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EXECUTIVE SUMMARY

THE TOTAL TRANSPORTATION PLAN FOR THE NORTH CENTRAL TEXAS REGION FOR 1990



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This publication, which is made available free of charge by the North Central Texas Council of Governments, is a summary of a more detailed report entitled *The Total Transportation Plan for the North Central Texas Region for 1990*. The full report may be obtained at a cost of \$10.00 by writing the Transportation Department, North Central Texas Council of Governments, P. O. Drawer COG, Arlington, Texas 76011. Additional copies of the Executive Summary are available free of charge from the same source. Technical reports on specific aspects of the evaluation process will be published at a later date.

On November 15, 1974, The Total Transportation Plan for the North Central Texas Region for 1990 was adopted by the Regional Transportation Policy Advisory Committee as the region's official plan for highway, public transportation and airport system development. Their action climaxed months of intensive evaluation and analysis by the Steering Committee of the Regional Transportation Policy Advisory Committee. Technical support for this effort was provided by the Transportation Department of the North Central Texas Council of Governments with the assistance of the Regional Planning Office, Texas Highway Department.



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THE TOTAL TRANSPORTATION PLAN
FOR THE NORTH CENTRAL TEXAS
REGION FOR 1990

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INTRODUCTION:

On November 15, 1974, the Regional Transportation Policy Advisory Committee unanimously adopted the Total Transportation Plan for the North Central Texas Region for 1990, climaxing nine months of evaluation by RTPAC's Steering Committee and establishing the region's first multimodal transportation plan. Like other planning efforts, this plan was developed based on socioeconomic projections, anticipated travel patterns and characteristics, and utilization of proposed facilities. Unlike other plans, the Total Transportation Plan goes beyond simple traffic volumes to explore the impacts of the ground transportation system on economics and land use, natural resources and the environment, and accessibility to employment opportunities as well as the many features to the transportation system itself. Rather than determining these impacts for just one proposed system, a total of six alternative ground transportation systems were explored and evaluated in the search for the optimum plan. Similarly, four alternative airport system concepts were identified and evaluated for inclusion in the Total Transportation Plan. As a result, the recommendations for airports, highways, and transit facilities represent the policy direction which appeared most favorable for the region in terms of social, environmental, and economic impacts when compared to all other options. This is the plan which will be explored in the pages to come.

THE TOTAL TRANSPORTATION PLAN FOR THE NORTH CENTRAL TEXAS REGION FOR 1990

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Recognition of the influence of the transportation system on shaping urban growth patterns, and even life styles, has significantly changed transportation planning and the responsibilities of the decision makers. Transportation systems can no longer be designed only for efficiency in moving people and goods. It is the total impact -- the effects of a system on development patterns, energy consumption, pollution, and other considerations -- that must be viewed in the decision-making process.

Additionally, transportation planning must now be approached on a multimodal basis, recognizing the total impossibility of developing an efficient transportation plan without considering all modes of travel simultaneously. Transportation planners today must develop various combinations of highway, transit, and air systems and project for the local elected official the social, economic, and environmental impacts of each alternative. This was the approach utilized by the Steering Committee of the Regional Transportation Policy Advisory Committee in determining the Total Transportation Plan for the North Central Texas Region for 1990. This effort has involved planning engineers, traffic engineers, urban planners, sociologists, demographers, and economists represented on the professional staffs of local governments, the Texas Highway Department, and the North Central Texas Council of Governments.

● WHAT AREA WAS INCLUDED IN THE PLAN?

Impact analysis of the various alternative ground transportation systems was confined to the 2,600-square-mile Intensive Study Area, which is that area originally delineated in 1964 as the area that could be expected to be urbanized by 1990. This Intensive Study Area, shown in Figure 1, consists of all of Dallas and Tarrant Counties and parts of Denton, Collin, Rockwall, Kaufman, Ellis, Johnson, and Parker Counties. In contrast, airport system planning was accomplished for a nineteen-county area, including both the North Central Texas and Texoma State Planning Regions. This larger area for airport system planning was necessary to consider the market area for general aviation in North Central Texas. This summary, however, will be confined to the Intensive Study Area.

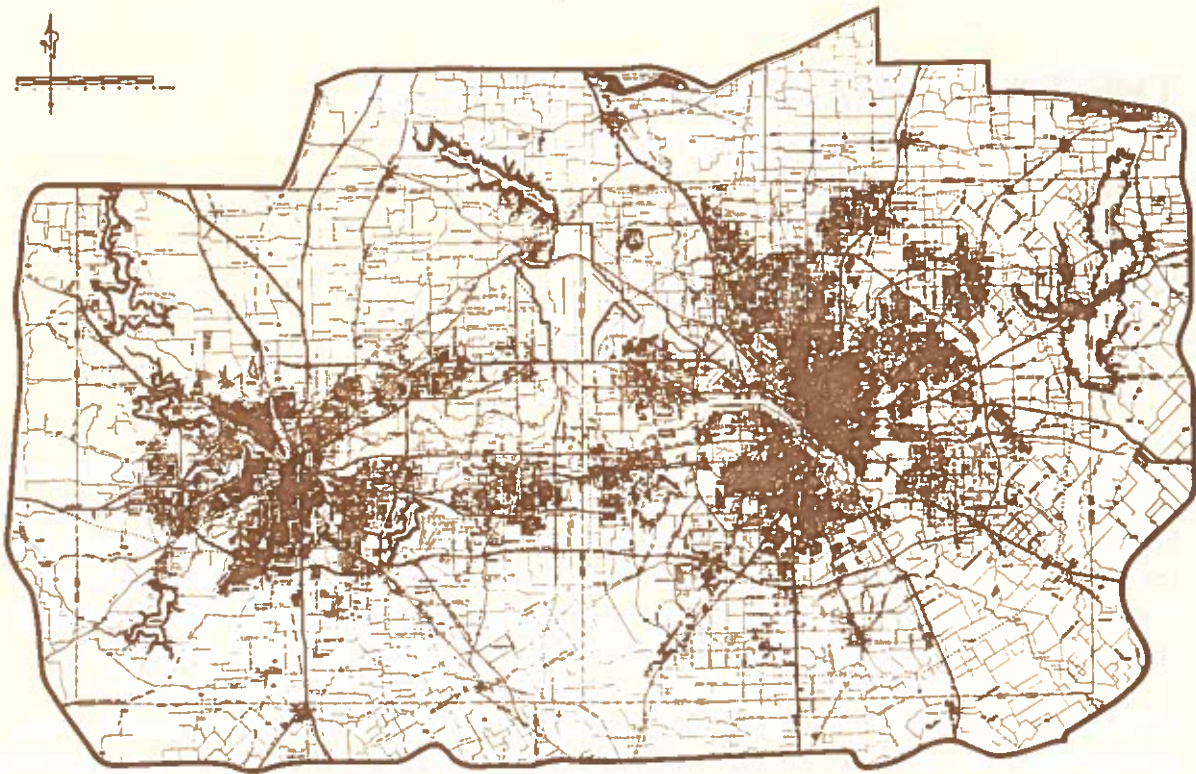


FIGURE 1
INTENSIVE STUDY AREA

● WHAT TRANSPORTATION ALTERNATIVES WERE CONSIDERED?

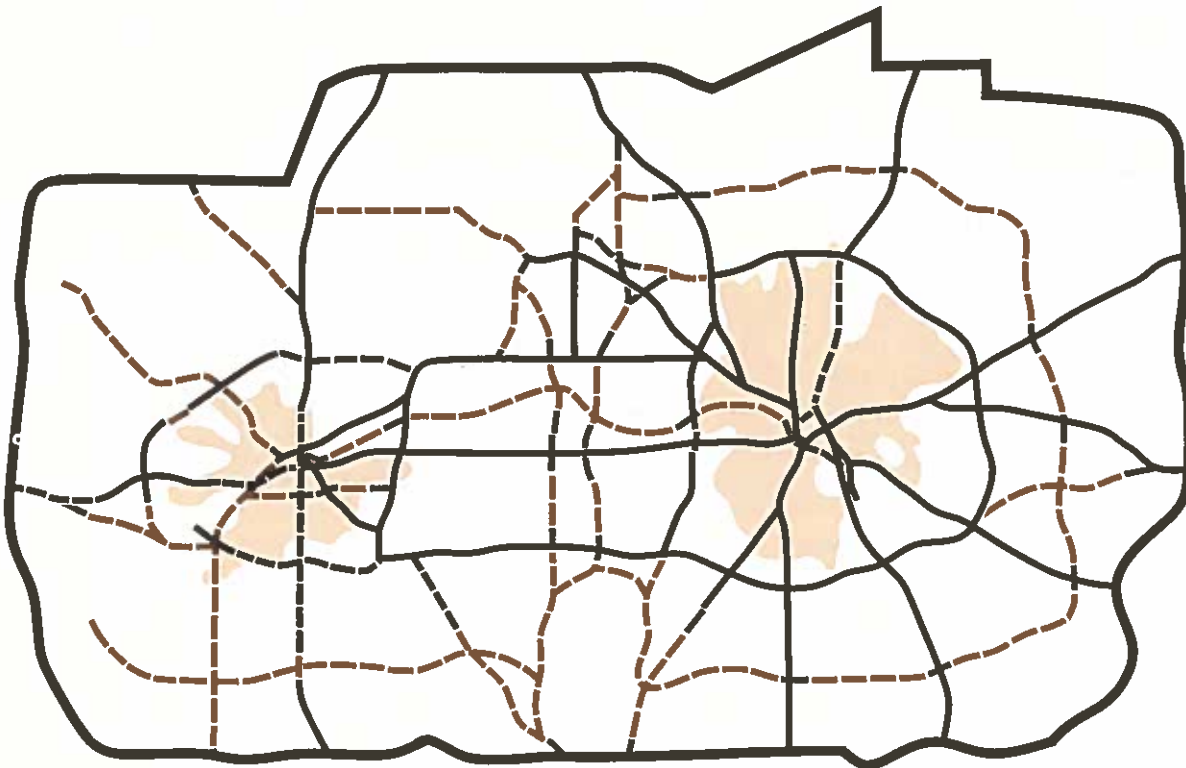
Although six different alternative ground transportation systems were eventually considered, five concepts were initially identified which appeared to offer the broadest range of highway and transit alternatives. These alternatives were proposed to build upon the existing highway system, which includes 446 miles of freeways, and the existing transit system, which includes one mile of fixed guideway transit and approximately 500 buses providing service within the Cities of Dallas and Fort Worth.

The Steering Committee first considered the two extremes of a total future investment in freeways -- the All Highway Alternative -- and a future investment solely in transit -- the All Transit Alternative. Under the All Highway Alternative, shown in Figure 2, 330 miles of freeways would be added to the existing system, while the existing level of transit service would be held constant. Under the All Transit Alternative, shown in Figure 3, transit service would be expanded to include 189 miles of rail rapid transit supported by feeder buses operating throughout the urbanized area and no additional miles of freeways. In these and all alternatives, the necessary arterial street system and bus feeder system to support the major transportation facilities were assumed.

While these two alternatives represent the extremes, two more balanced concepts were also identified which included both highway and transit improvements. These were the Primarily Highway Alternative and the Primarily Transit Alternative. Under the Primarily Highway Alternative, some 185 miles of freeways, 64 miles of exclusive guideway transit, and region-wide bus service were proposed. By contrast, the Primarily Transit Alternative was to include some 95 miles of new freeways, 107 miles of exclusive guideway transit, and region-wide bus service.

A fifth concept which represented no further capital investment -- the Do Nothing Alternative -- involved holding constant the existing highway and transit systems. Consideration of the Do Nothing Alternative enabled a determination to be made as to the need and benefit of any further capital investment in transportation.

After review of projected impacts of these alternatives, the Steering Committee directed the local professional staffs to delineate a sixth alternative which would improve upon the Primarily Highway Alternative, shown in Figure 4. This sixth alternative, which was eventually adopted by the Steering Committee as the 1990 ground transportation system, is shown in Figure 5 and included 256 additional miles of freeways and 103 miles of additional exclusive guideway transit, as well as region-wide bus service.



LEGEND

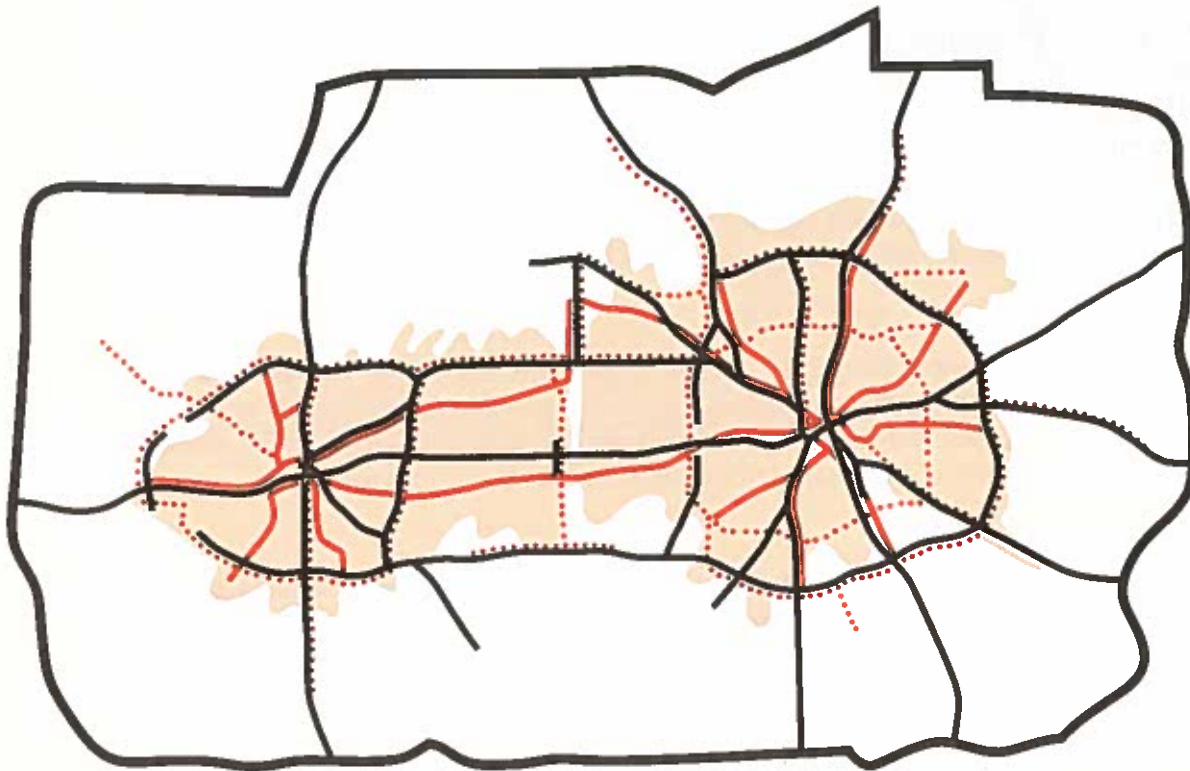
FREEWAYS

- EXISTING — NO IMPROVEMENT
- - - EXISTING — TO BE IMPROVED
- - - NEW CONSTRUCTION

TRANSIT

- TRANSIT SERVICE AREA

FIGURE 2
**1990 SYSTEM ALTERNATIVE NO. 1
 ALL HIGHWAY**



LEGEND

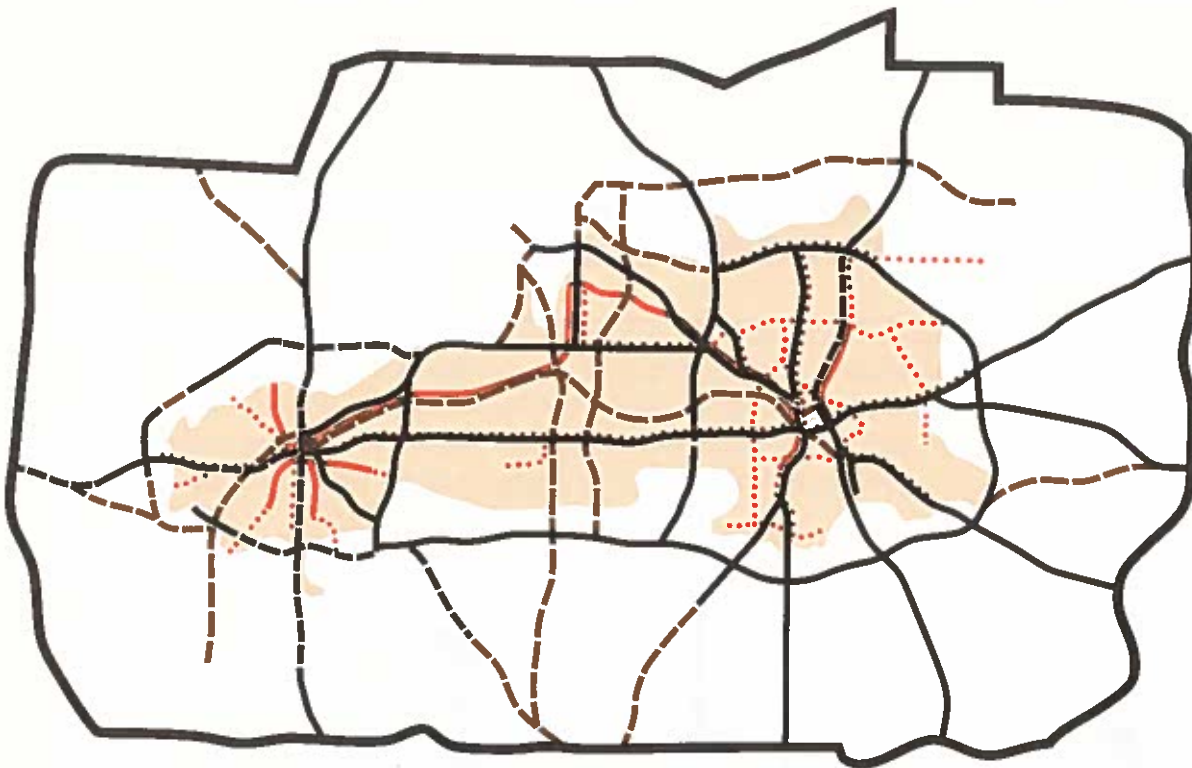
FREEWAYS

- EXISTING — NO IMPROVEMENT

TRANSIT

- RAIL RAPID TRANSIT
- BUS IN MIXED FLOW
- TRANSIT SERVICE AREA

FIGURE 3
**1990 SYSTEM ALTERNATIVE NO. 2
 ALL TRANSIT**



LEGEND

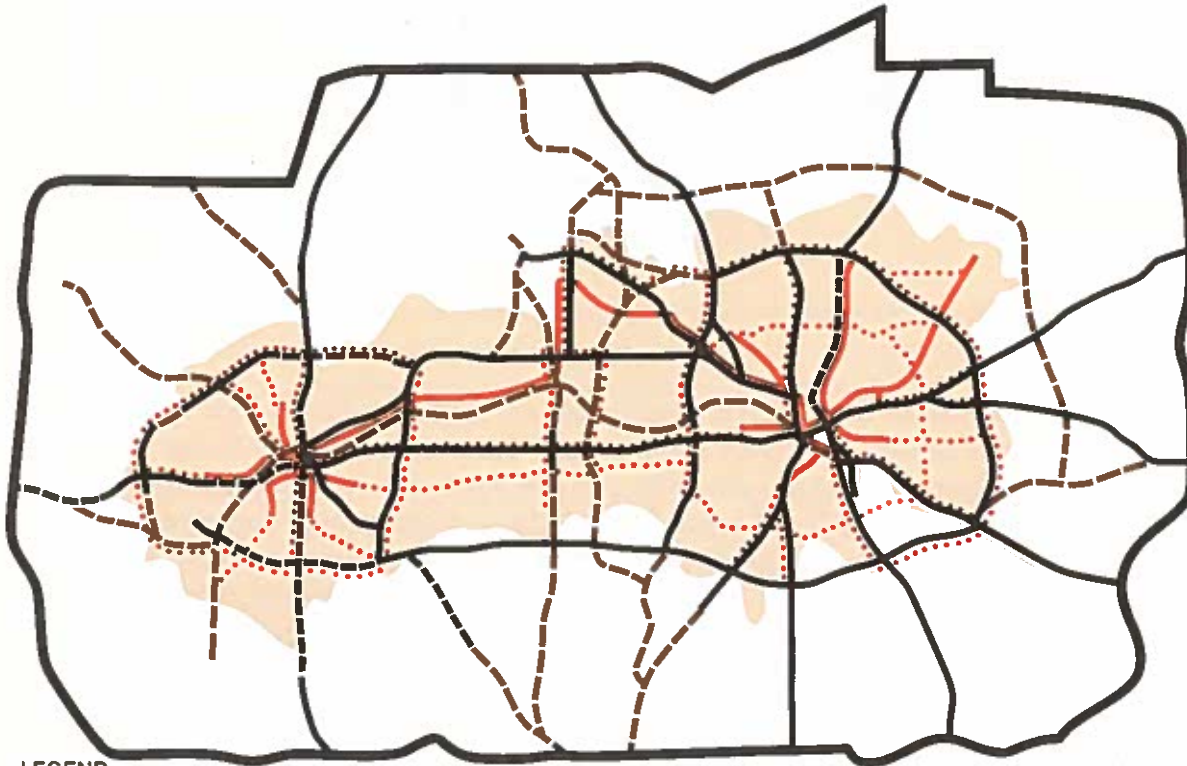
FREEWAYS

- EXISTING — NO IMPROVEMENT
- - - EXISTING — TO BE IMPROVED
- - - NEW CONSTRUCTION

TRANSIT

- EXCLUSIVE GUIDEWAY TRANSIT
- ... BUS IN MIXED FLOW
- TRANSIT SERVICE AREA

FIGURE 4
1990 SYSTEM ALTERNATIVE NO. 3
PRIMARILY HIGHWAY



LEGEND

FREEWAYS

- EXISTING — NO IMPROVEMENT
- - - EXISTING — TO BE IMPROVED
- - - NEW CONSTRUCTION

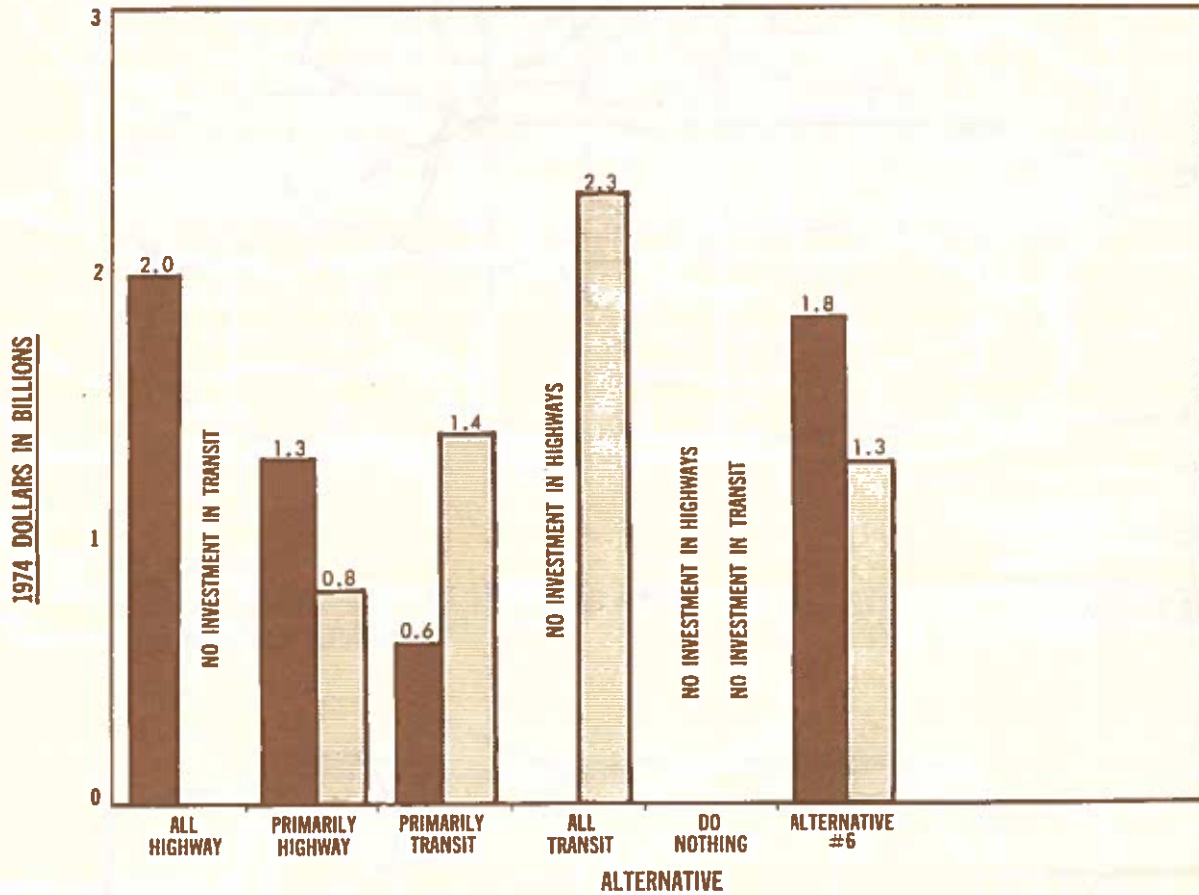
TRANSIT

- EXCLUSIVE GUIDEWAY TRANSIT
- ... BUS IN MIXED FLOW
- TRANSIT SERVICE AREA

FIGURE 5
1990 SYSTEM ALTERNATIVE NO. 6*

* ALTERNATIVE NO. 6 AS TESTED AND EVALUATED
 NON-FREEWAY IMPROVEMENTS ARE NOT SHOWN

● **WHAT IS THE CAPITAL COST OF EACH TRANSPORTATION ALTERNATIVE?**



HIGHWAYS
 TRANSIT

ONE-TIME CAPITAL EXPENSES

FIGURE 6

Freeway capital costs varied from \$2.0 billion in the All Highway Alternative to no investment in freeways in the All Transit Alternative. Freeway investment in the Primarily Highway Alternative was \$1.3 billion, in the Primarily Transit Alternative was \$0.6 billion, and in Alternative #6 was \$1.8 billion. Capital costs for transit varied from \$2.3 billion in the All Transit Alternative to no investment in transit in the All Highway Alternative. Transit investment in the Primarily Highway Alternative was \$0.8 billion, and was \$1.3 billion in Alternative #6. No investment in either freeways or transit was projected under the Do Nothing Alternative. Thus, total transportation system investments ranged from no investment under Do Nothing to \$3.1 billion under Alternative #6.

● WHAT METHODOLOGY WAS USED IN THE EVALUATION OF THE ALTERNATIVES?

Because of the influence that each alternative transportation system would have in the distribution of people and jobs, a fixed distribution of population and employment could not be considered for all alternatives. Beginning with a total projection of population and employment for the Intensive Study Area, residential and employment distributions were calculated under each alternative transportation system.

The importance of this technique must be stressed. It should be emphasized that the analysis did not begin with a planner's determination of what is best for the region; that is, whether the region should have high density or low density, or concentrated development or urban sprawl. Rather, this approach attempted to project the influence of alternative transportation systems on development patterns and present to the elected official the projected densities of population and employment which could be expected as a result of each transportation alternative.

Utilizing the current state of the art in the transportation planning process, the travel characteristics and use of both highway and transit facilities were projected. Finally, an evaluation was made of the impacts on economics and land use, travel benefits and costs, environmental and natural resources, and the social and quality of life.

● WHAT WOULD BE THE PROJECTED IMPACTS ON ECONOMICS AND LAND USE ?

As indicated previously, impacts were projected for each transportation alternative under four different subject headings, including economics and land use, transportation system features, environmental and natural resources, and accessibility to employment opportunities.

Evaluations under the heading of economics and land use considered the projected population and employment patterns which could be expected under each alternative. The projected population for 1990 for the Intensive Study Area of 3.9 million, and the projected employment of 1.8 million, along with the amount and location of developable land which has or will have sanitary sewer facilities by 1990, provided basic input to the modeling process and remained unchanged across the six alternatives. Population and employment were projected by small areas as a function, in part, of the relative accessibility provided by each transportation system being considered. Comparisons

were made of projected population and employment distributions under each alternative and areas which would grow more rapidly and less rapidly under each alternative were identified geographically. Under Alternative #6, higher growth rates could be expected in those residential areas adjacent to radial freeway and transit improvements. A higher population growth in these areas would necessitate a slower rate of growth in peripheral areas. Overall, however, little significant difference between the alternatives in population distribution by 1990 could be anticipated.

When similar comparisons were made for employment distributions, the impact of the transportation system was more significant. Those alternatives favoring transit improve-

1990 TOTAL EMPLOYMENT

TABLE 1

Alternative	Dallas CBD	Fort Worth CBD	Rest of Region	Total
Do Nothing	127,000	99,000	1,574,000	1,800,000
All Highway	188,000	121,000	1,491,000	1,800,000
All Transit	275,000	148,000	1,377,000	1,800,000
Primarily Highway	212,000	136,000	1,452,000	1,800,000
Primarily Transit	253,000	141,000	1,406,000	1,800,000
Alternative #6	274,000	151,000	1,375,000	1,800,000

ments concentrated more employment in the central cities, while highway-oriented alternatives produced a disbursement of employment to the suburbs. Under Alternative #6, higher employment densities could be expected in the central business districts of Fort Worth and Dallas and in other major concentrations of employment served by radial freeways and transitways.

● WHAT WOULD BE THE PROJECTED IMPACTS ON TRAVEL CHARACTERISTICS ?

Analysis of projected characteristics of the transportation system itself included the estimated usage of each mode of the transportation system, congestion on freeway facilities, and costs to the traveling public. As could be expected, most of the trips in the area would likely be made by private automobile.

Of approximately 16 million daily person trips projected for 1990, transit trips vary from approximately 200,000 daily trips under the Do Nothing Alternative (1.2%) to over 1.1 million transit trips per day (7.1%) under the All Transit Alternative. Of special

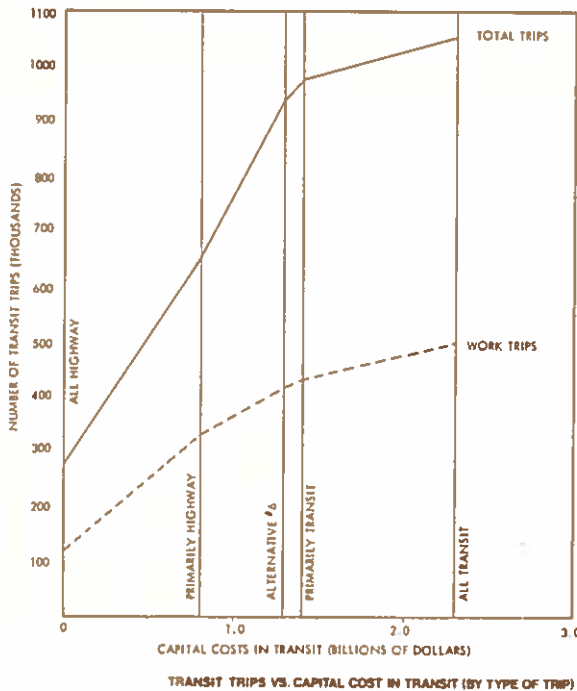


FIGURE 7

significance is the percentage of work trips attracted to transit, which could be expected to vary from 3.9% under the Do Nothing Alternative, to 22.3% under the All Transit Alternative, to 18.3% under Alternative #6. Increased transit ridership can basically be attributed to the increased capital investment in transit under each alternative, as reflected in the level of transit services.

Plots were made of anticipated ridership under each alternative, as compared to capital cost in transit. Figure 7 indicates that a decreasing rate of return, as measured in the number of trips attracted to transit, can be expected for expenditures above that estimated for Alternative #6. In other words, massive capital expenditures in transit beyond that proposed in Alternative #6 could not be expected to attract transit ridership at the same rate.

A study of travel patterns and characteristics was conducted for the six alternatives to determine the extent and location of congestion which could be expected during peak hours of travel. To provide a better understanding of various congestion levels, six highway level of service concepts are pictured and described in Figure 8.

Properly designed, urban freeways should be at level of service C or D during peak periods. Level of service concepts E and F, which indicate that traffic on the road has actually exceeded design capacity, were considered the levels of congestion

HIGHWAY LEVEL OF SERVICE CONCEPTS

FIGURE 8



Level of Service A: Free flowing traffic, with no restriction on maneuverability and drivers able to maintain their desired speeds with little or no delay.



Level of Service D: Approaches unstable flow of traffic, with drivers having little freedom to maneuver and operating speeds considerably affected.



Level of Service B: Stable flow of traffic, with drivers still having reasonable freedom to select lanes and maintain desired speeds.



Level of Service E: Unstable flow of traffic, with volumes at or near the capacity of the highway, resulting in stop-and-go operation of vehicles.



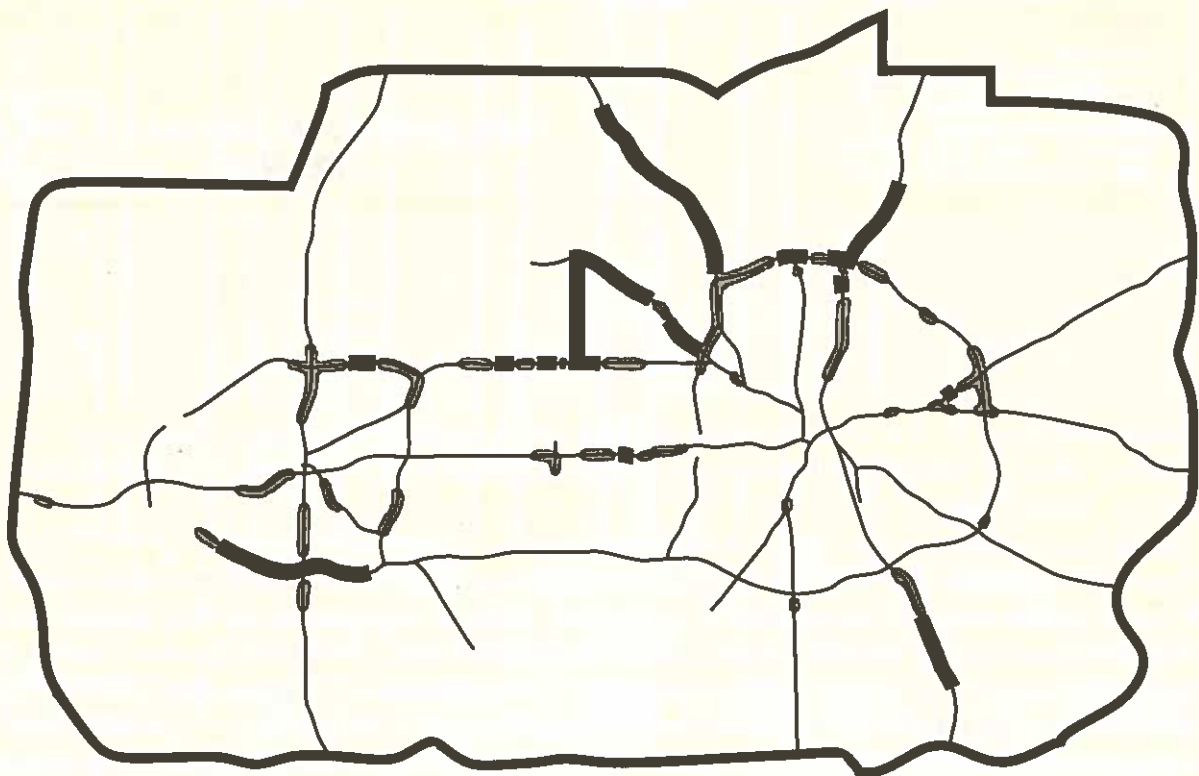
Level of Service C: Stable flow of traffic, but drivers having restricted freedom to select their own speed, change lanes, or pass.



Level of Service F: Forced flow operation at low speeds, with stoppages occurring for short or long periods due to congestion.

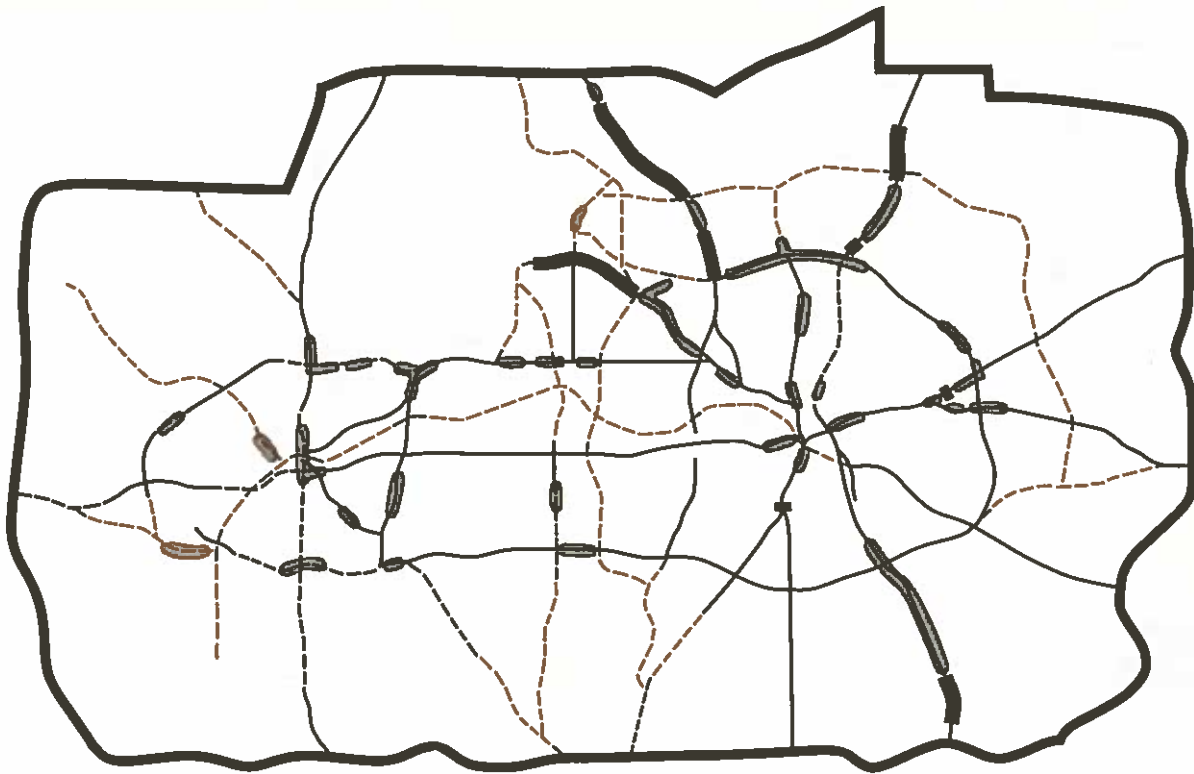
SOURCE: Highway Capacity Manual - 1965, Highway Research Board Special Report 87; National Academy of Sciences, 1965, Pages 84 and 85.

which should be noted. An analysis of the travel patterns projected for each of the six alternatives revealed that some congestion could be expected under all of the alternatives, with the Do Nothing Alternative being the most congested and Alternative #6 being the least congested of all those tested. Those freeway segments which would be congested in 1990 under the Do Nothing Alternative are shown in Figure 9. Significant segments expected to be congested include North Central Expressway; segments of I-635, I-35E north of I-635, State Highway 114, and State Highway 183; segments of Loop 820; and the South and West Freeways in Fort Worth. Significant by its absence on the congestion map is I-35E adjacent to the Dallas Central Business District. This lack of congestion is indicative of the results of redistributed population and employment under the Do Nothing Alternative. As indicated previously, the Do Nothing Alternative could be expected to contribute to a dispersal of residential development, more so than any other alternative tested. With an increase in the number of people and jobs moving away from the central city would



LEGEND
FREEWAYS
 EXISTING - NO IMPROVEMENT
 VOLUME / CAPACITY RATIO
 1.5+ (LEVEL OF SERVICE 'F')
 1.0-1.5 (LEVEL OF SERVICE 'E')

FIGURE 9
1990 SYSTEM ALTERNATIVE NO. 5
DO NOTHING - FREEWAY CONGESTION



FREEWAYS
 ——— EXISTING — NO IMPROVEMENT
 - - - EXISTING — TO BE IMPROVED
 - - - NEW CONSTRUCTION
VOLUME / CAPACITY RATIO
 ■■■ 1.5+ (LEVEL OF SERVICE 'F')
 ■■■ 1.0-1.5 (LEVEL OF SERVICE 'E')

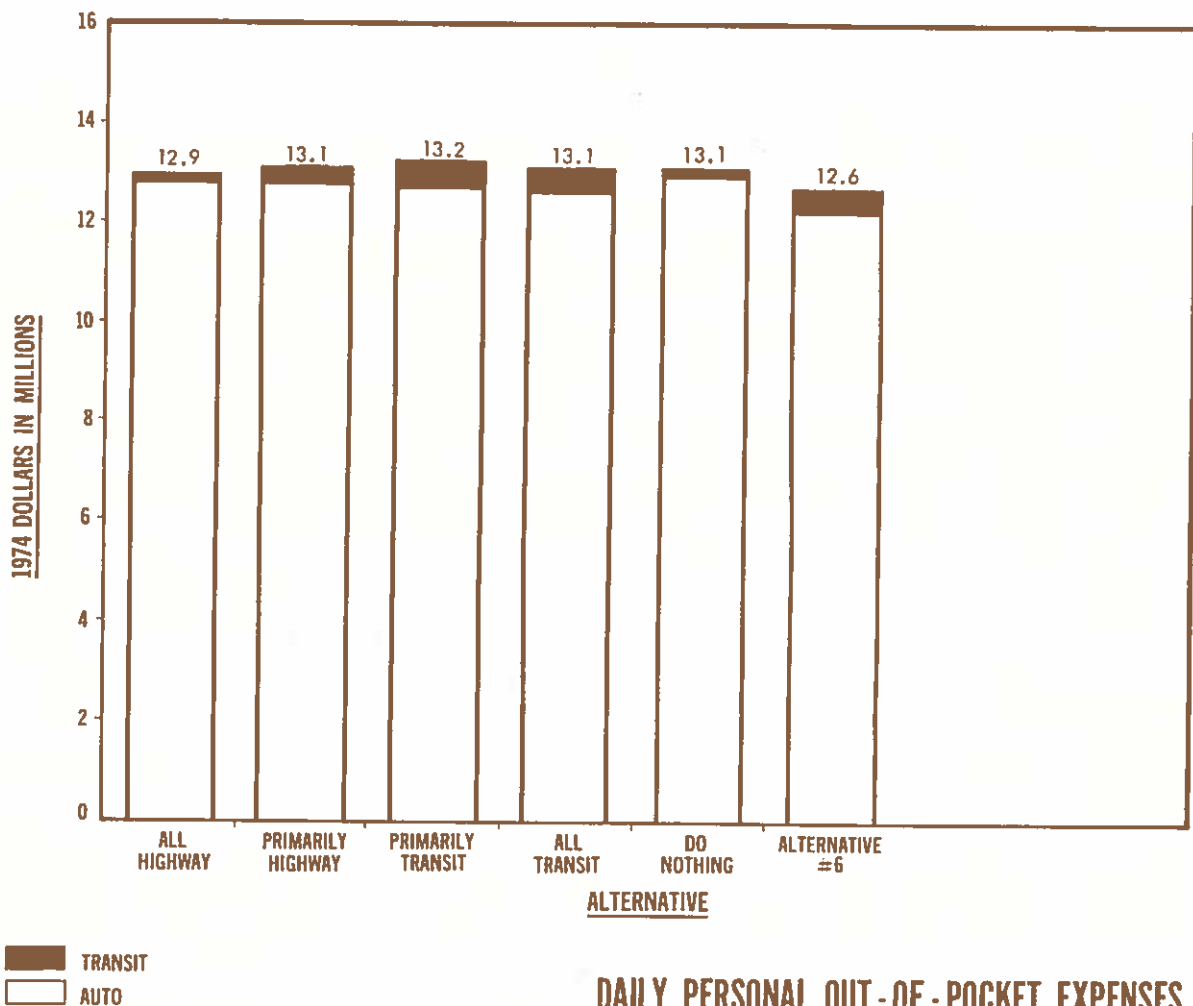
FIGURE 10
**1990 SYSTEM ALTERNATIVE NO. 6
 FREEWAY CONGESTION**

come a decrease in the trips oriented to the central business districts of Dallas and Fort Worth. Thus, a freeway adjacent to the central business district such as I-35E would attract fewer trips.

Figure 10 indicates the freeway congestion which could be expected under Alternative #6. It can be observed that the number of congested links in the freeway system is significantly reduced from that noted under the Do Nothing Alternative. Reduction in the number of congested freeway segments under Alternative #6 can be contributed to freeway and transit improvements in the more highly developed areas. An analysis of these improvements reveals that the widening of existing facilities was particularly effective in reducing congestion along radial and circumferential corridors in the more densely populated areas. In particular, severe congestion would probably be eliminated on Loop 820, the Dallas-Fort Worth Turnpike, State Highway 183, segments of I-635, and the North Central Expressway.

● WHAT WOULD BE THE OUT-OF-POCKET COSTS UNDER EACH ALTERNATIVE?

Daily personal out-of-pocket costs were compared under each alternative, as shown in Figure 11. These costs include gasoline, depreciation, insurance, etc., for the automobile driver and transit fares for transit users. While no significant difference is noted among the alternatives, Alternative #6 could be expected to result in an average personal out-of-pocket expense of \$3.27 per capita per day, slightly less than any other alternative principally due to reduced congestion and less travel by the automobile.



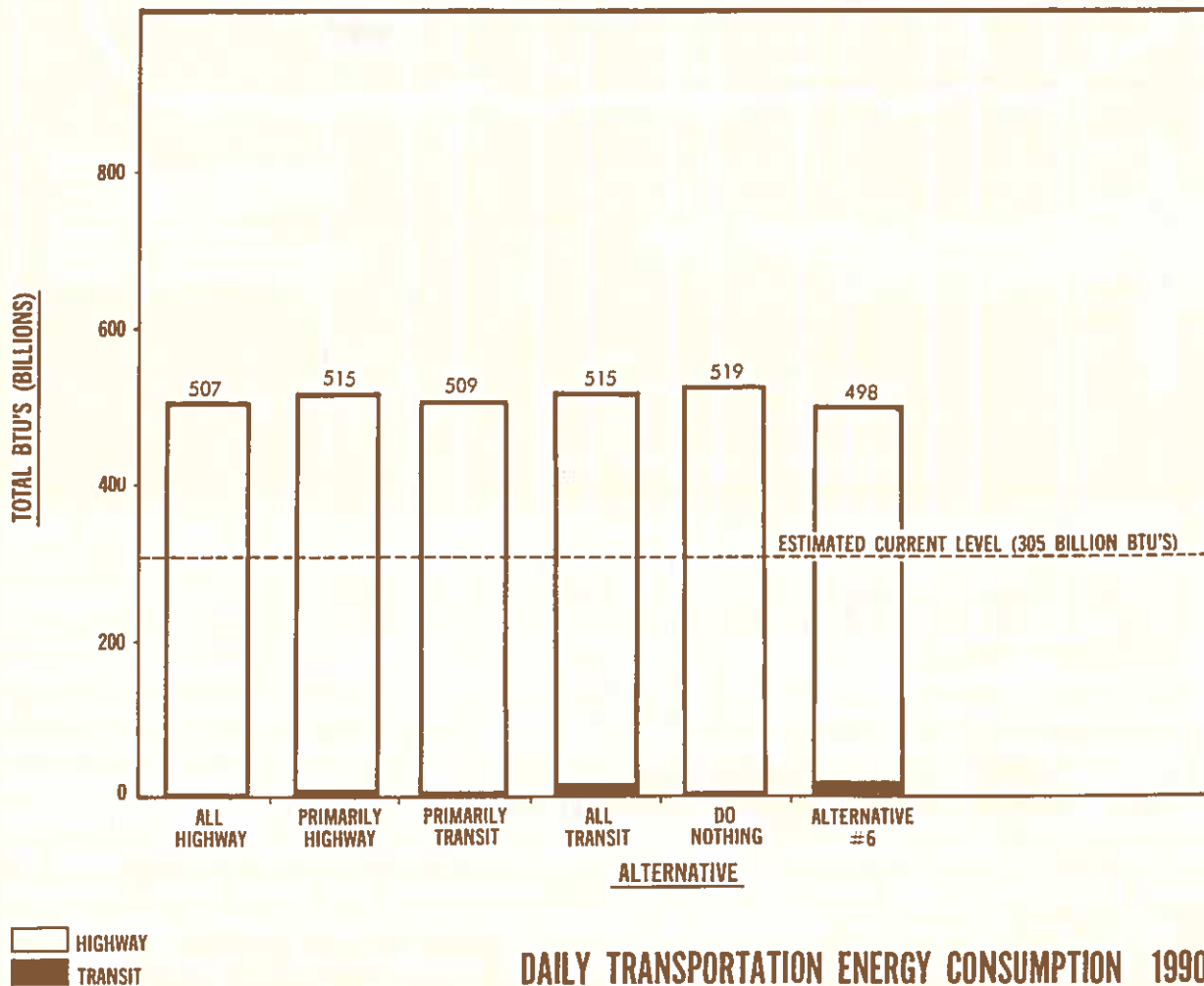
DAILY PERSONAL OUT-OF-POCKET EXPENSES

FIGURE 11

● WHAT WOULD BE THE IMPACT OF THE ALTERNATIVE TRANSPORTATION SYSTEMS ON NATURAL RESOURCES AND THE ENVIRONMENT?

Under this heading, two major projections were made for each alternative. These included estimates of the total energy consumed and the total emission of air pollutants under each alternative.

Figure 12 indicates a comparison of daily energy consumption in 1990 for each alternative. For the evaluation of the alternative systems, energy consumption was calculated in terms of BTU's to put gasoline, bus diesel fuel, and electrically-powered public transit on a common basis. It will be noted that, even with 1990 automobile gasoline efficiency assumed to be 20 miles per gallon instead of today's 13.5 miles per gallon, transportation energy consumption can be expected to increase by 60 to 70% over the estimated 305 billion BTU's per day currently consumed. Although a slight reduction in energy consumption

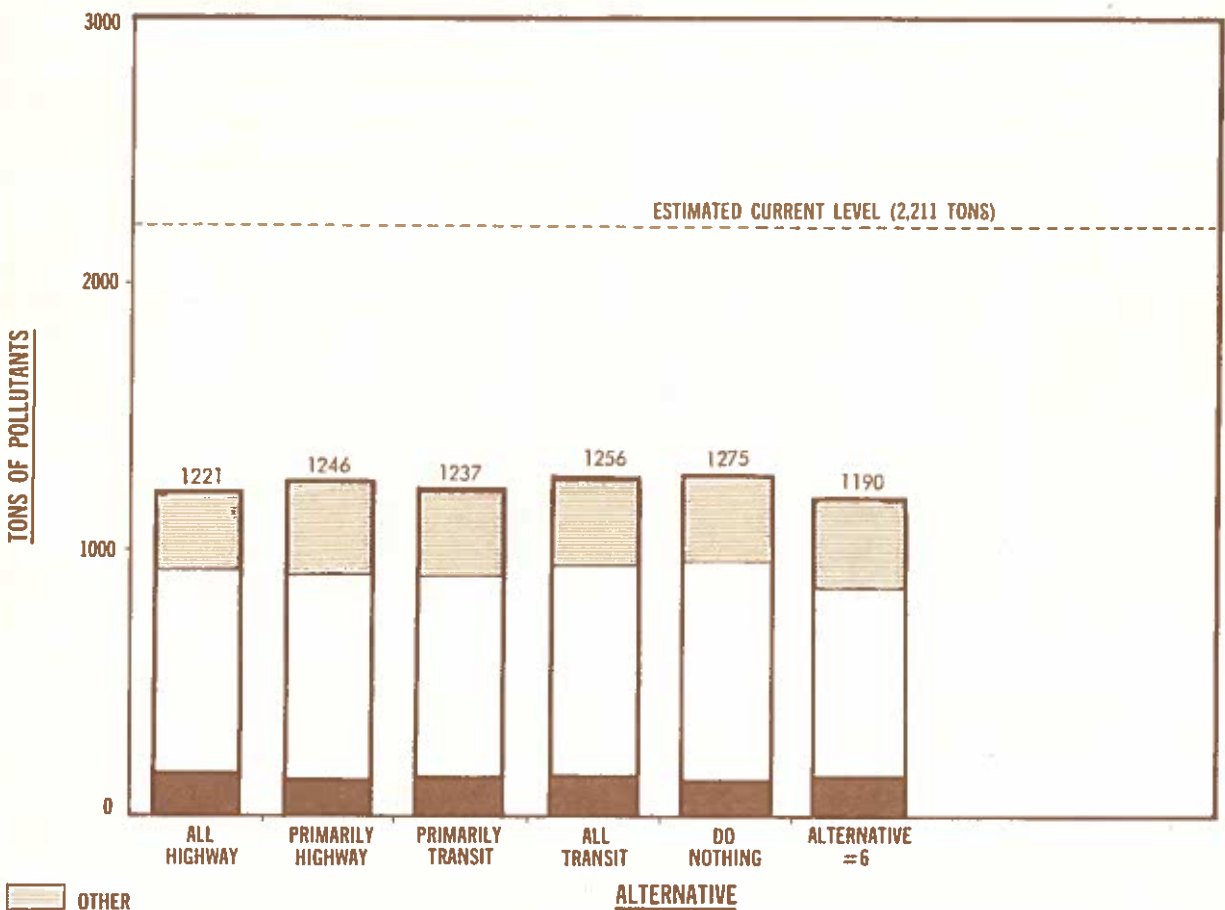


DAILY TRANSPORTATION ENERGY CONSUMPTION 1990

FIGURE 12

could be expected under Alternative #6, no significant reduction in transportation energy consumption could be expected under any of the alternatives delineated.

In comparing the total daily emission of air pollutants from automobiles and buses under each alternative for 1990, it will be noted in Figure 13 that none of the alternatives resulted in a significant reduction in the total pollutants emitted daily, although Alternative #6 indicated the least amount of daily pollutants emitted. Automobiles produced between now and 1990 were assumed to be in compliance with Environmental Protection Agency emissions standards. It will be noted that the Do Nothing Alternative would likely result in the most air pollution from ground transportation sources. This could be attributed principally to greater urban sprawl than under any other alternative; hence, more vehicle miles of travel could be expected under the Do Nothing Alternative, but under more congested conditions. The conclusion could be drawn that emission standards for automobiles would do much more to reduce total emissions than massive changes in the transportation system.



*EXCLUDES POLLUTANTS AT POWER PLANT FOR ELECTRICALLY POWERED TRANSIT MODES

* TOTAL DAILY POLLUTANTS EMITTED 1990

FIGURE 13

● WHAT WOULD BE THE IMPACT OF TRANSPORTATION ALTERNATIVES ON JOB ACCESSIBILITY?

AVERAGE JOB ACCESSIBILITY
AVERAGE PERCENT OF REGIONAL JOBS
 ACCESSIBLE WITHIN 30 MINUTES

TABLE 2

Alternative	Highway	Transit
Existing System (1970)	40%	2%
All Highway	35%	2%
All Transit	30%	15%
Primarily Highway	29%	7%
Primarily Transit	28%	12%
Do Nothing	29%	2%
Alternative #6	36%	9%

The social impacts of each alternative were based on accessibility to job opportunities, with each area of the region being compared to all others in terms of the number of jobs which could be reached in 30 minutes. This analysis revealed that, in 1990, highway accessibility to job opportunities will actually be less than is enjoyed today regardless of improvements to the system. However, Alternative #6 was found to provide the best highway accessibility of any alterna-

tive tested, including the All Highway Alternative, as Table 2 indicates, while providing an improved transit accessibility over today's conditions.

In summary, Alternative #6 could be expected to provide better highway accessibility than all other alternatives and only slightly less highway accessibility than the existing system. Transit accessibility under Alternative #6 was considerably improved over existing transit accessibility and was slightly improved over the Primarily Highway Alternative.

● WHAT CONCLUSIONS WERE REACHED IN REGARD TO THE GROUND TRANSPORTATION SYSTEM?

Considering all projected impacts, it was concluded that Alternative #6 provided the best plan for the future ground transportation system. It was this alternative which was included in the 1990 Total Transportation Plan.

● WHAT CONSIDERATIONS WERE GIVEN TO AIRPORT SYSTEM PLANNING METHODOLOGY?

The number and type of aviation facilities needed by an area essentially depends upon the demand created by aviation operations. This demand, which includes air carrier, air cargo, and general aviation operations, was projected for North Central Texas through 1990. The Dallas/Fort Worth Airport was considered as the air carrier airport for this region and its capacity to handle forecast air carrier and air cargo operations through 1990 was confirmed, provided currently-planned expansion is accomplished on a timely basis.

Emphasis was given to the general aviation requirements in the Intensive Study Area, recognizing that anticipated demand far exceeds existing capacity, as shown in Figure 14.

General aviation demands were projected by small areas and the demands compared with the capacity of the existing airport system to determine additional airport needs. The general aviation forecasts were based on socioeconomic factors, such as population, family income, and employment data.

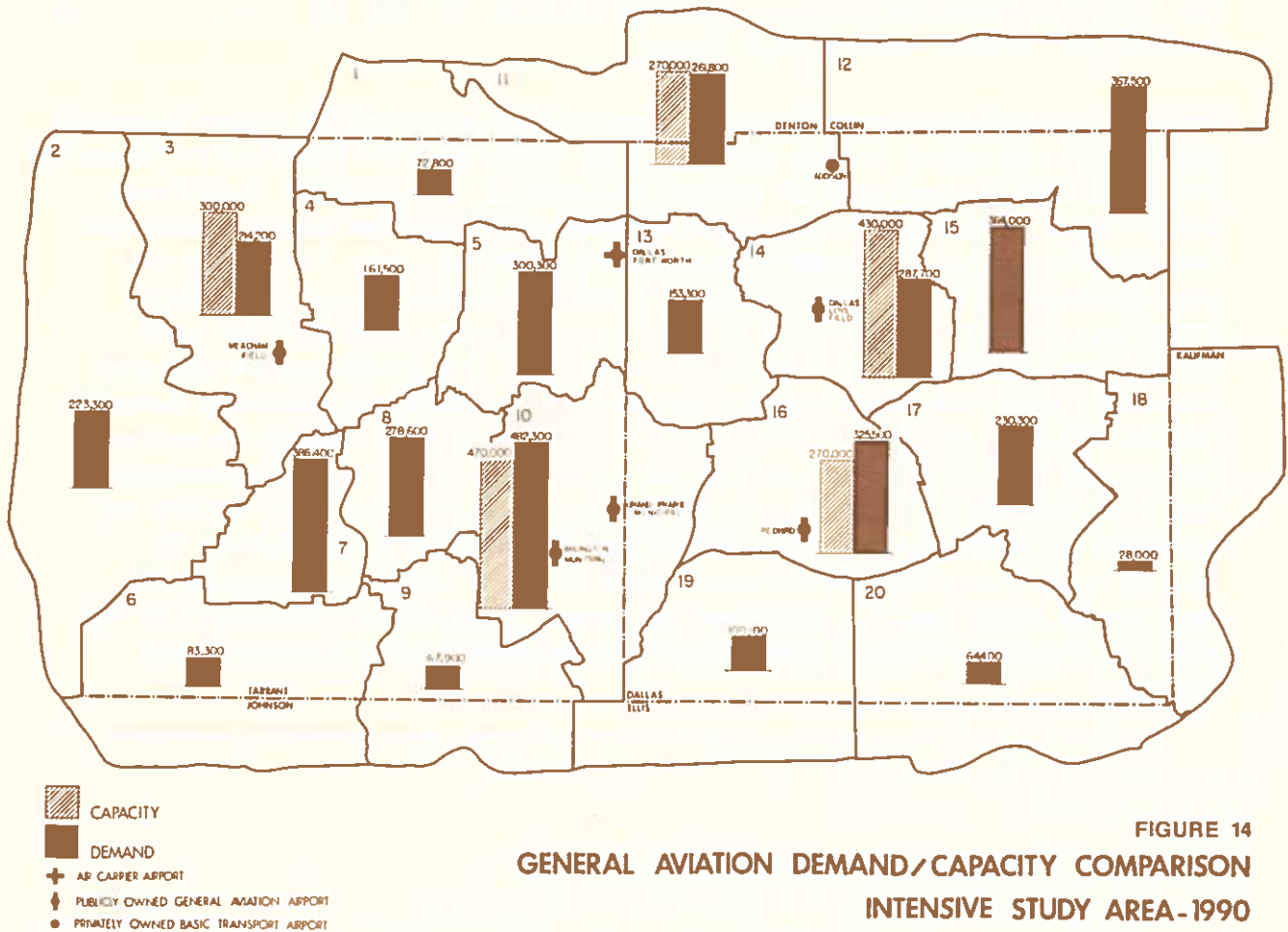


FIGURE 14
 GENERAL AVIATION DEMAND/CAPACITY COMPARISON
 INTENSIVE STUDY AREA - 1990

● DESCRIPTION OF THE TOTAL TRANSPORTATION PLAN

Highway, public transportation, and airport system improvements have been incorporated in one map of the 1990 Total Transportation Plan, which is included as Figure 15.

Highway improvements included within the adopted plan which are of particular significance are the construction of an elevated section along North Central Expressway in Dallas for use by both automobiles and buses, the widening of South Loop 820, West Freeway and South Freeway in Fort Worth, and the widening of the existing Dallas-Fort Worth Turnpike.

Without attempting to identify all of the freeways proposed for construction, the major projects would include the construction of Loop 9 to the east, north and west of Dallas, with the southern section designated for right-of-way acquisition and staged construction; the construction of the North Dallas North-South Freeway as an extension of the existing Dallas North Tollway; the extension of Interstate 635 to the Dallas/Fort Worth Airport; the construction of a freeway along the Trinity Route; the construction of State Highway 360, the Mid-Cities Freeway, and other freeway facilities designed to serve the Dallas/Fort Worth Airport area; and State Highways 199 and 121 extending outward from the Fort Worth Central Business District.

Particularly significant among the public transportation projects is the single line of rail rapid transit proposed to provide service between Dallas and Fort Worth and to the Dallas/Fort Worth Airport, and commuter service to residents of Irving and the Hurst-Euless-Bedford area. Transitways, or exclusive roadways constructed for use by carpools and transit vehicles only, are planned throughout the urbanized area. Transitways are proposed to extend from downtown Dallas toward the cities of Mesquite, Garland, Richardson, Farmers Branch, and Grand Prairie, and to serve Oak Cliff and south Dallas. From the Fort Worth Central Business District, five transitways are proposed, one serving north Fort Worth, one extending toward Arlington, two radiating southward, and one following the West Freeway alignment. All of the proposed transitways would link up with priority bus routes which would provide both radial and circumferential service in Dallas and Fort Worth. Across the southern Mid-Cities Areas, priority bus routes are proposed along the Dallas-Fort Worth Turnpike and U. S. Highway 80. Priority bus service is proposed in a north-south direction along State Highway 360 and the west leg of Loop 9. Throughout the system, major transit routes would be supported by a system of feeder buses circulating in neighborhoods and serving transit stations.
