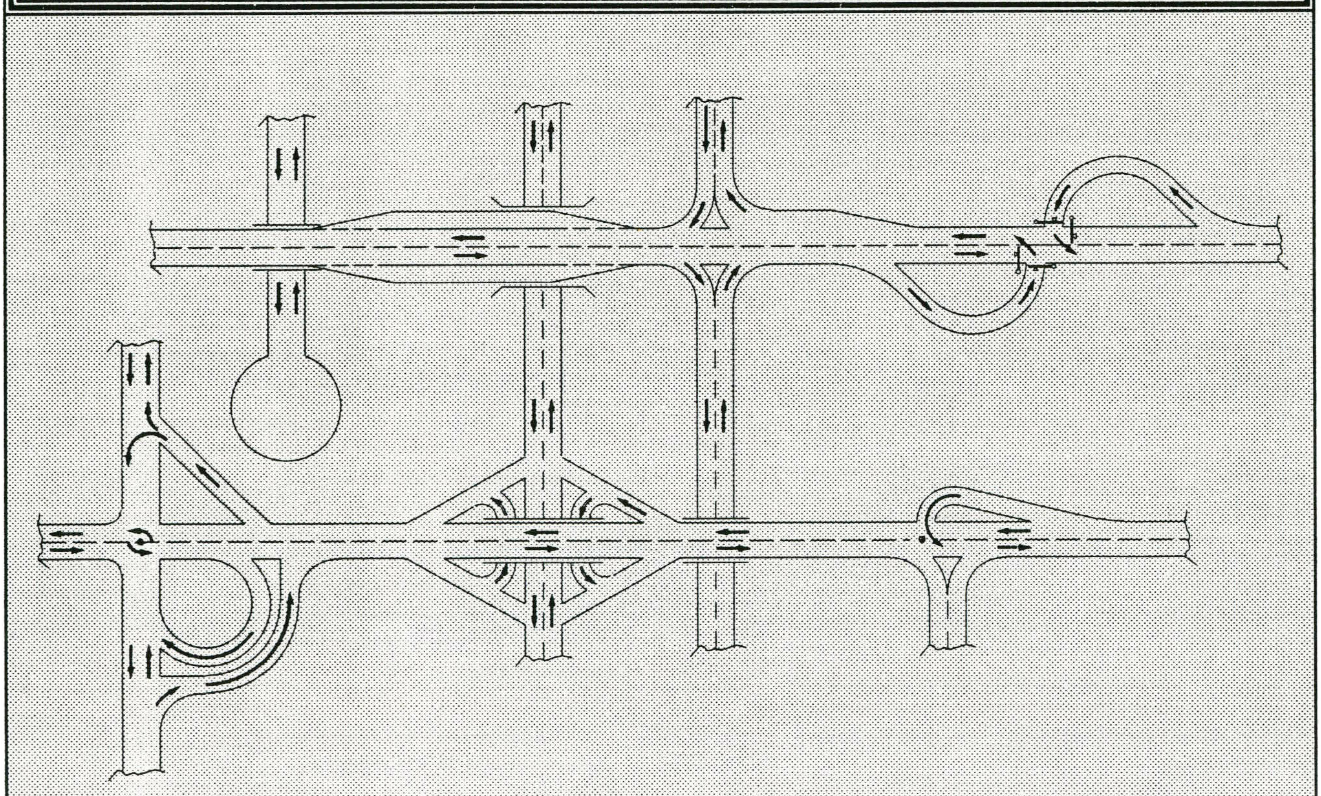
SUPERARTERIAL NETWORK STUDY

PROJECT NO. MPO-96-07

DADE COUNTY METROPOLITAN PLANNING ORGANIZATION

Technical Memorandum #2: Literature Review



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Superarterial Network Study
Dade County Metropolitan Planning Organization
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FIRST DRAFT

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February 1997

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1.INTRODUCTION

The purpose of this report is to summarize 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. For example, 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 report.

The last section of the report defines the Superarterial Network Concept and recommends improvement measures that could be used in Dade County.

2.OVERVIEW OF CONGESTION

2.1. Definition

Traffic congestion can be defined as a condition where the number of vehicles attempting to use a facilty 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.

As a result of the tremendous growth experienced by Dade in recent years, the existing and planned roadway system was unable to meet the transportation needs of the county. Since most of the growth occurred outside of the Central Business District, in the suburbs, people travel to and from locations dispersed throughout the County. A growing economy also translates into strong buying power which results in part in increase in car-ownership. The automobile, like in most other US urban areas, is the main mode of transportation. These are a few factors that contribute to increasing levels of congestion, and since these trends are projected to be even more pronounced in the future, the-County is then 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.

2.2. 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:

1. ***Local and Regional Impacts***
   When congestion occurs on a given roadway, the first impulse of the travelers is to find ways to bypass the congested area. This leads them into reaching for alternative paths, and frequently into residential neighborhoods or 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.

2. ***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.

3. ***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.

4. ***Safety***
   Accidents are more likely to occur on congested roadways where freedom to maneuver is severely restricted and drivers' frustration level is 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.

5. ***Environmental Quality***
The passage of recent laws such as the Clean Air Act demonstrate 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.

6. ***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 bottleneck areas, is often perceived as a prelude to increased crime activities in that area.

3. 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.

3.1. 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.

3.2. 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.

3.3. 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 van pools.

3.4. 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 para-transit. 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.

3.5. 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.

3.6. 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

3.7. 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.

3.8. 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 spacings, and separation of areas of conflicts between problematic traffic flows, and between vehicle and bicycle/pedestrian modes.

3.9. 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.

3.10. 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 widenings to previously constructed facilities and construction of new roads.

3.11. 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.

3.12. 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.

4.APPROACHES TO CONGESTION PROBLEMS

4.1. Local Approaches to Congestion Problems

Improvement measures undertaken by FDOT and the MPO to decrease congestion in Dade County include, among others, roadway widenings, 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:

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. A currently proposed corridor is 107th Avenue from Bird Road to SR 836.

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 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.

4.2. Nationwide Approaches to Congestion Problems

At the nationwide level, most counties apply methods similar studies to the ones mentioned above for 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.

4.2.1. 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 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 this freeway system 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 the arterials has been erroded 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 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 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 lane 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. This 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.

Figure 4.1 shows the proposed basic cross-section of a six-lane divided SAS. Figure 4.2 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 4.3 and 4.4 illustrate the operational movements to be expected along a SAS. Figure 4.5 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 4.6, 4.7 and 4.8 show layouts and approach cross-sections with right-of-way requirements for urban diamond-type interchanges constructed on minimum rights-of-way. Figure 4.9 is a layout similar to figures 4.6-4.7 with provisions for stage construction. Figure 4.10 shows construction of a diamond interchange at an intersection with minimum rights-of-way. Figure 4.11 illustrates a three-level interchange. Figures 4.12 and 4.13 show a type of directional crossover intersection design. Figure 4.14 shows a typical cross section an of arterial street overpass approach to diamond interchange.

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.

4.2.2. 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 form 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 is somewhere between a full freeway and a conventional arterial. These grade separations, referred to as flyovers, involve raising either through or turning lanes of an arterial over the signalized intersection. The simplest flyover 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 (flyovers)
- 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, 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 the 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.

4.2.3. 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 already planned.

The 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 accomodated. 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" (previoulsy shown on Figures 4. 5 and 4.6) type connector roads instead of a parallel frontage/connector road (previoulsy 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:

- 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 which would be needed for the super streets at selected loctions to accomodate 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.

4.3. International Approaches to Congestion Problems

At the international level, special attention was given to researching improvement measures being utilized in Europe 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.

4.3.1. 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 be accommodated. Congestion is prevented by avoiding unnecessary green phases and systematically monitoring all areas.

4.3.2. 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.

4.3.3. 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.

4.3.4. 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.

4.4. Alternatives Developed for Improving Arterial Flow

As seen from the previous studies, 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 rather than improvements that would result from policy changes, advanced technology applications, and public sector involvement. 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 sections illustrate the alternatives and approaches used in other areas.

4.4.1. Orange County, California

As part of the Super Street project, the Orange County Transportation Commission (OCTC) established a series of staged physical improvements for Beach Boulevard based on existing physical conditions, existing and projected traffic volumes, and land use. Each intersection along the 19.5 mile arterial was analyzed for a No-Build alternative plus three levels of improvements described below:

- Transportation System Management (TSM): this first level would include the following low-cost improvements: signal coordination, signal modification, signal optimization and intersection restriping.

- Moderate Level of Improvements: this second level would encompass intersection widening within the right-of-way available, parking turnouts, driveway consolidations, median closures, turning movement restrictions and minor roadway widening, in addition to the transportation system management improvements mentioned above.

- High Level of Improvements: this third level includes physical widening of the intersection where new right-of-way is required, and/or construction of roadway grade separations in addition to TSM and moderate level of improvements.

In 1988 The Orange County Transportation Commission (OCTC) and the Orange County Transit District (OCTD) established a new funding source for the Super Street Program. The two agencies agreed to transfer annually approximately $1.5 million in interest earned on reserve accounts for transitway developments to the Orange County Unified Transportation Trust Fund specifically for the Super Street Program. Three alternative strategies were developed for the estimated $7.5 million in available financing in 1989. The alternatives included: 1) program all available super street funding to Beach Boulevard until project is fully funded, 2) use future super street funding to make spot improvements over the entire 220-mile super street network, and 3) select a second super street corridor from the existing network and commence project studies. Strategy 3 was selected to preserve the integrity of the super street program and to maintain the corridor approach whereby a number of cities cooperate to provide regionally-significant transportation improvements to a single corridor. Members of the commission expressed reservations about moving to another super street project prior to Beach Boulevard being fully funded. However, designating all future super street funding to Beach Boulevard would not result in the project being fully funded due the high cost of acquiring some portions of the right-of-way. The Technical Advisory Committee suggested Beach Boulevard receive high priority of funding in the event a sales tax measure is successful.

OCTC staff recommended selecting a second super street corridor through a three-phase implementation approach. Phase I consisted of reducing the number of potential super street candidates from twenty-one to six or seven by eliminating those streets where construction costs for super street improvements clearly exceeded financing available (i.e. $7.5 million). Phase II would constitute a more thorough evaluation of the streets selected during Phase I, culminating with the Technical Advisory Committee recommending two finalists to the Commission for project study reports. Phase III would include the determination of the scope of improvements, preparation of conceptual design plans and provision of more detailed cost estimates for the two streets. Based on this results, the Commission would then select one of the two finalists as the next super street project.

Phase I has already been completed and approved by the Technical Advisory Committee. During Phase II, the OCTC staff evaluated each street in terms of its regional significance and potential as super street and forwarded the three highest rated to the Technical Advisory Committee: Katella Avenue, Moulton Parkway and Imperial Highway. The TAC considered this matter and unanimously recommended the commission to begin project reports on all three streets.

In January 1995, the Board of Directors requested that the three super street projects develop implementation plans to assist in the programming of all remaining super street program funds. In June 1996, the Orange County Transportation Authority (OCTA) received implementation plans for Katella Avenue, Imperial Highway, Moulton Parkway and a small remaining segment on Beach Boulevard. The total estimated costs of the Super Street Improvements in the four corridors is over $235 million. Because of limited funds, OCTA will have to select which Super Street segments receive funding. This process will be done based on the following approved criteria : cost benefit, project readiness and congestion reduction. Cities which provide additional local matching funding will enjoy a higher cost-benefit score. Once the criteria are approved, project evaluations will commence.

4.4.2. Harris County, Texas

Harris County uses a staged construction approach similar to that used by Orange County. By staging construction of the proposed improvements, provided that adequate rights-of-way are reserved, it is possible to adapt arterials to travel demand and land use development, reducing the risk of providing facilities before they are needed or cost-effective. Improvement measures include:

4.4.3. Proposed Alternatives for Dade County

Based on the extensive search conducted, 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
- 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 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.
- 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.

4.5. Testing of Recommended Altematives

This section summarizes the tools used in previous studies to measure and/or forecast the impact on implementing a superarterial network.

4.5.1. Harris County Strategic Arterial Street System

A county highway and street network was created to test the impact of the selected 492-mile superarterial network on the transportation system in Harris County. The speed on the arterials included in the network was increased by 5-10 mph in an effort to test the impact of the proposed improvements. The criteria for increasing the speed to test the superarterials in Harris County was based on the selection of a safe speed when traffic signals are present while still maintaining a lower speed from a freeway. The result of the model runs show an 8 percent reduction in the vehicles miles traveled (VMT) on the freeway system and a 36 percent VMT on the other arterials due to traffic being diverted to the improved superarterial system.

4.5.2. Orange County Super Streets

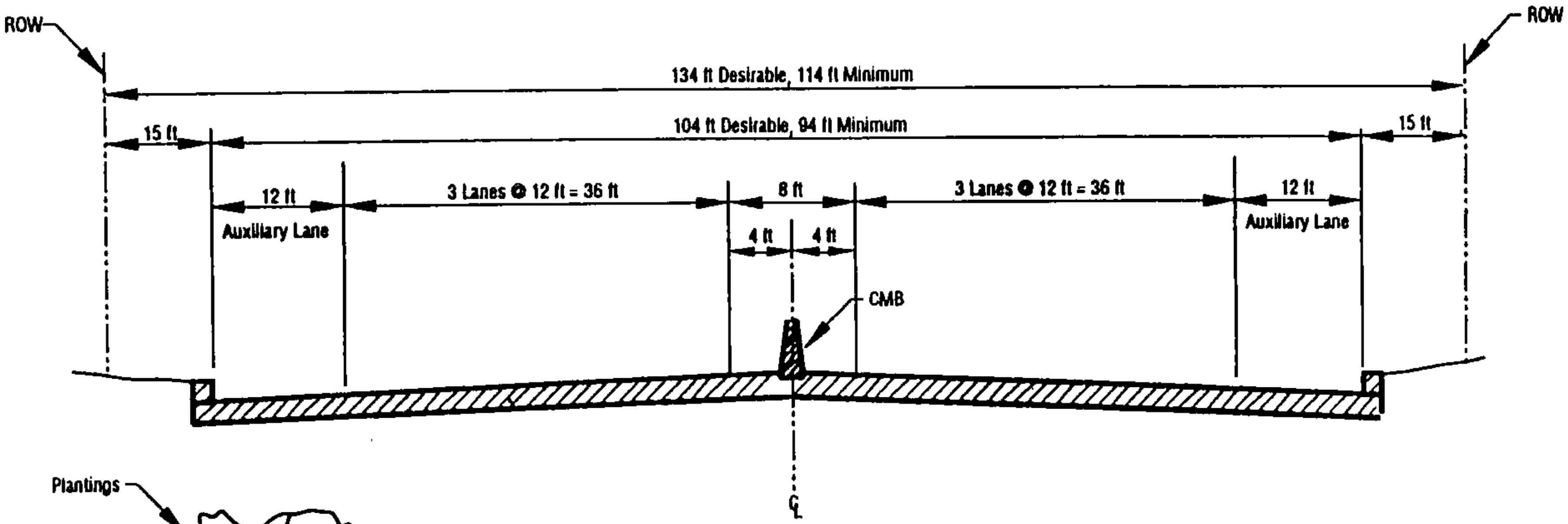
Because Orange County focused more on individual corridors rather than a network of corridors, they used a modified version of the Transyt6 traffic simulation model to test the corridor, system applications and effects of the superarterial concept in six case study locations within the county. Three different alternatives were evaluated to determine their relative effectiveness in improving arterial flow: signal optimization including coordination along a superarterial corridor, elimination of left turns with the utilization of vacated space as a through lane, and construction of a flyover.

Results from the California study indicate that elimination of left turns from an arterial will produce overall intersection improvements equivalent to a flyover. A flyover, however , will eliminate all delays on the elevated segment on the superarterial while elimination of left turn only reduces the delay by approximately 33 percent. While the elimination of left turns would improve the volume to capacity ratio between 10 to 20 percent for existing conditions, it will provide little reserve capacity to accommodate future growth. Signal optimization will reduce average intersection delays by 17 percent by permitting use of a shorter signal cycle length but will not increase capacity. Construction of a flyover accounts for a 300 percent increase in capacity in both directions on the superarterial, and a large increase in traffic could be accommodated before the at-grade intersection, above which the flyover passes, reached capacity.

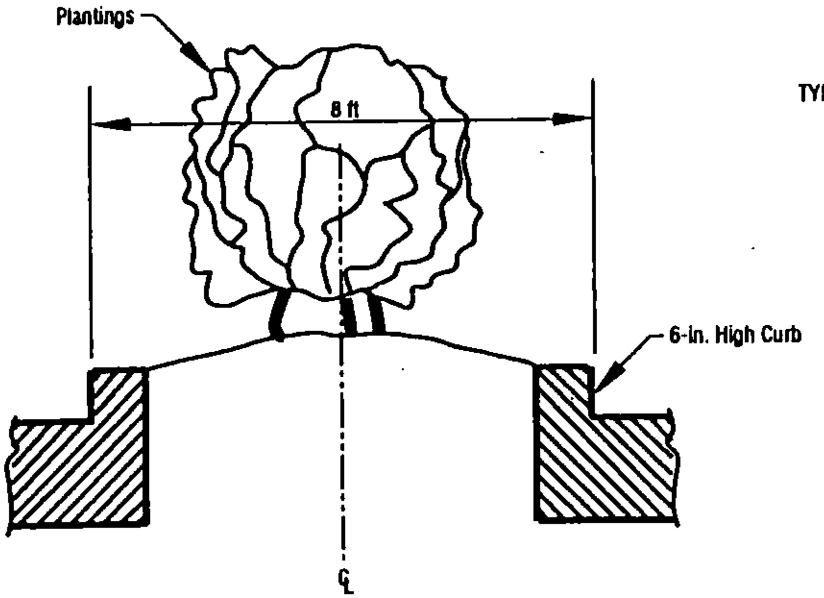
4.5.3. Mesa, Arizona Study

To measure congestion relief in the Mesa/Chandler study two MAGTPO transportation model runs were used. Changes were coded to the network to represent the Mesa/McQueen Corridor freeway and the Higley super street. No further information was supplied by the Mesa, Arizona study for the changes coded into the network for upgrading the selected roads from arterial to super street status A "free" assignment, a capacity restrained assignment, a selected link assignment, and a selected zone assignment were supplied by MAGTPO and used on the model runs. Upgrading Higley from a six-lane to a super street increases the projected 2015 daily traffic volumes from 30,000 to 50,000 based on the traffic assignment provided by MAGTPO. Most of the additional traffic on the Higley super street would be caused by longer trips attracted to the corridor by faster speeds and there would be little reduction in traffic on the parallel arterials. No formal estimate of traffic was made for the Mesa/Mc Queen super street. It is assumed that the volume would increase by 10,000 to 15,000 if it is developed into a super street with little diversion of traffic from the parallel arterials, as reflected in the Higley case. Vehicle speed used in the models were 55 mph for freeways, 40 mph for super streets, and 30 mph for arterials for off-peak travel times.

Figure 4.1



TYPICAL CROSS SECTION
(Not to Scale)

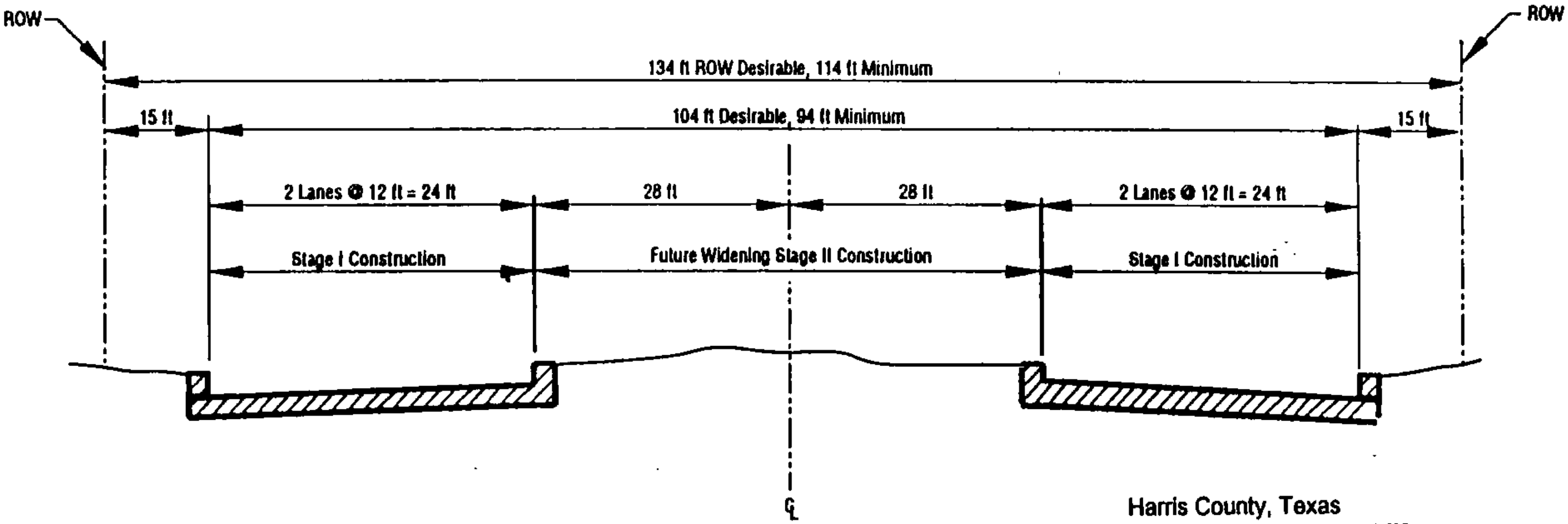


Alternate Median Design

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

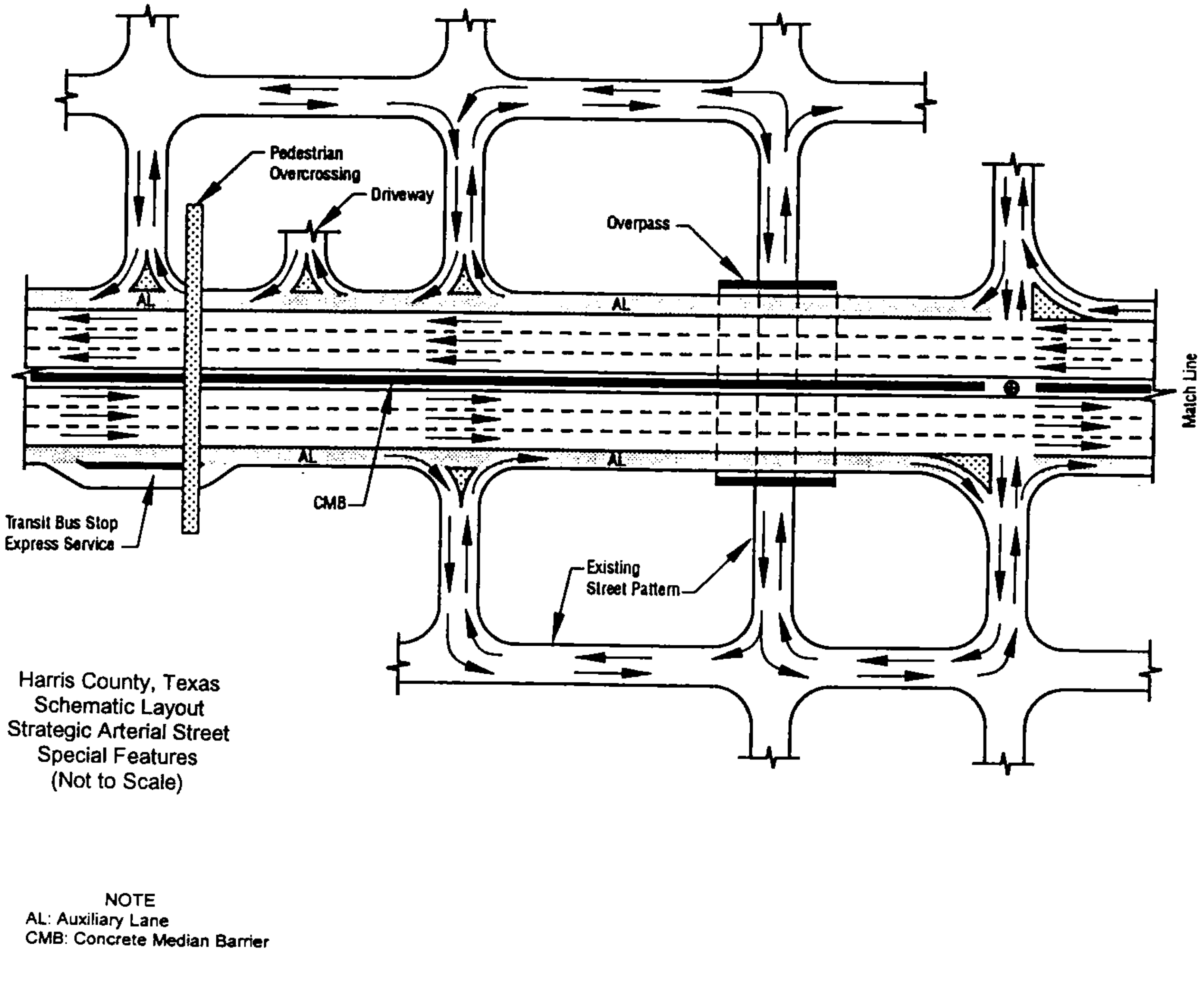
Harris County, Texas
STRATEGIC ARTERIAL STREET
(Left Turns Prohibited)
PROPOSED TYPICAL CROSS SECTION

Figure 4.2



TYPICAL CROSS SECTION
(Not to Scale)

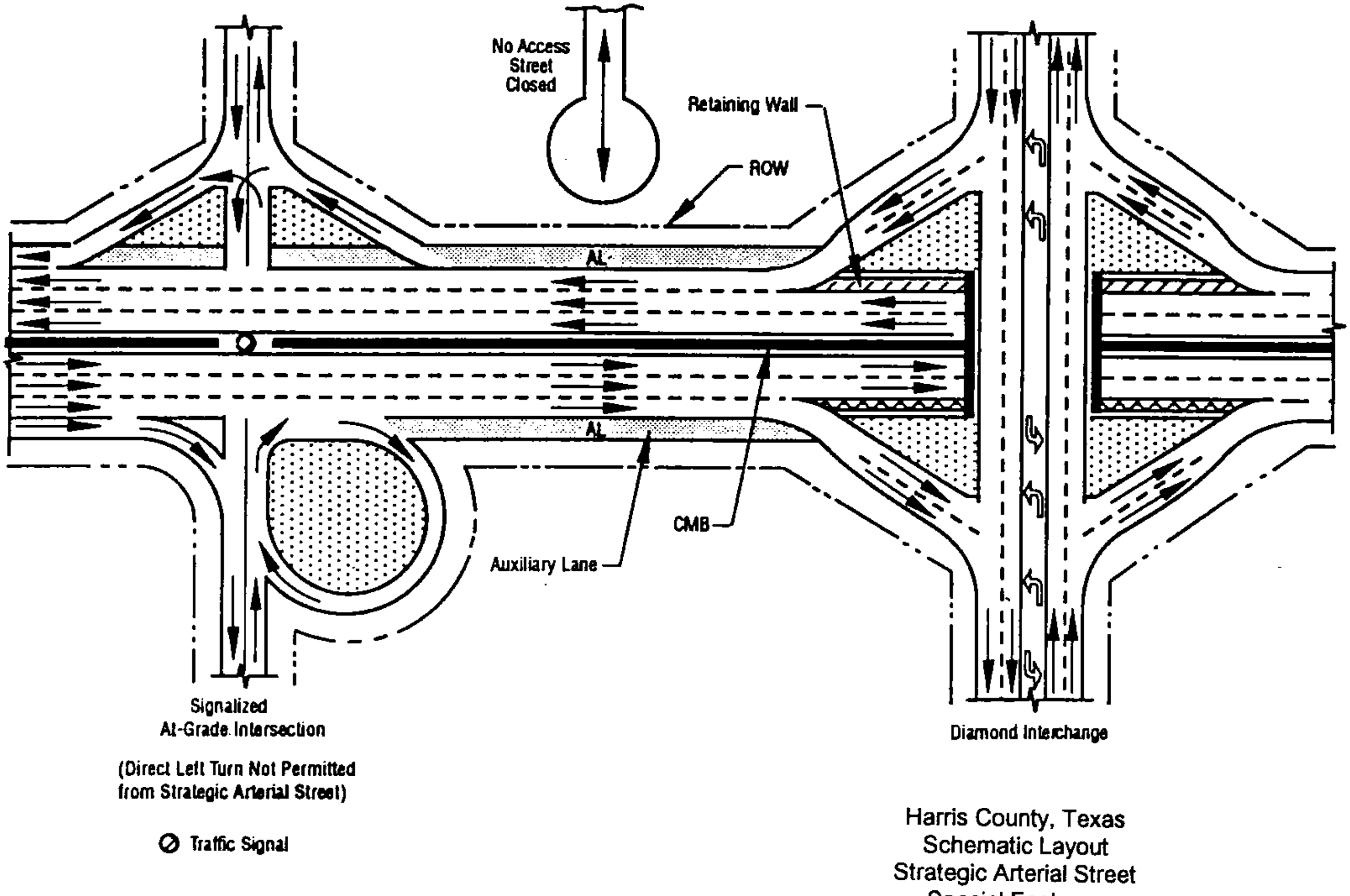
Harris County, Texas
STRATEGIC ARTERIAL STREET
(Left Turns Prohibited)
PROPOSED TYPICAL CROSS SECTION
STAGE CONSTRUCTION



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

NOTE
AL: Auxiliary Lane
CMB: Concrete Median Barrier

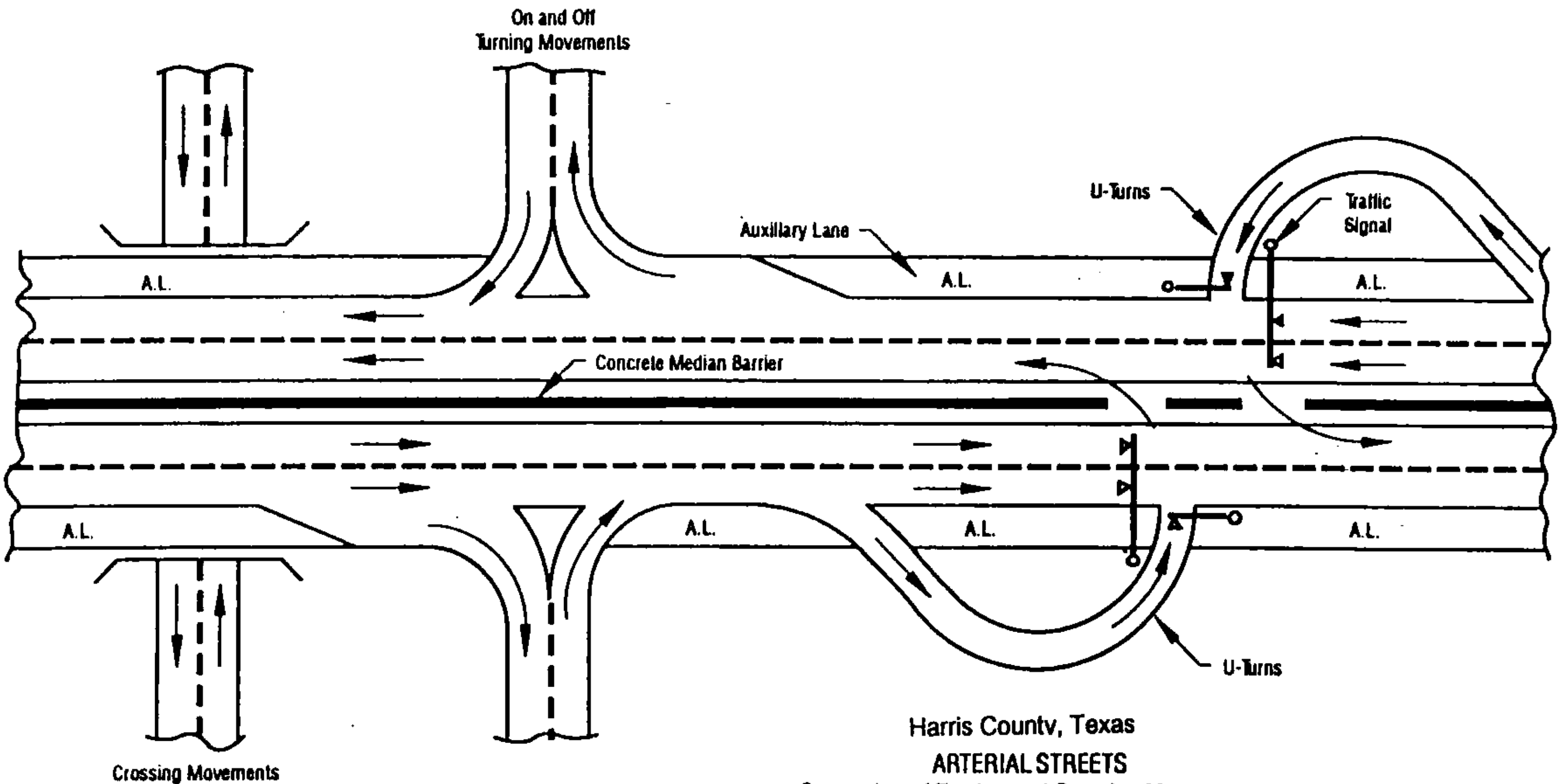
Figure 4.3



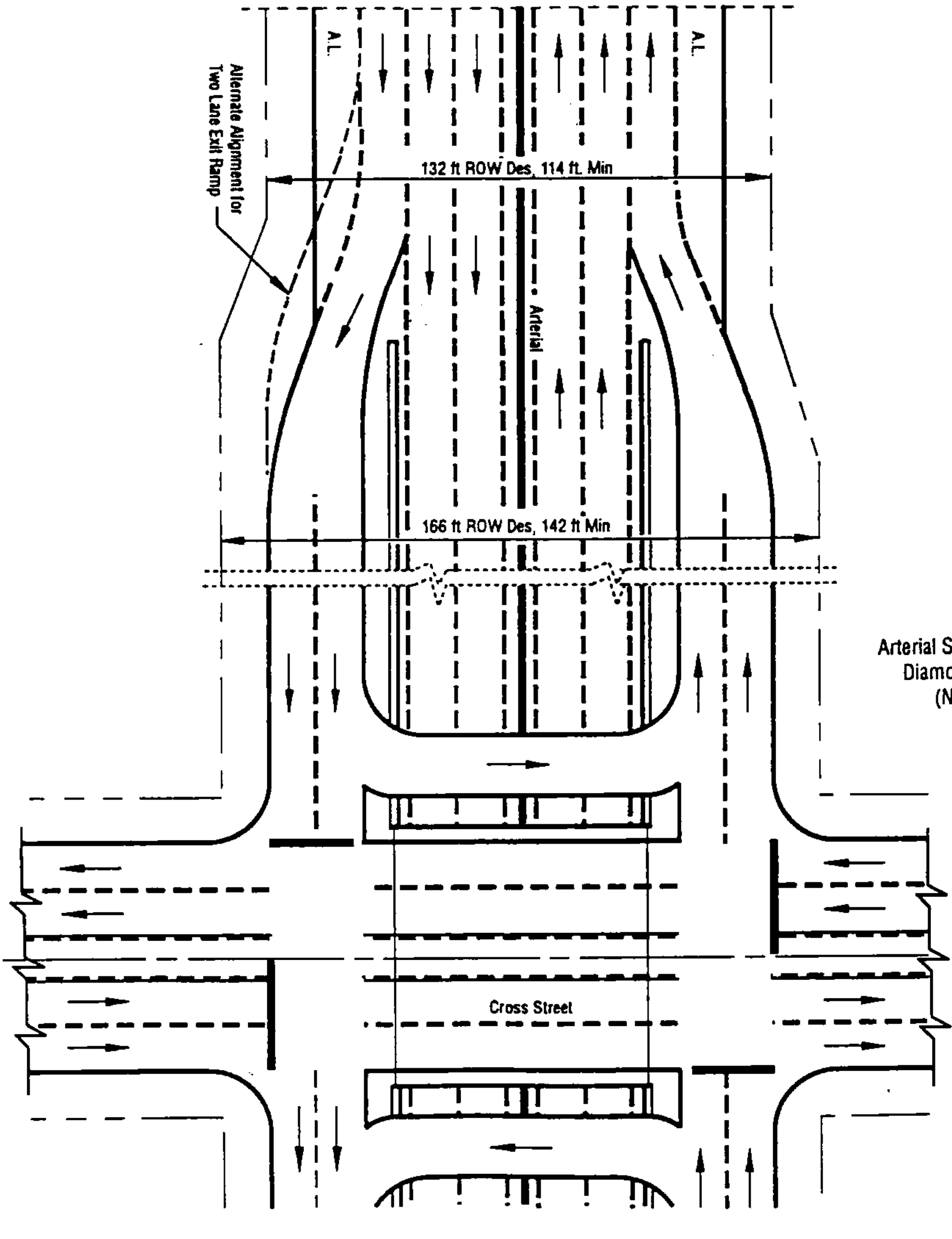
Harris County, Texas
Schematic Layout
Strategic Arterial Street
Special Features
(Not to Scale)

Figure 4.4

Figure 4.5



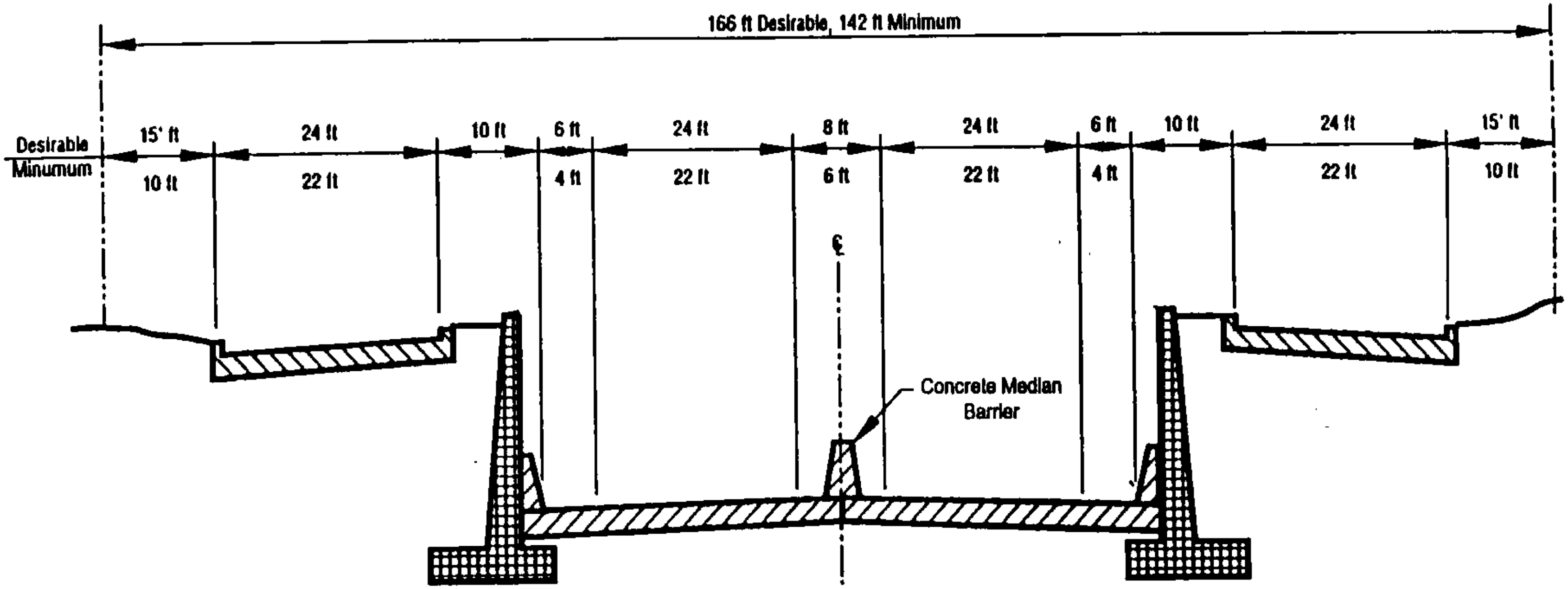
Harris County, Texas
ARTERIAL STREETS
Separation of Turning and Crossing Movements



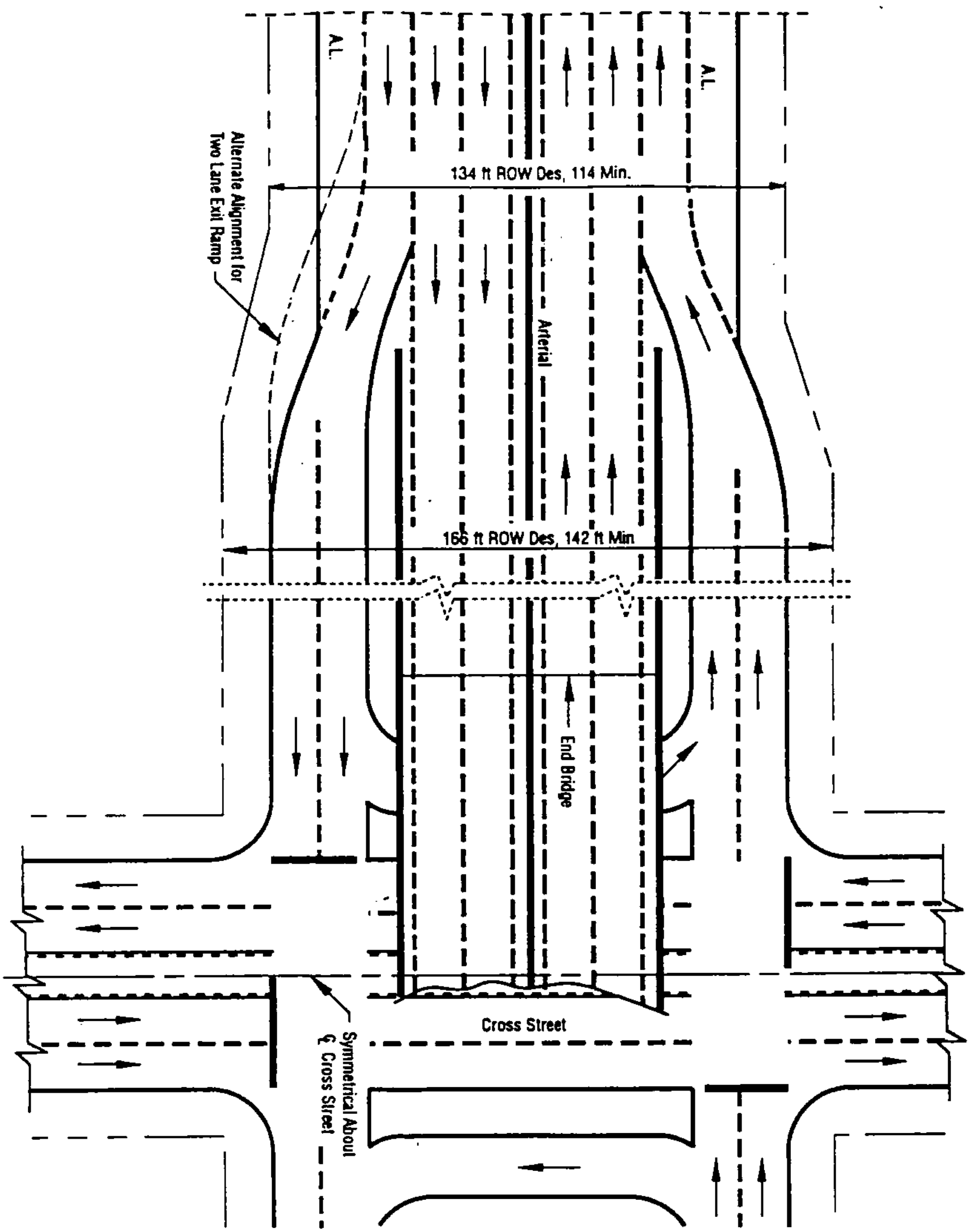
Half Plan
Arterial Street Underpass &
Diamond Interchange
(Not to Scale)

Figure 4.6

Figure 4.7

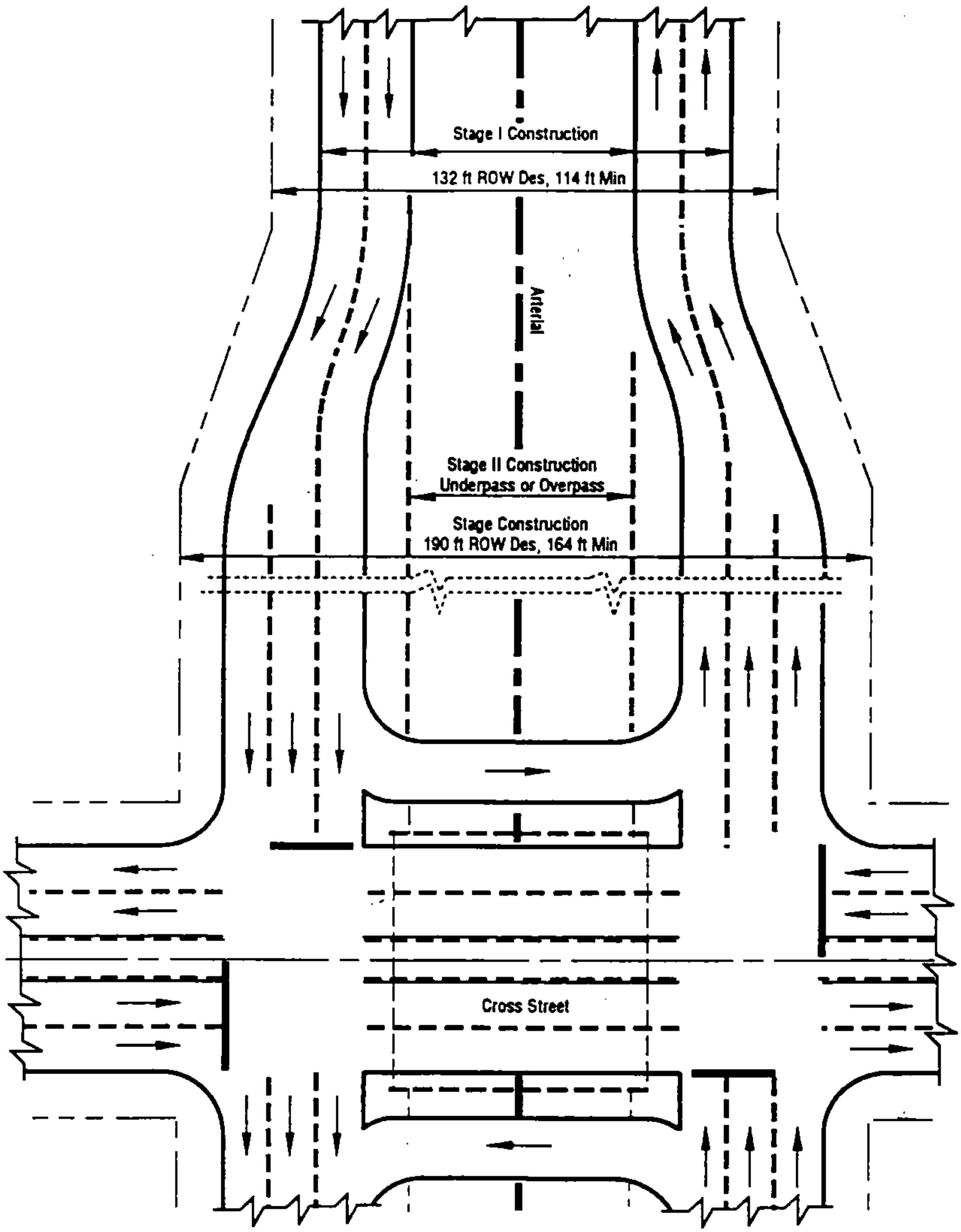


Typical Cross Section of Arterial Street Underpass Approaches to Diamond Interchange



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

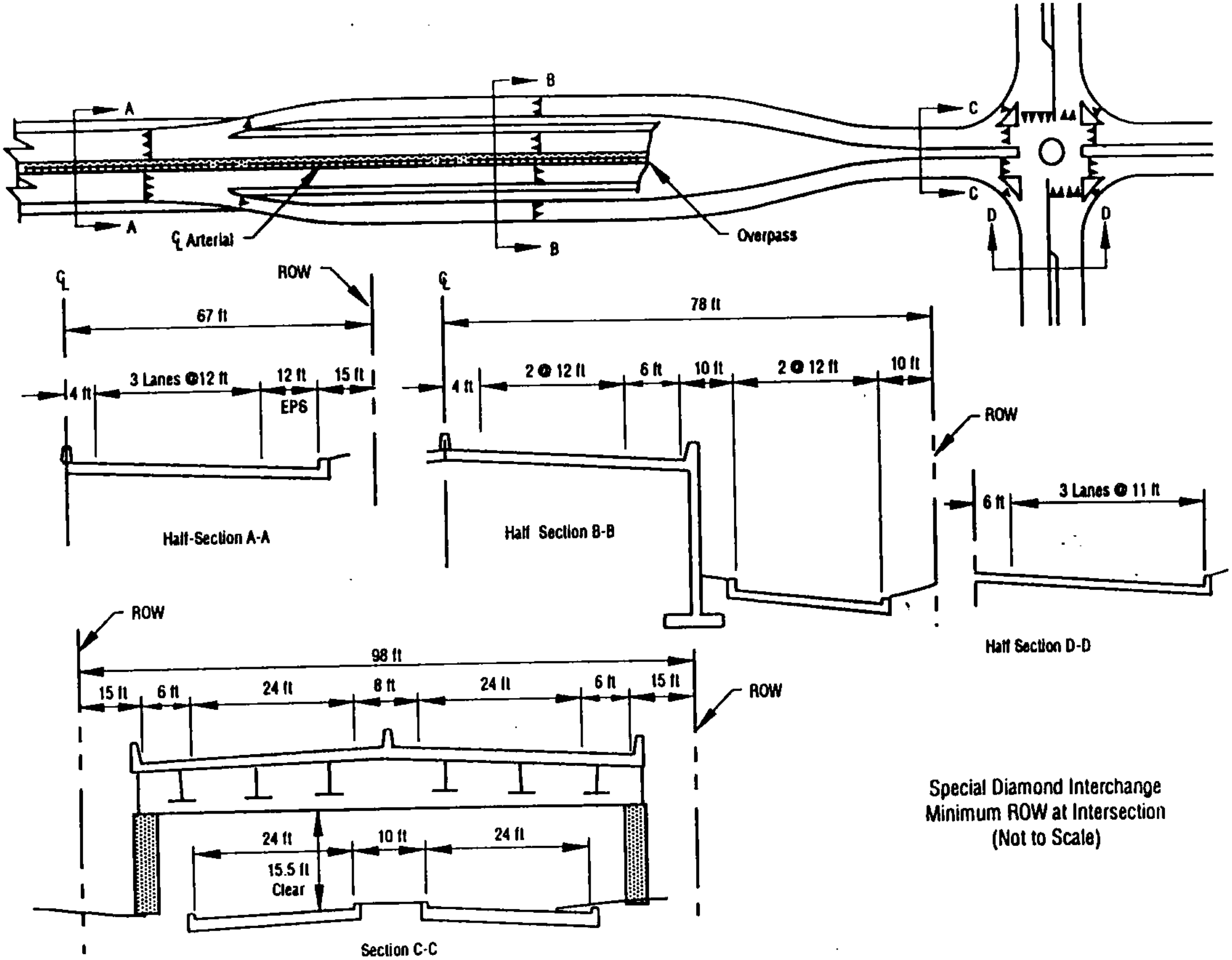
Figure 4.8



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)

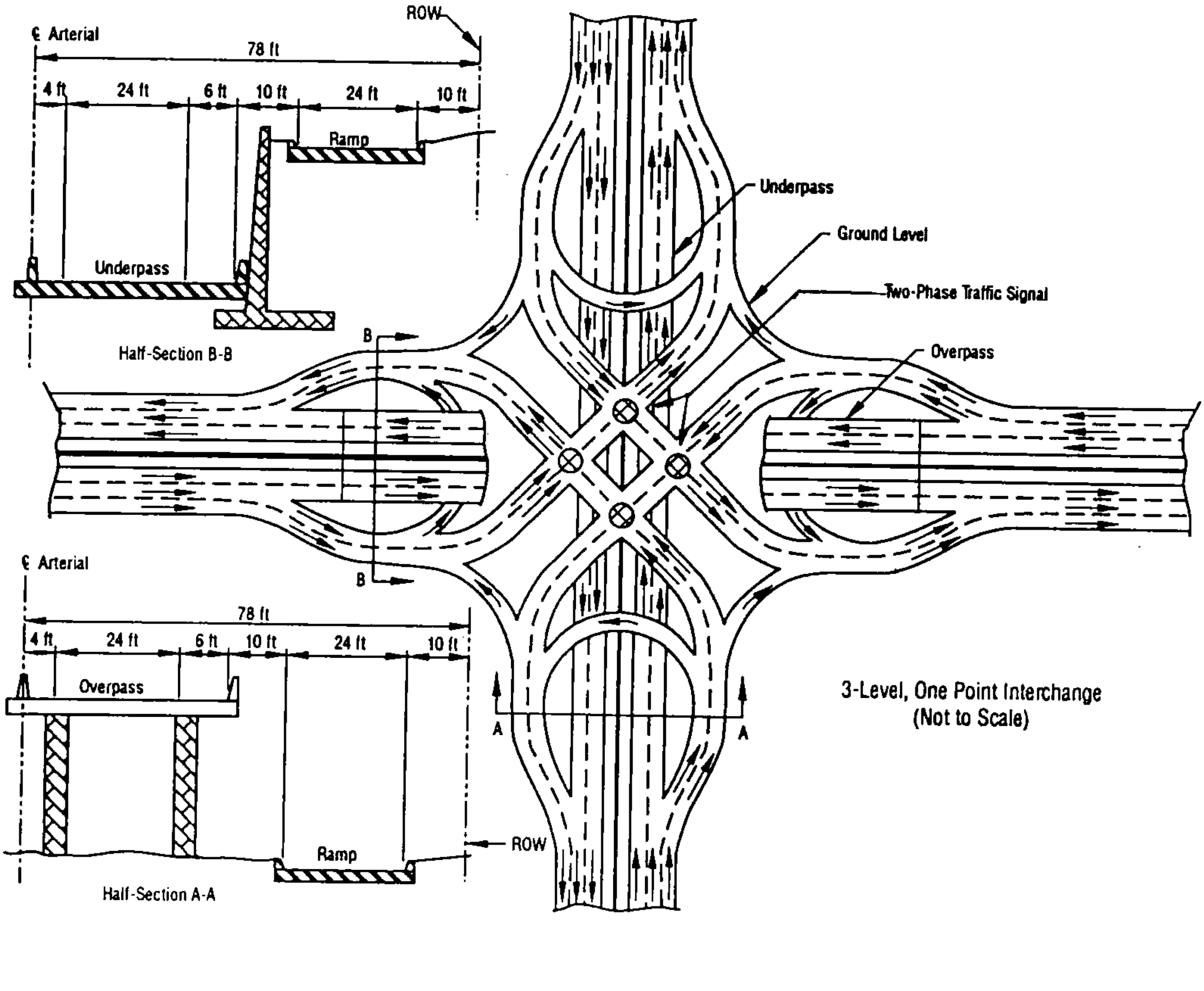

ROW
℄ Arterial
78 ft
4 ft
24 ft
6 ft
10 ft
24 ft
10 ft
Ramp
Underpass
Half-Section B-B
B
B
Underpass
Ground Level
Two-Phase Traffic Signal
Overpass
℄ Arterial
78 ft
4 ft
24 ft
6 ft
10 ft
24 ft
10 ft
Overpass
Ramp
ROW
Half-Section A-A
A
A
3-Level, One Point Interchange
(Not to Scale)

Figure 4.11

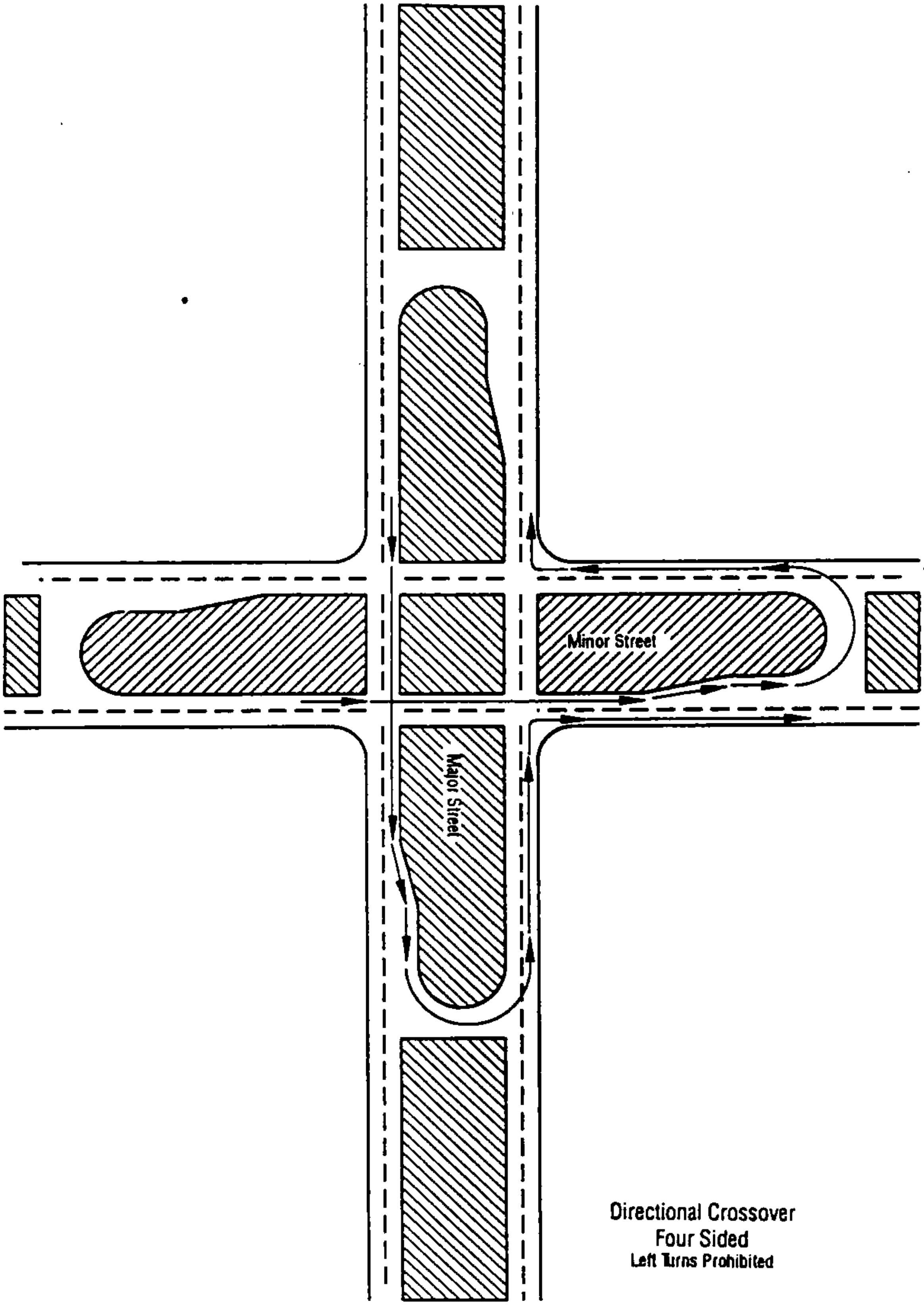

Minor Street
Major Street
Directional Crossover
Four Sided
Left Turns Prohibited

Figure 4.12

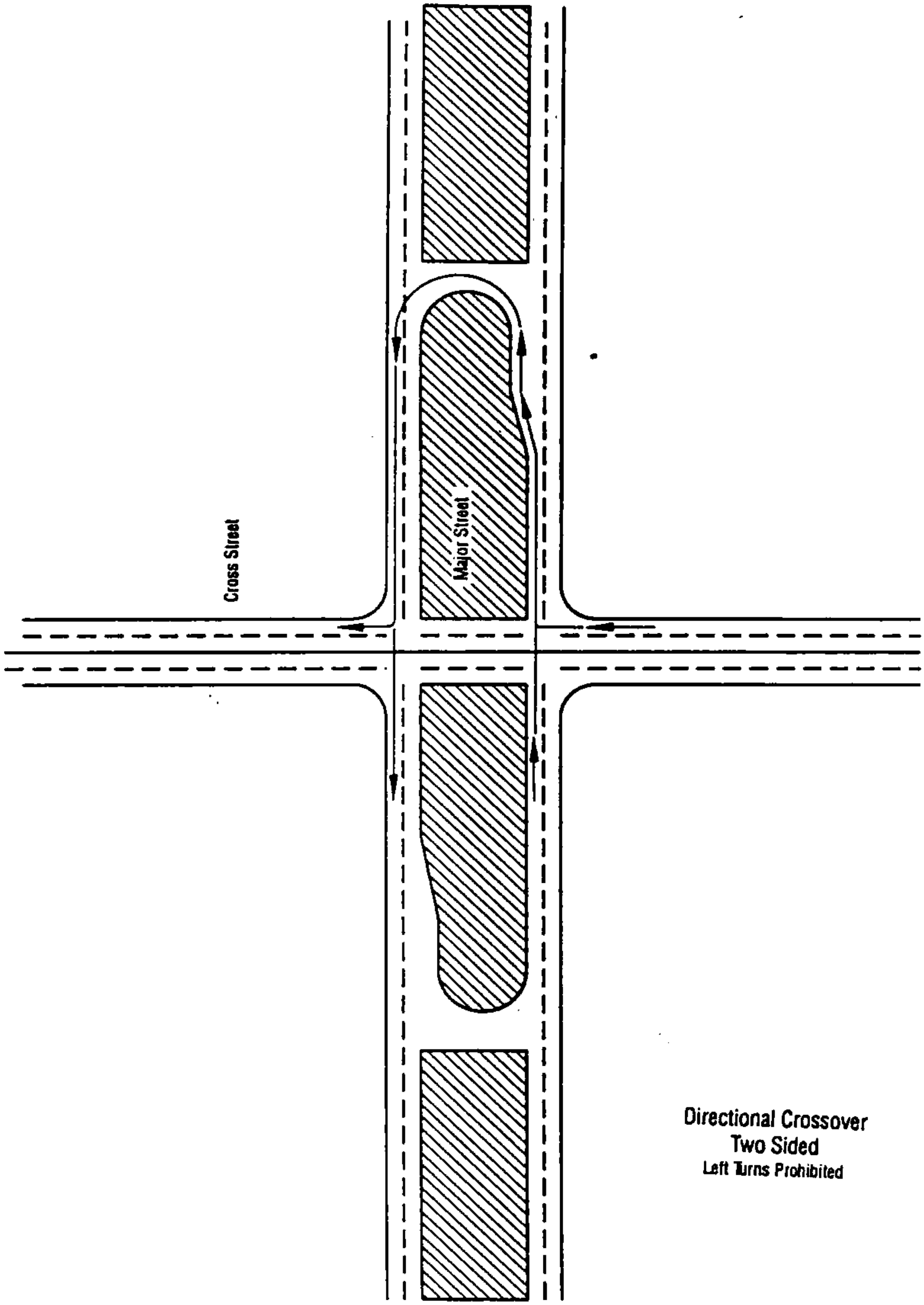
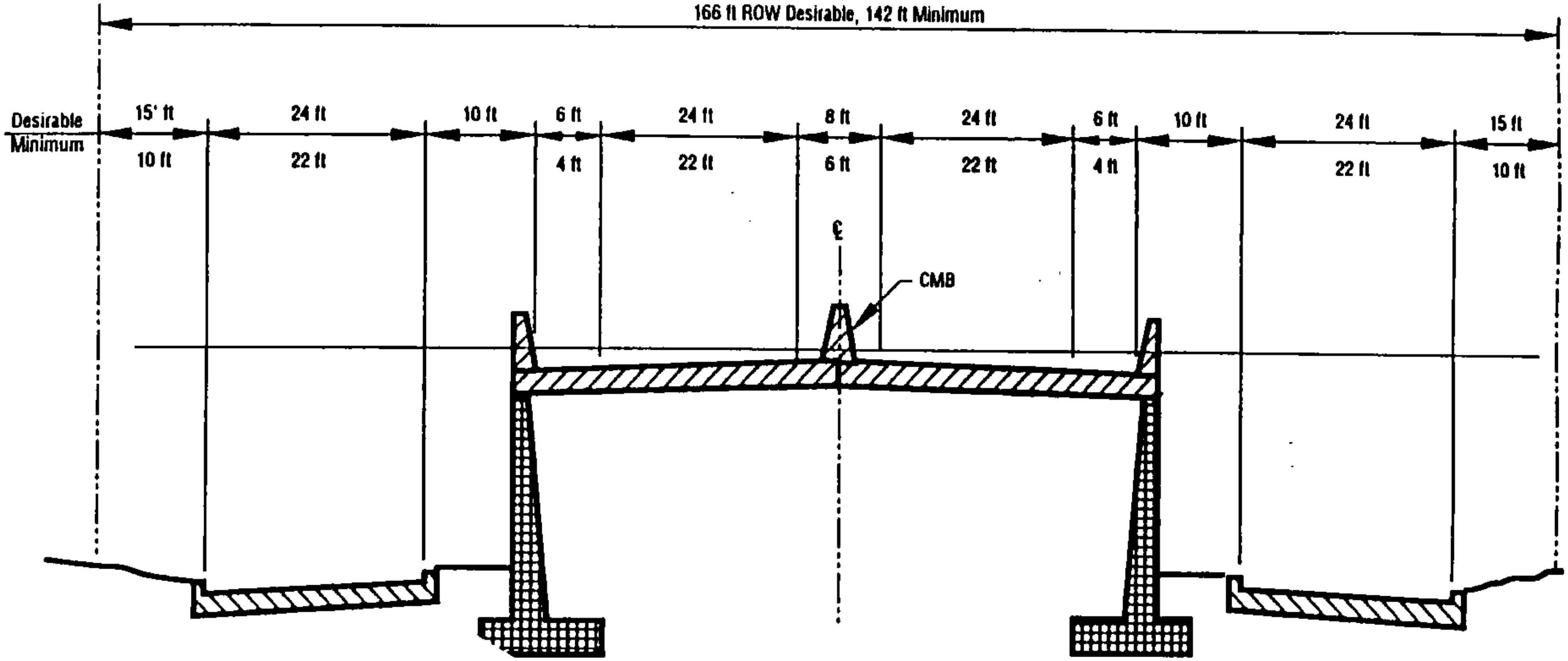

Cross Street
Major Street
Directional Crossover
Two Sided
Left Turns Prohibited

Figure 4.13

Figure 4.14



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

5.SUPERARTERIAL NETWORK CONCEPT

An arterial street is a major road that carries at least 7,500 vehicles per day, usually has four travel lanes with left turn provisions, and has the capacity to provide relatively uninterrupted (minimum number of traffic signals) long distance service through an urbanized area as well as provide access to adjacent developments. These arterials, by virtue of their location, attract commercial, residential and industrial developments due to their high visibility and easy access. Initially, a newly constructed or improved arterial will usually operate at a high level of service providing long distance (8 miles or more) through traffic service. As development proliferates along these streets, traffic increases, which in turn attracts more development. The carrying capacity of these roads diminishes with increasing congestion resulting from conflicts between turning vehicles (with unlimited access to and from the road) and through traffic. This process occurs naturally as urban developments mature and strip commercial developments are created, leading to an improper functioning of arterial streets. This results in an arterial street that operates at a less than optimum capacity and efficiency due to friction resulting from the conflicting service functions of land access and traffic movement.

5.1. Definition of Concept

All of the studies identified in the previous section 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 the years to 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 the cross-street
- Grade separation at critical intersections and at all railroad crossings
- Auxiliary or collector-distributor right lane 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, lower design speeds, partial access control, infrequent non-grade separated intersections, and lower right-of-way requirements for new alignments to accommodate the same number of lanes. Existing arterials can be upgraded to superarterials with minimum 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 the unacceptable travel speeds divert much more than a proportional share of short to intermediate 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.

The 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 constructed 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 to forego 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.

5.2. 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, social, political and ROW constraints). The Department of Transportation and the County were contacted to identify these arterials.
- Arterials with minimum continuos length of 4 miles
- Arterials with four lanes or more
- Arterials that provide direct access to an expressway
- Proximity 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 (incomplete networks)
- Arterial scheduled for improvements
- Congested arterials identified in the County Management System

The next phase of the project will involve selection of candidate facilities, and subsequent definition of the proposed superarterial network.

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