategies can include improved incident information dissemination; cooperative efforts between transportation agencies, police,

and emergency services; motorist information signing; route guidance systems; dynamic signal/meter control; and perplexed traffic management plans for special events;

- Incident clearance time improvement strategies include preplanning for incidents;
- Information routing/distribution includes providing advisory information to warn of traffic or transit congestion or delays, and suggest alternate paths;
- Alternative routing includes the preplanning of options under various incident scenarios with roles, responsibilities and the timing of implementation identified, and
- Management of traffic during construction allows for maintaining capacity where possible and should include time of day considerations.

The key to incident management is preplanning with multi-agency cooperation and coordination. Adequate forethought needs to be exercised to identify potential incident scenarios and develop appropriate clearance strategies. Cooperative efforts with law enforcement and emergency response agencies should be initiated to develop solutions which provide safe conditions for clearing the incident expeditiously while minimizing the impact to traffic. This process should include education and outreach to ensure the public that the implementing agency recognizes the need for incident management and is adequately prepared.

Another incident management strategy calls for maintenance of traffic plans for construction projects to be reviewed by traffic engineers to identify if changes in traffic signal timing patterns are appropriate. Often, congestion can be minimized by modifying signal timings to reflect lane closures. During periods when signals typically operate in an actuated mode, the signals could be switched to pre-timed mode if the loop detectors are not operating correctly (as typically found in construction zones). This will reduce delay caused by false loop detector readings on side streets.

Access Management

These strategies are designed to improve arterial flow by controlling access and egress to and from arterial roadways. Guidelines and ordinances are developed to govern road design and driveway construction. In general, these measures are appropriate for application on individual facilities. Access management strategies can be used to plan for:

- Driveway control (residential and business);
- Median control, and
- Frontage roads.

Each of these strategies requires the appropriate application of accepted engineering criteria. For new developments, this access control can be implemented during the permitting process. Retrofitting existing roadways typically requires studies to identify the impact of proposed changes and the identification of alternate access opportunities. Public outreach and education can be beneficial when implementing access control, with special attention placed on property directly impacted.

Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) include coordinated operational strategies implemented through technology. These systems can be applied to many of the strategies described above, especially in the areas of traffic operations, transit operations, and incident management. In addition, ITS can be applied throughout a region, along a transportation corridor, or on a specific facility. Samples of ITS effective at improving highway operations include:

- Automated toll collection systems to eliminate congestion and delays at toll booths;
- Advanced Traveler Information Systems (ATIS), which may include:
  - ⇒ *Travel Planning.* Pre-trip multi-modal travel information and ride matching services can help travelers determine their optimal mode choice, departure time, and route before their trips;
  - ⇒ *Traveler Information.* Real-time information to guide travelers during trips includes advisory services (to warn of traffic or transit congestion or delays), route guidance systems, and traveler services information;
- Commercial Vehicle Operations (CVO) include weigh station pre-clearance, automated safety inspections, on-board safety monitoring, and commercial fleet management, and
- Advanced Vehicle Control Systems (AVCS) are being researched to assess the viability of technology that could greatly enhance roadway capacity and safety, including systems for longitudinal collision avoidance, lateral collision avoidance, intersection crash warning and control, vision enhancement, impairment alert, and fully automated vehicles.

One of the keys to success for implementing ITS strategies is the availability of affordable, proven technology. Public outreach and education are also important when implementing new technologies. Some ITS strategies, such as advanced traveler information systems and commercial vehicle operations require multi-agency coordination.

CMS STRATEGIES - LEVEL FIVE

The fifth, and final level (the level of last resort) includes strategies to increase the capacity of the highway system by providing additional general purpose lanes. Table 5-5 summarizes this last tier of strategies, providing examples of strategies and the keys for successful implementation.

Table 5-5
LEVEL FIVE STRATEGIES
CMS STRATEGIES TO ADD CAPACITY FOR SOV AUTOMOBILES

Strategy Class	CMS Strategy Examples	Keys to Success
Addition of general purpose lanes	Freeway lanes	Major investment study; coordination with statewide and metropolitan planning processes; documentation of justification.
	Arterial lanes	Possible major investment study; alternatives analysis; engineering criteria; documentation of justification; incorporation of non-SOV strategies.

Addition of General Purpose Lanes

General purpose lanes may be used by all vehicular traffic modes (e.g., SOVs, HOVs, transit, and trucks). The addition of general purpose lanes may include the addition of lanes to an existing facility or the construction of a new facility, and is a strategy tailored toward an individual roadway. These infrastructure improvements may be the best approach to congestion management in some cases, as long as appropriate elements of the other strategies are incorporated into the design and operation of the new or expanded facility. It should also be noted that several measures that would increase the number of general purpose lane miles are also identified under traffic operational improvements and freeway operations and management (CMS Strategies - Level Four). The improvements in that section generally refer to smaller scale additions (e.g., turn lanes) or those for specific purposes (e.g., passing lanes).

Due to ISTEA requirements, one of the keys to successfully implementing additional general purpose lanes is the documentation of the evaluation process which results in the justification of additional lanes. If the improvement is on freeway, this should be accomplished through a major investment study (MIS). A MIS will probably not be required for non-freeway improvements.

As previously identified, the requirements for air quality attainment areas, such as Indianapolis, are not as stringent as for non-attainment areas. However, the hierarchical order of analysis presented in this technical memorandum is sufficient for even non-attainment areas. For example, satisfaction of the regulations can come through demonstration that non-SOV oriented strategies in Levels One through Four were considered and determined to be inadequate in meeting the needs. However, due to Indianapolis's current air quality status, it is not required that each of the first four levels be fully analyzed before additional lanes are justified.

POTENTIAL EFFECTIVENESS OF STRATEGIES

This section provides an initial estimate of the effectiveness of each strategy as it addresses the performance measures - congestion and speed. Where qualitative data are available, a range of percentage points is identified. In the absence of such data, qualitative estimates have been presented. The qualitative estimates are generally defined as follows:

- Low - less than five percent impact;
- Medium - between five and 15 percent impact, and
- High - greater than 15 percent impact, with 25 percent considered very high.

These estimates are based on data summarized in the National Highway Institute training course, Congestion Management for Technical Staff, prepared by JHK. As additional research is performed, and additional data becomes available, more quantitative estimates can be identified.

CMS Strategies - Level One

The first level includes actions which decrease the need for making the trip, such as growth management, the development of activity centers, congestion pricing and also certain types of transportation demand management. Table 5-11 summarizes the estimated impacts of these strategies.

Table 5-6
LEVEL ONE STRATEGIES
POTENTIAL IMPACTS FROM CMS STRATEGIES
TO ELIMINATE VEHICLE TRIPS

Strategy Class	Strategy	Potential Impacts by Performance Measure	
		Congestion Relief	**Increased Travel Speed**
Growth management/ Activity centers	Land use policies/ regulations	Medium	Medium
	Locations of jobs and housing	Medium	Medium
Congestion pricing	Road user fees	High	High
	Parking fees	High	High
Trans. demand management	Telecommuting	Low	Low
	Trip reduction ordinances	Medium-High	Medium-High

CMS Strategies - Level Two

The second level includes actions which attempt to place the trips not addressed in Level 1 into transit or other non-auto modes. This level of strategies includes capital investments in public transit, public transit operational improvements, intelligent transportation systems, methods to encourage the use of non-traditional modes and certain types of transportation demand management. Table 5-12 identifies the estimated effectiveness of strategies included in this seconds tier.

Table 5-7
LEVEL TWO STRATEGIES
POTENTIAL IMPACTS FOR CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Potential Impacts by Performance Measure	
		Congestion Relief	Increased Travel Speed
Public Transit Capital Improvements	Exclusive r.o.w. (Rapid rail)	High	High
	Exclusive r.o.w. (Commuter rail)	High	High
	Exclusive r.o.w. (Light rail)	High	High
	Exclusive r.o.w. (busways)	High	High
	Exclusive (bus lanes)	High	High
	Bus bypass ramps	Low	Low
	Fleet expansion	Low-Medium	Low
	Vehicle replacement/upgrade	Low-Medium	Low
	Park and ride facilities	Low	Low
	Other Intermodal facilities	Medium-High	Medium-High
	Paratransit services	Low	Low
	Increased transit security	Low-Medium	Low

Table 5-12 (cont.)

Strategy Class	Strategy	Potential Impacts by Performance Measure	
		Congestion Relief	Increased Travel Speed
Public transit operational improvements	Service enhancement/ Service expansion	High	High
	Fare reductions	Low-Medium	Low-Medium
	Transit information systems	Low-Medium	Low-Medium
	Transit coordination	Low-Medium	Low-Medium
	Transit marketing	Low-Medium	Low-Medium
Advanced Public Transportation Systems	Intelligent bus stops	Low-Medium	Low-Medium
	Advanced mode choice system	Low-Medium	Low-Medium
Encourage the use of non-traditional modes	Bicycle facilities	Low	Low
	Bicycle storage systems	Low	Low
	Pedestrian facilities	Low	Low
	Ferry service	Low-Medium	Low-Medium
Transportation demand management	Parking management	Medium-High	Medium-High

CMS Strategies - Level Three

The third level includes actions which attempt to place trips into high occupancy vehicles (HOVs) and includes various strategies which encourage HOV use and certain types of transportation demand management. Table 5-13 summarizes the anticipated impacts of the strategies included in this third tier.

Table 5-8
LEVEL THREE STRATEGIES
POTENTIAL IMPACTS FROM CMS STRATEGIES TO SHIFT TRIPS FROM SOV to HOV

Strategy Class	Strategy	Potential Impacts by Performance Measure	
		Congestion Relief	Increased Travel Speed
Encourage high occupancy vehicle use	HOV lanes	Medium	Medium
	HOV ramp bypass lanes	Low	Low
	HOV toll savings	Low-Medium	Low-Medium
	Park-and-ride lots	Low	Low
	Guaranteed ride home programs	Low	Low
	Employer trip reduction ordinances	Medium-High	Medium-High
Transportation demand management	Ride share matching services	Medium	Medium
	Vanpooling programs	Low-Medium	Low-Medium

CMS Strategies - Level Four

The fourth level includes actions to optimize the existing highway system's operation for automobile trips, whether HOV or SOV, and includes traffic and freeway operational improvements and management, incident management, access management and intelligent transportation systems. Table 5-14 summarizes the estimated impacts of the strategies included in this tier.

Table 5-9
LEVEL FOUR STRATEGIES
POTENTIAL IMPACTS FROM CMS STRATEGIES
TO IMPROVE HIGHWAY OPERATIONS

Strategy Class	Strategy	Potential Impacts by Performance Measure	
		Congestion Relief	**Increased Travel Speed**
Traffic operational improvements	Intersection widening	Medium-High	Medium-High
	Channelization	Medium-High	Medium-High
	Intersection turn restrictions	Medium	Medium
	Signalization improvements (including maintenance)	Medium	Medium (8-12%)
	Traffic control centers	Medium	High (16-25%)
	Computerized signal systems	Medium	High (16-25%)
	Traffic surveillance & control systems	Medium	Medium (11-15%)
	Roadway widening	Medium-High	Medium-High
	Truck restrictions	Low-Medium	Low-Medium
Freeway operations and management	Elimination of bottlenecks	Medium-High	Medium-High
	Commercial vehicle lanes	Low-Medium	Low-Medium
	Ramp metering	Medium	Medium-High

TABLE 5-9 (cont.)

Strategy Class	Strategy	Potential Impacts by Performance Measure	
		Congestion Relief	Increased Travel Speed
Incident management	Detection of incidents	Low-Medium	Low-Medium
	Response time improvements	High	High
	Clearance time improvements	High	High
	Information distribution	Low-Medium	Low (4-5%)
	Alternative routing	Low-Medium	Low (3-4%)
	Construction management	Medium-High	Medium-High
Access management	Driveway control	Medium	Medium
	Median control	Medium	Medium
	Frontage roads	Medium	Medium
Intelligent Transportation Systems	Automated toll collection	Medium-High	Medium-High
	Advanced traveler information systems	Low-Medium	Low-Medium
	Commercial Vehicle Operations	Low-Medium	Low-Medium
	Advanced Vehicle Control Systems	N/A	N/A

CMS Strategies - Level Five

The fifth level includes strategies to increase the capacity of the highway system by providing additional general purpose lanes. These strategies have the highest impact on congestion and travel speeds. Table 5-15 identifies the relative impact these strategies have on the performance measures.

Table 5-10
LEVEL FIVE STRATEGIES
POTENTIAL IMPACTS FROM CMS STRATEGIES
TO ADD GENERAL PURPOSE LANES

Strategy Class	**Strategy**	**Potential Impacts by Performance Measure**	
		Congestion Relief	**Increased Travel Speed**
Addition of general purpose lanes	Freeway lanes	High	High
	Arterial lanes	High	High

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CHAPTER 6: CONGESTION MANAGEMENT STRATEGIES RECOMMENDATIONS FOR THE CMS TARGET NETWORK

Data was collected on the project corridors by conducting research and field review. This information was used in conjunction with a congestion management strategy identification screening process developed by the Project Team.

The CMS strategy identification screening process involves reviewing the 64 identified potential strategies for each project corridor. In order to determine applicable congestion management strategies, each project corridor was screened by the 190 question selection process.

STRATEGY SCREENING

With such an extensive list of potential CMS strategies identified, a screening process was developed to determine which strategies are applicable for a given deficiency. This screening had to answer two questions. First, does the potential strategy have a high probability of success for the given application? For example, if there are not at least two transit agencies providing service within a deficient corridor, it will not be necessary to evaluate transit coordination. Second, does the strategy, or combination of strategies, adequately address the deficiency? For example, if a roadway is 10 percent over capacity, the potential strategy (or cumulative strategies) should have sufficient impact to eliminate the deficiency. Due to financial constraints, it may not be possible to mitigate all deficiencies, whether by CMS strategies or by roadway widening. In this case, the overall metropolitan and statewide planning process will determine what improvements best address the transportation goals and objectives for Indianapolis.

A list of questions were identified to determine which strategies could be effective for given application. Each question does not require an affirmative answer to justify additional analysis; however, the more affirmative answers to multiple questions usually indicates a higher likelihood of application.

SCREENING QUESTIONS

The screening questions are defined in the same five tiered hierarchy presented in the previous section. Unless otherwise noted, affirmative answers to the screening questions imply the strategy is potentially applicable. While Indianapolis was not required to consider the strategies in order (i.e. beginning with Level One, then Two, Three, Four and finally Five), this progression ensured all reasonable strategies were considered.

CMS Strategies - Level One

The first level includes actions which decrease the need for making the trip, such as growth management, the development of activity centers, congestion pricing and also certain types of transportation demand management. Table 6-1 summarizes the screening questions for this first tier of strategies. Many questions are related to existing and future development levels, as well as existing travel characteristics.

Table 6-1
CMS STRATEGIES TO ELIMINATE VEHICLE TRIPS

Strategy Class	Strategy	Screening Questions
Growth management/Activity centers	Land use policies/regulations	1. Is the majority of land developed? (Negative answer implies potential application.) 2. Is projected population and/or employment growth high? 3. Has the corridor been designated as a growth area? 4. Is the corridor's SOV share for work trips high? 5. Is the corridor's transit share for work trips low? 6. Does the corridor fail transit enhancement/expansion criteria? 7. Will alternative travel modes be available within corridor?
	Design standards	8. Is commercial office space being developed in corridor? 9. Are there pending building permits in the corridor? (Also see Land use policies/regulations above.)
	Locations of jobs and housing	10. Is there a large imbalance between jobs and housing? 11. Has the corridor been designated as a growth area?
Congestion pricing	Road user fees	12. Is the v/c ratio on at least 70% of corridor freeway/arterial lane miles greater than 1.1 (or CMS threshold)? 13. Is answer to question 1 still affirmative if proposed roadway for congestion pricing is excluded? 14. Is a limited access facility available in corridor? 15. Are alternative travel modes available in corridor? 16. Will revenues be used for transportation improvement projects? 17. Are tolls on the facility politically acceptable?
	Parking fees	18. Are there primarily commercial or retail land uses in the congested area? 19. Are alternative travel modes available within the corridor?
Transportation demand management	Telecommuting	20. Is the type of employment at activity center/downtown suitable for telecommuting? 21. Is public agency participation likely?
	Trip reduction ordinances	22. See Employee Trip Reduction Ordinances strategies in Level 3.

CMS Strategies - Level Two

The second level includes actions which attempt to place the trips not addressed in Level 1 into transit or other non-auto modes. This level of strategies includes capital investments in public transit, public transit operational improvements, intelligent transportation systems, methods to encourage the use of non-traditional modes and certain types of transportation demand management. Table 6-2 summarizes the screening questions for this second tier of strategies. Many of these questions relate to development densities, existing transit service and use, travel times and the availability of modal choices.

Table 6-2
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Public Transit Capital Improvements	Exclusive r.o.w. (Rapid rail)	1. Is the corridor's **net** residential density (the number of dwelling units divided by the area available for residential development) at least 12 d.u./acre, or is the gross population density at least 8,600/sq. mile? 2. Does the corridor's major employment area (downtown, activity center) have at least 50 million square feet of non-residential floor space? 3. Does the corridor's major employment area (downtown, activity center) have at least 70,000 employees? 4. Does the corridor's major employment area (downtown, activity center) have an employment density of at least 15,000/square mile?
	Exclusive r.o.w. (Commuter rail)	1. Is the corridor's **net** residential density (the number of dwelling units divided by the area available for residential development) at least 12 d.u./acre, or is the gross population density at least 8,600/square mile? 2. Does the corridor's major employment area (downtown, activity center) have at least 50 million square feet of non-residential floor space? 3. Does the corridor's major employment area (downtown, activity center) have at least 70,000 employees? 4. Does the corridor's major employment area (downtown, activity center) have an employment density of at least 15,000/sq. mile?

Table 6-2 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Public Transit Capital Improvements	Exclusive r.o.w. (Light rail)	1. Is the corridor's **net** residential density (the number of dwelling units divided by the area available for residential development) at least 12 d.u./acre, or alternatively, is the gross population density at least 8,600/square mile? 2. Does the corridor's major employment area (downtown, activity center) have at least 50 million square feet of non-residential floor space? 3. Does the corridor's major employment area (downtown, activity center) have at least 70,000 employees? 4. Does the corridor's major employment area (downtown, activity center) have an employment density of at least 15,000/square mile?
	Exclusive r.o.w. (busways)	1. Is the corridor's **net** residential density at least 3 d.u./acre, or alternatively, is the gross population density at least 1,900/square mile? 2. Does the corridor's major employment area (downtown, activity center) have at least 20 million square feet of non-residential floor space? 3. Does the corridor's major employment area (downtown, activity center) have at least 42,000 employees? 4. Does the corridor's major employment area (downtown, activity center) have an employment density of at least 10,000/square mile? 5. Does the corridor have any sections with a V/C of at least 0.80 with headways of 4 minutes or less in the peak hour?

Table 6-2 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Public Transit Capital Improvements	Exclusive r.o.w. (bus lanes)	1. Does the corridor have any sections with at least 8 scheduled buses in the peak hour? 2. If the answer to question 1 is yes, then do any of these sections have peak hour auto volumes of at least 200 vehicles per lane? 3. If the answer to question 2 is yes, then do any of these sections meet the following threshold: $q_B \geq \frac{q_A}{N - 1} X$ where q_A and q_B are hourly volumes of autos and buses, respectively; N is the total number of lanes per direction; and X is the ratio of average auto to bus occupancies?
	Bus bypass ramps	1. Does the corridor pass the exclusive r.o.w. busway screen? 2. Does the corridor have any exclusive busway sections? If yes, then go to question 5. 3. Does the corridor have any HOV lane sections? If yes, are there 15 or more buses scheduled on any of these sections in the peak hour? 4. Does the corridor pass the HOV lane screen? 5. Does the corridor have any freeway sections with v/c of at least 0.80 and 15 or more buses scheduled in the peak hour?

Table 6-2 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Public Transit Capital Improvements	Fleet expansion	1. Does the corridor pass the service enhancement/expansion screen identified later in this table?
	Vehicle replacement/upgrade	1. Does transit service exist in the corridor? 2. Is the corridor's transit mode share at least 2% for work trips? 3. Does the corridor's number of transit vehicles in peak hour revenue operation exceed 20? 4. For the transit operator's entire system, is the average age of bus fleet greater than 7 years, or is the average age of rail fleet greater than 15 years?
	Park and ride facilities	1. Does transit service exist in the corridor? 2. Is there at least one express bus in the corridor with a one-way trip length of at least 8 miles? 3. Is the corridor's HOV mode share greater than 15% for work trips? 4. Is there rapid rail, light rail or commuter rail service in the corridor? 5. Does the corridor pass the HOV lane, rapid rail, light rail, commuter rail or exclusive r.o.w. busway screen?
	Other intermodal facilities	1. Is there any location in the corridor where there is not an existing intermodal facility and at least two of the following modes in the corridor converge: rapid rail, light rail, commuter rail, express bus, intercity bus, intercity rail or local bus?
	Paratransit services	1. Are there any areas in the corridor not currently served by paratransit? 2. Are requests for paratransit being denied because of capacity restrictions?

Table 6-2 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Public Transit Capital Improvements	Increased transit security	1. Has the number of crimes related to transit service, or security-related complaints received by the transit agency serving the corridor, increased in each of the last two years?
Public Transit Operational Improvements	Service enhancement/ Service expansion	1. Are there any routes for which the peak hour load factor is greater than 0.8? 2. Is the population density of any zone or census tract in the corridor greater than 3150/square mile or the percentage of low income residents in the corridor greater than 20%?
	Traffic signal preemption	1. Does the corridor have transit service? 2. Are there any routes for which the peak hour load factor is greater than 0.8%? 3. Is the frequency of service for any of those routes > 6/hr?
	Fare reductions	1. Is transit mode split for work trips in the corridor greater than 2%? 2. Is the average population density in zones adjacent to these routes greater than 1575/sq. mile or the percentage of poor in these zones greater than 10%?
	Transit information systems	1. Is the peak hour load factor on any route in the corridor greater than 0.8%? If yes, are there at least 3 transfer points on any of these routes? 2. Does the corridor have any transfer center serving at least 3 routes?

Table 6-2 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Public Transit Operational Improvements	Transit coordination	1. Are there at least 2 transit agencies/operators providing service within the corridor? 2. If yes, are fare payment methods or the transit schedules coordinated? (Negative answer implies potential application.) 3. Are there at least 4 possible transfers within the corridor?
	Transit marketing	1. Is there at least one activity center with more than 500 employees in the corridor accessible by transit? 2. Is difference in travel time between competing modes <30%? 3. Can the transit system handles more patrons?
Advanced Public Transportation Systems	Intelligent bus stops	1. Is the average population density in any of the zones within 0.25 miles of the route >1575/sq. mile percentage of poor in these zones >10%? 2. If yes, is the load factor on any route within the corridor <0.8?
	Advanced mode choice system	1. Is the difference in travel time between transit & other competing modes <30%? 2. If yes, do more than 40% of the links on any route have peak hour $V/C \geq 0.8$?

Table 6-2 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM AUTOMOBILE TO OTHER MODES

Strategy Class	Strategy	Screening Questions
Encourage the use of non-traditional modes	Bicycle facilities	1. Does the corridor have any jurisdictions with a bicycle plan? 2. Are at least 15% of the corridor's work trips under 5 miles or 10 minutes in length? 3. Does the corridor have any rail or express bus service? 4. Is the corridor's net residential density at least 4.5 d.u./acre, or alternatively, is the gross population density at least 3,150/square mile? 5. Is the corridor's employment density at least 4,000/square mile? 6. Does the corridor have a college campus? 7. Are the majority of roadway miles classified as level?
	Bicycle storage systems	1. Does the corridor have any exclusive r.o.w. bicycle facilities? 2. Does the corridor pass the bicycle facilities screen? 3. Is the corridor's bicycle mode share at least 0.5% for work trips?
	Pedestrian facilities	1. Does the corridor have any rail or mixed-route bus service? 2. Is the corridor's net residential density at least 4.5 d.u./acre, or alternatively, is the gross population density at least 3,150/square mile? 3. Is the corridor's employment density at least 4,000/square mile? 4. Are the majority of roadway miles classified as level?
Transportation demand management	Parking management	1. Is there any kind of transit service in the corridor? 2. Are there any HOV lanes in the corridor or does the corridor pass the HOV lane screen? 3. Are there any park-and-ride lots in the corridor or does the corridor pass either the HOV or transit park-and-ride lot screen?

CMS Strategies - Level Three

The third level includes actions which attempt to place the trips into high occupancy vehicles (HOVs) and includes various strategies which encourage HOV use and certain types of transportation demand management. Table 6-3 summarizes the screening questions for this third tier of strategies. Most of these questions relate to existing travel characteristics.

Table 6-3
CMS STRATEGIES TO SHIFT TRIPS FROM SOV TO HOV

Strategy Class	Strategy	Screening Questions
Encourage high occupancy vehicle use	HOV lanes	1. Are lane additions planned or under consideration for any freeway segments that already have three or more mixed-flow lanes in one direction? 2. Are there any freeway segments of at least three miles with at least 70% of lane miles congested (v/c > 0.9)? 3. Are there any arterial segments of at least two miles with at least 70% of lane miles congested (v/c > 0.9)? 4. Are there 10 or more buses scheduled in the peak hour for a single facility in the corridor? 5. Is there employment of 20,000 or more in the corridor's chief activity center? 6. Is the corridor's HOV mode share greater than 15% for work trips? 7. Does the corridor contain freeway, expressway, or rural principal arterial facilities that connect a residential area to an employment center?
	HOV ramp bypass lanes	1. Does the corridor pass the HOV lane screen? 2. Does the corridor contain other HOV incentives, such as HOV lanes or HOV toll discounts? 3. Is there ramp-metering in the corridor?

Table 6-3 (Cont.)
CMS STRATEGIES TO SHIFT TRIPS FROM SOV TO HOV

Strategy Class	Strategy	Screening Questions
Encourage high occupancy vehicle use	HOV toll savings	1. Does the corridor have a toll facility? 2. Is the corridor's HOV mode share greater than 15% for work trips?
	Park-and-ride lots	1. Does the corridor pass the HOV lane screen? 2. Does the corridor contain other HOV incentives, such as HOV lanes or HOV toll discounts? 3. If park-and-ride lots exist in the corridor, is utilization greater than 50%?
	Guaranteed ride home programs	1. Does the corridor pass the HOV lane screen? 2. Does the corridor contain other HOV incentives, such as HOV lanes or HOV toll discounts?
	Employer trip reduction ordinances	1. Is the corridor already subject to an employer trip reduction ordinance? 2. Do 20% or more of employees in the corridor work for employers of 100 or more on-site employees? 3. Is the corridor's drive alone mode share at least 60% for work trips? 4. Is the corridor's transit mode share at least 2% for work trips?
	Ride share matching services	1. Does the corridor pass the parking management screen? 2. Are at least 60% of the corridor's work trips at least 9 miles?
	Vanpooling programs	1. Does the corridor pass the parking management screen? 2. Do 20% or more of employees in the corridor work for employers of 100 or more on-site employees? 3. Are at least 60% of the corridor's work trips at least 9 miles?

CMS Strategies - Level Four

The fourth level includes actions to optimize the existing highway system's operation for automobile trips, whether HOV or SOV, and includes traffic and freeway operational improvements and management, incident management, access management and intelligent transportation systems. Table 6-4 summarizes the screening questions for this fourth tier of strategies. Many of these questions relate to existing traffic characteristics, some of which may not be available during the screening process (e.g. turning movement volumes and accident reports). Therefore, reasonable strategies which cannot be addressed during the screening step due to the lack of information should proceed to the evaluation step, with the screening question addressed as part of the evaluation process.

Table 6-4
CMS STRATEGIES TO IMPROVE
HIGHWAY OPERATIONS

Strategy Class	Strategy	Screening Questions
Traffic operational improvements	Intersection widening	1. Is the deficiency isolated on a specific facility? 2. Is the left turn volume on any shared left/through lane greater than 100 vehicles per hour? 3. Is the left turn volume on any single left turn lane greater than 300 vehicles per hour? 4. Is the right turn volume on any shared right/through lane greater than 300 vehicles per hour?
	Channelization	1. Is the right turn volume at an intersection greater than 500 vehicles per hour? 2. Is there an adjacent signalized intersection within 300 feet? 3. Is the intersection skewed by less than 75 degrees? 4. Does a designated truck route turn at the intersection? 5. Is there a history of accidents due to wrong-way movements?
	Intersection turn restrictions	1. Is the deficiency isolated on a specific facility? 2. Can the intersection be widened? 3. Can the restricted movement (usually a left turn) be accomplished using other routes? 4. Is there significant conflicts between pedestrians and turning vehicles?

Table 6-4 (Cont.)

Strategy Class	Strategy	Screening Questions
Traffic operational improvements	Signalization improvements (including maintenance)	1. Is the deficiency isolated on a specific facility? 2. Have the signal timings been updated within the last five years? (Negative answer implies potential application.) 3. Is the signal inspected regularly? (Negative answer implies potential application.) 4. Is the left turn volume on any single left turn lane without signal protection greater than 100 vehicles per hour? 5. Does a field inspection, or capacity analysis, identify a need for re-timing?
	Traffic control centers	1. Is the geographic scale of the deficiency either regional or corridor? 2. Are incidents a major cause of congestion? 3. Are alternate routes available within deficient corridors? 4. Do "special events" (i.e. sports events, concerts, etc.) regularly create congestion?
	Computerized signal systems	1. On major arterials, are all signals within one half mile of adjacent signals interconnected? (Negative answer implies potential application.) 2. Have the timing patterns for existing system been reevaluated within the last five years? (Negative answer implies potential application.)
	Traffic surveillance and control systems	1. Does one or more facilities in a corridor experience significant congestion due to incidents, such as accidents? 2. Is ramp metering used, or is planned to be implemented, on the facility? 3. Are congestion patterns irregular?

Table 6-4 (Cont.)

Strategy Class	Strategy	Screening Questions
Traffic operational improvements	Roadway widening	1. Are through lane widths less than 12 feet? 2. Does the facility have multiple driveway connections on sections where the speed limit is $\geq$ 45 mph? 3. Does a capacity analysis show a need for additional through lanes? 4. Is the congestion localized between two or three adjacent intersections?
	Truck restrictions	1. Are through lane widths less than 12 feet? 2. Is the percentage of trucks during the peak hours greater than 10%? 3. Is there an acceptable alternate truck route available? 4. Do trucks block travel lanes when they load/unload?
Freeway operations and management	Elimination of bottlenecks	1. Is the congestion localized between two or three interchanges? 2. Does the interchange(s) design produce weaving of vehicles? 3. Does congestion on ramps spill over into the freeway? 4. For tolled facilities, are the number of toll booths sufficient to service the demand without creating long queues? (Negative answer implies potential application.)
	Commercial vehicle lanes	1. Is the percentage of trucks during the peak hour greater than 20 percent?
	Detection of incidents	1. Does one or more facilities in a corridor experience significant congestion due to poor detection of incidents, such as accidents? 2. Does the facility include a tunnel, or a bridge which is longer than one fourth mile?

Table 6-4 (Cont.)

Strategy Class	Strategy	Screening Questions
Freeway operations and management	Response time improvements	1. Does one or more facilities in a corridor experience significant congestion due to poor incident response times? 2. Does the facility include a tunnel, or a bridge which is longer than one fourth mile?
	Clearance time improvements	1. Does one or more facilities in a corridor experience significant congestion due to poor incident clearance time, such as accidents? 2. Does the facility include a tunnel, or a bridge which is longer than one fourth mile?
	Information distribution	1. Does one or more facilities in a corridor experience significant congestion due to incidents, such as accidents? 2. Do more than one agency manage the transportation system (i.e. various alternative modes of travel are available?) 3. Are there restricted lanes in the corridor (i.e. HOV lanes or tolled facilities)?
	Alternative routing	1. Does one or more facilities in a corridor experience significant congestion due to incidents, such as accidents? 2. Does the corridor have, or plan to have, an incident detection process? 3. Are alternative routes, or modes, available in the corridor?
	Construction management	1. Is construction planned in a congested corridor or on a congested facility? If yes, is the V/C ratio on the facility grater than 0.80?

Table 6-4 (Cont.)

Strategy Class	Strategy	Screening Questions
Access management	Driveway control	1. Does the facility have multiple driveway connections on sections where the speed limit is $\geq$ 45 mph? 2. Do accident reports reflect a high incidence of rear end and/or right angle collisions near driveways?
	Median control	1. Does the facility have more than two lanes, with a speed limit $\geq$ 45 mph, and no median? 2. Are existing median openings spaced less than one fourth mile apart? 3. Do accident reports reflect a high incidence of right angle collisions near driveways?
	Frontage roads	1. Does the facility have multiple driveway connections on sections where speed limit is $\geq$ 45 mph? 2. Do accident reports reflect a high incidence of rear end and/or right angle collisions near driveways? 3. Is it desirable to convert an existing facility from no, or limited, access control to full access control? 4. Is adequate right of way available for constructing the frontage roads?
Intelligent Transportation Systems	Automated toll collection	1. Is deficient facility currently tolled? 2. Are the number of toll booths sufficient to service the demand without creating long queues? (Negative answer implies potential application.) 3. Is the percentage of trucks during the peak hours greater than 10 percent?

Table 6-4 (Cont.)

Strategy Class	Strategy	Screening Questions
Intelligent Transportation Systems	Advanced traveler information systems	1. Are there alternative modes of travel available in the region or corridor? 2. Does the region or corridor experience a high level of congestion? 3. Are there alternative routes available?
	Commercial Vehicle Operations	1. Does the congested facility include a truck weigh station? 2. Are hazardous materials prohibited on the congested facility?
	Advanced Vehicle Control Systems	This strategy is currently unavailable for implementation.

CMS Strategies - Level Five

The fifth level includes strategies to increase the capacity of the highway system by providing additional general purpose lanes. Table 6-5 summarizes the screening questions for this last tier of strategies. These questions are largely based on volume to capacity ratios, with a check for other planned improvements in the corridor which may address the deficiency.

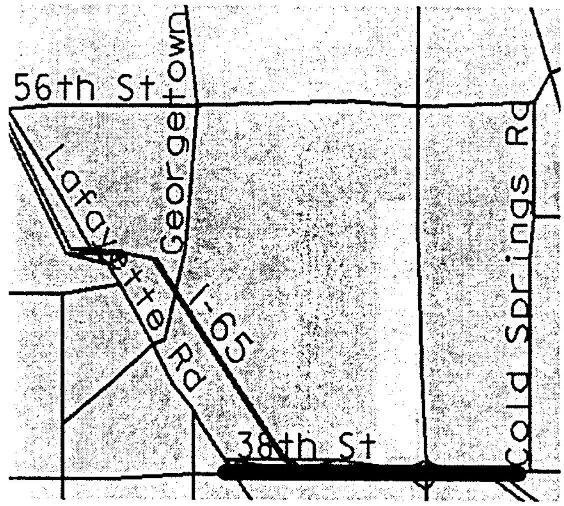
Table 6-5
CMS STRATEGIES TO ADD
CAPACITY FOR SOV AUTOMOBILES

Strategy Class	Strategy	Screening Questions
Addition of general purpose lanes	Freeway lanes	1. Are there any freeway segments of at least 3 miles with at least 70% of lane miles congested (v/c > 0.9)? 2. Are there any new freeways or freeway lane additions in approved regional transportation plans in the corridor?
	Arterial lanes	1. Are there any arterial segments of at least 2 miles with at least 70% of lane miles congested (v/c > 0.9)? 2. Are there any new arterials or arterial lane additions in approved regional transportation plans in the corridor?

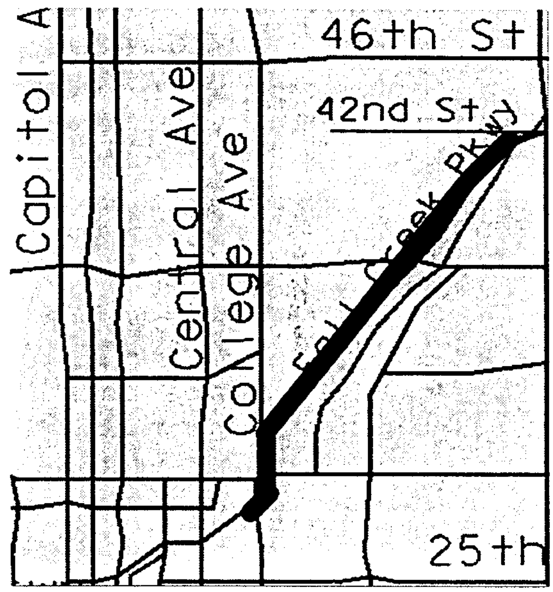
Each of the project corridors was reviewed through the screening process. Results of the preliminary strategy identification were distributed to the appropriate jurisdictional agents for review and comment. Review comments are incorporated into the final report and the project corridors and strategies are prioritized based upon traffic volume, congestion level and accident analysis. The prioritized results and recommendations are summarized in Table X-1. A technical appendix to this report contains the screening question answers for each project corridor.

The following pages illustrate transportation data and the first three prioritized recommended strategies for each project corridor. While only three prioritized strategies are listed in this document, the full strategy screening forms should be referenced during project analysis.

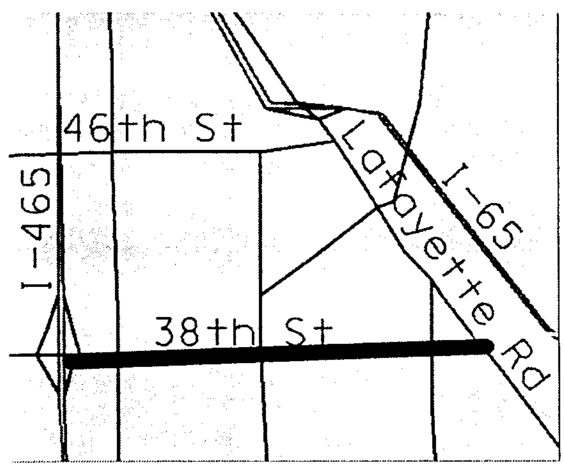
1) West 38th Street
Lafayette Rd. to Cold Springs Rd.
1995 Adjusted ADT: 54,458
Existing 1995 LOS: F
Predicted 2020 LOS: B
Annual Accidents per Mile: 88.38
Capacity Increasing Project - Year 2007-16
Limited Access Facility
Prioritized Strategies:
1) Incident Management
2) Transit/Expansion
3) Rideshare/Vanpool
Agency: Indianapolis DCAM



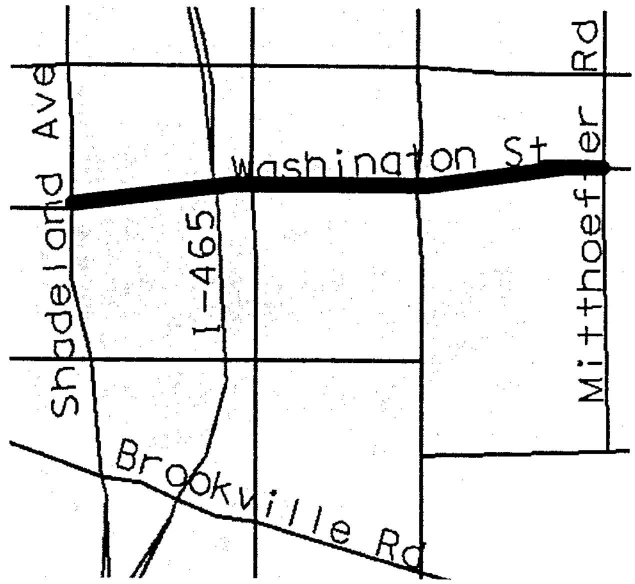
2) Fall Creek Parkway
42nd St. to College Ave.
1995 Adjusted ADT: 32,955
Existing 1995 LOS: F
Annual Accidents per Mile: 88.37
Reversible Center Lane
Geometric Constraint-Fall Creek
High Accident Area: 38th Street (68)
Prioritized Strategies:
1) Turn Restrictions (Peak Hour)
2) Intersection Improvements (38th St.)
3) Exclusive ROW-Busway/Rail
4) Bicycle and Pedestrian Facilities
Agency: Indianapolis DCAM



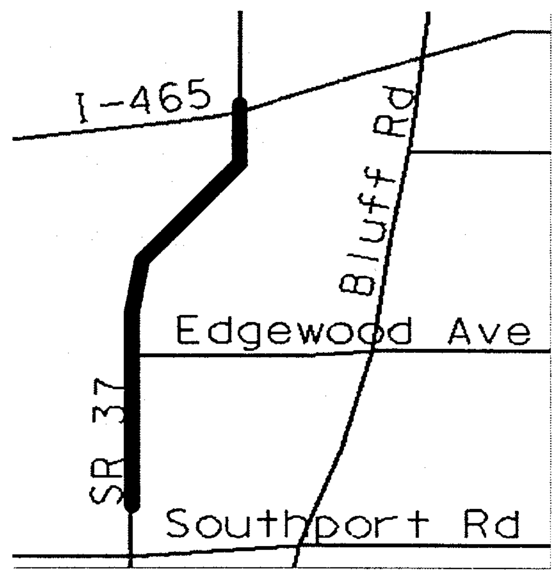
3) West 38th Street
I-465 to Lafayette Rd.
1995 Adjusted ADT: 45, 836
Existing 1995 LOS: E
Annual Accidents per Mile: 198.93
Fully Developed Area
Dense Commercial Centers
Prioritized Strategies:
1) Intersection Widening (High School Rd, Moller Rd)
2) Channelization
3) Access Management
Agency: Indianapolis DCAM



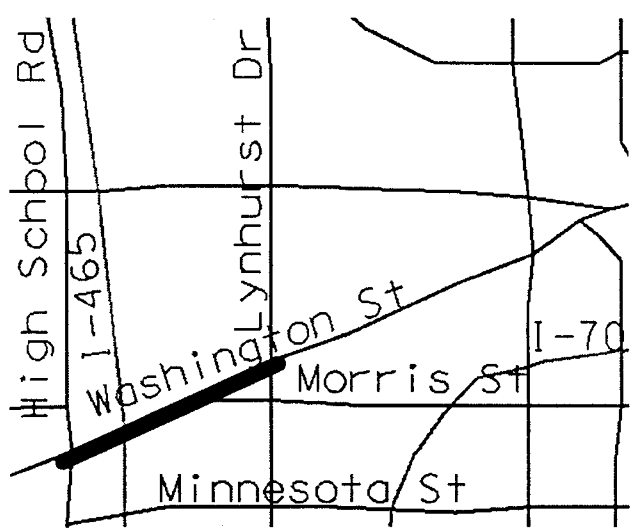
4) East Washington Street
Shadeland Ave. to Mitthoeffer Rd.
1995 Adjusted ADT: 30,924
Existing 1995 LOS: E
Predicted 2020 LOS: C
Annual Accidents per Mile: 141.26
Major Commercial and Retail Centers
Capacity Expansion Project - Year 1998-99
High Accident Areas: Shortridge(48), Franklin(38), Post (53), Mitthoeffer (85)
Prioritized Strategies:
1) Transit Enhancement/Expansion
2) Access Management
3) Channelization
Agency: INDOT



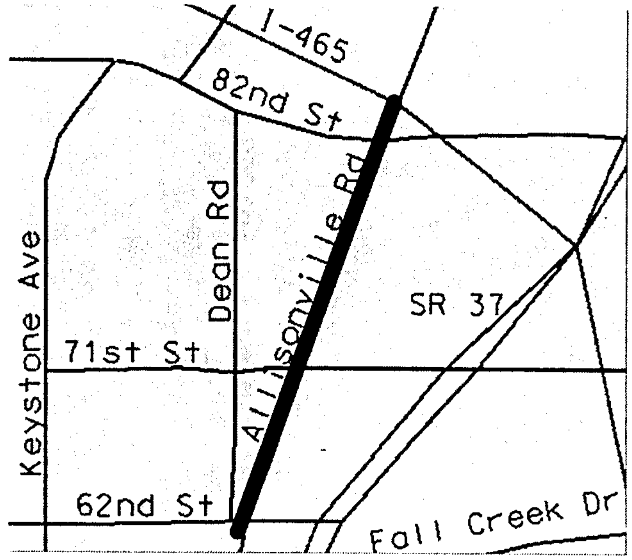
5) South SR 37
I-465 to Southport Rd.
1995 Adjusted ADT: 32,428
Existing 1995 LOS: F
Predicted 2020 LOS: E
Annual Accidents per Mile: 45.80
Capacity Increasing Project - Year 2000-06
Large Amount of Developable Land
Limited Access Facility
High Accident Area: Southport Rd. (31)
Prioritized Strategies:
1) Commuter Transit Service
2) Rideshare/Vanpooling
3) Intersection Widening
Agency: INDOT



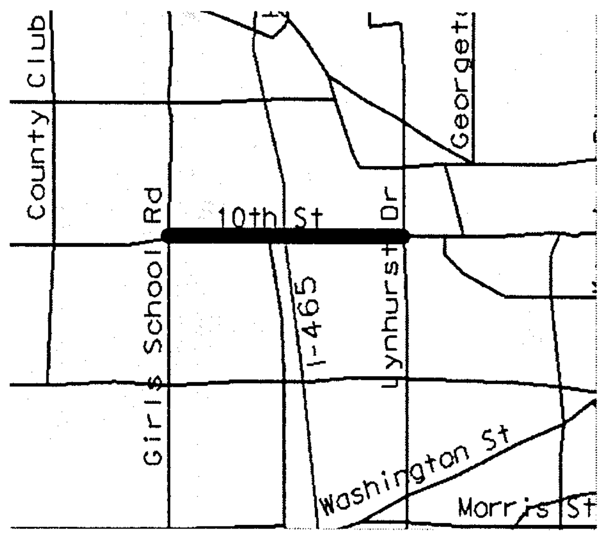
6) West Washington Street
High School Rd. to Lynhurst Dr.
1995 Adjusted ADT: 30,038
Existing 1995 LOS: E
Annual Accidents per Mile: 122.82
Large Major Employers-Park Fletcher, IAA
Uncontrolled Driveways
High Accident Areas: Lynhurst Drive (31), High School Road (64)
Prioritized Strategies:
1) Signalization Improvements
2) Transit Service Enhancement (Bus Stop Design Upgrades)
3) Access Management
Agency: INDOT



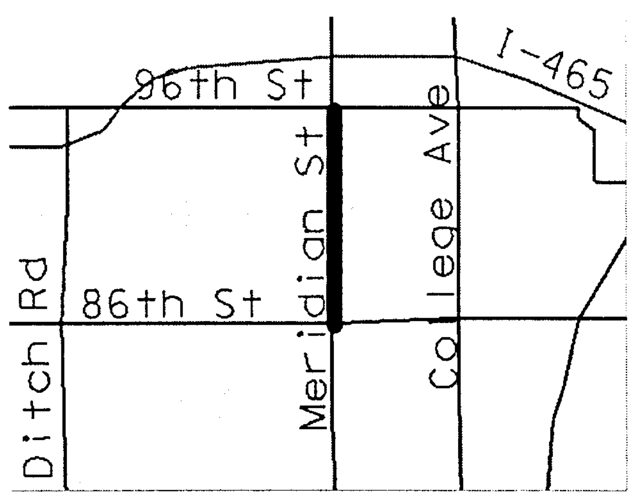
7) Allisonville Road
I-465 to 62nd St.
1995 Adjusted ADT: 27,063
Existing 1995 LOS: F
Predicted 020 LOS: D
Annual Accidents per Mile: 76.82
Capacity Increasing 2015-2020
Highly Developed Commercial Area
High Accident Area: 82nd St. (108)
Prioritized Strategies:
1) Access Management
2) Signalization Improvement (Actuation)
3) Median Control
Agency: Indianapolis DCAM



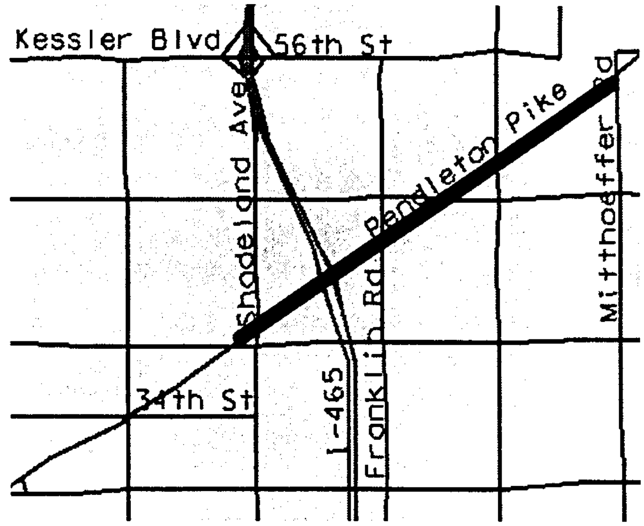
8) West 10th Street
Lynhurst Dr. to Girls School Rd.
1995 Adjusted ADT: 29,340
Existing 1995 LOS: E
Predicted 2020 LOS: E
Annual Accidents per Mile (1992-94): 93.20 (High)
Commercial Properties at I-465
High Accident Areas: Lynhurst (42),
High School Rd (64)
Prioritized Strategies:
1) Transit Service Enhancement/Expansion
2) Channelization (Lynhurst Dr.)
3) Access Management
Agency: Indianapolis DCAM



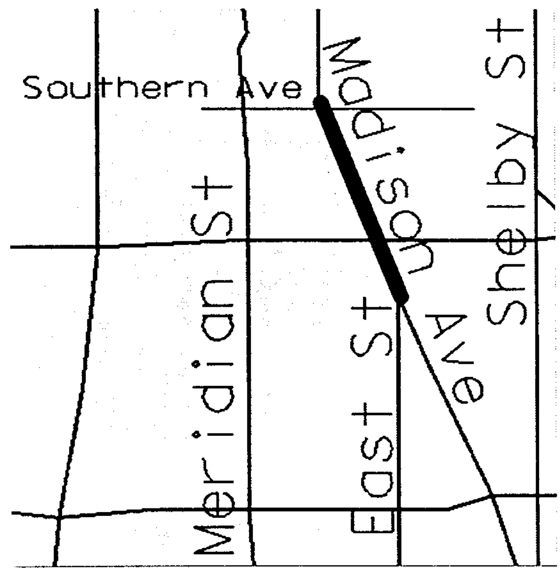
9) North Meridian Street
96th St. to 86th St.
1995 Adjusted ADT: 29,750
Existing 1995 LOS: E
Predicted 2020 LOS: D
Annual Accidents per Mile: 86.73
Capacity Increasing Project - Year 1996-98
Controlled Access Facility
High Accident Area: 86th Street (37)
Prioritized Strategies:
1) Transit Expansion/Enhancement
2) Transit Fare Reduction
3) Rideshare/Vanpooling
4) Exclusive ROW-Rail
Agency: INDOT



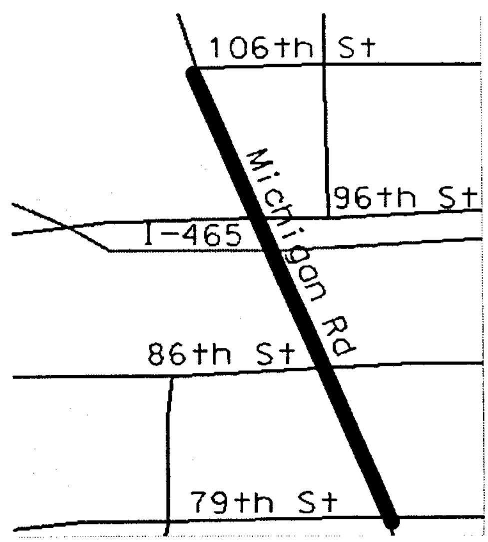
10) Pendleton Pike
Mitthoeffer Rd. to Shadeland Ave.
1995 Adjusted ADT: 25,286
Existing 1995 LOS: F
Predicted 2020 LOS: D
Annual Accidents per Mile: 74.46
Capacity Increasing Project - Year 2000-06
Highly Developed Commercial Area
High Accident Area: Shadeland Ave. (32)
Prioritized Strategies:
1) Access Management
2) Signalization Improvements
3) Transit Expansion
Agency: INDOT



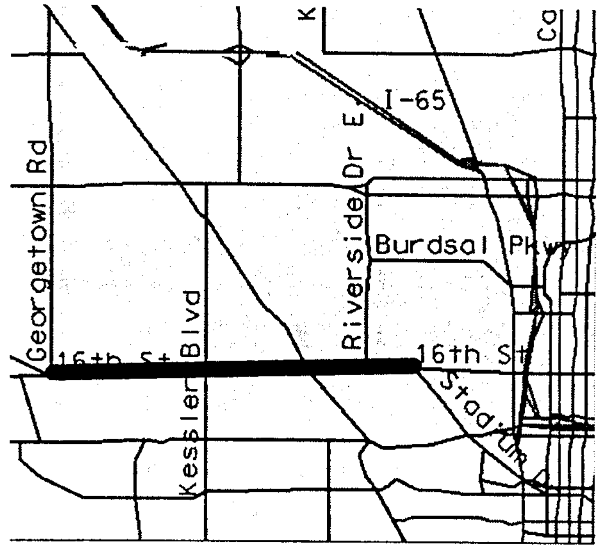
11) Madison Avenue
Southern Ave. to East St.
1995 Adjusted ADT: 33,710
Existing 1995 LOS: D
Annual Accidents per Mile: 84.98
Capacity Increasing Project - Year 1998-99
Heavily Developed Area
Major Commercial Area
Prioritized Strategies:
1) Rideshare/Vanpooling
2) Transit Service Expansion
3) Channelization
4) Bicycle and Pedestrian Facilities
Agency: INDOT



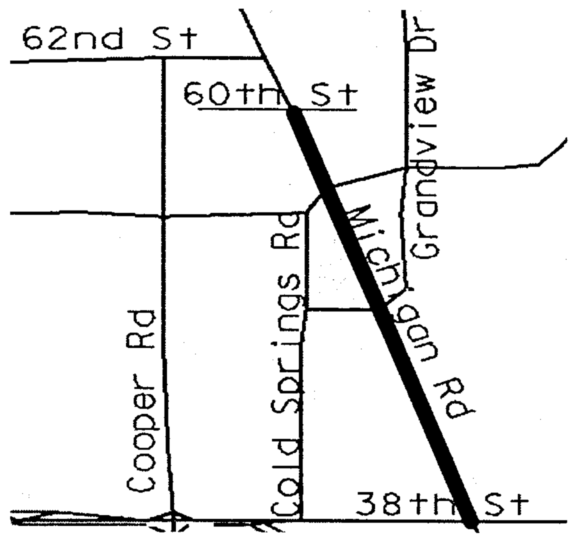
12) North Michigan Road
106th St. to 79th St.
1995 Adjusted ADT: 26,537
Existing 1995 LOS: F
Predicted 2020 LOS: C
Annual Accidents per Mile: 29.47
Highly Developed Commercial Area
Capacity Increasing Project - Year 1996-98
Prioritized Strategies:
1) Access Management
2) Transit Marketing
3) Land Use Policies
Agency: INDOT



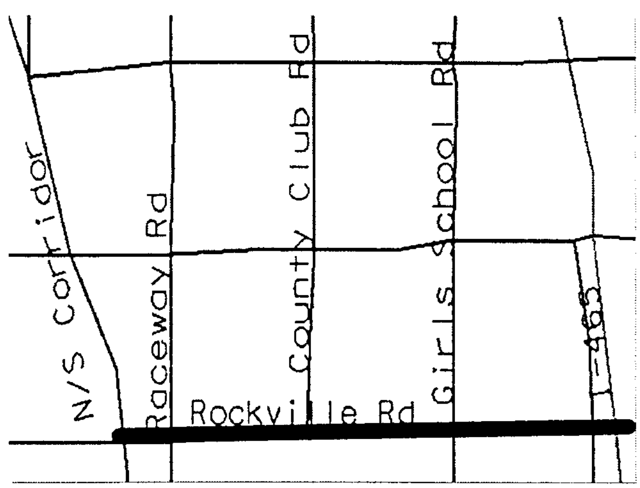
13) West 16th Street
Georgetown Rd to Stadium Dr.
1995 Adjusted ADT: 26,273
Existing 1995 LOS: E
Annual Accidents per Mile: 82.21 (High)
Special Event High Volume Traffic
Uncontrolled Driveways
High Accident Areas: Georgetown (35), Lafayette (29)
Prioritized Strategies:
1) Access Management
2) Transit Marketing
3) Intersection Improvements (Tibbs Ave, Georgetown Rd, Lafayette Ave)
Agency: Indianapolis DCAM



14) North Michigan Road
60th St. to 38th St.
1995 Adjusted ADT: 23,336
Existing 1995 LOS: F
Annual Accidents per Mile: 45.35
Geometric Constraint-White River
High Accident Areas: Kessler(31), 38th St.(38)
Prioritized Strategies:
1) Intersection Improvements (42nd and 51st Streets)
2) Driveway Control
3) Additional Arterial Travel Lanes
Agency: Indianapolis DCAM



15) Rockville Road
N/S Corridor to I-465
1995 Adjusted ADT: 29,138
Existing 1995 LOS: E
Predicted 2020 LOS: C
Annual Accidents per Mile: 47.87
PSI, Airport Tech Center
Capacity Increasing Project - Year 2000-06
High Accident Areas: Girls School (64), High School (53)
Prioritized Strategies:
1) Access Management
2) Growth Management
3) Rideshare/Vanpooling
Agency: INDOT



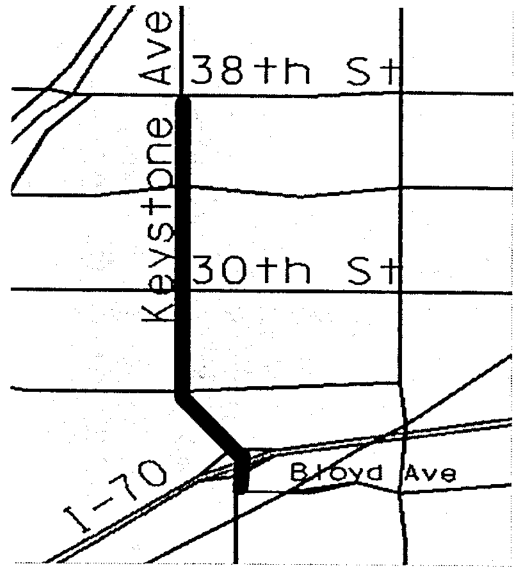
16) North Keystone Avenue
38th St. to Bloyd Ave.

1995 Adjusted ADT: 26,246
Existing 1995 LOS: D
Predicted 2020 LOS: D
Annual Accidents per Mile: 108.90
Fully Developed/Uncontrolled Driveways
High Accident Areas: 25th Street (30), 30th Street (31), 38th Street (54)

Prioritized Strategies:

1) Intersection Improvements (25th, 30th, and 34th Streets)
2) Access Management
3) Transit Enhancement/Expansion

Agency: Indianapolis DCAM



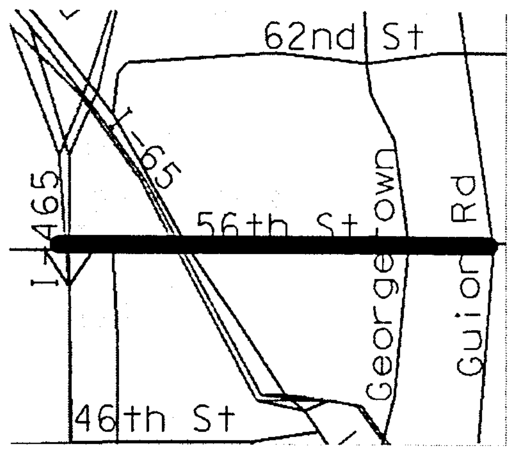
17) West 56th Street
I-465 to Guion Rd.

1995 Adjusted ADT: 18, 996
Existing 1995 LOS: F
Predicted 2020 LOS: D
Annual Accidents per Mile: 58.05
Capacity Increasing Project - Year 1998-99
High Accident Area: Georgetown (58)

Prioritized Strategies:

1) Intersection Widening
2) Bicycle and Pedestrian Facilities
3) Vanpooling

Agency: Indianapolis DCAM



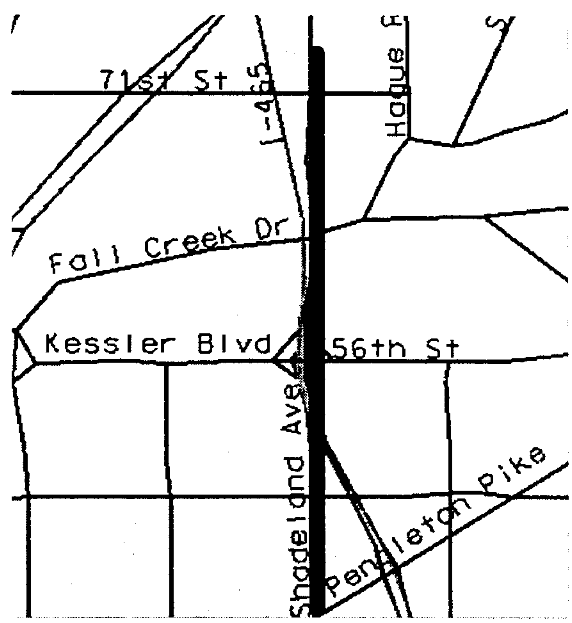
18) North Shadeland Avenue
71st to Pendleton Pike

1995 Adjusted ADT: 22,681
Existing 1995 LOS: F
Predicted 2020 LOS: D
Annual Accidents per Mile: 37.68
Capacity Increasing Project - Year 2007-15
Includes Limited Access Facility C-D Roads
High Accident Area: Pendleton Pike (32)

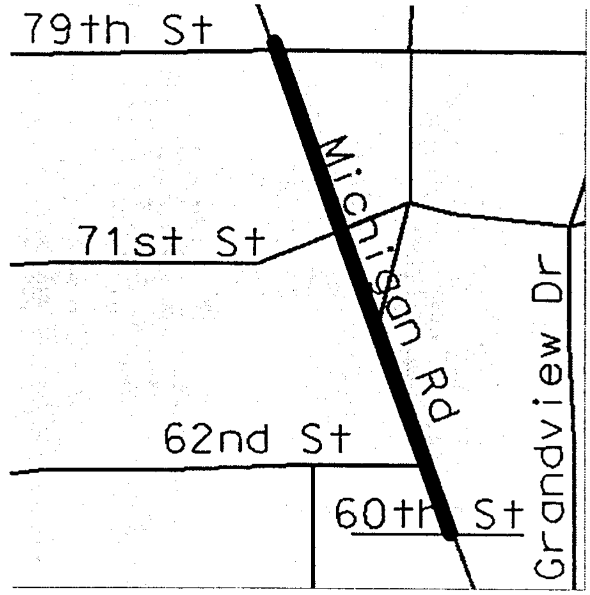
Prioritized Strategies:

1) Rideshare/Vanpooling
2) Telecommuting
3) Bicycle and Pedestrian Facilities

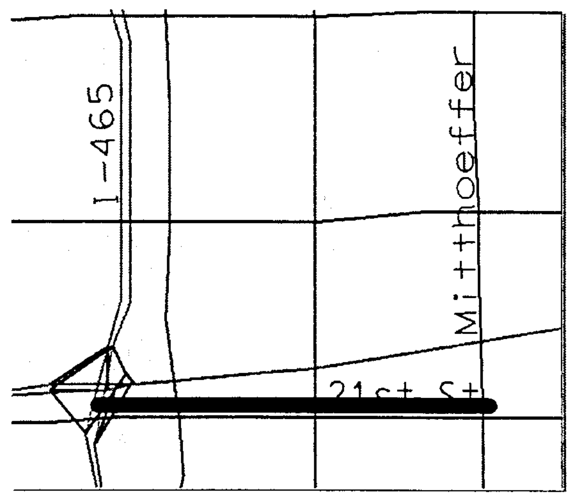
Agency: Indianapolis DCAM



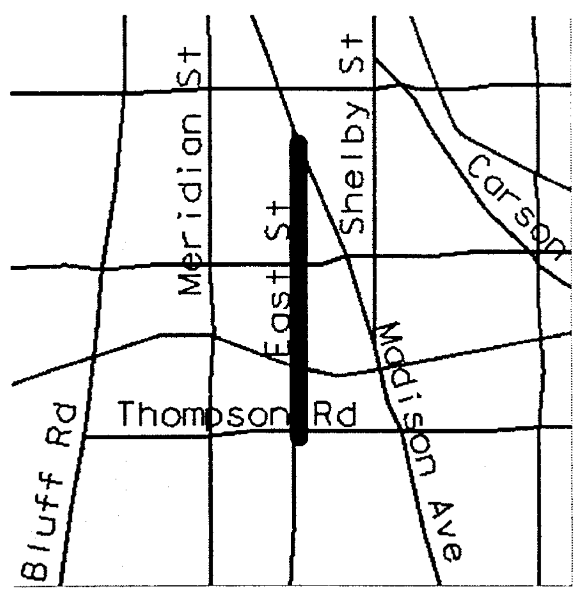
19) North Michigan Road
79th St. to 60th St.
1995 Adjusted ADT: 24,842
Existing 1995 LOS: E
Predicted 2020 LOS: F
Annual Accidents per Mile: 80.31
Capacity Increasing Project - Year 1997
Uncontrollable Driveways
Two Lanes from 73rd to 79th Streets
High Accident Area: 79th Street (79)
Prioritized Strategies:
1) Additional Arterial Travel Lane
2) Access Management
3) Transit Expansion/Enhancement
Agency: Indianapolis DCAM



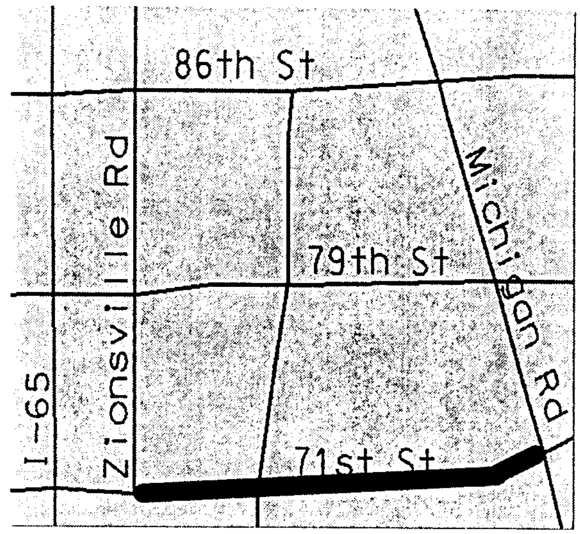
20) East 21st Street
I-465 to Mitthoeffer Rd.
1995 Adjusted ADT: 16,283
Existing 1995 LOS: F
Annual Accidents per Mile: 77.05
Fully Developed Area
Mixed Residential and Commercial Use
High Accident Area: Post Rd (77)
Prioritized Strategies:
1) Intersection Widening (Franklin Rd, Post Rd, and Mitthoeffer Rd)
2) Signalization Improvements
3) Transit Marketing
Agency: Indianapolis DCAM



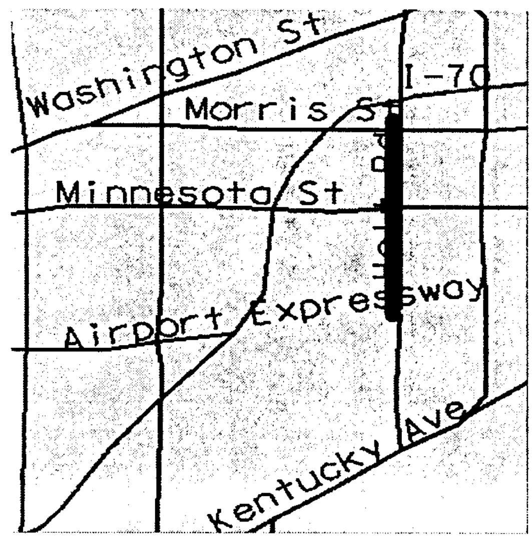
21) South East Street
Madison Ave. to Thompson Rd.
1995 Adjusted ADT: 32,127
Existing 1995 LOS: B
Annual Accidents per Mile: 63.09
Capacity Increasing Project - Year 1999
Major Commercial Centers
College Campus-University of Indianapolis
High Accident Area: Thompson Road (30)
Prioritized Strategies:
1) Transit Enhancement/Expansion
2) Transit Marketing
3) Bicycle/Pedestrian Facilities
Agency: INDOT



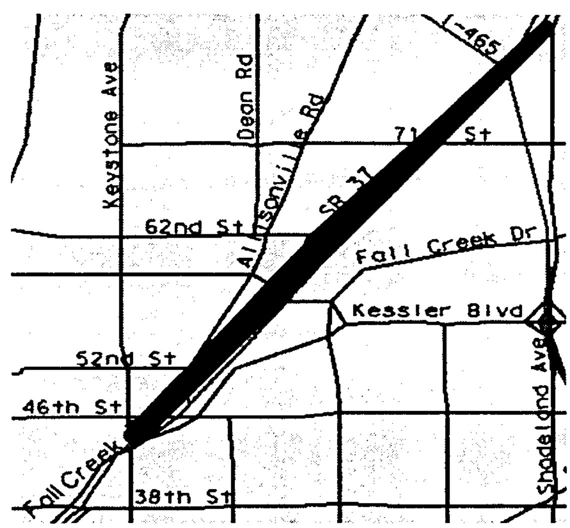
22) West 71st Street
Zionsville Rd. to Michigan Rd.
1995 Adjusted ADT: 18,884
Existing 1995 LOS: F
Annual Accidents per Mile: 37.83
Capacity Increasing Project - Year 2000-06
Highly Developed Commercial/
Industrial Area-Park 100
High Accident Area: Michigan Rd (47)
Prioritized Strategies:
1) Rideshare/Vanpooling
2) Signalization Improvements
3) Transit Expansion
4) Land Use Policies
Agency: Indianapolis DCAM



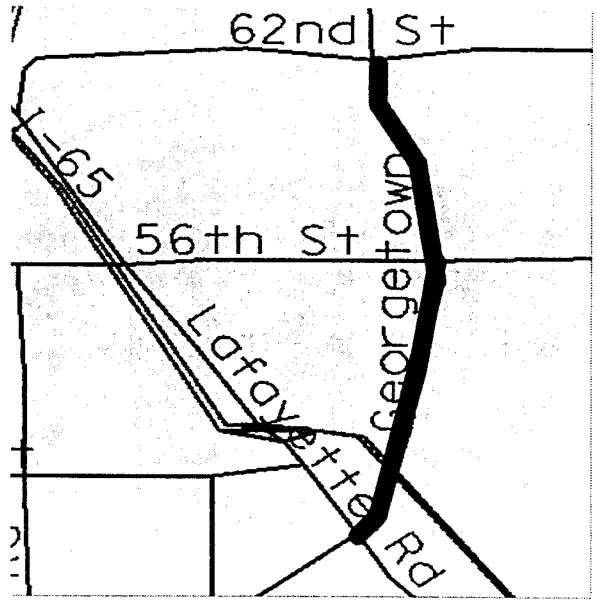
23) Holt Road
Morris St. to Airport Expressway
1995 Adjusted ADT: 22,665
Existing 1995 LOS: F
Annual Accidents per Mile: 20.30
Large Major Employers
Heavy Industrial Area
Prioritized Strategies:
1) Intersection Widening
2) Access Management
Agency: Indianapolis DCAM



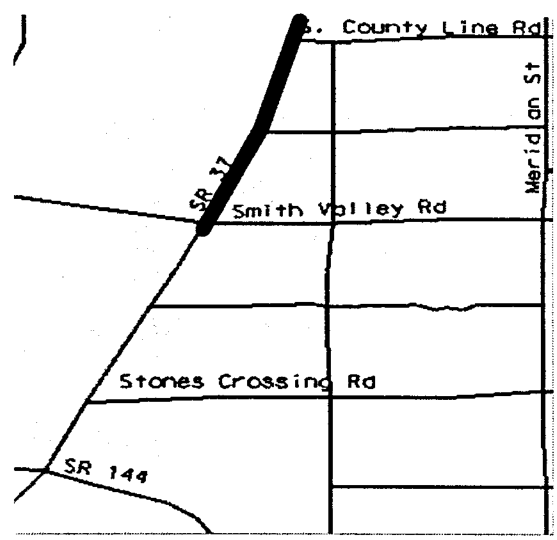
24) North SR 37
I-465 to Fall Creek Parkway
1995 Adjusted ADT: 25,639
Existing 1995 LOS: E
Predicted 2020 LOS: B
Annual Accidents per Mile: 109.05
High Accident Areas: 71st St.(29), 75th St.(30)
Prioritized Strategies:
1) HOV Lanes
2) Rideshare/Vanpooling
3) Exclusive ROW-Rail
Agency: INDOT



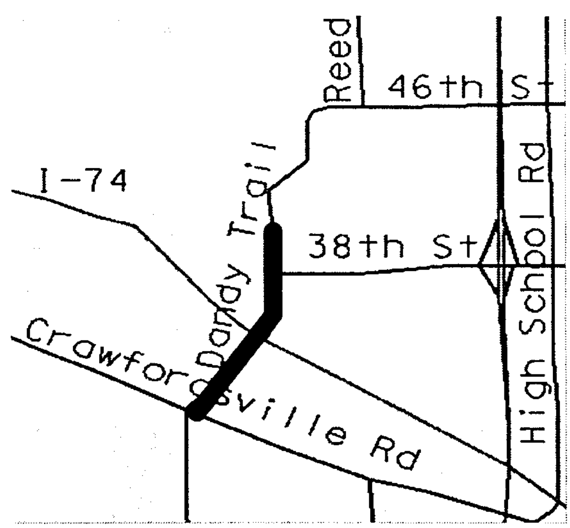
25) Georgetown Road
62nd St. to Lafayette Rd.
1995 Adjusted ADT: 19,838
Existing 1995 LOS: F
Predicted 2020 LOS: D
Annual Accidents per Mile: 17.43
Capacity Increasing Project - Year 2000-15
Open Land Available for Development
Prioritized Strategies:
1) Land Use Policies
2) Transit Marketing
3) Intersection Widening
4) Bicycle and Pedestrian Facilities
Agency: Indianapolis DCAM



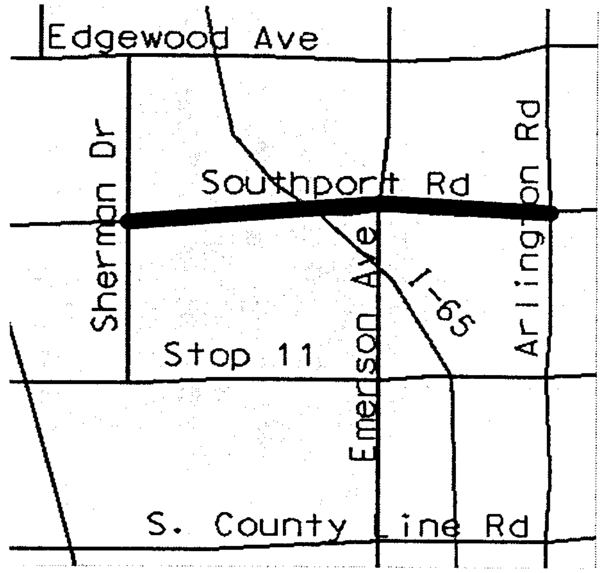
26) South SR 37
S. County Line Rd. to SR 144
1995 Adjusted ADT: 24,950
Existing 1995 LOS: C
Predicted 2020 LOS: B
Annual Accidents per Mile: 4.25
Capacity Increasing Project - Year 2000-06
Large Amount of Developable Land
Limited Access Facility
Prioritized Strategies:
1) Commuter Transit Service
2) Rideshare/Vanpooling
3) Intersection Widening
Agency: INDOT



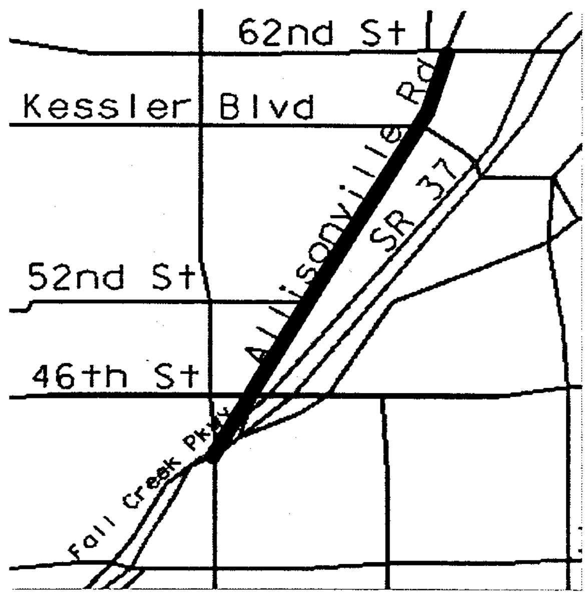
27) Dandy Trail
38th St. to Crawfordsville Rd.
1995 Adjusted ADT: 17,635
Existing 1995 LOS: E
Annual Accidents per Mile: 42.33
Developable Open Areas
Major Residential Development
Prioritized Strategies:
1) Land Use Policies-Growth Management
2) Transit Expansion/Enhancement
3) Intersection Widening
Agency: Indianapolis DCAM



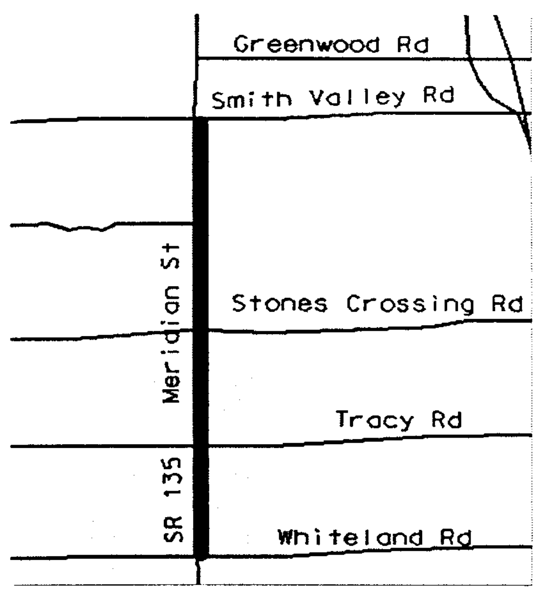
28) East Southport Road
Arlington Ave. to Sherman Dr.
1995 Adjusted ADT: 21,129
Existing 1995 LOS: C
Annual Accidents per Mile: 40.91
Large Amount of Developable Land
Commercial and Residential Centers
High Accident Area: I-65 Interchange (42)
Prioritized Strategies:
1) Land Use Policies
2) Turning Lanes
3) Access Management
Agency: Indianapolis DCAM



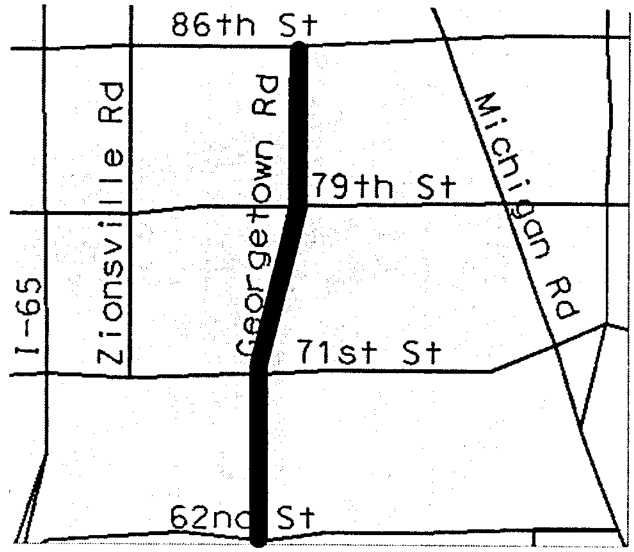
29) Allisonville Road
62nd St. to Fall Creek Parkway
1995 Adjusted ADT: 15,975
Existing 1995 LOS: E
Predicted 2020 LOS: F
Annual Accidents per Mile: 39.14
Uncontrolled Residential Driveways
High Accident Area: 62nd St. (30)
Prioritized Strategies:
1) Access Management
2) Signalization Improvements
3) Deceleration/Turn Lanes
4) Transit Expansion/Enhancement
5) Exclusive ROW-Rail
Agency: Indianapolis DCAM



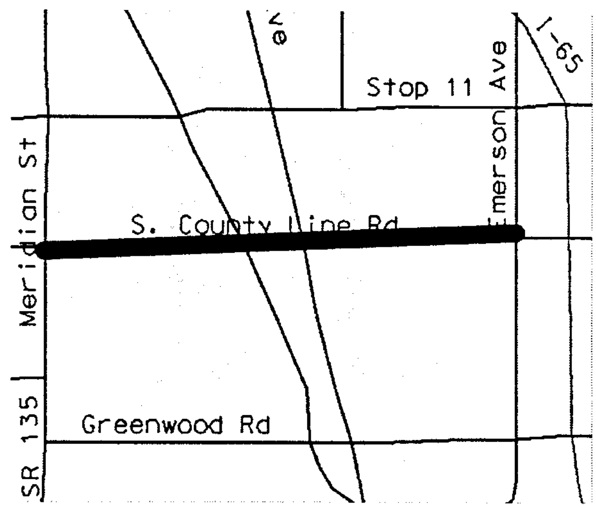
30) South Meridian Street
Smith Valley Rd. to Whiteland Rd.
1995 Adjusted ADT: 16,145
Existing 1995 LOS: F
Predicted 2020 LOS: A
Annual Accidents per Mile: 13.32
Capacity Increasing Project - Year 2007-15
Uncontrolled Residential Driveways
Prioritized Strategies:
1) Transit Expansion/Enhancement
2) Rideshare/Vanpooling
3) Bicycle and Pedestrian Facilities
4) Growth Management
Agency: INDOT



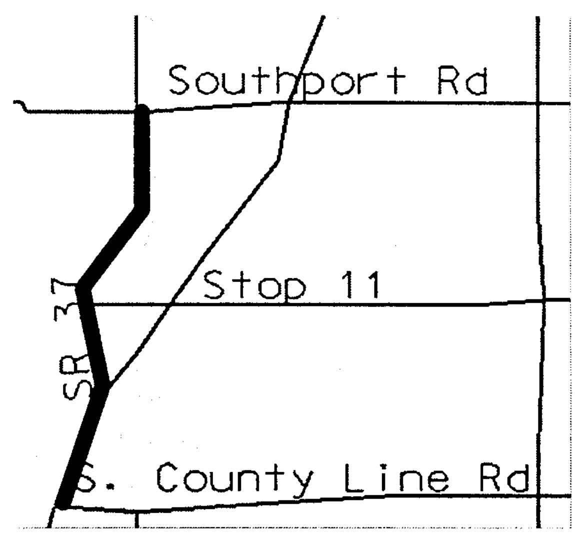
31) Georgetown Road
86th St. to 62nd St.
1995 Adjusted ADT: 14,327
Existing 1995 LOS: F
Predicted 2020 LOS: F
Annual Accidents per Mile: 17.43
Capacity Increasing Project - Year 2007-15
Existing Open Land for Development
Prioritized Strategies:
1) Land Use Policies
2) Transit Marketing
3) Transit Fare Reductions
4) Bicycle and Pedestrian Facilities
Agency: Indianapolis DCAM



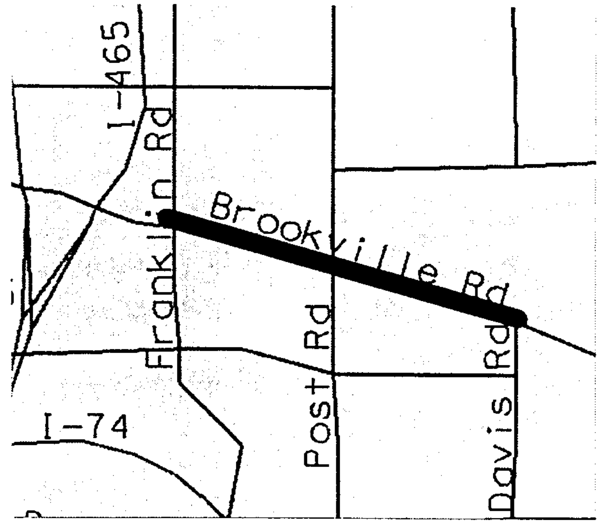
32) South County Line Road
Meridian St. to Emerson Ave.
1995 Adjusted ADT: 20,985
Existing 1995 LOS: E
Annual Accidents per Mile (1992-94): 17.40
Capacity Increasing Project - Year 1998
Developable Agricultural and Open Areas
Major Commercial Centers -
Greenwood Park Mall
High Accident Area: U.S. 31 (28)
Prioritized Strategies:
1) Land Use Policies
2) Signalization Improvements
3) Access Management
Agency: Indianapolis DCAM



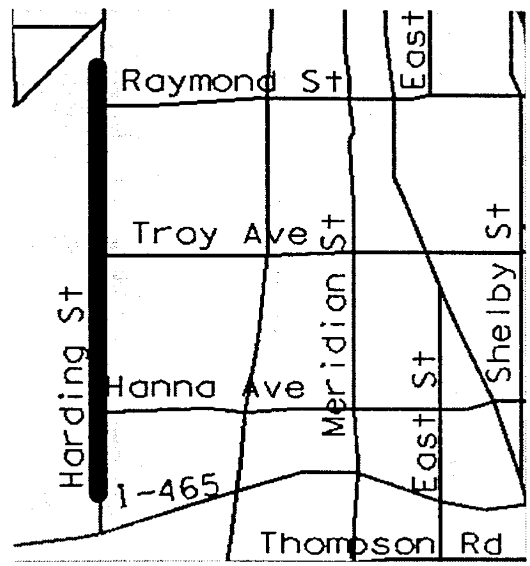
33) South SR 37
Southport Rd. to S. County Line Rd.
1995 Adjusted ADT: 28,218
Existing 1995 LOS: D
Predicted 2020 LOS: C
Annual Accidents per Mile: 23.33
Capacity Increasing Project - Year 2000-06
Large Amount of Developable Land
Limited Access Facility
Prioritized Strategies:
1) Commuter Transit Service
2) Intersection Widening
3) Rideshare/Vanpooling
Agency: INDOT



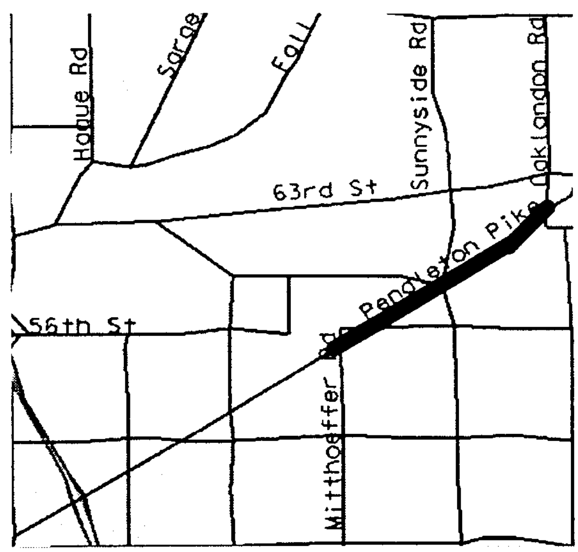
34) Brookville Road
Franklin Rd. to Davis Rd.
1995 Adjusted ADT: 15,520
Existing 1995 LOS: E
Predicted 2020 LOS: E
Annual Accidents per Mile: 22.38
Capacity Increasing Project - Year 2000-06
Open Land Available for Development
Prioritized Strategies:
1) Land Use Policies
2) Access Management
3) Frontage Roads
Agency: Indianapolis DCAM



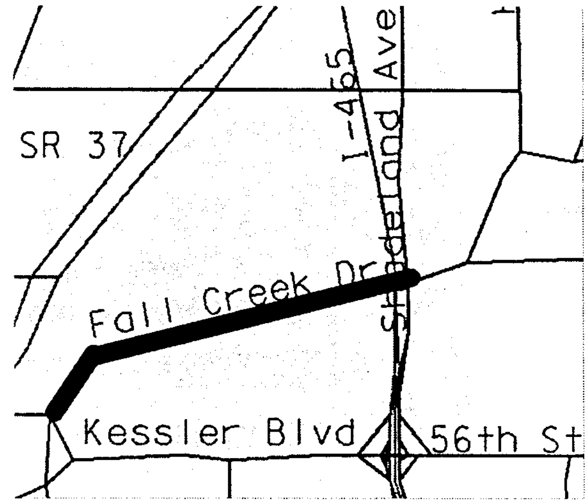
35) Harding Street
I-465 to Raymond Ave.
1995 Adjusted ADT: 14,180
Existing 1995 LOS: E
Predicted 2020 LOS: C
Annual Accidents per Mile: 26.00
Heavy Industrial Area
Railroad Crossing
Capacity Increasing Projects 2000-06, 2007-15
Prioritized Strategies:
1) Design Standards (Railroad Crossing)
2) Commercial Vehicle Operations
3) Intersection Widening
Agency: Indianapolis DCAM



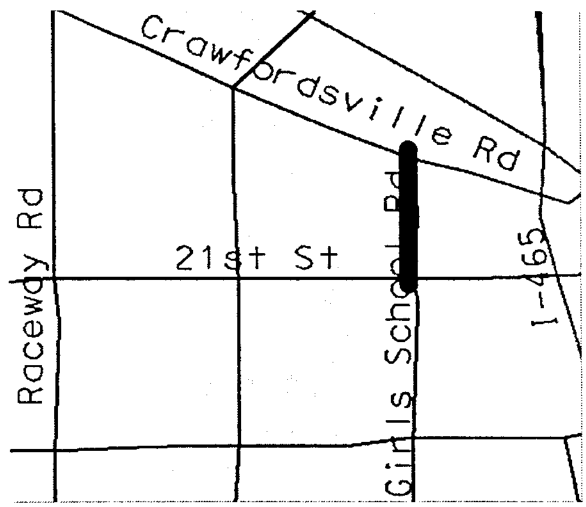
36) Pendleton Pike
Oaklandon Rd. to Mitthoeffer Rd.
1995 Adjusted ADT: 15,878
Existing 1995 LOS: E
Predicted 2020 LOS: E
Annual Accident per Mile: 3.04
Capacity Increasing Project - Year 2000-06
Uncontrolled Residential Driveways
Prioritized Strategies:
1) Access Management
2) Rideshare/Vanpooling
3) Transit Expansion
4) Park and Ride Facilities
Agency: INDOT



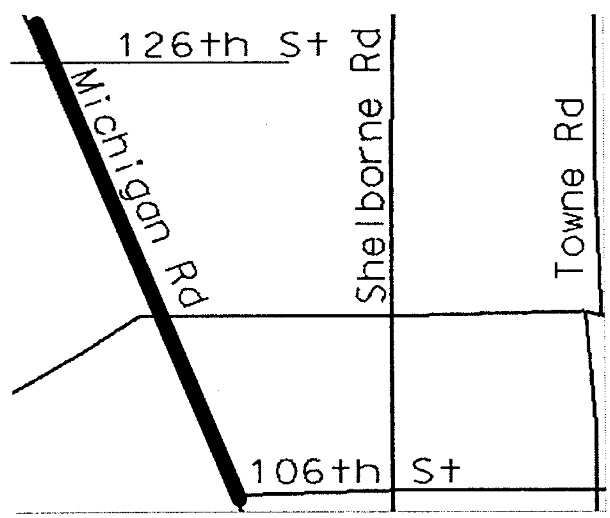
37) Fall Creek Drive
Shadeland Ave. to Kessler Blvd.
1995 Adjusted ADT: 8,922
Existing 1995 LOS: A
Predicted 2020 LOS: E
Annual Accidents per Mile: 31.16
High Growth/Future Congestion Predicted
Large Amount of Available Land to Develop
Prioritized Strategies:
1) Land Use Policies
2) Design Standards
3) Intersection Widening
Agency: Indianapolis DCAM



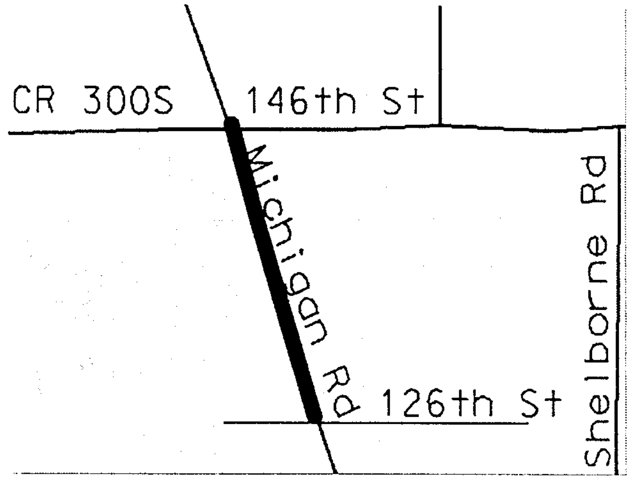
38) Girls School Road
Crawfordsville Rd. to 21st St.
1995 Adjusted ADT: 10,537
Existing 1995 LOS: C
Predicted 2020 LOS: E
Annual Accidents per Mile: 19.64
Large Amount of Developable Land
Prioritized Strategies:
1) Land Use Policies
2) Telecommuting
3) Turning Lanes
Agency: Indianapolis DCAM



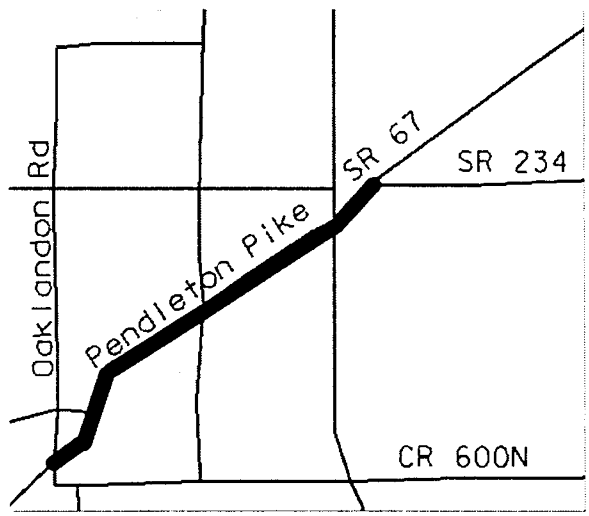
39) North Michigan Road
126th St. to 106th St.
1995 Adjusted ADT: 12,964
Existing 1995 LOS: A
Predicted 2020 LOS: B
Annual Accidents per Mile: 17.14
Large Amount of Developable Land
Capacity Increasing Project - Year 2007-2020
Prioritized Strategies:
1) Land Use Policies-Growth Management
2) Design Standards
Agency: INDOT



40) North Michigan Road
146th St. to 126th St.
1995 Adjusted ADT: 9,645
Existing 1995 LOS: A
Predicted 2020 LOS: B
Annual Accidents per Mile: 17.14
Large Amount of Developable Land
Capacity Increasing Project - Year 2007-2020
Prioritized Strategies:
1) Land Use Policies-Growth Management
2) Design Standards
Agency: INDOT



41) Pendleton Pike
SR 234 to Oaklandon Rd.
1995 Adjusted ADT: 8,768
Existing 1995 LOS: A
Predicted 2020 LOS: D
Annual Accidents per Mile (1992-94): 3.04
Capacity Increasing Project - Year 2000-06
Large Amount of Developable Land
Prioritized Strategies:
1) Land Use Policies
2) Rideshare/Vanpooling
3) Park and Ride Facilities
Agency: INDOT



VII.

CHAPTER 7. EVALUATION PROCESS AND UPDATE PROCEDURES FOR THE CMS

Evaluation of Effectiveness of Implemented Strategies

With good knowledge of effectiveness, better decisions can be made and better tools can be devised to assist in making those decisions. Thus, effectiveness evaluations are needed to calibrate various models used to evaluate strategy decisions.

The Interim Final Rules on the Management and Monitoring Systems provides the following guidance on the evaluation of congestion management strategy effectiveness:

"A process of periodic assessment of the effectiveness of implemented strategies, in terms of the area's established performance measures, shall be implemented. The results of this evaluation shall be provided to decision-makers to provide guidance on selection of effective strategies for future implementation."

The difficulty of making good evaluations of effectiveness is often underestimated. The evaluation of a strategy is no different than any other activity that uses the scientific method to determine whether the action taken had an effect and how much of an impact occurred. Detecting a change in travel/traffic is quite different from detecting a change in a controlled laboratory environment. Although there are observable trends in human behavior, there are many sources of variation in travel behavior from day to day. Evaluating effectiveness is much easier to achieve in a simulated environment, but one is not always sure whether the simulation matches reality.

Certain types of operational strategies typically affect only an isolated area, and have impacts that can be accurately estimated before implementation using proven analytical methods. Typically, there may be no need to evaluate the impacts for low cost, isolated actions that have proven effectiveness.

However, the CMS should provide for the evaluation of major investment strategies that will have corridor, subarea, or regional impacts, are designed to affect travel patterns/behavior, mode choice, or represent controversial actions that may be questioned by decision-makers or the public. Another criterion that should be used to assess whether or not the effectiveness of a strategy should be evaluated after implementation is the extent of existing knowledge of the effectiveness of the strategy. Where existing knowledge is limited or where the measured effectiveness of a strategy varies considerably between applications in other metropolitan areas or states, it is beneficial to evaluate the effectiveness for application, particularly if additional application of this strategy is envisioned.

It is possible that some strategies may defy evaluation, at least at a reasonable cost. The sketchiness of some of the existing information on strategy effectiveness testifies to the fact that the evaluation of effectiveness is not an easy task.

For every evaluation conducted, the context must be carefully described and understood to explain why the changes did or did not take place. For example, corridor evaluations must include parallel freeways or arterials as well.

Periodic Updating of the CMS

The Statewide CMS Prototype calls for a process to be established that would periodically update the Congestion Management System. It recommends *"that the CMS be updated along with the TIP and STIP, and that the process should perform the following:*

1) evaluate the existing CMS network and add any necessary elements/links,
2) review and update system performance objectives,
3) review and coordinate roadway and transit data collection with data needs for air quality and land use assessments,
4) provide a public information program to disseminate information on the operating status of roadway and transit system,
5) coordinate with other ISTEA management systems, and
6) integrate findings into continuous long-range planning and short-range programming activities."

The CMS should be updated every three years in TMAs and should include:

1) Status Report on CMS activities
2) State of the System Report
3) Performance Monitoring Report
4) Effectiveness Evaluation Report
5) CMS Master Plan Report

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