10.0 TRANSPORTATION

10.1 INTRODUCTION

The purpose of the Irving Thoroughfare Plan, as a component of the Comprehensive Plan, is to accommodate the existing and future roadway transportation needs of the City. The Thoroughfare Plan is one element of a coordinated transportation system to address the intermodal and multi-modal transportation needs of the City, while maintaining and improving the social, economic, and environmental quality of the community.

The thoroughfare system is one of the most visible and permanent elements of the urban structure. Once the alignment and right-of-way of major transportation facilities are established and adjacent property developed, it is difficult to obtain agreement to make significant changes to the system. Therefore, it is important that the City carefully evaluate its existing thoroughfare system with an eye toward preserving and enhancing its function. Because of increasing traffic congestion within the Dallas-Fort Worth Metroplex, the continued growth of Irving as an employment center will be dependent upon the integration of thoroughfares with other multi-modal transportation systems.

10.2 SYSTEM DEVELOPMENT

10.2.1 Function of Thoroughfare Planning

The Thoroughfare Plan defines a hierarchy of roadway functions that provide for both traffic movement and property access. The Plan also provides a clear statement of future roadway alignments, capacities (number of lanes), and right-of-way requirements within the City of Irving. It has been developed to support the Future Land Use Plan by providing adequate capacity to move both people and goods.

Thoroughfare Plan and Growth

The Thoroughfare Plan is the basic element for ensuring the orderly implementation of roadways in conjunction with economic growth and facilitates the preservation of right-of-way in the development review process. The Plan provides guidance for determining appropriate land uses by identifying the ultimate configuration of the network. It also provides a guide for the programming of projects and allows for a rational and systematic provision of capacity. The Plan should reflect

community goals; provide continuous routes; match expected land use patterns and characteristics; integrate with the regional freeway, expressway, and arterial system, as well as the plans of surrounding local jurisdictions; be sensitive to topographical features and constraints; and adapt to changing conditions.

Traffic Impact Analysis Process

In order to ensure that proposed land uses are compatible with the proposed roadway system and to help modify that system when necessary, a process of analyzing traffic impacts in conjunction with development proposals is recommended. This process should be conducted to ensure that adequate access is available for the proposed development; that sufficient roadway capacity exists to accommodate it; that the development is compatible with the characteristics of adjacent roadways; and to identify any improvements or modifications necessary to maintain mobility within the community.

Access Management

Managing access to arterial streets protects the public investment in roadways and ensures that the desire for access to private property is balanced with the mobility needs of the larger community. Safe and convenient access is in the interest of both the public traveling on a street and the needs of adjacent land uses. A system of roadway access management can promote both of these interests. Key objectives of access management include the limitation of the number of driveways; the encouragement of shared access drives between businesses, and a common circulation system within a cluster of businesses; and the incorporation of design features (such as left- and right-turn lanes and medians) which facilitate traffic flow.

Transportation System Management

Transportation management strategies focus on alleviating traffic congestion by allowing the existing transportation system to operate more efficiently and by reducing travel demand. Transportation system management (TSM) pertains to the management of roadway supply through the addition of high occupancy vehicle (HOV) lanes, intersection improvements, signal re-timing, sidewalk widening, traveler information systems (incident detection), etc. Transportation demand management (TDM) pertains to the alleviation of automobile traffic demand through enhanced transit and paratransit use, ridesharing, peak-spreading (flexible work schedules, staggered work hours, or compressed work weeks), and parking management. TDM programs are facilitated by Transportation Management Organizations (TMO) which are proactive and involve the private sector in addressing transportation problems and needs. TSM and TDM strategies are complementary and should be considered *before* undertaking capital-intensive projects.

Project Planning Coordination

Due to the shortage of public dollars for improvements to federal and state roadway facilities, it is critical that the City remain actively involved in the development of TxDOT, Texas Turnpike Authority, and other public and private roadway projects to ensure that areawide plans are coordinated with City planned roadways. In addition, future travel demand cannot be met by a transportation program limited to the construction of new roadways or the widening of existing facilities. Rather, a multi-modal system will be required which will provide alternative modes of travel to the private automobile. Therefore, the City should remain actively involved in the regional planning activities of DART and the Trinity Railway Express. With Irving emerging as a major business activity center, maintaining and enhancing traffic circulation will be vital to the economic health of the community.

Plan Update

The Thoroughfare Plan should be reviewed on a regular basis and updated to respond to changes in local conditions. As new information about prospective developments is obtained, the Plan should be refined to maintain a balance between public mobility and neighborhood integrity throughout the community.

The major benefits provided by the Thoroughfare Plan include:

- minimizing the amount of right-of-way needed in advance of new development, or as it occurs;
- designing roadways that will stabilize traffic and land-use patterns;
- limiting the potential for high traffic volumes on neighborhood streets;
- anticipating when funds must be programmed for needed roadway improvements; and
- reducing the potential deterioration of economic growth due to increased traffic congestion.

Five elements form the framework of an effective Thoroughfare Plan:

1. A long-range Plan that addresses projected growth.
2. A process to review the traffic impacts of new developments.
3. Implementation of access management and Transportation System Management programs.
4. Coordination with regional and state (Texas Turnpike Authority, TxDOT, Dallas County, DART) planning programs.
5. A process for updating/revising the Plan as conditions warrant.

10.2.2 Thoroughfare Planning Process

Several elements must be considered in the process of developing a Thoroughfare Plan, including the Future Land Use Plan, travel demands, movement and access requirements, and physical constraints to roadway construction. The type of land uses that are existing and planned for an area affect the roadway capacity and access needs for that area. For example, a densely developed commercial or office area with higher travel demand will require more closely spaced roadways with greater capacity than will a low density residential area. Moreover, special efforts will be required in the thoroughfare planning process to ensure that the integrity of residential neighborhoods is protected from unwanted and undesired vehicular traffic.

Balancing the movement and access functions of the thoroughfare system is another consideration in the planning process. Roadways serve two competing functions: the movement of traffic and access to properties. A conflict exists as ingress and egress maneuvers from local properties impede the movement of traffic on major roadways, and as high traffic volumes impede turning movements in and out of driveways. Controlling access so that these two competing functions occur on separate sections of the thoroughfare system is a primary objective of the process.

Finally, review and comment by government decision makers, civic and neighborhood interest groups, and the citizenry in general is one of the most important steps in the planning process. No planning can be successfully implemented without the input from, and support of, these groups and individuals, as they will ultimately determine the balance between maintaining mobility and neighborhood integrity.

One of the key analytical tools used in the preparation of most Thoroughfare Plans is a travel demand forecasting model. Currently, long range travel projections for the Metroplex are prepared by the North Central Texas Council of Governments (NCTCOG). To develop more detailed traffic forecasts for roadways within the City of Irving, the Traffic and Transportation Department initiated the development of a subarea model. This model uses the basic modeling procedures of the NCTCOG to maintain consistency in the traffic forecasting process, but focuses on the Irving area rather than the region as a whole. An overview of this process is described in a later section of this report. As with the NCTCOG regional model, the Irving model uses employment and population data based on the Future Land Use Plan prepared as a part of the comprehensive planning process.

10.3 EXISTING CONDITIONS

10.3.1 Overview of Existing Conditions

The initial step in the development of the Thoroughfare Plan was a complete assessment of the existing conditions of the transportation system. This assessment was prepared as part of the Baseline Analysis report submitted earlier in the process. In that analysis, three topic areas were addressed: the existing transportation framework, work travel characteristics, and factors influencing growth in future travel demand. A synopsis of conditions and issues is provided below.

Irving's existing transportation network is comprised of two distinct city-wide functional systems: the regional freeway network and the local arterial roadway network. Seven different freeways within Irving serve regional access throughout the Metroplex. These are IH 635, SH 114, SH 183, SH 161, SH Loop 12 and SH Spurs 348 and 482. Additionally, Irving is within close proximity to several other major regional facilities (IH 30, IH 35E, SH 360 and SH 121).

Within Irving, a network of arterial and collector roadways provides for vehicular traffic movement throughout the City. North-south movement is accommodated via Belt Line Road, MacArthur Boulevard, Valley View Lane, Esters Road, Story Road, and O'Connor Road/Boulevard. Of these, Belt Line and MacArthur serve as spines that provide cross-town circulation. East-west circulation is provided via Irving Boulevard, Shady Grove Road, Pioneer Drive, Rochelle Road/Boulevard, Northgate Drive, Walnut Hill Lane, and Royal Lane.

Traffic congestion in Irving has approached critical levels, particularly on the freeway system. Over the last 10 years, area freeways have experienced increases in traffic volumes ranging from 6-117%. The largest increases have been on SH 114 (82-117%), IH 635 (100%) and SH 183 (33-62%).

There are also several arterials within Irving that are experiencing moderate to heavy congestion during peak hours of operation. These include Belt Line Road, between Story and Pioneer, and most interchanges with SH 183, SH 114, and SH Loop 12. Map 8 illustrates current congestion areas.

Most of the arterial roadways within the City currently have either four or six lanes. The major roadways that have only a two-lane cross-section include portions of O'Connor Road/Boulevard, Rochelle Road/Boulevard, Pioneer Drive, and Nursery Road. The roadway rights-of-way vary according to location. Generally, in south Irving, rights-of-way vary between 60 and 100 feet because of preexisting adjacent development. In the more recently developed areas toward the north, right-of-way is typically 80 to 120 feet due to upgraded roadway standards.

Travel characteristics data compiled by NCTCOG have been reviewed to determine the distribution of work trips that travel to, from, and within Irving. The data show that 24% of the daily work trips are made by Irving residents to employment locations within Irving, 43% are imported to Irving, and the remaining trips (33%) depart Irving daily for destinations in other cities. Of trips originating in Irving, 40% remain in Irving while 34% depart for Dallas. Of trips destined for Irving, 16% and 11% are imported from Dallas and Arlington/Grand Prairie, respectively. Journey-to-work data indicate significant interaction between Irving and Dallas. With the SH 183 and SH 114 travel corridors exceeding capacity at current employment levels, the traffic impacts on the area freeway infrastructure associated with future employment growth within Irving will be significant.

Growth in Irving is influenced by current development trends, roadway initiatives for improvements, and transit initiatives for increased mobility. Regionally, DFW International Airport serves as a catalyst for economic growth in Irving. DFW, coupled with downtown Dallas and the emergence of Las Colinas as an economic center, make the SH 114/IH 635 corridor attractive for continued development.

High growth areas within Irving include Las Colinas, particularly in the Urban Center and along the SH 114 corridor, Valley Ranch, and the SH 161 corridor. The Urban Center currently employs nearly 30,000 persons. Based on the remaining land capacity for the Urban Center alone, the potential for growth could surge from three to five times that of existing levels. Approximately 28,000 persons are employed in developments along the SH 114 corridor. With several large tracts of land available, continued growth is likely. Other potential developments include the airport expansion zone; expansion of Texas Stadium by 40,000 seats; special generators in the Regional Activity District, such as a theme park near Texas Stadium; regional retail/commercial activity at the IH 635/SH 161 interchange area; commercial-related uses in south Irving in conjunction with the Lone Star Race Track in Grand Prairie; and the location of a major retail center at the IH 635/MacArthur interchange area.

Roadway initiatives contribute to development pressures on the roadway network by enhancing system capacity. Current roadway initiatives include City, County and State, and DART Transit Pass (Principal Arterial Street System) projects. Among the more significant projects are O'Connor Boulevard (SH Spur 348 to SH 161), Valley View Lane (SH 183 to Walnut Hill), Belt Line Road (Rock Island to south city limits), Belt Line Road at the Trinity Railway Express, MacArthur Boulevard (Oakdale to south city limits), Rochelle Boulevard (O'Connor to Leone Drive), County Line Road (SH 183 to Valley View), Las Colinas Boulevard (Royal to SH 161), Colwell Boulevard (Royal to Buffalo), and the recently completed MacArthur Boulevard (Royal to IH 635) and SH 161 frontage roads (O'Connor to IH 635). The Baseline Analysis report identified the specific locations of current transportation improvement projects (plate 27, page 138).

Several transit initiatives will serve to provide increased transit opportunities from and within Irving. With continued employment growth in north Irving, the potential exists for a reverse commute. Transit initiatives will serve to supplement the roadway network by providing alternative travel modes to commuters. Transit initiatives include the impending operation of the Trinity Railway Express from Dallas to the south Irving transit center; continued use of existing local DART bus service, express service, and park-and-ride facilities, and potential service to DFW Airport from north Irving; commuter rail service to the north Irving transit center; and the potential revival of the fixed guideway Las Colinas Area Personnel Transit (APT) for use within the Urban Center and to potential remote parking facilities.

10.3.2 Issues/Concerns

Several issues and concerns identified as part of the scoping interviews and Baseline Analysis are addressed in the Thoroughfare Plan. These are as follows:

- The need for east-west routes other than SH 183.
- Access to Las Colinas/Urban Center.
- Improvements to the Texas Stadium area.
- Access improvements from SH 183 to the Trinity Railway Express.
- Realignment of Hunter-Ferrell Road.
- Realignment of Valley View Lane.
- Traffic impacts of the proposed racetrack.
- Improved circulation at Irving Mall.
- Traffic impacts of a major retail center at IH 635/MacArthur Boulevard intersection.
- Additional access to Valley Ranch.

Of equal importance is the preparation of a Plan that will address changing commuting patterns. A report published by the Eno Transportation Foundation entitled *Commuting in America, II* examined population patterns and trends relative to commuting on the basis of 1990 census data. The study found that commuting patterns have changed due to the growth of the labor force as well as the continued suburbanization of metropolitan areas.

Americans increasingly prefer driving to work rather than using public transportation. The growth rate in the number of vehicles has outpaced that of population over the last decade. While population has increased by less than 10%, the number of vehicles has increased by more than 17%.

The report also found that 42% of the nation's jobs in 1990 were located in the suburbs, up from 37% in 1980. Reverse commuting (city to suburb) rose substantially, while traditional commuting (suburb to city) decreased. Single occupant private vehicle users increased by over 22 million, even though the number of workers increased by only 19 million. Fewer than 1 in 10 cars destined for work trips had an occupant other than the driver, while public transit was used by approximately 1 in 20 persons. On the basis of these trends, it will be necessary to maximize the efficiency of the existing street system, as well as to provide new roadways and alternative modes of travel. Only through a comprehensive approach can a Plan be developed that will sufficiently meet future travel desires, provide economic benefits for the community, and be compatible with other elements of the urban environment.

10.4 THOROUGHFARE PLAN DEVELOPMENT

Functional street classification and travel demand forecasting model development and application are two components of the Thoroughfare Plan development process. Functional classifications reflect the role or function that individual roadways are intended to serve within the overall system. The travel forecasting model assists in evaluating improvement alternatives by providing future travel forecasts for the local and regional transportation networks, thereby enabling a Plan to be developed that can adequately serve projected traffic demands.

10.4.1 Functional Street Classification

Functional street classification recognizes that streets are part of a system having diverse origins and destinations. A typical trip involves the following stages: primary movement, transition, collection/distribution, access, and termination. Functional classifications also describe and reflect a set of characteristics common to all roadways within each classification. Functions range from providing mobility for through traffic and major traffic flows to providing access to specific properties. Characteristics unique to each classification include the degree of continuity, general capacity, and traffic control characteristics.

The road system within a community can be divided into four general classifications based on a hierarchial function. These include:

Freeways/Expressways: High capacity facilities with controlled access. They are intended to carry high volumes of longer distance trips, and are a regional supplement to the arterial system. Freeways differ from expressways in that access is more restrictive in nature.

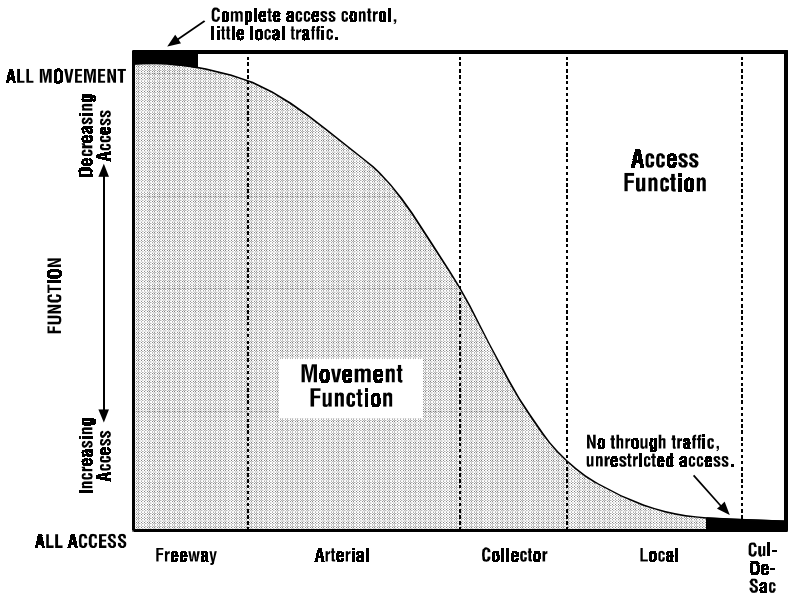
Arterial Streets: Facilities which are used to move large volumes of through traffic at relatively high speeds throughout the community. Arterial streets are more or less continuous throughout the community and their primary function is to provide movement of traffic. Property access is a low priority function.

Collector Streets: Those streets which are used to carry moderate amounts of traffic volumes and provide limited access to adjacent properties. Their function is to collect and distribute traffic to and from local and arterial streets. Collectors supplement the arterial system and should not be continuous for long distances.

Local Streets: Those streets which are used for low volume, low speed traffic movements. Their function is to provide direct access to adjacent properties.

In short, the functional classification of streets provides for the circulation of traffic in the hierarchy of movement from one classification to the next. Functional change can be subdivided further into major or minor designations to further describe their role in the community. For each classification there is typically a recommended set of operational and design criteria. Thus, facilities are grouped according to the character of service (movement or access) that they are intended to provide. Figure 16 illustrates the relative roles of each classification to achieve its intended function.

FIGURE 16 ROADWAY FUNCTION BY CLASSIFICATION



Ideally, neighborhoods should be developed between arterial streets so that traffic is routed around and not through these areas. Collectors should penetrate the neighborhoods to collect and distribute traffic, but not provide convenient cut-through routes. Land use planning efforts should attempt to encourage compatible land uses adjacent to streets. Commercial activities should be developed in such a way that the primary mobility and function of arterials is not degraded through access management. Wherever concentrations of traffic occur on collector streets, consideration should be given to prohibiting homes from fronting on such streets.

Table 7 describes the most important characteristics of street functional classifications. The arterial and collector classifications have been divided to include major and minor subclasses. These planning guidelines should be utilized, particularly in developing areas, to form a basic framework for the thoroughfare system. In developed areas, special conditions may exist whereby these planning guidelines may not be adapted. Also included is information on the typical level-of-service each roadway class is intended to provide. Level-of-service refers to a measure of capacity that a section of roadway or intersection can accommodate during peak traffic conditions. It is defined in terms of delay with six categories ranging from "A" through "F" being assigned to reflect the relationship between the design capacity and the traffic demand upon a particular segment. As demand approaches capacity, the level of service decreases. Table 8 provides definitions of roadway condition levels-of-service that generally apply to the different roadway function classifications.

While the above described conditions are ideal, it may not be practical or even possible to modify the existing streets in already developed areas to conform to the desired design standards for all the street functional classifications. In cases where neighborhood areas are bisected by major roadways, alternative cross sections may be applied to assure that neighborhood integrity is preserved while providing traffic access.

TABLE 7 ROADWAY FUNCTIONAL CLASSIFICATIONS AND GENERAL PLANNING GUIDELINES

Classifications	Function	Continuity	Approx. Spacing (Miles)[1] Spacing	Direct Land Access (veh./day)	Minimum Roadway Intersection (mph)	Volume Ranges	Speed Limit	Typ. LOS	Parking	Comments	Irving Example
Freeway and Expressway	Traffic movement; long distance travel.	Continuous	4	None	1 mile	45,000 to 150,000+	55 - 70	D-E	Prohibited	Supplements capacity and arterial street system and provides high speed mobility.	IH 635 SH 183 SH 114 Loop 12
Major Arterial	Moderate distance inter-community, intra-metro area, traffic movement. Minor function - land access. Serves long trip lengths.	Continuous	1/2 - 1 1/2[2]	Restricted - some movements may be prohibited; number and spacing of driveways controlled.	1/4 mile	10,000 to 45,000	35 - 55	C-E	Prohibited	Backbone of street system.	Belt Line Royal MacArthur
Minor Arterial	Mobility function is primary; access function is secondary. Serves moderate trip lengths.	Continuous	1/2 - 1 1/2[2]	May be limited to major generators; number and spacing of driveways controlled.	1/8 mile	10,000 to 30,000	30 - 45	C-E	Prohibited	Provides route and spacing continuity with major arterials.	Story O'Connor Shady Grove
Major Collector	Primary - collect/distribute traffic between local streets and arterial system. Secondary - land access; inter-neighborhood traffic movement.	Not necessarily continuous	1/4 - 1/2[2]	Safety controls; limited regulation.	300 feet	2,000 to 10,000	30 - 40	B-C	Limited	Through traffic should be discouraged.	Valley Ranch Kinwest Sixth
Minor Collector	Primary - internal to one neighborhood; serves short trip lengths. Secondary - land access.	Not continuous; should not extend across arterials	1/4 - 1/2[2]	Safety controls; limited regulation.	300 feet	1,000 to 5,000	30 - 35	A-B	Limited	Through traffic should be discouraged.	Senter Oakdale Irving Hts.
Local	Land access.	None	Two lot lengths.	Safety control only.	300 feet	200 to 1,000	30	A-B	Permitted	Through traffic should be discouraged.	Parkrow La Salle

[1] Spacing determination should also include consideration of travel projections in the area or corridor based on ultimate anticipated development.
[2] Denser spacing needed for commercial and high density residential districts.

TABLE 8 DEFINITION OF LEVEL-OF-SERVICE

Level of Service	Total Delay	Description (sec/veh)	Street Type
A and B	<6.5 6.5 < 19.5	No delays in intersections with smooth progression of traffic. Uncongested operations; all vehicles clear in a single signal cycle at signalized intersections.	Residential streets.
C	19.5 < 32.5	Moderate delays at intersections with satisfactory to good progression of traffic. Light congestion; occasional back-ups on critical approaches.	Collector street at off-peak hours.
D	32.5 < 52.0	Little or no progression of traffic along the roadway with a high probability of being stopped at every signalized intersection experiencing "D" condition. Significant congestion on critical approaches, but intersection functional. Vehicles required to wait through more than one cycle during short peaks.	Collector streets at peak hour. This is the design level of service for urban conditions.
E	52.0 < 78.0	Heavy traffic flow condition. Delays of two or more cycles probable. No progression. Limit of stable flow. Blockage of intersection may occur if signal does not provide for protected turning movements.	Arterial streets at peak hours. (O'Connor, Rochelle at Urban Center)
F	>78.0	Unstable traffic flow. Heavy congestion. Traffic moves in forced flow condition. Three or more cycles to pass through intersection. Total breakdown with stop-and-go conditions.	Freeway during peak hours. (SH 183, SH Loop 12)

10.4.2 Travel Demand Forecasting Model

A travel demand forecasting model has been developed for the City of Irving to project the future travel demands that will be placed on the thoroughfare network. The Irving travel forecasting model is based on the North Central Texas Council of Government's regional travel forecasting model to ensure consistency in the preparation of future travel projections. It is a subarea model that projects both local and regional traffic and uses the TRANPLAN travel forecasting software package. A detailed description of travel forecast modeling can be found in *Multi-modal Transportation Analysis Process (MTAP): A Travel Demand Forecasting Model*, prepared by the NCTCOG in 1990.

Model Development

The following discussion provides an overview of the steps used to develop the 1995 and 2015 traffic simulation models.

- **Travel Survey Zones:** The Irving traffic simulation model includes the entire NCTCOG regional study area. However, the Travel Survey Zone (TSZ) system was refined to add increased zonal definition within Irving and to aggregate all zones external to Irving. Given the highly interdependent nature of the area, it is necessary to model the entire region to

accurately reflect the interaction of both travel demand (land-use) changes and transportation supply characteristics.

- **Land use Data:** Land use characteristics, such as population, households, and employment, were determined for each TSZ in the study area. The base 1995 land use data were developed from estimates prepared by J.T. Dunkin Associates. Households, population, and income characteristics were developed by NCTCOG based on 1990 census data and through analysis of existing conditions. The following data were prepared for each TSZ:
    - Population
    - Households
    - Median Household Income (in 1990 Dollars)
    - Basic Employment (SIC Codes 5200-5999)
    - Retail Employment (SIC Codes 100-5100, 9100-9999)
    - Service Employment (SIC Codes 6000-9000) and
    - Total Employment

For the year 2015, the same land use variables were estimated for input into the travel demand model. Estimates were prepared by J.T. Dunkin Associates using 2010 demographic data from NCTCOG as a base and then projected forward using information developed from the proposed Future Land Use Plan. Population and employment data were prepared based on growth trends in the area, NCTCOG data, assumed densities, and floor-to-area ratios of the future land use.

- **Simulation Networks:** As with the TSZ structure, the starting point for the development of the highway networks was the original NCTCOG 1990 network. Increased definition was added to update the networks to 1995 conditions and to accommodate the increased zone structure in the model. Highway links were classified according to facility type (e.g., freeways, major arterial, minor arterials, etc.), number of lanes by direction, speed, and 24-hour lane capacity. For the 2015 highway networks, proposed facilities were added to the simulation networks using the same coding conventions as for the 1995 base networks.

- **Trip Generation:** Trip generation is the procedure by which the amount of travel generated within each TSZ is estimated. Travel is estimated in the form of trip productions and trip attractions, and each is calculated by applying trip production and attraction rates to the land-use data variables in each TSZ. Typically, a trip production is associated with the home end of the trip (e.g., based upon the location of the household), while trip attractions are associated with the non-home end of the trip (based upon the location of employment). Trip productions and attractions were estimated for four different trip purposes: home-based work, home-based non-work, non-home-

based, and other trips.

The trip generation rates in the Irving model are consistent with the rates developed by the NCTCOG. Trip productions are stratified by household size and income level. Trip generation has been performed for the 1995 validation and the 2015 horizon year.

- **Trip Distribution:** Trip distribution is the process by which the resulting trip productions and attractions are linked together to create travel flows between TSZs. Both the NCTCOG regional model and the Irving subarea model are based on the mathematical relationship for the physical law of gravity. In fact, this type of distribution model is commonly called a gravity model.

  The gravity model distributes trips based upon the relative attractiveness of each zone and inversely to the distance between each zone. The trip distribution model has been calibrated based on the interzonal travel times from the 1995 simulation network and the use of gravity model friction factors developed by the NCTCOG. Trip distribution has been estimated for each of the four trip purposes in the model. The interzonal travel times from the 2015 network and the 2015 trip generation production and attractions have been used to develop 2015 person trip tables by purpose.

- **Traffic Assignment:** After the implementation of trip distribution, the person trip tables by purpose were factored by vehicle occupancies to develop vehicle trip tables by purpose. The vehicle trip tables were then assigned to the simulation network. The assignment process accumulated the vehicle trips on each network link based upon the travel path taken for each origin-destination zone pair considering the effect that roadway congestion had on the network links selected to complete the trip.

  For the base year 1995 validation, the model-estimated volumes from the network simulation were compared to the observed traffic counts for selected screenline locations. From a total of 9 screenline locations, 7 were within 20 percent of the daily counts, and total estimated daily volumes were found to be within 3 percent of the total observed daily count. Once the validation of the 1995 travel demand model to the observed conditions was producing acceptable results, the year 2015 land use and network data were used to prepare 2015 highway assignments. The 2015 assignment results were prepared and analyzed to test different Thoroughfare Plan concepts and provide information in the development of the final recommended plan.

10.5 PROJECTED TRAVEL CONDITIONS

10.5.1 Projected Changes in Population, Employment, and Trip Generation

Based on the Future Land Use Plan for Irving, population is expected to increase by 23% from 164,885 to 202,983, or at an average annual rate of 1.2%. Total employment is anticipated to increase by 63% from 122, 289 to 199,186, or at an average annual rate of 3.1%.

Comparable increases in trip generation can also be expected. In 1995, there were approximately 967,000 trips in Irving for all trip purposes. By 2015, it is projected that there will be nearly 1.4 million trips, or an increase of 49% over base year levels. Tables 9 and 10 display the projected changes in population, employment, and trip generation between 1995 and 2015.

TABLE 9 1995 AND 2015 LAND USE STATISTICS FOR IRVING

	1995	2015	Percent Increase	Average Annual Increase
Population	164,885	202,983	23%	1.2%
Households	68,370	95,304	39%	2.0/%
Employment:				
- *Basic Employment*	*40,332*	*52,798*	*31%*	*1.5%*
- *Retail Employment*	*16,672*	*30,525*	*83%*	*4.2%*
- *Service Employment*	*65,285*	*115,823*	*77%*	*3.9%*
Total Employment	122,289	199,186	63%	3.1%

TABLE 10 1995 AND 2015 TRIP GENERATION STATISTICS

Trip Purpose	1995	2015	Percent Increase
Home-Based Work	250,193	371,632	+49%
Home-Based Non-Work	330,269	470,664	+43 %
Non-Home-Based	244,861	389,775	+59 %
Other	142,016	207,607	+46%
Totals	**967,339**	**1,439,678**	**+49%**

As employment growth outpaces population growth by nearly three times, the impact in terms of trip generation will be significant. The addition of 463,000+ trips to the roadway network will dramatically impact current congestion levels.

A review of trip generation at the TSZ level indicates that most of the increase in trips is attributable to projected growth in the north Irving area, particularly north of SH 114 in the vicinity of SH 161 and at the Las Colinas Urban Center. Other areas of increased trip activity will be SH 183 near SH 161, Belt Line Road, MacArthur Boulevard, Tom Braniff Drive, and East Grauwyler Road, and Belt Line Road south of Shady Grove Road. Figure 17 illustrates the locations in Irving with the largest projected increases in trip activity between 1995 and 2015.

10.5.2 Evaluation of Existing Thoroughfare Plan

To test the ability of the existing Thoroughfare Plan to accommodate projected 2015 traffic conditions, several assumptions were made with respect to improvements to the regional freeway network. These assumptions were based on information prepared as part of the NCTCOG Mobility 2020 Regional Plan and City Staff input and judgment as to potential facility development. Listed below are freeway capacity assumptions for 2015:

- SH 183: 8 lanes
- SH 114: 6 lanes (SH 183 - SH Spur 348), 8 lanes (SH Spur 348 - Freeport Pkwy.), 6 lanes (Freeport Pkwy. - SH 121)
- SH Loop 12: 8 lanes
- IH 635: 6 lanes
- SH 161: 6 lanes (SH 190 - Belt Line), 8 lanes (Belt Line - SH 183), 4 lanes (SH 183 - SH 30)
- SH 190/ SH 161 Connector Freeway: 6 lanes
- SH Spur 348: 6 lanes
- SH Spur 482: 4 lanes
- East-West Connector Freeway (DFW): 4 lanes
- Trinity Tollway: 4 lanes

Projected Traffic Volumes

The projected 2015 traffic volumes for the major freeways and arterials within Irving are illustrated in Map 9. As necessary, adjustments were made to traffic projections to account for localized conditions beyond the accuracy of traditional modeling techniques.

As shown on Map 9, major increases in traffic can be expected on the regional freeway system, as well as arterials leading to, or in the vicinity of, the Urban Center. However, traffic volumes in the established sections of Irving will remain relatively stable over the next 20 years.

Projected Travel Conditions

A capacity analysis was conducted to determine projected operating conditions of the network in 2015 and if any deficiencies are projected to occur. Capacity was tested on a link basis with average daily traffic as the measuring criterion.

Map 10 illustrates the areas where congestion is likely to occur. Illustrated are links which are projected to operate at Level of Service "D" and "E/F." As anticipated, areas in north Irving which are projected to generate significant trip activity contain roadway segments which will be placed under heavy demand in 2015. Due to regional use, area freeways can be expected to experience considerable demand on a daily basis. The regional significance that SH 161 and the East/West Connector play for travel to north Irving, Park West in Farmers Branch, and employment centers in North Dallas, will result in heavy usage by commuters.

Several arterial roadways leading into Las Colinas are projected to carry high traffic volumes, most notably those arterials which serve as portals to the Urban Center. Due to their direct approach to the area, Luna Road and Northwest Highway bear the greatest impacts. In south Irving, Irving Boulevard and areas near SH Loop 12 are also projected to experience congestion. This congestion will likely be the result of spillover from SH 183 and SH Loop 12.

10.6 PROPOSED THOROUGHFARE PLAN

The Thoroughfare Plan for Irving recommends guidelines for a roadway system that will enhance overall traffic circulation; provide a framework for future development; and increase operating efficiency by optimizing existing routes. Projected travel conditions for Irving indicate a significant increase in the number of trips that will be generated on a daily basis by 2015. While a majority of this growth will occur in north Irving, when coupled with the regional effects that future growth of the Metroplex brings to Irving area freeways, the impacts could be severe.

To address the long-range travel demand in Irving, a comprehensive approach will be required that includes a combination of multi-modal efforts such as upgrades to the thoroughfare system, increased transit options, rail opportunities, other supplemental modes of travel, and transportation systems management measures. The following section of this report discusses recommended improvements to the thoroughfare system.

10.6.1 Thoroughfares

The recommended Thoroughfare Plan is based on a functional classification system that includes seven classes: freeway/expressway, principal arterial, major arterial, minor arterial, major collector, minor collector, and local roads. With limited opportunity to provide for new roadway facilities because of existing development or jurisdictional limits, the proposed plan maximizes the existing thoroughfare system to the extent possible. Some of the specific features of the Plan relating to thoroughfares are as follows:

- Descriptions of the Irving roadways according to functional design criteria and designation of proposed roadway cross sections.
- Increased roadway capacity through signal improvements and improved intersections which provide for the separation of through traffic from turning movements.
- Increased access to the Urban Center in Las Colinas. Arterial improvements include increased access to the freeway facilities adjacent to the Urban Center, as well as modifications to the existing roadway network.
- Improvements to the Valley Ranch area street system to increase access and circulation within the development. Access improvements include a direct connection from East Valley Ranch Parkway to Valwood Parkway via the proposed SH 190/SH 161 Connector interchange.
- Discontinuous access to the University Hills residential area via the removal of the Wingren Drive connection to SH 114. This proposal limits through traffic to the Las Colinas Urban Center and protects neighborhood integrity.
- Improved access to, and circulation within, Irving Mall to relieve traffic congestion at the SH 183/Belt Line Road interchange. Recommended improvements include the implementation of a circulator roadway adjacent to Irving Mall, between SH 183 and Belt Line Road; and, as part of the SH 183 Major Investment Study (MIS) which will be initiated in 1997, the City to work with TxDOT to provide a westbound entry ramp east of Esters Road.
- Extension of Carl Road from Northgate Drive to SH 114 at Cistercian Road to facilitate north/south area circulation.

Map 11 illustrates the proposed Thoroughfare Plan for Irving. Appendix A contains a detailed listing of thoroughfare plan improvements on a roadway basis. In addition, the improvements listing also contains existing (1995) numbers of lanes as well as those identified in the existing Thoroughfare Plan. The following

section describes the relationship of the Plan to issues discussed in the Baseline Analysis report. Some of these recommendations exist as part of the current Thoroughfare Plan, and are reiterated to properly detail needs for various areas.

Issue: Las Colinas Urban Center

The Las Colinas Urban Center is projected to generate an additional 124,000 average daily trips over the 20 year planning period. In order to accommodate projected demands, a number of improvements to the area roadway network are recommended.

- Extend Walnut Hill Lane from O'Connor Boulevard south to Las Colinas Boulevard south of SH Spur 348 and provide a grade separation at SH Spur 348.
- Provide an east/west connection between Walnut Hill Lane and Las Colinas Boulevard (north of SH Spur 348 and Lake Carolyn).
- Upgrade SH Spur 348 to include service roads between O'Connor Boulevard and SH 114, and provide grade separations at Las Colinas Boulevard, the Walnut Hill Lane extension, and O'Connor Boulevard.
- Upgrade California Crossing between Las Colinas Boulevard and the Irving/Dallas city limits to a 6-lane facility; and encourage the City of Dallas to widen the section between the city limits and Luna Road to 6 lanes and to 4 lanes between Luna Road/Northwest Highway.
- Encourage the City of Dallas to re-align and improve Luna Road to a 6-lane facility as per their Thoroughfare Plan and to provide grade separation at Luna/Northwest Highway.
- Upgrade O'Connor Boulevard to 6 lanes between SH 161 and SH Spur 348.
- Extend Carl Road from Northgate Drive to SH 114 at Cistercian Road and maintain grade separation with SH 114.
- Extend Fuller Drive (in Urban Center) to intersect with Fuller west of SH 114 and provide a grade separation with SH 114.
- Extend Decker Drive west to connect with O'Connor Ridge Boulevard.
- As part of the SH 114 MIS which will be initiated in 1998/1999, work with TxDOT to incorporate the following ramp improvements on SH 114 and to make as many of the improvements as possible in the short term:

- braided exit/entry ramps, both north and southbound, north of the Fuller Drive interchange.
- U-turn lane on the northbound approach at the Hidden Ridge overpass.
- braided exit/entry ramps, both north and southbound, north of Wingren Drive.
- U-turn lane on the southbound approach at Rochelle Boulevard.
- eastbound entry ramp, west of Walnut Hill Lane.

• As part of the SH 114 MIS which will be initiated in 1998/1999, work with TxDOT to provide the following ramps on SH Spur 348:

- braided exit/entry ramps, both east and westbound, west of the proposed Walnut Hill Lane extension.
- eastbound entry ramp and westbound exit ramp to O'Connor Boulevard, east of O'Connor.
- westbound entry ramp and eastbound exit ramp, west of O'Connor Boulevard.

In addition to these road improvements, several other strategies are recommended to accommodate projected travel demand for the Las Colinas Urban Center. These are as follows:

• Evaluate the extension of O'Connor Boulevard to Northwest Highway in Dallas with direct access to the Northwest Highway main lanes.

• Coordinate planning efforts for improvements outside Irving with the Cities of Farmers Branch and Dallas for upgrades to Luna Road, Walnut Hill Lane, and California Crossing.

• Promote public/private cooperatives for trip reductions via the creation of a Transportation Management Organization to devise and implement an aggressive transportation management program aimed at reducing work trips to the Urban Center. Such strategies should include:

- coordination of HOV roadway improvements with TxDOT.
- identification/planning of secured remote parking facilities with transfer service to/from such sites.
- promotion of planning activities with DART for the revival of the Las Colinas APT to access remote parking sites.
- encouragement of private sector promotion of TSM strategies for:

ridesharing (carpool, vanpool)

peak-spreading (flex hours, staggered work week, compressed work week, telecommuting)

alternative modes of travel (bus, rail, pedestrian, water-taxi, bike)

If consensus cannot be reached, the City should investigate the implementation of an ordinance requiring TSM strategies that limit parking and/or reduce trips.

Issue: Provide additional east/west routes other than SH 183.

The role that SH 183 plays in regional mobility hinders east/west circulation through Irving due to congestion during peak operating periods. The recently completed capacity improvements on Irving Boulevard at SH Loop 12 will assist east-west circulation. To further facilitate east/west movement, the following improvements are recommended:

- Encourage the Texas Turnpike Authority and TxDOT to construct the Trinity Tollway across south Irving.
- As part of the SH Loop 12 MIS which will be initiated in 1997, work with TxDOT to provide a southbound exit ramp north of Pioneer Drive.
- Implement proposed Hunter-Ferrell Road (Trinity Parkway) between SH Loop 12 and Belt Line Road.
- Reduce the number of curb cuts for commercial areas along Irving Boulevard, and promote internal circulation among commercial sites.

Issue: Traffic problems in Texas Stadium area

Due to existing and projected traffic congestion near this facility, traffic operations over a broader area have been affected. To resolve this issue, it is recommended that Irving:

- Work with TxDOT on the SH 183 and SH Loop 12 MIS studies.
- Promote efforts associated with TxDOT's Value Engineering Study of the SH Loop 12/SH 183/ SH 114 area and TxDOT's efforts to promote area circulation.

Issue: Hunter-Ferrell road alignment

The implementation of the proposed Hunter-Ferrell Road (Trinity Parkway) improvements will provide much needed east/west circulation to south Irving. The connection with the completed section of Trinity Parkway in Grand Prairie will facilitate access to future SH 161 and will discourage commercial traffic from utilizing Shady Grove Road (to SH Loop 12). The construction of the Trinity Tollway across far

south Irving will also improve east-west traffic circulation. Access to Trinity Parkway should be limited to facilitate cross-town traffic movement within this corridor.

Issue: Impact of DFW Airport on Valley View Lane

The realignment and improvement of Valley View Lane across the Airport expansion area was recently completed.

Issue: Traffic impacts of proposed race track

The impending opening of Lone Star Race Track in Grand Prairie has raised issues with regard to traffic encroaching into Irving's residential areas. To project traffic conditions that are anticipated to arise from this facility, demographic data was revised to include total projected employment. Data was provided by the Lone Star Race Track. Projected 2015 volumes indicate that no significant impact will occur to Irving area roadways. The City of Grand Prairie is presently preparing a traffic management plan which will specifically address access and circulation for daily events.

Issue: Traffic impacts of a major retail center at Valley Ranch

Information on population and employment was also considered for commercial activities relative to the property northwest of MacArthur Boulevard and IH 635. Travel forecast model results for the year 2015 indicate that the adjacent MacArthur Boulevard and Belt Line Road interchanges with IH 635 will experience critical levels of operation. To minimize area levels of congestion, the following actions are recommended:

- Construction of Retail Center Drive between Ranch Trail and IH 635 with a grade separation at IH 635.
- Construction of the proposed IH 635 frontage roads between MacArthur Boulevard and Belt Line Road and associated ramps for Belt Line, Retail Center Drive, and MacArthur traffic.

Issue: Additional access to Valley Ranch

Valley Ranch is currently provided with few ingress/egress portals to the area. To facilitate area access and circulation, the following actions are recommended:

- Connect East Valley Ranch Parkway to Valwood Parkway via the proposed SH 190/SH 161 Connector interchange; investigate possibility of moving proposed interchange further south to accommodate potential intersection at East Valley Ranch Parkway between Santa Fe Trail and Cimmaron Trail.
- Construction of Retail Center Drive between Ranch Trail and IH 635 with a grade separation at IH 635. Construction of the proposed IH 635 frontage roads between MacArthur Boulevard and Belt Line Road and associated ramps.

- Construction of the proposed southbound East Valley Ranch Parkway to Valley View Lane connection.

Issue: Negative impacts of Urban Center traffic upon adjacent residential communities

Traffic currently generated by the Las Colinas Urban Center and developments along the west side of SH 114 have placed high demands on all portals west of SH 114 (O'Connor, Wingren, Rochelle). With Wingren Drive serving primarily as a residential collector roadway for adjacent residential development, high volumes of through traffic have severely impacted the residential atmosphere of this area. To minimize the impact of future Urban Center traffic, the following is recommended:

- Construction of the proposed extension of Decker Drive between O'Connor Road and a point west of Goodson Drive so as to serve as internal circulation for office developments on the west side of SH 114.

- Upon completion of the extension of Decker Drive, close Wingen between Decker Drive and Tampico Street so that Wingren will serve its intended function as a residential collector street.

Issue: Access to Trinity Railway Express

Impending use of Trinity Railway Express to provide commuter rail service between Irving and Dallas, and eventually to Fort Worth, has raised a concern about the ability to reach the rail stations. However, there are several north/south arterial roadways that will provide sufficient capacity to and from the rail stations.

Issue: Circulation for north/south arterials at SH 183

Several north/south arterials currently experience congestion at the interchanges with SH 183. Due to limited area for channelized improvements, minimal changes can be made other than experimenting with the changes in lane assignments. The SH 183 MIS which will be initiated in 1997 will address north/south access along with other issues related to the corridor, and will recommend improvements to grade separations. Short-term recommendations include:

- Conversion of a through lane to a left/through lane assignment to increase left turn capacity for both north and southbound turning movements. Should through traffic volumes experience a decrease in level of service, operations should revert to the original lane assignments.

Issue: Improve Circulation at Irving Mall

The travel demands associated with the high concentration of commercial activity along Belt Line Road have created circulation deficiencies in the area. A significant portion of this traffic is due to regional trips that use Belt Line Road to traverse Irving. With the implementation of the SH 183/SH 161 interchange,

regional traffic is expected to shift to SH 161. However, high traffic volumes are expected to remain on Belt Line Road due to the regional commercial attraction offered by the Mall. To improve circulation, it is recommended that the City:

- Provide a commercial collector behind the Mall between Belt Line Road and SH 183 and, as part of the SH 183 MIS which will be initiated in 1997, work with TxDOT to provide a westbound entry ramp east of Esters Road.
- Coordinate with private developers for roadway improvements, and promote shared access to adjacent commercial development west of the Mall.

Projected Traffic Volumes

The projected 2015 traffic volumes for the proposed Thoroughfare Plan are illustrated in Map 12. As necessary, adjustments were made to traffic projections to account for localized conditions beyond the accuracy of the forecast model. A comparison of traffic volumes to those of the existing Thoroughfare Plan reveal several areas where changes occurred. Increases were found on Belt Line Road, MacArthur Boulevard, Ranch Trail, SH Spur 348, and California Crossing. Decreases were found on O'Connor Boulevard and Las Colinas Boulevard.

The MacArthur increase is possibly a result of the additional access provided to Valley Ranch via the Valwood Parkway connection from East Valley Ranch Parkway. With the SH 161/ SH 190 Connector expected to have volumes exceeding capacity, some spillover is expected to occur for traffic headed to south and westbound destinations. This would also explain the residual increase on MacArthur at SH 114.

Traffic volumes on O'Connor Boulevard and Las Colinas Boulevard are forecasted to drop slightly. This decrease is related to the additional arterial capacity supplied to the Las Colinas Urban Center by the additional access provided by the Walnut Hill Lane extension (into the Urban Center) and the O'Connor extension to Northwest Highway in Dallas.

The most dramatic increase is related to SH Spur 348. The direct connection of O'Connor to Northwest Highway in Dallas also reduces the number of vehicles accessing the Urban Center via O'Connor Boulevard. Traffic volumes on California Crossing increased as a result of the increase in lane capacity.

Projected Travel Conditions

A capacity analysis of the proposed Thoroughfare Plan was conducted to determine if any deficiencies were projected to occur. Again, capacity was tested on a link basis, with average daily traffic as the measuring criterion. Map 13 illustrates areas where

congestion is forecasted to occur. Illustrated are links which are projected to operate at levels of service "D" and "E/F."

As was with the existing Thoroughfare Plan, regional freeway facilities are expected to continue operating under heavy demand levels. Within Irving, several sections of Belt Line Road, MacArthur Boulevard and O'Connor Boulevard are also projected to operate below acceptable levels-of-service.

Measures that can assist in increasing capacity to the roadway network relate to intersection improvements and access management. Intersection improvements such as additional lanes for turning movements increase the carrying capacity by providing storage for turning vehicles off of main lanes and thereby reducing demand for main lane capacity. Map 14 illustrates intersection improvement locations which could potentially enhance the carrying capacity of the roadway network. Typical improvements include flaring intersections for single or dual left-turn bays and separate right-turn bays.

Measures for Trip Reduction

With north Irving projected to generate an immense number of trips, measures aimed at reducing demands are essential. The overall goal of a sound transportation plan is the *movement of people and goods, and not vehicles*. Two time-tested strategies for maximizing the efficiency of the existing transportation system are Transportation Systems Management (TSM) and Transportation Demand Management (TDM).

TSM encompasses a wide range of improvement strategies that are low capital intensive, and utilize both demand management and supply optimization to improve operations on existing highway and transit-related facilities. The supply can be increased by adding lanes, intersection improvements, signal re-timing, widening sidewalks, etc., whereas the demand can be managed by enhanced transit and paratransit use, flexible work schedules, etc. TDM concentrates exclusively on travel demand, rather than transportation supply. The two approaches are complementary and should be considered *before* undertaking capital-intensive projects. Potential TSM and TDM strategies are listed in Tables 11 and 12, respectively.

As highlighted by many studies, congestion levels continue to worsen in the Metroplex and the region continues to exceed the National Ambient Air Quality Standards for ozone established by the Environmental Protection Agency (EPA). Coupled with lack of sufficient funding for regional transportation improvements, there is an increasing need for the City of Irving to incorporate TSM and TDM measures in all levels of planning.

Potential TDM strategies include Transportation Management Associations (TMA), Trip Reduction Ordinances (TRO), and negotiated agreements. All three approaches

are intended to encourage greater cooperation between the private and public sectors. While private efforts focus on the implementation of transportation management associations, the public approach focuses on enactment of trip reduction ordinances. Joint efforts consist of negotiated agreements implemented through the modification of existing development and occupancy permit review processes.

The Las Colinas Urban Center and SH 114 Business Corridor are forecast to capture increasing levels of employment. Based on future traffic projections for major roadways and roadway improvement plans, the system capacity will be inadequate to accommodate expected growth. To ensure efficient accessibility to the Urban Center, it is imperative that the City initiate and encourage TSM and TDM strategies.

Rising employment densities can lead to increased ridesharing and transit usage. The demand for high occupancy modes can be promoted and accommodated through a TMA. A TMA is a voluntary organization of business associations, employers, developers, landowners, building management companies, transit agencies, and local governments whose aim is to improve the accessibility of the area by addressing issues of direct participant interest. Private sector TMAs derive their financial support from private sources and can offer incentives based on direct self-interest. The most common reason for TMA initiation is traffic congestion.

Whereas developers and landowners are more likely to initiate TMAs in response to growth and land use issues, state and local governments are likely to emphasize trip reduction ordinances and air quality as reasons for promoting TMAs. TDM measures sponsored by TMAs focus more on information services such as carpool-matching assistance, transportation management plans, and transit schedules, and less on direct modal incentives or parking management strategies. Benefit assessment districts, in which landowners voluntarily tax themselves with matching funds provided by the City, can be a viable option to implement transportation improvements in the Las Colinas Urban Center.

TABLE 11 CLASSES OF TSM ACTIONS

Class	Strategy Group	Sample Actions
Traffic Management Aimed at improving vehicle movements by increasing the capacity and safety of the existing facilities and systems.	Traffic Operations	Intersection and roadway widening One-way streets Turn lane installation Turning movement and lane use restrictions Parking restrictions New freeway lane using shoulders
	Traffic Control	Local intersection signal improvement Arterial signal system coordination and progression Area signal system Freeway diversion and advisory signing Freeway surveillance and control
	Roadway Assignment	Exclusive bus lane-arterial Take-a-lane Add-a-lane Bus-only street Contraflow bus lane Reversible lane systems Freeway HOV bypass Exclusive HOV lane-freeway Take-a-lane Add-a-lane
	Pedestrian and Bicycle	Widen sidewalks Pedestrian grade separation Bikeways Bike storage Pedestrian control barriers Simplified fare collection
Transit Management Designed to increase ridership by providing expanded and more efficient public transportation.	Transit Operations	Bus route and schedule modifications Express bus service Bus traffic signal preemption Bus terminals
	Transit Management	Marketing program Maintenance improvements Vehicle fleet improvements Operations monitoring program
	Itermodal Coordination	Park-n-ride facilities Transfer improvements
Demand Management Oriented toward reducing trips or number of vehicles by encouraging other types of transportation services.	Paratransit	Carpool matching programs Vanpool programs Taxi/group riding programs Dial-a-ride Jitney service Elderly and handicapped service
	Work Schedule	Staggered work hours and flextime Four-day week
Restraint Measures Aimed at discouraging vehicle use mostly through restrictive controls.	Parking Management	Curb parking restrictions Residential parking control Off-street parking restrictions HOV preferential parking Parking rate changes
	Restricted Areas	Area licensing Auto-restricted zones Pedestrian malls Residential traffic control
	Commercial Vehicle	On-street loading zones Off-street loading zones Peak-hour on-street loading prohibition Truck route system
	Pricing	Peak-hour tolls Low-occupancy vehicle tolls Gasoline tax Peak/off-peak transit fares Elderly and handicapped fares Reduce transit fares

Source: Institute of Transportation Engineers, Planning Urban Arterial and Freeway Systems, A Recommended Practice, 1988, p. 50.

TABLE 12 TRANSPORTATION DEMAND MANAGEMENT AND TRAVEL BEHAVIOR

Aspect of Travel Strategies	TDM Objective	TDM Implementation
Trip generation	Eliminate trip entirely.	*Land use:* growth control (eliminate specific activities associated with trip making). *Transportation*: telecommunications substitution for travel (telecommuting, teleshopping, teleconferencing) (eliminate trip making associated with specific activities).
Trip distribution	Shift trip from a more congested to a less congested destination.	*Land use:* zoning restrictions that limit the density of development, type of land use, etc., thus shifting the location of activities within urban or regional areas. *Transportation*: trip chaining, satellite activity locations (satellite work locations, on-site daycare facilities, personal services, cafeterias, restaurants, etc.)
Mode choice	Shift trip from a lower-occupancy mode of travel (e.g., drive alone) to a higher-occupancy one.	*Land use:* increasing allowable density of development (to improve the market for high occupancy vehicle facilities). *Transportation*: mode-specific incentives and disincentives, such as parking pricing, carpool, vanpool, and transit subsidies; bicycle and pedestrian amenities; guaranteed ride home programs; etc.
Route selection (spatial)	Shift trip from a more congested route to a less congested one.	*Land use:* noise reduction (removal of through traffic from residential streets through creation of permanent or temporary barriers). *Transportation:* smart highways and vehicles (technologies capable of the instantaneous delivery of current route information, including identification of the route with the shortest travel time, based on ambient traffic conditions before or during the trip).
Route selection (temporal)	Shift trip from a more congested time period to a less congested one.	*Land use:* mixed use development, jobs/ housing balance (where different land uses exhibit different peaking characteristics of trip generation). *Transportation:* alternative work schedules (flexible work hours, staggered work shifts, and compressed work weeks).

Source: Eric Ferguson, Transportation Demand Management, Planning, Development and Implementation, APA Journal, Autumn 1990, p. 443.

Thoroughfares in Adjacent Communities

Thoroughfares that extend to the city limits of Irving link directly to a similar roadway cross-section in an adjacent municipality. The proposed Irving Thoroughfare Plan has been developed to be compatible with current Thoroughfare Plans in surrounding communities.

10.6.2 Transit

In most higher density urbanized areas or activity centers, the system of planned thoroughfares is often so heavily taxed with vehicular traffic demand that it is necessary to supplement the roadway system capacity with some form of transit service. In the City of Irving, that recognition has already occurred with the provision of a combination of local bus, park-and-ride, and commuter rail service, mainly to accommodate travel between Irving and Dallas. The expected growth in the Urban Center and the larger Regional Activity District (RAD) potentially creates the need to consider expansion of existing transit service to accommodate travel demand to and from these major activity centers. The following specific improvements are proposed:

- **Local Bus Service:** Establish and/or increase service between the RAD and major residential areas within Irving.
- **Park-and-Ride Service:** Provide additional express or limited stop routes between the North Irving Transit Center and other transit centers and transit passenger concentrations outside of Irving but within DART's Service Area.
- **Commuter Rail Service:** As an extension of the soon to open Trinity Railway Express service between the south Irving Transit Center and downtown Dallas, as well as the future extension to downtown Fort Worth, examine the potential for establishing commuter rail passenger service along the Burlington Northern Railroad (BNRR) right-of-way between the south Irving Station and a multi-modal transportation center within the Urban Center. Since DART owns the former Cotton Belt Railroad right-of-way across the northern part of the Dallas urbanized area (which connects with the BNRR ROW), it would also be possible to create a commuter rail passenger service connection between the Urban Center and this important sector of the region.
- **Light Rail Transit Service:** Although the current DART Service Plan calls for commuter rail service in the northwest corridor of Dallas parallel to Stemmons Freeway, with a potential connection to the Urban Center in Irving using a railroad spur alignment south of Walnut Hill Lane, there appears to be justification to consider more frequent higher capacity light rail transit (LRT) service in lieu of the commuter rail service in this corridor.
- **Las Colinas APT Service:** Based on its present configuration, this service had to be discontinued due to limited travel demand. With the full development of the Urban Center and the RAD, and/or if any combination of the above described transit services are implemented, there will be the opportunity and probable need to complete the implementation of the APT System Plan envisioned by the developers of Las Colinas.

All of these transit opportunities are depicted on Map 15. Depending on the ultimate configuration and density of development in these activity centers, the required combination of transit services could significantly vary. The determination of the specific requirements should be the subject of a more comprehensive analysis conducted in cooperation with DART.

10.7 DESIGN STANDARDS

10.7.1 Thoroughfares

Irving's proposed functional classification consists of seven classes: freeway/expressway, principal arterial, major arterial, minor arterial, major collector, minor collector, and local roads. For all classes below freeway/expressway, a range of standards has been established for Irving. Standards for freeways/expressways are the responsibility of TxDOT. In developed areas, varying design standards can be implemented to accommodate existing conditions. Figure 18 illustrates the roadway cross-section design standards and Table 13 details design criteria for the various cross-sections.

TABLE 13 ROADWAY STREET CROSS-SECTION DESIGN CRITERIA FOR IRVING

Roadway Type	2-lane Undiv. (2U)	3-lane Undiv. (3U)	4-lane Undiv. (4U - 1)	4-lane Undiv. (4U - 2)	5-lane Undiv. (5U)	4-lane Div. (4D)	6-lane Div. (6D)	6-lane Div. (6D-R)
ROW	52'	58' or 62'	62'	66'	80' or 86'	86' or 96'	104' or 114'	140'
Pavement Width	30'	36' - 40'	40'	44'	58' or 64'	64' or 74'	82' or 92'	98'
Traffic Lanes	2	3	4	4	4	4	6	6
Lane Width	15'	12' - 14'	10'	11'	11-12'	12'	11'	12'
Median	none	none	none	none	none	16' or 26'	16' or 26'	26'

10.7.2 Access Management

Access management is defined as control of the location, design, and operation of driveways, median openings, and street connections in order to improve the efficiency and safety of the transportation network. The importance of access management for corridor preservation and congestion management is emphasized in the Intermodal Surface Transportation Efficiency Act of 1991(ISTEA). Since most land development decisions are made at the local level, whereas the authority for access management is embodied in various levels of government, interjurisdictional coordination is required to reach efficiency in procedures.

Access management techniques provide varying degree of access control according to the functional hierarchy of roadways. Freeways have the highest level of access controls, followed by expressways, arterials, collectors, and local streets. Access management preserves and enhances the capacity of a roadway for through-travel, and minimizes the potential for vehicular and/or pedestrian conflicts.

A well developed access management program can contribute to the achievement of land use planning objectives by encouraging compatible land uses and orderly layouts. It can also promote aesthetics by encouraging longer, landscaped medians, and by distancing parking lot access from major intersections. A continuous and consistent planning and regulatory program for access management will solidify the legal basis for administrative decision making in the development review process. In addition, it will provide greater predictability to developers and the general public in terms of access control requirements.

Some of the regulatory measures employed by local governments for access management include stipulations on minimum lot size, minimum lot frontage, and minimum setbacks. Many jurisdictions examine access related issues during the subdivision and site plan review process. Overlay zones and flexible zoning are innovative means for managing access along high priority corridors and planned unit developments, respectively. Table 14 lists commonly used access management strategies.

TABLE 14 TYPES OF ACCESS CONTROLS

Driveway Access Principles	- Property Access - Number of access points - Number of ingress lanes - Number of egress lanes - One way access - Joint and cross access
Driveway Placement	- Driveway location - Driveway spacing - Corner clearance - Property clearance
Driveway Design	- Driveway grades - Width and curb return radius - Driveway angle
Channelization Islands and Median Dividers	- Turning roadway width - Island size - Elongated driveway island width plus length - Throat length
Deceleration Lanes	- Right-turn deceleration lanes - Right-turn lane length
Median Openings	- Median opening spacing
Median Opening Design	- Median opening design - Median opening length - Median end treatment - Median left-turn lane width - Left turn storage requirements

10.8 RECOMMENDATIONS

The Thoroughfare Plan calls for the implementation of a multi-modal approach to meeting projected travel demands by growth and development over the next twenty years. Because of the regional implications associated with the freeway network coupled with a thoroughfare system that is for the most part in place, a high degree of importance is placed on maximizing the efficiency of the existing roadway system. Additionally, optimization of transit options, rail opportunities, supplemental modes of travel, and measures to manage transportation demands through Transportation Systems Management (TSM) and Travel Demand Management (TDM) will need to be realized in a concurrent approach in order to achieve a comprehensive transportation system capable of meeting projected travel needs in 2015.

The following highlights general recommendations as it relates to implementation of the Thoroughfare Plan:

- Adopt a Thoroughfare Plan that classifies the roadway network according to a functional role that facilities are intended to provide.
- Develop and maintain a transportation forecast modeling database which can assess the impacts of existing and future land uses on the roadway network.

- Implement an access management program designed to reduce the number of conflicts between through and turning movements. Encourage the use of shared access drives and common circulation systems within clusters of development.
- Develop Transportation Systems Management (TSM) strategies to improve accessibility and circulation throughout the community. Promote employer based Transportation Demand Management (TDM) strategies in new developments.
- Establish guidelines for the requirement of traffic impact analyses for all major development proposals in the City.
- Investigate interface of the Trinity Railway Express and DART transit services to employment and activity centers.

With regards to specific roadway improvements, the following improvements have been identified to address specific areas of Irving. Note that most of the recommended improvements exist as part of the current Thoroughfare Plan and are reiterated to properly detail needs.

- Extend Walnut Hill Lane from O'Connor Boulevard south to Las Colinas Boulevard south of SH Spur 348 and provide a grade separation at SH Spur 348.
- Provide an east/west connection between Walnut Hill Lane and Las Colinas Boulevard (north of SH Spur 348 and Lake Carolyn).
- Upgrade SH Spur 348 to include service roads between O'Connor Boulevard and SH 114, and provide grade separations at Las Colinas Boulevard, the Walnut Hill Lane extension, and O'Connor Boulevard.
- Upgrade California Crossing between Las Colinas Boulevard and the Irving/Dallas city limits to a 6-lane facility, and encourage the City of Dallas to widen the section between the city limits and Luna Road to 6 lanes and to 4 lanes between Luna Road/Northwest Highway.
- Encourage the City of Dallas to re-align and improve Luna Road to a 6-lane facility as per their Thoroughfare Plan and to provide grade separation at Luna/Northwest Highway.
- Upgrade O'Connor Boulevard to 6 lanes between SH 161 and SH Spur 348.
- Extend Carl Road from Northgate Drive to SH 114 at Cistercian Road and maintain grade separation with SH 114.
- Extend Fuller Drive (in Urban Center) to intersect with Fuller west of SH 114 and provide a grade separation with SH 114.

- Extend Decker Drive west to connect with O'Connor Ridge Boulevard.
- As part of the SH 114 MIS which will be initiated in 1998/1999, work with TxDOT to incorporate the following ramp improvements on SH 114, and to make as many of the improvements as possible in the short term:
  - braided exit/entry ramps, both north and southbound, north of the Fuller Drive interchange.
  - U-turn lane on the northbound approach at the Hidden Ridge over-pass.
  - braided exit/entry ramps, both north and southbound, north of Wingren Drive.
  - U-turn lane on the southbound approach at Rochelle Boulevard.
  - eastbound entry ramp, west of Walnut Hill Lane.
- As part of the SH 114 MIS which will be initiated in 1998/1999, work with TxDOT to provide the following ramps on SH Spur 348:
  - braided exit/entry ramps, both east and westbound, west of the proposed Walnut Hill Lane extension.
  - eastbound entry ramp and westbound exit ramp to O'Connor Boulevard, east of O'Connor.
  - westbound entry ramp and eastbound exit ramp, west of O'Connor Boulevard.
- Evaluate the extension of O'Connor Boulevard to Northwest Highway in Dallas with direct access to the Northwest Highway main lanes.
- Coordinate planning efforts for improvements outside Irving with the Cities of Farmers Branch and Dallas for upgrades to Luna Road, Walnut Hill Lane, and California Crossing.
- Promote public/private cooperatives for trip reductions via the creation of a Transportation Management Organization to devise and implement an aggressive transportation management program aimed at reducing work trips to the Urban Center. Such strategies should include:
  - coordination of HOV roadway improvements with TxDOT.
  - identification/planning of secured remote parking facilities with transfer service to/from such sites.
  - promotion of planning activities with DART for the revival of the Las Colinas APT to access remote parking sites.

- encouragement of private sector promotion of TSM strategies for ridesharing (carpool, vanpool); peak-spreading (flex hours, staggered work week, compressed work week, telecommuting); and alternative modes of travel (bus, rail, pedestrian, water-taxi, bike).

If consensus cannot be reached, the City should investigate the implementation of an ordinance requiring TSM strategies that limit parking and/or reduce trips.

- Encourage the Texas Turnpike Authority and TxDOT to construct the Trinity Tollway across south Irving.
- As part of the SH Loop 12 MIS which will be initiated in 1997, work with TxDOT to provide a southbound exit ramp north of Pioneer Drive.
- Implement proposed Hunter-Ferrell Road (Trinity Parkway) between SH Loop 12 and Belt Line Road.
- Reduce the number of curb cuts for commercial areas along Irving Boulevard, and promote internal circulation among commercial sites.
- Work with TxDOT on the SH 183 and SH Loop 12 MIS studies.
- Promote efforts associated with TxDOT's Value Engineering Study of the SH Loop 12/SH 183/ SH 114 area and TxDOT's efforts to promote area circulation.
- Construct Retail Center Drive between Ranch Trail and IH 635 with a grade separation at IH 635.
- Construct the proposed IH 635 frontage roads between MacArthur Boulevard and Belt Line Road and associated ramps for Belt Line, Retail Center Drive, and MacArthur traffic.
- Connect East Valley Ranch Parkway to Valwood Parkway via the proposed SH 190/SH 161 Connector interchange; investigate possibility of moving proposed interchange further south to accommodate potential intersection at East Valley Ranch Parkway between Santa Fe Trail and Cimmaron Trail.
- Construct the proposed southbound East Valley Ranch Parkway to Valley View Lane connection.
- Construct the proposed extension of Decker Drive between O'Connor Road and a point west of Goodson Drive so as to serve as internal circulation for office developments on the west side of SH 114.

- Upon completion of the extension of Decker Drive, close Wingen between Decker Drive and Tampico Street so that Wingren will serve its intended function as a residential collector street.
- Increase left-turn capacity at major north-south interchanges with SH 183; evaluate the conversion of a through lane to a left/through lane assignment to increase left turn capacity for both north and southbound turning movements. Should through traffic volumes experience a decrease in level of service, operations should revert to the original lane assignments.
- Provide a commercial collector behind the Mall between Belt Line Road and SH 183 and, as part of the SH 183 MIS which will be initiated in 1997, work with TxDOT to provide a westbound entry ramp east of Esters Road.
- Coordinate with private developers for roadway improvements, and promote shared access to adjacent commercial development west of the Mall.

10.9 TRANSPORTATION SYSTEM POLICIES

The following goals, objectives, and policies have been developed to provide guidance and direction in the planning, design, and implementation of a multimodal transportation system for the City of Irving. These policies should be supported by specific actions by the City to ensure that the desired levels of mobility, safety, and land use compatibility are attained.

Goal 1: ***Provide a transportation system that will effectively and economically serve the existing and projected travel needs of the community in a safe and efficient manner.***

Objective 1 : ***Develop the thoroughfare system consistent with the Comprehensive Plan objectives.***

Policy 1: Maintain a Master Thoroughfare Plan which is coordinated with the land use development considerations in the Comprehensive Plan.

Policy 2: Develop and maintain a transportation modeling database which can assess the impacts of existing and future land uses on the roadway network.

Policy 3: Maintain a transportation planning process which addresses long-

range needs, but emphasizes short and mid-range problem solving.

Policy 4: Establish a process for continual update of demographic data (population and employment) for use in the TRANPLAN Travel Forecasting Model.

Policy 5: Promote regulations that maximize the use of the existing transportation system.

Policy 6: Ensure that roadway/rail expansion plans support local development goals for meeting housing, economic, community, and employment needs.

Policy 7: Support and include community participation throughout the transportation planning process.

Objective 2: ***Achieve a clearly expressed and visibly consistent hierarchy of the roadway network.***

Policy 1: Develop and implement a functional classification system which provides for graduation of traffic flow from the movement function to the access function.

Policy 2: Develop a hierarchy of linkages centered on major north-south and east-west thoroughfares.

Policy 3: Implement an access management program designed to reduce the number of conflicts between through and turning movements. Encourage the use of shared access drives and common circulation systems within clusters of development.

Policy 4: Create "character zones" along major accessways and other major corridors through a comprehensive landscape, streetscape, and signage program.

Objective 3: ***Maintain high property values for residential property by minimizing any negative neighborhood impacts of transportation improvements.***

Policy 1: Address neighborhood impacts while reviewing zoning changes along transportation improvements.

Policy 2: Avoid new road construction or widening that will negatively impact established neighborhoods or business districts.

Policy 3: Discourage through truck traffic and hazardous cargo routes in the vicinity of residential neighborhoods.

Policy 4: Promote the arrangement of land use patterns by controlling the location of city streets.

Objective 4: ***Maintain the competitive edge of the City of Irving in attracting and retaining top quality businesses by providing a high degree of accessibility.***

Policy 1: Encourage development of linkages among DFW Airport, Las Colinas, the SH 114 corridor, and downtown Irving.

Policy 2: Encourage Transportation System Management (TSM) measures to improve accessibility.

Objective 5: ***Encourage development patterns in vacant areas of the City (North Irving) which promote transportation efficiency.***

Policy 1: Support infill, compact, and higher densities for urban development.

Policy 2: Encourage major private and public facilities to locate along transit lines.

Policy 3: Cluster home and work locations to minimize commuting distances.

Objective 6 : ***Account for the impact of development on transportation facilities in the region.***

Policy 1: Establish guidelines for the requirement of traffic impact analyses for all major development proposals in the City.

Policy 2: Promote employer based Transportation Demand Management (TDM) strategies in new developments.

Objective 7: ***Provide safe and efficient ingress and egress to major activity centers such as the Regional Activity District and Texas Stadium.***

Policy 1: Investigate interface of the Trinity Railway Express to activity centers.

Policy 2: Identify and enhance accessibility from DART transit centers to activity centers.

Policy 3: Encourage non-motorized modes for visitors and residents that reside within the vicinity of such centers.

Policy 4: Provide for a circulator system for transfer of visitors to and from the remote parking lots.

Objective 8: ***Adopt and enact urban design guidelines for development along all major transportation links to enhance Irving's visual image and identity.***

Policy 1: Create visual "gateways" at principal entry points to Irving and develop a design "theme" that is used throughout the City to create a sense of unity and identity.

Policy 2: Develop a unique visual identity for regional transportation corridors that pass through Irving by streetscape, building facade, noise buffering, and median landscaping treatments.

Policy 3: Require new development proposals to dedicate land for on-site and frontage pedestrian, bicycle, and transit amenities as a part of the subdivision and rezoning process.

Objective 9: ***Acquire and preserve right-of-way in the most economical manner.***

Policy 1: Establish right-of-way widths which incorporate public transit and future needs for pedestrian walkways, bike lanes**,** landscape buffers, etc.

Policy 2: Enact ordinances to preserve and protect public rights-of-way from encroachment.

Policy 3: Identify and acquire abandoned rights-of-way for future rail transit, pedestrian, or bike facilities.

Policy 4: Encourage private sector investments in transportation.

Objective 10: ***Minimize overall energy consumption in the transportation sector.***

Policy 1: Consider energy consumption in the evaluation of alternative system-wide plans.

Policy 2: Promote measures encouraging the use of alternative fuels.

Policy 3: Develop a public information campaign for energy conservation.

Goal 2: ***Ensure that the City of Irving's thoroughfare system is compatible with the regional network.***

Objective 1: ***Develop a local transportation planning process that ensures coordination with the regional transportation goals.***

Policy 1: Actively participate in the regional transportation planning process.

Policy 2: Adjust the time cycle for plan revisions to correspond with regional plan improvements.

Policy 3: Highlight areas of conflict between the regional and local thoroughfare plans early in the process to ensure timely resolution.

Policy 4: Develop guidelines for coordinating local transportation improvements with the regional Transportation Improvement Program (TIP).

Objective 2: ***Support regional and inter-city transportation needs.***

Policy 1: Give high priority to improvements serving regional travel.

Policy 2: Enhance the efficiency of regional and inter-city transportation facilities.

Policy 3: Propose and encourage land use regulations that enhance the capacity of regional travel facilities.

Goal 3: ***Ensure that transportation planning promotes preservation and enhancement of natural resources.***

Objective 1: ***Review developments affecting natural features such as Elm Fork Trinity River, West Fork Trinity River, and North Lake.***

Policy 1: Actively monitor the Trinity Park and Greenbelt Master Plan.

Policy 2: Plan and provide links to natural features while recognizing their environmental sensitivity.

Policy 3: Devise innovative solutions for adapting the standard grid thoroughfare system in the vicinity of meandering natural features.

Policy 4**:** Avoid new road alignments encroaching through environmentally sensitive areas.

Goal 4: ***Strive to optimize mobility of Irving's residents through enhanced mode choice.***

Objective 1: ***Identify opportunities to provide and enhance intermodal connections at DART transit centers and proposed Trinity Railway Express stations.***

Policy 1: Promote planning efforts utilizing the Las Colinas Area Personnel Transit (APT) to provide linkages with transit facilities.

Policy 2: Maximize the role of Trinity Railway Express along the Dallas/Fort Worth commuter rail corridor in achieving community design objectives.

Policy 3 : Identify and enhance opportunities for providing bicycle/pedestrian linkages to the transit centers.

Policy 4 : Identify, enhance and facilitate park-and-ride lots, kiss-and-ride lots, bus-rail interface, and share-a-taxi opportunities.

Objective 2: ***Decrease dependency on single-occupancy vehicles.***

Policy 1: Strive to develop a transit-friendly transportation system which gives high occupancy vehicles a time and speed advantage over single-occupancy vehicles.

Policy 2: Identify corridors that emphasize transit, bicycle facilities, and pedestrian access.

Policy 3: Place high priority on serving captive riders with public transportation.

Policy 4: Ensure that areas not served by fixed-route transit have access to demand responsive service.

Policy 5: Incorporate and publicize a bicycle safety education program.

Policy 6: Investigate opportunities to utilize ISTEA funding for implementation of multi-modal transportation options such as Area Personnel Transit (APT) and water-taxi for linkages throughout the Regional Activity District.