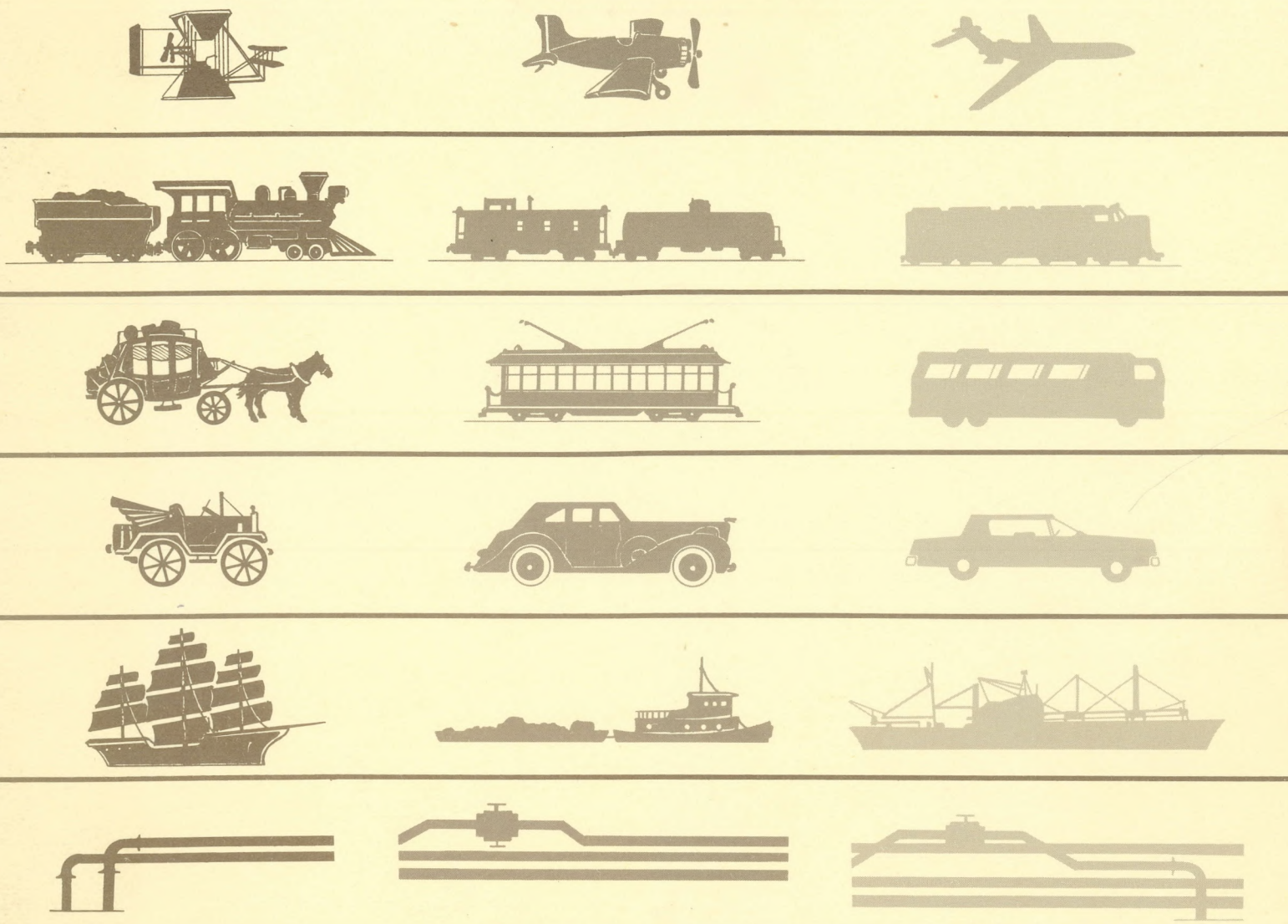

TRANSPORTATION IN TEXAS: PAST, PRESENT, AND FUTURE

Prepared by
The Texas Transportation Institute

August, 1981

The Texas A&M University System
College Station, Texas

The Texas Transportation Institute (TTI) is a part of The Texas A&M University System. It provides research, development, test, and evaluation services for the public and private sectors of the United States transportation community. The Institute is an official research arm of the Texas State Department of Highways and Public Transportation, the Railroad Commission of Texas, and the Texas Aeronautics Commission. Activities of TTI are, however, nationwide in scope; its services are available to all entities concerned with transportation systems — municipal, state, and federal agencies and private corporations — through the University contracting agency, the Texas A&M Research Foundation.

PREFACE

This report was prepared by the Economics and Planning Division staff at the Texas Transportation Institute under the direction of Dr. C. V. Wootan. Mr. G. Sadler Bridges was the study supervisor. Staff members and their contributions were:

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The Institute is grateful to the members of its Advisory Committee for their review and comments on an earlier draft of this report.

This report is presented to the people of Texas to further their understanding of transportation's important role in the State's past, present, and future development.

August, 1981
College Station, Texas

Dock Burke
Principal Investigator

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INTRODUCTION AND OBJECTIVES

Transportation is seldom of value in and of itself. It generally is a means rather than an end, and for this reason the importance of transportation is often unnoticed. In fact, a smoothly-working, well-ordered transportation system may likely be taken for granted in much the same sense as the air we breathe is taken for granted. But if a disruption occurs in this efficient system, the results are immediate, often dramatic, and potentially destructive. A traffic accident can instantly block the flow of an entire freeway resulting in huge losses of valuable travel time and the waste of hundreds of gallons of fuel. A truck or rail strike can cut deliveries of goods to the point of creating significant shortages and distorting the entire price structure of local economies. A cut-off of crude oil shipments—an embargo—can precipitate national and international crises.

An efficient, complete transportation network provides a foundation upon which a society can develop and improve its economy; resources can be moved to their most productive uses; people can pursue their freely-chosen lifestyles; and governments can pursue policies to enhance the benefits of the governed. To these ends, transportation is as crucial to a society as blood circulation is to the human body. Without transportation, a free society cannot survive.

The analysis of transportation reported here has two objectives:

(1) to focus attention upon the current status, critical issues, trends, and needs that exist in the Statewide transportation network; and

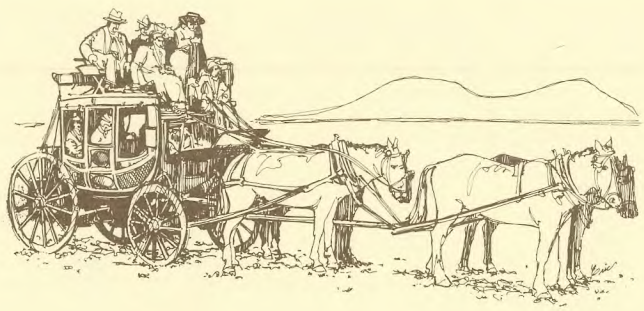
(2) to indicate the value of transportation implicit in other major issue categories—economics, human services, natural resources, population, government, and relations with Mexico.

TRANSPORTATION IN TEXAS: HISTORICAL DEVELOPMENTS AND HIGHLIGHTS

Most early settlers of Texas came overland on foot, by horseback, covered wagon, and ox cart from settlements in the eastern part of the country. Others landed at Indianola, or one of the other coastal ports established earlier by explorers, and then moved inland.

As late as 1836 when Texas became a Republic, transportation in Texas consisted solely of these primitive ports, rivers, roads, and trails. By about 1850, a network of roads had been developed from the coast up through the eastern part of the State and west generally to San Antonio and Fort Worth. Only four cross-country roads (El Paso to San Antonio; El Paso to Fort Worth; Mexico through Del Rio; Indian Territory of Oklahoma across the Panhandle of Texas) served travel westward through Texas.

In the early 1850's, a private company opened a canal connecting Galveston and the Brazos River. Subsequently, a number of river and harbor projects financed by the State were begun.



Railroads

A railroad was chartered in 1836 by the Congress of the Republic of Texas. It wasn't until 1853, though, that the first railroad operated in Texas—Harrisburg to Stafford's Point, a distance of about 29 miles. By the start of the Civil War, some eleven separate railroads had been built in Texas. The advantages of the railroad were immediately apparent in increasing speed and capacity and reducing the cost of movement of both persons and goods by as much as 50 percent.

At the end of the Civil War, a period of rapid development of railroads in Texas began. During the 1865-1900 period, 9,400 miles of track were constructed, representing more than one-half of all the track miles ever constructed in Texas. The two major factors that spurred rail development were the land grant program and incentives offered by cities for rail service.

Railroad mileage peaked in 1932 when there were more than 17,000 miles of track in Texas. Since that time, railroad mileage has declined to its present level of about 13,000 miles. Texas is still the leading state in rail mileage, and the railroad industry remains vital to the Texas economy. By 1977, Texas rail freight operations produced an all-time high level of net operating revenue—more than $320 million.

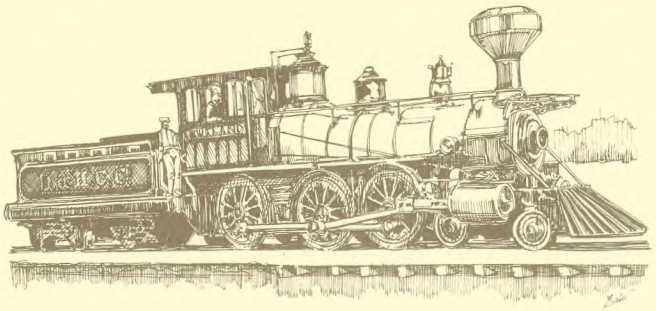
In the 1970's, the output mix of the Texas economy continued to generate a demand for rail services to carry commodities that are rail freight intensive. Over 42 percent of chemical and allied products shipped from Texas moved by rail in 1972. Forty-four percent of food and kindred products left Texas by rail.

Petroleum products are such a large part of the tonnage originated in Texas that they tend to dominate any distribution of tonnage or ton-miles by mode. Excluding petroleum and coal products, movement of 42 percent of Texas manufactured tonnage originated by rail in 1972.

Geographically, two regions dominate manufactured shipment-originations in Texas: The Houston Standard Metropolitan Statistical Area (SMSA), Beaumont-Port Arthur-Orange SMSA, and the Galveston-Texas City SMSA generated 41 percent of rail tons in Texas; The Dallas and Fort Worth SMSA's contributed an additional 10 percent. Thus, the Houston Gulf Coast area and Dallas-Fort Worth are important regions in terms of total manufactured commodity tonnage shipped by rail.

Intercity Transportation: Rail Passenger

From 1880 to 1900 the railroads were virtually the only mode of intercity transportation available. Due to the existence of the railroads, significant inland developments existed in Texas by 1900. The presence of these developments increased the demand for intercity travel. Also, isolated rural residents desired the opportunity to travel conveniently to the emerging cities.



Conventional steam railroads were not satisfactorily accommodating these demands. As a result, interurban railroads emerged to provide inexpensive frequent service along a few dense travel corridors in the State. By 1915 these interurban railroads were serving over 20 percent of the total intercity travel in Texas.

Due primarily to the growth of automobile travel on an expanding network of paved highways, passenger ridership declined rapidly during the 1920's. The Depression further curtailed the demand for intercity rail travel. By the end of the 1920's and throughout the 1940's, railroads played a relatively minor role in serving the total intercity travel market, except during World War II.

After the war the only advantage railroads had was in serving long intercity trips, and the development of air travel took away this advantage. The railroads found themselves in a position of offering less flexibility than automobiles, costing more than buses, and being slower than airplanes. Accordingly, both the absolute and relative demand for rail passenger service declined to insignificant levels. It became apparent by the late 1960's that, unless some major actions were taken, rail passenger service would cease to exist. In response to this situation, in 1971 Congress created Amtrak to operate the vast majority of rail passenger service in the country.

Initially, two Amtrak routes were established within Texas. The *Lone Star* provided daily service between Chicago and Houston via Fort Worth. Triweekly service was offered between New Orleans and Los Angeles via Houston, San Antonio and El Paso on the *Sunset Limited.* Later, tri-weekly service was added from Chicago to Laredo via St. Louis, Dallas-Fort Worth and San Antonio on the *Inter-American.* By the end of 1975, these Amtrak routes operated within Texas with a combined route mileage of 1,989 miles. Fewer than 400,000 total passengers rode Amtrak, and 65 percent of this 1975 ridership was generated by the *Lone Star.*

But by January 1981, ridership on the *Inter-American* was up 36% from the previous year. As is the case with all Amtrak routes, the Texas routes required subsidization. More than $8 million in subsidy were needed to sustain Amtrak's Texas routes in 1975. The *Lone Star* has since been discontinued.

Highway Transportation

At the time of the advent of the automobile, road construction and maintenance were a local and county responsibility. The Texas Highway Department was established in 1917. The disastrous transportation dilemma created by World War I stimulated a very rapid development of a highway network throughout the nation and particularly in Texas. The Federal-aid program, in which the federal government apportions to the states the federal highway user taxes collected in the states, fostered the building of an efficient, hard surfaced system of roads. Travel by automobiles soared.

Post World War II activities were directed at rebuilding the system that had deteriorated during the war years. Subsequently, the Interstate and Defense Highway System was begun in 1956. This program produced a system of high-design, safe roadways that were a critical link in completing the intercity network. During the 1950's and 1960's, rapid development of an urban highway and arterial network occurred. Freeways, widened thoroughfares, and by-passes became prominent facilities of post-war highway expansion in Texas.

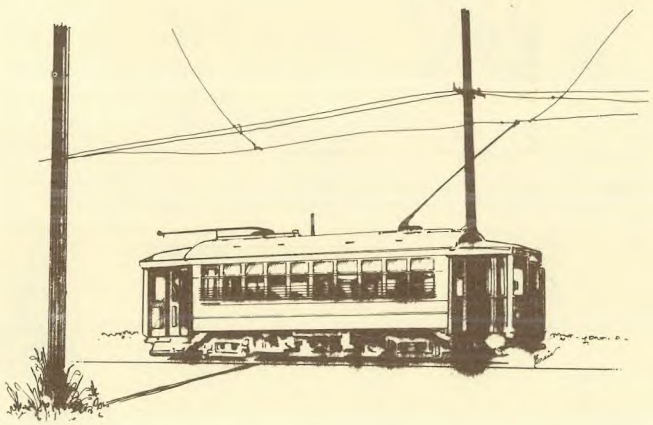
Today the interstate, primary and secondary highways, farm to market and ranch to market roads, urban thoroughfares, streets, and country roads throughout Texas constitute a road system that is certainly one of the best in the world.

Along with the automobile's challenge to rail passenger transportation came the motor truck's challenge for a role in the State's transportation of goods between cities and towns. The development of the highway system gave motor vehicles a decided advantage in price and time in the shipment of many commodities and the movement of people between cities in Texas.

In 1917, there were 5,000 motor trucks registered in the State. By 1978 the number of trucks operating on the Texas highway system had grown to more than 2 million and were producing more than 40 billion ton-miles of intercity freight movement. The importance of the trucking industry to Texas is dramatized by the fact that without trucks, nearly two thirds of all Texas' communities would have no freight service at all. Some industries rely completely on truck shipments. For example, over 99 percent of the fruits, vegetables, and livestock grown in Texas are transported by trucks to principal markets.

Urban Transit

Transit development in Texas generally paralleled that in other states, except that Texas cities did not grow large enough prior to the implementation of mechanized transit to necessitate high-density residential development. As a result, rapid-rail transit was not built in any city of the State. Texas cities were helped by transit service to retain, rather than to obtain, low-density housing. For example, horsedrawn trams appeared in Dallas in 1871, when the city's population was less than 4,000 persons. Electric streetcars appeared in 1891, when the total Dallas population was less than 40,000. San Antonio, the largest city in Texas at the time, began muledrawn tram service in 1874, when the city had only 15,000 people.



Street car service was as popular in Texas as in any other part of the country in the early 1900's. At one time, virtually every city in Texas with a population of 5,000 persons or more had streetcar service. However, the motor bus rapidly replaced the streetcar in most Texas cities during the 1920's and early 1930's. Dallas continued to operate some streetcar service as late as 1973.

Since World War II, transit ridership in Texas has declined at about the same rate as the national average. The five largest Texas cities managed to reverse the ridership trend temporarily during the mid-1960's; but ridership began dropping once again in the late 1960's. Ridership has since stabilized and begun to increase.

In 1954, privately-owned transit companies provided service in 37 Texas cities. By 1974, transit operations had ended in 19 of those cities. Of the remaining 18 systems, only four were in private operation with no local tax support. The other transit systems were either municipally owned or received local tax support.

The trend of increasing public ownership and reduction in number of transit systems was a result of persistent financial losses to private owners. In turn, a city was left with the possible alternatives of not having transit service or purchasing and operating the system. All of the larger cities where private transit services were terminated realized the need for a continuing transit operation and subsequently bought their private systems.

The U.S. Urban Mass Transit Administration and the Texas Mass Transit Commission (TMTC) were established as agencies responsible for assisting in the revitalization of the ailing transit industry. Subsequently, the functions of TMTC were assigned to the State Department of Highways and Public Transportation (formerly the Texas Highway Department).

Waterways

Development of what is now a multibillion dollar Texas waterway network began in the late 1800's when the Port of Galveston was completed. This first deep water port in Texas provided a channel of movement of foreign and domestic commerce. Since that time, nine other major ports have been built, including the Port of Houston which has become the third ranking port in the nation for total exports. In conjunction with operating as major terminals for export and import in both world and domestic trade, Texas ports provide an interface between the major surface transportation modes (railroads and motor carriers) and the major waterborne transportation modes (deep draft cargo ships and shallow draft barges).

Barge traffic in Texas moves primarily on the 426-mile long Texas portion of the Gulf Intracoastal Waterway (GIWW). The GIWW in Texas was begun in the early 1900's when canals and shallow channels connecting bays and ports were dredged to allow inland travel between ports. This waterway, protected from the sometimes rough waters of the Gulf, quickly grew as a major water transportation channel. One of the first important roles of the GIWW was to provide a safe inland avenue for the shipment of goods during World War II.

Petroleum Pipelines

The very first pipeline in Texas was built in Nacogdoches County in 1867. In 1901, the first salt dome oil discovery was made at Spindletop. This led to the boom in oil exploration in Texas and consequently spurred the need for pipelines. After the Spindletop discovery, Texas quickly became the leading oil producing state in the nation.

The growth of oil production in Texas was accompanied by the rapid growth of pipelining activity. In 1959, about one-third of total U.S. petroleum and trunk gathering lines, or about 53,000 miles, were in Texas. However, the growth in pipeline mileage slowed in the 1950's as crude oil production leveled off. Texas now has about 64,000 miles of oil and petroleum product pipelines.

Natural Gas Pipelines

Lone Star Gas Company built Texas' first long-distance pipeline in 1909 to supply gas to Dallas and Fort Worth. Despite its potential as a clean, easy-to-use energy source, natural gas lagged behind crude oil as an energy source worthy of development until the discovery of large gas reserves in Texas, most notably the Hugoton field. Gas from the Hugoton field was piped to Amarillo, but wide distribution of natural gas did not begin until after World War II. Since then, the development of stronger pipeline materials and arc welding technology led to rapid growth in utility gas pipeline mileages. In 1950 there were over 41,000 miles of natural gas pipeline in Texas, and by 1965 that number had more than doubled.

Air Transportation

Air travel in Texas has a shorter history than have the other modes, but its growth rate has been dramatic, particularly since World War II. Several aviation milestones highlight the early developments of Texas' air transportation:

- Texans were among the first to build flying machines after the Wright brothers inaugurated the air age in 1903.
- The first airplane used by the War Department was based in San Antonio.
- In October 1911, a transcontinental flight from New York to California carried mail postmarked from Dallas, Waco, and San Antonio.
- On March 17, 1912, an aviator delivered a pouch of mail from the postmaster at Galveston to the postmaster at La Marque, a distance of 15 miles, and returned to Galveston with the official mail receipt.

In World War I, the State quickly became the chief training area for Canadian and American airmen. After the war, returning pilots, using civilian aid, pioneered the development of commercial aviation. Air transport companies were financed by Texans, and the planes were flown by Texas pilots. When World War II threatened, Texas again became the major training ground for the Army Air Corps. Many of the military training fields established during World Wars I and II were subsequently decommissioned and turned over to Texas cities for development into civil airports. These former military fields remain a significant portion of today's Texas airport system.

Many Texas airports now operating were dedicated in the late 1920's and early 1930's, e.g., Vernon Municipal, Graham Municipal, and Alice International. During the late 1960's and early 1970's, the Texas Aeronautics Commission (TAC) helped develop new airports in many smaller towns such as Caldwell, Lampasas, Bay City, and Knox City. The dedications of Houston Intercontinental in 1969 and Dallas-Fort Worth Regional in 1973 were significant milestones in Texas aviation. These two airports enplaned 79 percent of the total Texas enplanements by Civil Aeronautics Board (CAB) certificated air carriers in 1979.

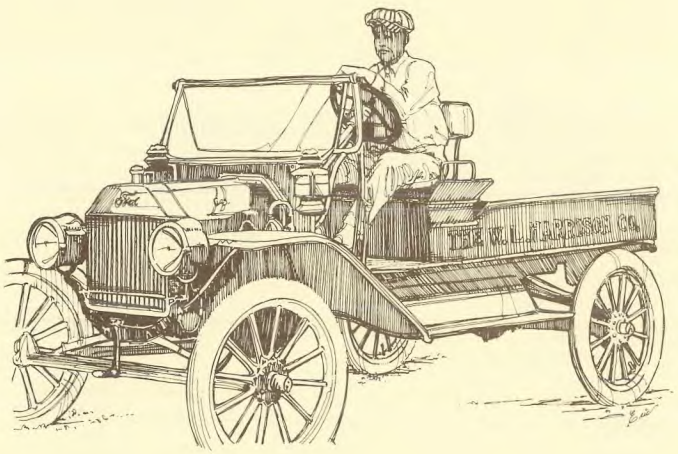
The Texas Aeronautics Commission was established in 1945 by the Texas Aeronautics Act. In 1961, the TAC was given limited regulatory authority of scheduled intrastate carriers not operating under CAB regulations. It was 1969 before the Legislature appropriated money for TAC regulatory activities and amended laws to allow TAC to regulate rates of its certificated air carriers.

In 1965, the Airport Aid Program was established to provide State grants to sponsors for development of city and county airports. Historically, the Airport Aid Program has been primarily aimed at smaller communities. Funding for the program was from unclaimed State taxes on aviation fuel with occasional supplements from general revenues. In 1979, the Legislature eliminated the tax on aviation gasoline, and since 1979, funding for the Airport Aid Program has been from general revenues.

TRANSPORTATION AND PROGRESS

Introduction

Texas began as a few sparsely populated, subsistence oriented settlements tied together by primitive trails and rivers. The complexity of today's transportation system reflects the historical development of the interrelationships among transportation and three crucial processes: economic activity, population growth, and technological advance.



Growing population provides a vital impetus to economic growth. The resulting production of goods and services for consumption, investment, government, and net export activities generates demands for transportation service inputs. Public and private funds combine to build, maintain, and operate the resulting transportation network. The efficiency of this network is highly dependent upon the available technology and its energy requirements.

As Texas moves toward the twenty-first century, transportation will continue to affect and be affected by economics, population, and energy.

Texas Transportation and Economic Activity

As stated at the outset, transportation has no significant value per se. Its importance lies in its contribution to the social and economic well-being of Texas citizens. The inner workings of the relationships between transportation and economic activity are complex. But, they are not so complex that they defy analysis, measurement, and understanding.

Generally, low valued bulk commodities moving long distances will be shipped by rail. Conversely, smaller sized shipments of high valued products moving shorter distances tend to be transported by motor carrier. Two other examples will suffice to illustrate other relationships between transportation and economic activity. Land values increase when developers become aware that a new highway will be built through their urban or suburban property. Why? Subsequent access to the property afforded by the highway will generate land use improvements (buildings, apartments, houses, etc.) that make the land more valuable. If the resulting land use improvements include a shopping center, it will be because of the convenience that the transportation improvement gives to shoppers, as well as the advantage to shopkeepers of being located near a mass of willing consumers. Finally, transportation allows different regions of Texas to specialize in production; it also encourages certain production activities to occur in specialized locations. Citrus and vegetables are intensely farmed in the Valley because the products can be sold elsewhere. Refineries and petrochemical plants are located on the Gulf Coast to take advantage of among other things, inexpensive waterborne transportation.

These examples indicate the ever-present role that transportation has on the major economic variables—prices, production, distribution, and growth of goods and services in the Texas economy.

Transportation and Prices

Transportation affects prices through both direct and indirect cost contributions. A substantial share of the price of any item is due to the cost of its shipment, including the cost of transporting raw materials to the production site and the cost of shipping the finished product to market. The cost of transporting items depends, to a large degree, upon their physical characteristics. For commodities such as sand or gravel, transportation cost makes up over half of the final product price. On the other hand, some lighter and higher unit-valued items such as business machines or calculators have low transportation costs relative to price.

Transportation also affects prices in indirect ways. One is by contributing to price stability in local market areas. Long-haul transportation causes markets and hence market prices to be less responsive to purely local supply and demand conditions. For example, a decline in local supplies or an increase in local demand will stimulate an influx of supply via the long-haul transportation. As more distant suppliers contribute to the local market, the market price is subject to downward pressure.

The relationship between product prices and transportation costs influences the usage and the price of land. Improved transportation increases the value of land by increasing the number of economically viable productive alternatives of land usage. The increase in land value is translated into higher prices for land. This same principle applies to other natural resources and their price relationship with transportation.

Transportation and Production

Raw materials or other inputs have no value unless they can be moved to locations where they are used in a productive process that transforms a mixture of inputs into finished products. Transportation creates value by enabling inputs to be added to the productive process at the proper time. If inputs are not available at the right time, production costs increase. Two cost-reducing solutions exist. Either large inventories of inputs must be held until they are needed in the productive process, or the transportation of input supplies can be improved to achieve better timing.

Also, large-scale production processes, which require the delivery of tremendous amounts of inputs to the place of production, often yield lower per unit costs of output than do small-scale processes. The huge output of a modern economic system is the result of these large-scale operations, which are inextricably linked with transportation.

Since geographical regions are not equally endowed with resources or climate, products produced in one particular region may differ from products of other regions. Some regions possess a comparative advantage in the production of certain items. As a result, regional specialization in production occurs, and costs of production are reduced.

Transportation and Distribution

Produced goods are of little value unless they can be moved to the place where they are demanded. Transportation creates value by moving goods to markets at the time they are needed. Thus, transportation is important in the prevention of market surpluses and shortages of goods. Clearly, large-scale production can occur only if mass distribution of output is possible. Transportation improves buyer accessibility to products and broadens markets to bring about mass distribution of products. Therefore, lower per-unit production costs result from transportation's distribution efficiencies.

Transportation and Economic Growth

The previously described relationship of transportation to production and distribution is both direct and crucial. Tremendous gains in economic growth on both state and national levels are directly due to an accumulation of large production capacity and a broad distribution system. Transportation, therefore, provides a foundation upon which the development of the economy depends. Just as production and distribution improvements are required for economic growth, the transportation foundation itself must also be maintained and improved. If no new efficiencies occur in the transportation sector and the transportation system remains unimproved or deteriorates, then the burden of fostering economic growth falls solely upon other improvements in production and distribution, such as increased labor and capital productivity.

Transportation Expenditures and Economic Activity

To document, empirically, the importance of transportation in Texas, one would first calculate the amount of money Texans spend in a year for *all* goods and services produced in the State, i.e., the value of gross state product. Next, calculate the amount of money Texans spend on all forms of transportation in a year, i.e., the transportation expenditure bill. These calculations have been made at the Texas Transportation Institute for the period 1959-1976. Results from the data show that one-fourth of the value of the total output of the State is devoted to expenditures for transportation. This 25 percent share is significantly greater than the 20 percent of GNP spent in the U. S. for transportation and reflects the relative greater importance that transportation has in Texas. Significantly, for the period 1959-1976, the annual share of gross state product committed to transportation—both passenger and freight—has remained at 25 percent. This empirical fact suggests that, whether the economy of Texas is growing, stagnant, or receding, certain levels of expenditures for transportation are necessary to support the prevailing level of economic activity. In a growing economy, such as is reasonably expected for Texas during the next twenty years, increases in transportation expenditures will be forthcoming to accompany that expansion.

But, the constancy of the 25 percent share of gross state product going for transportation does not mean that significant readjustments have not occurred in transportation. Analysis of expenditures by transportation mode makes this clear.

Modal Shares of Texas Transportation Expenditures

History is replete with examples of the decline in popularity of some means of transportation and the increased use of alternative means. While such factors as politics and technology influence the shift between transportation modes over time, economics also plays an important role.

Expenditures for automobile travel in Texas were 88 percent of all passenger transportation expenditures in 1976, a share that has been maintained since the late 1950's. Air passenger transport expenditures grew rapidly during the same period from a six percent share (1959) to about a 10 percent share in 1976. However, expenditures for bus (urban and intercity) transportation, taxis, and rail passenger transportation have declined.

These trends indicate that passenger travel in Texas will continue to be mainly by automobile in the next twenty years. Increases in fuel costs probably will cause continued shifts to smaller automobiles and perhaps to new fuel sources; but there probably will be only limited growth of rail and bus passenger travel, unless there are severe fuel shortages (such as during World War II) or large government subsidies to these modes.

Several freight transportation modes registered declines in relative shares of transportation expenditures between 1959 and 1976. Oil pipelines had a 42 percent decline in the period studied, but subsequent increases in petroleum activity have likely slowed this decline. Rail and water transportation shares declined approximately 30 percent and 18 percent, respectively. It should be emphasized, however, that these are declines relative to the expenditures for all transportation. In absolute terms, freight movements by rail, water, and pipeline have increased over this time period. The highway freight share of expenditures has increased 12 percent. Although air freight represents a very small portion of all Texas transportation outlays, its relative share almost doubled from 1959 to 1976.

The importance of private automobile transportation and highway freight transportation is shown by the relative magnitude of expenditures in these two modes. Together, these two highway-related modes account for almost 82 percent of all transportation expenditures in Texas. Additionally, automobile and highway freight expenditures in the State are extremely sensitive to business cycle fluctuations. As a result, there is a direct relationship between these two principal modes and the level of economic activity in Texas.

Other modes, smaller in terms of expenditure, also play critical roles in the Texas economy. Bus passenger travel is critical to those people without cars. Buses also are helpful in relieving urban congestion and providing transportation during severe energy shortages. In freight transportation, expenditures for rail, pipeline, and water shipments are small relative to expenditures for goods movements on highways; but the expenditure levels do not fully reflect the importance of these non-highway modes in the Texas economy. The relatively low dollar level of expenditures in these modes is due to highly efficient movements of large quantities of raw materials and other heavy products at low cost per ton-mile. Crude petroleum, natural gas, and related products transported by pipelines are, of course, important and fundamental outputs of the Texas economy. Similarly critical are the many agricultural, mining, and manufactured products hauled by rail, both within the State and for export. Transportation of petroleum products through the intracoastal waterway is very important to the Gulf Coast and Texas economies, as are the many products imported and exported through Texas' deepwater ports.

In the next twenty years, it will be critical that the State not only maintains its transportation systems but also improves these systems. Even though there will be modal shifts and technological change, all modes play important roles in the future growth of Texas. It is especially vital that the State and local governments maintain existing roadways and make improvements in these roadways. As an example, the efficiency and safety of divided, controlled access highways have been proven; however, many existing miles of rural highways could be upgraded to four-lane divided facilities. The amount of benefits in terms of fuel savings and reduced travel time is several times the cost of these facilities. Importantly, the increased safety and comfort of such roadways, which Texans will expect as smaller cars become more prevalent, create additional significant benefits. Also, expenditures will be needed in and near the growing urban and suburban counties of the State to facilitate the population and economic growth that will occur in the next twenty years.

Population and Transportation in Texas

The demand for transportation facilities in Texas is affected to a great extent by population growth and the redistribution of population within the State. Since 1970, population has increased by 26 percent according to a preliminary 1980 census count that shows 14,228,383 persons residing in Texas.

In-migration to Texas

The much-heralded Sunbelt migration phenomenon is a very real, if fairly recent, trend. In Texas, the number of persons currently moving into the State is ten times greater per year than it was in the 1950-60 decade. This positive migration stream now accounts for 55 percent of the State's population growth.

In-migrants tend to be in middle and upper socioeconomic levels, often in child-bearing phases of the family life cycle. These newcomers can be expected to have multiple-vehicle households and an aggressive demand for expanded roadways and ready access to jobs and commercial and service centers.

Texas Transportation Institute studies have shown a pronounced increase in per capita passenger and freight transportation expenditures (expressed in constant dollars) over time. These expenditures per person for transportation are likely to increase at a steady rate during the near-term future. Thus, the impact of increasing numbers of residents will be keenly felt by persons and agencies responsible for providing transportation services.

Redistribution of the Texas Population

Texas has been shifting from a rural to an urbanized environment. In 1980, 80 percent of Texas' residents lived in metropolitan areas of 50,000 people or more. Texas has many major centers of population concentration that differentiate it from its neighbors. Arkansas had only 30 percent metropolitan residents in 1980, with New Mexico having 42 percent, Oklahoma 58 percent, and 63 percent in Louisiana.

In recent years, metropolitan growth has been more rapid in Texas than in the nation as a whole. Eighty-five percent of the past decade's population growth has been in only twenty percent of all counties. The central counties of these metropolitan clusters are growing at a slower pace than the remainder of counties in metropolitan settings. The central cities of Dallas and Fort Worth, for example, had a combined three percent growth rate during the past decade, while the remainder of Dallas and Tarrant counties registered a 40 percent increase. The nine remaining counties in the Dallas-Fort Worth Standard Metropolitan Statistical Area (SMSA) showed a 65 percent growth rate.

With all other factors held constant, the more dispersed the population in a given geographic area, the more is the cost per person to construct a common facility such as a road. Additionally, with increased dispersal of populations throughout entire urban regions, mass transit becomes a less feasible transportation mode in the suburban and rural-urban fringe portions of these metropolitan areas.

It should not be concluded that metropolitan areas have been the only "catchment areas" for population increases. Nonmetropolitan counties, which now contain 20 percent of Texas' residents, grew 16 percent between 1970 and 1980. Because of the larger net in-migration and renewed interest in a semirural lifestyle, nometropolitan counties in Texas are now in a new, history-making growth phase. Until 1970, these counties had lost population for many decades.

Importantly, the increases in nonmetropolitan population occurred primarily in those counties adjacent to metropolitan counties. Overall, there appears to be a slowing of movement to the largest cities. Continued population dispersal outward from major central cities in Texas is likely during the near-term future.

In the past decade, many large corporations have moved their headquarters to Texas. In addition, new plants have been built in previously rural counties, and these facilities attract subsidiary service companies. This further stimulates a cyclical process of population dispersal. The basic reason for this outward movement in Texas is that both businesses and residents have found that fringe areas offer net benefits unique to both city and country environments. Transportation facilities must meet the increasing demands for access to the periphery of large cities, as well as into downtown areas. Further, metropolitan deconcentration will be closely linked with an increase in automobile usage in Texas and with a heightened need for more efficient deliveries of increased quantities of goods and services.

Changing Population Composition

Monitoring the changing age structure with Texas' population is important because different age groups have different transportation demands and usage patterns. While 1980 census tabulations are not yet available for age segments, several patterns of the changing age structure are emerging:

- Median age of the Texas population is increasing;
- Children under 18 years of age represent a smaller proportion of the total population;
- Reflecting the baby boom of the 1950's and 1960's, persons aged 18-64 have increased in numbers relative to the total population; and
- The number of elderly persons is greatly increasing relative to the total population in the State—it tripled between 1940 and 1970.

The larger numbers of Texans in the 20-39 age group and the 65-and-over age segment have accelerated the demand for new households, as well as for transportation facilities. For example, the number of housing units increased 44 percent in the past decade, while the population increased 26 percent. One of the most pronounced reversals has been the reduction in persons per household. In 1970, there were 3.16 persons per Texas household. There were only 2.57 persons per household in 1980, based on preliminary census tabulations. The 19 percent reduction in household size can be attributed to several factors, including: (1) the increasing number of young adults who leave their parental homes to establish nonfamily households of their own; and (2) the increasing number of older persons who, after their families have dissolved, continue to maintain homes apart from any relatives. This trend—decreasing household size—has significant implications for an expanded demand for use of private vehicles by younger people and a reduced number of older persons who can rely on other household members for transportation. Young adults and older persons have traditionally been users of available transit services. Because of the increase in numbers of older persons, use of transit facilities by this group will likely increase. As young adults become established in their own households, acquisition of an automobile is likely to be a high priority item. To the degree that they suceed in getting private vehicles, the size of this segment of transit ridership could be reduced, relative to its size in the 1970's.

Energy and Texas Transportation

In the United States, transportation consumes about 25 percent of all energy. However, transportation is heavily dependent on petroleum products and consumes about 58 percent of those scarce resources. Other than electric railroads, mass transit and limited electric vehicles for urban travel, the dependency of transportation on petroleum will persist well into the future.

Texas transportation is heavily dependent on energy, primarily because of the reliance on automobile and truck transportation. The reasons for this reliance are rooted in certain geographic and

developmental characteristics of Texas:

(1) Population densities within urban areas of Texas are low. These lower densities are less conducive to the success of mass transportation than in the more dense cities of the eastern seaboard.

(2) Travel distances between urban areas in Texas are relatively great. Texas has more urban areas than any other state, but they are more widely spaced. In Texas there is one SMSA per 38,000 square miles. Nationwide the figure is one per 28,000 square miles.

(3) The development in Texas has been automobile oriented. Texas cities developed in their present form after the invention of the automobile.

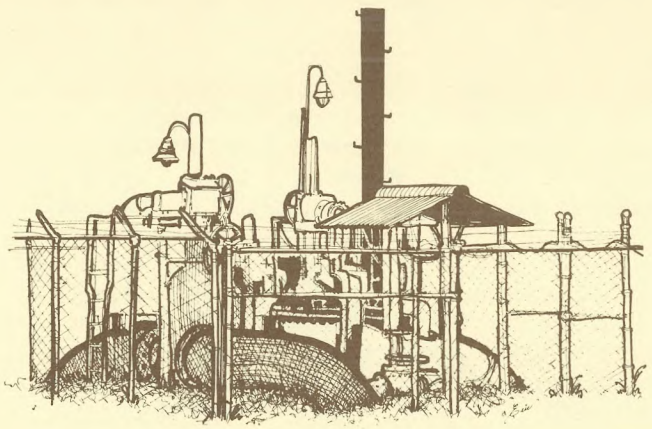
(4) Per capita consumption of transportation energy is higher in Texas. In 1978, Texas vehicles consumed 16.8 gallons of gasoline per week compared with 14.3 gallons per week for the U. S. Texans consume 646 gallons per person per year as compared with 507 gallons for the nation as a whole.

Since 1978 Texans, like other U. S. residents, have been consuming less transportation energy. This trend is expected to continue to the end of the century if the real price of fuel continues to increase sufficiently to offset increasing population and increasing real income. The collusive price policy of the OPEC countries and higher production costs of domestic supplies seem to assure that the real price (the price of motor fuel relative to all other prices) will continue to increase.

Current calculations indicate that a ten percent increase in the real price of fuel reduces consumption by about two percent, relative to what it would have been, within the first year after the increase. However, the longer term reduction as consumers fully adjust may be as much as three times larger than the initial effect. Increases in real prices have done more to reduce motor fuel consumption than has any other transportation energy conservation program.

Most conservation programs simply allow an alternative for a consumer who is looking for a way to reduce fuel consumption. Improvements in public transportation and encouraging carpooling are examples of conservation programs. In Texas, vanpooling supported by private industry has been particularly successful. Texas now leads the nation in van pools; however, their total impact on fuel savings is presently very small.

More fuel efficient cars are in greater demand as a result of rising fuel prices, although they are also required by federal energy efficiency standards. Larger numbers of smaller, more fuel efficient cars in the fleet will produce significant energy savings in the transportation sector over the next twenty years.



TEXAS TRANSPORTATION NETWORK: CURRENT STATUS

Introduction

There are some applicable superlatives that indicate the magnitude of Texas' current transportation system:

- Texas has more road and street mileage than any other state — more than 250,000 miles;
- Texas has the most gas pipeline mileage of any state — more than 110,000 miles;
- Texas has the most railroad mileage of any state — 13,000 miles;
- Texas has the largest number of airports of any of the states — 1,200;
- The State Department of Highways and Public Transportation is one of the largest state agencies in Texas; and
- The transportation industry is a major employer in Texas.

The current status of the transportation system is a result of the historical development of the State. The modes that dominate today have not always done so; thus, it is crucial to understand that transportation is essentially a dynamic activity that shapes and is, in turn, shaped by the social and economic processes it serves.

Highways

The Texas highway and road system is the key facility in providing transportation services to Texans. It will continue to be the primary feature of our transportation network for the rest of this century. This system has more than 71,000 miles of highways, 135,000 miles of country roads, and 55,000 miles of city streets. The maintenance and orderly expansion of this investment are imperative if Texas is to absorb and integrate the increased population and economic activity that will occur during the next two decades.

The overwhelming importance of roads and highways in Texas is indicated by the magnitude of annual (1980) vehicular miles of travel in the State:

- More than 111 billion total vehicle miles;
- Almost 7 billion vechicle miles of intercity truck travel;
- Over 65 billion vehicle miles of travel in urban areas; and
- About 10 billion vehicle miles of urban truck travel.

These data indicate that movements of persons and goods both between and within Texas' towns and cities are heavily dependent upon a well-maintained system of roads and highways. Some additional facts further illustrate the extent to which Texans rely on their roads and highways:

- In 1980, 65 percent of the State's population held drivers licenses;
- In 1980, Texans consumed almost 9.6 billion gallons of fuel in roadway travel;
- In 1980, approximately 150 million passengers were carried over the urban street and highway network by public transit buses;
- In 1980, Texans owned 7.5 million passenger cars, 2.2 million pickups, and 250,000 commercial trucks; and
- In 1980, 85 percent of the intercity person movement was by highway.

In addition to the direct inputs to transportation furnished by highways and vehicles, there are many related activities that facilitate highway transportation, some of which are:

- The entire automotive sales, rental, and maintenance industry in Texas;
- Thousands of gasoline stations and truck stops;
- Hundreds of heavy construction operations;
- A vast array of freight warehousing and distribution facilities; and
- State, county, and local roadway and street departments.

The breadth of service provided by the highway and road network is reflected in taxpayers' support of State, regional, and local expenditures for the maintenance and orderly expansion of the system. At the State level, user fees from sales of fuel (excluding 25 percent that goes to the school fund) are combined with motor vehicle registration fees (excluding a portion retained by county governments) to provide an earmarked source of revenue for the construction and maintenance of the State highway system. The stability of this revenue fund, supplemented by reimbursed user fees collected by the Federal government from Texas drivers, has been a primary factor in the development of Texas' first-class highway system. To perpetuate the stability and needed growth in highway expenditures, legislative action in 1977 provided for supplemental funds to offset the disrupting inflationary spiral in highway construction and maintenance costs.

Newly created regional transit authorities in the Houston and San Antonio metropolitan area have been given significant taxing powers to build and operate public transit systems, which use the urban highway and street systems. Several other cities commit significant amounts of tax revenue to support local transit operations. Also, street and road improvements are consistently major items paid for by taxes collected and voted for at the county and local levels of government.

Urban Transportation

Passenger

Of the several important characteristics that distinguish urban person movement, the following are especially notable:

- 80 percent of Texas drivers reside in metropolitan areas;
- Over 65 billion vehicle miles were traveled in Texas urban areas during 1980;
- Approximately three percent of Texas' work force uses public transportation in the seven major metropolitan areas of the state; and
- 1979 public transit ridership was slightly over 145,000,000 — an increase of over 25 percent in five years.

State, county, and local governments are responsible for construction and maintenance of approximately 91,000 miles of urban highway and streets. For transit systems, agency responsibilities vary. There are seven localized, private transit companies and 19 publicly operated transit facilities, including two regional transit authorities — VIA in San Antonio and METRO in Houston. The total cost for operating these transit systems in 1979 was almost $100 million, with 47 percent of the revenues coming from fares and 53 percent from public subsidies.

Historically, mobility in Texas cities has consistently been improving. Even in Houston — the most congested of Texas cities — from 1950 to 1970, new lane miles of freeway were opened at a rate equal to the growth in travel demands. But, about 1970, two things began to happen. First the rate at which new freeways were built slowed considerably, due largely to funding and procedural concerns. While lane-miles of urban freeway increased about 50 percent in selected major Texas cities during the 1960's, lane-mileages in those same systems increased only about 10 percent during the 1970's. At the same time, an increasing urban population, combined with an increased propensity for per capita travel, resulted in even greater rates of travel. Both vehicle-miles of travel and vehicle registrations in cities such as Houston increased at annual rates of 6 percent.

During the 1970's, in the more congested Texas cities, vehicle-miles of travel per lane-mile of freeway doubled. During a part of the 1970's, the distance a motorist could travel during the peak 30 minutes in Houston was declining by 10 percent per year. In short, whereas Texas' largest cities may have had the near ultimate in mobility in 1970, some of them, especially Houston, are now among the most congested in the nation.

Surveys of public opinion in urban areas consistently show that transportation is a major concern. Trends toward more families residing in multi-family dwelling units, as well as substantial increases in property values inside circumferential freeway loops in major urban areas, are partially the result of the decreased urban mobility experienced in Texas during the 1970's.

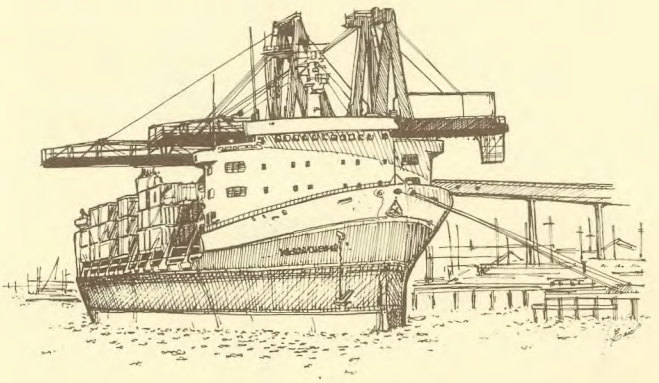
Freight

Urban goods movement is commonly overlooked when urban transportation needs are discussed. However, it is a very large activity. Nearly a quarter of the nation's total transportation expenditure is devoted to urban goods movement. The cost of urban goods movement is substantially greater than intercity truck, rail, air, or water expenditures considered singly and is nearly as large as all intercity freight transport combined. Urban goods movement is accomplished by motor truck and crosstown rail movements. About 15 percent of total urban vehicle miles of travel is made by trucks involved in the goods movement process.

In most parts of urban areas, trucks can successfully use the transportation system designed for person movement. However, at major truck traffic generators, such as the CBD, industrial parks, and port facilities, special attention needs to be given to the requirements of urban trucking.

Waterways

The 426 mile-long Gulf Intracoastal Waterway (GIWW) was dredged to its present dimensions, 12-feet deep by 125-feet wide, in 1949. There are 10 deep draft channels and 20 shallow draft channels providing access from the Gulf and GIWW to Texas ports.



Almost 68 million tons of cargo were moved on the GIWW in Texas in 1979 compared with 66 million tons in 1978. The dominant products transported on the Texas GIWW are crude petroleum, petroleum products, and chemicals. Waterborne commerce for Texas ports set a record of 347 million tons in 1979. This was a four percent increase over 1978.

Activity on the waterway and in the ports translates into a large economic plus for Texas and its citizens. Some of the benefits are: increased employment, increased income, a larger tax base, energy savings from an energy efficient method of transportation, and reduced consumer prices resulting from lower transportation costs.

The transportation of industrial materials and products is not the only activity on the GIWW and its tributary channels. Commercial fishing boats are major users, and some of the navigable channels are maintained more for the use of fishing and private craft than for commercial traffic.

In the past, the major costs for construction, maintenance, and operation of the GIWW have been financed by the U. S. Army Corps of Engineers. While Texas ports have relied heavily on federal financing, revenues from port authorities, navigation districts, counties, and other local entities have partially financed some port developments.

In 1975, the Texas Coastal Waterway Act authorized the State of Texas to act as local nonfederal sponsor of the GIWW in Texas and designated The State Department of Highways and Public Transportation Commission as agent for the State. The role of the State as nonfederal sponsor is complicated by a conflict between federal statutes and the Texas Constitution. Federal law requires the nonfederal sponsor to have full authority and capability to pay damages, if any, incurred by an improvement project. It is argued that this requirement, in effect, pledges the credit of the State, which is a violation of the Texas Constitution. The nonfederal sponsor is also required to construct or pay for all levees, weirs, and drainage ditches required for the containment of dredged materials. The Corps of Engineers has rescinded its ruling until further study is conducted. Dredging, which is necessary for continued safe navigation, is still being done by the Corps at the present time.

Pipelines

Although pipelines are not the only means of transporting natural gas, crude oil, and refined petroleum products, they are the most efficient method of carrying liquid fuels across land. The majority of Texas' oil pipelines lead to Gulf Coast refineries. There crude oil is transformed into usable fuel products — including gasoline, kerosene, and chemical feed-stocks, which are shipped to demand centers via pipelines, tankers, and railroads. The combination of these economical forms of transporting oil has played an important role in making Texas the leader in the petroleum industry.

Texas' oil and petroleum product pipelines are centered along the Gulf Coast, reaching out across that state from West Texas to the Arkansas border. About 27,000 miles of the network are small lines used to gather crude oil from the fields and move it to the larger trunk lines. Another 27,000 miles of trunk lines connect oil producing regions to refineries and ports. In 1978, pipelines moved 712 million barrels of crude oil to Texas refineries. The trunk lines are operated as common carriers and are available to any shipper. The 10,000 miles of product lines in Texas carry gasoline, kerosene, fuel oil, and other petroleum products from refineries to distribution centers, market areas, and petrochemical plants.

Pipelines also deliver natural gas from West Texas, the Texas Panhandle, and the Gulf Coast to metropolitan centers in the Midwest and on the East and West Coasts. By the end of 1979, Texas led all states in miles of utility natural gas pipelines with about 112,000. This includes 14,000 miles of field and gathering lines, 39,000 miles of transmission lines, and 59,000 miles of distribution mains.

Intercity Rail and Truck Transportation

Concurrent with the continuing growth of Texas' economy and labor force have been increases in the level of rail and truck transportation. Railroads, for example, despite a decreasing number of operators, have seen their revenue freight increase from slightly over 211 million tons in 1970 to well over 242 million tons in 1977. This seven year increase of almost 32 million tons produced revenue per-ton-mile increases from $.0134 in 1970 to $.0213 in 1977. As of 1978, there were 34 rail carriers operating in Texas. Nine of these are Class I railroads; the others are short line or switching carriers. Generally speaking, these carriers transport mostly "long haul" and/or bulk cargoes into and out of Texas. Freight levels of many of these cargoes, such as grain, coal and chemicals, are increasing. Unlike the majority of railroads in the Northeast, most railroads in Texas continue to be profitable enterprises.

Like rail, truck transportation levels in Texas continue to rise. As of 1978, there were 163 common carriers and 17 contract carriers headquartered in Texas. Much of what moves by truck both in Texas and nationwide are shorter haul time-sensitive commodities, as reflected by the percentage of fresh and frozen meats (80.7 percent as of 1980) and dairy products (80.5 percent in 1980) which are truck transported.

Texas originates 21 percent of all rail carloads of hazardous materials, more than any other state. The majority of the rail carloads of hazardous materials moving in Texas originates in the heavily populated Houston Metropolitan Area. In 1979, there were 107 train accidents in which hazardous materials were involved. There were 19 releases of hazardous materials; 504 people were evacuated.

Shipments of hazardous materials are not confined to rail and waterway modes. Motor trucks, in fact, haul tremendous quantities of these products. The National Transportation Safety Board has determined that 91 percent of all hazardous materials accidents occur on highways. The threat to public safety from hazardous materials that move through and within Texas is likely to continue.

Intercity Surface Passenger Transportation

Bus

Scheduled intercity bus service, which is provided by privately owned and operated common carriers, serves over fifteen million passengers per year. Since rail passenger service is almost nonexistent, intercity bus and air transportation support the automobile in handling almost all intercity passenger movements in the State.

In approximately 1,000 small towns and rural communities in Texas, intercity bus service is the only public transportation link to urban areas. Buses are the only affordable transportation for many Texas residents who are too young, too old, or too poor to drive a car. Buses are also the most energy efficient mode of intercity travel.

The major metropolitan airports being served by large commercial aircraft are, for the most part, in excellent condition to meet today's traffic demand. The primary weaknesses of today's airport system are:

- Lack of a reliever airport system for Houston and Dallas-Fort Worth;
- Deterioration of many general aviation airports; and
- Lack of State funding for construction, development, and maintenance.

Despite low cost and energy efficiency, intercity bus service in recent years has been a declining industry. The decline is characterized by a decreasing market share in terms of total passenger-miles. Although the passenger market has not been growing, the industry has been able to generate additional revenues from other services. Larger carriers have relied on package express for increased revenue, while smaller carriers have expanded charter business.

Rail

At present, Amtrak service accounts for about 0.1 percent of total intercity person travel in Texas. The two remaining trains, the *Sunset Limited* and the *Inter-American*, are still part of transcontinental routes. The service they provide to Texans is limited (daily or tri-weekly) and not a significant element of the State's transportation system.

Air Transportation

The physical expanse of Texas and the great distances from Texas to many out-of-state centers of population, commerce, and government make air travel essential for several activities in the State. Today, scheduled air passenger service by one or more carriers is available from 36 Texas cities. As of March 1981, Texas was served by 18 CAB certificated air carriers, 10 foreign flag air carriers, and 5 TAC certificated commuter carriers. In 1979, Texas ranked sixth in the United States in enplaned passengers and second in aircraft departures. Five Texas cities, Dallas-Fort Worth, Houston, San Antonio, El Paso, and Austin, had 92 percent of the State's enplanements.

By far, the vast majority of Texas cities rely on general aviation for direct access to air travel. Texas has approximately 1,330 landing facilities of various types, including 285 privately owned airports open for public use, 645 farm and ranch strips for personal use only, and 1 airship port. In January 1979, there were approximately 15,000 active general aviation based aircraft and 61,000 active pilots in the State.

Initiative for airport construction and development rests with local governments, which have traditionally sought State and federal financial assistance. During the past decade, the overall condition of the State's medium-sized and small airports, serving primarily general aviation, have declined. Construction costs, demand growth, and maintenance needs have out-paced available funding.

The Federal Airport and Airway Revenue Act of 1970 created an Airport and Airway Trust Fund from user taxes on aviation fuel, passenger tickets, air freight, and aircraft. These funds were earmarked for grants to establish a nationwide system of public airports adequate for present and future needs of civil aeronautics. This program, which has been the backbone for airport construction in Texas for ten years, expired September 30, 1980. Legislation to reestablish the program is pending in Congress.

At the State level, the TAC may grant or loan funds to establish, construct, reconstruct, enlarge, or repair airports and air navigational facilities. Since 1966, the State has provided grants for airport construction and improvement projects at 196 locations, including new airports in 67 communities previously without air access. The 66th Legislature appropriated $3.2 million for airport aid projects for each year of the 1980-1981 biennium, but the second year's program was vetoed.

CRITICAL TRANSPORTATION PROBLEMS AND ISSUES

Introduction

The dynamic response of transportation to accelerated population and economic growth, at any given time, is not perfect. Disequilibrium is inherent due to many factors. Lagged recognition of problem areas, differential growth rates, short-run institutional and industrial inflexibility, and funding constraints are just a few. Also, the nature of the response to changing demands for transportation services is two-fold. First, operational adjustments in the existing transportation network are a short-run response to solving a particular problem. Efforts to make the existing transportation system more efficient include activities such as highway maintenance, altered travel or delivery schedules, and marginal improvements in network capacity. The other type of response includes more long-range and strategic activities that add to and expand the existing capital stock of the transportation network, e.g., new highway facilities, new vehicle technology, new public transit systems.

Consequently, at any given time, the transportation problems that exist will reflect the extent of the disequilibrium as well as the status of both the short-run policies and long-run strategy being pursued.

Currently in Texas, a myriad of transportation problems exist. Others, which will become very real before the year 2000, are taking shape. In the following discussion, the most important problems have been identified; some more clearly than others. The issues surrounding these problems have been defined; some more sharply than others. And, in some instances, resolution of the issues and possible solutions to the problems have been suggested.

Highways

The highway and road system will foster and respond to the economic development and growth that is to occur in the next twenty years. Major statewide program changes, such as occurred with the undertaking of construction of the Interstate system, are not likely to be initiated. Rather, reconstruction and rehabilitation of the existing highway system will be accomplished in lieu of principal commitments to build new facilities on new locations. To be sure, though, some new additions will be needed in and around the primary population growth centers to provide those areas a complete infrastructure of highway facilities. The State Department of Highways and Public Transportation has developed and is keeping up-to-date a 20-year plan of priority projects that are needed now. Additional strategic planning efforts, which will identify additional projects needed to respond to and support expected population and economic growth, are also underway. Similarly, metropolitan and regional planning agencies consistently give high priority to highway improvements needed in their areas.

Along with capital improvements to the highway system, maintenance of existing facilities has been given top priority through legislative and administrative emphasis. The State of Texas needs to protect its multibillion dollar highway investment. As this investment ages, more extensive and expensive rehabilitation and reconstruction will be in order. Additional usage from a larger population and a higher level of economic activity will add further wear and tear on the system. It would be contrary to the interest of the State to pursue transportation policies and programs that avoided a vigorous maintenance activity designed to protect and perpetuate the highway system.

User taxes on fuel along with license and vehicle registration fees will continue to provide the bulk of State level funding for highway system improvements. The precise level of these user taxes should be adjusted to achieve the needed level of finance. If high inflation persists in the cost of highway construction and maintenance, continued supplemental funding may be needed.

The issue of funding, in part, depends on technological developments in the vehicle fleet, both passenger and freight, over the next twenty years. Specifically, as passenger cars become smaller and lighter to achieve increased fuel efficiencies, sales of motor fuel do not keep pace with the growth in travel demands. Thus, user taxes on fuel will need to be evaluated in view of the expected continuation of fuel economy improvements throughout the remainder of the century. More economically efficient trucks, on the other hand, will be larger and probably heavier to haul more payload per vehicle mile.

Oversized, double-trailer, and triple-trailer trucks probably can be accommodated safely on Texas roadways of high design, e.g., the Interstate type highway. The appropriate level of user charges on these vehicles, however, needs to be determined for financing repairs, as well as marginal improvements, on the facilities they travel.

Other significant technological changes are likely to occur in highway construction and maintenance practices. New techniques, different materials, and shorter construction schedules will, as they occur, tend to offset the effects of escalating highway costs.

The technology embodied in the internal combustion engine will continue to dominate as the power plant for motor vehicles. Improved fuel efficiencies will result as motorists respond to rising fuel prices. Fuel mixes, e.g., more diesel and other alternate fuels, may change if petroleum gasoline prices continue to rise relative to prices of these substitutes. The transportation sector, historically consuming 25 percent of energy used, has led and will likely continue to lead the State's efforts to improve energy utilization.

The transportation of energy on the other hand is not a significant highway-related activity, given the preponderance of pipeline, rail, and waterborne movements of petroleum, petroleum products and natural gas. However, oil and gas field exploration and development activities inflict tremendous damage on local highways, roads, and structures. A fuller appreciation of these negative effects resulting from a continued oil and gas boom is warranted. Related resource development of Texas lignite and its transportation do not portend to be a serious threat to the highway network.

For the next twenty years, highway safety is likely to continue as an issue of considerable public importance. Motor vehicle accidents are a sobering reminder of some of the indirect costs being paid for mobility. More and better crashworthy vehicles will be added to the fleet during the next two decades. However, unless "passive" passenger restraint systems are improved, the widespread use of smaller vehicles will cause the number of fatal and severe injury accidents to increase by as much as 20 percent. Continued efforts to identify and counteract accident hazards and causes are imperative. Improved roadway fixtures, better designs, and better materials all have a role to play in improving the safety environment on Texas roads and highways. As for improvements in the physical environment, highway vehicle emissions and noise problems are essentially confined to limited urban areas in the State. Emission control technology is becoming sufficiently advanced so that it in itself seems to offer a genuine solution over the next few years to the problems of engine exhausts. Noise reduction requirements are even more geographically limited to particular sound sensitive areas. Noise abatement structures coupled with continued improvements in tire and muffling equipment designs will probably be needed to bring noise levels created by very large trucks down to acceptable criteria.

The preeminence of the Texas highway system has often been associated with a vigorous research and development program. This needs to continue. Personnel and facilities in the State offer modern, high technology research tools and technical skills to solve problems in highway structures, traffic engineering, materials, pavements, safety, transportation economics, planning and other related areas. The SDHPT, in cooperation with other state agencies and universities, has played the key role in keeping Texas as the premier state in transportation research and development.

Urban Transportation

The effective provision of urban passenger transportation, both in terms of roadways and modal mix, is dependent on various economic and population configurations in the metropolitan environment. Changing population distribution and density levels in urban areas and the redistribution of commercial, service, and industrial activities determine how transportation facilities must be altered and expanded. Because both businesses and residences are becoming more dispersed, there is an accelerated need to serve the resulting increased travel demands. Safety and travel time improvements must be included in developing efficient transportation facilities.

While 80 percent of Texas' licensed drivers presently reside in metropolitan areas, 1990 projections point to a 35 percent increase in the number of motorists in the six largest: Houston, Dallas-Fort Worth, San Antonio, El Paso, Austin, and Corpus Christi. Further, 1990 mode choice projections show a continued growth in the proportion of workers driving to their jobs. The upshot of these projections is an accelerated increase in highway travel. Conservative estimates of future highway growth combined with optimistic projections of the future role of transit suggest that traffic volume will double on major urban roadways by 1995. Travel times can be expected to increase by a similar amount.

Due to the increased travel of larger urban populations, many freeways now carry traffic levels far in excess of design capacities. Many major urban arterials are nearing the end of design life and will deteriorate at present maintenance levels; many others are in need of major repairs and expansion. For new urban facilities, construction costs have increased at a rate greater than the inflation rate, and this problem is compounded by the time required to build new facilities. From the time a freeway project need is identified, a period of at least 10 years will lapse before that project is opened to traffic. Thus, once traffic congestion in an urban area builds to unacceptable levels, a "catch up" process is immediately required. Subsequently, time consumed in project development exacerbates the effects of congestion. As a result, most transportation experts agree that traffic congestion in Houston is worsening every day and will continue to do so. A similar trend may very well develop in other Texas cities such as San Antonio,

Dallas, and Fort Worth. At some point, this increased magnitude of traffic congestion will lessen the attractiveness of major Texas cities as economic growth centers.

Improvements to existing facilities can accommodate some of the increased travel. For example, the contraflow lane on Interstate 45 in north Harris County has increased urban passenger capacity by 15 percent at peak travel periods. This high occupancy vehicle (HOV) improvement reserves the lane left of the median for exclusive use by buses and van pools. If enough buses were to become available and enough people chose to ride them, then HOV lanes could move 40,000 persons per hour—a volume much greater than the total hourly corridor travel demand that will exist in any Texas corridor in the next 10 to 20 years. These high-occupancy vehicle improvements also enhance the attractiveness of vanpooling programs. Presently, about 40 percent of the person volume on the Houston contraflow lane is served by vans. Innovative approaches such as special high-occupancy vehicle facilities will, by necessity, have to play a more significant role in serving the projected large-scale increases in urban travel demands. In fact, additional high occupancy vehicle (HOV) lanes are planned for Houston freeways, with plans for similar improvements in San Antonio. Other traffic engineering improvements in urban areas have allowed vehicles to operate more efficiently and have eliminated unnecessary speed changes in the traffic stream. Improved freeway metering, progressive signalization systems, and improved signing in metropolitan settings have eased traffic congestion in many cases. Maintenance and road repairs are now being undertaken at night in Houston, San Antonio, and Dallas to reduce interruptions for peak period travel. However, night maintenance is more costly to perform and more dangerous to the workers.

Currently, urban freeways are being modified to use shoulders as lanes, and existing lanes are being narrowed. However, these short-term alterations greatly increase maintenance needs. To further ease traffic congestion, major improvements are warranted but would require the diversion of traffic off a given facility for two months or more. The involvement of many organizational entities in such decision-making presents problems in planning and implementing major facility improvements.

Advanced traffic management centers to control traffic, including busways, on a real-time basis are warranted for many major urban arterials in the State. Again, because of the need for heavy inputs for manpower, no control organization has yet been formed.

Although the automobile serves over 95 percent of all urban travel in Texas, this does not mean that public transit has no important role in serving urban Texans. In fact, the number of transit riders in the state has increased by over 25 percent within the most recent five-year period. But, it is important to note that public transit is best suited for serving travel to and from concentrated activity centers.

Also, minimal public transit systems provide some level of mobility to the transportation disadvantaged—those who otherwise would not be able to travel. Public transit can be used as an internal circulation system—a means for moving people within major activity centers. Several Texas cities presently use buses to provide circulation within the downtown areas. Finally, an effective transit system is necessary to support the downtown development that is occurring in Dallas and Houston. Although transit serves a small percentage of total daily travel, more than 20 percent of the peak-period travel destined to major activity centers is commonly served by transit. Realistically, though, transit could never serve the variety of dispersed, diverse trips undertaken daily by the average urban resident. The objectives for public transit in Texas must be clarified and further service improvements geared to meet these goals.

The increase in transit ridership has been achieved with subsidized expenditures for capital improvements and operations. Approximately 57 percent of governmental financial assistance has been for capital expenditures. Local governments have provided 45 percent of this portion. Federal subsidies were 52 percent, and State capital assistance was 3 percent.

Because of proposed re-direction in federal capital grant subsidies, new rail transit systems, as being planned in the Houston Westpark corridor, will receive no federal money in the near future. The aim of federal transit subsidies will be improvements to and maintenance of existing, proven facilities. Most significantly, transit operating subsidies may be eliminated by 1985. Since 43 percent of government subsidies are for operating expenditures, transit operators may have to improve operating efficiencies, reduce service, or raise fares. Further, State and local contributions to transit operations need to be reevaluated in light of proposed federal cutbacks.

Technological improvements affecting urban transportation often have been closely tied to social, economic, and energy policy directives. New additions to the bus fleets in Texas have been primarily advanced design vehicles, many of which are "kneeling" buses and/or have wheelchair lifts to meet the needs of elderly and handicapped riders. Federal regulations surrounding these "full accessibility" features have generated heated controversy and reflect one of transit's most critical issues.

Vanpooling has increased rapidly in Texas during the past five years. By April 1981, more than 1,800 vanpools were in operation in Houston alone. Current vanpooling programs, sponsored almost exclusively by employers, could expand considerably in the next 10 years. Funding from the Federal Highway Administration for vanpooling allows for a 25 percent match of funds by the State. The State Department of Highways and Public Transportation, however, considers financing of any losses incurred in the operation of vanpools to be constitutionally prohibited and has not participated heavily in the program. A resolution of the constitutionality issue has implications for further developments of vanpooling in urban Texas.

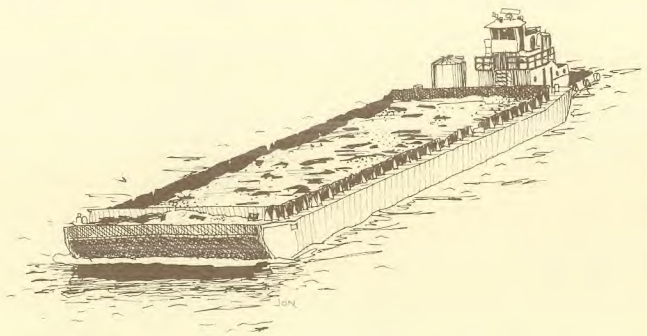
While vanpools tend to serve the long-distance (20 mile) work trips, carpools provide a means of reducing auto travel for shorter urban distances. A limited number of urban trips, primarily those to work in areas of concentrated activity, are conducive to carpooling. Car sharing is increasing, and the State Department of Highways and Public Transportation is building park-and-pool lots for commuters. Still, only about five or six percent of all urban trips are the type that could be effectively pooled.

Development of more refined strategic planning efforts is needed to bring together managerial and organizational expertise to solve critical urban transportation issues. Cost-benefit analyses of escalating costs for capital and operating expenditures are warranted. Analysis of modal mixes needed for urban areas in the 1980's should be pursued. Other urban transportation topics warranting immediate research include:

- Monitoring the distribution of traffic volumes and population growth within the state;
- Assessing the feasibility of other viable metropolitan transit organizations;
- Determining the feasibility of HOV lanes on major urban freeways;
- Improving traffic engineering techniques for use on major urban arterials;
- Assessing cost effective approaches and locational considerations for park-and-pool as well as park-and-ride lots surrounding urban areas;
- Vanpooling for small (less than 100 employees) firms;
- Improved methods and materials for city street design, construction, maintenance, and operations; and
- Relationships among land use, growth, and transportation demands.

Waterways

After decades of debate in the U. S. Congress, a user charge to be paid by commercial users of certain inland waterways, including the GIWW, was put into effect in October 1980. Revenues from this charge, which is in the form of a fuel tax, are deposited in a trust fund which is to be used for inland waterway projects. Recently announced federal proposals could, if enacted, increase the current 4¢ per gallon fuel tax to 30¢ per gallon. This could be devastating to parts of the industry, particularly to the carriers of low value commodities that travel long distances. There is also discussion of reducing federal financing for or abandoning altogether the low volume portions of some waterways, which includes the section of the GIWW from Brownsville to Corpus Christi.



Congestion is a growing problem on the GIWW and in Texas' ports. This is due to the steadily increasing flow of commodities, larger vessel sizes, and increased recreational use of waterways. Increased tonnage has been accommodated safely in the past primarily due to technological improvements in vessels and equipment. The consensus of those directly involved in the inland navigation industry is that further advances in technology can no longer be depended upon to absorb the brunt of increasing traffic. Further efficiencies in the marine transportation industry must come from improvements in port layouts and other facilities. For example, due to channel dimensions, tows on the GIWW are restricted to an average of only five barges. This compares with maxima of 40-barge tows on the Mississippi River; 20-barge tows on the Ohio River; and 15-barge tows on the Monongahela River. Also, the relatively shallow depth of the GIWW constrains the allowable draft and reduces maximum cargo weights. Fewer movements would be required to move the same amount of cargo, resulting in cost savings for the carriers and reducing congestion on the waterway, if the channel were widened and deepened. There is also a problem of the degree of curvature on some bends in the GIWW. At present, traffic is reduced to one-way operation at some curves. This creates delays and unsafe conditions.

With the advent of very large deep water ships, port facilities in the U. S. have fallen behind those of many other countries. It is imperative for the continued economic growth of Texas that its ports be improved to accommodate the deeper draft and larger turning basin requirements of modern vessels. Several proposals for both onshore and offshore deep water ports have been made. Among these are a deep water port at Galveston and a supertanker port somewhere off the coast. The user charge issue has been very controversial, but it must be resolved.

An often overlooked benefit of water transportation is its safety record in the movements of hazardous materials. A very high percentage of all tonnage moved on Texas waterways is classified as hazardous materials — in 1970, over 96 percent.

Controversy over the environmental impacts of maintaining the GIWW and ports abounds. Much of it centers around disturbances caused by dredging and disposal of dredged materials. There is no doubt that these activities change the ecosystems in which they occur. Continued monitoring and study are necessary to weigh the costs and benefits of past as well as future maintenance and improvements.

Research must continue to look for solutions to manage and develop the water transportation system of Texas to maximize economic benefits, while at the same time protecting the environment. Continued evaluation of the effects of user charges on not only waterway users but also local, regional, and State economies is also very important. Study of capital expansions to keep pace with increasing tonnages and larger vessels is a must.

The immediate concern of the State of Texas is the possible loss of the inherent advantages of its waterway system due to new federal policies. Implicit in this concern is a need to examine the role and future of the State as the nonfederal sponsor for the GIWW. Efforts should be made to prevent the loss of jobs and income that could result if the water transportation industry is severely damaged. The State's ability to attract and sustain industry dependent on marine transportation could be in jeopardy.

Pipelines

The increasing number of active drilling rigs will require that new pipelines be constructed to bring oil and gas to refineries and markets. But the cost of laying pipelines has more than doubled (for even the smallest pipelines) in the past five years. Even before a new system design is completed and bids are sent out, construction costs will probably have been underestimated due to continuing inflation. Considering delays due to the environmental impact statements required, the permitting process, and the financing process, the actual costs may ultimately be twice those originally estimated. Any increased costs will result in higher transportation costs and ultimately in higher energy costs to consumers. Nevertheless, pipelines continue to be the most efficient and cost effective mode for transporting oil and gas.

Present State law governing the eminent domain powers of the pipeline industry appear adequate to insure:

(1) that the public is afforded due process; and

(2) that pipeline companies are afforded right-of-way access for their facilities.

A possible pipeline issue during the next 20 years involves the coal slurry technology. At the present time, the only coal slurry pipeline in operation in the United States is the Black Mesa line which transports coal from northern Arizona to southern Nevada. It carries 4.8 million tons of coal per year. In the past few years there has been renewed interest in slurry pipeline transportation. Because these pipelines are still in a relatively early stage of development, there are many areas in which technological improvements may increase productivity.

Because most of the low sulfur coal is in the West and because many utilities in the South, East and West have been required to develop plans for transition to coal, several slurry pipelines, which were on the drawing boards in the late 1970's, will likely be completed in the 1980's. Major problems faced by builders of slurry lines will be finding adequate investment money and an adequate water supply.

Intercity Freight Transportation: Rail and Truck

The efficient transportation of intercity freight, whether by truck or rail, depends on several factors. Physical facilities must be adequate to meet transportation demands. The regulatory environment must not stifle innovation, capital formation, or development. Management must react to changing demand and business conditions and engage in competition for the service and equipment requirements to satisfy user needs.

Movement of freight in Texas is a private sector activity using its own equipment, facilities, and management skills. Freight movements by motor carrier are over publicly provided rights-of-way, while the railroads provide and maintain their own rights-of-way.

As economic activity in an area increases, freight transportation industries respond to the increased service demands. In most instances, it is not the lack of service that impedes economic development. Congestions, delays, equipment shortages, and related factors inhibit full service in areas of high transportation demand. Rail terminal congestion in highly urbanized areas such as Houston is a prime example. Expansion of facilities, such as yards, is severely constrained due to physical limitations. However, throughput of the facilities can be increased by the application of available technology such as signalization and computerization. Rail carriers are currently planning and constructing yard facilities outside congested urban areas to improve operations.

Railroads and motor carriers in Texas are presently profitable enterprises. Their continued profitability will provide a source of funds to finance needed maintenance and capital expansion in the next 20 years. Whether or not the amounts of these funds will be enough cannot be known at this time. Continued profitability, however, is clearly a prerequisite.

Class I railroads operating in the Western District, which includes Texas, showed a 4.4 percent rate of return compared to a 1.6 percent national average for the 1978. In 1977, the last year for which these data were compiled by the Texas Railroad Commission, 36 carriers operating in Texas reported a total of $321.6 million in net revenue from railway operations. Railroads operating in Texas, unlike some of those in the Northeast and some in the Midwest are, for the most part, profitable operations. With the recent removal of restrictive regulations and increased merger activities, the number of railroad companies serving Texas probably will decline.

The composite 1979 reports of 857 motor carriers operating throughout the nation showed a return on transportation investment of 15.4 percent. Comparable information is not readily available on either a regional or state basis. It should be noted that the investment requirements of the railroad and motor carrier industries differ significantly and comparisons between the two should be made carefully.

One of the concerns confronting the State is railroad truck maintenance and its effect on rail safety. For several years a large amount of maintenance was deferred due to declining traffic and revenue. Efforts are currently being made by the carriers to correct this situation, and in 1977, $3.5 billion was spent on maintenance-of-way and structures by U. S. Class I railroads in the nation.

There is a continuing need for track maintenance as shown by the fact that over 40 percent of all U. S. reported train accidents are track defect related, and an additional 20 percent are related to maintenance procedures and equipment. In Texas in 1979, there were 754 reported train accidents of which 39 percent were related to track defects, and an additional 16 percent were related to maintenance procedures and equipment.

Maintenance needs for highway facilities are related to damages caused by vehicle loads. Heavily loaded vehicles (e.g., 80,000 pounds) cause disproportionately more damage than do lightly loaded vehicles. The exact relationship between vehicle axle weights and roadway damages is highly controversial, because the amount of taxes to be paid by highway users can be argued to depend upon the damages users inflict on highway facilities. The allocation of user charges will need examination in the near future; this is particularly true, given the recent declines in Texas' motor fuel tax collections and the invigorated Federal emphasis on transportation user charges.

The State and the nation are entering into a new era in the area of transportation deregulation. The trend at the federal level over the last few years has been away from regulation of railroads and motor carriers and toward more reliance on a competitive environment. It is too early to determine the outcome of this trend on the carriers, the users, and the role of the State.

Government finance of freight transportation has traditionally been that of providing funding for highway construction and maintenance. Until recently, the only financial involvement of government in the railroad industry was the early "land grant" program. Federal financial assistance is now available to the railroad industry through low interest loans. There are no State programs to assist the railroad industry. During the next 20 years, the role and importance of the railroad industry to the State will increase. Service demands will be placed on the railroads that may go beyond their financial ability. If so, State involvement and assistance may be required. Efforts should be initiated now to identify the role of the State as it relates to the railroad industry and to develop programs and implementing mechanisms to support that role.

Principal technological changes in freight transportation relate to primary intermodal activities. Increased use of containerization and truck/rail freight movements is expected. Existing regulatory procedures affecting the intermodal movements need critical evaluation. With the growth of intermodal traffic, public assistance to develop multi-carrier terminal interchange facilities must be evaluated. Allowing larger motor trucks (with larger payloads) is a controversial issue. Increased truck productivity will have to be evaluated against increased highway maintenance expenditures, safety, and other related aspects of highway travel.

Movements of unit trains in Texas will definitely increase throughout the rest of the century. These unit trains will carry coal, grain, containerized freight, and other high volume traffic such as sand and gravel. Large volumes of coal and crushed stone currently move through Texas by rail every day. Communities located along the rail corridors for this traffic will experience increased congestion and delays. There are currently no programs to assist these communities in solving anticipated problems.

Because of the large volume of hazardous materials transported in Texas and the potential damage resulting from an accident, improved safety is a vital interest to the State. Presently, the lack of a clearly defined lead State agency hampers efforts to ensure public safety in the shipment of hazardous materials. The State's role in the movement of these dangerous materials between and within Texas towns and cities needs to be defined. Clearly, accidents involving trucks or trains hauling hazardous materials need to be reduced. More generally though, the number of severe accidents involving motor trucks, particularly tractor-trailer combinations, has increased during the past five years relative to the number of accidents involving other vehicles. This disturbing trend must be abated and emphasis placed on efforts to identify the causes and propose remedies.

In urban Texas, trucks will continue to compete for available street facilities to serve an expanded demand for freight shipments. In the future, in an effort to better use existing facilities, more attention will need to be given to matters such as off-street truck loading space requirements and special truck streets. A transportation system that will continue to allow for the efficient and economical distribution of goods and services in urban areas is a necessary element for urban growth.

Intercity Surface Passenger Transportation

Bus

The most critical issue facing the intercity bus industry in Texas is regulatory reform. It appears certain that Congress will significantly reduce Federal regulation of the industry. It is, however, not completely clear how deregulation will affect the industry. Advocates of deregulation contend that deregulation will improve efficiency through competition. Others speculate that many areas will lose service because they are not profitable and are currently being cross-subsidized by other routes.

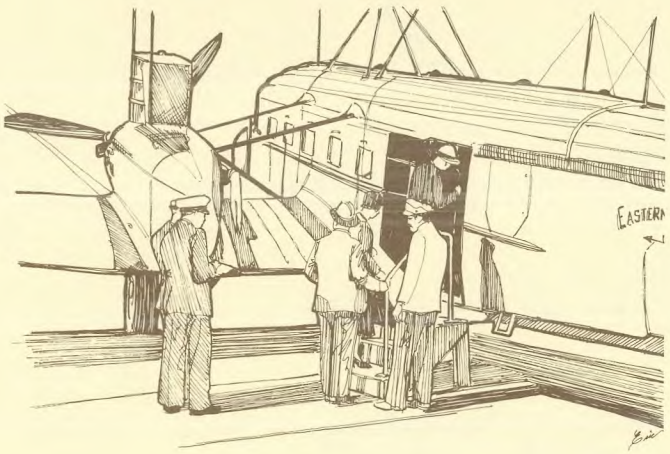
Texas appears to be different from most other states because intercity bus service appears to be relatively more profitable here. However, it is not known how many smaller carriers are providing regular route service just to obtain or retain charter authority. Under deregulation, these carriers would not need to provide regular route service in order to have charter authority.

Rail

Given current concerns such as highway funding, energy, and highway capacity, the future role of rail passenger service in the State is not well defined at this time. It is clear that a corridor type service (probably emphasizing service to the Dallas-Fort Worth, Houston, and San Antonio triangle) would be the most effective rail service for the State if a need for rail service exists. In the near term, more study of this form of transportation is needed to better understand its role in future intercity transportation.

Air Transportation

The critical issues in air transportation involve service and facilities. Service is primarily a private enterprise responsibility, as federal and state economic regulation of air transportation is reduced. Facilities - airports, airways, air navigation equipment, instrument and visual landing aids, and the air traffic control system - have historically been a governmental responsibility. Private ownership of public use airports has been declining for many years. Although private airports presently play a critical role in several Texas urban areas, continued reliance on private airports is not prudent, particularly under existing taxing and zoning laws and ordinances.



Commercial Aviation

The full effects of air cargo and airline deregulation and the dramatic increase in aviation fuel costs on commercial air service are not known at this time. A great deal of restructuring, experimentation, and learning is still taking place. Early trends suggest the following:

- Air cargo rates have risen but service availability has not been significantly affected;
- Domestic and international service in Texas has increased;
- New service strategies (such as short-haul, low fare, high frequency service) have been widely established;
- Airplane load factors have increased;
- Scheduled air service will continue at most Texas locations presently being served;
- Commuter airlines will continue to grow faster than air carriers operating large aircraft;
- The commuter airlines industry will be in disequilibrium (characterized by a high degree of market entry and exit, attempts to develop new markets, and price competition) for the next years;
- Fuel costs will continue their dramatic effect on scheduled air passenger service, costs, and fares. Increases in fuel prices led to a 28 percent increase in ticket prices in 1980; and
- Growth in Texas' commercial activity will exceed that of the U. S. as a whole.

Transport aircraft technology improvements are expected in engine components, supercritical wing design, active controls, energy efficient engines, and composite materials in primary structures. Fuel efficiency will be the major concern of aircraft designers. The fuel efficiency of jet aircraft is forecasted to improve by 32 to 40 percent between now and the year 2000. The ability of airlines to generate sufficient capital to purchase these new higher technology aircraft is crucial to the long term viability of the air carrier industry.

General Aviation

Most Texas communities receive direct access to the air transportation system through general aviation and local community airports. General aviation includes all civil aviation not classified as air carrier or commuter, especially corporate and business aviation and personal flying.

Trends in the overall economy are creating major changes within general aviation, which is becoming increasingly important for business transportation. Changes in tax legislation, business dispersion and centralized management, changing air carrier route patterns, and increased airline fares have increased business use of general aviation. Particularly important to Texas is the trend of business to locate plants in smaller communities in the southern half of the United States.

Fuel cost is the single most important factor affecting the composition of the general aviation industry. Aviation gasoline prices have increased 228 percent, and jet fuel prices are up 186 percent since 1973. Consequently, sales of single engine piston aircraft used primarily for personal and instructional purposes have recently declined. In contrast, sales of multi-engine piston and turboprop aircraft increased in 1979 and 1980. Orders for turbojet and turboprop aircraft for business use are approaching backlogs of three years.

Aviation Facilities and Finance

Government plays a critical role in providing facilities for air transportation. Airway navigational facilities and the air traffic control system are operated and maintained by the FAA. Local governments, using State and federal financial assistance, provide airports and visual and instrument landing aids.

The Texas Airport System Plan estimated the 20-year development cost of the State airport system at $1.1 billion (in 1978 dollars). About 80 percent of these costs are needed to develop the 18 airports served by large commercial aircraft. Dallas-Fort Worth Regional and Houston Intercontinental alone will need over $750 million to meet forecasted demand. Pending federal legislation may eliminate federal funds for up to seven airports in Texas (Dallas-Fort Worth Regional, Houston Intercontinental, San Antonio International, Love Field, William P. Hobby, El Paso International, and Austin's Robert Mueller). These seven can probably meet their capital requirements, if "head taxes" are instituted. The remaining 11 airports with large airplane service are presently in excellent condition and can probably meet capital requirements with federal formula allocations and local funds.

The continued viability of air carrier airports depends on the development of an adequate reliever airport system to handle general aviation aircraft, provide for the separation of large and small airplane traffic, and reduce delay at air carrier airports.

The development of general aviation airports in urban areas is the most serious airport system development problem facing Texas. Cities with an air carrier airport are reluctant to sponsor a general aviation airport. Smaller communities adjacent to the larger cities have neither the citizen support nor the tax base to develop general aviation airports designed to meet the needs of a large urban area. Consequently, only two new urban area airports were constructed between 1970 and 1980, both in smaller towns 35 miles from the nearest city. Twenty-five new urban general aviation airports are needed now, as are changes in the way urban general aviation airports are planned, financed, constructed, and operated.

The present status of the system of community general aviation airports shows that:

(1) some airports have not been upgraded to accommodate current business air craft technology;

(2) some have not been adequately maintained;

(3) some have deteriorated to levels requiring reconstruction; and

(4) some are located at inadequate sites.

State and federal assistance, traditionally relied on by many communities for airport capital funds, has not increased in proportion to need or to increased construction costs. Texas leads the nation in number of general aviation airports but is the twenty-second state in total funds provided by state aviation agencies. The backlog of general aviation airport grant applications for State and federal funds exceeds $50 million. Without increased funding, particularly from the State, this backlog will increase and the condition of general aviation airports in Texas will continue to decline. If Texas' locations for potential industrial sites are to be competitive, adequate air access is a necessity.

Summary

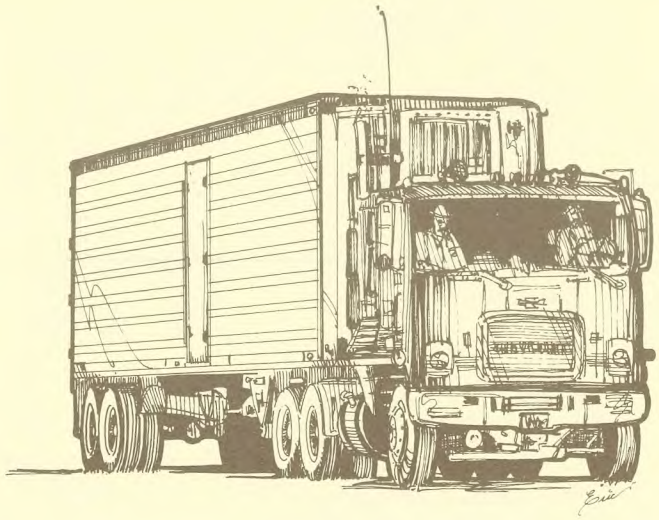
During the next 20 years, a lot of private and taxpayer dollars will be spent on maintaining and expanding the productivity of the transportation system. Transportation facilities and the monetary investment they represent must be protected by an adequate maintenance activity lest they deterioriate before they have been used up. Those facilities that are used up in providing for expanded population and economic growth must be reconstructed, rehabilitated, or replaced. New facilities will be needed in those areas where growth is highest. These facilities will be very expensive to build. To avoid building them, on the other hand, may be even more costly.

New transport technology will offer cost reducing economies in production and distribution. Absorption of technological change may lead to unexpected differential effects on the various modes of transportation. Energy saving technologies will be very attractive to suppliers and users of transportation services.

The roles of various levels of government in some transportation activities must be more clearly defined. Responsibilities must be coordinated to insure the wise expenditure of taxpayers' dollars. Stable revenue sources need to be secured by all levels of government to advance the orderly expansion of the network.

The complete transportation system must combine safety with efficiency to protect lives and property adjacent to and on the facilities. The development of Texas' transportation system during the next 20 years must retain the balance of safety and efficiency.

Finally, planning and problem solving in transportation are no different from similar activities in other industries. A vigorous research and development effort in Texas must continue to provide the knowledge base, analytical tools, and expertise to identify and solve the critical transportation problems.



SUMMARY AND CONCLUSIONS

Texas has one of the best transportation systems, if not the best, in the United States. Our mature network of roads and streets, railroads, waterways, pipelines, and aviation has responded to the growth of the State and has itself helped shape that growth. This interaction between growth and transportation has characterized the historical development of Texas and will affect the State's success in planning for and meeting the challenges of the remaining nineteen years in this century.

Texas Transportation: Trends and Problems

The current status of Texas' transportation network and its expected future use are factors that must be paramount in strategic planning efforts to develop State policies, programs, and priorities that will influence the way Texans live in the year 2000.

Many of the expected trends have been identified. Briefly, they are:

- An expanding transportation system will be needed to facilitate and respond to Texas' economic and population growth.
- Private sector and government expenditures both will be needed to finance the maintenance of and capital improvements to the transportation infrastructure.
- Urban areas in Texas will need a wide variety of transportation improvements to enhance the productivity and quality life of urban Texans.
- All of the transportation modes will be important, but motor vehicles (cars, buses, and trucks) travelling on highways, roads and streets will be the dominant mode.
- Technological changes will improve fuel efficiencies, and Texans will respond to rising real prices of transportation fuels.
- Government expenditures for transportation will depend upon user taxes and general tax revenue.

Given these trends, the existing transportation network is not adequate to meet future needs. The specific problems to be solved will ultimately, of course, depend on the hard choices implicit in the allocation of our scarce resources. But, given what is now known plus what is reasonably expected, the following transportation problems must be addressed:

- Maintenance — The highway, road, and street system must not be allowed to deteriorate. Railroad tracks and terminals need upgrading. The GIWW needs continuous dredging, as do other port and waterway facilities. General aviation and commercial airports need expanded maintenance. Urban transit systems must improve their maintenance strategies and operations.

- Improvements — Rural highways and roads will need expanded reconstruction and rehabilitation. Urban street and highway capacities need to be increased by improvements such as HOV lanes, vanpooling, and park-and-ride lots. Intermodal facilities at ports and other terminals will be needed. The GIWW and Texas port facilities must be expanded to accommodate more efficient, larger cargo vessels. Public transit must be tailored to fit the needs of urban Texans. Some airports will need reconstruction.

- Capital Expansion — New highways and roads will be needed on the periphery of Texas' rapidly expanding cities, as well as in those cities. New general aviation airports are needed in several Texas towns; and reliever airports are needed in Dallas-Fort Worth and Houston. New pipelines will be needed for expanded and newly discovered oil producing areas. New vehicle technology (smaller cars and larger trucks) will be incorporated into the fleet. Expanded rail yard capacity and double tracking will be needed in the railroad sector.

- Finance — State government will continue to rely on user taxes to support the State highway system. Private sector capital will finance improvements in the rail truck, and pipeline industries. Waterway user charges will be an increasing source of revenue for GIWW and other public waterway improvements. Aviation will need additional user, State, and local finance as Federal expenditures are reduced. Profitability of railroads will provide a principal source of funds to this industry to finance its expansion. Additional sources may be needed to supplement the railroads' profits if they are inadequate. Public transit systems will need increased government expenditures for operations. Cities will continue use of ad valorem and sales taxes and bond sales to finance street improvements and expansion.

- Safety — Safe travel by motor vehicles will be expected by Texans. Safer roadways, more crashworthy vehicles, accident countermeasures, and improved traffic operation will reduce losses to persons and property. Specific problems of public safety, such as the safe movement of hazardous materials and aviation safety, must be addressed.

- Energy — Texas' reliance on motor vehicle transportation makes it energy dependent on petroleum. New fuel mixes, e.g., more alternate fuels and diesel, will affect the amount of gasoline used as Texans adjust to changing real prices of fuel. Public transit in urban Texas will experience greater use if fuel prices rise drastically or if persistent severe shortages of petroleum occur. Pipelines will continue their dominance of petroleum and gas shipments. Increasing use of Western coal and other bulk commodities will expand the need for adequate railroad (track and rolling stock) maintenance due to increased numbers of unit train movements. Oil and gas field developments will require expanded maintenance and reconstruction of localized roads and highways.

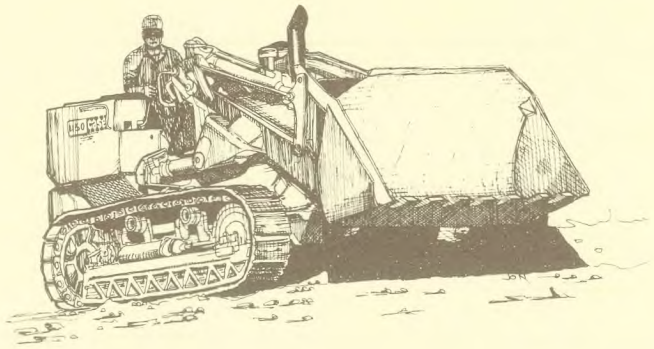
- Deregulation — Recent (and expected future) deregulation of motor, air, and rail transportation is likely to be a two-edged sword. Increased competition may lower transportation costs to consumers. But, service curtailments will likely be experienced in Texas' smaller towns and communities. Continuous, cautious monitoring of the dynamics of deregulation is warranted to identify and remedy the undesirable effects.

- Research — Texas will need to continue its vigorous transportation research and development activities. Many of Texas' transportation problems can be solved by the application of modern research techniques utilizing skilled expertise and analytical tools. Transportation finance, safety, engineering, structures, planning, and economics are problem categories that demand continued research and development.

Transportation's Relationship to Other Major Texas Activities

The people of Texas are the principal beneficiaries of our transportation system. At the same time, the people are the State's most important resource. As such, they rely on an efficient transportation system to get them to and from their jobs, to give them access to commercial and service activities, and to enhance the quality of their lives. Population growth must be accompanied by expansion of the transportation system and greater utilization and improved efficiency of the present capital stock.

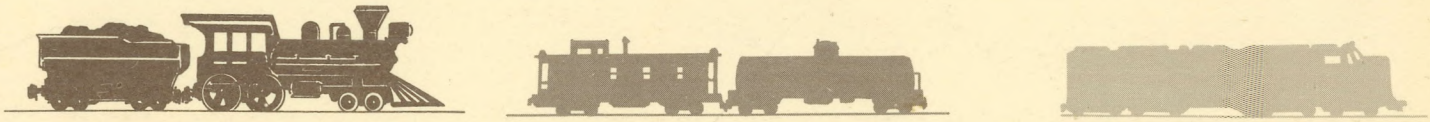
Similarly, the growth of two of Texas' principal industries, agriculture and energy, depends on a complete, efficient network for goods movements. Without it, primary resources cannot be developed and products cannot be moved to markets. Texas' other industries - mining, manufacturing, wholesale, retail, and service - will all require improved and/or expanded transportation service to bring inputs to industrial locations and move the resulting goods and services to markets.

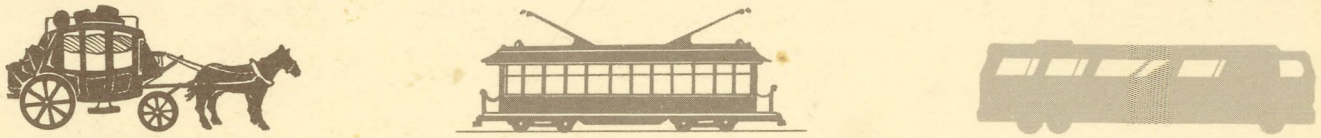


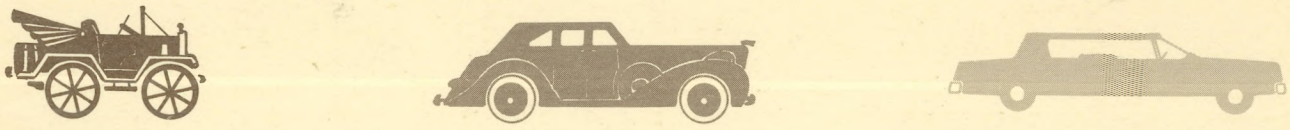
Government's role in transportation is essentially that of a supplier of transportation facilities and a user of transportation services. People and industry expect government to complement the private sector in providing a complete, safe, and efficient transportation network. To do so, governments at all levels in the State must determine the levels of expenditures for transportation and then levy taxes. To this end, government has to decide on the appropriate level and mixture of transportation user-taxes and general revenues to balance the distribution of benefits and costs of transportation service.

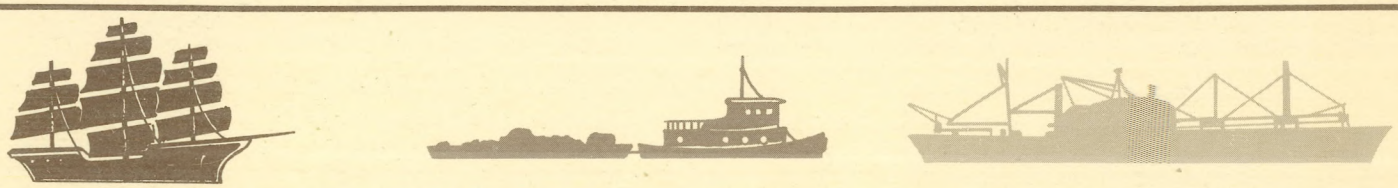
The role of governments in Texas is partially defined by Federal transportation policy. Accordingly, Texas needs to exert its influence at the national level to help shape transportation policies, programs, and expenditures that will be beneficial to Texans. Finally, State, county and local governments need to adjust their transportation-related activities to complement changes in national transportation policy, programs, and expenditures.

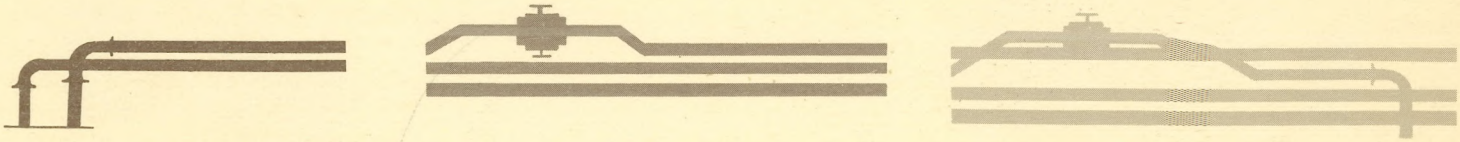
Because the transportation network does not end at the State's geographical boundaries and border, Texas' transportation affects our relationships with neighboring states and Mexico. Cooperative efforts between Texas and Mexico can improve the efficiency and expand the flow of goods movements across the Rio Grande. These efforts have been underway in Brownsville-Matamoros and other "twin-cities" along the border for some time and require continued work for successful implementation. The economies of Texas and Mexico are likely to become more interdependent in the next twenty years, and a well-coordinated, integrated transportation network linking the two will enhance the future success of our relationships with Mexico.











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