Congestion Management System

MANUAL OF PRACTICE

Second Edition

September 2002

Prepared by

NOACA

Planning For Greater Cleveland

NOACA

Planning For Greater Cleveland

The Northeast Ohio Areawide Coordinating Agency (NOACA) is a public Organization serving the counties of and municipalities & townships within Cuyahoga, Geauga, Lake, Lorain and Medina (covering an area with 2.1 million people). NOACA is the agency designated or recognized to perform the following functions:

- **Serve as the Metropolitan Planning Organization (MPO), with responsibility for comprehensive cooperative and continuous planning for highways, public transit, and bikeways, as defined in the Transportation Equity Act for the 21st Century.**
- **Perform continuous water quality, transportation-related air quality and other environmental planning functions.**
- **Administer the area clearinghouse function, which includes providing local government with the opportunity to review a wide variety of local or state applications for federal funds.**
- **Conduct transportation and environmental planning and related demographic, economic and land use research.**
- **Serve as an information center for transportation and environmental and related planning.**
- **At NOACA Governing Board direction, provide transportation and environmental planning assistance to the 172 units of local, general purpose government.**

The NOACA Governing Board is composed of 38 local public officials. The Board convenes monthly to provide a forum for members to present, discuss and develop solutions to local and areawide issues and make recommendations regarding implementation strategies. As the area clearinghouse for the region, the Board makes comments and recommendations on applications for state and federal grants, with the purpose of enhancing the region's social, physical, environmental and land use/transportation fabric. NOACA invites you to take part in its planning process. Feel free to participate, to ask questions and to learn more about areawide planning. For more information, call:

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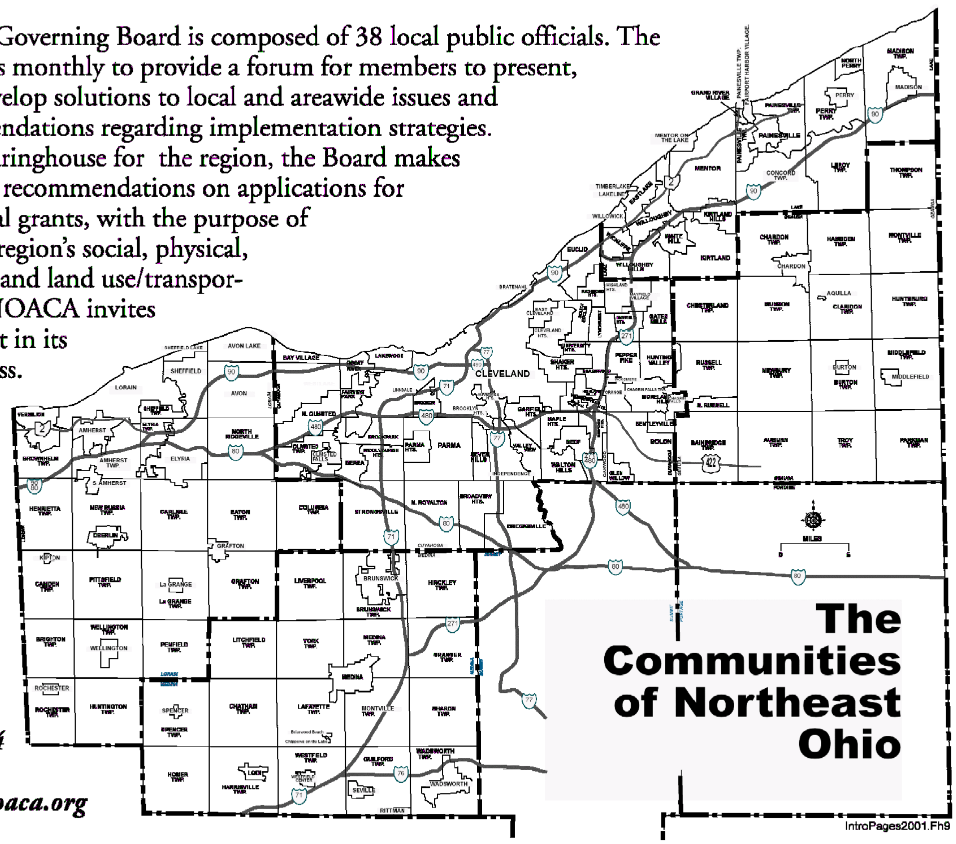

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CMS Manual of Practice
Second Edition

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Prepared by

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CONGESTION MANAGEMENT SYSTEM
MANUAL OF PRACTICE
Second Edition

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EXECUTIVE SUMMARY

Why a Second Edition?

The first congestion management system manual of practice was adopted in 1997 by the NOACA Governing Board Resolution 97-077. It was necessary to revise the first manual of practice to update information and improve its usability. The CMS Manual of Practice, Second Edition, differs from the original one in the following respects:

- Edited report text to remove obsolete subject matter and enhance readability, flow and clarity. For example, the current Highway Capacity Manual is HCM2000. References to previous Manuals were updated and old values were replaced with current ones.
- Emphasized Level of Service (LOS) thresholds more clearly. Level of Service (LOS) "D" will be the threshold for peak periods in urbanized areas and LOS "C" will be the threshold for peak periods in rural areas.
- Inserted specific threshold values to certain other measures of performance such as the range of travel speeds as shown in table 8-7 of the CMS manual of practice.
- Made substantial improvements to the CMS road network maps which included:

  - Addition of newly constructed roadways to the network, such as the Jennings Freeway, which conform to the criteria governing the selection of the transportation network, and adding roadways that provide access to newly constructed interchanges;
  - Correction of roadway designations to change incorrectly coded state or U.S. routes to local municipal or county roads or streets;
  - Correction of nomenclature such as misplaced roadway names and route numbers; and
  - Replacement of black-and-white maps with color maps to enhance various types of roadways and railways on the transportation network.

About The Manual of Practice

The Congestion Management System (CMS) provides for a systematic process to address traffic congestion on the region's transportation network. The Transportation Equity Act (TEA 21) requires that a CMS be part of the transportation planning process. It also requires that the States, in cooperation with the MPOs, develop, establish and implement congestion management systems for their respective metropolitan areas.

Because a CMS could mean different things to different people, and because the development, establishment and implementation of a CMS is not only intricate but also large in scope, a manual of practice to help achieve the establishment and implementation of a CMS became necessary. The manual represents the blueprint upon which the construction of a CMS will be based. It contains NOACA's goals and objectives, the criteria for defining the transportation network, specific congestion management and mobility enhancement strategies, and measures of performance for evaluating the transportation system. Future expansion of or modification to the CMS will be necessary as new information and technology become available. Therefore, the CMS manual of practice will be a dynamic document.

The CMS road Network described in this manual of practice is one of the principal components of the CMS. Defining the network is critical for the implementation of NOACA's congestion management system. The network contains approximately 403 miles of freeways and freeway ramps, 290 miles of U.S. routes, 850 miles of State routes and 652 miles of local thoroughfares (county, township and municipal roads and streets). The transportation network covers NOACA’s entire five-county area and is the foundation upon which the congestion management system will be built.

The CMS manual of practice provides guidelines for assessing system performance and identifying areas, network links or road sections, that experience or will likely experience congestion. It also serves as a guide to select, evaluate and implement traditional and nontraditional congestion management and mobility enhancement strategies to yield a more efficient transportation system.

Under TEA-21, it is necessary to assess the performance of the transportation system and to measure how effectively congestion will be managed using the various congestion management strategies. Measures of performance listed in this manual of practice provide a benchmark to help judge how well the transportation system performs under existing and future conditions when gauged using locally accepted values or thresholds that describe such performance measures. Locally accepted threshold values were not predetermined for all measures of performance enumerated in the CMS manual of practice. Establishing additional threshold values will be left up to the collective judgment and general consensus of the region's public officials and decision-makers.

Traditional measures of performance, such as volume-to-capacity (v/c) ratio and level-of-service (LOS), are relevant for assessing the performance of the transportation system in terms of the mobility of vehicles. They are, however, location-specific. They are not appropriate for measuring the mobility of people and goods or for assessing the effectiveness of certain appropriate, region wide congestion management strategies. Therefore, additional and more diverse measures of performance need to be developed to better evaluate the transportation system.

Travel time-based and delay-based measures of performance are the best and most appropriate measures to use in identifying or describing congestion. Although “delay” (the difference between desired or free flow and actual travel time) does not provide an indication of the specific causes or locations of congestion, highway users find it easier to understand them because shorter travel time, or less delay, is generally considered an indication of less congestion.

CHAPTER 1

INTRODUCTION

Legislative Basis and Historical Overview

The genesis of the CMS, and consequently the Manual of Practice to help guide its development, came as the result of a federal act in 1991 called the Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA required that management systems be developed by the states in cooperation with the Metropolitan Planning Organizations (MPOs). The Act also required that in Transportation Management Areas[1] (TMAs) the transportation planning process include a congestion management system that provides for the effective management of congestion on existing and new transportation facilities that are eligible for federal funding. This requirement of the ISTEA was re-affirmed in the subsequent reauthorization of the Act in TEA 21. It places the Congestion Management System at equal status with other major elements required for the planning process, such as the Long-Range Transportation Plan, the State Implementation Plan (SIP) and the Transportation Improvement Program (TIP). The CMS is expected to lead to the implementation of specific actions or strategies to manage congestion and improve the mobility of traffic, people and goods. Part 500, Section 500.109c of TEA 21 states, in part, that "In a TMA designated as nonattainment for carbon monoxide and/or ozone, the CMS shall provide an appropriate analysis of all reasonable 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 is proposed." The phrase "significant increase in capacity for SOVs" means "adding general purpose lanes to an existing highway or constructing a new highway." The Act further states that "if the analysis demonstrate 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." Capacity-addition projects in non-attainment TMAs shall be advanced only as the result of a CMS evaluation process.[2]

[1] Transportation Management Areas (TMAs) are urbanized areas with a population of 200,000 people or more.

[2] It will not be required to have or conduct a CMS evaluation if an agency adds or intends to add capacity without using federal or state funds.

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 required that the states, in cooperation with MPOs and affected public agencies receiving assistance under the Federal Transit Act, develop, establish and implement a traffic monitoring system and six transportation infrastructure management systems. The transportation infrastructure management systems are:

1. Pavement of Federal-Aid Highways Management System (PMS);
2. Bridge Management System (BMS);
3. Highway Safety Management System (SMS);
4. Public Transportation Facilities and Equipment Management System (PTMS);
5. Intermodal Transportation Facilities and Systems Management System (IMS); and
6. Traffic Congestion Management System (CMS).

The purpose of the above listed six transportation infrastructure management systems is to provide consistent, systematic processes to cost-effectively increase the efficiency of the transportation system and to provide information to policy-makers to assist them in carrying out the transportation planning process. Subsequent legislation, however, promulgated in the National Highway System Designation Act of 1995, relaxed the ISTEA mandatory requirement and made the development, establishment, and implementation of the above mentioned management systems voluntary for the states. It, nonetheless, required the states to establish and implement a traffic monitoring system and the MPOs to establish and implement a Congestion Management System for their respective metropolitan areas.

Definition of Congestion

Congestion occurs when travel demand exceeds the traffic-carrying capacity of a roadway either naturally or due to external interferences such as incidents or construction zones. In a somewhat more technical terms, congestion occurs when flow (the number of vehicles per unit time) exceeds the traffic carrying capacity of the roadway (the number of vehicles per the same unit time that the roadway can accommodate). Congestion becomes more evident when commuters begin to experience stop-and-go conditions or when delay causes longer travel times. Congestion is defined qualitatively in Title 23, Part 500, Section 500.109 of TEA 21 as "the level at which transportation system performance is no longer acceptable due to traffic interference". It should be recognized, however, that the term "acceptable" will depend on the type of each transportation facility, size of city, time of day and type of area. This definition recognizes that the levels of acceptable congestion vary throughout the country and between metropolitan and non-metropolitan areas. It will be left to the states, in cooperation with the MPOs, local governments, transit operators and other transportation officials to determine what an acceptable level of congestion will be in their respective areas. A manual of practice, therefore, becomes necessary in order to define specific measures of performance to quantify the term “acceptable” or, conversely, “unacceptable” congestion by associating locally accepted values (thresholds) to such measures of performance.

Purpose of the CMS Manual of Practice

The purpose of this Manual of Practice is to provide a framework for the development, establishment, and implementation of a Transportation Congestion Management System (CMS) within NOACA's five-county region. The manual is designed to serve as a foundation for an on-going process of transportation system evaluation and congestion management. It is intended to be dynamic so that the policies, procedures, and performance measures and standards contained in it can be amended to suit changing conditions and expectations.

The following principles provide the framework for the development, establishment, and implementation of an effective congestion management system:

1. The transportation planning process must be the mechanism through which decisions are made about how transportation needs will be met. It is the logical avenue for debating and making decisions about how congestion should be addressed on a regional or metropolitan level. The congestion management system should be viewed as one of the cornerstones of the overall transportation planning process;

2. Data collection encompasses two sets of data that will be needed to effectuate a successful Congestion Management System: (i) Pre-implementation data needed to identify the location, duration and severity of existing congestion on the transportation system; and (ii) Post-implementation data needed to evaluate the effectiveness of implemented congestion management strategies in order to provide the necessary feedback to make future decisions or introduce any adjustments;

3. The NOACA CMS need not require reinventing the planning process, but should build upon it to increase the "value" of such process;

4. NOACA’s staff and local public officials must have great flexibility in order to develop and implement a successful CMS and establish the criteria for the desirable levels of system performance tailored to address the transportation needs or problems in the area;

5. The development of any CMS must include all appropriate transportation modes and modal interconnections. It is the movement of people and goods, not just vehicles, that need to be addressed;

6. The CMS must cover a geographic area and not just isolated facilities, for congestion on a facility may cause or is caused by problems elsewhere on other facilities in the area;

7. Although the transportation planning process has dealt mainly with recurring congestion, an effective congestion management system must address both recurring congestion (congestion that occurs regularly at the same times and locations) and non-recurring congestion (congestion that occurs sporadically due to isolated incidents which, when frequent, can amount to recurring congestion);

8. In addition to the array of congestion management strategies enumerated in this Manual of Practice, the CMS must provide for the identification of additional, appropriate congestion reduction strategies and for the evaluation of the potential effectiveness of such strategies;

9. The ultimate usefulness or benefit of NOACA's CMS can only be realized in the implementation of congestion reduction and mobility enhancement actions or strategies. Thus, a plan or program for the implementation of appropriate congestion management strategies must be devised. Such implementation plan, known also as the Congestion Management Plan, must include proposed actions, identification of implementation responsibilities, time frame for implementation, and possible funding sources; and

10. Monitoring and evaluating implemented strategies must be conducted in order to determine whether such strategies are producing the anticipated results to fulfill their intended purpose.

The Relationship Between the CMS and the Transportation Planning Process

NOACA's CMS is designed to operate within the transportation planning process. It describes cost-effective congestion mitigation strategies that will be evaluated and proposed for implementation pursuant to NOACA's goals and policies.

The Congestion Management System is not expected, for it would be impractical, to encompass or address every existing roadway in the NOACA region. Therefore, a transportation system network that reasonably represents the most important or heavily traveled roads in the NOACA region was objectively identified according to the criteria specified in Chapter Six.

Title 23, Part 450, Subpart C, Section 450.320(a) states that "Within all metropolitan areas, congestion, public transportation and intermodal management systems, to the extent appropriate, shall be part of the metropolitan transportation planning process required under the provisions of 23 U.S.C. 134 and 49 U.S.C." Title 23, Section 450.320(b) states that "In TMAs, the planning process must include the development of a CMS that provides for effective management of new and existing transportation facilities through the use of travel demand reduction and operational management strategies."

CHAPTER 2
RECURRING AND NON-RECURRING CONGESTION

Congestion, in general, is a condition that exists when there is increased traffic flow and decreased roadway capacity. NOACA's Congestion Management System will focus primarily on measuring the degree (frequency and magnitude) of recurring traffic congestion, identifying the causes of such recurring congestion and developing congestion management and mobility enhancement strategies to mitigate it. Although incidents or events that cause non-recurring congestion may take place anywhere every day, predicting and measuring non-recurring congestion will be secondary to forecasting and identifying recurring congestion. When non-recurring congestion becomes a chronic problem at specific locations, it may be viewed and treated as recurring congestion. When examining congestion and searching for appropriate solutions, it is important to distinguish between two types of congestion; recurring and non-recurring.

Recurring Congestion

Recurring congestion is a predictable event and typically occurs during peak commute periods at the same locations when traffic flow exceeds road capacity. A "bottleneck," for example, that forms as the result of frequent heavy traffic flow at an on-ramp, off-ramp, a lane drop, a steep grade, a weave area or a narrow road cross-section such as a narrow bridge represents a case of recurring congestion. Regardless of the cause, recurring congestion occurs when traffic demand persistently exceeds the capacity of the roadway. During non-congestion conditions (that is when volume is less than capacity), traffic flows smoothly. Near or at capacity, a decrease in average speed will occur as the volume of traffic increases. When the capacity of a roadway is reached, flow on the mainline becomes critical. When a highway is operating at such critical condition, any additional traffic or capacity-reducing event, such as a lane blockage, slow-downs or weaving will cause the roadway to "break down" and will create stop-and-go conditions. Recurring congestion can be identified by one or more of the following methods: (i) NOACA's regional Transportation Demand Model (TDM) using peak hour assignments; (ii) ODOT's CMAQ5A post-processing sub-routine; (iii) Ground-based or aerial-based field observations; (iv) Available analysis software such as the Highway Capacity Software; or (v) Appropriate manual calculations.

Non-Recurring Congestion

Non-recurring congestion usually occurs due to unpredictable incidents or the presence of construction zones which completely or partially block travel lanes. Roadway capacity is diminished due to merging maneuvers and decreased travel speeds. Roadway incidents are usually unpredictable and consist of different kinds as follows:

Crashes: In addition to causing congestion, the initial crash may cause secondary crashes when drivers abruptly react to the crash, especially within the platoon involving vehicles that follow too closely or which drivers fail to react timely to slowing traffic or the suddenness of the crash.

Disabled Vehicles: Even when disabled vehicles are stopped on the hard shoulder, a disabled vehicle causes side friction which reduces roadway capacity due to decreased speeds. In certain instances, the disablement may be "spectacular" in nature, such as a car on fire or a stationery police vehicle attending to a roadway matter, resulting in excessive curiosity, dubbed rubber-necking, which causes more congestion.

Spilled Loads: A spilled load can block several lanes, and if it involves hazardous material, complete closure of a freeway or roadway may become necessary requiring re-routing of traffic.

Adverse Weather Conditions: The NOACA region is prone to adverse weather conditions such as snow, ice or heavy rain, which can slow the movement of traffic. In some extreme cases, snow or ice may warrant the closure of sections of roadways especially those which contain bridges.

Special Events: Large event facilities such as the Gateway Stadium, Jacobs field, and CSU's Convocation Center/Arena in Cleveland may generate significant traffic volumes that can congest nearby freeways and major arterials in a relatively short period. It is possible, however, to plan and implement traffic congestion management for most events because the start and end times are usually known or can be estimated fairly accurately. Different types of events, however, create varying traffic volumes and flow distribution.

Road Reconstruction or Maintenance: Road reconstruction or maintenance activities on freeways, arterials and streets represent a form of "planned" incidents. They are random events to most motorists even when adequate advance notice or announcement are provided to help commuters plan their travel schedules or use alternative routes to mitigate the magnitude of potential traffic congestion. Although the tolerance level of motorists may increase as they become more familiar and accustomed to the presence of prolonged construction or maintenance activities, the effects of congestion such as delay, increased fuel consumption and pollution remain until the roadway reconstruction or maintenance is completed.

CHAPTER 3
DEFINITION AND COMPONENTS OF THE CMS

Definition of the CMS

The Congestion Management System is an on-going systematic process of examining the transportation system. It is designed to assist transportation decision-makers in evaluating, selecting and implementing cost-effective congestion reduction or prevention strategies that can improve the efficiency and safety of, and protect the investment in, the region's transportation infrastructure.

Components of the CMS

There are seven key components that represent the foundation upon which an effective CMS can be built. These key elements, described in more detail throughout this Manual of Practice, are listed and defined below:

1. **Area of Application** - This is the geographic area for which congestion management strategies or actions will be developed, applied and evaluated, and where congestion levels will be monitored. Because the NOACA region is an Air Quality Maintenance Area and a designated transportation management area the area of application will be the entire NOACA five-county planning region.

2. **Transportation System Network** - This is the road network that will be subject to the application of any one or more of the congestion management and mobility enhancement strategies. It includes the various transportation modes and the road network that will be examined using the tools described in the latest edition of the HCM or any other generally accepted methods.

3. **Measures of Performance** - Measures of performance are technical terms and principles, associated with certain threshold values, used to describe or quantify traffic congestion on the roadway system and to identify the location and extent of such congestion. These Measures of Performance will also be used in gauging or measuring the effectiveness of appropriate proposed or implemented congestion management strategies or actions. Only

the measures of performance identified in this manual of practice and adopted by NOACA will be used when performing the technical analysis for assessing the operation of the transportation system or any part of it.

4. **Data Collection and Processing** - Data collection and processing involves gathering, processing and banking of data needed to perform the required analysis.

5. **Identification and Evaluation of Appropriate Congestion Management and Mobility Enhancement Strategies** - This is the process by which the determination of appropriate congestion management and mobility enhancement strategies will be made to address identified system deficiencies or congestion problems. The application of this element of the CMS can be either system-wide or facility-specific.

6. **System Performance Monitoring** - Performance monitoring is a set of procedures for the periodic evaluation of the performance of the transportation system, or any part thereof, in order to measure the effectiveness of implemented or proposed congestion management strategies or actions.

7. **Coordination Plan for the Selection, Management and Implementation of Congestion Management Strategies** - The CMS process will be better served with the establishment of a coordination plan to develop and implement the various congestion management strategies to ensure timely and effective delivery of traffic congestion mitigation solutions. Coordination and cooperation among all concerned agencies in the region is essential in order for a CMS to function efficiently and to produce the desired results. This element of the CMS provides for reviewing the technical principles, activities, procedures and implementation techniques set forth in the CMS Manual of Practice. This review can be used to update or improve the CMS process as new congestion management techniques and technology become available.

CHAPTER 4

OBJECTIVE, GOALS AND PROCESS OF NOACA'S CMS

Objective

The objective of NOACA's Congestion Management System (CMS) is to maximize or at least preserve the efficiency of the existing transportation system of the region through a systematic and continuous process.

Goals

The following goals must be achieved to fully realize the objective of the CMS:

1. Improve safety on the surface transportation system;
2. Increase the operational capacity of the transportation system by improving its service delivery capabilities;
3. Reduce emissions and environmental costs associated with traffic congestion; and
4. Educate and urge public officials to have better cooperation and coordination.

Process

The following process should be used in order to achieve the goals and satisfy the objective of NOACA's CMS:

1. Evaluation and monitoring of the operational performance of the transportation network;
2. Evaluation and identification of appropriate and cost-effective strategies to alleviate congestion;
3. Implementation of appropriate congestion management or mobility enhancement strategies;
4. Evaluation of the effectiveness of implemented strategy(ies); and
5. The creation of an institutional environment in which the development and deployment of a CMS can flourish.

CHAPTER 5

MODELING OF THE TRANSPORTATION SYSTEM

Although NOACA's CMS addresses both recurring and non-recurring traffic congestion, it will, however, identify only recurring systemwide traffic congestion under three primary scenarios. The first scenario consists of the base-year network, currently referred to as the 1993 base-year network, with base-year traffic volumes. The base-year network uses the 1990 socio-economic census data and the 1993 network data. The second scenario consists of the existing network with existing or most recent traffic volumes. The third scenario consists of a horizon-year network made up of the existing network and a committed network assigned with the horizon-year traffic.

Congestion may be identified on individual network links or sections, at intersections, and on interchanges. The first scenario will be needed to establish the base-year congestion levels for forecasting and comparison purposes. The base-year network is the only network for which ADT is available and were used to validate the transportation demand model. It is helpful to note that validation of the transportation demand model, as opposed to calibration of the model, involves the process of making a comparison between the model output values (the assignments) and real data collected from the field, such as traffic or ridership counts.

The various scenarios described above are summarized as follows:

1. First Scenario: Base-year network with base-year traffic volumes
2. Second Scenario: Existing network with existing or recent traffic volumes
3. Third Scenario: Horizon-year network with horizon-year traffic

Identifying existing systemwide traffic congestion or predicting recurring traffic congestion anywhere on the entire road network relies on the use of transportation models and the proper processing and interpretation of their outputs. Modeling of the transportation network encompasses the entire five-county region. Testing the feasibility or effectiveness of one or more of the traffic congestion management strategies requires incorporating such strategies into the transportation model.

The CMAQ5A model, a computerized post-processing sub-routine developed by ODOT, breaks down two-directional, 24-hour traffic volumes into one-directional hourly volumes and calculates v/c ratios. Although this model will not be the only tool to use for identifying congestion problems, it will be used to quantify congestion on a system-wide level. TRANPLAN assignment outputs will be used as input into the CMAQ5A model after the CMAQSA parameters have been adjusted to reflect conditions in the NOACA region. Supplemental data, gathered or derived, such as traffic volumes, travel time and delay studies, level-of-service, and transit capacity may be produced from off-line models and techniques.

CHAPTER 6

NOACA'S AREAWIDE CMS ROAD NETWORK

The CMS road Network is one of the principal components of the CMS Manual of Practice. Defining it is critical for the establishment, implementation and administration of NOACA's Congestion Management System. The network covers NOACA's entire five-county area and is the foundation upon which the Congestion Management System will be established. A separately bound large map of the NOACA region CMS Network, Figure 6-0, will be included in this Manual of Practice and made a part of it. Individual maps showing the part of the CMS Network within each county of the NOACA area are included in this manual in Figures 6-1, 6-1A, 6-2, 6-3, 6-4, and 6-5.

The road network consists of roadways that are governed by one or more of the following criteria:

1. All roadways included in the National Highway System (NHS);
2. All roadways classified as principal arterials in the Federal Functional Classification System;
3. Roadways programmed for capacity addition in the most current and most recently approved Transportation Improvement Program (TIP);
4. Roadways in NOACA's Long Range Transportation Plan recommended for the addition of general purpose lanes;
5. Roadways in the NOACA region identified by NOACA or any local member community, by means of a traffic study, as operating at Level-of-Service E or below;
6. Roadways forecast to experience congestion, identified through NOACA's congestion management reports, recommended by NOACA's Technical Advisory Committee and approved by the NOACA Governing Board;
7. Roadways, or segments thereof, needed to provide continuity of the CMS Network;
8. Roadways serving major or critical activity centers and intermodal facilities; and
9. Roadways that carry one or more main bus routes and are known as or said to be bus route(s) 'trunk.'

FIGURE 6-0 THE NOACA AREA CMS ROADS NETWORK

Second Edition, September 2002

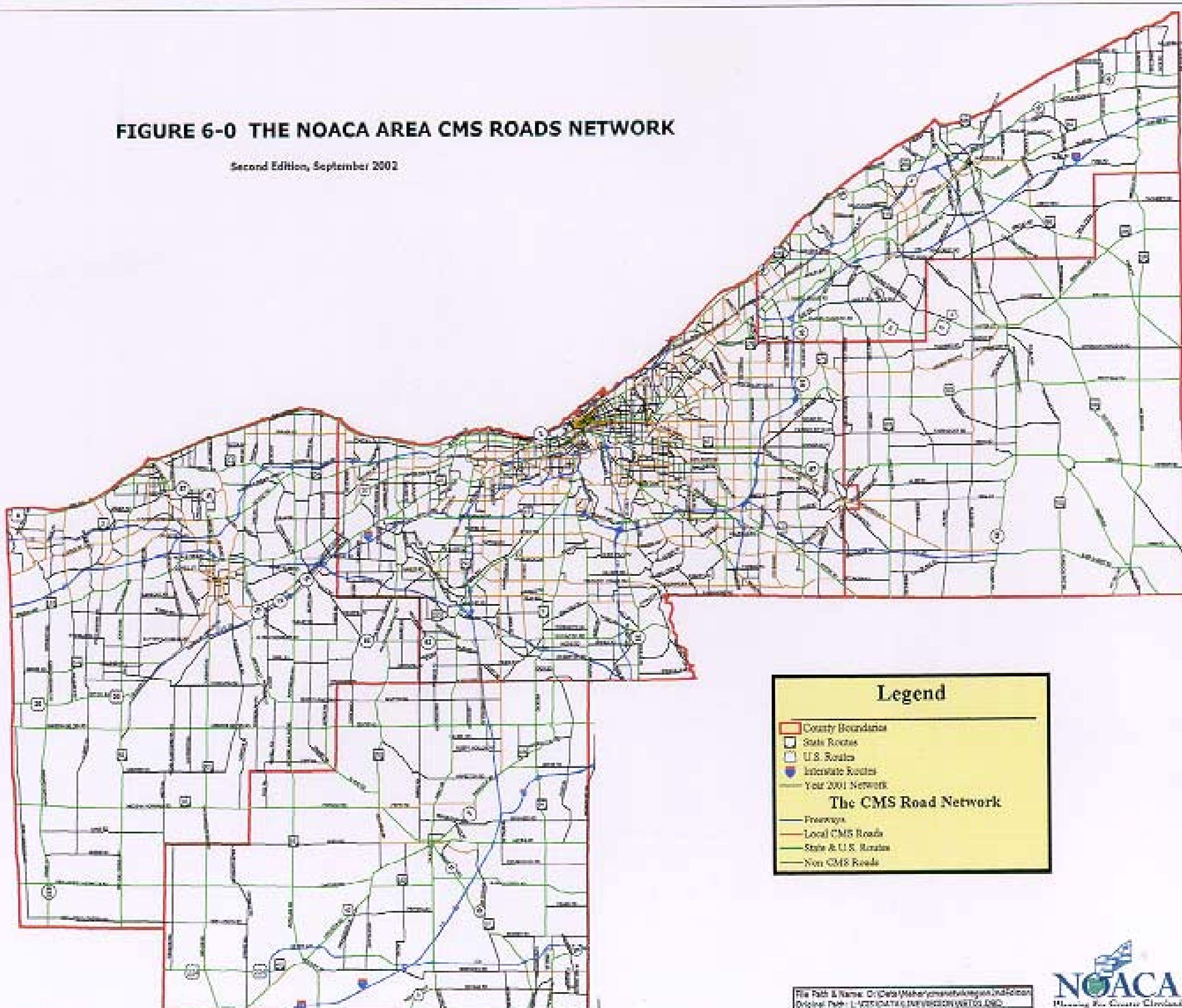


Figure 6-1 Cuyahoga County CMS Network

Second Edition, September 2003

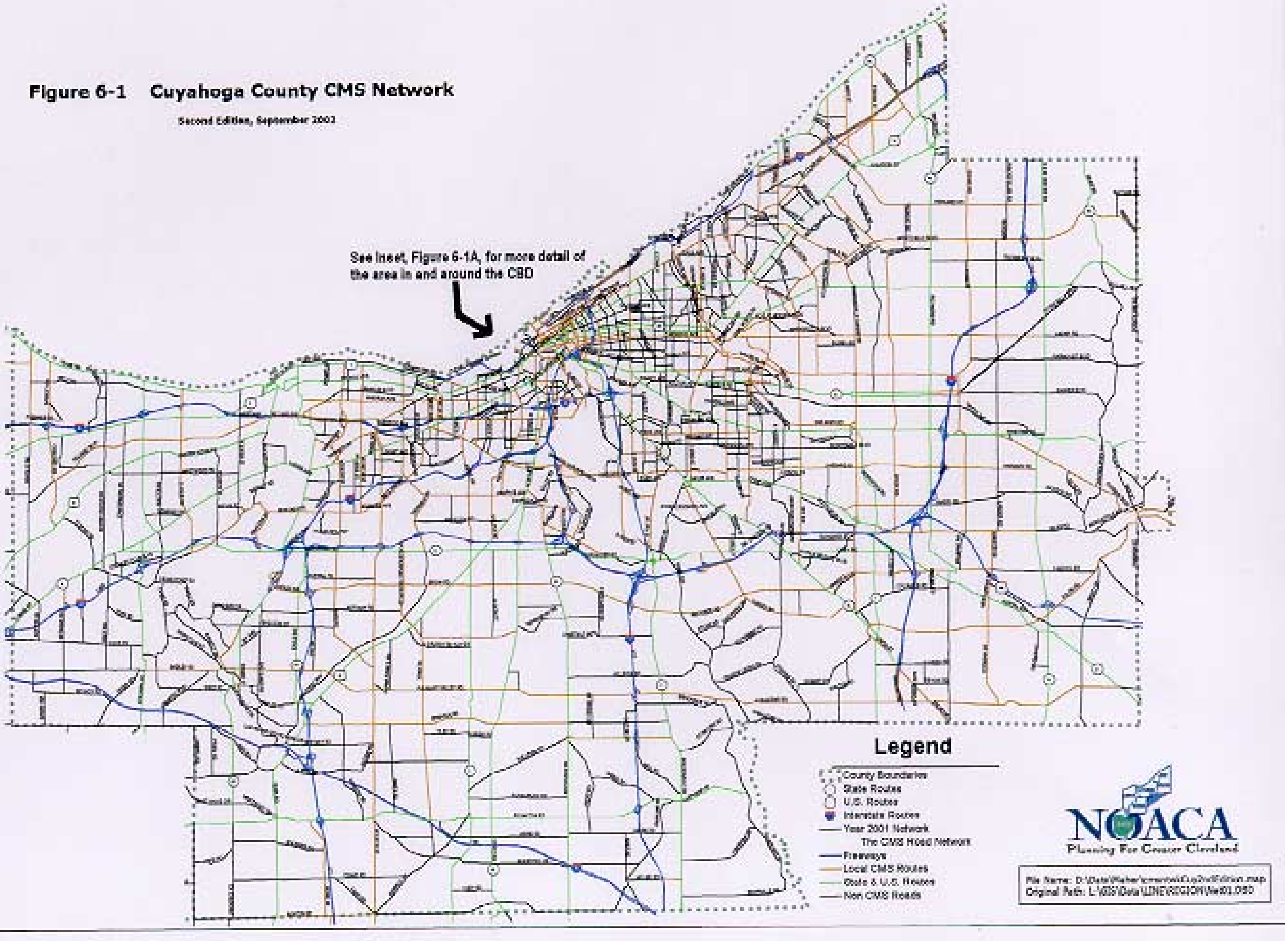


Figure 6-2 Lake County CMS Network

Second Edition, September 2002

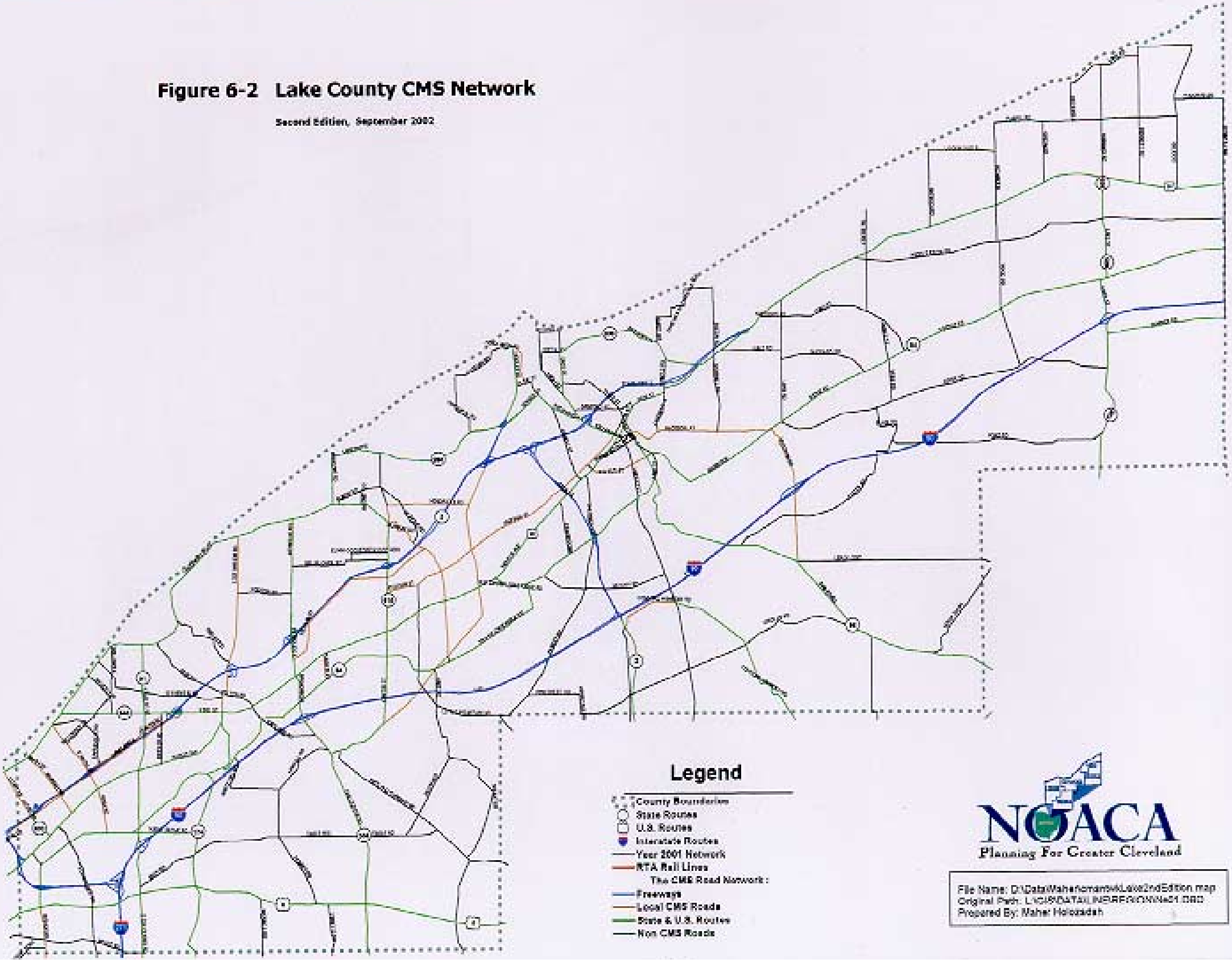


Figure 6-3 Geauga County CMS Network

Second Edition, September 2002

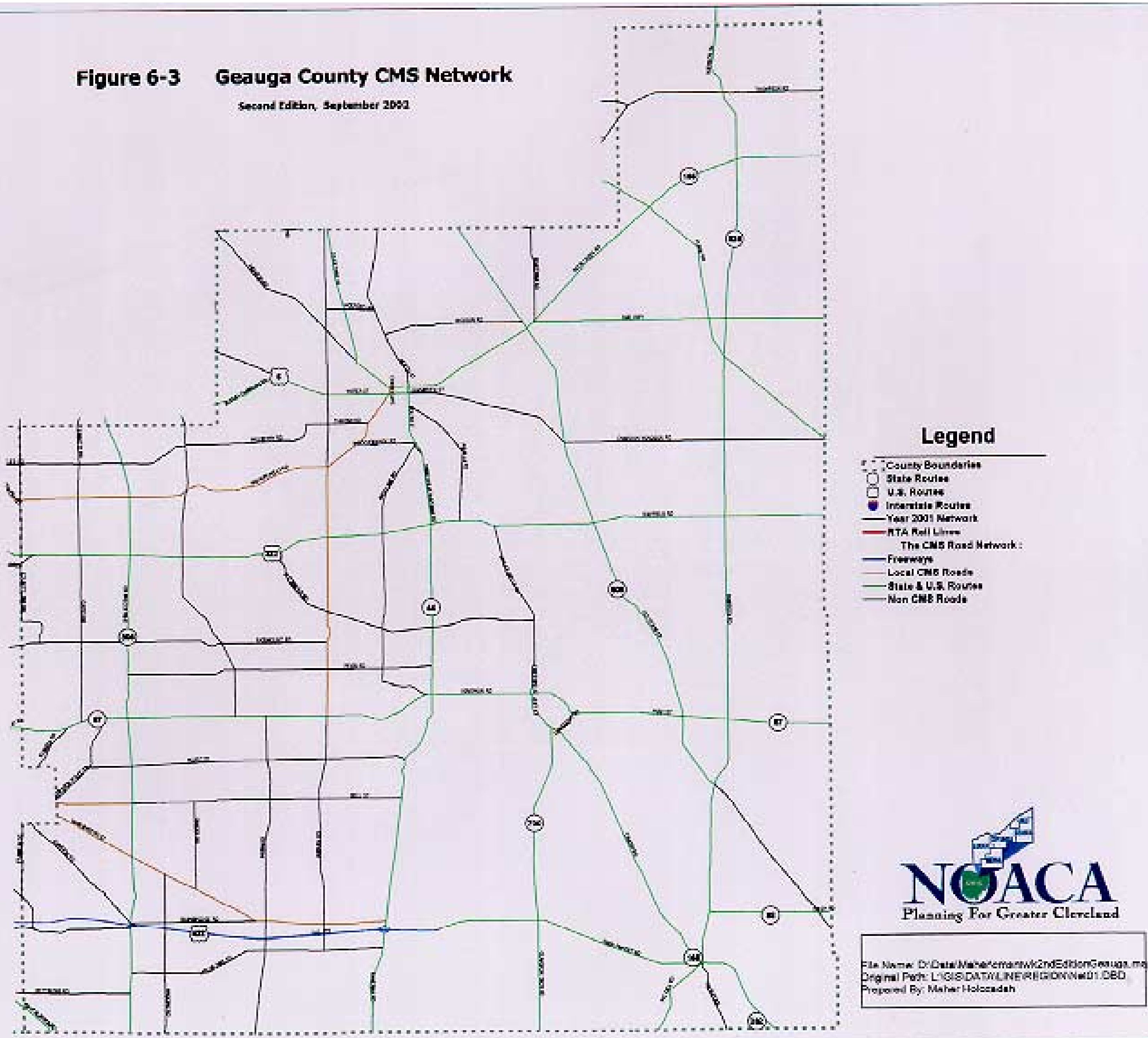
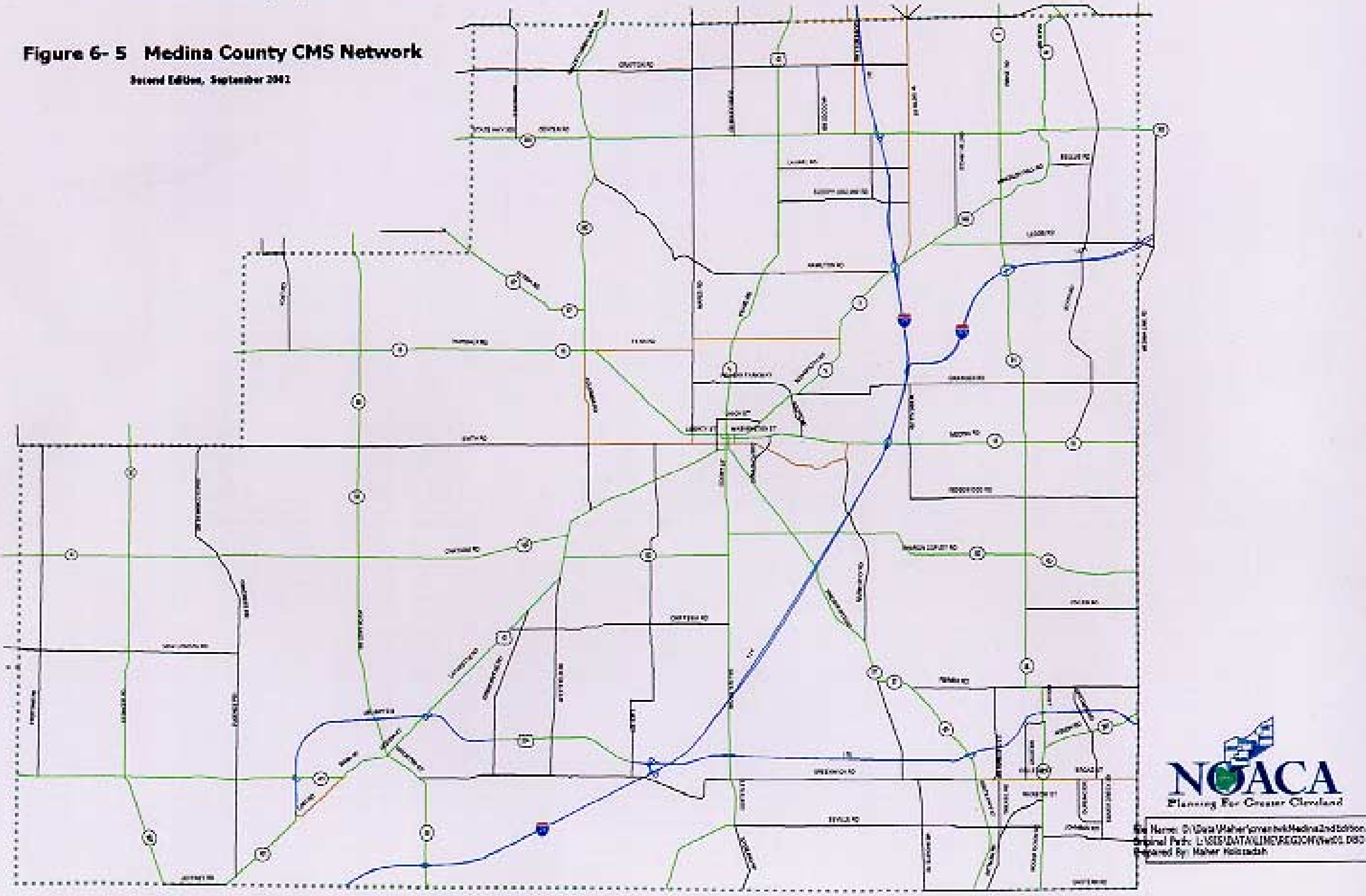


Figure 6-4 Lorain County CMS Network

Second Edition, September 2001

Figure 6- 5 Medina County CMS Network

Second Edition, September 2001



The CMS road network as governed by the afore mentioned criteria encompasses the following types of roadways: (1) interstate routes; (2) U.S. routes; (3) state routes; (4) county routes; (5) township roads; and (6) municipal streets. Table 6-1, below, shows the number of individual routes by name designation and their total center-line length. The CMS road network contains NOACA's portion of the National Highway System (NHS) which represents about twenty percent (20%) of the network. Tables 6-2 and 6-3 provide detailed descriptions of the composition of the NHS within the NOACA region.

TABLE 6-1

Type of Roadway	Number of Routes by Name Designation	Length in Miles
Interstate Routes (mainline)	9	245
Freeway Ramps	Not available	158
US Routes	7	290
State Routes	50	895
County Roads, Township Roads and Municipal Streets (Local)	Not Available	652
TOTAL	Not Available	2,240

TABLE 6-2

COMPOSITION OF THE NATIONAL HIGHWAY SYSTEM WITHIN THE NOACA AREA

ROUTE	COUNTY	MILES	DESCRIPTION
I-71	Medina	26.68	Wayne Co. Line to Cuyahoga Co. Line
	Cuyahoga	19.12	Medina Co. Line to I-90
I-76	Medina	12.03	I-71 to Summit Co. Line
I-77	Cuyahoga	15.97	Summit Co. Line to I-90
I-80	Lorain	20.80	Ohio Turnpike: Erie Co. Line to Cuyahoga Co. Line
	Cuyahoga	18.90	Ohio Turnpike: Lorain Co. Line to Summit Co. Line
I-90	Lorain	13.85	Ohio Turnpike to Cuyahoga Co. Line
	Cuyahoga	30.20	Lorain Co. Line to Lake Co. Line
	Lake	29.21	Cuyahoga Co. Line to Ashtabula Co. Line
I-271	Medina	6.58	I-71 to Summit Co. Line
	Cuyahoga	16.65	Summit Co. Line to Lake Co. Line
	Lake	1.75	Cuyahoga Co. Line to I-90
I-480	Lorain	2.17	Ohio Turnpike I-80 to Cuyahoga Co. Line
	Cuyahoga	26.39	Lorain Co. Line to I-271 (break
	Cuyahoga	0.42	(Resume) I-271 to Summit Co. Line
I-480N	Cuyahoga	2.07	I-480 to I-271
I-490	Cuyahoga	2.43	I-90 to E. 55th St.
US-6	Lorain	0.47	Erie Avenue: Broadway SR-57 to Colorado Avenue/ Port of Lorain
	Cuyahoga	0.48	West Memorial Shoreway: Herman Avenue Ramps to W. 25th Street Ramps
US-6A	Cuyahoga	0.79	Detroit Avenue: W. 49th Street to W. 25th Street
US-20	Lorain	15.92	Via Oberlin-Norwalk Road, Kipton East Road and New Freeway: Huron Co. Line to the SR-10/SR-57 Junction
US-224/US-42	Medina	15.97	Ashland Co. Line to I-71/I-76 Junction with Overlap on US-42 West and North of Lodi

TABLE 6-2 Continued

COMPOSITION OF THE NATIONAL HIGHWAY SYSTEM WITHIN THE NOACA AREA

ROUTE	COUNTY	MILES	DESCRIPTION
US-422	Cuyahoga	7.01	Freeway: I-480N/I-271 Junction to Geauga Co. Line
	Geauga	19.49	Via Freeway and Main Market Road: Cuyahoga Co. Line to Portage Co. Line
SR-2	Lorain	11.14	Freeway: Erie Co. Line to I-90
	Cuyahoga	3.25	Memorial Shoreway: US-6 (Ramp to W. 25th St.) to I-90 (Break)
	Cuyahoga	0.55	(Resume) I-90 to Lake Co. Line
	Lake	13.54	Cuyahoga Co. Line to SR-44
SR-10	Lorain	5.77	Freeway: US-20/SR-57 Junction to I-480
SR-18	Lorain	13.96	Huron Co. Line to Medina Co. Line
	Medina	21.13	Lorain Co. Line to Summit Co. Line
SR-43	Geauga	0.94	Aurora Rd.: Portage Co. Line to Cuyahoga Co. Line
	Cuyahoga	3.08	Aurora Rd.: Geauga Co. Line to SR-91 SOM Center Road
SR-44	Geauga	19.34	US-422 to Lake Co. Line with overlap on US-6 and US-6DA in Chardon
	Lake	6.20	Geauga Co. Line to SR-2
	Lake	2.43	Heisley Rd.: SR-2 to Headlands Rd.
SR-57	Lorain	1.81	Broadway: E. 28th Street to US-6 Erie Avenue
SR-91	Cuyahoga	0.67	SOM Center Road: SR-43 Aurora Road to US-422
	Lake	2.43	SOM Center Road: I-90 to SR-2
SR-176F	Cuyahoga	3.81	Jennings Freeway: I-480 to I-71
SR-237	Cuyahoga	1.69	Airport Freeway: Hopkins Airport to I-480
SR-252	Cuyahoga	4.45	Via Great Northern Blvd., Lorain Road and Columbia Road: I-480 to I-90
E. 9th St	Cuyahoga	1.20	I-90 Innerbelt Freeway to SR-2 Memorial Shoreway
W. 49th St	Cuyahoga	0.13	US-6A Detroit Avenue to Herman Avenue
Herman Ave	Cuyahoga	0.17	W. 49th Street to US-6 Memorial Shoreway

TABLE 6-2 Continued

COMPOSITION OF THE NATIONAL HIGHWAY SYSTEM WITHIN THE NOACA AREA

ROUTE	COUNTY	MILES	DESCRIPTION
Middle Ridge	Lorain	0.62	CR-32: SR-2 to Cooper Foster Park Road
CR-202 and Broadway	Lorain	1.87	Cooper Foster Park Road to E. 28th Street SR-57

TABLE 6-3

The NOACA Area NHS Length in Each Political Jurisdiction

County	Length in Miles	Remarks
Cuyahoga	159.43	The Interstate, U.S. and state routes represent most of the NHS miles in the NOACA area. They comprise 421.54 miles out of the 425.53 miles that make up the area's portion of the National Highway System. County roads comprise 1.72 miles and municipal streets comprise 2.27 miles.
Lorain	88.38	
Medina	82.39	
Lake	55.56	
Geauga	39.77	
Areawide Total	425.53	
Statewide Total	4328.11	

CHAPTER 7

MEASURES OF PERFORMANCE

The requirement of ISTEA of 1991 to develop and implement a congestion management system has altered the way longstanding transportation system measures of performance are viewed. Under ISTEA and later TEA 21 it is not only necessary to assess the performance of the transportation system. It is but also necessary to measure how effectively congestion will be managed.

Although traditional measures of performance such as volume-to-capacity (v/c) ratio and level-of-service (LOS) are relevant for assessing the performance of the transportation system in terms of the mobility of vehicular traffic, they are not appropriate for measuring the mobility of people and goods. Therefore, more diverse and appropriate measures of performance must be considered to evaluate the overall performance of the transportation system as a whole and not just specific facilities or locations. Table 7-1 lists measures of performance appropriate for assessing the roadway network. These measures of performance, grouped in Table 7-2 according to their applicability, can be used to identify or determine congestion in metropolitan areas and on components of the CMS road network. They can also be used to determine the effectiveness of appropriate regional or facility-specific congestion mitigation and mobility enhancement strategies.

The purpose of using measures of performance is to provide a means to determine how well the transportation system is performing based on generally or locally accepted thresholds given to such measures of performance. Threshold values, quantitative where applicable and qualitative where necessary, serve as benchmarks that are accepted by general consensus by public officials for all measures of performance. They serve as explicit indicators of deficiencies or "problems" in the transportation system.

While level-of-service is the most commonly used measure of performance to expose the degree of vehicular traffic congestion, it is nonetheless location-specific. Another measure of performance developed by the Texas Transportation Institute and proposed by ODOT for the quantification of congestion in an area is the "Congestion Index." The Congestion Index provides an indication of how well a roadway network in any metropolitan area, such as NOACA's, is performing when compared with roadway networks in other areas. The Congestion Index gauges the effectiveness of congestion management strategies that are designed to reduce VMT regardless of whether they are implemented regionwide or just within a particular corridor.

Travel time-based and delay-based measures of performance are the two best measures of performance. Delay, expressed in terms of the difference between "free flow" (desired) travel time and "actual" travel time, is considered a good measure of congestion, even though it does not pinpoint the specific causes of congestion. Travel time is a widely used measure of performance because both highway and transit users generally understand it, as shorter travel time indicates less congestion.

TABLE 7-1

MEASURES OF PERFORMANCE
APPROPRIATE FOR EVALUATING THE ROAD NETWORK

Travel Time-Based Measures of Performance

1. Average travel speed (in mph on a roadway or segment of a roadway)
2. Average travel time (in minutes between two specific points on a roadway)
3. Average travel rate (in minutes per mile on any specific roadway)
4. Travel time contours (in minutes measured on roadways starting from a concentric point, such as a core area, to each contour ring)
5. Origin-Destination travel time (in minutes)
6. Percent travel time under delay conditions (travel time under delay conditions minus travel time under non-delay conditions divided by travel time under delay conditions times 100%)

Volume-Based Measures of Performance

1. Volume per lane (number of vehicles per hour, or per day, per lane)
2. Ratio of traffic volume to roadway capacity (v/c ratio)

Index-Based Measures of Performance

1. Congestion Index (An Index developed by the Texas Transportation Institute and suggested by ODOT for use to compare the magnitude of congestion in various metropolitan areas within or outside the State)

$$CI = \frac{[(\text{Fwy. VMT})^2/\text{Fwy Lane-Miles}] + [(\text{Art. VMT})^2/\text{Art. Lane-Miles}]}{(13{,}000 \times \text{Fwy. VMT}) + (5000 \times \text{Art. VMT})}$$

Delay-Based Measures of Performance

1. Vehicle hours of delay
2. Person hours of delay
3. Vehicle hours of delay per Lane Mile
4. Vehicle hours of delay per vehicle mile traveled
5. Vehicle hours of delay per Incident
6. Total vehicle hours of delay (total delay, in vehicle-hours, due to recurring or non-recurring congestion)

Level-of-Service-Based Measures of Performance

1. Lane-miles at LOS "X" or below
2. Vehicle-miles traveled (VMT) at LOS "X" or below
3. Intersection LOS “X” or below
4. Number of congested intersections (number of intersections at LOS “X” or below)
5. Duration, in minutes, of Operation at LOS “X” or below (Duration of Congestion in minutes)

TABLE 7-2

MEASURES OF PERFORMANCE GROUPED BY THEIR RESPECTIVE APPROPRIATENESS

	Type Of Area Or Facility To Be Studied	
	Metropolitan Areas	**Highway Corridors and other Components of the CMS Road Network**
Appropriate Measures of Performance	1. Congestion Index 2. VMT at LOS "X" 3. Origin-Destination Travel Time 4. Vehicle Hours of Delay per Vehicle Mile Traveled 5. Total Vehicle Hours of Delay 6. Number of Intersections Operating at LOS "X" 7. Duration at LOS "X" or below	1. Average Travel Speed 2. Average Travel Rate 3. Percent of Travel Time during Delay Conditions 4. Volume per Lane 5. V/C Ratio 6. Vehicle Hours of Delay 7. Total Vehicle Hours of Delay 8. LOS "X" or below

Remarks

- LOS "X" is any Level of Service, accepted locally, that represents the least acceptable level of performance (the minimum threshold) for any transportation facility. In the NOACA region, LOS "D" in urbanized areas will be considered acceptable. While decision-makers and public officials will strive to achieve LOS "C" or better, LOS "D" will be deemed satisfactory when there are no possible or reasonable alternative solutions. Parameters for reasonable solutions include cost, design and construction constraints, environmental and social impacts, availability of funds, and economic impact.
- For purposes of running the Transportation Demand Model, NOACA calculates capacity for LOS "C". All capacities input into the TDM were calculated based on LOS 'C'. The V/C ratio thresholds indicating the level of congestion are:
  V/C ≤ 1.0 indicates no congestion.
  V/C ≥1.01 <1.25 indicates moderate congestion.
  V/C ≥1.25 indicates severe congestion.
- For signalized intersections, LOS will be used as a measure of spot congestion defined in terms of average stopped delay per vehicle for a 15-minute analysis period. Stopped delay, based on traffic volumes by turn movement, is dependent on a number of variables including the quality of progression, cycle length, green ratio and the v/c ratio for each approach at the intersection. Measuring congestion using only stopped delay as a measure of performance is not recommended. Level of Service designations and their threshold values for signalized intersections are shown in Table 7-3.
- For arterial streets, LOS is based on average travel speed. Average travel speed is calculated based on running time on the arterial segment and delay at intersection approach. Level of Service designations and their thresholds for urban and suburban arterials are shown in Table 7-4.
- For freeway segments, the Highway Capacity Manual (HCM) classifies freeway LOS based on vehicular density per mile per lane. Level of Service designations and associated threshold values for basic freeway segments are shown in Table 7-5.
- Because speed is a major indicator of service quality, NOACA attempted to describe the level of congestion on freeways in terms of travel speed. Table 7-6 contains a NOACA-developed matrix showing a range of travel speeds associated with perceived degrees of congestion.

Table 7-3
LOS Designation and Threshold Values for Signalized Intersections

Level of Service	A	B	C	D	E	F
Control Delay per vehicle (in sec.)	≤ 10	> 10 ≤ 20	>20 ≤ 35	>35 ≤ 55	>55 ≤ 80	>80.0

Exhibit 16-2, page 16-2 HCM 2000

Table 7-4
LOS Designation and Threshold Values for Urban and Suburban Arterials

Arterial Class	Range of free flow speeds (mph)	Typical free flow speed (mph)	Level of Service and Associated Average Travel Speed					
			A	B	C	D	E	F
I	45 - 55	50	>42	>34-42	>27-34	>21-27	>16-21	<16
II	35 - 45	40	>35	>28-35	>22-28	>17-22	>13-17	<13
III	30 - 35	35	>30	>24-30	>18-24	>14-18	>10-14	<10
IV	25 - 35	30	>25	>19-25	>13-19	>9-13	>7-9	< 7

Exhibit 15-2, page 15-3 HCM, 2000

Table 7-5
LOS Designation and Threshold Values for Basic Freeway Segments

Level of Service Designation	Density Range (pc/mi/ln)
A	0 –11
B	>11 – 18
C	>18 – 26
D	>26– 35
E	>35 – 45
F	> 45

Summary Table, page 23-3 HCM 2000

Table 7-6
Degree of Congestion Relative to Range of Travel Speed on Freeways

Range of Travel Speed	Degree of Congestion on Freeways
≥ 60 mph	No Congestion
<60 – 55 mph	Minor Congestion
<55 – 40 mph	Moderate Congestion
<40	Heavy Congestion (Below the minimum speed limit)
Remarks This table was derived from NOACA’s travel time studies and field observations made during data collection field trips.	

CHAPTER 8

DATA COLLECTION AND MONITORING OF THE TRANSPORTATION SYSTEM AND IMPLEMENTED CONGESTION MANAGEMENT STRATEGIES

The CMS will require a continuous program of traffic data collection to identify and monitor system problems, identify system needs, analyze alternative solutions, and measure the effectiveness of implemented congestion management strategies or actions. NOACA currently obtains the majority of its data needs from the Ohio Department of Transportation (ODOT). NOACA also obtains data from city and county engineers and collects data on a case-by-case basis or project-by-project as needed. Identification of congestion on NOACA's CMS Transportation Network, in a systematic and objective manner, will mean collecting a large amount of data and conducting of extensive analyses to quantify the measures of performance.

A matrix of data collection techniques used for collecting data needed for select measures of performance to support NOACA's Congestion Management System is presented in Table 8-1. The matrix aggregates these data collection techniques into groups relative to the following five purposes:

1. Travel time estimation;
2. Density calculation;
3. Data for monitoring traffic flow;
4. General purpose data; and
5. Data for travel pattern determination.

TABLE 8-1

Matrix of Suitable Techniques for the Collection of Data for Select Measures of Performance

		Measure of Performance					
Purpose	**Data Collection/Acquisition Techniques**	**Travel Time**	**Traffic Volume**	**Delay**	**LOS**	**Vehicle Occupancy**	**The Movement of Goods byTruck**
Travel Time Estimation							
	Floating Vehicle	•	-	θ	o	-	o
	License Plate Matching	•	-	-	-	-	θ
	Cellular Telephone Reporting	θ	-	o	-	-	-
	Vehicle Detection Systems	•	•	-	-	-	-
	Automated Vehicle Identification	o	-	-	-	-	•
	Global Positioning	θ	-	-	-	-	•
Density							
	Aerial Photography (visual inspection)	θ	-	-	-	-	-
	Satellite Photography (visual inspection)	θ	-	-	-	-	-
	Video Surveillance (visual inspection)	θ	o	-	-	o	-
	Motorist Information Systems	o	•	-	-	-	-
	Traffic Volume Counts	-	•	θ	•	-	-
Monitoring of Traffic Flow							
	Instrumented Vehicles	•	-	o	-	-	•
	Probe Vehicles	•	-	-	-	-	o
	Video Surveillance	θ	o	-	-	o	-
	Motorist Information Systems	o	θ	-	-	-	o
	Cellular Telephone Reporting	θ	-	-	-	-	θ
	IVHS/ATMS	θ	θ	-	-	-	θ
	Traffic Operations and Control Systems	•	θ	-	-	-	-
	Vehicle Detection Systems	θ	•	-	-	-	-
	Aerial Observation Traffic Reporting	-	-	-	-	-	-
Collection of General Purpose Data							
	Transit Ridership Counts	o	•	-	-	•	-
	Highway Performance Monitoring System	•	•	-	θ	•	•
	Cordon/Screenline Counts	-	•	-	-	•	•
	Traffic Volume Counts	-	•	θ	•	-	•
Determination of Travel Patterns							
	Travel Demand Models	θ	θ	o	θ	θ	θ
	Panel Surveys	-	-	-	-	-	θ
	Travel Diaries	o	-	θ	-	-	θ

• Strongly Related θ Moderately Related o Poorly Related - Not Related

The matrix also describes, using one of the following four rankings, how closely each data collection technique relates to each select CMS measure of performance:
1) strongly related; 2) moderately related; 3) poorly related; and 4) not related at all.

Data collection and traffic monitoring to support NOACA's CMS should be done in coordination and cooperation with ODOT, local public agencies, private agencies and the area's transit operators in order to determine the following variables:

1. Type of data to be collected;
2. Frequency of data collection;
3. Data collection locations;
4. Data collection responsibility;
5. Data processing and analysis techniques;
6. Database management requirements;
7. Resources and costs associated with data collection;
8. Type of data to be maintained, shared, and stored; and
9. Real-time data collection to support incident management and ITS.

Agencies other than NOACA involved in gathering, processing, banking, and disseminating traffic data include ODOT, county engineers and city engineers. ODOT, for example, is responsible for collecting traffic data on state, interstate, and U.S. Routes. Traffic volume and vehicle classification data are collected by ODOT at regular intervals at pre-established countstations. The Cuyahoga County Engineer has traditionally collected traffic data (volume and vehicle classification) on a three-year cycle for most of Cuyahoga County's road network. NOACA may obtain such data when it requests it on a need basis. NOACA, however, will collect its own data for the part of the CMS transportation network that is not covered by any of the above-described agencies. NOACA will rely on the transit agencies to collect and provide data such as load factors, transit coverage areas, frequency of service and population served. This data will be needed to assess the operation of the transit systems within the CMS transportation network.

CHAPTER 9

CONGESTION MANAGEMENT AND MOBILITY ENHANCEMENT STRATEGIES

NOACA's CMS Manual of Practice provides a means to assess system performance based on pre-established measures of performance and the identification of areas that experience or will likely experience congestion. It also provides a means for the selection, implementation and evaluation of traditional and nontraditional congestion management strategies to provide a more efficient transportation system. In all application areas, priority shall be given to cost-effective strategies that will improve the efficiency of the existing transportation system without expanding its physical capacity. Table 9-1 lists various types of congestion management strategies and their implementation methods, implementation time frame, applicable areas of implementation, the range of their capital and operating costs, an estimate of expected congestion relief, and a range of their cost-effectiveness. The congestion management and mobility enhancement strategies suggested in this manual for consideration to improve the transportation system are:

1. Transportation Demand Management (TDM) Measures;
2. Roadway System Operational Improvements;
3. High Occupancy Vehicle (HOV) Facilities;
4. Public Transit System Capital Improvements;
5. Public Transit System Operational Improvements;
6. Nontraditional Modes of Transportation;
7. Congestion Pricing;
8. Growth Management;
9. Access Management;
10. Incident Management;
11. Intelligent Transportation Systems (ITS);
12. Designation of Alternate Relief Routes; and
13. Capacity Addition by providing new General-Purpose Lanes.

TABLE 9-1
TYPE OF CONGESTION MANAGEMENT STRATEGIES AND THEIR METHODS OF IMPLEMENTATION, AREA OF APPLICATION, RANGE OF CAPITAL & OPERATING COSTS, AND LEVEL OF EFFECTIVENESS

Type of Strategy	Method of Implementation	Implementation Time Frame	Area of Application	Capital Cost	Operating Cost	Expected Congestion Relief	Cost-Effectiveness
TDM	Ridesharing	S	A/S/P	L	M	M	M-H
	Incentives/Disincentives	S-M	A/S/P	L	M	M-H	M-H
	Alternative Work Arrangements and Work Hour Schedules	S	S/P	L	L	M-H	H
HOV	HOV Lane Priority	M-L	C	H	M	L	L
	HOV Signal Priority	S	S/C	M	M	L	M
	HOV Access Priority	M	C/P	M	M	L	L-M
	HOV Support Facilities and Services	S-M	C/P	L-M	L-M	L	M
Transit Improvements	Transit Routing	S	C	M	H	L-M	M
	Transit Service Quality	S	A	M	H	L-M	M
	Transit Coordination/Marketing/Promotion	S	A/S	L	L-M	L-M	M-H
	Commuter Rail	L	A/C	H	H	L	L
Congestion Pricing	Levy Surcharges through Toll Gates, and by using automatic vehicle identification systems	M	A	L	L	H	H
	Parking costs and time restrictions	M	S/C	L	M	M/H	H
Growth Mgmt.	Land Use Policies/Regulations	L	A/S	L-M	M	M	M
	Design Standards	M	A/S	L-M	M	L-M	M
	Location of Jobs and Housing Stocks	L	A/S	L	L	M	M
Road System Operational Improvements	Traffic Signal Improvements	S	S/C/P	L	L-M	M	H
	Highway Geometric Improvements	M	S/C/P	M	M	M-H	H
	Traffic Operational Improvements	S-M	S/C/P	M	L-M	M	H
Access Mgmt.	Driveway Siting and Control	S-M	C	L-M	L	M	H
	Median Control	S-M	C	M	L	M	H
Incident Mgmt.		S-M	C	M	M	L-M	M
	Detection	S	S/C	L	M-H	H	M-H
	Response	S	S/C	L	M-H	H	M-H
	Clearance	S-M	S/C	M	M	L-M	M
	Real Time Commuter Information/Re-Routing or Use of Alternate Routes						
ITS/IVHS	Traffic Management	M	S/C	M	H	M	M
	Transit/TDM Activities Improvements	M	S/C	M	M	L-M	M
	Traveler Information	M	A/S/C	M	L	L-M	L-M
General Purpose Lanes	Freeway Lanes	L	C	H	L	H	M
	Arterial Lanes	L	C	H	L	H	M
	Intersection Widening and Channelization	S/M	P	M	L	H	H
Non-Traditional Modes of Transportation	Bike Lanes and Bikeways	S	S/C	L	L	L	H

Key:

Implementation Time Frame	S = Short	M = Medium	L = Long	
Capital Cost	L = Low	M = Medium	H = High	
Operating Cost	L = Low	M = Medium	H = High	
Congestion Relief	L = Low	M = Medium	H = High	
Cost-Effectiveness	L = Low	M = Medium	H = High	
Area of Application	A = Areawide	S = Subarea	C = Corridor	P = Spot

1. Transportation Demand Management:

Transportation demand management (TDM) consists of actions and programs designed to reduce travel demand on the transportation system. These actions and programs include carpooling, vanpooling, alternative work hours, telecommuting and parking management. NOACA currently uses several transportation demand management methods to reduce the demand on the transportation system. Within NOACA, these measures are administered under the reverse commute/job access/TMA assistance Program.

The major elements of the reverse commute/job access/TMA assistance Program as currently administered by NOACA are described as follows:

A) *RIDESHARE! Program:* The RIDESHARE Program promotes of carpools and vanpools.

Carpools

The RIDESHARE! carpool program is a free ride-matching assistance service to encourage the region's citizens to change their commuting habits by enabling them to share their daily work trip with others traveling in the same direction instead of driving alone. The goals of the program include decreasing traffic congestion by reducing the number of vehicles on the roads, improving air quality by reducing vehicle emissions, and conserving energy and natural resources. By calling 1-800-825-RIDE, commuters can register their home-to-work information with RIDESHARE and find out if there are other people living nearby with whom they may be able to share a ride. RIDESHARE provides new registrants with a number of possible carpool matches generated by the computer to provide for a greater potential of finding carpool partners. Commuters can then choose whom they want to carpool with from RIDESHARE list.

Vanpools

For commuters that must travel long distances to work, a vanpool may be a cost effective mode. Staff help groups of seven to fifteen people who share similar commute patterns or schedules to form a vanpool. RIDESHARE staff assist the group by coordinating with a third party leasing agent, scheduling pick up and drop off points and times, and recruiting a vanpool driver. Vanpooling is beneficial for employees who live and work in the same general area. One vanpool eliminates about 14 cars from rush hour traffic.

B) Guaranteed Ride Home Program

To further encourage commuters to consider ridesharing as an alternative means of travel, NOACA developed and established the **Guaranteed Ride Home Program** (GRH). It offers persons registered in the computer database who carpool or vanpool a guaranteed ride home in the event of emergency, illness or unexpected overtime that would cause them to miss normal rideshare connections. The Guaranteed Ride Home Program reimburses carpoolers/vanpoolers 80 percent of the cost of the ride home - whether it is in a rental car, taxicab or bus. Ride-sharers may use the program up to four times per year.

C) Work Access Program

NOACA's staff work with transit, social service and employment agencies to establish vanpools to transporting central city residents to job sites inaccessible by public transit. By setting up this transportation service, city residents can search for job opportunities in locations that they might not normally consider for employment.

D) Employer Campaigns

NOACA staff travels to the offices of major employers and business parks to distribute materials, explain the commuter services program and benefits to employees and collect commuter information for car and vanpool ridematching. Staff regularly makes "breakfast break" presentations before the start of the workday to employees interested in ways to minimize traffic congestion, save money on their commute and reduce commute-related stress.

Depending on employers needs, NOACA staff can prepare proposals on various "traffic control measures" that employers may adopt to help reduce traffic congestion, including parking management, flexible or staggered work hours, company-sponsored vanpools and telecommuting.

E) Park-N-Ride or Park-N-Pool Service Areas

Park-and-Ride or Pool Service Areas are facilities located and designed to enhance intermodality. The segregation of travel modes (cars, vans, buses and trains) causes a tremendous strain on the overall transportation system by creating an imbalance in the level of use of each mode. One of many methods used to restore some balance to these transportation modes to increase the efficiency of the entire transportation system is the provision of Park-and Ride areas. They enable access to mass transit, vanpools and carpools. The concept of providing Park-and-Ride areas was born as a result of the need to reduce the overwhelming travel demands on the road system and to reduce environmental pollution. It is recognized that mass transit system works best when it serves areas of high population concentration. Urban sprawl and the prevalence of low-density land use precludes the use of transit as a viable transportation option in many areas. Therefore, the use of Park-and-Ride areas is a surrogate practice to attract a critical mass of commuters to universal locations and link them with convenient, economical and safe transit services or shared ride arrangements.

Planning for transportation has changed over recent years as the focus shifted from constructing new roadways to increasing the efficiency of the existing transportation system. One of the new elements added to the transportation planning process is the development and establishment of a regional congestion management system. As stated earlier, the primary purpose of such system is to increase the efficiency of and protect the investment in the existing transportation system. NOACA's long-range Transportation Plan has evolved. Its objectives are now based more on the need to increase the efficiency of the road network rather than provide additional physical capacity. Several communities in the NOACA region, such as the cities of Euclid, Westlake and Strongsville, have embraced the concept of providing Park-and-Ride areas and have allowed them within their political jurisdictions. A Park-and-Ride area that includes a day care center and a convenience store, for example, has been planned for the Windermere Rapid Transit Station in the City of East Cleveland. These facilities not only help reduce traffic congestion, but also help the transit system flourish.

Area transit agencies, in cooperation with the Ohio Department of Transportation and NOACA staff, determine where Park-N-Ride areas should be located. Appropriately located Park-N-Ride areas provide transit users, carpoolers and vanpoolers with a convenient meeting place where they can safely leave their cars. Commuters can obtain from NOACA a brochure identifying existing Park-N-Ride areas in Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit counties.

F) Transportation Management Associations and Transportation Stores

NOACA's Commuter Services Program encourages businesses to consider planning various congestion-reducing alternatives in cooperation with other businesses and organizations in their general vicinity. The program can help a group of employers in one area to set up a Transportation Management Association (TMA). A group of employers that have formed a TMA can collectively institute and promote transportation control measures, such as preferred parking programs, flexible work hours and vanpooling. NOACA's TMA assistance program offers information and financial assistance to qualified TMAs. NOACA's staff can also help establish a "transportation store" for employers. The store is a centrally-located space where rideshare information and incentives can be distributed to employees. Depending on availability, Commuter Services staff may be available one day a week to answer questions, distribute new material and perform on-site ridematching services.

2. **Roadway Operational Improvements:**

Roadway operational improvements include all improvements, other than the addition of new lanes, made to the roadway system or to a roadway facility, that result in maximizing the service capacity of the system or facility. Operational improvements include, but are not limited to:

- lane widening;
- improved traffic signal timing;
- traffic signal coordination;
- intersection widening and reconfiguration;
- roadway pavement marking and channelization;
- reversible lanes;
- ITS-aided enhancements;
- real-time motorist information systems;
- ramp metering; and
- traffic surveillance and rapid response systems

NOACA provided its member communities with numerous studies, including but not limited to signal timing and coordination studies, intersection improvement studies, accident studies and transportation system performance assessment studies, to help them undertake transportation system improvements.

3. <u>High Occupancy Vehicle (HOV) Facilities:</u>

The use of high occupancy vehicles will be investigated, proposed and promoted where appropriate. High occupancy vehicles (HOVs) include buses, trains, vans and ordinary passenger vehicles carrying two or more passengers. Encouraging and facilitating the use of HOVs as a congestion management strategy serves the mobility needs of commuters and can only be successful if the needed infrastructure is available. The infrastructures and programs needed to promote the use of high occupancy vehicles include, but are not limited to, HOV lanes, HOV ramps and bypass lanes, employer-based trip-reduction programs, guaranteed ride home programs, park-and-ride centers, and signal pre-emption for prioritizing the passage of high occupancy vehicles.

4. <u>Public Transit Capital Improvements:</u>

Public transit capital improvements are projects that are intended to expand the physical capacity of the transit system. They include, but are not limited to, the construction of new rail lines, the purchase of rail cars or buses, the provision of park-and-ride facilities, the construction of new service garages and transit centers, the acquisition and dedication of transit vehicle right-of-way and the provision or expansion of paratransit services.

5. **Public Transit Operational Improvements:**

Operational improvements of the transit system are those which would result in an increase in the service capacity of the system without having to increase its physical capacity. Such improvements are usually not capital-intensive and do not require a large timeframe to implement them. Operational improvements include, but are not limited to, improved scheduling, increased service frequency, addition of new service routes, administrative re-structuring, ITS-aided enhancements, signal pre-emption systems, incentive fare structures and transit information systems.

The public transit network consists all the transit rail lines and all the bus routes. The public transit routes in the NOACA area are operated by the GCRTA, LAKETRAN, Lorain County Transit, Medina County Transit, the Brunswick Transit Alternative and Geauga County Transit. The evaluation of the effect of the transit service may be confined to the transit routes that are common with the CMS road network in order to evaluate the ability of the mass transit service to reduce traffic congestion on such routes.

6. **Non-Traditional Modes of Transportation:**

The primary non-traditional mode of transportation is bicycling. Encouraging the use of bicycles as a mode of transportation will be predicated upon the provision of facilities and conditions that will make such strategy possible. This mode of transportation, however, is severely constrained by the region's climate and weather conditions. Pedestrian facilities and pedestrian-friendly environments could provide a limited alternative to driving.

7. **Congestion Pricing:**

The principal purpose of congestion pricing is to alleviate congestion by means of levying surcharges for the use of certain congested facilities during peak-traffic periods. The expected effect of surcharges is to discourage some trips altogether or to cause some trips to shift to off-peak periods, to other modes of transportation, to higher occupancy vehicles, or to other routes away from the congested facilities. Congestion pricing is also referred to as value pricing.

8. **Growth Management:**

Growth management within the context of the CMS means the introduction and application of control measures by local communities in the region, either individually or collectively, to guide and use and to consciously deliberate the link between land use and the limitations of existing or future transportation infrastructure. Compact land use, for example, that provides transit-receptive or pedestrian-friendly environments should be made a major feature of the architectural and layout design of future developments to mitigate congestion problems. Mixed land uses, as opposed to the practice of segregating land uses, is another growth management tool that will help mitigate congestion as fewer and shorter trips will be made. Levying impact fees, when permitted under state law, will compliment other efforts by local governments to mitigate adverse land use and transportation conditions.

9. **Access Management:**

Access management, known also as access control, is an effective method to minimize and manage congestion. Access management techniques include traffic signal timing and coordination, signal spacing, the use of non-traversable medians, proper spacing of median openings, the proper location, design, and spacing of driveways, the provision of acceleration and deceleration lanes, use of inter-parcel circulation and marginal roads, and the location of bus stops.

Controlling access to or from arterials reduces conflict between turning and through traffic, promotes better traffic movements and reduces the potential for crashes. Access management relies on a variety of access control measures which include, but are not limited to the following:

1. Reduce or separate points of conflicting vehicular movements.
2. Minimize the effect of deceleration by providing deceleration lanes.
3. Segregate turning vehicles from through traffic.
4. Provide proper spacing between signalized intersections and synchronize and coordinate traffic signals to facilitate platoon progression.
5. Provide adequate on-site storage; and
6. Provide adequate room for vehicle maneuvering to accommodate the movement of ingressing and egressing traffic

Implementing access management on existing or new roadways as part of a congestion management system improves traffic operation along the arterials and increases safety within the driving environment.

10. <u>Incident Management:</u>

The degree of effectiveness of any incident management system depends largely on the effectiveness of the means required to initiate and complete the following five essential actions:

1. Incident detection, identification and verification;
2. Determining the nature and extent of the needed response to any incident;
3. Incident site management;
4. Motorist information; and
5. Incident removal.

Some of these actions can take place simultaneously and may be performed iteratively. The initial response to an incident, for example, begins with preliminary information about the incident and then such response may change as the nature of the incident becomes more clearly understood.

Information regarding incident history is elemental in the prediction of potential problems on any particular corridor. The time and frequency of incident occurrence, incident duration, nature of incident and the impact of each incident on traffic flow are important historical information.

Because collecting incident history data is both resource and time-intensive, it is advisable to develop and implement a permanent monitoring system. Permanent monitoring requires the response agency to set up an incident tracking database that will be used to provide for continued evaluation of the incident management system. This database will provide the data needed to make decisions about expanding, reducing or changing the incident management system.

Successful operation of an incident management system depends on the cooperation and mutual understanding of all responsible agencies. This cooperation requires constant communication among the various agencies and ongoing training of all involved personnel. In order for a regional incident management system to function as an effective congestion management strategy, the following three potential impediments must be removed:

1. Jurisdictional limitations;
2. Conditions that prevent the sharing of costs and resources; and
3. Barriers that prevent or impede administrative cooperation and coordination.

Jurisdictional limitations, which are mainly the political boundaries that define the region's various political subdivisions can represent an obstacle which, if not addressed, will impede or prevent the development, establishment and implementation of an effective incident management system. Establishing an autonomous regional incident management apparatus will be the most productive method to implement a successful incident management system. Such an apparatus should be used to address the following jurisdictional and logistical issues:

1. Defining the responsibilities of the teams charged with managing the site of any incident;
2. Establishing intra-agency field communications;
3. Developing a plan for administrative coordination among agencies;
4. Evaluating potential legal liabilities;
5. Forming consensus among agencies; and
6. Accounting for political sensitivities and public expectations.

Sharing costs and resources means identifying available and needed resources, such as equipment, staff and funds, which must be shared in an equitable manner. The costs of developing, implementing and administrating a regional incident management system must be proportionately borne by the participants. Formulating intra-agency working agreements, for example, may be the vehicle to alleviate resource deficiencies in some areas.

Because resource sharing is the most cost-effective way of providing for a regional incident management system, cooperation among agencies and the development of mutual assistance agreements take on added importance.

Administrative cooperation and coordination among agencies is necessary in order to eliminate jurisdictional barriers, determine who should manage the response to an incident, and provide for the sharing of equipment and staff whenever possible. The Road Crewzer program is an ODOT-sponsored incident management program that assists motorists with disabled vehicles along freeways by moving their vehicles to the roadside and performing minor repairs or other assistance. The program is designed to help motorists continue their trips and minimize a vehicle's breakdown time, thereby minimizing the opportunity for congestion. The Road Crewzers patrol the freeways from 6 AM to 7 PM and help manage minor incidents. The 'Road Crewzers' are in constant communication with Metro Traffic (a traffic news reporting agency) and other news media to inform them of disabled vehicles and other incidents in order to broadcast traffic conditions to inform motorists.

11. ITS Technology:

This congestion management and mobility enhancement strategy represents an opportunity to invite or encourage the deployment and acceptance of advanced transportation technology to increase the efficiency of the transportation system. Applying advanced or emerging technologies such as information processing and communications to the surface transportation system enables a more efficient utilization of the region's transportation infrastructure and public agency resources as making better informed decisions or choices about travel and route alternatives become possible. Therefore, successful deployment of ITS technology will result in improvements in safety, mobility and productivity and will reduce the harm to the environmental caused by congestion.

In 1995, a consultant hired by ODOT District-12 Office using FHWA Early Deployment IVHS Funds, prepared an *IVHS Strategic Deployment Plan* for the NOACA region. The plan incorporates IVHS technologies into transportation improvement projects. This plan identifies the various projects that incorporate IVHS applications, their phasing, priorities, costs, and how they will help meet the areas' current and future traffic demands.

The *IVHS Strategic Deployment Plan* for the NOACA region focuses on the expressway and interstate System and the integration of highway and transit management. The plan provides for the following:

1. Identification of regional transportation problems and concerns.

2. Identification of potential IVHS solutions.

3. Coordination of current and future IVHS initiatives.

4. Promotion of interagency cooperation and coordination.

5. Presentation of an implementable program that allows the region to proceed with IVHS deployment in a systematic manner.

The *IVHS Strategic Deployment Plan* is based on the premise that it will be driven by user needs; not just by technology. The plan identifies the user service needs in the region. This was accomplished in part by examining the existing system and identifying problems. Examples of system problems include traffic congestion, high accident locations, lack of institutional coordination and intermodal inefficiencies. Identifying these user service needs allows for establishing a means to achieve user service objectives, such as reduction of congestion, traffic incidents and duration of incidents.

The plan also identifies elements required to support the user service needs and correlates such needs to IVHS technologies. Elements required to support user service needs include the following:

1. Transportation system surveillance;
2. Communications;
3. Traveler interface;
4. Control strategies;
5. Navigation/guidance instruments;
6. Data processing; and
7. In-vehicle sensors.

Agreement on a "Regional Architecture" for the NOACA area remains a requirement before any deployment can be accomplished.

12. Designation of Alternate Relief Routes:

This congestion management strategy involves the identification, selection, improvement and designation of alternate relief routes for motorists to use when any component of the road network breaks down due to excessive traffic demands or due to an incident that requires prolonged closure of the roadway.

13. <u>Addition of General-Purpose Lanes:</u>

Although the congestion management strategies specified in this Manual of Practice are not listed in any order of priority, the addition of physical capacity to a roadway by providing general purpose lanes to increase its traffic-carrying capacity is deemed a solution of last resort. The addition of physical capacity means the addition of lanes or the construction of new facilities. Lane widening is not considered addition of physical capacity but rather a physical improvement to increase the functional capacity of existing facilities.

CHAPTER 10

DEVELOPMENT AND IMPLEMENTATION OF NOACA'S CMS

A number of important players must become involved and should participate in the process of developing and implementing NOACA's congestion management system. Several governmental units and stakeholders in the NOACA region certainly have interests in the design and implementation of an effective CMS. The following organizations and institutions can, individually or collectively, influence the degree of success or failure of any CMS:

1. ODOT and its District-3 and District-12 Offices;
2. County governments;
3. Municipalities;
4. Transit operators;
5. Freight carriers;
6. Air and lake port authorities;
7. Governments of counties and municipalities adjacent to the NOACA region; and
8. Transportation management associations (TMAs), employers, and developers.

It is essential that all parties who have a stake in the policies and actions used to implement NOACA's CMS play an active role in the development of the CMS. This is especially important when congestion is defined by locally accepted thresholds and performance measures. Although NOACA will have the lead role in developing and implementing any CMS in concert with key representatives from the above-mentioned agencies and transportation operators, the formation of two committees, one for technical and the other for policy aspects of the CMS, is highly recommended. The technical committee would have oversight responsibility for tasks required for the development of NOACA's CMS plan. The policy committee, on the other hand, would oversee all aspects of the congestion management planning process pertaining to administration, implementation, financial cooperation, infrastructure preservation and economic development.

Success of NOACA's CMS will be predicated upon the following conditions:

1. Proper definition and adoption of appropriate performance measures and thresholds: A set of evaluation criteria for the assessment of system performance, and congestion management strategies;

2. Identification and adoption of appropriate analysis procedures;

3. Delineation of data collection responsibilities and procedures;

4. Definition of the boundaries of congestion areas;

5. Definition of the road and public transit networks that will be subject to the CMS performance and evaluation standards; and

6. Identification of the CMS implementation methods and responsibilities.

Table 10-1 lists the possible roles and responsibilities of the players involved in the various development and implementation of NOACA's Congestion Management System.

TABLE 10-1

POSSIBLE ROLES OF PARTIES PARTICIPANT IN THE CMS

	Role of Participant			
CMS Activity	**State DOT**	**MPO**	**City, County**	**Transit Operator**
<u>Organizational:</u>				
Provide Forum & Discussion	**P**	**L**	**P**	**P**
Define Boundaries	**C**	**L**	**P**	**P**
Delegate Responsibility	**L**	**P**	**P**	**P**
Bi-Regional Agreements	**L**	**P**	**P**	**P**
<u>Identify Performance Evaluation Standards (performance measures):</u>	**C**	**L**	**P**	**P**
Provide Forum & Conflict Resolution	**P**	**L**	**P**	**P**
Select Measures	**P**	**L**	**P**	**P**
Select Standards (thresholds)				
<u>Define the CMS Network:</u>				
Provide Forum & Discussion	**P**	**L**	**P**	**P**
Establish Criteria	**P**	**L**	**P**	**P**
<u>Data Collection for Monitoring and Performance Evaluation:</u>				
Provide Forum & Discussion	**P**	**L**	**P**	**P**
Identify Data Needs	**P**	**L**	**P**	**P**
Develop Definitions & Submission Protocol	**P**	**L**	**P**	**P**
Define Methodology	**P**	**L**	**P**	**P**
Provide Traffic Counts	**P**	**C**	**P**	**P**
Provide Transit Data	**P**	**C**	**P**	**L**
Perform Baseline Evaluation	**P**	**L**	**P**	**P**
Identify Baseline Deficiencies	**P**	**L**	**P**	**P**
Perform Forecasts	**P**	**L**	**P**	**P**
Identify Future Deficiencies	**P**	**L**	**P**	**P**
Data Dissemination	**P**	**L**	**P**	**P**
Maintain Database	**P**	**L**	**P**	**P**
<u>Identify and Evaluate Improvement Strategies:</u>				
Provide Forum & Discussion	**P**	**L**	**P**	**P**
Identify Candidate Strategies	**P**	**C**	**P**	**P**
Evaluate Strategies	**P**	**C**	**P**	**P**
<u>Implementation:</u>				
Provide Forum & Discussion	**P**	**L**	**P**	**P**
Develop Program Criteria	**P**	**C**	**P**	**P**
Development Implementation Program	**P**	**C**	**P**	**P**
Implement Program	**P**	**C**	**P**	**P**
Evaluate Implemented Strategies	**P**	**L**	**P**	**P**
<u>System Administration:</u>				
Provide Forum & Discussion	**P**	**L**	**P**	**P**
Integrate with Management Systems	**L**	**P**	**P**	**P**

L: Lead (Initiate action or have primary role in achieving results)
P: Participate (Combine information and data collection, perform analysis or provide central focus)
C: Coordinate (Coordinate information, data, or analysis or perform specific implementation actions)

REFERENCES

1. Chapter 1 Title 23, "Code of Federal Regulations (CFR), Part 500 Management and Monitoring Systems.

2. FHWA-HI-94-046, "Congestion Management for Technical Staff" NHI Course #15259, April, 1994.

3. FHWA "Metropolitan Planning Technical Report - 1 Congestion Management Systems", Cambridge Systematics, Inc., July, 1994.

4. Hoeft, Brian, TR News 173 "Developing Congestion Management Systems", August, 1994.

5. Metropolitan Washington Council of Governments (WASHCOG), "Congestion Management System Work Plan", July, 1994.

6. Texas Department of Transportation & Texas Transportation Institute (TTI). "Congestion Management Systems State-of-the-Practice Review", February, 1994.

7. FHWA, Demonstration Project Number 86. "Incident Management Workshop", March, 1993.

8. FHWA, National Program Plan (NPP) for Intelligent Transportation Systems (ITS), November, 1994.

9. FHWA, "Guidance on Management and Monitoring Systems", Memorandum, May, 1994.

10. JHK & Associates, paper "Thoughts on Preparing a Congestion Management System Work Plan", June, 1994.

11. FHWA-RD-92-097, "New and Emerging Technologies for Improved Accident Data Collection", March, 1993.

12. Highway Capacity Manual 2000 (HCM 2000), TRB, 2000 Update.

13. ODOT's Policy for Applying LOS and v/c Ratio in the Transportation Development Process, February, 1998.

14. NOACA, "Freeway System Bottleneck Study", September, 1996.