2030 OCARTS PLAN
Technical Supplement

Oklahoma City Area Regional
Transportation Study

Adopted by the Intermodal Transportation Policy Committee
and Endorsed by the Board of Directors
of the Association of Central Oklahoma Governments
on August 18, 2005

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GLOSSARY

ACOG ..... Association of Central Oklahoma Governments
ADA ..... Americans with Disabilities Act of 1990
CART ..... Cleveland Area Rapid Transit
CMP ..... Congestion Management Process
COTPA ..... Central Oklahoma Transportation and Parking Authority
DEIS ..... Draft Environmental Impact Statement
EDP ..... Early Deployment Plan
EPA ..... Environmental Protection Agency
FEIS ..... Final Environmental Impact Statement
FHWA ..... Federal Highway Administration
FTA ..... Federal Transit Administration
GAM ..... Growth Allocation Model
GIS ..... Geographic Information Systems
HOV ..... High Occupancy Vehicle
IME ..... Intermodal Element
ITPC ..... Intermodal Transportation Policy Committee
ITS ..... Intelligent Transportation System
ITTC ..... Intermodal Transportation Technical Committee
LOS ..... Level of Service
MIS ..... Major Investment Study
MPO ..... Metropolitan Planning Organization
MSA ..... Metropolitan Statistical Area
NEPA ..... National Environmental Policy Act
OCARTS ..... Oklahoma City Area Regional Transportation Study
ODOT ..... Oklahoma Department of Transportation
OTA ..... Oklahoma Turnpike Authority
PIP ..... Public Involvement Process
ROW ..... Right-of-Way
SAFETEA-LU ... Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
STIP ..... Statewide Transportation Improvement Program
TAZ ..... Traffic Analysis Zone
TDM ..... Transportation Demand Management
TMA ..... Transportation Management Area
TEA-21 ..... Transportation Equity Act for the 21st Century
TIP ..... Transportation Improvement Program
UZA ..... Urbanized Area
V/C ..... Volume to Capacity
VHT ..... Vehicle Hours of Travel
VMT ..... Vehicle Miles of Travel

CHAPTER 1: INTRODUCTION

BACKGROUND OF THE 2030 OCARTS PLAN

Transportation plays a vital role in today's economy, providing jobs and income, and supporting economic activity throughout the country. Travel is also an integral part of our mobile society. However, convenient travel options and movement of people and goods would not be possible without an advanced multi-modal transportation network, linking all regions, connecting small and large cities, as well as urban and rural areas.

Based on existing and anticipated transportation needs, the 2030 Oklahoma City Area Regional Transportation Study (OCARTS) Plan - the comprehensive transportation plan for the Central Oklahoma area - was developed in compliance with the Transportation Equity Act for the 21st Century (TEA-21) passed in 1997. This transportation plan represents a cooperative local, state, and federal effort to craft a document and a process that meet the challenges of preserving as well as expanding the multi-modal transportation system. Following the directives of TEA-21, it includes the policies, goals, analyses, and recommendations necessary to build and maintain an efficient, effective, and affordable regional transportation system.

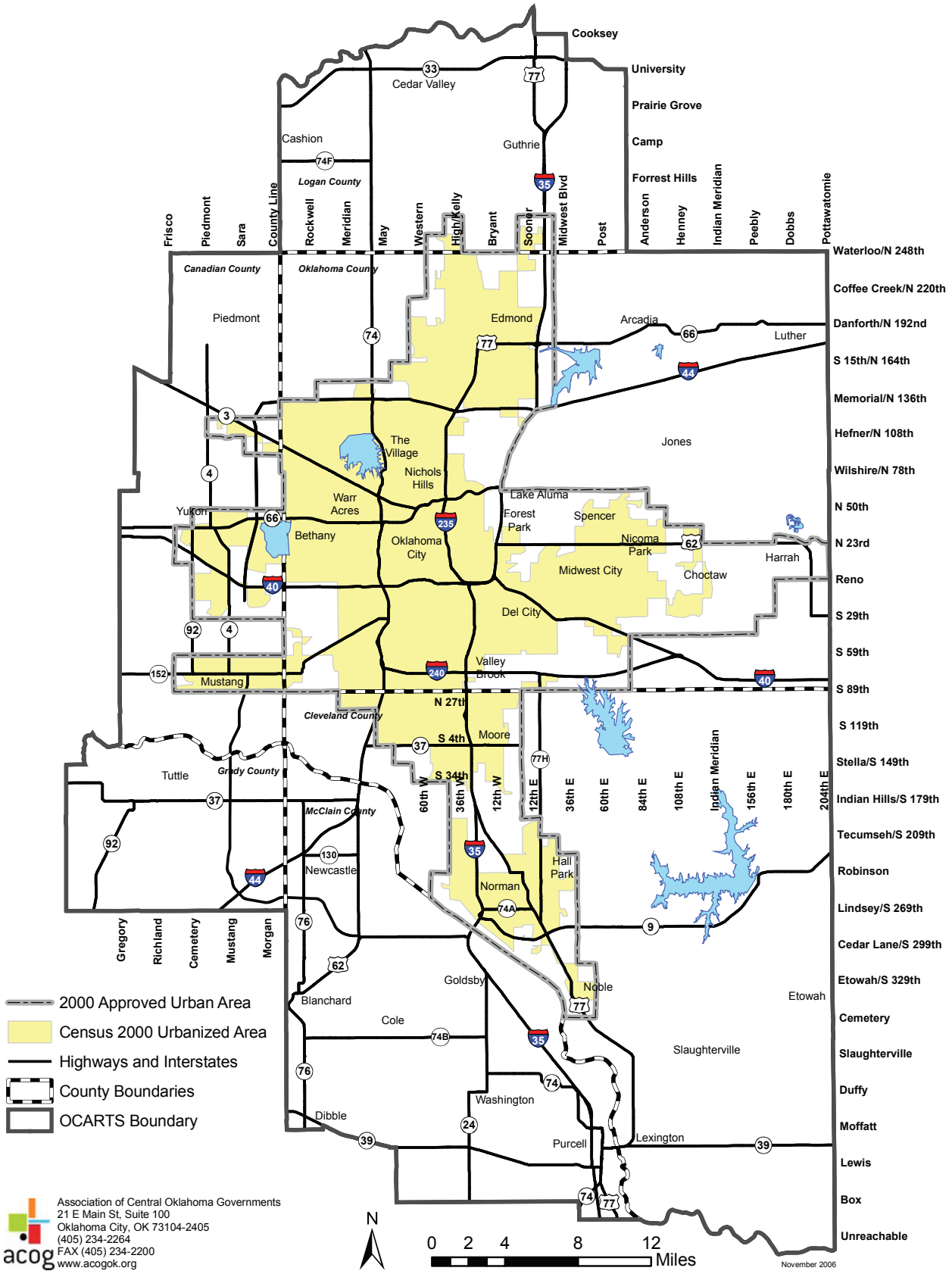
The Association of Central Oklahoma Governments (ACOG) serves as the Metropolitan Planning Organization (MPO) for the transportation study area, and is responsible for guiding the development of the OCARTS Plan. The OCARTS Plan reflects the comprehensive, continuing and cooperative planning process, outlined by a Memorandum of Understanding (MOU) between the Oklahoma Department of Transportation (ODOT), the Central Oklahoma Transportation and Parking Authority (COTPA) and the Association of Central Oklahoma Governments (ACOG), as well as the University of Oklahoma - Transit Services and ACOG. These agreements establish the responsibility for transportation policy, plan selection, and development of programs for plan implementation by the Intermodal Transportation Policy Committee (ITPC). The ITPC is composed of an elected official from each member entity located within the transportation study area. Also included on the ITPC are representatives of local, state, and federal transportation agencies serving Central Oklahoma, including ODOT, the Oklahoma Transportation Commission, COTPA, the Oklahoma City Airport Trust, and the Federal Transit, Highway and Aviation Administrations. Decisions of the ITPC are endorsed by the ACOG Board of Directors.

TRANSPORTATION PLANNING GEOGRAPHY

The OCARTS area consists of approximately 2,085 square miles, covering all of Cleveland and Oklahoma Counties and portions of Canadian, Grady, Logan, and McClain Counties. A total of 37 incorporated cities and towns are located wholly or partially within this geography, which was expanded to its current size in February 2002.

The OCARTS geography includes an urbanized core and surrounding areas of growth, which are expected to continue growing over the next several decades. A map of the OCARTS area, including the urbanized area and adjusted urban boundary, as of the August 2005 plan adoption date, is provided in Figure 1.

Figure 1:
OCARTS Transportation Management Area and Urbanized Area



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PRIOR TRANSPORTATION PLANS

Local governments in the OCARTS area have been continuously engaged in regional transportation planning since 1965. The transportation planning process, initiated by ODOT, resulted in the adoption of the 1985 Oklahoma City Area Regional Transportation Study (OCARTS) Plan. This was the first regional transportation plan ever adopted in the state of Oklahoma. The 1985 OCARTS Plan was developed using forecasts of land use and socioeconomic data identified in a 1965 home interview survey as being the most accurate indicators of present and future trip modeling. It was recognized that if development did not occur as forecasted, then the transportation plan would not provide optimum service to the area. It was therefore considered essential to provide for the periodic reevaluation of land development patterns and to determine the effect of these development patterns on the transportation plan.

ODOT and ACOG jointly reviewed the progress of urban development for the years 1965 through 1971 and found that there were some inconsistencies with the forecasted trends that had provided the basis for the development of the 1985 OCARTS Plan. These land use changes were documented and described in the 1971 Transportation Technical Report, published jointly by ODOT and ACOG. Following consideration of these land use changes, the Intermodal Transportation Technical Committee (ITTC), recommended to the Intermodal Transportation Policy Committee (ITPC) that the 1985 OCARTS Plan be updated to the year 1995, so as to insure that the regional transportation plan would provide a realistic 20 year forecast of transportation facility needs. The ITPC agreed with that recommendation, and an update to the 1985 OCARTS Plan, known as the 1995 Central Oklahoma Regional Transportation Plan, was developed. The 1995 Central Oklahoma Regional Transportation Plan was adopted on May 19, 1976 by the ITPC and was subsequently endorsed by the ACOG Board of Directors on June 16, 1976.

In the early 1980's, another update to the long-range transportation plan was begun. Efforts were initiated to revise the plan that would forecast transportation needs to the year 2005. Once again, analysis of continuing changes in land use patterns, and socioeconomic factors that would influence such changes, were a primary part of the planning process. The resulting 2005 OCARTS Plan, adopted March 31, 1988, was used as the blueprint for transportation improvements in the OCARTS area until the adoption of the 2020 OCARTS Plan in 1995.

The 2020 OCARTS Plan was developed in accordance with the Intermodal Surface Transportation Efficiency Act (ISTEA) passed in 1991. With its passage, ISTEA ushered in a new post-interstate era that emphasized a commitment of preserving and utilizing the existing transportation system. The 2020 OCARTS Plan specifically addressed 15 factors detailed in the Act. These factors included preservation of existing transportation facilities, strategies to reduce congestion, increased transit use, efficient movement of freight, better connections among modes, the development of transportation management systems, and consideration of social, economic, energy and environmental effects of transportation decisions.

The 2025 OCARTS Plan, adopted in September 2000, was developed in compliance with TEA-21. It continued to emphasize the preservation and improvement of the multi-modal transportation system; however, the planning factors addressed included economic vitality, increased safety and security, increased accessibility and mobility options, environmental protection and conservation, enhanced integration and modal connectivity, efficient system management, and preservation of the existing system.

OUTLINE OF THE TECHNICAL SUPPLEMENT

The purpose of this technical supplement is to provide an understanding of the analytical methods and processes used by the MPO in developing the 2030 OCARTS Plan. The technical supplement therefore provides detailed information on the transportation modeling techniques used to test the efficiency of each street and highway alternate network, and a synopsis of the Intermodal Element methodology.[1] It is not the intention of this document to justify the selection of specific projects; rather, the technical supplement has been developed to provide an account of and insight into the strategies and analyses used by MPO staff to ensure that the plan results reflect the goals and objectives set forth in the 2030 OCARTS planning process. The technical supplement to the 2030 OCARTS Plan Report is organized in seven chapters, including this introduction. The coverage of the remaining chapters is as follows:

Chapter 2: Socioeconomic Data explores the key components and methodology employed for the Growth Allocation Model (GAM). The GAM was first used by the MPO to develop population and employment growth forecasts for the 2005 OCARTS Plan. The model is a modification of a similar system developed by Rice University for the Houston-Galveston Council of Governments.

Chapter 3: Intermodal Element provides a profile of the alternate modes of transportation (transit, bicycle, pedestrian, rail, trucking, and airport access) addressed in the 2030 OCARTS Plan. In addition, a summary of the intermodal recommendations is presented.

Chapter 4: Calibration of the Base Year (2000) Travel Demand Model presents an overview of the process used to calibrate the 2000 base year travel demand model. Careful completion of this step was critical since the 2030 traffic projections would be forecasted based on the calibrated base year model. Specific topics covered in this chapter include trip generation - productions, attractions, K Factors, vehicle occupancy rates, special generators; trip distribution - gravity model, external traffic; and trip assignment. The performance measures that were used to validate the calibration process also are discussed.

Chapter 5: Development and Evaluation of Alternates identifies five alternate street and highway networks created to evaluate the ability of each to meet the region's projected transportation needs through the year 2030. The chapter provides a general description of each alternate including construction, maintenance, and right-of-way costs. The chapter also examines the travel conditions projected for each alternate street and highway network in the year 2030. Evaluation factors include each network's ability to meet projected daily transportation demand; network performance in terms of volume-to-capacity ratios, cutline analysis, vehicle miles of travel, vehicle hours of travel; and projected vehicle emissions.

Chapter 6: Potential Plan Impacts explores the social, economic and environmental impacts for each composite alternate network (including street and highway, transit, truck, and rail, airport access, and bicycle and pedestrian improvements).

Chapter 7: Additional Planning Considerations identifies other key issues addressed in the long-range planning process, which are likely to require greater attention in the coming years. Specific topics covered include major investment studies, air quality, congestion management, transportation enhancement projects, eligibility for federal-aid highway funds, and the federal transportation planning factors.

[1] The FYE 2005 UPWP Report - Task 2.01, Subtask 4d, *Intermodal Element for 2030 OCARTS Plan,* ACOG, March 2005, is available at the ACOG offices. It addresses alternate forms of travel and goods movement, which are typically described as the non-highway aspects of the plan (transit, bicycle, pedestrian, rail, trucking and airport access).

CHAPTER 2: SOCIOECONOMIC DATA

INTRODUCTION

PURPOSE AND NEED FOR SOCIOECONOMIC DATA

In order to forecast future travel needs, accurate base year (2000) and projected future (2030) socioeconomic data are required for the OCARTS area travel demand model. The model inputs include: land use, population, dwelling units, employment, income, and school enrollment. In conjunction with additional regional parameters, the travel demand model, calibrated to represent the current state of the regional transportation system, assisted in developing a picture of the 2030 OCARTS area. Adjustments to the network were then suggested in order to retain adequate regional mobility.

Base year socioeconomic data were gathered from a variety of sources and forecast year data was developed using differing techniques, such as historical trend analysis or land use model based growth allocation. The underlying methodologies and processes are described in the following report sections.

BACKGROUND INFORMATION

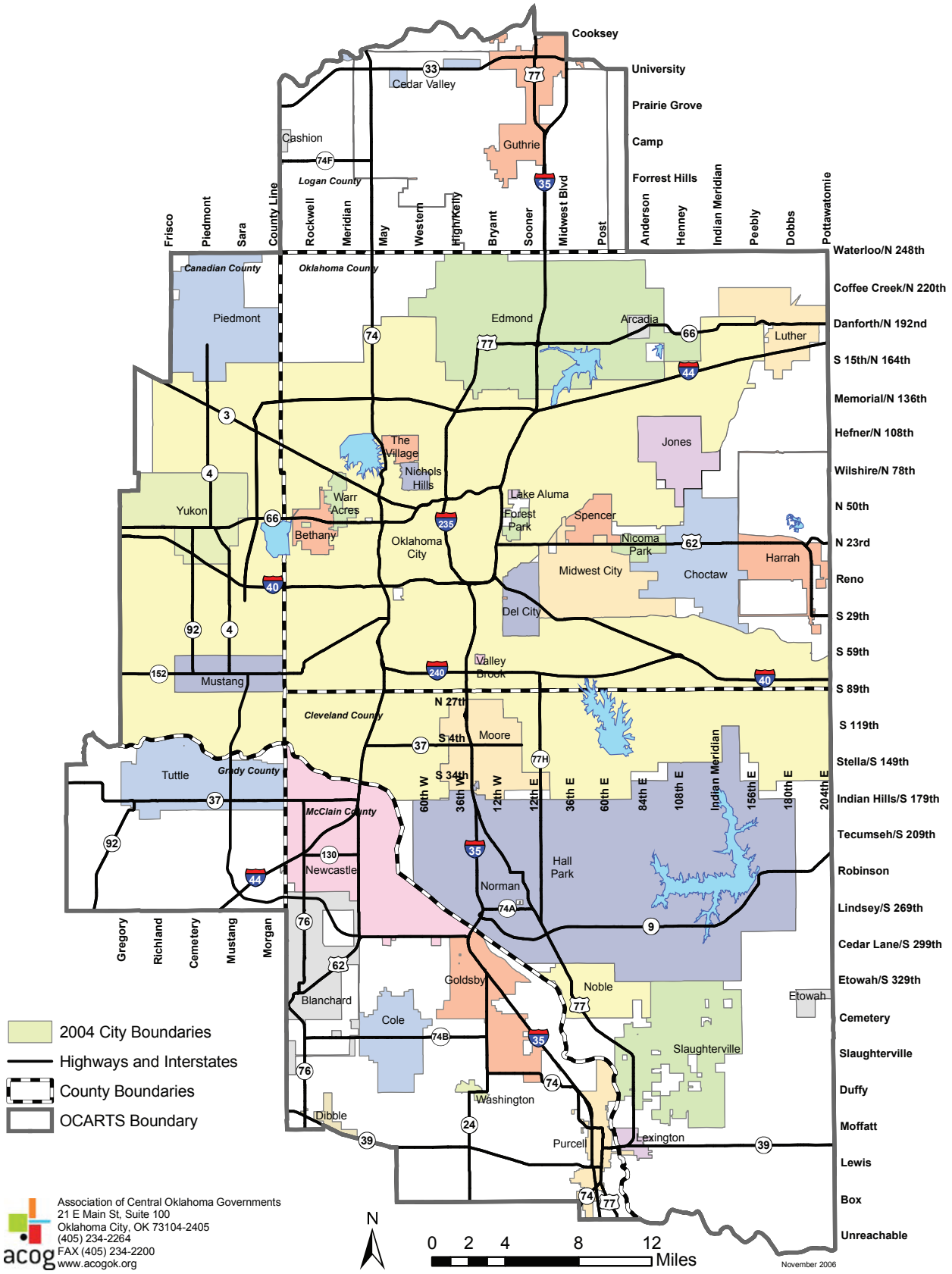
OCARTS BOUNDARY CHANGE

In February 2002, the Intermodal Transportation Policy Committee approved an expansion of the transportation study area in Cleveland and McClain Counties to the south and southwest. The expanded OCARTS area measures 2,085 square miles, which is 395 square miles (25 percent) larger than the area used to develop the previous 2025 OCARTS Plan.

The OCARTS area expansion was recommended and approved after a study by MPO staff, using 2000 Census data to evaluate population growth, density, as well as proximity and trips between the areas of growth and the OCARTS area. This change in geography should be kept in mind when comparing statistics related to the current 2030 OCARTS Plan with data from previous plans.

Figure 2.1 shows the expanded 2030 OCARTS Plan study area along with member jurisdictions.

Figure 2.1:
OCARTS Area



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GROWTH ALLOCATION MODEL (GAM)

Forecasting the spatial distribution of the region's future population and employment is accomplished by the OCARTS area Growth Allocation Model (GAM), which is a land use allocation model designed to distribute residential and employment growth based on historical trends and assumptions about future development in the region. The model works within the confines of regional and sub regional projections.

The OCARTS area GAM is a modification of a similar system designed by Rice University for the Houston-Galveston Area Council of Governments. The Association of Central Oklahoma Governments (ACOG) first used this model for the development of socioeconomic forecasts for the 2005 OCARTS Plan in the 1980s and deployed the model again for the development of the 2020 and 2025 OCARTS Plans. Minor adjustments to the GAM have been made over time.

The GAM is designed to take regional estimates of population and employment growth and distribute that growth to various subareas. The model requires considerable data input, including base year (2000) and forecast year (2030) land use, population, and employment data. The difference between the 2000 and 2030 socioeconomic data is the portion that is allocated by the model. In order to conduct the allocation process, growth factors are used to quantify the growth potential or attractiveness of different parts of the region; and growth assumptions are used to describe the size, type, and density of future population and employment subsets. Then, using mathematical equations, the GAM allocates population and employment to the various subareas in the OCARTS area and these allocations are used in the region's transportation model.

Various levels of geography were used to accomplish this task. (See Figure 2.2: Geographic Hierarchy for GAM.) The levels, listed here from smallest to largest in a hierarchy, include:

- Census Block
- Data Zone
- Traffic Analysis Zone
- Census Tract
- Traffic District
- City
- County
- OCARTS area

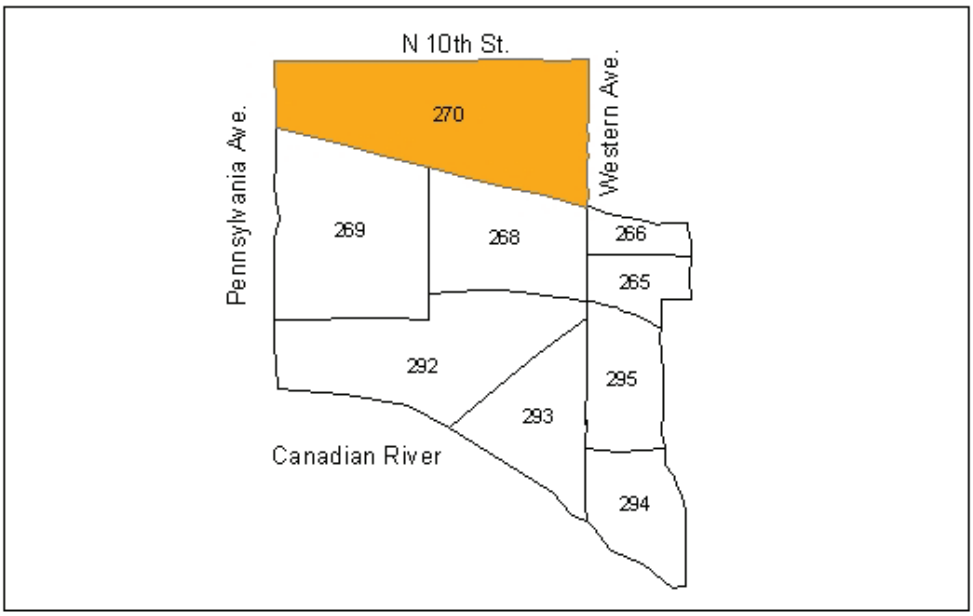
The GAM model allows for several combinations of geographic areas to which growth can be allocated and subsequently aggregated. The census blocks can be summed to data zones, data zones to traffic analysis zones (TAZs), traffic analysis zones to traffic districts, and traffic districts to the OCARTS area. Additionally, data zones can be configured and aggregated to the city, town, and county level, a tool used frequently in checking data.

Typically, the model works with the geography in a two-step process. The initial allocation is at the traffic district level; then traffic district totals are suballocated to the data zone level (and in turn aggregated to the traffic analysis zone level for transportation modeling purposes).

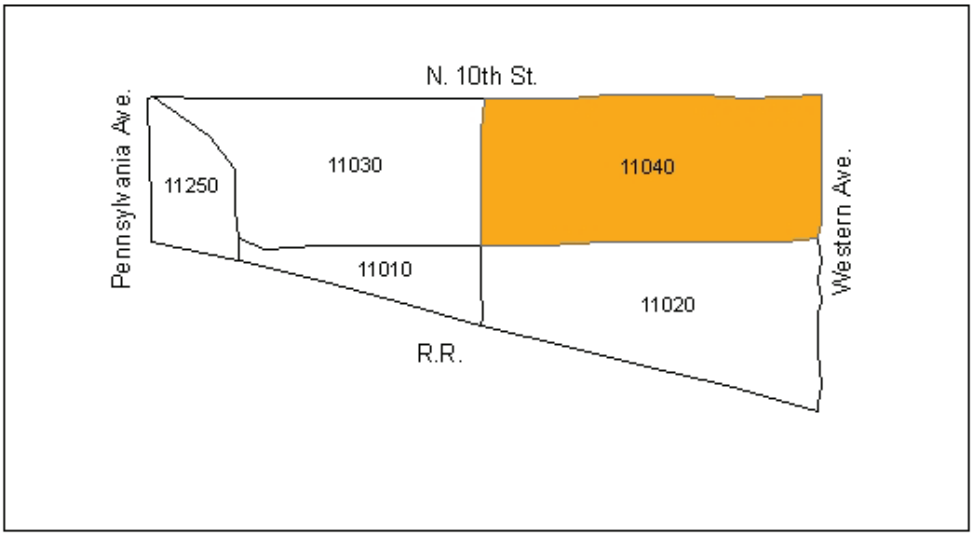
Since the primary purpose of this report is to document the data development and analysis for the transportation model, this report primarily discusses the data zone (which can be summed to the traffic analysis zone) and traffic district levels of geography.

Figure 2.2:
Geography Hierarchy for Growth Allocation Model

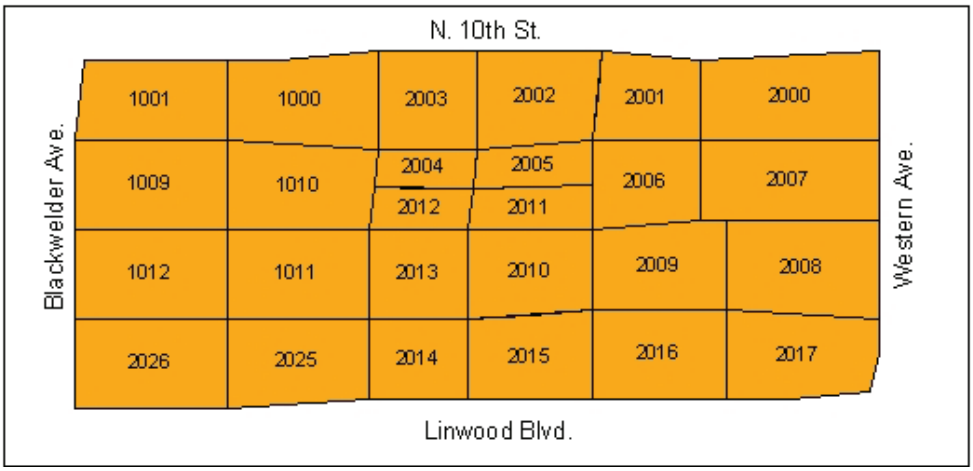
Traffic Zones in Traffic District 11



Data Zones in Traffic Zone 270



Census Blocks in Data Zone 11040



BASE AND FORECAST YEAR SOCIOECONOMIC DATA

LAND USE DATA DEVELOPMENT

Base year as well as future land use information forms the basis to properly model the growth of the OCARTS area population and the location of new housing and employment centers.

2000 Base Year Land Use

The MPO worked closely with OCARTS area local governments to acquire current land use information. The land use information was collected using the nine land use categories as shown in Table 2.1. In most cases, city staff reviewed the 1995 land use maps from the OCARTS database and marked changes or modifications. In some instances, local entities had computerized land use data and they were able to transmit the information to ACOG. In addition, digital aerial photography was used to verify changes in the rural parts of the OCARTS area.

The 2000 base year land use was compiled in ArcGIS software, using latitude and longitude coordinates. The land use data was formatted to include data zone, city, and county boundary information. Subsequently, the ArcGIS software was able to aggregate acreage information by different levels of geography.

Table 2.1:
Base Year - Land Use Categories

Single-Family Single Family (detached/attached) Mobile Home Duplex (Includes large exurban and suburban acreages of 1 to 40 acres, and urban residential development at 2-12 units/acre)	**Industrial** Warehousing Light Industrial Moderate and Heavy Industrial Transportation and Utilities Mineral Extraction Land Fill Water/Sewage Treatment Plant
Multi-Family 3 or more dwelling units per structure (Includes urban residential complexes at 13+ units/acre)	**Parks and Open Space** Open Space and Recreational Areas Lakes and Waterways, Floodways
Commercial/Mixed Use Retail Commercial Wholesale Commercial Office in Commercial Setting Malls	**Transportation Corridors** Railroad, Highway, Arterial Right-of-Way **Office Center** Office, Public/Private State Capitol Complex
Institutional/Public Schools Hospitals Colleges Local Public Office Buildings Other Institutional Uses	**Vacant** Active Agricultural Passive Agricultural Vacant, Farmsteads Planned or future land uses

2030 Forecast Year Land Use

Future year land use was cooperatively developed to determine where various land use changes were planned or where area would be available for development. This information was vitally important for the GAM allocation process to ascertain the availability of land for commercial and residential development. Table 2.2 shows the land-use categories used to develop the future land use:

Table 2.2:
Forecast Year - Land Use Categories

Agriculture 10+acres/dwelling unit	**Office** Public or private sector office building
Agriculture Residential 5-10 acres dwelling/unit	**Public/Institutional**
Suburban Residential 1-4 acres/dwelling unit	**Industrial**
Single-Family Residential 2-12 dwelling units/acre Apartments, townhouses, condominiums	**Park, Open Space, Flood Plain**
Multi-Family 13 or more units per acre	**Transportation - Roads/Railways**
Commercial Retail Commercial Wholesale Commercial Office Malls	**Vacant**

POPULATION DATA DEVELOPMENT

2000 Base Year Population

The 2000 base year population numbers were developed from the 2000 Census block data. ArcGIS software was used to aggregate the population figures to data zone, traffic analysis zone, traffic district, city, and county levels of geography. The 2000 OCARTS area population totaled 990,595.

2030 Forecast Year Population

2030 regional population projections were available from the U.S. Census Bureau, the State Data Center at the Oklahoma Department of Commerce (ODOC), from Woods & Poole Economics and NPA Data Services as shown in Table 2.3:

- The Census Bureau figures were generated from the 2000 Census population figures by linear regression. The projections were available for each county.
- ODOC State Data projections were available in five-year increments at the Metropolitan Statistical Area (MSA), county and city level.
- The Woods & Poole Economics data were available in five-year increments at the county level. Woods & Poole used 2000 Census numbers as a base and then developed forecasts using a traditional cohort component method based on fertility and mortality. Linear regression analysis was used to extend the 2020 projections to 2030.
- NPA county population figures were also available in five year increments, and were higher than all other projections in each case.

Considering that some OCARTS counties grow at a faster rate than suggested by the State Data Center figures, a combination of Woods & Poole Economics and State Data Center projections were chosen for the 2030 county population totals. These county figures were then used to develop "whole" county population totals for the OCARTS counties as described in the next section.

Table 2.3:
1980–2000 Census Population and 2010-2030 Population Estimates for Whole Counties Contributing to the 2000 OCARTS Area

YEAR	CENSUS	OKLAHOMA STATE DATA CENTER AT ODOC	WOODS & POOLE	NPA
1980	845,220			
1990	941,950			
2000	1,063,341			
2010	1,168,291*	1,150,500	1,165,395	1,189,800
2020	1,277,352*	1,225,000	1,274,674	1,320,090
2030	1,386,412*	1,288,900	1,383,317**	1,452,500

*Projection is the result of linear regression of the decennial census data shown.
**Projection is the result of linear regression using Woods & Poole five-year county 2000-2020 population forecasts.

2030 Whole County Totals

Further analysis determined that Woods & Poole data provided the most realistic population forecast for Oklahoma, Grady, Cleveland, and Canadian counties. For these counties, the Woods & Poole forecasts approximated the mean between the NPA and the ODOC forecasts as shown in Table 2.4. In addition, Woods & Poole county forecasts had already been used in the 2030 Norman Comprehensive Plan[2]; and were similar to the trend of the ODOC population estimates for 2001, 2002, and 2003.

The ODOC population figures for McClain County forecasted the most population growth. Since it is policy to use the ODOC forecast as a minimum, this projection was chosen over the other sources.

The ODOC forecast was also selected for Logan County. Analysis showed ODOC forecasts closely fit the historical decennial census trend for the county and those presented in the Guthrie Comprehensive Plan[3].

Table 2.4 provides an overview of the recommended whole county totals.

Table 2.4:
Suggested 2030 Whole County Population Projections for Use in Determining 2030 OCARTS Area Population

	Year	County						Total
		Canadian	Cleveland	Grady	Logan	McClain	Oklahoma	
Census	1980	56,452	133,173	39,490	26,881	20,291	568,933	**845,220**
Census	1990	74,409	174,253	41,747	29,011	22,795	599,735	**941,950**
Census	2000	87,697	208,016	45,516	33,924	27,740	660,448	**1,063,341**
Projection	2010	100,700 W&P	238,215 W&P	49,160 W&P	38,700 ODOC	32,900 ODOC	707,180 W&P	**1,166,855**
Projection	2020	113,210 W&P	268,504 W&P	52,800 W&P	43,500 ODOC	38,400 ODOC	760,630 W&P	**1,277,044**
Projection	**2030**	**126,034 W&P***	**299,169 W&P***	**56,516 W&P***	**47,800 ODOC**	**43,500 ODOC**	**812,922 W&P***	**1,385,941**

*Projection is the result of linear regression using Woods & Pool five-year county 2000-2030 population forecasts.

2030 OCARTS Area County Totals

As previously described, the 2000 OCARTS area contains all of Oklahoma and Cleveland Counties. However, significant portions of the Logan, Canadian, Grady, and McClain Counties are not within the study area. City population projection totals were used to determine the population portion residing within the OCARTS area from the suggested whole county totals.

2030 OCARTS Entity Totals

Preliminary growth trends for each OCARTS area entity were calculated using linear regression of the ODOC 2030 city population forecasts and the 2001 – 2003 city population estimates. The regression trends were applied to the respective entity's 2000 population to produce the initial 2030 forecasts. One-by-one, the initial 2030 entity population projections were compared

[2] Ross and Associates Inc and Clarion Associates Team, "Norman 2030 Land Demand Analysis: Final Draft," January 2, 2004, http://www.ci.norman.ok.us/planning/Development/2020Update/pdf_files/0104042030LandDemand.pdf
[3] RDG Crose Gardner Skukert, "The Guthrie Plan," 2002, http://www.cityofguthrie.com/Documents_Forms/CompFile/Guthrie Plan.pdf

against the trend in recent building permits, gross capacity of available land, the 1995 and 2025 population figures from the last plan, and the trend of the ODOC 2001-2003 population estimates. If necessary, entity population forecasts were modified to reflect growth, and when summed, to reflect the whole county trends. If available, entity population forecasts outlined in comprehensive plans were followed as closely as possible.

There are several cities and unincorporated areas with only a portion of their land area located in the OCARTS region. For partial contributions, the initial population projections were subdivided into the contributing and non-contributing portions. This split was based on the percentages of the 1990 and 2000 population in the OCARTS area, taking into account any significant changes in the municipal boundaries during that time. Building permits and digital aerial photography analysis also helped to determine the growth within the OCARTS area.

Final Approval of 2030 OCARTS Area Population Control Totals: Region, County and Entity

The 2030 population projections by region, county, and entity were accepted by the Intermodal Transportation Policy Committee (ITPC) in May 2004.

Table 2.5 presents a county level summary of the 1990 and 2000 data, and approved OCARTS 2030 population projections, along with the gross population change and the 30 year growth rate. For the OCARTS portion of Canadian, Grady, Logan, and McClain, the approved partial county populations fall within the suggested whole county populations listed in Table 2.4. However, following in depth analysis of local growth trends, the approved city populations for Oklahoma and Cleveland counties resulted in county population figures above the previously suggested population data.

Table 2.5:
Approved 2030 Population Projections for County Portions within the 2000 OCARTS Area

Entity	1990 Population	2000 Population	2030 Proposed Population	2000-2030 Population Change	30 Year Growth Rate
Canadian County Total (part)	53,068	64,507	102,931	38,424	59.56%
Cleveland County Total	174,253	208,016	302,469	94,453	45.41%
Grady County Total (part)	8,762	10,575	16,412	5,837	55.20%
Logan County Total (part)	21,058	24,588	35,744	11,156	45.37%
McClain County Total (part)	21,586	22,461	37,858	15,397	68.55%
Oklahoma County Total	599,611	660,448	839,622	179,174	27.13%
OCARTS Grand Total	**878,338**	**990,595**	**1,335,036**	**344,441**	**34.77%**

Development of OCARTS area Population Forecasts by Traffic District and Traffic Analysis Zone Geography

The OCARTS area GAM was used to determine the 2030 population growth distribution and the resulting population data by traffic district and traffic analysis zone. This process is described in detail in the following section during the discussion of the GAM allocation of the forecasted population.

DWELLING UNIT DATA DEVELOPMENT

2000 Base Year Dwelling Units[4]

The 2000 total dwelling unit data was also collected from the 2000 Census. The mix of data on single family homes, multi family housing and group quarters (such as dormitories, shelters, prisons and nursing homes) was again aggregated by the various geographies, which proved difficult as total units and single family/multi family occupied units were derived from different census sources (summary file 1 and summary file 3). In some cases, digital aerial photography was required to more accurately assess the mix of dwelling units, as well as to evaluate and resolve the discrepancies between the Census data and the information shown on the aerials.

2030 Forecast Year Dwelling Units

To estimate the total number of dwelling units anticipated in the OCARTS area in the year 2030, staff used the approved 2030 population projections for each OCARTS area entity. The population was then reconfigured, in terms of households and dwelling units, by using the Growth Allocation Model (GAM) assumptions regarding single-family and multi-family distribution and household size.

Detailed discussion on this topic is included in the upcoming section on GAM Calibration, Growth Assumptions, and Population and Dwelling Unit Allocation.

EMPLOYMENT DATA DEVELOPMENT

2000 Base Year Employment

The 2000 wage and salary employment data was developed primarily from the Oklahoma Employment Security Commission's (OESC) ES-202 file. The file included business name, address, city, zip code, number of employees and Standard Industrial Classification (SIC) code, as well as the North American Industry Classification System (NAICS) code.

The original ES-202 file contained 60,459 records that covered all of the counties that were relevant to the OCARTS area. The file was sorted into three Microsoft Excel files for further analysis. The first file contained records for only Oklahoma county, the second for Canadian and Cleveland counties, and the third for Grady, Logan and McClain counties.

These initial employment files contained aggregated data for certain employers and thus required additional research to list out sub-office locations along with the respective number of employees. To enhance the ability of staff to accurately find physical addresses for these and other records in the base employment files, various other sources of information were integrated; InfoUSA (CD-ROM) Local Business Directory, Blythe's Criss-Cross Directories, World Wide Web, field surveys, local phone book records, and past OCARTS employment files were used to provide supplemental employment and address information.[5] In certain cases, even employment records that had assigned addresses were verified to determine the accuracy of the data.

[4] Unlike the Census Bureau (and many local communities), the OCARTS MPO definition of single family residential includes mobile homes and duplexes.

[5] A related report, FYE 1998 UPWP - Task 1.01, Subtask 1, *Methodology for Developing Employment Data (1995) for Land Use and Transportation Models*, ACOG, January 1999, is available at the ACOG offices.

Address Matching

ArcGIS software was used to address match the wage and salary employment data with an updated 2000 TIGER/Line street file. Address matching was accomplished by giving each employer a specific "point" along a line segment on a geographic map. This "point" or location was then given a latitude and longitude coordinate. The latitude and longitude coordinates (NAD 83 Oklahoma - State Plane North) were also used to allocate each employer (point) to its respective data zone and traffic analysis zone. Individual address matching runs were done for each municipality, and the employment records were then aggregated back into the main employment files. The ArcGIS software was also used to compare and verify the year 2000 locations with the employment records from the previous plan.

After effectively removing employment records with addresses located in those portions of Canadian, Grady, McClain, and Logan counties outside of the OCARTS area, a final 2000 OCARTS wage and salary employment figure of 491,694 was calculated from a recombined employment file, consisting of just under 30,000 records.

Self-Employed Individual/Proprietor Employment Information[6]

The OCARTS area total workforce was made up of not only wage and salary employed, but of self-employed/proprietor as well. The 2000 base year figure for the self-employed/proprietor was collected from the 2000 Census Transportation Planning Package (CTPP). After determining a very close correlation between the OESC wage and salary employment and CTPP work trip data, the CTPP self employment ratio to CTPP total workers was used for the OCARTS area, resulting in a total 2000 OCARTS self-employed figure of 47,701.

When compared to the previous 2025 OCARTS Plan, the self-employed comprised 7.13% of the total 1995 OCARTS employment, whereas the 2000 self-employed, as derived from the 2000 CTPP, represented 8.84% of the total 2000 OCARTS workforce.

The next step involved testing the CTPP place of work data to determine its correlation with year 2000 OESC wage and salary employment data at the traffic analysis zone level. Again, a close correlation resulted (with a coefficient of 0.96), indicating that the CTPP and OESC employment data was satisfactorily matched to the proper traffic analysis zones. Having determined the validity of the CTPP data, staff proceeded to use the CTPP self-employed/proprietor to CTPP total workers ratio specific to each traffic analysis zone as the basis for projecting self-employment by traffic analysis zone. Therefore, a traffic analysis zone's self-employment was determined by multiplying the TAZ's wage and salary employment by the TAZ's ratio of self-employment to total workforce.

[6] Proprietors include individuals such as the self-employed; the proprietor group excludes wage & salary employees, government workers, and unpaid family employees. The term "self-employed" and "proprietor" is used interchangeably in this report. The historical proprietor employment data was developed using information from the Census Bureau and the Bureau of Economic Analysis – both agencies are under the U.S. Dept. of Commerce. The first ACOG study to seriously consider proprietor employees in the OCARTS employment picture was the evaluation of the 1995 employment data.

The final OCARTS 2000 total employment figure of 539,395, as shown in Table 2.6, was approved by the ITPC on February 26, 2004.

Table 2.6:
2000 OCARTS Area Wage & Salary and Self-Employed by Retail Commercial and Other Employment

	WAGE & SALARY	SELF-EMPLOYED	TOTAL
RETAIL COMMERCIAL	109,042	10,651	109,042
OTHER EMPLOYMENT	382,652	37,050	419,702
TOTAL	**491,694**	**47,701**	**539,395**

Assigning Retail/Other Designations for Transportation Modeling

According to a Retail/Other SIC code equivalency file, the employment records were separated into "retail commercial" or "other employment" categories for transportation demand modeling purposes. Indicative of the general type of service provided, "Retail" designations referred to establishments that engage in commercial activity and, from a transportation standpoint, typically attract a high volume of continuous vehicular trips from patrons throughout the workday. Examples of retail establishments include department stores, restaurants, commercial banks, gas stations, and grocery stores. The "Other" category referred to all non-commercial entities that usually attract vehicular trips in patterns reflective of morning and afternoon journey-to-work commutes. Offices, auto manufacturing plants, schools, government offices, and nursing homes are some examples of establishments fitting the "Other" designation. This designation was subject to change at a later time, if analysis revealed that the assigned category was in conflict with historical data or corresponding land use parcels.

("Retail" and "Other" assignments for self-employed/proprietor data were calculated at the traffic analysis zone level through applying the ratios of "retail" or "other" wage and salary employment to total wage and salary employment respectively. Similar methodology was also applied in assigning COIP land use codes, as described below.)

Classification of Employees for GAM Modeling

To properly model employment distribution and growth in the OCARTS area Growth Allocation Model (GAM), staff also used the SIC codes of the employment records to group jobs into similar employment categories or divisions. Using a land use/SIC code equivalency file, each SIC code corresponded to an employment based land use, i.e. Commercial, Office, Industrial, or Public (COIP). The resulting employment-land use association was then overlaid with the 2000 base year land use information to allow both land use vs. employment checks, as well as a comparison to land use and employment information from previous plans at various levels of geography. ArcGIS software was utilized to compare COIP information for 1990, 1995, and 2000.

2030 Forecast Year Employment

2030 Forecast Year Regional Employment Control Totals

Three datasets of historical and projected county employment figures were analyzed and compared to determine year 2030 employment control totals for each of the entire six Central Oklahoma counties comprising the OCARTS area. As with previous plans, control figures representative of the standard county level of geography were determined from federal and private data sources and later adjusted to account for the unique OCARTS geography composed of both full and partial counties. The sources of the datasets were the U.S. Department of Commerce Bureau of Economic Analysis (BEA), ODOC, NPA Data Source, Inc., and Woods & Poole Economics, Inc.

The BEA and ODOC datasets were obtained without cost from their respected websites. The datasets were identical since ODOC used historical and localized BEA figures for its purposes. However, no forecasts and only historical employment data by county were available from BEA/ODOC. Therefore, historical five-year employment counts, from 1980 to 2000, were used in a linear regression equation to project county employment in five-year increments from 2000 out to 2030.

To develop the 2030 OCARTS Plan data, ACOG purchased population and employment forecasts from NPA Data Services and Woods & Poole. The NPA dataset contained county employment forecasts to the Year 2030. The Woods & Poole dataset listed employment projections to year 2025. Again, a linear regression equation was applied to extrapolate year 2030 forecasts.

Table 2.7 lists the summed totals of the three employment forecasts for the six full counties comprising the OCARTS area.

Table 2.7:
1980-2000 Employment Counts and 2010-2030 Forecasts of the Six Central Oklahoma Counties Comprising the 2000 OCARTS Area*

OCARTS: SUM OF 6 COUNTIES	1980	1990	2000	2010	2020	2030
BEA/ODOC**	505,846	561,200	696,225	762,798	850,873	938,948
WOODS & POOLE***	505,850	561,200	696,230	772,450	863,660	951,685
NPA DATA SOURCE	505,850	561,200	697,470	798,920	912,740	997,140

***** The employment figures within the three datasets were derived from IRS tax forms, which often trace to a proprietor's "place of residence" instead of "place of work." Therefore, to match the Year 2000 employment database, the selected control totals were later factored accordingly to only reflect "place of work" employment.
****** BEA/ODOC forecasts from year 2000 to 2030 were based upon a regression analysis equation that factored five-year employment counts from 1980 to 2000.
******* The Woods & Poole forecast for year 2030 was based upon the trend line of Woods & Poole county projections for Year 2025.

Selecting 2030 County Control Totals

The three sets of projections were compared against historical figures from past OCARTS Plans, and it was determined that the Woods & Poole figures were the most congruent. Staff therefore considered the Woods & Poole figures and forecasts to be the most reasonable to utilize in developing 2030 county employment totals. Compared to the Woods & Poole figures, the BEA/ODOC figures appeared too conservative while the NPA forecasts seemed inflated. Table 2.8 contains the Woods & Poole whole county forecasts selected for use in developing OCARTS county 2030 control totals. The whole county forecasts were presented to the various ACOG committees in April 2004 for review and comment:

Table 2.8:
Woods & Poole - Full County Employment Forecasts
Selected for Use in the 2030 Plan

COUNTY	1980	1990	2000	2010	2020	2030*
CANADIAN	21,210	26,510	35,650	41,680	47,210	52,712
CLEVELAND	43,060	61,620	87,480	100,160	114,640	128,815
GRADY	16,650	17,220	20,810	23,060	25,410	27,765
LOGAN	8,260	10,200	13,150	15,430	17,600	19,805
MCCLAIN	6,070	7,500	10,050	11,630	13,290	14,953
OKLAHOMA	410,600	438,150	529,090	580,490	645,510	707,635
TOTALS	**505,850**	**561,200**	**696,230**	**772,450**	**863,660**	**951,685**

*The Woods & Poole forecast for year 2030 was based upon the trend line of Woods & Poole county projections for Year 2025.

Adjusting for Employment by Place of Work

The Woods & Poole employment counts and forecasts were based upon the addresses of IRS tax filers, and contain both wage and salary employment, as well as self-employment/proprietor records. However, the dataset inherently contains some proprietor employment that traces to "place of residence" rather than "place of work." This occurs when a proprietor files federal income tax forms and lists his/her home address for correspondence, although the actual business is located in a neighboring county. Consequently, county employment counts were slightly skewed as some proprietor employment was assigned to the wrong county, or accounted for more than once in different counties.

Therefore, a ratio specific to each county was applied to the 2030 forecasts to correct this matter. The ratio - the year 2000 OESC wage and salary employment and CTPP self-employment full county totals divided by the year 2000 Woods & Poole whole county employment totals - was applied to the Woods & Poole year 2030 county forecasts and resulted in 2030 county employment by "place of work."

Adjusting for OCARTS Geography

Once the county forecasts were factored to account for employment by place of work, the next step required determining and attributing the proper proportion of county employment to the OCARTS area. As noted before, four of the six Central Oklahoma counties had only a portion of their jurisdictions in the OCARTS geography.

Using geography ratios, the county employment control totals were trimmed to reflect estimated county employment reflective of the OCARTS geography. The geography ratio was determined by dividing adopted year 2000 OCARTS county employment totals by year 2000 Woods & Poole whole county employment totals. These ratios were then multiplied with the 2030 county employment by place of work forecasts, resulting in place of work forecasts for the partial counties - Canadian, Grady, Logan, and McClain counties. Since their entire jurisdictions are located within the OCARTS area, geography ratios were not applied to the 2030 employment by place of work forecasts for Cleveland and Oklahoma counties.

Fine-tuning the OCARTS Area Employment Forecasts at the County Level

After factoring the Woods & Poole full county forecasts to account for place of work employment and OCARTS geography, the resulting full and partial county forecasts were analyzed and adjusted as necessary to select a valid set of year 2030 OCARTS county control totals. Various quantitative methods were applied to account for differing growth scenarios that could impact the county forecasts. Such methods considered historical trends, regional growth rates, past OCARTS Plans and figures, employment to population ratios, and proprietor to wage and salary employment ratios. After comparing and contrasting variations of these forecasts, staff selected county figures with reasonable growth rates and in accordance with historical OCARTS figures and trends. The year 2030 projected employment for the OCARTS area was 728,100 - a figure that represents a 35.0% growth rate and a net gain of 188,704 jobs from 2000 to 2030 for the OCARTS area. Table 2.9 lists the approved OCARTS county control totals.

Table 2.9:
2030 Employment: OCARTS County Control Totals

County	Year 2000 Employment	Year 2030 Employment	2000-2030 Growth Rate	2000-2030 Net Gain
Canadian	20,013	31,000	54.9%	10,987
Cleveland	74,569	109,000	46.2%	34,431
Grady	1,569	2,200	40.2%	631
Logan	6,476	9,800	51.3%	3,324
McClain	6,034	10,500	74.0%	4,466
Oklahoma	430,735	565,600	31.3%	134,865
Totals	**539,396**	**728,100**	**35.0%**	**188,704**

Development of OCARTS area Employment Forecasts by Entity, Traffic District and Traffic Analysis Zone Geography

The OCARTS area GAM was used to determine the 2030 employment growth distribution and the resulting employment data by entity, traffic district, and traffic analysis zone. The county level control totals were used to forecast 2030 employment figures by entity, traffic district and traffic analysis zone and this process is described in detail in the section on the GAM allocation of the forecasted employment.

INCOME DATA DEVELOPMENT

2000 Base Year Income Data

The year 2000 median household income was taken from the 2000 Census Bureau's Summary File 3 (SF-3). (Note: The CTPP Part 2 - Traffic Analysis Zone data release was scheduled too late for this plan update.) The SF-3 data was available at the block group, which was aggregated to the traffic analysis zone (TAZ) level; however, in some cases where block groups did not match TAZ geography, the income data had to be interpolated to that level of geography.

2030 Forecast Year Income Data

The 2030 median household income was not forecasted for the 2030 OCARTS Plan due to the difficulty of forecasting income data 30 years into the future. As a substitute for year 2030 median household income, vehicle ownership per dwelling unit was used in the travel demand model.

SCHOOL ENROLLMENT DATA DEVELOPMENT

2000 Base Year School Enrollment

To obtain the 2000 base year enrollment data, the MPO staff used several sources, including the Oklahoma Department of Education, the Oklahoma State Department of Vocational and Technical Education, the Oklahoma State Regents for Higher Education, the National Center for Education Statistics, the Southwestern Bell Telephone Directory, various newspaper articles, and telephone surveys. The school enrollment data was projected for four different categories of education: public schools (pre-kindergarten through 12th grade), private schools (pre-kindergarten through 12th grade), vocational-technical schools, as well as universities and colleges.

2030 Forecast Year School Enrollment

The methodologies used to project school enrollment to the year 2030 were based on the relationship between population growth and school enrollment and a historical analysis of this relationship within each school district in the OCARTS area.

Year 2030 public school district projections were based upon the traffic analysis zone level ratio of established 2000 population and associated school enrollment figures. The enrollment figures were then re-aggregated to entity or school district level for comparison purposes with previous plan data. Figure 2.3 shows the OCARTS area school district boundaries as of 2000.

New school enrollments were included only if a known location of the school could be provided by the district. Comments from school district planning personnel were solicited and considered in the case of magnet or other specialty schools.

Projections for private and vocational-technical schools, as well as universities and colleges were developed using historical trend analysis of available enrollment data from 1990-2002. Also considered were planned changes or enrollment capacity identified by school administrators.

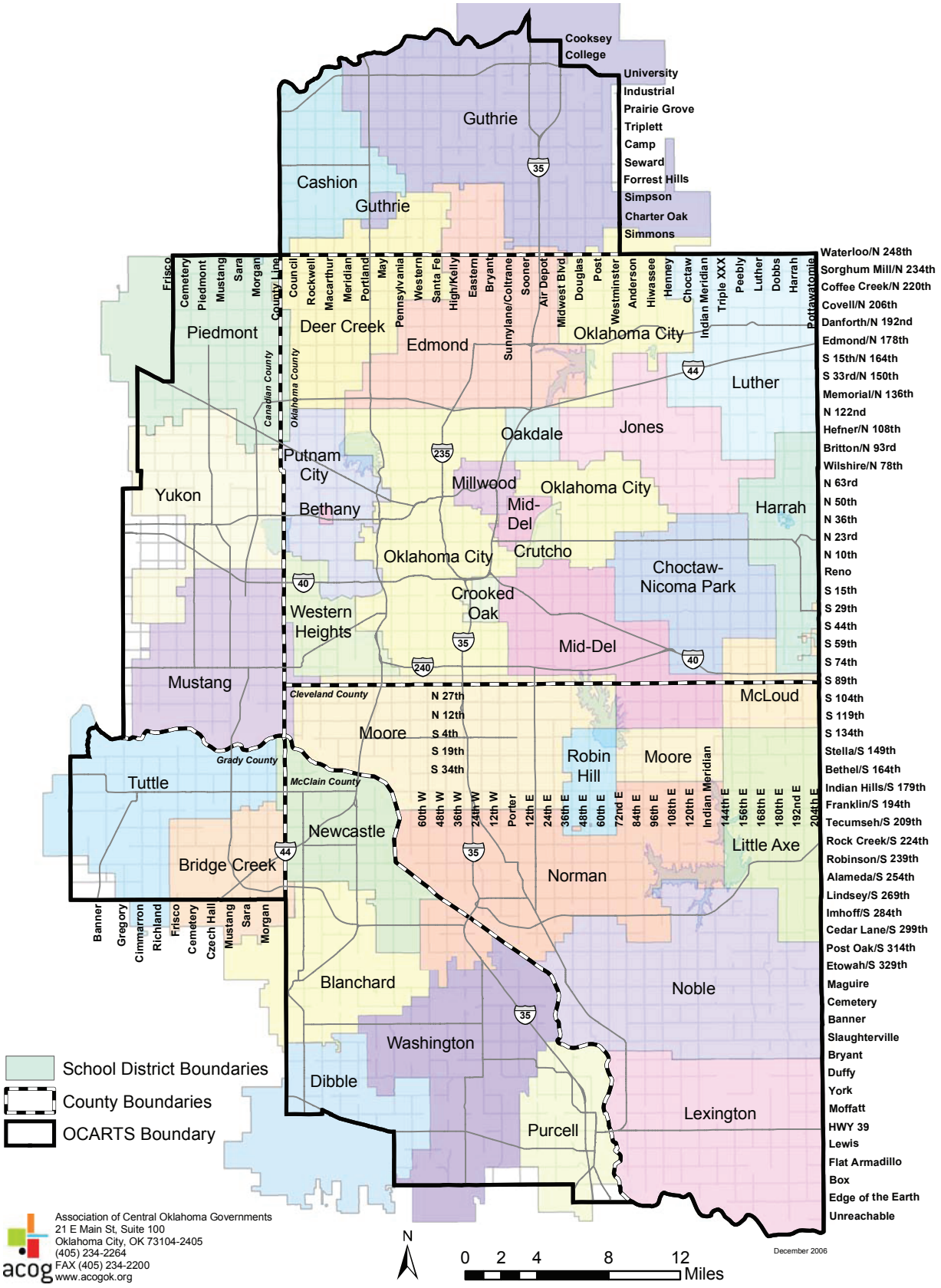
Generally, school enrollment is expected to increase in the OCARTS area at about the same rate as the population. As shown in Table 2.10, total school enrollment is estimated to increase 33.6 percent over the planning period from approximately 257,527 students in 2000 to more than 343,920 in 2030.

Table 2.10:
Base Year 2000 and Forecast Year 2030 School Enrollment by Entity

Entity	2000			2030		
	Public PK-12	Private PK-12	Other*	Public PK-12	Private PK-12	Other*
Bethany	3,737	31	2,283	4,247	45	3,371
Blanchard	1,322	0	0	2,549	0	0
Choctaw	3,367	0	650	5,506	0	670
Del City	4,655	1,030	0	5,408	1,672	0
Dibble	532	0	0	773	0	0
Edmond	13,953	2,157	13,989	22,754	2,912	15,491
Forest Park	146	0	0	170	0	0
Guthrie	3,108	123	0	4,525	223	0
Harrah	2,309	33	0	3,271	0	0
Jones	1,027	0	0	1,615	0	0
Lexington	1,022	0	0	1,309	0	0
Luther	768	0	0	1,208	0	0
Midwest City	9,443	432	7,905	11,015	581	10,194
Moore	9,487	541	309	14,453	780	423
Mustang	4,602	0	0	7,611	0	0
Newcastle	1,051	0	0	1,775	0	0
Nichols Hills	0	298	0	0	384	0
Nicoma Park	1,220	0	0	1,995	0	0
Noble	2,727	0	0	4,097	0	0
Norman	14,188	1,138	25,553	19,497	1,647	29,737
Oklahoma City	70,263	6,236	25,832	86,090	9,018	35,779
Piedmont	1,431	0	0	3,311	0	0
Purcell	1,327	0	0	2,133	0	0
Spencer	639	218	0	733	433	0
The Village	601	864	0	664	1,408	0
Tuttle	1,227	0	0	2,134	0	0
Warr Acres	3,647	0	0	4,195	0	0
Washington	673	0	0	1,071	0	0
Yukon	5,538	481	0	7,645	657	0
Grady Co.*	1,053	0	0	1,169	0	0
Oklahoma Co.*	1,503	0	0	4,619	0	0
OCARTS	**167,424**	**13,582**	**76,521**	**228,462**	**19,808**	**95,650**

Table reflects only those communities that have at least one school.
*Other – Colleges, Universities and Vocational-Technology Centers

Figure 2.3:
OCARTS Area School Districts



Map Disclaimer Applies. See the report Table of Contents
or http://www.acogok.org/mapdisclaimer.asp

GROWTH ALLOCATION MODEL

As previously mentioned, forecasting the spatial distribution of the region's future population and employment is accomplished by the OCARTS area Growth Allocation Model (GAM), which is a land use allocation model designed to place residential and employment growth based on historical trends and assumptions about future development in the region.

FUTURE RESIDENTIAL GROWTH ASSUMPTION

The GAM uses growth assumptions to determine the 'type' of population growth each zone should receive. Using the assumptions of future residential densities, dwelling unit mix, occupancy rates, household size, units lost, and group quarters growth, the GAM distributes the growth into the amount of group quarters population, as well as single and multi family growth for both population and number of dwelling units.

These underlying residential growth assumptions are discussed in greater detail in the following sections.

Single Family Density Assumptions

The 2030 single family residential density assumptions were created from an analysis of several sources of existing data. The resulting future density assumptions are as follows:

- **R** - Single Family Residential: Typical city residential densities of two to twelve residential units per acre; generally consisting of single family and duplex dwellings.
- **S** - Suburban Residential: Large lots, possibly on the periphery of a large city or the main-stay of a small, low density city with lots of one to four acres per dwelling unit (DU), i.e., 1 DU/Acres to 0.25 DU/Acre.
- **B** - Rural Residential: Small areas of agricultural land or large suburban lots of five to ten acres per dwelling unit, i.e., 0.2 DU/Acre to 0.1 DU/Acre.
- **A** - Agriculture/Farm: Generally large tracts of agricultural land with ten or more acres per dwelling unit, i.e., locations with less than 0.1 DU/Acres.

For the suburban residential (S), agriculture residential (B), and agriculture (A) residential density assumptions, the density producing the greatest amount of units in an acre, as described above, was used, i.e., 1.0 DU/Acre, 0.2 DU/Acre, and 0.1 DU/Acre respectively. These assumption values allowed the GAM to maximize potential development in these specific classes of future residential areas.

For single family residential (R) density assumptions, 2025 GAM density assumptions were used as the basis for 2030 assumptions. Known dwelling unit information from building permits on recent or future development was used to adjust the density assumptions to allow for the expected development. Additional density data was determined from zoning information, recent aerial photography, and parcel area records from the counties[7]. In addition, residential density assumptions from Norman[8], Oklahoma City[9], Mustang[10], and Guthrie comprehensive plans were also utilized wherever possible, in order to replicate the cities' plan information.

[7] County assessor Web sites for Oklahoma and Cleveland counties
[8] Norman land demand analysis footnote
[9] OKC comprehensive plan
[10] Mustang comprehensive plan

Due to the year 2000 expansion of the OCARTS area boundary, additional traffic districts in McClain and Cleveland Counties were added to the region. For these new districts where there were no 2025 Plan assumptions, an initial density value from a similar area was used.

Multi Family Density Assumption

Multi family developments consist of apartments, town homes and condominiums, and independent living centers:

- **M** - Multi Family Residential: Medium- to high-density residential areas, as defined by the land use classification, with thirteen or more units per acre.

Developments for institutional facilities (e.g., school/college/university dormitories, hospitals, nursing homes, and assisted living centers) are considered group quarters and were not considered in the multi family density analysis.

As with single family, the 2025 GAM multi family densities were used as the initial assumptions for traffic districts common to the 2025 and 2030 OCARTS geography; for new traffic districts in McClain and Cleveland Counties, an initial density value from a similar area was used.

Recent apartment and condominium complex additions, anticipated developments, and planned unit developments (PUDs), identified through building permits, various newspaper articles, and the Oklahoma City 2002 Apartment Report (CCRC - Multi Family Investment Services) were also used to adjust the initial assumptions.

Traffic District Assumptions

Table 2.11 provides the year 2000 present residential densities and the forecasted 2030 residential density assumptions. These assumptions were used by the GAM to guide the amount of dwelling units allocated to an area, given the amount and type of available land.

For the 2000 densities, the acreages used in the computations were the single family and multi family acres from the 2000 present land use categories. However, for the 2030 densities, the acreages used were a combination of the 2000 present residential land uses and the future 2030 available single family or multi family land use categories.

Table 2.11:
2000 Residential Densities and 2030 Density Assumptions
by Traffic District by Entity

TD	Entity	2000 Density Calculation		2030 Density Assumption				
		SF	MF	R (SF)	S (SF)	B (SF)	A (SF)	M (MF)
	OKLAHOMA COUNTY							
11	Oklahoma City	8.23	18.43	6.50	1.00	0.20	0.10	18.00
12	Oklahoma City	5.50	53.95	6.50	1.00	0.20	0.10	80.00
13	Oklahoma City	5.70	19.56	6.50	1.00	0.20	0.10	35.00
14	Oklahoma City	5.91	23.92	6.50	1.00	0.20	0.10	20.00
15	Oklahoma City	6.01	33.05	7.00	1.00	0.20	0.10	20.00
16	Oklahoma City	5.83	32.09	6.50	1.00	0.20	0.10	20.00
21	Oklahoma City	5.37	24.69	6.50	1.00	0.20	0.10	24.00
22	Oklahoma City	4.71	22.10	6.50	1.00	0.20	0.10	20.00
22	Oklahoma Co Uninc	8.73	0.00	6.50	1.00	0.20	0.10	18.00
22	Valley Brook	3.89	0.00	6.50	1.00	0.20	0.10	18.00
23	Oklahoma City	6.06	21.08	6.50	1.00	0.20	0.10	20.00
23	Oklahoma Co Uninc	0.00	0.00	6.50	1.00	0.20	0.10	18.00
24	Del City	0.00	0.00	6.50	1.00	0.20	0.10	8.20
24	Oklahoma City	5.67	15.18	6.50	1.00	0.20	0.10	18.00
25	Nichols Hills	1.93	20.51	4.00	1.00	0.20	0.10	8.20
25	Oklahoma City	5.28	22.23	6.50	1.00	0.20	0.10	22.00
25	Oklahoma Co Uninc	0.00	0.00	6.50	1.00	0.20	0.10	18.00
26	Nichols Hills	0.00	0.00	2.00	1.00	0.20	0.10	8.20
26	Oklahoma City	3.06	12.23	6.50	1.00	0.20	0.10	18.00
26	Oklahoma Co Uninc	0.00	0.00	6.50	1.00	0.20	0.10	18.00
31	Oklahoma City	2.54	19.98	6.50	1.00	0.20	0.10	22.00
32	Bethany	3.55	20.62	4.50	1.00	0.20	0.10	22.00
32	Oklahoma City	3.92	20.81	6.50	1.00	0.20	0.10	22.00
32	Warr Acres	3.24	15.62	4.50	1.00	0.20	0.10	20.00
32	Woodlawn Park	1.20	10.30	3.00	1.00	0.20	0.10	8.20
33	Oklahoma City	4.49	18.35	6.50	1.00	0.20	0.10	22.00
33	Warr Acres	0.00	0.00	4.50	1.00	0.20	0.10	20.00
34	Oklahoma City	4.11	16.31	8.00	1.00	0.20	0.10	18.00
34	Oklahoma Co Uninc	0.00	0.00	6.50	1.00	0.20	0.10	18.00
34	The Village	3.11	0.00	5.44	1.00	0.20	0.10	16.00
34	Warr Acres	0.00	0.00	4.50	1.00	0.20	0.10	20.00
35	Nichols Hills	1.94	0.00	2.40	1.00	0.20	0.10	8.20
35	Oklahoma City	4.54	21.61	8.00	1.00	0.20	0.10	22.00
35	Oklahoma Co Uninc	1.88	0.00	6.50	1.00	0.20	0.10	18.00
35	The Village	4.38	17.05	5.44	1.00	0.20	0.10	16.00
36	Oklahoma City	2.43	10.58	6.50	1.00	0.20	0.10	18.00
37	Oklahoma City	0.74	12.26	8.00	1.00	0.20	0.10	18.00
37	Oklahoma Co Uninc	0.27	0.00	6.50	1.00	0.20	0.10	18.00
38	Edmond	2.54	12.99	6.50	1.00	0.20	0.10	16.00

Table 2.11: (Cont.)
2000 Residential Densities and 2030 Density Assumptions
by Traffic District by Entity

TD	Entity	2000 Density Calculation		2030 Density Assumption				
		SF	MF	R (SF)	S (SF)	B (SF)	A (SF)	M (MF)
OKLAHOMA COUNTY (Cont.)								
38	Oklahoma City	3.08	17.39	8.00	1.00	0.20	0.10	18.00
38	Oklahoma Co Uninc	0.29	0.00	6.50	1.00	0.20	0.10	18.00
39	Edmond	1.65	11.69	6.50	1.00	0.20	0.10	16.00
39	Oklahoma City	1.37	26.04	6.50	1.00	0.20	0.10	28.00
39	Oklahoma Co Uninc	1.00	0.00	6.50	1.00	0.20	0.10	18.00
41	Choctaw	0.55	0.00	5.44	1.00	0.20	0.10	8.20
41	Harrah	0.33	0.00	4.00	1.00	0.20	0.10	8.20
41	Midwest City	1.52*	0.00	6.50	1.00	0.20	0.10	12.00
41	Oklahoma City	0.89	10.78	6.50	1.00	0.20	0.10	18.00
41	Oklahoma Co Uninc	0.35	0.00	6.50	1.00	0.20	0.10	18.00
42	Del City	3.59	17.99	6.50	1.00	0.20	0.10	20.00
42	Forest Park	0.53	0.00	1.00	1.00	0.20	0.10	8.20
42	Lake Aluma	0.48	0.00	2.00	1.00	0.20	0.10	8.20
42	Oklahoma City	1.64	13.37	6.50	1.00	0.20	0.10	18.00
42	Oklahoma Co Uninc	0.40	0.00	6.50	1.00	0.20	0.10	18.00
42	Smith Village	1.17	0.00	4.00	1.00	0.20	0.10	8.20
43	Midwest City	3.20	19.31	6.50	1.00	0.20	0.10	22.00
43	Oklahoma City	0.00	0.00	6.50	1.00	0.20	0.10	18.00
43	Oklahoma Co Uninc	1.06	0.00	6.50	1.00	0.20	0.10	18.00
43	Spencer	1.27	0.00	5.94	1.00	0.20	0.10	8.20
44	Choctaw	0.68	0.00	5.44	1.00	0.20	0.10	8.20
44	Midwest City	1.25	20.65	6.50	1.00	0.20	0.10	22.00
44	Nicoma Park	0.98	0.00	3.60	1.00	0.20	0.10	8.20
44	Oklahoma City	0.75	0.00	6.50	1.00	0.20	0.10	18.00
44	Oklahoma Co Uninc	0.53	0.00	6.50	1.00	0.20	0.10	18.00
44	Spencer	1.39	0.00	5.94	1.00	0.20	0.10	8.20
45	Choctaw	0.32	0.00	5.44	1.00	0.20	0.10	8.20
45	Jones	0.64	9.02	4.00	1.00	0.20	0.10	8.20
45	Midwest City	2.77	0.00	6.50	1.00	0.20	0.10	12.00
45	Oklahoma City	0.43	7.91	6.50	1.00	0.20	0.10	18.00
45	Oklahoma Co Uninc	0.34	0.00	6.50	1.00	0.20	0.10	18.00
45	Spencer	0.93	0.00	5.94	1.00	0.20	0.10	8.20
46	Choctaw	0.52	13.39	5.44	1.00	0.20	0.10	8.20
46	Harrah	0.69	10.62	4.00	1.00	0.20	0.10	12.00
46	Luther	0.24	0.00	4.00	1.00	0.20	0.10	8.20
46	Oklahoma City	0.19	0.00	6.50	1.00	0.20	0.10	18.00
46	Oklahoma Co Uninc	0.27	0.00	6.50	1.00	0.20	0.10	18.00
47	Arcadia	0.72	0.00	4.00	1.00	0.20	0.10	8.20

*Based on the 1995 SF density calculation.

Table 2.11: (Cont.)
2000 Residential Densities and 2030 Density Assumptions
by Traffic District by Entity

TD	Entity	2000 Density Calculation		2030 Density Assumption				
		SF	MF	R (SF)	S (SF)	B (SF)	A (SF)	M (MF)
OKLAHOMA COUNTY (Cont.)								
47	Edmond	0.26	0.00	6.50	1.00	0.20	0.10	11.00
47	Luther	0.97	0.00	4.00	1.00	0.20	0.10	8.20
47	Oklahoma City	0.32	0.00	6.50	1.00	0.20	0.10	18.00
47	Oklahoma Co Uninc	0.25	0.00	6.50	1.00	0.20	0.10	18.00
50	Cleveland Co Uninc	0.00	0.00	4.00	1.00	0.20	0.10	8.20
50	Moore	5.25	16.15	5.50	1.00	0.20	0.10	9.20
50	Oklahoma City	2.57	17.10	6.50	1.00	0.20	0.10	22.00
51	Cleveland Co Uninc	0.00	0.00	4.00	1.00	0.20	0.10	8.20
51	Norman	4.71	15.77	5.00	1.00	0.20	0.10	18.00
52	Hall Park	2.56	0.00	4.61	1.00	0.20	0.10	8.20
52	Norman	5.15	16.29	5.00	1.00	0.20	0.10	18.00
53	Norman	4.46	20.36	5.00	1.00	0.20	0.10	22.00
54	Hall Park	2.01	0.00	4.61	1.00	0.20	0.10	8.20
54	Norman	0.65	14.18	5.00	1.00	0.20	0.10	18.00
55	Cleveland Co Uninc	0.29	0.00	4.00	1.00	0.20	0.10	8.20
55	Norman	1.80	18.77	5.00	1.00	0.20	0.10	18.00
55	Oklahoma City	0.00	0.00	6.50	1.00	0.20	0.10	8.20
56	Cleveland Co Uninc	0.26	0.00	4.00	1.00	0.20	0.10	8.20
56	Moore	0.37	0.00	4.00	1.00	0.20	0.10	8.20
56	Norman	0.20	0.00	5.00	1.00	0.20	0.10	8.20
56	Oklahoma City	0.22	0.00	6.50	1.00	0.20	0.10	18.00
57	Cleveland Co Uninc	1.81	0.00	4.00	1.00	0.20	0.10	8.20
57	Moore	3.04	14.96	4.00	1.00	0.20	0.10	20.00
57	Norman	2.33	0.00	5.00	1.00	0.20	0.10	8.20
57	Oklahoma City	0.75	16.27	6.50	1.00	0.20	0.10	20.00
58	Cleveland Co Uninc	0.00	0.00	4.00	1.00	0.20	0.10	8.20
58	Oklahoma City	0.21	0.00	6.50	1.00	0.20	0.10	18.00
59	Cleveland Co Uninc	0.28	0.00	4.00	1.00	0.20	0.10	8.20
70	Cleveland Co Uninc	0.48	0.00	4.00	1.00	0.20	0.10	8.20
70	Noble	1.10	9.70	4.00	1.00	0.20	0.10	18.00
71	Cleveland Co Uninc	0.27	0.00	4.00	1.00	0.20	0.10	8.20
71	Lexington	2.02	13.54	6.50	1.00	0.20	0.10	18.00
71	Noble	0.20	0.00	4.00	1.00	0.20	0.10	8.20
71	Purcell	0.00	0.00	4.00	1.00	0.20	0.10	8.20
71	Slaughterville	0.29	0.00	4.00	1.00	0.20	0.10	8.20
72	Cleveland Co Uninc	0.15	0.00	4.00	1.00	0.20	0.10	8.20
72	Etowah	0.12	0.00	4.00	1.00	0.20	0.10	8.20
72	Norman	1.33	0.00	5.00	1.00	0.20	0.10	8.20
72	Slaughterville	0.25	0.00	4.00	1.00	0.20	0.10	8.20

Table 2.11: (Cont.)
2000 Residential Densities and 2030 Density Assumptions
by Traffic District by Entity

TD	Entity	2000 Density Calculation		2030 Density Assumption				
		SF	MF	R (SF)	S (SF)	B (SF)	A (SF)	M (MF)
	CANADIAN COUNTY							
61	Canadian Co Uninc	2.55	0.00	4.00	1.00	0.20	0.10	8.20
61	Mustang	1.29	12.86	5.94	1.00	0.20	0.10	20.00
61	Oklahoma City	0.24	0.00	6.50	1.00	0.20	0.10	18.00
61	Yukon	1.74	15.94	4.00	1.00	0.20	0.10	16.00
62	Oklahoma City	2.24	17.90	6.50	1.00	0.20	0.10	18.00
62	Yukon	3.19	19.37	4.00	1.00	0.20	0.10	18.00
63	Canadian Co Uninc	0.62	0.00	4.00	1.00	0.20	0.10	8.20
63	Oklahoma City	0.62	1.33	6.50	1.00	0.20	0.10	18.00
63	Piedmont	0.66	0.00	3.92	1.00	0.20	0.10	8.20
63	Yukon	0.20	0.00	4.00	1.00	0.20	0.10	8.20
64	Canadian Co Uninc	0.28	0.00	4.00	1.00	0.20	0.10	8.20
64	Piedmont	0.37	0.00	3.92	1.00	0.20	0.10	8.20
	GRADY COUNTY							
65	Blanchard	0.32	0.00	4.00	1.00	0.20	0.10	8.20
65	Grady Co Uninc	0.24	0.00	4.00	1.00	0.20	0.10	8.20
65	Tuttle	0.59	6.92	4.00	1.00	0.20	0.10	8.20
	McCLAIN COUNTY							
66	McClain Co Uninc	0.29	0.00	4.00	1.00	0.20	0.10	8.20
66	Newcastle	0.30	5.46	4.00	1.00	0.20	0.10	8.20
67	Blanchard	0.67	3.89	4.00	1.00	0.20	0.10	18.00
67	Cole	0.49	0.00	4.00	1.00	0.20	0.10	8.20
67	Dibble	0.83	0.00	4.00	1.00	0.20	0.10	8.20
67	Goldsby	0.35	0.00	4.00	1.00	0.20	0.10	8.20
67	McClain Co Uninc	0.31	15.67	4.00	1.00	0.20	0.10	8.20
67	Newcastle	0.36	0.00	4.00	1.00	0.20	0.10	8.20
67	Washington	1.57	0.00	4.00	1.00	0.20	0.10	8.20
68	Goldsby	0.55	0.00	4.00	1.00	0.20	0.10	8.20
68	McClain Co Uninc	0.37	0.00	4.00	1.00	0.20	0.10	8.20
68	Purcell	1.81	21.10	4.00	1.00	0.20	0.10	20.00
68	Washington	0.71	0.00	4.00	1.00	0.20	0.10	8.20
	LOGAN COUNTY							
81	Cashion	0.27	0.00	4.00	1.00	0.20	0.10	8.20
81	Cedar Valley	0.93	0.00	3.00	1.00	0.20	0.10	8.20
81	Cimarron City	0.00	0.00	4.00	1.00	0.20	0.10	8.20
81	Guthrie	0.00	0.00	6.50	1.00	0.20	0.10	8.20
81	Logan Co Uninc	0.36	0.00	4.00	1.00	0.20	0.10	8.20
82	Guthrie	1.36	10.33	6.50	1.00	0.20	0.10	18.00
82	Logan Co Uninc	0.33	0.00	4.00	1.00	0.20	0.10	8.20
83	Guthrie	0.07	0.00	6.50	1.00	0.20	0.10	8.20
83	Logan Co Uninc	0.27	0.00	4.00	1.00	0.20	0.10	8.20

PERCENT SINGLE FAMILY AND MULTI FAMILY DWELLING UNITS ASSUMPTION

The GAM requires information concerning the percentages of single and multi family dwelling units in comparison to total dwelling units for each traffic district in the OCARTS area. This ratio is also referred to as single family/multi family housing unit mix (SF/MF Mix). The 2030 SF/MF Mix was used to guide the division of the total household (non-group quarters) population and dwelling units into either the single or multi family classification.

The SF/MF Mix was developed from an analysis of 1980, 1990, and 2000 census tract housing unit data reported in the census summary file 3 (SF-3). Using the census data, historical trends were computed, and from this trend, an initial 2010 assumption was developed, keeping the rate of change within ±2.5%, since past trend changes have tended to be within that range. Recent and anticipated developments, especially in downtown Oklahoma City (e.g., Bricktown, Deep Deuce), were incorporated as adjustments to the initial assumption. As needed, further modifications were made to reflect the overall character and development potential of each traffic district. The resulting 2010 SF/MF Mix assumptions were carried forward to represent the initial 2030 assumptions.

Traffic District Assumptions

Table 2.12 lists the 2030 single and multi family percent of total dwelling unit assumptions. These assumptions were used by the GAM to guide the population allocation to each traffic district, given the amount and type of available land. Also considered were additional local government comments and data, which helped determine the final single and multi family population and dwelling unit allocations, as detailed below.

Traffic Analysis Zone Assumptions

Certain final percentages shown in Table 2.12 have been re-aggregated from the traffic analysis zone (TAZ) to the traffic district level of geography to account for zonal fluctuations within the districts. The GAM was allowed to deviate from the initial district assumptions, where TAZ level SF/MF Mix information, provided by cities or through building permit data, produced a significantly different mix than the district assumptions.

Additionally, although a district's initial assumption (based on historical trends), showed no multi family units, local review and/or local data may have prompted the final assumptions to reflect some future percentage of multi family units.

Table 2.12:
2000 Single and Multi Family
Percentage of Total Dwelling Units and 2030 Assumption

TD	Single Family Percent of Total Dwelling Units			Multi Family Percent of Total Dwelling Units		
	2000 Census	Initial 2030	Final 2030	2000 Census	Initial 2030	Final 2030
OKLAHOMA COUNTY						
11	85.9	86.7	**85.9**	14.1	13.3	**14.1**
12	5.4	3.7	**3.4**	94.6	96.3	**96.6**
13	65.1	45.0	**62.6**	34.9	55.0	**37.4**
14	66.7	65.0	**65.2**	33.3	35.0	**34.8**
15	53.9	54.7	**53.9**	46.1	45.3	**46.1**
16	81.5	82.6	**81.5**	18.5	17.4	**18.5**
21	75.3	73.6	**75.8**	24.7	26.4	**24.2**
22	73.7	74.3	**74.7**	26.3	25.7	**25.3**
23	86.3	86.2	**85.8**	13.7	13.8	**14.2**
24	83.6	83.5	**83.6**	16.4	16.5	**16.4**
25	72.7	73.1	**72.7**	27.3	26.9	**27.3**
26	92.2	91.4	**94.7**	7.8	8.6	**5.3**
31	67.3	70.6	**69.8**	32.7	29.4	**30.2**
32	63.5	64.7	**64.6**	36.5	35.3	**35.5**
33	75.3	74.9	**77.8**	24.7	25.1	**22.2**
34	67.5	71.6	**67.5**	32.5	28.4	**32.5**
35	58.2	57.6	**60.7**	41.8	42.4	**39.3**
36	79.4	81.7	**80.9**	20.6	18.3	**19.1**
37	73.2	84.5	**73.2**	26.8	15.5	**26.8**
38	86.3	84.4	**88.8**	13.7	15.6	**11.2**
39	80.7	79.9	**83.2**	19.3	20.1	**16.8**
41	88.3	92.2	**89.8**	11.7	7.8	**10.2**
42	85.3	87.2	**87.8**	14.7	12.8	**12.2**
43	79.7	78.9	**81.2**	20.3	21.1	**18.9**
44	99.7	99.5	**99.7**	0.3	0.5	**0.3**
45	97.9	98.4	**98.9**	2.1	1.6	**1.2**
46	94.3	95.4	**94.3**	5.7	4.6	**5.7**
47	100.0	100.0	**99.0**	0.0	0.0	**1.0**

Table 2.12: (Cont.)
2000 Single and Multi Family
Percentage of Total Dwelling Units and 2030 Assumption

TD	Single Family Percent of Total Dwelling Units			Multi Family Percent of Total Dwelling Units		
	2000 Census	Initial 2030	Final 2030	2000 Census	Initial 2030	Final 2030
CLEVELAND COUNTY						
50	83.7	84.9	**86.2**	16.3	15.1	**13.8**
51	30.0	38.3	**31.5**	70.0	61.7	**68.5**
52	65.4	63.6	**67.9**	34.6	36.4	**32.1**
53	72.8	73.0	**75.3**	27.2	27.0	**24.7**
54	83.9	91.5	**83.9**	16.1	8.5	**16.1**
55	88.4	88.5	**90.9**	11.6	11.5	**9.1**
56	100.0	100.0	**99.0**	0.0	0.0	**1.0**
57	90.0	87.9	**92.5**	10.0	12.1	**7.5**
58	100.0	100.0	**99.0**	0.0	0.0	**1.0**
59	100.0	100.0	**99.0**	0.0	0.0	**1.0**
70	92.8	93.0	**93.3**	7.2	7.0	**6.7**
71	98.3	97.4	**98.3**	1.7	2.6	**1.7**
72	100.0	100.0	**99.0**	0.0	0.0	**1.0**
CANADIAN COUNTY						
61	91.7	90.7	**91.7**	8.3	9.3	**8.3**
62	90.3	86.8	**91.8**	9.7	13.2	**8.2**
63	99.8	97.4	**99.8**	0.2	2.6	**0.2**
64	100.0	100.0	**99.0**	0.0	0.0	**1.0**
65	98.5	98.9	**98.5**	1.5	1.1	**1.5**
McCLAIN COUNTY						
66	97.1	96.0	**97.1**	2.9	4.0	**2.9**
67	98.8	98.3	**98.8**	1.2	1.7	**1.2**
68	95.5	96.1	**95.5**	4.5	3.9	**4.5**
LOGAN COUNTY						
81	100.0	100.0	**99.0**	0.0	0.0	**1.0**
82	95.3	93.5	**95.3**	4.7	6.5	**4.7**
83	100.0	100.0	**99.0**	0.0	0.0	**1.0**

DWELLING UNIT OCCUPANCY RATE ASSUMPTION

In order to allow the GAM to properly allocate population growth in the OCARTS area, occupancy rates of single and multi family dwelling units within each traffic district are required. The 2000 Census Summary File (SF 1B) was used to provide the base year occupancy rates. As with other assumptions, the Census data was brought into ArcView software and aggregated to align with the 2000 OCARTS traffic district geography.

The data was separated into single family and multi family categories using the OCARTS area land use definitions. The occupancy rate was then calculated by dividing the total number of units by the number of occupied units for each category, both single family and multi family, resulting in certain traffic districts having multi family occupancy rates of 100%. This was due to small numbers of units and is generally considered not sustainable.

1980, 1990, and 2000 Census data, as well as 1995 data, which was developed for the previous 2025 OCARTS Plan, were used as the base for the development of the 2030 occupancy rates. Both single family and multi family units showed lower occupancy rates in 1990 and 1995 than they did in 1980 or 2000. Also of interest was that the 1995 occupancy rates largely maintained 1990 Census year levels.

Linear regression analysis was used to predict the initial 2010 figures. These 2010 regression figures were really quite random based on the inconsistent trend in occupancy between 1980 and 2000. It was assumed that the 2010 occupancy rates would be held constant for 2030.

After review and comment from member entities, some adjustments were made to the initial regression trends. Specifically, the Oklahoma City (OKC) Planning Department staff suggested that rates in downtown OKC, (i.e. traffic districts 11-16) should remain at 2000 Census levels. Using the 2000 rates would reflect Oklahoma City's renewed interest in increasing residential development in downtown. Additional downtown multi family development, required higher occupancy rates than have been recorded in the past, i.e., five percent increase over year 2000 rates. Other OKC suggestions included lowering the 2030 occupancy rates for older urban traffic districts to three percent less than the rates recorded in the 2000 Census.

Traffic District Calculation

Several rural traffic districts (TD) historically have not contained multi family units. In those cases where a 2000 Census multi family occupancy rate could not be calculated, the occupancy rate from the rural OKC TD 46 was used as a reference, i.e., occupancy rate of 91.5%. Additionally, during a final review, several occupancy rates were lowered from the regression trend forecasts back to the 2000 Census occupancy rates.

It is also important to note that the occupancy rate includes zonal variations that the GAM applied to the TD level occupancy rate assumptions during the model execution. Table 2.13 provides the 2000 occupancy rates as derived from the 2000 Census data and the final 2030 occupancy rate assumptions used by the GAM.

Table 2.13:
2030 Single and Multi Family
Occupancy Rate Assumptions by Traffic District

TD 2000	Single family Occupancy Rate			Multi family Occupancy Rate		
	2000 Census	Initial 2030	Final 2030	2000 Census	Initial 2030	Final 2030
OKLAHOMA COUNTY						
11	77.05%	76.99%	**77.05%**	77.27%	81.76%	**82.27%**
12	64.41%	64.04%	**56.25%**	81.07%	86.56%	**87.06%**
13	79.82%	71.39%	**80.67%**	65.03%	64.44%	**66.59%**
14	81.91%	81.82%	**81.91%**	68.13%	76.21%	**73.13%**
15	87.04%	87.69%	**86.72%**	78.15%	81.31%	**83.64%**
16	81.49%	81.42%	**81.49%**	67.53%	70.78%	**72.53%**
21	95.93%	94.66%	**92.93%**	89.39%	90.38%	**86.39%**
22	89.81%	87.76%	**86.81%**	85.50%	84.34%	**82.50%**
23	87.95%	87.27%	**84.98%**	74.69%	73.62%	**71.51%**
24	84.87%	81.38%	**81.28%**	81.41%	78.37%	**81.40%**
25	92.27%	90.49%	**89.35%**	81.60%	80.43%	**78.36%**
26	90.07%	87.93%	**86.71%**	57.21%	61.52%	**53.94%**
31	85.02%	79.01%	**79.96%**	84.13%	83.15%	**81.13%**
32	94.02%	93.06%	**92.97%**	83.30%	83.45%	**83.47%**
33	97.69%	95.54%	**94.69%**	90.22%	89.15%	**87.22%**
34	98.02%	96.25%	**95.02%**	83.24%	80.19%	**80.24%**
35	94.56%	93.10%	**91.56%**	86.15%	86.39%	**86.15%**
36	92.74%	89.44%	**89.74%**	70.87%	76.53%	**67.87%**
37	91.86%	88.92%	**90.95%**	84.62%	86.32%	**84.39%**
38	96.42%	95.89%	**96.34%**	90.29%	91.15%	**90.29%**
39	96.18%	95.80%	**96.34%**	91.55%	92.00%	**91.62%**
41	91.84%	90.67%	**91.31%**	86.21%	86.38%	**86.21%**
42	93.40%	93.45%	**93.40%**	87.30%	87.20%	**87.30%**
43	93.22%	93.10%	**93.22%**	89.79%	89.57%	**89.79%**
44	93.67%	93.69%	**93.67%**	86.96%	87.10%	**86.96%**
45	89.40%	87.16%	**86.40%**	72.55%	74.63%	**69.55%**
46	93.51%	93.65%	**93.06%**	91.50%	91.40%	**91.50%**

Table 2.13: (Cont.)
2030 Single and Multi Family
Occupancy Rate Assumptions by Traffic District

TD 2000	Single Family Occupancy Rate			Multi Family Occupancy Rate		
	2000 Census	Initial 2030	Final 2030	2000 Census	Initial 2030	Final 2030
CLEVELAND COUNTY						
47	88.87%	89.62%	**88.87%**	N/A	N/A	**91.50%**
50	97.24%	96.95%	**97.24%**	82.90%	88.68%	**82.91%**
51	94.66%	95.19%	**94.66%**	92.25%	90.31%	**92.25%**
52	94.63%	94.74%	**94.52%**	91.38%	91.11%	**91.37%**
53	94.43%	94.32%	**94.43%**	89.31%	88.93%	**89.31%**
54	96.99%	94.21%	**96.03%**	72.30%	72.00%	**72.30%**
55	97.14%	96.12%	**97.14%**	87.55%	88.80%	**87.55%**
56	94.29%	94.40%	**94.29%**	N/A	N/A	**91.50%**
57	93.94%	94.46%	**94.25%**	76.86%	83.93%	**82.91%**
58	93.47%	89.20%	**90.47%**	N/A	N/A	**97.00%**
59	89.74%	88.83%	**88.93%**	N/A	N/A	**91.50%**
70	92.71%	92.80%	**92.91%**	77.58%	77.10%	**75.72%**
71	92.03%	91.93%	**92.03%**	61.90%	61.90%	**61.90%**
72	87.87%	87.67%	**87.87%**	N/A	N/A	**91.50%**
CANADIAN COUNTY						
61	96.48%	95.72%	**95.36%**	86.19%	83.85%	**86.19%**
62	95.95%	95.60%	**96.82%**	91.25%	90.81%	**91.25%**
63	96.72%	93.50%	**94.97%**	100.00%	100.00%	**91.50%**
64	96.95%	97.02%	**96.95%**	N/A	N/A	**91.50%**
GRADY COUNTY						
65	95.80%	95.96%	**95.80%**	94.92%	95.38%	**94.92%**
McCLAIN COUNTY						
66	95.48%	95.77%	**95.48%**	92.45%	91.94%	**92.45%**
67	93.54%	93.73%	**93.54%**	90.91%	90.99%	**90.91%**
68	90.75%	91.18%	**90.75%**	90.91%	91.04%	**90.91%**
LOGAN COUNTY						
81	94.47%	94.25%	**94.47%**	N/A	N/A	**91.50%**
82	91.00%	91.40%	**91.00%**	83.05%	80.61%	**83.05%**
83	87.41%	87.66%	**87.04%**	N/A	N/A	**91.50%**

HOUSEHOLD SIZE ASSUMPTION

Another parameter required by the GAM to determine the allocation of the forecasted population and dwelling units is the assumption of household (HH) size (persons per dwelling unit).

In the 2030 GAM, the HH population was the primary forecast parameter. Given the HH population forecast, the GAM was able to approximate the dwelling units by applying the HH size assumption to the population. In previous plans, where the dwelling units were the primary forecast parameter, the household size was used to derive the forecasted household population.

Census data research showed a historical decline in the national average HH size from 3.35 to 2.59 persons per HH from 1960 to 2000 respectively. The State of Oklahoma recorded a decline in HH size from 3.10 in 1970, to 2.49 in 2000. This decline can be attributed to several factors including a decrease in family size and an increase in one-person households.

Following these trends, the average OCARTS area household size also continues to decline. Several factors such as ethnicity, aging population, and urban versus rural residences are expected to have varying influences on the rate of this decline through the 2030 forecast year:

Ethnic groups are more likely to form traditional married-with-children families, resulting in larger HH sizes. An analysis from OKC emphasized the importance of taking into account the spatial diversity in population and household profiles.

It also needs to be considered that a large segment of the population (baby boomers) will retire within the 2030 Plan horizon. The increase in the percentage of older persons and related mortality rates will continue to influence smaller household sizes.

Furthermore, since suburban/rural residences generally have more persons living in the same household, the difference in household sizes should also be taken into account when analyzing urban and suburban/rural areas.

Based on in-depth analysis, the influence of factors pointing to smaller households was assumed to be balanced by the increasing ethnic populations migrating to the OCARTS area, and the larger households they typically represent. Therefore, the household size was determined by examining the historical trend between household sizes from the 1980, 1990[11], and the 2000[12] Census[13]. Through linear regression, an initial household size trend for each traffic district (TD) was computed to the year 2010, which was assumed to stay constant through the year 2030. The trends were then modified to keep the rate of change within a range of +/- 10% from the year 2000. Upon further review, the average percentage of minority population and the SF/MF DU mix within each TD were also used to modify the assumed household size.

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[11] FYE 1993 UPWP Report - Task 1.01, Subtask 1 (Part 2), 1*990 Growth Allocation Model (GAM), Growth Assumptions and Population Base File – Persons per Household*, ACOG, March 1993.

[12] 2000 Census Tract data was aggregated to the OCARTS area traffic district geography.

[13] Pre-2000 Census data does not provide a breakdown of household size by single family or multi family dwelling units. The breakdown offered is by Renter or Owner occupied units. New in the 2000 Census was the breakdown of Population by Tenure (renter or owner-occupied) by units in structure (1 unit detached, 1 unit attached, 2 units, 3-4 units, etc.), which allowed for the calculation of Household Size by occupied SF/MF Dwelling Unit. In this way, SF/MF household size was compiled by county, census tract, and block group. (Note: There are differences between the SF-1 100% data and the SF3 sample data, which created some data equivalency problems.)

Traffic District Assumption

Table 2.14 provides the final 2030 HH size assumption for each TD as used by the GAM in determining the population and dwelling unit growth allocation. Also included in the table are the 2000 census and the initial 2030 trend.

Table 2.14:
2030 Single and Multi Family Household Size Assumptions by Traffic District

TD	Single Family Household Size			Multi Family Household Size		
	2000 Census	Initial 2030	Final 2030	2000 Census	Initial 2030	Final 2030
OKLAHOMA COUNTY						
11	3.18	3.22	**3.28**	2.13	2.45	**2.18**
12	2.42	2.14	**2.52**	1.34	1.73	**1.39**
13	2.61	2.36	**2.61**	2.36	2.35	**2.36**
14	2.40	2.34	**2.25**	2.02	1.94	**1.87**
15	2.36	2.62	**2.28**	1.26	1.30	**1.26**
16	2.29	2.20	**2.14**	1.57	1.55	**1.62**
21	2.51	2.53	**2.51**	1.88	1.83	**1.82**
22	2.45	2.45	**2.45**	1.89	1.85	**1.78**
23	2.58	2.59	**2.58**	2.33	2.37	**2.38**
24	2.83	2.92	**2.93**	2.19	2.22	**2.24**
25	2.20	2.22	**2.19**	1.61	1.65	**1.61**
26	2.33	2.22	**2.18**	2.22	1.76	**2.13**
31	2.63	2.60	**2.63**	2.11	2.07	**1.96**
32	2.54	2.55	**2.54**	2.01	2.00	**2.01**
33	2.77	2.83	**2.76**	1.66	1.84	**1.71**
34	2.28	2.32	**2.26**	1.50	1.56	**1.50**
35	2.31	2.34	**2.30**	1.73	1.81	**1.73**
36	2.79	2.70	**2.76**	1.64	1.49	**1.49**
37	2.98	2.73	**2.95**	1.65	1.53	**1.65**
38	2.83	2.87	**2.83**	1.63	1.64	**1.62**
39	2.73	2.74	**2.70**	1.90	1.94	**1.90**
41	2.84	2.68	**2.73**	2.50	2.54	**2.50**
42	2.51	2.45	**2.43**	1.97	1.95	**1.82**
43	2.51	2.49	**2.46**	1.86	1.84	**1.79**
44	2.69	2.64	**2.63**	4.00	3.56	**3.90**
45	2.63	2.51	**2.52**	1.96	1.82	**1.81**
46	2.72	2.56	**2.58**	2.41	2.49	**2.46**
47	2.66	2.54	**2.61**	N/A	N/A	**2.46**

Table 2.14: (Cont.)
2030 Single and Multi Family Household Size Assumptions by Traffic District

TD	Single Family Household Size			Multi Family Household Size		
	2000 Census	Initial 2030	Final 2030	2000 Census	Initial 2030	Final 2030
CLEVELAND COUNTY						
50	2.77	2.76	**2.75**	1.65	1.65	**1.60**
51	2.52	2.68	**2.62**	1.86	1.88	**1.86**
52	2.43	2.36	**2.37**	1.93	1.88	**1.91**
53	2.35	2.32	**2.34**	1.63	1.62	**1.63**
54	2.74	2.66	**2.67**	2.10	1.95	**1.97**
55	2.81	2.69	**2.73**	1.61	1.61	**1.61**
56	2.81	2.74	**2.76**	N/A	N/A	**2.90**
57	2.81	2.71	**2.79**	1.88	1.56	**1.88**
58	2.58	2.43	**2.48**	N/A	N/A	**2.90**
59	2.80	2.75	**2.73**	N/A	N/A	**2.90**
70	2.66	2.53	**2.60**	2.09	2.02	**2.00**
71	2.71	2.72	**2.71**	1.54	2.00	**1.54**
72	2.82	2.82	**2.82**	N/A	N/A	**1.54**
CANADIAN COUNTY						
61	2.82	2.75	**2.74**	2.00	1.98	**2.00**
62	2.83	2.78	**2.78**	1.82	1.82	**1.82**
63	2.78	2.68	**2.78**	2.80	2.78	**2.80**
64	2.96	2.95	**2.94**	N/A	N/A	**2.00**
GRADY COUNTY						
65	2.83	2.79	**2.83**	2.02	1.97	**1.95**
McCLAIN COUNTY						
66	2.75	2.75	**2.75**	1.82	1.88	**1.82**
67	2.74	2.74	**2.74**	1.60	1.61	**1.60**
68	2.59	2.60	**2.59**	2.36	2.37	**2.36**
LOGAN COUNTY						
81	2.85	2.78	**2.82**	N/A	N/A	**1.90**
82	2.55	2.57	**2.52**	1.80	1.65	**1.65**
83	2.61	2.54	**2.53**	N/A	N/A	**3.00**

DWELLING UNITS LOST ASSUMPTION

The GAM must determine not only the number of residential dwelling units (DUs) that will be gained through population growth, but also the number of houses that will be lost to; for example, fire or demolition, between the base and forecast year.

The OCARTS dwelling units lost assumption by traffic district (TD) was based on the housing losses recorded in historical census data and on data provided by local entities.

The initial dwelling units lost assumption was developed by correlating historical census data with demolition permit data obtained from Oklahoma City. The Oklahoma City (OKC) Planning Department staff indicated that approximately 800 residential dwelling units were lost per year within the OKC limits. In light of the yearly loss suggestion by OKC staff, the number of demolition permits was multiplied by three to arrive at the 800 dwelling units lost per year. This assumed that only every third residential demolition had received a permit.

Using the factored OKC demolition permits, demolitions were compared to the total dwelling units in the respective TD. From this comparison a ratio of "units lost per year, per 100 dwelling units" was established. In instances where the traffic districts contained other entities *and* OKC, the DU lost ratios based on OKC demolition permits were extrapolated to account for the entire TD area.

The demolition and building permit data was also used to determine any adjustments to the housing stock, such as units rebuilt after tornadoes in the OCARTS area. Care was taken to remove those units demolished due to the SE 29th Street redevelopment in Midwest City, and the I-40 relocation in Oklahoma City, so that the losses experienced in these areas would not impact the ratio of the surrounding residential areas.

Traffic District Assumption

In previous OCARTS plans, the methodology to determine the dwelling unit loss percentage was based on using building and demolition permit data, in coordination with historical Census data. However, past assumptions did not account for contributing facts such as median value of housing stock, median age, vacancy rates, and vacancy rate changes, etc.

For the 2030 OCARTS Plan, dwelling unit information by traffic district for the years 1980, 1990, and 2000 was analyzed[14]. The total dwelling units, change in dwelling units, vacancy rates, and change in vacancy rates over time were compiled and analyzed. In addition, tables of the 2000 median value (monetary) of housing units, the average decade of dwelling units construction, and median age of dwelling units were prepared for each district. Each TD variable was compared to its county average.

An algorithm and classification scheme was derived combining the historical census data (1980, 1990, 2000) for the total dwelling unit change, the total vacancy rate, the vacancy rate change, median house value, and median age of the dwelling units. This algorithm resulted in a factor of –5 to +4, which described the amount of dwelling unit losses to be expected based on the historical trends. A value of -5 indicated the maximum amount of dwelling unit loss, and +4 indicated the least amount of dwelling unit loss in a TD.

[14] The 2000 census tract data was aggregated by traffic district for the following: single family dwelling units, multi family dwelling units, vacancy rate, median household value, and median age of structure information. The 1980 and 1990 single family/multi family housing, and vacancy information was obtained from the FYE 1993 UPWP Report – Task 1.01, Subtask 1 (Part 3). The 1980 and 1990 dwelling units lost, 1990 county median value, and decade of most structures built was taken from the FYE 1993 UPWP Report - Task 1.01, Subtask 1 (Part 1).

The percentage of demolition seen in OKC Traffic Districts was then correlated to the factors determined from the Census data, i.e., the –5 to +4 DU loss factor. Through correlation, five categories of the percentage of assumed dwelling unit loss were developed for the dwelling unit loss factors:

- Assumed DU Loss of 1.50% per year for TDs with a DU Loss factor of –5 or –4
- 0.65% DU Loss per year for TDs with a factor of –3 or –2
- 0.25% DU Loss per year for TDs with a factor of –1, 0, or +1
- 0.12% DU Loss per year for TDs with a factor of +2 or +3
- 0.01% DU Loss per Year for TDs with a factor of +4

Table 2.15 shows the resulting DU loss ratios used by the OCARTS GAM for each TD.

In most instances, the GAM responded to lost units and the resulting available land in the traffic districts by reallocating new units, thus balancing out those that were lost. This rebuilding of the lost housing units was due to the increase in forecasted population for the majority of traffic district areas within the OCARTS area.

Table 2.15:
2030 Single and Multi Family Dwelling Units Lost Assumptions by Traffic District

TD	Percentage of Dwelling Unit Loss Per Year
OKLAHOMA COUNTY	
11	0.65
12	1.50
13	1.50
14	0.65
15	0.25
16	1.50
21	0.25
22	0.25
23	0.65
24	0.65
25	0.25
26	0.65
31	0.65
32	0.25
33	0.01
34	0.25
35	0.25
36	0.25
37	0.01
38	0.01
39*	0.12
41	0.25
42	0.65
43	0.25
44	0.25
45	0.25
46	0.12
47	0.12

TD	Percentage of Dwelling Unit Loss Per Year
CLEVELAND COUNTY	
50	0.25
51	0.25
52	0.25
53	0.65
54	0.25
55	0.25
56	0.25
57	0.65
58	0.25
59	0.25
70	0.25
71	0.25
72	0.65
CANADIAN COUNTY	
61	0.12
62	0.25
63	0.12
64	0.12
GRADY COUNTY	
65	0.01
McCLAIN COUNTY	
66	0.12
67	0.25
68	0.25
LOGAN COUNTY	
81	0.01
82	0.25
83	0.25

GROUP QUARTERS POPULATION ASSUMPTION

The GAM must determine what percentage of the total population forecast to either allocate to residential households (HH) or to group quarters (GQ) facilities, i.e., hospitals, college dormitories, and assisted living centers[15].

In previous plans, the methodology for calculating the horizon year GQ population called for the base year HH/GQ ratio to remain constant during the allocation of the forecast year traffic analysis zone population growth. In comparison to the methodology used previously, the ratio used by the 2030 GAM to identify the household/group quarters mix for the forecast year was based either on:

1. A ratio of the base year GQ to total population—i.e., the same HH/GQ mix ratio used for 2030 as in the year 2000 Census data. This implies that, for zones with modest residential growth, there will also be the same relative growth in GQ populations. This would account for any additional licensing of beds within facilities, minor renovations, or rebuilding of facilities at a slightly higher capacity; or

2. The direct use of a number of persons associated with anticipated GQ population growth. This methodology was used in several traffic analysis zones where:

   a) GQ land use did not previously exist.
   b) there was a significant shift from the 2000 base year HH/GQ ratio (i.e., significant household population growth forecast relative to group quarters growth).
   c) GQ facilities were recently closed, demolished, or converted to non residential uses.
   d) new GQ facilities have recently been, or are anticipated to be, built.

<u>Traffic District Assumption</u>

No specific traffic district level assumptions for the HH/GQ mix were developed for the 2030 OCARTS Plan. The percentages used in the GAM were either based on the 2000 base year HH/GQ mix ratio or, where additional information was available, the HH/GQ ratio was adjusted to account for anticipated infrastructure developments in specific traffic analysis zones.

CALIBRATION AND GROWTH FACTOR ANALYSIS

Also of importance to the accuracy of the GAM population and employment growth forecasts is the GAM calibration, which determines the significant variables influencing the attractiveness of geographic areas and therefore the allocation of the forecasted population and employment growth within the OCARTS region.

The GAM population distribution works by evaluating growth factors (attractiveness), in each subarea to define what share of the forecasted population growth for each entity will occur in a specific zone within the limits created by the previously discussed growth assumptions. The factors used by the residential GAM included: existing residential densities, perceived school district quality, median household income, and historical residential trends.

Using a series of mathematical equations, each zone is assigned a percent attraction, which when summed with the other districts, equals 100 percent of the county total.

[15] It is important to note that, in general, the GAM does not consider any limiting factors to GQ growth such as state bed licensing considerations.

CALIBRATION METHODOLOGY

During the calibration of the GAM, residential dwelling unit growth, recorded between the 1990 and 2000 Census, was correlated to independent variables referred to as growth factors in order to replicate the OCARTS area environment. The calibration process entailed adjusting the model's parameters to accurately reproduce the recorded dwelling unit growth. Specifically, the calibration process involved determining:

1. the variables with a significant relationship to the 1990-2000 residential dwelling unit growth to be considered as GAM growth factors.
2. the rating scheme for each factor in order to normalize the data by developing criteria to group data for rating purposes.
3. the relative correlation of each growth factor to the 1990-2000 residential dwelling unit growth.
4. the weight (relative significance) of each growth factor in respect to the other growth factors.

The following growth factors were determined as significant and were used in the 2030 GAM:

- existing residential densities
- household income
- school district
- past residential growth trends in a subarea

These factors leading up to the 2030 growth forecasts were extensively researched prior to the GAM calibration and the following sections provide an in-depth discussion of the findings, as well as the process leading to the 2030 population, dwelling unit and employment forecasts.

GROWTH FACTOR RATINGS

The growth factor analysis was performed by correlating candidate-variables to the dwelling unit growth reported by the 1990 and 2000 Census. It is important to note that:

- the method for determining the 1990 to 2000 growth was based on the total dwelling unit change by square mile. (This was due to inconsistencies in size between 1990 and 2000 OCARTS area traffic analysis zones.)
- the correlation analysis was preformed on the 1990 OCARTS area.
- the 2000 dwelling unit data was approved by the ITPC on December 12, 2003[16].
- the delayed release of the 2000 CTPP Part 1 data (fall 2003) precluded its use in calibration.

In the 2025 OCARTS Plan[17], the growth factors of median household income, perception of school district quality, residential density, and historical growth trend were used by the GAM at the Data Zone (DZ) geography[18]. These same growth factors were analyzed for use in the 2030 OCARTS Plan. In addition, the median dwelling unit age, median population age, and

[16] FYE 2003 UPWP Report - Task 1.01, Subtask 4, *Year 2000 Population and Dwelling Units*, ACOG, January 2004.
[17] See 1990-2020 Growth Allocation Model Evaluation, Residential Growth Component, Growth Factors Analysis for a historical discussion and analysis of growth factors and weights used for the 1980-2005, 1990-2020, and 1995-2025 OCARTS Plans.
[18] It was recommended in the FYE 1998 UPWP Report – Task 1.01, Subtask 2, *1990-2020 Growth Allocation Model Evaluation Residential Growth Component and Growth Analysis Factors*, ACOG, June 1998, that data zone level growth factors be used instead of traffic district level growth factors which limited the flexibility of the GAM.

mean travel time to work variables were analyzed for possible inclusion in the 2030 GAM. However, these last three new variables were ultimately not used in the Plan due to low correlation scores and data inconsistencies.

Five data categories, referred to as ratings, were developed for each growth factor to normalize the variable data. The ranges for each rating scheme were determined by staff to be adequate in predicting growth. The ranges were based on natural breaks in the distribution of the data or historical GAM calibration rating schemes.

Residential Density Rating

The residential density rating was determine by multiple assumptions described in great detail in the preceding section, concerning Single Family (SF) Density, Multi-Family (MF) Density, SF/MF Mix, Occupancy Rate, Household Size, Dwelling Units Lost, and Group Quarter Population. Traffic Analysis Zone (TAZ) level data was used for this correlation.

Table 2.16 shows that the dominant density for residential growth is 2–2.99 DU/Acre, closely followed by 1–1.99 DU/Acre. The preference for other densities falls rapidly:

Table 2.16:
Residential Density Ratings: 1990–2000 Dwelling Unit Change by Density

Residential Density DU/Acre	TAZ Count within Category	1990-2000 Total TAZ DU Change	Total TAZ Area in SQ Miles	1990-2000 DU Change per SQ Mile	Assigned Rating
<1	343	16,064	215	75	**2**
1-1.99	62	7,505	19	395	**4**
2-2.99	53	7,997	14	590	**5**
3-3.99	45	3,377	19	181	**3**
>=4	299	707	64	11	**1**

Perception of School District Quality

The factor related to the perceived attractiveness of the school districts was determined by examining the 1990 – 2000 dwelling unit growth within each school district. Table 2.17 provides a summary of the base year 2000 school district ratings:

Table 2.17:
School District Ratings:
1990-2000 Dwelling Unit Change by School District

1990-2000 Dwelling Unit Change per Square Mile for any School District	Assigned Rating
< 0	**1**
10-11	**2**
11-20	**3**
21-40	**4**
> 40	**5**

Income Rating

The income data was sorted into five categories that were developed in $25,000 increments. As a way of determining the ratings system, an analysis of dwelling units added to each TAZ between 1990 and 2000 was completed. In order to adequately compare traffic analysis zones of different sizes or acreages, the number of dwelling units gained or lost per square mile was calculated. The income categories that gained the most dwelling units per square mile were given a higher rating, as shown in Table 2.18:

Table 2.18:
Income Ratings: 1990-2000 Dwelling Unit Change by Median Household Income

Income	Sample Size	1990-2000 Total DU	Mean	Acres	Sq. Mile	DU Change Per Sq. Mile	Rate
< 25000	158	-2620	-17	42621	67	-39	**1**
25000-50000	388	12127	31	562141	878	14	**2**
50000-75000	256	19688	77	441932	691	29	**3**
75000-100000	29	6286	217	34201	53	118	**5**
> 100000	8	349	44	6736	11	33	**4**

Growth Trend

The growth trend variable simply referred to the growth in total dwelling units between 1990 and 2000. Approximately forty percent of TAZs in the OCARTS area lost dwelling units during that timeframe. Therefore, zones reporting any loss of dwelling units were given a rating of 1. A complete overview of the ratings is shown in Table 2.19:

Table 2.19:
Trend Ratings: TAZ Level 1990-2000 Dwelling Unit Change

DU Change per Sq. Mile	TAZ Count within category	1990-2000 Total DU Change	Total TAZ Area in Sq. Miles	1990-2000 DU Change per Sq. Mile	Rating
<0	352	-10,780	295	-37	**1**
0-50	334	4,837	738	7	**2**
51-100	78	5,487	297	18	**3**
101-200	56	8,244	220	37	**4**
>200	78	27,542	150	184	**5**

Correlation Analysis

After applying the factor-rating scheme, the correlation analysis was preformed against the 1990 to 2000 dwelling unit change. As shown in Table 2.20, the variables of density, school quality, income, and trend proved to have significant correlation to the growth seen in dwelling units between 1990 and 2000.

Table 2.20:
2000-2030 GAM Growth Factor Analysis Correlations

Variable	R
Density	0.31
School District	0.36
Income	0.36
Trend	0.84

WEIGHT ANALYSIS

The 2030 GAM used weighting to define each growth factor's influence on the dwelling unit growth distribution for the forecast year. Since the correlation coefficient measures the relationship between the dependent variable (total dwelling units) and the independent variables (density, school, income, and trend), the percent of the total correlation was used to determine the weight assigned to each growth factor. Table 2.21 shows each factor's weight used in each zone in the OCARTS area.

Table 2.21:
2000–2030 GAM Growth Factor Correlations and Weights

GROWTH FACTOR	R	% OF TOTAL CORRELATION (WEIGHT)
Residential Density	0.31	16%
School District	0.36	19%
Income	0.36	19%
Trend	0.84	45%
Total	**1.87**	**100%**

Once the GAM calibration process was complete, the GAM used the growth factor ratings and weights to calculate the initial share of 2000-2030 population growth to be allocated to each zone, which is discussed in detail in the following section.

2030 POPULATION GROWTH ALLOCATION

The GAM was run to distribute 2030 regional population projections to the most attractive areas. The GAM applied the 2030 growth assumptions to quantify the type and amount of residential dwelling unit growth for each area. The resulting 2030 OCARTS population and dwelling unit forecasts described the population and residential growth expected to occur between the years 2000 and 2030. Most growth was in the form of new homes or dwelling units. However, a small share of the new residential growth was in group quarters, such as dormitories and other group residential settings.

The following sections describe the population growth allocation in greater detail.

ALLOCATION OF THE FORECAST YEAR 2030 POPULATION

Preliminary traffic district (TD) population projections were developed by suballocating the accepted entity and county projections to the TD geography. In several cases, entities were located in only one traffic district. However, in cases where entities contributed to more than one district, the entity population was distributed based on available land, recent building permit trends, and anticipated residential subdivision growth, as outlined in the calibration process.

The GAM was run using the preliminary traffic district projections. Based on the detailed analysis of the model results and the comments gathered at meetings with local area staff, necessary changes to the traffic district projections were made to best fit each entity's growth trends. The GAM was run several times to optimize the distribution of the TD population control totals to the data zone level of geography. All population trend analysis was completed at the data zone level and then aggregated back to traffic analysis zones and traffic districts.

The resulting TD projections were provided to the APTAC and ITTC members in July 2004. Comments received after the July committee meetings were incorporated into successive model runs.

Table 2.22 lists the ITPC approved 2030 OCARTS area population figures at the traffic district level by entity.

Table 2.22:
Approved 2030 OCARTS Area Population by County by Traffic District by Entity

		2000 Population			2030 Population Projection			2000 - 2030
Traffic District	Entity	House-hold	Group Quarters	Total	House-hold	Group Quarters	Total	Total Change
OKLAHOMA COUNTY								
11	OKC	2,551	639	3,190	2,686	654	3,340	150
11 Total		**2,551**	**639**	**3,190**	**2,686**	**654**	**3,340**	**150**
12	OKC	1,212	2,315	3,527	3,584	2,943	6,527	3,000
12 Total		**1,212**	**2,315**	**3,527**	**3,584**	**2,943**	**6,527**	**3,000**
13	OKC	1,657	213	1,870	3,989	356	4,345	2,475
13 Total		**1,657**	**213**	**1,870**	**3,989**	**356**	**4,345**	**2,475**
14	OKC	4,103	133	4,236	4,596	140	4,736	500
14 Total		**4,103**	**133**	**4,236**	**4,596**	**140**	**4,736**	**500**
15	OKC	3,592	67	3,659	4,077	92	4,169	510
15 Total		**3,592**	**67**	**3,659**	**4,077**	**92**	**4,169**	**510**
16	OKC	7,517	215	7,732	7,859	223	8,082	350
16 Total		**7,517**	**215**	**7,732**	**7,859**	**223**	**8,082**	**350**
21	OKC	39,165	527	39,692	40,746	554	41,300	1,608
21 Total		**39,165**	**527**	**39,692**	**40,746**	**554**	**41,300**	**1,608**
22	OK Co Uninc	13	0	13	13	0	13	0
22	OKC	16,619	241	16,860	18,197	303	18,500	1,640
22	Valley Brook	817	0	817	900	0	900	83
22 Total		**17,449**	**241**	**17,690**	**19,110**	**303**	**19,413**	**1,723**
23	OK Co Uninc	0	0	0	0	0	0	0
23	OKC	45,538	595	46,133	46,391	609	47,000	867
23 Total		**45,538**	**595**	**46,133**	**46,391**	**609**	**47,000**	**867**
24	Del City	0	0	0	0	0	0	0
24	OKC	36,695	119	36,814	37,694	120	37,814	1,000
24 Total		**36,695**	**119**	**36,814**	**37,694**	**120**	**37,814**	**1,000**
25	Nichols Hills	2,777	0	2,777	2,842	0	2,842	65
25	OK Co Uninc	0	0	0	0	0	0	0
25	OKC	59,674	1,338	61,012	61,010	1,372	62,382	1,370
25 Total		**62,451**	**1,338**	**63,789**	**63,852**	**1,372**	**65,224**	**1,435**
26	Nichols Hills	0	0	0	0	0	0	0
26	OK Co Uninc	0	0	0	0	0	0	0
26	OKC	10,624	875	11,499	10,955	895	11,850	351
26 Total		**10,624**	**875**	**11,499**	**10,955**	**895**	**11,850**	**351**

Table 2.22: (Cont.)
Approved 2030 OCARTS Area Population by County by Traffic District by Entity

Traffic District	Entity	2000 Population			2030 Population Projection			2000 - 2030 Total Change
		House-hold	Group Quarters	Total	House-hold	Group Quarters	Total	
OKLAHOMA COUNTY (Cont)								
31	OKC	12,329	1,998	14,327	15,294	2,133	17,427	3,100
31 Total		**12,329**	**1,998**	**14,327**	**15,294**	**2,133**	**17,427**	**3,100**
32	Bethany	19,001	1,306	20,307	19,956	1,354	21,310	1,003
32	OKC	38,022	207	38,229	43,014	211	43,225	4,996
32	Warr Acres	9,640	95	9,735	10,338	97	10,435	700
32	Woodlawn Park	161	0	161	170	0	170	9
32 Total		**66,824**	**1,608**	**68,432**	**73,478**	**1,662**	**75,140**	**6,708**
33	OKC	32,363	236	32,599	46,306	408	46,714	14,115
33	Warr Acres	0	0	0	0	0	0	0
33 Total		**32,363**	**236**	**32,599**	**46,306**	**408**	**46,714**	**14,115**
34	OK Co Uninc	0	0	0	0	0	0	0
34	OKC	17,239	63	17,302	23,909	93	24,002	6,700
34	The Village	1,370	0	1,370	1,380	0	1,380	10
34	Warr Acres	0	0	0	0	0	0	0
34 Total		**18,609**	**63**	**18,672**	**25,289**	**93**	**25,382**	**6,710**
35	Nichols Hills	1,279	0	1,279	1,284	0	1,284	5
35	OK Co Uninc	31	0	31	34	0	34	3
35	OKC	20,204	439	20,643	24,082	561	24,643	4,000
35	The Village	8,782	5	8,787	9,904	6	9,910	1,123
35 Total		**30,296**	**444**	**30,740**	**35,304**	**567**	**35,871**	**5,131**
36	OKC	13,087	43	13,130	17,276	58	17,334	4,204
36 Total		**13,087**	**43**	**13,130**	**17,276**	**58**	**17,334**	**4,204**
37	OK Co Uninc	1,691	18	1,709	3,016	28	3,044	1,335
37	OKC	1,419	27	1,446	14,305	75	14,380	12,934
37 Total		**3,110**	**45**	**3,155**	**17,321**	**103**	**17,424**	**14,269**
38	Edmond	27,762	175	27,937	45,786	282	46,068	18,131
38	OK Co Uninc	688	0	688	1,918	0	1,918	1,230
38	OKC	14,728	379	15,107	40,002	548	40,550	25,443
38 Total		**43,178**	**554**	**43,732**	**87,706**	**830**	**88,536**	**44,804**
39	Edmond	36,955	1,658	38,613	51,284	1,798	53,082	14,469
39	OK Co Uninc	192	0	192	232	0	232	40
39	OKC	5,393	1,244	6,637	7,249	1,488	8,737	2,100
39 Total		**42,540**	**2,902**	**45,442**	**58,765**	**3,286**	**62,051**	**16,609**

Table 2.22: (Cont.)
Approved 2030 OCARTS Area Population by County by Traffic District by Entity

Traffic District	Entity	2000 Population House-hold	2000 Population Group Quarters	2000 Population Total	2030 Population Projection House-hold	2030 Population Projection Group Quarters	2030 Population Projection Total	2000 - 2030 Total Change
OKLAHOMA COUNTY (Cont)								
41	Choctaw	540	0	540	600	0	600	60
41	Harrah	161	0	161	250	0	250	89
41	Midwest City	78	0	78	90	0	90	12
41	OK Co Uninc	4,035	0	4,035	5,510	0	5,510	1,475
41	OKC	26,266	520	26,786	38,889	561	39,450	12,664
41 Total		**31,080**	**520**	**31,600**	**45,339**	**561**	**45,900**	**14,300**
42	Del City	22,072	56	22,128	24,274	66	24,340	2,212
42	Forest Park	1,066	0	1,066	1,240	0	1,240	174
42	Lake Aluma	97	0	97	110	0	110	13
42	OK Co Uninc	126	0	126	140	0	140	14
42	OKC	2,825	83	2,908	3,954	221	4,175	1,267
42	Smith Village	40	0	40	40	0	40	0
42 Total		**26,226**	**139**	**26,365**	**29,758**	**287**	**30,045**	**3,680**
43	Midwest City	44,968	478	45,446	46,924	522	47,446	2,000
43	OK Co Uninc	216	3	219	216	3	219	0
43	OKC	0	0	0	0	0	0	0
43	Spencer	1,734	75	1,809	1,831	78	1,909	100
43 Total		**46,918**	**556**	**47,474**	**48,971**	**603**	**49,574**	**2,100**
44	Choctaw	7,416	102	7,518	12,390	219	12,609	5,091
44	Midwest City	8,561	0	8,561	15,099	60	15,159	6,598
44	Nicoma Park	2,415	0	2,415	2,656	0	2,656	241
44	OK Co Uninc	1,072	0	1,072	1,660	0	1,660	588
44	OKC	9	0	9	20	0	20	11
44	Spencer	95	0	95	250	0	250	155
44 Total		**19,568**	**102**	**19,670**	**32,075**	**279**	**32,354**	**12,684**
45	Choctaw	566	0	566	838	0	838	272
45	Jones	2,381	136	2,517	2,787	143	2,930	413
45	Midwest City	3	0	3	5	0	5	2
45	OK Co Uninc	79	0	79	90	0	90	11
45	OKC	6,192	0	6,192	12,492	0	12,492	6,300
45	Spencer	1,842	0	1,842	2,181	0	2,181	339
45 Total		**11,063**	**136**	**11,199**	**18,393**	**143**	**18,536**	**7,337**
46	Choctaw	753	0	753	1,053	0	1,053	300
46	Harrah	4,468	90	4,558	6,095	155	6,250	1,692
46	Luther	12	0	12	20	0	20	8
46	OK Co Uninc	3,489	54	3,543	4,092	58	4,150	607
46	OKC	192	0	192	242	0	242	50
46 Total		**8,914**	**144**	**9,058**	**11,502**	**213**	**11,715**	**2,657**
47	Arcadia	250	29	279	287	33	320	41
47	Edmond	1,729	36	1,765	5,491	59	5,550	3,785
47	Luther	600	0	600	690	0	690	90
47	OK Co Uninc	1,611	0	1,611	2,992	0	2,992	1,381
47	OKC	605	162	767	2,050	217	2,267	1,500
47 Total		**4,795**	**227**	**5,022**	**11,510**	**309**	**11,819**	**6,797**
OKLAHOMA COUNTY TOTAL		**643,454**	**16,994**	**660,448**	**819,826**	**19,796**	**839,622**	**179,174**

Table 2.22: (Cont.)
Approved 2030 OCARTS Area Population by County by Traffic District by Entity

Traffic District	Entity	2000 Population			2030 Population Projection			2000 - 2030 Total Change
		House-hold	Group Quarters	Total	House-hold	Group Quarters	Total	
CLEVELAND COUNTY								
50	Cleveland Co Uninc	0	0	0	2	0	2	2
50	Moore	2,748	0	2,748	5,448	0	5,448	2,700
50	OKC	34,841	339	35,180	53,001	679	53,680	18,500
50 Total		**37,589**	**339**	**37,928**	**58,451**	**679**	**59,130**	**21,202**
51	Cleveland Co Uninc	0	0	0	0	0	0	0
51	Norman	6,569	4,580	11,149	9,769	4,593	14,362	3,213
51 Total		**6,569**	**4,580**	**11,149**	**9,769**	**4,593**	**14,362**	**3,213**
52	Hall Park	883	0	883	1,145	0	1,145	262
52	Norman	20,633	726	21,359	23,843	989	24,832	3,473
52 Total		**21,516**	**726**	**22,242**	**24,988**	**989**	**25,977**	**3,735**
53	Norman	35,420	706	36,126	36,788	926	37,714	1,588
53 Total		**35,420**	**706**	**36,126**	**36,788**	**926**	**37,714**	**1,588**
54	Hall Park	205	0	205	255	0	255	50
54	Norman	7,651	0	7,651	26,898	0	26,898	19,247
54 Total		**7,856**	**0**	**7,856**	**27,153**	**0**	**27,153**	**19,297**
55	Cleveland Co Uninc	209	0	209	209	0	209	0
55	Norman	10,879	59	10,938	24,517	583	25,100	14,162
55	OKC	0	0	0	0	0	0	0
55 Total		**11,088**	**59**	**11,147**	**24,726**	**583**	**25,309**	**14,162**
56	Cleveland Co Uninc	2,795	0	2,795	3,450	0	3,450	655
56	Moore	58	0	58	410	0	410	352
56	Norman	8,372	0	8,372	10,281	0	10,281	1,909
56	OKC	8,235	0	8,235	13,235	0	13,235	5,000
56 Total		**19,460**	**0**	**19,460**	**27,376**	**0**	**27,376**	**7,916**
57	Cleveland Co Uninc	231	0	231	331	0	331	100
57	Moore	38,069	263	38,332	51,811	331	52,142	13,810
57	Norman	99	0	99	1,129	0	1,129	1,030
57	OKC	3,091	62	3,153	5,516	137	5,653	2,500
57 Total		**41,490**	**325**	**41,815**	**58,787**	**468**	**59,255**	**17,440**
58	Cleveland Co Uninc	0	0	0	0	0	0	0
58	OKC	703	0	703	925	0	925	222
58 Total		**703**	**0**	**703**	**925**	**0**	**925**	**222**
59	Cleveland Co Uninc	1,520	0	1,520	1,900	0	1,900	380
59 Total		**1,520**	**0**	**1,520**	**1,900**	**0**	**1,900**	**380**
70	Cleveland Co Uninc	685	0	685	835	0	835	150
70	Noble	4,822	106	4,928	6,186	132	6,318	1,390
70 Total		**5,507**	**106**	**5,613**	**7,021**	**132**	**7,153**	**1,540**
71	Cleveland Co Uninc	1,043	0	1,043	1,343	0	1,343	300
71	Lexington	1,976	110	2,086	2,425	135	2,560	474
71	Noble	332	0	332	382	0	382	50
71	Purcell	0	0	0	0	0	0	0
71	Slaughterville	2,822	19	2,841	3,874	26	3,900	1,059
71 Total		**6,173**	**129**	**6,302**	**8,024**	**161**	**8,185**	**1,883**
72	Cleveland Co Uninc	2,785	2,480	5,265	3,796	3,134	6,930	1,665
72	Etowah	122	0	122	150	0	150	28
72	Norman	0	0	0	0	0	0	0
72	Slaughterville	731	37	768	906	44	950	182
72 Total		**3,638**	**2,517**	**6,155**	**4,852**	**3,178**	**8,030**	**1,875**
CLEVELAND COUNTY TOTAL		**198,529**	**9,487**	**208,016**	**290,760**	**11,709**	**302,469**	**94,453**

Table 2.22: (Cont.)
Approved 2030 OCARTS Area Population by County by Traffic District by Entity

Traffic District	Entity	2000 Population			2030 Population Projection			2000 - 2030 Total Change
		House-hold	Group Quarters	Total	House-hold	Group Quarters	Total	
CANADIAN COUNTY								
61	Canadian Co Uninc	0	0	0	2	0	2	2
61	Mustang	13,014	142	13,156	20,274	226	20,500	7,344
61	OKC	2,967	0	2,967	5,462	0	5,462	2,495
61	Yukon	1,134	0	1,134	2,620	0	2,620	1,486
61 Total		**17,115**	**142**	**17,257**	**28,358**	**226**	**28,584**	**11,327**
62	OKC	18,823	54	18,877	33,146	225	33,371	14,494
62	Yukon	19,379	319	19,698	22,767	563	23,330	3,632
62 Total		**38,202**	**373**	**38,575**	**55,913**	**788**	**56,701**	**18,126**
63	Canadian Co Uninc	493	0	493	640	0	640	147
63	OKC	4,467	0	4,467	7,267	0	7,267	2,800
63	Piedmont	673	0	673	2,300	0	2,300	1,627
63	Yukon	211	0	211	250	0	250	39
63 Total		**5,844**	**0**	**5,844**	**10,457**	**0**	**10,457**	**4,613**
64	Canadian Co Uninc	107	0	107	139	0	139	32
64	Piedmont	2,724	0	2,724	7,050	0	7,050	4,326
64 Total		**2,831**	**0**	**2,831**	**7,189**	**0**	**7,189**	**4,358**
CANADIAN COUNTY TOTAL		**63,992**	**515**	**64,507**	**101,917**	**1,014**	**102,931**	**38,424**

Oklahoma City Totals (reiterated here)								
	OKC - Can Co	26,257	54	26,311	45,875	225	46,100	19,789
	OKC - Cle Co	46,870	401	47,271	72,677	816	73,493	26,222
	OKC - Okl Co	419,820	12,678	432,498	528,623	17,080	545,703	113,205
OKLAHOMA CITY TOTAL		**492,947**	**13,133**	**506,080**	**647,175**	**18,121**	**665,296**	**159,216**

Table 2.22: (Cont.)
Approved 2030 OCARTS Area Population by County by Traffic District by Entity

Traffic District	Entity	2000 Population			2030 Population Projection			2000 - 2030 Total Change
		House-hold	Group Quarters	Total	House-hold	Group Quarters	Total	
GRADY COUNTY								
65	Blanchard	33	0	33	40	0	40	7
65	Grady Co Uninc	6,248	0	6,248	9,372	0	9,372	3,124
65	Tuttle	4,262	32	4,294	6,960	40	7,000	2,706
65 Total		**10,543**	**32**	**10,575**	**16,372**	**40**	**16,412**	**5,837**
GRADY COUNTY TOTAL		**10,543**	**32**	**10,575**	**16,372**	**40**	**16,412**	**5,837**
LOGAN COUNTY								
81	Cashion	144	0	144	200	0	200	56
81	Cedar Valley	58	0	58	200	0	200	142
81	Cimarron City	0	0	0	0	0	0	0
81	Guthrie	0	0	0	0	0	0	0
81	Logan Co Uninc	5,095	0	5,095	8,024	0	8,024	2,929
81 Total		**5,297**	**0**	**5,297**	**8,424**	**0**	**8,424**	**3,127**
82	Guthrie	9,119	790	9,909	11,457	937	12,394	2,485
82	Logan Co Uninc	5,122	0	5,122	9,170	0	9,170	4,048
82 Total		**14,241**	**790**	**15,031**	**20,627**	**937**	**21,564**	**6,533**
83	Guthrie	16	0	16	25	0	25	9
83	Logan Co Uninc	4,229	15	4,244	5,712	19	5,731	1,487
83 Total		**4,245**	**15**	**4,260**	**5,737**	**19**	**5,756**	**1,496**
LOGAN COUNTY TOTAL		**23,783**	**805**	**24,588**	**34,788**	**956**	**35,744**	**11,156**
McCLAIN COUNTY								
66	McClain Co Uninc	90	0	90	180	0	180	90
66	Newcastle	4,715	0	4,715	7,900	0	7,900	3,185
66 Total		**4,805**	**0**	**4,805**	**8,080**	**0**	**8,080**	**3,275**
67	Blanchard	2,750	31	2,781	4,397	53	4,450	1,669
67	Cole	473	0	473	650	0	650	177
67	Dibble	209	0	209	450	0	450	241
67	Goldsby	359	0	359	510	0	510	151
67	McClain Co Uninc	4,330	10	4,340	8,479	24	8,503	4,163
67	Newcastle	719	0	719	1,190	0	1,190	471
67	Washington	514	0	514	712	0	712	198
67 Total		**9,354**	**41**	**9,395**	**16,388**	**77**	**16,465**	**7,070**
68	Goldsby	845	0	845	1,540	0	1,540	695
68	McClain Co Uninc	1,839	0	1,839	3,535	0	3,535	1,696
68	Washington	6	0	6	8	0	8	2
68	Purcell	5,390	181	5,571	7,836	394	8,230	2,659
68 Total		**8,080**	**181**	**8,261**	**12,919**	**394**	**13,313**	**5,052**
McCLAIN COUNTY TOTAL		**22,239**	**222**	**22,461**	**37,387**	**471**	**37,858**	**15,397**
OCARTS GRAND TOTAL		**962,540**	**28,055**	**990,595**	**1,301,050**	**33,986**	**1,335,036**	**344,441**

2030 EMPLOYMENT GROWTH ALLOCATION

Following the distribution of the forecasted population growth, the GAM used the approved OCARTS area county level employment forecast, employment density assumptions, and various employment related growth factors as the basis for the distribution of the anticipated 2030 employment growth for each city, town, and unincorporated county part in the OCARTS area[19].

GAM CALIBRATION FOR EMPLOYMENT ALLOCATION

The GAM process of employment distribution was similar to the distribution of the forecasted population growth discussed in the previous sections. The GAM evaluated the competitive attractiveness of each traffic analysis zone within a traffic district and through a series of mathematical equations, the model analyzed the likelihood that certain types of employment growth would occur in specific zones.

The ability of certain variables (growth factors or attractiveness) to prompt employment growth was tested by examining the ability of the model using 1990 base year data to predict year 2000 employment by category. In predicting employment, the GAM examined employment in relation to the four basic employment-based land use categories - Commercial, Office, Industrial, or Public (COIP). The GAM also considered the amount of available land for initial or more intensive development when allocating employment from traffic districts to traffic analysis zones.

Over 75 independent variables were reviewed for use in the GAM to forecast employment. Yet, only 11 variables, which were easy to collect and gave credible results, were selected for the modeling process. The 11 independent variables used in the GAM for employment forecasting included:

- population
- office employment
- existing commercial density
- existing industrial density
- acres for planned commercial development
- acres for planned transportation uses
- existing office density
- existing public sector density
- acres for planned industrial development
- acres for planned public sector development
- acres for office development

Based on multiple regression analysis, the variables found to most significantly predict future **commercial employment** included year 2000 population, the existence of year 2000 office employment centers, as well as available land for planned commercial, industrial, and transportation corridor uses.

The variables found to most significantly predict future **office employment** included year 2000 population, year 2000 office and public sector employment, as well as the availability of land for planned office use.

[19] For the purposes of this report text and tables, an incorporated city or town, or unincorporated portion of county, may also be described as an entity or local government entity.

Available tracts of land for industrial and transportation corridor uses were found to most significantly predict **industrial employment**.

Year 2000 **public sector employment** and available land for planned office use were the most influential factors in forecasting public employment.

Additionally, an analysis of historical BEA industry sector trends and future Woods and Poole industry forecasts was undertaken to estimate the proportions of commercial (retail/other), office, industrial, and public jobs by county in the year 2030, and these ratios were also factored by the GAM in distributing employment to traffic analysis zones.

EMPLOYMENT DENSITY ASSUMPTION

Along with the already developed population figures and land use data, employment density was also a component used by the GAM to allocate forecasted COIP employment to traffic districts, and in turn to traffic analysis zones and data zones.

Measured at the TD by place level within corresponding COIP categories, year 2000 employment densities equaled year 2000 employment, divided by the acres of year 2000 existing land use. The year 2000 employment densities were then used to recommend year 2030 densities for each COIP variable by TD by place. The year 2030 maximum traffic district densities were programmed not to exceed 125% of the corresponding year 2000 densities. In other words, a 25% employment density growth allowance from 2000 to 2030 was programmed into the GAM. For TDs without a year 2000 employment density, the year 2000 traffic district density from a similar district was substituted.

Employment densities served two functions in the GAM. First, density was used to define the quantity of a certain type of employment that could be contained in available land that the model defined as likely to attract future employment. Second, density also restricted the amount of employment allocated to a data zone, to avoid a situation where there would not be enough land to support additional employment.

The employment density assumption has a significant influence on the GAM employment allocation, because the assumption has the ability to alter forecast year employment densities above or below the 125% of the base year density threshold, if circumstances dictate such adjustments. Specific geographical areas experiencing or expecting an influx of new employment—due to local land use policies or market forces—will likely have forecast year employment densities higher than 125% of the base year.

The following sections describe the employment growth allocation in greater detail. As discussed, the “Retail” and “Other” designation, as well as the Commercial, Office, Industrial, or Public (COIP) classification were considered by the GAM when making employment projections.

PRELIMINARY EMPLOYMENT CONTROL TOTALS BY ENTITY

The employment control totals by county were processed through the GAM to produce preliminary employment counts for each entity in the OCARTS area.

The city forecasts were reviewed and checked against historical trends and past OCARTS Plans. As necessary, these initial city forecasts were adjusted to better align with historical data and

to match anticipated employment developments at the local level. In some cases, a city's employment forecast was increased to surpass its adopted projection in the 2025 OCARTS Plan. However, such adjustments did not alter the year 2030 employment county control totals.

PRELIMINARY EMPLOYMENT FORECASTS BY TRAFFIC DISTRICTS BY PLACE

Using the approved year 2030 employment control totals by city as constants, the GAM was run again to redistribute forecasted employment to the traffic districts composing the OCARTS area. The resulting output were preliminary TD employment forecasts by place (city or local entity). Each TD's preliminary year 2030 employment figure consisted of the year 2000 employment already assigned to the traffic district plus the additional employment forecasted by the GAM for that specific TD in year 2030.

As with the previous set of 2030 employment forecasts, the preliminary traffic district by place employment figures were analyzed and modified after being compared to the figures from past OCARTS Plans, regression analysis trends of historical employment datasets, and the availability of planned COIP land use by acre at the TD level.

Recent and anticipated employment developments at the local level were also tracked and factored into the preliminary TD employment figures. News articles, from various local newspapers that detailed new employment developments in the OCARTS area since year 2000, were collected and used to ensure that enough forecasted employment was assigned to the affected traffic districts.

Furthermore, during May and June 2004, staff met with planners from the cities of Edmond, Midwest City, Moore, Mustang, Norman, Oklahoma City, and Yukon to identify specific geographic areas where future employment development was expected, and such information was also incorporated into these preliminary TD employment totals.

ALLOCATION OF THE FORECAST YEAR 2030 EMPLOYMENT BY TRAFFIC ANALYSIS ZONE BY PLACE

The approved 2030 employment figures by traffic district by place were used to run the GAM several times, making adjustments as necessary, thus resulting in year 2030 employment forecasts by traffic analysis zone (TAZ) by place. (Please note that the calculations in the GAM were made at the data zone level and then aggregated to the traffic analysis zone level.)

The year 2030 employment forecasts by traffic analysis zone included subsets of COIP and retail/other employment. These subcategories are also found in the year 2000 employment dataset and the land use data, providing continuity and allowing for quantitative comparisons between the datasets. As discussed previously, the COIP and retail/other base year counts and forecasts are evaluated when modeling to predict future traffic volumes and patterns.

Table 2.23 shows the final year 2030 employment projections[20] by TD by entity.

[20] A more detailed description of the GAM runs resulting in the final employment projections can be viewed in Attachment 1.

Table 2.23:
Final 2030 Employment by Traffic District by Entity

Traffic District	Entity	2000 Employment			2030 Employment			2030-2000 Change		
		Retail	Other	Total	Retail	Other	Total	Retail	Other	Total
OKLAHOMA COUNTY										
11	OKC	811	6,071	6,882	1,070	7,864	8,934	259	1,793	2,052
11 Total		**811**	**6,071**	**6,882**	**1,070**	**7,864**	**8,934**	**259**	**1,793**	**2,052**
12	OKC	1,430	20,740	22,170	1,947	26,987	28,934	517	6,247	6,764
12 Total		**1,430**	**20,740**	**22,170**	**1,947**	**26,987**	**28,934**	**517**	**6,247**	**6,764**
13	OKC	2,389	5,464	7,853	3,645	7,101	10,746	1,256	1,637	2,893
13 Total		**2,389**	**5,464**	**7,853**	**3,645**	**7,101**	**10,746**	**1,256**	**1,637**	**2,893**
14	OKC	920	23,456	24,376	1,278	29,449	30,727	358	5,993	6,351
14 Total		**920**	**23,456**	**24,376**	**1,278**	**29,449**	**30,727**	**358**	**5,993**	**6,351**
15	OKC	658	6,574	7,232	892	8,681	9,573	234	2,107	2,341
15 Total		**658**	**6,574**	**7,232**	**892**	**8,681**	**9,573**	**234**	**2,107**	**2,341**
16	OKC	567	1,950	2,517	851	2,710	3,561	284	760	1,044
16 Total		**567**	**1,950**	**2,517**	**851**	**2,710**	**3,561**	**284**	**760**	**1,044**
21	OKC	4,730	6,898	11,628	6,023	8,880	14,903	1,293	1,982	3,275
21 Total		**4,730**	**6,898**	**11,628**	**6,023**	**8,880**	**14,903**	**1,293**	**1,982**	**3,275**
22	OK Co Uninc	19	21	40	0	0	0	-19	-21	-40
22	OKC	6,119	6,905	13,024	8,057	9,745	17,802	1,938	2,840	4,778
22	Valley Brook	84	132	216	135	202	337	51	70	121
22 Total		**6,222**	**7,058**	**13,280**	**8,192**	**9,947**	**18,139**	**1,970**	**2,889**	**4,859**
23	OK Co Uninc	12	489	501	14	583	597	2	94	96
23	OKC	6,268	23,099	29,367	7,588	29,399	36,987	1,320	6,300	7,620
23 Total		**6,280**	**23,588**	**29,868**	**7,602**	**29,982**	**37,584**	**1,322**	**6,394**	**7,716**
24	Del City	0	0	0	0	0	0	0	0	0
24	OKC	3,107	15,862	18,969	4,263	20,405	24,668	1,156	4,543	5,699
24 Total		**3,107**	**15,862**	**18,969**	**4,263**	**20,405**	**24,668**	**1,156**	**4,543**	**5,699**
25	Nichols Hills	399	1,053	1,452	447	1,264	1,711	48	211	259
25	OK Co Uninc	1	45	46	1	57	58	0	12	12
25	OKC	12,619	39,968	52,587	15,924	51,070	66,994	3,305	11,102	14,407
25 Total		**13,019**	**41,066**	**54,085**	**16,372**	**52,391**	**68,763**	**3,353**	**11,325**	**14,678**
26	Nichols Hills	0	0	0	0	3	3	0	3	3
26	OK Co Uninc	0	0	0	0	0	0	0	0	0
26	OKC	3,785	25,325	29,110	4,763	32,565	37,328	978	7,240	8,218
26 Total		**3,785**	**25,325**	**29,110**	**4,763**	**32,568**	**37,331**	**978**	**7,243**	**8,221**

Table 2.23: (Cont.)
Final 2030 Employment by Traffic District by Entity

Traffic District	Entity	2000 Employment			2030 Employment			2030-2000 Change		
		Retail	Other	Total	Retail	Other	Total	Retail	Other	Total
OKLAHOMA COUNTY (cont)										
31	OKC	5,342	31,794	37,136	7,323	39,419	46,742	1,981	7,625	9,606
31 Total		**5,342**	**31,794**	**37,136**	**7,323**	**39,419**	**46,742**	**1,981**	**7,625**	**9,606**
32	Bethany	1,516	5,235	6,751	1,924	6,514	8,438	408	1,279	1,687
32	OKC	4,177	6,056	10,233	5,408	8,123	13,531	1,231	2,067	3,298
32	Warr Acres	1,972	2,968	4,940	2,409	3,717	6,126	437	749	1,186
32	Woodlawn Park	0	3	3	0	3	3	0	0	0
32 Total		**7,665**	**14,262**	**21,927**	**9,741**	**18,357**	**28,098**	**2,076**	**4,095**	**6,171**
33	OKC	2,327	4,187	6,514	3,203	5,854	9,057	876	1,667	2,543
33	Warr Acres	171	459	630	201	584	785	30	125	155
33 Total		**2,498**	**4,646**	**7,144**	**3,404**	**6,438**	**9,842**	**906**	**1,792**	**2,698**
34	OK Co Uninc	0	0	0	0	0	0	0	0	0
34	OKC	1,158	6,497	7,655	1,817	8,662	10,479	659	2,165	2,824
34	The Village	304	261	565	443	425	868	139	164	303
34	Warr Acres	943	1,696	2,639	1,149	2,269	3,418	206	573	779
34 Total		**2,405**	**8,454**	**10,859**	**3,409**	**11,356**	**14,765**	**1,004**	**2,902**	**3,906**
35	Nichols Hills	10	105	115	12	121	133	2	16	18
35	OK Co Uninc	0	0	0	0	0	0	0	0	0
35	OKC	2,151	3,537	5,688	3,004	4,688	7,692	853	1,151	2,004
35	The Village	1,292	2,860	4,152	1,734	4,055	5,789	442	1,195	1,637
35 Total		**3,453**	**6,502**	**9,955**	**4,750**	**8,864**	**13,614**	**1,297**	**2,362**	**3,659**
36	OKC	1,345	6,521	7,866	1,750	8,785	10,535	405	2,264	2,669
36 Total		**1,345**	**6,521**	**7,866**	**1,750**	**8,785**	**10,535**	**405**	**2,264**	**2,669**
37	OK Co Uninc	13	366	379	21	537	558	8	171	179
37	OKC	238	2,387	2,625	694	4,739	5,433	456	2,352	2,808
37 Total		**251**	**2,753**	**3,004**	**715**	**5,276**	**5,991**	**464**	**2,523**	**2,987**
38	Edmond	1,917	4,720	6,637	3,233	6,976	10,209	1,316	2,256	3,572
38	OK Co Uninc	5	112	117	7	153	160	2	41	43
38	OKC	3,752	4,729	8,481	4,920	6,504	11,424	1,168	1,775	2,943
38 Total		**5,674**	**9,561**	**15,235**	**8,160**	**13,633**	**21,793**	**2,486**	**4,072**	**6,558**
39	Edmond	6,067	11,373	17,440	8,169	14,520	22,689	2,102	3,147	5,249
39	OK Co Uninc	2	36	38	3	90	93	1	54	55
39	OKC	1,259	1,614	2,873	1,719	2,301	4,020	460	687	1,147
39 Total		**7,328**	**13,023**	**20,351**	**9,891**	**16,911**	**26,802**	**2,563**	**3,888**	**6,451**

Table 2.23: (Cont.)
Final 2030 Employment by Traffic District by Entity

Traffic District	Entity	2000 Employment			2030 Employment			2030-2000 Change		
		Retail	Other	Total	Retail	Other	Total	Retail	Other	Total
OKLAHOMA COUNTY (cont)										
41	Choctaw	36	32	68	71	71	142	35	39	74
41	Harrah	200	75	275	255	86	341	55	11	66
41	Midwest City	0	0	0	0	126	126	0	126	126
41	OK Co Uninc	44	125	169	51	213	264	7	88	95
41	OKC	1,480	31,679	33,159	3,683	40,419	44,102	2,203	8,740	10,943
41 Total		**1,760**	**31,911**	**33,671**	**4,060**	**40,915**	**44,975**	**2,300**	**9,004**	**11,304**
42	Del City	1,866	4,179	6,045	2,482	5,350	7,832	616	1,171	1,787
42	Forest Park	12	126	138	29	291	320	17	165	182
42	Lake Aluma	0	5	5	0	5	5	0	0	0
42	OK Co Uninc	5	85	90	6	102	108	1	17	18
42	OKC	385	804	1,189	508	1,046	1,554	123	242	365
42	Smith Village	0	0	0	0	3	3	0	3	3
42 Total		**2,268**	**5,199**	**7,467**	**3,025**	**6,797**	**9,822**	**757**	**1,598**	**2,355**
43	Midwest City	7,781	12,270	20,051	10,692	16,475	27,167	2,911	4,205	7,116
43	OK Co Uninc	8	6	14	11	10	21	3	4	7
43	OKC	0	0	0	0	0	0	0	0	0
43	Spencer	89	461	550	156	752	908	67	291	358
43 Total		**7,878**	**12,737**	**20,615**	**10,859**	**17,237**	**28,096**	**2,981**	**4,500**	**7,481**
44	Choctaw	311	1,151	1,462	465	1,641	2,106	154	490	644
44	Midwest City	213	270	483	305	409	714	92	139	231
44	Nicoma Park	191	552	743	252	754	1,006	61	202	263
44	OK Co Uninc	5	10	15	7	15	22	2	5	7
44	OKC	2	83	85	3	92	95	1	9	10
44	Spencer	46	66	112	67	106	173	21	40	61
44 Total		**768**	**2,132**	**2,900**	**1,099**	**3,017**	**4,116**	**331**	**885**	**1,216**
45	Choctaw	0	98	98	0	141	141	0	43	43
45	Jones	107	418	525	167	617	784	60	199	259
45	Midwest City	0	0	0	0	5	5	0	5	5
45	OK Co Uninc	0	3	3	0	10	10	0	7	7
45	OKC	87	765	852	138	1,103	1,241	51	338	389
45	Spencer	31	258	289	54	409	463	23	151	174
45 Total		**225**	**1,542**	**1,767**	**359**	**2,285**	**2,644**	**134**	**743**	**877**
46	Choctaw	10	233	243	15	323	338	5	90	95
46	Harrah	199	894	1,093	299	1,260	1,559	100	366	466
46	Luther	0	0	0	0	4	4	0	4	4
46	OK Co Uninc	20	113	133	23	136	159	3	23	26
46	OKC	0	4	4	0	7	7	0	3	3
46 Total		**229**	**1,244**	**1,473**	**337**	**1,730**	**2,067**	**108**	**486**	**594**
47	Arcadia	3	78	81	6	99	105	3	21	24
47	Edmond	83	915	998	214	1,052	1,266	131	137	268
47	Luther	16	187	203	22	235	257	6	48	54
47	OK Co Uninc	14	41	55	33	66	99	19	25	44
47	OKC	5	52	57	9	99	108	4	47	51
47 Total		**121**	**1,273**	**1,394**	**284**	**1,551**	**1,835**	**163**	**278**	**441**
OKLAHOMA COUNTY TOTAL		**93,128**	**337,606**	**430,734**	**126,064**	**439,536**	**565,600**	**32,936**	**101,930**	**134,866**

Table 2.23: (Cont.)
Final 2030 Employment by Traffic District by Entity

Traffic District	Entity	2000 Employment			2030 Employment			2030-2000 Change		
		Retail	Other	Total	Retail	Other	Total	Retail	Other	Total
50	Cleveland Co Uninc	0	0	0	0	0	0	0	0	0
50	Moore	174	224	398	346	369	715	172	145	317
50	OKC	1,424	4,038	5,462	2,619	6,452	9,071	1,195	2,414	3,609
50 Total		**1,598**	**4,262**	**5,860**	**2,965**	**6,821**	**9,786**	**1,367**	**2,559**	**3,926**
51	Cleveland Co Uninc	1	100	101	1	115	116	0	15	15
51	Norman	550	9,872	10,422	938	13,283	14,221	388	3,411	3,799
51 Total		**551**	**9,972**	**10,523**	**939**	**13,398**	**14,337**	**388**	**3,426**	**3,814**
52	Hall Park*	2	30	32	3	41	44	1	11	12
52	Norman	1,928	6,044	7,972	3,124	7,952	11,076	1,196	1,908	3,104
52 Total		**1,930**	**6,074**	**8,004**	**3,127**	**7,993**	**11,120**	**1,197**	**1,919**	**3,116**
53	Norman	9,769	13,871	23,640	12,590	15,809	28,399	2,821	1,938	4,759
53 Total		**9,769**	**13,871**	**23,640**	**12,590**	**15,809**	**28,399**	**2,821**	**1,938**	**4,759**
54	Hall Park*	1	5	6	3	12	15	2	7	9
54	Norman	180	1,612	1,792	739	5,082	5,821	559	3,470	4,029
54 Total		**181**	**1,617**	**1,798**	**742**	**5,094**	**5,836**	**561**	**3,477**	**4,038**
55	Cleveland Co Uninc	0	0	0	0	3	3	0	3	3
55	Norman	784	5,124	5,908	2,288	8,712	11,000	1,504	3,588	5,092
55	OKC	0	0	0	0	0	0	0	0	0
55 Total		**784**	**5,124**	**5,908**	**2,288**	**8,715**	**11,003**	**1,504**	**3,591**	**5,095**
56	Cleveland Co Uninc	42	56	98	43	83	126	1	27	28
56	Moore	0	0	0	0	8	8	0	8	8
56	Norman	143	836	979	232	1,154	1,386	89	318	407
56	OKC	46	357	403	90	609	699	44	252	296
56 Total		**231**	**1,249**	**1,480**	**365**	**1,854**	**2,219**	**134**	**605**	**739**
57	Cleveland Co Uninc	29	97	126	45	126	171	16	29	45
57	Moore	3,019	8,095	11,114	4,838	11,402	16,240	1,819	3,307	5,126
57	Norman	24	32	56	322	178	500	298	146	444
57	OKC	166	1,271	1,437	282	1,758	2,040	116	487	603
57 Total		**3,238**	**9,495**	**12,733**	**5,487**	**13,464**	**18,951**	**2,249**	**3,969**	**6,218**
58	Cleveland Co Uninc	0	0	0	0	0	0	0	0	0
58	OKC	69	685	754	189	1,003	1,192	120	318	438
58 Total		**69**	**685**	**754**	**189**	**1,003**	**1,192**	**120**	**318**	**438**
59	Cleveland Co Uninc	62	49	111	83	55	138	21	6	27
59 Total		**62**	**49**	**111**	**83**	**55**	**138**	**21**	**6**	**27**
70	Cleveland Co Uninc	31	65	96	58	98	156	27	33	60
70	Noble	408	1,436	1,844	1,064	2,473	3,537	656	1,037	1,693
70 Total		**439**	**1,501**	**1,940**	**1,122**	**2,571**	**3,693**	**683**	**1,070**	**1,753**
71	Cleveland Co Uninc	20	37	57	34	57	91	14	20	34
71	Lexington	67	354	421	100	428	528	33	74	107
71	Noble	19	167	186	28	191	219	9	24	33
71	Purcell	0	0	0	0	0	0	0	0	0
71	Slaughterville	21	85	106	41	158	199	20	73	93
71 Total		**127**	**643**	**770**	**203**	**834**	**1,037**	**76**	**191**	**267**
72	Cleveland Co Uninc	12	994	1,006	19	1,217	1,236	7	223	230
72	Etowah	0	2	2	0	3	3	0	1	1
72	Norman	0	0	0	0	0	0	0	0	0
72	Slaughterville	7	33	40	9	41	50	2	8	10
72 Total		**19**	**1,029**	**1,048**	**28**	**1,261**	**1,289**	**9**	**232**	**241**
CLEVELAND COUNTY TOTAL		**18,998**	**55,571**	**74,569**	**30,128**	**78,872**	**109,000**	**11,130**	**23,301**	**34,431**

Table 2.23: (Cont.)
Final 2030 Employment by Traffic District by Entity

Traffic District	Entity	2000 Employment			2030 Employment			2030-2000 Change		
		Retail	Other	Total	Retail	Other	Total	Retail	Other	Total
61	Canadian Co Uninc	1	19	20	1	24	25	0	5	5
61	Mustang	807	2,175	2,982	1,088	3,559	4,647	281	1,384	1,665
61	OKC	20	385	405	26	641	667	6	256	262
61	Yukon	808	890	1,698	895	1,925	2,820	87	1,035	1,122
61 Total		**1,636**	**3,469**	**5,105**	**2,010**	**6,149**	**8,159**	**374**	**2,680**	**3,054**
62	OKC	766	7,993	8,759	892	12,162	13,054	126	4,169	4,295
62	Yukon	1,281	3,502	4,783	1,551	5,584	7,135	270	2,082	2,352
62 Total		**2,047**	**11,495**	**13,542**	**2,443**	**17,746**	**20,189**	**396**	**6,251**	**6,647**
63	Canadian Co Uninc	6	63	69	6	89	95	0	26	26
63	OKC	71	510	581	222	999	1,221	151	489	640
63	Piedmont	24	109	133	50	273	323	26	164	190
63	Yukon	3	73	76	3	90	93	0	17	17
63 Total		**104**	**755**	**859**	**281**	**1,451**	**1,732**	**177**	**696**	**873**
64	Canadian Co Uninc	1	23	24	1	37	38	0	14	14
64	Piedmont	36	447	483	62	820	882	26	373	399
64 Total		**37**	**470**	**507**	**63**	**857**	**920**	**26**	**387**	**413**
CANADIAN COUNTY TOTAL		**3,824**	**16,189**	**20,013**	**4,797**	**26,203**	**31,000**	**973**	**10,014**	**10,987**

Oklahoma City Totals (reiterated)										
	OKC-Canadian Co	857	8,888	9,745	1,140	13,802	14,942	283	4,914	5,197
	OKC-Cleveland Co	1,705	6,351	8,056	3,180	9,822	13,002	1,475	3,471	4,946
	OKC-Oklahoma Co	67,111	283,021	350,132	90,480	366,697	457,177	23,369	83,676	107,045
OKLAHOMA CITY TOTAL		**69,673**	**298,260**	**367,933**	**94,800**	**390,321**	**485,121**	**25,127**	**92,061**	**117,188**

Table 2.23: (Cont.)
Final 2030 Employment by Traffic District by Entity

Traffic District	Entity	2000 Employment			2030 Employment			2030-2000 Change		
		Retail	Other	Total	Retail	Other	Total	Retail	Other	Total
GRADY COUNTY										
65	Blanchard	0	0	0	0	0	0	0	0	0
65	Grady Co Uninc	13	443	456	19	631	650	6	188	194
65	Tuttle	249	864	1,113	256	1,294	1,550	7	430	437
65 Total		**262**	**1,307**	**1,569**	**275**	**1,925**	**2,200**	**13**	**618**	**631**
GRADY COUNTY TOTAL		**262**	**1,307**	**1,569**	**275**	**1,925**	**2,200**	**13**	**618**	**631**
LOGAN COUNTY										
81	Cashion	0	0	0	0	3	3	0	3	3
81	Cedar Valley*	11	65	76	11	84	95	0	19	19
81	Cimarron City	0	0	0	0	0	0	0	0	0
81	Guthrie	0	0	0	0	0	0	0	0	0
81	Logan Co Uninc	63	332	395	64	772	836	1	440	441
81 Total		**74**	**397**	**471**	**75**	**859**	**934**	**1**	**462**	**463**
82	Guthrie	1,420	3,810	5,230	1,800	5,634	7,434	380	1,824	2,204
82	Logan Co Uninc	32	185	217	36	384	420	4	199	203
82 Total		**1,452**	**3,995**	**5,447**	**1,836**	**6,018**	**7,854**	**384**	**2,023**	**2,407**
83	Guthrie	0	0	0	0	0	0	0	0	0
83	Logan Co Uninc	117	441	558	141	871	1,012	24	430	454
83 Total		**117**	**441**	558	**141**	**871**	1,012	24	430	454
LOGAN COUNTY TOTAL		**1,643**	**4,833**	**6,476**	**2,052**	**7,748**	**9,800**	**409**	**2,915**	**3,324**
McCLAIN COUNTY										
66	McClain Co Uninc	0	1	1	0	2	2	0	1	1
66	Newcastle	554	913	1,467	983	1,351	2,334	429	438	867
66 Total		**554**	**914**	**1,468**	**983**	**1,353**	**2,336**	**429**	**439**	**868**
67	Blanchard	240	539	779	485	1,008	1,493	245	469	714
67	Cole	7	12	19	10	16	26	3	4	7
67	Dibble	11	119	130	21	210	231	10	91	101
67	Goldsby	20	199	219	39	380	419	19	181	200
67	McClain Co Uninc	38	193	231	133	346	479	95	153	248
67	Newcastle	14	89	103	34	144	178	20	55	75
67	Washington	18	158	176	31	251	282	13	93	106
67 Total		**348**	**1,309**	**1,657**	**753**	**2,355**	**3,108**	**405**	**1,046**	**1,451**
68	Cole	0	0	0	0	0	0	0	0	0
68	Goldsby	112	174	286	200	262	462	88	88	176
68	McClain Co Uninc	20	81	101	33	120	153	13	39	52
68	Purcell	804	1,718	2,522	1,500	2,941	4,441	696	1,223	1,919
68	Washington	0	0	0	0	0	0	0	0	0
68 Total		**936**	**1,973**	**2,909**	**1,733**	**3,323**	**5,056**	**797**	**1,350**	**2,147**
McCLAIN COUNTY TOTAL		**1,838**	**4,196**	**6,034**	**3,469**	**7,031**	**10,500**	**1,631**	**2,835**	**4,466**
OCARTS GRAND TOTAL		**119,693**	**419,702**	**539,395**	**166,785**	**561,315**	**728,100**	**47,092**	**141,613**	**188,705**

CHAPTER 3: INTERMODAL ELEMENT

All modes of transportation play a vital role in addressing mobility needs within the OCARTS area. In addition to private automobile travel on the street and highway network, the region's multimodal transportation system is characterized by transit, bicycle, pedestrian, intermodal freight (air, rail, and truck), as well as airport access movements.

To address all these alternate modes of transportation, the Intermodal Element (IME), a component of the 2030 OCARTS Plan, was compiled concurrently with the development of the street and highway network. The IME creates a profile for each particular alternate transportation mode by reviewing existing and forecasted needs and issues, as well as assessing the 2000 base year condition and recommending the level of transportation services in the forecast year of 2030. Each of the transportation modes is addressed independently, as well as intermodally, as they are connected among each other and the street and highway network, thus emphasizing the importance of intermodal integration. The final IME report was presented to the ACOG transportation committees in March 2005.[21]

Based on the IME, the following sections provide a summary of each alternate mode of transportation, along with the mode specific recommendations, which were based on the previous 2025 OCARTS Plan recommendations; transportation survey results; Open House and subarea meeting comments from citizens, local governments and local transportation agencies; as well as comments received from OCARTS freight stakeholders. The IME recommendations were developed with the understanding that they would be coupled with the approved street and highway network to complete the 2030 OCARTS Plan. The recommendations are general in nature and not project specific.

TRANSIT

Public transportation within the OCARTS area has several components. These include, but are not limited to, traditional fixed route bus service, flexible route service, specific services for the elderly and disabled, demand response programs for rural portions of the region, taxi operations, and passenger rail service. This section of the report provides a brief summary of the profile given in the Intermodal Element (IME), which describes the base year 2000 and existing transit system (2004), a needs assessment, cost and revenue analysis, and options and recommendations for future transit service through the year 2030. Transit issues and needs were not only analyzed as part of Intermodal Element, but also as part of the development of the COTPA Long Range Transit Plan, which was completed in 2001.[22]

PUBLIC TRANSIT SERVICE

The lead agency in designing and managing the majority of public transportation services for the OCARTS area is the Central Oklahoma Transportation and Parking Authority (COTPA), a trust of the City of Oklahoma City. During the 2000 base year of the 2030 OCARTS Plan, COTPA was the sole administrator and grant recipient for both the Oklahoma City metro and Norman

[21] The Intermodal Element report is available at the ACOG offices and on the ACOG Web site at: http://www.acogok.org/Newsroom/Downloads/ime2030.pdf

[22] Development of the COTPA Long Range Transit Plan (LRTP) was initiated in April 2000. The COTPA Board of Trustees adopted the LRTP in April 2001, followed by the Oklahoma City City Council in May 2001. The OCARTS area Intermodal Transportation Policy Committee approved the integration of the LRTP recommendations in April 2001.

areas. However, due to a change in urban area designations in 2002[23], the Cleveland Area Rapid Transit (CART) authority, operated by the University of Oklahoma, now provides and manages transportation services within the City of Norman. This development is reflected in the way transit data has been compiled. Therefore, public transit information for the base year of this report reflects a combination of both areas, and current data is reported as specified for COTPA and CART.

PASSENGER RAIL SERVICE

In 1999, Amtrak service was reinstated in Oklahoma after a nearly two decade absence. Rail service in the OCARTS area consists of the Heartland Flyer service to Fort Worth (train service includes Norman, Purcell, Pauls Valley, and Ardmore, as well as Gainesville, Texas).

The Oklahoma Department of Transportation updated a High Speed Passenger Rail Feasibility Study in 2002. The study recommends that the Heartland Flyer service be extended north to Newton, Kansas to augment the current service to Ft. Worth. The study also concludes that further expansion of the Heartland Flyer route to Denver, Colorado should be considered along with the incremental development of passenger rail service between Oklahoma City and Tulsa.

Most transportation funding issues were settled with final passage of the SAFETEA-LU. However, funding for Amtrak is not part of the reauthorization measure and must be set in the annual transportation appropriations process. Federal proposals may change the way Amtrak is funded in the future, which could include providing federal matching grants to states for rail infrastructure improvements, giving states the responsibility of operating the lines and allowing other operators to compete with Amtrak.

In 2005, the State of Oklahoma approved nearly $2 million in the 2006 fiscal year for the continued operation of the Heartland Flyer. Amtrak funding is included beyond FY 2006 in House Bill 1078, subject to revenue growth for the State. The future of Amtrak service in the OCARTS area in its current or expanded form is dependent upon continued funding at the state and federal levels.

EXISTING SYSTEM

Public Transit Service

Since the adoption of its Long Range Transit Plan in 2001, COTPA has achieved many of the short term goals and continues to make progress on other goals. COTPA and the cities of Edmond and Midwest City have partnered to extend service in those communities. METRO Transit has worked to enhance its public image and marketing efforts. ADA accessibility was increased with the acquisition of new buses that are wheelchair accessible. Most notably, a new transit center was constructed at NW 5th Street and Hudson Avenue in downtown Oklahoma City.

A Fixed Guideway Study[24] was initiated by COTPA in December 2004 and was completed in 2006. The study considered the feasibility of light rail and several other transit technologies for the region as an alternative to automobile travel. Briefly, the findings of the study recommended enhancing the current bus system to serve a larger portion of the OCARTS area population as well as increasing the frequency of its current service; connecting Norman,

[23] According to the 2000 Census and revisions to the U.S. Census Bureau's criteria for determining urban and rural territories, Norman was designated a separate urbanized area from Oklahoma City beginning October 1, 2002. Therefore, COTPA and CART are now separate recipients of federal transit funding.
[24] Fixed Guideway Study, Carter Burgess, July 2006.

Midwest City and Edmond via commuter rail transit (CRT); serving the northwest and west areas of the region with bus rapid transit (BRT); and enhancing travel in the core of Oklahoma City with a circulating streetcar/light rail system. In addition, the study provided a preliminary phasing plan for the various technologies through the year 2030, and recommended development of a new downtown intermodal transportation center to provide a centrally located hub for transfers between bus, BRT, CRT and the streetcar circulator.

Furthermore, to identify the unmet need for transportation services within the City of Norman area and to develop possible transportation solutions, the University of Oklahoma, the City of Norman and COTPA (on behalf of CART), together with a consultant team, conducted a Transportation Needs Assessment.[25]

Passenger Rail Service

The Heartland Flyer passenger rail service provided through Amtrak and the State of Oklahoma, operates two trains per day, one in each direction along the BNSF rail line between Oklahoma City and Ardmore, then continuing service to Gainesville and Fort Worth, Texas. Ridership totaled 66,968 for FFY 2005, representing an increase of 23 percent over FFY 2004.

FUTURE OPTIONS AND RECOMMENDATIONS

Recommendations of the COTPA LRTP are grouped into three phases, short-term (1-2 years), medium-term (3-10 years) and long-term (11-25 years). Since many of the short-term recommendations have already been implemented and progress on the medium- and long-term goals is being made, only select recommendations are listed here. Those goals and recommendations are as follows:

- Implement the *COTPA Long Range Transit Plan* through –
  - providing a range of mobility options to serve the Greater Oklahoma City Area
  - increasing the number of hours of transit service and the frequency of service
  - delivering innovative services that are responsive to the market needs of the community, which place the customer first
  - delivering services that are reliable, on time, safe, clean, and friendly
  - being an active partner in promoting the economic growth of the Greater Oklahoma City area
  - providing services that efficiently use financial resources and are responsive to funders of service
- Work to secure a more stable transit funding source, such as a dedicated tax.
- Encourage local governments to furnish adequate matching funds for the operation of transit service.
- Maintain the Oklahoma Spirit trolley in downtown Oklahoma City and between downtown and the I-40/Meridian hotel area as called for by the Metropolitan Area Projects (MAPS) program.
- Increase transportation options for commuting to and from Will Rogers World Airport (WRWA) and other public airports in the region.

Additionally, COTPA has built a business relationship with several other local governments in the OCARTS area, and services have been provided primarily through contract arrangements. This structure could continue, or other options may be pursued to create a transit system that addresses a broader geography in its administrative, financial and service delivery structure.

[25] *Transportation Needs Assessment Study, A Study of Transit Need for Norman, Oklahoma;* prepared by: KA Associates; for the City of Norman, the University of Oklahoma, and COTPA; 2003.

A summary of the recommendations for transit service within the Norman area, as identified in the Transportation Needs Assessment Study, is listed below:

- Increase frequency of bus service.
- Provide service between downtown Norman and the University of Oklahoma campus.
- Develop a transit route to serve east Norman.
- Address the needs of the elderly and disabled population; consider subsidized cab service.
- Increase coordination between CART and Norman area social service agencies.
- Create demand responsive service for rural areas in eastern and northern Norman.
- Create a park-and-ride lot in northern Norman for commuter route to Oklahoma City.
- Replace loop fixed routes with linear fixed routes.

Rural transit operators such as Delta Public Transit in McClain County, and First Capitol Trolley System in Logan County provide an important service to transit patrons in the more rural parts of the OCARTS area. These services, along with transportation assistance for the elderly and persons with disabilities (provided by non-profit organizations operating under the FTA Section 5310 funding program) should continue to receive support in the OCARTS area planning and funding process.

Other actions that should be considered in relation to all transit service in the OCARTS area are listed below:

- Continue State acquisition of abandoned rail right-of-way for possible future use for commuter, tourism, or economic development purposes. Pursue efforts to expand passenger rail service within Oklahoma, including the development of local recreation/ excursion routes and Amtrak service linking Oklahoma City with other cities and states.
- Encourage local governments to improve coordination between land use development and transit planning, with particular attention to pedestrian access, bikeways, convenient bus stop locations, transit shelters, park-and-ride lots, access for elderly and disabled, transit oriented development, and an efficient network of streets for vehicular circulation throughout the service area.
- Encourage local governments to install sidewalks adjacent to fixed bus routes.
- Continue to promote regional clean air goals by providing alternates to single occupant motor vehicles, including a vastly expanded offering of express bus routes, rideshare opportunities, reduced or free bus fare on Clean Air Alert Days, and purchase of clean-fueled buses.
- Continue compliance and documentation of compliance, with Title VI of the Civil Rights Act of 1964 and the 1997 U.S. Department of Transportation Order on Environmental Justice. These requirements ban discrimination on the basis of race, color, or national origin under any program receiving federal aid; and require federally funded programs to identify and address disproportionately high adverse effects of such programs on minority and low-income populations.
- Continue compliance with other federal requirements such as the 1990 Americans with Disabilities Act (ADA). The ADA states that an individual with a disability, solely by reason of his or her disability, cannot be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.
- Enhance marketing of new and existing transit services to expand ridership.
- Encourage the continued financing of passenger rail in the OCARTS area.

BICYCLE AND PEDESTRIAN TRAILS

Bicycle and pedestrian transportation is an important component of the Intermodal Element. Pedestrian facilities are fundamental to an integrated transportation system, as it is the mode most often used in conjunction with other modes of transportation. Bicycle facilities serve commuter needs, provide users with direct routes to recreational and non-recreational destinations, and generally provide an alternative means of travel.

Sidewalks, bicycle facilities, and multi-use trails have historically been planned and implemented at the local level. However, federal transportation laws charge metropolitan areas with the development of a regional trails network through coordinated planning and implementation among jurisdictions. The IME contains the detailed information about the existing pedestrian and bicycle systems, a complete assessment of pedestrian and bicycle issues and concerns, discussion of revenue sources and estimated costs for pedestrian and bicycle improvements, along with proposed and envisioned trail facility improvements and associated recommendations.

The following section gives a brief overview of the existing system and future recommendations.

EXISTING SYSTEM

Bicycle facilities are located in various urban, suburban, and recreational areas across Central Oklahoma. Within the OCARTS area, 16 local government entities have existing bicycle or multi-use trail facilities. As of February 2005, there are approximately 198 miles of existing and 429 miles of planned bicycle facilities in the region.

Sidewalks and pedestrian facilities throughout the OCARTS area are typically planned and built as required by local municipal codes and funded through local revenues or by private developers. However, many communities in the region do not require sidewalks to be constructed as part of the building permit or land development process, therefore pedestrian facilities currently appear in a sporadic pattern, hindering pedestrian connectivity within and between local entities.

FUTURE OPTIONS AND RECOMMENDATIONS

Bicycle Recommendations:

- Encourage municipalities to adopt ordinances providing for the implementation of safe bicycle facilities within communities that meet minimum design standards as provided by AASHTO[26].
- Encourage connection of bicycle facilities between municipalities throughout the region, as well as linking neighborhoods with popular destinations, such as schools, employment centers, retail establishments, tourist attractions, medical facilities and outdoor recreation areas (i.e. parks and lakes) within communities.
- Encourage cooperation and coordination among cities, state agencies and the private sector, when developing trails plans or connections between cities in the region.
- Continue to regularly update the OCARTS area bicycle database containing existing and planned facilities.

[26] Guide to the Development of Bicycle Facilities, updated in 1999 by the American Association of State Highway Transportation Officials (AASHTO).

- Encourage public awareness, education and safety relating to bicycles. Various forms of media could be used to increase public awareness, education, and acceptance of bicycle traffic. Encourage communities and bicycle groups to provide information through the local school systems on bicycle safety and etiquette. Similar bicycle awareness curricula could be provided as part of drivers' education classes or defensive driving courses, as well as an education program for bicyclists.
- Promote bicycle facilities by encouraging Bike-to-Work days and encourage employers and businesses to provide bicycle support facilities (i.e. secure bike parking and showers) for employees who bicycle to work.
- Evaluate potential connections between transit routes, park-and-ride lots, pedestrian ways, and existing and planned bike routes for opportunities to improve connections among transportation modes.
- Explore opportunities for preservation/construction of bicycle facilities within floodways, greenways, public open spaces, utility rights-of-way, abandoned railroad rights-of-way, and school land.
- Encourage cities and the Oklahoma Department of Transportation to include wider shoulders and wider pavement or lanes for bicycles when constructing and improving arterial streets, highways, and bridges.
- Encourage local governments to pursue a variety of funding sources to plan and implement bicycle facilities including federal, state, local, and private funds.
- Encourage cities and the Oklahoma Department of Transportation to develop on-street bicycle facilities, where appropriate, improved with signage, pavement symbols, and actuated signals as a cost-effective alternate to off-street facilities.
- Encourage the Central Oklahoma Transportation and Parking Authority (COTPA) and Cleveland Area Rapid Transit (CART) to install bicycle racks on its public transit buses.
- In order for Extended Vision plans and facilities to become a reality, local governments must formally decide to adopt and sponsor such routes by adding them to their local master trails plans and/or securing funding for their construction. Local priorities and available funds will ultimately determine which facilities are constructed. However, the full regional plan—with Extended Vision routes—can provide an informal guide for future bicycle and multi-use trail development.

Pedestrian Recommendations:

- Encourage local municipalities to adopt and enforce ordinances requiring sidewalk construction in conjunction with new residential and commercial development and redevelopment along adjacent arterial, collector, and neighborhood streets. All such sidewalks must be in conformance with the Americans with Disabilities Act (ADA).
- Explore opportunities for preservation/construction of pedestrian pathways within floodways, greenways, public open spaces, utility rights-of-way, abandoned railroad rights-of-way, and school land.
- Pedestrian systems should be linked with transit stop locations, nearby schools, and retail centers. The transit stops should include such amenities as bus shelters or benches.
- Encourage local governments to pursue a variety of funding sources to plan, implement, and maintain sidewalks using federal, state, local and private revenues. Communities should include sidewalks in conjunction with federal aid street improvement projects, as appropriate.

INTERMODAL FREIGHT

Freight transportation enables connections between businesses, suppliers, markets, and customers. Local and national economy relies on efficient, safe, and secure freight transportation. The intermodal freight chapter of the IME reviews existing OCARTS area freight movements for truck, rail, and air cargo and provides a profile of existing services and current trends, an analysis of issues and concerns, and a discussion of future options.

FREIGHT DATA

The knowledge of current and forecasted freight tonnage is of utmost importance to the analysis of freight movements and their current and future impact on freight infrastructure and facilities. OCARTS area specific freight data is not readily available, however, 2000 base year data has been obtained from Reebie Associates, a private firm specializing in freight related, spatial information. The consultant's expertise was previously employed for the development of the 2025 Intermodal Element.

The primary sources for the Reebie data are the Census of Transportation Commodity Flow Survey, Annual Rail Carload Waybill Sample, Federal Aviation Administration, Annual U.S. Department of Energy Coal Movement Statistics, Annual Department of Agriculture Produce Movement Data, Annual Corps of Engineers Waterborne Commerce Statistics, Import/Export Trade Statistics and Inland Traffic Survey, as well as several other supplementary sources.

METHODOLOGY

The 2000 Reebie data underwent an extensive validation process, which included comparing the data with freight information available at the state and national level, as well as comparing it to the data used in the previous 2025 Intermodal Element. Also undertaken were comparisons to local airport activity, local truck traffic counts, and correlation to population and employment growth.

Freight forecast assumptions for the OCARTS area were developed in house, following extensive research of freight transportation literature, available local freight data sources, and local historical trends.

The following section gives a brief overview of the existing intermodal freight system and associated future recommendations for the OCARTS area.

EXISTING SYSTEM

The existing OCARTS freight movement network is a well-established combination of trucking, railroad and air cargo facilities, interconnected by an extensive street and highway network. The OCARTS area does not possess any shippable waterways for freight transportation.

Highways and truck traffic are critical components of the freight transportation system. The performance of the highway and street network is directly tied to the efficiency of truck transportation. Reliable travel times are critical to truckers who serve just-in-time manufacturing and distribution systems. Approximately 367 trucking companies are located in the OCARTS area, each categorized as one of the seven types of haulers: general, heavy, light, liquid/dry bulk, local cartage, motor freight, and refrigerated hauling. Of these, forty-two trucking companies employ 50 or more workers and 18 companies employ 100 or more workers. The U.S. Postal Service and private parcel post carriers, add another 16 distribution sites with 50 or more employees and 12 distribution sites with 100 or more employees.

The use of railroad to move freight continues its uninterrupted growth since the 1980's, while the extent of railroad track declines and the number of locomotives and railcars increases. In particular, rail-intermodal freight has grown tremendously over the past years. The OCARTS area is served by two Class I railroads - Burlington Northern Santa Fe (BNSF) and Union Pacific (UP). BNSF is operating on the most extensive network of tracks within the study area. Amtrak has trackage rights on BNSF owned tracks. Two Class III railroads operate within the OCARTS area – Southern Kansas & Oklahoma (SK&O) and Stillwater Central Railroad (SLWC). These so called short-lines have taken up operations on multiple miles of state owned tracks, based on a long-term lease and operating agreement with ODOT. Four rail terminals are located within the OCARTS area: two of them owned by BNSF, another located on the Stockyard grounds, and one terminal serving the GM Assembly Plant.

Air freight is fast and reliable, but is also more expensive than truck or rail freight transportation. While air freight growth is dependent on market conditions, it has been forecasted that long term air cargo rate of growth will be considerably higher than truck freight or rail freight growth. A fraction of one percent of freight is carried in and out of OCARTS via air carrier operations. The OCARTS area has seven public airports, but is not in possession of a major hub airport and therefore has no significant portion of through freight transported by air.

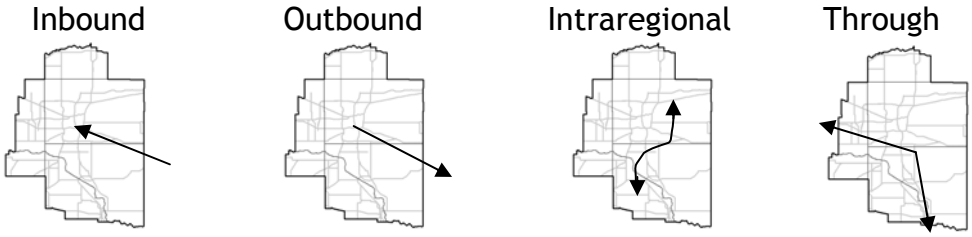


Table 1 shows the OCARTS 2000 base year and 2030 forecast year freight information as portions of inbound, outbound, intraregional, and through freight:

Table 3.1:
2000 and Projected 2030 Inbound, Outbound, Intraregional and Through Freight

Freight Type	2000 Tons	Percent of Total Tonnage	2030 Tons	Percent of Total Tonnage	2000-2030 Growth
Inbound	30,697,774.1	19.4%	53,336,968.1	15.4%	73.7%
Outbound	16,308,806.5	10.3%	31,798,008.6	9.2%	95.0%
Intraregional	1,773,896.1	1.1%	3,224,105.0	0.9%	81.8%
Through	109,279,981.8	69.1%	257,633,217.1	74.5%	135.8%
TOTAL	**158,060,458.5**	**100.0%**	**345,992,298.7**	**100.0%**	**118.9%**

Source: Reebie Associate, September and December 2004 and ACOG, December 2004

Tables 2 and 3 show the base year 2000 as well as forecasted tonnage for the year 2030 for each the inbound and outbound freight by mode of transportation.

Table 3.2:
2000 and Projected 2030 Inbound Freight by Mode of Transportation

Mode	2000 Tonnage	2000 Percent by Mode	Projected 2030 Tonnage	2030 Percent by Mode	2000-2030 Growth
Truck	27,118,034.3	88.3%	47,277,011.3	88.6%	74.3%
Rail	3,551,860.7	11.6%	5,940,363.0	11.1%	67.2%
Air	27,879.2	0.1%	119,593.7	0.2%	329.0%
TOTAL	**30,697,774.1**	**100.0%**	**53,336,968.1**	**100.0%**	**73.7%**

Source: Reebie Associate, September and December 2004, and ACOG December 2004

Table 3.3:
2000 and Projected 2030 Outbound Freight by Mode of Transportation

Mode	2000 Tonnage	2000 Percent by Mode	Projected 2030 Tonnage	2030 Percent by Mode	2000-2030 Growth
Truck	15,525,861.3	95.2%	30,006,031.3	94.4%	93.3%
Rail	758,938.7	4.7%	1,607,610.3	5.1%	11.8%
Air	24,006.5	0.2%	184,367.0	0.6%	668.0%
TOTAL	**16,308,806.5**	**100.0%**	**31,798,008.6**	**100.0%**	**95.0%**

Source: Reebie Associate, September and December 2004, and ACOG December 2004

Table 4 and 5 show the base year 2000 and forecast year 2030 tonnage for intraregional and through truck and rail freight[27]:

Table 3.4:
2000 and Projected 2030 Intraregional Freight by Mode of Transportation[28]

Mode	2000 Tonnage	2000 Percent by Mode	Projected 2030 Tonnage	2030 Percent by Mode	2000-2030 Growth
Truck	1,770,018.1	99.8%	3,217,056.6	99.8%	81.8%
Rail	3,878.0	0.2%	7,048.4	0.2%	81.8%
TOTAL	**1,773,896.1**	**100.0%**	**3,224,105.0**	**100.0%**	**81.8%**

Source: Reebie Associate, September and December 2004, and ACOG December 2004

Table 3.5:
2000 and Projected 2030 Through Freight by Mode of Transportation

Mode	2000 Tonnage	2000 Percent by Mode	Projected 2030 Tonnage	2030 Percent by Mode	2000-2030 Growth
Truck	95,896,531.4	87.8%	227,440,756.3	88.3%	137.2%
Rail	13,383,450.3	12.3%	30,192,460.8	11.7%	125.6%
TOTAL	**109,279,981.8**	**100.0%**	**257,633,217.1**	**100.0%**	**135.8%**

Source: Reebie Associate, September and December 2004, and ACOG December 2004

[27] Movements of air cargo within the region or through the OCARTS area do not occur.
[28] Since detailed information on intraregional freight growth by mode was unavailable, intraregional truck and rail traffic were assumed to grow at the same rate.

Trucking directly impacts every goods-moving industry in Oklahoma, where 68 percent of the communities do not possess rail or airport access and solely rely on truck transportation. In the OCARTS area, truck traffic represents nine percent of total street and highway traffic.

FUTURE OPTIONS AND RECOMMENDATIONS

Intermodal Freight Recommendations:

- Develop intermodal facilities and connections to enhance and integrate the area freight movement with the remainder of the regional transportation system.
- Increase the transportation system efficiency through the application of demand management techniques and intelligent technology. Focus Intelligent Transportation System (ITS) applications on commercial vehicle operations, traveler information systems, and incident management.

Truck Freight Recommendations:

- Efforts to improve commercial vehicle routes should be made in conjunction with highway construction or reconstruction projects. Regionally, this could include identification of opportunities to build or designate special purpose lanes for truck traffic, especially in relation to major development efforts, such as the I-35 Trade Corridor. For local facilities, such improvements could include wider turning radii, greater pavement strength, and improved access management, and others as appropriate. Design improvements to eliminate safety hazards should have a high priority.
- The MPO should work with the State, local jurisdictions, and the appropriate private stakeholders to study and coordinate potential future rerouting of through traffic around the core metropolitan area.
- To manage and operate the existing transportation system more efficiently, Travel Demand Management (TDM) measures and Intelligent Transportation Systems (ITS) technologies should be applied. Special consideration should be given to technologies concerned with Commercial Vehicle Operations (CVO), which allow a more efficient use of resources and an overall increase in motor carrier safety.
- Encourage ODOT to continue deployment of dynamic message signs along major thoroughfares to provide real time traffic, as well as advanced traveler information regarding detours, alternate routes, etc.
- ODOT, in coordination with local jurisdictions should examine and inventory the system of designated truck routes, which include certain major and minor arterials within OCARTS.
- The ODOT administered Pavement Management System should monitor designated commercial vehicle routes, including frequent traffic counts and data on pavement distress from truck traffic. This information should be supplemented with surveys of local trucking firms and used for early diagnosis of problem areas to increase the operational life of truck routes.
- Support ODOT's efforts to closely monitor the condition of bridges within the OCARTS area; and encourage the Department to frequently update public information on bridge conditions, in order to minimize negative impacts for truck freight movements.
- ODOT and the MPO should closely coordinate their efforts of routine freight data collection as well as freight modeling.
- Encourage ODOT to move scale house facilities to the borders of the state to maximize efficiency of enforcement activities.

- Encourage the appropriate agencies to coordinate a public education campaign that informs the motoring public about how passenger vehicles and trucks can safely share the road.
- Encourage BNSF, the owners of the Flynn Yard at 8401 S Eastern Avenue in Oklahoma City that previously provided a site for truck to rail transition, to preserve the existing intermodal infrastructure to allow for a reactivation of intermodal activities when needed.

Rail Freight Recommendations:

- Transportation planning efforts and industrial development should include provisions for rail access to industrial areas and improved coordination with the street and highway network to enhance intermodal freight movement.
- Strengthen coordination with street and highway construction to ensure adequate grade separations between rail and highway modes to enhance public safety.
- ODOT Rail Division should continue working with communities through the Federal Aid Railroad Surface Improvement Corridor Safety Program to review railroad crossings for safety concerns, upgrade key crossings with mast arms, lights and/or other safety features, and eliminate unnecessary or poorly functioning crossings.
- Operating railroads and the ODOT Rail Division should regularly monitor the condition of the railroad tracks to identify and repair broken rails, fractures and fissures, which would otherwise render the rail unfit for normal operation.
- Ensure that emergency responders have timely access to hazardous materials information.[29]
- Consider improving the capacity of existing rail yards and the implementation of more extensive intermodal rail facilities to allow the OCARTS region to better tap into the forecasted increase in rail freight. ODOT and the MPO should continue coordination with private stakeholders to implement and expand intermodal facilities, serving the OCARTS area.
- Encourage ODOT to continue its involvement in monitoring and preserving certain components of the rail system. Such public support, coupled with private investment, should spur increased utilization of rail facilities to accommodate growing freight movements, and reduce congestion, air pollution, and pavement wear.
- Data on rail freight, tonnage, freight traffic, and rail line conditions should be collected routinely to monitor the effectiveness of the local rail system, assist in preservation of rail corridors, program safety improvements, and guide preventive maintenance efforts.
- Encourage ODOT and private railroad companies to explore all available options to expand rail capacity.

Air Freight Recommendations:

- Continue close coordination of airport planning and transportation planning efforts to ensure enhanced airport operations, as well as optimal use of the street and highway network accessing the airport facilities.
- Planning efforts should include coordination with street and highway construction to ensure adequate access to and from the airport facilities, in light of recent and projected increases in air freight.
- Consider implementing Travel Demand Management (TDM) strategies and Intelligent Transportation Systems (ITS) technologies to increase the capacity of the street and highway network providing access to the airport.
- Encourage the Oklahoma City Department of Airports and the management at Will Rogers World Airport to preserve the available land for future expansion of airport operations.

[29] As recommended in the Federal Railroad Administration Action Plan for Addressing Critical Railroad Safety Issues, released by the U.S. DOT Federal Railroad Administration on May 16, 2005.

AIRPORT ACCESS

As an important element of the intermodal transportation system, aviation facilities provide valuable services, such as scheduled air cargo, airline service, general aviation service, military functions, and emergency services to OCARTS area residents and businesses. It is important that these facilities are fully accessible by the existing transportation network. The airport access chapter of the IME provides a profile of current and future conditions and transportation service needs of the airports. The IME focuses on access from the surrounding multimodal transportation network, rather than addressing airport operations, development, or future land use plans within the individual airport properties. Such issues are handled through separate airport master plans.

The following section gives a brief overview of the existing airport facilities, associated airport access and future recommendations.

EXISTING SYSTEM

The OCARTS area has seven publicly owned and publicly used airports - Will Rogers World Airport, Wiley Post Airport, Max Westheimer Airport, Guthrie-Edmond Regional Airport, David Jay Perry Airport, Clarence E. Page Airport, and Purcell Municipal Airport. The OCARTS area is furthermore home to a publicly owned and publicly used heliport, several privately owned and publicly used airports and heliports, and one military airport – Tinker Air Force Base.

FUTURE OPTIONS AND RECOMMENDATIONS

Access to area airports should be enhanced though the following actions:

- Improve signalization and signage on roadways, which provide access to airports.
- Use dynamic message signs and other technologies to provide traveler information about delays on airport access roads.
- Post information on available transit services at airports, websites, etc.
- Monitor the ridership and continue to support the bus service provided by the Central Oklahoma Transportation and Parking Authority (COTPA) to Will Rogers World Airport.
- Encourage COTPA to increase the frequency of bus and shuttle service to Will Rogers World Airport and to provide for the transportation of persons with disabilities.
- Study the need and feasibility of expanding bus and/or shuttle services to directly connect various cities within the metropolitan area with Will Rogers World Airport.
- Provide facilities for pedestrians at airports, to include sidewalks, ramps, bus shelters, etc.
- Enhance access to Will Rogers World Airport by decreasing congestion on surrounding streets as recommended by the street and highway element of the long range plan.
- Continue to monitor airport access road congestion levels, and program additional improvements as appropriate.
- Encourage employer-sponsored rideshare programs for airport and other employees based on or around the airport.

CHAPTER 4: CALIBRATION OF THE BASE YEAR (2000) TRAVEL DEMAND MODEL

BACKGROUND

Chapter 4 summarizes the work performed by the MPO staff in calibrating the traffic forecasting model to simulate 2000 base year conditions for use in the development of the 2030 Oklahoma City Area Regional Transportation Study (OCARTS) Plan. However, before detailing the steps used in calibrating the model, an overview of the improvements made to the 2000 base year network are described below.

DEVELOPMENT OF THE 2000 STREET AND HIGHWAY NETWORK

The coded highway network represents the streets, roads, thoroughfares, and freeways that make up the regional roadway system.[30] Without accurate depiction of the street and highway network, meaningful representation of travel demand is impossible. That is why the MPO initiated a program in 1998 to provide for the continued maintenance of the OCARTS model.

The base year for the development of the street and highway network and the associated 2030 travel demand model is the year 2000. The OCARTS study area geography was expanded in February 2002, prior to the development of the 2030 OCARTS Plan. The study area is now approximately 25% larger than the area represented in the previous long range transportation plan, which in turn added approximately 6.6% to the street and highway network mileage.[31]

Figure 4.1 illustrates the difference between the 1995 and 2000 OCARTS study area.

NETWORK CONFIGURATION

During the process of base year network conversion and expansion, staff carefully reviewed every link and centroid connector to ensure that the base network was accurately representing the conditions as they existed in 2000. The attributes investigated on each network link and centroid connector include:

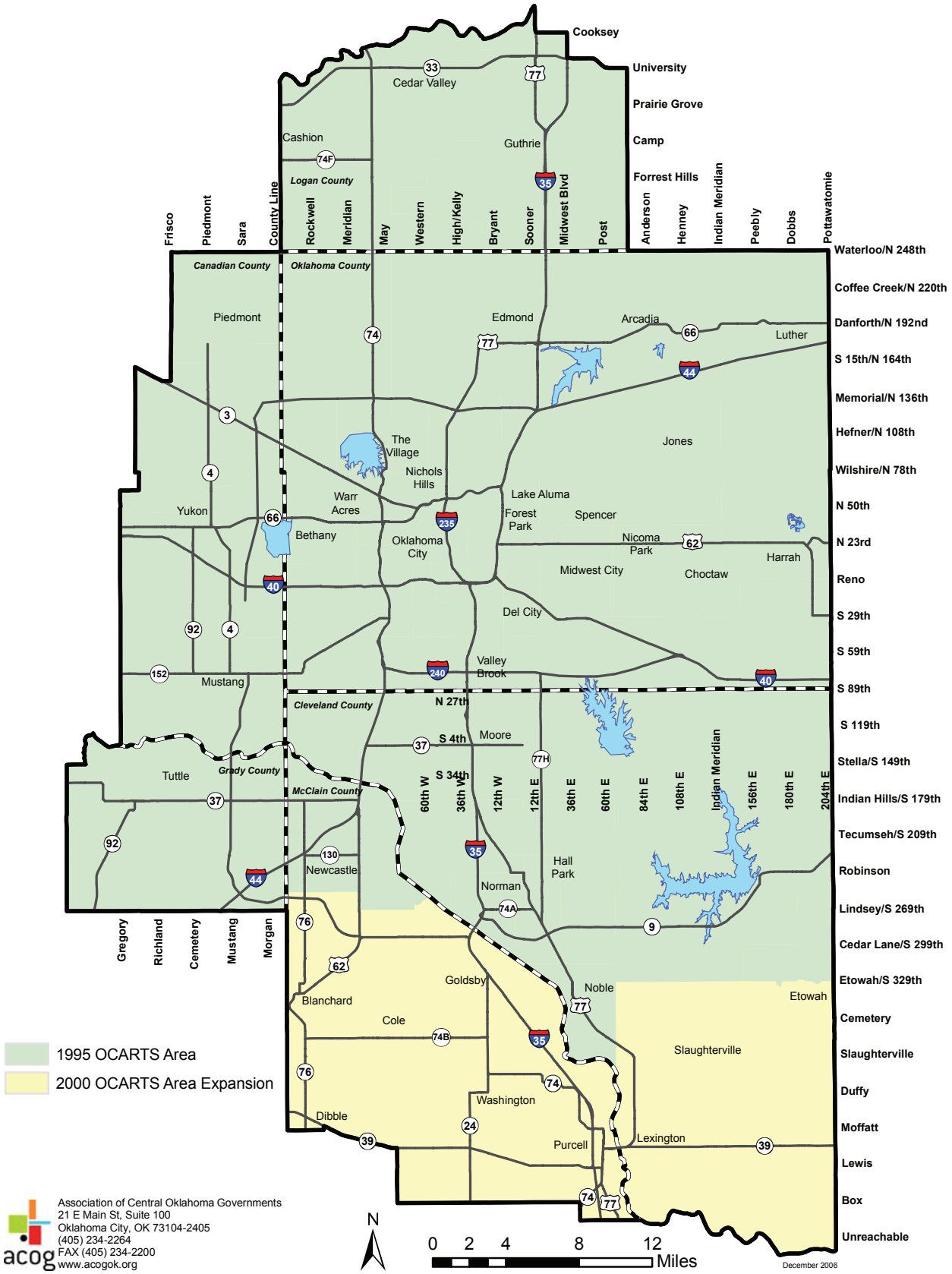
- number of lanes – by direction
- facility class – roadway designation as either interstate/freeway, principal arterial, minor arterial, collector, turnpike, or centroid connector
- missing nodes or links
- posted speeds
- subarea type – designation as either OKC-CBD, Central Subarea, or Other Subarea

Other network errors investigated include:

- elimination of “double links” – i.e., links hidden under other links
- one-way links going in the wrong direction
- misplaced centroid connectors – i.e., connectors that did not accurately represent access points from local streets to the collectors/arterials in the system

[30] The regional roadway system refers to the OCARTS Long Range Plan network and not the Federal Aid Functional Classification network.
[31] The 2000 base year model network and the associated socio-economic and traffic data were calibrated and based on the 2002 OCARTS geography.

Figure 4.1:
OCARTS Boundary Change between 1995 and 2000



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Map Disclaimer Applies. See the report Table of Contents or http://www.acogok.org/mapdisclaimer.asp

LINK CAPACITIES

Traditionally, the MPO has used 24-hour capacities (vpd) corresponding to level of service (LOS) C in the OCARTS model. This stems from early federal planning regulations that encouraged metropolitan planning organizations to develop long range transportation systems that exhibited low levels of congestion. However, the passing of Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 and the Reauthorization of TEA-21 (Transportation Equity Act for 21st Century) in 1998 changed the dynamics of how long range plans could be developed.

ISTEA and TEA-21 stipulated that a region's long range plan had to be financially constrained. That is, a region must demonstrate a balance between the estimated costs and anticipated revenues for carrying out the Plan. As a result, planning at LOS C became more problematic because to acquire this level of network efficiency it could involve the implementation of projects beyond the Plan's anticipated revenues. Additionally, it has become common practice in the nation's metropolitan areas to utilize maximum capacities (LOS E) in long range plan projects.

Table 4.1 shows the network capacities' threshold at LOS E capacities.

Table 4.1:
Network Capacities

FACILITY TYPE	LOS E CAPACITY
Expressways	
4 lane expressway	80,000 vpd
6 lane expressway	125,000 vpd
8 lane expressway	165,000 vpd
City Arterials	
2 lane arterial	17,100 vpd
4 lane arterial (undivided)	34,200 vpd
4 lane arterial (divided)	38,000 vpd
5 lane arterial (center turn lane)	36,000 vpd
6 lane arterial (undivided)	52,300 vpd
6 lane arterial (divided)	58,000 vpd
One way street (per lane)	11,000 vpd

OBSERVED SPEEDS

The OCARTS area transportation model has traditionally coded speeds by facility functional classification. Due to the change in the federal speed limit on interstate facilities in 1997, the MPO adjusted its speeds accordingly from 55 mph to 60 mph in the plan network. Speeds on other functionally classified roadways were also adjusted due to the affect of the new interstate speed.

In addition, the coded Turnpike speed was adjusted by adding a cost impedance of $0.10 per mile to the network. It was believed that the adjustment would more accurately reflect the attractiveness of turnpike in the region.

Table 4.2 displays the speeds by functional classification.

Table 4.2:
Network Speeds

FUNCTIONAL CLASSIFICATION	ADJUSTED 2030 OCARTS PLAN CALIBRATION
Interstate	60
Principal Arterial	45
Minor Arterial	40
Collectors	30
Turnpikes	60
CBD	25
Centroid Connectors	15

LINK DISTANCES

The most important factor in determining how the gravity model distributes trips throughout the network is travel time. Since travel time is a function of link distance, accurate depiction of this parameter was essential. Due to the expansion of the OCARTS study area, the 2000 base network contains 12,929 directional links. Links distances in the OCARTS area were recalculated. Table 4.3 below reveals the change in total mileage by functional classification.

Table 4.3:
Total Mileage by Functional Class - 2000 OCARTS Plan Network

FUNCTIONAL CLASSIFICATION	1995 OCARTS NETWORK MILEAGE	2000 OCARTS NETWORK MILEAGE
Interstate/Freeway	148.82	168.82
Principal Arterial	344.40	442.58
Minor Arterial	1,370.50	1,382.17
Collector	150.00	204.11
Turnpike	23.80	59.14

TRIP GENERATION

Trip generation is the phase of the urban travel demand model where the relationships that exist between land use and travel are determined and quantified. As such, trip generation analysis occupies a critical and difficult position between land use and transportation planning. An error that occurs in this step will have a negative impact on the remaining analysis steps (i.e., trip distribution and assignment).

For trip generation analysis, the travel path is usually expressed in terms of trip ends. Therefore, two sets of trip generation relationships are developed. One set of relationships is developed for the production end of a trip and (primarily but not always) involves relating trip ends to residential land uses. The other set of relationships is developed for the attraction end of the trip and involves relating trip ends to primarily nonresidential land use.

Because trips made for different purposes exhibit different patterns, it is necessary to classify trips by purpose. The various categories of home-based productions are associated with residential land use characteristics, while the categories of non-home based trip productions and the various categories of trip attractions are correlated with nonresidential land use characteristics. The trip generation model used for the OCARTS area uses five trip purposes:

- Home-Based Work (HBW)
- Home-Based Shopping (HBSH)
- Home-Based Social/Recreational (HBSR)
- Home-Based Other (HBO)
- Non-Home Based (NHB)

In addition, truck, internal-external and external-external trips are estimated.

TRIP PRODUCTIONS

Productions in the OCARTS area are estimated using a disaggregate (household based) cross-classification model. The basic premise of this type of model is to determine the average response, or the average value of the dependent variable for defined categories of two or more independent variables. Because no mathematical relationship is postulated between trip-making characteristics and household characteristics, it is important that the variables chosen have a causal relationship with trip generation. For the OCARTS area study, **auto ownership** and **household size** proved to be the most significant to predict the level of trip making.

The cross-classification equations require population, occupied dwelling units and automobiles for input while the regression equations use population, occupied dwelling units, retail and other employment and total public school enrollment.

In order to utilize these variables, population and occupied dwelling unit data for the 2000 base year were calculated. For trip generation, it was necessary to summarize the 2000 population by traffic analysis zone from the Census Summary File 1 (SF1) file, resulting in a Single-Family / Multi-Family (SFMF) population of 942,540 used for the 2000 equations, which represents a 10% increase over the 1995 population of 877,867.

The 2000 occupied dwelling units (DU) were tabulated to traffic analysis zones by adding single family occupied DUs and multiple family occupied DUs together for a total of 390,444, a 13% increase over the 1995 SFMF DUs of 346,376. Both population and dwelling unit information was distributed to Traffic Analysis Zones (TAZs) accordingly.

A rate for vehicles per dwelling unit was tabulated using the 2000 Census Transportation Planning Package (CTPP)[32] for 832 of the 878 traffic analysis zones where the rate was available. The vehicle rate for the remaining TAZs was adjusted and calculated using Census Summary File 3 (SF3) block group data.

Table 4.4 shows the final cross-classification matrix by trip purpose.

[32] Browser Table 1-109 "Aggregate Number of Vehicles in the Household"

Table 4.4:
Production Matrices by Trip Purpose - 2000 OCARTS Plan Network

Home Based Work (HBW)

AUTOS/HOUSEHOLD	PERSONS/HOUSEHOLD			
	1	2	3	4+
0	0.28	0.53	1.50	0.96
1	0.72	0.62	1.27	1.82
2	1.38	1.66	1.93	2.03
3+	1.07	1.24	2.56	2.62

Home Based Shopping (HBSH)

AUTOS/HOUSEHOLD	PERSONS/HOUSEHOLD			
	1	2	3	4+
0	0.37	0.53	1.19	1.85
1	0.63	0.86	0.88	1.43
2	0.50	1.13	0.86	1.61
3+	0.58	1.07	0.99	1.57

Home Based Social Recreation (HBSR)

AUTOS/HOUSEHOLD	PERSONS/HOUSEHOLD			
	1	2	3	4+
0	0.31	0.34	1.08	1.93
1	0.69	1.05	1.24	2.97
2	0.76	1.10	1.35	2.69
3+	1.05	1.25	1.66	2.59

Home Based Other (HBO)

AUTOS/HOUSEHOLD	PERSONS/HOUSEHOLD			
	1	2	3	4+
0	0.64	0.70	3.43	2.79
1	0.92	1.96	3.42	4.85
2	0.76	1.46	2.91	4.77
3+	1.03	1.54	2.85	4.52

Non Home Based (NHB)

AUTOS/HOUSEHOLD	PERSONS/HOUSEHOLD			
	1	2	3	4+
0	0.84	2.06	1.14	3.25
1	1.56	2.37	3.88	4.86
2	2.24	2.58	4.05	5.95
3+	3.18	2.99	4.38	6.11

TRIP ATTRACTIONS

The location of trip destinations represents the fulfillment of the relation between land use patterns and travel. For modeling purposes, the destination of a trip is the non-residential end and is referred to as the trip attraction. Attractions are quantified by means of a mathematical relationship between the intensity and character of land use activities and the number of trip ends occurring in a zone. Multiple regression analysis was used in the OCARTS model to calculate the attraction relationship.

Multiple regression analysis is a statistical procedure in which the relationship between two or more related items may be expressed in mathematical form according to specified criteria. As a statistical analysis technique, there are various tests of validity that can be used to evaluate the relationship. However, multiple regression is only as accurate and useful as the validity of the assumptions that underlie the relationship and then are supported by the statistical significance of the results obtained.[33] It is possible to produce results that meet all of the various statistical criteria and yet offer no explanation of the causative relationships affecting trip generation. In order to forecast with any reliability, such a causative relationship is imperative. The derived relationships are then presumed to remain stable over time and allow valid trip forecasts to be obtained by introducing changes in the socioeconomic and land use characteristics.

DEVELOPMENT OF TRIP ATTRACTION EQUATIONS

The regression equations and their associated coefficients used for 2000 base year trip attraction calculations and forecasting were the same that were used for the base year of the 2025 OCARTS plan. For detailed procedures on how those trip attraction equations were developed, please refer to Attachment 2.Table 4.5 reveals the attraction equations by trip purpose used for 2030 OCARTS Plan.

Table 4.5:
Attraction Equations by Trip Purpose used for 2030 OCARTS Plan

TRIP PURPOSE	EQUATION	MULTIPLE CORRELATION COEFFICIENT	MEAN	STANDARD ERROR
HBW	0.563839 (Occupied Dwelling Units) + 0.307381 (Total Employment)	0.67	438.38	355.01
HBSH	0.556027 (Occupied Dwelling Units) + 0.637868 (Retail Employment)	0.59	302.17	340.73
HBSR	0.29197 (Population) + 0.464984 (Retail Employment) + 0.141994 (Total Public School Enrollment)	0.54	410.57	429.20
HBO	0.47843 (Population) + 0.418043 (Retail Employment) + 0.586611 (Total Public School Enrollment)	0.60	683.65	689.47
NHB	3.683328 (Retail Employment) + 1.156753 (Office Employment) + 0.856396 (Total Public School Enrollment)	0.66	975.25	902.65

[33] C. S. Papacostas and P. D. Prevedouros, *Transportation Engineering and Planning*, 2nd ed., Prentice Hall, Englewood Cliffs, NJ, 1987, p. 317.

Internal/External and External/External Trips

An external station study was not conducted for the 2000 model calibration. In order to develop a trendline, external trip information was generated using origin and destination studies conducted in the past and complemented with 2000 traffic counts collected at each of the 30 external stations. 4 more external stations were added to 2000 base network because of the increase in the study area.

Special Generators

Special attention was given to major land uses for which the standard trip generation and distribution models did not provide reliable estimates of their travel patterns. Trip generators of this magnitude included military bases, airports, shopping malls, colleges and universities, hospitals, etc. The 2000 OCARTS area has 40 special generators. 10 of these 40 special generators were newly added during the 2030 plan development.

Table 4.6 lists the special generators used in the 2000 model calibration.

TRIP DISTRIBUTION

After having predicted the number of trips produced by a zone or attracted to it, the next step in the overall travel-estimation process was to determine how people, who are about to make a trip, decide on their destination. Generally speaking, trip distribution is a function of:[34]

- The type and extent of transportation facilities available in the area
- The pattern of land use in the area
- The various social and economic characteristics of an urban area's population

The OCARTS area uses the gravity model for the distribution of internal/internal trips and internal/external trips for the 2000 trip table. As the name infers, the gravity model is an adaptation of the gravitational attraction concepts first introduced by Isaac Newton in 1686.[35] Essentially, the gravity model operates on the relationship that all attraction zones are in competition with each other to attract trips from each production zone. The degree to which a zone can attract trips is dependent upon its relative attractiveness when compared to all other zones; and its relative accessibility for trips from production zones. This function of spatial separation between zones can be measured by several parameters. For the OCARTS model, the most effective measure is travel time.

[34] John W. Dickey, *Metropolitan Transportation Planning*, 2nd ed., Virginia Polytechnic Institute, Hemisphere, NY, 1983, p. 197.
[35] Bureau of Public Roads, *Calibrating & Testing a Gravity Model for Any Size Urban Area*, U.S. Dept. of Commerce, October 1965, p. II-1.

Table 4.6:
Special Generators and Related Vehicle Trips -
2000 OCARTS Plan Network

SPECIAL GENERATOR	HBW	HBS	HBSR	HBO
Baptist Hospital	27,697	11,272	7,958	11,998
Central State Hospital	3,378	1,802	1,814	3,509
Converges	2,198	739	825	1,408
Crossroads Mall	13,754	9,405	7,964	12,427
Daily Oklahoman	2,584	430	568	1,007
Dayton Tire	1,934	1,015	1,209	2,628
Deaconess Hospital	4,707	3,158	3,186	5,664
FAA	5,558	2,155	1,928	3,063
General Motors	2,740	1,834	2,213	3,984
Heritage Park Mall	6,420	4,225	4,275	7,635
Kerr McGee	1,954	53	31	31
Lucent	3,690	1,550	943	947
Mercy Hospital	9,407	4,163	4,616	8,092
Midwest Regional Hospital	5,640	2,893	2,701	4,712
Moore Norman Vo-Tech	391	55	47	70
Norman Regional	8,187	2,413	3,649	9,271
ODEQ	1,827	66	39	42
OKC Post Office	8,425	1,567	2,008	3,576
OU (1 of 3) Students	32,501	23,180	20,305	35,314
OU (2 of 3) Dormitory Housing	5,624	3,527	3,202	5,146
OU (3 of 3) Staff Lloyd Noble	2,370	1,587	1,683	2,982
OU Medical Center (1 of 2)	9,660	2,277	2,236	3,651
OU Medical Center (2 of 2)	41,504	1,913	1,226	1,374
Penn Square Mall	18,441	10,390	7,331	11,919
Quail Springs Mall	48,204	13,163	7,972	7,972
Seagate	8,699	669	1,338	2,007
Shepherd Mall	7,504	12,832	741	1,259
Sooner Fashion Mall	27,463	10,824	15,948	40,360
South Comm. Hospital	7,006	4,809	6,089	10,656
St. Anthony Hospital	12,709	5,028	3,107	4,888
St. Michaels/Hill Crest Hospital	2,480	1,263	1,363	2,720
State Capital (1 of 4)	3,379	1,904	2,432	5,504
State Capital (2 of 4)	2,906	605	605	1,064
State Capital (3 of 4)	3,102	1,146	819	1,241
State Capital (4 of 4)	4,113	72	41	41
UCO , Edmond	6,618	4,655	5,976	10,430
UPS	8,688	1,118	681	686
US Court Administration	1,411	200	125	112
Will Rogers World Airport	7,587	4,437	4,717	8,291
York Int.	1,607	144	158	271

CALIBRATION OF THE GRAVITY MODEL – FRICTION FACTOR DEVELOPMENT

The calibration of the gravity model is often thought to be a confusing step in the travel demand forecasting process. It is during this phase that the transportation model is given its unique personality. Calibration attempts to "bridge the gap" between the travel behavior patterns witnessed in the origin-destination (O-D) study and the travel times produced from the simulation model. This is accomplished through the development of travel time or friction factors.

Friction factors attempt to show the effect that travel time has on trip making.[36] To develop friction factors, the O-D survey trip table for each trip purpose is combined with the matrix of zone-to-zone total travel time derived from the traffic simulation model to produce a trip length frequency distribution. A one-minute frequency distribution of trip occurrence for each trip purpose is created. An iterative process is then necessary to adjust the friction factors until the resulting frequency distribution matches the origin-destination survey distribution. At this point, the model is considered calibrated and should be tested to reveal its ability to reproduce the existing travel pattern.

THE OCARTS GRAVITY MODEL

Before the gravity model could be run, it was necessary to build the 2000 street and highway network. Once the network was coded, minimum path travel times from zone to zone were computed. However, in order to get to "total" travel time that is required for comparison with the known travel behavior, intrazonal travel time and terminal times were added to each zone-to-zone interchange.

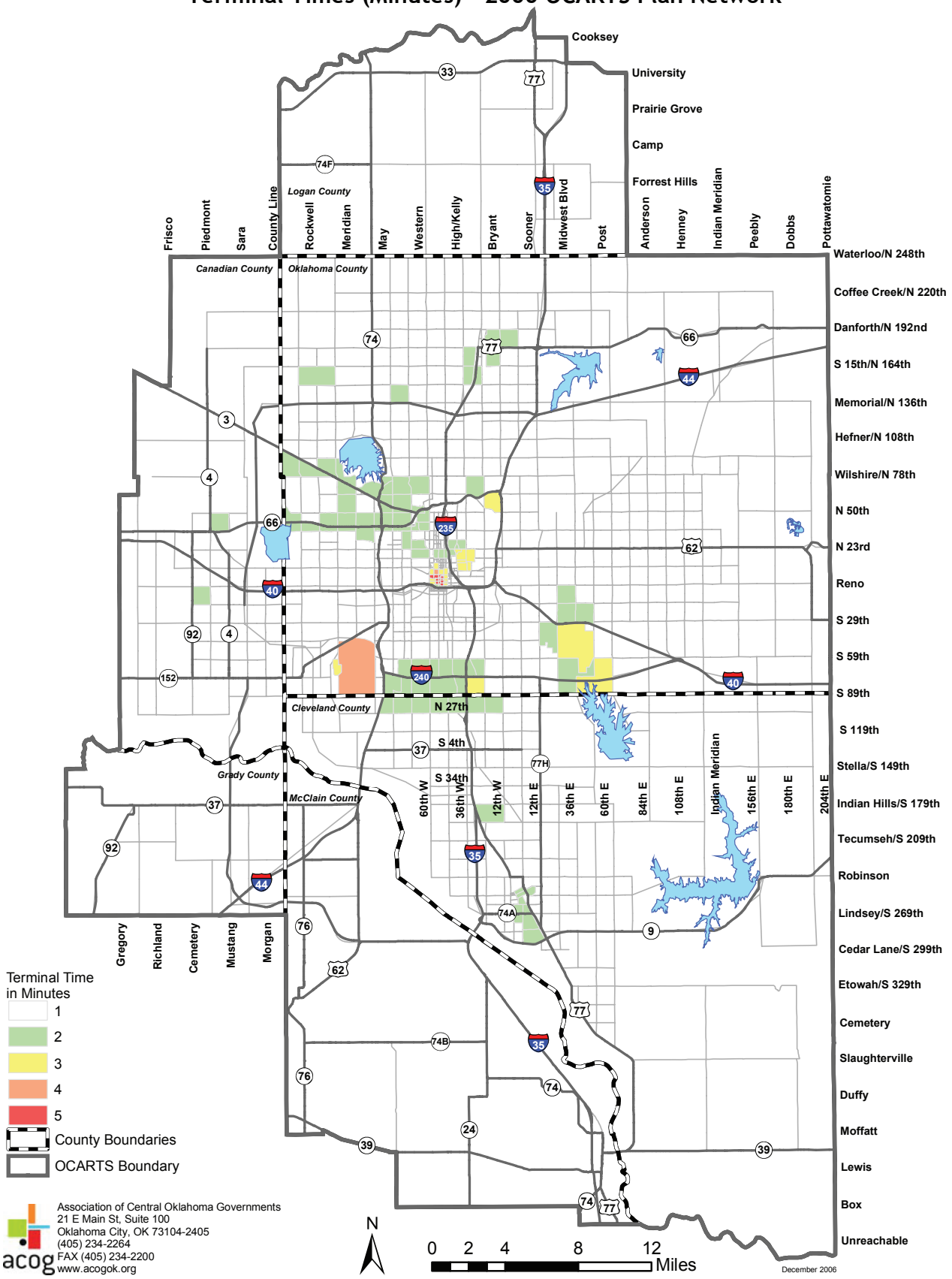
Intrazonal travel times were added first in order to calculate travel times representative of trips with its origin and destination in the same zone. The OCARTS intrazonal times were calculated by averaging the time it took to travel to the four adjacent zones.

The final travel time component was terminal time. Terminal times were needed to reflect the "out of vehicle" travel time. Adding terminal times provide a more realistic measure of spatial separation, expressed as time, between each pair of zones. It is these differences in time that influence travelers in their trip making. For the 2000 OCARTS model, terminal times ranged from 1 to 5 minutes depending on the density and degree of activity in the zone.

Figure 4.2 reveals terminal time by TAZ.

[36] Federal Highway Administration, *An Introduction to Urban Travel Demand Forecasting*, U.S. Dept. of Transportation, 1997, p. 4-17.

Figure 4.2:
Terminal Times (Minutes) - 2000 OCARTS Plan Network



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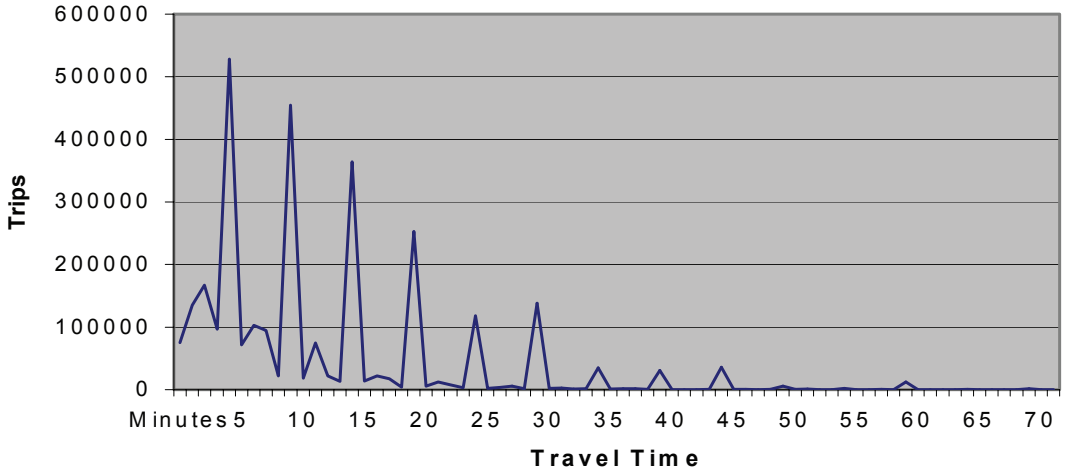
Once "total travel time" was simulated for each zonal pair, attention shifted to preparing a person trip matrix by travel time for each trip purpose. According to the 1995 National Personal Transportation (NPTS) survey, travel time ranged from 1 to 72 minutes. Figure 4.3, below summarizes those findings.

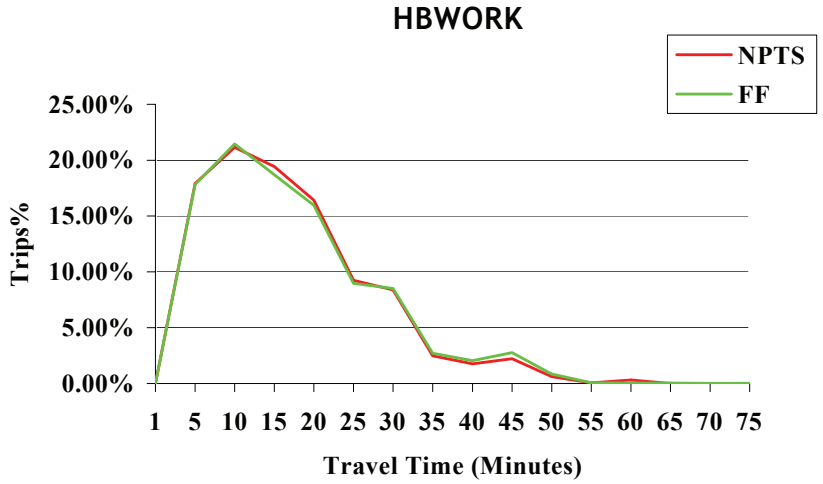
Figure 4.3:
Person Trips by Travel Time - 2000 OCARTS Plan Network

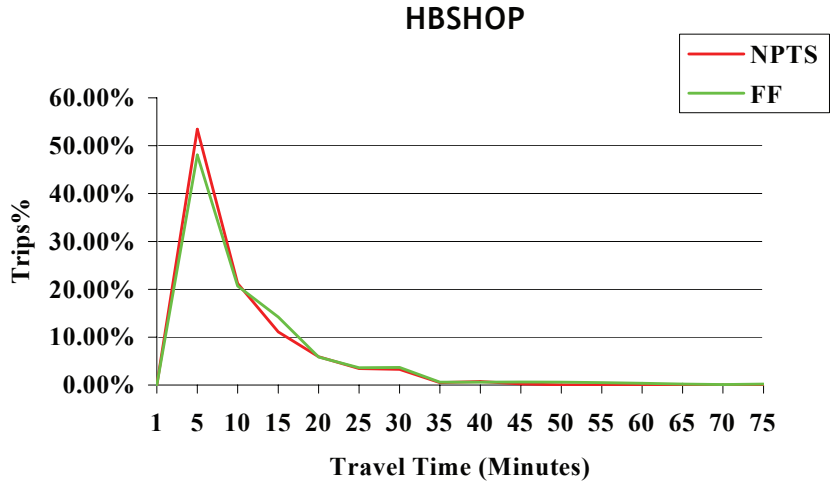


Like most surveys, respondents to the NPTS survey had a tendency to round their travel time to the nearest five-minute interval. In fact, only 18% of the trips reported were not rounded. This presented a potential problem in our analysis. Unless a procedure could be developed to "smooth" the data, too much disparity would be present to draw any conclusions. Problems with the data are clearly shown by the multiple peaks in Figure 4.3. It was agreed to group the remaining 18% of trips into the five-minute increments. The procedure involved using the midpoint between the five-minute increments so if a respondent's reported travel time fell below the midpoint it would be placed in the lower five-minute group. For example, if the reported travel time was six minutes, it was placed in the five-minute group since it was lower than the midpoint (7.5) for the five and ten minute groups.

This process was done for each trip purpose and then the data was smoothed by developing an exponential curve to get the results back to one-minute intervals. The "smoothed" curve was then input into the gravity model along with the simulated curve from the model to produce a comparable trip length frequency distribution. If, for each trip purpose, the average trip length derived from the gravity model was within a specified percent (based on trip purpose) of the average trip length of the origin and destination (O-D) trips, the model was considered calibrated. If the model was not balanced, friction factors (FF) were adjusted and input into the gravity model for another run. This procedure was repeated until the results approximated the survey data for each trip purpose. The final trip length frequency distribution for each trip purpose is shown in Figure 4.4.

Figure 4.4:
Trip Length Frequency Distribution - 2000 OCARTS Plan Network





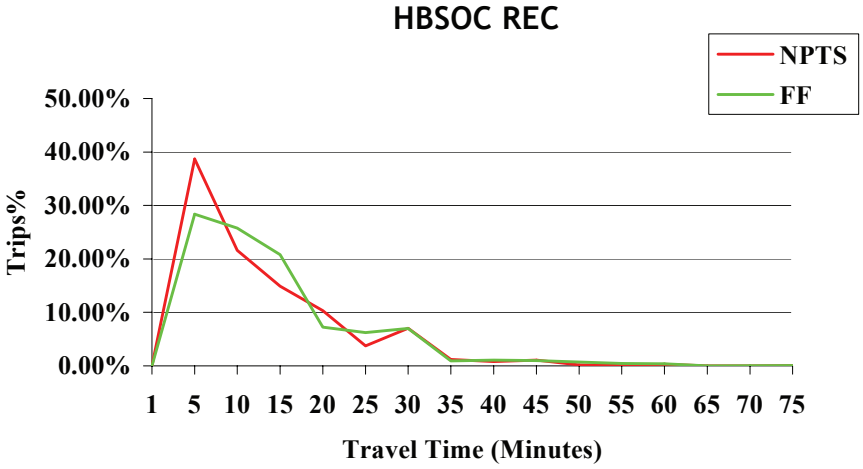
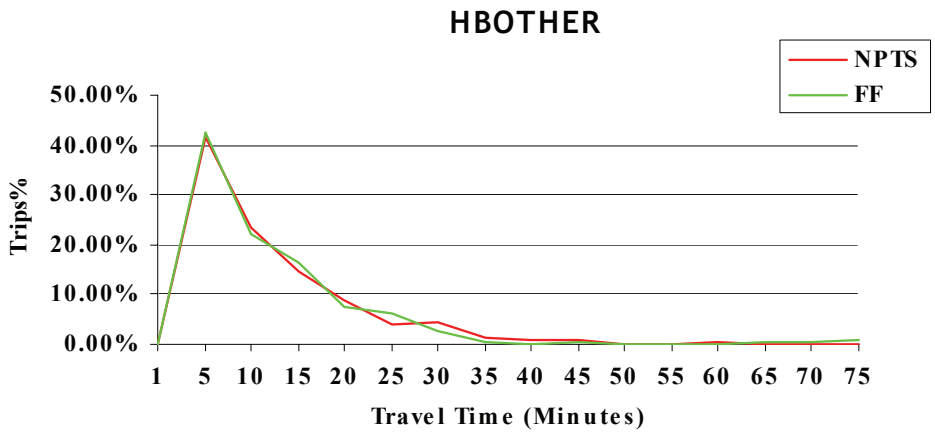
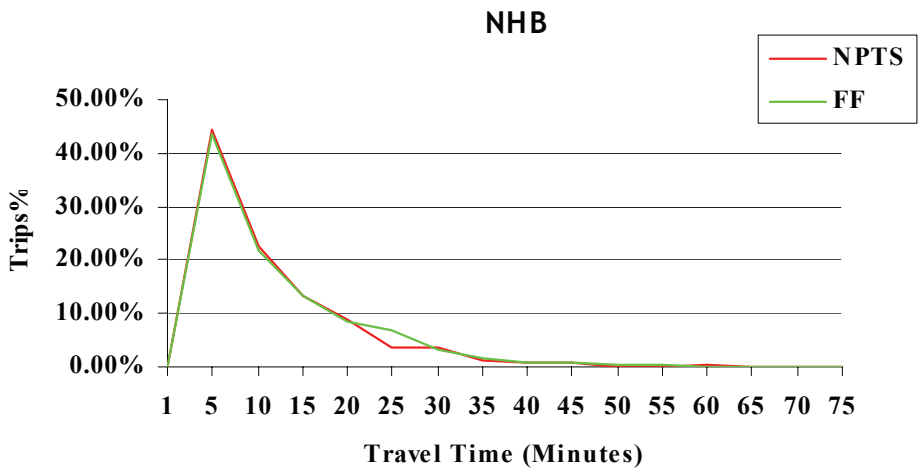


Figure 4.4 (Cont.):
Trip Length Frequency Distribution - 2000 OCARTS Plan Network





VEHICLE TRIPS

Until this time, we have been dealing exclusively with "person trips." In order to prepare the data set for model assignment, person trips had to be converted to vehicle trips. This was accomplished by multiplying each trip purpose with its corresponding vehicle occupancy (VO) rate. VO rates were developed from the NPTS sample. Table 4.7 gives a comparison of the 2000 VO rates to those used in 1995.

Table 4.7:
OCARTS Area Vehicle Occupancy Rates

TRIP PURPOSE	PERSONS PER VEHICLE	
	1995	**2000**
Home Based Work (HBW)	1.07	1.08
Home Based Shopping (HBSH)	1.40	1.40
Home Based Social Recreation (HBSR)	1.57	1.57
Home Based Other (HBO)	1.58	1.58
Non Home Based	1.47	1.47

EXTERNAL TO EXTERNAL (E/E) TRAFFIC DISTRIBUTION

As stated earlier, an external station study was not conducted for the 2000 model calibration. As a result, external trip information was generated using origin and destination studies conducted in the past and complemented with 2000 traffic counts collected at each of the 30 external stations in order to develop a trendline. The Fratar technique was used to distribute the E/E traffic among the external stations. Table 4.8 provides a breakdown of the external trip data.

Table 4.8:
External Trips - 2000 OCARTS Plan Network

LOCATION	2000 TAZ	2000 COUNT	2000 INTERNAL – EXTERNAL TRIPS	2000 EXTERNAL – EXTERNAL TRIPS
SH-105 e/o Westminster	880	2,453	2,330	62
SH-33 e/o I-35	881	7,800	7,410	195
I-35 n/o SH 33	882	18,639	14,166	2,237
US-77 n/o SH 33	883	1,634	1,552	41
SH-74 n/o SH 33	884	4,717	3,915	401
SH-33 w/o County Line Rd.	885	1,691	1,606	43
SH-74 w/o County Line Rd.	886	2,500	2,375	63
SH-3 w/o Cimarron Rd.	887	3,503	3,398	53
SH-66 w/o Cimarron Rd.	888	6,167	5,427	370
I-40 w/o Cimarron Rd.	889	32,000	28,160	1,920
SH-152 w/o Cimarron Rd.	890	1,975	1,857	59
SH-37 w/o SH 92	891	2,574	2,445	65
SH-92 s/o S. 32nd Street	892	1,614	1,533	41
I-44 w/o S. 32nd Street	893	15,000	12,750	1,125
Sara Rd. s/o S. 32nd Street	894	478	454	12
SH-76 s/o S. 24th St.	896	3,458	3,285	87
US-62 s/o S. 24th St.	895	7,203	6,843	180
I-35 s/o SH 9	898	37,640	32,747	2,447
US-77 s/o Cemetery Rd.	905	7,991	7,751	120
SH-9 e/o Harrah Rd.	899	3,896	3,234	331
SE 149th e/o Harrah Rd.	900	2,028	1,927	51
I-40 e/o Harrah Rd.	901	43,556	39,200	2,178
SE 29th e/o Harrah Rd.	902	2,962	2,399	282
SH-62 e/o Harrah Rd.	903	10,141	9,330	406
I-44 e/o Luther Rd.	904	20,000	12,600	3,700
SH 66 n/o Luther Rd.	879	3,975	2,663	656
SH-74 South of Study Area	897	2,900	2,755	73
SH-39 East of Study Area	906	3,850	3,658	96
SH-39 West of Study Area	907	1,700	1,615	43
SH-24 South of Study Area	908	830	789	21
Total		**269,890**	**236,674**	**21,254**

TRAFFIC ASSIGNMENT

With the trip distribution step complete, attention shifted to the final step in the traditional four-step process – trip assignment. During this phase, our primary concern was to determine why travelers chose one route over another.[37] While there are several traffic assignment procedures in practice today that perform this task (i.e., all or nothing, capacity restraint etc.), the OCARTS area uses an equilibrium load technique. While equilibrium load operates on similar concepts as capacity restraint assignment, it differs in that there are normally several equally good paths through the network for each origin-destination pair produced during trip distribution. These extra paths, it is believed, help produce a more accurate assignment, since they buffer the effect of link speeds on link volumes. That is, since a traveler has several equally good paths to get to his/her destination, a small change in speed will not produce a disproportionate share of traffic volume on that path.[38]

As stated earlier, link capacities for the 2000 calibration reflected LOS E capacities. As a result, the Bureau of Public Roads (BPR) speed-capacity curves that were used in previous models did not perform very well. In particular, speeds were not being reduced fast enough as the link traffic volume approached capacity. The standard BPR formula is presented below.

Standard BPR Equation: $S = S_f / [1 + \alpha (v/c)^{\beta}]$

Where:
S = Actual Speed
S_f = Free Flow Speed
v = volume
c = capacity at LOS C
$\alpha = 0.15$
$\beta = 4$

In order to rectify this problem, the BPR formula was manipulated in an effort to lower speeds as vehicles approached LOS C. Staff decided to increase the BPR exponent from 4 to 7, which reduced the problem substantially. In addition, the UROAD factor of 0.70 was introduced to represent LOS C design capacities. The equation for the adjusted BPR curve is presented below.

Adjusted BPR Equation: $S = S_f / [1 + \alpha (v/c^* \text{UROAD})^{\beta}]$

Where:
S = Actual Speed
S_f = Free Flow Speed
v = volume
c = capacity at LOS E
$\alpha = 0.15$
$\beta = 7$
UROAD = 0.70

[37] John W. Dickey, *Metropolitan Transportation Planning*, 2nd ed., Virginia Polytechnic Institute, Hemisphere, NY, 1983, p. 221.
[38] Federal Highway Administration, *Calibration and Adjustment of System Planning Models*, U.S. Dept. of Transportation, December 1990, p. 28.

TRANSIT ASSIGNMENT

A transit network was developed and added to the 2000 highway network. The 2000 CTPP (Census Transportation Planning Package) Travel Survey on Means of Transportation found that in OCARTS transportation planning study area, the public transit trips currently account for only about 0.18 percent of all trip purposes. Due to the low percentage of transit trips, ACOG did not conduct a rigorous and costly behavior survey. Staff used the CTPP data to develop a transit trip matrix for the mode choice component. Over 16,000 trips were assigned to a transit network through the model. The output of the transit trip assignment include a loaded transit network and skim matrices with network level-of-service values.

TRAFFIC MODEL VALIDATION

Model validation is arguably the most important step in the travel demand forecasting process. It is during this phase that the model's ability to predict future behavior is put to the test. If the model cannot accurately replicate current conditions, how can we expect it to provide a reliable forecast 30 years in the future?

The model validation step is typically an iterative process linked closely with model calibration. It involves checking model results against observed data and adjusting parameters until model results fall within an acceptable range of error.[39]

VALIDATION PROCEDURE

Model validation for the OCARTS area primarily consisted of comparing assigned volumes with traffic counts maintained from the year 1997 to 2004. Eight years of traffic counts were used to get better count coverage throughout the region. As a result, 57% of the links were used in the analysis.

The OCARTS area model validation procedure involved sequentially testing the calibrated model at various levels of geography, beginning with a regionwide analysis and ending with a link-specific analysis. The results at each level of geography were then compared with acceptable error recommendations by FHWA.[40]

The following section details the geographic levels studied and the final validation results. When reviewing this section, it must be kept in mind that validation is an iterative process and that calibration and changes to model parameters at one level of geography will have effects on other levels as well. Obviously, it was hoped that parameter changes would reflect better results at every level of study.

Regionwide

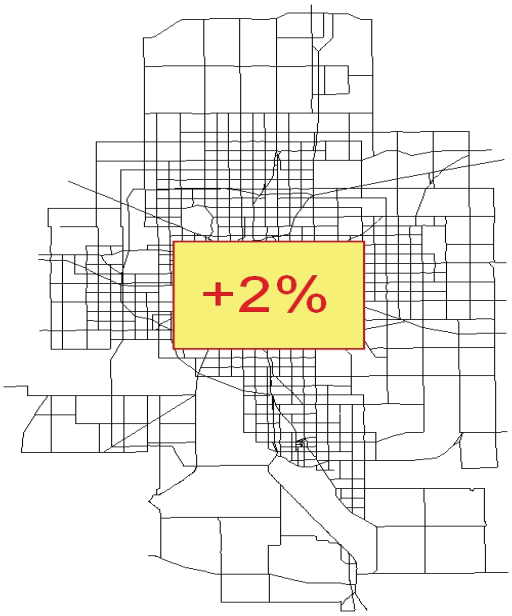
This was the first test conducted for validation. Its main purpose was to get a "feel" for how well the model was performing. This test was performed by dividing the sum of the assignment on links with traffic counts by the sum of the traffic counts.

$$29{,}168{,}000/28{,}360{,}000 = 1.03\%$$

The model difference of less than 2% is well below the Federal Highway Administration (FHWA) recommendation that the percentage difference should be no more than 5%.

[39] Prepared by Barton-Ashman Associates, Inc., *Model Validation and Reasonableness Checking Manual*, (Prepared for Travel Model Improvement Program, Federal Highway Administration, February 1997), p. 2.
[40] Ibid.

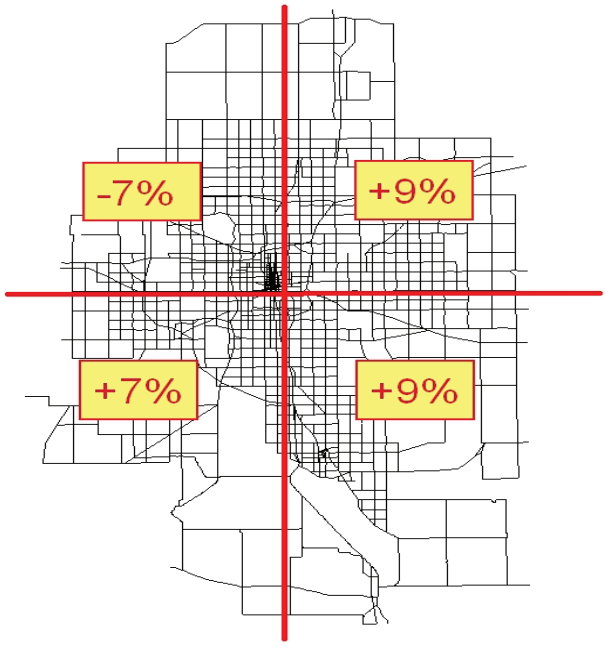
Figure 4.5:
Regionwide Percent Variation



Quadrant Level

While FHWA does not provide an acceptable percent error check for this level of geography, staff felt that if the model did not exceed a 10% error then it was performing fairly well. Figure 4.6 displays the final results.

Figure 4.6:
Quadrant Percent Variation



City Level Analysis

In preparation of the OCARTS 2025 Transportation Plan, K-factors were used in Edmond, Norman and Midwest City to increase the number of trips generated in order to match 1995 traffic counts. While the data set for the 2030 Transportation Plan was different, similar adjustments were expected.

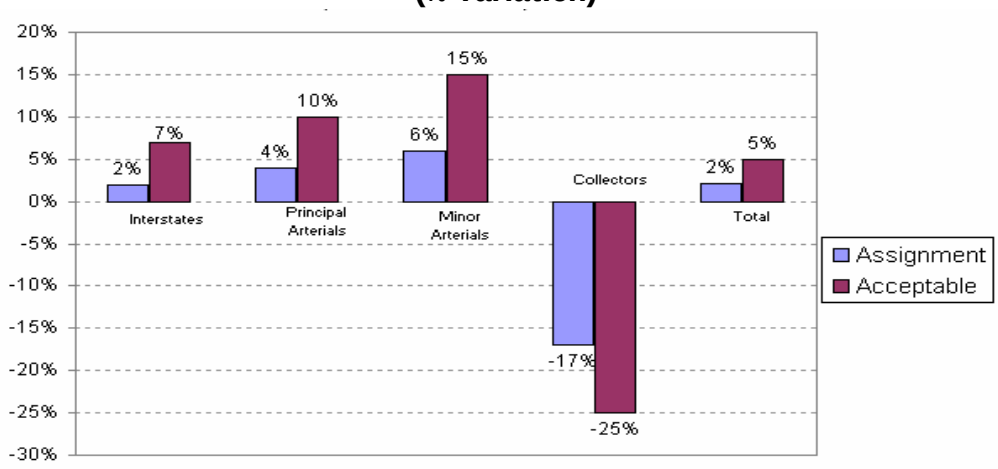
Analysis at the city level revealed that the model was under-assigning Edmond by nearly 20%. Initially it was thought that the production equations were under-assigning trips "from" the Edmond households and that separate equations should be generated. However, after additional analysis, it was determined that the model was in fact accurately reflecting Edmond trips per DU, but was under-representing the attraction trips to Edmond. After a period of trial and error, the desired assignment results were obtained by doubling the number of attraction in every Edmond TAZ.

Additional trip rate adjustments were made at specific locations throughout the region where there were irregularities in the assignment. For example, by doubling the special generator trips for the University of Oklahoma, the 5% under-assignment in the City of Norman was abated. Likewise, doubling the number of attraction trips in TAZs 145 (Southern Nazarene University) and 146 (SW Bible College) raised Bethany's under-assignment from 65% to 90%.

Functional Classification Analysis

This test provided insight into whether the model assignment was loading trips onto the functionally classified system in a reasonable manner. Figure 4.7 provides a comparison between FHWA suggested error limits and the percent error derived from the final model assignment.

Figure 4.7:
Functional Classification
(% Variation)



Screen Line Analysis

Two major screen lines and 13 auxiliary screen lines were used in this calibration (see Figure 4.8). Major screen lines were used to measure traffic flow across the entire OCARTS area, whereas the auxiliary screen lines checked traffic at the corridor level.

Figure 4.8:
Screen Line Map

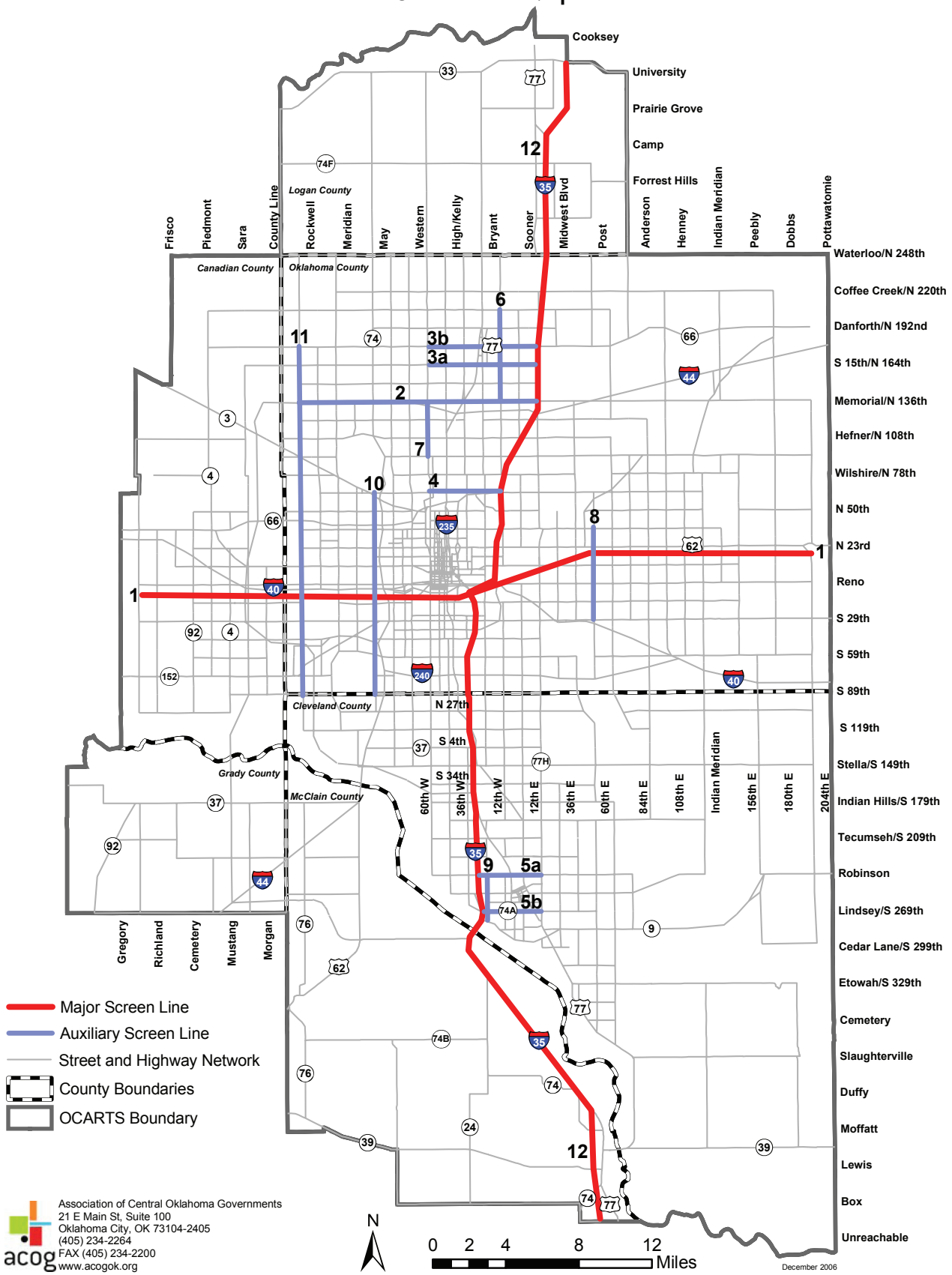


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Table 4.9 compares individual screen line performance with the acceptable variation recommended by FHWA. According to this performance measure, the model appears to be operating sufficiently.

Table 4.9:
Screen Lines -
Percent Variation between Model Performance and Traffic Counts

SCREEN LINE	LOCATION	ACCEPTABLE VARIATION	PERCENT VARIATION
NORTH-SOUTH			
1*	South Canadian River	<=5%	3%
2	Memorial Rd. – Council Rd. to Sooner Rd.	<=10%	4%
3A	15th St. (Edmond) – Western Ave. to Sooner Rd.	<=10%	0%
3B	Edmond Rd. – Western Ave. to Sooner Rd.	<=10%	-3%
4	NE 63rd St. – Western Ave. to Bryant Ave.	<=10%	2%
5A	Robinson Rd. – I-35 to 12th St.	<=10%	5%
5B	Lindsey Ave. – I-35 to 12th St.	<=10%	2%
EAST-WEST			
6	Bryant Ave. – Covell Rd. to Memorial Rd.	<=10%	9%
7	Western Ave. – Memorial Rd to Britton Rd.	<=10%	-8%
8	Douglas Ave. – 29th St. to 36th Street	<=10%	0%
9	Eastern Ave. (Norman) – Robinson to	<=10%	0%
10	Portland Ave. – NE 63rd St. to SE 89th St.	<=10%	-5%
11	Council Rd. – SE 89th St. to Edmond Rd.	<=10%	-5%
12*	I-35 – North Study Area to South Study Area	<=5%	3%

* denotes major screen line

Selected Link Analysis

Heavily congested corridors in the region were tested next. While there are no specific FHWA guidelines recommended at this level, staff attempted to stay within 10% of the traffic counts. The results are exhibited in Table 4.10. The highest variation occurs on Shields Blvd. which is under-assigned by 10%.

Table 4.10:
Selected Link Analysis of Model Performance

LOCATION	FROM/TO	PERCENT VARIATION
Broadway Extension	Edmond Road to I-44	-1%
I-235	I-44 to I-40	8%
I-35	I-40 to South of Study Area	2%
I-40	MacArthur Boulevard to Douglas Boulevard	3%
I-44	N. 39th Expressway to Lincoln Avenue	2%
Lindsey Street	I-35 to 12th Avenue E.	9%
Main Street (Norman)	W. 36th Street to Porter Avenue	-8%
N. 39th Expressway	I-44 to County Line Road	3%
Shields Boulevard	Reno Avenue to SE 44th Street	-10%

CONCLUSION

Based on the results of the calibration tests, it was concluded that the model sufficiently meets criteria established by FHWA and can be used in forecasting traffic and capacity deficiencies in the OCARTS area for the year 2030. Table 4.11 provides an overview of the model's performance compared against FHWA guidelines. The calibrated model network was then used to develop the alternate street and highway scenarios described in Chapter 5.

Table 4.11:
Summary of Model Calibration Performance, 2000 OCARTS Plan Network

VALIDATION TEST	MODEL PERFORMANCE	FHWA GUIDELINES*
Regionwide	Less than 2%	Less than 5%
R^2	93%	Greater than 88%
Trips per dwelling unit	10	7.6-11.8
Auto Occupancy		
– HBW	1.08	1.07-1.20
– HBSH	1.40	1.40-1.71
– HBSR	1.57	1.40-1.71
– HBO	1.58	1.40-1.71
– NHB	1.47	1.31-1.54
Trip length in minutes		
– HBW	17.5	15-20
– HBSH	11.4	13-17
– HBSR	14.7	13-17
– HBO	12.1	13-17
– NHB	11.7	13-17
VMT by functional class		
– Interstates/Freeways	46%	33-38%
– Principal Arterials	32%	27-33%
– Minor Arterials	21%	18-22%
– Collectors	1%	8-12%
VMT per Person	27 miles	17-24 miles
VMT per Dwelling Unit	66 miles	40-60 miles

* Prepared by Barton-Ashman Associates, Inc., *Model Validation and Reasonableness Checking Manual*, Prepared for Travel Model Improvement Program, Federal Highway Administration, February 1997.

CHAPTER 5: DEVELOPMENT OF STREET AND HIGHWAY ALTERNATES

Five alternate street and highway networks were developed in the 2030 OCARTS Plan process. These networks depict the major roads in the region.[41] Each network was analyzed to determine how it would serve the needs of the OCARTS region in the year 2030 when the population is projected to be nearly 1.34 million, and total employment is projected at approximately 728,000 individuals. Characteristics of the transportation network in the year 2000 were used as a baseline, and these are included in the following section for reference (see "Base Year Network" in "Description of Network Alternates").

Based on the analyses described in this chapter, the **Alternate Four-B** network was adopted as the **2030 OCARTS Plan Street and Highway Network** by the MPO's Intermodal Transportation Policy Committee on August 18, 2005.

NETWORK PERFORMANCE MEASURES

The following performance measures were used in the analysis to determine the efficiency of each street and highway network alternate.

CONGESTED ROAD MILES

In order to determine potential congestion levels for the alternate street and highway networks, the traffic volumes for the forecast year were assigned to each of the five alternates individually. After each alternate assignment, the 24-hour non-directional capacities based on level of service (LOS) E, were applied to derive volume-to-capacity (V/C) ratios for individual links on the networks. A roadway segment was considered moderately congested if its V/C ratio was greater than 0.69 and seriously congested if the V/C ratio was above 0.99.

The purpose of this analysis was to provide a picture of the anticipated congestion levels in the year 2030 using different improvement scenarios. With the aid of these detailed modeling results, local planners, engineers, and elected officials could focus on the individual congested locations to propose localized improvements without losing sight of regional mobility and network continuity goals.

VEHICLE MILES OF TRAVEL

Daily vehicle miles of travel (VMT) is an indicator of the usage of streets and highways over a 24-hour period by the traveling public. The VMT estimates were generated by the TP+ transportation modeling software, which sums the assigned volume multiplied with the associated link distance for all links within each individual street and highway network alternate, including a separate estimate for freeway and non-freeway facilities.[42]

Generally, with the same amount of trips being estimated (generated and distributed), the higher the VMT, the more traffic travels on the network. Consequently, a higher VMT estimate

[41] Local and neighborhood streets are typically under the care of local governments and are not included in the regional plan network.
[42] The freeway classification includes free and toll limited access facilities. The non-freeway classification includes principal arterials, minor arterials, and collectors.

generated by any one alternate indicates that performance of the particular alternate is less desirable when compared to other street and highway network alternates.

The VMT estimates were also used to project estimates of accidents, road user costs in the calculation of benefit-cost analysis, fuel consumption, and vehicle emissions for each of the five alternates.

VEHICLE HOURS OF TRAVEL

Vehicle hours of travel (VHT) is another indicator of network efficiency. The VHT estimates were generated by TP+ as well, providing a separate estimate for freeway and non-freeway facilities for each alternate.

As with VMT, with the same amount of trips being estimated (generated and distributed), the higher the VHT, the more time the traveling public spends on the roadway due to slow moving, congested conditions on the network.

AVERAGE SPEEDS

Another performance measure used in the network alternate analysis was the average speed for freeways and non-freeway facilities. The speeds were calculated by dividing the VMT by the VHT for the two functional classification categories.

PROJECTED ACCIDENTS

Accidents were forecast as part of the performance analysis of the networks. The annual accidents by accident type and functional classification were projected using the VMT estimates for each alternate.

The fatality and injury accident rates per hundred million VMT, were derived from the 2002 Highway Safety Performance Index published by FHWA. The index did not provide "property damage only" (PDO) accident rates. The PDO accident rates were forecast using regional estimates from the 2000 OCARTS accident data files.

PROJECTED VEHICULAR EMISSIONS

Air quality conformity analysis was not required for the 2030 OCARTS Plan update, since Central Oklahoma remains in compliance with the National Ambient Air Quality Standards (NAAQS). Nonetheless, vehicular emission estimation was an essential element in the modeling and performance analysis process. Vehicular emissions[43] were estimated using the VMT and speeds generated in TP+. The estimates of VMT and speeds were then used as input to the Mobile 6.2a program for estimating the emissions of carbon monoxide, hydrocarbons, and nitrogen oxide for each alternate. The minimum and maximum temperatures used in Mobile 6.2a were 70.5 and 93.7 degrees respectively in the summer for estimating the hydrocarbons and nitrogen oxide, and 24.5 and 47.5 degrees in the winter for estimating carbon monoxide emissions. The temperatures were verified with the data provided by the National Weather Service at Will Rogers World Airport.

[43] MOBILE 6.2a is a computer program, released by U.S. EPA, that estimates hydrocarbon (HC), carbon monoxide (CO), and oxide of nitrogen (NO_x) emission factors for gasoline-fueled and diesel highway motor vehicles. MOBILE 6.2a calculates emission factors for eight vehicle types in two regions (low-and high-altitude) of the country. For additional information, see Chapter 7.

COST FOR STREET AND HIGHWAY ALTERNATES

The MPO developed cost estimates for each street and highway network alternate. These estimates were based on unit costs derived primarily from the Oklahoma Department of Transportation's *2003 State Highway Needs Assessment Study and Sufficiency Rating Report*. Unit costs for the maintenance of streets under the jurisdiction of local entities were developed with local entity input and were based on recent maintenance costs. Unit costs were adjusted to reflect year 2000 dollars.

Table 5.1 below lists the unit cost per lane mile to calculate the total costs for the 2030 OCARTS Plan alternates. The cost estimates for new construction include grading, drainage, base, surface, structures, sod, signing, utilities, and engineering. The cost for right-of-way acquisition was considered separately. Maintenance cost listed is for a 2 inch overlay, assuming a useful life of ten years. Thus, over the 30-year planning period (2000-2030), three maintenance cycles would be required.

Table 5.1:
Transportation Improvement Costs Per Lane Mile (Year 2000 dollar value)

IMPROVEMENT TYPE	INTERSTATES & FREEWAYS	OTHERS*
URBAN AREA:		
Reconstruction or widening on existing alignment, with access roads	$3,590,800	N/A
Reconstruction or widening on existing alignment, no access roads	$2,650,800	$697,500
Construction on new alignment	$2,755,300	$668,700
Maintenance (roadways under ODOT jurisdiction)	$93,590	$70,500
Maintenance (roadways under local jurisdiction)	N/A	$40,000
Bridges (if constructed separately) - *per square foot*	$56	$56
Right-of-way - *per acre*	$245,700	$204,700
RURAL AREA:		
Resurface on existing alignment and add shoulders (no addnl. lanes)	N/A	$295,200
Reconstruction along existing alignment (add lanes)	$1,316,000	$557,000
New construction on new alignment	$1,316,000	$570,000
Parallel construction (add lanes; no improvement on existing lanes)	$996,400	$417,600
Parallel construction (add lanes; widen and resurface existing lanes)	N/A	$391,200
Maintenance (roadways under ODOT jurisdiction)	$65,800	$43,240
Maintenance (roadways under local jurisdiction)	N/A	$36,000
Bridges (if constructed separately) - *per square foot*	$56	$56
Right-of-way - *per acre*	$163,800	$98,700

* Principal arterials, minor arterials, and collectors.

DESCRIPTION OF ALTERNATE NETWORKS

The following section provides a summary of transportation characteristics and lists the underlying improvements for each transportation system alternative.

Each alternate's ability to meet projected daily transportation demand was evaluated. Its network performance in terms of congestion speed and daily accidents, as well as projected vehicle emissions and estimated costs to implement associated transportation projects were also addressed. (Note: A side-by-side comparison of all network alternates can be found at the end of this chapter.)

In addition to the factors reflected in the following tables, the alternates were also evaluated based on their projected corridor congestion levels, their volume-to-capacity ratios, and cost effectiveness, derived from benefit-cost ratios. Also taken into account were potential economic, environmental and social impacts, including and environmental justice analysis of the potential impacts to low income and minority populations.[44]

BASE YEAR NETWORK

The 2000 Base Year Network includes all regional streets and highways as they existed in 2000.

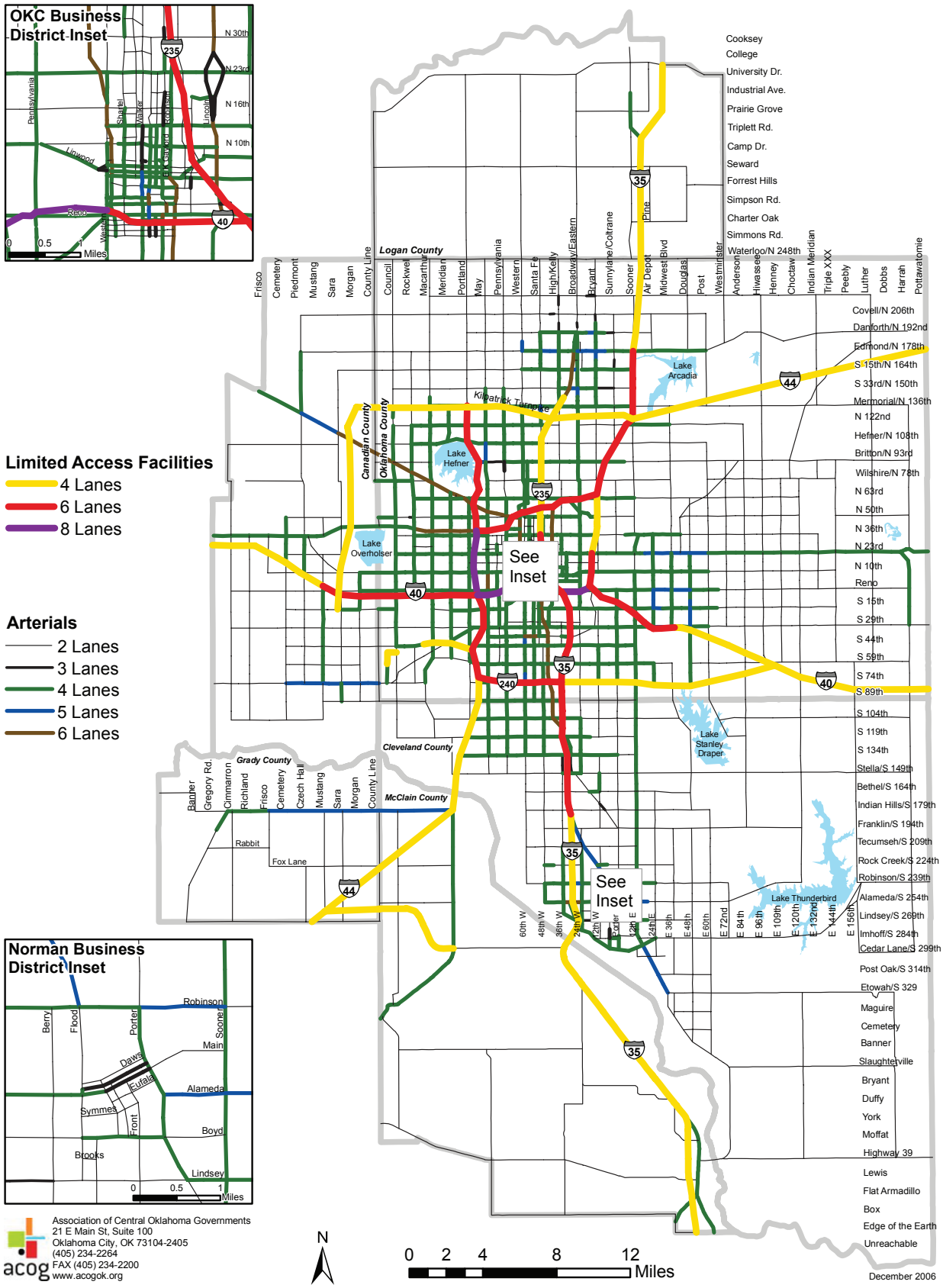
Congested Road Miles*	201 miles
Vehicle Miles of Travel/Day	26,739,000
Vehicle Hours of Travel/Day	607,480
Average Overall Speed	44 mph
Daily Accidents	38
Daily Fuel Consumption	1,565,900 gallons
Tons of Air Quality Emissions/Day	Carbon Monoxide: 943 tons Hydrocarbons: 52 tons Nitrogen Oxide: 80 tons

* Congested road miles include all street segments with a volume/capacity ratio greater than 0.69

A base year model is developed to mimic driver behavior on the road system according to current network characteristics and land uses. Once satisfactory calibration to real world data is achieved, the transportation network or land uses can be changed so as to reflect future developments.

[44] Copies of the FYE 2005 UPWP Report – Task 1.01, Subtask 7a, *Evaluation of Social, Economic, and Environmental Impacts of the 2030 OCARTS Plan*, ACOG, July 2005 - are available at the ACOG office.

Figure 5.1:
2030 OCARTS Plan Base Year Network



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ALTERNATE ONE – PRESENT PLUS COMMITTED NETWORK

Alternate One, the present plus committed network, includes all existing streets and roads, and those for which plans have been finalized and funding was expected to be committed by October 2005. This is a "bare bones" approach, which would allow the region to complete projects currently underway. Virtually all remaining street and highway funds until the year 2030 would be used to maintain the present system.

Congested Road Miles	564 miles
Vehicle Miles of Travel/Day	41,208,000
Vehicle Hours of Travel/Day	1,009,950
Average Overall Speed	41 mph
Daily Accidents	58
Daily Fuel Consumption	2,553,500 gallons
Tons of Air Quality Emissions/Day	Carbon Monoxide: 499 tons Hydrocarbons: 16 tons Nitrogen Oxide: 14 tons
Estimated Cost	$1,547,978,000

This scenario of a 2030 network was tested with the projected 2030 traffic volumes. The results indicate this alternate is relatively inexpensive in terms of money, but costs would be born by the user in terms of more congestion and longer travel times.

The cost breakdown for this alternate is shown in Table 5.2 below:

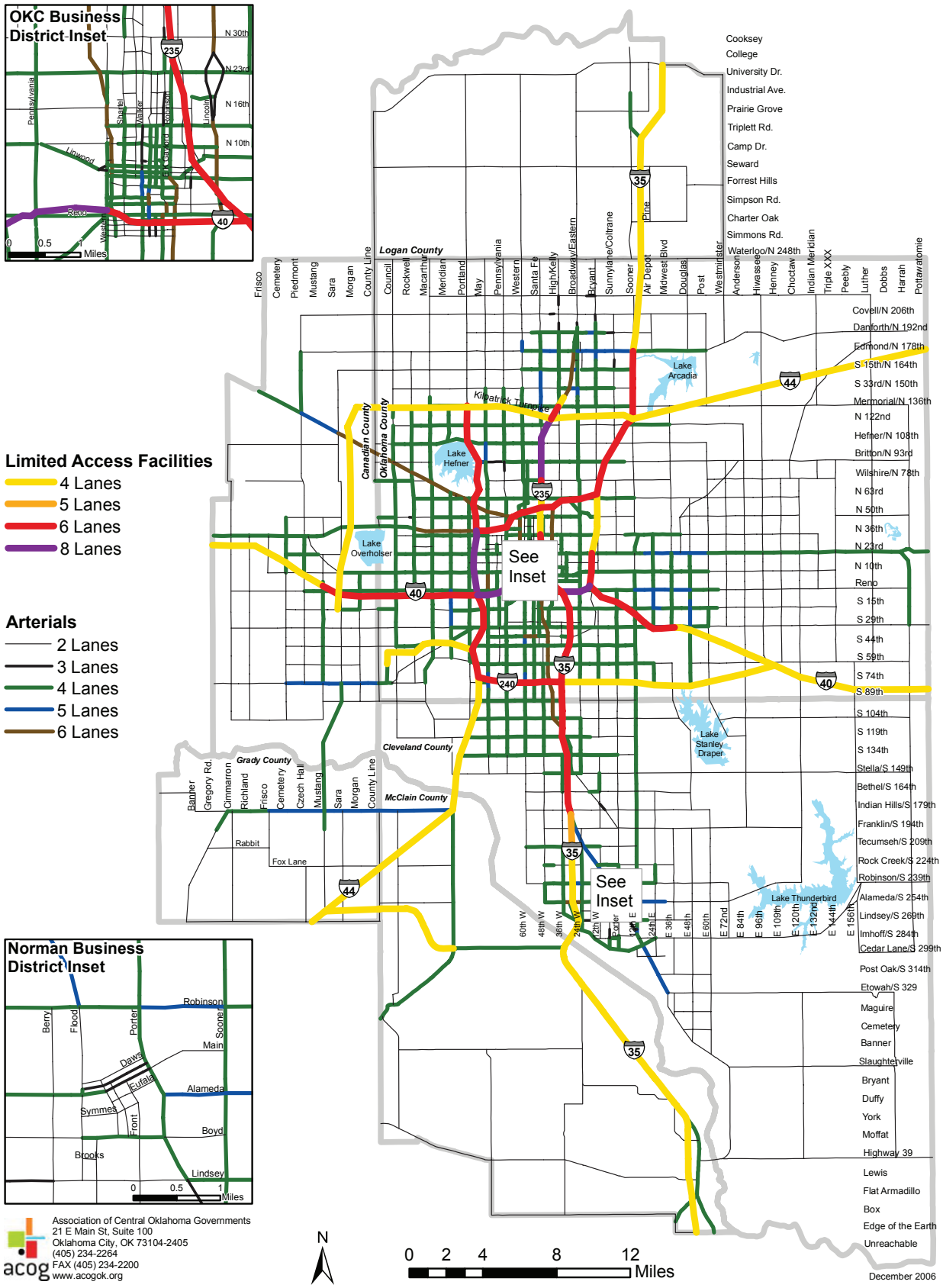
Table 5.2:
Cost Estimates for Implementing Alternate One of the 2030 OCARTS Plan

FUNCTIONAL CLASSIFICATION	LINEAR MILES	LANE MILES	COST (IN THOUSANDS)			
			CONST.	MAINT.	R.O.W.	TOTAL
Turnpikes	60.00	240.00	60,961	75,096	6,164	142,221
Interstates & Freeways	168.08	858.76	232,054	215,729	13,000	460,783
Principal Arterials	446.29	1,659.47	35,049	234,219	16,274	285,542
Minor Arterials	1,388.37	3,469.48	119,452	407,403	57,893	584,748
Collectors	204.11	515.98	10,532	59,812	4,340	74,684
TOTAL	**2,266.84**	**6,743.69**	**$458,048**	**$992,259**	**$97,671**	**$1,547,978**

Note: Only includes street and highway costs. The construction cost figures include structure costs. Maintenance costs are for a two inch asphalt-concrete overlay every ten years over the planning period (2000-2030).

Source: ODOT, "2003 State Highway Needs Assessment Study and Sufficiency Rating Report" was utilized to develop unit costs for construction, maintenance, and right-of-way acquisition. The unit cost numbers were converted to 2000 dollars based on the Consumer Price Indexes, provided by the U.S. Department of Labor, Bureau of Labor Statistics.

Figure 5.2:
2030 OCARTS Plan Alternate One



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ALTERNATE TWO – 2025 OCARTS PLAN NETWORK

Alternate Two, the 2025 OCARTS Plan network, includes the present plus committed network plus the expansion of the street and highway network as indicated in the 2025 OCARTS Plan. It also includes consideration of Intelligent Transportation Systems (ITS), travel demand management (TDM), and traffic system management (TSM) improvements on specified congestion corridors. The ITS, TDM, and TSM strategies include techniques such as traffic signal coordination, changeable message signs, improved bus service, and incident management and alternate routes.

Congested Road Miles	390 miles
Vehicle Miles of Travel/Day	41,141,000
Vehicle Hours of Travel/Day	949,460
Average Overall Speed	43 mph
Daily Accidents	57
Daily Fuel Consumption	2,549,300 gallons
Tons of Air Quality Emissions/Day	Carbon Monoxide: 507 tons Hydrocarbons: 16 tons Nitrogen Oxide: 14 tons
Estimated Cost	$4,518,688,000

This network was evaluated for its ability to handle anticipated 2030 traffic demand. In addition to substantial maintenance work, the network calls for the widening of several interstates and section line roads. Also included in the 2025 OCARTS Plan is the construction/continuation of an outer loop in southwest parts of the region. In the 2025 Plan, this facility was defined as a tollway.

Table 5.3:
Cost Estimates for Implementing Alternate Two of the 2030 OCARTS Plan

FUNCTIONAL CLASSIFICATION	LINEAR MILES	LANE MILES	COST (IN THOUSANDS)					
			CONST.	MAINT.	R.O.W.	MAJOR INTER-CHANGE	NON-TRAD'L IMPRV'TS[d]	TOTAL
Turnpikes[a]	80.00	320.00	424,961	84,036	6,164	7,000		522,161
Interstate & Freeway[b]	172.40	968.48	1,025,425	207,603	84,000	[c]245,969	18,995	1,581,952
Principal Arterials	446.78	1,785.08	247,008	221,579	95,882		17,745	582,214
Minor Arterials	1,397.58	4,109.66	904,566	395,017	382,650		3,630	1,685,863
Collectors	207.09	558.39	55,770	59,847	30,882			146,499
TOTAL	**2,303.84**	**7,741.61**	**$2,657,730**	**$968,082**	**$599,578**	**$252,969**	**$40,330**	**$4,518,688**

Notes: Only includes street and highway costs. The construction cost figures include structure costs. Maintenance costs are for a 2-inch asphalt-concrete overlay every 10 years over the planning period (2000-2030).

[a]Southwest Outer Loop was considered a toll facility; and the cost figures were based on the Outer Loop Corridor MIS (updated to 2000 dollars) and information provided by OTA.

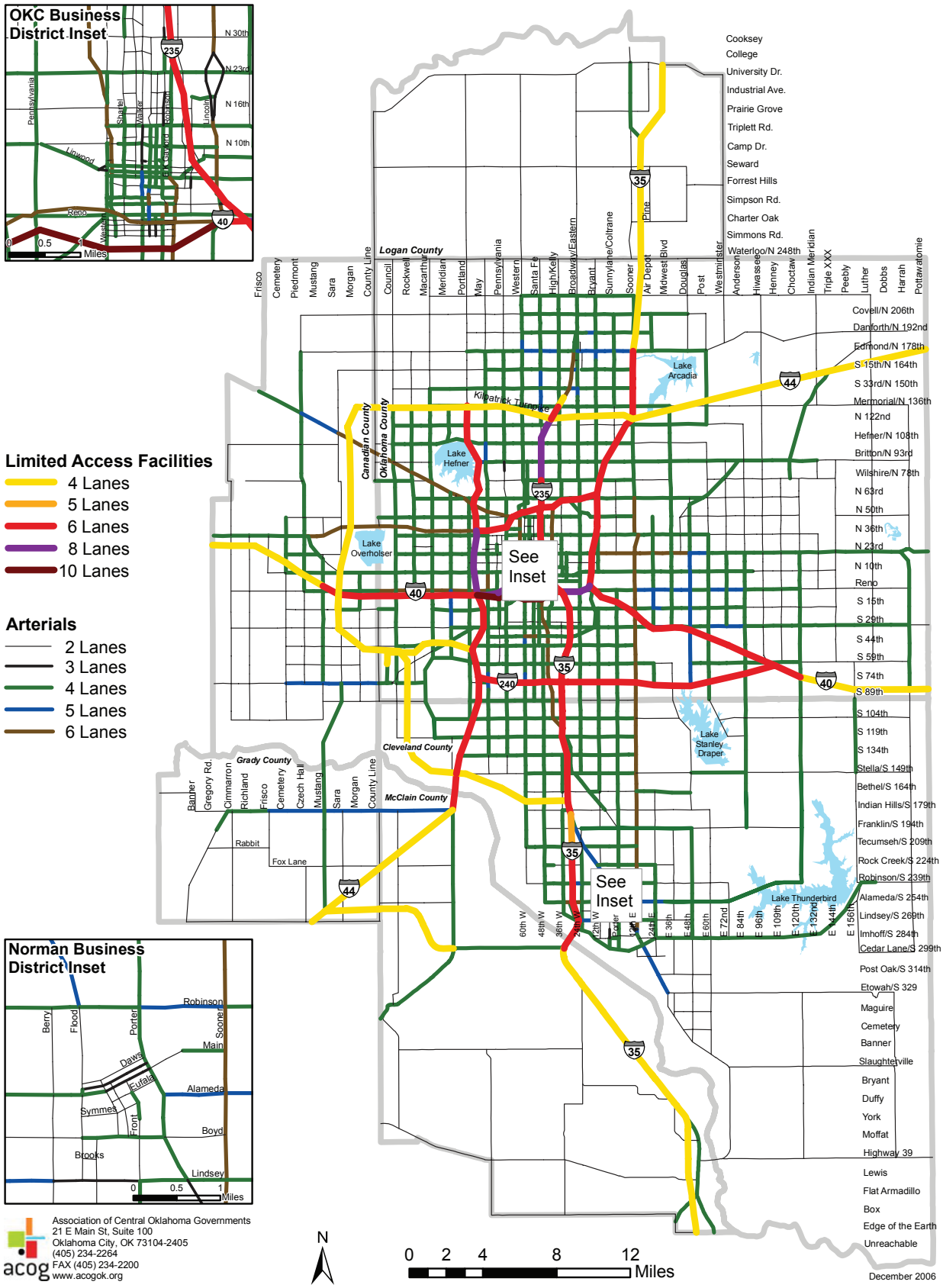
[b]Construction ($289 million) and ROW acquisition ($71 million) for the I-40 Crosstown realignment project was based on information provided by ODOT.

[c]Major Interchanges include I-240/I-35, I-44/I-235 (project also includes widening of I-35 from N 63rd St. to N 36th St. from 4 to 6 lanes; widening of Santa Fe from N 50th St. to N 63rd St.), Broadway Extn./Memorial Road, I-40/Morgan Rd., I-35/Shields Ave.

[d]The non-traditional improvements in the aggregate are expected to cost approximately $40 million, and they will be implemented for the most part on freeways and principal arterials. Non-traditional improvements include the deployment of Intelligent Transportation Systems (ITS), Travel Demand Management (TDM), and Traffic System Management (TSM).

Source: "2003 State Highway Needs Assessment Study and Sufficiency Rating Report" and "Consumer Price Indexes"

Figure 5.3:
2030 OCARTS Plan Alternate Two



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ALTERNATE THREE – REVISED 2025 OCARTS PLAN NETWORK

Alternate Three includes the present plus committed network (Alternate One), all street and highway projects in the 2025 OCARTS Plan (Alternate Two), as well as the following projects:

1) Approved 2025 OCARTS Plan Amendments:

- SH-9, from 168th Avenue E to Cleveland/Pottawatomie County line. Widen 2 to 4 lanes.
- SH-74 (Portland), from Waterloo Road (N. 248th) to Memorial Road (N. 136th). Widen 2 to 4 lanes.
- Kelly Avenue, from Waterloo Road (N. 248th) to Coffee Creek Road (N. 220th). Widen to 2 to 4-lane divided.

2) Oklahoma City General Obligation Bond Projects:

- N. 122nd Street, from Broadway Extension to Kelley Avenue. Widen 2 to 4 lanes.
- Morgan Road, from S. 15th Street to S. 29th Street. Widen 2 to 4 lanes.
- S. 29th Street, from MacArthur Avenue to Meridian Avenue. Widen 2 to 4 lanes.
- Hefner Road (N. 108th), from County Line Road to Council Road. Widen 2 to 4 lanes.
- Wilshire Boulevard (N. 78th), from Northwest Expressway to Rockwell Avenue. Widen 2 to 4 lanes.
- Britton Road (N. 93rd), from County Line Road to Council Road. Widen 2 to 4 lanes.
- S. 15th Street, from Morgan Road to County Line Road. Widen 2 to 4 lanes.

Congested Road Miles	350 miles
Vehicle Miles of Travel/Day	40,850,000
Vehicle Hours of Travel/Day	941,180
Average Overall Speed	43 mph
Daily Accidents	57
Daily Fuel Consumption	2,531,300 gallons
Tons of Air Quality Emissions/Day	Carbon Monoxide: 503 tons Hydrocarbons: 16 tons Nitrogen Oxide: 14 tons
Estimated Cost	$4,611,820,000

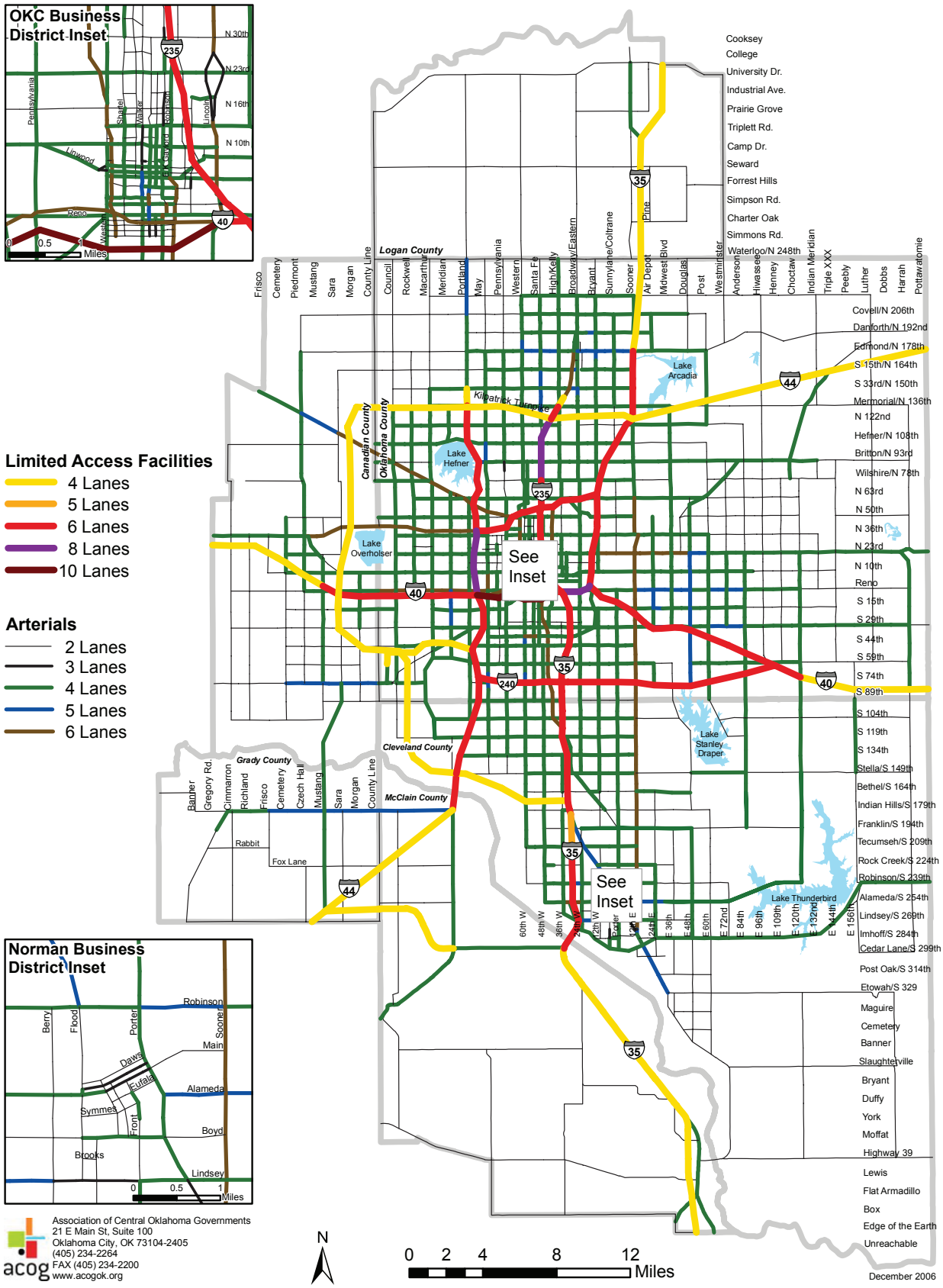
The cost estimate for implementation of this alternative is shown in Table 5.4 below:

Table 5.4:
Cost Estimates for Implementing Alternate Three of the 2030 OCARTS Plan

FUNCTIONAL CLASSIFICATION	LINEAR MILES	LANE MILES	COST (IN THOUSANDS)					
			CONST.	MAINT.	R.O.W.	MAJOR INTER-CHANGE	NON-TRAD'L IMPRV'TS[d]	TOTAL
Turnpikes[a]	80.00	320.00	424,961	84,036	6,164	7,000		522,161
Interstate & Freeway[b]	173.33	979.10	1,063,274	209,589	84,000	[c]245,969	18,995	1,621,787
Principal Arterials	456.90	1,826.19	270,610	224,970	105,484		17,745	618,809
Minor Arterials	1,423.84	4,161.39	899,670	400,883	384,334		3,630	1,688,517
Collectors	216.15	589.99	63,210	63,301	34,036			160,547
TOTAL	**2,350.22**	**7,876.67**	**$2,721,725**	**$982,779**	**$614,018**	**$252,969**	**$40,330**	**$4,611,820**

Notes: See footnotes provided with Alternate Two.

Figure 5.4:
2030 OCARTS Plan Alternate Three



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ALTERNATE FOUR-A – REVISED 2025 OCARTS PLAN AS MODIFIED BY LOCAL GOVERNMENTS

Alternate Four-A includes all improvements reflected in Alternate Three. Additionally, it includes the improvements suggested for inclusion in the 2030 Plan by local governments.

Federal law mandates that the 2030 OCARTS Plan be financially constrained, therefore, evaluation of suggested projects must consider that (a) anticipated revenues may not be sufficient to cover the cost of all proposed projects; and (b) not all projects demonstrate a strong need for implementation by the year 2030. To meet the federal requirements, ACOG staff recommended that the proposed plan projects be evaluated and prioritized. As a result, it was agreed that suggested projects would be prioritized based on the following two criteria:

a) Volume-to-capacity ratio of the road segment in Alternate Three
b) Percent Reduction in the volume-to-capacity ratio of the road segment in Alternate Four

To objectively evaluate the performance of the projects, staff developed the following scoring system for the criteria:

A) VOLUME-TO-CAPACITY (V/C) RATIO OF THE ROAD SEGMENT IN ALTERNATE THREE:

ALTERNATE THREE V/C RATIO	SCORE
1.00 or more (Serious Congestion)	4
0.85 to 0.99 (Moderate Congestion)	3
0.70 to 0.84 (Moderate Congestion)	2
0.50 to 0.69 (Satisfactory Congestion)	1

Projects that received an Alternate Three V/C ratio of less than 0.5 were excluded from further consideration. The assumption is that the conditions that currently exist are adequate and do not need improvement. More emphasis was placed on projects with higher V/C ratios, since this indicates that the segment capacity was inadequate and needed improvement.

B) PERCENT REDUCTION IN THE VOLUME-TO-CAPACITY (V/C) RATIO IN ALTERNATE FOUR:

ALTERNATE THREE V/C RATIO	SCORE
20 percent or greater	4
15 to 19.9 percent	3
10 to 14.9 percent	2
Less than 10 percent	1

The assumption was that projects that showed greater improvement (largest percent reduction in V/C ratio) would receive higher priority in project selection for Alternate Four.

An example of this scoring system used on two projects will serve to explain the suggested scoring system:

Project	Alternate Three # of Lanes	Suggested Alternate Four # of Lanes	Alternate Three V/C Ratio	Alternate Four V/C Ratio	Percent Reduction V/C Ratio	Total Score
Project A	2	4	0.95 (3)	0.91	4.2% (1)	4
Project B	2	4	1.01 (4)	0.85	15.8% (3)	7

Multiple projects were analyzed for inclusion in the 2030 OCARTS Plan using the above criteria. However, it was determined that only the following projects exhibited enough congestion to warrant construction by 2030:

- US-77, from Etowah Road (S. 329th) to Purcell east city limits. Widen 2 to 4 lanes.
- Covell Road (N. 206th), from Pennsylvania Avenue to Western Avenue. Widen 2 to 4 lanes.
- SH-74, from I-35 to 5.50 miles south of I-35 (S. 250th). Widen 2 to 4 lanes.
- Broadway Avenue, from Waterloo Road (N. 248th) to Coffee Creek Road (N. 220th). Widen 2 to 4 lanes.
- Lindsey Street, from 24th Avenue E (Air Depot) to 36th Avenue E (Midwest Boulevard). Widen 2 to 4 lanes.
- Waterloo Road (N. 248th), from Kelley Avenue to I-35. Widen 2 to 4 lanes.
- Main Street, from Carter Road to 12th Avenue E (Sooner). Widen 2 to 4 lanes.
- 12th Avenue E (Sooner), from SH-9 to Cedar Lane Road (S. 299th). Widen 2 to 4 lanes.
- Rock Creek Road (S. 224th), from 36th Avenue W (Kelley) to 24th Avenue W (Eastern). Widen 2 to 4 lanes.
- Rock Creek Road (S. 224th), from Grandview Avenue (0.5 miles west of 36th Avenue W) to 36th Avenue W (Kelley). Widen 2 to 4 lanes.
- Mustang Road, from Wagner Road (N. 50th) to SH-66. Widen 2 to 4 lanes.
- N. 23rd Street/Vandament Avenue, from Mustang Road to Sara Road. Widen 2 to 4 lanes.
- Sara Road, from S. 15th Street to S. 74th Street. Widen 2 to 4 lanes.
- S. 29th Street, from Sooner Road to I-40. Widen 4 to 5 lanes.
- SH-9, from 24th Avenue E (Eastern) to 12th Avenue E (Sooner). Widen 4 to 6 lanes.
- S. 15th Street, from I-40 to Sooner Road. Widen 4 to 5 lanes.
- Reno Avenue, from Air Depot Boulevard to Douglas Boulevard. Widen 4 to 5 lanes.
- MacArthur Boulevard, from Wilshire Road (N. 78th) to N. 36th Street. Widen 4 to 5 lanes.

Congested Road Miles	341 miles
Vehicle Miles of Travel/Day	41,022,400
Vehicle Hours of Travel/Day	943,980
Average Overall Speed	43 mph
Daily Accidents	58
Daily Fuel Consumption	2,541,900 gallons
Tons of Air Quality Emissions/Day	Carbon Monoxide: 506 tons Hydrocarbons: 16 tons Nitrogen Oxide: 14 tons
Estimated Cost	$4,702,611,000

Alternate Four-A also includes the following projects recommended for more modest improvements than those shown in the 2025 Plan:

- Reno Avenue, from Bryant Avenue to Air Depot Boulevard. 6 to 5 lanes
- 84th Avenue E (Anderson), from Bethel Road (S. 164th) to Franklin Road (S. 194th). 4 to 2 lanes
- 120th Avenue E (Choctaw), from Stella Road (S. 149th) to Alameda Street (S. 254th). 4 to 2 lanes
- Franklin Road (S. 194th), from 24th Avenue W (Eastern) to 48th Avenue W (Douglas). 4 to 2 lanes
- Alameda Street (S. 254th), from 0.5 miles W of 36th Avenue E (Midwest Boulevard) to 120th Avenue E (Choctaw). 4 to 2 lanes
- MacArthur Boulevard, from S. 104th Street to S. 119th Street. 4 to 2 lanes
- Robinson Avenue, from Main Street to Sheridan Avenue. 4 to 2 lanes
- Sheridan Avenue, from E.K. Gaylord Avenue to Lincoln Boulevard. 4 to 2 lanes

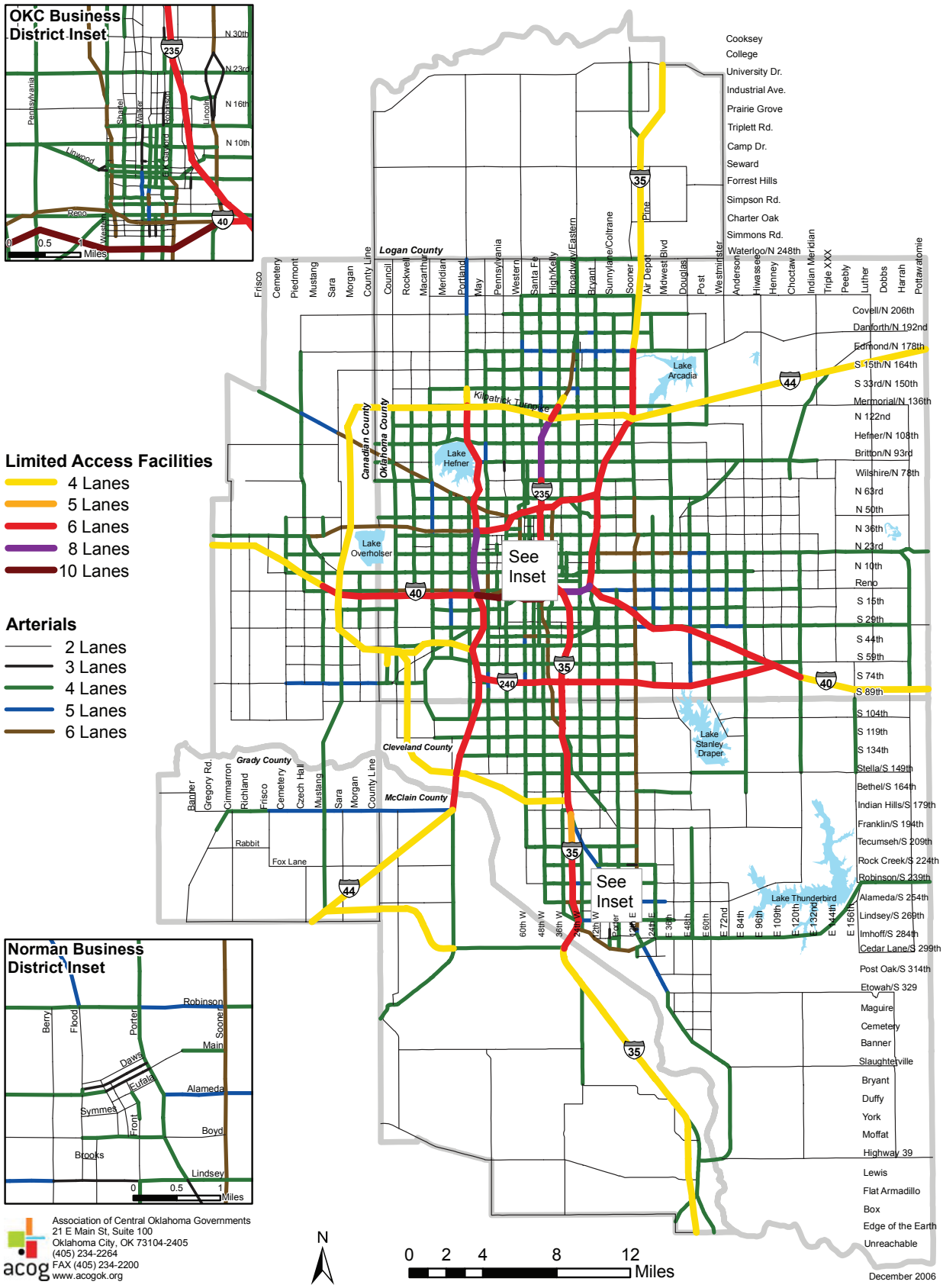
Table 5.5 lists the detailed cost estimates established for Alternate Four-A:

Table 5.5:
Cost Estimates for Implementing Alternate Four-A of the 2030 OCARTS Plan

Functional Classification	Linear Miles	Lane Miles	COST (in thousands)					
			Const.	Maint.	R.O.W.	Major Inter-change	Non-Trad'l Imprv'ts[d]	Total
Turnpikes[a]	80.00	320.00	424,961	84,036	6,164	7,000		522,161
Interstate & Freeway[b]	173.33	979.10	1,063,274	209,589	84,000	[c]245,969	18,995	1,621,787
Principal Arterials	456.90	1,863.87	331,950	225,228	130,644		17,745	705,567
Minor Arterials	1,423.84	4,144.89	894,893	402,675	382,316		3,630	1,683,514
Collectors	216.15	591.07	69,626	62,875	37,082			169.583
TOTAL	**2,350.22**	**7,898.93**	**$2,784,704**	**$984,403**	**$640,206**	**$252,969**	**$40,330**	**$4,702,611**

Notes: See footnotes provided with Alternate Two.

Figure 5.5:
2030 OCARTS Plan Alternate Four-A



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ALTERNATE FOUR-B – 2030 OCARTS PLAN NETWORK

After local government staff expressed concerns that the following two improvements did not meet the minimum V/C ratio for inclusion in Alternate Four-A, a meeting was arranged with ACOG staff to review recent traffic impact analyses and the *Norman 2025 Land Use and Transportation Plan* forecasts. The ITTC approved a motion to review and reconsider the two segments in the model. The proposed improvements and related network segments were:

- Cedar Lane, from 12th Avenue E to ½ mile E of 24th Avenue E, from 2 to 4 lanes.
- Franklin Road, 48th Avenue W to I-35, from 2 to 4 lanes.

Also included in the motion was a request by the City of Norman to evaluate the following project for inclusion in Alternate Four:

- Indian Hills Road, 48th Avenue W to 36th Avenue W, from 2 to 4 lanes.

Norman staff provided supplemental local traffic data for the 2030 regional travel model from recent traffic impact analysis studies conducted in the area and asked ACOG staff to consider using some of that data to determine the need of the road improvements.

Additionally, ODOT staff requested, and the ITPC approved, consideration of the following interstate improvements to also be tested for inclusion in Alternate Four-B:

- I-35, N. 246th Street (Waterloo Road) to N. 178th Street (Second Street), from 4 to 6 lanes.
- I-40, Choctaw Road to Oklahoma/Pottawatomie County line, from 4 to 6 lanes.
- I-35, SH-9 (west interchange) to SH-74 (Goldsby exit), from 4 to 6 lanes.

Analysis of the projects shows the following improvements meet the minimum volume/capacity threshold (V/C ≥ 0.50) in Alternate Three; and thus demonstrate sufficient need for inclusion in Alternate Four-B:

LOCATION	TO	FROM	PROPOSED IMPROVEMENT	V/C RATIO
Indian Hill Rd.	48th Ave. W	36th Ave. W	2 to 4 lanes	0.54
Franklin Rd.	48th Ave. W	I-35 Frontage Rd.	2 to 4 lanes	0.56
I-35	N. 178th St.	Waterloo Rd.	4 to 6 lanes	1.04
I-40	Choctaw Rd.	Pottawatomie Rd.	4 to 6 lanes	1.04
I-35	SH-9 West	SH-74 Jct./Goldsby exit	4 to 6 lanes	1.16

The Cedar Lane Rd. project did not meet the minimum criteria. Its V/C ratio was 0.36.

Alternate Four-B is the recommended 2030 OCARTS Plan Street and Highway Network. It includes all improvements listed in Alternate Four-A with the following additions:

- I-35, from Waterloo Road (N. 248th) to SH-66. Widen 4 to 6 lanes.
- I-40, from Choctaw Road to Pottawatomie Road. Widen 4 to 6 lanes.
- Indian Hills Road (S. 179th), from 48th Avenue W (Santa Fe) to 36th Avenue W (Kelley). Widen 2 to 4 lanes.
- Franklin Road (S. 194th), from 48th Avenue W (Santa Fe) to I-35 Frontage Road. Widen 2 to 4 lanes.
- I-35, from SH-9 West Interchange to SH-74/Goldsby Exit. Widen 4 to 6 lanes.

Congested Road Miles	327 miles
Vehicle Miles of Travel/Day	40,982,800
Vehicle Hours of Travel/Day	933,500
Average Overall Speed	44 mph
Daily Accidents	57
Daily Fuel Consumption	2,539,500 gallons
Tons of Air Quality Emissions/Day	Carbon Monoxide: 507 tons Hydrocarbons: 16 tons Nitrogen Oxide: 14 tons
Estimated Cost	$4,813,625,000

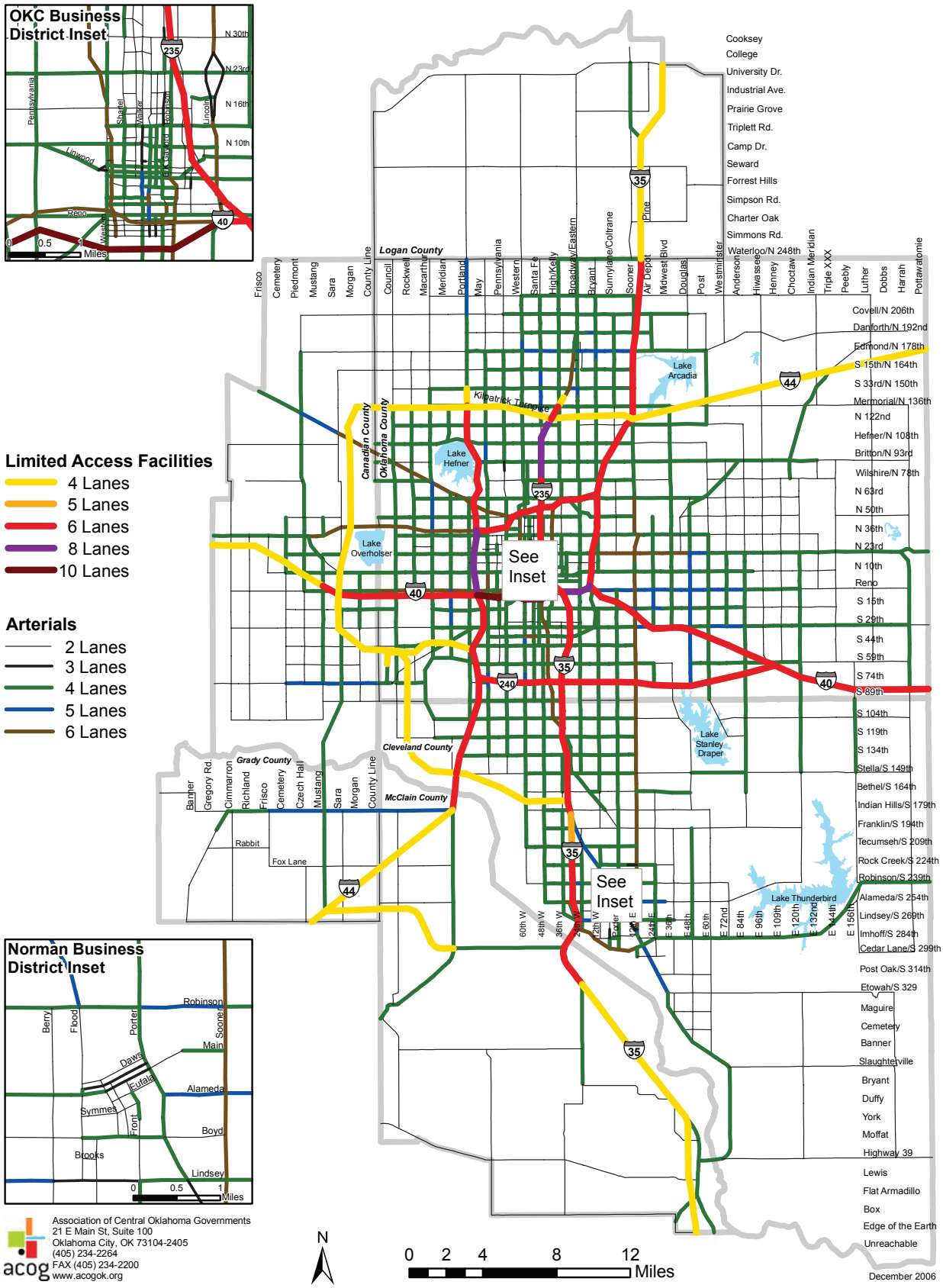
Table 5.6 shows the detailed costs estimate for the implementation of the 2030 OCARTS area transportation plan:

Table 5.6:
Cost Estimates for Implementing Alternate Four-B of the 2030 OCARTS Plan

Functional Classification	Linear Miles	Lane Miles	Cost (in thousands)					
			Const.	Maint.	R.O.W.	Major Inter-change	Non-Trad'l Imprv'ts[d]	Total
Turnpikes[a]	80.00	320.00	424,961	84,036	6,164	7,000		522,161
Interstate & Freeway[b]	173.33	1,005.72	1,154,580	202,825	84,000	[c]245,969	18,995	1,706,329
Principal Arterials	456.90	1,863.87	330,216	225,228	132,039		17,745	705,228
Minor Arterials	1,424.84	4,154.91	905,705	402,282	388,238		3,630	1,699,855
Collectors	219.47	602.47	76,266	63,641	40,146			180,053
TOTAL	**2,354.53**	**7,946.97**	**$2,891,728**	**$978,012**	**$650,587**	**$252,969**	**$40,330**	**$4,813,625**

Notes: See footnotes provided with Alternate Two.

Figure 5.6:
2030 OCARTS Plan Network



Map Disclaimer Applies. See the report Table of Contents or http://www.acogok.org/mapdisclaimer.asp

Table 5.7:
Side-by-Side Comparison of 2030 OCARTS Network Alternates - Population and Transportation Statistics

	2000 Base Year	2030 OCARTS Area Projections				
		Alternate One	Alternate Two	Alternate Three	Alternate Four-A	Alternate Four-B
1. Demographic Data						
Population	990,595	1,335,036	1,335,036	1,335,036	1,335,036	1,335,036
Employment	539,395	728,100	728,100	728,100	728,100	728,100
2. Daily Transportation Demand						
Vehicle Miles of Travel (thousands)	26,739.0	41,208.0	41,141.0	40,850.0	41,022.0	40,982.8
Vehicle Hours of Travel (thousands)	607.5	1,009.9	949.5	941.2	943.9	933.5
Vehicle Trips (thousands)	3,144.0	4,298.0	4,298.0	4,298.0	4,298.0	4,298.0
Transit Ridership (thousands)[45]	15.1	21.5	21.5	21.5	21.5	21.5
3. System Performance						
Congested Road Miles	201	564	390	350	341	327
Average Overall Speed (mph)	44	41	43	43	43	44
Average Freeway Speed (mph)	48	43	46	46	46	47
Average Arterial Speed (mph)	41	38	40	41	40	40
Daily Accidents	38	58	57	57	58	57
4. Environment						
Daily Fuel Consumption (thousand gallons)	1,565.9	2,553.5	2,549.3	2,531.3	2,541.9	2,539.5
Carbon Monoxide Emissions (tons/day)	942.9	499.4	507.1	503.2	505.7	506.9
Hydrocarbon Emissions (tons/day)	52.4	16.1	15.7	15.7	15.7	15.6
Nitrogen Oxide Emissions (tons/day)	80.1	13.5	13.6	13.5	13.6	13.6
5. Total Estimated Plan Costs[46]						
Street & Highway Capital (mil.)	-	$555.7	$3,550.7	$3,629.1	$3,718.2	$3,835.6
Street & Highway Maintenance (mil.)	-	$992.3	$968.0	$982.7	$984.4	$978.0
Street & Highway Subtotal (mil.)	-	*$1,548.0*	*$4,518.7*	*$4,611.8*	*$4,702.6*	*$4,813.6*
Transit (mil.)	-	$661.8	$661.8	$661.8	$661.8	$661.8
Bicycle & Pedestrian (mil.)	-	$98.5	$98.5	$98.5	$98.5	$98.5
Total (mil.)	**-**	**$2,308.3**	**$5,279.0**	**$5,372.1**	**$5,462.9**	**$5,573.9**

Sources: U.S. Census Bureau; Environmental Protection Agency, Mobile 6.2a; Association of Central Oklahoma Governments

[45] Transit Ridership is based on average weekday ridership information.
[46] All costs are estimated in year 2000 Dollars.

CHAPTER 6: SOCIAL, ECONOMIC, AND ENVIRONMENTAL IMPACTS

As part of the 2030 OCARTS Plan, a list of potential social, economic, and environmental impacts applicable to the study area was prepared for the region. Data relating to these topics was gathered and analyzed in relation to the transportation networks considered for the 2030 OCARTS Plan. ACOG staff, along with the Intermodal Transportation Policy Committee (ITPC), Intermodal Transportation Technical Committee (ITTC), Citizens Advisory Committee (CAC), and the Areawide Planning and Technical Advisory Committee (APTAC), identified social, economic, and environmental characteristics of the OCARTS region which could impact, or be affected by the transportation plan alternates.

It is important to note that this impact analysis is general and regional in nature. It in no way replaces the detailed Environmental Impact Statement (EIS) required by the National Environmental Policy Act (NEPA)[47] for any transportation improvement project utilizing federal funds.

ASSESSMENT CATEGORIES

Staff gathered information on the following topics relating to the social, economic, and environmental impacts of the 2030 OCARTS Transportation Plan:

- Social Impacts
  - Archaeological sites
  - Tribal Lands
  - Historic Sites and Districts
  - Safety (annual accidents predicted)
- Economic Impacts
  - Total Cost
  - Residential/Employment displacements
  - Low Income Neighborhoods
- Environmental Impacts
  - Air Quality
  - Parks/Open Space
  - Endangered Species
  - Floodplains
  - Surface and Subsurface/Aquifer Water Quality
  - Hazardous Waste and Superfund Sites
  - Leaking Underground Storage tanks
  - Noise Sensitive Land Uses

All topics were analyzed in relation to the five street and highway alternates to assess the existence of potential impacts.

[47] The National Environmental Policy Act (NEPA) [42 U.S.C. 4321 et seq.] was signed into law on January 1, 1970. The Act establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment, and it provides a process for implementing these goals within the federal agencies. The Act also establishes the Council on Environmental Quality (CEQ). The complete text of the law is available for review at http://ceq.eh.doe.gov/nepa/nepanet.htm.

ANALYSIS DATA

The data collection process included contacting numerous federal, state, and local agencies via correspondence, personal interviews, and telephone conversations. In most cases, these agencies were asked to provide the most recent impact data along with any associated physical locations. If the database included a complete address field, the information could be linked with a physical location by using the address-matching feature in the ESRI's ArcGIS software. (Unfortunately, this was not always possible due to inadequate address information in the impact's data.) The ArcGIS software was then used to map each impact by the physical locations identified from the databases. This was done by manually locating the address range and inserting a point, or by digitizing the feature on separate layers into the active GIS file. (See Attachment 3 for a description of the data sources used to gather and create the analysis data.)

ANALYSIS METHODOLOGY

To better illustrate how the 2030 OCARTS Plan transportation improvements would impact the social, economic, and environmental quality of the area, maps were developed to visually represent the location of the potential impacts. In cases where an impact could not be mapped appropriately (e.g. estimated costs, predicted air pollutant levels), a chart or table was developed to show the comparison between the different alternates.

In conjunction, proximity analyses were performed, where applicable, using GIS software to evaluate the specific social, environmental, and cultural features that could impact the various network improvements. This process first involved selecting all network links (i.e., road segments) expecting improvements between Alternates Two and Four-B. Using only these links, buffered selections of 150 ft on each side of limited access facilities, and 50 ft on each side of the other street network links were used to determine which potential sites/features might be adversely impacted by the transportation improvement or construction.

SOCIAL IMPACTS

ARCHAEOLOGICAL SITES

The Oklahoma State Archaeologist was consulted to determine the archaeological sites within the OCARTS area. Due to confidentiality and sensitivity issues, information on the sites was only provided as a county total. Approximately 812 recorded sites are located in the OCARTS area. It was emphasized that only a small amount of the land in the OCARTS area has been studied and there was a great probability for the discovery of more sites. Therefore, the State Archaeologist recommended that new projects be reviewed on a case-by-case basis as required National Environmental Policy Act (NEPA) review process for street and highway projects utilizing federal funds.

Since the exact location of any archaeological sites was not determined, maps and proximity analysis of the sites was not produced.

TRIBAL LANDS

Tribal land includes those lands under the jurisdiction or control of a Native American Tribe, including land held in federal trust by the Bureau of Indian Affairs (BIA) for the tribe. Information was requested from various tribal organizations in the Central Oklahoma area including the Bureau of Indian Affairs (BIA) in Anadarko and Ada, the Chickasaw Nation, and the Kickapoo Tribe. The Iowa, Sac and Fox, Citizen Pottawatomie Tribes were also contacted and indicated land holdings did not exist within the OCARTS area.

The BIA in Anadarko was able to provide maps of the Absentee Shawnee land holdings within Cleveland County (dated 1999). The Kickapoo Tribe provided a map of their tribal lands without the type of land holding (map and data was not dated). Inquiries to the Chickasaw Nation as to its land holdings within Grady and McClain counties were referred to the BIA (Ada). The BIA (Ada) does not store/file records of its trust land holdings in a manner that was accessible for a regional query.

Because of the sensitivity of the data, a detailed site-specific proximity analysis, and graphical display of the individual land holdings was not produced. The location of the specific tribal land holdings was only determined on a regional level. In general, State Highway 9 improvements, surrounding the Lake Thunderbird area, will potentially impact Absentee Shawnee tribal-held and trust lands. This and other unforeseen potential impacts on tribal land from street and highway improvements would involve possible added delays and costs in the site-specific planning of the improvement.

NATIONAL HISTORIC SITES AND DISTRICTS

Information on historic sites and districts was collected from the National Park Service, the Oklahoma State Historical Society, and the City of Oklahoma City Planning Department. As of January 2005 there were 111 sites and 28 districts listed with the National Registry of Historic Places (NR) within the OCARTS area. Data from Oklahoma City indicated an additional 13 sites and 58 districts were pending approval for the NR or were in the application preparation process. It is important to note that there is also a State Registry of Historic Places (SR) that may be consulted during the site-specific review process.

In general, the potential impacts on historic sites/district from street and highway improvements would involve possible added delays and costs in the site-specific planning for the improvement.

SAFETY

The annual fatality and injury rates for the OCARTS area were determined using OCARTS area accident counts from the 2000 Oklahoma Department of Transportation (ODOT) accident database and the vehicle miles traveled (VMT) modeled for the OCARTS base year 2000 street and highway network.

The fatality and injury rates were applied to the annual estimates of VMT for each Plan Alternate. In general, the total OCARTS area fatalities are projected to increase from approximately 94 in the year 2000 to approximately 144 in the year 2030. Injuries are projected to increase from approximately 13.7 thousand in 2000 to approximately 20.8 thousand in 2030. The increase in fatality and injuries is directly correlated to the increase in forecasted 2030 VMT.

ECONOMIC IMPACTS

TOTAL COST

Total costs for implementing the street/highway and intermodal improvements for each alternate network, are provided in Table 5.7. The total costs range from $2.31 billion for Alternate One to $5.57 billion for the final Alternate Four-B.

RESIDENTIAL DISPLACEMENTS

The Oklahoma Department of Transportation (ODOT), Oklahoma Transportation Authority (OTA), and local area transportation planning staff were contacted in regards to the possible number of residential and business displacements that could be caused by the 2030 Plan projects. The time frame included projects that were started in 2000 and will be completed by 2030. Some projects that are currently in the NEPA process did not have final estimates; however, an estimate is that approximately 73 residential and approximately 119 business would be displaced. The majority of these displacements were attributed to the I-40 relocation in downtown OKC, the extension of SH-4 from Yukon to Tuttle, the H.E. Bailey Turnpike Spur through Grady and McClain counties, and the reconstruction of the I-44/I-35 interchange. Potential displacements from the construction of a SW outer-loop/turnpike through Canadian and Cleveland Counties were not determined due to the lack of an alignment at the time of Plan adoption.

NEIGHBORHOODS, LOW INCOME AND TRADITIONALLY UNDERSERVED GROUPS

Acquisition of rights-of-way and/or close proximity of improvements may negatively impact low-income and minority groups. For further information, see the FYE 2005 UPWP Report – Task 1.01, Subtask 7b, *Environmental Justice Analysis of the 2030 Plan*, ACOG, July 2005, at the ACOG offices.

ENVIRONMENTAL IMPACTS

AIR QUALITY

The OCARTS area has been designated as being in attainment based on national standards for both Carbon Monoxide (CO) and Ozone. Ozone is influenced by Nitrogen Oxides (NOx) and Volatile Organic Compounds-Hydrocarbons (VOC HC) vehicle emissions. In the OCARTS area, elevated CO levels are considered more prevalent in the winter months. VOC HC and NOx, components forming ozone, are considered of greater significance in the summer months. Monitoring stations are located in the metro area to measure the air quality on a daily/hourly basis.

For the 2030 OCARTS Plan, the Environmental Protection Agency's (EPA) vehicular emissions model, MOBILE 6.2a, was used to determine future vehicular emissions based on each plan alternate's VMT forecast, i.e., as modeled by TP+. The MOBILE model provides emission estimates by vehicle class, and by functional-classification of roadway.

The MOBILE model was run with the default vehicle type distribution and efficiency provided with the model. However, OCARTS area specific data included the max/min daily temperatures, the morning and afternoon relative humidity, the approximate Reid Vapor Pressure (RVP) for OCARTS area fuels, and the average speed of the Plan Alternates.

Model scenarios were developed for each Alternate for the winter (January) CO emissions, and the summer (July) ozone component emissions. Further scenarios were developed for each season based on the two functional classes of roads described for the Alternates, limited access facilities and other roads. Therefore, 24 MOBILE scenarios were developed given the two seasons multiplied by two road type categories multiplied by five alternates plus the base network.

PARKS AND OPEN SPACES

The inventory of present and future park and open space areas was developed from combining digital geographic maps of park boundaries from Norman, Edmond, and OKC with existing public land extracted from the 2000 OCARTS land use map. The inventory includes state parks, municipal and neighborhood parks, golf courses, sports complexes, trails, wildlife refuge areas, and public areas surrounding significant bodies of water.

In all there are 17,800+ acres of parkland and open space, 15,500+ acres of water, 8,100+ acres of golf and sports complexes, and approximately 10,600 acres of wildlife preserves.

In general, the potential impacts to parks and open spaces from street and highway improvements would involve possible added delays and costs in the site-specific planning for the improvement.

WILDLIFE AND ENDANGERED SPECIES

U.S. Fish and Wildlife Services (USFWS), Southwest Region, provides a listing on their website of all endangered and threatened species for Oklahoma counties. The animals identified (and their status), potentially located within the OCARTS area counties are the:

- American peregrine falcon (recovered, but monitoring)
- Arkansas River Shiner (threatened)
- Bald Eagle (threatened)
- Black-capped Vireo (endangered)
- Black tailed prairie dog (endangered candidate taxon)
- Least tern (endangered)
- Piping Plover (threatened)
- Whooping crane (endangered)

The Arkansas River Shiner is the only OCARTS area species to have an official USFWS critical habitat delineation, i.e., along the South Canadian River. Further consultation with USFWS staff, revealed that although species are listed for the OCARTS counties, it does not ensure they actually exist or nest in the area.

The least tern, piping plover, whooping crane, bald eagle, and the Arkansas River shiner species are all dependent on river and/or lake habitats for nesting and feeding. Therefore, a potential habitat of a one-mile buffer surrounding major lakes and rivers was considered as an adequate potential habitat for these species. Although not considered in this analysis, rural lakes and streams may provide additional habitat for these species.

Species such as the black-capped vireo is not water dependent, prohibiting the delineation of the species' potential habitat. USFWS staff also stated that it is important to note that the black capped vireo, least tern, piping plover, whooping crane, and bald eagle are all migratory birds and may only reside within OCARTS during specific times of the year.

In conclusion, a potential habitat for the aquatic dependent species was determined as a one-mile buffer surrounding the OCARTS area major lakes and rivers. For the remaining species, potential nesting or feeding habitats must be determined during the site-specific road improvement review and planning process. In general, the potential impacts on endangered and threatened wildlife from street and highway improvements would involve possible added delays and costs in the site-specific planning for the improvement.

FLOODPLAINS

Staff acquired the digital Federal Emergency Management Agency (FEMA) floodplain data for Cleveland, Canadian, Grady, and Oklahoma counties from the U.S. Department of Agriculture (USDA) spatial data gateway. Digital data for Logan County was extracted from the 2025 Plan flood zone data file and does not contain the 500-year flood zone boundaries. Flood zones within McClain County were digitized using georeferenced digital scans of the FEMA flood zone maps, provided by Association of South Central Oklahoma Governments (ASCOG) staff.

The 100 and 500-year flood hazard zones within the OCARTS area were extracted from the countywide data. In the OCARTS area there are:

- approximately 224 thousand acres of 100-year flood zone.
- approximately 204 thousand acres of 500-year flood zone, not including the 500-year zones not digitized in Logan County.
- approximately 7 thousand acres which have not been digitized and may contain potential flood hazard zones.

Proximity analysis determined that approximately 74 roads identified in Alternate Four-B (may include multiple projects per road) would pass through the 100 or 500-year FEMA flood hazard zones. In general, the potential impacts from flood zones to street and highway improvements would involve added possible delays and costs in the site-specific planning. Refer to the Water Quality section of this document for additional information regarding potential source water protection requirements within these flood zones.

WATER QUALITY

Within the OCARTS area, the OWRB has identified four major aquifers; three alluvial aquifers and one bedrock aquifer. The Garber Wellington Aquifer is located in central Oklahoma and covers parts of Canadian, Cleveland, Oklahoma and Logan Counties. This aquifer consists of the Garber Sandstone, and Wellington geologic formations. It is a significant natural feature and a source of ground water for many entities within the OCARTS area. Most of the recharge for the aquifer is located east of I-35. Construction and widening projects in the eastern part of the OCARTS area may have a limited impact on groundwater quality near the project site. The three remaining major alluvial aquifers located in the OCARTS area are the N. Canadian River, S. Canadian River, and Cimarron River Aquifers. In general, alluvial aquifers consist of shallow (<=approximately 50ft), porous sand and gravel deposits along the floodplains of major rivers. A few entities within the OCARTS area, such as Noble and Bethany, draw water from these aquifers for their public supply. Care must be taken to ensure the quality of the alluvial aquifer source water. Potential pollution from sewage outfall, illegal dumping, agriculture, construction, and stormwater runoff must be avoided or controlled since the recharge of these aquifers from the river water is relatively rapid.

Many of the larger Alternate Four-B improvements may require National Pollutant Discharge Elimination System (NPDES) project and stormwater permitting[48] by the ODEQ. In general, the potential impacts from source water protection and runoff permitting to street and highway improvements would involve added possible delays and costs in the site-specific planning.

HAZARDOUS WASTE SITES/SUPERFUND SITES

The Superfund program, also known as the National Priorities List (NPL), was created as a result of the Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA was enacted in 1980, and amended by the Superfund Amendments and Reauthorization Act of 1986. These acts establish broad authority for the government to respond to problems posed by the release, or threat of release, of hazardous substances, pollutants, or contaminants. CERCLA also imposed liability on those responsible for releases and provided the authority for the government to undertake enforcement and abatement action against responsible parties.

Staff obtained the 2004 listing of open and archived hazardous waste sites from the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) online database. Both archived and open CERCLA sites must be considered for environmental impact studies, as confirmed by Oklahoma Department of Transportation (ODOT) staff.

The EPA database listings were obtained for OCARTS counties and, if applicable, matched against existing geographic coordinates from 2025 Plan Leaking Underground Storage Tanks (LUST) data. Additional attribute and coordinate information was found in the Right to Known (RTK) Net CERCLA database. Property coordinates were manually located for all unmatched CERCLA records.

In total, 4 superfund and 130 hazardous waste sites are located within the OCARTS area. Of the 130 hazardous waste sites, 23 are open investigations, which may require remedial activities. The remaining 107 are listed in the archive with status of 'no further remedial activity planned' (NFRAP).

Proximity analysis determined that no superfund sites are within the vicinity of Alternate Four-B improvements. However, several hazardous waste sites were found located within the buffer zone (150 ft surrounding limited access facilities and the 50 ft surrounding all other roads).

In addition to the CERCLA hazardous waste sites, information was provided by Oklahoma Department of Environmental Quality (ODEQ) on the locations of nine large-quantity waste generating companies, six hazardous waste storage and disposal locations, and 186 bio-solid, (i.e., waste-water sludge) land application sites within the OCARTS area. A proximity analysis determined that approximately 4 land application sites were in immediate proximity of Alternate Four-B improvements. Additionally, the Madewell & Madewell site at Choctaw Road & N. 93rd Street in Jones, a large quantity generator and storage/disposal location, fell in proximity of the Hogback Road improvements between N. 136th Street and N. 93rd Street.

[48] The EPA National Pollutant Discharge Elimination System (NPDES) Stormwater program is a comprehensive two-phased national program for addressing non-agricultural sources of stormwater discharge into local water bodies. The program uses the NPDES permitting mechanism to require the implementation of controls designed to prevent harmful pollutants from being washed by stormwater runoff and deposited in our lakes and rivers. Any project disturbing more than one acre of land must obtain a Construction General Permit (CGP).

LEAKING UNDERGROUND STORAGE TANKS (LUST)

The current listing of the LUST database[49] was provided by Oklahoma Department of Transportation (ODOT) staff. The listing includes tank locations from 1987 to 2004 that have open or closed investigation and/or clean-up status.

The hard-copy listings were converted to digital tables, then georeferenced using OCARTS area street data and approximate property locations. Due to the sensitivity of this information, the data was only used for internal analysis.

In total, there are approximately 106 open LUST investigations within the OCARTS area, 100 of which are confirmed releases. Additionally, there are 1,216 closed LUST investigations within the OCARTS since 1987, 890 of which were confirmed releases.

The proximity analysis was performed on the known LUST data falling within the 150 ft buffer of limited access facilities and the 50ft buffer of all other road improvements scheduled in Alternate Four-B. The analysis determined a total of approximately 94 LUST locations near the scheduled improvements, 11 of which are open investigations of confirmed releases.

In general, the potential impacts from known and undiscovered LUSTs to street and highway improvements would involve possible delays and additional costs in site-specific planning.

PUBLIC NOISE SENSITIVE AREAS

An extensive listing of potential public noise sensitive areas was compiled which included: child care facilities, schools, colleges, universities, hospitals, nursing homes, and religious organizations. These locations may be adversely effected by the noise associated with construction or the increase in traffic from a road improvement project.

The noise sensitive locations were determined from a subset of the 2000 employment file based on those Standard Industrial Classification (SIC) codes falling within the noise sensitive guidelines. The total number of locations identified within the OCARTS area was 2,292.

Proximity analysis identified several noise sensitive locations within the 150 ft buffer of limited access facilities and the 50ft buffer of all other road improvements scheduled in Alternate Four-B. In total,

- approximately 18 health services fell in the buffer zones.
- approximately 27 educational services (schools, colleges, universities, etc.) fell within the buffer zones.
- approximately 29 child day care services fell within the buffer zones.
- approximately 81 religious organizations/churches fell within the buffer zone.

It is certain that additional noise sensitive locations in the proximity of the street and highway improvements would be considered during the site-specific planning. In general, the potential impacts on noise sensitive locations from street and highway improvements would involve possible added delays and costs in the site-specific planning for the improvement. Regardless of possible noise, it is important to recognize that some institutions will prefer situating adjacent to the street and highway improvements for improved access and visibility.

[49] The list of leaking underground storage tanks was provided to ODOT boy the Oklahoma Corporation Commission, Petroleum Storage Tank Division. The data was printed in a tabular format listing by sorted by county.

CONCLUSION

Upon completion, analysis found that the social, environmental, or economic impacts, identified at the regional level, would not preclude final plan adoption. Several potential impacts to locations may require increased time and costs in the planning and review process due to compliance with environmental and historical regulations, additional rights-of-way acquisition, and potential accommodations to neighborhoods, businesses, and historical places. Furthermore, a detailed site-specific impact assessment is required, as outlined by the National Environmental Policy Act (NEPA), for any street or highway project utilizing federal funds. In short, the regional analysis process provided a forum for discussion and consideration of the potential system level impacts during the plan adoption phase.

Table 6.1:
Potential Social Impacts of the 2030 OCARTS Plan Alternates

Social Impacts	Alternate One Street and Highway plus Intermodal Element	Alternate Two Street and Highway plus Intermodal Element	Alternate Three Street and Highway plus Intermodal Element	Alternate Four-A Street and Highway plus Intermodal Element	Alternate Four-B Street and Highway plus Intermodal Element
Archaeological Sites	There are approximately 812 archaeological sites within the OCARTS area; minor accommodations may be necessary for specific projects; no anticipated impact.				
Tribal Lands	There is little federal tribal trust land in the OCARTS area; mostly located in the eastern parts of Oklahoma and Cleveland counties; the BIA and individual tribes must be contacted to determine exact locations; no anticipated impact.				
National Historical Sites and Districts	There are 111 sites and 28 districts in the OCARTS area that are listed on the National Park Service's National Register of Historic Places; minor accommodations may be necessary for specific projects; no anticipated impact.				
Safety (Annual Accidents Predicted)	Fatalities - 145 Injuries – 21, 301	Fatalities - 145 Injuries – 20,761	Fatalities - 144 Injuries – 20,712	Fatalities - 144 Injuries – 21,013	Fatalities - 144 Injuries – 20,833

Table 6.2:
Potential Environmental Impacts of the 2030 OCARTS Plan Alternates

Environmental Impacts	Alternate One Street and Highway plus Intermodal Element	Alternate Two Street and Highway plus Intermodal Element	Alternate Three Street and Highway plus Intermodal Element	Alternate Four-A Street and Highway plus Intermodal Element	Alternate Four-B Street and Highway plus Intermodal Element
Air Quality (Daily Totals) • Carbon Monoxide (CO) • Volatile Organic Compounds Hydrocarbons (VOC HC) • Nitrogen Oxides (NOx)	**Winter Months:** CO - 499 tons (443 tons < in 2000) **Summer Months:** VOC HC - 16 tons (36 tons < in 2000) NOx - 13 tons (67 tons < in 2000)	**Winter Months:** CO - 507 tons (436 tons < in 2000) **Summer Months:** VOC HC - 16 tons (37 tons < in 2000) NOx - 14 tons (67 tons < in 2000)	**Winter Months:** CO - 503 tons (440 tons < in 2000) **Summer Months:** VOC HC - 16 tons (37 tons < in 2000) NOx - 14 tons (67 tons < in 2000)	**Winter Months:** CO - 506 tons (437 tons < in 2000) **Summer Months:** VOC HC - 16 tons (37 tons < in 2000) NOx - 14 tons (67 tons < in 2000)	**Winter Months:** CO - 507 tons (436 tons < in 2000) **Summer Months:** VOC HC - 16 tons (37 tons < in 2000) NOx - 14 tons (67 tons < in 2000)
Parks and Recreational Areas	There will be minimal effects from bike or pedestrian paths on the natural environment; increased costs to handle additional stormwater runoff may develop; minor accommodations may be necessary for specific projects.				
Wildlife, and Endangered Species	There are seven endangered or threatened species in the OCARTS area; a portion of the South Canadian River, between McClain and Cleveland counties, has been designated a critical habitat by the Fish and Wildlife Service; the exact habitat of threatened avian species is unpredictable from year to year due to their migratory nature; minor accommodations may be necessary for specific projects.				
Flood Plains	Street widening and construction projects across or near Cottonwood Creek, North Fork Walnut Creek, Deep Fork, Cimarron, Little, North or South Canadian Rivers or other major flood prone areas will incur increased construction costs; minor accommodations may be necessary for specific projects.				
Water Quality: Surface and Aquifers	Street widening and construction projects will incur increased costs to protect surface and underground water resources from stormwater runoff and construction activities (EPA NPDES, Oklahoma's CSGWPP, and other Source Water Protection Programs); minor accommodations may be necessary for specific projects.				
Hazardous Waste and Superfund Sites	There are 130 hazardous waste sites (some of which may require remediation) and 4 superfund sites within the OCARTS area; planning and design of street widening/construction projects will require special attention; minor accommodations may be necessary for specific projects.				
Leaking Underground Storage Tanks	There are approximately 198 open investigations of suspected or confirmed leaking underground storage tanks in the OCARTS area; removal of tanks and remediation could delay progress on intersection improvements or street widening projects; minor accommodations may be necessary for specific projects.				
Noise Sensitive Areas/Sites	There are 2,292 noise sensitive locations, (e.g., day care centers, schools, colleges, nursing homes, hospitals) within the OCARTS area; street widening and construction projects could also increase noise levels for residential areas and accommodations may be necessary for specific projects.				

Table 6.3:
Potential Economic Impacts of the 2030 OCARTS Plan Alternates

ECONOMIC IMPACTS	ALTERNATE ONE STREET AND HIGHWAY PLUS INTERMODAL ELEMENT	ALTERNATE TWO STREET AND HIGHWAY PLUS INTERMODAL ELEMENT	ALTERNATE THREE STREET AND HIGHWAY PLUS INTERMODAL ELEMENT	ALTERNATE FOUR-A STREET AND HIGHWAY PLUS INTERMODAL ELEMENT	ALTERNATE FOUR-B STREET AND HIGHWAY PLUS INTERMODAL ELEMENT
Residential and Employment Displacements	Approximately 73 residential and 119 business displacements are anticipated.				
Neighborhoods Low Income and Traditionally Underserved Groups	Acquisition of rights-of-way and/or proximity of improvements may negatively impact low income groups; accommodations may be necessary for specific projects.				
Bike/Ped Trails	$98.5 Million	$98.5 Million	$98.5 Million	$98.5 Million	$98.5 Million
Transit	$ 661.8 Million	$ 661.8 Million	$ 661.8 Million	$ 661.8 Million	$ 661.8 Million
Highway Network*	$1,548.0 Million	$4,518.7 Million	$4,611.8 Million	$4,702.6 Million	$4,813.6 Million
Total Cost	$2,308.3 Million	$5,279.0 Million	$5,372.1 Million	$5,462.9 Million	$5,573.9 Million

Note: Estimates do not account for any potential displacements resulting from any possible alignment of the southwest outer loop.
* Includes estimated construction & maintenance costs.

CHAPTER 7: ADDITIONAL PLAN CONSIDERATIONS

MAJOR METROPOLITAN INVESTMENTS

Prior federal law required a metropolitan investment study (MIS)[50] for major transportation investments involving federal funds to ensure the evaluation of multimodal strategies within multiple corridors. MIS results could then be incorporated into a Draft Environmental Impact Statement (DEIS) and Final EIS (FEIS) in accordance with the National Environmental Policy Act (NEPA) requirements of the Environmental Protection Agency (EPA).

In 1998, the subsequent federal transportation law – the Transportation Equity Act for the 21st Century (TEA-21) – removed the MIS requirement as a separate process under the transportation planning guidance. In order to reduce duplication of effort, new regulations streamlined the relationship between investment studies and the NEPA requirements.

The following studies were begun under the MIS process and continue to impact the 2030 OCARTS Plan.

I-40 CROSSTOWN EXPRESSWAY MIS

The I-40 Crosstown Expressway MIS/DEIS was initiated by the Oklahoma Department of Transportation (ODOT) in October 1995. This MIS evaluated several alternate alignments for the relocation of the elevated portion of I-40 in downtown Oklahoma City between I-235 and Meridian Avenue based on their potential environmental, social and economic impacts; ease of construction; and total cost. The MIS recommended an alignment approximately four blocks south of the current structure in the Union Pacific railroad corridor. The MIS also recommended the removal of the existing elevated structure and construction of an at-grade boulevard in its place.

The preferred alignment recommended by the MIS/DEIS was further evaluated in the FEIS, and submitted by ODOT to the Federal Highway Administration (FHWA) in November 2001. On May 1, 2002, FHWA issued a Record of Decision (ROD) approving the preferred alignment for the I-40 Crosstown Expressway relocation. This approval constituted FHWA's acceptance of the project location and concepts described in the FEIS, which included a list of mitigation measures. Right-of-way acquisition is almost complete and final engineering design for the project is underway. The 2030 OCARTS Plan street and highway Alternates Two, Three, Four A and Four B were modeled based on the approved realignment of I-40 described in the FEIS.

SOUTHWEST OUTER LOOP MIS

An Outer Loop MIS was begun in February 1998. This study was jointly sponsored by ODOT, ACOG and the Oklahoma Turnpike Authority (OTA), and was initiated at the request of several communities within the OCARTS area. ODOT agreed to serve as the lead agency. The purpose of the Outer Loop MIS was to determine if an outer loop highway encircling the metro area, and/or other transportation strategies, would reduce anticipated future congestion on existing highways. In the event, that an outer loop proved to mitigate the anticipated congestion, the study results would then be used to guide the preservation of right-of-way.

[50] The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and subsequent guidance, published jointly by the Federal Highway Administration and Federal Transit Administration, required a metropolitan investment study for anticipated large-scale transportation improvements.

Early in 1999, the scope of the study for the highway alternates was narrowed to focus on the southwest portion of the region—where projected travel demand on the arterial network was the greatest, and the analysis came to be known as the Southwest Outer Loop Study. (The northwest leg of the outer loop was subsequently developed as the Kilpatrick Turnpike, constructed by the OTA.)

Numerous highway corridors were evaluated and eventually narrowed to an alignment within the corridor shown in the 2025 OCARTS Plan. This corridor was used as a placeholder for traffic modeling and financial feasibility purposes in the development of the 2030 OCARTS Plan. Subsequent to the adoption of the 2030 OCARTS Plan, an updated final report[51] on the Outer Loop MIS was completed by the study consultant and presented to the sponsoring agencies. An environmental impact study (EIS), in conformance with federal guidelines, will be necessary to establish a final alignment within the corridor reflected in the 2030 Plan. Purchase of right-of-way cannot begin until after such an environmental study.

AIR QUALITY

The Clean Air Act Amendments of 1990 (CAAA) strengthened the need for improved coordination between air quality and transportation planning. The CAAA, for example, set forth detailed requirements that apply to numerous metropolitan areas, including provisions for estimating transportation emissions and evaluating the conformity of the transportation plans, programs and projects to the State Implementation Plans (SIPs) for attaining air quality standards.

Ozone and carbon monoxide levels are measured regularly throughout the Central Oklahoma region. Although, the OCARTS area has been in attainment for carbon monoxide since 1990, and for ozone since 1978, the region continues to monitor growth rates, track vehicle miles of travel (VMT), and forecast the impacts of transportation options.

Ozone (O_3) is a colorless gas associated with smog or haze when the precursor emissions, hydrocarbons (HC) and nitrogen oxides (NO_x), react in the presence of sunlight. High levels of ozone produce an unhealthy environment, can hamper breathing, and irritate the nose, eyes or throat. Approximately 60 percent of ozone is attributed to vehicle emissions.

Carbon monoxide (CO), the other major pollutant in the metropolitan area, is a colorless and odorless gas, formed in large part by incomplete combustion of fuel. When inhaled, CO displaces oxygen in the blood and deprives the heart, brain, and other vital organs of oxygen. Large amounts of CO can lead to losing consciousness and ultimately to suffocation. Approximately 90 percent of CO emissions are generated by mobile sources (vehicles).

EARLY ACTION COMPACT AND CLEAN AIR ACTION PLAN

Due to an ever-increasing amount of traffic, ozone and carbon monoxide continue to be a problem despite significant reductions in emissions per vehicle. And, while the OCARTS area is not violating federal air quality standards now, the region is challenged to remain in compliance in the future.

[51] Outer Loop Corridor Major Investment Study for the Oklahoma City Metropolitan Area, Final Document, Cobb Engineering Co., October 2006.

In December 2002, ACOG notified the EPA of its intent to participate in a new, proactive air quality strategy called the 8-Hour Ozone Early Action Compact (EAC). The EAC is a Memorandum of Agreement (MOA) between ACOG, representing the local governments within the OCARTS area, the Oklahoma Department of Environmental Quality (ODEQ) and the United States Environmental Protection Agency (EPA). The purpose of the EAC is to develop and implement a Clean Air Action Plan (CAAP) that will reduce ground-level ozone concentrations in the Central Oklahoma area to comply with the 8-hour ozone standard by December 31, 2007, and maintain the standard beyond that date.[52]

AIR QUALITY ANALYSIS OF THE 2030 OCARTS PLAN

The following section describes the variables and methodology used to estimate and analyze the vehicle emissions for each alternate network scenario in the OCARTS plan.

Vehicle Miles of Travel

An inventory of miles of travel by vehicle, an important product of the regional transportation modeling process, is one of the basic components needed to develop vehicle emission estimates. The transportation modeling software TP+ is capable of providing this information by estimating the number of vehicle miles traveled (VMT)[53] on facilities represented on the regional network. For the purpose of this analysis, the street and highway network was divided into two categories: freeway and non-freeway facilities. The freeway classification includes all interstate routes as well as all expressways. The non-freeway category includes principal arterials, minor arterials, and collectors. Local street VMT was not included in the analysis.

Speed

Vehicle speeds also play an important role in emissions production. Again utilizing TP+, average vehicle speeds were derived by dividing the VMT by vehicle hours traveled (VHT) for the two classification categories. The speeds were then reviewed for consistency and to assure they were representative of actual speeds.

Computer Modeling of Vehicle Emissions

Once the speeds and VMT from each alternate network were computed, they were input into the computer program called Mobile 6.2a for emissions determination.[54] The Mobile emission modeling was developed by EPA to estimate CO, NO_x, and Volatile Organic Compound (VOC) emissions for gasoline-fueled and diesel-fueled motor vehicles. Mobile 6.2a is capable of calculating the rates at which different pollutants are emitted per mile of travel by various types of vehicles. These emissions include gases generated by operation of their internal combustion engines, and evaporative losses from their fuel systems occurring during vehicle operation, refueling, and storage. Mobile 6.2a emission factor estimates depend on various other conditions such as ambient temperatures, operating modes, fuel volatility, and mileage accrual rates.

Table 7.1 shows the parameters used for the OCARTS area vehicle emissions analysis.

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[52] Additional information about the EAC and the CAAP is contained in the, FYE 2004 UPWP Report, Task 2.06, Subtask 1, *Air Quality Planning*, ACOG, December 2004.

[53] Daily VMT is an indicator of the usage of streets and highways over a 24-hour period. The TP+ VMT estimate was created by adding the product of assigned volume and link length for all network links.

[54] United States Department of Transportation and Environmental Protection Agency, *Clean Air Through Transportation: Challenges in Meeting National Air Quality Standards, Appendix F – Transportation and Emissions Modeling,* August 1993.

Table 7.1:
Air Quality Model Inputs

DESCRIPTIVE INPUT	
Model Years	2000 Base and 2030 Forecast
Alternates modeled	Base and Alternates One, Two, Three A, Three B, Four A, and Four B
Seasons modeled	Winter Conditions (January) and Summer Conditions (July)
Roadway Types modeled	Freeway and Non-Freeway
LOCAL AREA PARAMETERS	
Region	Low Altitude
Min-Max Temperatures in Winter Conditions	24.5 degrees 47.5 degrees
Min-Max Temperatures in Summer Conditions	70.5 degrees 93.7 degrees
Relative Humidity in Winter Conditions	78% (Morning) / 63% (Afternoon)
Relative Humidity in Summer Conditions	80% (Morning) / 55% (Afternoon)
Reid vapor pressure (RVP) Winter Conditions	10.0 psi
Reid vapor pressure (RVP) Summer Conditions	8.2 psi
Average Speed[55] by Roadway Type	Freeway: 47.72 mph (Base), 47.11 mph (Four B) Non-Freeway: 41.02 mph (Base), 40.54 mph (Four B)
Fuel volatility control program - Period 2 Start	1991
Fuel Sulfur Content	300 ppm
Diesel sales fraction considered?	Yes

[55] The following speeds (in mph) were also used for emission modeling (listed by 2030 OCARTS Plan Alternate): Freeway: 42.55, Non-Freeway: 38.47 (One); Freeway: 46.28, Non-Freeway: 40.10 (Two); Freeway: 46.05, Non-Freeway: 39.90 (Three-A); Freeway: 45.57, Non-Freeway: 40.63 (Three-B); and Freeway: 46.31, Non-Freeway: 40.35 (Four-A).

CONGESTION MANAGEMENT

BACKGROUND

Demand for highway travel continues to grow as population increases, particularly in metropolitan areas. Construction of new highway capacity to accommodate this growth has not kept pace, and congestion has continued to rise. Increased traffic congestion also threatens economic growth and increases pollution. Federal rules require that Metropolitan Planning Organizations in urban areas, with a population over 200,000, develop a congestion management system.

A Congestion Management System (CMS) is a process that provides information on transportation system performance and alternate strategies for the efficient management of transportation facilities, in order to alleviate congestion and enhance the mobility of persons and goods.

SHORT RANGE CONGESTION MANAGEMENT

ACOG uses three performance measures to monitor congestion in the OCARTS area: volume-to-capacity ratio, intersection accident rate, and travel time data. Based on historical data, 14 corridors have been identified as having recurring congestion problems. These corridors listed below:

1. I-235/Broadway Extension - between I-40 in Oklahoma City and 0.5 mile north of Memorial Road on Broadway Extension (N. 142nd Street) in Oklahoma City
2. US-77/Broadway Extension - between N. 142nd Street and Edmond Road in Edmond
3. I-40 - between Western Avenue in Oklahoma City and Douglas Boulevard in Midwest City
4. Shields Boulevard/US-77 - between S. 19th Street in Moore and I-40 in Oklahoma City
5. Northwest Expressway/SH-3 - between Council Road and Classen Boulevard in Oklahoma City
6. 39th Expressway/SH-66 - between Council Road and Hefner Parkway/SH-74 in Bethany, Warr Acres, and Oklahoma City
7. I-44 - between Hefner Parkway/SH-74 and Pennsylvania Avenue in Oklahoma City
8. I-40 - between Council Road and Eastern Avenue in Oklahoma City
9. Main Street - between 36th Avenue W and Porter Avenue in Norman
10. Boyd Street - between Berry Road and Classen Boulevard in Norman
11. Lindsey Street/SH-74A - between I-35 and 12th Avenue E (Sooner Road) in Norman
12. I-35 - between I-40 and SH-9 in Oklahoma City, Moore, and Norman
13. SH-9 - between I-35 and John Saxon Boulevard in Norman
14. I-44 and Hefner Parkway/SH-74 - between I-240 and Northwest Expressway/SH-3

LONG RANGE CONGESTION MANAGEMENT

Based on modeling results for the 2030 OCARTS Plan, most of the 14 recurring congestion corridors listed above are expected to operate more efficiently in the future. This is due in part to planned intersection and interchange improvements and roadway widening within these corridors. Anticipated use of Intelligent Transportation Systems (ITS) technologies, such as close circuit television cameras and dynamic message signs, also contribute to improved performance.

However, several of the corridors continue to show moderate levels of congestion despite the recommended Plan improvements and small portions of the following corridors even show severe congestion forecasts for the year 2030:

- I-235/Broadway Extension
- US-77/Broadway Extension
- I-40 (eastern portion: Western Avenue to Douglas Boulevard)
- Northwest Expressway/SH-3
- Lindsey Street/SH-74A
- I-35

INTELLIGENT TRANSPORTATION SYSTEMS AND TRAFFIC INCIDENT MANAGEMENT

Regional ITS Planning and Deployment Activities

The new federal transportation law — SAFETEA-LU — continues to encourage the research, development and use of Intelligent Transportation Systems (ITS) technologies, and continues to push for the integration of ITS initiatives into the overall metropolitan transportation planning process.

In 1999, the Oklahoma Department of Transportation (ODOT) and the Association of Central Oklahoma Governments (ACOG) conducted an ITS Early Deployment Plan (EDP) study to improve the understanding of traffic incidents[56] and recurring traffic congestion within the OCARTS area. The EDP provided a framework for using ITS technology to enhance the OCARTS area transportation system. The study outlined short-, medium-, and long-term projects to address transportation problems and opportunities and served as the basic guide for the coordinated, region-wide planning and implementation of ITS initiatives.

Complementing the EDP is the OCARTS area Regional ITS Architecture[57], which was completed in 2003. It describes the multi-jurisdictional, institutional and operational framework underlying current and future ITS improvements and details roles and responsibilities of the entities involved. Maintenance of the Regional ITS Architecture is ongoing, as new players and systems come onboard.

Additionally, the EDP has since been updated with an OCARTS area ITS Implementation Plan[58], which documents the revised short- and long-term ITS projects to be undertaken in the metropolitan area. Finalized in 2004, the ITS Implementation Plan was also developed in coordination with ODOT. ITS improvements to date are in accordance with the EDP and the Regional ITS Architecture, and will continue to be consistent with the Implementation Plan. When possible, improvements are based on newer technologies and associated cost savings; and expansion capabilities are built into the system.

Traffic Incident Management Activities

Additional elements of the EDP included the Incident Management and Alternate Route Plans, which address the fact that more than half of the OCARTS area congestion is caused by incidents[59].

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[56] For the purpose of the study, an incident is any event that interrupts traffic flow for a significant amount of time.
[57] FYE 2003 UPWP Report, Task 2.03, Subtask 2, *Intelligent Transportation Systems – Regional ITS Architecture*, ACOG, May 2003, describes the architecture development in detail.
[58] Copies of the *2003 OCARTS Area ITS Implementation Plan*, can be obtained at the ACOG office.
[59] Texas Transportation Institute, *2005 Urban Mobility Study*.

Developed to provide an overall framework for managing traffic incidents, the Incident Management Plan assessed existing practices, identified needs and opportunities, and included an Incident Management Procedures Manual. The Alternate Route Plan was designed to facilitate traffic diversions in the event of an incident in the OCARTS area by providing recommended alternate routes for seven major corridors.

The momentum gained with the finalization of these documents lead to the 2002 development of a regional Traffic Incident Management - Memorandum of Understanding (IM MOU) and updated Alternate Routes. Building on this multi-agency effort was the 2004 completion of a regional Traffic Incident Management Guide (IM Guide)[60], developed cooperatively with local first response agencies as well as other stakeholders and aimed at providing the region with an excellent tool to improve the efficiency of the traffic incident management activities. The new Quick Clearance law, enacted in 2003, further enhances these efforts by making provisions for the speedy removal of disabled vehicles or spilled cargo during non-injury traffic incidents.

ENHANCEMENT PROGRAM ACTIVITIES

Enhancement activities are intended to expand the availability of alternate modes of travel, preserve and renovate historic transportation facilities and structures, and creatively integrate transportation facilities into their surrounding communities and the natural environment. Transportation enhancement activities must be related to the intermodal transportation system by function, proximity, or impact, and may include such improvements as the development of bicycle and pedestrian routes, conversion of abandoned railroad right-of-way to other transportation uses, landscaping (of transportation routes), renovation and reuse of historic transportation-related buildings, and feasibility studies to accomplish such activities.

The Federal Transportation Enhancement Program, which began in the early 1990s, utilizes 10 percent of the Surface Transportation Program (STP) funds allocated to the State of Oklahoma. The Special Projects Branch of the Oklahoma Department of Transportation (ODOT) administers the program, which totaled approximately $12 million annually for the State of Oklahoma under TEA-21.

In 1998, the Oklahoma Transportation Commission (OTC) approved a minimum annual dedicated funding of $7 million for five broad categories of ODOT-sponsored enhancement projects. The remaining enhancement funds are made available for competitive application by federal and state agencies, as well as tribal, county and local governments. ODOT utilizes a committee representing diverse transportation, preservation and environmental interests to review applications and to make funding recommendations to the OTC.

Since the inception of the Enhancement Program, numerous OCARTS area enhancement project phases have been completed or are under design or construction.

[60] FYE 2004 UPWP Report, Task 2.03, Subtask 3, *Incident Management Guide,* ACOG, February 2004.

The following projects were approved for funding from the Transportation Enhancement Program since the last Plan update in 2000:

- Walk Downtown Blanchard, Blanchard
- Del City Trail Extension – Ray Trent Park, Del City
- Coffee Creek Trail – Mitch Park, Edmond
- Harrah Trail System, Harrah
- Harrah Community Trail Project – Phase 2, Harrah
- Little River Commuter Trail, Moore
- Downtown Streetscape and Pedestrian Improvements, Norman
- Legacy Trail North Extension, Norman
- Capitol-Medical Pedestrian/Bicycle Facility, Oklahoma City
- Experience Stockyard City, Oklahoma City
- Hefner/Overholser Trail, Oklahoma City
- Katy Trail, Oklahoma City
- Lightning Creek Trail, Oklahoma City
- NE. 6th Street Centennial Gateway Project, Oklahoma City
- NE. 23rd Street Streetscape Project, Oklahoma City
- North Canadian River Central Greenway Trail Link, Oklahoma City
- Will Rogers World Airport Landscape Corridor – Phase 1, Oklahoma City Airport Trust
- Will Rogers World Airport Landscape Corridor – Phase 4, Oklahoma City Airport Trust
- Tuttle Pedestrian and Bicycle Trail, Tuttle
- SH-66/Main Street Sidewalk Replacement, Yukon
- Bicycle and Pedestrian Facilities – Chisholm Trail Park and Freedom Trail Park, Yukon

SAFETEA-LU continues the Transportation Enhancement Program and will contribute to the implementation of additional trails, landscaping, and other transportation enhancements within the OCARTS area.

ELIGIBILITY FOR FEDERAL-AID HIGHWAY FUNDS

Federal transportation law requires each state and metropolitan area to cooperatively develop and maintain a functional classification of its streets and highways, including identification of proposed routes for designation of a National Highway System. This federal functional classification system[61] is approved by the Federal Highway Administration and is used to determine eligible routes for federal-aid assistance, as well as to provide a planning tool for needs assessments, establishment of jurisdictional (urban/rural) responsibilities, design criteria, and other planning activities.

The expenditures of federal-aid funds in metropolitan areas is restricted to locations that are functionally classified as rural major collectors, urban collectors, arterials, freeways, or interstates.

[61] The 2000 Oklahoma City Urban Area Functional Classification System was approved by the Federal Highway Administration – Oklahoma Division Office, on November 7, 2002, and subsequently amended as approved by FHWA.

However, in order to maintain the integrity and safety of the overall transportation system, bridge[62] improvements on any public road may be accomplished using eligible federal-aid funding categories regardless of functional classification or location on the OCARTS street and highway network.

The 2030 OCARTS Plan street and highway network includes routes that are the most regionally significant in terms of traffic demand. Not all streets located within Central Oklahoma are included on the OCARTS network. Additionally, not all streets included in the OCARTS network are a part of the federal functional classification system described above or vice-versa.

Street and highway improvements involving new construction, reconstruction, rehabilitation, resurfacing or widening must be included on both the 2030 OCARTS Plan network and the federal functional classification plan in order to be eligible for federal-aid funding. Locations eligible for federal-aid safety improvements[63] funding, such as traffic signals, school zone signals, or traffic signs, must be part of the federal functional classification system, but sometimes are not included in the OCARTS street and highway network, if they have lower traffic volumes.

CONSIDERATION OF TEA-21 TRANSPORTATION PLANNING FACTORS

Federal transportation law demands that the metropolitan transportation planning process establish a cooperative, continuous, and comprehensive framework for making transportation investment decisions in metropolitan areas. The transportation law also charges the MPOs to address the many challenges transportation systems are facing, such as improving safety, reducing traffic congestion, improving efficiency in freight movement, increasing intermodal connectivity, and protecting the environment, as well as laying the groundwork for addressing future challenges.

Since the development of the 2030 OCARTS Plan was governed by the Transportation Equity Act for the 21st Century (TEA-21), seven factors must be considered by Metropolitan Planning Organizations as part of the transportation planning process[64]. These factors are listed on the next page, along with the sections of this document that address each factor.

[62] A bridge is defined in Title 23 CFR 650/403 as a structure erected over a depression or obstruction (water, highway, or railway for carrying traffic or other moving loads) having an opening of more than 20 feet.
[63] Safety improvements reflected in TEA-21 include traffic control signalization, pavement marking, commuter carpooling and vanpooling, or installation of traffic signs, traffic lights, guardrails, impact attenuators, concrete barrier end treatments, breakaway utility poles, or priority control systems for emergency vehicles at signalized intersections.
[64] In the new transportation law – SAFETEA-LU – the seven metropolitan transportation planning factors remained largely unchanged, with one exception – safety and security of the transportation system are now separate planning factors.

Table 7.2:
Metropolitan Transportation Planning Factors – under TEA-21

PLAN REQUIREMENT	ADDRESSED IN THE FOLLOWING:
Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity and efficiency	Part 3 – Intermodal Element Part 5 – Development of Street and Highway Alternates
Increase the safety and security of the transportation system for users of motorized vehicles, non-motorized travel aides and others	Part 3 – Intermodal Element Part 5 – Development of Street and Highway Alternates Part 7 – Congestion Management (Intelligent Transportation Systems and Traffic Incident Management)
Increase the accessibility and mobility options available to people and freight	Part 3 – Intermodal Element Part 7 – Major Metropolitan Investments Part 7 – Congestion Management Part 7 – Enhancement Program Activities
Protect and enhance the environment, promote energy conservation and improve the quality of life	Part 6 – Social, Economic, and Environmental Impacts Part 7 – Congestion Management
Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight	Part 2 – Socioeconomic Data Part 3 – Intermodal Element Part 5 – Development of Street and Highway Alternates
Promote efficient system management and operation	Part 3 – Intermodal Element Part 5 – Development of Street and Highway Alternates Part 7 – Congestion Management
Emphasize the preservation of the existing transportation system.	Part 3 – Intermodal Element Part 5 – Development of Street and Highway Alternates Part 7 – Congestion Management

Now that the 2030 OCARTS Plan has been adopted by the OCARTS area Intermodal Transportation Policy Committee in August 2005, the metropolitan area long range transportation plan will be incorporated – as required by federal law – into the Statewide Intermodal Transportation Plan, prepared by the Oklahoma Department of Transportation.

ATTACHMENT 1:
OCARTS GROWTH ALLOCATION MODEL – EMPLOYMENT ALLOCATION RUN DESCRIPTIONS

EMPLOYMENT ALLOCATION – RUN ONE (MAY 2004)

Using year 2000 base assumptions and the predetermined year 2030 OCARTS employment control totals by county, Run One of the GAM produced initial year 2030 employment forecasts by county, city, and traffic district by place. After some adjustments to the initial outputs, the year 2030 employment control totals by county and city were approved by the ITPC in June 2004. Preliminary TD by place forecasts from Run One were reviewed by the ITTC in July 2004, and slight modifications were made as suggested by local staff. Modifications did not alter the year 2030 county and city employment control totals. The modified preliminary TD by place figures would later be incorporated in subsequent runs of the GAM.

EMPLOYMENT ALLOCATION – RUN TWO (JULY 2004)

GAM Run Two was conducted to allocate year 2030 employment to the traffic analysis zone level. Various factors were adjusted for Run Two. Approved year 2030 county and city and preliminary TD by place employment forecasts were used as control totals. All commercial, office, industrial, and public employment land use densities were increased by 25-percent—over year 2000 figures—to account for the assumption of more intense development by year 2030. Forecasted year 2030 market shares of COIP and retail/other employment by county were also factored into Run Two. An ArcView shapefile, containing the locations and future employment estimates of OCARTS special employment generators and future employers (post year 2000), was used to determine minimum employment allotments per TAZ. Analysis focused on the commercial, office, industrial, and public employment forecasts by traffic district by place, and manual adjustments occurred as necessary.

EMPLOYMENT FINAL ALLOCATION – RUN THREE (JULY 2004)

GAM Run Three was conducted using the same assumptions as Run Two, with modifications made to ensure that forecasts equaled or exceeded year 2000 COIP employment counts at the TD by place level. This was necessary because some year 2030 employment forecasts from Run Two failed to equal year 2000 employment at corresponding TD by place geographies.

Using the output of Run Three, the preliminary year 2030 employment forecasts by TD and TAZ, with retail and other breakdowns, were taken to the ITTC and ITPC for review and comment in August 2004. Slight adjustments were subsequently made to account for late-developing employment generation scenarios—i.e., the arrival of Dell Computers (Oklahoma City) and the development of two new Wal-Marts (Del City and Midwest City). Analysis and adjustments were also undertaken to ensure that adequate retail employment was forecasted at the traffic analysis zone by place level. Such analysis prompted the addition of more retail employment in Guthrie and Piedmont. After incorporating these adjustments, the final year 2030 employment forecasts by TD and TAZ, were presented and formally approved by the ITTC and ITPC in September 2004.

ATTACHMENT 2:
DEVELOPMENT OF TRIP ATTRACTION EQUATIONS

In order to develop the attraction equations by trip purpose, it was necessary to geocode the unmatched work and non-work addresses provided in the NPTS sample. Unlike home addresses (needed for trip production), that had a 95.5% geocode rate, work and non-work locations were more difficult to match. The following section describes the procedure initiated to resolve the geocoding problems inherent in the NPTS sample.

Work Trips

Of the 3,484 work locations, 499 or 15% could not be geocoded to obtain a latitude/longitude coordinate because of incomplete address information. In addition, of the 85% that could be geocoded, 275 records or 9% reported a different city name then was indicated by the coordinate location. While the records with incorrect city names were corrected, the other 499 records went through the following process.

1) All city names were checked for spelling. Since the NPTS was a telephone survey, input error was a problem.
2) Street addresses were checked for spelling
3) If the record still could not be geocoded, the record was allocated by zip code if available.
4) If the zip code was unavailable, the travel distance was checked and a likely TAZ was chosen based on the combination of distance and the most active TAZ at that distance.
5) If the location was outside the study area, the most likely path of travel was considered and the external TAZ was assigned.

Using this method, all but 30 records were placed in a traffic analysis zone resulting in a geocode rate of 99%.

Non-Work Trips

The non-work location file contains 12,474 records of which 4,767 or 38% could not be located initially. Of the 4,767 unmatched records, 1,413 (8%) were located outside the study area leaving 3,334 (30%) in need to be geocoded to the regional street network. Table 4.5 reveals the final geocode match rate by city.

1995 NPTS Match Rate by City

City	NPTS Records	Unmatched Records	Match Rate
Arcadia	3	0	100%
Bethany	220	32	85%
Cashion	22	2	91%
Cedar Valley	1	0	100%
Choctaw	112	0	100%
Deer Creek	1	0	100%
Del City	217	16	93%
Edmond	967	2	99%
Guthrie	172	7	96%
Harrah	89	8	91%
Jones	19	6	68%
Luther	2	0	100%
Midwest City	720	55	92%
Moore	489	41	92%
Mustang	117	8	93%
Newcastle	66	10	85%
Nichols Hills	6	0	100%
Nicoma Park	18	4	78%
Noble	65	13	80%
Norman	1183	48	96%
Oklahoma City	5993	410	93%
Piedmont	24	4	83%
Spencer	15	0	100%
Tuttle	25	0	100%
The Village	14	0	100%
Warr Acres	35	3	91%
Yukon	405	46	89%

Once the trip records from the NPTS survey matched, linear regression equations for estimating the five trip purposes were developed. (The final attraction equations are shown in Table 4.5 on page 79.)

ATTACHMENT 3:
2030 OCARTS PLAN IMPACT STUDY METHODS AND DATA SOURCES

ARCHAELOGICAL SITES

Dr. Robert Brooks, Oklahoma State Archaeologist, provided the approximate number of archaeological sites within the OCARTS area in any emailed response on December 20, 2004. As stated in our last plan, the locations of the sites are important for a site-by-site impact analysis as required by the National Environmental Policy Act (NEPA) for any street or highway project utilizing federal funds.

FEDERAL TRIBAL LAND

Mike Figueroa, Land Trust Office of the BIA in Anadarko, provided paper maps of 1999 tribal land holdings for the Absentee Shawnee Tribe. The maps included allotted, surface owned, and tribal owned land in east-central Cleveland County. Additionally, the Kickapoo Tribe provided a map of tribal land holdings (not dated).

This data was used to correct the 1995 tribal land map produced for the OCARTS 2025 Plan. According to the current Oklahoma County parcel data obtained from James Mallory, GIS Director, Oklahoma County, the only tribal land holdings in the county are those in the vicinity of the properties identified by the Kickapoo Tribe.

Tribal land holdings for the Chickasaw Nation exist in McClain in Grady Counties. The Chickasaw Nation falls under the jurisdiction of Jessie Kemp, BIA in Ada. Ms. Kemp stated that all land holdings were in textual format for each section i.e., not conducive for mapping. Therefore it was assumed that the site-by-site impact analysis would determine any potential holdings within these counties.

In the shapefile OCARTS2005_TribalLand.shp includes all digitized versions of the data described above as well as several generalized area polygons, which were used to present this sensitive data to public groups.

NATIONAL REGISTER OF HISTORICAL SITES AND DISTRICTS

Jim Gabbert, National Register Coordinator of the Oklahoma State Historical Preservation Office, referred initial inquires to National Park Service (NPS) websites http://www.cr.nps.gov/nr/research/index.htm, http://www.nr.nps.gov/nrdown1.htm, and http://www.nr.nps.gov/NRISGEO/. Specifically, the NRISGEO site contained both historic district (histplc_region.shp) and site (histplc_point.shp) shapefiles. However, the data's usefulness was hampered by numerous geography errors. Therefore, the historic sites were re-digitized by using the latitude and longitude supplied by the NPS or information determined from aerial photography and/or physical address information from geocoding. The historical district shapefile was corrected to align the district geography with that seen on aerial photography.

Additional data was provided by John Calhoun and Jerry Hunter, Oklahoma City Planning Department. Mr. Calhoun and Mr. Hunter provided a shapefile of pending and current historical districts. Oklahoma City's historical district boundary data was used to replace the same features in the NPS dataset. OKC planning also provided a spreadsheet containing names and

addresses of historical sites within the OKC area. This data was geocoded or manually located and incorporated into the corrected NPS shapefiles.

The resulting shapefiles of historic sites and districts are respectively named OCARTS2004_histsitespt.shp and OCARTS2004_histdistrict.shp.

PARKS

The 2004 OCARTS parks map, OCARTS2000_ParkBndryPolygons.shp, was compiled from a variety of digital and digitized sources.

The following digital geographic parks maps were acquired:

- Norman parks map, Joyce Green and Scott Woodruff, City of Norman.
- Oklahoma City parks map, Ambika Narayan and Terry Ash, OKC Parks and Recreation.
- Edmond parks map, Sara Cobb, City of Edmond.
- Lake Thunderbird State Park map, Ron McWhirter, Oklahoma Tourism and Recreation Department.

Digital parks maps were merged together with park land and golf courses identified in the 2000 OCARTS land use, i.e., land use categories 7 and G. Digital adjustments were made, as needed to land use and OKC park data, based on the 2003 NAIP aerial photography. Additional parks were added based on information found in the Mosher-Adams - 19th Addition - City Street Atlas.

Oklahoma wildlife management (refuge) areas were digitized based on information from the Oklahoma Department of Wildlife Conservation maps of maintenance areas, which were taken from the online Digital Wildlife Management Areas Atlas at http://www.wildlifedepartment.com/wmas2.htm.

WILDLIFE/ENDANGERED SPECIES

US Fish and Wildlife Services, Southwest Region, provides a listing of all endangered and threatened species for Oklahoma counties on their website at http://ifw2es.fws.gov/endangeredspecies/lists/ListSpecies.cfm.

The major OCARTS rivers OCARTS2000HabitatRivers.shp were compiled by feature selection from OWRB and TIGER river shapefiles. The ESRI rivers shapefile was consulted for additional river selection. Lake habitat boundaries OCARTS2000HabitatLakes.shp was developed from the land use adjusted TIGER major lakes shapefile.

To determine the likely habitat within the OCARTS area, a 1-mile buffer around the river and lake features was created in OCARTS2000EndangeredSpeciesHabitat.shp. However, there is the distinct possibility these species may also be inhabiting areas surrounding minor rivers and lakes due to urban expansion and other unknown factors.

Further email correspondence with Ken Collins, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service (USFWS) suggested that using a 1-mile buffer should be “adequate, particularly for those species that are dependent on these habitats (least tern, piping plover, whooping crane, bald eagle and Arkansas River shiner). However, other species such as vireos and whooping crane are not strictly aquatic dependent species. The vireo certainly is not.” The whooping crane does use major rivers as loafing and nighttime roost locations but they

typically forage in the uplands. Unfortunately, there is insufficient information on the movements of the whooping crane to precisely tell where they might stop to loaf, feed, or roost. It must also be noted that the vireo, tern, plover, crane, and eagle are migratory and only occur within the project area during certain limited times of the year.

The Arkansas River Shiner critical habitat shapefile (incorporated into the OCARTS area habitat shapefile) was obtained from the USFWS critical habitat mapper website at http://criticalhabitat.fws.gov/. The critical habitat is also contained in the final habitat shapefile OCARTS2004EndangeredSpeciesHabitat.shp.

FLOOD PLAINS

Federal Emergency Management Agency (FEMA) Q3[65] Flood Data for Oklahoma, Cleveland, Grady, and Canadian Counties was obtained from the United States Department of Agriculture (USDA) Geospatial Data Gateway website, http://datagateway.nrcs.usda.gov/. The data was merged together with existing digitized data from the 2025 OCARTS Plan for Logan County to complete coverage of the OCARTS area.

Digital copies of the current McClain County Flood Insurance Rate Maps (FIRM) were obtained from Cindy Simms, ASCOG. McClain County maps were georeferenced, and then 100 and 500 flood hazard areas were digitized (traced) using ArcGIS 9.0 software. Additional areas in southern Cleveland County were manually digitized to correct inaccurate Q3 data surrounding the Slaughterville and Lexington area.

The county composite boundary files, OCARTS2000_floodplainsFEMA.shp, contains data from several different years. Oklahoma, Cleveland, Grady, Logan, and Canadian Counties are current as of 1999. McClain County is current as of 2004.

AQUIFERS

Shapefiles of the major and minor bedrock and alluvium aquifers were obtained from Mike Sughru, Oklahoma Water Resources Board. (Statewide Shapefiles: minor_bedrock_aquifer_OWRB.shp, minor_alluvium_aquifer_OWRB.shp, major_bedrock_aquifer_OWRB.shp, and major_alluvium_aquifer_OWRB.shp). The shapefiles clipped to the OCARTS area were named:

OCARTS2000_minor_bedrock_aquifer_OWRB.shp,
OCARTS2000_major_bedrock_aquifer_OWRB.shp,
OCARTS2000_major_alluvium_aquifer_OWRB.shp

HAZARDOUS WASTE/SUPERFUND SITES

The hazardous waste spills and cleanup locations are identified by the U.S. EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database. County searches on this web-based database were preformed for current and archived CERCLA sites. According to Greg Worrell, Hazardous Waste Coordinator, Environmental Studies Branch ODOT, the department must consider impacts on all active clean up sites, and those that have been archived, i.e., determined that 'no further remedial actions are planned' (NFRAP).

[65] The Q3 Flood Data are derived from the Flood Insurance Rate Maps (FIRM) published by the Federal Emergency Management Agency (FEMA). More detailed information may be obtained from the paper FIRM.

Current (2004) hazardous waste and superfund sites were found at http://www.epa.gov/enviro/html/cerclis/cerclis_query.html
Archived (NFRAP) sites were found at http://cfpub.epa.gov/supercpad/arcsites/srchsites.cfm
In addition, the entire database (replicated in 2001) can be found at a Right to Know website at http://www.rtknet.org/cer/. The RTKNET database was used and verified against the EPA data due to the availability of tabular data output. The resulting shapefile for active and archived hazardous waste locations (including superfund sites) was OCARTS2004_HazardousWaste.shp. The shapefile for the superfund sites within the OCARTS area was named OCARTS2000_SuperfundSites.shp.

Additional shapefiles were provided by David Pruitt, Water Quality Division, ODEQ, showing the locations of OCARTS area large quantity waste generators, waste storage locations, and bio-solid application sites, which were named OCARTS_ODEQ1999_lg_qty_gen.shp, OCARTS_ODEQ2001_treatmnt_Stor_disposal.shp, and OCARTS_ODEQ2000_land_app.shp respectively. These shapefiles were created by clipping the statewide data with the OCARTS boundary.

LEAKING UNDERGROUND STORAGE TANKS

Greg Worrell, Hazardous Waste Coordinator, Environmental Studies Branch ODOT provided a tabular print out of the Oklahoma Corporation Commission (OCC), Petroleum Tank Division, Leaking Underground Storage Tanks (LUST) statewide database. Staff had initially requested the data directly from OCC. However, due to recent regulations and the sensitivity of the data, Terin Morris, OCC, suggested that ODOT request the data for ACOG.

The OCARTS area counties' data was scanned and converted to digital text by the scanner's optical character recognition (OCR) utility. The data was then processed in a spreadsheet to compensate for multi line entries in the tabular print out. Records were discarded based on the 'facility location city' attribute if outside the OCARTS area.

The resulting data was geocoded to the cities centerline data or TIGER files. Unmatched records were manually located based on information from the Oklahoma and Cleveland County assessors mapping sites.

The resulting shapefile, OCARTS2004_LUST.shp, provides a map of all active/opened and inactive/closed LUST investigations within the OCARTS area from 1987 through the end of 2004.

AIR QUALITY

An executable copy of EPA MOBILE6.2 Vehicle Emission Modeling Software was obtained from http://www.epa.gov/otaq/m6.htm#m60. The model was run for the year 2000 and all OCARTS highway and street network alternates for the forecast year 2030. The model was run for the summer months (July) and the winter months (January). Specific OCARTS area related input parameters were used as input to the model:

1. The average speed for each road type was obtained from the transportation model output.
2. Maximum and minimum daily temperatures for January and July were obtained from the Oklahoma Climatological Survey (OCS) Monthly Climate Summaries, i.e., MCS_December_2004.pdf and MCS_June_2004.pdf (climate normals are contained in the previous month's reports).

3. Average morning and afternoon Relative Humidity, Oklahoma City, OK. National Climatological Data Center, NOAA, http://ols.nndc.noaa.gov:80/plolstore/plsql/olstore.prodspecific?prodnum=C00095-PUB-A0001, http://www.ncdc.noaa.gov/oa/climate/online/ccd/relhum.txt
4. Reid Vapor Pressures (RVPs) of 8.2psi for the July and 10.0 psi for January were provided by Douglas Rex, ACOG.

The input file OCARTS.IN included all input data for the base year and alternate scenarios for both July and January for either the freeway or arterial road type, for each alternate, resulting in a total of 24 modeled scenarios.

The MOBILE6.2 output file OCARTS.TXT provided a summary of the model results. The model also provided a file OCARTS.TB1, which contained the model results in a tabular format for each vehicle class for each pollutant.

The model results were analyzed in a spreadsheet Vehicle Emissions OCARTS 2030 Plan.xls to calculate the daily amount of total pollution produced by the OCARTS Plan Alternate for each road type.

PUBLIC NOISE SENSITIVE SITES

Locations falling under the SIC CODES for Hospitals, Day Care Centers, Nursing Homes, Churches, and Schools were extracted from the geocoded year 2000 employment dataset, i.e., those derived from the Oklahoma Employment Security Commission (OESC) "ES-202" wage and salary file. The noise sensitive site shapefile is named OCARTS2000_Noise.shp.

SAFETY

The year 2000, accident rates were determined from the ODOT 2000 accident database. All highway and interstate accidents were geocoded to the ODOT highway shapefile based on mile marker information. Accidents on local roads were determined by selecting all accidents for cities in the OCARTS area. Furthermore, all county road accidents (i.e., those without any city or road name information) were selected if the accident was referenced to an OCARTS area ODOT control section. The resulting shapefile was named OCARTS2000_ODOTAccidents.shp.

Fatality and injury rates for the limited access roads (i.e., turnpikes, interstates, and Hefner Parkway) were determined by dividing the number of accidents on these facilities in the shapefile by the year 2000 limited access facility VMT*365 days/year.

The fatality and injury rates for the non-limited access facilities (i.e., principals, arterials and collectors) were also calculated by obtaining the accident counts from the shapefile and dividing by the year 2000 VMT*365 days/year.

In the spreadsheet, Vehicle Accidents OCARTS 2030 Plan.xls, these rates were then applied to all plan alternates to determine the approximate number of fatalities and injuries per year per functional class of roadway.