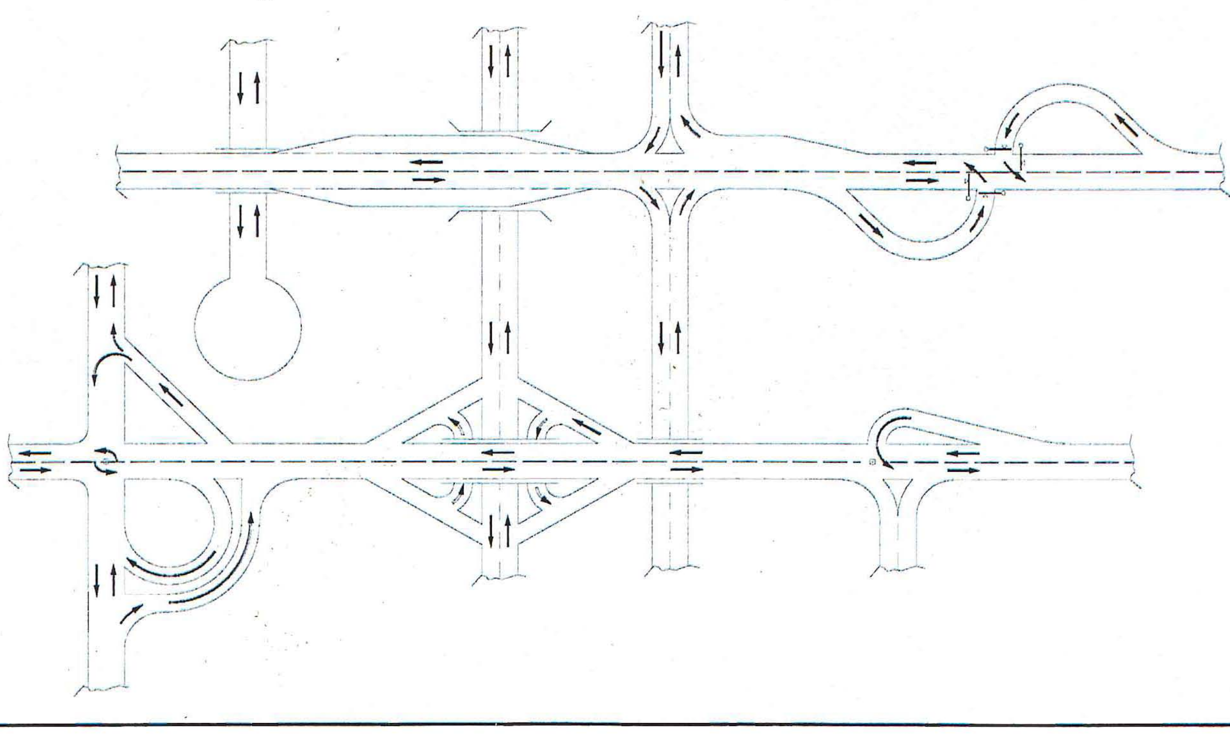
SUPERARTERIAL NETWORK STUDY

PROJECT NO. MPO-96-07

MIAMI - DADE

DADE COUNTY METROPOLITAN PLANNING ORGANIZATION

FINAL REPORT



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Superarterial Network Study

Miami-Dade County Metropolitan Planning Organization

Project Number: E96-MPO-07

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October 1998

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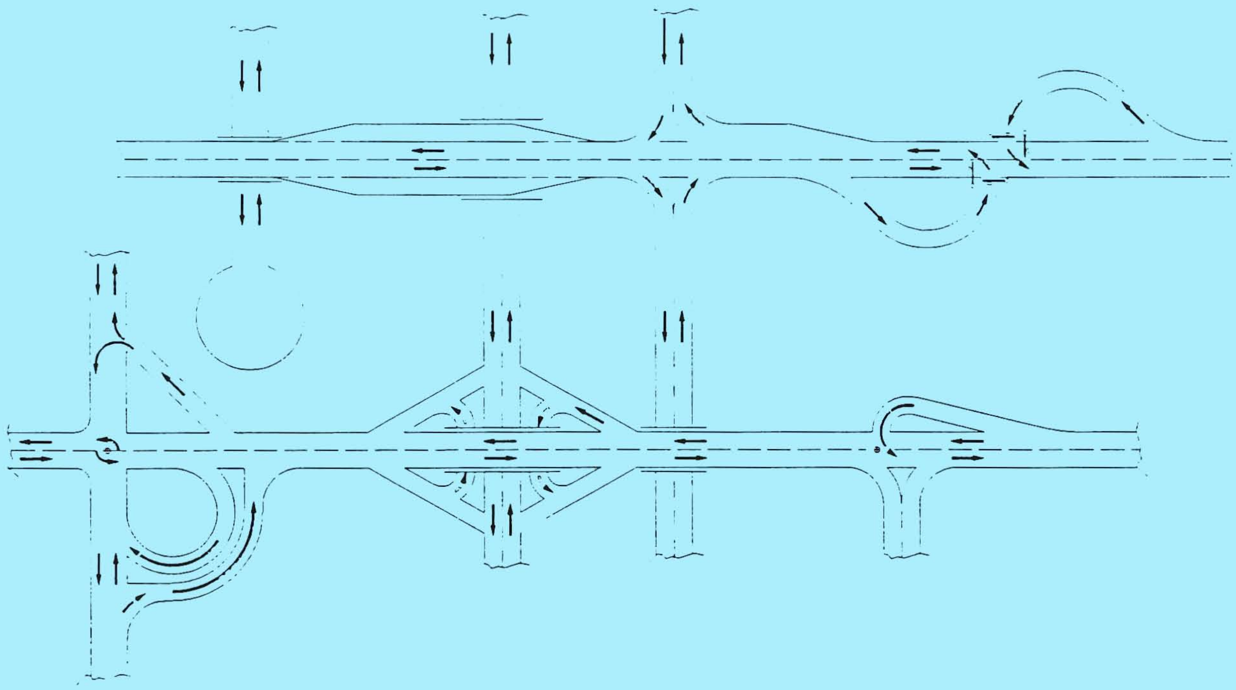


EXECUTIVE SUMMARY

The purpose of the Superarterial Network Study is to examine ways of alleviating congestion by focusing on the development of a network of "super streets", based on the existing Countywide arterial system. Roadways to be designated Superarterials would be adequately spaced and strategically selected to cover most of the developed and developing areas of Miami-Dade County. The Superarterial Network Study offers a global and more unified and systematic approach to alleviate congestion within the urbanized area than traditional approaches, by developing a network of facilities and approaching the congestion problem systematically across the entire County as opposed to looking at spots or segments individually.

The Superarterial Network consists of selected arterials specifically designed and/or upgraded to increase vehicle throughout and alleviate congestion, provide improved connectivity and accessibility between the regional expressway system and local collector roadways, and offer alternate intracounty travel routes to the freeway system. The preliminary Superarterial network consisted of 67 arterials, further refined to 29. This network is composed of roadways already carrying large volumes of traffic. The network would contain most of the major east-west and north-south arterials forming the foundation of the transportation network in the County.

The following are some of the modification parameters that would be used to upgrade existing facilities to a Superarterial or would be used as design parameters for future roadways:

- Partial access control
- Median barrier-separated roadways
- Left turns only at selected intersections
- Bus turnouts
- Improved signal progression
- Signalized at-grade intersections spaced at intervals of approximately one to two miles
- Favored treatment for the Superarterial traffic over cross traffic where non-grade separated intersections occur (e.g. green time allocations of 70% to the arterial and 30% to the cross street
- Exclusive lanes for high occupancy speed vehicles (HOV)
- Pedestrian treatments
- Design speeds 40-50 miles per hour
- Provisions for U-turns
- Route continuity for average trip lengths
- Grade separation at critical intersections and at all railroad crossings
- Auxiliary or collector-distributor right lane for speed change in entering and exiting traffic, or for emergency pull-offs.
- Consideration for public transit

In developing the network, the County was first divided into Transportation Corridors based on general traffic patterns within the County. These corridors were essential in identifying arterials within specific areas of the County that reflect the traffic characteristics within each corridor. These arterials were then grouped to form Transportation Areas, creating manageably sized areas for testing and implementation of the Superarterial Network concept. Evaluation criteria were then developed and applied to each of the existing and proposed major roadways within the County. The appropriate arterials, for which the criteria applied, were then included in the Superarterial Network.

Study Goals

The main objective of the study is to evaluate a proposed system of arterials to better manage and help alleviate congestion throughout Miami-Dade County. The following goals were identified for this study:

- Identify current approaches used to develop Superarterial Networks
- Explore the development and implementation of a Superarterial Network by coordinating proposed arterial improvements for identified congested corridors or County subareas with those of adjacent and intersecting corridors or subareas, to ultimately encompass all major surface arterials in the County.
- Develop strategies for alleviating congestion and improving LOS on crowded arterials within primary transportation corridors or major Miami-Dade County subareas through application of the Superarterial Network Concept. This goal also includes developing an integrated and systematic approach of proposed corridor-wide and/or area-wide operational improvements in concert with application of Travel Demand Management (TDM) techniques and limited site specific roadway improvements.
- Identify a set of arterials to be included in Dade County's Superarterial Network
- Develop a list of potential corridors and/or subareas to be further tested as possible demonstration projects
- Perform a preliminary macroscopic, urban-area model based evaluation in a selected test area
- Develop a plan of action intended to serve as a model for implementation of the concept, to one area and eventually throughout Miami-Dade County.
- Develop recommendations regarding the applicability and acceptability of the Superarterial Network concept on a countywide basis.

The Process

An important component of the study process is the creation of a Steering Committee to provide a framework for the participation of local and state agencies with jurisdiction over the arterial facilities in the analysis and decision-making stages. This Committee was composed of representatives from the State and County's transportation and highway planning, operations, and transit departments.

Draft technical memoranda describing activities of each task were submitted to the members of the Steering Committee for their review and comments. These documents were finalized after being revised to address the concerns and ideas of the committee members.

With input from the Steering Committee members, the Superarterial Network for the County was identified and one area selected for preliminary testing. The preliminary testing was performed first based on existing data and extensive field visits. An extensive list of strategies and techniques to alleviate or manage congestion were compiled from a literature search. These strategies and techniques were grouped based on their ability to solve specific types of transportation deficiencies. The results of the data collection effort was used to identify transportation deficiencies along the arterials selected for preliminary testing. The resulting recommendations were then incorporated to the extent feasible into the MPO's urban area travel model to assess existing and future impacts of the implementation of the combined recommendations, on both the selected arterials and the region as a whole.

The study also proposes a plan for further analysis of the arterials selected for preliminary testing. This action plan identifies items such as data needs, public involvement, identification of potential funding mechanisms, implementation of recommended improvements, and monitoring program. The plan is provided as a guide for analysis and implementation of the Superarterial concept throughout the County.

Conclusions and Recommendations

To develop a successful network of Superarterials, the location and cause of the existing and future congestion must be identified. The main congestion locations identified in this study -isolated intersections, isolated roadway segments, transportation corridors, and activity centers- serve as a point of departure toward developing appropriate solutions. Sets of solutions based on the different causes and locations of congestion problems were identified and presented in detail. These solutions range from those with low costs and short implementation periods, such as restriping, and improved signalization, to major improvements such as grade separation and new transit services. Some of these solutions are relatively easy to implement while others would require major funding, high-level technical and transportation policy decisions, and extensive community outreach to ensure acceptance and successful implementation.

The Transportation Corridors, Transportation Areas, and Superarterial Network selected, based on the criteria defined in this report, represent a basic roadway network needed to enhance mobility throughout Miami-Dade County. Superarterials are intended to provide east-west and north-south continuity to the grid system, alleviate increasing reliance on freeways, provide improved access to major activity centers and employment areas, and offer alternate routes for mid- to longer-distance intracounty travel. Transportation Areas (TA) were defined to work independently; therefore the concept may be phased so countywide implementation occurs gradually as funding becomes available. Implementation can also be further broken down, and may be applied to a single arterial that spans a number TAs, or even be a single facility which lies within one TA. Many Superarterial approaches may also be integrated with already planned improvements on previously selected roadways identified for superarterial treatment in this report.

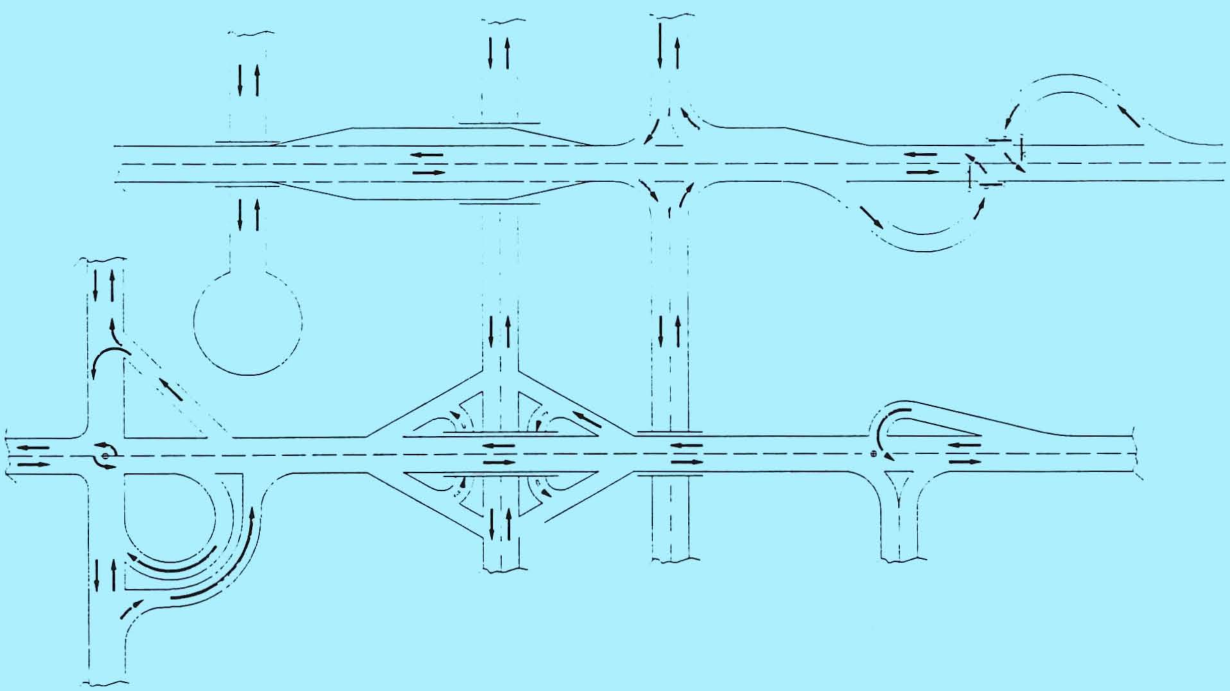
The solutions presented in this report can be used as either preventive or corrective actions. New facilities should be carefully planned to handle both short and long term congestion problems by incorporating some of the suggested techniques. In developing areas, appropriate measures can be used to acquire enough right-of-way to accommodate optimum design standards. In mature areas where right-of-way is scarce and usually too costly, implementation of some of the techniques described in this report is harder to achieve. In these areas the potential benefit of the proposed improvements (increase in mobility, congestion reduction, increase in travel speed, ridership increase) needs to be carefully weighed against implementation costs, and economic, environmental and social impacts. A proactive approach should be stressed to anticipate and prevent high levels of congestion in "new" corridors, to make the necessary provisions for adequate right-of-way acquisitions now for future transportation needs, and to apply Superarterial design criteria for those roadways designated for (future) Superarterial status. A strong community involvement program is recommended in developing and implementing the Superarterial Network.

The Superarterial Network concept bridges the gap between the different improvement programs currently in place at the state and county levels. By looking at arterials within a specific area, the Superarterial Network broadens the scope of the Resourceful Use of Streets and Highways (RUSH) program and the Project Development and Environmental Study (PD&E) process, which look at specific spots and single arterials respectively. The concept compliments and extends these programs, while being more focused than the Long Range Transportation Plan (LRTP).

CHAPTER 1

STUDY COORDINATION

FINAL REPORT



1. STUDY COORDINATION

As congestion increases on Dade County's arterials and freeways, the Metropolitan Planning Organization is looking for ways to maintain, and where possible, to improve mobility within the County. One way to improve mobility is to increase the traffic carrying capacity of existing roads by increasing vehicle throughput on these facilities. This can be accomplished by a variety of improvements in design, traffic engineering applications, and advances in technology, without extensive widening; major construction of extensive, multiple new roadway links; or systematic reconstruction of existing roadways. When these are applied to a major surface roadway, as opposed to an expressway, the result is often referred to as a "Super Street" or a "Superarterial". It may be possible to develop a number of Superarterials into a network to address growing local congestion, offer viable alternatives to expressways for lengthy, but still shorter than trips spanning the entire length of the County and to improve mobility for high numbers of daily Miami-Dade County drivers.

The Superarterial Network Study examines ways of alleviating congestion by focusing on the development of a network of Super Streets, based on the existing Countywide arterial system, but more widely spaced and strategically selected, to cover most of the developed and developing areas of Dade County. The study defines the guidelines for establishing this Superarterial network and evaluates strategies to improve the mobility enhancement and/or increase the capacity of such network. These strategies are grouped in the following categories: operational improvement, travel demand management, high occupancy vehicles' strategies, intelligent transportation systems, and transportation system management among others. These techniques have been used in the past and are even now being studied and applied for implementation on different roads and roadway sections within the County.

However, this study will attempt to offer a global and more unified and systematic approach to alleviate congestion within the urbanized area by developing a network of such facilities and approaching the congestion problem systematically across the entire County.

Throughout Dade County, arterials provide access to a mix of important commercial, industrial, and residential land uses, as well as servicing high volumes of work-trip commuter travel and midday traffic, which is not particularly commuter oriented, although it may be work-related travel. Intersection geometries, driveway locations and spacing, limited right-of-way, and general traffic characteristics are among the features of the County's major arterial system that must be taken into account in developing the recommended improvements to alleviate congestion. The needs of the users of the arterial system, the complexity of the roadways themselves, and the special features of the County's arterial system, pose strong challenges to the development of a Superarterial Network. Effective treatments would preferably have low to moderate individual costs; short implementation times, and provide a tangible increase in capacity within available rights-of-way.

1.1 Goals and Objectives

The traditional approach has been, and to a large extent still remains, to focus on major capital investments for expressways or major transit guideways to create large capacity increases for moving goods and people. These mega-projects involve tremendously high capital investments over long periods of time, with traditional reliance on non-local funding that is becoming increasingly scarce as federal and state budgets shrink. In addition, major capacity improvements require significant and lengthy real estate takings that are often expensive and usually disruptive to local communities.

The primary intent of the study is to determine the feasibility of implementing a countywide Superarterial network. The study will explore a variety of alternative transportation and mobility enhancement opportunities on select major arterials, to provide other options to increase traffic throughput and manage travel growth within the County. The study will focus on the arterial system in the County and look at improvements that can be implemented in order to improve mobility or better manage its current and potential future levels of congestion. A Superarterial Network offers the possibility of moving more people and goods faster on existing facilities through implementation of low to moderate cost improvements in congested corridors. The following objectives have been identified for this study:

1. Develop criteria to identify arterials and areas to be included in the network.

2. Explore the development and implementation of a Superarterial Network by coordinating proposed arterial improvements for identified congested corridors or County subareas with those of adjacent and intersecting corridors or subareas, to ultimately encompass a number of strategic surface arterials in the County.

3. Perform preliminary testing on a selected corridor or area, by applying identified strategies for alleviating congestion and projecting results which may be anticipated with implementation of Superarterial concepts.

4. Develop a list of potential corridors and/or subareas to be further tested as possible demonstration projects

5. Develop recommendations regarding the applicability and acceptability of the Superarterial Network concept on a countywide basis.

1.2 Study Process

The following sections describe the process that was followed for selection of the Superarterial Network for Miami-Dade County.

1.2.1 Previous Studies

In the past, Dade County, the Florida Department of Transportation, and other local agencies have sponsored numerous studies focusing on the development of operational improvements to solve localized congestion at intersections, corridors and subareas. Other studies have focused on state-of-the-art techniques in the areas of travel demand management and intelligent transportation systems. These former studies have usually been directed at specific areas, while the latter studies have for the most part focused on the major freeways and expressways. With the advent of ISTEA, the County initiated and continues to develop a series of transportation system management options through its Congestion Management Plan of which this study may be considered as an extension. The Congestion Management Plan (CMP) recognized that many programs already exist at the state and local levels to address traffic congestion and mobility. The plan has already identified a series of corridors with various levels of congestion and a proposed structure for the Mobility Management Process. The CMP also focuses on traffic projections and other future considerations in developing alternatives performance measures and introduced the concept of arterial investment studies.

1.2.2 Steering Committee

An important component of the study process was the creation of a Steering Committee to provide a framework for the participation of local and state agencies with jurisdiction over the arterial facilities in the analysis and decision-making stages.

The members of the Steering Committee (listed in Appendix A) represent a broad range of the local and regional technical staff of agencies with jurisdiction over transportation activities within Dade County. All work will be coordinated with local municipal agencies charged with roads or traffic operations where proposed improvements involve local streets within their jurisdiction, as well as state and county staff involved with arterial operations.

Draft technical memoranda describing activities of each task were submitted to the members of the Steering Committee for their review and comments. These documents were finalized after being revised to address the concerns and ideas of the committee members. Meetings with the members were held monthly for a maximum of six meetings. This gave the members an opportunity to review the direction of the study.

In addition to the Steering Committee meetings, one (1) presentations was made to the Dade County Transportation Planning Council (TPC), one (1) to the Citizens Transportation Advisory Committee (CTAC). These presentations were to update the committees on the status of the study, and to gain approval of the findings and recommendations.

1.2.3 Study Development

In analyzing the potential for capacity improvement treatments on the congested corridors in Dade County, the Superarterial Network Study is the first of its kind. Past studies of arterials focused on single corridors and/or single intersections. The main purpose of this study is to identify a system of select arterials that would be linked and capable of providing much needed improved levels of mobility. This could be achieved by applying series of specific and moderately scaled improvements. The study process was developed to meet the unique demands of this study and meet the goals and objectives previously stated.

Technical Memoranda were prepared at each major milestone of the study as follows:

Technical Memorandum 1: Study Coordination - This report summarizes the purpose of the study and gives an overview of the study process.

Technical Memorandum 2: Literature Review - This report summarizes the results of a literature search undertaken to discover previously performed work related to the planning, developments, and implementation of operational improvements on major arterials, specifically focusing on efforts related to super streets or Superarterials, and on Superarterial networks. Research was conducted for local, national and international examples.

Technical Memorandum 3: Data Collection - The purpose of this report is to summarize the traffic characteristics within the County, travel patterns, and development growth. The information gathered in this phase was used to select the roadways to be included in the Superarterial network.

Technical Memoranda 4 & 5: Definition of Corridors Transportation Areas and the County's Superarterial Network. Based on the information gathered during the literature search and the local data collection effort, a set of criteria was developed to define the corridors and areas to be included in the network. Transportation areas are as sections of Dade County, defined by existing travel patterns, and expected to include intersecting Superarterials and encompassing corridors as well. Technical Memoranda 4 & 5 reports the development and finalization of the criteria, the areas and corridors considered, and the County's Superarterial network based on the findings documented in the previous reports.

Technical Memorandum 6: Identification of Strategies and Techniques - This report summarizes the different strategies and techniques used to alleviate congestion and identify their relative advantages and disadvantages as well as the situations and locations where they may be applied.

Technical Memorandum 7: Preliminary Evaluation and Selection of Candidates for Further Testing - A set of criteria and methods to measure mobility improvements, level of service improvements, and congestion reduction measures was developed. Estimates of the cumulative impacts of different improvements applied simultaneously to a particular corridor or area were developed. The evaluation methods were then applied to selected corridor or area, and candidate arterials were selected for further testing. This Technical Memorandum documents these activities.

Technical Memorandum 8: Estimation of Test Implementation Requirements - Technical Memorandum 8 reports on the Action Plan developed to test the application of the Superarterial concept to major arterials within the selected corridors or subareas. The plan includes: the facility to be tested; a list of improvements proposed for implementation; data collection needs; implementation schedule and a test time span for the test implementation, criteria, standards, and measures to assess the results; and an estimate of the costs associated with the test implementation project. The plan also includes guidance on which local agency might be most appropriate to conduct the study, and potential sources of financing to fund the test project.

1.3 Superarterial Network

Prior to the development of the actual network, items such as concept definition, purpose and needs, applicability of the concept to Miami-Dade County, potential benefits from and potential obstacles to the implementation of the concept were carefully identified and are summarized below.

1.3.1 Concept Definition

The conceptual definition of a Superarterial Network is a system of urban area-wide arterial streets that are developed or improved to strongly emphasize the traffic movement function of the arterial facilities comprising the network. The arterials included in such a network are usually the backbone of the transportation system within an urban area, and provide access to major land uses, other arterials, and freeways. Because of their importance, these arterials are not only typically heavily traveled during peak hours; they are also usually heavily traveled throughout the day as well.

Roadways fall into a hierarchy based on their function and characteristics. The following is a definition of the different types of roadways including Superarterials:

1. Freeway/Expressway - A facility with full control of access to give preference to through traffic (i.e., interstate and turnpike).

2. Superarterial - An arterial street developed to high design standards to strongly emphasize the traffic movement function of the arterial more so than the Primary Arterial.

3. Primary Arterial - A facility usually with a painted or physical median separating opposing traffic flows, carrying most of the long trips made within and through an urban area. These roads emphasize traffic movement rather than land use access and carry higher volumes than any facility except freeways and Superarterials. Depending on the design standards used, primary arterials may infrequently qualify as Superarterials, but are certainly the most viable candidates usually considered for conversion to Superarterial status with implementation of appropriate modifications.

4. Secondary Arterials - Similar to a primary arterial, except with no painted or physical median barriers to separate opposing traffic flows, although these roadway will often incorporate much narrower double line striping to separate traffic flows. Secondary arterials generally have more signals per miles, with few if any frontage roads serve less through traffic and more land access than primary arterials.

5. Collector - A street which gathers traffic from local neighborhoods and channels it to the arterial system. A small amount of through traffic can be carried on collector roads, but the system primarily provides access to abutting land by carrying local traffic between or within residential neighborhoods and commercial areas, or to roadways with more capacity.

1.3.2 Purpose and Need

Traffic data clearly indicate that congestion is an increasing problem in Dade County and undesirably low levels of service are continually experienced on major arterials. Demographic forecasts point to continued population and employment growth, and subsequent growth in travel indicates that congestion will not only continue to increase, but that its rate may be expected to accelerate. Between 1995 and 2020, the permanent resident population is expected to increase by 30 percent. With a current population close to 2 million people in Dade County; the area can expect more than half a million new people living in the urbanized area in the next 25 years, and a majority of them will become drivers.

The current Transportation Improvement Plan prepared by the Dade County Metropolitan Planning Organization shows that the local and state agencies are planning considerable improvements for the major expressways and travel corridors within the County. There is, however, a need to maximize the potential capacity of many of the existing major arterials in order to alleviate existing congestion in the region, and to be better prepared to manage continually increasing future traffic and congestion resulting from the area's ever-increasing growth.

As construction of new lanes on expressways and freeways and of new facilities becomes increasingly difficult and cost prohibitive, the arterial system will be called upon to carry a greater share of existing and projected future traffic demand. The expansion of the transit system alone will not solve the current traffic congestion. The spatial distribution of the County's activity, employment, and residential areas; the geography of growth; and the high proportion of individual and household automobile ownership tend to counteract transit initiatives. All these factors tend to promote automobile use that causes congestion of the roadways within the metropolitan area.

The following sections illustrate the need to develop a system of Superarterials based on the travel characteristics and the current state of the freeway system in Dade County.

1.3.2.1 Travel Characteristics

Travel characteristics have changed in the past decades and the Central Business District (CBD), commonly referred to as the Downtown area is no longer the single major destination or origin of peak hour trips. As developers are attracted to the relatively low land prices, and availability of large tracts of suburban land, major residential and employment centers have been created in the areas of Dade County beyond the urban core. These major activity centers, often referred to as "edge cities", resemble "mini" downtown areas, manifest significant impacts on virtually all the County's limited expressways and those arterials which serve both the major activity centers and the downtown. There is, therefore, a need to provide adequate capacity to not only efficiently move traffic within suburban areas, but also to utilize existing infrastructures within the already developed urban areas.

1.3.2.2 Freeway System

The freeway system is undoubtedly a major component of the transportation system in Dade County. Given the current vision of Dade's transportation future, this system is largely complete, having undergone and still undergoing major improvements to increase its capacity and efficiency. The few remaining socially and community acceptable potential missing links to the system may provide enhanced mobility in the future for developing areas, rather than relieve congestion within the developed areas. The current Transportation Improvement Plan and the Long Range Transportation Plan focus on rehabilitation of older freeways, capacity addition where feasible, and incorporation of multimodal facilities to the existing freeway system. Although needed, freeway improvements often carry with them very high construction costs, right-of-way constraints, potentially detrimental social impacts, and long planning and design periods. This points out the need to also develop a set of systematic, low to moderate cost improvements with relatively short implementation times on facilities other than freeways.

1.3.3 Applicability

The success of a Superarterial Network is highly dependent on the applicability and potential benefits to a region. The following sections highlight why this concept could be applicable to Dade County and what potential benefits the region would gain from developing such a system.

Arterial Grid Network

Dade County is a good candidate for developing a Superarterial network due to the almost complete grid system layout of its major arterials. An arterial grid system allows for continuous travel in a given direction, and usually provides reasonable capacity for a significant distance. While features other than continuity are important, continuity plays a major role in connecting major activity centers with each other throughout the County, and with the residential areas, from which much of the roadway traffic, and virtually all of the region's commuter travel, is originated. The few missing links needed to complete the grid system are affected and often seriously constrained by geographical and physical barriers such as bridges, other roadways, and waterways (the Miami River, the Intracoastal Waterway, and numerous canals).

Planning Process

Extensive work has been conducted to identify the major improvements and new roadways that will be needed in the next 20 years to handle most, but not all of the projected traffic demand. The Transportation Improvement Plan for 1996-1999 identifies major highway and arterial projects in excess of $297 million. Approximately one third of these funds are for studies and improvements to expressways, with the remainder for arterial studies and related improvements.

The Long Range Transportation Plan (LRTP) has also identified in its "Needs" plan nearly 100 major capacity improvements that address the mobility needs of the communities within the metropolitan area. However, only 60 percent of these improvements can be implemented due to the lack of available funding. This results in the inability to provide for all the improvements needed to enhance mobility and reduce or alleviate congestion through the year 2015 within the urban area.

The Long Range Transportation Plan also identifies the need to provide for over 60 miles of exclusive right-of-way for priority transit service and approximately 40 miles of High Occupancy Vehicle (HOV) lanes along the major expressways. Very few projects involve construction of new highways, which is indicative of a matured urban area, and the LRTP has an urban area-wide focus on maximizing, and/or enhancing the potential of existing facilities.

The plans also stress the importance of non-motorized modes of transportation, such as bicycle and pedestrian facilities which are more heavily emphasized than in past plans. One and one-half percent of all eligible surface transportation funds have been reserved for non-motorized modes of transportation, and a Comprehensive Bicycle/Pedestrian Planning Programs study has been incorporated into the Long Range Transportation Plan.

Special planning studies and initiatives are also included in the plan in order to identify ways of incorporating the latest technologies available, such as Intelligent Transportation Systems (ITS) and Intelligent Corridor Systems (ICS). Other projects such as the Congestion Management Study are included to identify a variety of strategies to deal with urban travel congestion. This Superarterial Study is an example of the latter.

Dependence on Single Occupant Vehicles

The latest data show that travel by private car accounts for more than 95 percent of the total urban travel in Dade County. This is reflective of the high number of private vehicles (1.2 million) which is expected to increase by 60 percent by the year 2015. The current ratio of cars per household is 2.6.

Numerous improvements to, and construction of, new transit elements are planned throughout the County. The addition of new bus routes, extension of the existing Metrorail, and the construction of a new East-West rail line are only a few of the projects that are planned to increase transit services and mobility within the County. However, transit alone will not solve the congestion problems in Dade County.

Approximately 75 percent of all travel is performed in vehicles with one or two persons. This figure includes both private automobiles and mass transit vehicles such as buses and trains. Taking into account that mass transit vehicles typically carry 15 to 100 people depending on mode and time of day, the exceptionally high use of single occupant vehicles in Miami-Dade County becomes apparent. These statistics demonstrate that Dade County residents rely very heavily on their automobiles, and that highway-oriented mobility improvement planning needs to continue.

Congested Freeways

The freeways represent 17 percent of the total roadway lane-miles available in Dade County, based on the 1990 Miami travel demand model. This percentage carries approximately 33 percent of the daily County vehicle-miles traveled (VMT). These figures demonstrate the high demand placed on the existing freeway system. One of the benefits of a Superarterial Network is the potential to divert some freeway traffic onto the arterial system if the capacity and enhanced operating efficiencies are available on the arterials serving general travel patterns as the freeways.

Decentralization and Suburbanization of Business, Shopping and Cultural/Recreational Activities.

For the past decades, major activity centers have been developed outside the Downtown area creating a decentralization of the urban area activities away from the CBD. Preceding this phenomenon, major residential developments have also been built in the suburbs. These areas are served by numerous arterials providing access to both these major activity centers and the freeways leading to the Downtown area. These arterials would potentially become part of the Superarterial Network and appropriate improvements assigned to them.

1.3.4 Potential Benefits

Many short-term and long-term benefits can be achieved at relatively low to moderate costs and within a short time after implementation of improvements along the arterials considered for inclusion within the proposed Superarterial network. A discussion of these potential benefits follows.

Higher Mobility

A Superarterial network has the potential of increasing mobility throughout the County by creating a region-wide system of linked major surface streets ("Super Streets") improved to provide better traffic flow. Higher mobility can be achieved by implementing selected capacity improvements (limited roadway widening, intersection widening, urban arterial interchanges), concerted applications of traffic management operational improvements (progressive signal synchronization, computer monitoring analysis and control), transportation demand management (TDM) strategies, Intelligent Transportation System (ITS) measures, bicycle and pedestrian facility improvements, and other improvements that would improve mobility on the arterials.

Impacts on Air Pollution

By improving the flow of traffic and alleviating congestion, a Superarterial network has a direct impact on travel speeds and therefore on air quality. Although in a mature area such as Dade County there would not be a sizable decrease in the level of pollution as a result of these improvements, they may stabilize and/or slow down the auto emissions and the rate of pollution.

Economic Impacts

Implementing a Superarterial network should have a positive impact on the economy of Dade County. By increasing vehicle throughput and decreasing delay, a Superarterial network may decrease fuel consumption and on the household level, incrementally allow travelers savings in auto operating costs. On a nationwide basis, implementation of a Superarterial network has the potential to reduce energy use, to reduce dependency on foreign oil, thereby reducing the flow of US dollars out of the country, in turn reducing the US trade imbalance, and thus contribute to reducing the national debt.

Such a network may present the opportunity to decrease the amount of time spent driving, allowing more time for other activities, many of which will be consumer-oriented money-spending activities, thus also incrementally increasing local County economic activity in the aggregate.

A Superarterial network will increase mobility by allowing faster travel from origins to destinations. This also increases productivity of freight movement by shippers and suppliers, which in turn increases the economic potential of the County by allowing higher level of responsiveness to consumers, businesses, and commercial needs. An increase in the economic activity leads to a broader commercial base for the county and therefore greater wealth for the community. Businesses often move away from congested areas and are attracted to areas with adequate transportation network. People also tend to avoid working and shopping in highly congested areas. A County Superarterial network can offer options for increasing consumer business viability, increased retention of existing business, and increased attraction for new business to locate here.

Reduced Delay

A major factor affecting typical arterial performance is the amount of delay experienced at intersections along the arterials. These delays can be reduced by improving signal timing, intersection geometry, and providing special treatment for transit vehicles and HOVs, all of which are part of the improvements envisioned for the arterials within the network. And as previously noted, reducing the highway delay can increase productivity for business and individuals, as well as for communities.

Decreased Collision Rate

Decreased collision rates are often a direct benefit of enhanced capacity because occurrences of collision-induced bottlenecks are reduced. Additionally, even some minor improvements such as creation of left and right turn bays, better signal coordination, and creation of bus bays eliminate or reduce conflicts between vehicles which is a primary cause of collisions.

Better Use of Arterial System

The primary function of an arterial is to accommodate traffic movement. Many of the arterials in Dade County inefficiently function below standards because they have degraded into virtual major collector/distributor facilities due to the high numbers of access points to and from abutting land-uses and the high frequency of closely-spaced sites with individual driveways. The primary function of the arterial can be restored through implementation of an efficient Superarterial network aimed at managing access to land uses along the facilities, improving signal progression, managing transit vehicles and HOVs, and improving operations at intersections.

1.3.5 Potential Obstacles

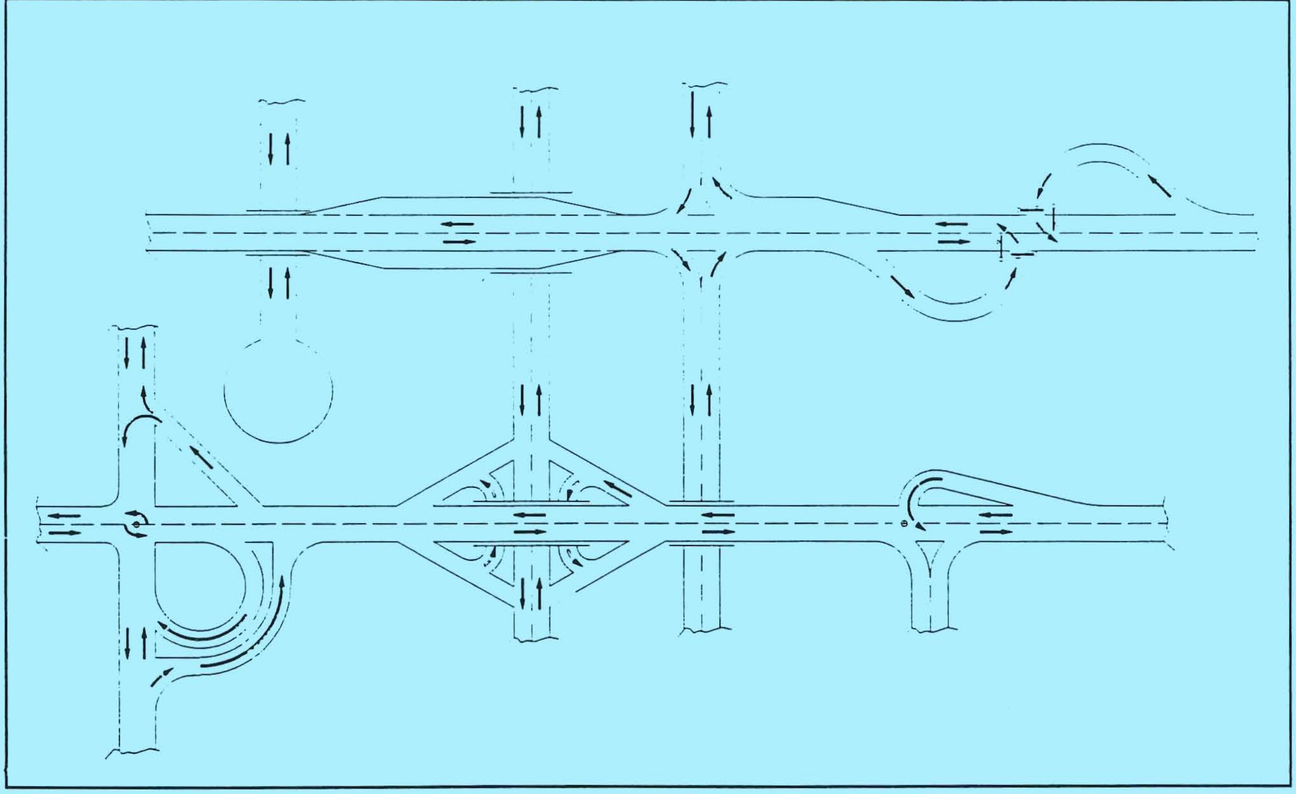
Although many benefits can be gained from a Superarterial network, there are a few obstacles to its implementation. Perhaps the most important is community acceptance of the proposed improvements to individual arterials to transform them into super streets even before considerations of linking them to establish a Superarterial network are addressed. For example, it may be necessary to add a missing link in the arterial grid network to provide connectivity to a major activity center and improve level of service on an adjacent facility. However, the community may reject it if these improvements are seen as increasing traffic through a particular neighborhood. In other cases, business owners may be reluctant to consolidate their access points although it would improve mobility on the major arterial serving their business. A reduction or consolidation of access points might be perceived as negatively affecting their livelihood by reducing easy access to their individual business site. Indeed, In recent years, a number of neighborhoods within the County were successful in discontinuing some projects and blocking other on the brink of construction for a variety of reasons. It can be foreseen that localized community objections are a potential obstacle to the implementation of a Superarterial network in Dade County.

Other major obstacles to implementing a Superarterial network are availability of funding and the acquisition of rights-of-way. Although the improvements envisioned may be low to moderate costs and have minimal impacts to surrounding land uses, the level of congestion at some intersection may in some cases require extensive, albeit localized, improvements to more successfully manage traffic at that location. These improvements may require additional right-of-way, which in developed urban areas is often rather expensive land with existing structures housing viable business, which may increase costs significantly. In a few instances, a localized major improvement may be the best recommendation for increasing arterial throughput, and may include significant, although localized, construction, which may also critically raise costs. For all transportation improvement projects considered, allocating scarce fiscal resources will always be a problem to be resolved. As with other programs designed to alleviate congestion the advancement of Superarterials and the creation of a Superarterial network must also wrestle with the allocation of funds to support development and implementation of the concept within the overall transportation system.

CHAPTER 2

CONGESTION MITIGATION APPROACHES

FINAL REPORT



2. CONGESTION MITIGATION APPROACHES

This chapter summarizes the results of an extensive literature review of the different approaches used locally, nationally, and internationally to mitigate congestion problems. An overview of congestion is presented, followed by specific approaches used in the US and abroad to manage or alleviate this problem.

Texas and California have conducted feasibility studies that have concluded that a region-wide approach similar to the Superarterial Network proposed by Dade County is an important tool for solving existing and future congestion problems. Description of the concepts developed in Texas and California, along with the criteria used to select the arterials to be improved and the improvement measures are among the items included in this chapter.

2.1 Overview of Congestion

In order to identify appropriate measures to alleviate and or manage congestion, the following sections present an overview of how congestion is defined and its impacts on the community and livelihood of a region.

2.1.1 Definition

Traffic congestion can be defined as a condition where vehicular demand for a facility exceeds the facility's capacity; that is, the number of vehicles attempting to use a facility is greater than what the facility can carry during a specific period of time at an acceptable level of service. Congestion is thus the result of several elements, such as the number of vehicles being carried by a facility at a certain time, vehicle spacing, safety, and individual vehicle maneuverability in the traffic stream, in relation to the size and configuration of the facility.

As a result of the tremendous growth experienced by Miami-Dade in recent years, the existing and planned roadway system is unable to meet the transportation needs of the county. Since most of the growth increasingly occurred outside of the Central Business District, in the suburbs, people increasingly travel to and from locations more dispersed throughout the County. A growing economy also translates into strong buying power, which results in part in increase in car ownership. The automobile, in Miami-Dade as in most other US urban areas, is the dominant mode of transportation. These are a few factors that contribute to increasing levels of congestion. Because these trends are projected to be even more pronounced in the future, the County is faced with the need to find appropriate solutions. In 1996, Dade County was again ranked 4th in congestion level among US cities, surpassed only by Los Angeles, Washington DC, and San Francisco.

2.1.2 Impacts

The impacts of traffic congestion are not limited to roadways. Traffic congestion has serious impacts on the community as a whole. Some of the impacts associated with congestion are:

Local and Regional Impacts

When congestion consistently occurs on a given roadway, the first impulse of travelers is to find ways to bypass the congested area. This leads them into searching for alternative paths, and frequently into residential neighborhoods on streets designed to handle local traffic at usually much lower speeds. These streets are typically designed to provide access to surrounding land uses rather than use as a bypass route for through traffic. This congestion-derived cut-through traffic may make streets unsafe and impinges on the common perspectives of quiet neighborhood streets.

Community Access

Residents want the assurance that their neighborhood is easily accessible to them and to emergency services such as fire and police. On the same level, business owners depend on the transportation system to bring their goods and customers to their place of business. Increased congestion lowers accessibility by increasing travel times in general, and may specifically impede site accessibility by obstructing points of access through build-ups of vehicle queues.

Economic Growth

One of the factors that help attract new development is a good transportation system. Such a system is crucial in providing access to employment and shopping sites. This in turn increases the economic base of the community by providing expansion opportunities to businesses and developers. However, one consequence of conventional transportation system-enhanced growth is increased congestion which may discourage new business and employers from coming to the area. Therefore a good transportation system should consider potential impacts to the area's economy.

Safety

Accidents are more likely to occur on congested roadways where the ability to maneuver is severely restricted and drivers' frustration levels are high. Reducing the congestion level generally tends to reduce the number of accidents. Hazardous situations are also created by drivers trying to bypass congested roadways and using other facilities not designed for through traffic.

Environmental Quality

The passage of recent laws such as the Clean Air Act demonstrates the national focus on environmental quality, especially air quality. Congested roadways can affect the environment, since a slow moving vehicle releases more emissions into the atmosphere and remains on the road for a longer period of time. Therefore, managing or alleviating congestion can have a positive impact on the environment.

Quality of Life

To some people, traffic congestion is a sign of a growing economy, while to others, it is a sign that the quality of life in an area is deteriorating. The majority of people living in the suburbs have moved from congested areas to avoid urban problems like traffic jams. In addition, increased traffic in residential neighborhood from travelers avoiding locations where congestion occurs, is often perceived as a prelude to increased crime activities in that area, furthering the perceptions of declining quality of life.

2.2 Available Tools to Alleviate and Manage Congestion

Traffic congestion is one of the most compelling issues facing our society today, and is predicted to worsen in the next 20 years without proper planned improvements. Following is a brief description of the different techniques currently being employed locally, nationwide, and internationally to improve mobility and/or reduce traffic congestion. They range from the conventional approaches to transportation engineering, to newer approaches which can combine engineering, planning, behavioral, and land use elements.

2.2.1 General Purpose Lanes

Improvement techniques in this category include addition of lanes to an existing facility without road widening by eliminating the shoulder or the median. These techniques include traditional roadway widening to previously constructed facilities and construction of new roads.

2.2.2 Traffic Operational Improvements

These include operational signal timing and phasing improvements, equipment replacement, elimination and/or relocation of traffic signals, one-way street implementation, intersection improvements, restrictions on turning movements, enforcement and educational programs, and development of Superarterial networks. These improvements are geared toward increasing the vehicle moving capacity of a facility.

2.2.3 Public Transit Improvements

Public transit is defined as all modes of high occupancy and shared-ride services. Public transit is usually divided into three categories: rail/fixed guideway transit, bus transit and paratransit. Public transit improvements can be categorized into two areas: capital improvements and operational improvements. Some examples of capital improvements underway in Dade County include: 1) development of the exclusive South Dade Busway, 2) development of park and ride facilities, 3) acquisition of vehicles, 4) roadway improvements/amenities for transit, 5) signal preemption. Operational improvements currently implemented encompass express bus service, feeder bus services, improvements to bus routes, monitoring services, modifications in the public transit fare structure, promotion of transit passes, and implementation of other transportation modes and services such as jitneys, paratransit and water-transit.

2.2.4 Access Management

Access management programs employ the use of several strategies with the purpose of improving both average travel speeds and capacity of roads. Access management elements often include (but are not limited to): restriction of left turns and direct access driveways, driveway consolidations, utilization of frontage roads, elimination of roadside parking, implementation of minimum intersection spacing, and separation of areas of conflicts between problematic traffic flows, and between vehicle and bicycle/pedestrian modes.

2.2.5 Incident Management

Incident detection and management systems alert drivers to congested conditions and allow diversion to alternate routes if necessary. The system employs a combination of service vehicles; motorists aid call boxes, citizen band radios and cellular phones, incident teams, volume monitoring and ramp metering devices, motorist information systems, traffic diversion and alternate route identification.

2.2.6 Bicycle and Pedestrian Treatments

The goal of these treatments is to increase the use of non-motorized ground transportation modes such as bicycling and walking and to improve the existing physical facilities provided for these modes. Some of the programs currently underway include the promotion of bicycle programs, implementation of bicycle routes, paths and lanes, integration of bicycle/pedestrian facilities with public transportation facilities, bicycle ordinances, and sidewalk and walkway facilities and amenities.

2.2.7 Growth Management

Growth management can be defined as the strategic use of public policy in order to regulate the location, density, quality, geographic pattern and rate of development through land use policies, general housing and open space developments, specific zoning codes, economic development, and community infrastructure. The State of Florida requires all proposed developments to provide for facilities including parks, schools, emergency services and infrastructure under the Concurrency Management Law.

2.2.8 Urban Design/ Community Development Master Plans

To date, there has been no single unified set of land use policies or programs either at the federal or state level for Urban Design. Land use planning has been left at the local level of government. In the past decades most new residential developments have created "pockets", areas where through traffic is not permitted, forcing vehicles onto major arterials and leaving minimal choices for travel routes. These "pockets" have also limited the accessibility to transit modes.

At the regional level, there are State guidelines for Community Development Master Plans (CDMP) already in place.

2.2.9 High Occupancy Vehicle Treatments

The primary purpose of High Occupancy Vehicle facilities (HOV) is to increase the total person-moving rather than the vehicle moving capacity of a highway or street, to optimize transportation system performance through the effective management of scarce highway space during peak periods. These HOV facilities may consist of contra-flow or exclusive lanes on freeways or arterial roadways. This program is especially effective when it is used in conjunction with car and/or vanpools.

2.2.10 Travel Demand Management

Travel Demand Management (TDM) can be defined as any action or set of actions directed at reducing the impact of traffic by influencing people's travel behavior, either by mitigating existing congestion problems or avoiding future congestion. TDM programs are designed to maximize the total person moving capability of the transportation system. This can be achieved by influencing the occupancy per vehicle, and the time or need to travel. Examples of this program would include on-site employer transportation coordinator, establishment of shuttle service, ridesharing, preferential parking for vanpools and carpools vehicles, emergency ride home programs and alternative work hours, among others.

2.2.11 Congestion Pricing

The objective of the congestion pricing strategy is to employ variable pricing to encourage motorists to shift their driving patterns from peak-hour periods to non-peak hours, and/or use alternative modes and routes. Congestion pricing uses monitoring devices on the road and in the vehicles to encourage the use of less congested roads by charging motorists the costs they create in using a particular road. Other techniques being utilized under this category to relieve congestion include the implementation of auto restricted zones and parking pricing on certain roads. The benefits of such pricing strategies could be substantial in that congestion would be reduced or additional revenues would be collected to supply and maintain the necessary infrastructure. Congestion pricing can be used on both freeways and arterials.

2.2.12 Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) apply advanced technology alternatives along existing or newly constructed transportation systems by utilizing real-time information for more efficient trip making. Some examples of projects currently underway or in the planning stages for the Miami Metropolitan area include an automatic vehicle location system for the Metro-Dade Transit Agency, an advanced traffic management system for principal arterials in the Southeast Florida Intelligent Corridor System, and strategically posted traveler information kiosks.

2.3 Local Approaches to Congestion Problems

Improvement measures undertaken by FDOT and the MPO to decrease congestion in Dade County include, among others: roadway widening; the South Dade Busway implementation; a congested intersection improvements study; implementation of the South Florida Intelligent Corridor System; MDTA's automatic vehicle location system; an ITS coordination plan; alternatives for intermodal improvements; and parking policies. The following is a list of selected studies currently underway in Dade County in an effort to maintain and/or improve mobility on both the freeways and arterials, which serves to illustrate several of the approaches noted above:

I-95 Multimodal Plan and HOV Monitoring Report

The Multimodal Plan addresses the potential for alternate modes to accommodate future demand through the year 2020. The HOV monitoring report includes an annual assessment of the newly implemented I-95 HOV lanes' performance in addition to average vehicle occupancy, person throughput, time saving, and enforcement activities.

Krome Avenue Corridor Access Plan

Eighteen-month study on the 37-mile corridor focusing on access management improvements that can be implemented temporarily until ultimate improvements can be financed and staged.

Arterial Investment Study

This one-year study is part of the statewide Congestion Management System to alleviate traffic congestion and improve mobility, and will include a strong public involvement effort to help identify multimodal alternatives for highly congested facilities. The 107th Avenue corridor from Bird Road to SR 836 is currently being analyzed.

I-195 Operational Master Plan

A short-range evaluation of operational and access issues on I-195 between I-95 and Biscayne Boulevard.

Intermodal Management System

This project addresses the use of specific criteria to determine the operation, condition and performance of intermodal facilities of statewide significance.

Vanpool Program

An average of 25 vans per year will be put in service in the summer of 1997 for trips within Dade County only. The Request for Proposal final draft is pending approval by the County Attorney's Office and GSA Department.

Freight Movement Study

This project analyzes the current movement of goods, recommends alternatives to improve freight traffic, and proposes a methodology to forecast freight movement within the County.

Alternatives for Intermodal Improvements

This project helps identify potential locations for implementing intermodal transfer stations to promote the integration of different transit services and encourage the use of public transit.

Parking Policy Study

This project will integrate parking regulations throughout the County and develop parking strategies to alleviate congestion. The feasibility of forming a Parking Authority is also evaluated in this project.

Other Studies

Numerous studies in individual corridors, spots, or areawide are also being conducted or just completed. These studies recommend for the most part improvements such as access management control, signal optimization, traffic signal design and turn lane addition at intersections.

2.4 Nationwide Approaches to Congestion Problems

At the nationwide level, most counties apply methods and research studies similar to the ones mentioned above for Miami-Dade County. Three areas, Harris County, Texas; Orange County, California; and Mesa, Arizona have looked into the feasibility of implementing a system of high flow arterials similar to the superarterial network concept envisioned for Dade County. The following is an overview of the studies.

2.4.1 Harris County, Texas: Conceptual Strategic Arterial Street System (SASS)

The existing level of development and the state of the transportation system in Harris County parallel Miami-Dade County in several aspects. Declining traffic mobility is a serious problem facing both counties where the freeway system is the critical element in delivering mobility and providing traffic service. Many segments of these freeway systems have become overloaded with traffic being diverted from congested arterials. The interactions of population growth, land use, political constraints, environmental constraints, and increased construction costs combined with declining funds for highway improvements have coalesced to restrain the planning and construction of new freeway facilities and the expansion of existing facilities. This results in a limited network of freeways with many overloaded segments offering limited capacity for improvement which must continue to serve a growing urban population. Like in Dade County, the primary function of Harris County's arterials has been eroded to the level of collector-distributor rather than to serve through traffic.

The University of Texas (UT), sponsored by the Texas State Department of Highway and Public Transportation, developed a 490-mile Conceptual Strategic Arterial Street System (SASS) Network for Harris County to provide route continuity within and outside the county and to expand county-wide high-quality traffic service provided by the freeway system. The goal of the Conceptual Strategic Arterial Street System for Harris County (Houston metro area) was to demonstrate the feasibility and cost-effectiveness of enhancing the efficiency of the arterial streets. This SASS network was designed to meet the present and future demands for traffic service in those areas of the county not conveniently accessible to the freeway system, provide better access to the freeway system and offer alternative travel routes in lieu of the freeway system. All of the arterials included in the SASS are situated along existing and projected city and county street rights-of-way. The pattern of the SASS was adapted to conditions in specific areas to provide high-quality traffic service to the county as a whole.

One important characteristic of Harris County, as compared to other US urban areas of similar size and population density, is that arterial streets accommodate a smaller proportion of the vehicle trip demands. This is due mainly to deficiencies in the arterial street system, causing freeway congestion by too many motorists using the freeway for shorter trips (10 miles or less) which should usually utilize the arterials. A selected system of high flow arterials needs to be planned and designed to provide acceptable alternate travel routes to freeways. In order to be effective, these arterials should be constructed to high design standards, and operate in a manner that would make them as desirable to use as the freeway system for short trips. The conceptual design standards selected for Harris County were as follows:

- Adequate traffic capacity
- Good geometric design
- Progressive signalization
- Route continuity with contiguous facility lengths of 4 miles or more
- Access control and management
- Considerations for public transit
- Grade separations at railroad crossings and at critical cross-street intersections
- Design speeds of 40-50 mph
- Median barrier separated roadways
- No left turns
- Provisions for U-turns
- Emergency lane or speed change lanes to facilitate traffic exiting and entering the Strategic Arterial Street (SAS)
- Favored treatment for the SAS traffic over cross traffic where non-grade separated signalized intersections occur.

Thus, the roadway design features proposed are a combination of the features associated with freeways and arterials. The Harris County study proposes the utilization of geometric designs and design standards that have been used by various public agencies for arterial streets that can be adopted for the SASS. Geometric design features associated with the SASS were intended to be distinctive and easily perceived by the drivers as being different from other arterials (see Appendix B).

The estimated cost of the implementation of the whole network ranges between $2.5 and $3.0 billion (1990 US Dollars). The lower estimate assumed the minimum number of grade separations necessary so that the SASS will have a significant impact on mobility. The higher estimate provided for additional grade separations. The cost estimate was performed for the network as a whole, since the selected arterials were not prioritized according to a development schedule. The Conceptual Strategic Arterial Street System for Harris County has not been implemented to date due to lack of funding, although is has been well received by the community.

2.4.2 Orange County, California: Continuous Flow Boulevard/High Flow Arterial/Super Streets Concept

The Orange County Transportation Commission identified the Continuous Flow Boulevard concept as a solution to the travel demands expected on the County freeway and arterial system in the mid 1970's. The original Continuous Flow Boulevard concept encompassed grade separations at intersections and elimination of left turns from the boulevard or main arterial. This system would allow traffic to flow continuously on the boulevard or main arterial without interruptions from the cross streets traffic or opposing left turns.

In the early 1980's a High Flow Arterial Concept Feasibility Study was conducted to identify options for improving traffic flow and increasing the capacity on arterial streets with special focus on grade separations and signal coordination. Grade separation is conventionally associated with freeway construction, and their associated standard design restricts their applications in urban areas. The adaptation of this concept holds significant potential, however, for effectively reducing conflict points at major intersections while increasing arterial capacity, efficiency and safety by eliminating stoppage of traffic flow at signals. This results in a facility that operates somewhere between a full freeway and a conventional arterial. These grade-separated facilities referred to as flyovers, involve raising either through or turning lanes of an arterial over the signalized intersection. The simplest flyovers design would be a bridge or underpass that separates one high volume intersection movement, either the through traffic or the turning movements, from the at-grade intersection. The at-grade intersection would remain a signalized location with all the traffic movements possible. The high volume movement is given an access ramp and bridge to separate it from the at-grade intersection, allowing redistribution of the signal time to the other approaches. The High Flow Arterial Concept Feasibility study points out that although the flyover is proven as a spot improvement tool, the impacts on corridor or system-wide traffic flow are not documented.

As stated in the study, the concept of the High Flow Arterial provides for the increase in capacity on arterial streets and highways (non-freeway) by whatever means available, low cost or capital intensive (beyond TSM limits), and can include any or all of the following elements:

- Traffic signal synchronization
- Intersection grade separation (flyover)
- Right hand turn loops for left turn movements
- Grade separated turning movements
- Access control
- Frontage roads
- Pedestrian grade separation
- Any other element which may be found useful, such as introduction of one-way arterial street network, reversible lane operation, and prohibition of short term lane closures during peak travel periods (for example for utility companies routine maintenance and inspections).

The evaluation methodology employed in this study involved the identification and measurement of potential impacts. These were classified into two basic categories: traffic flow impacts and physical impacts. Traffic flow impacts include travel time, travel speed, volume, saturation level, number of stops/mile, delay/vehicle, fuel consumption and pollution emissions. These impacts were estimated for all portions of the transportation network that were affected by the specific High Flow Arterial concept. The physical impacts include residential land removal, commercial land removal, parking space removal, commercial accessibility, residential accessibility, public transit conflicts, and multi-jurisdictional conflicts.

The High Flow Arterial Concept was later replaced by the Super Street Concept. This Super Streets Program study for Orange County, conducted in 1984, identified a potential 220-mile Super Streets arterial network. The study also established a priority system based on existing and future demands, included an engineering and environmental assessment of four case studies, and developed a model agreement, which defines project implementation responsibilities between local governments. Based on the findings of this study, the Orange County Transportation Commission recommended that a demonstration project be undertaken, and four arterial streets, Beach Boulevard, Harbor Boulevard, Katella Avenue, and Moulton Parkway/Irvine Center Drive, were identified as candidates. Beach Boulevard was selected in 1984 as Orange County's first Super Street Project. The goal of the Super Streets Demonstration Project was to develop conceptual engineering plans, environmental documentation, and an economic analysis for ultimate implementation of the high-flow arterial concept on Beach Boulevard.

The adopted improvements for Beach Boulevard were divided into three steps for phased implementation: short term (0-5 years), intermediate term (6-15 years), and long term (15-20 years). These improvements were selected to provide an acceptable peak hour level of service, minimize right-of-way acquisition and potential negative environmental impacts, maintain a consistent number of lanes, be cost effective, and maximize the project's long-term economic benefits while minimizing temporary adverse economic impacts. A summary of the adopted improvements include:

- Intersection widening/restriping within the existing right-of-way
- Intersection widening/restriping requiring new right-of-way
- Restriction/elimination of on-street parking
- Widening and restriping Beach Boulevard to accommodate a larger number of lanes
- Signal coordination along the entire length of the 19.5-mile highway
- Bus turnouts at selected locations
- Signal modifications at selected intersections
- Access control, median closure, and driveway consolidation at selected locations
- Roadway improvements such as drainage and pavement rehabilitation where needed

The cost estimate of the adopted improvements for this 19.5 mile corridor is approximately $14 million (1985 US Dollars). Actual project construction is 60% of the total cost; the remaining 40% is required for right-of-way-acquisition. Of the total construction cost, 76% would go to intersection improvements and 24% for midblock improvements.

2.4.3 Mesa, Arizona: Corridor Study

The Mesa-Chandler-Gilbert North-South Corridor Study in Arizona is an analysis of the existing and future north-south travel demands in the three East Valley cities. The study examines whether a need exists for north-south facilities, and the location and the type of facility that will best serve the projected traffic demand, in addition to those facilities previously planned.

The already planned freeway system leaves a 15-mile gap between north-south freeways that is far from ideal, does not adequately serve downtown Mesa or Gilbert, and only partially serves downtown Chandler. Major arterials are expected to be heavily congested by the year 2015. The range of alternatives considered for this area included additional six-lane arterials, super streets for some arterials, and new freeways.

The Super Street alternative included upgrading the north-south streets to six lanes and grade separations constructed at each intersection with major east-west streets. The north-south Super Streets would be free-flow through the grade separation while the east-west streets would have a signalized intersection with frontage roads where turning movements would be accommodated. A minimum right of way width of 150 feet was proposed on the super streets for the grade separation for a distance of approximately 1,100 feet in each direction from the major cross street.

Another possible configuration for grade separation include one or more "jug-handle" (shown on Figures 4. 5 and 4.6) type connector roads instead of a parallel frontage/connector road (shown on Figure 4.7), that intersect the major streets approximately 1,000 to 1,200 feet from the grade separated intersection.

The following improvements were considered for the selected corridor but were not implemented:

- Upgrade existing interchanges at selected locations where the freeways intersect the super street
- Replace the existing standard diamond interchange with a platform diamond interchange at a selected location for the freeway intersecting the super street. The platform would involve removing existing on-and off-ramps and replacing them with longer ramps that would connect to a "platform" to be built above the existing bridge that carries the selected super street across the freeway forming a three level interchange as shown on Figure 4.12. New ramps would also be provided to connect the super street to the platform where all turn movements would occur. There would be no traffic signals for traffic traveling on the super street across the freeway
- Additional right-of-way needed for the super streets at selected locations to accommodate the improvements.
- Widening of the north-south streets to six lanes not already planned to be six-lane and projected to be congested. Street widening was assumed to occur within dedicated right-of-way, except at selected locations where additional right-of-way would need to be purchased.

2.5 International Approaches to Congestion Problems

Special attention was given to researching improvement measures being utilized in Europe, at the international level to decrease congestion and increase mobility. In contrast to most domestic approaches, improvement measures most utilized in Europe focus on increasing ridership for mass transit systems and reducing the utilization of private vehicles through the implementation of traffic signal preemption and automatic vehicle location systems for buses in particular. Evidence of a "flyover " concept was also found in some European cities in a effort to relieve severely congested intersections. A brief overview of each concept is included below.

2.5.1 Traffic Signal Preemption

Transit Signal Preemption has been in use in Europe since approximately 1968. Deployment varies tremendously; some cities use it at the vast majority of signalized intersections, while it is unknown in other cities. However, it is now being installed at a rapid pace in response to a growing concern with the impacts of traffic congestion.

Signal preemption is achieved by prolonging the green phase or shortening the red phase in a traffic signal cycle for the preferred road or mode. Trams and buses are allowed to proceed only when they need to, but they do so with no delay. When a public transport vehicle crosses several traffic lights, the traffic controller normally activates a synchronized green zone for it. Although priority is given to public transit, the same volume of private vehicles as before can still be accommodated. Congestion is prevented by avoiding unnecessary green phases and systematically monitoring all areas.

2.5.2 Automatic Vehicle Location System

Installation of automatic vehicle location/control (AVLC) in public transit systems started in Europe in 1965. Most European cities use an infrared signpost-based AVLC system, allowing for bus stop spacing of approximately 1/3 mile, left turns from the right lane without the bus stopping and bus-only signals provided at intersections.

2.5.3 Vehicle Restriction Improvement Measures

Improvement measures utilized to alleviate congestion within "micro centers", such as high-density downtown areas, include the deterrence and/or prohibition of private vehicles from entering these areas. These improvement measures have worked extremely well when implemented in constrained downtown areas with adequate public transit. Mobility improvement is achieved through the decrease in vehicle volume and the elimination of parking facilities. These micro-centers are also good candidates for "pedestrian-only" zones.

Other vehicle restriction measures to improve mobility also included the restriction of heavy vehicles from selected roads during peak traffic hours.

2.5.4 Other Improvement Measures

Improvement measures employed in Europe to decrease traffic congestion such as the utilization of elevated "cars only" traffic lanes in urban areas hold potential for relieving severely congested intersections. Buses and trucks are excluded from the through flow of automobiles on these flyovers. This concept focuses on spot improvements but not on system solutions for an areawide network. The European flyover concept contrasts the grade separation facilities in the United States and should not be confused with our more conventional grade separation methods and strict design standards. Implementation of flyovers in the European cities of Brussels and Hannover have been found to minimize interference with existing traffic flow, have the capability of expansion, minimize maintenance requirements, are esthetically acceptable, and are reasonably priced.

2.6 Proposed Alternatives for Dade County

Based on the extensive research, the alternatives developed for improving traffic flow focused mainly on improvements that could be implemented within relatively short time frames and which would result in measurable capacity increase easily recognized by travelers. These selected alternatives focused on physical improvements, advanced technology applications, and public sector involvement, rather than improvements that would result from policy changes. This study recognizes the importance of these measures as tools to alleviate and manage congestion and that they should be part of the County's programs to enhance mobility.

The following categories are therefore recommended as potential improvement measures to be applied to the arterials selected to be part of the Superarterial Network in Dade County, and would complement other measures already being implemented by local government:

- Transportation System Management
- Traffic Operational Improvements
- Access Management
- Public Transit Improvements (i.e. service and operations not capital improvements)
- HOV Treatments
- Bicycle & Pedestrian Treatments
- General Purpose Lanes
- Other Improvements (such as heavy truck restrictions during the peak hours, private vehicle access restriction and/or designation of pedestrian-only zones within selected areas).

The following categories are not directly applicable to the superarterial concept since they are long term improvement measures and therefore do not meet the goals and objectives of this study:

- Travel Demand Management: extensive employer participation is required to implement this program
- Public Transit: Dade County population relies heavily on the use of private vehicles and only long term capital improvements as the ones being envisioned by MDTA would produce a mode shift that would in turn reduce congestion on the arterials.
- Congestion Pricing: such measures are usually applied to freeways. An areawide road pricing scheme would be considered another form of taxation and therefore population reaction could be quite unfavorable.

- Growth Management: Dade County has a growth management policy in plan periodically monitored.
- Intelligent Transportation System: several ITS studies are currently underway in Dade County.
- Urban Design/Community Development Master Plans: current Urban Design/CDMP policies are already in place in Dade County.
- Incident Management: not considered a treatment for long term congestion reduction or management.

2.7 Selection Criteria for Candidate Corridor and Arterials

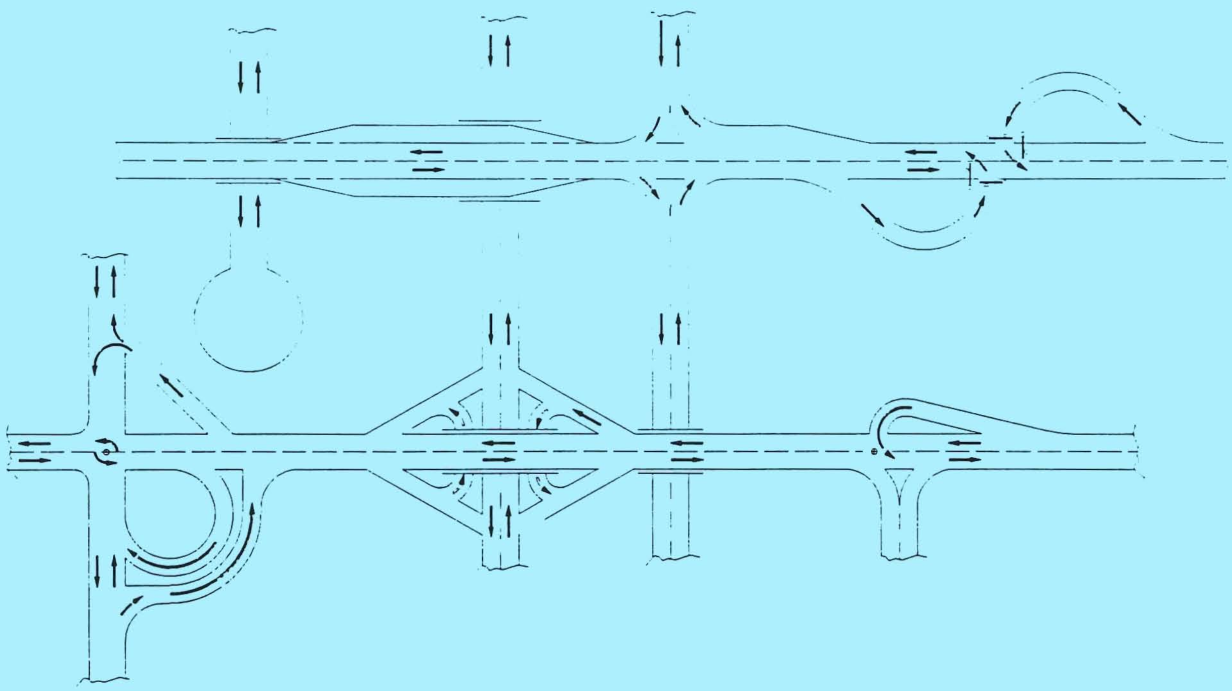
A preliminary list of criteria was selected by the Steering Committee to identify roadways that could be included in the superarterial network was developed and included the following:

- Process of elimination to exclude arterials that are off-limits (such as historic roads, undesirable physical characteristics, ROW constraints and perceived social and political objections). The Department of Transportation and the County were contacted to identify these arterials.
- Arterials with minimum continuous length of 4 miles
- Arterials with four lanes or more
- Arterials that provide direct access to an expressway
- Close and parallel to an existing freeway
- Uncongested arterials parallel to congested arterials
- Arterials that provide direct access to major activity centers
- Arterial that may be good candidates for one-way pairs
- Arterials with major transit routes
- Arterials with potential for establishing currently non-existing links (network completing links)
- Arterial scheduled for improvements
- Congested arterials identified in the County Congestion Management System.

CHAPTER 3

EXISTING AND FUTURE CONDITIONS

FINAL REPORT



3. EXISTING AND FUTURE CONDITIONS

Changes in demographics and travel behavior characteristics have resulted in significant challenges for transportation decision makers, planners and practitioners throughout Miami-Dade County. Efforts to meet these challenges have had varying degrees of success and/or failure.

Looking to the future, it appears that dealing with existing and evolving transportation needs will only become more difficult. Commuting in Miami-Dade County has evolved substantially over the past several years, from the more traditional commuting pattern with the central business district as the main destination, to new travel patterns with destinations increasingly dispersed throughout the County. This trend, along with tremendous growth in population, has caused a great increase in congestion in Dade County. There is therefore, an urgent need to explore ways and methods of alleviating and/or improving this situation.

The purpose of this chapter is to summarize geographic travel pattern, growth, and development trends in Dade County, and to address how these factors can help identify potential roadways to be included in the superarterial network. The data presented in this chapter summarizes existing and future conditions collected from reports and studies provided by the Florida Department of Transportation (FDOT) and the Metropolitan Planning Organization (MPO).

Dade County is located along the southeast edge of the Florida Peninsula, with a total area of 2,430 square miles. It is bound by Biscayne Bay and the Atlantic Ocean on the east, the Everglades on the west, the Florida Keys to the south, and connects to metropolitan Broward County and Fort Lauderdale to the north. The natural boundaries have created a relatively narrow north-south strip of land that can be developed. Although some modifications were made over the past years by the draining and filling of wetlands, current environmental policies make it very unlikely that conservation areas located in the west area of Dade will ever be developed. In recent years, large scale suburban residential and commercial developments have been built west of SR 826 (Palmetto Expressway). As a result, extensive growth occurred in that area and in the vicinity of the Miami International Airport, creating a sizable increase of east-west commuter flow, in addition to the typical north-south travel pattern. This east-west flow is not well served by the county's existing transportation infrastructure.

3.1 Levels of Congestion

In order to determine the magnitude of the congestion in the County, it is necessary to measure the levels of congestion on the County's main thoroughfares. A common method had to be developed since the Florida Department of Transportation and Dade County use different methods in determining congestion.

The State uses the following Florida Department of Transportation Level of Service (LOS) tools to measure congestion on state roads:

1. Generalized LOS Tables - FDOT's generalized LOS tables were developed based on the definitions and methodology of the 1985 HCM.

2. Arterial Planning Computer Model (ART PLAN) - Computer template using Lotus 1-2-3 software for planning level traffic analysis on interrupted flow facilities. The program has a capacity to analyze an arterial with up to 20 intersections and allows each intersection to be treated differently.

3. Arterial Table Computer Model (ART TAB) - This template is similar to ART-PLAN, but assumes the same traffic characteristics for all signalized intersections being studied.

4. Freeway Table Computer Model (FREE TAB) - produces generalized tables for freeways.

Dade County's LOS methodology is similar to FDOT's methodology, but uses Average Week Day Traffic (AWDT) to calculate LOS rather than Annual Average Traffic (AADT). In order to use a common base to evaluate congestion on both county and state roadways, the County developed the Relative Congestion Ratio (RCR) method as part of the Congestion Management Plan/Congestion Management System (CMP/CMS) study. A Relative Congestion Ratio (RCR) is defined as the ratio between the existing volume to capacity (V/C) ratio obtained from travel demand model and the maximum V/C ratio allowed according to local conditions.

$$\text{Relative Congestion Ratio} = \frac{\text{Existing V/C Ratio}}{\text{Maximum V/C Ratio Allowed}}$$

The existing V/C ratio is obtained from the model network, and the maximum V/C ratio allowed is established by the County or state standards.

Based on the RCR measure, Dade County developed the following criteria for measuring the level of congestion on arterials and freeways:

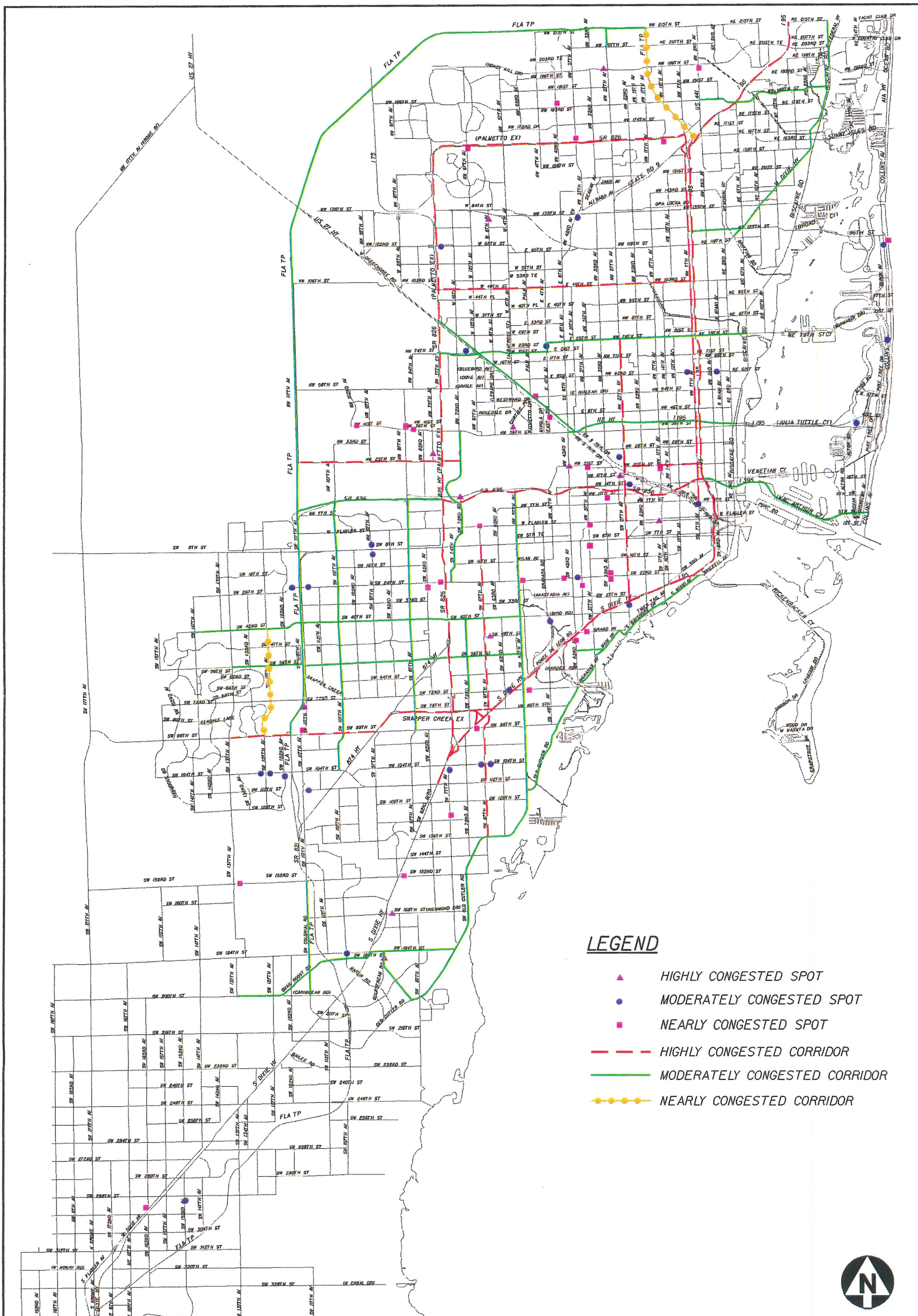
Nearly Congested	$0.9 < RCR <= 1.0$
Moderately Congested	$1.0 < RCR <= 1.20$
Highly Congested	$RCR > 1.20$

Table 3-1 summarizes the various congested ***corridors*** in Dade County, also shown on Figure 3-1.

Table 3-1: Congested Corridors

	Corridor	From	To
Highly Congested Corridors			
1	SR 826 (Palmetto Express)	US 1(South Dixie Highway)	Golden Glades Interchange
2	SW 67th Avenue (Ludlam Road)	SW 136th Street	SW 8th Street
3	West 27th Avenue	US-1 (South Dixie Highway)	NW 79th Street
4	NW 7th Avenue	I-95	SR 826 (Palmetto Expressway)
5	I-95	Broward County Line	US-1 (South Dixie Highway)
6	SW 88th Street (Kendall Drive)	SW 137th Avenue	SR 874 (Don Shula Expressway)
7	SR 874 (Don Shula Expressway)	SW 88th Street (Kendall Drive)	SR 878 (Snapper Creek Parkway)
8	SR 878 (Snapper Creek Parkway)	SR 874 (Don Shula Expressway)	US-1 (South Dixie Highway)
9	US-1	SW 112th Street	I-95
10	NW 103rd Street	SR 826 (Palmetto Expressway)	NW 7th Avenue
11	SR 836 (Dolphin Expressway)	SR 826 (Palmetto Expressway)	I-95
Moderately Congested Corridors			
1	Florida Turnpike	SW 88 Street (Kendall Drive)	NW 17 Avenue
2	SW 117th Avenue	SW 200 Street	SW 152 Street (Coral Reef Drive)
3	SW 107 Avenue	SR 874	SR 836
4	SW 87 Avenue	SW 88 Street	SR 836
5	NW 72 Avenue	SW 72 Street	NW 36 Street
6	SW 57 Avenue	Old Cutler Road	SR 836
7	Ingraham/Main Highway	SW 72 Street	Grand Avenue
8	McFarlane /Bayshore Drive	Grand Avenue	SW 12 Avenue
9	Old Cutler Road	SW 200 Street	SW 72 Street (Sunset Drive)
10	W Dixie Highway	NE 125 Street	NE 215 Street
11	NE 125 Street	I-95	West Dixie Highway
12	Miami Gardens Drive	NW 2 Avenue	US-1
13	Okeechobee Road	SR 826	SR 112
14	N 74/79 Street	SR 826	US-1
15	SR 112	Okeechobee Road	NW 7 Avenue
16	SR 836	H.E.F.T	SR 826
17	I-395	I-95	Collins Avenue
18	SW 40 Street (Bird Road)	SW 147 Avenue	SW 57 Avenue
19	SW 56 Street (Miller Road)	SW 137 Avenue	SW 57 Avenue
20	Quail Roost/Caribbean Blvd.	SW 137 Avenue	Old Cutler Road
Nearly Congested			
1	SR 91 (Turnpike Connection)	Golden Glades	Florida Turnpike
2	SW 127 Avenue	SW 88 Street (Kendall Drive)	SW 40 Street (Bird Road)

Source: 1995 Dade County Mobility Management Process: Congestion Management System



SUPERARTERIAL NETWORK STUDY

MIAMI-DADE COUNTY

CONGESTED CORRIDORS AND SPOTS

Figure 3.1

The following is a summary of the degree of congestion in Dade County:

Highly Congested	54 miles
Moderately Congested	141 miles
Nearly congested	45 miles

The congested ***spots*** were determined using the RCR method, and are based on roadway segments that are short (less than two miles), and isolated from congested corridors. Table 3.2 summarizes the congested spots in the County. Figure 3.1 shows the location of these spots.

Table 3-2: Congested Spots

Highly Congested Spots			
1	Miami International Airport Entrance	7	South Perimeter Road east of NW 72 Avenue (Sunset Drive)
2	SW 168 Street east of US 1	8	NW 17 Street west of NW 27 Avenue
3	Curtis Parkway North of NW 36 Street	9	SW 117 Avenue south of SW 72 Street
4	NW 79 Avenue North of NW 25 Street	10	SW 97 Avenue south of US 1
5	NW 199 Street west of NW 27 Avenue	11	SW 1 Street west of SW 17 Avenue
6	NW 62 Avenue south of Gratigny Parkway	12	SW 48 Street east of SW 67 Avenue
Moderately Congested			
1	NW 37 Avenue south of NW 135 Street	16	SW 97 Avenue north of SW 8 Street
2	NW 122 Street east of SR 826	17	SW 97 Avenue south of SW 8 Street
3	Harding Avenue south of SW 92 Street	18	SW 22 Street East of 42 Street
4	NW 74 Street west of Okeechobee Road	19	SW 27 Avenue south of US 1
5	E 4 Avenue south of NW 79 Street	20	SW 72 Street west of Ponce de Leon Boulevard
6	NW 62 Street west of NW 7 Avenue	21	SW 104 Street (Killian Parkway) west of SW 127 Avenue
7	NW 62 Street west of Miami Avenue	22	SW 104 Street (Killian Parkway) east of SW 127 Avenue
8	NW 26 Street west of NW 27 Avenue	23	SW 104 Street (Killian Parkway) west of 67 Avenue
9	NW 14 Street east of NW 27 Avenue	24	SW 104 Street (Killian Parkway) east of 67 Avenue
10	W 63 Street west of Collins Avenue	25	SW 77 Avenue south of SW 104 Street
11	Alton Road south of Arthur Godffrey Road	26	SW 112 Street east of SW 117 Avenue
12	NW 7 Avenue south of NW 7 Street	27	SW 122 Avenue south of SW 104 Street
13	Alhambra south of SW 40 Street	28	SW 107 Avenue south of SW 184 Street (Eureka Drive)
14	SW 24 (Coral Way) Street west of HEFT	29	SW 152 Avenue south of SW 288 Street
15	SW 24 (Coral Way) Street east of HEFT		
Nearly Congested			
1	NW 42 Avenue (LeJeune Road) north of NW 183 Street (Miami Gardens Drive)	19	SW 24 Street west of SR 826
2	NW 2 Avenue south of NW 199 Street	20	SW 82 Avenue south of SW 24 Street
3	NW 67 Avenue south of SR 826	21	SW 22 Street east of SW 57 Avenue
4	NW 37 Avenue north of SR 826	22	SW 22 Street west of SW 42 Avenue
5	NW 12 Avenue south of SR 826	23	Madrid Avenue east of SW 57 Avenue
6	NW 62 Avenue south of Gratigny Parkway	24	University Drive west of SW 42 Avenue
7	Harding Avenue south of SW 96 Street	25	SW 32 Avenue north of SW 22 Street
8	East Drive south of Okeechobee Road	26	SW 32 Avenue south of SW 22 Street
9	NW 54 Street east of Okeechobee Road	27	Grand Avenue east of US 1
10	NW 87 Avenue north of NW 41 Street	28	SW 42 Avenue south of US 1
11	NW 41 Street east of HEFT	29	SW 72 Street east of SW 57 Avenue
12	NW 87 Avenue north of NW 41 Street	30	SW 117 Avenue north of SW 88 Street
13	NW 37 Avenue south of 21 Street	31	SW 88 Street east of US 1
14	NW 17 Avenue south of NW 20 Street	32	SW 77 Avenue north of SW 128 Street
15	NW 32 Avenue south of SR 836	33	SW 152 Street east of SW 137 Avenue
16	NW 67 Avenue north of Flagler Street	34	SW 152 Street east of US 1
17	SW 37 Avenue south of Flagler Street	35	SW 97 Avenue south of SW 184 Street
18	SW 37 Avenue south of SW 8 Street	36	SW 296 Street west of US 1

Source: 1995 Dade County Mobility Management Process: Congestion Management System

3.2 Miami-Dade County Traffic Characteristics

The traffic characteristics for Miami-Dade County obtained from the 1990 Southeast Regional Planning Model-IV (SERPM), the 1994 FDOT Classification Count Summary, and the 1990 Dade County Model Validation Report are presented below. The Southeast Regional Planning model is based on the MPO County models for Dade, Broward, and Palm Beach Counties, and provided additional information such as truck distribution for Dade County.

3.2.1 General Trip Distribution by Time of Day

Trip distribution by time of day provides a good indication of the extent of the congestion problem by identifying the time of day and length of the congested periods. Twenty-four hour traffic counts were recorded in 1,400 stations in Miami-Dade County. Total hourly trips were calculated by adding traffic counts observed for the same hour at all stations. Percentage of trips in time-of-day was calculated from total hourly trips and are illustrated on Table 3-4.

Figure 3.2 illustrates the trip distribution by time of day and the "peak spreading" phenomenon occurring within the county. The morning and afternoon peaks are 7:00 to 10:00 AM and 3:00 to 7:00 PM. These extended peak hour periods from the conventional 7-9 AM and 4-6 PM, are yet another indication of growing congestion in the metropolitan area. The data shows that the highest hourly volume occurs between 4:00 and 5:00 PM, and the second highest hourly volume between 7:00 and 8:00 AM. Volumes higher than 1,800,000 vph occur between 6 AM and 6 PM, with peaks during the 7 to 9 AM and the 12 to 6 PM periods. Seventy percent of the total daily trips occur between 7:00 AM and 7:00 PM, and 40 percent during the morning and afternoon peak hours.

3.2.2 Truck Trips Distribution by Time of Day

This data is based on 35 count stations in Miami-Dade County. The morning peak is found to be between 7:00 and 10 AM and afternoon peak is from 3:00 to 7:00 PM. On average, about 16 percent of daily truck trips were made during the morning peak period and about 27 and 56 percent during the afternoon peak and off-peak periods respectively. Table 3.3 summarizes the truck travel pattern in Dade County.

Table 3-3: Truck Trip Distribution by Time-of-Day

AM-Peak Hour	Off-Peak	PM-Peak Hour
16.39%	56.24%	27.37%

The 1994 Classification Counts Summary obtained from FDOT shows an average daily truck percentage on arterials ranging from 1.3 to 21 percent, and from 4 to less than 1 percent on freeways where data was collected. In summary, although truck traffic varies considerably by location, it is generally significantly higher in the central, northwest, and airport and airport west areas. The average truck percentage during the peak hour is approximately half of the daily truck percentages on both freeways and arterials.

Table 3-4: 24-Hour Traffic Count Distribution Summary

Time		Total Miami-Dade County Hourly Trips (vph)	Percent of Total Daily Trips	Period Percentage
Start	End			
0 :00	1 :00	282,913	0.84%	11.36%
1 :00	2 :00	173,586	0.52%	
2 :00	3 :00	130,806	0.39%	
3 :00	4 :00	147,733	0.44%	
4 :00	5 :00	318,881	0.95%	
5 :00	6 :00	947,498	2.82%	
6 :00	7 :00	1,814,832	5.40%	
7 :00	**8 :00**	**2,174,739**	**6.47%**	18.19%
8 :00	9 :00	2,046,168	6.09%	
9 :00	10 :00	1,889,518	5.63%	
10 :00	11 :00	1,905,071	5.67%	30.05%
11 :00	12 :00	1,968,276	5.86%	
12 :00	13 :00	2,008,537	5.98%	
13 :00	14 :00	2,041,746	6.08%	
14 :00	15 :00	2,171,427	6.46%	
15 :00	16 :00	2,301,624	6.85%	20.37%
16 :00	**17 :00**	**2,383,270**	**7.09%**	
17 :00	18 :00	2,158,556	6.43%	
18 :00	19 :00	1,787,831	5.32%	20.02%
19 :00	20 :00	1,438,191	4.28%	
20 :00	21 :00	1,211,074	3.61%	
21 :00	22 :00	1,011,375	3.01%	
22 :00	23 :00	771,714	2.30%	
23 :00	0 :00	505,782	1.51%	
Total		**33,591,148**	**100.00%**	**100.00%**

vph = vehicles per hour.

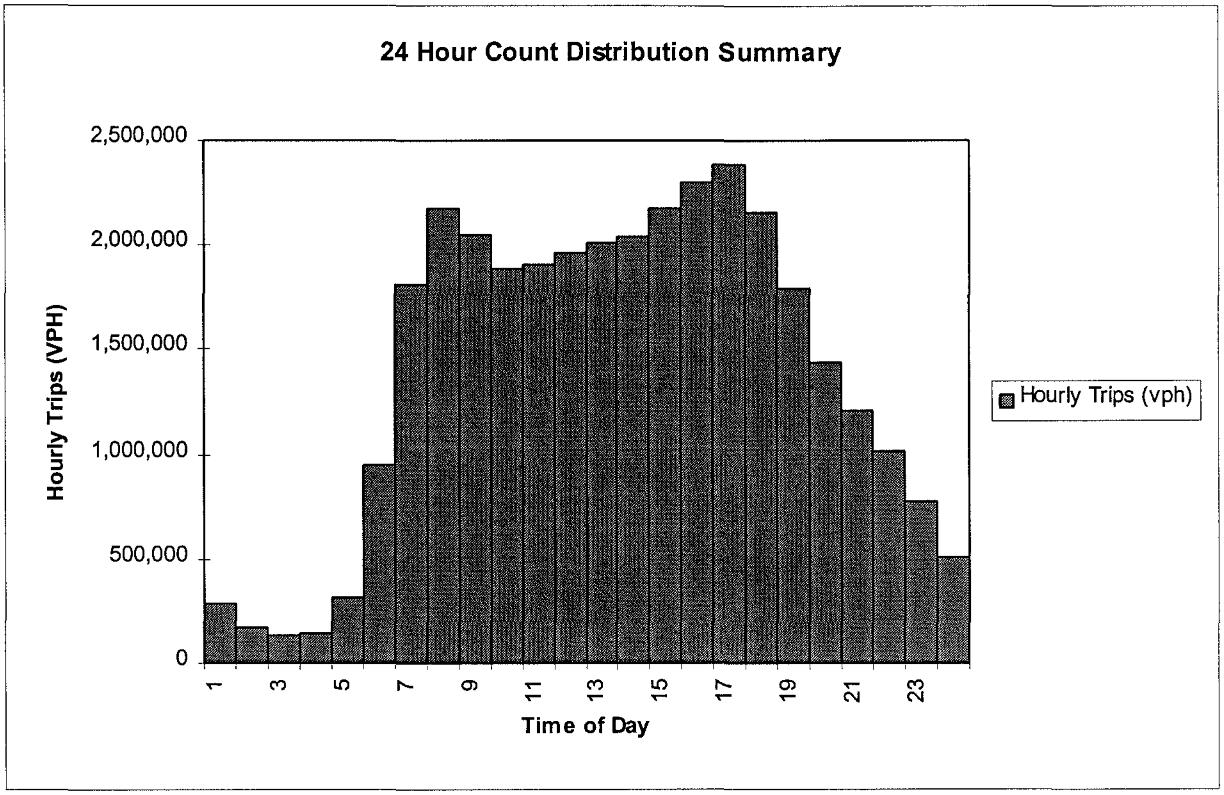


Figure 3-2: 24 Hour Count Distribution Summary

3.2.3 Initial and Constrained Speed by Facility Type

Speeds obtained from the 1990 Dade County Model Validation and the Southeast Regional Planning Model Reports give a good indication on the extent of the congestion throughout the County in the absence of actual speed surveys. Initial speed refers to design speed conditions and constrained speeds refers to operational conditions, and are developed for the different types of roadway facilities in an urbanized metropolitan area. The definition for each facility type is shown on Table 3.5. Table 3.6 shows that the current volume of trips being handled by the divided arterials existing may reduce the traveling speeds by as much as 35 percent.

Regionally, speeds are reduced on all facilities by approximately 25 % during the congested periods.

Table 3-5: Definition of Facility Type

Facility Type	Definition of Facility Type
Freeway / Expressway	A facility with full control of access to give preference to through traffic (e.g., I-95, the Florida Turnpike, SR 836, etc.).
Divided Arterial and Expressway	A facility with a painted area wide enough to protect a left-turning vehicle, or with barrier or median (raised or depressed) separating opposing traffic flows, carrying most of the long trips made within and through an urban area, emphasizing traffic movement rather than land access, and carrying higher volumes than any facility except freeways. Expressways have some grade-separated intersections, fewer signals per mile than arterial, and some frontage roads (e.g. US 1, MacArthur Causeway, Crandon Blvd.).
Undivided Arterials	Similar to a divided arterial, except no painted area or physical barrier separates opposing traffic flows. Generally has more signals per mile and fewer frontage roads, serves fewer through trips, and serves more land access than divided arterial (e.g. SW 27th Ave, NW 36th St., Okeechobee Rd).
Collector	Street that "collects" traffic from local streets in the neighborhoods and channels it into the arterial system. A small amount of through traffic may be carried on collector streets, but the system primarily provides access to abutting land by carrying local traffic between or within residential neighborhoods and commercial areas, or to roadways with more capacity.
High Occupancy Vehicle (HOV) Facilities	Any facility on which traffic is restricted to a specific trip purpose, or to vehicles with a particular number of passengers (I-95 HOV lanes are the sole type of this facility in operation in Dade County).
Source: Florida Department of Transportation	

Table 3-6: Initial and Constrained Speed by Facility Type

Speeds (mph)	Freeways and Tolls	Divided Arterials	Undivided Arterials	Collectors	HOV	All Facilities
Initial	60.21	38.72	31.94	30.74	60.00	**34.89**
Constrained	42.29	24.24	24.98	25.35	38.94	**25.84**
Percent Reduction	30%	35%	22%	18%	35%	**26%**

3.2.4 Initial and Constrained Speed by Area Type

The initial and constrained speeds were also compared by area type in order to determine the areas with the highest level of congestion due to speed reduction. Table 3.7 shows the definition of each area type analyzed.

Table 3-7: Definition of Area Type

Area Type	Definition of Area Type
Central Business District (CBD)	An area where the predominant land use is intense business activity. Characterized by large numbers of pedestrians, commercial vehicles, loading of goods and people, a large demand for parking space, and a high degree of turnover in parking.
CBD Fringe	The portion of a municipality immediately outside the CBD. Exhibits a wide range of business activities (small businesses, light industry, warehousing, automobile service centers, and intermediate strip development, with some concentrated residential areas). Traffic in these areas generally involves trips that do not have an origin or destination within the area. Less pedestrian traffic and lower parking turnover than in the CBD. However, large parking areas servicing the CBD might be present.
Residential	An area within the influence of a municipality in which the predominant land use is residential development (small businesses may be present). Characterized by few pedestrians and low parking turnover.
Outlying Business District (OBD)	An area within the influence of a municipality that is normally separated by some distance from the CBD and its fringe area, but has the intense activity characteristic of a central area. The principal land use is business, and there may be heavy traffic or through movements, causing vehicles to operate at lower speeds than in fringe areas. Also characterized by large demand for parking and high turnover, and moderate pedestrian traffic. This category does not include off-street shopping on one side of a street only. ***Moderate to heavy strip development on both sides of a street should be coded OBD.***
Rural	A sparsely developed area within the influence of a municipality in which the predominant land use is other than those described in the four preceding categories.
Source: Florida Department of Transportation	

Table 3.8 shows a comparison between initial and congested speeds for the different area types. The data shows that the Outlying Business Districts have the highest speed reductions followed by residential areas.

Table 3-8: Initial and Constrained Speed by Area Type

Speeds (mph)	CBD	Fringe	Residential	OBD	Rural	All Areas
Initial	26.14	31.26	35.35	34.66	34.77	**34.89**
Constrained	24.73	26.27	26.91	20.44	33.71	**25.84**
Percent Reduction	**5%**	**16%**	**24%**	**41%**	**3%**	**26%**

Comparing initial and constrained speed by both facility and area types, the impact of congestion seems to be higher on arterials providing access to commercial land uses away from the Central Business District. Most suburban areas exhibit significant levels of ever increasing congestion as reflected in the model output in Table 3.8. The greatest degradation of travel speeds are observed in the Outlying Business District area type. *It should be noted that the OBD area type and the suburbs are characterized by intense strip malls and shopping centers along their arterials.*

3.3 Activity Centers

Traffic patterns are strongly influenced by the location of major attraction zones labeled as activity centers. Depending on the land use of these centers, they can be generally divided into the following categories: special attractions, educational centers, regional retail centers, and regional hospitals. Because of their magnitude, these centers attract traffic from large, or in a number of cases, all areas of the County. Traffic is then concentrated on the arterials providing direct access to each particular center. Figure 3.3 shows the location of most of the major activity centers within Miami-Dade County, which are summarized on Table 3.9.

Table 3-9: Activity Centers

Special Attraction Centers and Areas			
1	Coconut Grove	7	Miccosukee Indian Casino
2	Miami International Airport	8	South Beach
3	Metro Zoo	9	Proplayer Park
4	Miami Seaquarium	10	Orange Bowl
5	Port of Miami	11	Miami Beach Convention Center
6	Miami Arena	12	Downtown Miami
Educational Centers			
13	Florida International University, University Park	16	Miami-Dade Community College, North Campus
14	Florida International University, Bay Vista Campus	17	University of Miami
15	Miami-Dade Community College, Kendall Campus		

Table 3.9 (Continued): Activity Centers

Regional Retail Centers			
18	Aventura Mall	22	International Mall
19	Cutler Ridge Mall	23	The Falls
20	Dadeland Mall	24	Westland Mall
21	Florida Keys Outlet Mall	25	163rd Street Mall
Regional Hospitals and Medical Centers			
26	Baptist Hospital	33	Mercy Hospital
27	Doctor's Hospital	34	Miami Children's Hospital
28	Parkway Regional Medical Center	35	Mount Sinai Hospital
29	Hialeah Hospital	36	North Shore Hospital
30	Jackson Memorial Hospital/U.M.	37	Palmetto General Hospital
31	Cedars Hospital V.A.	38	South Miami Hospital
32	Kendall AMI		

3.3.1 Special Attraction Centers

Special attraction facilities include: entertainment centers, sports facilities, seaports and airports, and other centers. The traffic patterns in special attraction areas vary depending on the usage. For example, at South Beach and Coconut Grove, which are mainly entertainment areas, the traffic is high on evenings and weekends. Sports facilities such as the Miami Arena, Pro Player Park, and the Orange Bowl episodically generate high traffic during special events like concerts and other sporting events. The Miami International Airport and the Port of Miami generate high traffic virtually throughout the day all year-round, with higher peaks during certain days and months of the year. Other special attractions such as Metro Zoo, the Miami Seaquarium, and the Miami Beach Convention Center generate high traffic during weekends, public holidays, and special events.

3.3.2 Educational Centers

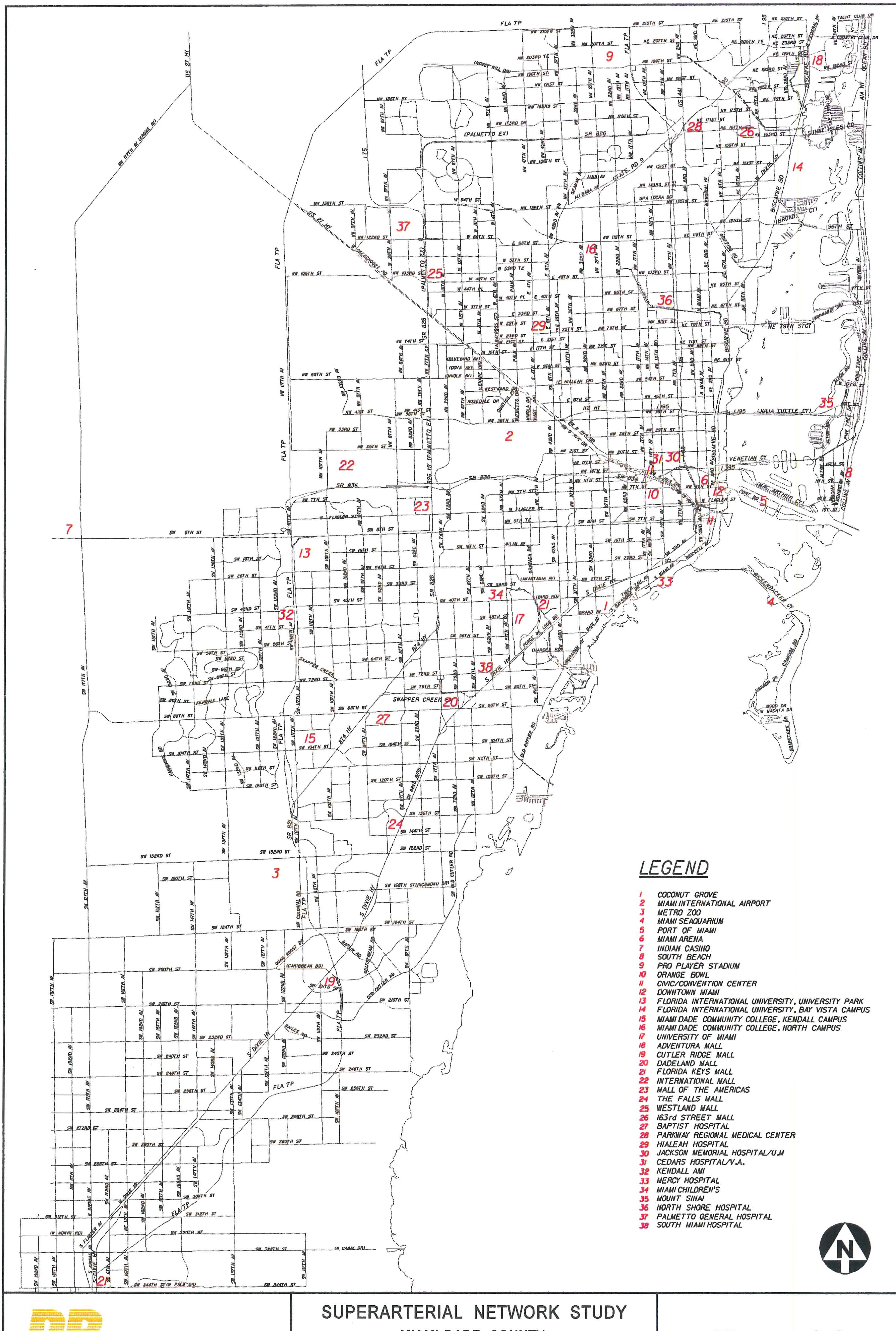
Educational centers include most universities and community colleges. While elementary, middle, and senior high schools generally generate traffic during regular peak hours, higher level, and some community-level education institutions usually generate high traffic throughout the day, including evenings, because classes are held both in the day and evenings.

3.3.3 Regional Retail Centers

Regional retail centers generate high traffic during the evening and weekend throughout the year with even higher peaks during the holiday seasons.

3.3.4 Regional Hospitals

Regional hospital traffic generation patterns depend on the size and the function of the facility. The Civic Center, where hospitals like Jackson Memorial and Cedars are located, generate high traffic during the day compared to Kendall Regional Medical Centers. This is due to high concentration of doctors' offices, special clinics, special treatment centers, and research activities. The high traffic generation occurs throughout the day, including evenings when visiting hours are in effect.



SUPERARTERIAL NETWORK STUDY

MIAMI-DADE COUNTY

SPECIAL ATTRACTION CENTERS AND AREAS

Figure 3.3

3.4 Transit

Miami-Dade County is served by several modes of public transportation regulated by two public transit agencies:

- Miami-Dade Transit Agency (MDTA) Operating Metrobus, Metrorail and Metromover.
- Tri-County Commuter Rail Authority (Tri-Rail) operating commuter rail through Dade, Broward, and Palm Beach Counties.

This section provides background information on the services provided by the two agencies.

The Miami-Dade Transit Agency (MDTA) is responsible for the planning and provision of public transit services which consist of four major components: the Metrobus fleet, Metrorail, Metromover, and Special Transportation Services, designed to meet the needs of the disabled riders who can not use regular transit services.

The Metrobus system has 73 routes, including one midday only and nine peak hour only routes. Metrorail is a 21-mile light rail system extending from the Okeechobee station, its north-west terminal in Hialeah, to the Dadeland South station at its southern terminal in east Kendall. Downtown area service is provided through the Government Center station where connection to the Metromover, a 4.4-mile elevated people mover, provides access to major land uses within the Central Business District. Metrorail began operation to its initial 10 stations on the south line on May 20, 1984. Five additional stations on the north line were opened in December 1984 and five in May 1985. The Tri Rail station was added to the system in March 1989.

Parking facilities, whether covered garages or open lots, are generally located in close proximity to Metrorail stations. A major concern in some key locations is that parking is not immediately adjacent to the stations, forcing drivers to negotiate local streets to reach Metrorail. Parking is available at 17 of the 21 Metrorail stations. The following stations have covered parking garages: Dadeland North and South, South Miami, Dr. Martin Luther King, Earlington Heights, and Okeechobee.

Public transit is also provided by private operators called jitneys. Jitney and minibus operators provide service on numerous roads that supplement, or partially compete with, Metrobus services. Three jitney operators (Liberty City, King Jitney and Dade Jitney) were providing public transit services prior to 1981 when the original Jitney Ordinance was adopted to regulate all jitneys operating in Dade County at that time. Another Jitney Ordinance was passed in 1985.

The problem of unlicensed and unregulated jitney services operating along the heaviest MDTA bus routes is being addressed through enforcement of the Dade County Ordinance regulating the jitney industry.

3.4.1 System Operation

Metrobus operates 22 hours per day, with the first bus beginning service at 4:33 AM and the last bus returning to the garage at 2:13 AM. It should be noted that the span of services is shorter than 22 hours for most routes. Metrobus operates every day of the year. There is a total of 73 bus routes in the Metrobus system. Peak period services are from 5:30 AM to 8:30 AM and 4:30 PM to 6:30 PM. Express buses operate within the peak periods.

Metrorail operates every day from 5:30 AM to midnight. Metromover operates every day from 6:00 AM to midnight. Metrorail trains have a single operator on board. Metromover operation is totally automated; there are no operators on board the vehicles.

In February 1997 the exclusive Busway on US 1 was inaugurated.

3.4.2 System Performance Indicators

Metrobus operates slightly over 27.5 million annual miles and 2.0 million annual vehicle hours, according to Section 15 data from Fiscal Year (FY) 1995.

Figure 3.4 shows the major transit routes operated by MDTA within Miami-Dade County.

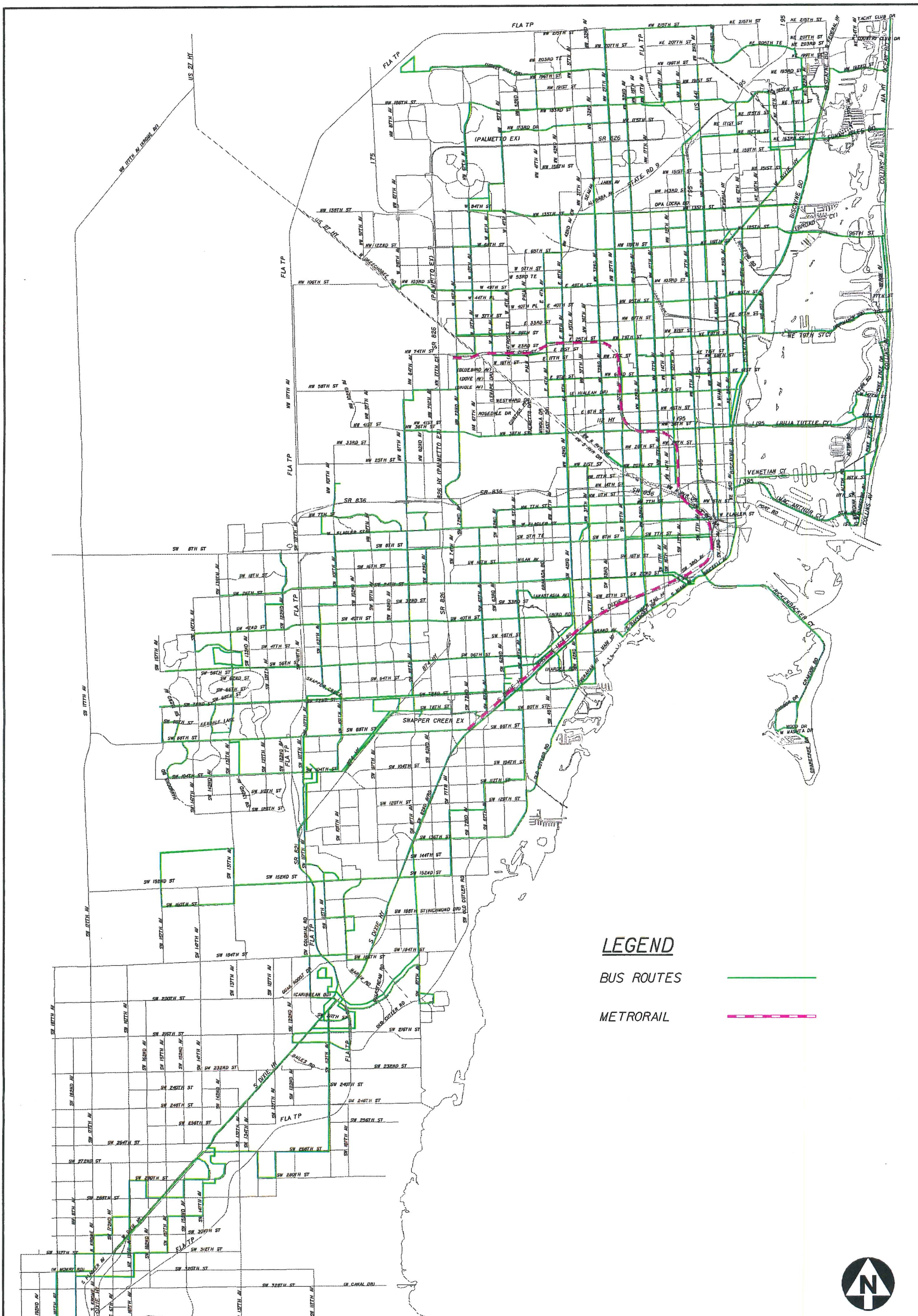
3.5 Future Conditions

3.5.1 Development Trends

Urban pressures, including rising congestion in established areas in Central Dade, have created a westward movement of population, which has resulted in what we know today as the sprawling suburbs. Over the next twenty years, the Miami-Dade County Planning Department projects that employment will increase by 45 percent, population will increase by 39 percent, school enrollment will increase by 41 percent, and occupied dwellings will increase by 31 percent. The projected population growth is expected to occur mainly in the southern and western areas of the County.

Existing residential development in Miami-Dade County varies in type and affordability from high rise condominiums to single-family homes, with examples of virtually every housing type and density spanning the range. Single-family residential lot sizes generally range from one-quarter to one-half acre, with lots in some older neighborhoods up to one acre in size. The latest trend in residential development shows a significant reduction in lot sizes resulting in higher density developments with few access and egress points. These types of development patterns create large pockets in the roadway networks where only internal development trips are served, forcing the majority of the traffic onto already congested arterials. There is no indication that this trend will not continue in the future.

As additional and comparatively less expensive land became available in the western areas of the County, large suburban developments have been created in the past decades. This trend is also expected to continue in the future, adding to the already existing traffic congestion problems.



SUPERARTERIAL NETWORK STUDY

MIAMI-DADE COUNTY

MAJOR TRANSIT ROUTES

Figure 3.4

3.5.2 Proposed and Planned Transportation Improvements

The 2015 Metro Dade Long Range Transportation Plan (LRTP) addresses projected transportation needs in Dade County to the year 2015. The LRTP objectives are designed to improve transportation for residents, businesses, employees and visitors of Miami-Dade County.

The projects planned include connecting major transportation centers, major cultural and civic centers, developing an innovative transportation program that eases congestion by offering alternatives to single occupant vehicles, and improving and upgrading existing infrastructure to assure the roads will be able to handle increased traffic growth. In terms of relieving congestion, several short term strategies, as well as continuing non-capital intensive approaches, include highway design and employer-based travel demand management measures, such as car-pool incentives and programs that encourage the use of mass transit are identified.

The 2015 transportation plan shows a 35.2 percent increase in trips, and 33.7 percent increase in the number of personal autos compared to existing conditions. The plan lists the needs and the recommended transportation plan that will be needed to meet most of these increased demands based on available funds. The improvements include widening of roads to higher numbers of lanes, limited new roadway construction, corridor improvements, and transit improvements, including Metrorail extensions. Figure 3.5 shows the major transportation improvements planned throughout Miami-Dade County.

3.6 Summary

The following is a summary of the information gathered through the data collection effort:

1. 240 miles of congested roadways, and 36 specific congested locations have been identified, ranging in congestion severity from nearly congested to severely congested.

2. Truck traffic accounts for as much as twenty percent of the total daily traffic on specific arterials within the County. Approximately 27 percent of the regional daily truck trips occur between 3:00 and 6:00 PM, intruding into the afternoon peak traffic time.

3. Miami-Dade County exhibits a high temporal commuter traffic pattern based on the fact that approximately 40 percent of the total region-wide daily trips occur during morning (7:00 to 10:00 AM) and afternoon (4:00 to 7:00 PM) peak periods. The roadways within Miami-Dade County are also heavily traveled throughout the day; approximately 30 percent of the region-wide daily trips occur between 10:00 AM and 4:00 PM, the midday period.

4. Based on model validation reports, traffic volumes account for an approximate 26 percent reduction in speed along most major arterials and freeways within the County. The percentage of speed reduction is higher on largely suburban arterials providing access to outlying business districts such as strip shopping centers.

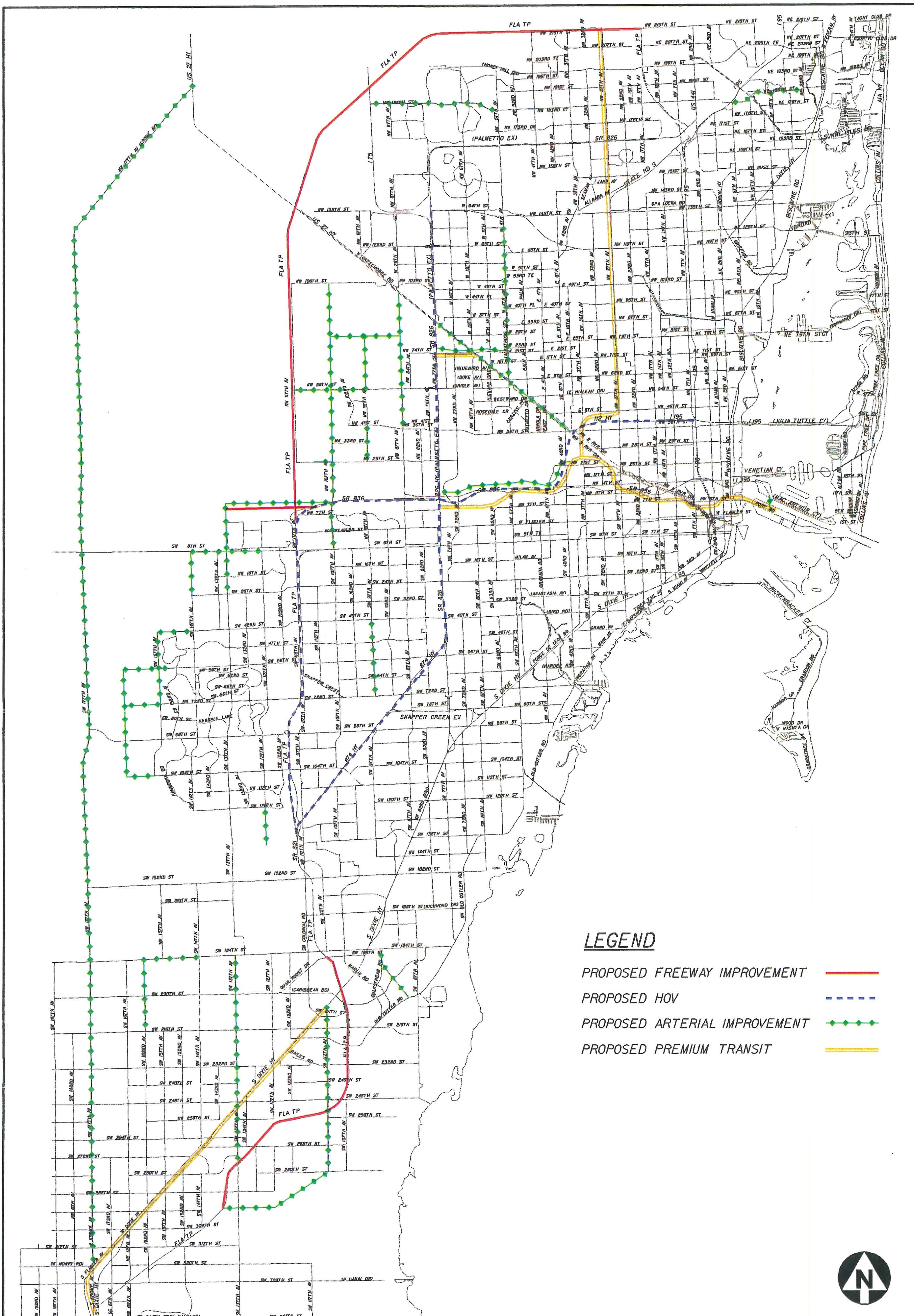
5. A list of 39 of the major attraction centers and areas was compiled. Most of the arterials providing access to these centers show some level of congestion; many are highly congested.

6. The data show that arterials along major bus and transit routes experience some levels of congestion; again, many experience high levels of congestion.

7. Current development trends create large pockets with high density land uses forcing traffic onto already congested arterials; development areas are located along the western edge of the County. Population is expected to increase by 39 percent by the year 2015.

8. Proposed transportation improvements planned through the year 2015 will address much of the existing and foreseeable congestion problems but only within the available limited funding.

The information presented in this report clearly demonstrates an overwhelming need to improve the arterial system in Dade County. This study proposes to identify and recommend improvements to selected arterials to be part of the Superarterial Network. The goal of this network is to propose an alternative to building new roadways by capitalizing on the existing roadway system through a series of improvements in effort to alleviate and manage existing and future congestion levels within the County.



SUPERARTERIAL NETWORK STUDY

MIAMI-DADE COUNTY

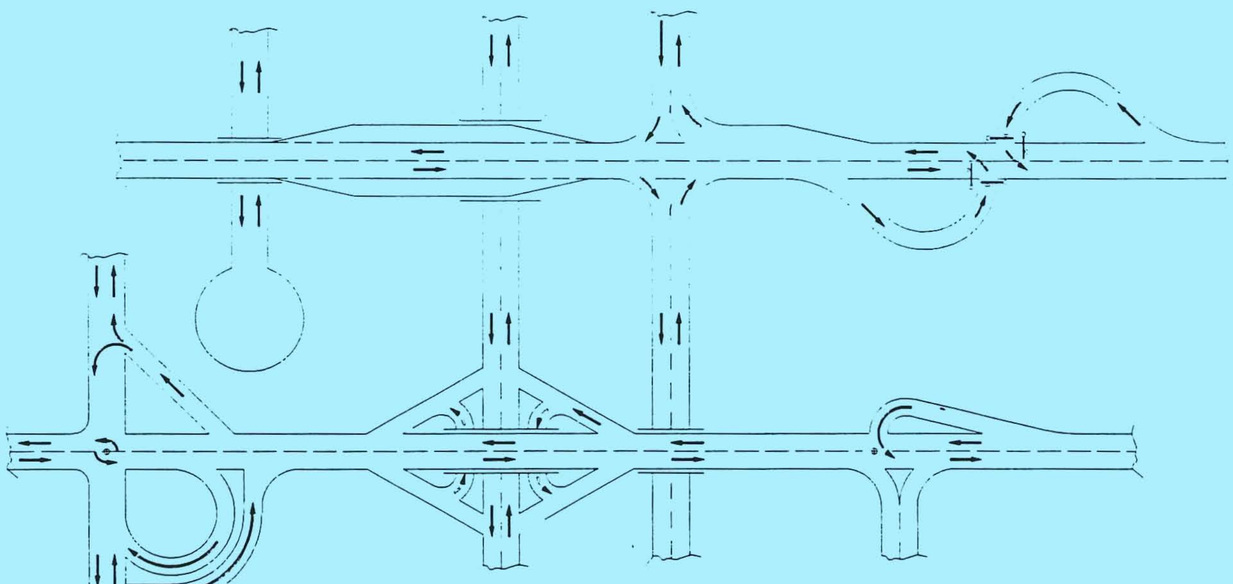
2015 PLANNED TRANSPORTATION IMPROVEMENTS

Figure 3.5

CHAPTER 4

DEFINITION OF CONCEPT

FINAL REPORT



4. DEFINITION OF CONCEPT

This section defines the Superarterial Concept along with the different components of the network that were developed in order to identify the arterials to be included in the network.

4.1 Concept Definition

The extensive literature search pointed out that the superarterial concept started by focusing on the possible implementation of grade separated intersections as the main tool to alleviate congestion along arterials. This concept evolved over time to also include improvements ranging from signal optimization to access management.

The Superarterial Network concept consists of a series of distinct design and operational parameters applied to a network of arterials in order to increase capacity and alleviate congestion in an urban environment. Such parameters include:

- Design speeds of 40 to 50 mph
- Partial access control
- Median barrier-separated roadways
- Left turns only at selected intersections
- Signalized at-grade intersections spaced at intervals of approximately one to two miles
- Green time allocations of 70% to the arterial and 30 % to cross-streets
- Grade separation at critical intersections and at all railroad crossings
- Auxiliary or collector-distributor right lanes for speed change for entering and exiting traffic, or for emergency parking
- Bus turnouts
- Provisions for U-turns

Although a superarterial has many characteristics similar to a freeway facility, it is not a freeway. The differences between the two types of facilities include, among others, design speeds, access control, properties of grade separated intersections, and right-of-way requirements for new alignments to accommodate the same number of lanes. Existing arterials can be upgraded to Superarterials with relatively moderate new construction, compared to the extensive major construction for the entire length of a new expressway.

The superarterial can also have a positive impact on freeway mobility. The lack of continuity on some arterials and their unacceptable travel speeds divert much more than a proportional share of short to intermediate length trips to the urban freeway network. A superarterial network could divert these short trips to the arterial network, improving the flow of traffic on the freeway. For this to occur, the arterial network must provide adequate capacity and continuity for at least the average trip length.

A most important aspect in designing a superarterial network system is anticipating the direction of economic growth and development for the area being considered, in order to designate sufficient system mileage to provide for future mobility needs. The Superarterial Network system should be developed in increments based on available funding. The system should also be revised and expanded, if necessary, every few years to meet the rate of growth and development of the area or unanticipated growth in new areas or directions. Right-of-way requirements and provisions for utilities are critical issues in all aspects of planning the network. It is possible to adapt the arterials to traffic demand and land use requirements through staged construction, provided provisions are made for reserving necessary rights-of-way. Staged construction allows forgoing features recommended as necessary for a superarterial (minimum number of left turns, median barriers, grade separations, and others), until traffic conditions are such that they would require implementation of the next stage.

4.1 Definition of Transportation Corridors.

A transportation corridor provides temporal and geographical indication of traffic flow, such as peak period time and duration, direction of travel, trip purpose, origin and destination, mode share, and type of vehicle. Transportation corridors also provide crucial information on travel patterns to and from major activity centers, level of congestion on arterials within the corridor, routes used as alternate routes to expressways facilities, and intensity of transit service. These corridors may encompass sections or entire facilities of the county's expressway system, as well as major arterials. Although expressways usually represent the focus or axis of the corridors and are strong indicators of corridor direction and extent, they will not be candidates for inclusion in the county's Superarterial Network. Transportation corridors are therefore essential in assisting in the selection of candidate arterials to be included in the Superarterial Network.

Travel patterns within Miami-Dade County show that the major transportation corridors are defined by the major expressway facilities within the County: Turnpike, SR 826, I-75, and I-95 for north-south travel, and SR 836, SR 826, Gratigny Expressway, and SR 112 for east-west travel. The County may be divided in the following major transportation corridors:

The **South Corridor** encompasses all roadways south of SW 216th Street. Congestion in this corridor is lighter than congestion in the remainder of the County. Peak periods usually occur within normal commuting hours and last for shorter periods than other areas in Dade County. The major facility within the corridor is US 1 (South Dixie Highway) which serves as access to the Turnpike and SR 826 further north, as well as being a major north-south arterial.

The **Mid-South Corridor** includes the area between SW 216th Street and SW 8th Street (Tamiami Trail). Congestion in this area is more pronounced, and lasts longer than in the south corridor. Traffic patterns are, to a large extent, a reflection of the high number of residential communities ranging from single family homes to high density apartment buildings. This corridor is also home of mostly young families which tend to generate higher number of trips per households. Major activity centers ranging from numerous shopping malls, strip centers, hospitals, universities and colleges to transit stations and office complexes which also coexist in this corridor. Traffic patterns in the morning are from west to east to the Turnpike, SR 826, and US 1; then north to major arterials and freeways leading to downtown and major employment centers in the remainder of the County.

The **Central Corridor** shows heavy travel in both north-south and east-west directions. Major employment centers such as the Miami International Airport, the Port of Miami, the Civic Center and Downtown Miami are within the Central Corridor. This corridor is limited to the north by NW 36th Street and contains two of the most traveled freeways in the County, SR 826 and SR 836.

The County can be divided into two Transportation Corridors north of NW 36th Street based on traffic patterns. The Northwest Corridor, west of SR 826, is mostly occupied by industrial developments and some residential communities. This corridor has a high percentage of heavy vehicles throughout the day. In the peak hours, the corridor is mainly used by commuters from the north in the morning headed towards the Central Corridor.

The main facility within the Northeast Corridor is I-95 which carries commuter traffic to and from the northern parts of the county, and downtown Miami, to connecting routes to Miami Beach. This corridor also shows very high levels of congestion being a densely populated, mature area.

Miami Beach is included in a separate corridor. Although north-south traffic is relating heavy all day long due to area's north-south geographical orientation, morning peak hours are from west to east as employees enter the island from the mainland. The heaviest peak period on the southern part of the island, South Beach, is in the evening and on weekends, because it is heavily oriented towards entertainment and tourist activities. Collins Avenue is the main north-south facility in that corridor.

Figure 4.1 shows the County's Transportation corridors.

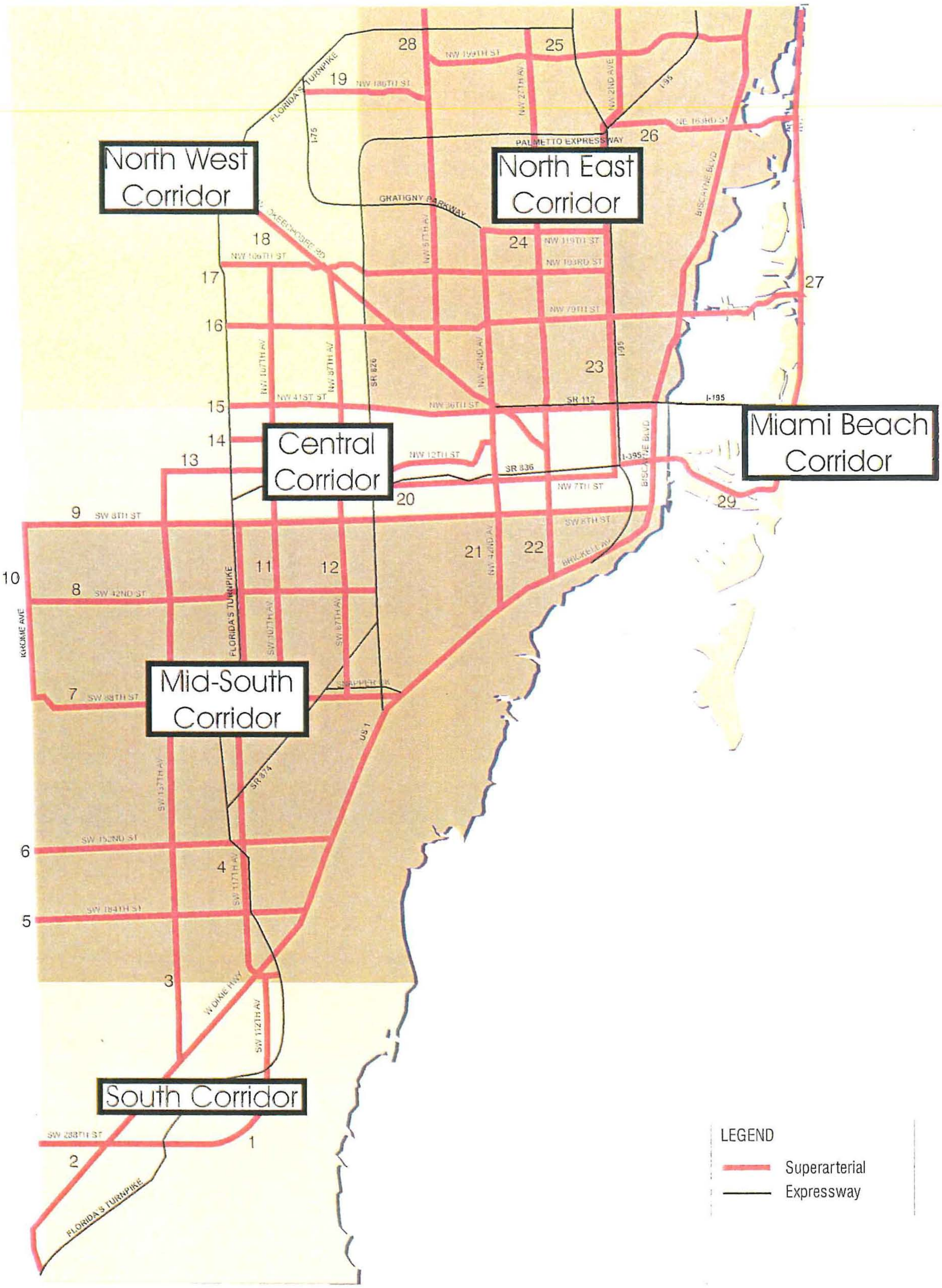
4.2 Definition of Transportation Areas

A Transportation Area (TA) is defined to be a section of metropolitan Miami-Dade County, encompassing several intersecting Superarterials, and defined by existing travel patterns within transportation corridors, as well as generally cohesive and some divisive factors. A series of twelve Transportation Areas were established within Dade County, the sum of which equals the urbanized area of the County. These areas were developed as a suitable approach to testing the Superarterial Network concept before the network would be implemented in actual practice. Testing a Transportation Area, as opposed to the whole County, represents a cost-effective alternative that allows to observe the full impact of the proposed improvements to conflicting major arterials with similar priority ranking.

The selection of the Transportation Areas was performed taking into consideration both cohesive and divisive factors. The following criteria were used in the selection of the transportation areas:

1. Existing travel patterns, observed in the field and from available traffic counts, were used to identify roadways within Transportation Corridors where traffic converges or diverges during commuting hours.

2. Areas that could work independently as a network to the extent possible, recognizing that the Superarterials Network concept may only be implemented in one area at a time as funding becomes available.



PREPARED FOR: MIAMI-DADE COUNTY METROPOLITAN PLANNING ORGANIZATION BY: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	SUPERARTERIAL NETWORK STUDY TRANSPORTATION CORRIDORS	*Figure 4.1*

3. Areas should include arterials with a minimum length of four miles, because this represents the minimum length on which improvements are considered corridor improvements as opposed to spot improvements.

4. Areas that include whole cities and Community Development Plan Areas as much as possible in order to preserve the cohesiveness of the neighborhoods within the County.

5. Areas containing Major Attraction Centers, as these usually represent major trip attraction or production sites for trip origins or destinations.

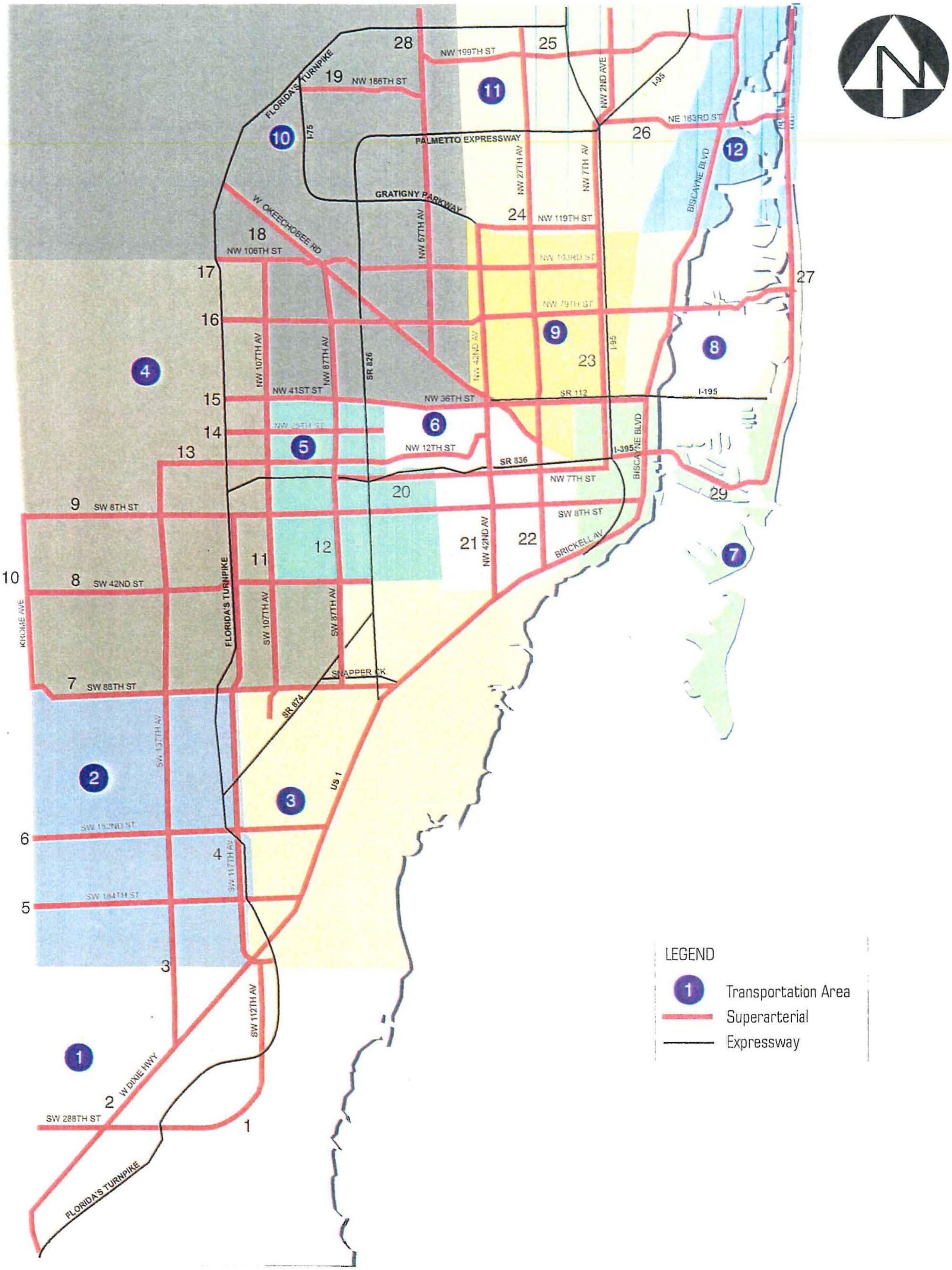
6. Areas that include intersecting major transportation facilities that have good potential to be included in the Superarterial Network and represent a decision point for two major conflicting traffic flows.

Figure 4.2 shows the County's Transportation Areas.

4.3 Definition of the Superarterial Network

Based on the Superarterial Network concept described above, the consultant team presented to the Steering Committee members a preliminary list of selection criteria to identify or exclude arterials to be included in the network. Each criteria was selected to help gauge the appropriateness and the potential for an arterial to meet the objective of the study. These criteria were narrowed down and refined based on each of the Steering Committee members particular background and area of expertise: signals, planning, transit, and traffic operations. The following criteria were developed and used in defining the Miami-Dade County Superarterial Network:

1. Arterials that provide direct access to major activity centers
2. Arterials that provide direct access to an expressway
3. Arterials that serve major Transit Routes
4. Congested arterials parallel to congested arterials
5. Arterials that provide or will provide continuity over 4 miles
6. Arterials that have or will have a minimum of 4 lanes
7. Arterials that are good candidates for one-way pairs
8. Historic roads (noted specifically for exemption)
9. Arterials with potential for establishing currently non-existing links (incomplete networks)



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SUPERARTERIAL NETWORK STUDY
TRANSPORTATION AREAS

Figure 4.2

In addition, the following characteristics were used in the selection of the Superarterials:

- Congested arterials identified in the County Management System
- Arterials scheduled for improvements
- Arterials that serve as major bus routes
- Proximity and parallel to an existing freeway
- Arterials that offer attractive alternative routes for intracounty vehicular travel

Future year improvements identified in the Long Range Transportation Plan (1995) were considered in the definition and selection of roadways as Superarterial candidates.

Based on the improper functioning of the existing arterial streets due to friction resulting from the conflicting service functions of land access and traffic movement, it is highly recommended that future expansion of roadways should take into consideration the design criteria for a Superarterial.

The selection criteria were applied to all major arterials in Miami-Dade County and a preliminary network consisting of 67 arterials was developed. The resulting initial Superarterial Network was based on the existing roadway network, existing and future travel patterns, the 2015 Long Range Plan Highway Network adopted 12/95, the Land Use Map adopted 4/95, and the 2010 Urban Expansion Area Boundary.

This preliminary network was further scrutinized and other factors applied to the arterials selected. The limits of the proposed arterials were carefully defined to remain within the limits of the Urban Boundary, and freeways were chosen for the most part as the natural terminus for a Superarterial. Community impact was also a factor in selecting the location and the limits of the proposed arterials. For the most part, a Superarterial linked two other Superarterials or a freeway to another Superarterial.

Each of the selected arterials was reexamined. Some arterials were excluded due to obvious obstacles such as anticipated community opposition, incompatibility with adjacent land uses, and known environmental concerns. In addition, the initial Superarterial Network was reduced in an attempt to develop a more acceptable concept in terms of manageability, cost-effectiveness, and total cost associated with implementing the whole network. Although the arterials selected in the preliminary phase would provide an efficient and complete transportation system for the County, the resulting 29 arterials constitute a more realistic network for implementation of the Superarterial Concept while still meeting the objectives of the study. Table 4.1 is a summary of the 29 selected arterials included in the proposed Superarterial Network.

The selected 29 arterials and the Transportation Areas constitute the extent of the initially proposed Superarterial Network, as shown on figure 4.3. Table 4.2 shows the arterials existing level of congestion from the 1995 Mobility Management Process/Congestion Management System (MMP/CMS), who has jurisdiction over the selected arterials, roadways scheduled for improvements from the Long Range Transportation Plan (LRTP) 1995-2015, and arterials that serve as major bus routes. This table lists the scheduled improvements for the selected arterials, including those outside the Superarterial limits. As shown on Table 4.2, the County and the State recognize the importance of these roads since the majority of the selected arterials are scheduled for improvements, hence the opportunity to upgrade these arterials by applying the design parameters for a Superarterial.

Table 4.1
Superarterial Network Study
Selected Arterials

		Proposed Limits		1	2	3	4	5	6	7	8	9
	Arterials	From	To	Provides Direct Access to Major Activity Centers	Provides Access to an Expressway	Serves Major Transit Routes	Uncongested Arterial Parallel to Congested Arterial	Provides or Will Provide Continuity over 4 miles	Has or Will Have 4 lanes or more	Candidate for One-Way Pairing	Historic and/or Special Consideration Road	Completes County Grid System
1	SW 288th Street	SW 177th Ave through SW 112th Ave (1)	US 1	Reserve Homestead Air Base	Turnpike	US 1		Yes	US 1 to SW 137th Ave.			Yes
2	US 1	Florida Turnpike	Dade-Broward County Line	Dadeland, The Falls	I-95			Yes	Yes	Some sections already paired		
3	SW 137th Ave	US 1	NW 12th Street	Homestead Air Force Base, Malls	SR 826 Extension (future)			Yes (10)	Yes			Yes
4	SW 117th Ave/SW 211th St.	Florida Turnpike	SW 8th Street (Tamiami Trail)	Cutler Ridge Mall	Turnpike	Kendall Drive	Florida Turnpike	Yes	Yes			Yes
5	SW 184th Street (Eureka Drive)	SW 177th Avenue (Krome Ave) (1)	US 1		Turnpike	US 1			Yes (2015)			Yes
6	SW 152nd Street (Coral Reef Dr)	SW 177th Avenue (Krome Ave)	US 1	Metro Zoo	Turnpike	US 1			SW 137th Ave. to US 1			Yes
7	SW 88th Street (Kendall Dr)	SW 177th Avenue (Krome Ave)	US 1	4 major malls and Baptist Hospital	Turnpike, SR 874, SR 878, SR 826	US 1		Yes				Yes
8	SW 40th Street (Bird Rd)	SW 177th Avenue (Krome Ave) (1)	SR 826	Tropical Park, Strip Malls	Turnpike, SR 826	US 1		Yes	from SW 157th Ave. to SW 57th Ave.		SW 57th Ave. to US 1	Yes
9	SW 8th Street (Tamiami Trail)	SW 177th Avenue (Krome Ave)	US 1	FIU, Downtown	Turnpike, SR 826, I-95		Flagler, SR 836	Yes		Already from NW 27th Ave. to Biscayne Blvd.		Yes
10	177th Avenue (Krome Ave)	SW 88th Street Kendall Dr) (1)	SW 8th Street (Tamiami Trail) (1)					Yes	No			Yes
11	SW / NW 107th Avenue	SW 104th Street	NW 106th/103rd Street	International Mall	SR 836	Kendall Drive	Turnpike	Yes (10)	from SW 104th Street to NW 25th Street			Yes
12	SW/NW 87th Avenue	SW 88th Street (Kendall Dr)	NW 106th/103rd Street				SR 826	Yes (10)	Yes			Yes
13	NW 12th Street	NW 137th Avenue	NW 42nd Avenue (Le Jeune Rd)	International Mall, Miami International Airport			SR 836, NW 25th Street	Yes	Yes			
14	NW 25th Street	Turnpike	NW 72nd Avenue		SR 826		SR 836	Yes	Yes			
15	NW41st/36th Street	Turnpike	US 1	Miami International Airport	Turnpike, SR 826, SR 112		SR 112	Yes	Yes			Yes

Notes
(1)= Western limits of 2010 Urban Expansion Area Boundary
(10)= If extended and connected to other major arterials

Table 4.1 (Continued)
Superarterial Network Study
Selected Arterials

	Arterials	Proposed Limits From	To	1 Provides Direct Access to Major Activity Centers	2 Provides Access to an Expressway	3 Serves Major Transit Routes	4 Uncongested Arterial Parallel to Congested Arterial	5 Provides or Will Provide Continuity over 4 miles	6 Has or Will Have 4 lanes or more	7 Candidate for One-Way Pairing	8 Historic and/or Special Consideration Road	9 Completes County Grid System
16	NW 74/79th Street	Turnpike	Collins Avenue	Hialeah Race Track, Hialeah Hospital	SR 826, I-95	NW 27th Avenue		Yes	Yes	81st Street between NW 14th Avenue and John F. Kennedy Causeway		Yes
17	NW 106th/103rd Street	Florida Turnpike	I-95	Westland Mall, Miami-Dade Community College	SR 826, I-95	NW 27th Avenue		Yes	Yes			Yes
18	Okeechobee Road	Turnpike	NW 27th Avenue		SR 826			Yes	Yes			
19	NW 186th Street (Miami Gardens Dr.)	I-75	NW 57th Avenue		I-75, I-95		SR 826	Yes	Yes			Yes
20	NW 7th Street	NW 87th Avenue	NW 7th Avenue	Fountainebleau			Flagler St., SR 836	Once the section over the Palmetto is added.	Yes			
21	NW 42nd Ave (Le Jeune Rd)	US 1	Gratigny Parkway	Miami International Airport	SR 836	East-West (future)		Yes (10)	Yes			Yes
22	SW/NW 27th Avenue	US 1	Dade-Broward County Line	Miami Dade Community College	SR 836, SR 826			Yes	Yes			Yes
23	NW 7th Avenue/US 441	NW 7th Street	Dade Broward County Line	North Shore Hospital	Turnpike		I-95	Yes	Yes			Yes
24	NW 119th Street	Gratigny Parkway	I-95		I-95							
25	NW 199th St/Honey Hill Dr./Ives Dairy Rd/NW 203rd St	NW 57th Avenue	US 1	Aventura Mall, Calder Race Course, JRS	I-95		Turnpike	Yes	Yes			
26	NE 167th/NW 163rd Street	Golden Glades Interchange	Collins Avenue	The Mall at 163rd, Beaches	SR 826, I-95, Turnpike		Miami Gardens Drive (NW 185th Street)	Yes	Yes			
27	Collins Ave/Ocean Dr	South Beach	Dade-Broward County Line									
28	NW 57th Avenue	Okeechobee Road	Dade-Broward County Line	Opa Locka Airport	Turnpike			Yes (10)	Yes			Yes
29	Mac Arthur Causeway/5th Street	I-395	Collins Avenue									

Notes
(1)= Western limits of 2010 Urban Expansion Area Boundary
(10)= If extended and connected to other major arterials

Table 4.2
Superarterial Network Study
Level of Congestion, Proposed Improvements, and other Characteristics of Selected Arterials.

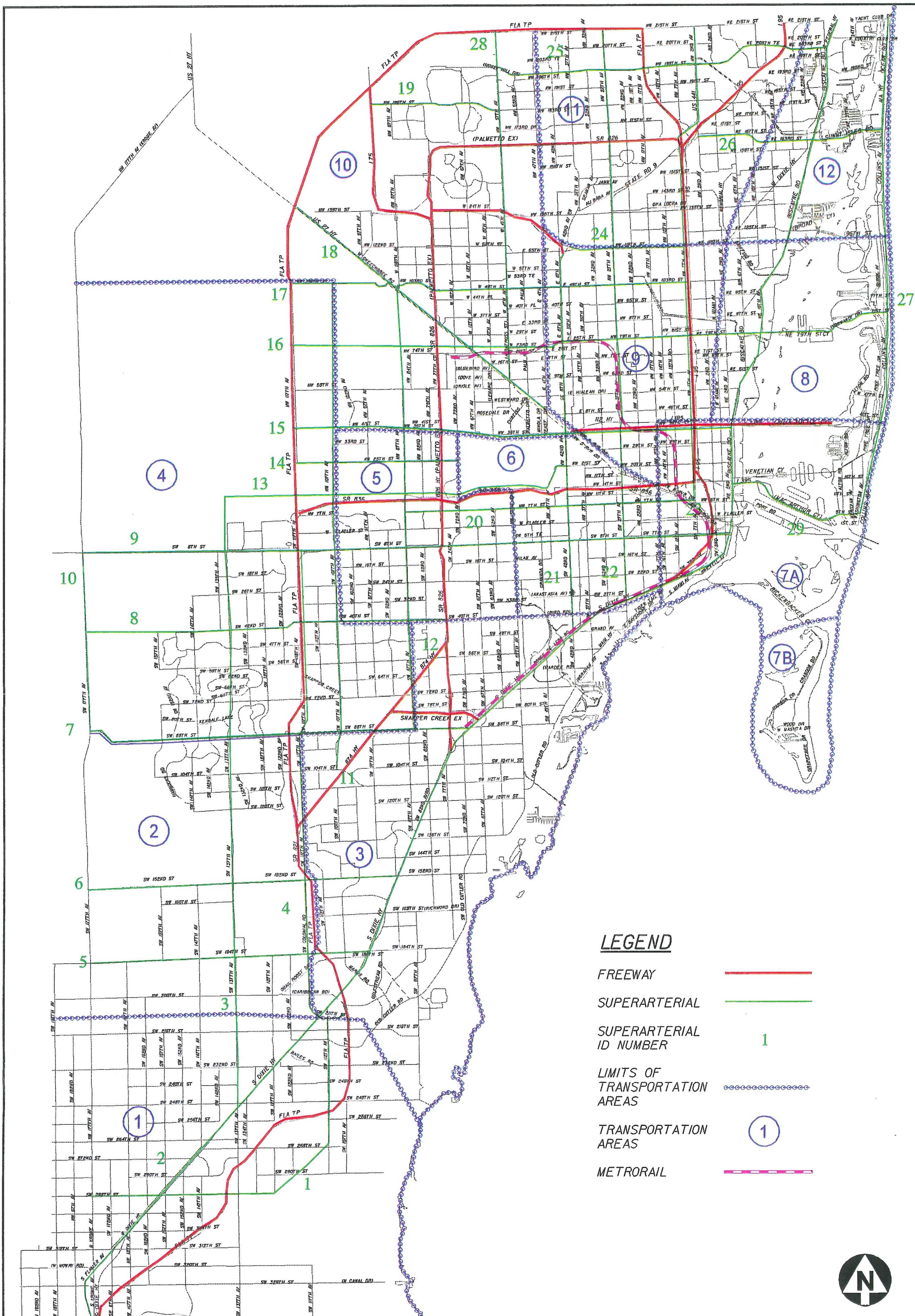
		Proposed Limits		1	2	3	4
	Arterials	From	To	Level of Congestion	Scheduled for Improvements	State Road	Major Bus Route
1	SW 288th Street	SW 177th Ave through SW 112th Ave (1)	US 1			No	
2	US 1	Florida Turnpike	Dade-Broward County Line	Highly congested from SW 112th St. to I-95.	P I. multilane reconstruction (8 lanes) from NE 163 St. to Miami Gardens Dr. preliminary engineering (6 lanes) from SW 344 St to SW 112 Ave. Multilane reconstruction (8 lanes) from NE 163rd St to Miami Gardens Dr. Multilane reconstruction (8 lanes) from Miami Gardens Dr. to Lehman Causeway Corridor Improvement from Florida City to S Dadeland Metrorail Station. Multi-lane reconstruction from Card Sound Rd to SW 304 St (outside super arterial limits) New Road Construction from S of STR S-18 to Card Sound Dr. (outside super arterial limits) P IV (Unf): premium transit Downtown to County Line.	SR 5	Yes
3	SW 137th Ave	US 1	NW 12th Street		P I: 4 to 6 lanes from SW 88 St to SW 42 St. 2 to 6 lanes from SW 184 St to SW 152 St. Add lanes and reconstruct (4 lanes) from SR 821/HEFT to SW 336 St. 2 to 4 lanes from SW 344 St to SW 312 St. (outside super arterial limits) P III : 2 to 6 lanes from NW 12 St to SW 8 St 4 to 6 lanes from SW 8 St. to SW 26 St. 2 to 4 lanes from US 1 to HEFT P IV: widen to 4 lanes from SW 184 St. to US 1.	SR 825	Yes (SW 56th St to SW 84th St)
4	SW 117th Ave/SW 211th St.	Florida Turnpike	SW 8th Street (Tamiami Trail)	Moderately congested from SW 200th St. to SW 152nd St.	P I: PE, R/W, 2 to 4 lanes from SW 152 St. to SW 184 St. 2 to 4 lanes from SW 40 St. to SW 8 St. 2 to 4 lanes from SW 152 St. to SW 104 St.	No	Yes (SW 104th St to SW 72nd St)
5	SW 184th Street (Eureka Drive)	SW 177th Avenue (Krome Avenue) (1)	US 1		P I: Widen to 5 lanes from US 1 to Franjo Rd (SW 97th Ave). P IV: 2 to 4 lanes from SW 157 Ave to SW 147 Ave	No	Yes (SW 120th Ave to SW 107th Ave)
6	SW 152nd Street (Coral Reef Dr.)	SW 177th Avenue (Krome Avenue)	US 1		P I: 2 to 6 lanes divided from SW 137 Ave to Zoo Entrance. 4 to 6 lanes from Zoo Entrance to HEFT. P IV (Unf): 2 to 4 lanes from US 1 to SW 312 St.	SR 992	Yes (SW 102nd Ave to SW 77th Ave)
7	SW 88th Street (Kendall Dr)	SW 177th Avenue (Krome Avenue)	US 1	Highly congested from SW 137th Ave to SR 874	P IV (Unf): premium transit from Dadeland North to SW 147 Ave	SR 94	Yes Transit
8	SW 40th Street (Bird Rd)	SW 177th Avenue (Krome Avenue) (1)	SR 826	Moderately Congested from from SW 147th to SW 57th Ave	PI: Widen to 3 lanes and resurface from US 1 to SW 27 Ave. (outside superarterial limits)	SR 974	Yes
9	SW 8th Street (Tamiami Trail)	SW 177th Avenue (Krome Avenue)	US 1		P I: PD&E study from SR 826 to SW 27 Ave. P II: 4 to 6 lanes from SW 127th Ave to SW 152nd Ave.	SR 90	Yes
10	SW 177th Ave (Krome Avenue)	SW 88th Street (1) (Kendall Dr)	SW 8th Street (1) (Tamiami Trail)		P I: Corridor Improvements from Florida City to Okeechobee Rd. PD&E Study from SW 127th Ave. to SW 152 Ave. P IV: 2 lanes with access rights protection from SW 8th St. to US 1 2 lanes with access rights protection from SW 8 St. to Okeechobee (outside suparterial limits)	SR 997	
11	SW / NW 107th Avenue	SW 104th Street	NW 106th/103rd Street	Moderately congested from SR 874 to SR 836	P I: PD&E, SW 40 St to SW 24 St. Multi-lane reconstruction from SR 836 to SW 8 St. Bike path from SW 70 St to SW 80 Terr. Widen bridge/add turn lanes over Tamiami Canal PE, R/W, 2 to 4 lanes from Quailroost Dr. to SW 160 St. (outside super arterial limits) 2 to 5 lanes from Okeechobee Rd. to NW 138 St. (outside super arterial limits) P IV: 4 to 6 lanes from SW 8 St to NW 41 St. widen to 4 lanes from NW 41 St to NW 106 St. P IV (Unf): 4 to 6 lanes from SW 40 St to SW 24 St.	SR 985	Yes (SW 104th St to NW 14th St)

Notes: 1: Western limits of 2010 Urban Expansion Area Boundary.
P : Priority; **PI** : 1996 to 2000; **PII**: 2000 to 20005; **PIII**: 2005 to 2010; **PIV**: 2010 to 2015; **UNF:** Unfunded

Table 4.2 (Continued)
Superarterial Network Study
Level of Congestion, Proposed Improvements, and other Characteristics of Selected Arterials.

		Proposed Limits		1	2	3	4
	Arterials	From	To	Level of Congestion	Scheduled for Improvements	State Road	Major Bus Route
12	SW/NW 87th Avenue	SW 88th Street (Kendall Dr)	NW 106th/ 103rd Street	Moderately Congested from SW 88th St to SR 836	P I: Bridge over I-75 and approaches from NW 138 St. to NW 154 St. 2 To 4 lanes from NW 154 St. to NW 186 St. 2 to 4 lanes and bridge crossing I-75 from NW 138 St to NW 154 St. 2 to 5 lanes from NW 122 St to NW 138 St. (ouside superarterial limits) P II: 4 to 6 lanes from NW 36 St to NW 58th St. P III: new 4 lane from NW 58 St to Okeechobee Rd. P IV (Unf). 2 to 4 lanes from SW 168 St to SW 216 St.	SR 973	Yes
13	NW 12th Street	NW 137th Avenue	NW 42nd Avenue (Le Jeune Road)		P I: Add 2 lanes and 4 lanes railroad crossing from NW 97 Ave to NW 87 Ave. Construct 2 lanes from NW 127 Ave to NW 122 Ave. P II: New 4 lanes from NW 110 Ave to NW 107th Ave. P III: 2 to 4 lanes and new 4 lanes from NW 110 Ave to NW 137 Ave.	No	
14	NW 25th Street	Turnpike	NW 72nd Avenue	Highly congested from HEFT to NW 72 Ave	P I: Misc reconstruction from SR 826 to Airport. P II: 4 to 6 lanes (+ interchange improvements) from NW 79th Ave to NW 67th Ave. PIII: 2 to 4 lanes from NW 107 Ave to NW 112 Ave.	No	
15	NW41st/36th Street	Turnpike	US 1		P I: 4 to 6 lanes from NW 87 Ave to NW 77 Ave. Multi-lane new construction from North River Dr. to NW 17 Ave. Resurface and Restripe from NW 142 Ave to NW 117 Ave. (outside superarterial limits) P IV (Unf): Express Street (grade separation, ITS, etc) from NW 42 Ave to HEFT	SR 948/SR 25	Yes
16	NW 74th/79th Street	Turnpike	Collins Avenue	Moderately Congested from SR 826 to US 1	P I: PD&E study from SR 823 (Red Rd, NW 57 Ave) to SR 826. P II: 4 to 6 lanes from NW 57th Ave to SR 826. P IV (Unf): new 6 lane road from SR 826 to HEFT	SR 934	Yes Metrorail
17	NW 106th/103rd Street.	Florida Turnpike	I-95	Highly Congested from SR 826 to NW 7 Ave.		SR 932	Yes
18	Okeechobee Rd.	Turnpike	NW 27th Avenue	Moderately Congested from SR 826 to SR 112	P I: 6 lanes (Major Federal) (EIS) from SR 826 to SR 112.	SR 25/US 27	
19	NW 186th Street (Miami Gardens Dr.)	I-75	NW 57th Avenue		P I: Multilane reconstruction from NW 57 Ave to NW 27 Ave (outside super arterial limits) PD&E Study from I-95 to SR 5/Biscayne Blvd. (outside super arterial limits)	SR 860	Yes (from 67th Ave)
20	NW 7th Street	NW 87th Avenue	NW 7th Avenue		P I: Widen to 5 lanes from NW 60 Ct to NW 57 Ave	No	Yes. Will provide access to future transit station
21	NW 42nd Ave (Le Jeune Road)	US 1	Gratigny Parkway		P I: Reconstruct 2 lane divided roadway from NW 156 St to NW 167 St. P IV: 5 to 6 lanes from SR 112 to NW 103 St.	SR 953	Yes
22	SW/NW 27th Ave	US 1	Dade-Broward County Line	HIghly Congested from US 1 to NW 79 St.		SR 9/SR 817	Yes
23	SW/NW 7th Ave/US 441	NW 7th Street	Dade Broward County Line	Highly Congested from I-95 to SR 826		SR 7/US 441	Yes
24	NW 119th Street	Gratigny Parkway	I-95			No	Yes
25	NW 199th St/Honey Hill Dr/Ives Dairy Rd./NW 203rd Street	NW 57th Avenue	US 1			No	
26	NE 167th/NW 163rd Street	Golden Glades Interchange	Collins Avenue			SR 826	Yes
27	Collins Ave/Ocean Dr	South Beach	Dade-Broward County LIne		P I: Preliminary engineering (6 lanes) from 5 St/US 41 to 26th St	SR A1A	Yes
28	NW 57th Avenue	Okeechobee Rd	Dade-Broward County Line		P I: PD&E study, 6 lanes, from Okeechobee Rd to NW 138 St. P II: 4 to 6 lanes from Okeechobee Rd to NW 138 St.	SR 959/SR 823	
29	Mac Arthur Causeway/ 5th Street	I-395	Collins Avenue		Hwy -Traffic Operations Improvements	SR A1A	Yes

Notes: 1: Western limits of 2010 Urban Expansion Area Boundary.
P : Priority; **PI** : 1996 to 2000; **PII**: 2000 to 20005; **PIII**: 2005 to 2010; **PIV**: 2010 to 2015; **UNF:** Unfunded



SUPERARTERIAL NETWORK STUDY

MIAMI-DADE COUNTY

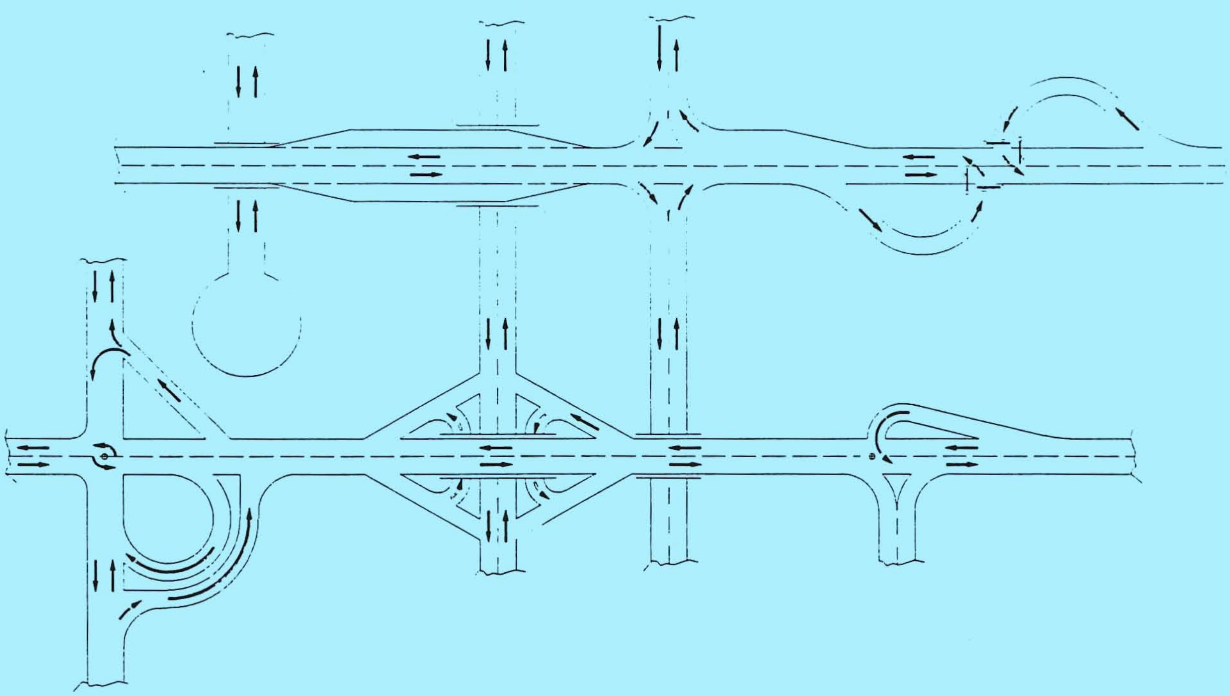
TRANSPORTATION AREAS AND SUPERARTERIAL NETWORK

Figure 4.3

CHAPTER 5

IDENTIFICATION OF STRATEGIES AND TECHNIQUES

FINAL REPORT



5. IDENTIFICATION OF STRATEGIES AND TECHNIQUES

This chapter presents strategies and techniques to be applied to create the Superarterial Network. These strategies would be used to upgrade existing roadways or plan new facilities based on specific parameters designed to enhance traffic flows on arterials. The recommended strategies and techniques are summarized in a matrix format identifying potential locations where they are best suited for application, and their relative advantages and disadvantages. Both global and detailed views of applicable strategies and techniques are presented in this chapter; however not all strategies identified will be applied to the Superarterials selected for actual testing. Each strategy/technique identified is suitable for a specific problem, and their application depends on the particular problem being addressed for the selected arterials within the Transportation Area. Appropriate prospective solutions are identified and conditions for application, potential implementation problems and evaluation factors are discussed for each strategy/technique. The application of *sets* of solutions to a facility, will elevate conventional arterials to Superarterials.

5.1 Design Parameters

Because the role of Superarterials is to increase vehicle throughput and allow traffic to flow faster and more smoothly, they should therefore have specific design and operational parameters intended to accommodate a greater volume of vehicles and improve traffic flow on existing and future facilities. The following are some of the design parameters that would ideally be used to upgrade existing facilities within transportation corridors to Superarterials:

- Design speeds of 40-50 miles per hour
- Route (facility) continuity for average trip length
- Grade separation at the most critical intersections and at railroad crossings
- Favored treatment for the Superarterial traffic over cross traffic where non-grade separated signalized intersections occur (for example: green time allocations of 70% to the arterial and 30% to the cross street)
- Signalized at-grade intersections spaced at intervals of approximately one to two miles
- Improved signal progression
- Median barrier-separated roadways
- Left turns only at selected intersections
- Partial access control
- Provisions for U-turns
- Auxiliary or collector-distributor right lane for speed change in entering and exiting traffic, or for emergency parking
- Exclusive lanes for high occupancy vehicles (HOV)
- Considerations for public transit
- Bus turnouts

- Pedestrian treatments

These design parameters would result in defining a new class of arterials that would operate at speeds that are higher than typical arterials yet not be required to satisfy freeway access requirements, which would still allow them to be used as access roads to adjacent land-uses.

The Superarterial Network is intended to consist of selected arterials specifically designed and/or upgraded to increase capacity and alleviate congestion in an urban environment. These arterials would also provide connectivity and accessibility between the regional expressway system and local collector roadways, and offer alternate routes for intracounty vehicular travel in lieu of the freeway system. Although a Superarterial may share a number of similar characteristics with a freeway facility, it is not a freeway. The differences between the two types of facilities include design speeds, amount of access control, proportion of grade separated intersections, and right of way requirements for new alignments to accommodate the same number of lanes.

5.2 Strategies for Reducing Congestion

Causes of traffic congestion are attributable to three basic factors: population and employment growth, more extensive use of the automobile, and a supply of facilities (roads or transit) which is lower than the rate of growth of vehicular travel demand. The resulting congestion can be alleviated or managed by using either supply-side approaches, demand-side strategies, or a combination of both.

However, while these strategies may help to alleviate or manage general congestion, they may not fully eliminate it, or successfully address the more concentrated problem of peak-hour traffic congestion throughout the entire County. In theory, congestion would be eliminated if the available capacity of the transportation system were increased to the extent that every single commuter could travel during peak hour at an acceptable level of service. This would require extensive right-of-way acquisition to widen existing roadways and construct new ones. Other impacts such as environmental, community, economic, and traffic during construction could also hinder such a task.

Therefore, any improvements to increase the current available capacity on the major arterials and freeways will generally, at most ease traffic congestion, and only eliminate it at specific intersections or along specific roadway segments, and most probably only until latent current demand or future general-based demand exceeds system capacity.

The following sections define the supply-side and demand-side strategies.

5.2.1 Supply-Side Strategies

Supply-side strategies focus on tactics that would increase the current available person and/or vehicle carrying capacity of the roadway network for a particular area. These strategies focus on altering the physical characteristics of the roadway by implementing relatively low cost improvements or operating strategies. These strategies range from signal timing and phasing enhancements to the provision of additional lanes and new roadway segments.

5.1.1 Demand-Side Strategies

These strategies focus on relieving congestion by reducing the number of vehicle-trips through the use of a more efficient transportation system. Demand-side strategies are oriented towards the "behavior modification" of a person in selecting transportation modes. In general, their approach stresses moving the same number of travelers with fewer vehicles, shifting travel away from peak congestion periods, reducing travel distances or eliminating travel. Alternatives may include mode shift, transit options, transit ride sharing, alternative work hours, parking management, and electronic telecommuting among others.

5.1.2 Combined Strategies

Greater benefits from traffic congestion mitigation can be obtained when the use of the capacity of the transportation system is maximized. These benefits can be achieved by the simultaneous implementation of the demand and supply side strategies.

This study, however, focuses on the supply-side in order to meet its objective of providing solutions that are potentially lower cost physical improvements and which can be implemented within a relatively short time frame. The strategies presented in this chapter are meant to compliment the approaches, both traditional and novel, currently being studied and implemented by the state and the county.

5.2 Congestion Problems, Solution Strategies and Corrective Techniques

The extensive literature search performed early in the study resulted in a comprehensive list of strategies and techniques that would be applicable to the proposal Miami-Dade County Superarterial Network. Strategies may be defined as a set of general approaches or processes taken toward the solution of a broadly categorized circumstance or set of problems, such as excessive congestion. Techniques, on the other hand, are defined as more specific methods oriented towards the solution of one particular problem area or circumstance, such as inadequate left turn capacity at a specific intersection.

5.2.1 Congestion Problem Locations

Congestion usually occurs at isolated intersections; along street segments; at approaches to commercial development, employment centers and at the greater scale of the entire urbanized area; and within specific transportation corridors. The nature and causes of congestion at each of these locations are both distinct and similar.

The key to finding appropriate strategies and techniques lies in proper identification of the location and cause of congestion for specific areas. The following sections present the most common causes of congestion for each of the problem locations, as well as strategies and techniques designed to alleviate congestion.

5.2.2 Strategies and Techniques at Isolated Intersections and Roadway Segments

Traffic operation along a roadway segment is highly influenced by the operation at signalized intersections within that segment and vice-versa. These two categories were therefore grouped since a given set of strategies is usually applicable to relieve congestion at both locations. Three main causes can be identified in searching for the cause of congestion at isolated intersections and along roadway segments:

- Vehicle flow conflicts and accidents (Table 5.1)
- Traffic congestion (Table 5.2)
- Conflicts with pedestrians (Table 5.3)

Tables 5.1, 5.2, and 5.3 present the transportation deficiencies – the most common causes of the problem -, the solution strategies - what needs to be done to remedy the deficiency, and the corrective techniques -, what specific improvement will achieve the goal of reducing or eliminating the problem. As previously discussed, the same set of strategies and techniques may be applicable to two different problems. This is the case for strategies and techniques for vehicle flow conflicts and accidents, and for traffic congestion: the solutions and techniques are similar, but they are applied to two different sets of transportation deficiencies.

Table 5.1
Traffic Flow Improvements Strategies and Techniques for Isolated Intersections and Roadway Segments

Transportation Deficiency	Solution Strategies	Corrective Techniques
Turning movements and parking maneuvers inhibit traffic flow	1. Reduce delays and conflicts by separating flows	a) Grade separation (overpasses and underpasses; "urban arterial interchanges") b) Addition of turn lanes c) Construction of islands d) Installation of new signals e) Channelization f) Striping g) Signal phasing and timing changes h) Two-way left turns i) Expanded off-street parking and loading areas j) Removal of on-street parking k) On-street parking restriction at intersection
	2. Reduce delays and conflicts by diverting movements	a) Jug-handle b) Side streets and curb cuts closures c) Left turn prohibition or restriction during peak hours d) On-street parking removal e) On-street parking restriction at intersections f) Expanded off-street parking and loading areas

Table 5.1 (Continued)
Traffic Flow Improvements Strategies and Techniques for Isolated Intersections and Roadway Segments

Transportation Deficiency	Solution Strategies	Corrective Techniques
Inadequate site and stopping distances	1. Reduce delays and conflicts by diverting movements	a) Jug-handle b) Side streets and curb cuts closures c) Left turn prohibition or restriction during peak hours d) On-street parking removal e) On-street parking restriction at intersections f) Expanded off-street parking or loading areas
	2. Increase time for driver reaction	a) New signals or stop signs b) Signal phasing and timing changes c) Speed restriction d) Warning devices

Table 5.2
Traffic Flow Improvements Strategies and Techniques for Isolated Intersections and Roadway Segments

Transportation Deficiency	Solution Strategies	Corrective Techniques
Turning movements and parking maneuvers inhibit traffic flow	1. Reduce delays and conflicts by separating flows	a) Grade separation (overpasses and underpasses; "urban arterial interchanges") b) Addition of turn lanes c) Turbo lanes at "T" intersections d) Construction of islands e) Installation of new signals f) Channelization g) Striping h) Signal phasing and timing changes i) Two-way left turns j) Expanded off-street parking and loading areas k) Removal of on-street parking l) On-street parking restriction at intersections
	2. Reduce delays and conflicts by diverting movements	a) Jug-handle b) Side streets and curb cut closures c) Left turn prohibition or restriction during peak hours d) On-street parking removal e) On-street parking restriction at intersections f) Expanded off-street parking and loading areas
Inadequate capacity to handle peak traffic volumes	Reduce delay by increasing capacity	a) New through and turn lanes b) Frontage roads c) Signal timing

Table 5.3
Traffic Flow Improvements Strategies and Techniques for Isolated Intersections and Roadway Segments

Transportation Deficiency	Solution Strategies	Corrective Techniques
Conflicts between pedestrians, cyclists and vehicular traffic	1. Reduce conflicts by separating flows	a) New walkways or overpasses b) Crossing design and operation c) Crosswalk striping and marking d) New signals for vehicles or pedestrians and cyclists e) Signal phases f) Exclusive bicycle lanes g) Loop/Shuttle bus h) Modified transit routes i) Relocated bus stops j) Warning messages
	2. Inadequate capacity for walking or cycling and waiting	a) Exclusive bicycle lanes b) Addition of sidewalks where none exist c) New walkways d) Widen crosswalk or sidewalk e) Waiting shelters f) Bicycle storage at bus stops g) Relocated bus stops

5.2.3 Strategies and Techniques for Transportation Corridors

A transportation corridor provides temporal and geographical indication of traffic flow, such as peak period time and duration, direction of travel, trip purpose, origin and destination, mode share, and type of vehicle. Transportation corridors also provide crucial information on travel patterns to and from major activity centers, level of congestion on arterials within the corridor, alternate routes to expressways facilities, and intensity of transit service. These corridors may encompass sections or entire facilities of the county's expressway system, as well as major arterials.

Causes of congestion within a transportation corridor can usually be attributed to one of the following problems:

- Traffic congestion on the arterial within the corridor (Table 5.4)
- Inadequate transit service (Table 5.5)
- Traffic congestion on cross-streets to the main arterials within the corridor (Table 5.6)

Travel patterns within transportation corridors are usually concentrated on certain arterials within the corridor. Insufficient capacity on the main arterials affect traffic operations within the entire corridor. Potential safety and economic impacts usually result as through traffic uses residential streets to avoid congestion. Table 5.4 summarizes the potential strategies and techniques that can be applied to remedy such situations.

Table 5.4
Traffic Flow Improvement Strategies and Techniques for Transportation Corridors

Transportation Deficiency	Solution Strategies	Corrective Techniques
Insufficient capacity to handle peak traffic volumes at acceptable level of service	1. Reduce travel delay by increasing capacity	a) Grade separation (overpasses and underpasses; "urban arterial interchanges") b) New segments paralleling or by-passing congested segments c) New general purpose lanes d) New reversible lanes e) Street and intersection geometry improvements f) Exclusive bus or carpool lanes g) Signal preemption for buses
	2. Reduce travel delay through more effective use of existing capacity	a) Reversible lanes b) Restripe to add additional lanes without additional right-of-way c) One-way pairing d) Modified intersection geometry e) Signal coordination f) Signal timing and phasing g) Turn prohibition, restriction or rerouting h) Remove on-street parking i) Access management j) Truck traffic restriction
	3. Reduce delay by encouraging travelers to use alternate modes of transportation (i.e. transit, carpool)	a) Exclusive bus lanes b) Bus and carpool by-pass lanes c) Expanded bus routes d) Limited stops or express buses e) Increase bus frequency f) Modified transit distribution routes g) Park and ride lots h) Increased parking fees i) Employer pooling programs j) Employer subsidy of transit passes k) Signal preemption l) Real time travel information

Congestion within transportation corridors can also be caused by inadequate transit services. Lack or inefficiency of transit services within a transportation corridor discourages the use of mass transit and therefore encourages the use of private automobile, usually with a very low occupancy rate. An adequate transit service maximizes the use of existing capacity through the same roadway segment. Table 5.5 shows sets of potential strategies and techniques applicable to such transportation deficiency.

Table 5.5
Traffic Flow Improvement Strategies and Techniques for Transportation Corridors

Transportation Deficiency	Solution Strategies	Corrective Techniques
Crowded buses slow running time, inconvenience passengers, and discourage the use of transit as a viable mode of travel	1. Reduce peak hour load factors by adding transit capacity to corridor	a) Limited-stop or express services b) Increase bus frequency c) New local bus routes d) Articulated buses
	2. Reduce peak load factors by diverting trips to off-peak times	a) Increase frequency in shoulder periods b) Reduce off-peak fares c) Increase peak fares

Inadequate capacity of streets crossing major arterials or freeways adds to the level of congestion within transportation corridors. Excessive delay on the cross-streets usually results from the surge of traffic during peak hours. A typical problem occurs when parallel arterials do not offer continuity for the average trip length. This causes traffic on these arterials to converge to streets crossing arterials that provide that continuity or provide access to freeways. This also causes tremendous delays at specific intersections where no amount of improvement seems to suffice. Table 5.6 presents some strategies and techniques aimed at alleviating such a deficiency.

Table 5.6
Traffic Flow Improvement Strategies and Techniques for Transportation Corridors

Transportation Deficiency	Corrective Strategies	Techniques
Insufficient capacity to handle peak traffic volumes at acceptable levels of service	1. Reduce travel delay by creating new access paths	a) New segments b) Intersection realignment c) Signal phasing and timing changes d) Signal coordination e) Discourage the design of closed cul-de-sac in communities of residences f) Discourage the implementation of street barricades
	2. Reduce travel delay by increasing the effective capacity of the existing facilities	a) New segments b) New lanes c) Street and intersection geometry improvements d) Access control e) Signal coordination

5.2.4 Strategies and Techniques for Approaches to Activity Centers

Activity centers such as large commercial and employment sites usually attract large volumes of vehicular and non-vehicular traffic. Two types of problems can generally be observed on the approaches to these centers: traffic congestion on arterials near the centers, and unsafe conditions for non-vehicular traffic.

Congestion on the arterials near the approaches to the centers can be the result of insufficient capacity on the roadway segments or at the intersections. Congestion can also result from improper internal circulation and parking deficiencies. These cause traffic generated by the centers to use the capacity of the surrounding arterials for storage and parking. Such situations usually cause through traffic on the arterials to slow down, and increases the risk of accidents. Table 5.7 presents potential strategies and techniques that can alleviate such deficiency.

Table 5.7
Traffic Flow Improvement Strategies and Techniques for Commercial and Employment Centers

Transportation Deficiency	Corrective Strategies	Techniques
Insufficient capacity to handle peak traffic volumes at acceptable levels of service	1. Reduce travel delay by adding capacity	a) New segments b) New lanes c) Intersection geometry design improvements
	2. Reduce travel delay by increasing the effective capacity of the existing facilities	a) Signal coordination b) Turn lanes, signal timings and phases c) One-way street pairings d) On-street parking and loading restrictions e) Expanded off-street parking and loading areas f) Parking enforcement g) Relocated bus stops h) Street and intersection geometry improvements i) Side street and curb cut closures j) Driveway consolidation
	3. Reduce traffic delays by reducing external circulation trips	a) Access management b) Driveway consolidation
	4. Increase service quality of alternative modes to discourage SOV and other auto trips to minimize traffic volumes	a) Bus lanes b) Increased transit/circulation services frequency during peak shopping hours c) Shuttle buses from transit stations d) Covered walkway and waiting areas e) Bicycle lanes and storage facilities

By attracting both large numbers of vehicular and non-vehicular traffic, activity centers increase safety concerns associated when the two types of traffic present. These can, however, be minimized or eliminated by applying the strategies and techniques identified in Table 5.8.

Table 5.8
Traffic Flow Improvement Strategies and Techniques
for Commercial and Employment Centers

Insufficient capacity for pedestrians and cyclists	Increase capacity for walking, cycling, and waiting	a) Wider sidewalks b) New crosswalks c) New walkways or bikeways d) Relocated bus stops e) Waiting shelters f) Auto restricted zones
Interference between vehicular and pedestrian/cyclists and traffic	Reduce conflicts between pedestrian/cyclists and vehicular traffic	a) Crosswalk design and operation b) New walkways and overpasses c) Loop/shuttle buses d) Modified transit routes e) Relocated bus stops f) Auto restricted zones

5.2.5 Corrective Techniques

Each of the techniques identified in the previous sections is individually described in great detail in this section. An overview is provided for describing when the particular technique is applicable. Further details on each technique are provided on the tables included in Appendix C. Each table provides information on the following areas: desired impacts, problems addressed, conditions for application, potential implementation problems, and evaluation factors.

1. **New lanes** - This oldest and perhaps most conventional and widely applied of techniques is used to add capacity to a congested facility, or to provide for projected future capacity needs. These lanes can either be for general use traffic or for high occupancy vehicles, such as buses or carpools. However, widespread capacity increases of this type are becoming increasingly difficult, or virtually impossible, as urban development encroaches upon available right-of-way.

   Aside from being costly, almost all urban areas experience traffic growth beyond the ability to widen facilities. It is this phenomenon which has prompted the MPO to evaluate alternatives to systematic and widespread roadway widening through the Superarterial Network Study (see Appendix C, Table C-1).

2. **Turn lanes addition and phasing** - Based on volume or demand for left or right turns, separate lanes with adequate storage lengths may reduce delay on approaches to an intersection and on the associated street segments. Added lanes increase turn volume capacity and throughput for each turn phase, and longer turn lanes remove turn queues from impeding through lanes. When exclusive turn-lanes are already in place, it may be necessary to lengthen them or improve signal phasing to allow better operation at intersections (see Appendix C, Table C-2).

3. **Frontage roads** - This technique frees up capacity on the main lanes on an arterial, and improves safety by separating through traffic from traffic interacting with the land uses along the arterial. Frontage roads require extensive right-of-way and advance planning (see Appendix C, Table C-3).

4. **Channelization** - Channelization is used to provide clear and usually physical separation between movements (see Appendix C, Table C-4).

5. **Islands** - Islands are used to improve safety by separating opposite movements and can also serve as crosswalk refuges for pedestrians and cyclists (see Appendix C, Table C-4).

6. **Jug-handle** - This geometry forces left-turning vehicles to make a right hand turn and then a through movement instead, hence eliminating or reducing conflict between through and left-turning vehicles (see Appendix C, Table C-5).

7. **Two-way left turn lanes** - Also known as a continuous turn lane, this technique is used to provide a separate lane to left turning vehicles along arterials where access to adjacent land uses is desired. Some increase in mobility results from removing the left turn traffic from through moving vehicle streams (see Appendix C, Table C-6).

8. **Reversible lanes** - Along many arterials, traffic is unbalanced during peak hours, i.e. very heavy flow in one direction. Additional capacity in the peak direction can be obtained by reversing the direction of one lane or more, if traffic conditions allow adequate capacity for traffic in the opposite direction. In some cases, all of the lanes on the arterial can be designated for one-way operation if alternate routes can be provided for the traffic in the opposite direction (see Appendix C, Table C-7).

9. **Parallel or by-pass segments** - When additional capacity is needed but additional right-of-way is cost prohibitive or not available on a particular arterial, a new roadway segment parallel and close to the congested segment can provide additional capacity (see Appendix C, Table C-8).

10. **Grade separation** - This technique is ideal when two major arterials intersect, both with heavy traffic volumes. This technique is also used to reduce delay when a major and a minor arterial meet. Separating the two facilities allows traffic on one of them, usually the major arterial, to flow without conflicting with the minor street traffic and/or turning vehicles. Examples of various grade separated intersections and other urban interchanges were provided in Technical Memorandum 2 prepared for this study (see Appendix C, Table C-9).

11. **Walkways or pedestrian/cyclist overpasses** - Overpasses allow pedestrians and cyclists to safely cross major arterials without interrupting or impeding vehicular traffic (see Appendix C, Table C-10).

12. **Exclusive bicycle lanes** - Exclusive bicycle lanes improve traffic flow by preventing cyclists from using the outside travel lanes which tend to slow vehicular traffic and raise safety concerns (see Appendix C, Table C-11).

13. **New signal installation** - Introducing new signals reduces delay at locations where volume of traffic during peak hours is so heavy that some movements have little or no opportunity to take place. However, this must be done judiciously. If too many signals occur too close together, they may actually impede flow and increase delay (see Appendix C, Table C-12).

14. **Signal phasing and timing changes** - Such a treatment may be introduced to favor a movement or approach based on volumes, or to promote better flow by fostering good signal progression along a corridor (see Appendix C, Table C-13).

15. **New pedestrians/cyclists signals** - New signals for pedestrians and cyclists improve safety, and therefore improve traffic flow by reducing or eliminating incidents along arterials (see Appendix C, Table C-14).

16. **Turbo Lanes** - Also called Continuous Green T-Intersections, are signalized T-intersections where one or more through lanes are not stopped when the side street left-turn signal phase is active. These intersections may be constructed for a variety of reasons, including increased intersection capacity, improved arterial traffic flow, or to eliminate vehicle queues along the turbo all green lane approach for operational or safety reasons (see Appendix C, Table C-15).

17. **Striping** - This technique is used to increase capacity at an intersection or along a segment without acquiring additional right-of-way. A lane can sometimes be added by narrowing the existing lanes. This technique is also useful in providing the driver clear indication of lane usage (see Appendix C, Table C-16).

18. **Crossing design** - This technique is geared to improve traffic operation at intersections where heavy vehicular and non-vehicular traffic are found. Proper design elements, such as location of street furniture, intersection alignment, and turning radii help reduce conflicts between pedestrians, cyclists, and vehicular traffic, and therefore increase the safety and capacity of an intersection. Appropriate radii can also promote intersection clearance times by trucks and buses, thereby reducing intersection congestion (see Appendix C, Table C-16).

19. **Crosswalk striping and marking** - Conventional efforts to address pedestrian safety, such as enforcement campaigns targeted to the elderly, or directed at motorists that failed to yield to pedestrians, have produced only limited benefits. Conflicts between pedestrians and vehicles can be reduced or completely eliminated through physical separation, but this can be expensive and difficult to implement. A recent study performed in Clearwater, Florida involving the use of special signs and pavement markings produced encouraging results. The signs (18 in x 24 in) contained a pictogram of the crosswalk indicating the location of the three relevant threats to pedestrians from turning movements, along with the message (prompt)"LOOK FOR TURNING VEHICLES", posted adjacent to the pedestrian signal. The message painted on the crosswalk with white paint "WATCH TURNING VEHICLES" printed in three lines with 12-inch lettering. All sites were studied before, immediately after, and approximately one year after prompts were introduced. Results of this study demonstrate that the presence of two prompts in combination was more effective in improving the percentage of pedestrians looking for turning vehicles and in decreasing

conflicts, than one prompt only. Prompting seems to have a significant effect on pedestrian safety and may prove especially beneficial at locations where elderly pedestrians and turning vehicles are present. It is possible that the signs and markings were effective because people concluded that their presence indicated that these intersections were particularly dangerous (see Appendix C, Table C-16).

20. **Access management** - Close signal and driveway spacing increases conflicts between through traffic and cross or local traffic, and therefore contributes to congestion. Access management looks at ways to reduce these conflicts and improve the capacity of a facility by managing the number and location of access points or left turn points. Driveway consolidation is one aspect of access management. That technique limits conflict between through and local traffic by encouraging trips between adjacent land uses to remain off the main arterial (see Appendix C, Table C-7).

21. **Side streets and curb cut closures** - Such a technique increases the vehicle throughput on the main arterial by reducing the number of access points to the arterials from side streets and adjacent land uses and, in many instances, reducing the number of signals. However it places a considerably increased stress on the remaining open intersections to handle increased volumes of traffic diverted from closed points of access. This technique should therefore be used judiciously (see Appendix C, Table C-17).

22. **One-way pairing** - This technique can be applied when two heavily traveled arterials are at close proximity to one another (usually one or two blocks). Studies have shown changes in hourly capacity on a particular roadway increase between 20 and 50 percent when converted to a one-way street (see Appendix C, Table C-18).

23. **Left turn prohibition or restriction** - In locations where traffic delay results from conflicts with left-turning vehicles, this movement can be restricted or prohibited, usually during peak hours. This technique can also be applied if the left turn volume during peak hours does not warrant a separate lane, and the geometry on the receiving approach allows the use of that lane as a through lane, for example. It is particularly effective in fully developed areas where intersection widening cannot be performed (see Appendix C, Table C-5).

24. **Auto restricted zones** - In major retail areas or central business districts, the interaction between cars and pedestrians causes major conflicts and makes the area chaotic for both. An auto restricted zone may restore order to the area, provided that adequate alternate routes and parking facilities are offered for vehicular traffic (see Appendix C, Table C-19).

25. **Truck traffic restriction** - Trucks use more space on the roadway, and tend to be slower and less maneuverable than cars, most decidedly when turning. Traffic flow can improve on roadways heavily used by trucks by restricting them from using the facility during peak periods (see Appendix C, Table C-20). This technique would not however be recommended within industrial areas.

26. **Bus stops spacing and design** - Spacing between bus stops is based primarily on the type of surrounding land uses. Shorter spacing translates into shorter walk distances for transit patrons, but also means more frequent stops and therefore a potentially longer bus trip, and more disruption to vehicular traffic. Greater distances between spacing usually mean longer walking distances, but more infrequent stops, a shorter bus trip, and less disruption to vehicular traffic. Bus stops themselves should be designed to promote safety and avoid conflicts between pedestrians and vehicular traffic. Proper location of bus stops, especially near intersections, is crucial in maintaining and preserving roadway capacity. Proper design of bus shelters is also a technique that can be used to improve traffic flow and safety. Inadequate capacity at waiting shelters discourages transit mode choices. If ridership does occur in significant volumes, it creates conflict with pedestrians, cyclists, and vehicles. Transit ridership may improve slightly if proper storage facilities are provided for cyclists. Storage facilities provided at proper locations near bus stops also leave the sidewalk free for pedestrian use (see Appendix C, Table C-21).

27. **Bus bays** - This technique is implemented to allow vehicular traffic to flow while buses are stopped for boarding and alighting. Among other factors, a bus bay is usually considered when traffic in the curb lane exceed 250 vehicles per hour (vph), traffic speed is greater than 40 miles per hour (mph), and bus volume is 10 or more during the peak hour. Nationwide studies have shown that provision of a bus bay can result in an average increase in vehicular speed of 2 to 7 mph (see Appendix C, Table C-22).

28. **Signal preemption for buses** - Signal preemption is achieved by prolonging the green phase or shortening the red phase in a traffic signal cycle for the preferred road or mode. Buses are allowed to proceed only when they need to, but they do so with no delay. When a transit vehicle crosses several traffic lights, the traffic controller normally activates a synchronized green zone for it. Although priority is given to public transit, the same volume of private vehicles as before can be accommodated. Congestion is prevented by avoiding unnecessary green phases and systematically monitoring all areas (see Appendix C, Table C-23).

29. **Expanded bus routes** - A transit route is a designated set of streets or separated rights-of-way which transit vehicles regularly serve. Transit routes may be modified to reach a larger or denser drawing area or provide service too newly constructed major activity centers. By reaching a greater drawing area, increased ridership and revenues may be obtained as well as greater mobility on the selected routes for drivers (see Appendix C, Table C-24).

30. **Limited stops or express bus routes** - Travel time increases with the number of stops along a particular bus route. Operation strategies, such as skip-stop or express bus routes on arterials or freeways, reduce transit travel time, and may increase transit ridership by offering time savings over other modes of transportation (see Appendix C, Table C-25).

31. **Increased bus frequency** - Service frequency is the number of transit units passing a given point along a route per hour. Increased bus frequency improves service along given facilities by providing greater riding comfort on otherwise overcrowded buses, via higher transportation capacity on the service route and by decreasing waiting time. Lower travel times may also result from increased service, encouraging mode shift from private automobiles to mass transit. Higher ridership in turn may alleviate congestion on overcrowded arterials (see Appendix C, Table C-26).

32. **Loop Routes/Shuttle buses** – Loop Routes/Shuttle buses can increase transit ridership a number of ways and alleviate congestion. Provision of loop buses at major activity centers, such as the Civic Center area, reduces conflicts between pedestrians and vehicular traffic and enhances traffic flow conditions. It may also eliminate the need to use private vehicles to travel distances perceived as too far to walk during the midday, especially during the lunch hours. Shuttle buses provided between transit stations or major bus routes and employment or commercial centers can reduce the number of vehicles on the arterials providing access to these centers. Loop/shuttle services can also serve many suburban and low density urban employment and commercial centers located away from major transit routes, where travel to these centers is particularly difficult for people not having regular access to automobiles (see Appendix C, Table C-27).

33. **Articulated buses** - Service can be improved on a particular route if adequate capacity is provided through the use of articulated buses; fewer buses can be used to carry the same number of passengers because articulated buses are larger vehicles. The benefits of such techniques are similar to increasing bus frequency with the added benefit of not increasing the number of transit vehicles on congested roadways (see Appendix C, Table C-26).

34. **Increased transit frequency in shoulder periods** - More and more communities are seeking Transportation Demand Management solutions in order to alleviate their ever increasing congestion problems. One such option is to encourage travel during non-peak periods in order to reduce the volume of vehicles during the peak hours of the day. Providing adequate transit service in shoulder periods may encourage such a trend and complement other Transportation Demand Management (TDM) measures (see Appendix C, Table C-28).

35. **Transit Fares** - Reducing fares during off-peak periods, or increasing fares during peak periods, may also encourage travel during the off-peak periods. The benefits of such technique are similar to increasing frequency in shoulder periods (see Appendix C, Table C-28).

36. **Exclusive bus and carpool lane** - The effective person-carrying capacity of an arterial can be increased by reserving a lane to be used exclusively by buses and carpools. That lane can either be a curb or median lane, and should offer some time savings to its potential users. The goal of this technique is to increase auto-occupancy along selected arterials and reduce the use of single occupancy vehicles (see Appendix C, Table C-29).

37. **Park-and-ride lots** - This technique allows access to a transit route to users outside of the immediate drawing area by providing a safe location to park their cars. Sufficient patronage can seldom be achieved on transit routes serving low density residential areas. These areas usually have circuitous street patterns that increase travel time and hinder the maneuverability of large vehicles. Park and ride lots can be provided at selected locations to link these areas to existing or proposed transit routes. These lots can expand the drawing areas of a transit system and increase ridership while limiting transit operation to arterials, preserving the integrity of residential areas. Park-and-ride lots would make transit accessible to low density areas that would not warrant implementation of a bus route under conventional transit walk-access conditions (see Appendix C, Table C-30).

38. **Expanded off-street parking and loading areas** - This technique can be applied near or at manor activity centers. On-street parking and loading areas interfere with the traffic on arterials and raise safety concerns. Providing adequate loading areas and parking off-street reduces conflicts on the arterial and therefore improves mobility and safety (see Appendix C, Table C-31).

39. **On-street parking restriction and/or removal** - On-street parking maneuvers force both the parking space user and other traffic on the arterial to slow down, and therefore reduce the throughput of the facility. If additional capacity on the facility is only needed during peak hours, on-street parking can be allowed during off-peak only. On-street parking should be banned all together if the additional capacity is needed throughout the day, or if it poses safety concerns (see Appendix C, Table C-32).

40. **Increased parking fees** - Increasing parking fees may help reduce congestion by encouraging transit use. This technique is very effective mostly in central business districts, and in major activity centers where parking fees are enforced (see Appendix C, Table C-33).

41. **Warning devices** - Properly located, devices can increase the safety and vehicle throughput of a facility by giving the driver time to adjust, and therefore plan for, upcoming conditions (see Appendix C, Table C-34).

42. **Employer pooling program** - Employers of sizable companies, or groups of employees within an area, can set up a carpool program by matching employees interested in such a program. This program decreases the number of single-occupant vehicles on the road, therefore increasing the vehicle throughput and the person-carrying capacity of a facility (see Appendix C, Table C-35).

43. **Employer subsidy of transit passes** - As part of the TDM measures used to alleviate congestion, employers may encourage increased transit ridership by offering to share or cover the cost of travel when done using transit. The purpose of this programs is to discourage the use of private automobile and reduce the number of vehicles using the roadway network during peak travel periods. This program also increases safety and mobility near major activity centers by reducing the number of vehicles accessing the centers (see Appendix C, Table C-36).

44. **Speed reduction** - This technique is mainly used to correct locations where safety is a concern. However, the overall vehicle throughput of the facility may be enhanced, because there are fewer breakdowns in traffic flow due to accidents (see Appendix C, Table C-37).

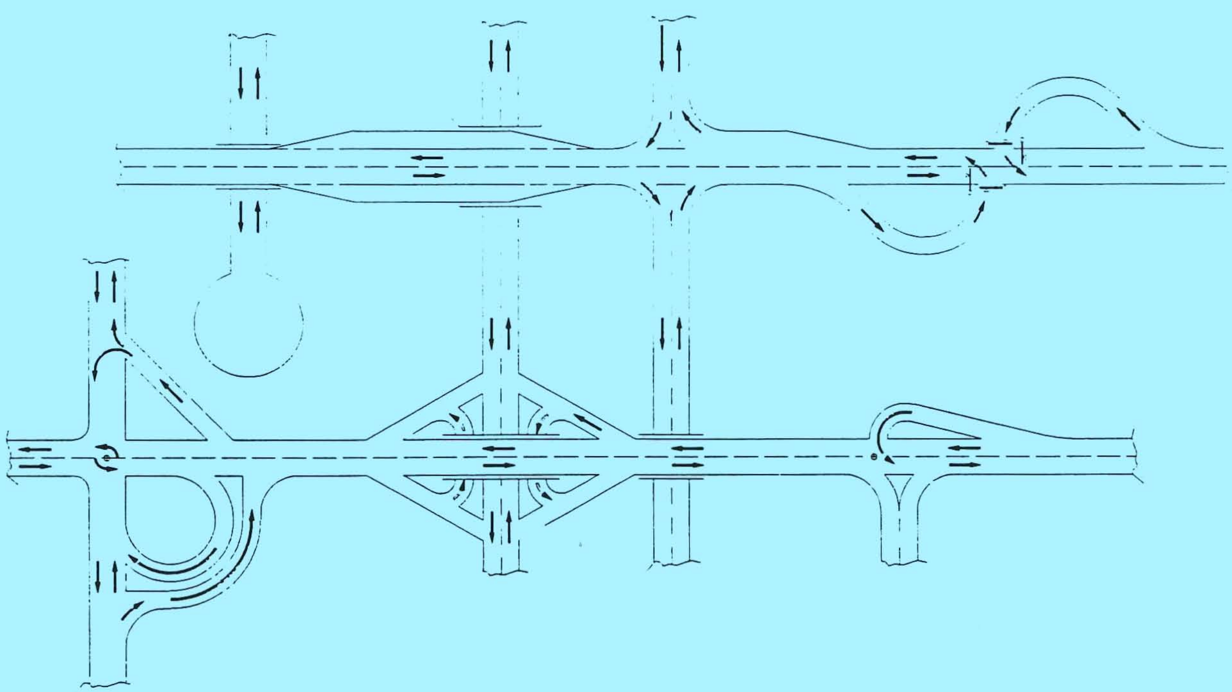
45. **Crosswalk, sidewalk, and bike path width** - Appropriate width for crosswalks, sidewalks, and bicycle paths improves safety along major arterials by reducing conflicts between vehicles, pedestrians, and cyclists. Travel lanes adjacent to crowded sidewalks usually operate at lower speeds due to the perceived safety problems. The same phenomenon occurs when cyclists are either on narrow sidewalks or using the outside travel lane as bike path. Inadequate crosswalk widths reduce the volume of pedestrians that can cross major arterials during allotted time. Safety problems result from pedestrians using areas outside of the crosswalk, jay-walking, or crowding the street corners waiting for the next pedestrian signal phase (see Appendix C, Table C-38).

46. **Other Techniques** - Problems may arise where none of the techniques discussed above are applicable. Engineering judgment should then be applied to provide solutions based on field observations and available data.

CHAPTER 6

PRELIMINARY TESTING AND EVALUATION OF TEST CANDIDATES

FINAL REPORT



6. PRELIMINARY TESTING AND EVALUATION OF TEST CANDIDATES

Chapter 6 documents the results of applying previously identified mobility-enhancing and congestion-reducing strategies and techniques on the selected arterials. For this purpose, evaluation criteria were developed and approved by the Steering Committee. These criteria identified existing measures and parameters to appraise mobility improvements, level of service (LOS) improvements, and congestion reduction approaches for the purpose of assessing how well contemplated strategies and techniques perform when applied to candidate test facilities within the selected Transportation Area. This evaluation criteria were adapted from both new and existing methods to estimate and quantify traffic flow improvements resulting from the application of suitable strategies and techniques to major arterials with similar priority rankings.

6.1 Evaluation Criteria for Appraising Mobility Improvements

Application of the techniques presented in the previous chapter is dependent upon the location and the nature of the specific problems for which solutions are sought. This section presents the evaluation criteria that were selected based on the desired impacts of each of the improvements.

The purpose of each criteria is to provide a measure to compare the benefits and disadvantages of applying one or a set of techniques to a particular location. These criteria can also be used as monitoring tools in before and after studies aimed at measuring how well the implemented improvements matched the desired results.

The following is a description of the extensive list of evaluation criteria that can be used to evaluate both existing problems and proposed solutions. In general, only a few criteria need to be applied to assess the effectiveness of proposed solutions. The criteria listed also include other factors that are influenced by transportation such as air quality issues, effects on economic growth, and land use impacts. These are usually indirect factors that, nonetheless, represent considerations that are important and may influence not only the operation of the transportation system, but the choice of treatment(s) as well.

1. **Travel Time -** One of the effects of increased mobility is a reduction in travel time. This criterion is therefore a good tool to measure the impacts of proposed improvements. This criteria is not, however, a direct result of implementing all of the selected strategies and techniques, but may be a secondary impact as in the case of transit improvements. In that case, travel time may decrease on selected arterial due to a mode shift from private vehicles to transit. As can be seen, this criteria is multi-modal and applies not only to personal vehicular travel but also to public transit options, and includes items such as door-to-door or journey times, point-to-point travel times, intersection delay times, and wait times.

2. **Travel Costs -** The proposed improvements should ideally reduce total travel costs, including fuel costs and the cost of time.

3. **Travel Speed -** One of the first impacts of increased congestion is a reduction in travel speed. The proposed improvements should therefore be aimed at increasing the speed to a level reflective of the desired level of service, between 30 and 40 percent of the average existing travel speed, rising to corresponding to levels of service E and D in excessively congested urban areas.

4. **Delay -** Delay is proportional to the amount of extra time experienced by drivers, passengers and pedestrians compared to ideal travel times as a result of lack of capacity, control measures (signals), or interaction with other users of a facility. Improvements should therefore be aimed at directly or indirectly reducing this additional travel time experienced beyond what would reasonably be desired for a given trip.

5. **Traffic Volume -** This criterion should be carefully weighed against other measures. An increase in the number of cars traveling through a section of roadway may be a positive impact if other factors are also present, such as, maintenance of safety standards and reduction of conflicts between pedestrians and vehicles.

6. **Capacity Increase -** Mobility is greatly and most directly improved with increased capacity. This criteria is applicable to all modes of surface travel: personal automobile, transit, bicycle, and pedestrian movements.

7. **Congestion Level-** Since congestion is caused by many factors, it represents an excellent tool to measure the effectiveness of almost all proposed improvements. It is usually measured by the ratio of the volume to capacity, and the resulting level of service is the indicator. The level of service resulting from different alternatives can be compared to each other or to the desired level of service for specific facilities to evaluate approaches to reduce congestion.

8. **Signal Progression -** Adequate traffic signal progression along an arterial can often significantly help reduce congestion levels, increase capacity on the facility, and reduce delay at intersections. Traffic signal improvements are an effective, low cost tool for reducing congestion on arterials, regardless of whether the improvements are performed on isolated intersections or on signalized networks. Signalized intersections, together with other improvements on the arterial street system, provide significant opportunities for increasing capacity and making better use of existing roadways, without major new construction.

9. **Automobile Occupancy -** Some of the proposed improvements are geared towards reducing the number of vehicles on certain facilities by encouraging trip sharing or public transit. An increase in the automobile occupancy rate is one measure of how well proposed behaviorally oriented strategies are meeting the desired impacts.

10. **Safety -** This criteria applies to all travel modes including personal automobile, public transit, pedestrians and bicycles. Other improvements should be carefully examined to assess their potential impacts in reducing or increasing public safety along the selected facilities.

11. Environmental Impacts - The impacts of the proposed improvements on air quality, noise, energy, and aesthetics should be a factor in determining the appropriateness of such improvements. However, many more localized traffic flow improvements may result in individually immeasurable small air quality improvements when compared to urban areawide environmental impacts.

12. Implementation Costs - The cost of implementing the proposed improvements should be accounted for in determining the appropriateness of such improvements. This criteria can also be used when various improvements may meet the desired goals and objectives, to discriminate among choices with similar magnitudes of congestion-reducing effects.

13. Operating and Maintenance Costs - Operating and maintenance costs are a very important factor to consider in the recommendation of proposed improvements, particularly as they are ongoing, perpetual costs.

14. Capital Costs - Same as above.

15. Right-of-Way Costs - Same as above.

16. Construction Costs - Same as above.

17. Enforcement Costs - The cost of enforcing proposed improvements such as parking, turning movements and truck restrictions during peak hours should be a consideration in evaluating the different options available to reduce and/or manage congestion. All too often, these costs are either not considered, or enforcement is withdrawn after initial project implementation. In the latter case, conditions may revert to a previous congested situation, and improvement gains may be lost.

18. Land Use Impacts - Impacts on adjacent land uses should also be considered. Implementation of a one-way pair system may have very positive impacts on traffic flow. One-way pair may also have negative impacts on property values and on numbers of patrons frequenting commercial land uses along the arterials by restricting access to these properties. The type of proposed improvements should also be compatible with the surrounding land uses as to avoid undesirable secondary impacts such as neighborhood intrusion, and division of established communities.

19. Ridership - A comparison of the existing and expected ridership, or actual ridership after implementation, is a good criteria to evaluate the applicability or the appropriateness of proposed transit improvements. Ridership may be measured not only within the immediate area of implementation but also on parallel and cross facilities.

20. Transit Revenue - The success of implementing new transit routes or expanding existing ones may depend heavily on the revenues generated. Transit is not self-supporting, and service improvements must balance positive effects against new incremental costs. Fairbox recovery ratios should ideally be no lower than the system wide average.

21. **Parking Space -** The change in the parking space occupancy rate, number of vehicles parking in a center per day, and forecast parking revenues, are effective tools to measure the impacts of proposed improvements.

Table 6.1 depicts the evaluation criteria that are used to measure the impacts of each of the proposed strategies and techniques.

6.1 Test Area

Superarterial Network concept improvements are aimed at managing and if possible alleviating existing congestion. These improvements are also aimed at improving or at least maintaining existing levels of congestion in the future. Therefore two different tools were used to develop sets of improvements that would be both useful today and in the future. The following sections describe the methodology and the results of the preliminary testing performed for Transportation Area 4. This transportation area is located in central west Miami-Dade, between Krome Avenue to the west, SW/NW 107th Avenue to the east, NW 103rd Street to the north, and SW 88th Street to the south. The area was selected because of tremendous growth in recent years, with some room for expansion of transportation facilities, and is not overly constrained by pre-existing development.

6.2 Testing Methodology

Testing of existing conditions along the arterials within the study area was limited to available traffic counts and relied heavily on actual data observed during peak hours. Data such as geometry, location of bus stops, queue lengths, lane utilization, and other factors were compiled and analyzed to determine the most appropriate solution for specific locations within the study area. The extensive list presented in Technical Memorandum 6 was used, and the appropriate strategies for managing or alleviating congestion were identified based on the nature of the problems along the arterials. Right-of-way availability was the only constraint used in selecting the appropriate improvements. These improvements were therefore limited to locations where right-of-way acquisition did not appear to be too extensive, and where it would have limited impacts on land uses and communities.

The resulting improvements were then incorporated in the regional model in order to measure the impacts of the improvements on future travel patterns within the study area. The study team and the Steering Committee recognized that a travel demand model is limited and macroscopic in nature and would not provide enough information to measure impacts of all of the improvements recommended. The testing was therefore limited to measuring the regional impacts of the proposed improvements and to provide the team with a tool that would help to evaluate the combined impacts of all of the major recommendations. The regional model developed by the Metropolitan Planning Organization is a useful and readily available tool used in this study to investigate the impacts of the most significant/largest proposed improvements on future travel patterns within the study area.

Table 6.1
Evaluation Criteria

Strategies and Techniques	Evaluation Criteria																				
	Travel											Costs									
	Time	Costs	Speed	Delay	Traffic Volume	Capacity Increase	Congestion Level	Signal Progression	Auto Occupancy	Safety	Environemtal Impacts	Implementation	O&M	Capital	ROW	Construction	Enforcement	Land Use Impacts	Parking	Transit Revenue	Ridership
New Lane and/or Street Segment	■				■		■			■	■	■	■	■	■	■		■	■		
Turn Lane Addition and Phasing	■			■			■			■		■	■		■				■		
Frontage Roads			■			■	■			■		■	■	■	■	■		■			
Street and Intersection Geometry Improvements: Striping, Channelization, and Islands	■									■	■										
Reroute Turning Traffic	■			■			■			■		■			■		■	■			
Intersection Turn Lanes and Mid-Block Two-\Way Continuous Left Turn Lanes	■		■			■	■			■									■		
Reversible Lanes	■		■	■		■	■			■	■	■	■				■		■		
Parallel or By-Pass Segment			■		■		■					■					■				
Grade Separation	■		■	■		■	■	■		■	■	■		■	■	■		■			
Walkways or Pedestrians/Cyclists Overpasses			■				■	■		■	■	■		■	■	■					
Exclusive Bicycle Lanes			■				■			■		■			■	■					
New Signal Installation			■	■			■			■		■	■								
Signal Phasing and Timing Changes			■	■			■				■										
New Pedestrian/Cyclists Signal			■							■	■										
Turbo Lanes			■	■		■	■			■											
Crossing Design, Striping and Marking				■		■				■											
Access Management/Driveway Consolidation	■		■			■	■			■								■	■		
Paired One-Way Streets to Improve Flow	■					■	■	■		■	■							■	■		
Auto Restricted Zones	■		■			■			■	■							■	■	■		■

Note: Land Use Impacts = Commercial Property Value
Number of Patrons

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Table 6.1 (Continued)
Evaluation Criteria

Strategies and Techniques	Evaluation Criteria: Travel: Time	Travel: Costs	Travel: Speed	Delay	Traffic Volume	Capacity Increase	Congestion Level	Signal Progression	Auto Occupancy	Safety	Environemtal Impacts	Costs: Implementation	Costs: O&M	Costs: Capital	Costs: ROW	Costs: Construction	Costs: Enforcement	Land Use Impacts	Parking	Transit Revenue	Ridership
Truck Traffic Restrictions	■	■	■			■	■				■						■	■			
Bus Stop Spacing and Design	■		■							■											■
Bus Bays	■		■				■		■	■		■		■			■	■			
Signal Preemption for Buses	■		■	■			■	■	■			■	■	■				■			■
Expanded Bus Route							■		■		■	■	■	■						■	■
Limited Stops or Express Bus Routes	■						■		■			■	■							■	■
Increased Bus Frequency							■		■		■	■	■	■						■	■
Loop Shuttle Buses	■						■		■		■	■	■	■						■	
Increased Frequency in Shoulder Periods	■						■					■	■							■	■
Exclusive Bus and Carpool Lane(s)	■				■		■		■		■	■	■	■		■	■			■	■
Park and Ride Lots Along Transit Routes	■	■	■		■		■				■	■		■						■	■
Expanded Off-Street Parking and Loading Areas			■				■					■	■		■	■		■	■	■	■
Parking Restriction and/or Removal			■			■	■					■	■					■			
Increased Parking Fee		■	■				■				■							■	■	■	■
Warning Devices			■	■						■		■	■				■				
Employer Car-Pooling Program	■		■		■				■		■	■	■						■	■	■
Employer Subsidy of Transit Passes			■			■	■												■		■
Speed Reduction	■		■			■				■	■						■				
Crosswalk, Sidewalk and Bike Path Width			■			■				■		■		■							

Note: Land Use Impacts = Commercial Property Value
Number of Patrons

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6.3 Testing of Candidate Corridors

Due to the limited data readily available, the preliminary testing of the arterials relied heavily on field observations. The field visits were performed along the arterials selected during both morning and afternoon peak periods. The purpose of the field visits was to assess levels of congestion, traffic flow characteristics, location and nature of the problems, and to intensify the knowledge of the area in order to develop the recommended actions. The following is a detailed description of the conditions observed during the course of the visits.

6.3.1 SW 137th Avenue

Existing Geometry

SW 137th Avenue is a north-south arterial extending from SW 176th Street to NW 10th Street. It is a four-lane divided facility with left turn pockets from Kendall Drive (SW 88th Street) to Bird Road (SW 40th Street). North of Bird Road, the geometry changes to a six-lane divided facility to Coral Way (SW 26th Street), and back to a four-lane divided facility from Coral Way to SW 8th Street (Tamiami Trail). From SW 8th Street to NW 10th Street, SW 137th Avenue is a two-lane undivided facility. Land use along this corridor is mixed residential and commercial. Residences constitute the majority of the land uses along SW 137th Avenue. North of SW 8th Street, land uses along SW 137th Avenue change to primarily industrial. SW 137th Avenue currently ends at the Rinker Company where sand is shipped to construction sites.

Observed Conditions

SW 137th Avenue carries heavy northbound traffic during the morning peak period and southbound during the afternoon peak period through the study area. Drainage problems were observed during the field visits between Kendall Drive and Coral Way in both directions along SW 137th Avenue, adding to the existing congestion on this facility. On rainy days, the right lanes in both directions are completely flooded, causing the facility to operate as a highly congested two-lane divided facility.

Delays observed at the intersection of Kendall Drive and SW 137th Avenue were mainly due to heavy traffic on both arterials, with Kendall Drive carrying higher volumes. During the PM peak period, the southbound to westbound right turn forms a queue that extends to nine blocks north SW 79th Street, approximately one mile. Cars were observed to turn right at SW 84th Street, enter the shopping center located at the northwest corner of the intersection and exit on Kendall Drive west of the intersection.

Delays observed at the intersection of SW 137th Avenue and Miller Drive (SW 56th Street) are mainly due to the crossing of two major arterials with heavy flow during the peak hours, combined with insufficient capacity on Miller Drive. A similar situation was observed at the intersection of SW 137th Avenue and Bird Road. At that intersection, commuter traffic patterns for the morning peak period produce a heavy volume for the right turn movement northbound to eastbound at SW 137th Avenue and SW 8th Street. The queue for that movement was observed to back up to SW 11th Street. Although that movement is not controlled by a signal, the heavy eastbound movement on SW 8th Street prevents drivers from making the right turn from SW 137th Avenue. Drivers avoid this movement by making a left turn into the shopping center on the southwest corner of the intersection, cutting through the parking lot, and exiting the shopping center onto SW 8th Street westbound west of SW 137th Avenue. The queue reaches SW 142nd Avenue during the morning peak period. Queues, with minimum of ten vehicles, were observed at each of the multiple access points to the shopping center. The average waiting time before entering SW 8th Street from any of the access points to the shopping center was observed to be four minutes.

A similar situation was observed during the afternoon peak period for the westbound to southbound left turn movement from SW 8th Street. Storage capacity for this left turn is insufficient. Drivers trying to avoid the lengthy wait traveled westbound on SW 8th Street, then northbound, make a left turn into the shopping center, and finally exit the shopping center on SW 137th Avenue south of the intersection. This is illustrated on Figure 6.1.

Minimum northbound through traffic was observed on 137th Avenue at SW 8th Street. Signal phasing allowing northbound and southbound movements to occur simultaneously would allow sufficient time for the northbound to westbound movement. Additional capacity should be provided on SW 137th Avenue north of SW 8th Street for buses coming out of the maintenance yard, and trucks from the Rinker Company. On this two-lane road, trucks and buses are unable to make the westbound to northbound right turn from SW 8th Street without the use of both lanes, creating conflicts for the westbound SW 8th Street through movement as well as the southbound traffic on SW 137th Avenue.

Future proposed improvements for this area include the extension of SR 836 to SW 137th Avenue, widening of SW 137th Avenue to six lanes from SW 8th Street to the SR 836 extension and construction of NW 12th Street. The SR 836 Extension will greatly increase traffic volumes along SW 137th Avenue. Necessary provisions should be taken now at the intersection on SW 137th Avenue and SW 8th Street to provide adequate capacity, intersection improvements or grade separation, for the future.

Recommended Improvements

Table 6.2 shows the transportation deficiencies, applicable corrective strategies/techniques and recommended actions at each of the congested location on SW 137th Avenue. Based on the field observation, an additional lane is warranted along Miller Drive north and south of SW 137th Avenue. However, that area is built out and all of the available right-of-way seems to have already been used for roadway improvements. Right-of-way acquisition along Miller Drive may reveal to be infeasible due to costs and community impact. An alternate solution would be to provide exclusive eastbound and westbound right turns on Miller Drive at SW 137th Avenue. Some right-of-way would still be needed to accommodate the additional turn lanes.

FIGURE 6.1
Traffic Patterns at SW 137th Avenue and SW 8th Street

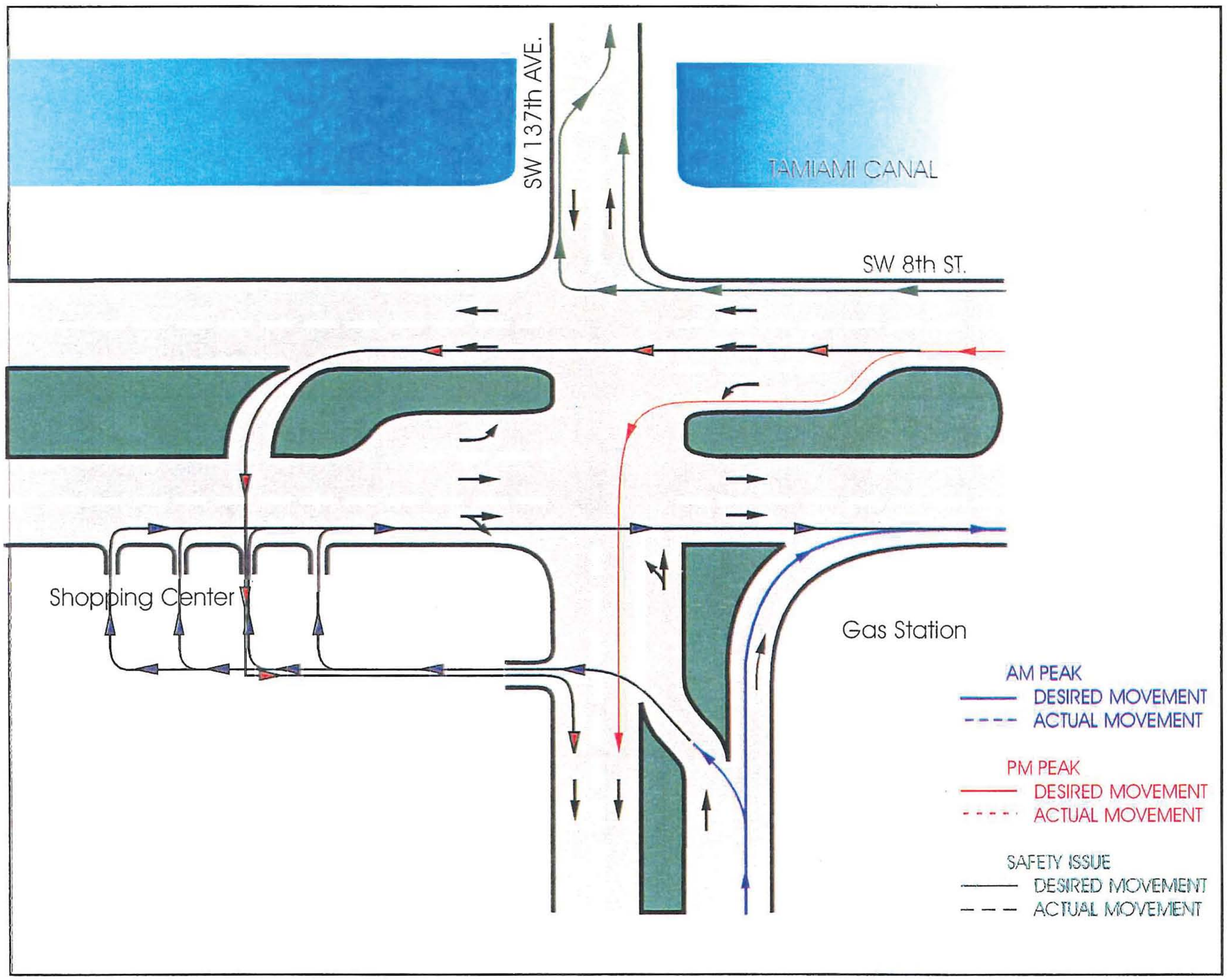

Table 6.2
SW 137th Avenue (From SW 88th Street to NW 10th Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
1.	SW 137th Avenue @ Kendall Drive	• Insufficient capacity for southbound to westbound RT during the PM peak period	• Signs on SW 137th Ave. encouraging the use of SW 84th St. and SW 142nd Ave. as an alternate route, and access to the shopping center through SW 84th St. (1)		• Same as corrective strategy/technique
		• Crossing of two major arterials	• Grade Separation (Urban interchange) with Kendall Drive over SW 137th Avenue (2)	• Right-of-way, costs, social and economic impacts	• Coordinate with Major Improvement Study
		• Insufficient capacity on SW 137th Avenue during the peak periods	• Provide new lanes on SW 137th Avenue from Kendall Drive to Bird Road (3)	• Right-of-way	• Same as corrective strategy/technique
		• Drainage problems on SW 137th Avenue north of Kendall Dr.	• Provide adequate drainage (4)		
2.	SW 137th Avenue @ Miller Drive	• Insufficient capacity on Miller Drive causing delays on 137th Ave. during peak hours.	• Provide additional through lanes on Miller Drive (5)	• Right-of-way	• Detailed analysis based on actual traffic counts needs to be performed.
		• Drainage problems on SW 137th Ave.	• Provide adequate drainage (6)		• Same as corrective strategy/technique

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

Table 6.2 (Continued)
SW 137th Avenue (From SW 88th Street to NW 10th Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
3.	SW 137th Avenue @ Miller Drive	• Insufficient capacity southbound to eastbound LT during the PM peak period	• Increase length of storage bay (7)		• Detailed geometry analysis needs to be performed.
4.	SW 137th Avenue @ Bird Road	• Delays due to crossing of two major arterials with heavy flow during the peak periods	• Increase number of through lanes on Bird Road (8)	• Right-of-way • Environmental problems due to the canal on the south side of Bird Road	• Detailed geometry, traffic counts, and signal timing and phasing analyses need to be performed.
		• Friction due to numerous access points north of Bird Road on southbound SW 137th Ave.	• Driveway consolidation (parking lots are already connected) (9)	• Opposition from business owners	• Same as corrective strategy/technique
5.	SW 137th Avenue between Coral and SW 8th Street	• Drainage problems	• Provide adequate drainage (10)		• Same as corrective strategy/technique
6.	SW 137th Avenue @ SW 8th Street	• Delays on SW 137th Ave. due to heavy volumes on SW 8th St. Heavy northbound to eastbound and westbound to southbound delays during the AM and PM peak periods, respectively	• Widen 8th Street west of SW 127th Avenue (11) • Increase length of storage bay for westbound to southbound left turn (12) • Connect SW 6th Street to SW 137th Avenue to provide alternate route to SW 8th Street (13)	• Community opposition	• Same as corrective strategy/technique

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

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Table 6.2 (Continued)
SW 137th Avenue (From SW 88th Street to NW 10th Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
7.	SW 137th Avenue @ 8th Street		• Grade separation (14) (Interim improvement : provide overlap phasing for the north-south movements)	• Right-of-way • Opposition from business owners	
		• High percentage of trucks and school buses. Bridge is not wide enough to accommodate heavy vehicles	• Widen bridge on SW 137th Avenue north of SW 8th Street (15)	• Environmental problems	• Detailed geometry analysis needs to be performed
		• Insufficient capacity on SW 137th Avenue during peak periods	• Provide additional lanes on SW 137th Avenue from Coral Way to SW 8th Street (16)	• Right-of-way	• Detailed analysis needs to be performed
		• Delays due to toll plaza on Turnpike's ramp	• Improve toll collection through the installation of AVI (Automatic Vehicle Identification) (17)		• Coordinate with the Tunpike authorities

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

6.3.2 SW 117th Avenue

Existing Geometry

SW 117th Avenue is north-south arterial extending from Quail Roost Drive to SW 8th Street, with the exception of an unbuilt section between SW 168th Street and SW 152nd Street (Coral Reef Drive). It is a five-lane facility from the Turnpike to Sunset Drive (SW 72nd Street), changing to a four-lane divided facility from Sunset Drive to Bird Road, and a two-lane undivided facility from Bird Road to SW 8th Street. SW 117th Avenue runs parallel to the Turnpike, providing an alternate route to this major tolled expressway for commuters living and/or working in southwest Dade County.

Observed Conditions

Delays observed on SW 117th Avenue from Kendall Drive to the Turnpike northbound off ramp are mainly due to insufficient capacity on the cross streets (Sunset Drive, Miller Drive, and Bird Road), and conflicts between heavy traffic flow on both the cross-streets and SW 117th Avenue.

Toll plaza operation and access ramps to and from the Turnpike also contribute to congestion on SW 117th Avenue near Bird Road. The Turnpike northbound-off ramp is located on SW 117th Avenue within a short distance just south of Bird Road. A combination of short spacing between signals and heavy traffic flow prevents drivers exiting the Turnpike to make necessary lane changes to reach Turnpike's ramps, stay on SW 117th Avenue, and turn on Bird Road. Moreover, additional lane usage indicator signs are needed on northbound SW 117th Avenue south of SW 40th Street (Bird Road) to allow drivers on SW 117th Avenue ample time to make necessary lane changes. Some drivers find themselves trapped in the wrong lane, one of which leads to the Turnpike northbound on-ramp. The additional signs placed further ahead of the intersection would reduce unnecessary conflict points at the intersection, increasing traffic flow.

From the Turnpike northbound off ramp to SW 8th Street, SW 117th Avenue does not have the capacity to meet the demand during peak periods. During morning peak hours, delays due to the toll plaza on the Turnpike northbound cause the northbound on-ramp to back up, forming a queue that spills over on SW 117th Avenue. SW 117th Avenue is also used by commuters to avoid the toll plaza located on the Turnpike just north of Bird Road. Drivers avoiding the toll plaza proceed on SW 117th Avenue to SW 8th Street, make a left turn onto SW 107th Avenue to the SR 836 eastbound on-ramp. Increasing capacity on SW 117th Avenue will encourage drivers to use this alternate route causing loss of revenue for the Turnpike. Although one of the recommendations is to widen SW 117th Street north of Bird Road, the impact of this widening on toll plaza revenues should also be taken into consideration.

SW 117th Avenue is also used by students entering the Florida International University (FIU) campus located on SW 117th Avenue at SW 17th Street. The heavy volume of FIU students and through traffic on SW 117th Avenue cause a queue to form on SW 117th Avenue northbound that moves at 5 MPH during the peak hours. The excessive demand placed on this facility is aggravated with numerous traffic lights in this section of the road, causing further delays for the commuter.

Proposed plans for the Turnpike toll plaza include relocating the mainline toll plaza further south (closer to Miller Drive), and new toll facilities at the Bird Road northbound on-ramp. Improvements to the Turnpike northbound on-ramp include a two-lane ramp, with an additional 1,000 feet of storage from the existing layout. This would increase the storage capacity for the northbound on ramp and may help alleviate the congestion on SW 117th Avenue. The northbound off-ramp will remain at its present location, south of Bird Road.

Recommended Improvements

Table 6.3 shows a summary of the transportation deficiencies, corrective strategies/techniques applicable, and recommended actions at each problem location for SW 117th Avenue.

Table 6.3
SW 117th Avenue (From SW 88th Street to SW 8th Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
1.	SW 117th Ave. @ Kendall	• Delays due to crossings of two major arterials	• Improvements to Kendall Drive to be coordinated with the proposed Major Improvement Study (18)		• Same as corrective strategy/technique
2.	SW 117th Avenue @ 7700 Block	• Traffic signals spaced too close together.	• Signal timing coordination (19)		• Same as corrective strategy/technique
3.	SW 117th Avenue @ Sunset Drive	• Insufficient capacity on Sunset Drive causing delays on 117th Ave. during peak hours.	• Provide additional through lanes on Sunset Drive (20)	• Right-of-way, costs, and community impacts.	• Detailed analysis based on actual traffic counts and available right-of-way needs to be performed.
4.	SW 117th Avenue @ Miller Drive	• Insufficient capacity on Miller Drive	• Provide additional lanes on Miller Drive (21)	• Right-of-way, costs, and community impacts.	• Detailed analysis based on actual traffic counts and available right-of-way needs to be performed.

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

Table 6.3 (Continued)
SW 117th Avenue (From SW 88th Street to SW 8th Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
5.	SW 117th Avenue from Turnpike northbound off-ramp to SW 8th Street	• Delays due to exiting traffic from Turnpike northbound-off ramp	• Relocate ramp further south (22)	• Cost • Environmental problems • Community opposition	• Detailed analysis to quantify number of vehicles bypassing Toll Plaza
		• Delays due to friction caused by improper lane usage indicator signs	• Improve signage on SW 117th Avenue south of SW 40th Street (23)		• Coordinate with proposed improvements at Toll Plaza
		• Delays due to crossing of two major arterials at Bird Road with heavy flow during the peak periods.	• Widen Bird Road west of SW 117th Avenue (24)	• Right-of-way • Environmental problems due to the canal on the south side of Bird Road • Costs • Community impacts	
		• Delays due to Turnpike northbound on-ramp and mainline Toll Plaza	• Incorporate Turnpike improvements • Provide Automatic Vehicle Identification on future ramps (26)		
		• Insufficient capacity on SW 117th Avenue	• Provide additional lanes on SW 117th Avenue (27)	• Community opposition • Turnpike opposition due to potential loss of revenue	

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

6.3.3 SW/NW 107th Avenue

Existing Geometry

SW 107th Avenue is a north-south major arterial extending from Quail Roost Drive to NW 41st Street to the north, with an unbuilt section between SW 160th Street and SW 104th Street. SW 107th Avenue is a five-lane facility with a continuous left turn lane from Kendall Drive to Bird Road, widening to a six-lane divided arterial from Bird Road to SW 8th Street. SW 107th Avenue narrows down to a four-lane divided arterial from SW 8th Street to NW 41st Street, and then to a two-lane undivided facility to NW 58th Street.

Observed Conditions

Delays observed on SW 107th Avenue from Kendall Drive to SW 8th Street are mainly due to crossing of two major arterials with heavy volumes during the peak periods and insufficient capacity on the cross streets.

Very high levels of congestion were observed during the field visits on this facility between SW 8th Street and SR 836. SW/NW 107th Avenue is used in that segment as a bypass route to access and/or exit SR 836 by commuters avoiding the Turnpike Toll Plaza located at Bird Road, and by residents of the surrounding neighborhoods (Sweetwater, Fountainbleau Park). The congestion on SW 107th Avenue is also due to the current lack of north-south arterials crossing SR 836. In much of southwest Miami-Dade, continuous arterials exist at the one-mile section lines. However, in the case of SW/NW 107th Avenue and SW/NW 87th Avenue between SW 8th Street and NW 36th Street, continuity is offered only at the two-mile section line, placing an abnormally high demand on this facility that is much greater than the actual capacity. Proposed improvements by the County to improve SW/NW 97th Avenue include widening and an overpass at SR 836. Other factors influencing the high levels of congestion observed are:

- slow speed zones for the two schools in the area of SW 107th Avenue and SW 4th Street,
- the opening of the new FIU campus on SW 107th Avenue and Flagler Street,
- the high number of businesses along the arterial, and
- the high population density resulting from numerous apartments and condos.

At the time this study was performed, FIU was holding upper level classes on this campus, however this fact will change in the near future when regular classes will also be held, placing even higher traffic demand on SW 107th Avenue.

SW 109th Avenue is used as an alternate route to SW 107th Avenue between SW 8th Street and NW 7th Street during the peak hours. As a result, very heavy eastbound to northbound left-turn volumes are seen at the intersections of SW 107th Avenue with Flagler Street and NW 7th Street (Fountainbleau Boulevard).

Between SR 836 and NW 25th Street, the facility has insufficient capacity to meet the demand. Truck traffic accounts for approximately 15 percent of the total traffic volume in the area. As part of the Beacon TradePort development, NW 107th Avenue will be widened to six lanes from NW 12th Street to NW 27th Street. It is expected that the intersection of NW 107th Avenue and NW 41st Street will be one of the busiest intersections in Miami-Dade County in the next 10 years, due to an increase in residential, commercial, and industrial development in that area.

Recommended Improvements

Table 6.4 shows a summary of the transportation deficiencies, corrective strategies/techniques applicable, and recommended actions at each problem location for SW 107th Avenue. Based on the field observation, an additional lane is warranted along Sunset Drive (SW 72nd Street) north and south of SW 107th Avenue. However, that area is built out and all of the available right-of-way seems to have used for roadway improvements. Right-of-way acquisition along Sunset Drive may reveal to be infeasible due to costs and community impact. An alternate solution would be to provide exclusive eastbound and westbound right turns on Sunset Drive at SW 107th Avenue. Some right-of-way would still be needed to accommodate the additional turn lanes.

Table 6.4
NW/SW 107th Avenue (From SW 88th Street to NW 41st Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
1.	SW 107th Avenue @ Sunset Drive	• Insufficient capacity on Sunset Drive east and west of SW 107th Avenue	• Provide exclusive right turn lanes eastbound and westbound (28)	• Eastbound right turn lane maybe accommodated by moving existing bus stop further west • Westbound right turn would require right-of-way acquisition	• Detailed analysis based on actual traffic counts needs to be performed • Coordination with MDTA for bus stop relocation
2.	SW 107th Avenue @ Miller Drive	• Moderate delay on Miller Drive east and west of SW 107th Avenue	• Provide exclusive eastbound to southbound and westbound to northbound right turn lanes (29)	• Additional right-of-way may be required	• Detailed analysis based on actual traffic counts needs to be performed
3.	SW 107th Avenue @ Bird Road	• Delay due to crossing of two major arterials with heavy flow during peak periods	• Provide grade separation (30)	• Right-of-way • Opposition from business owners	• Detailed geometry analysis needs to be performed
4.	SW 107th Avenue @ Coral Way	• Heavy Eastbound to northbound left turn movement in the morning peak period	• Additional storage capacity for the left turn movement (31)		• Detailed analysis based on current counts and signal timings needs to be performed
5.	SW 107th Avenue between SW 8th Street and Flagler Street	• Conflicting Turning Movements	• Prohibit left turns except at Flagler, 8th St., and 4th Street during peak hours (32)		• Detailed traffic and geometry analysis needs to be performed.

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

Table 6.4 (Continued)
NW/SW 107th Avenue (From SW 88th Street to NW 41st Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
6.	SW 107th Avenue between SW 8th Street and Flagler Street	• Numerous access points within short distance	• Consolidate driveways between shopping centers (33) • Provide access to shopping centers from side streets only (34)	• Business owners community opposition	• Coordinate with the 107th Avenue Arterial Investment Study and proposed PD&E study
		• Insufficient capacity	• Add new lanes on SW 107th Avenue (35) • Widen bridge over Tamiami Canal (36) • Provide dual left turn at Flagler (eastbound to northbound) **or** restripe to allow left turn from inside through lane (37) • Resurface SW109th Avenue. And encourage SW 109th Avenue as an alternate route between SW 8th Street and NW 7th Street (38) • Shuttle service between FIU campuses (39) • Bicycle path (40)	• Right-of-way • Environmental impacts • Right-of-way needs to be acquired to add left turn lane. • Community opposition: 109th Avenue traverses residential area and dead ends at NW 7th Street.	
		• School Zone	• Provide additional access to school directly from SW 8th Street (41)	• Requires canal crossing and going through residential neighborhood. • Environmental impacts due to new canal crosiing.	

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

Table 6.4 (Continued)
NW/SW 107th Avenue (From SW 88th Street to NW 41st Street)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
7.	NW 107th Avenue between Flagler Street and SR 836	• Insufficient capacity • Conflicting turning movements	• Add new lanes on SW 107th Avenue (42) • Improve intersection at NW 7th Street and NW 107th Avenue to accommodate rerouted traffic (increase se storage length, improve signal timing) (43) • Provide dual lefts from freeway eastbound off-ramp (44)	• Coordination with proposed PD&E study.	• Detailed traffic and right-of-way analyses need to be performed
8.	NW 107th Avenue between SR 836 and NW 25th Street	• Insufficient capacity • Truck percentage for the area is 15%	• Add new lanes on NW 107th Avenue (45) • Prohibit trucks during peak hours (46)	• Right-of-way • Opposition from business owners and truck operators.	• Coordinate with Beacon TradePost Center being developed in the area.
9.	NW 107th Avenue from NW 25th Street to NW 41st Street	• Insufficient capacity	• Increase number of lanes on NW 107th Avenue (47)	• Right-of-way would need to be acquired	• Coordinate with Public Works in order to obtain necessary right-of-way from future developments.
10	NW 107th Avenue @ NW 41st Street	• Crossing of two major arterials	• Provide grade separation (48)	• Right-of-way • Cost • Community impacts	• Detailed geometry analysis needs to be performed
11	NW 107th Avenue north of NW 41st Street	• Lack of continuity	• Provide connectivity to NW 103rd Street (49) • Use design criteria for Superarterial on new segments (50)	• Right of way would need to be acquired to add new segments	• Coordinate with Public Works in order to obtain necessary right-of-way from future developments. • Detailed study needs to be conducted to measure impacts to surrounding roadways

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations.

6.3.4 SW 40th Street (Bird Road)

Existing Geometry

SW 40th Street (Bird Road) runs east-west and extends from SW 157th Avenue to US 1. SW 40th Street is a two-lane facility from SW 157th to SW 147th Avenue, a four-lane divided from SW 147th Avenue to SW 117th Avenue, and a six-lane divided with left turn pockets east of SW 117th Avenue. Land use patterns on Bird Road west of SW 147th Avenue is residential, development from SW 147th Avenue to SW 117th Avenue are mixed residential and commercial, and east of SW 117th Avenue land uses are mainly commercial.

Observed Conditions

Major improvements were just completed on Bird Road, increasing overall capacity on this facility. Traffic flows fairly smoothly, except at the intersection of SW 117th Avenue and Bird Road, and east of SW 102nd Avenue. The heavy traffic volumes east of SW 102nd Avenue are due to commuters accessing SR 826. This congestion can be alleviated by providing alternate north-south routes to SR 826 between SW 107th Avenue and SR 826. Existing north-south routes include SW 117th Avenue, SW 107th Avenue and SW 87th Avenue. SW/NW 97th Avenue will be extended in the future over SR 836 and will provide an alternate route to SR 826, potentially diverting some traffic from Bird Road. To provide an alternate route to SR 826, SW 97th Avenue should be extended to NW 41st Street, at a minimum. Other arterials, such as SW 102nd Avenue, would not appear suitable for widening since they transverse residential areas and do not provide continuity north of SR 836. Other factors adding to the congestion on Bird Road include numerous driveways and school zones. The implementation of pedestrian friendly treatments would help reduce congestion in this corridor.

Recommended Improvements

Table 6.5 shows a summary of the transportation deficiencies observed in the field and the recommended corrective actions

Table 6.5

SW 40th Street (Bird Road) (From SW 87th Avenue to SW 157th Avenue)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problem	Recommended Actions
1.	SW 40th from SW 87th Avenue to SW 102nd Avenue	• Delays due to crossing of SW 40th Street by SW 87th Avenue	• Provide alternate route to SR 826 (51) • Provide continuity on crossing arterials every 1/2 mile (52) • Provide adequate capacity on crossing arterials to offer alternate routes to SR 826 (34)	• Community opposition	• Studies are needed to evaluate which arterials can be extended north of Bird Road and prioritize their construction
2.	SW 40th Street @ SW 107th Avenue	• Delay due to crossing of two major arterials with heavy flow during the peak periods	• Provide grade separation (30)	• Right of way • Opposition from business owners • Cost	• Detailed geometry and constructability analyses need to be performed, and impacts need to be evaluated
3.	SW 40th from SW 117th Avenue to SW 147th Avenue	• Insufficient capacity	• Widen Bird Road from SW 147th Avenue to SW 117th Avenue (54)	• Right-of-way and environmental problems	• Same as corrective strategy/technique

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

6.3.5 SW 8th Street (Tamiami Trail)

Existing Geometry

SW 8th Street (Tamiami Trail) extends east-west throughout the entire width of Miami-Dade County. Within Transportation Area 4, SW 8th Street is a four-lane divided facility from SW 177th Avenue (Krome Avenue) to SW 127th Avenue, and a six-lane divided facility from SW 127th Avenue to SW 107th Avenue. Land use along this facility is primarily commercial, and includes numerous shopping centers, each with multiple access points to the arterial. The Tamiami Canal in located on the north side of SW 8th Street, running along this major arterial for most of its length.

Observed Conditions

The section on SW 8th Street between Krome Avenue and SW 137th Avenue is expected to be one of the busiest corridors ten years from now. Sufficient right-of-way should be acquired now to accommodate future transportation improvements, whether those improvements would be an overpass, a continuous flow intersection, or a standard intersection with multiple turn and through lanes in all directions. The lack of right-of-way at many of the intersections from SW 137th Avenue to SW 107th Avenue compounded by the environmentally sensitive Tamiami Canal on the north side of SW 8th Street, prevents the implementation of many of the superarterial treatments which are needed.

High levels of congestion were observed on this arterial from SW 142nd Avenue to the ramps to and from the Turnpike during peak periods. During the AM peak period, queues of eastbound commuters start building on SW 8th Street from SW 142nd Avenue and continue for approximately 2 miles up to the Turnpike ramps. The main factor contributing to the congestion level is the heavy volume of commuters accessing the Turnpike ramps. These ramps are tolled and cause traffic to back up onto SW 8th Street. Provision for electronic toll collection, which is planned for the near future, will help alleviate congestion on SW 8th Street as vehicles are processed faster at the toll plaza. Another factor contributing to the congestion in this area is the inadequate capacity of the cross streets causing high levels of frustration and unsafe driving maneuvers. At the intersection of SW 107th Avenue and SW 8th Street, delays are mainly caused to the crossing of two major arterials with heavy volume of cars during the peak periods. Travel patterns are reversed for this corridor for the PM peak period; however, the same factors contribute to the congestion observed during the afternoon peak period.

Future proposed improvements that will have direct impact on this facility include the extension of SR 836 to SW 137th Avenue, widening of SW 137th Avenue to six lanes and construction of NW 12th Street from NW 107th Avenue to NW 137th Avenue. The SR 836 extension will greatly increase traffic volumes along SW 137th Avenue north of SW 8th Street. Necessary provisions should be taken now to provide adequate capacity (i.e., grade separation) for the future at the intersection on SW 137th Avenue and SW 8th Street. The County is also planning the widening of SW 8th Street west of SW 127th Avenue from a four-lane to a six-lane facility.

The unique geometry of SW 8th Street, due to the canal along the north side of the arterial and the travel patterns along this arterial, lends itself to the application of continuous green lanes or turbo lanes. Turbo lanes are signalized T-intersections where one or more through lanes are not stopped when the side-street left turn signal phase is active. The implementation of turbo lanes is generally regarded as undesirable due to safety concerns. However, when certain conditions are present, the appropriate design criteria can be implemented in order to minimize safety problems and provide significant operational benefits. Several factors will determine the operational benefits of turbo lanes, such as heavy arterial volumes, heavy side-street volumes, and the volume of left turns from the side street. This is an important consideration, since a condition of moderate to heavy left turn volumes from the side-streets and heavy arterial volumes is usually not conducive to the successful implementation of turbo lanes. Conditions on SW 8th Street are favorable to the application of turbo lanes on several sections of this facility, due to travel flow characteristics and commuter travel patterns along this corridor. Detailed analyses need to be performed to assess the operational benefits of turbo lane implementations.

Recommended Improvements

Table 6.6 shows a summary of the transportation deficiencies observed in the field and the recommended corrective actions.

Table 6.6
SW 8th Street (From SW 107th Avenue to SW 177th Avenue)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problems	Recommended Actions
1.	SW 8th Street @ SW 107th Avenue	• Delays due to crossing of two major arterials with heavy flow during peak periods	• Widen SW 107th Avenue north of SW 8th Street (35) • Widen bridge over Tamiami Canal (36)	• Right-of-way • Community opposition	
2.	SW 8th Street from Turnpike to SW 137th Avenue	• Access to shopping centers	• Consolidate access to shopping centers (55)	• Community and business opposition	• Detailed study is recommended to measure the impacts of access management. • Coordinate with business owners and show potential benefit to traffic circulation and safety
		• Insufficient storage for access to Florida Turnpike	• Reduce queue by increasing number of tollbooths and/or provide AVI at tollbooths (56)		• Coordinate with the Turnpike on AVI implementation
		• Inadequate capacity for westbound vehicles making a left turn at SW 122nd Avenue during the PM peak period	• Increase length of westbound to southbound left turn storage bay (57)		• Same as corrective action

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

Table 6.6 (Continued)
SW 8th Street (From SW 107th Avenue to SW 177th Avenue)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problems	Recommended Actions
3.	SW 8th Street @ SW 127th Avenue	• Conflicts due to absence of drop warning signs	• Provide sign on SW 8th Street westbound indicating right lane drop at the intersection (58)		• Same as Corrective strategy/technique
4.	SW 8th Street @ SW 132nd Avenue	• Delays on cross streets due to heavy volume on SW 8th Street	• Provide enforcement to prevent traffic from blocking intersections along SW 8th Street (59)		
		• Inadequate capacity for traffic wanting to access two major schools on SW 6th Street between SW 129th and SW 127th Avenue during the AM peak period	• Widen bridge at SW 132nd Avenue north of SW 8th Street (60) • Connect SW 6th Street to SW 137th Avenue to provide additional access to schools and residences (13)	• Implementation Cost • Opposition from residential community	• Detailed studies are recommended to measure environmental and social impacts, as well as traffic improvements
		• Inadequate capacity for northbound to eastbound right turn lane during the AM peak period	• Relocate bus stop from near SW 8th Street to mid-block on SW 132nd Avenue (61) • Extend E/W LT bays (62)		• Same as corrective action

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

Table 6.6 (Continued)
SW 8th Street (From SW 107th Avenue to SW 177th Avenue)
Recommended Strategies for Traffic Flow Improvements

	Problem Location	Transportation Deficiency	Corrective Strategy/Technique	Potential Implementation Problems	Recommended Actions
4.	SW 8th Street at SW 137th Avenue	• Delays on cross street due to heavy volumes on SW 8th Street. Heavy northbound to eastbound and westbound to southbound delays during the AM and PM peak periods, respectively	• Widen 8th Street west of SW 127thAvenue (11) • Increase storage of westbound to southbound left turn (12) • Connect SW 6th Street to SW 137th Avenue (13) • Access management • Grade separation (14) (interim improvement: provide overlap phasing for the NB to westbound movement)	• Community opposition • Opposition from business owners	• Same as corrective action
		• High percentage of trucks and school buses. Bridge is not wide enough to accommodate heavy vehicles.	• Widen bridge on SW 137th Avenue (15)	• Environmental problems	• Detailed geometry analysis needs to be performed
		• Delays due to Toll Plaza	• Improve toll collection through the installation on AVI (Automatic Vehicle Identification) (63)		

Note: These recommendations were based on field observations only. Detailed analyses are required before final recommendations

6.3.6 Area Wide Improvements

Table 6.7 shows some of the recommended improvements to alleviate and or manage congestion throughout Transportation Area 4. These improvements are of a multimodal nature and encourage other modes of travel such as bicycles and walking.

Table 6.7
Strategies for Area Wide Traffic Flow Improvements

Corrective Strategy/Technique	Recommended Actions
• Encourage alternate modes of transportation (carpool and bicycles) • Provide continuous walkways for pedestrian and bicycle use • Pedestrian friendly amenities connecting contiguous shopping areas • Use shopping centers and employment centers for transit stops • Provide shuttle between FIU campuses • Provide shelters and bicycle storage facilities at bus stops • Bus bays • Exclusive right-turn lanes	• Coordinate with the Bicycle/Pedestrian Coordinator to promote use of these alternate modes within the area • Coordinate with congestion management efforts in the MPO and FDOT District 6 to expand car-pool programs and encourage the development of TMAS (Transportation Management Association), especially at major activity center such as FIU.
• Right turn green arrows during the complimentary left turn movement to increase right turn capacity when U-turn from the left turn lane can be sacrificed	• Coordinate with MDTA and FIU to investigate the feasibility and development of such programs

6.4 Regional Impacts

The recommended improvements were tested using the validated regional model from the Metropolitan Planning Organization. The 1990 and 2010 base models were obtained from the MPO and used to provide information on traffic patterns and volumes without the recommended improvements. The model was then modified to incorporate some of the improvements. Table 6.8 shows the changes made to the networks in an effort to reflect the proposed improvements.

Table 6.8
Recommended Action for Testing of Proposed Improvements

	Type of Recommended Improvement	Recommended Model Adjustment
1.	Exclusive right turn lanes	• Only allow through movement at the intersections and provide separate link for right turns.
2.	Grade separation	• Provide exclusive link for separated movement
3.	Access Management	• Adjust default capacity based on reduce number of curb cuts and/or signals.
4.	Additional lanes	• Adjust number of lanes in network
5.	Additional link	• Provide additional link in network
6.	Implement AVI at Toll booths	• Reduce service time in TOLLLINK card • Increase the number of toll booths to represent processing rate with AVI • Update toll configuration in TOLLLINK card
7.	Bridge widening	• Increase number of lanes on bridge
8.	Increase storage length and/or Provide exclusive left turn lanes	• Add link where only left turns would be allowed and prohibit left turns from link representing through movements.
9.	Relocate or provide exclusive bus bays	• Increase capacity based on projected increase from previous studies.

The model results show that throughput would increase by as much as 17 percent based on 1990 conditions on the arterials north of NW 40th Street. This increase would however be as low as one percent in 2010 due to the projected land use density in the region. By 2010, throughput would increase by as much as 10 percent on the arterials north of SW 8th Street as can be seen in Table 6.9. Volumes would remain unchanged on the east-west arterials. This was expected since most of the capacity improvements were considered on the north-south roadways.

Table 6.10 shows no changes in overall vehicle miles and vehicle hours traveled. However, further analysis of the results show a small shift from freeways to arterials as a result of the increased capacity on the arterials. The 2010 analysis shows an expected reduction in total delay due to congestion of approximately 8,000 vehicle-hours.

Table 6-9
Comparison of Peak Season Weekday Average Daily Traffic

	1990 Conditions			2010 Conditions		
Link	Base Model	Modified	% Change	Base Model	Modified	% Change
North of NW 40th Street						
Turnpike	189	159	-16%	1,481	1,507	2%
NW 107th Avenue	-	164	100%	261	261	0%
NW 97th Avenue	78	52	-33%	173	175	1%
Average % Change			**17%**			**1%**
North of SR 836						
Turnpike	189	159	-16%	1,435	1,450	1%
NW 117th Avenue	-	-	0%	181	237	31%
NW 107th Avenue	406	466	15%	561	570	2%
NW 97th Avenue	261	271	4%	233	234	0%
Average % Change			**1%**			**9%**
North of Tamiami Trail						
NW 137th Avenue	32	32	0%	355	447	26%
Turnpike	769	770	0%	1,822	1,903	4%
NW 107th Avenue	289	291	1%	487	521	7%
NW 97th Avenue	267	269	1%	463	479	3%
Average % Change			**0%**			**10%**
North of Bird Road						
NW 137th Avenue	153	145	-5%	457	485	6%
SW 127th Avenue	122	119	-2%	297	283	-5%
Turnpike	472	471	0%	1,733	1,781	3%
NW 117th Avenue	140	132	-6%	242	221	-9%
NW 107th Avenue	138	138	0%	378	397	5%
NW 97th Avenue	137	140	2%	369	381	3%
Average % Change			**-2%**			**1%**
East of 137th Avenue						
Tamiami Trail	138	138	0%	538	450	-16%
Coral Way	121	118	-2%	293	298	2%
Bird Road	203	223	10%	349	332	-5%
Miller Drive	206	186	-10%	435	416	-4%
Sunset Drive	181	181	0%	382	396	4%
Average % Change			**0%**			**-4%**
East of Turnpike						
Tamiami Trail	180	180	0%	514	518	1%
Coral Way	252	263	4%	397	396	0%
Bird Road	280	285	2%	513	527	3%
Miller Drive	250	252	1%	336	327	-3%
Sunset Drive	212	212	0%	329	325	-1%
Average % Change			**1%**			**0%**
East of 107th Avenue						
Tamiami Trail	228	210	-8%	445	478	7%
Coral Way	252	259	3%	499	477	-4%
Bird Road	281	289	3%	496	527	6%
Miller Drive	288	285	-1%	360	354	-2%
Sunset Drive	264	265	0%	410	404	-1%
Average % Change			**-1%**			**1%**
Average % Change North-South			5%			6%
Average % Change East-West			0%			-1%

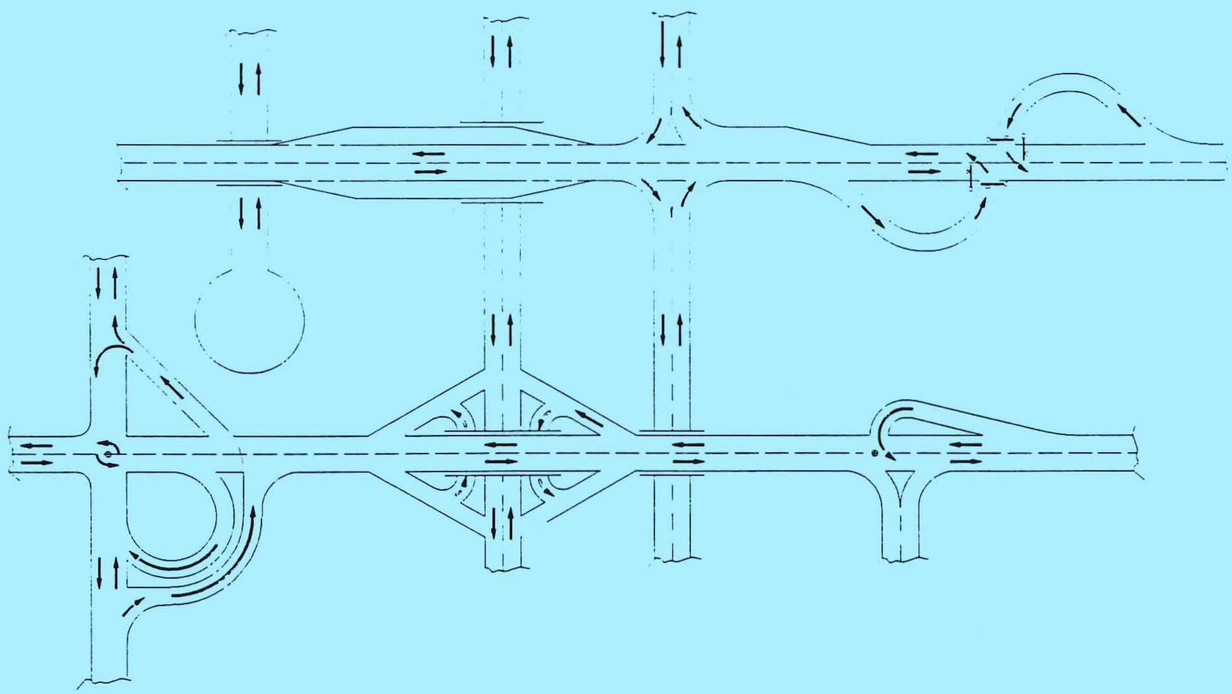
Table 6-10
Comparison of Regionwide Statistics

Link	1990 Conditions				2010 Conditions			
	Base Model	Modified	Difference	% Change	Base Model	Modified	Difference	% Change
Vehicle Miles Traveled								
Freeway	11,047,110	10,984,155	(62,955)	-1%	20,536,777	20,548,832	12,055	0%
Divided Arterials	12,856,497	12,802,051	(54,446)	0%	22,213,254	22,214,394	1,140	0%
Undivided Arterials	6,804,882	6,912,594	107,712	2%	10,041,856	10,091,498	49,642	0%
Collector Streets	3,243,226	3,234,706	(8,520)	0%	4,947,054	4,883,525	(63,529)	-1%
Total	33,951,715	33,933,506	(18,209)	**0%**	57,738,941	57,738,249	(692)	**0%**
Vehicle Hours Traveled								
Freeway	300,065	296,834	(3,231)	-1%	760,040	754,291	(5,749)	-1%
Divided Arterials	466,017	465,072	(945)	0%	1,022,779	1,026,233	3,454	0%
Undivided Arterials	262,993	264,636	1,643	1%	505,270	503,738	(1,532)	0%
Collector Streets	120,389	120,023	(366)	0%	238,475	233,605	(4,870)	-2%
Total	1,149,464	1,146,565	(2,899)	**0%**	2,526,564	2,517,867	(8,697)	**-1%**
Ratio of Volume Over Capacity								
Freeway	0.94	0.94		0%	1.44	1.44		0%
Divided Arterial	1.18	1.18		0%	1.59	1.60		1%
Undivided Arterials	1.04	1.03		-1%	1.51	1.50		-1%
Collector Streets	0.75	0.75		0%	1.29	1.28		-1%
HOV	n/a	n/a		n/a	2.06	2.03		-1%
Total	1.02	1.02		**0%**	1.54	1.51		**0%**
Congested Speeds								
Freeway	37.48	37.53	0	0%	30.54	30.70	0	1%
Divided Arterials	30.15	30.13	(0)	0%	23.97	23.95	(0)	0%
Undivided Arterials	30.32	30.47	0	0%	24.56	24.68	0	0%
Collector Streets	31.46	31.47	0	0%	25.62	25.79	0	1%
HOV	n/a	n/a	n/a	n/a	22.54	22.59	0	0%
Total	31.24	31.30	0	**0%**	25.10	25.18	0	**0%**
Total Delay Due to Congestion (veh-hrs)								
Freeway	65,840	63,865	(1,974)	-3%	266,866	262,452	(4,414)	-2%
Divided Arterials	119,081	119,668	587	0%	424,726	428,098	3,372	1%
Undivided Arterials	72,016	70,806	(1,209)	-2%	225,685	222,694	(2,991)	-1%
Collector Streets	25,786	25,675	(111)	0%	94,703	91,693	(3,010)	-3%
HOV	n/a	n/a	n/a	n/a	65,260	63,675	(1,585)	-2%
Total	282,723	280,015	(2,707)	**-1%**	1,077,240	1,068,613	(8,627)	**-1%**
Miscellaneous Statistics								
Total VHT V/C	1.02	1.02		0%	1.52	1.51		-1%
Total Congested Speed	31.24	31.30		0%	25.10	25.18		0%
Total Fuel Use	2,921,373	2,921,249	(124)	0%	4,890,382	4,889,598	(784)	0%
Total Delay due to Congestio	282,723	280,015	(2,707)	-1%	1,077,240	1,068,613	(8,627)	-1%

CHAPTER 7

TEST IMPLEMENTATION REQUIREMENTS

FINAL REPORT



7. TEST IMPLEMENTATION REQUIREMENTS

This chapter presents a plan of action for implementing the Superarterial Network concept to a selected area of Dade County, and is intended to serve as a model for implementation of the concept to other areas and eventually throughout Dade County. This plan of action is based on the results of the preliminary testing performed for Transportation Area 4. An implementation schedule is presented, including test time span and monitoring program, as well as potential funding sources of the test project. Figure 7.1 identifies the different steps needed to successfully implement the Superarterial Network concept in Dade County. The process shown in this figure is detailed in the following sections from funding source identification to the monitoring program.

7.1 Potential Funding Sources

The Superarterial Network concept was one of the recommended improvements identified in the Dade County Mobility Management Process/Congestion Management System (Dade County MMP/CMS) which identifies numerous funding sources. Some of the potential sources of funding are described below:

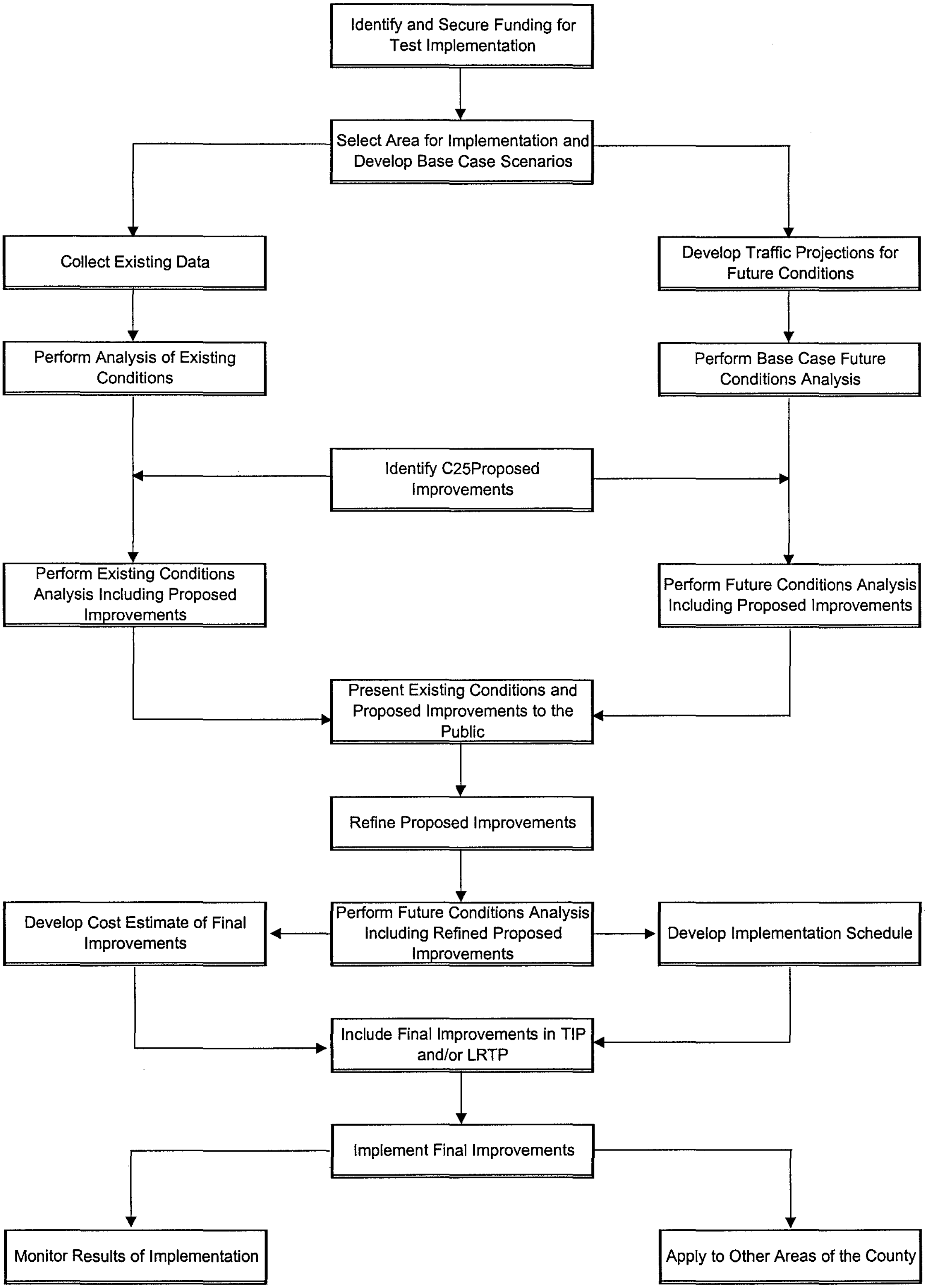
- National Highway System funds are available from Federal Highway Administration (FHWA) for improvements to and maintenance of principal arterials. Up to 80 percent of the program funds can be obtained from the federal government.
- FHWA projects funds can be obtained for demonstration projects including projects that would relieve congestion using advanced technologies and unique financing techniques.
- Congestion Mitigation Air Quality funds are available for highway projects that reduce vehicle emissions and other forms of air pollution to meet targeted air quality standards.
- FIHS Non-Interstate Program funds (FDOT) can be used for improvements on primary intrastate roadways from the state.
- State of Florida Gas Tax funds are available for roadway improvements as well as the Motor Vehicle Fuel Taxes collected by the County.
- Road impact fees are collected from new developments in order to provide new facilities or upgrade existing ones to serve the proposed development.

7.2 Base Case Scenarios

Two base case scenarios are proposed to determine the impacts of the proposed improvements: existing and 2010 conditions. The existing base case scenario will be measured using actual field data from traffic counts, and field surveys. Traffic information for the 2010 base case scenario will be obtained from the 2010 adopted Long Range Plan documented in Chapter 6. This information should be updated if approved changes were made to the 2010 plan at the time of the test implementation study.

Figure 7.1

Action Plan for Test Implementation



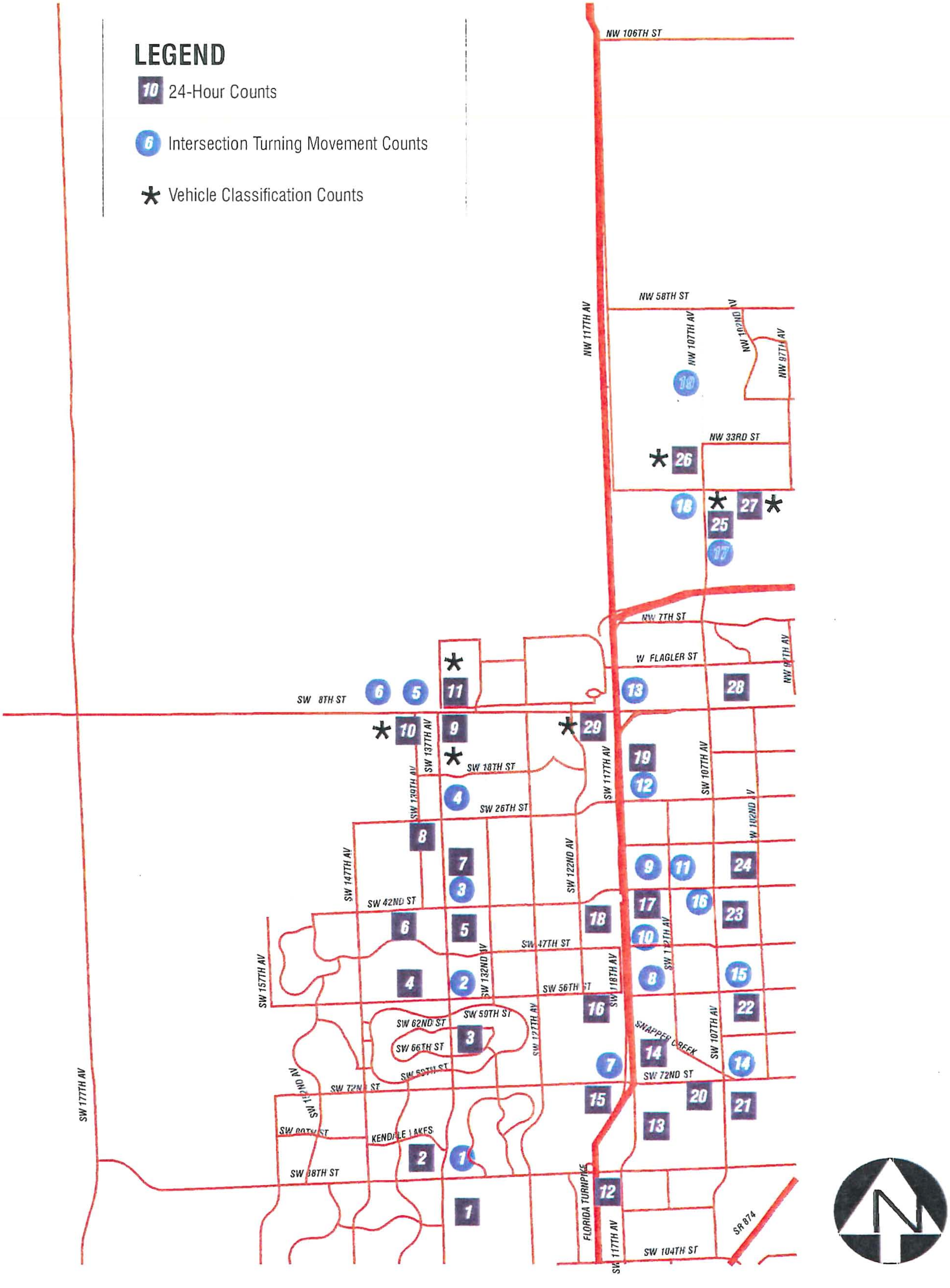
7.3 Data Collection

The purpose of the data collection effort is to provide updated information in order to assess base case conditions accurately and provide information on traffic patterns that will be used to evaluate the proposed improvements and also to serve as a base for monitoring system. The data collection effort was then tailored to these objectives and is described in the following sections.

7.3.1 24-hour Traffic Counts

The purpose of the 24-hour counts is to provide information on average peak hour conditions and traffic flow between intersections along the arterials selected for analysis. A minimum of three-day counts is recommended and should be performed on weekdays between Tuesday and Thursday. Figure 7.2 shows the recommended locations for 24-hour counts listed below.

1. SW 137th Avenue south of SW 88th Street (Kendall Drive)
2. SW 88th Street (Kendall Drive) east of SW 137th Avenue
3. SW 137th Avenue and Kendale Lakes Circle
4. SW 56th Street (Miller Drive) west of SW 137th Avenue
5. SW 137th Avenue north of SW 47th Street
6. SW 40th Street (Bird Road) west of SW 137th Avenue
7. SW 137th Avenue north of SW 40th Street (Bird Road)
8. SW 24th Street (Coral Way) west of SW 137th Avenue
9. SW 137th Avenue south of SW 8th Street (Tamiami Trail)
10. SW 8th Street (Tamiami Trail) west of SW 137th Avenue
11. SW 137th Avenue north of SW 8th Street (Tamiami Trail)
12. SW 117th Avenue south of SW 88th Street (Kendall Drive)
13. SW 117th Avenue south of SW 72nd Street (Sunset Drive)
14. SW 117thAvenue north of SW 72nd Street (Sunset Drive)
15. SW 72nd Street (Sunset Drive) west of SW 117th Avenue
16. SW 56th Street (Miller Drive) west of SW 117th Avenue
17. SW 117th Avenue south of SW 40th Street (Bird Road)
18. SW 40th Street (Bird Road) west of SW 117th Avenue
19. SW 117th Avenue north of SW 24th Street (Coral Way)
20. SW 72nd Street (Sunset Drive) west of SW 107th Avenue
21. SW 107th Avenue south of SW 72nd Street (Sunset Drive)
22. SW 56thStreet (Miller Drive) east of SW 107th Avenue
23. SW 107th Avenue south of SW 40th Street (Bird Road)
24. SW 40th Street (Bird Road) east of SW 107th Avenue
25. NW 107th Avenue south of NW 25th Street
26. NW 107th Avenue north of NW 25th Street
27. NW 25thStreet east of NW 107th Avenue
28. SW 8th Street (Tamiami Trail) east of SW 107th Avenue
29. SW 8th Street (Tamiami Trail) west of SW 117th Avenue



SUPERARTERIAL NETWORK STUDY
MIAMI-DADE COUNTY

TRAFFIC DATA COLLECTION LOCATIONS

Figure 7.2

7.4 24-hour Vehicle Classification Counts

The purpose of these counts is to obtain updated information regarding truck traffic on selected arterials within the area. The proposed improvements on these selected arterials focus on means of alleviating congestion by minimizing the impacts of truck traffic. A minimum of three-day bi-directional 24-hour classification counts are recommended at the following locations and should be conducted while the 24-hour counts are being collected:

1. SW 137th Avenue south of SW 8th Street (Tamiami Trail)
2. SW 8th Street (Tamiami Trail) west of SW 137th Avenue
3. SW 137th Avenue north of SW 8th Street (Tamiami Trail)
4. NW 107th Avenue south of NW 25th Street
5. NW 107th Avenue north of NW 25th Street
6. NW 25th Street east of NW 107th Avenue
7. SW 8th Street (Tamiami Trail) west of SW 117th Avenue

These locations are also illustrated on Figure 7.2.

7.4.1 Turning Movement Counts

Current turning movement information at intersections is crucial in determining the base case conditions and help in developing future traffic based on current traffic patterns. These counts should be performed concurrent with the 24-hour counts for a minimum of three days, from 6:30 AM to 9:00 AM and from 4:30 PM to 6:30 PM at the following locations:

1. SW 137th Avenue and SW 88th Street (Kendall Drive)
2. SW 137th Avenue and SW 56th Street (Miller Drive)
3. SW 137thAvenue and SW 40th Street (Bird Road)
4. SW 137th Avenue and SW 24th Street (Coral Way)
5. SW 137th Avenue and SW 8th Street (Tamiami Trail)
6. SW 142nd Avenue and SW 8th Street (Tamiami Trail)
7. SW 117thAvenue and SW 72nd Street (Sunset Drive)
8. SW 117thAvenue and SW 56thStreet (Miller Drive)
9. SW 117thAvenue and Bird Road (SW 40th Street)
10. SW 117th Avenue and Turnpike northbound-off ramp
11. SW 117th Avenue and Turnpike northbound-on ramp
12. SW 117th Avenue and SW 24th Street (Coral Way)
13. SW 117th Avenue and SW 8th Street (Tamiami Trail)
14. SW 107th Avenue and Sunset Drive (SW 72nd Street)
15. SW 107thAvenue and Miller Drive (SW 56th Street)
16. SW 107th Avenue and Bird Road (SW 40th Street)
17. NW 107th Avenue and NW 12th Street
18. NW 107th Avenue and NW 25th Street
19. NW 107th Avenue and NW 41st Street

These locations are also shown on Figure 7.2. The turning movement counts should also include any pedestrian activity at the locations being surveyed.

7.4.2 Travel-time and Speed-Delay Studies

Change in travel time and in travel speed is one of the measures of effectiveness recommended for assessing the impacts of the proposed improvements within Transportation Area 4. These can be measured using travel-time and Speed-delay studies. These data will also be useful during the monitoring phase of the implementation process. Results of these studies are also crucial in calibrating some traffic simulation modeling software used for microscopic analysis of detailed traffic operations along arterials taking into account the influence of traffic patterns at both the intersections and mid-block. Travel-time and speed-delay studies are recommended along all the arterials within the study area.

7.4.3 License Plate Survey

One of the proposed improvements is to widen NW 117th Avenue between Bird Road (SW 40th Street) and Tamiami Trail (SW 8th Street). However, this roadway is currently used as an alternate route to bypass the toll plaza on the Florida's Turnpike. A license plate survey would provide information on the extent of the number of drivers bypassing the toll facility and will be useful in determining the impact of the proposed widening on toll plaza revenues. A license plate survey is an alternate mode of obtaining origin-destination information without encumbering drivers with survey cards. License plate surveys are recommended at the following locations, concurrent with the 24-hour and the intersection counts for a three-day period:

1. SW 117th Avenue south of Bird Road (SW 40th Street)
2. Bird Road (SW 40th Street) west of SW 117th Avenue
3. SW 117th Avenue south of Tamiami Trail (SW 8th Street)

Although the location of the new toll plaza will have a significant influence in the amount of diverted trips, the license plate survey will provide enough information for future analysis.

7.4.4 Right-of-Way Studies

Information regarding right-of-way availability along the selected arterials is crucial in determining the magnitude of the costs involved in the implementation of the Superarterial Network concept within Transportation Area 4. Right-of-Way availability and cost information should be collected along all the selected arterials within Transportation Area 4.

7.4.5 Signal Timing and Phasing

This information is needed at all signalized intersections within the study area. This information will be used to evaluate the existing level of operation, provide recommendation on fine tuning existing phasing and timing based on actual field data, and also for calibration of the traffic operational simulation models that may be used to perform traffic analysis.

7.4.6 Queue Length Studies

Because of the level of congestion within Transportation Area 4, traffic back-ups are experienced throughout the area, especially at the signalized intersection. Queue lengths studies are therefore recommended at all the signalized intersections for which turning movement counts are required. Queue lengths studies should be performed concurrent with the turning movement counts data collection effort.

7.5 Public Involvement

The success of the implementation of the Superarterial Network concept is highly dependent on the public's acceptance of the program. It is therefore recommended that education activities be undertaken with various interested and affected groups throughout the study area. Some of the improvements such as changes in signal timing and phasing may not require input from the community, while other improvements such as access management will require extensive coordination with the entities that will be affected by such a measure. A public involvement plan is therefore highly recommended to obtain comments from the public prior to finalization and implementation of the proposed improvements.

7.6 Traffic Analysis

The regional travel demand model was used in the preliminary testing phase of this study. The model was mainly used to measure the regional impacts of the proposed improvements and to obtain traffic projections resulting from the addition of new segments. Because of the macroscopic nature of the regional model, it is therefore recommended that this phase of the study be based on a more microscopic level of analysis for better quantification of the impacts of the Superarterial network concept within Transportation Area 4. The analysis tools recommended to assess the impact of the proposed improvements should be able to provide detailed information that can be used to measure the impacts of the proposed improvements based on the criteria provided. The tools to be used should address operations at isolated intersections, along individual arterials, and for a network of arterials.

7.7 Implementation Schedule

The schedule for implementation of the recommended improvements on the selected arterials will be based on the type of improvements and how they fit into the current adopted transportation plans developed by the MPO and FDOT. The proposed improvements were grouped in three distinct categories:

- Near-term improvements are improvements that are not included in the current transportation plans but can be implemented within the next five years. The improvements would include items such as changes in signal timing and phasing, striping, warning devices, and minor modifications to streets and intersection geometry. These improvements would most likely be considered low to moderate cost improvements.

- Short-term improvements are improvements that can be coordinated with current projects in the five-year transportation plan. These improvements would usually be included in the moderate to high implementation costs and may require right-of-way acquisition, design changes, and/or coordination with other programs or entities.

- Long-term improvements are improvements that need to be incorporated into the County's or state transportation plans, would be considered high cost, and may require right-of-way acquisition, and coordination with other programs or entities. These improvements also include improvements that can be incorporated into already planned improvements in the Cost Feasible Long-Range Transportation Plan.

Table 7.1 shows the proposed schedule for implementation of the recommended improvements.

7.7.1 Monitoring System

Miami-Dade County is constantly growing at a very fast pace. A monitoring system therefore needs to be designed and followed in order to assess the impacts of the implementation of the Superarterial Network concept. The monitoring system would also allow the County and the state transportation agencies to make appropriate adjustments to the improvements as a result of changes in traffic patterns. The monitoring system would consist of measuring actual field data and comparing them with the measures of effectiveness values obtained before implementation of the concept. Table 7.2 shows the different measures of effectiveness used, and the type of field data needed in order to test the impacts of the improvements. A of three to six months is recommended prior to testing the results of the implemented measures.

7.7.2 Local Agency

Coordination between the County, local municipalities, the public, and FDOT is essential for the success of the implementation of the Superarterial Network concept throughout Dade County. The Metropolitan Planning Organization should be the agency overseeing the preparation of the test implementation study and the implementation of the concept based on the following facts:

- The concept is a measure for managing and alleviating congestion that was recommended under the Dade County Mobility Management Process/Congestion Management System.

- The improvements developed under this concept will need to be coordinated with other programs being developed by the County and the state.

The recommended improvements will need to be included or coordinated with the TIP and the LRTP and appropriate funding earmarked for implementation of the improvements.

Table 7.1 Proposed Implementation Schedule

Location	Type of Improvements	TIP Project No (1)	Implementation Time Frame
SW 137th Avenue @ Kendall Drive	• Grade Separation • Signage • Drainage	671509	Long-term (2005-2010 Short-term Medium-term (2000-2005)
SW 137th Avenue @ Miller Drive	• Add new lanes on Miller Drive • Drainage • Increase length of storage bay on Miller Drive	671509	Long-term Medium-term Short-term
SW 137th Avenue between Coral Way and Tamiami Trail	• Drainage		Medium-term
Sw 137th Avenue @ SW 8th Street	• Add new lanes on SW 137th Avenue • Add new lanes on SW 8th Street west of SW 127th Avenue • Widen Bridge on SW 137th Avenue • Increase length of Westbound to Southbound left turn storage bay on SW 8th Street • Provide connection between SW 6th Street and SW 137th Avenue • Signal Timing and Phasing • Improve toll collection • Provide SR 836 exit to SW 137th Avenue • *Add new lanes on SW 137th Avenue north of SW 8th Street*	6113881 6151882 6113860	Medium-term Medium-term Long-term) Medium-term Long-term Short-term Medium-term Long-term Long-term
SW 117th Avenue @ Kendall Drive	• Improvements to Kendall Drive		Long-term
SW 117th Avenue @ 7700 Block	• Signal Coordination		Short-term
SW 117th Avenue @ Sunset Drive	• Add new lanes on Sunset Drive		Long-term
SW 117th Avenue @ Miller Drive	• Add new lanes on Miller Drive		Long-term

(1) Source: 1998 TIP

Table 7.1 Proposed Implementation Schedule (Continued)

Location	Type of Improvements	TIP Project No (1)	Implementation Time Frame
SW 117th Avenue from Turnpike northbound off-ramp to SW 8th Street	• Signage • Relocate ramp • Add new lanes on Bird Road • Improve toll collection • Add new lanes on SW 117th Avenue	 1996 TIP (page 129) *	Short-term Long-term Long-term Medium-term Medium-term
SW 107th Avenue @ Sunset Drive	• Add turn lane on Sunset Drive		Long-term
SW 107th Avenue @ Miller Drive	• Add turn lane on Miller Drive		Long-term
SW 107th Avenue @ Bird Road	• Grade separation	6113770	long-term
SW 107th Avenue @ Coral Way	• Increase length of storage bay for eastbound to northbound left turn on Coral Way	6113770	Medium-term
SW /NW 107th Avenue between SW 8th Street and Flagler Street	• Access Management • Dual left turn for the eastbound to northbound movement on Flagler Street • Resurface SW 109th Avenue • Shuttle service • Bicycle path • Widen Bridge over Tamiami Canal	6113948 671106 (1996 TIP) 671105 (1996 TIP)	Medium-term Medium-term Medium-term Long-term Long-term Medium-term
NW 107th Avenue between Flagler Street and SR 836	• Intersection improvements at NW 7th Street and NW 107th Avenue • Add new lanes on NW 107th Avenue • Dual left turn from freeway eastbound off-ramp	6113948 6113948	Medium-term Medium-term Medium-term
NW 107th Avenue between SR 836 and NW 25th Street	• Add new lanes on NW 107th Avenue • Truck restrictions		Long-term (2010-2015) Short-term
NW 107th Avenue between NW 25th Street and NW 41st Street	• Add new lanes		Long-term (2010-2015)
NW 107th Avenue @ NW 41st Street	• Grade separation		Long-term
NW 107th Avenue north of NW 41st Street	• Add new segment		Long-term (2010-2015)

(1) Source: 1998 TIP

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Table 7.1 Proposed Implementation Schedule (Continued)

Location	Type of Improvements	TIP Project No (1)	Implementation Time Frame
SW 40th Street between SW 147th Avenue and SW 117th Avenue	• Add new lanes		Long-term
SW 40th Street @ SW 107th Avenue	• Grade separation		Long-term
SW 8th Street @ SW 107th Avenue	• Add turn lane on SW 107th Avenue		Long-term
SW 8th Street between the Florida Turnpike and SW 137th Avenue	• Access management • Improve toll collection • Increase length of storage bay for westbound to southbound left turn on SW 8th Street at SW 122nd Avenue	 6151882 6113881	Long-term Medium-term Medium-term
SW 8th Street @ SW 127th Avenue	• Signage		Short-term
SW 8th Street @ SW 132nd Avenue	• Widen bridge over Tamiami Canal • Relocate bus stop • Increase length of storage bay on SW 8th Street	 6113881 (1996 TIP)	Long-term Short-term Medium-term
SW 8th Street @ SW 137th Avenue	• Add new lanes on SW 8th Street • Increase length of storage bay on SW 8th Street • Access management • Signal phasing	6113881 (1996 TIP) 6113881 (1996 TIP) 6113881 (1996 TIP)	Medium-term Medium-term Medium-term Short-term

(1) Source: 1998 TIP
671509: 4 to 6 lanes, SW 137th Avenue from SW 88th Street to SW 42nd Street (3 miles)
6151882: Tamiami Toll Plaza replacement (2 miles)
6113860: SR 836 new road construction to SW 137th Avenue
6113770: PD&E/EMO study SW 107th Avenue from from Bird Road to Coral Way
6113948: Transportation Planning NW/SW 107th Avenue from SW 8th Street to SWR 836
671106: Phase 1 New 4 lane bridge and approaches over Tamiami Canal. Phase 2: Widen to 3 lanes from Tamiami Canal to Flagler Street
671105: Widen bridge over Tamiami Canal/Add turn lanes
6113881: PD&E Study SW 8th Street from SW 127th Avenue to SW 152nd Avenue
* : 2 to 4 lanes SW 117th Avenue from Bird Road to SW 8th Street.

Table 7.2
Proposed Monitoring System Plan

Location	Measures of Effectiveness												Data to be Collected						
	Travel												Counts			Studies			
	Time	Costs	Speed	Delay	Traffic Volume	Capacity Increase	Congestion Level	Signal Progression	Safety	Environmental Impacts	Land Use Impacts	Ridership	Turning Movement	24-Hour	Vehicle Classification	Travel time and Speed Delay	Right-of-Way	Signal Phasing and Timing	Queue Length
SW 137th Avenue @ Kendall Drive		■	■	■		■	■	■		■	■		■	■		■	■	■	■
SW 137th Avenue @ Miller Drive	■	■		■	■		■		■				■	■		■	■	■	■
SW 137th Avenue @ Bird Road	■	■		■	■	■	■		■		■		■	■		■	■	■	■
SW 137th Avenue between Coral Way and SW 8th Street	■	■	■	■			■						■	■	■	■	■	■	■
SW 137th Avenue @ SW 8th Street	■	■	■	■	■	■	■		■	■			■	■	■	■	■	■	■
SW 117th Avenue @ 7700 Block		■	■	■			■			■				■		■		■	■
SW 117th Avenue @ Sunset Drive	■	■			■		■		■				■	■		■	■	■	■
SW 117th Avenue @ Miller Drive	■	■			■		■		■				■	■		■	■	■	■
SW 117th Avenue between Turnpike northbound off-ramp and SW 8th Street	■	■		■	■	■	■		■				■	■	■	■	■	■	■
SW 107th Avenue @ Sunset Drive		■		■			■		■				■	■		■	■	■	■
SW 107th Avenue @ Miller Drive		■		■			■		■				■	■		■	■	■	■
SW 107th Avenue @ Bird Road)		■	■	■		■	■	■	■	■	■		■	■		■	■	■	
SW 107th Avenue @ Coral Way		■		■			■		■							■	■	■	■
SW 107th Avenue between SW 8th Street and Flagler Street	■	■	■	■		■	■		■		■	■				■	■	■	■

Note: Land Use Impacts = Commercial Property Value
Number of Patrons

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Table 7.2
Proposed Monitoring System Plan

Location	Measures of Effectiveness												Data to be Collected						
	Travel												Counts			Studies			
	Time	Costs	Speed	Delay	Traffic Volume	Capacity Increase	Congestion Level	Signal Progression	Safety	Environemtal Impacts	Land Use Impacts	Ridership	Turning Movement	24-Hour	Vehicle Classification	Travel time and Speed Delay	Right-of-Way	Signal Phasing and Timing	Queue Length
NW 107th Avenue between Flagler Street and SR 836	■	■		■	■		■		■	■						■	■	■	■
NW 107th Avenue between SR 836 and NW 25th Street	■	■	■		■	■	■		■				■	■	■	■	■	■	■
NW 107th Avenue between NW 25th Street and NW 41st Street	■	■			■		■		■				■	■	■	■	■	■	■
NW 107th Avenue @ NW 41st Street		■	■	■		■	■	■	■	■	■		■	■		■	■	■	
NW 107th Avenue north of NW 41st Street	■	■	■	■	■	■	■			■	■								
SW 40th Street between SW 147th Avenue and SW 117th Avenue	■	■			■		■		■				■	■		■	■	■	■
SW 40th Street between SW 102nd Avenue and SW 87th Avenue	■	■	■	■	■		■		■					■		■	■	■	■
SW 8th Street @ SW 107th Avenue	■	■			■	■			■					■		■	■	■	■
SW 8th Street from Turnpike to SW 137th Avenue	■	■	■	■		■	■		■	■	■		■	■	■	■	■	■	■
SW 8th Street @ SW 127th Avenue		■	■	■					■										
SW 8th Street @ SW 132nd Avenue	■	■	■	■	■	■	■		■	■									
SW 8th Street at SW 137th Avenue	■	■	■	■	■	■	■		■		■		■	■		■	■	■	■

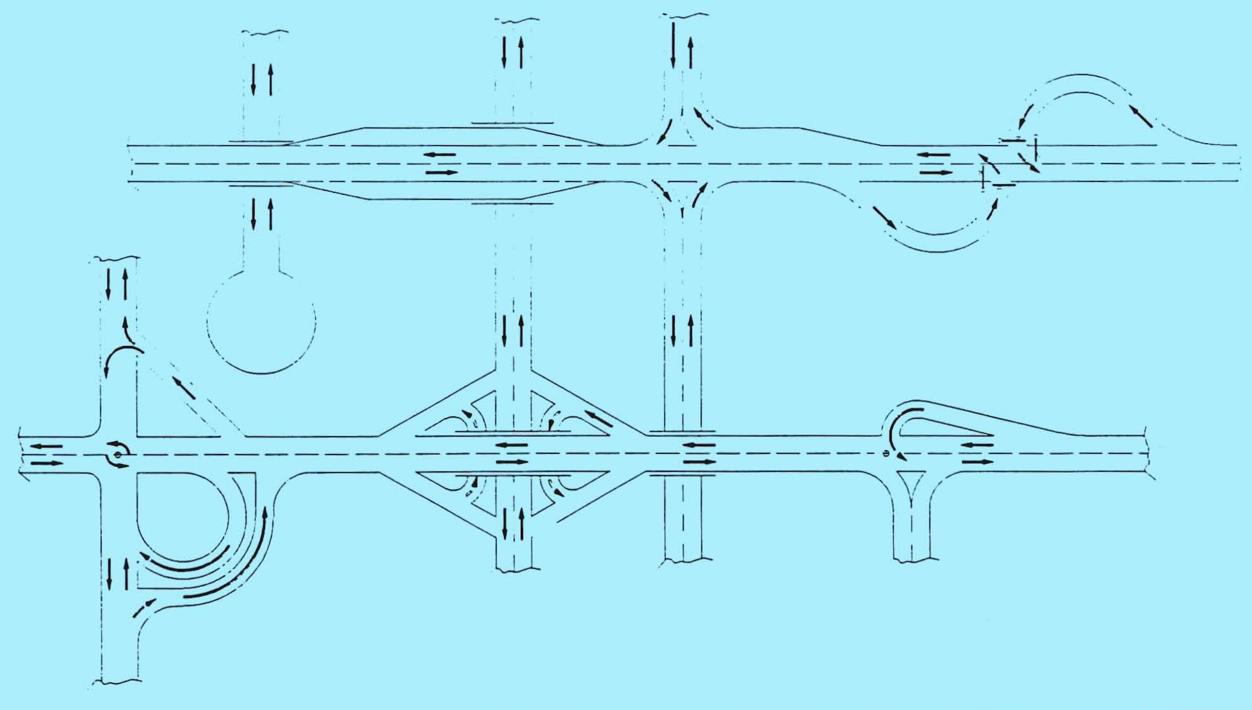
Note: Land Use Impacts = Commercial Property Value
Number of Patrons

P:projects/supart/final/Tm8-2-8.xls

CHAPTER 8

CONCLUSION

FINAL REPORT



8. CONCLUSION

Limited funding, prohibitive right-of-way costs, and environmental and social impacts hinder the ability of public agencies to provide roadway facilities that would enable all vehicles to operate at acceptable levels of service at all times. The Superarterial Network Study set out to investigate additional means of alleviating or managing congestion.

As congestion increases on Miami-Dade County's arterials, there is an increasing need to look for ways to maintain and where possible, to improve mobility within the County by increasing the traffic carrying capacity of existing roads, or by increasing the vehicle throughput on these facilities. This can be accomplished by a variety of improvements in design, traffic engineering applications, and advances in technology, without overly extensive widening, major construction of new roadways, or reconstruction of existing roadways.

To develop a successful network of Superarterials, the location and cause of the existing and future congestion must be identified. The main congestion locations identified in this report - isolated intersections, isolated roadway segments, transportation corridors, and activity centers - serve as a departure point toward developing appropriate solutions. Sets of solutions based on the different causes and location of congestion problems were identified and presented in detail in this report. These solutions range from those with low costs and short implementation periods such as restriping, to major improvements such as grade separation and new transit services. Some of these solutions are relatively easy to implement while others would require extensive community outreach to ensure acceptance.

The Transportation Corridors, Transportation Areas, and Superarterial Network selected, based on the criteria defined in this report, represent the optimum network needed to enhance mobility throughout Dade County. Superarterials are intended to provide east-west and north-south continuity to the grid system, alleviate freeway congestion, and provide access to major activity centers and employment areas, and furnish alternate routes. Because the Transportation Areas were defined to work independently, the concept may be phased so countywide implementation occurs gradually as funding becomes available. Implementation can also be further broken down, and be applied to a single arterial within a Transportation Area.

The wide range of strategies and techniques presented in this report demonstrate that a variety of means are available to alleviate or manage congestion. These strategies and techniques can be applied individually, or as packages. Some techniques are complimentary with others and some are antagonistic; a carefully arranged blend results in maximizing the potential for increasing mobility on the Superarterials. These strategies and techniques should be tailored to each particular situation, and the advantages weighed against the disadvantages of implementing selected improvements. The strategies and techniques discussed in this document have been used to develop a set of recommended improvements for specific Superarterials within the transportation area selected for preliminary testing.

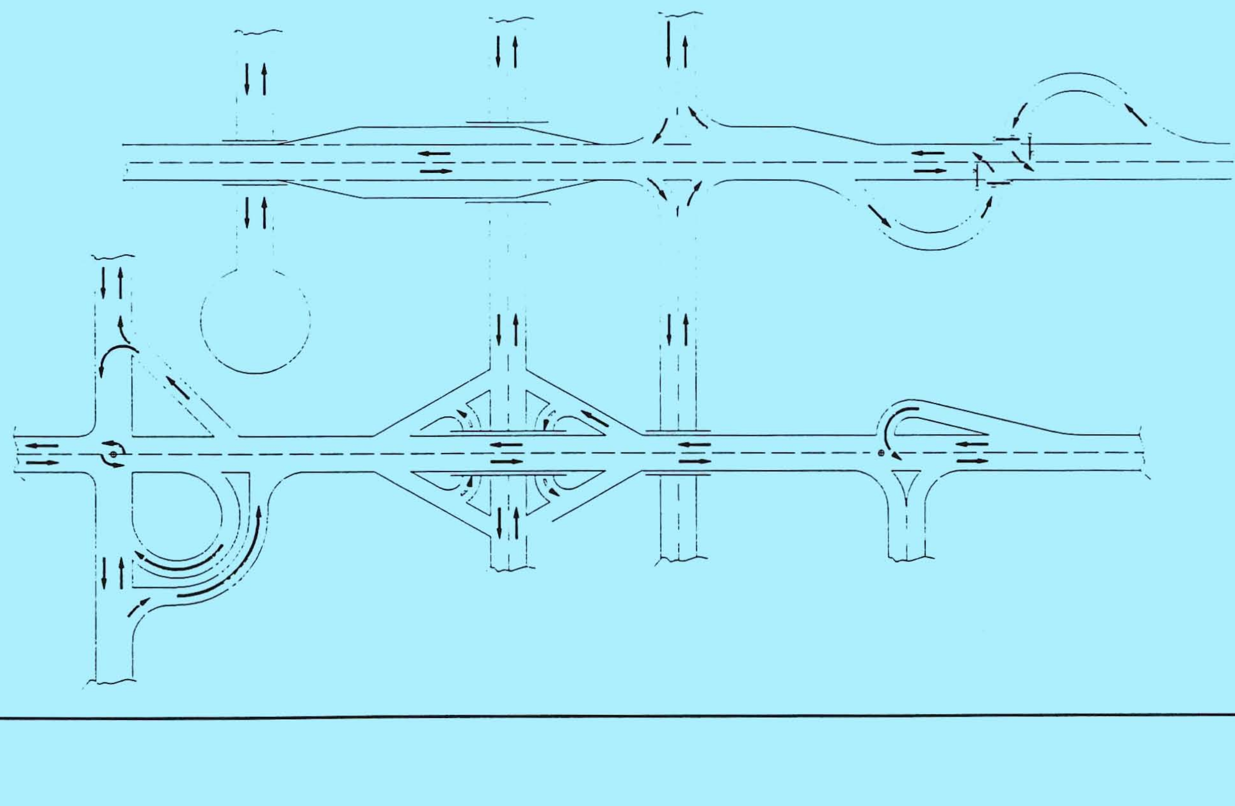
A proactive approach should be stressed to anticipate and prevent high levels of congestion on "new" corridors, make the necessary provisions for adequate right-of-way acquisitions for future transportation needs, and apply Superarterial design criteria. A strong community involvement program is recommended in developing and implementing the Superarterial Network. One example would be the intersection of NW 107th Avenue and NW 41st Street, which will undoubtedly be one of the busiest intersections in Dade County in the next 10 years. Sufficient ROW should be acquired now to accommodate future needs and avoid the constraints faced with several of the intersections challenged with congestion problems in the present.

The solutions presented in this report can be used as preventive or corrective actions. New facilities should be carefully planned to handle both short and long term congestion problems by incorporating some of the suggested techniques. In these developing areas, appropriate measures can be used to acquire enough right-of-way to accommodate optimum design standards. In mature areas where right-of-way is scarce and usually too costly, implementation of some of the techniques described in this report is harder to achieve. In these areas the potential benefit of the proposed improvements (increase in mobility, congestion reduction, increase in travel speed, ridership increase) need to be carefully weighed against implementation costs, and economic, environmental and social impacts.

Preliminary testing of the Superarterial Network concept shows that this concept bridges the gap between the different improvement programs currently in place at the state and county level. By looking at arterials within a specific area, the Superarterial Network broadens the scope of the Resourceful Use of Streets and Highways (RUSH) program and the Project Development and Environmental Study (PD&E) which look at specific spots and single arterials respectively. The concept also compliments these programs while being more focused than the Long-Range Transportation Plan (LRTP).

APPENDIX A

FINAL REPORT



APPENDIX A

Steering Committee Members

Frank Baron
MPO Project Manager
Metropolitan Dade County

Jesus Guerra
MPO Congestion Management
Metropolitan Dade County

Randy Fox
FDOT District VI Planning
FDOT District VI

Rory Santana
FDOT District VI Operations
FDOT District VI

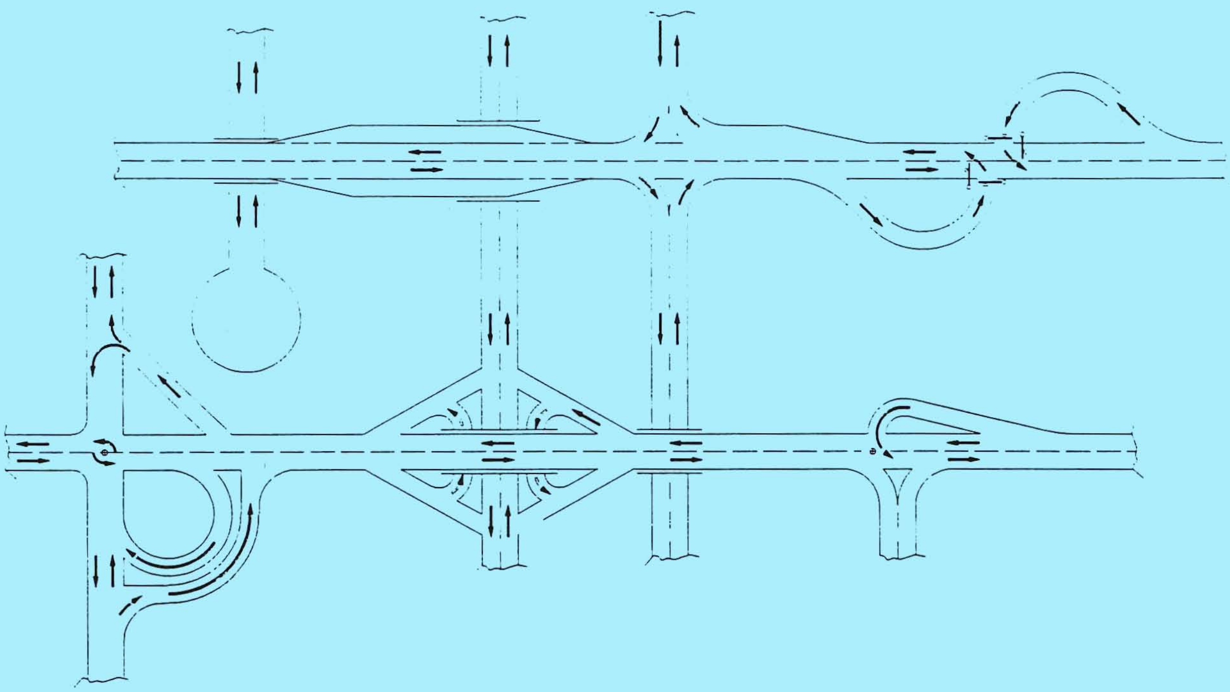
Bob Williams
Traffic Signals and Signs Division
Dade County Public Works

Bob Owen
Dade County Public Works
Metropolitan Dade County

Bob Pearsall
Metro-Dade Transit Agency
Metropolitan Dade County

APPENDIX B

FINAL REPORT



APPENDIX B

Figure A-1 shows the proposed basic cross-section of a six-lane divided SAS. Figure A-2 illustrates the configuration for stage construction of the proposed improvements. Two stages are identified in this figure, suggesting that some features recommended as necessary for a SAS (such as median barriers, no left turns and grade separations) can be postponed until traffic conditions and land use development make the conversion to Stage II necessary. Figures A-3 and A-4 illustrate the operational movements to be expected along a SAS. Figure A-5 is a diagram showing how the traffic movements are separated along an arterial, providing the same traffic service as the diamond interchange. with the need for a traffic signal to accommodate U-turns. Figures A-6, A-7 and A-8 show layouts and approach cross-sections with right-of-way requirements for urban diamond-type interchanges constructed on minimum rights-of-way. Figure A-9 is a layout similar to figures A-6 and A-7 with provisions for stage construction. Figure A-10 shows construction of a diamond interchange at an intersection with minimum rights-of-way. Figure A-11 illustrates a three-level interchange. Figures A-12 and A-13 show a type of directional crossover intersection design. Figure A-14 shows a typical cross section an of arterial street overpass approach to diamond interchange.

LIST OF FIGURES

Figure 4.1

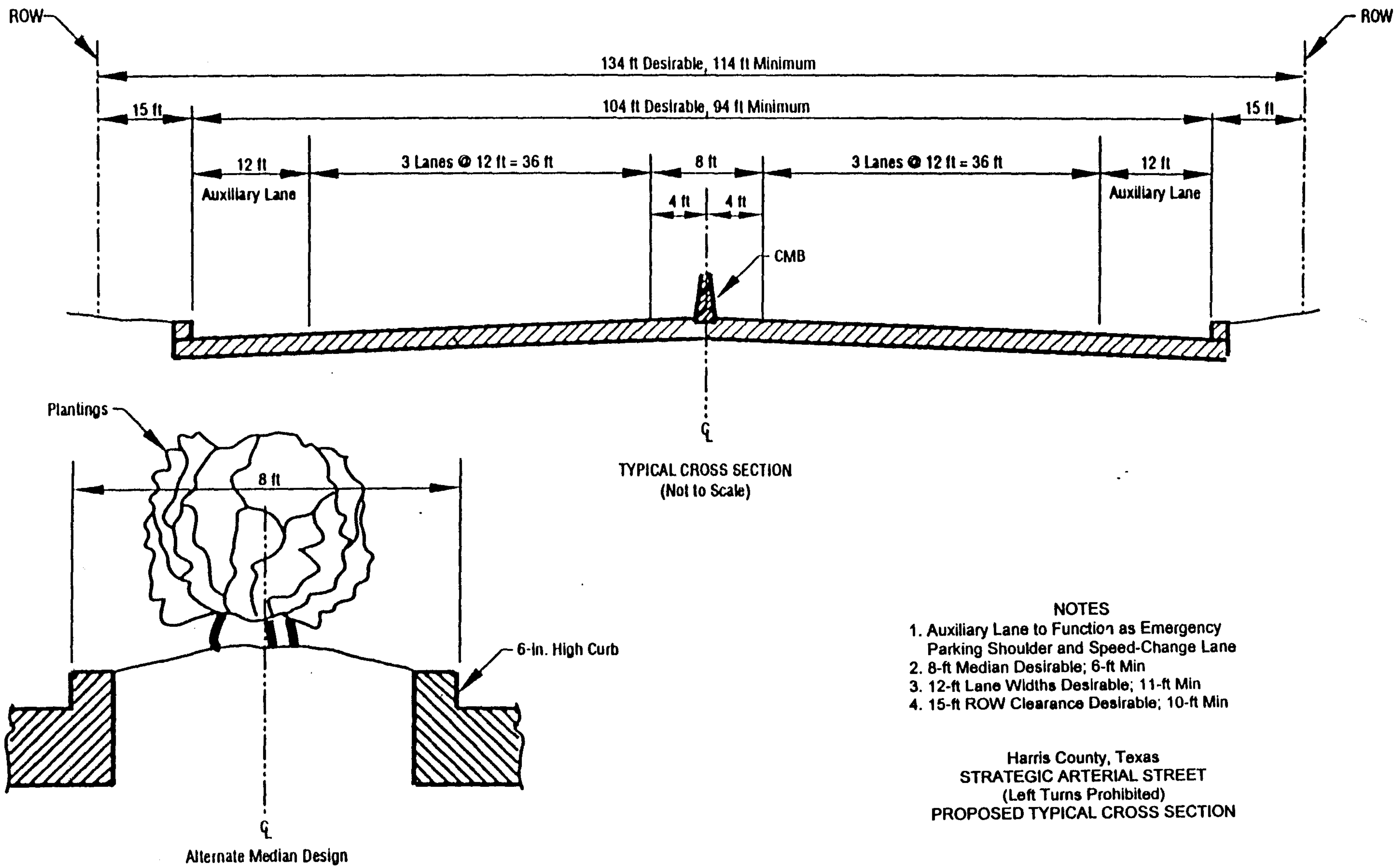
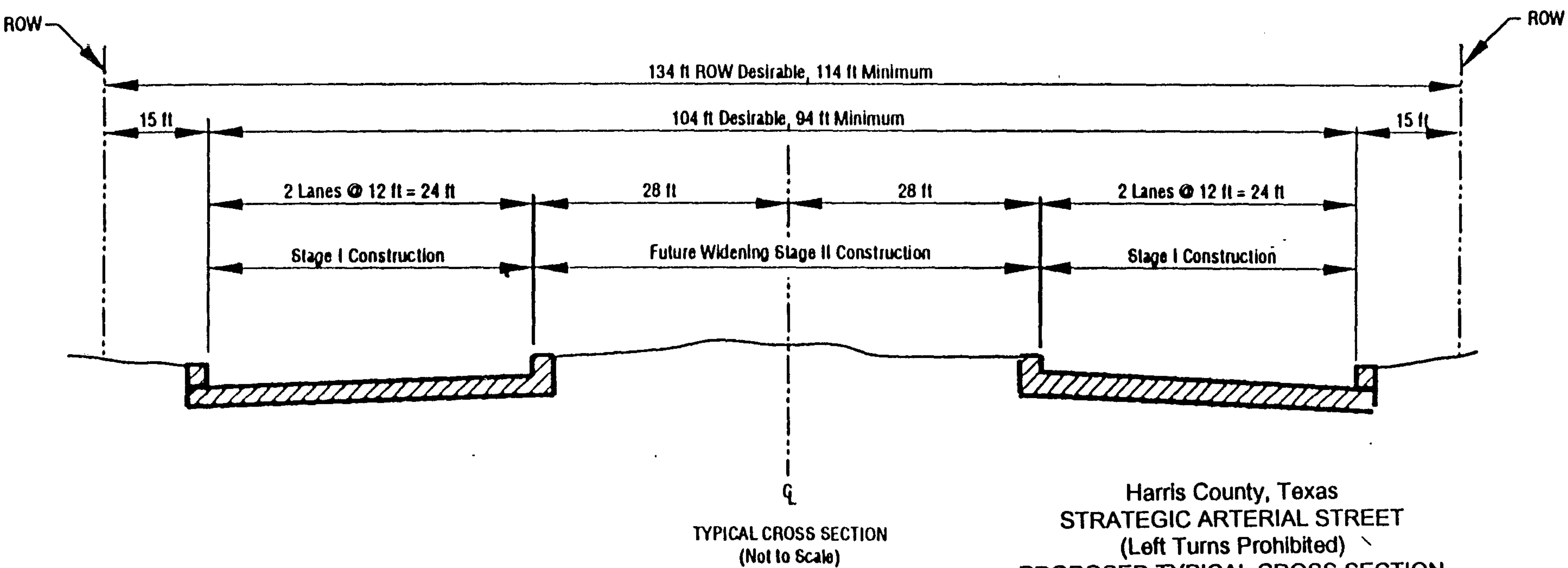
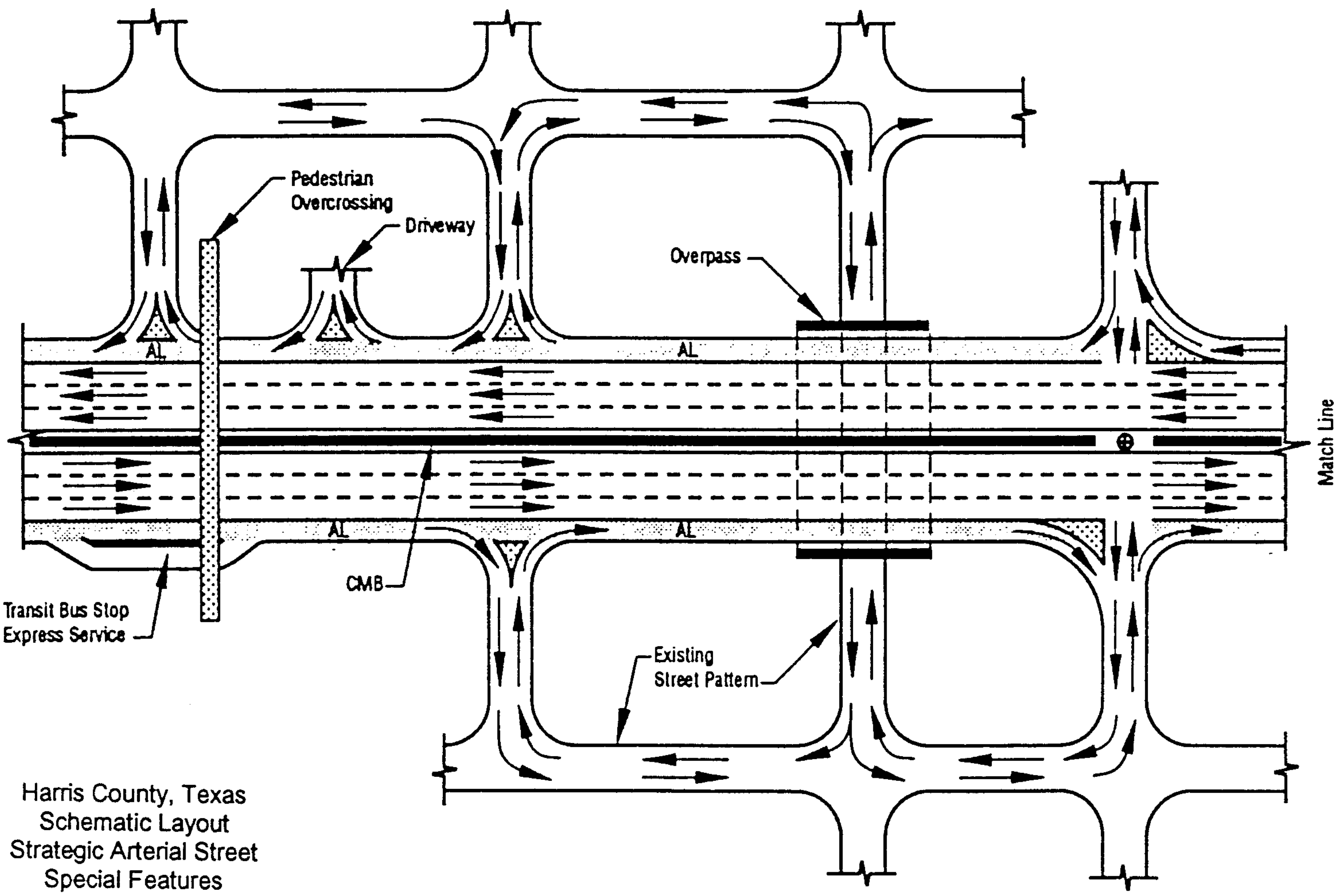

ROW
ROW
134 ft Desirable, 114 ft Minimum
15 ft
104 ft Desirable, 94 ft Minimum
15 ft
12 ft
Auxiliary Lane
3 Lanes @ 12 ft = 36 ft
8 ft
4 ft
4 ft
3 Lanes @ 12 ft = 36 ft
12 ft
Auxiliary Lane
CMB
CL
TYPICAL CROSS SECTION
(Not to Scale)
Plantings
8 ft
6-In. High Curb
CL
Alternate Median Design
NOTES
1. Auxiliary Lane to Function as Emergency Parking Shoulder and Speed-Change Lane
2. 8-ft Median Desirable; 6-ft Min
3. 12-ft Lane Widths Desirable; 11-ft Min
4. 15-ft ROW Clearance Desirable; 10-ft Min
Harris County, Texas
STRATEGIC ARTERIAL STREET
(Left Turns Prohibited)
PROPOSED TYPICAL CROSS SECTION

Figure 4.2



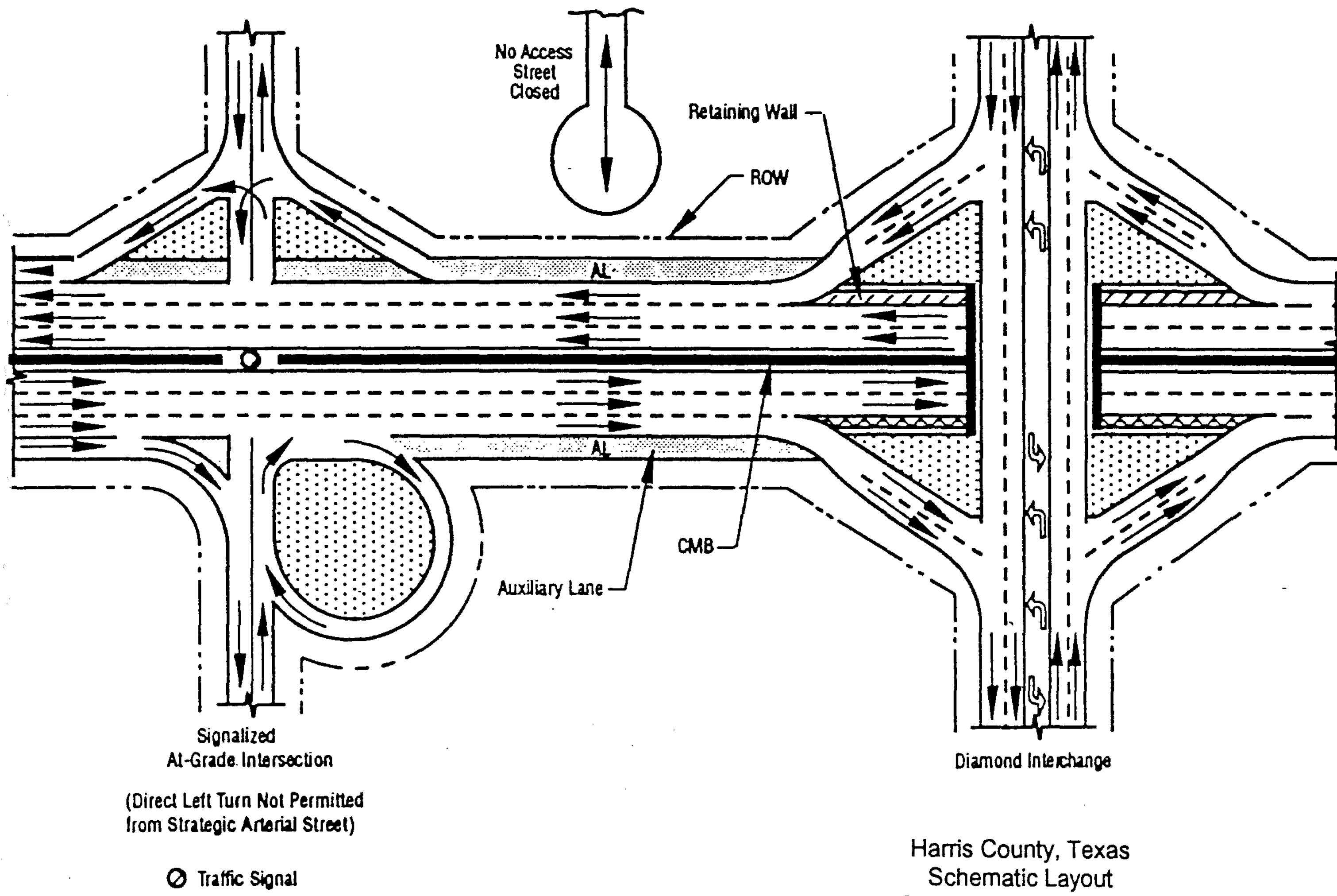
Harris County, Texas
STRATEGIC ARTERIAL STREET
(Left Turns Prohibited)
PROPOSED TYPICAL CROSS SECTION
STAGE CONSTRUCTION



Harris County, Texas
Schematic Layout
Strategic Arterial Street
Special Features
(Not to Scale)

NOTE
AL: Auxiliary Lane
CMB: Concrete Median Barrier

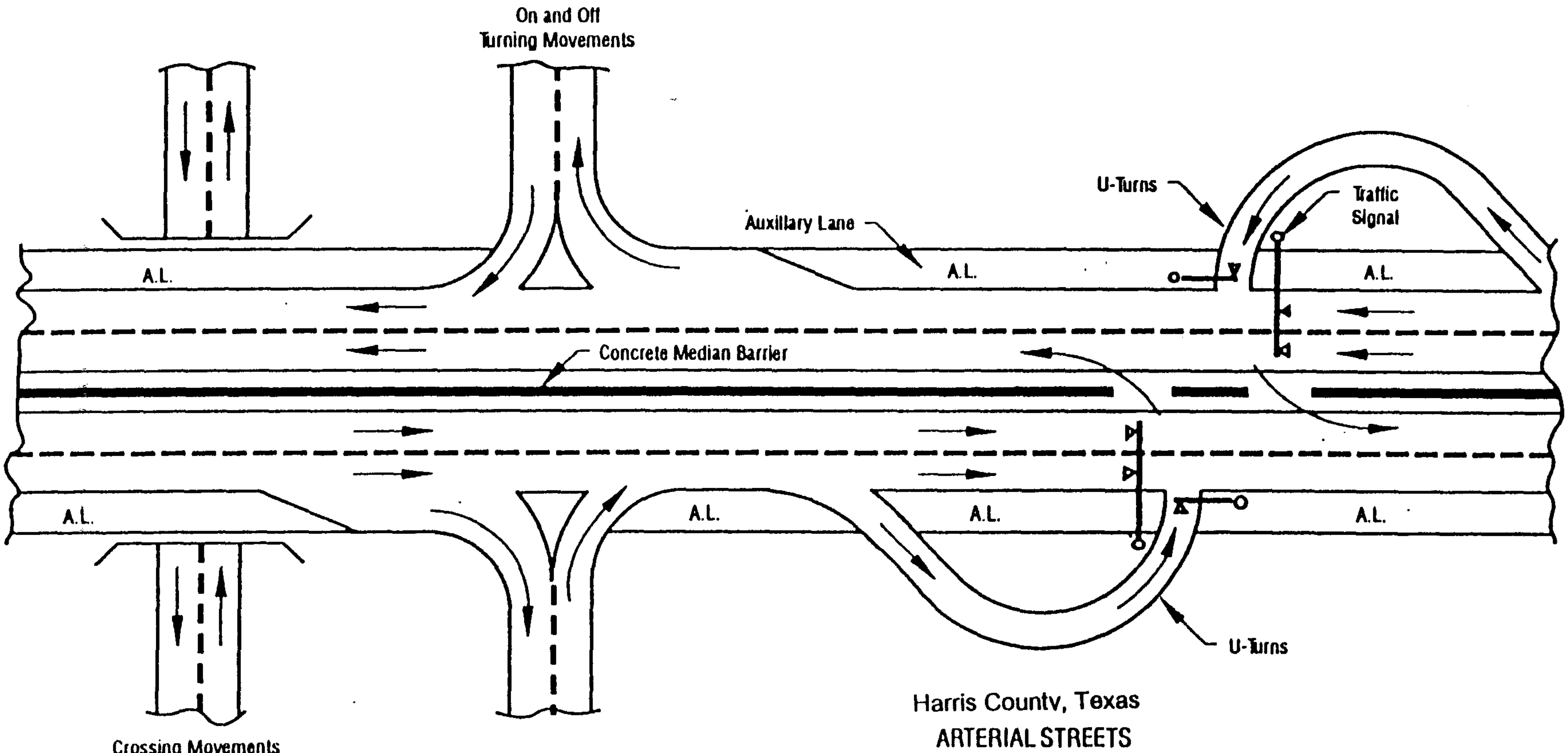
Figure 4.3



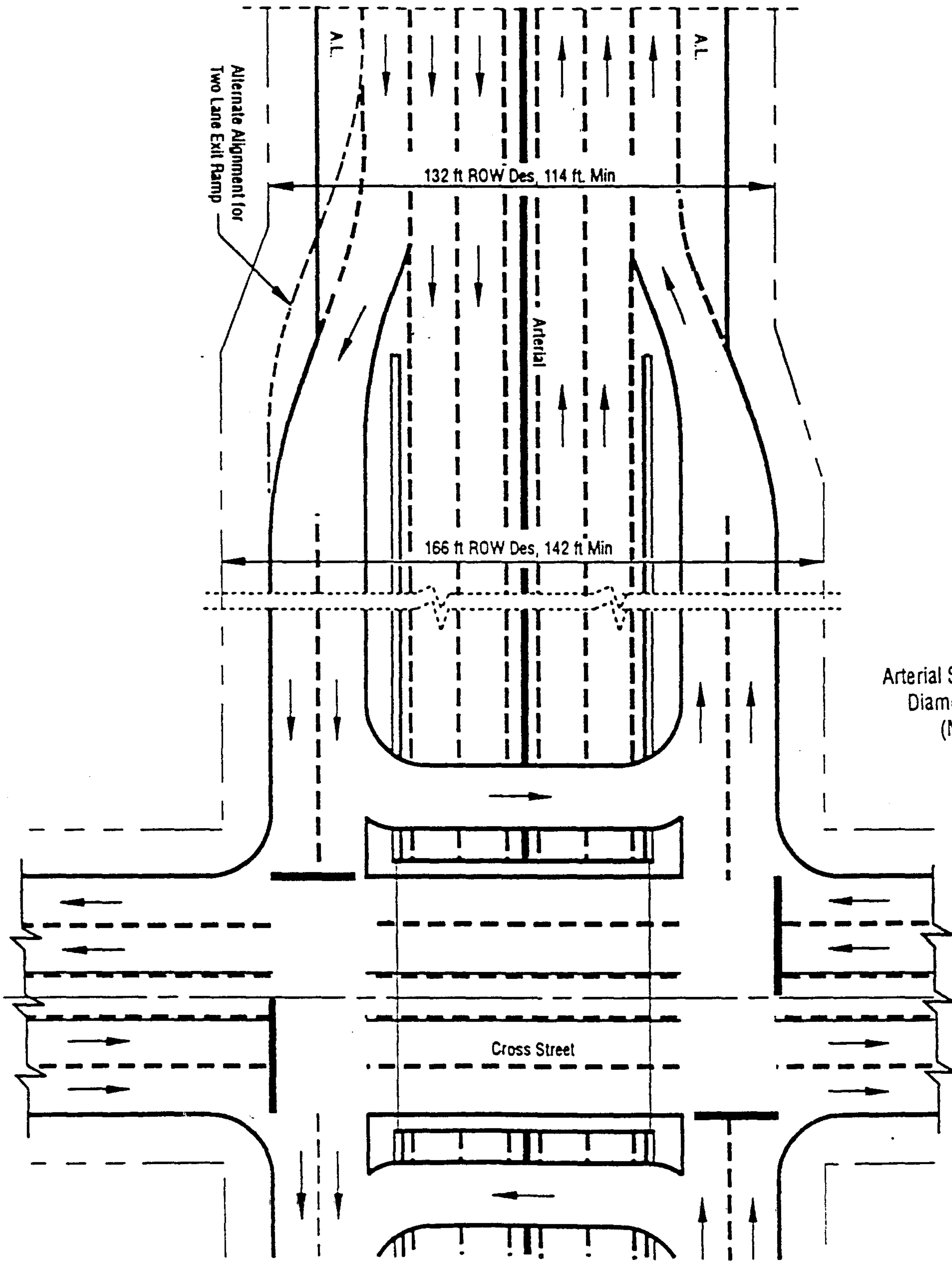
Harris County, Texas
Schematic Layout
Strategic Arterial Street
Special Features
(Not to Scale)

Figure 4.4

Figure 4.5



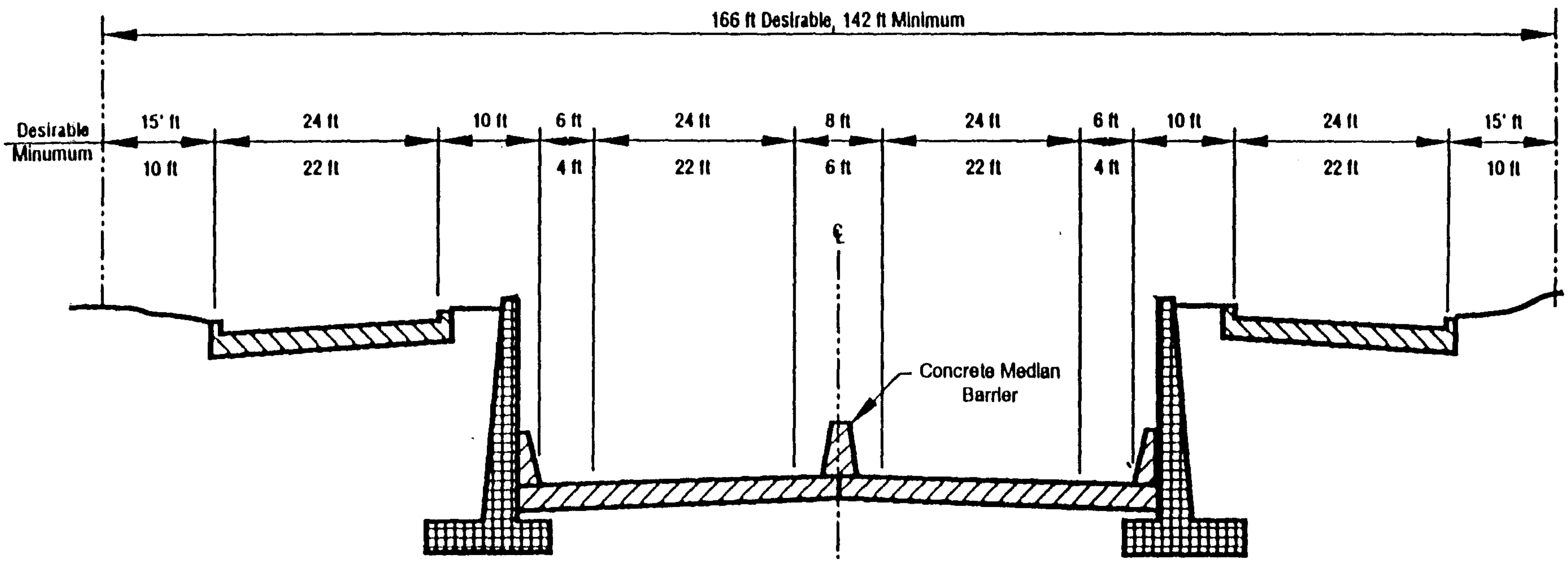
Harris County, Texas
ARTERIAL STREETS
Separation of Turning and Crossing Movements



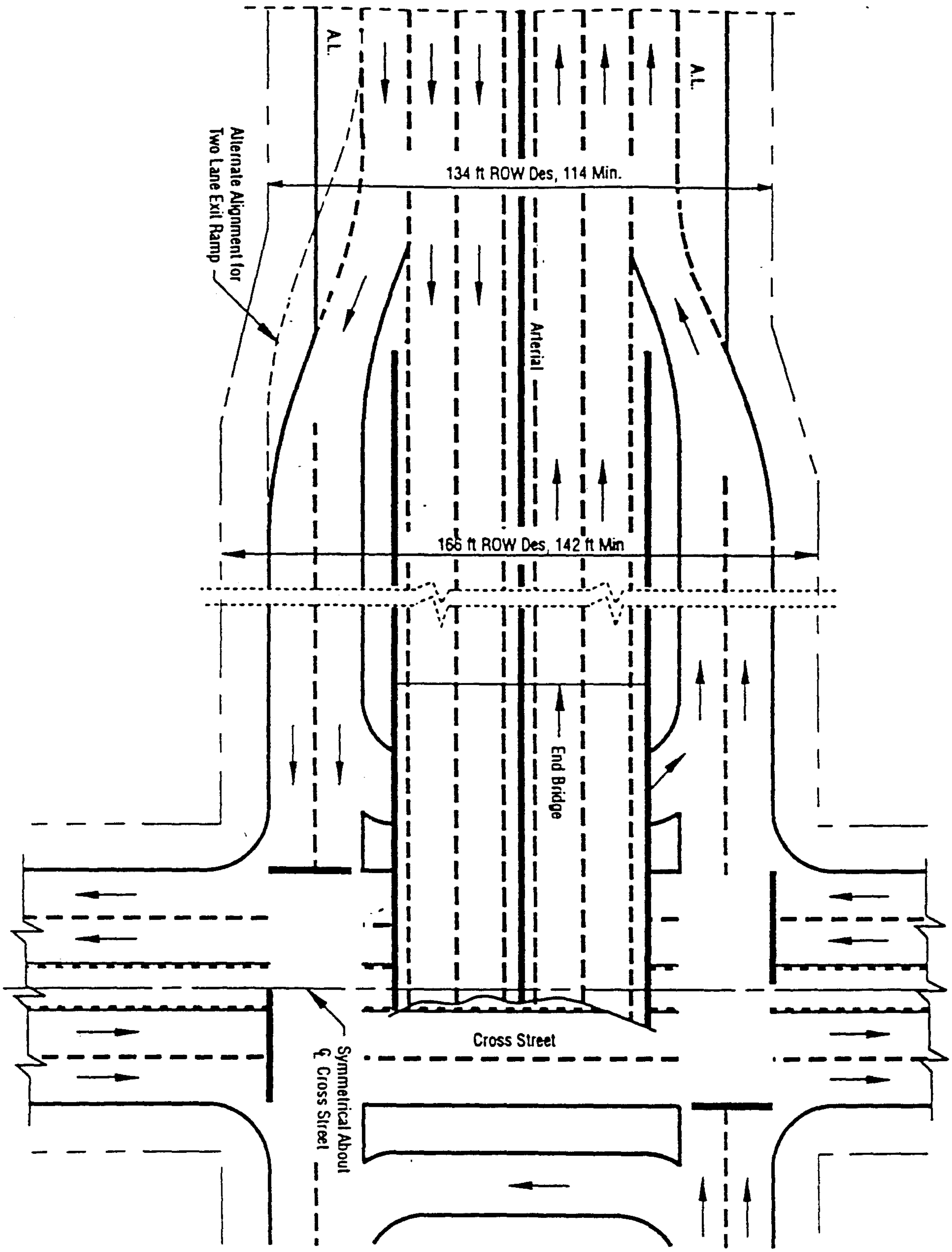
Half Plan
Arterial Street Underpass &
Diamond Interchange
(Not to Scale)

Figure 4.6

Figure 4.7

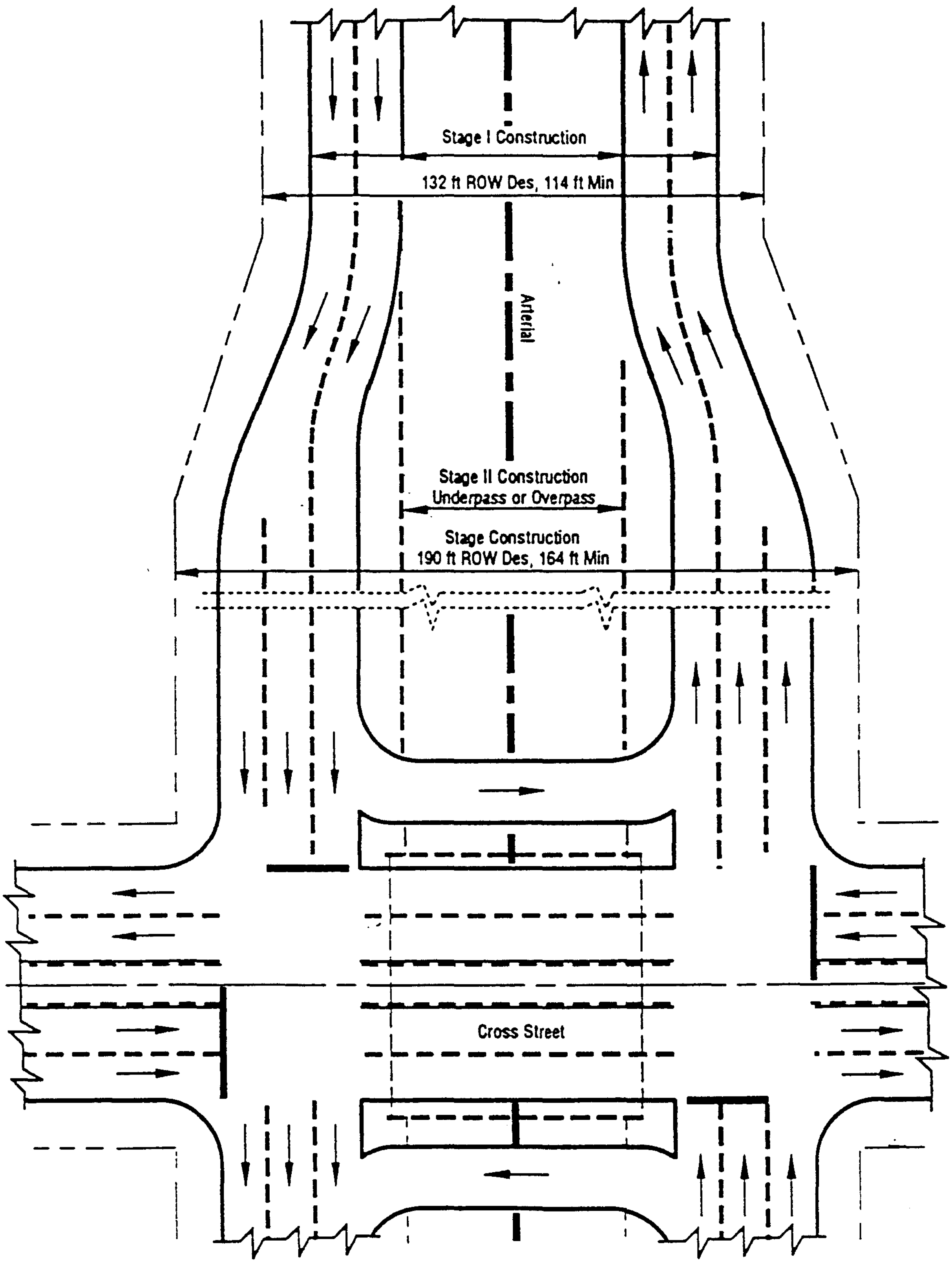


Typical Cross Section of Arterial Street Underpass Approaches to Diamond Interchange



Half Plan
Arterial Street Overpass & Diamond Interchange
(Not to Scale)

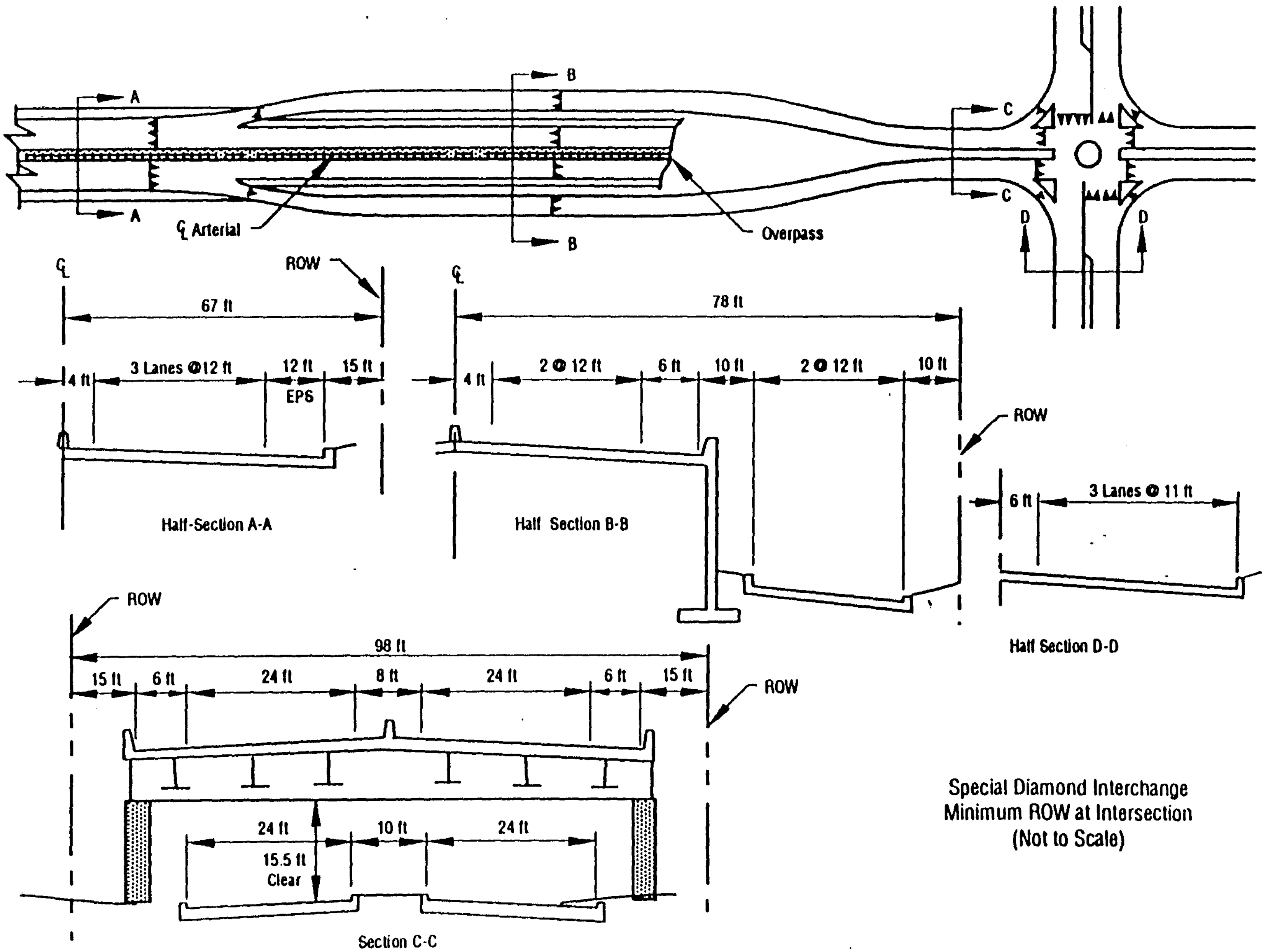
Figure 4.8



Half Plan
Arterial Street Diamond Interchange Stage Construction
(Not to scale)

Figure 4.9

Figure 4.10



Special Diamond Interchange
Minimum ROW at Intersection
(Not to Scale)

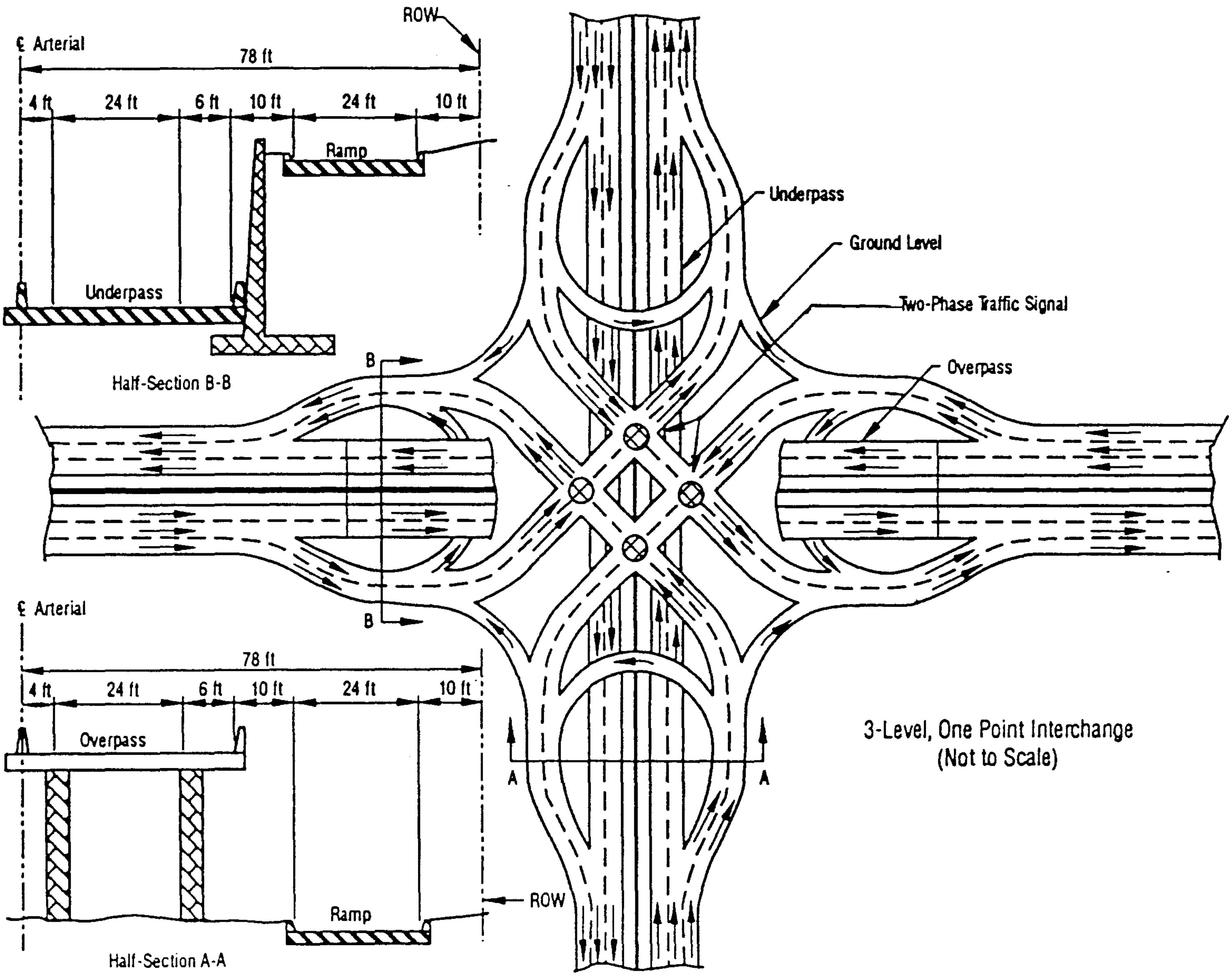

ROW
℄ Arterial
78 ft
4 ft
24 ft
6 ft
10 ft
24 ft
10 ft
Ramp
Underpass
Half-Section B-B
B
B
Underpass
Ground Level
Two-Phase Traffic Signal
Overpass
℄ Arterial
78 ft
4 ft
24 ft
6 ft
10 ft
24 ft
10 ft
Overpass
Ramp
ROW
Half-Section A-A
A
A
3-Level, One Point Interchange
(Not to Scale)

Figure 4.11

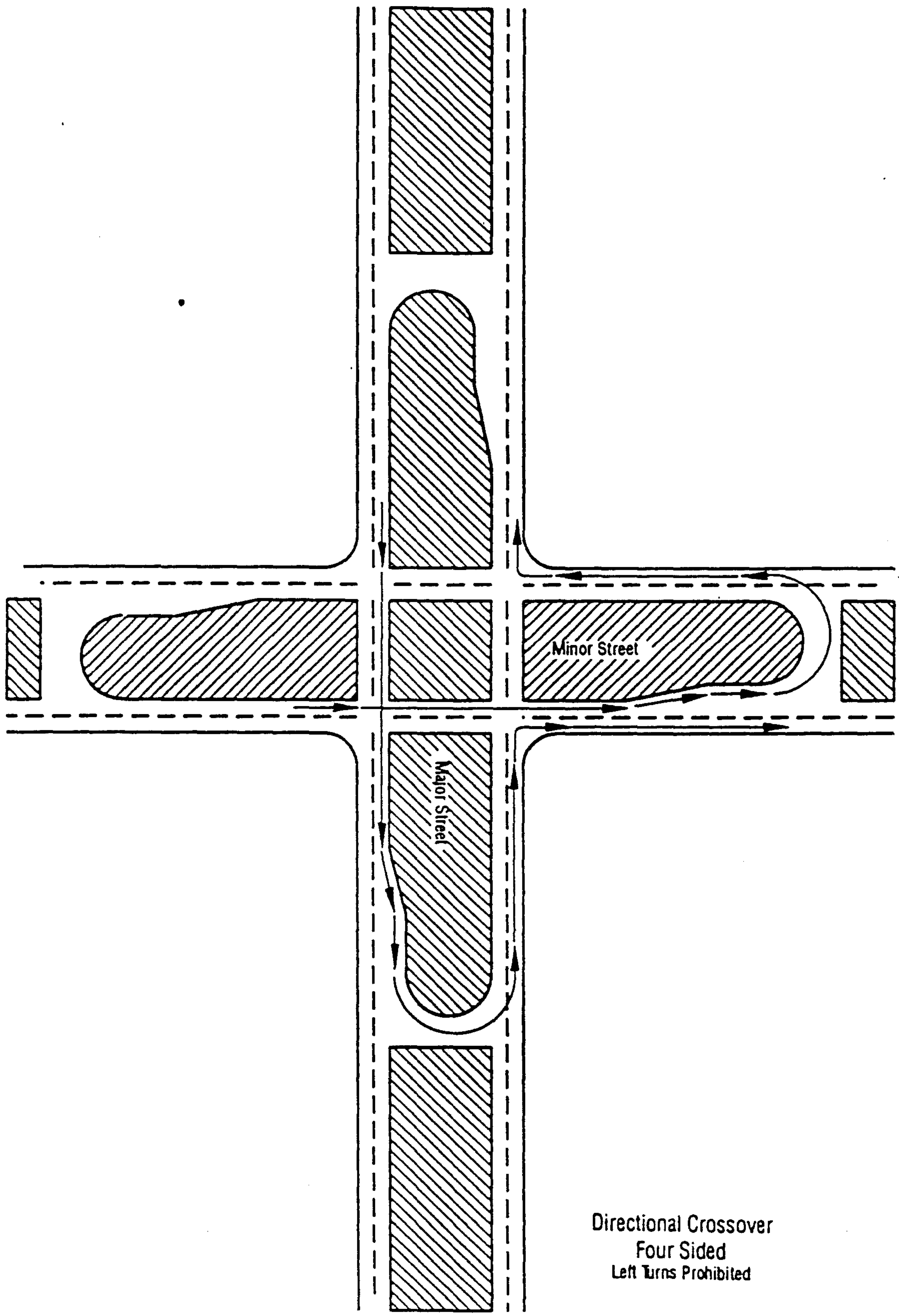

Minor Street
Major Street
Directional Crossover
Four Sided
Left Turns Prohibited

Figure 4.12

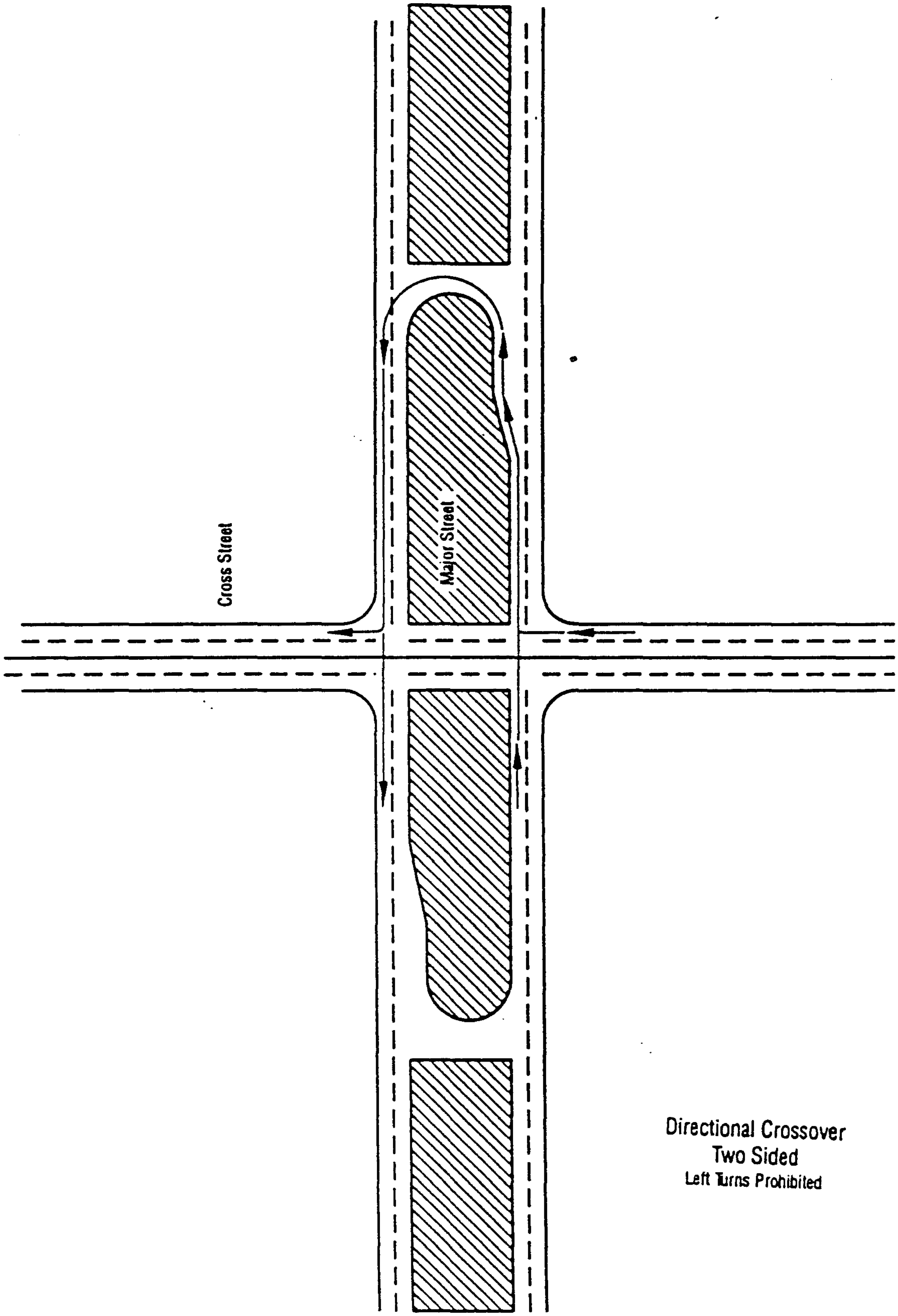
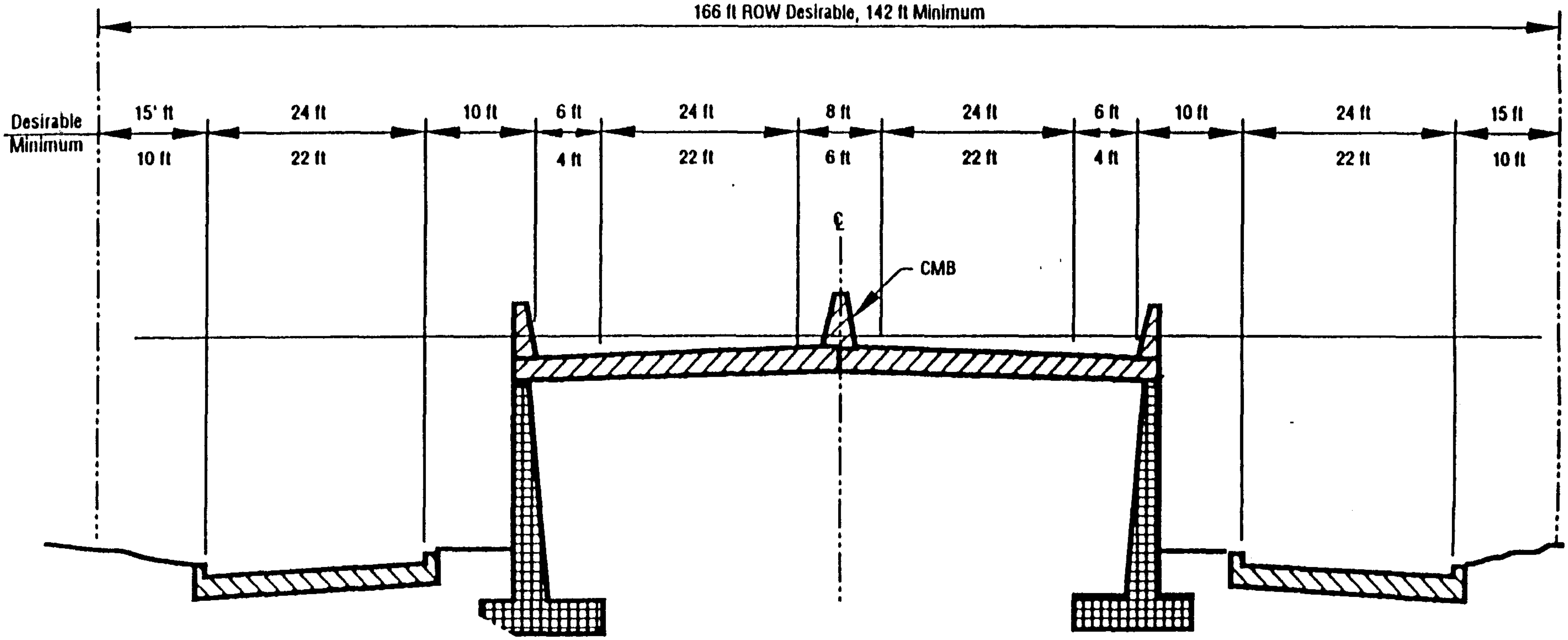

Cross Street
Major Street
Directional Crossover
Two Sided
Left Turns Prohibited

Figure 4.13

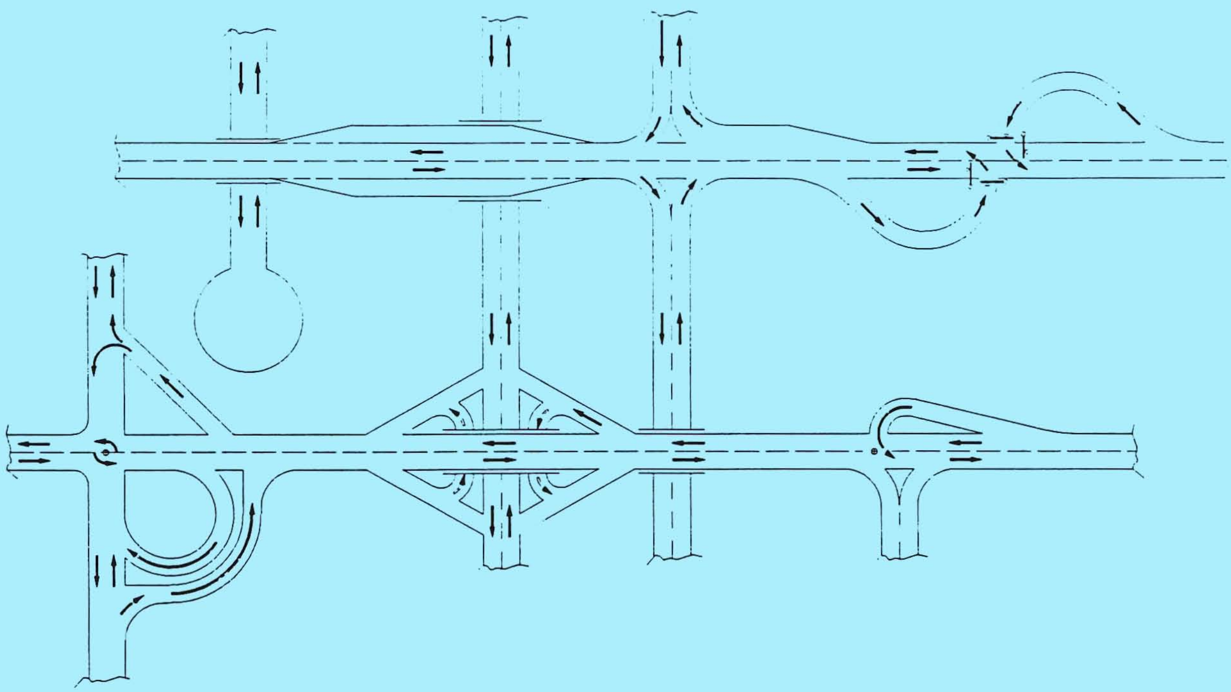
Figure 4.14



Typical Cross Section of Arterial Street Overpass
Approaches to Diamond Interchange
(Not to Scale)

APPENDIX C

FINAL REPORT



APPENDIX C

STRATEGIES AND TECHNIQUES PROFILES

Table C-1
Profile # 1: New Lane and/or Street Segment

Desired Impacts	a) Provide continuity and increased connectivity to arterial network b) Increase in overall system capacity c) Increase in local area road capacity
Problems Addressed	a) Delays and low average travel speeds on arterials and cross streets b) Residential streets used as bypass routes to avoid bottlenecks c) High accident rates attributable to heavy turning traffic from cross-streets d) Congestion due to traffic being forced onto the arterials since no other alternative route exists
Conditions for Application	a) Available right of way b) Minimal to no environmental impacts
Potential Implementation Problems	a) Community opposition where new segment or lanes would be constructed b) Natural barriers such as waterways c) Right-of-way acquisition costs if not in public domain
Evaluation Factors	a) Changes in peak traffic volumes on arterials within the area b) Change in peak travel times along existing sections of the corridor considered c) Change in level of service at affected intersections d) Reduction in accident rates e) Capital costs of new segment or lanes f) Annual maintenance cost of new segment or lanes and associated improvements

Table C-2
Profile # 2: Turn Lanes Addition and Phasing

Desired Impacts	Reduce intersection delay where there is a heavy demand for turning movements
Problems Addressed	a) Heavy delay for left turn movements b) Accidents attributable to conflicts between left turning and opposing through moving vehicles c) Disruption caused by left turning vehicles to the opposing traffic d) Heavy delay for right turning vehicles when crossroad through traffic is also heavy
Conditions for Application	a) Adequate storage should exist to provide for turning vehicles b) Demand for a separate phase should be substantiated by the left turn volumes, number of opposing lanes, and facility speed.
Potential Implementation Problems	a) Signal coordination may suffer with the introduction of a longer cycle length b) Capacity of other movements may decrease
Evaluation Factors	a) Change in levels of service of affected intersection for all approaches b) Change in delay at affected intersections and on street segments c) Reduction in accident rate d) Implementation costs e) Change in annual maintenance cost at the affected intersection

Table C-3
Profile # 3: Frontage Roads

Desired Impacts	Reduce congestion on main lanes on an arterial by providing separate facility for local traffic
Problems Addressed	a) Heavy local traffic b) Improve safety by separating through traffic from traffic interacting with the land uses along the arterial
Conditions for Application	Adequate right-of-way
Potential Implementation Problems	Cost
Evaluation Factors	a) Change in accident rate on main arterial b) Change in vehicle throughput c) Increase in operating speeds on arterial d) Change in level of service on arterial

Table C-4
Profile # 4: Street And Intersection Geometry Improvements: Striping, Channelizations, and Islands

Desired Impacts	Maximize use of existing capacity, increase vehicle throughput, and reduce delay
Problems Addressed	a) Peak hour delay at intersections b) Vehicular conflict between through and turning movements c) Air quality issues
Conditions for Application	Available right-of-way
Potential Implementation Problems	Implementation cost
Evaluation Factors	a) Change in travel time at intersections b) Change in accident rate c) Change in air pollutant emmsions

Table C-5
Profile # 5: Reroute Turning Traffic (Jug Handle, Left Turn Prohibition or Restriction)

Desired Impacts	inate or reduce conflicts between vehicular movements
Problems Addressed	a) Conflicts between turning vehicles, pedestrians, bus and other traffic flows b) Safety consideration at intersections
Conditions for Application	a) Convenient alternate route available for rerouting b) Proximity of streets and small blocks to accommodate a left turn through three right turns c) Increase in travel time due to rerouting should be minimal d) Right-of-way availability for constructing jug-handle or other urban interchange design
Potential Implementation Problems	a) Opposition from business owners if new design is perceived to limit access to their sites b) Community opposition form land owners and occupants on the alternate route c) Opposition from business owners on the route from where traffic will be diverted
Evaluation Factors	a) Change in level of service or average delay at affected intersections b) Change in travel times for rerouted traffic c) Change in travel time along straight routes in the study area d) Accident reduction e) Implementation and right-of-way costs

Table C-6
Profile # 6: Two-Way Left Turn Lanes

Desired Impacts	Reduce delay at intersections and along arterial segments
Problems Addressed	a) Heavy delay experienced by turning vehicles b) High accident rates c) Heavy delay experienced by through movement waiting for turning movement to clear
Conditions for Application	a) Available right-of-way b) Volume of turning vehicles c) Multiple access points along arterial need to be accommodated
Potential Implementation Problems	a) Safety consideration associated with two-way left turn lanes b) Right-of-way
Evaluation Factors	a) Change in travel time b) Change in travel speed c) Change in level of service d) Change in vehicle throughput

Table C-7
Profile # 7: Reversible Lanes

Desired Impacts	Increase in vehicle throughput or capacity in peak direction of travel during peak hour
Problems Addressed	a) Peak hour traffic congestion due to high traffic volume b) Higher than standard air pollutants produced during the peak periods
Conditions for Application	a) Very heavy directionality in traffic flow during peak hours b) Adequate striping and overhead signs and signals should be provided for safe operation c) Sufficient capacity should be provided for the flow in the minor direction d) Current geometry should not have medians, barriers, islands, turn lanes, or other channelization devices e) Adequate capacity at beginning and end points to the reversible lane(s) to allow for easy transition between normal and reversed lane conditions
Potential Implementation Problems	a) Unsafe conditions created by motorists confusion b) Reversible lanes create operational problems at their termini c) Control efforts may be needed to prevent violations of the lane-use regulations
Evaluation Factors	a) Increase in capacity b) Increase in operating speeds c) Change in air pollutant emissions d) Operating and maintenance costs of lane control devices e) Implementation costs f) Change or reduction in accident rates g) Differences in bus speeds/travel times in both directions

Table C-8
Profile # 8: Parallel or By-Pass Segments

Desired Impacts	a) Decrease vehicular traffic by encouraging the use of parallel or by-pass segments. b) Reduce delay by adding capacity in corridor
Problems Addressed	a) Insufficient capacity to handle peak traffic volumes at acceptable levels of service b) Peak hour traffic congestion along corridors, in CBD, and in major employment and commercial centers.
Conditions for Application	a) Available right-of-way b) Convenient parallel routes or by-pass segments with adequate capacity
Potential Implementation Problems	a) Through traffic on residential streets used as by-pass segment creates a hazard for residents b) Through traffic degrades the residential quality of the neighborhood if parallel or by-pass segments use residential streets
Evaluation Factors	a) Change in traffic volume on arterial and on adjacent and parallel routes b) Change in travel speeds and level of service on arterials during peak periods.

Table A 9
Profile # 9: Grade Separation

Desired Impacts	Reduce delay at intersections of two major arterials or a major arterial and a minor arterial.
Problems Addressed	a) Congestion at the intersection of two major arterials or a major arterial and a minor arterial b) Higher than typical or allowable air quality concentrations resulting from intersection delays
Conditions for Application	a) Adequate right-of-way b) Severely congested intersection conditions c) Consideration for pedestrians and cyclists
Potential Implementation Problems	a) Cost b) Right-of-way c) Community opposition d) Environmental problems e) Access to existing and future land parcels
Evaluation Factors	a) Change in travel speeds and level of service on arterials during peak periods b) Change in delay at intersection c) Change in air pollutant emissions during peak periods d) Change in vehicular capacity e) Change in accident rate f) Improved signal progression g) Changes in client traffic of adjacent businesses

Table C-10
Profile # 10: Walkways or Pedestrian/Cyclist Overpasses

Desired Impacts	Safe crossing of major arterials for pedestrians and cyclists
Problems Addressed	a) Interruption of traffic flow on congested arterials or corridors b) Unsafe crossing of major arterials for pedestrians and cyclists c) Peak hour traffic congestion along corridors, in CBD, and in major employment and commercial centers
Conditions for Application	a) Congested intersections or corridors b) Significant pedestrians/cyclists traffic c) Unsafe crossing conditions
Potential Implementation Problems	a) Construction cost of new facility b) Cost of amenities such as landscaping and lighting
Evaluation Factors	a) Change in travel speeds and level of service on arterials during peak periods b) Change in air pollutant emissions during peak periods c) Changes in the number of reported pedestrians/cyclists-vehicular accidents d) Improved signal progression

Table A 11
Profile # 11: Exclusive Bicycle Lanes

Desired Impacts	Improve traffic flow and safety
Problems Addressed	a) Slow vehicular traffic on outside travel lanes being used by cyclists b) Unsafe condition from interaction of vehicles and bicycles
Conditions for Application	Adequate right-of-way
Potential Implementation Problems	Construction costs
Evaluation Factors	a) Reduction in accident rate b) Changes in operating speed and level of service of outside travel lanes

Table C-12
Profile # 12: New Signal Installation

Desired Impacts	Improve traffic flow and safety at intersections
Problems Addressed	Excessive delay at intersections especially from turning movements
Conditions for Application	Heavy peak hour traffic volume preventing some movements to take place
Potential Implementation Problems	a) Too many signals close together may impede flow and increase delay b) Impacts on signal progression
Evaluation Factors	a) Change in level of service at affected intersection b) Change in average delay at affected intersection c) Implementation cost d) Reduction in accident rate e) Change in travel speed along improved roadway segments

Table C-13
Profile # 13: Signal Phasing and Timing Changes

Desired Impacts	Reducing congestion and improving traffic flow
Problems Addressed	Poor traffic Flow resulting from excessive delay at intersections
Conditions for Application	Adequate data available to assess proposed changes
Potential Implementation Problems	Adverse impact on cross-street movements
Evaluation Factors	a) Change in level of service on all approaches to the intersection b) Change in delays for all approaches c) Change in amount of pollutant emissions d) Change in travel speed along improved roadway segments

Table C-14
Profile # 14: New Pedestrians/Cyclists Signal

Desired Impacts	Improve safety
Problems Addressed	a) Unsafe crossing conditions for pedestrians and cyclists b) Reduction or elimination of accidents along an arterial
Conditions for Application	High pedestrian or cyclists volume
Potential Implementation Problems	a) Implementation and maintenance costs b) Adverse impacts on arterial traffic progression
Evaluation Factors	a) Change in accident rate b) Change in travel speed along arterial c) Change in pollutant emissions

Table C-15
Profile # 15: Turbo Lanes

Desired Impacts	Improve traffic flow by increasing intersection capacity
Problems Addressed	a) Poor arterial flow b) Operational or safety problems caused by conflicting movements at T-intersections
Conditions for Application	a) Adequate geometric design b) Heavy arterial volume c) Low volume of side street left turns
Potential Implementation Problems	a) Introduction of hazardous conditions not present in typical signalized T intersections b) Safety and operational concerns associated with merging and/or weaving traffic conditions created as a result of a turbo lane implementation
Evaluation Factors	a) Change in level of service for traffic using the turbo lanes b) Change in delay at intersection c) Change in intersection capacity d) Change in travel speeds e) Change in accident rate

Table C-16
Profile # 16: Crossing Design, Striping and Marking

Desired Impacts	Improve safety and reduce congestion
Problems Addressed	a) Conflicts between pedestrians, cyclists, and vehicular traffic b) Safety concerns caused by inadequate design c) Congestion due to inadequate design
Conditions for Application	Heavy non-vehicular traffic
Potential Implementation Problems	Right-of-way availability for design improvements
Evaluation Factors	a) Change in accident rate b) Change in delay at intersection c) Change in capacity of cross walk

Table C-17
Profile # 17: Access Management

Desired Impacts	a) Reduce congestion by improving traffic flow b) Improve safety by reducing number of conflict points
Problems Addressed	a) Conflicts between turning and through vehicular movements b) Friction resulting in capacity reduction due to traffic entering and exiting adjacent land uses c) Business relocation due to heavy congestion and safety concerns on arterials
Conditions for Application	a) Multiple access points along the arterial b) Multiple access points for a single development c) Individual access points provided to abutting commercial developments which could be connected through their parking lot d) Poor on-site circulation plan that forces traffic onto the main arterial to access more than one store e) Inadequate throat length forcing traffic to use the main arterial for storage
Potential Implementation Problems	a) Opposition from business owners b) Opposition from property owners
Evaluation Factors	a) Change in travel speed b) Change in accident rate c) Change in client traffic of adjacent businesses d) Change in vehicle throughput on the arterial e) Change in travel time

Table C-18
Profile # 18: Paired One-Way Streets to Improve Flow

Desired Impacts	Increase in capacity and vehicle throughput along parallel roadways
Problems Addressed	a) Peak hour traffic congestion due to heavy traffic or parking maneuvers b) High occurrence of accidents involving turning vehicles c) Higher than standard air pollutants produced during peak periods
Conditions for Application	a) This measure is most effective on streets with three lanes or less b) Equal capacities can be provided in both directions to match travel patterns c) Proper geometry allows clear and easy to negotiate transition from one-way to two-way traffic and vice-versa d) Compatible parallel facilities located within a few blocks e) Compatible land use types on facilities to be paired
Potential Implementation Problems	a) Opposition of business owners along the proposed arterials b) Opposition of patrons wanting to use the adjacent facilities since "easy access" to these facilities may be impeded
Evaluation Factors	a) Change in vehicle throughput b) Change in level of service c) Change in accident rate d) Change in pollutant emissions e) Change in bus travel times along one-way portions of their routes f) Change in client traffic of adjacent business

Table C-19
Profile # 19: Auto Restricted Zones

Desired Impacts	Improve pedestrian safety
Problems Addressed	High number of accidents involving pedestrians
Conditions for Application	a) Adjacent development should be able to support enough pedestrian activity b) Facility should be easily accessed through transit c) Adequate capacity should be provided on adjacent streets to which vehicular traffic would be rerouted
Potential Implementation Problems	a) Emergency vehicle access b) Opposition from businesses owners and patrons c) Lack of convenient pick-up and drop-off points for taxis and delivery vehicles
Evaluation Factors	a) Change in number of accidents on improved and adjacent facilities b) Change in vehicle throughput on adjacent and parallel facilities c) Change in travel speed on adjacent facilities d) Change in ridership on transit servicing the area e) Change in economic activity in the area

Table C-20
Profile # 20: Truck Traffic Restrictions

Desired Impacts	Increase existing capacity by banning truck use of the arterial during peak hours
Problems Addressed	Peak hour congestion
Conditions for Application	High percentage of heavy truck traffic during peak hours
Potential Implementation Problems	a) Opposition from truck owners and operators b) Opposition from business owners who rely on trucks for supplies, especially during peak periods c) Enforcement
Evaluation Factors	a) Change in travel time b) Change in travel speed c) Change in level of service d) Change in pollutant emissions e) Change in vehicle throughput f) Enforcement costs

Table C-21
Profile # 21: Bus Stops Spacing and Design

Desired Impacts	a) Improve traffic flow by encouraging transit use b) Improve safety at bus stops
Problems Addressed	a) Conflicts between pedestrians, cyclists and vehicular traffic b) Low transit use caused by inadequate bus stops
Conditions for Application	a) Potential drawing area within walking distance b) Volume of cyclists warrant design changes to incorporate bicycle storage c) Traffic flow can be improved by moving location of bus stop
Potential Implementation Problems	a) Frequent stops will disrupt vehicular traffic during the peak periods b) Long walks to bus stops (greater than 1/3 mile) discourage the use of transit
Evaluation Factors	a) Change in travel speed for the outside travel lanes b) Change in accident rate c) Change in ridership d) Change in bus travel time

Table C-22
Profile # 22: Bus Bays

Desired Impacts	Improve traffic flow
Problems Addressed	a) Vehicular traffic is delayed when buses stop for boarding and alighting b) History of repeated traffic and/or pedestrian accidents at bus stop locations
Conditions for Application	a) Potential for auto/bus conflicts warrants separation of transit and passenger vehicles b) Traffic in the curb lane exceeds 250 vehicles per hour (vph) c) Bus volume is greater than 10 per hour during the peak hour d) Passenger volumes exceed 20 to 40 boardings an hour e) Average peak-period dwell time exceeds 30 seconds per bus f) Sight distance (i.e. hills, curves) prevent traffic from stopping safely behind a stopped bus g) Right-of-way width is adequate to construct bus bay without adversely affecting sidewalk pedestrian movement h) Right turn lanes can be used by buses as a queue jumper lanes i) Appropriate bus signal priority treatment exists or can be implemented at intersections j) Bus parking in the curb lane is prohibited
Potential Implementation Problems	Increased delay for buses during the peak hours when trying to re-enter travel lanes
Evaluation Factors	a) Change in bus and/or vehicular traffic travel time b) Change in bus and/or vehicular traffic travel speed c) Change in bus and/or vehicular traffic level of service

Table C-23
Profile # 23: Signal Preemption for Buses

Desired Impacts	Improve traffic flow by promoting transit use
Problems Addressed	Reducing bus delay by providing priority to public transit at intersections
Conditions for Application	a) Signal timing and phasing can be modified to allow buses to proceed on demand and without delay. b) Exclusive bus lane needs to be provided especially in severely congested areas
Potential Implementation Problems	a) Implementation cost b) Maintenance cost c) Increase in delay on cross streets d) Right-of-way cost if exclusive bus lane is needed
Evaluation Factors	a) Change in transit ridership b) Change in bus travel time and level of service c) Change in vehicular traffic level of service d) Change in vehicular traffic travel speed e) Change in vehicular traffic delay at intersections

Table C-24
Profile # 24: Expanded Bus Routes

Desired Impacts	Decrease congestion level by providing proper bus service to encourage mode shift
Problems Addressed	a) Residential areas that meet warrants for direct bus service but are not served by existing routes b) New or proposed employment or commercial centers not adequately served by existing routes
Conditions for Application	Residential density of 2000 or more people per square mile
Potential Implementation Problems	a) Residential streets geometry (dead-end, curvilinear, etc.) may hinder transit coverage b) Community opposition to routing of buses through residential streets c) Implementation cost d) Operating and maintenance cost
Evaluation Factors	a) Changes in ridership on modified routes b) Fleet requirement c) Capital, operating and maintenance costs d) Changes in revenue e) Change in level of service on arterials within the area

Table C-25
Profile # 25: Limited Stops or Express Bus Routes

Desired Impacts	a) Decrease congestion levels by providing proper bus service to encourage mode shift b) Improve bus service c) Reduce operating costs
Problems Addressed	a) Low passenger loads on outer segments of transit route and in the reverse direction b) Schedule maintenance problems and travel delays due to long and variable running times
Conditions for Application	a) Passenger loads should warrant at least 8-10 bus trips per hour during peak periods b) Most riders should be traveling to a few destinations (and from these destinations in the evening peak) c) Corridor should be at least two miles long, but preferably over six miles long
Potential Implementation Problems	Community opposition due to increased headways
Evaluation Factors	a) Changes in ridership on modified routes b) Change in fare c) Changes in peak vehicle requirements d) Changes in vehicle miles operated e) Change in revenues f) Changes in operating costs g) Changes in wait and travel times h) Change in level of service on arterials

Table C-26
Profile # 26: Increased Bus Frequency

Desired Impacts	Reduce congestion by encouraging mode shift Improve service on selected routes
Problems Addressed	a) High levels of congestion during peak hours b) Overcrowded transit vehicles during peak hours c) Poor travel times due to excessive wait at bus stops
Conditions for Application	a) Observed increase in demand for transit service during peak periods b) Potential travel time savings significant enough to encourage mode shift
Potential Implementation Problems	Additional operating and maintenance costs
Evaluation Factors	a) Changes in ridership b) Fleet requirement c) Capital, operating and maintenance costs d) Changes in revenue e) Changes in wait time f) Change in level of service on arterials Changes in vehicle miles operated

Table C-27
Profile # 27: Loop/Shuttle Buses

Desired Impacts	Decrease congestion levels
Problems Addressed	a) Difficult or unsafe pedestrian circulation b) Business expansion plans will cause traffic congestion c) Inadequate parking for shoppers and other short-term users
Conditions for Application	a) Centers where on-site major attractions are separated from each other or from parking facilities b) Works best in mixed land use (retail, medical, education, and employment) c) Routes connected by shuttle should offer reliable service d) Clearly marked stops with waiting shelters, route maps and schedules may be necessary for infrequent users
Potential Implementation Problems	a) Regulatory approval of the shuttle may be required b) Back-up arrangements will be necessary to insure high level of reliability c) Insurance may be expensive or difficult to obtain d) Traffic congestion near the center may interfere with the reliable operation of the proposed service
Evaluation Factors	a) Average daily operating, maintenance, and capital costs b) Changes in daily revenue c) Implementation cost d) Average wait and travel time e) Change in level of service on arterials in the area

Table C-28
Profile # 28: Increased Frequency in Shoulder Periods

Desired Impacts	a) Reduce congestion by encouraging mode shift during shoulder periods b) Encourage off-peak hour travel as a complement to the Travel Demand Management program
Problems Addressed	a) High levels of congestion during peak hours b) Inadequate service during shoulder periods c) Poor travel times during shoulder periods
Conditions for Application	a) Observed increase in demand for transit service during off-peak periods b) Potential travel time savings significant enough to encourage mode shift for off-peak period travelers c) Travel Demand Management measure encouraging change in standard work hours (staggered or flexible work hours) should be contemplated or already in operation
Potential Implementation Problems	Additional operating and maintenance costs
Evaluation Factors	a) Changes in ridership b) Changes in revenue c) Changes in level of service on affected arterials d) Changes in travel time Changes in operating and maintenance costs

Table C-29
Profile # 29: Exclusive Bus and Carpool Lane

Desired Impacts	Reduce congestion by encouraging ride-sharing and transit use
Problems Addressed	a) Traffic congestion during peak periods b) Air quality issues c) High transit operating costs attributable to congestion and delays along specific arterials
Conditions for Application	a) Significant time saving to encourage mode shift from single occupant vehicles b) Potential for ride-sharing exists c) Adequate street width to provide for a minimum of two unrestricted lanes in each direction d) High vehicle occupancy to allow enough riders to justify at least 30 buses during peak periods e) Provide for traffic turning across the reserved lane f) The arterials should operate at level of service D or worse to encourage mode shift to the reserved lane
Potential Implementation Problems	a) Strong opposition from non-HOV passengers if congestion seems to increase on other lanes b) Strong community opposition if HOV lanes are not used to the fullest c) Safety consideration if contraflow lane is provided instead of directional lane d) Without enforcement, HOV lane may become congested with intrusion of non-HOV traffic and travel time savings is not achieved e) Available right-of-way if lane has to be added
Evaluation Factors	a) Travel time savings b) Changes in vehicle and passenger volumes of single and high occupancy vehicles c) Changes in volume on parallel or on affected arterials d) Changes in air pollutant emissions during peak hours e) Construction and implementation costs f) Changes in facility operating and maintenance costs g) Change in enforcement costs h) Changes in transit operating and maintenance costs i) Changes in transit ridership and revenues on affected arterials

Table C-30
Profile # 30: Park And Ride Lots Along Transit Routes

Desired Impacts	Improve vehicular traffic flow on major arterials by encouraging the use of transit
Problems Addressed	a) Peak hour traffic congestion along corridors, in CBD, and in major employment and commercial centers b) Higher than typical or allowable air quality concentrations resulting from congestion on the arterials c) Local bus service operating in low density areas that do not meet productivity or cost recovery standards d) Congestion along corridors and roadway segments
Conditions for Application	a) Sites conveniently located to serve the intended areas b) Current transit routes would not need to be significantly modified to access the lots c) Car availability of residents of the prospective drawing area d) Park-and-ride lots should be at least four miles from employment or commercial centers served by transit route e) Conditions encouraging mode shift should exist, such as time savings, high level of congestion on arterial, or high parking costs at the destination f) Good transit service quality on routes serving the sites g) Lots should be safe and offer adequate shelters
Potential Implementation Problems	a) Cost of convenient sites b) Cost of amenities such as landscaping and lighting c) Potential transit deficits if lot users are diverted from parallel bus routes that continue to operate
Evaluation Factors	a) Travel times and out-of-pocket costs for corresponding auto trips for the trips which the transit replaces b) Change in transit ridership on adjacent and parallel routes. c) Change in traffic volumes on arterials within the area d) Change in travel speeds and level of service on arterials during peak periods e) Change in air pollutant emissions during peak periods f) Change in transit revenues on route served by the park-and-ride lot and on parallel routes g) Change in transit operating costs on route served by the park-and-ride lot and on parallel routes

Table C-31
Profile # 31: Expanded Off-Street Parking and Loading Areas

Desired Impacts	Improve traffic flow by reducing conflicts on the arterial
Problems Addressed	a) Reduction of on-street space, proposed to meet transportation or other objectives, is expected to limit the availability of parking b) People using the centers are parking on adjacent residential streets c) High occupancy rate of existing parking is discouraging shoppers and business expansion d) On-street parking is contributing to the congestion on the arterial
Conditions for Application	Parking occupancy throughout the center should exceed 85 percent of capacity
Potential Implementation Problems	a) Available sites for new spaces may be beyond the acceptable walking distance of many shoppers or employees b) New lots or garages may hinder pedestrian access from adjacent neighborhoods c) Diversion of patrons to private automobiles may reduce transit or taxi revenues
Evaluation Factors	a) Change in parking space occupancy rate b) Change in number of vehicles parking in center per day c) Change in retail sales d) Change in number of people entering center e) Construction costs f) Change in operating and maintenance costs g) Change in parking revenues h) Change in transit ridership and revenues i) Change in taxi patronage and revenues j) Change in operating speeds or level of service on streets around center

Table C-32
Profile # 32: Parking Restriction and/or Removal

Desired Impacts	Increase roadway and intersection capacity during peak hours.
Problems Addressed	a) Peak hour congestion on arterials and intersections b) Intersection delays contributing to higher than standard air pollutants concentration
Conditions for Application	a) Convenient parking should be available within short distance to make up for the spaces lost during the restricted times b) On-street parking should only be serving patrons going to adjacent land-uses and not other uses such as taxi or bus drop-off and pick-up area c) Appropriate curb radius should be present to allow safe turning of vehicles and not create a hazard
Potential Implementation Problems	a) Adjacent business owners may see the removal of the on-street parking as a threat to business survival b) Parked cars usually offer a buffer for pedestrians and removing the on-street parking should be reconsidered if the curb abuts a narrow and heavily used sidewalk
Evaluation Factors	a) Change in travel speeds or level of service during peak hours b) Change in sales of commercial establishments along the adjacent on-street parking c) Change in number of users of commercial establishment adjacent to the on-street parking d) Change in vehicle throughput

Table C-33
Profile # 33: Increased Parking Fee

Desired Impacts	Reduce traffic congestion and air pollutant emissions by encouraging transit use
Problems Addressed	a) Traffic congestion during peak periods b) Air quality issues c) All day parkers leave insufficient spaces for short-term visitors d) Street capacity near center is insufficient to handle traffic volumes expected if business expansion plans are implemented
Conditions for Application	a) Action will be most effective if good transit service is available b) No more than 15 percent of off-street all day spaces should be vacant in a major employment center at the end of the morning commuting peak if the action is to appear justified
Potential Implementation Problems	a) Revenue loss b) Business opposition c) Garage and lot owners opposition d) Nearby residents may object if center users shift to parking on the streets
Evaluation Factors	a) Change in vehicles entering the center during the morning commuting period b) Changes in peak operating speeds or level of service on arterials around the center c) Change in number of spaces unoccupied at the end of the morning peak d) Change in air pollutant emissions e) Change in parking revenues f) Change in ridership and revenues on transit routes serving the center g) Change in number of people entering the center h) Change in retail sales

Table C-34
Profile # 34: Warning Devices

Desired Impacts	a) Reduce congestion caused by driver confusion at decision points b) Increase safety at decision points along arterials and at intersections
Problems Addressed	a) High levels of congestion during peak hours resulting from last minute lane changes b) Inadequate advance warning of upcoming changes in roadway and intersection geometries
Conditions for Application	a) Observed safety problems at specific locations b) Changes in roadway geometry or intersection configuration c) Major intersections with multiple turn and through lanes d) Unusual roadway and intersection configuration e) Observed high number of last minute lane changes
Potential Implementation Problems	a) Initial implementation costs b) Additional maintenance costs c) Enforcement costs
Evaluation Factors	a) Changes in accident rates b) Changes in average travel speeds along improved arterials during peak periods c) Changes in delay at intersections d) Implementation, maintenance and enforcement costs

Table C-35
Profile # 35: Employer Pooling Program

Desired Impacts	Reduce congestion by encouraging ride-sharing
Problems Addressed	Peak hour congestion
Conditions for Application	a) Long commutes (more than 5 miles or 20 minutes) b) Employers or employment centers with more than 500 employees and regular working hours provide the best site for this action c) Management commitment to match carpoolers d) Limited transit service currently provided to employment site
Potential Implementation Problems	Management needs to establish and active, on going program to find new members for existing pools and encourage the formation of new pools
Evaluation Factors	a) Changes in hourly vehicle volumes entering or leaving center, or on key approaches, during commuting hours b) Changes in peak operating speeds in, near, or on approaches to center c) Changes in air pollutant emissions during peak periods d) Changes in peak ridership and revenue on routes serving center e) Changes in parking lot and garage patronage, revenues and operating costs f) Costs of implementing and operating the action

Table C-36
Profile # 36: Employer Subsidy of Transit Passes

Desired Impacts	Reduce congestion by encouraging mode shift from private automobiles to transit
Problems Addressed	a) High levels of congestion during peak hours b) Inadequate parking facilities c) Safety concerns at employment center access points
Conditions for Application	a) Commuters travel more than 5 miles or 20 minutes to reach the place of employment b) Potential travel time and travel costs savings significant enough to encourage mode shift c) Employment centers should be large enough to have an impact on traffic operation.
Potential Implementation Problems	a) Additional costs incurred by employers b) Private sector participation at a scale large enough to be significant c) Adequate and efficient transit service provided to and from employment centers d) Cost of program
Evaluation Factors	a) Changes in ridership on routes servicing employment centers b) Changes in vehicular speed and level of service on arterials providing access to employment centers c) Changes in vehicle throughput on arterials providing access to the employment centers d) Changes in parking use

Table C-37
Profile # 37: Speed Reduction

Desired Impacts	a) Improve safety for vehicular and non-vehicular traffic b) Reduce congestion by minimizing number of accidents caused by conflicts between vehicular and non-vehicular traffic
Problems Addressed	a) High number of accidents b) Unsafe conditions for non-vehicular traffic
Conditions for Application	a) High number of speed related accidents b) High number of non-vehicular traffic
Potential Implementation Problems	Enforcement
Evaluation Factors	a) Changes in average travel speeds along arterials b) Changes in number of accidents involving non-vehicular traffic c) Changes in vehicle throughput d) Changes in pollutant emissions

Table C-38
Profile # 38: Crosswalk, Sidewalk and Bike Path Width

Desired Impacts	a) Reduce congestion by minimizing number of accidents caused by conflicts between vehicular and non-vehicular traffic b) Improve capacity for non-vehicular traffic
Problems Addressed	a) High levels of congestion during peak hours b) High number of accidents c) Reduction in travel speeds due to impact of non-vehicular traffic on vehicular traffic
Conditions for Application	High number of non-vehicular traffic
Potential Implementation Problems	Right-of-way costs
Evaluation Factors	a) Changes in average travel speeds along improved arterials during peak periods b) Changes in number of accidents involving non-vehicular traffic c) Changes in vehicle throughput