Enid Area Long Range Transportation Plan

Prepared for

Enid Metropolitan Planning Organization

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In Cooperation With

Oklahoma Department of Transportation
City of Enid
Enid Metropolitan Area Planning Commission

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CHAPTER I
INTRODUCTION

Purpose of the Transportation Plan

The purpose of the long-range transportation plan is to provide a framework for the implementation of transportation improvements in the Enid metropolitan area over a 20 to 25 year period. The transportation plan provides an opportunity to coordinate land use development with transportation needs. The plan provides local officials with information regarding the amount of funding available to meet transportation needs. The planning process itself provides a means for area residents to influence future transportation decisions.

The Federal Highway Act of 1962 mandated that metropolitan areas with a population of 50,000 or more prepare a long-range transportation plan before federal highway funds could be spent in the area. Developing a transportation plan is a required activity for Metropolitan Planning Organizations (MPO). MPOs were created in 1975 by the federal government to carry out the urban transportation planning mandates of the Federal Highway Administration (FHWA) and the newly formed Urban Mass Transportation Administration, now the Federal Transit Administration (FTA). MPOs were established in all urbanized areas over 50,000 population and work in cooperation with state Departments of Transportation. A recent decline within the Enid area rendered the population below the 50,000 person threshold. However, this study is being performed to provide continuity to past planning efforts and to maintain eligibility for federal funding given the recent increases of development in the area, which could result in the population of the Enid area to exceed the 50,000 level at the next decennial census.

The Enid area began its long-range planning process in 1965. The transportation planning process was to be "continuing, cooperative and comprehensive", and MPOs were to provide a "forum for cooperative decision making" for local political officials located within each metropolitan area. As such, the Enid area became eligible for new transportation funding sources, but also had to comply with the federal planning requirements. In response, the first long-range transportation plan was completed in the 1967. An update to the initial plan was completed in 1980.

The Intermodal Transportation Efficiency Act (ISTEA) of 1991 and the Clean Air Act Amendments of 1990 (CAAA) have placed a new emphasis on the transportation planning and project programming functions of MPOs. ISTEA has strengthened the previous federal requirements for comprehensiveness in planing by specifying factors that must now be considered in developing transportation plans and programs, and which ultimately are used as the basis for project selection. The new regulations now require, in addition to highway and street plans, the consideration of bicycle and pedestrian planning, transit alternatives, and transportation demand management to improve mobility and air quality. Additionally, the plan includes significant public involvement.

Study Area

The Long-Range Transportation Plan (LRP) is being prepared for the Enid metropolitan area. The metropolitan area boundary encompasses the area which is expected to contain urban development at the plan horizon date, the year 2020. Urbanized areas are located in areas where the population is 50,000 or more and is defined by the U.S. Census to include those areas having a population density of 1,000 persons per square mile or more. The study area includes the part of the metropolitan area which is the detailed part of the urban transportation model.

The current Enid study area is indicated in Figure I-1. The study area and traffic zones used in this study are basically the same as those used in the previous studies. Additional zones were added to better model the new commercial developments along W. Garriott Road. The study area contains 102 square miles and is divided into 191 internal and nine external traffic zones.

Three United State numbered routes and two State numbered highways serve traffic into and through the study area. US-81, generally following Old Chilsom Trail, traverses the entire state from north to south. Traffic east and west of Enid is served by US-412, US-60 and US-64. State Highway 45 serves traffic desiring to go northwest from Enid.

The Enid metropolitan area is served by various levels of nonautomobile transportation. Public transportation is provided by a 10 vehicle demand-response transit system. The Union Pacific, Burlington-Northern, and Atchison, Topeka and Santa Fe railroads connect the study area with the rest of the county. The municipal airport offers air service with daily scheduled flights to airports in Oklahoma and the surrounding states.

Existing Street Network and Classifications

The existing street network is comprised of the major streets in the Enid area. These streets have been classified by the Transportation Technical Committee following guidelines prepared by the Federal Highway Administration.

Figure I - 1 Study Area Map

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The existing street functional classification is shown in Figure I-2. The functional classification definitions are listed below:

- Principal Arterial - Streets and highways contain the greatest proportion of through or long distance travel. Such facilities serve the high volume travel corridors that connect the major generators of traffic. The selected routes provide an integrated system for complete circulation of traffic, including ties to the major rural highways entering the urban area. Generally, major arterials include all high traffic volume streets.

- Minor Arterial - Streets and highways connect with all remaining arterial and collector roads that extend into the urban area. Minor arterial streets and highways serve less concentrated traffic generating areas such as neighborhood shopping centers and schools. Minor arterial streets serve as boundaries to neighborhoods and collect traffic from collector streets. Although the predominant function of minor arterial streets is the movement of through traffic, they also provide for considerable local traffic that originates or is destined to points along the corridor.

- Collector - Streets provide direct services to residential areas, local parks, churches, etc. To preserve the amenities of neighborhoods, they are usually spaced at about half mile intervals to collect traffic from local access streets and convey it to major and minor arterial streets and highways. County collectors are rural roads which serve movement from field to arterial routes. Direct access to abutting land is essential.

- Local-Access - Streets that are those not selected for inclusion in the arterial or collector classes. They allow access to individual homes, shops, and similar traffic destinations. Direct access to abutting land is essential, for all traffic originates from or is designated to abutting land. Through traffic should be discouraged by using appropriate geometric designs and traffic control devices.

Transportation Goals and Objectives

The first step in planning a comprehensive transportation system is to define its values. Values related to livability, safety, mobility, and use of the land have a major influence on the transportation system that is best suited to a particular jurisdiction. Often, issues related to transportation and community character are complex, and include many differing viewpoints. Informed decisions about the individual choices your community faces can be made by drawing

ENID AREA LONG RANGE TRANSPORTATION PLAN

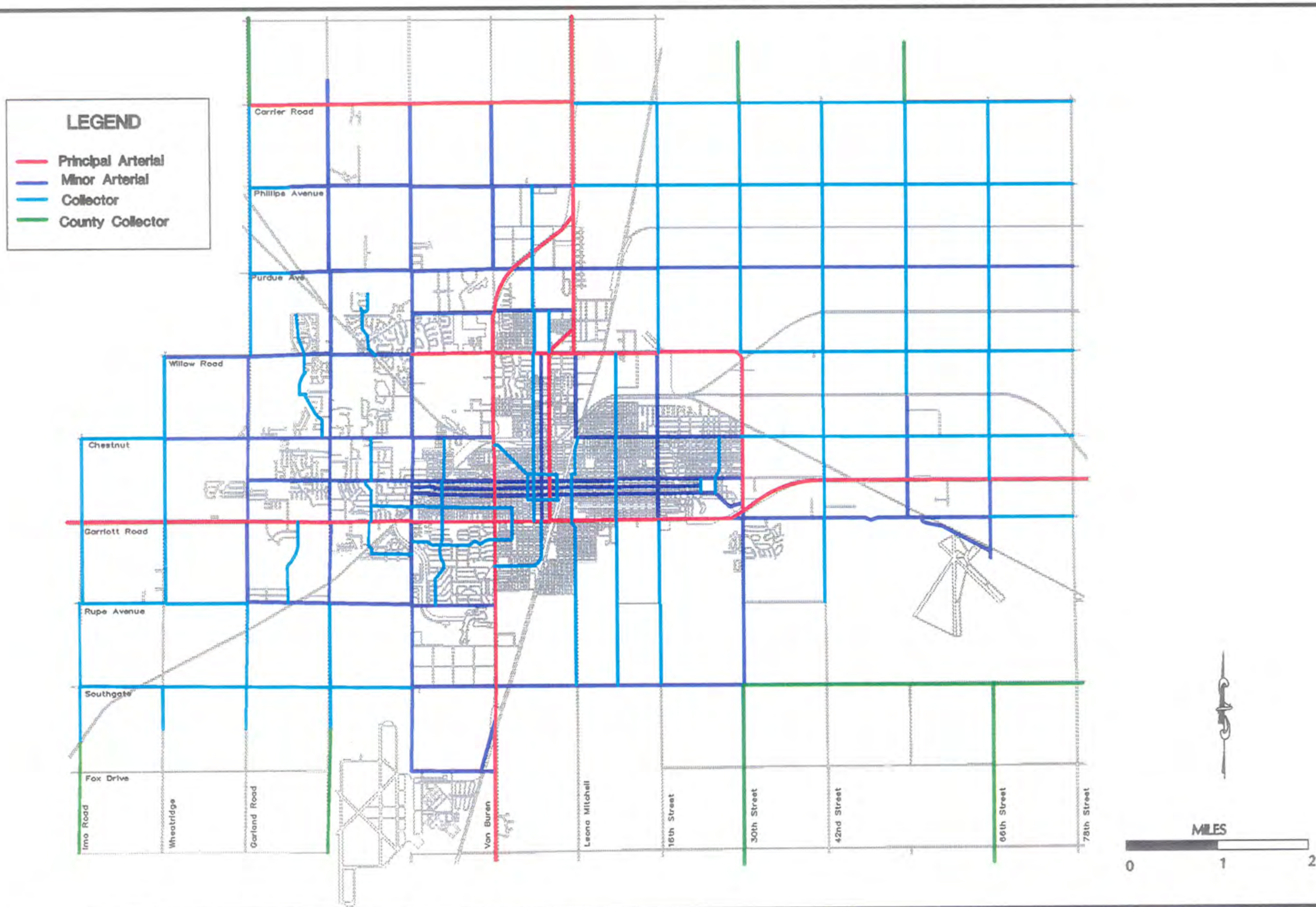

Figure I - 2 Functional Classification Map on the broad goals discussed during the public meetings conducted as part of the Enid Transportation Plan development.

The community discussion reflects a number of unique characteristics of the Enid area. The area has its origins as an oil industry community. Its urban form reflects the layout of Enid and North Enid as a township with section lines forming major arterial routes. The Enid area was platted in 1893. A major travel route, the Chisolm Trail, now US-81 was and is a primary travel route. Enid has had a strong industrial base. Items produced include drilling rigs, clothing, dairy products, steel products and agricultural machinery. Enid has large terminal facilities for wheat storage. Located within the study area is Vance Air Force Base, a pilot training base established in 1941, and Phillips University chartered in 1906.

During the course of the study, three public meetings were conducted to obtain public input and comment into the planning process. The public involvement process included an initial scoping meeting attended by local and state government officials, workshops with the planning commission, public focus groups, and public presentations. A community questionnaire was distributed at one public meeting. Specific goals and issues identified through the public involvement process included the following:

- Transportation system improvements are needed to support economic development;
- There is a need to improve congested areas by widening segments of key roadways to provide turn lanes;
- Pedestrian and bicycle travel needs to be encouraged with a trail or route system;
- Long-range transportation needs to accommodate new development;
- Through traffic alternatives need to be studied, particularly as it relates to hazardous materials transportation; and
- Grade separation of road and rail needs study at specific locations.

These issues and other issues identified throughout the study process are described in the remainder of the report.

CHAPTER II
SOCIOECONOMIC INVENTORY AND PROJECTION

Introduction

A purpose of this study is to define transportation mobility problems and solutions within the Enid metropolitan area which both currently exist or are likely to exist in the future. The analysis of expected future transportation conditions is based upon both current development and forecasted growth. This future population and employment growth is likely to increase traffic flows from those levels currently being experienced.

The transportation system serves the population and industry of an area. As such, there is a direct relationship between land use and transportation. A transportation plan should be responsive to the dynamics of an area, such as population and employment change, and the distribution of these activities across the urban area. In addition, both ISTEA and the CAAA mandate the study of the land use transportation relationship. Both acts require that transportation plans be consistent with land use plans and prescribe a balance between future land use development and infrastructure needs.

This section describes how future land use estimates were prepared as part of the Enid area future land use plan. The future land use plan was prepared by local planners, public officials, and public citizens and was guided by population projections developed by the Oklahoma State Department of Commerce.

Socioeconomic Elements

The volume of traffic which moves through an area is directly related to the social and economic characteristics of that area. Prevailing land uses also influence the movement of traffic, and in turn, affect the location of neighborhoods and commercial areas.

The socioeconomic inputs to the Enid Area Transportation Model include:

- Population:
- Dwelling units;
- Automobiles;
- School enrollment: and
- Employment.

Demographic information on population, dwelling units, and automobiles were obtained from the 1990 Census. This information was identified at the Traffic Analysis Zone (TAZ) level utilizing the U.S. Bureau of the Census' TIGER/Line census files.

Population. The population counts for the transportation study area were obtained from the 1990 Census, using the technologies described above. The population for the Enid transportation study area was 47,151.

Dwelling Units. Dwelling unit counts were obtained by using the 1990 Census dwelling unit count as the base. Subsequent building and demolition permit information as of April 1, 1990 (the day the Census was taken for the Cities of Enid and North Enid) were plotted in the appropriate transportation zone. By adding to or subtracting from the base, a current dwelling unit count per zone was obtained. Total dwelling units for the study were compiled and estimated at 22,093.

Automobiles. Automobiles in each traffic zone were estimated based on 1990 Census information indicating the number of dwelling units which have no automobiles, one automobile, or two or more automobiles. The value of 2.2 automobiles was selected as the arbitrary weight for those dwelling units which have two or more. Subsequently, each category was weighted accordingly, added together, and divided by the number of dwelling units to get as regional average of approximately 1.58 automobiles per dwelling unit.

The second estimation technique was determined using the number of persons over the age of 15 who reside in the Enid transportation study area. By dividing the respective automobile registration counts by the number of dwelling units, 1.58 automobiles per dwelling unit was obtained. The value of 1.58 was multiplied by the number of dwelling units in each traffic zone to determine the number of automobiles per zone. Accordingly, automobiles in the Enid study area numbered 35,374.

School Enrollment. Current school enrollment figures were obtained from the Enid Board of Education for the City's public schools, as well as by telephone calls to the various parochial, private, and higher education institutions in the region. The enrollment numbers were positioned within the transportation zone which corresponds with the address of the school or institution. School enrollment, including figures for Phillips University, Enid Higher Education Program (EHEP), and Autry Tech, numbered 11,110.

Retail Employment. The number of retail establishments by transportation zone were determined by first searching the 1993-1994 Cole Directory, the Southwestern Bell Yellow Pages, and recollection of new businesses that were not listed in either directory. Each establishment was then called to ascertain their number of employees. Retail employment for the Enid transportation study was 5,125.

Other Employment. The number of "other" employees was obtained through previously collected data from the Enid Chamber of Commerce and the Oklahoma State Department of Commerce, from the 1993 Polk Directory, and by estimating the number of at-home employees to be approximately 5 percent of the dwelling units. Other employment was estimated to be 13,727 bringing total employment for the Enid transportation study area to 18,852.

Data Comparisons. Prior to using these data in the transportation study, they were compared to similar data from other Oklahoma cities as a validation of its relative accuracy. This comparison, shown in Table II-1, illustrates that the socioeconomic data ratios for Enid compared with the ratios for other urban areas in Oklahoma. A review of the data provided three primary conclusions which impact the travel forecast process. First, the Enid area has a smaller percentage of retail employment than many of the other areas surveyed. This is somewhat unexpected, given the potential for Enid to serve as a regional retail center. A second finding is that there is a higher automobile ownership per capita and per dwelling unit in Enid than the other communities. Thirdly, there is a higher percentage of employees per capita in Enid than in the other communities. The data, by traffic analysis zone, is shown in report appendix.

TABLE II-1
Enid Transportation Study
Socioeconomic Data Comparisons
Enid Study Area

	Enid	Ardmore	Altus	Ponca	Guymon	Muskog	Stillwater
Retail % of Emp.	21%	25%	38%	20%	30%	24%	32%
Pop/OccDU	2.59	2.49	2.77	2.46	2.60	2.50	2.59
Pop/DU	2.13	2.17	2.40	2.32	2.23	2.13	2.32
Auto/DU	1.58	1.50	1.50	1.60	1.70	1.39	1.54
Auto/Emp	1.56	1.51	1.28	1.50	1.36	1.45	1.26
Enroll/Cap	.20	.18	.19	.17	.20	.18	.11
Emp/Cap	.48	.40	.42	.45	.48	.38	.47

Sources of Information for comparisons:

Population: 1990 Census for all cities, although the population for Enid includes transportation zones that are outside of the Enid corporate limits. This data was obtained from the 1990 TIGER/Line Files.

Occupied Dwelling Units: 1990 Census.

Total Dwelling Units: 1990 Census for all cities with adjustments made for Enid for building and demolitions of dwelling units since the 1990 Census.

Automobiles: 1990 Census information, weighted for the indicated number of automobiles. For the category of two or more automobiles per dwelling units, an arbitrary weight of 2.2 was chosen.

School Enrollment: 1990 Census for grades 1 through 12. The information for Enid was obtained from the Enid Board of Education.

Employment: 1990 Census labor force information. For the Enid MSA, the data was obtained from the Oklahoma Employment Security Commission.

Retail: Extrapolated county business pattern information at the county level and applied it to each respective city. Enid retail data was obtained from the OESC.

Land Use Map

The existing land use map provided the basis for forecasting subsequent future land use and the socioeconomic variables for the target year. The City's land use map was updated to account for additional land development and other recent changes in land use since 1980. The current land use map is shown in Figure II-1.

The fundamental difference between previous land use projections and forecast and the existing 1994 land use map is that growth did not occur equally in all four quadrants of the City. Based upon the current inventory, residential, commercial, and public development declined in all quadrants except the northwest quadrant.

Residential. The amount of current residential development is more extensive, especially in the northwest quadrant of the Enid area than what was anticipated in 1980. The 1980 Plan projected more residential development east of 30th Street and the Phillips' University area, as well as extensive development north of the Purdue and Van Buren Street intersection.

Since 1980, residential growth has primarily occurred in the western half of the City, predominantly in the areas west of Cleveland Street, extending to the western boundary of the transportation study area, in addition to numerous areas of distinct growth near Oakwood Mall, north of Rupe Avenue. Willow Avenue, Oakwood Road, and Cleveland Street have seen expanded commercial development, as has south Van Buren Street. The Oakwood Mall and adjacent areas on west Owen K. Garriott Road is the major retail location in the study area.

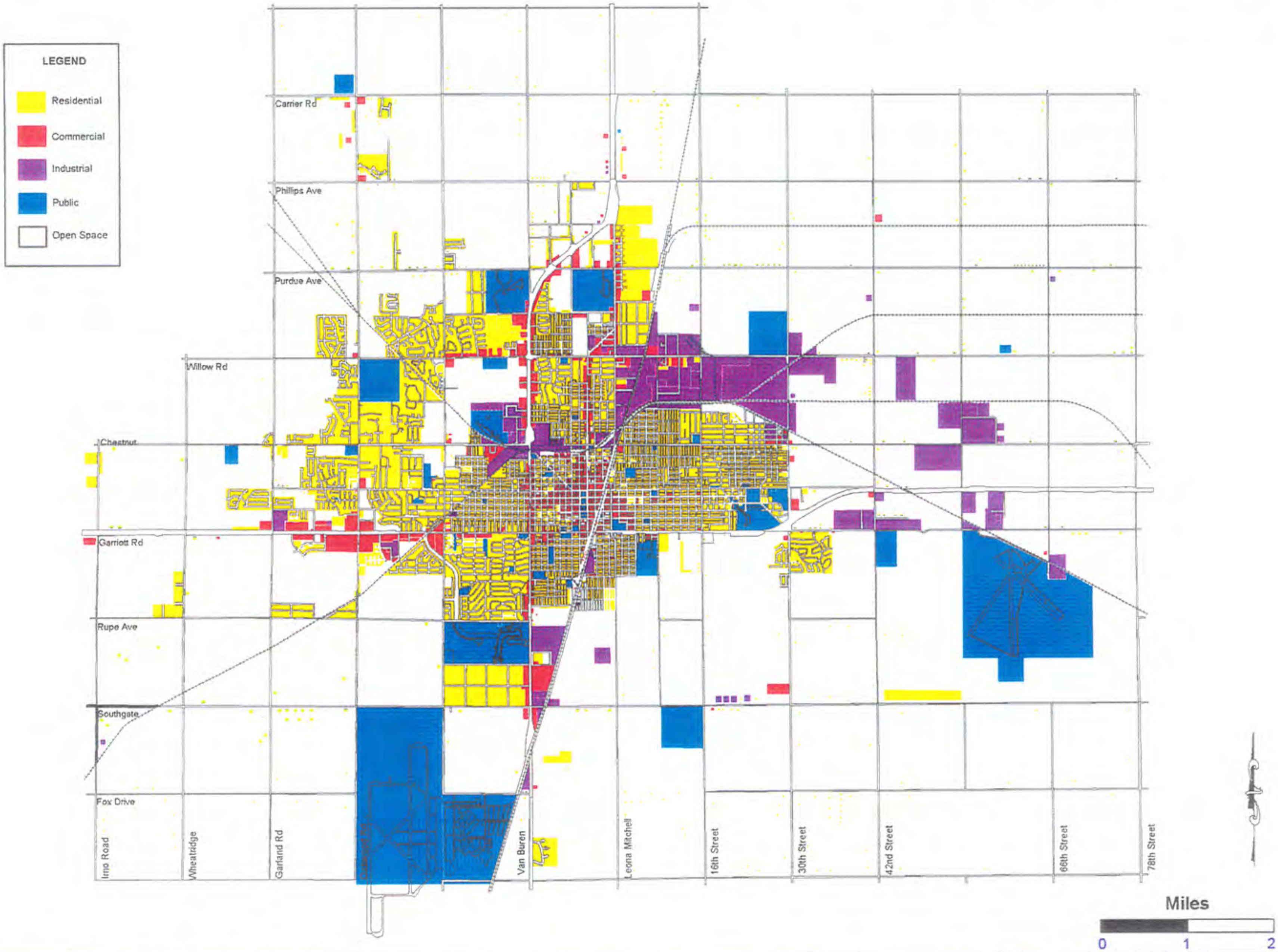

Figure II - 1 Existing Land Use

Present industrial development had taken place in the eastern portion of the transportation study area, with large pockets of industrial development located east of 4th Street and north of Cherry Street, predominantly in the areas adjacent to the railroad tracks. Similar pockets of industrial development also occurred along Market Street and directly surrounding Sooner Trend Road, and along Chestnut Road, immediately east of the City. Limited industrial sector growth has transpired in specific areas of the City, primarily on South Van Buren

Public land use can be classified as any institution that is generally open to the public, such as churches, schools, parks, and government lands or buildings. The major public land uses include Vance Air Force Base, Woodering Airport, the Northern Oklahoma Resource Center (formerly the Enid State School), Meadowlake Golf Course and park, education facilities, Garfield County Fairgrounds, and local, county, and federal buildings. In addition, the area west of Van Buren and immediately south of Purdue is now a significant regional park.

Future Year Land Use Forecasts

A future year land use maps was prepared by the City of Enid and the Northern Oklahoma Development Authority. This information was used to prepare future socioeconomic projections which are required to generate expected future year travel patterns. The future land use map is shown in Figure II-2. The process used to prepare the socioeconomic projections are described in the following sections.

Population projections for the Enid area were prepared utilizing a cohort component projection methodology defined by the Oklahoma State Department of Commerce (ODOC). Using this method, each component of population change, birth, deaths, and migration were independently projected in five year cohorts through the year 2020.

The City of Enid modified the population projection techniques by using a 1995 population estimate as its base year, rather than the 1990 population estimate which reflects a lower population. The revised population projections are based on the following assumptions:

- Enid has experienced an improved economy since 1991;
- ODOC's base year, 1990, was the beginning of economic recovery for Enid and Garfield County. The revised projections, based on the population for the year 1995, consider trends from 1990 to 1995, when the population grew considerably.

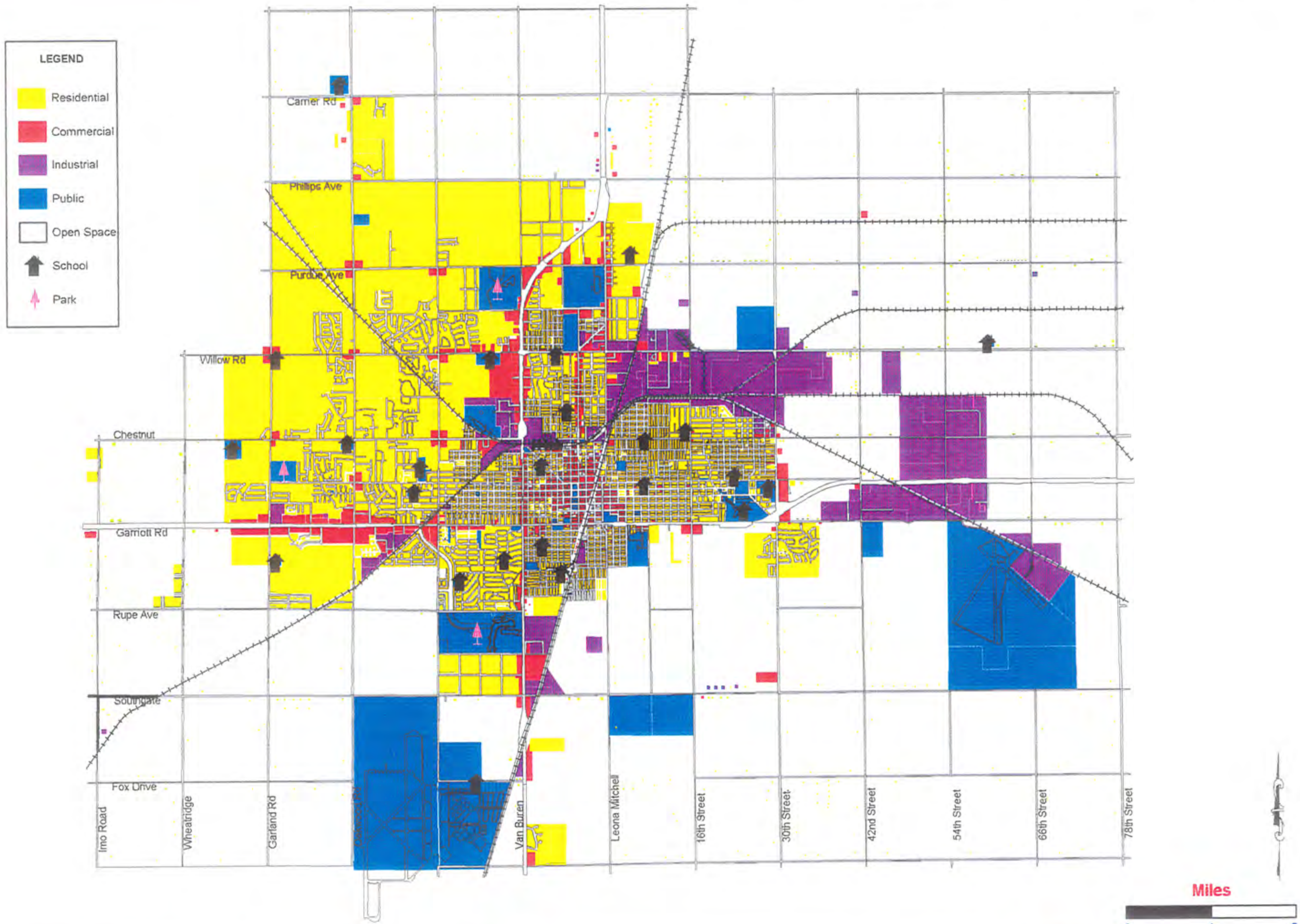

Figure II - 2 Future Year 2020 Land Use

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The population projections for the study area from the two methods are shown in Table II-2. The population for the urbanized area is expected to increase by the year 2020 to nearly 52,000 using the ODOC projection techniques and to over 54,500 using the modified City of Enid technique.

TABLE II-2
Population Projections
Enid Study Area

	ODC Projection			Enid Projection		
Year	**Population**	**Growth Rate**	**Change**	**Population**	**Growth Rate**	**Change**
1995	47,191	-	-	47,151	-	-
2000	48,566	3%	1,415	49,037	4%	1,886
2005	50,023	3%	1,457	50,998	4%	1,961
2010	51,023	2%	1,000	52,527	3%	1,529
2015	51,737	1.4%	714	53,787	2.4%	1,260
2020	51,996	0.5%	259	54,593	1.5%	806

Socioeconomic inputs to the transportation model were prepared for the plan horizon year of 2020. The projections are a function of the population projections and are based upon the following assumptions:

- Vance Air Force Base will remain open, or will remain economically viable;
- No additional wastewater plant will be built outside of the present watershed;
- The economy will remain steady with agriculture, and oil and gas as its primarily economic sectors; and
- The economy will continue to diversify.

The year 2020 socioeconomic projections are listed in Table II-3.

TABLE II-3
Socioeconomic Data Summary
Enid Study Area

	1994	2020
Population	47,151	54,593
Dwelling Units	22,093	25,531
Autos	35,374	40,731
School Enrollment	11,110	15,280
Retail Employment	5,125	8,462
Other Employment	13,727	14,478

CHAPTER III
TRAVEL DEMAND MODEL DEVELOPMENT

Introduction

The purpose of this chapter is to describe the process taken to prepare the Enid, Oklahoma metropolitan area travel demand forecasting model. The purpose of developing such a model is to set up a computerized mathematical process in which to estimate travel movements within the metropolitan area. The first step in developing a travel model is to build and refine the model until it accurately reflects current transportation conditions. This process is called network development and calibration. After this is done, the model can be used to predict future year traffic flows based upon anticipated changes in land use and development.

The model development process involves the following steps:

- Updating socio-economic data;
- Creating a computerized street network;
- Developing trip generation equations and estimating the number of trips generated;
- Distributing the trips between transportation analysis zones (TAZs); and
- Assigning the trips to the transportation network.

The process used to update socioeconomic data was described in Chapter II. The process used to complete the other steps listed above are described in the following sections.

Street Network Development

At its simplest level, a network is a computerized representation of the street system. As such, it can be analyzed by the computer in order to study the effects of certain variables, to plan changes in the existing street system, or to forecast new patterns if the system is upgraded or modified.

The street network is comprised of intersections which are represented in the computer model as nodes, and street segments which are represented in the computer model as links. The information required for each link includes:

- Distance;
- Speed;
- Functional classification;
- Area type;

- Number of lanes; and
- Capacity

A transportation network is used to compute travel time and distances which in part determines the amount of travel on a particular route. Input to the travel model, as developed from networks, is represented in terms of travel impedances between zones. The impedances are then used in trip assignment process in which trips from each zone are assigned to the street network. The assignment is based on three factors, the logical shortest paths between origin and destination, the accumulation of vehicle trips on each link, and the computation of congestion reflected in vehicle speed. A computerized network of the existing street system in the Enid area was built using TRANPLAN software. The network includes most routes within the study area classified as collector or higher by the federal functional classification system. Other roads were added to represent local streets and to provide for additional connections between these facilities. There are a total of 730 lane miles of roadway on the network, which include 432 lane miles of major and minor arterials, 127 lane miles of collector or secondary routes, and 171 of connector routes which represent local streets.

The Consultant developed the Enid metropolitan area transportation network based upon the digitized base map and functional classification map prepared by the City of Enid. In addition, the City provided information on the number of lanes and posted speed limits for the major streets in the study area. This information was coded into the transportation model. Using the posted speeds, a base or speed and capacity table was developed to code into TRANPLAN. In some cases, the speed-capacity table was modified to reflect specific or unique speed locations. The base link speed and capacity table is listed in Table III-1. The transportation network is shown in Figure III-1.

Trip Generation

Trip generation determines how many trips are produced in, or attracted to, each transportation analysis zone. These productions and attractions are calculated by multiplying applicable socio-economic data by trip generation equations. A major task in the trip generation modeling phase is determining and estimating appropriate trip generation equations.

The first step was to review the previous trip generation equations developed in 1974 for the Enid metropolitan area. Following review, the Consultant, ODOT, and the City of Enid agreed that significant changes had been made over the last 20 years in the area of trip generation study and that additional research should be conducted to update the trip generation equations. ODOT provided trip generation equations being used by the Tulsa area and by the Oklahoma City area. The consultant reviewed recent federal studies and specific reports conducted for the Michigan DOT and the Illinois DOT for small or medium sized metropolitan areas.

TABLE III-1
Speed-Capacity Table

	Facility Type				
Area Type	**State Highway (w/turn bays) 1**	**Major Arterial 2**	**Minor Arterial 3**	**Collector 4**	**Centroid Connector 5**
C.B.D. (1)	700	600	500	450	10000
	35 (mph)	30	30	25	10
City (2)	800	800	550	450	10000
	35	35	30	30	15
Suburb (3)	900	800	600	500	10000
	45	40	35	30	15
Rural (4)	900	800	600	500	10000
	55	45	45	45	15

The review indicated that many of the smaller and medium sized metropolitan areas directly use or have modified the trip generation equations listed in the NCHRP Report 187 Quick-Response Urban Travel Estimation Techniques. This is particularly true for the trip attraction equations. Trip productions are primarily estimated at the household and are often cross classified by persons per household and by either the number of automobiles owned or household income. Tulsa follows this process of using the NCHRP Report 187 methods for estimating trip attractions and using local information to obtain trip production estimates. Based upon the review, it was determined that the Enid trip generation equations would follow the approach used by Tulsa. The trip productions were then modified based upon comparisons with the 1974 data and with other communities.

The form of the socio economic data provided in Enid required modification of the Tulsa cross classification rates. A regression equation was fitted to the Tulsa rates in order to apply a standard parameter to the average number of persons and vehicles per zone as provided in the Enid socio economic database. The regression parameters were adjusted upward to reflect the slightly higher trip rates historically found in Enid and to conform with recent experience of trips

Figure III - 1 Base Transportation Network per household and trips per person. Truck trip estimates were updated based upon the US DOT Characteristics of Urban Travel Demand (1982). The Enid trip generation equation formulas are listed in Table III-2.

TABLE III-2
Equations for Trip Productions and Attractions

Productions
HBW = 0.4360 (Auto/DU) + 0.2860 (Person/DU) HBO = 1.3101 (Auto/DU) + 1.0504 (Person/DU) NHB = 0.7208 (Auto/DU) + 0.7497 (Person/DU) Truck = Truck Attractions IE = Developed from Cordon Counts
Attractions
HBW = 1.53 (TotEmp) HBO = 11.7 (RetEmp) + 1.0 (Non RetEmp) + 1.0 (DU) + 0.2 (ScEn) NHB = 2.0 (RetEmp) + 2.0 (Non RetEmp) + 1.0 (DU) + 0.1 (ScEn) Truck = 1.58 (RetEmp) + 0.26 (Non RetEmp) + 0.5 (DU) IE = 2.01 (DU) + 2.3 (RetEmp) + 0.4 (Other Emp)
Where:
HBW = Home Based Work HBO = Home Base Other NHB = Non-Home Based Truck - Truck Trips IE = Internal-External DU = Dwelling Units TotEmp = Total Employment Non RetEmp = Non Retail Employment

TABLE III-3
Special Generators
Trip Attraction Rates

High School	College/University	Regional Mall/ Community Shopping Center	Where:
HBW = 1.53 (TotEmp) HBO = 0.966 (ScEn) NHB = 0.414 (ScEn)	HBW = 1.3 (TotEmp) HBO = 1.659 (ScEn) NHB = 0.711 (ScEn)	HBW = 1.6 (Ret Emp)	HBW = Home Based Work HBO = Home Based Other NHB = Non-Home Based TotEmp = Total Employment ScEn = School Enrollment RetEmp = Retail Employment

TABLE III-4
Special Generator Zones

Name	Address	TAZ
Enid High School	611 W. Wabash	63
Phillips University	100 S. University Ave.	97
Oakwood Mall	4125 W. Owen Garriott	162
K-Mart	4010 W. Owen Garriott	167
WALMART	4406 W. Owen Garriott	167
Chisholm High School	4018 W. Carrier Road	175
Autry Technical	1201 W. Willow	2
Enid Higher Ed. Program	2929 East Randolph	97
Vance Air Force Base	1300-2300 West Fox	155

The trip generation equations were then applied to the land use inventory prepared for each TAZ to compute productions and attractions for each zone. The productions and attractions were then compared to rates developed in past studies and with other Oklahoma studies. The results indicate an increase in the number of person trips per dwelling unit and per person between 1994 and the previous study results calculated for 1974. The trip rate comparison is listed in Table III-5.

TABLE III-5
Trip Comparisons

Internal Vehicle Trips per Dwelling Unit

Trip Purpose	1994	1974
Home based Work	1.32	1.00
Home based Other	3.64	4.91
NonHome Based and Truck	3.34	3.79
Total	8.30	9.70

Internal Trips Per Capita

Trip Purpose	1994	1974
Home Based Work	.62	.37
Home Based Other	1.70	1.82
NonHome Based and Truck	1.56	1.41
Total	3.88	3.60

Internal Vehicle Trips - Percent by Purpose

Trip Purpose	1994	1974	National Average*
Home Based Work	16.00	10.30	16
Home Based Other	52.00	50.60	61
NonHome Based	32.00	39.10	23
Total	100.00	100.00	

* NCHRP Report 187

Traffic Distribution Procedures

A base year trip table was built using the gravity model formulation provided in TRANPLAN. A trip table is the compilation of trips from each zone to each other zone. The gravity model is based on the premise that trips produced in any given area will distribute themselves in accordance with the accessibility of other areas and the level of activity they offer. In general terms, trips between zones are affected by distance and cost and by the size or attractiveness of the destination.

The gravity model is adjusted to each urban area by specifying travel time factors. These factors represent the attractiveness of a trip length in one minute increments.

The travel impedance or cost is comprised of distinct elements. One is terminal time. Terminal time is the time in minutes required to park and/or walk to complete a trip. Terminal times for each zone in the study area were estimated based upon land use type and density. Travel impedance also includes the time it takes to travel on the street network itself to reach a destination. Other impedance factors can include road tolls or even parking costs.

External Trips

There are three types of external trips. Internal-external (I-X) trips begin in and end outside the Enid area. The opposite is true for (X-I) trips. External to external trips (X-X) are through trips which pass through the Enid area without stopping.

I-X and X-I trips were estimated based upon equations from other small metropolitan areas. The equations were adjusted based upon comparisons with current Enid traffic counts. X-X trips are based upon the 1972 external origin destination study completed for Enid. These values were updated based upon current traffic count data. The zone to zone interchanges are shown in Table III-6.

TABLE III-6
External Trip Table

Zone	192	193	194	195	196	197	198	199	200	Total
192	0	19	35	47	6	4	14	5	20	150
193	18	0	162	252	39	11	98	0	25	605
194	36	160	0	375	53	18	144	2	36	824
195	49	253	372	0	88	27	225	3	57	1074
196	6	38	54	87	0	3	35	0	8	231
197	5	12	16	29	3	0	9	0	3	77
198	12	98	146	226	34	10	0	1	11	538
199	3	2	2	2	0	0	2	0	0	11
200	20	24	36	56	9	3	12	0	0	160
Total	149	606	823	1074	232	76	539	11	160	3670

Travel Modes

The primary mode of travel in Enid is the private automobile. A small level of public transportation is provided by a paratransit system. This system provides curb-to-curb transportation to eligible persons who reserve rides in advance.

The primary modal impact on transportation forecasting is carpooling or sharing rides. This involves estimating vehicle occupancy rates for each trip type. The USDOT publication Characteristics of Urban Transportation Demand, An Update (1988) was used to compare values with those provided as defaults in TRANPLAN. More recent surveys tend to indicate lower vehicle occupancy rates than for studies conducted in the 1970s or early 1980s. The following vehicle occupancy factors were used in the Enid model:

Home Based Work	1.11
Home Based Other	1.40
NonHome Based	1.35

Traffic Assignment

The purpose of completing the numerous steps previously described is to have a model which can accurately produce traffic volume estimates. A traffic assignment is completed by connecting the trip table with the transportation network. The assigned traffic flows on the links is the result of traffic assignment. The traffic assignment was completed using the TRANPLAN equilibrium assignment module EQUILB.

Analysis of the initial assignment revealed the need to review or "calibrate" the model inputs. Calibration is the procedure used to estimate the parameters of a model or to adjust a model to replicate actually measured conditions. The inputs reviewed included trip generation, travel time factors, vehicle occupancy factors, and network travel speeds. Specific speed adjustments were made in the Enid central business district (CBD) and in a few other locations. These modifications improved the calibration of the traffic model.

Vehicle Miles of Travel Check

Vehicle miles of travel (VMT) are calculated by multiplying the length of the street segment by the number of vehicles either counted or assigned to that segment. As calculated, the Enid model assignment resulted in a VMT of 7,588,000. This accounted for 100 percent of the VMT calculated using the ground traffic counts.

The next level of calibration occurred by analyzing the VMT of the assigned volumes versus ground counts for each street functional classification and area type. The area types represent district types of development in Enid including: 1) CBD: 2) city: 3) suburban and 4) rural.

Next, screenline volumes were compared. This study used the same screenlines as in the previous study. The Union and Pacific Railroad line bisects the metropolitan area and as such was used as the screenline for this study. Comparisons between the traffic counted and that estimated by the computer indicated that the computer simulation was within 14 percent of the recorded volumes.

Baseline Traffic Conditions

The calibrated traffic model provides a baseline from which to examine future traffic impacts. Current traffic congestions levels can be indicated on the base year model. The level of current congestion can be compared with future year forecasts to determine what congestion is a result of existing problems or by projected growth.

While there are precise measures of roadway volume-capacity relationships, determining when a roadway is considered congested can also involve subjective criteria.

Level-of-service standards relate to measuring the performance of the transportation system and establishing criteria which determines whether a particular element of the system is not functioning within acceptable parameters. Determining what is acceptable is typically based upon local or state policies.

The 1985 Highway Capacity Manual (HCM) is the source that most transportation professionals recognize as providing the techniques to measure transportation facility performance. The level of detail provided by these techniques exceeds the scope of this document; however, the general methodology can be used. Using the HCM procedure, the quality of traffic operation can be graded into one of six levels: A, B, C, D, E, or F. Levels-of-Service (LOS) A and B represent the best traffic operation. Levels C and D represent intermediate operation and Levels E and F represent higher levels of congestion. The Enid Area MPO will evaluate and define a regionally acceptable level of service standard for intersections and street segments. For the purpose of this study, the standard will be LOS C, except in specific cases where the cost of improvement may exceed benefits. The transportation model produces volumes on each link or street segment. For the purposes of system planning, link volume to capacity ratios of 0.80 or lower are considered acceptable. Problem areas will be considered to occur where volume-capacity exceeds 0.80 on a link.

Locations where base year model volumes exceed 80 percent of link capacity are indicated in Figure III-2. These locations include:

- Garriott Road, from 5th Street to west of Oakwood;
- Willow, from Van Buren to Cleveland;
- Cleveland at Garriott Road; and
- Major intersections on Van Buren Road between Chestnut and Garriott Road.

Solutions for the traffic capacity deficiencies identified in the base year analysis will be addressed in the next section of this report.

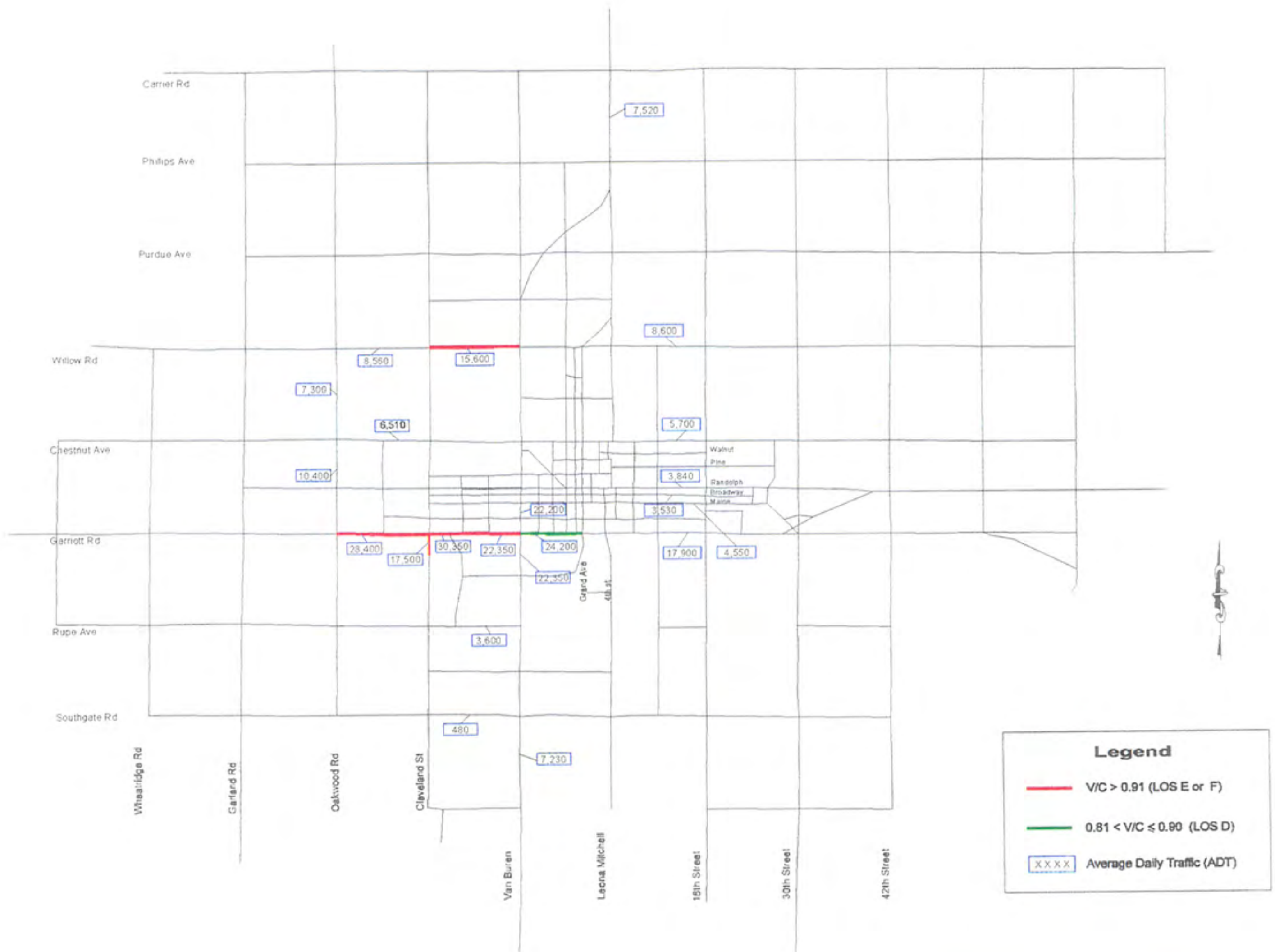

Figure III - 2 Existing Network - Congested Locations

CHAPTER IV
FUTURE TRANSPORTATION IMPACTS

Introduction

The long-range transportation plan (LRP) addresses a comprehensive list of factors considered in identifying transportation solutions to predicted travel constraints. The transportation plan has been expanded from previous efforts to include greater coordination between street and highway improvements, bicycle and pedestrian planning, transit alternatives, transportation demand management. The LRP includes a stronger multimodal emphasis, recognizes the need to conform with congestion management guidelines, and clean air standards. The LRP has also been prepared with a recognition of the need for the efficient movement of freight.

The LRP includes consideration of 15 interrelated factors as stated in ISTEA. These factors are listed in Table IV-1. The LRP has been prepared to be consistent with the Enid area land use plan and includes study of intermodal connectivity . The LRP also emphasizes the importance of preserving existing transportation facilities and increasing the current systems's efficiency by managing travel demand during peak time or at congested locations. Also included in the plan is a financial evaluation of proposed projects. The recommended plan reflects the financial constraints that the projects included in the LRP have an adequate financial commitment.

ISTEA requires that adequate technical methods and procedures be developed to carry out the new requirements for developing the LRP. The long-range nature of the plan requires that a methodology be developed and used to predict transportation conditions in the future. The transportation model developed and described in Chapter II was used to predict expected travel flows for the year 2020.

Existing Plus Committed Network

The existing or base year street network was updated to include new or planned street improvement projects. The projects which impact travel flows the most are new street projects or street widening projects. The two projects in which funding or planning is currently committed are:

- Owen Garriott Road, widen from four to five lanes from Hoover to Jefferson.
- Willow Road, widen from two to five lanes from Van Buren to Cleveland.

TABLE IV-1
Factors to be Considered in Metropolitan Plans

(1)	Preservation of existing transportation facilities and, where practical, ways to meet transportation needs by using existing transportation facilities more efficiently.	(9)	The transportation needs identified through use of the management systems required by Section 303 of this title.
(2)	The consistency of transportation planning with applicable federal, state, and local energy conservation programs, goals, and objectives.	(10)	Preservation of rights-of-way for construction of future transportation projects, including identification of unused rights-of-way which may be needed for future transportation corridors and identification of those corridors for which action is most needed to prevent destruction or loss.
(3)	The need to relieve congestion and prevent congestion from occurring where it does not yet occur.	(11)	Methods to enhance the efficient movement of freight.
(4)	The likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with provisions of all applicable short- and long-term land use and development plans.	(12)	The use of life-cycle costs in the design and engineering of bridges, tunnels, or pavement.
(5)	The programming of expenditures on transportation enhancement activities, which is required in Section 133.	(13)	The overall social, economic, energy, and environmental effects of transportation decisions.
(6)	The effects of all transportation projects to be undertaken in the metropolitan area, without regard to whether such projects are publicly funded.	(14)	Methods to expand and enhance transit services and to increase the use of such services.
(7)	International border crossings and access to ports, airports, intermodal transportation facilities, major freight distribution routes, national parks, recreation areas, monuments and historic sites, and military installations.	(15)	Capital investments that would result in increased security in transit systems.
(8)	The need for connectivity of roads within the metropolitan area with roads outside the metropolitan area.		

Source: Intermodal Surface Transportation Efficiency Act Section 134(f).

Future year transportation impacts were simulated by imputing the project future year land use growth forecasts into the transportation model and assigning the resulting vehicle traffic to the existing plus committed street system. The results of the future year traffic assignment are shown in Figure IV-1. The congested routes identified in the figure are those where projected traffic volumes are over 80 percent of the roadways theoretical capacity.

The results of the traffic analysis indicates that anticipated future growth will impact the existing plus committed street system as follows:

- Despite improving Garriott Road to a minimum five lane cross section, the section between 4th Street and Oakwood Road will remain congested;

- Widening Willow from two to five lanes between Van Buren and Cleveland will improve that one mile section of roadway. Traffic volumes will also be nearing capacity between Cleveland and Oakwood;

- Projected traffic growth indicates that traffic congestion is anticipated on Oakwood Road between Willow and Chestnut; and

- The intersections of Van Buren at Garriott and of Cleveland at Garriott are already congested.

The results of the future year analysis show that future growth will add traffic to specific segments of the street system. It also indicates that additional improvements or strategies will be needed to have a transportation network which conforms to the service standard of achieving a minimum level-of-service D. The potential strategies to address these transportation problem areas are described in the following section.

Transportation Alternatives

The results of the future year traffic assignment described in Chapter Four indicate that construction of the committed transportation improvement projects will have a positive impact on reducing anticipated traffic congestion. However, the committed improvements are not sufficient to eliminate projected traffic congestion in three major corridors. These corridors are:

- Garriott Road;
- Oakwood/Cleveland; and
- A section of Willow Road.

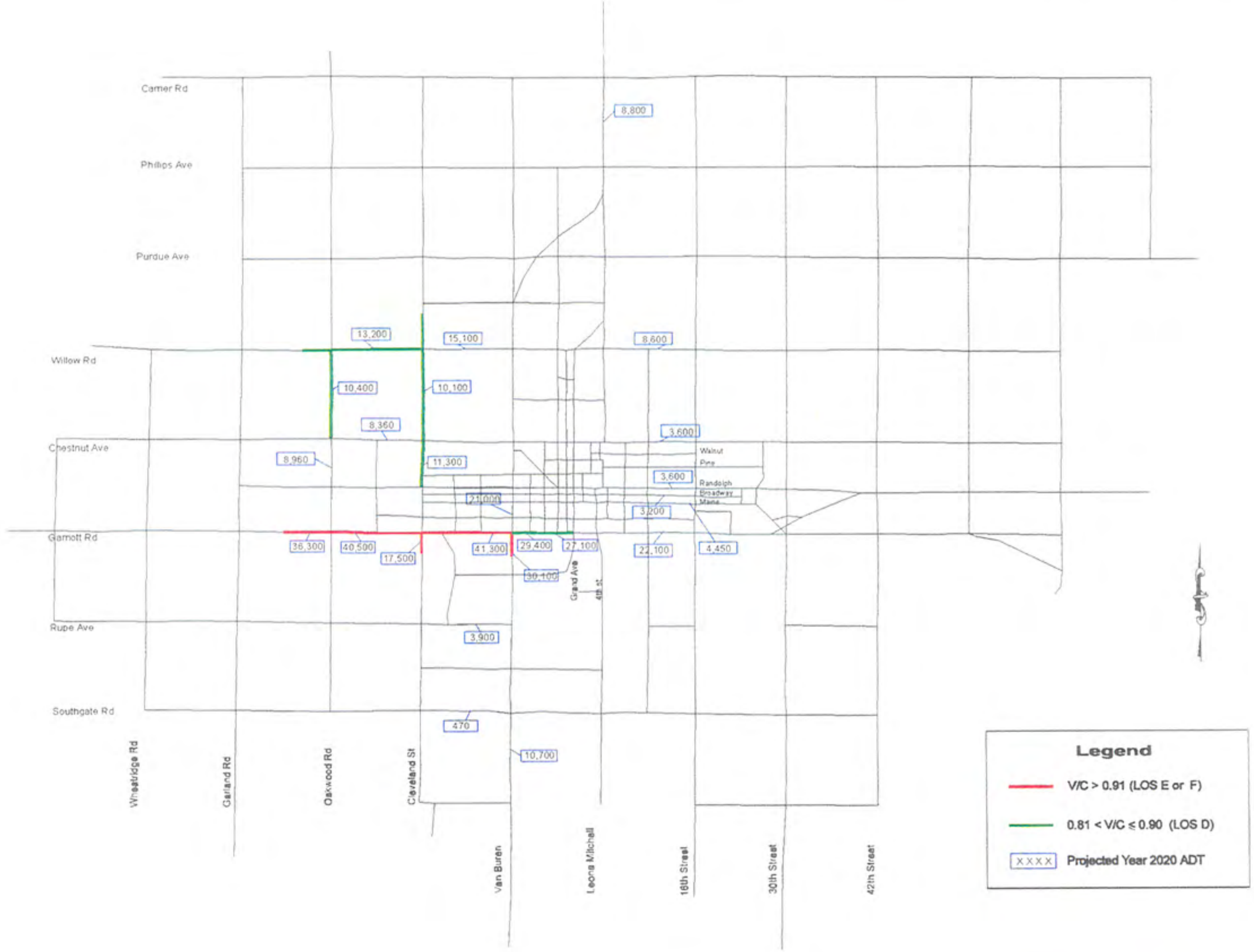

Figure IV - 1 Future Growth Plus Committed Network - Congested Locations

This plan presents a comprehensive and coordinated approach to addressing transportation issues. The LRP addresses both new capacity and noncapacity improvements as the primary solutions to traffic congestion. The following strategies are described in the subsequent sections:

- Public transportation:
- Transportation demand management:
- Pedestrian and bicycle options:
- Transportation systems management:
- Land use alternatives: and
- New road construction and widening.

Public Transportation

Shifting travel from single occupant vehicles to public transportation is one method to improving transportation conditions. Public transportation can also fulfill important social and economic goals. Public transportation serves individuals collectively described as the transportation disadvantaged. This term described those individuals without access to or who are unable to utilize privately owned vehicles.

Public transportation is currently provided in Enid and North Enid by a 10 vehicle demand-response transit system. The system is open to the public. There are two types of reservation services provided. One is a prereserved trip 1 day prior to the trip in which a pickup is made within a 30 minute time period. The second is a call received the day of the trip where service is provided within 45 minutes. Service is provided between 6:00 a.m. and 12:00 midnight.

The Enid Public Transit Authority provides the transit service. The authority operates over 300,000 miles of service and provides between 85,000 to 90,000 passenger trips annually. Nearly 75 percent of the system's users are elderly or disabled. The cost per trip for persons age 6 to 59 is $2.50. Half price fares are provided to elderly or disabled patrons.

Annual operating costs are currently approximately $600,000. The system has a fairbox recovery ratio of 27 percent which is higher than many other transit systems. Federal operating assistance provides half of the funding for the system. The remainder of the funding for the transit system is provided from the City of Enid's general fund.

Transportation Demand Management

Throughout the country, communities face steadily increasing traffic congestion and deteriorating air quality usually as a result of growth and greater use of the automobile. Where as building new roads is a solution to congestion problems, capital improvement funds must now compete with other demands. Increasing environmental concerns and economic policy issues complicate the problem. However, congestion and air quality problems are not necessarily the inevitable outcome of economic growth.

A major cause of morning and evening peak period congestion is the daily commute to and from work. Typically, up to 90 percent of the vehicles during the peak hours are single occupant vehicles. Shopping, school, or vacation related trips usually involve multioccupancy vehicles but occur during the nonpeak periods. Since commute trips are a major source of the congestion deterioration problem, a reduction in the number of these trips is one solution to improving traffic conditions.

Transportation demand management (TDM) is an alternative that places the emphasis on reducing the travel demand rather than constructing new facilities to increase the available roadway supply. TDM typically includes the following:

- Carpooling/Ridesharing;
- Alternative work hours; and
- Parking pricing.

Carpooling/Ridesharing. One of the most effective means of reducing peak hour congestion would be to persuade single occupant drivers to share rides. For every ten percent of lone drivers, shifting to a two-person carpool would result in a 3.4 percent reduction in peak hour trips.

The difficulty is in convincing persons to share rides. A voluntary approach can provide another travel option to individuals, but a large shift in ridesharing typically needs to be tied to local government policies. These policies are often tied to awarding a building permit or through a city or state wide trip reduction ordinance.

Ridesharing is typically most effective for longer commutes. Given the size of the Enid metropolitan area, it is unlikely that 10 percent of commuters would shift to ridesharing unless as a result of factors other than traffic congestion.

Parking Pricing. Many people drive their own vehicles because parking is free. The amount saved from free parking outweighs the costs of gasoline and vehicle depreciation. Parking costs are often the key determinate of transit ridership. The highest transit ridership occurs in the areas where parking costs are greatest.

Parking pricing typically occurs in downtown areas only. This often provides no incentive for downtown development and tends to lead to more development in the automobile dominated suburban areas with private parking lots. Parking pricing policies would be controversial in the Enid area and may be difficult to implement metropolitan wide.

Alternate Work Hours. Many peak hour trips could be shifted to other times of the day by staggering work hours among different companies, adopting flextime policies, or through a four day work week. This strategy would be encouraged, but is typically voluntary.

A similar strategy is telecommuting. Some employees who used to spend each weekday in the office are now working at home part of the time. Computers and electronic communications have made working at home more feasible than ever before. Employees can communicate work and messages using telephone lines, modems, and fax machines.

Despite these advantages, few people can work at home all the time. The need for face-to-face contact often limits the effectiveness of this alternative. This options is primarily limited to the office industry and would be less effective on a manufacturing and service-based economy such as in the Enid areas.

Pedestrian and Bicycle Use

Bicycling and walking attract a relatively small but dedicated group of commuters. There is evidence that this group is growing and that these modes are becoming a legitimate commuting alternative. According to the World Watch Institute, the production of bicycles has quadrupled since 1969 while automobile production has shown only modest increases.

There are a number of barriers which limit bicycle and pedestrian commuting and travel growth. A survey performed by Bicycling Magazine in 1991 indicated:

- If there were safer lanes on roads and highways, 20 percent of American adults would sometimes commute to work by bicycle;
- If their employers offered a financial incentive for bicycle commuting, 18 percent of American adults would occasionally commute to work by bicycle;
- If secure storage and showers were made available, 17 percent of American adults would sometimes commute to work by bicycle; and
- If fuel prices reached $2.00 a gallon, one in four Americans would use their bicycles for some trips they make by car.

IVHS offers the technology to provide better information about traffic conditions, allowing drivers to make better decisions, thereby potentially reducing traffic congestion. This approach is limited by motorists which already have the information that a route is congested, but make the trip anyway. Advances in traffic signal technology and in vehicle guidance will likely increase road capacity.

IVHS applications are being studied in many metropolitan areas. A likely first application of IVHS in the Enid area would be in the area of traffic signal coordination and monitoring. Other applications are possible within the 25 year planning period.

Land Use Alternatives

A fundamental relationship defining how a transportation system operates is the linkage between land use and transportation. Trip making patterns and traffic volumes are largely a function of the spatial distribution of land.

Land use can be used to improve transportation system performance in two ways. Control over the trip generating characteristics of land use at an individual site can be used to ensure that traffic demand does not overburden the existing street capacity. Secondly, over a period of years, the spatial distribution of land can impact travel patterns. The reverse can also be true where land use patterns are impacted by the level of accessibility provided by the street system. The predominate area of expected future development is in the northwest quadrant of Enid. Given this concentration of development, transportation improvements will be focused in this area. This is especially true for commercial development along West Garriott Road. A balance between the amount of commercial activity and the street system is needed to maintain both a viable commercial area and a well functioning street system.

New Road Construction

New road construction is traditionally the most utilized response to addressing projected long-term congestion. Building new roads often adds needed street capacity to accommodate current or projected travel flows.

Over time, building new roads or expanding existing ones may not necessarily reduce the level of traffic congestion on a particular route, especially in growing corridors such as West Garriott. This is true because motorists quickly shift their routes and timing of travel. The new capacity will also encourage new development which leads to additional traffic volumes. For example, the widening of Garriott to five lanes did not sufficiently resolve the expected traffic congestion in that corridor. However, the congestion would likely be worse without the street improvement.

Given the fundings from the traffic model, additional street capacity projects were identified by the Enid MPO. The improvements were then coded as future street network scenarios and tested in the model. The impacts of each of these scenarios is described in the following chapters.

CHAPTER V
FUTURE ALTERNATIVE TRANSPORTATION NETWORKS

Based on the review of the future year traffic assignment on the existing plus committed street network and the assessment of noncapacity improvements, the three additional alternative street networks were loaded with the projected year 2020 traffic for evaluation. Each of these three future street network alternatives will be evaluated and compared with financial resources and potential social, economic, and environmental concerns. Based on this evaluation, a multimodal future transportation plan will be recommended. A list of projects were identified from both review of transportation model results and from public input. The projects were grouped into three alternatives as indicated in Figure V-1. The alternatives are described in the following sections.

Future Alternative 1

- Widen Randolph to four or five lanes from 30th Street to Oakwood;
- Construct an overpass of railroad tracks on 16th Street;
- Pave currently unpaved section of roadway where projected traffic volumes exceed 500 average daily traffic; and
- Signalize Rupe and Van Buren intersection.

Analysis of the future traffic assignment on the existing plus committed network revealed that despite widening Garriott to five lanes, sections of that route would remain congested. This congestion is a result of two factors; 1) a lack of alternative east-west routes between Garriott and Willow, and 2) a high concentration of development within the Garriott corridor itself.

Alternative 1 was designed to address this first concern. The following changes were made to the existing plus committed network in the computer simulation.

<u>Randolph Widening</u>

Randolph was widened to four lanes with center turn lanes from Oakwood to Cleveland. The houses between Randolph and James would be acquired to enable this section to be developed as a single parkway. The intersection of Randolph and Van Buren would be redesigned. The four lanes of Randolph between Van Buren and Grand would not be changed. Randolph would

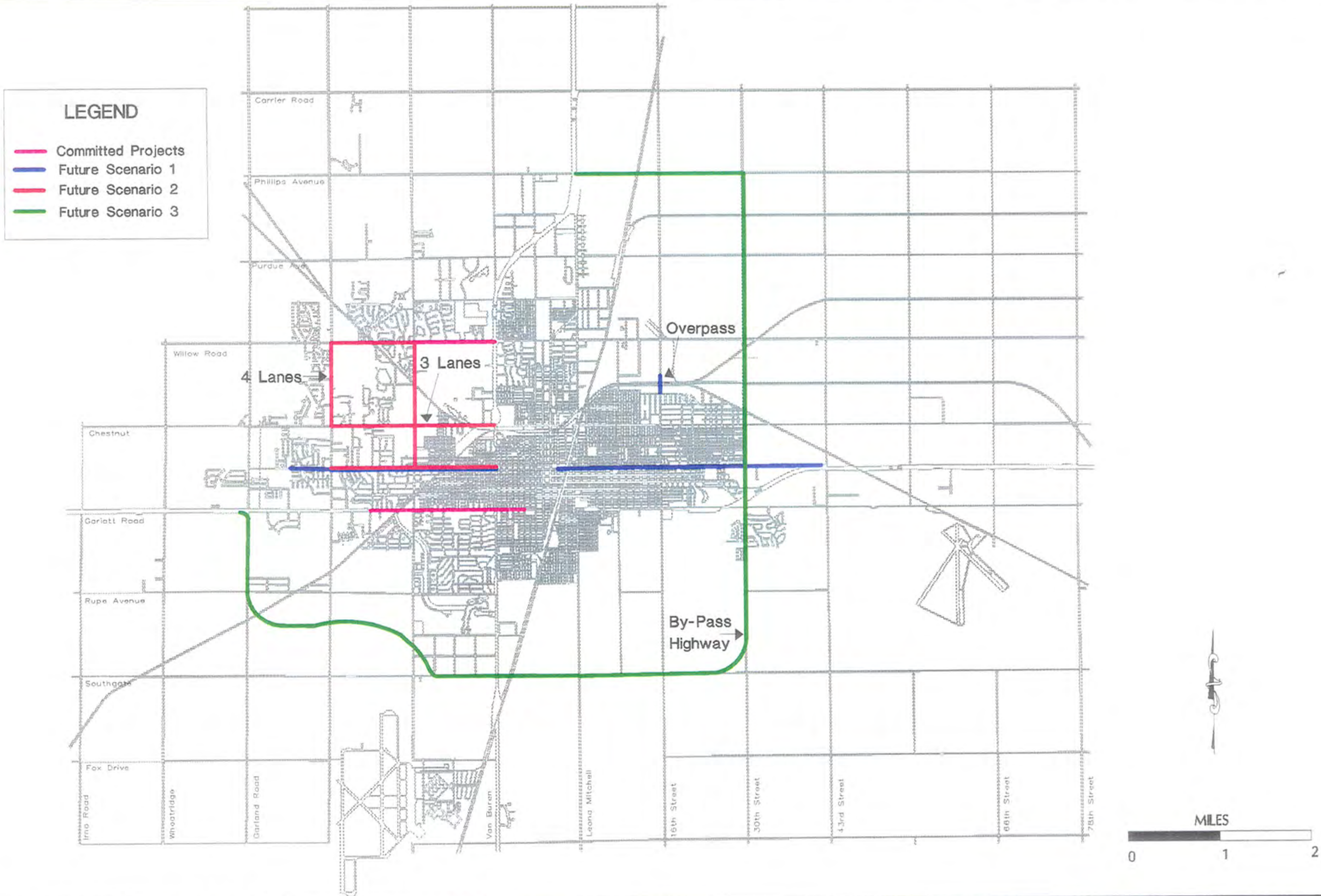

Figure V - 1 Future Year Project Scenarios be widened to four lanes with center left turn lane provided at major intersection from Grand to 30th Street. The results of this traffic assignment are shown in Figure V-2.

Evaluation. The improvement of Randolph created a second major east-west route through central Enid. The improvement resulted in an expected increase of traffic on Randolph and a decrease of traffic on Garriott Road relative to the previous future year scenario.

Given expected growth patterns, traffic increases are projected to be slight on Randolph, Broadway, and Main Streets east of the central business district (CBD). The traffic growth which is expected to occur east of CBD is on Garriott Road, where volumes would increase from an average 16,000 average daily traffic (ADT) currently to 22,000 ADT in 2020. Improving Randolph would result in attracting additional volumes from Broadway, Main, and Garriott to increase the projected ADT on Randolph to between 15,000 and 16,000. To the east of the CBD, this alternative would create a direct travel route through Enid into the CBD. Given the existing amount of street capacity in this part of the metropolitan area, widening Randolph would not result in any significant capacity improvement.

Widening Randolph has more impact on addressing projected congested areas west of Van Buren. Future year traffic projections on the existing plus committed network indicated daily volumes on Garriott west of Van Buren of between 35,000 and 41,000. By widening Randolph, traffic on Garriott would be expected to decline to between 30,000 and 35,000 ADT. The projected volume on Randolph west of Van Buren would range from 15,000 to 25,000 ADT.

16th Street Overpass over Railroad Tracks

16th Street crosses a series of railroad tracks and switching yard tracks. In total, their are 16 tracks which are crossed at grade. The capacity of this roadway is reduced due to extensive switching operations or train crossings. Alternative improvements include construction of an overpass over the tracks, closing the road, or relocating 16th Street to 22nd Street or 26th Street so not to interfere with switching operations. Moving the crossing to 22nd or 26th Street would reduce the number of tracks from 16 to only three.

Evaluation. The results of coding in a grade separation of the roadway indicate an increase in traffic volumes on 16th Street from the current 750 ADT to a projected 3,250 ADT.

Future Alternative 2

Analysis of the previous future year traffic assignment indicated improvements in the Garriott Corridor; however, the improvement of Randolph alone did not fully address transportation needs in the northwest quadrant of the metropolitan area. Additional street improvements were

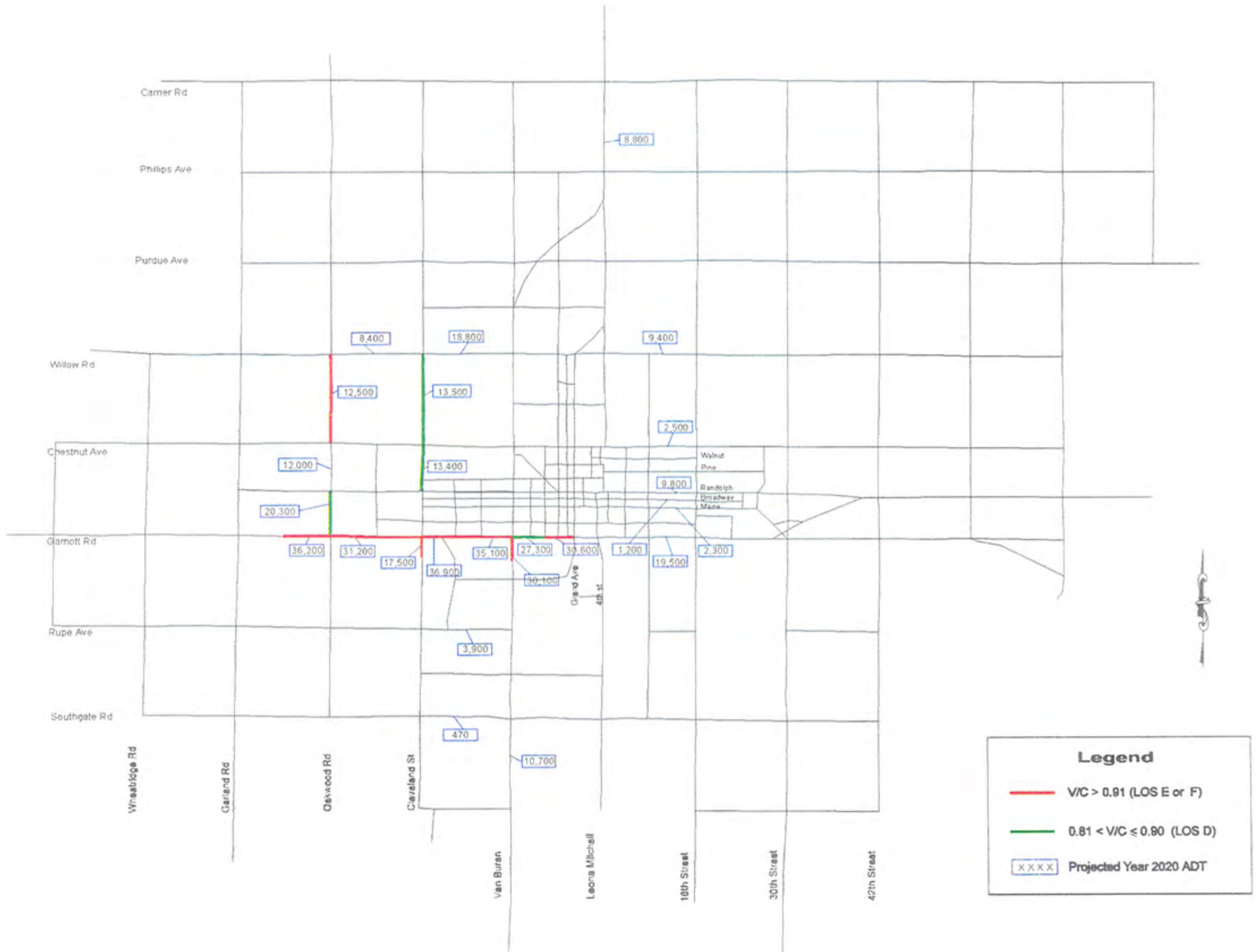

Figure V - 2 Future Alternative 1 - Congested Locations

identified as needed to support projected future growth in the area, as well as provide additional traffic alternatives to West Garriott Road. The following projects were tested in Future Alternative 2:

- Widen Willow from Oakwood to Cleveland to four lanes;
- Widen Oakwood from Chestnut to Willow to four lanes;
- Widen Cleveland from Randolph to Willow to four lanes;
- Widen Chestnut from Van Buren to Oakwood to three lanes; and
- Widen Randolph from Oakwood to Van Buren to four lanes.

The results of this future year traffic assignment are illustrated in Figure V-3.

Evaluation. This alternative addresses the anticipated congestion on Willow, Cleveland, and Oakwood. All of the improvements improve anticipated traffic conditions. In combination, the improvements mitigate traffic increases on Garriott Road. In this scenario, traffic volumes range from 26,000 ADT to 34,000 ADT between Oakwood and Van Buren. The timing of the projects should be based upon the timing of development and projected future traffic volumes.

Future Alternative 3

Bypass Route

The movement of freight and hazardous materials through the Enid metropolitan area is a concern of many of the individuals who participated in the plan development. In addition, projected congestion on Garriott Road will also impede through traffic movements on US-412. As such, a bypass alternative was studied.

The analysis through trip movements is based upon a through movement survey conducted as part of a previous model evaluation. Thus, through trip movements reflect older information which may not be as valid today. The through trip estimates were updated using current traffic volumes in order to provide the most accurate travel estimation possible.

A bypass alignment was not studied on the previous model evaluation, nor has a preliminary location study been performed. The initial route tested in the model diverged from US-412

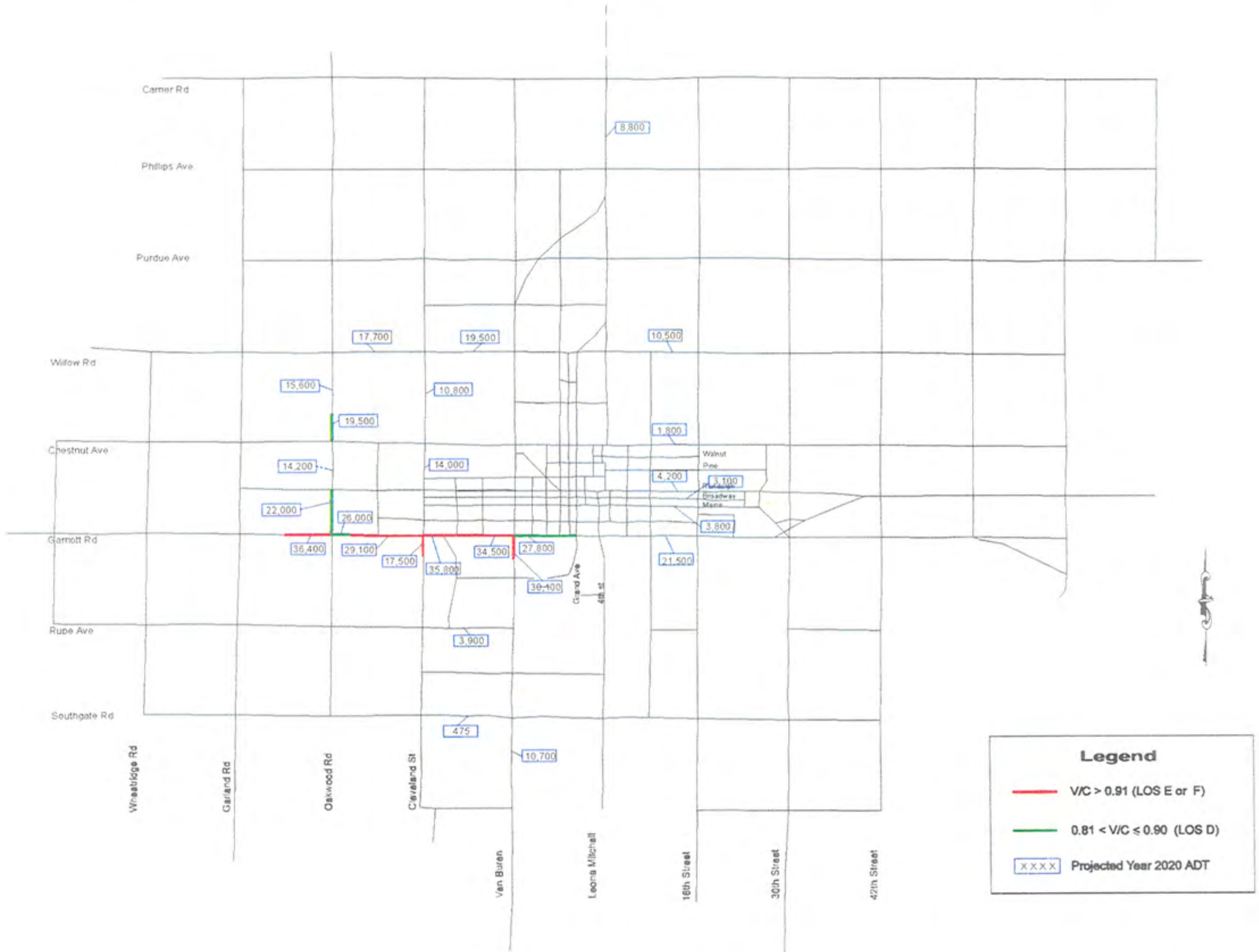

Figure V - 3 Future Alternative 2 - Congested Locations

east of the airport, continued southwest to the Southgate alignment and returned to US-412 at Garland. The northeast connector continued northwest bound at 72nd Street and connected with Carrier Road. A second closer-in alignment was tested which utilized 42nd Street, Southgate, Garland, and Carrier Road right-of-ways. Based upon discussion with the Technical Advisory Committee and the public, this location was moved further west from 42nd Street to 30th Street. The results of this traffic assignment are summarized in Figure V-4.

<u>Evaluation</u>. The bypass route as tested did not attract high volumes of traffic. Projected traffic volumes on the bypass ranged from 1,000 ADT to 7,800 ADT. The results indicate the route would need to be on the west side of the Woodring Airport in order to carry additional volumes. The route also does not provide sufficient travel time to induct bypass travel from US-81 to travel around Enid. The highest traffic use of the route was on the Southgate alignment. Ultimately, the lack of heavy through movement precludes the effectiveness of this alternative between US-412 and State Route 45.

Future Alternative 4

Based on the analysis of the first three alternatives, this alternative was developed in order to test a combination of projects which would provide a comprehensive traffic congestion mitigation strategy. The alternatives tested previously were shown to improve traffic conditions; however, the Garriott Corridor remained congested at certain segments. This scenario includes the following projects:

- Widen or improve Randolph from Van Buren to west of Oakwood;
- Widen Willow from Oakwood to Cleveland to four lanes;
- Widen Cleveland from Randolph to Willow to four lanes;
- Widen Chestnut from Van Buren to Oakwood to three lanes;
- Construct/improve a four lane arterial "bypass" route for US-412 using 30th Street, Southgate, and Garland Road; and
- Construct frontage roads or right turn lanes on Garriott between Cleveland and Garland.

The results of the future year assignment are illustrated in Figure V-5.

<u>Evaluation</u>. This alternative tests a series of roadway construction projects to provide additional traffic route alternatives to Garriott Road. Alternative 4 provides satisfactory traffic operation for nearly the entire street network. A short section of Garriott between Grand and Monroe remains overcongested. The projected level of traffic on Garriott at this point is 29,400, which is 1,000 less than the 1992 traffic count.

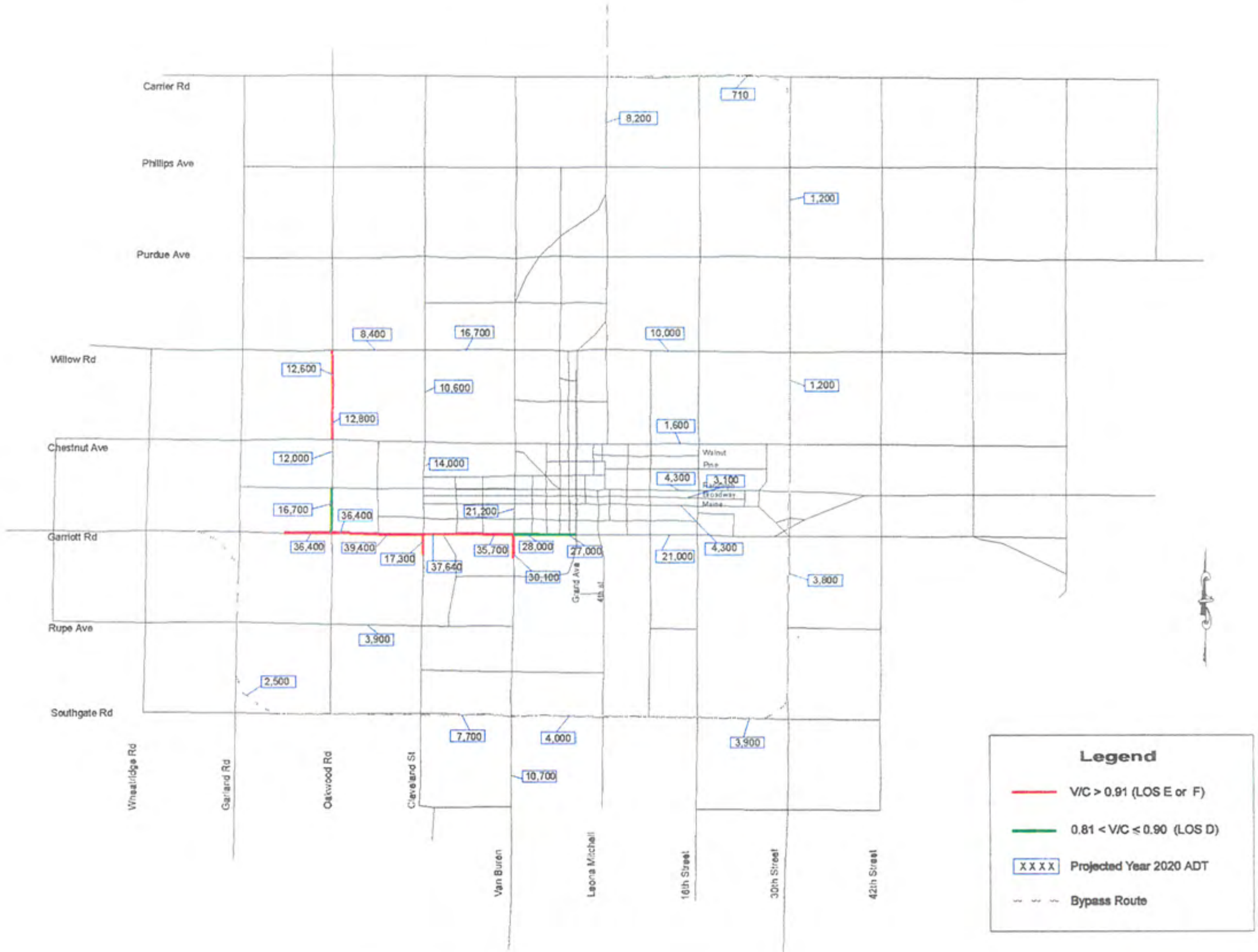

Figure V - 4 Future Alternative 3 - Congested Locations

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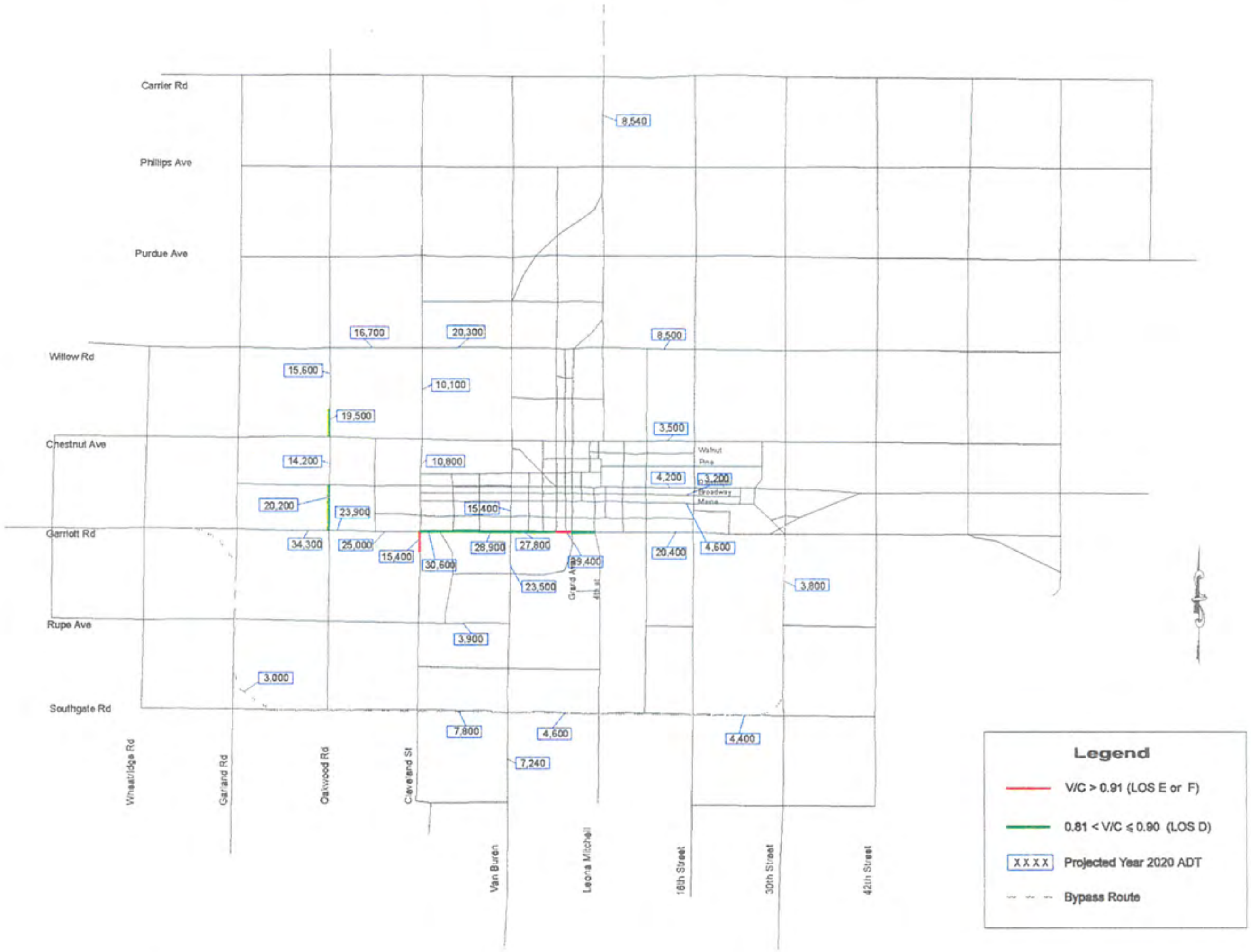

Figure V - 5 Future Alternative 4 - Congested Locations

CHAPTER VI
FINANCE AND IMPLEMENTATION

Transportation funding programs were dramatically restructured in ISTEA from the previous law. The past federal aid highway program had been directed to the construction of four route systems, interstate, primary, secondary and urban. Under ISTEA there are only two systems, the National Highway System and the Interstate System which is a component of the National Highway System. In addition, the Surface Transportation Program was created as a block grant program for use on all roads not classified as local or rural minor collectors. Each of these systems are described below.

Federal Funding Programs

National Highway System. This system comprises major routes of national significance. This system includes interstates and many principal arterials. The match on this program is 80 percent federal and 20 percent local or state. US-412 is on the National Highway System.

Interstate System. This system is part of the national highway system. The interstate maintenance program finances projects to rehabilitate, restore, and resurface the interstate system. The match on this program is 90 percent federal and 10 percent local or state.

Surface Transportation Program. The STP provides block grants that can be used by the state and the MPO for any roads which are not local or rural collectors. This road system is referred to as federal aid roads. Transit capital projects are also eligible under this funding category. Ten percent of these funds must be set aside for safety projects. Another 10 percent must be used for enhancements which include aesthetic and environmental activities, including pedestrian or bicycle trails and beautification projects. The program provides an 80 percent federal match of local or state funds.

Bridge Replacement and Rehabilitation Program. This program funds replacement, repair, or enhancement of any public road bridge. The federal match of this program is 80 percent.

Demonstration Projects. These projects are designated by congress to address one of the following concerns:

- High cost bridge;
- Congestion relief;
- High priority National Highway System corridors;
- Rural or urban access;
- Intermodal priorities; and
- Innovative projects.

National Recreational Trails Funding Program. Recreational trails for nonmotorized uses can be funded from the highway program.

Transit Formula Programs. Transit formula grant programs, Section 9, 16B2 and 18 are included in this classification. Section 9 funds urban transit systems, Section 16B2 provides names for nonprofit organizations, and Section 18 provides nonurban assistance. Section 18 funds serve transit needs outside the urban area of 50,000 population. The Enid area now is only eligible for Section 18 funding.

Section 3 Discretionary and Formula Capital Program. These funds provide capital assistance for bus, rail, and other projects. The federal share is 80 percent of project funding.

Planning. Metropolitan planning is funded by one percent of the funds authorized by the National Highway System, Surface Transportation Program, Interstate Maintenance Program, Bridge Program, and Congestion Management and Air Quality Program (not applicable to Enid).

Local Sources of Revenue

A large percentage of the projects and programs recommended by this transportation study will be funded through federal and state revenues. Additionally, the use of local sources of revenue will be required to assist in the plans implementation, both in leveraging state and federal dollars and as single source funding.

Current Local Funding Sources. Currently, the City of Enid is making use of four local funding sources for transportation projects. These are:

Capital Improvement Fund. The Capital Improvement Fund is composed of several city revenue sources allocated on an annual basis. A wide variety of city capital projects are funded through this source. Annual funding for all projects is approximately $2 million. Of this total, normally between $500,000 and $600,000 is made available for transportation project funding. In 1994-95, transportation projects will receive $659,000 in funding.

Community Development Block Grant. These federal grants, which are distributed to cities, can be used for a wide variety of municipal projects within areas which meet program guidelines, such as income levels for area residents. Normally, approximately $60,000 of transportation projects are annually funded through Community Development Block Grants. In 1994-95, transportation projects will receive $100,000 in funding.

Streets/Alley Fund. This fund is used for ongoing maintenance projects by the Public Works Department. Approximately, one-third of monies allocated is used for paving of unpaved streets. Two-thirds of monies allocated are used for overlaying streets. Normally, approximately $300,000 of these funds are used for transportation projects. In 1994-95, transportation projects will receive $322,750 in funding.

Enid Economic Development Authority (EEDA). The EEDA was created in 1987 to help fund projects of economic significance to the City of Enid. The City has used the EEDA for a wide variety of projects, including transportation projects such as the construction of roads to the industrial park, relocation of utilities, the acquisition of right-of-ways for newly locating businesses, etc. Although the EEDA was abolished in 1991, there is still approximately $3.6 million in the fund. On an annual basis, approximately $500,000 of monies is allocated through the fund, with transportation projects generally receiving approximately $150,000 in revenues. In 1994-95, transportation projects will receive $150,000 from the EEDA.

It is anticipated that each of these four funding sources will remain viable sources for funding the Transportation Plan, at levels equal to and/or exceeding current levels.

Potential New Local Funding Sources. The following new sources of funding are recommended to be considered by City of Enid officials in implementing the Transportation Plan.

Sales Tax. Tax on the retail sales of taxable goods and services. Currently, the City of Enid has a 7.25 cents sales tax. Of that amount the City gets 3 cents and the State of Oklahoma the remainder. Each 1 cent equals approximately $4.7 million dollars annually.

Many communities utilize sales tax revenues to help fund capital projects. The City of Enid is currently using 1 cent of their 3 cents of sales tax to help pay off capital debt. This special sales tax will expire in the year 2017. Additionally, 2 cents of sales tax revenues are currently used to pay annual operations of the City.

In the past, the City has been 3/4 cent above its current sales tax level. A special election would be required to increase the sales tax.

Impact Fees. These fees are allowed by state statute and are a common form for funding transportation projects. Broken Arrow is one Oklahoma community utilizing impact fees to help pay for transportation projects. In addition to the language in the state statute, individual communities can add language specific to design issues for their cities.

General Obligation Bonds (G.O.B.). This funding approach is bonded indebtedness issued with the approval of the electorate for capital improvements and general public improvements. The City of Enid currently has no General Obligation bonded indebtedness. G.O.B.'s are a very common source of funding capital projects. As an example, the project consultants have recently finished a survey of 53 midwestern communities regarding funding sources for parks and recreation capital projects and found General Obligation Bonds to be the most frequently used financing tool for these projects.

General Obligation Bonds are considered to be an excellent source for funding projects which will have a long-term life expectancy. Usage of bonds allows both current and future community residents an opportunity to pay for project costs which will benefit them today and in future years.

Transportation Funding

The potential local and federal funding sources over the 25 year planning period was estimated and tabulated in Table VI-1. Listed in the table are the federal and local funding categories and the estimated annual allocation of thee funds. The annual funding was projected for the 25 year planning period. The analysis indicates that over the planning period, $43 million dollars is anticipated to be available from the federal government. Another $36 million would be generated from local sources.

Project Costs

A general opinion of the probable costs of the transportation projects are listed in Table VI-2. The projects include recommended street improvement projects, the US-412 bypass improvement, traffic signals, signal coordination, transit system operation, a 3 mile trail construction, and maintenance costs. The total costs over the 25 year period in 1994 dollars is $69 million. Thus, over a twenty-five year period, the recommended projects would be funded given anticipated resources.

The projects will be unable to be funded under a few conditions. The first is if the rate of inflation for construction projects exceeds the increase in revenue from the listed sources. Second, since it will take time to obtain the funds, the project cost will increase by the time sufficient funds are obtained. Third, the analysis assumes that the bypass route will be constructed with National Highway System funding.

TABLE VI-1
Anticipated Transportation Funding

	Funds Allocated 1994 ($000s)	25-Year Funding** Availability (1994 $000s)
Federal		
NHS*		10,000
STP	1,000	25,000
Trails		500
Transit	300	7,500
Subtotal	1,300	43,000
Local		
Capital Improvement Funds	600	15,000
CDBG	100	2,500
Streets/Alleys	300	7,500
EEDA	150	3,750
General Fund	150	3,750
Transit Fares	150	3,750
Subtotal	1,450	36,250
Total		79,250

* Funding is allocated by the State on a project need basis. The only routes which are currently eligible in Enid is US-412 and U2-81.

** Assumes current status of funding will continue, figures in 1994 $s.

TABLE VI-2
Transportation Expenditures
(Includes Maintenance Cost)

Project	Description	Length	Cost (Millions) (1994 $)
Randolph	Van Buren intersection, housing acquisition widening from Van Buren to Oakwood	3.0 miles	$4.5
Willow	Widen to four lanes from Oakwood to Cleveland	1.0 mile	$2.0
Oakwood	Widen to four lanes from Chestnut to Willow	1.0 miles	$1.9
Cleveland	Widen to four lanes from Randolph to Willow	1.5 miles	$3.0
Chestnut	Widen to three lanes from Van Buren to Oakwood	2.0 miles	$1.4
US-412 Bypass	Improve as four lane by-pass arterial	10.0 miles	$11.9
22nd or 26th Street	New Connection	0.3 miles	$0.83.1
Willow	Wider to four lanes from Oakwood to Garland	1.0	$2.0
Garland	Widen to four lanes from Willow to Garriott	2.0	$4.0
Signal Coordination			$0.5
Intersection Improvements (4) New Signals (3)			$2.4
Transit System	Demand Response Service	City-Wide	$0.6/annual
Trail			$0.3
Maintenance/Paving			$1.0/annual
Total (25 year cost)			$77.8

Given the overall positive financial position of the Enid area, funds might be obtained earlier in the planning period by issuing General Obligation Bonds. This is one method to reduce the potential of future year cost increases.

CHAPTER VII
RECOMMENDED LONG-RANGE TRANSPORTATION PLAN

Introduction

The transportation projects and strategies needed to support anticipated growth and change during the 25 year planning period are described in this chapter. The plan also reflects the financial capacity of the Enid area to obtain funding for potential improvements. The future transportation options selected for the long-range transportation plan were selected from those described previously, comparing the project or strategy cost-effectiveness, and refining the list through the public involvement process. The future strategies from which the long-range transportation plan is based include:

- Major Street Capacity Improvements;
- Transit System Improvements;
- Pavement Upgrade and Collector System;
- Trail System; and
- Transportation Systems Management.

Major Street Capacity Improvements

Street improvements in the Enid metropolitan area are divided into two types; major capacity improvements and pavement upgrades and collector street construction.

The scheduling of major construction projects was based upon an analysis of the following factors: current traffic counts, project traffic volumes, existing and future volume-to-capacity ratios, opinions of generalized project cost, and the availability of funds.

The street construction portion of the long-range transportation plan is indicated in Figure VII-1. The figure defines those projects which are both needed to maintain acceptable travel conditions in the year 2020 and are fundable. The project scheduling includes four categories as listed below:

- Committed projects are those projects in which construction funds have been obtained or have been budgeted;

- Short/mid-range projects are those projects identified in the LRP which are recommended to be constructed within a 5 to 10 year time period;

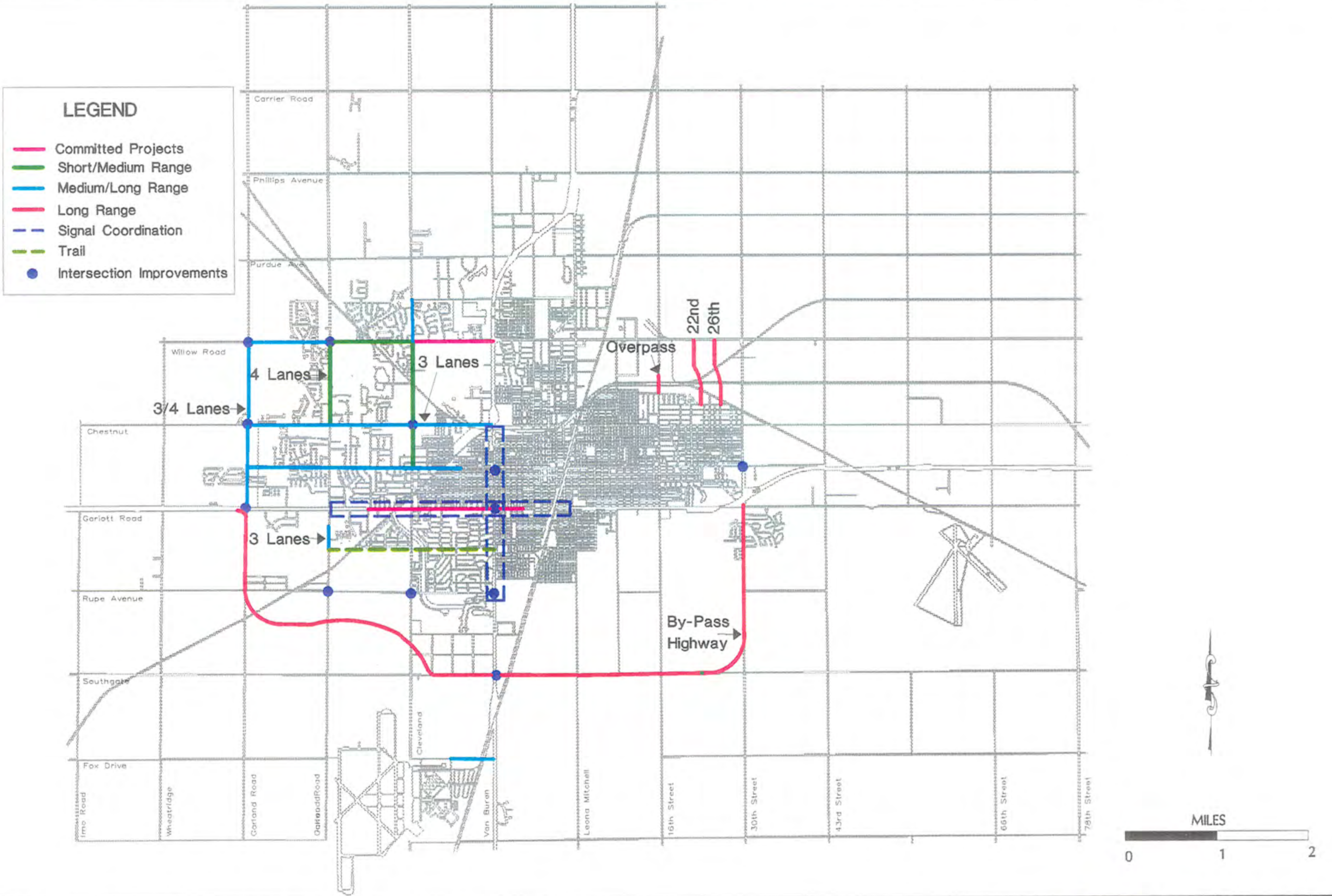

Figure VII - 1 Recommended Improvements

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- Mid/long-range projects are those projects which are recommended to be constructed after the short/mid-range projects. These projects are likely to be constructed within a 7 to 15 year time period: and

- Long-range projects are those projects which are recommended to be constructed to meet long-range needs. These projects are likely to be constructed within a 15 to 25 year time period. The exact timing of this project will depend upon funding availability.

Transit System Improvements

The transit system is currently fulfilling its function to provide a means of transportation to persons unable to utilize a private automobile. No change in system type or service structure is envisioned.

Given projected population changes. the current fleet size of 10 demand-response vehicles will be adequate to serve the current level of demand. A fixed route was operated for a brief time during the 1980s. However, it was determined to be marginally productive and was discontinued.

A future source of dedicated transit funding is desirable to ensure continued operation of the transit system at current service levels. Operating costs which rose during the 1980s and early 1990s are expected to continue to increase. A dedicated transit funding source outside the general city operating budget is a desired alternative for many communities.

Pavement Upgrade and Collector Network

These types of projects include major signalization, collector street construction, and pavement of unpaved streets. Recommended improvements are indicated in Figure VII-2.

<u>Signal Improvement</u>. The long-range planning process does not fully encompass the requirements for determining this type of need. There are other signal placement criteria as described in the Manual for Uniform Traffic Control Devices (MUTCD) which are outside the scope of a long-range transportation plan. There are three locations which are identified as needing signalization placement or improvement. These include:

- Garriott and Van Buren - improve intersection timing to reflect projected volume changes;

- Rupe and Van Buren - install new signal;

- Garland and Chestnut - improve intersection, potential signal
- Garland and Garriott - improve intersection, potential signal
- Garland and Willow - improve intersection, potential signal
- Rupe and Oakwood - monitor volumes in order to determine when signal is warranted
- 4th Street at Willow - monitor volumes in order to determine when signal is warranted; and
- Cleveland and Chestnut - improve intersection, improve signalization.

Pavement of Streets. A number of rural roadways will become urbanized within the next 20 to 25 years. Many of these roads are unpaved and will need to be paved. For the purpose of this study, pavement upgrade was considered warranted on unpaved streets accommodating over 400 vehicles per day.

Collector Street Construction. The service levels provided by the recommended future street network are dependent upon construction of a supporting collector street network. A collector street network currently exists for much of the present Enid area. A collector street system should be part of new growth areas. The street system can accommodate many shorter trips without requiring the vehicle to travel on arterial streets. Lack of a good collector network leads to excessive volumes and delay on the arterial street system. A number of potential future collector street segments are indicated in Figure VII-2. Additional street segments will also likely be needed and should be reviewed during the subdivision platting process.

Trail System

The long range transportation plan includes a recommended bicycle/pedestrian trail. The recommended trail location is parallel one-half mile south of Garriott Road extending along an abandoned railroad right-of-way. The trail could be extended or be marked as a bicycle route to connect with Meadowlake Park.

Transportation Systems Management (TSM)

Transportation systems management improvements are recommended for two highly traveled corridors. The most beneficial management approach will be to improve signal coordination and timing for Garriott Road and for Van Buren Street in order to maximize the capacity of the current street system. Signal coordination is a particularly valuable strategy given the limitations to widen sections of both Garriott Road and Van Buren Street.

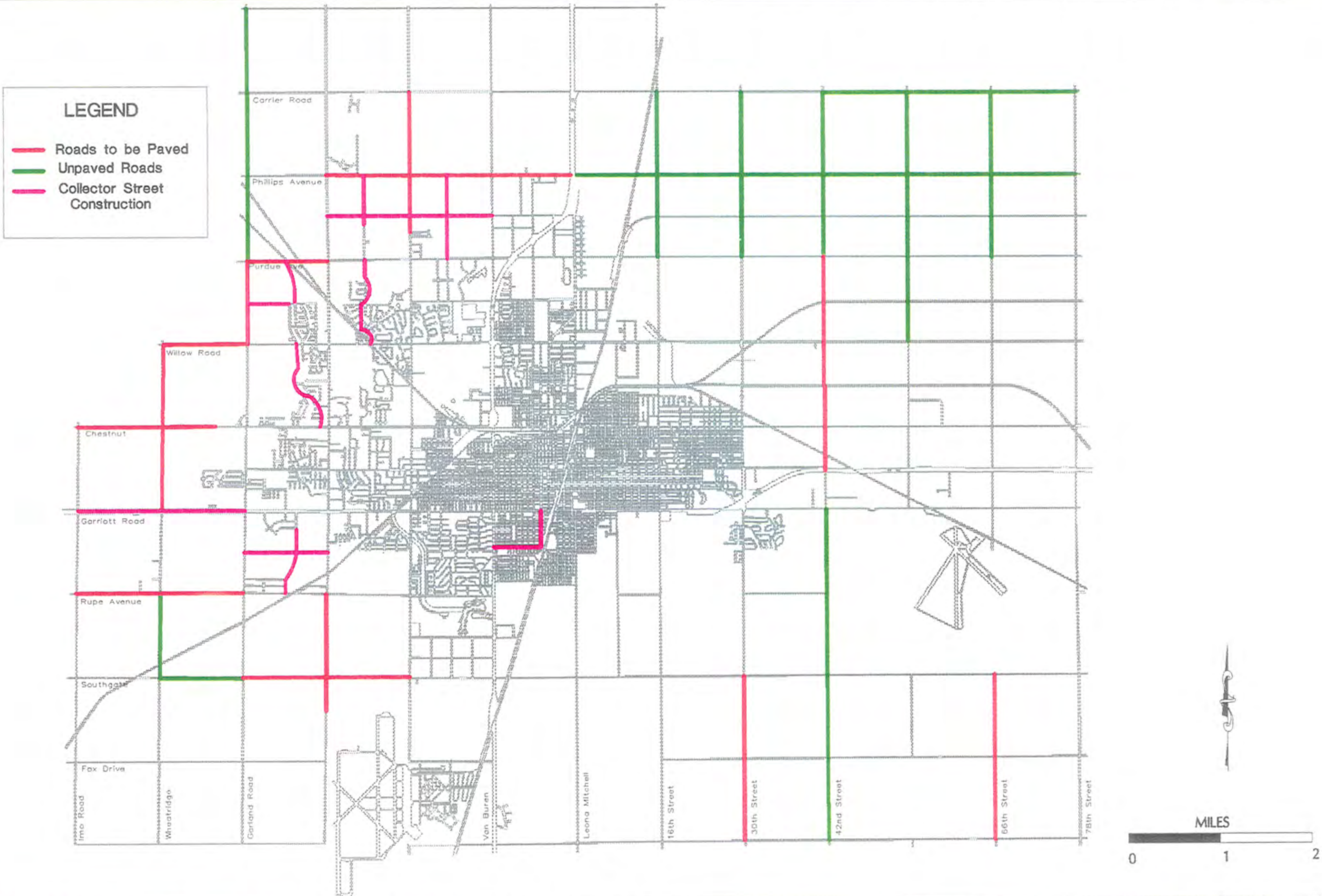

Figure VII - 2 Future Year Pavement Upgrade

A minor geometric TSM improvement is recommended at Randolph and Van Buren Street. This project would involve geometric improvements to the west side of the intersection to allow eastbound traffic to be aligned with Randolph Street.

Design Standards

The recommendation of future street improvements only is not sufficient to ensure improved future transportation conditions. It is also important that these improvements are constructed to desired standards and that the routes are not degraded by excessive adjacent access. The appropriate design standards for arterial and collector streets are not only dependent on function, but also on adjacent land use, and are often constrained by existing developments. These standards can be used for future construction or reconstruction projects.

Principal Arterial. This street section includes two 12 foot through lanes in each direction and a 14 foot center two-way left turn lane or turn bay. Traffic volumes on this type of facility ideally should range between 12,000 and 32,000 vehicles per day. The center turn lane type street is appropriate because of frequent entrances into higher traffic generator land users such as business parks and retail centers. Numerous turning movements, especially from commercial vehicles, are expected. Parking should be prohibited. For design speeds greater than 35 mph, or for peak hour right-turn-in traffic volumes exceeding 100 vehicles, it is recommended that a right-turn lane be constructed along the arterial approaching the curb cut. Alternatively, in less dense commercial areas, a median can be used with left turn bays provided at intersecting streets.

Minor Arterial. This street section includes four 12 foot through lanes and should provide a additional left turn bays at all signalized intersections. The outside lane with gutter section will have a width of 14 feet. Intersection street spacing should be related to design speed in accordance with a five lane roadway. The ideal traffic volume for a four lane street should range between 12,000 and 24,000 vehicles per day. Four lane arterials are appropriate for carrying traffic through primarily residential land use without directly accessing any of the properties. A street width of 52 feet and right-of-way width of 90 feet are recommended. Six foot wide sidewalk should be provided on both sides, or alternatively a six or eight foot bikeway on one side.

Three Lane Minor Arterial/Collector. This street section includes two 12 foot through lanes and one 12 foot center left turn lane. The three lane roadway section is appropriate for a collector type facility in a commercial land use area, such as adjacent to a business park or shopping center where traffic demand is expected to range between 1,500 and 12,000 vehicles per day. The recommended street width for a three lane collector including curb and gutter is 40 feet, and right-of-width to allow for street, sidewalk and lighting should be 70 feet minimum. Four foot wide sidewalks should be provided on both sides.

Two Lane Collector. This type of street is appropriate for a traffic collection function through a residential neighborhood. Because traffic volumes may range between 1,500 and 12,000 vehicles per day, properties abutting the collector may not be as desirable as those abutting only a local street. Parking and private access to the collector should be discouraged and parking should be allowed on one side only. The street width should accommodate two 13.5 foot lanes, and curb and gutter for an overall width of 30 feet. To accommodate the recommended sidewalk and street lighting, a right-of-way of 60 feet is required. Four-foot wide sidewalks should be provided on both sides.

Two Lane Local. All other streets in the city not previously described classify as local streets. The ideal traffic volume for local streets is less than 1,500 vehicles per day. Local streets should provide direct access to private property, and generally parking is permitted; however, in order to meet fire codes which require a 20 foot path for equipment, parking should be permitted on one side only. Recommended street widths are 27 feet back of curb. Four foot wide sidewalks should be constructed on both sides. The recommended right-of-way is 60 feet.

Table VII - 1
Street Design Standards

	Principal Arterial	Minor Arterial	Arterial Collector 3-Lane	Collector 2-Lane	Local 2-Lane
Right-of-Way	120	90	70	60	60
Number of Lanes	5	4	3	2	2
Lane Width (through)	12 foot	12 foot	12 foot	13.5 foot	13.5 foot
Street Width (Back-To- Back)	64	52	40	30	27
Design Volume (ADT) Range	12,000 - 32,000	12,000- 24,000	1,500- 12,000	1,500- 12,000	<1,500
Design Speed (MPH)*	40-55	35-45	30-40	30-35	20-30
Max Grade	5%	6%	8%	8%	8%
Sidewalk (ft)	6-both sides	6-both sides**	6-both sides	6-both sides	4-both sides
Min Private Curb Cut Spacing (ft)	300	250	150	one per property	one per property
Min Median Width (ft)	14	--	--	--	--

* Design Speed criteria for horizontal and vertical alignment should meet the requirements of the current edition of "A policy of Geometric Design of Highways and Streets, AASHO".

** Alternatively, a bike path on one side.

Access Control

An objective of this section of the report is to define the street capacity needed to accommodate future travel demand. Street capacity can be increased or decreased in a number of ways. The method utilized most frequently to increase capacity is to widen a street to provide additional travel lanes. Other methods include constructing intersection improvements, turn bays, medians, or providing traffic signal timing improvements. Conversely, street capacity can be decreased by adding cross streets, driveways, traffic signals, or other stop controls.

Specific design characteristics associated with each functional classification depend on factors such as projected traffic volumes and local access control policies. Higher traffic volumes, for example, those exceeding 15,000 vehicles per day, would warrant construction of a four or five lane arterial street. Traffic volumes of 10,000 or 15,000 vehicles per day can be accommodated by a four lane arterial street or a two lane arterial street which includes turn bays, good signal and intersection spacing, and private driveway access control. In many cases, a well built two lane arterial street can function as well as a four lane street at approximately 60 percent the cost. Specific access control guidelines are listed below for public street intersection spacing, driveway spacing and corner clearance, and signal spacing.

Intersection Spacing -- In order to provide through motorists an opportunity to respond to traffic entering the street from a side street, adequate distance should be maintained between intersections. Although existing street layouts may limit the minimum spacing possible on street realignment construction projects, new street projects should be constructed to the following minimum intersection spacing standards based on design speed as listed in Table VII - 2.

Table VII - 2
Minimum Intersection Spacing Standards

Design Speed	Minimum Intersection Spacing (feet)
25	300'
30	300'
35	300'
40	600'
45	600'

Driveway Spacing -- Like a street, private driveways create an intersection with a public street. Conflicts and potential congestion occur at all intersections, public and private. Methods to reduce conflict include: 1) separate the conflicts by reducing the number of driveways and intersections, 2) limit certain maneuvers such as left turns and 3) separate conflicts by providing turn lanes.

No access drive should be located within the operations area of an intersection. Driver conflicts need to be spaced in order to eliminate overlaps between through traffic and right turns.

It is recommended that driveway locations, at a minimum, should not be closer than 150 feet to an intersection, measured from centerline to centerline. This is to permit adequate storage and stacking of automobiles on the public street. This distance may have to be increased in cases with high volumes to ensure that driveways do not interfere with the operation of turning lanes at intersections.

The number of driveways should be minimized, with the following guidelines listed in Table VII - 3.

Table VII - 3
Minimum Driveway Guidelines

Undivided Arterial Streets Length of Lot Frontage	Maximum Number of Driveways
0 - 300	1
300 - 660	2
661 - 1,320	3

For each 500 feet of frontage, one additional drive is recommended. For divided arterial streets, the maximum driveway frontage distances would double.

Signal Spacing -- Optimal and uniform signal spacing is essential if efficient progression and appropriate travel speeds are to be achieved. On arterial streets, signal spacing of at least one-fourth mile is a desired signal spacing. While up to one-half mile spacing is desirable, practical circumstances make one half mile or one-fourth mile difficult. If a loss in arterial efficiency is acceptable, a minimum spacing of one-eight mile (660 feet) is often accepted by local governments.

Level II - Major Review

Major review of the Long-Range Transportation Plan can be initiated at any time the Transportation Policy Committee feels it is justified or if it appears necessary following a Level I Review.

A major review involves extending the forecast period for a new 20-year period. Computer programming of the new socioeconomic data is used to produce future trip data which is assigned to the comprehensive plan. Evaluation is then made as to whether the current plan is satisfactory. The result of the Level II Review will either be a revised Recommended Transportation Plan or a reaffirmation by the Transportation Policy Committee that the current plan is satisfactory. A review of this magnitude will be needed to maintain a 20 year forecast period and would be conducted at the latest in the year 2000.

Level III - Plan Re-Evaluation

The Level III Review of the continuing phase is an in-depth analysis and re-evaluation of the recommended transportation and land use plans. This analysis includes an overall appraisal of the planning process used to conduct the original transportation study and extends the forecast of each of the surveillance items forward to obtain 20 year design data. This level of review is made if justified by a Level II Review or if the Transportation Policy Committee deems it necessary.

Conclusion

This chapter includes recommendations for future transportation improvements and programs needed to support anticipated growth and change over the 25 year planning period. The plan reflects the financial limitations and funding programs available to the Enid metropolitan area. The recommended plan reflects public input, policy committee involvement, and technical findings.

The recommended long-range transportation plan describes major street improvements, continuation of the demand-response transit system, pavement upgrade and collector street construction, development of a pedestrian trail, and signal coordination projects. The plan includes a discussion of design standards to be used to guide the construction of the projects.

The long-range transportation plan has been a collaborative effort between the local governments in the metropolitan area, affected agencies, and the Oklahoma Department of Transportation. A detailed computer model was developed as part of this project. Subsequent updates can utilize this model and will be needed to react to future changes in development patterns if they occur in future years.