

City of Kearney Transportation Plan Update



*A Companion Document to the
Comprehensive Plan Update*

Final Report



Prepared for
City of Kearney



Prepared by
Olsson Associates

September 2004



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CITY OF KEARNEY

TRANSPORTATION PLAN UPDATE

KEARNEY, NEBRASKA

Final Report

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OA Project No. 2003-0493

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1.0 INTRODUCTION

This report documents the results of a project conducted to update the long-range transportation planning element of *The Kearney Plan*, the City's Comprehensive Plan. Olsson Associates (OA) conducted the project under contract with the City of Kearney. Funding for the project was provided, in part, through the Nebraska Department of Roads (NDOR) Comprehensive Plan Assistance Program.

Kearney is located in south-central Nebraska and is the county seat for Buffalo County. The current population of Kearney, based on the 2000 census data, is approximately 27,500. A study area map is shown in Figure 1-1.

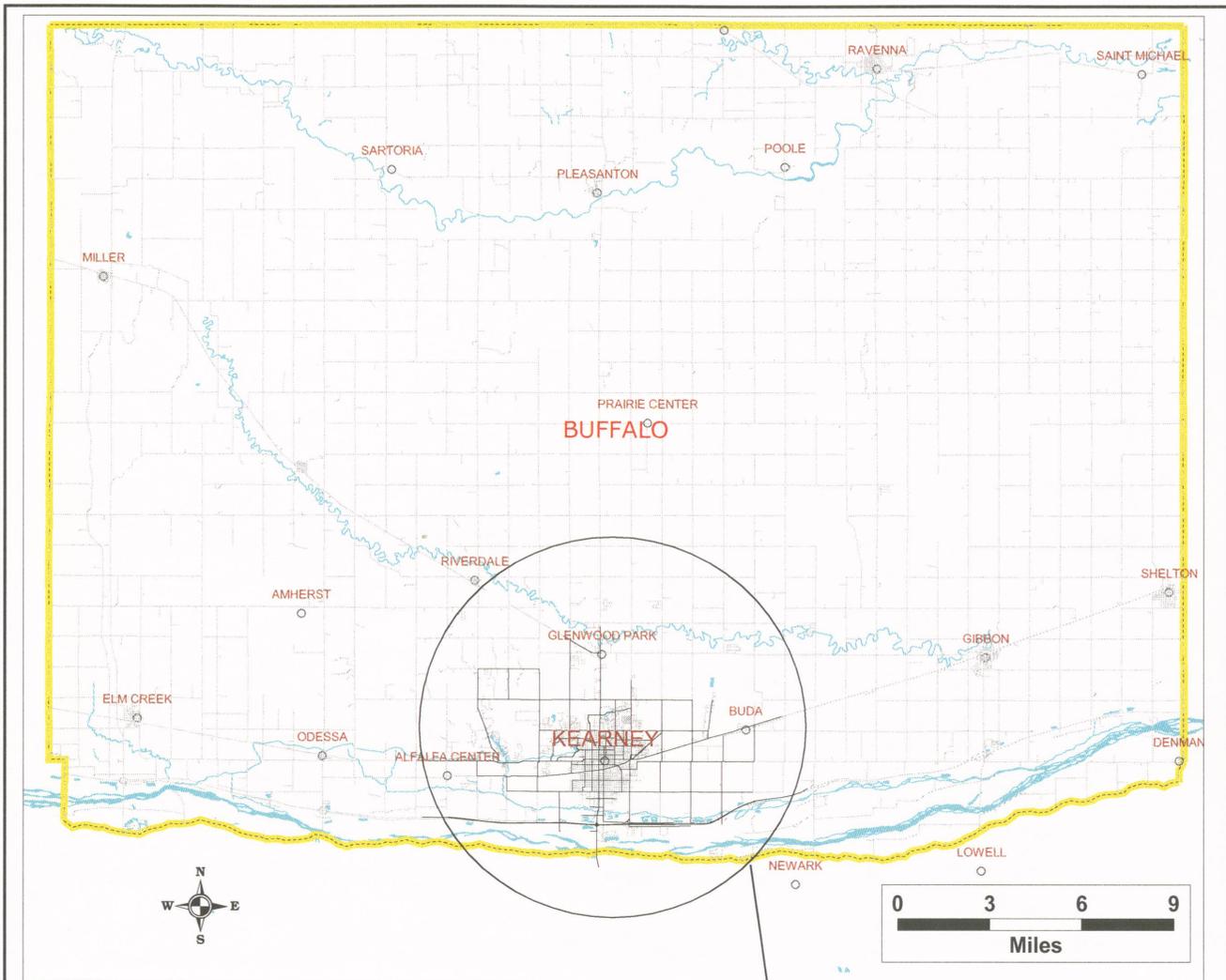
1.1 Study Objective

The primary study objective was to update the long-range transportation element of the City's comprehensive plan. The current Transportation Plan was adopted in 1997 along with subsequent amendments. Development of a computerized, citywide transportation model, in accordance with NDOR standards, was a focal point of the land use and transportation planning process. Key deliverables of this project include:

- A state-of-the-art computerized transportation model developed using TransCAD.
- A Long-Range Transportation Plan (LRTP) with recommended improvements prioritized for the short-, mid-, and long-range time frames.
- A transportation plan that is compatible with City and NDOR geographic information systems (GIS).
- Final project report to supplement the Transportation Chapter in the City's Comprehensive Plan document.

The scope of work for this project was based primarily on planning level analysis. Utilizing the results of a public survey and input from City staff, several existing deficiencies were identified including signal progression along 2nd Avenue and additional signal needs. Phase II of this project will study, in detail, existing speed limits on key collector and arterial roadways and signal progression along 2nd Avenue (Hwy. 10 and 44), 25th Street (Hwy. 30) and 39th Street. Conclusions and recommendations from that study will be presented in a separate document.

A citywide field review was conducted as part of the model development process. Operational level recommendations, such as additional turn lanes and intersection alignments, were made for selected locations, as appropriate, based on the results of the field review. Most recommendations, however, are based on planning level analysis and are targeted at "big picture" improvements such as adding lanes to an existing roadway, replacing an at-grade railroad crossing with a viaduct, or providing a new roadway connection where no road exists today.



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Study Area	
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This distinction is important, as most major roadway improvement projects must be identified and included in a long-range transportation plan for many years before funding is available.

1.2 Task Force

A project Task Force was organized at the beginning of the project to assist City staff and provide oversight for the work of the consultant project team. The Task Force was selected to represent a wide variety of community interests. City staff and Task Force members are listed in Table 1-1.

**Table 1-1
City Staff and Task Force Members**

Name	Affiliation
Allen Johnson	City of Kearney
Bruce Grupe	City of Kearney
Butch Brown	Brown Transfer Company
Darlene Pfeiffer	City of Kearney
Dennis Heermann	NDOR District 4
Dick Mercer	Double M Farms, Inc.
Janet Fox	Resident
Jeffrey Rumery	Mid-Nebraska Community Action
Jim Catterson	Kearney Public Schools
Jon Abegglen	Platte Valley State Bank & Trust Co.
Judy Almarier	Easton Corporation
Lance Lang	City of Kearney
Mark Sutko	Platte Valley State Bank & Trust Co.
Michele Stover	Expression Wear
Rod Wiederspan	City of Kearney
Roger Jasnoch	Kearney Visitors Bureau
Ron Sklenar	Buffalo County Highway Department
Ron Tillery	The Economic Development Council
Tom Farber	NDOR District 4
Tom Henning	Cash-Wa Distribution Company

The project Task Force met a number of times over the course of the project. They provided guidance to the project team on land use and transportation planning issues and reviewed interim project materials. Task Force meetings were held on the following dates:

- June 25, 2003
- November 13, 2003
- April 22, 2004
- July 15, 2004
- August 12, 2004

1.3 Technical Documentation

During the course of this project, interim material and/or technical documents were prepared for review by the City and project Task Force members. These items, which are listed below, were prepared in draft format to summarize technical progress and/or issues relevant to the project.

- Existing Transportation Conditions Technical Memorandum
- Issues and Opportunities Visioning Exercise
- Population and Employment Goals and Objectives
- Travel Demand Model Validation Summary
- Travel Demand Model Assignment Plots
- Transportation Alternatives and Recommendations Summary

The above information, including comments received from the City and the Task Force and revisions to address these comments, have been incorporated into this final project report.

1.4 Plan Adoption Process

This report documents the study process and presents transportation plan recommendations to supplement those in the current Comprehensive Plan. Following review and approval of this document by City staff and the project Task Force, final recommendations will be incorporated, by reference, into a draft final report. This draft final Transportation Plan Update document will then be presented for review and approval of the Planning Commission and City Council. Public hearings will be held with the Planning Commission and City Council meetings to provide opportunity for input from the public. Upon review and comment by all parties, a final project report and Transportation Chapter will be presented to incorporate into or reference in *The Kearney Plan*, the City's Comprehensive Plan document.

1.5 Report Organization

The remainder of this report is organized as outlined below:

- Chapter 2 – Demographics and Land Use
- Chapter 3 – Existing Transportation Conditions
- Chapter 4 – Transportation Model Development and Alternative Analysis
- Chapter 5 – Alternative Transportation Elements Evaluation
- Chapter 6 – Recommended Transportation Plan

2.0 Demographics and Land Use

This section of the report documents the demographic analysis and land use planning analysis used to develop future population, employment and land development trends during the planning period.

2.1 Land Use Planning

The relationship between transportation systems and land use underlies all activities related to transportation planning. Any number of projects commonly thought of as transportation planning—a bypass roadway, transit service for persons with disabilities, the location of a highway interchange—have implications for land use. As a result, no transportation planning effort can be concerned with transportation services alone.

The complexity of the land use/transportation issue is influenced by two key factors. First, the relationship between land use and transportation is reciprocal: land use patterns affect travel decisions and travel decisions affect land use patterns. Second, the activity patterns of businesses and households change independently of land use and transportation in response to changing values, jobs, age, income and preferences. Great effort must be taken to try to better understand this relationship.

Therefore, the transportation demand and land development cycle was evaluated as part of this effort to ensure that transportation improvements can support growth and redevelopment in desired areas and, conversely, that in some areas only specific land uses are encouraged or allowed based on limited transportation capacity.

The following is a description of existing and future land uses for Kearney and existing demographics and projected future data that were used in the transportation modeling process.

2.2 Existing Conditions

Land Use

Land use defines where people live, work and play. Land use patterns shape the nature of socioeconomic data by reflecting urban and non-urban activity through population, employment, dwelling units, school enrollment, and other related demographic data. Some locations represent areas with a greater density of urban activity such as residential, commercial, industrial, institutional or recreational land uses, while some locations represent less dense activity which may include agriculture and open space.

In general, Kearney's existing land use pattern is predominately suburban in nature, with a density of approximately 3.4 dwelling units per acre. However, the City is also the location of a large university campus, regional medical facilities, a regional shopping center, and the largest manufacturing operations in the region, making Kearney the employment focal point of the region.

The predominant use of land within the planning area is residential with approximately 35% of the total land area in Kearney. The great majority of these residential uses are single-family residential, which make up 74% of the residential land area. While 44% of Kearney's housing stock is renter occupied, mobile home and multi-family housing constitutes only 16% of the residential land area. Commercial and office land uses account for nearly 9% of the land area in Kearney and are concentrated in the Downtown area and along the 2nd Avenue and US Hwy. 30 corridors. Just less than 5% of developed land is occupied by industrial land uses. The majority of these uses are located along US Hwy. 30 in the east part of the City. Finally, civic uses such as parks, recreation areas, and schools occupy nearly 25% of the total land area. This high percentage may be attributed to the University of Nebraska—Kearney campus. The existing land use map from *The Kearney Plan* is illustrated in Figure 2-1.

Population and Employment

Kearney is the County Seat and population center of Buffalo County. With a population of nearly 30,000, Kearney has over 70% of the population in the county. It is estimated that total work force within a 60-mile radius of Kearney is 145,305 and that the primary retail trade area for the City contains a population of 124,956. As a result, Kearney attracts commuters, shoppers, students, and visitors from a large area who all use the transportation system.

2.3 Population and Employment Projections

The Kearney Plan, the City's comprehensive development plan, was used as the basis for the population, employment and land use projections for the transportation modeling process. The plan summarizes the prospects for population growth as follows:

“During the next twenty years, natural population growth and continued rates of migration will produce a population of about 40,000 persons. Kearney has the unusual opportunity to define the nature of its future as it faces a potential for significant new growth. This planning effort will enable Kearney to manage development, reinforce the City's existing character, and accommodate new residents as a resource for the future of the community.”

Kearney's diverse regional economy includes substantial employment in health care, education, manufacturing and retail sectors. In fact, Kearney has experienced remarkable retail sales growth since 1995. From 1995 to 2001, the City reported nearly 40% growth in retail sales and from 2001 to 2002, retail sales grew by 27%.

The strong retail base, along with a diverse manufacturing base, regional medical facilities and the University of Nebraska—Kearney, create a positive employment and economic climate for Kearney now and into the foreseeable future. Future employment projections for the planning period were based on a conservative, stable growth rate of approximately 1.8% annually.

2.4 Future Land Use

Once again, *The Kearney Plan*, was the basis for developing future land use projections for the transportation model. Population and employment estimates were tested against the future land use recommendations included in the plan. The plan outlines future land use policies as follows:

“Kearney’s growth policies must manage new development to project the quality, character, and health of the community.

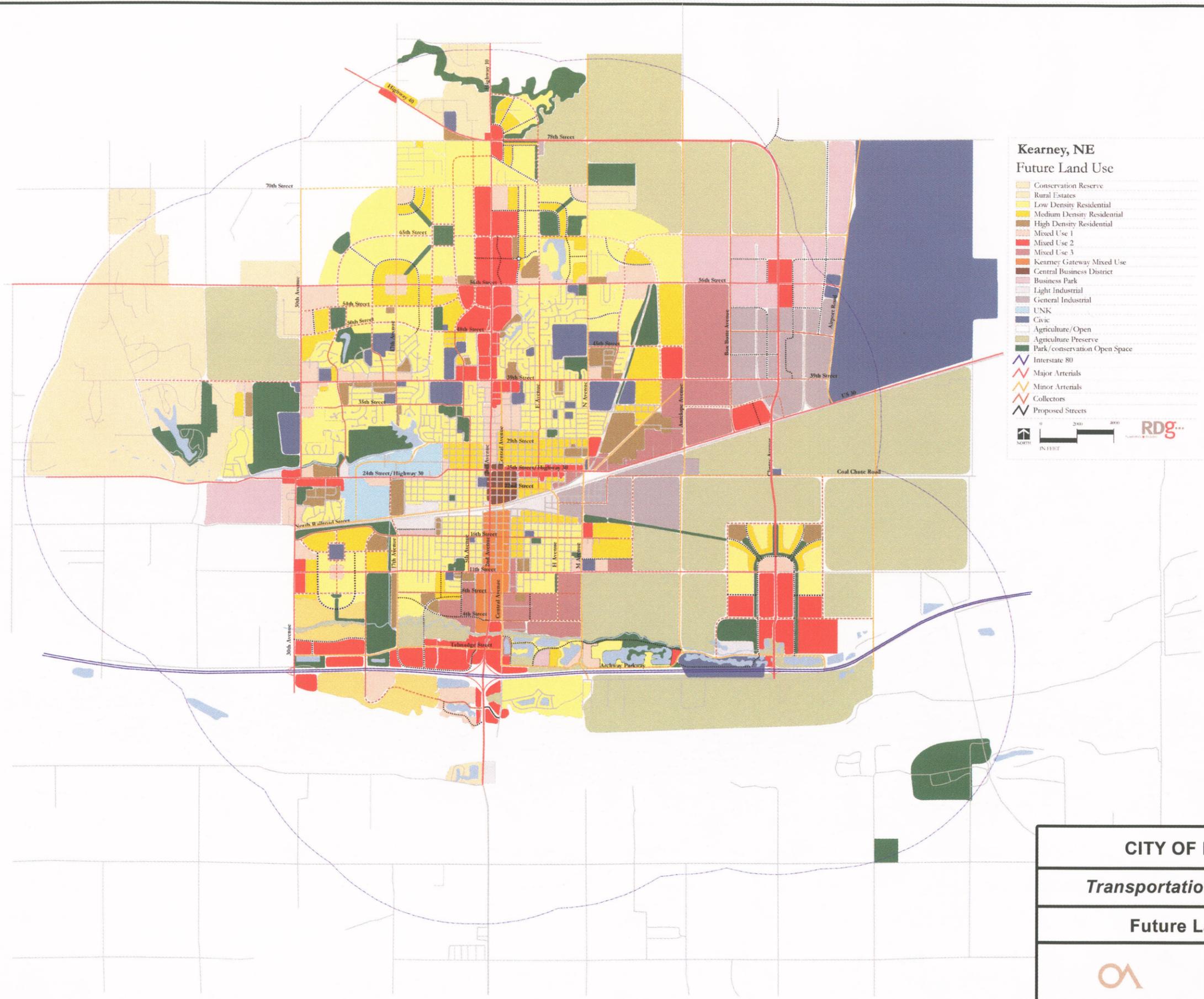
The City’s growth program should:

- Designate growth areas for residential development, designed to provide the appropriate amount of land for urban conversion.
- Ensure that new development is consistent with the traditional land and street patterns for the City.
- Encourage adequate commercial growth to respond to market needs supported by the City’s service systems.
- Provide adequate land to support an economic development program that capitalizes on Kearney’s resources.”

The future land use plan from *The Kearney Plan* recommends identifying distinct development tiers to provide for sound growth and urban development, consistent with the gradual expansion of urban services. This tier system is designed to permit logical extension of urban services and appropriate development, and to avoid hemming urban growth inside rural density subdivisions using rural roadway standards.

Population and employment projections were based on the progression of development through the six-tier development format outlined in the plan. Key areas of development over the planning period include continuing commercial development along the 2nd Avenue and Hwy. 30 corridors. Another major commercial growth area is in southeast Kearney and is associated with the development of the Cherry Avenue interchange with Interstate 80 (I-80) and the

Cherry Avenue by-pass roadway. Primary growth areas for residential land uses are projected in largely the northwest part of the City and to a lesser extent in the northeast part of the City. The future land use map presented in *The Kearney Plan* is illustrated in Figure 2-2.



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Future Land Use


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Figure 2-2

Source: THE KEARNEY PLAN (RDG Planning & Design, 2003)

3.0 EXISTING TRANSPORTATION CONDITIONS

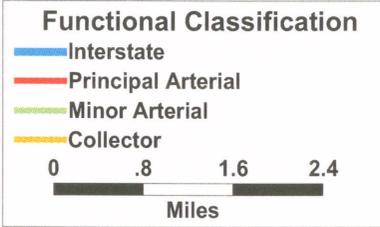
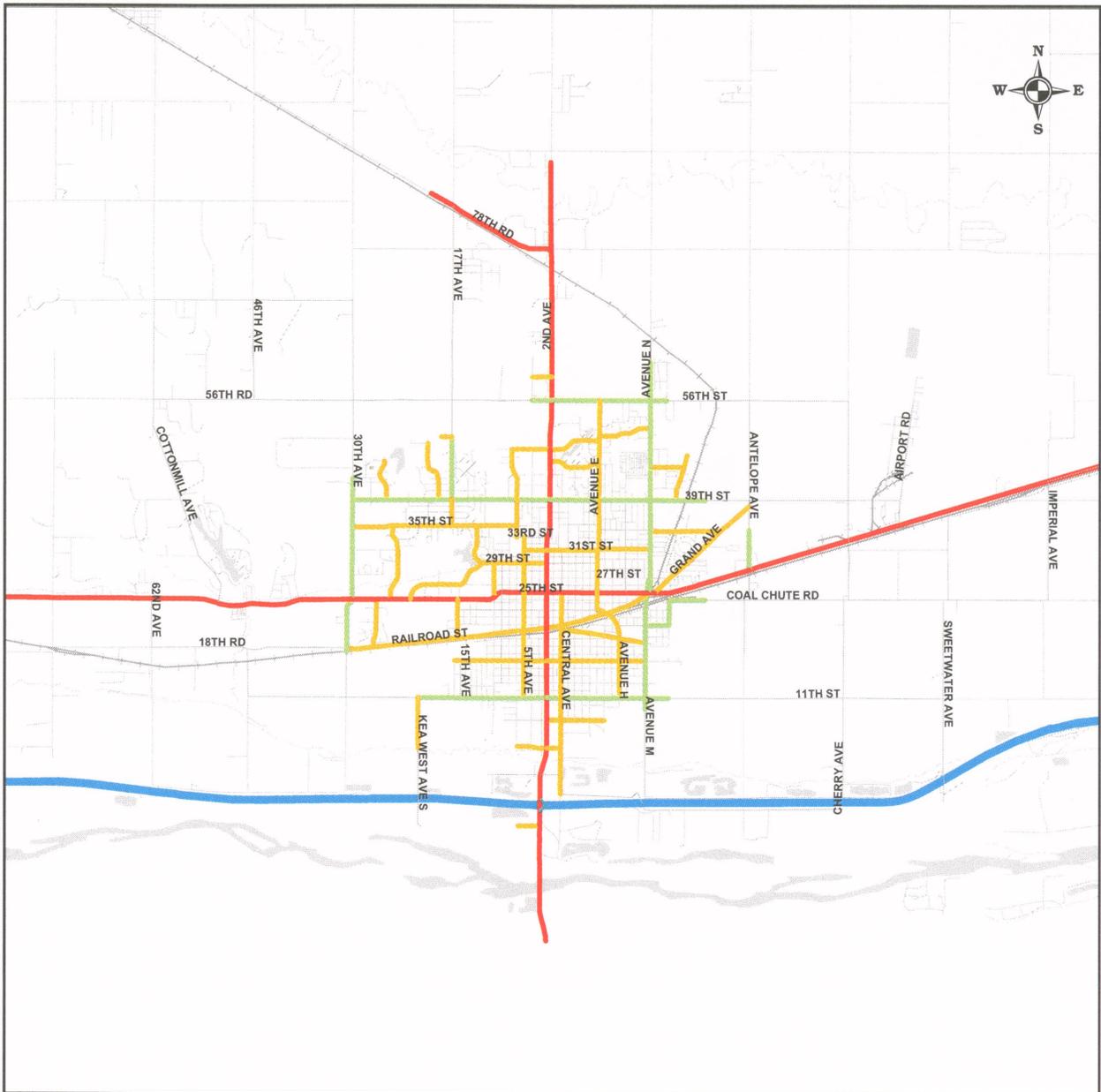
The purpose of this chapter is to document existing transportation conditions in the City of Kearney. The primary focus of this effort was to document the existing transportation system so that it could be accurately reflected in the transportation model developed for the project. This task included a comprehensive field review and data collection effort. In addition to the field review, a public survey was conducted to better understand existing roadway network deficiencies and areas of confusion. The survey results were sorted for review and can be found in Appendix A. Accident data was also reviewed to identify safety deficiencies that could potentially be addressed through transportation improvements included in the transportation plan. Information from previous studies and reports was utilized to better understand existing transportation conditions in the City.

3.1 Existing Transportation System

The existing street network and functional classification system for Kearney is shown in Figure 3-1. The existing functional classification map for Kearney was developed from information provided by the City and NDOR. Roadway functional classification describes how a particular roadway is intended to function with respect to capacity, speed, mobility and level of access provided. Higher functional classifications provide greater capacity, higher speeds, and limited access. Lower functional classifications provide lower capacity, lower speeds, and high levels of access to adjacent properties.

Freeways and expressways represent the highest functional classification, capable of moving large volumes of traffic at high speeds with limited access from cross streets. Major arterials are also intended to move relatively large volumes of traffic at high speeds (typically 40-45 mph) with limited conflicts from side streets and adjacent properties. Minor arterials, while similar to major arterials, typically have lower speeds (less than 40 mph), less capacity, and more direct access to adjacent properties. In developed urban areas, major arterials are typically spaced at one-mile intervals. Minor arterials, in some instances, may be spaced at 0.5-mile intervals from other arterials. Collector and local streets round out the functional classification system. Collectors provide access from neighborhoods to the arterial street system. Even on collector streets, it is desirable to limit direct driveway access to the extent possible.

The Kearney transportation system can be characterized as a grid network with the exception of Railroad Street, Grand Avenue and University Drive. These three roadways run diagonally on a northeasterly alignment through Kearney. The grid network is bisected by Nebraska Hwy. 10/44 (2nd Avenue) and US Hwy. 30 (24th/25th Streets). Other primary north/south roadways include Antelope Avenue, Avenue M/N, Avenue H, Avenue I, Avenue E, Central Avenue, 5th/6th Avenues, 17th Avenue, and 30th Avenue.



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Existing Functional Classification	
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Additional key east/west roadways include 11th Street, 16th Street, 22nd Street, 29th Street, 31st Street, 39th Street, and 56th Street. Several other roadways throughout Kearney carry major traffic but dead end or “zigzag” at many locations and are not considered primary, or at least continuous, routes.

3.2 Field Review and Data Collection Summary

It was necessary to document a number of key traffic and roadway characteristics to fully understand the existing transportation system and serve as inputs to the transportation model development process. These characteristics, most of which were collected through an extensive field review, include:

- Number of lanes
- Intersection geometrics
- Speed limits
- Parking characteristics
- Location and type of traffic control devices
- Urban vs. rural roadway cross section data (curbed vs. uncurbed)
- Functional Classification

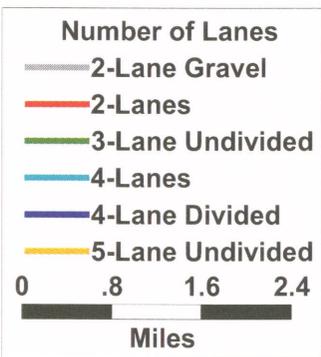
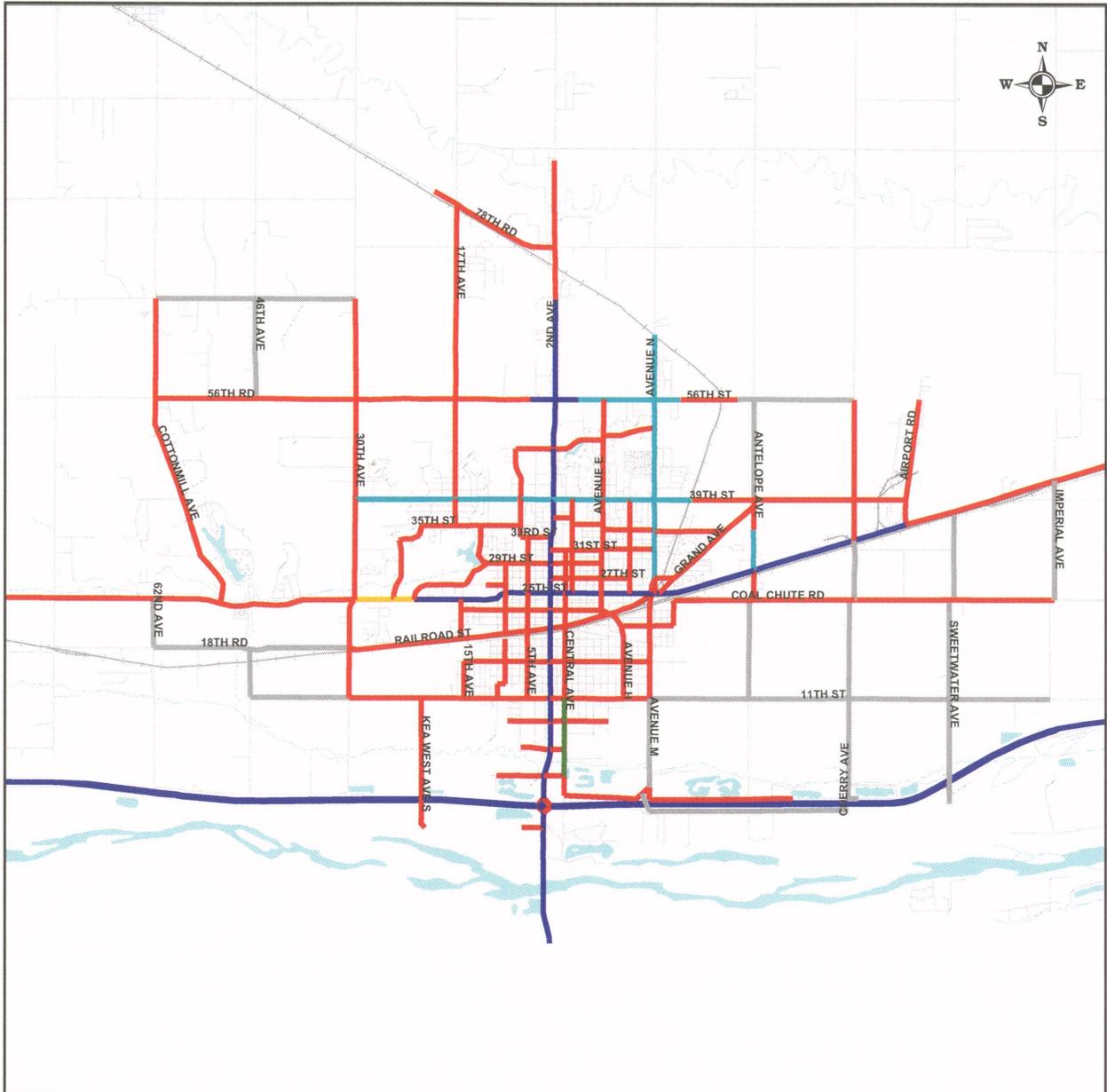
All of these parameters are critical in developing the model roadway network and establishing appropriate roadway capacities. The number of lanes on each major roadway, existing speed limits, existing parking characteristics, existing traffic control device locations, and typical roadway section information are illustrated in Figures 3-2 through 3-6, respectively.

Existing traffic volumes (typically 2002 data) were also obtained from City, County, and NDOR sources to use in the model development and calibration process. These volumes were supplemented by traffic count data from recent traffic studies conducted for the City of Kearney to provide good coverage of the existing street network. The existing daily traffic volumes used in the study are illustrated in Figure 3-7.

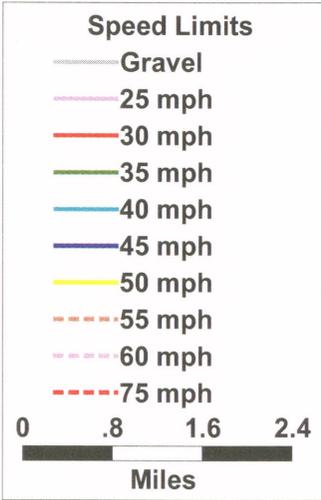
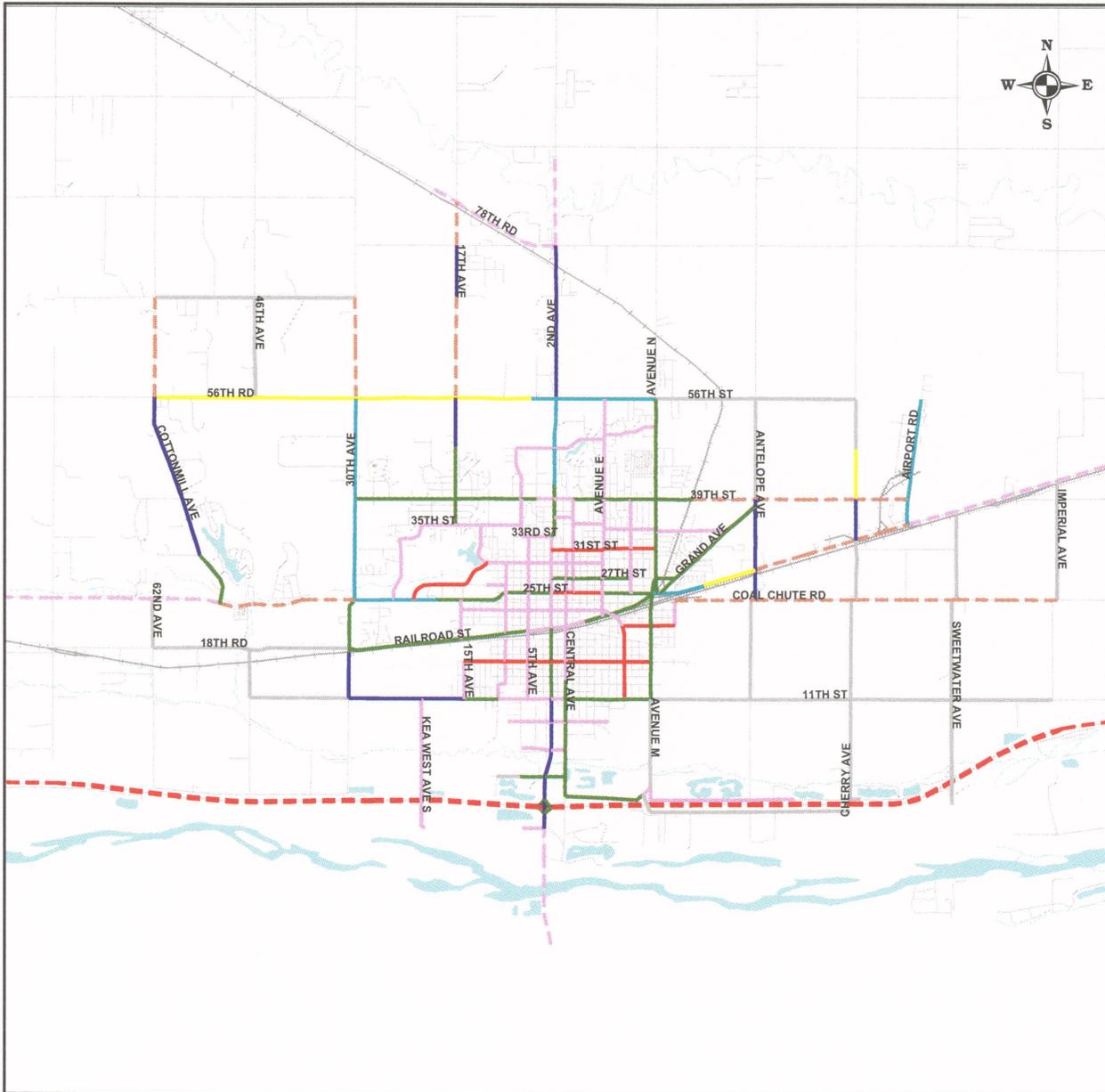
3.3 Traffic Operations and Safety Evaluation

Although this is primarily a planning study, operational analyses for many signalized intersections (specifically along 2nd Avenue, 25th Street and 39th Street) from past studies/reports were reviewed as part of the existing conditions analysis.

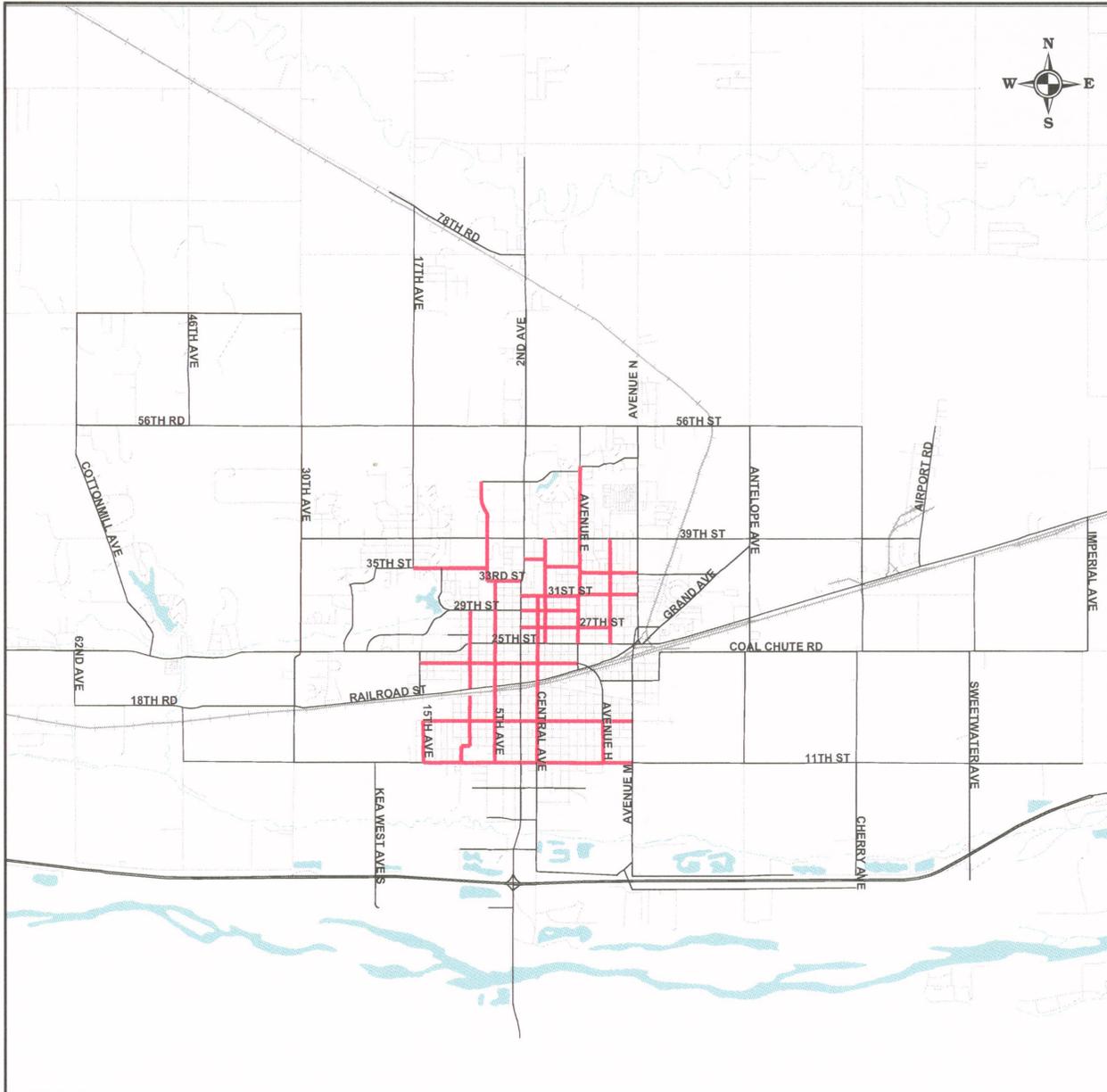
Accident data was reviewed for intersections citywide to identify potential safety deficiencies that should be addressed as part of the transportation plan. Accident analyses were conducted at all intersections where good count data was available. The results of these analyses are discussed briefly in this section.



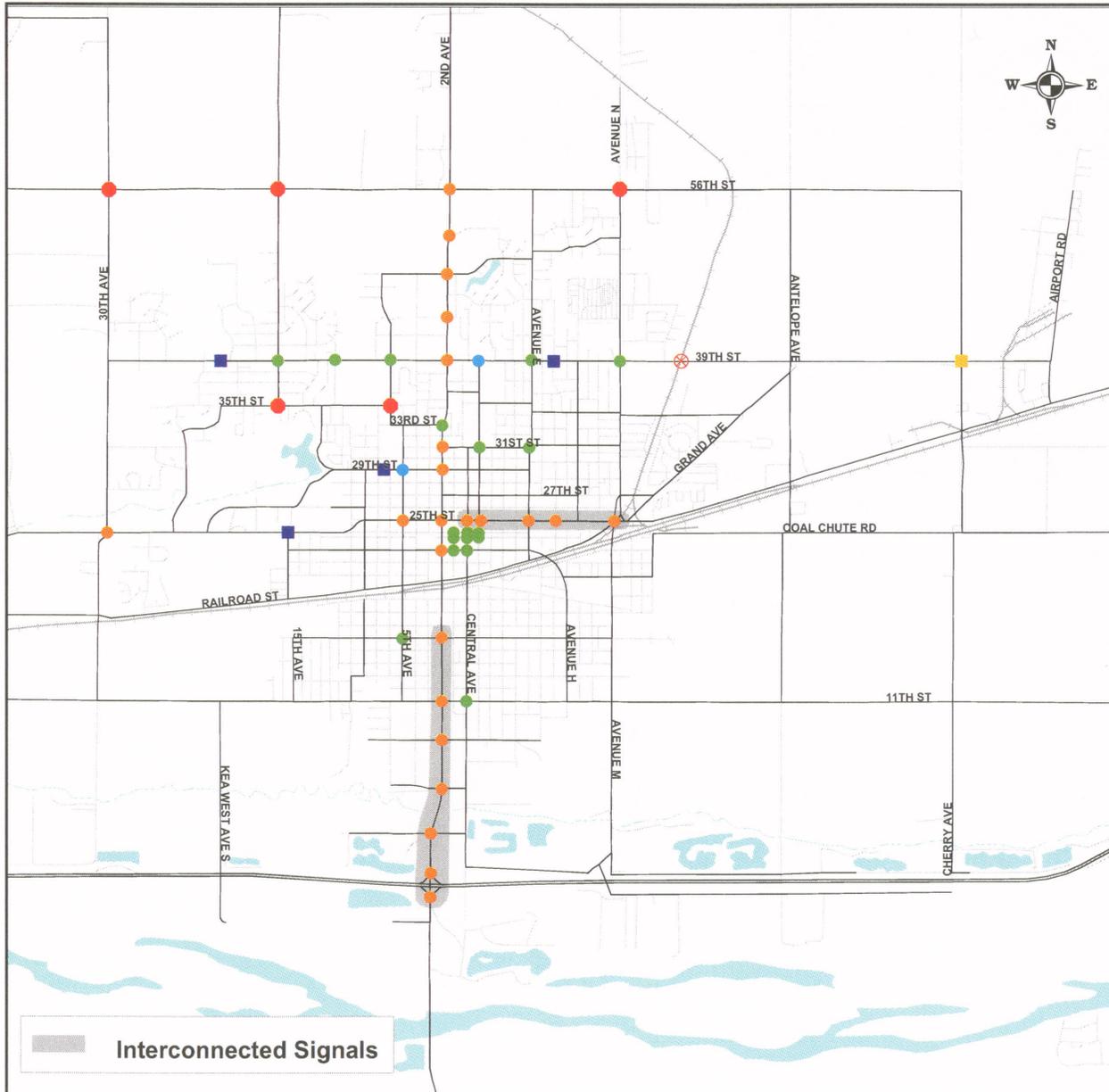
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Existing Number of Lanes	
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Existing Speed Limits	
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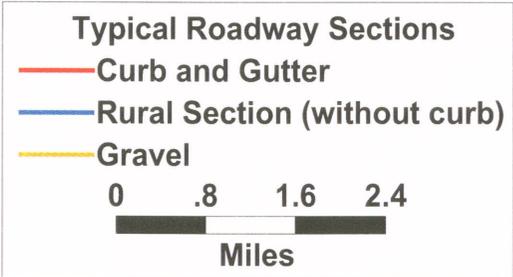
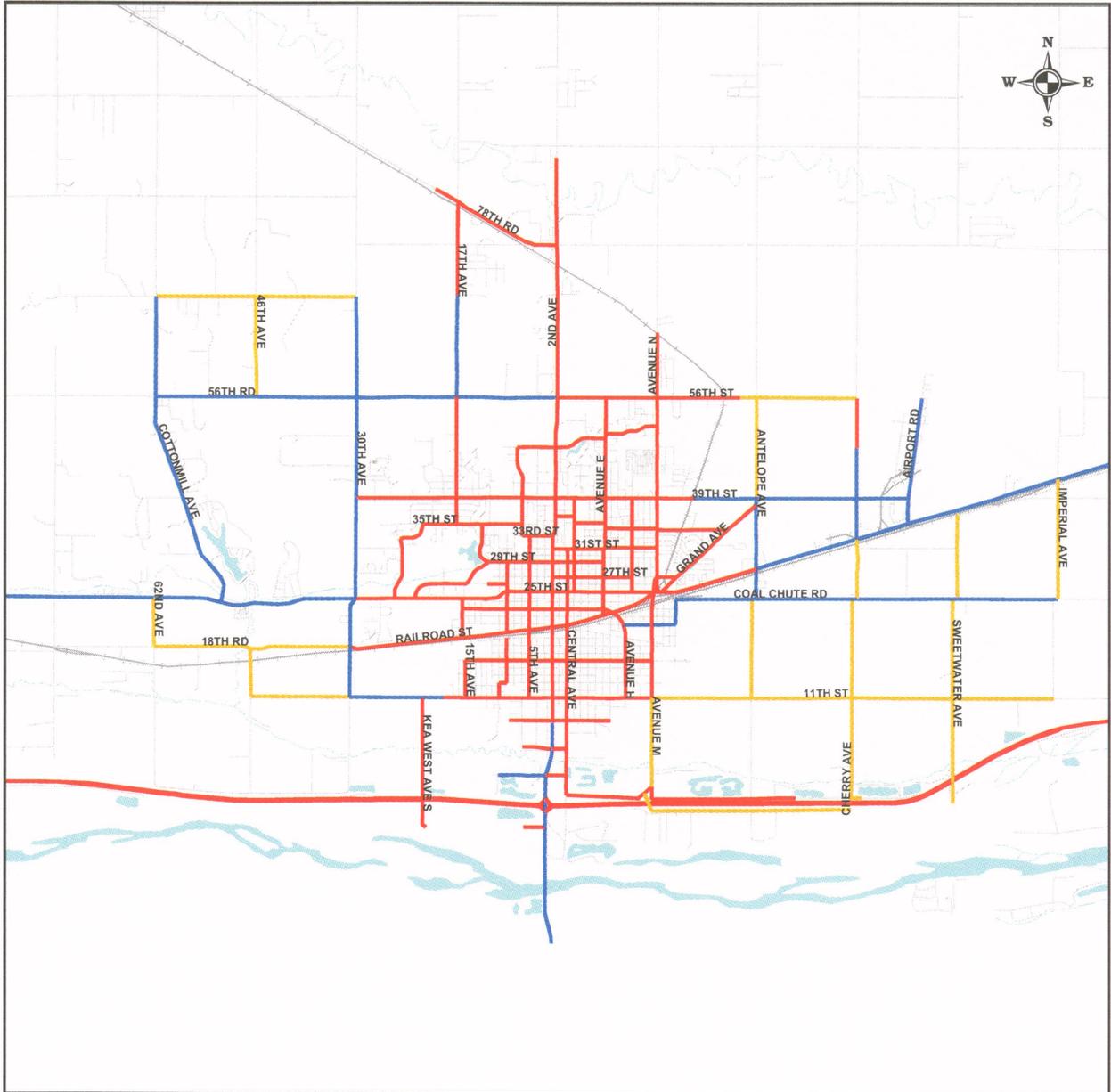
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Existing On-Street Parking Locations	
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Interconnected Signals

- Type of Traffic Control**
- NDOR Traffic Signal
 - City of Kearney Traffic Signal
 - Future Traffic Signal
 - 4-Way Stop
 - Flashing Yellow/Red
 - Pedestrian Signal
 - ⊗ RR Stop Sign
- 0 .5 1 1.5
Miles

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Existing Traffic Control Device Locations	
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Existing Typical Roadway Sections	
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A more detailed summary of this information can be found in the *Existing Transportation Conditions Technical Memorandum* included in the Appendix.

The review of accident data as part of this project and the results of previous studies indicate that accident rates for sections of 2nd Avenue and 39th Street are higher than statewide average accident rates for similar roadway facilities. A number of intersections along these two roadways also have higher than average accident rates. This trend can be attributed to the relatively high traffic volumes on these roadways coupled with frequent driveways, closely spaced signalized intersections, turn lane storage deficiencies at some intersections, and the roadway section (4-lane divided vs. 3-lane or 5-lane section with two-way center left-turn lane). Many of the primary commercial/retail areas in Kearney are located along these roadways, likely contributing to driver inattention and the documented accident history. NDOR does have a grading project planned to improve sight distances at the intersection of 2nd Avenue and 39th Street that will help to improve safety and operations on these roadways.

The results of previous studies indicate that nearly all signalized intersections in Kearney operate at an acceptable Level of Service (LOS C or better). *The Kearney Plan* documented that existing roadways in Kearney currently operate at acceptable levels of service (LOS C or better) with the exception of segments of 2nd Avenue and Hwy. 30 (25th Street). The segment of 2nd Avenue between the Union Pacific viaduct and 39th Street operates at LOS D and E. Several segments of 25th Street east of 2nd Avenue currently operate at an unacceptable LOS D. Most intersections also operate at LOS C or better, although there are a few intersection movements that currently operate at LOS D or worse. Although intersection operations appear to be acceptable for the most part, public input surveys and conversations with City staff indicated that the progression of signals along 2nd Avenue is currently unsatisfactory.

3.4 Summary

The City of Kearney has been experiencing significant growth throughout recent years. The City of Kearney must make every effort to plan the growth of its Transportation network ahead of this population surge. Failing to do this will result in similar, and possibly more severe problems than exist today, such as the loss of continuity in the roadway network and improper intersection spacing along major arterials (2nd Avenue and 25th Street). The majority of the roadway system in Kearney continues to operate at an acceptable LOS and is not experiencing high accident rates. However, several segments of 24th/25th Streets, 39th Street and 2nd Avenue operate at LOS D or worse and have intersections with unacceptable LOS movements and above average accident rates. The intersection of 25th Street and 2nd Avenue, noted in previous studies as having LOS deficiencies has been improved through recent City projects.

All transportation needs, however, are not quantified based simply on capacity calculations. Two major issues were apparent based on the existing conditions review that should be considered in developing a transportation plan for the community:

- **Capacity improvements are needed along 2nd Avenue** – 2nd Avenue is currently serving as the only continuous north/south arterial through the heart of Kearney. Although existing volumes are less than the theoretical capacity of this roadway, current operations are not acceptable to most City staff, elected officials, and residents of the community. A number of factors, including intersection and traffic signal spacing, quality of signal timing and progression, inadequate intersection geometrics, and less than ideal access management practices have reduced the capacity of these major roadways.
- **North/South Roadway Continuity must be improved** – The existing street system lacks continuous arterial roadways to complement 2nd Avenue. Most other arterial roadways lack continuity or don't really function as arterial roadways due to frequent residential driveways or on-street parking.

A number of potential transportation system improvements were identified based on the results of the existing conditions review. These improvements are described in detail in Chapter 6.0 of this report.

4.0 TRANSPORTATION MODEL DEVELOPMENT AND ALTERNATIVE ANALYSIS

This chapter of the report provides an overview of the transportation model development and calibration process. Development of future year traffic volume assignments and evaluation of transportation alternatives is also discussed in this chapter. A complete list of recommended roadway improvements based on the transportation modeling and analysis effort are presented in Chapter 6.0 of this report. The complete *Travel Demand Model Documentation Report* is included in the Appendix.

4.1 Transportation Modeling Process Overview

The transportation model for the City of Kearney was developed using the TransCAD modeling software, version 4.5. The model utilized the 2003 transportation network and estimated 2003 socioeconomic data (residential dwelling units, number of employees, square feet of office or retail development, number of students, etc.). The transportation model is a representation of the Kearney area's transportation facilities and the travel patterns using these facilities. The traffic model contains inventories (location, posted speed limit, number of lanes, parking characteristics, etc.) of the existing roadway facilities and residential and non-residential land use data by traffic analysis zones (TAZs).

The transportation modeling process consists of several steps including estimation of daily vehicle trips by TAZ based on the land use data, distribution of vehicle trips by TAZ, and then assignment of vehicle trips to the street network. The transportation model assignments are then compared to current traffic counts. When the traffic assignments match the existing traffic counts within acceptable ranges of error the model can be used to test future year scenarios. These scenarios may be either land use or transportation network modifications. Future traffic volumes can then be estimated using the model to aid in making planning or programming decisions.

The Kearney transportation modeling process included the following steps:

- Development of 2003 transportation roadway network
- Determination of 2003 land use data
- Trip generation – generation of vehicle trips for each land use
- Trip distribution – geographical distribution of vehicle trips between origin and destination TAZ
- Trip assignment – assignment of traffic volumes to specific roadways

4.2 Model Calibration

The transportation model was calibrated and validated using the transportation network, socioeconomic estimates, and traffic counts for the year 2003. Model calibration involves running the model using existing data and comparing model results to actual traffic counts. Between each calibration run, different parameters are evaluated and necessary adjustments made so that model calibration can be achieved. The model calibration and validation included review of several statistical performance measures such as percent assignment error, root mean square error (RMSE), and coefficient of determination.

The percent assignment error and percent root mean square error by facility type are summarized in Tables 4-1 and 4-2, respectively. As shown in Table 4-1, the percent error of the traffic assignment for each functional classification and the network as a whole are well within the recommended error ranges. Engineering practice suggests that a RMSE of 35% or lower is representative of a well-calibrated model. The 19.65% RMSE for the Kearney model is considerably lower than this target value. Another tool to measure the overall model accuracy is the coefficient of determination or R^2 value. A desirable R^2 value is 0.88, thus the R^2 value of 0.6 achieved in Kearney is very good.

**Table 4-1
Percent Assignment Error**

Functional Class	Percent Error	
	Computed	Suggested Range*
Urban Principal Arterial	N/A	<10%
Urban Major Arterial	1.8%	<15%
Urban Minor Arterial	0.7%	<25%
Urban Collector	2.7%	<25%
Urban Local	N/A	N/A
Rural Principal Arterial	N/A	<10%
Rural Major Arterial	0.1%	<15%
Rural Minor Arterial	4.9%	<15%
Rural Collector	5.4%	<25%
Rural Local	N/A	N/A
Total Network	0.6%	<5%

*Source: *Calibration and Adjustment of System Planning Models*, Federal Highway Administration, December 1990.

**Table 4-2
Percent Root Mean Square Error**

Functional Class	Percent RMSE
Urban Major Arterials	11.85%
Urban Minor Arterials	25.04%
Urban Collector	26.24%
Urban Local	0%
Rural Principal Arterial	N/A
Rural Major Arterial	8.00%
Rural Minor Arterial	42.86*%
Rural Collector	25.21%
Rural Local	N/A*
Total Network	19.65%

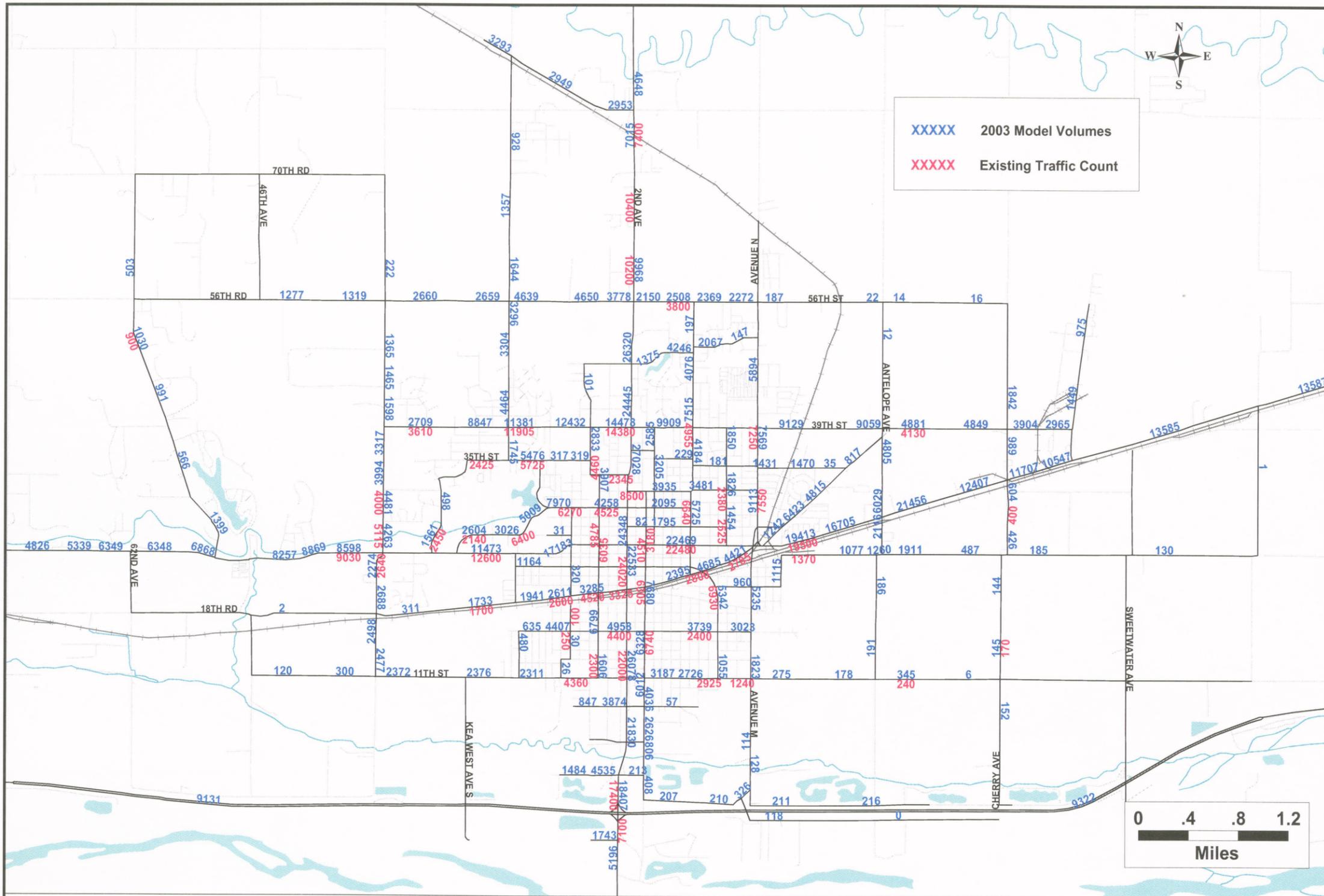
*Only two counts available for comparison

4.3 Year 2003 Traffic Assignment

The traffic assignments for the year 2003 based on the model development and calibration process described above are illustrated in Figure 4-1. The existing year 2002 traffic counts are also shown on selected roadway links where they were available. As shown in Figure 4-1, there is typically very good correlation between assigned volumes and existing volumes on specific roadway links. Based on the 2003 traffic assignments, all roadways in Kearney currently operate at level of service (LOS) C or better with the exception of segments of 2nd Avenue. LOS C, stable flow, should be the goal of a community the size of Kearney. This typically represents a condition in which no more than 70-80 percent of a roadway's capacity, on a daily basis, is utilized. It must be kept in mind that the model is intended to represent average daily traffic conditions. As such, it is possible for there to be isolated roadway segments or intersections with some peak hour operational deficiencies. This is consistent with the existing peak hour operational issues, primarily along 25th Street and 2nd Avenue, identified in the existing conditions analysis.

4.4 Future Year Traffic Forecasts

The next step in the transportation planning process was the estimation of base future year traffic volumes using projected land use information. For purposes of this study, land use and traffic volume projections were prepared for an approximate 25-year horizon year (Year 2030). The future year traffic assignments were developed using the future land use plan presented in Chapter 2.0. Based on this plan, detailed land use characteristics (population, employment, number of dwelling units, square footage of commercial or retail development, etc.) were defined for each TAZ in the model. Future year traffic assignments were then developed for each roadway through the trip generation, distribution, and assignment process.



CITY OF KEARNEY
Transportation Plan Update
 Year 2003 Traffic Assignment


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Figure 4-1

Only major roadway improvements included in the City's current Capital Improvement Program (CIP) or identified by City staff were assumed to exist in the base future roadway network. The base future roadway network, also commonly referred to as the "Existing Plus Committed Roadway Network", included the following improvements to the existing roadway network:

- 30th Avenue Widening Improvement (Lacrosse Drive to 39th Street) – Construction of 4-lane roadway section. Construction estimated to be complete in 2004.
- Antelope Avenue Paving Project (39th Street to 78th Street) – Pave the existing 2-lane roadway. Construction estimated to be complete in 2005.
- 11th Street Widening Improvement (1st Avenue to 7th Avenue) – Construction of 4-lane roadway section. Construction estimated to be complete in 2004.
- 48th Street Extension (6th Avenue to 17th Avenue) – Construct a new 2-lane collector roadway extending 48th Street to the west. Construction estimated to be complete in 2008.
- 17th Avenue Widening Improvement (48th Street to 56th Street) – Construction of 4-lane roadway section. Construction estimated to be complete in 2012.
- 30th Avenue Widening Improvement (39th Street to 56th Street) – Construction of 4-lane roadway section. Construction estimated to be complete in 2012.
- 11th Street Widening Improvement (7th Avenue to 17th Avenue) – Construction of 4-lane roadway section. Construction estimated to be complete in 2012.
- 11th Street Roadway Improvement (Avenue M to Cherry Avenue) – Construction of 2-lane roadway section. Construction estimated to be complete in 2013.
- 30th Avenue Widening Improvement (11th Street to the existing overpass) – Construction of 4-lane roadway section. Construction estimated to be complete in 2016.
- 11th Street Widening Improvement (17th Avenue to 30th Avenue) – Construction of 4-lane roadway section. Construction estimated to be complete in 2016.
- 11th Street Widening Improvement (1st Avenue to Cherry Avenue) – Construction of 4-lane roadway section. Construction estimated to be complete in 2024.

The proposed I-80 interchanges at Cherry and 30th Avenues were not included as base improvements in order to present a worse case scenario along 2nd Avenue. Note that some of these improvements may already be constructed or currently be under construction. However, the model was calibrated for the year 2003. Therefore, the improvement, for modeling purposes, is considered a future improvement and not part of the existing transportation network.

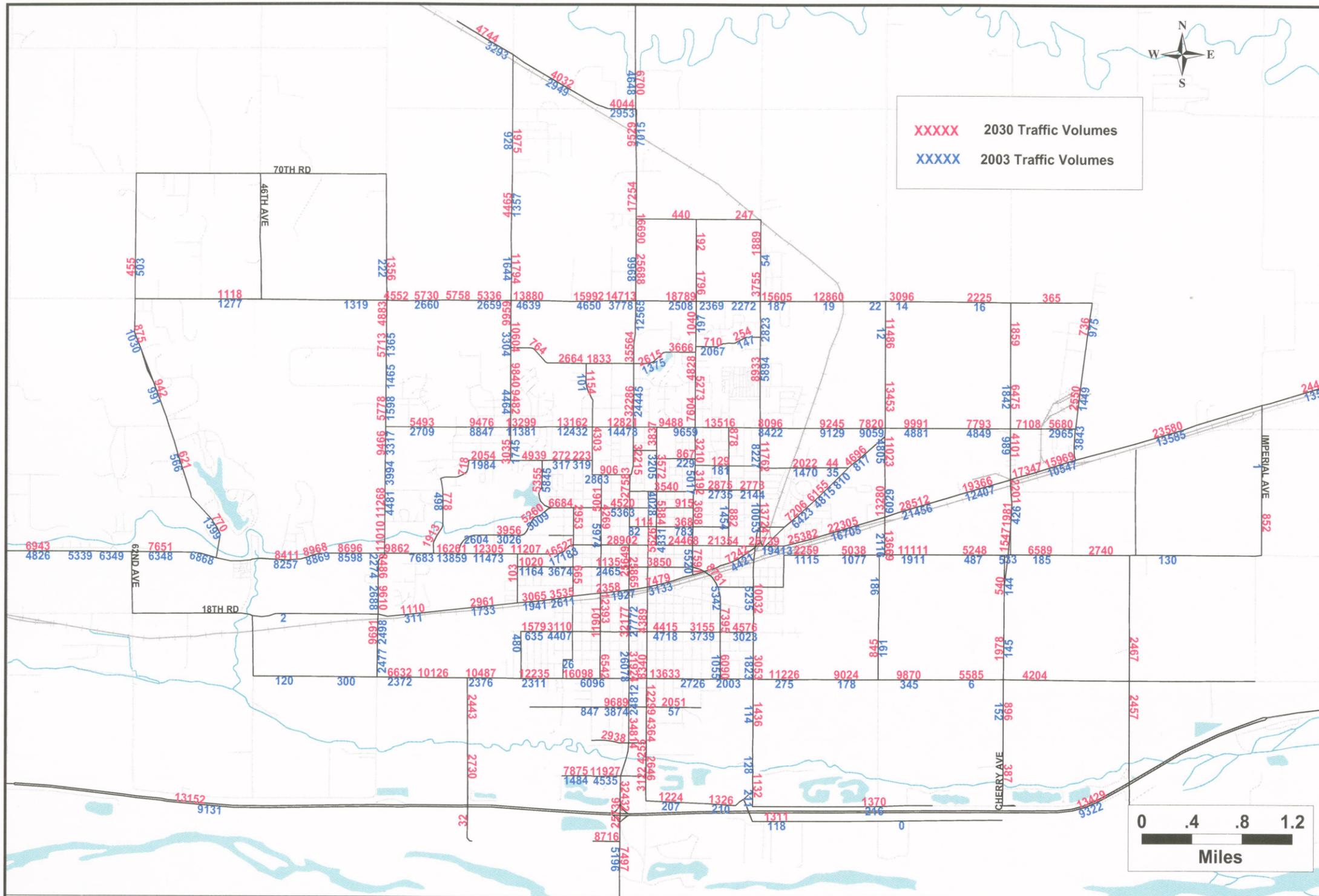
The base future year (Year 2030) traffic assignments on the existing plus committed roadway network are shown in Figure 4-2. For reference, the 2003 calibration year traffic assignments are also shown in Figure 4-2. The future year traffic volumes indicate substantial traffic volume growth (9,000 - 16,000 vpd) on 56th Street between 17th Avenue and Antelope Avenue. Traffic volume increases on 2nd Avenue generally range from 5,000 - 8,000 vpd over existing volumes. There are also sizeable traffic volume increases in the range of 5,000 - 11,000 vpd on 11th Street, 30th Avenue and US Hwy. 30 east of 2nd Avenue. Volume increases on most other collector and arterial roadways are typically in the range of 1,000 - 3,000 vpd.

Volume decreases, typically in the range 1,000 - 2,000 vpd, are projected along portions of 39th Street and 16th Street. This trend can likely be attributed to some traffic diversion from these roadways to 11th and 56th Streets as well as some land use changes shifting high traffic generators further west and north.

To better evaluate potential future roadway deficiencies, roadway segments projected to operate at LOS D or worse (volume to capacity ratio greater than 0.70) were identified. The following roadway segments are expected to operate over this threshold based on the future volume assignments:

- 17th Avenue – 56th Street to ½ mile north
- 5th Avenue – 16th to Railroad Streets
- 2nd Avenue – I-80 north ramp to UPRR viaduct, 29th to 56th Streets and 63rd to 78th Streets
- Central Avenue – 11th to 16th Streets
- Antelope Avenue – Coal Chute Road to US Hwy. 30

Thus, other than a large portion of 2nd Avenue, a majority of the major roadways in Kearney are expected to operate at LOS C or better based on the 2030 traffic volume projections. This does not mean that there will not be isolated intersection problems at some locations. However, the overall street network, with the noted exceptions, is expected to operate at an acceptable level of service. The capacity of Central Avenue could be improved by extending the existing three-lane roadway section to 16th Street. That same roadway section could be pursued along 5th Avenue. Ideally, 2nd Avenue would also be widened to add capacity and improve traffic operations. Unfortunately, widening of 2nd Avenue is unlikely and would have significant impacts – both financially (to the City and NDOR) and to adjacent properties. As a result, other alternatives to improve the operations along 2nd Avenue must be identified.



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Transportation Plan Update
Year 2030 Traffic Assignment


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Figure 4-2

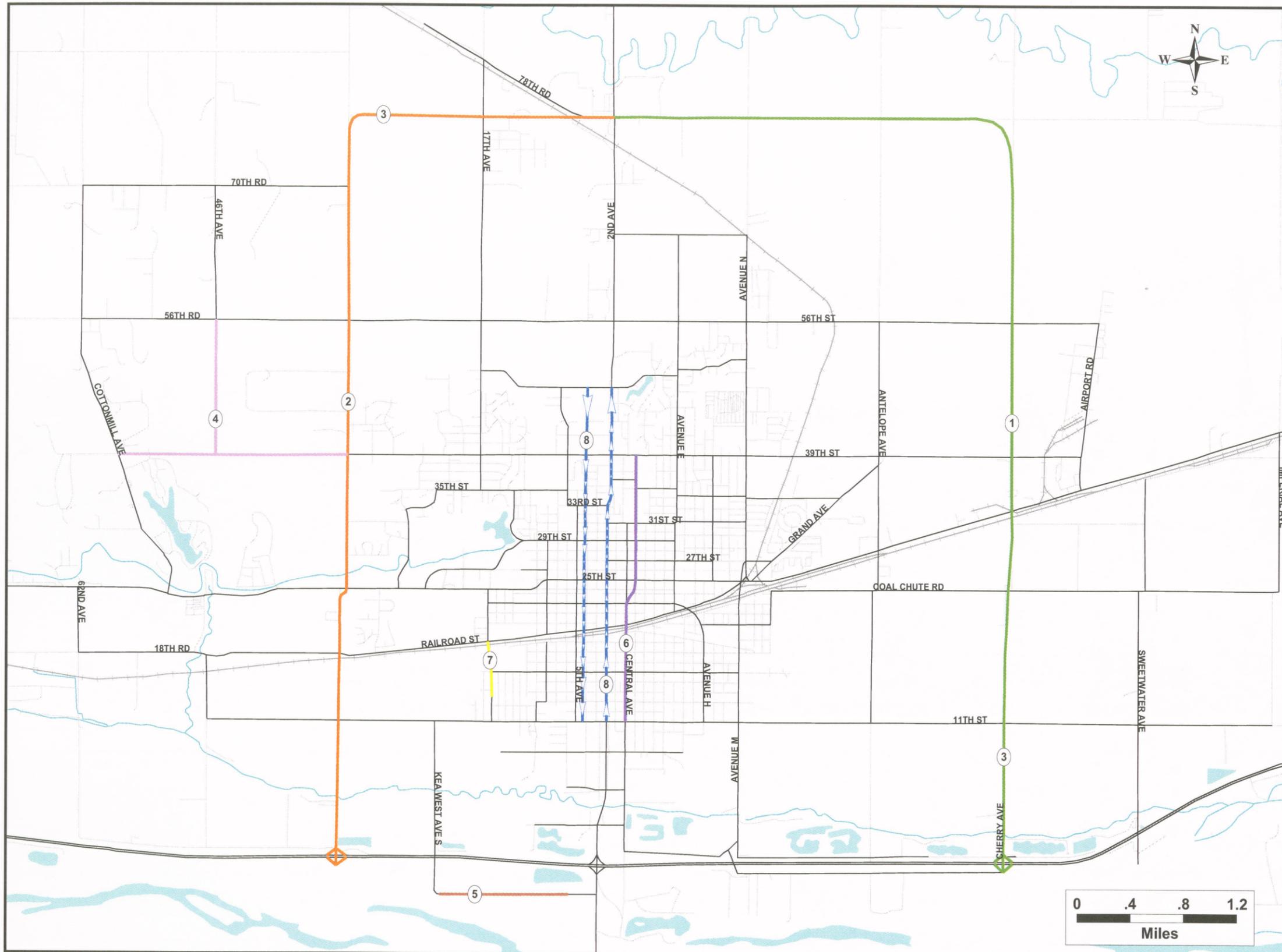
4.5 Transportation Alternatives Evaluation

A number of potential transportation alternatives were evaluated for the Kearney area. Alternatives were developed based on the existing conditions analysis, existing or projected transportation model results, and discussion and input from City staff and project Task Force members. Transportation alternatives were generally identified to accomplish one of the following goals:

- Improve roadway segments with unacceptable operations (i.e., level of service D operation)
- Improve a roadway to provide better compliance with the desired roadway functional classification
- Provide logical extensions to existing roadways
- Provide roadway connections that do not exist today to improve overall circulation and network continuity
- Provide major transportation improvements such as additional interchanges, bypass roadways or railroad viaducts that are needed to ensure an effective transportation system in the future

Based strictly on projected future year traffic volumes, major transportation improvements were not required to address existing capacity deficiencies with the exception of 2nd Avenue. However, a number of these alternatives may have merit to improve traffic flow in specific locations throughout the City and to ensure long-term success of the City's transportation system.

The transportation alternatives evaluated as part of the modeling effort are outlined below and illustrated in Figure 4-3. The discussion that follows includes a description of the improvement as well as a brief discussion regarding the expected traffic impacts associated with each alternative. Traffic volume assignment plots for each alternative are included in the Appendix.



**Year 2030 Model
Test Alternatives**

- ① Interchange at Cherry Ave with an East Bypass
- ② Interchange at 30th Ave with a West Bypass
- ③ Interchange at Cherry Ave and 30th Ave with East and West Bypass Roadways
- ④ Expansion of Roadway Network into Cottonmill Park and Rolling Hills Developments
- ⑤ Connection of Kea West Ave
- ⑥ Central Avenue / Avenue A Connection
- ⑦ Railroad Viaduct Connecting 15th and 17th Avenues
- ⑧ One-Way Pair Couplet through Kearney (with 2nd and 4th Avenue)

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Transportation Modeling Alternatives



Figure 4-3

Alternative 1 – Interchange at Cherry Avenue with an East Bypass

Description: This alternative tested an interchange with Interstate 80 at Cherry Avenue. In this alternative, a high speed (55mph), four-lane divided bypass would also exist around the east and north sides of Kearney and then tie into the existing intersection of Hwy. 10 (2nd Avenue) and Hwy. 40. Currently, only one Interstate 80 interchange exists at 2nd Avenue in Kearney.

Traffic Impacts: Serving as the only I-80 interchange and continuous north/south roadway through Kearney, 2nd Avenue is currently experiencing significant peak hour congestion and delay. 2nd Avenue traffic volumes currently range between 22,000 to 28,000 vehicles per day (vpd). Year 2030 projected volumes range from 26,000 to 35,600 vpd along this roadway. With the addition of the Cherry Avenue interchange and bypass, projected volumes along 2nd Avenue (I-80 to 25th Street and 56th to 78th Street) are expected to decrease by 1,500 to 6,700 vpd. In addition, significant decreases of 1,500 to 5,300 vpd are expected east of 2nd Avenue along 11th Street, Coal Chute Road, 39th Street, Hwy. 30 and 56th Street. The bypass is expected to carry volumes ranging from 12,000 to 16,500 vpd between I-80 and 39th Street and between 2,000 to 8,000 vpd north of 39th Street. A Cherry Avenue interchange and bypass roadway is recommended to accommodate projected traffic volumes and alleviate congestion on 2nd Avenue.

Alternative 2 – Interchange at 30th Avenue with a West Bypass

Description: This alternative tested an interchange on the west side of Kearney at 30th Avenue. This alternative assumed 30th Avenue and 78th Street would serve as a four-lane divided, high speed (45mph – 55mph) arterial roadway around the west and north sides of Kearney.

Traffic Impacts: This alternative was tested primarily to observe the benefits of an interchange on the west side of Kearney. The impacts of this alternative were noticeable both along and to the west of 2nd Avenue. Significant decreases in traffic volumes ranging from 1,500 to 5,500 vpd occur along 2nd Avenue south of 25th Street. Traffic volumes decrease 1,500 to 3,500 vpd along west 11th Street and 5th Avenue and volume increases of 2,500 to 3,500 can be expected on Hwy. 30 west of 2nd Avenue. The west bypass/30th Avenue is expected to carry volumes ranging from 8,500 to 16,500 vpd from I-80 to 56th Street. A 30th Avenue interchange and west bypass would be a significant addition to the Kearney transportation network and should be studied further in the future. It should be noted that this alternative could be pursued without the high speed west bypass,

Alternative 3 – Interchanges at Cherry Avenue and 30th Avenue with East and West Bypass Roadways

Description: This alternative tested the combination of interchanges at Cherry Avenue and 30th Avenue with the existing 2nd Avenue Interchange. With I-80 on the south side, this alternative would also create a high-speed, four-lane arterial roadway on all four sides of Kearney.

Traffic Impacts: As would be expected, this alternative results in traffic volume decreases over a majority of the roadways in Kearney. Considerable volume decreases on 11th Street, Coal Chute Road, 5th Avenue, 2nd Avenue, Avenue H, north Antelope Avenue and east Hwy. 30 are in the range of 2,500 - 6,000 vpd. When running these alternatives together the east bypass traffic volumes remain essentially the same as in Alternative 1. However, along the west bypass, volume decreases ranging from 1,000 to 2,000 vpd resulted when testing the interchanges in combination. These results suggest that both interchanges would carry significant traffic volumes and be major additions to the transportation network.

Alternative 4 – Expansion of Roadway Network into Cottonmill Park and Rolling Hills Developments

Description: This alternative tested an expansion of major arterial roadways into Cottonmill Recreation Area and the Rolling Hills development to provide additional north/south and east/west access. Roadway network expansion included extending 39th Street west to Cottonmill Avenue and connecting 46th Avenue between 18th and 56th Streets.

Traffic Impacts: This alternative had little effect on the existing roadway network. However, even though volume increases are small along 39th Street and 46th Avenue, this alternative provides the framework for future population growth. It is important that the City of Kearney plans and acquires right-of-way for the extension of existing arterial roadways, similar to this scenario, before development occurs. Failing to do so may result in roadway continuities comparable to some north/south and east/west roadways in Kearney today.

Alternative 5 – Connection of Kea West Avenue

Description: This alternative modeled the extension of Kea West Avenue, near the Tri-City Arena, west to tie into the existing segment of Kea West Avenue south of Interstate 80. The Kea West Avenue interstate overpass is programmed for reconstruction by NDOR in the near future and could be built in conjunction with this project.

Traffic Impacts: This alternative does not appear very attractive when looking strictly at daily traffic volumes. However, the connection of this roadway would provide an additional access to the Tri-City Arena and accompanying developments. This benefit alone could be enough to warrant construction of this roadway as many people commented in the public survey about large traffic delays during special events at the arena. In addition, this connection also provides roadway continuity and more efficient emergency vehicle access in south Kearney. Finally, coupled with the Yanney Park development, this roadway could be a location of potential future growth for the City of Kearney.

Alternative 6 – Central Avenue / Avenue A Connection

Description: This alternative tested the transition of Central Avenue into Avenue A near 25th Street. Both Central Avenue and Avenue A were modeled as two-lane roadway sections with parking, similar to what exists today. Although this improvement would require a significant right-of-way acquisition near the point of transition, it was felt that this was an important alternative to test due the lack of north/south continuity in Kearney. To lessen the impact on existing developments and buildings downtown, this transition could occur to the south near Railroad Street. However, the key to this alternative is that it modeled an additional continuous north/south road to complement 2nd Avenue.

Traffic Impacts: This alternative resulted in small traffic volume decreases of 1,000 to 2,000 vehicles on 25th Street between 2nd Avenue and Avenue A and on a small portion of 22nd Street in downtown Kearney. Minor increases of 500 to 1,000 vehicles occurred on 25th Street between Avenue I and Avenue A. This alternative may have had a greater effect if modeled as 3- or 4-lane roadway section, but would result in a loss of parking in downtown Kearney along these streets. Additional right-of-way may also need to be required if a 4-lane roadway is pursued. However, without raising the speed limit or increasing significantly capacity, the close proximity of these roads to 2nd Avenue will likely nullify any potential decreases in 2nd Avenue traffic volumes.

Alternative 7 – Railroad Viaduct Connecting 15th and 17th Avenues

Description: This alternative modeled an additional railroad viaduct in southwest Kearney connecting 15th and 17th Avenue. Currently, an at-grade crossing at 5th Avenue is the only north/south connection over the railroad tracks between 2nd Avenue and 30th Avenue. It was felt this alternative should be tested to observe if there were substantial benefits of constructing an additional connection (likely a 2-lane viaduct) other than improved north/south continuity.

Traffic Impacts: This alternative is a fairly attractive addition to southwest Kearney. Although traffic volume increases on 15th and 17th Avenues only range from 1,000 to 3000 vpd, there are other benefits that would be realized. Significant decreases of 1,000 to 2,500 vpd are expected on both 5th and 30th Avenues. This addition to the roadway network will also add roadway continuity, more efficient emergency vehicle access and a greater potential for future growth to a region of Kearney that is currently lacking these characteristics today. As growth does occur in south Kearney, this roadway could be extended to a frontage road north of I-80. The construction of this viaduct is recommended to improve the roadway network in southwest Kearney.

Alternative 8 – One-Way Pair Couplet through Kearney

Description: This alternative tested a north/south one-way pair couplet through Kearney. Based on discussion with City staff, a 2nd Avenue/4th Avenue one-way couplet between 11th and 48th Streets was modeled for analysis. Both roadways under this alternative were modeled as three-lane, low-speed (35 – 40 mph) roadways.

Traffic Impacts: This alternative results in multiple changes to volumes along the roadway network. Large portions of 11th Street, Avenue H, Avenue N, Avenue E, 39th Street and 17th Avenue experience volume increases ranging from 1,000 to 2,500 vpd. Segments of 35th Street, University Drive, 39th Street, Avenue A and Railroad Street all experience decreases of 1,000 to 3,000 vpd. Both 2nd Avenue and 4th Avenues would carry traffic volumes ranging between 14,000 to 22,000 vpd between 11th and 48th Streets, which is near capacity for one-way traffic on a 3-lane roadway. Although this alternative would split forecasted 2nd Avenue traffic onto two separate roadways, thus largely eliminating the existing progression problem along this corridor, the cost may outweigh the benefits. Construction of this alternative would require a combination of major right-of-way acquisition, roadway reconstruction, new signals, lighting, and supplementary items along 2nd Avenue, 4th Avenue, 11th Street and 48th Street. Politically, socially and environmentally this alternative may be unacceptable.

5.0 ALTERNATIVE TRANSPORTATION ELEMENTS EVALUATION

This chapter provides a summary of the evaluation of alternative transportation elements including transit, trails, aviation, rail, and intelligent transportation systems (ITS).

5.1 Transit

The Community Action Partnership of Mid-Nebraska and Buffalo County Community Health Partner operate Reach Your Destination Early or “RYDE” Transit. RYDE started in 2000 with one bus and one employee. In the last reporting year (2002-2003), RYDE carried 78,256 riders and had annual operating expenses of \$341,154.30. RYDE serves medical trips for elderly and handicapped. RYDE also serves work-related trips. The population of the Kearney region may exceed the Federal Transit Administration (FTA) definition for “rural” transit within the next decade. When this occurs, RYDE will fall into different categories for FTA funding.

RYDE has received from FTA a \$982,260 grant for a joint maintenance facility shared with UNK, Nebraska Safety Center, City of Kearney, Good Samaritan Hospital, Buffalo County Sheriff & Kearney Public Schools.

The Regional Transit Intelligent Transportation System (ITS) Architecture was completed for RYDE in April 2003. The Regional Architecture recommends the following projects be completed by 2006.

- 2004 – Digital wireless communication for transit automatic vehicle location (AVL) and mobile data terminals (MDT) in the buses.
- 2005 – System wide AVL/MDT implementation
- 2006 – Transfer RYDE operation to the NDOR District Operations Center.

There are a broad range of transit needs for RYDE, Kearney and the surrounding areas. Transit demand has been and is expected to increase steadily. Existing riders include traditional rural transit users such as elderly, handicapped, and transit-dependent persons. In addition, UNK students and employees at various businesses utilize the transit system. These needs are expected to continue to grow into the foreseeable future.

Currently, there is an existing unmet demand during peaks. At least 60 ride requests are not being served monthly due to lack of peak hour capacity. Typical peak hours are 6:45-8:00 a.m., 11:45 a.m.-12:15 p.m., and 3:00-4:00 p.m. During those hours, new riders are nearly impossible to accommodate in a timely manner. There is also an existing unmet demand outside of RYDE business hours. There are several populations within Kearney with unmet transportation needs due to RYDE hours of operations – 6:00 a.m. to 6:00 p.m., Monday through Friday. This includes transit dependent people in food service and

hospitality jobs. People in these industries often need to arrive or depart outside of RYDE hours of operation. Also, people depending on transit for social, entertainment or personal reasons often have needs outside of RYDE's normal hours of operation.

The aging of RYDE vehicles is also a major concern. Presently vehicles average 7.5 years old and 104,641 miles. FTA recommends retirement at 5 years and/or 100,000 miles. Vehicle maintenance currently consumes about 10% of RYDE's annual budget.

The Kearney area is rapidly reaching the population that differentiates rural and urban transit demographics. As Kearney continues to grow, many elderly and other transit dependent persons are relocating out of the traditional City core. This change in demographics is making transit trips longer, reducing the number of trips that can be completed daily by each bus. As Kearney's population grows, the need for fixed transit routes to supplement or replace some demand-responsive service is expected to grow. This trend is expected to continue for the foreseeable future.

Coordination between rural providers is a growing need. Currently RYDE coordinates trips with other rural transit providers operated by the Community Action Project of Mid-Nebraska. These providers include Franklin County Transportation, Kearney County Transportation, Gosper County Transportation, and City of Ravenna Transportation. All of these systems make frequent trips to Kearney. Informal coordination occurs with Loup City Transportation, Dawson County Transportation and Holdrege Transportation. Opportunities for future coordination exist with Valley County Handi-Bus. FTA has approved a grant for \$736,695 for statewide AVL and supporting communication. AVL, coupled with computer-aided dispatching, will enable broader coordination among rural transit agencies.

Several transit improvements are suggested to address transit needs in the Kearney area. These improvements range from traditional transit projects to providing Intelligent Transportation Systems (ITS) to improve transit operations and efficiency.

Proposed Short-Term Projects (Zero to Five years):

- Transit Projects:
 - Construct maintenance facility.
 - Replace old buses.
 - Purchase additional buses (capacity).
 - Study and implement cost-effective additional transit service options, including limited fixed routes, extended hours of operation, and weekend operations.
- ITS Projects:
 - Deploy AVL/MDT on entire Community Action Partnership of Mid-Nebraska transit fleet.
 - Study impacts of traffic signal systems on RYDE trips and total riders, especially during peaks. Determine if transit signal priority would beneficially impact RYDE demand-responsive and/or fixed route transit trip capacity.
 - Depending upon recommendations of NDOR Statewide Rural Transit Study starting in June, 2004, transfer RYDE operations to NDOR District Operations Center as a part of a regional consolidation of rural transit dispatching, reservations, and trip coordination.
 - Coordinate with statewide AVL implementation project.

Proposed Mid-Term Projects (Six to 15 years):

- Transit Projects
 - Replace and add buses as needed.
 - Expand service hours as demand increases.
- ITS Projects
 - Update Regional Transit ITS Architecture.
 - Implement ITS Projects from Regional Architecture

5.2 Trails

The City of Kearney has developed an extensive system of trails throughout the City and surrounding areas. These trails serve recreational travel as well as work or shopping trips. The trails connect major recreational facilities and parks throughout the Kearney area. It is estimated that trails are the most widely used recreational resource in the City. The Kearney Trail Comprehensive Plan was published in 2003.

Many elements of the trail plan are complete and operational, including Phases I and II of the Cottonmill Trail. Other elements of the master plan are under construction or planned. There is currently a need for more trails and trail connectivity in the northern parts of the City.

The City has instituted a unique policy to widen sidewalks and trails as new development occurs. Developers are required to provide four-foot wide sidewalks. In key areas, the City pays for an additional four feet so the sidewalks can be multi-use for pedestrians and bicycles. Several trails meeting this criterion have been built including the Avenue M Trail connection to the Ft. Kearney Archway Trail. In the future, trails will be added or widened with street widening projects.

It is recommended that all future roadside trails be constructed with at least five feet of setback from public streets. This offset design allows for the following:

- A safety margin for children
- Reduced vehicle/pedestrian conflicts
- Reduced splashing of pedestrians from passing vehicles
- Space for snowplows to push and store snow
- Space for utilities and traffic control devices

In locations where this offset cannot be provided, it is recommended that the trail be constructed with a minimum width of ten feet. Additionally, all future trails should be constructed in eight foot concrete sections instead of two side by side four foot sections whenever possible. This will allow for a smoother, more continuous and travel friendly trail (particularly for roller-bladers or skaters).

Several comments about trails were received from citizens in the public survey. Some of the comments focused on trail signage at busy cross streets. A few people expressed concern about the narrow trail under the UPRR. That underpass was built with limited funding and required UPRR approval. "Narrow Trail" warning signs are in place at both ends of the underpass. A few riders expressed the need for more places to find bottled water or drinking fountains along the trails. However, most comments from the public expressed the need for more trails in north Kearney.

The City of Kearney desires to develop a complete network of trails and enhanced sidewalks to connect the University of Nebraska – Kearney, schools, parks, and major commercial/retail areas in the City. Trail usage will transition from primarily recreational to more multi-purpose uses including commuting and shopping trips.

The existing and proposed trails listed in *The Kearney Plan* are illustrated in Figure 5-1. This Kearney Trails Master Plan includes several trail projects over the next 20 years, which are shown in Table 5-1.

**Table 5-1
Planned Trail Projects**

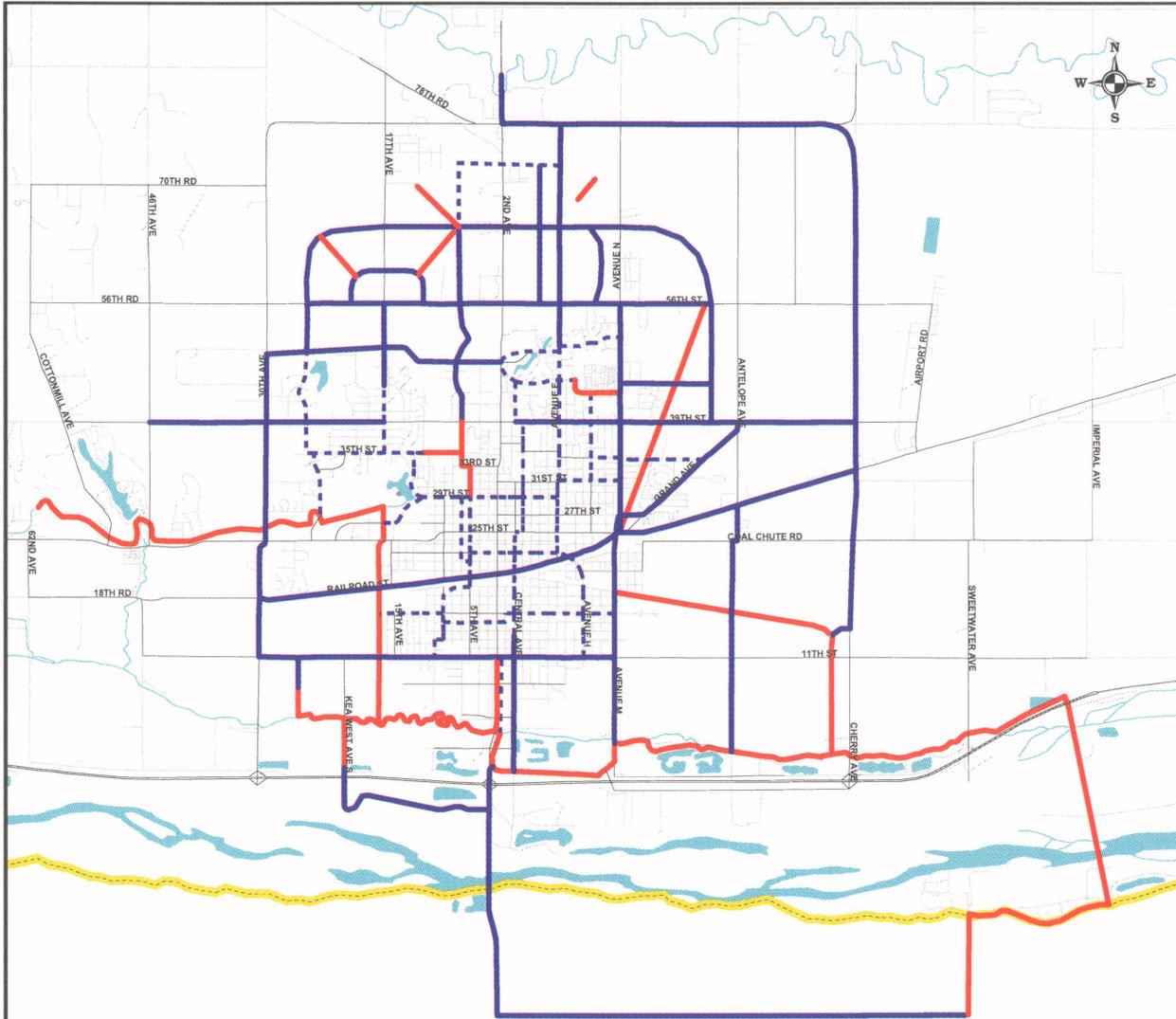
2004-2007	2008-2012	2013-2017	2018-2022
Cottonmill Trail completion	30 th Avenue	Burlington Trail	Bypass Trail
Railroad Trail to 5 th Avenue	Ted Baldwin Trail	Cherry Avenue Trail	Fort Kearney Trail via N-44 and L-50
M/N Avenue to 56 th Street	56 th Street Central	Lincoln Highway Trail	North Neighborhoods Trail
Harmon Park Trail	M Avenue South	Northside Parkway	
Harvey Park Connection	Union Pacific – 5 th Street to Avenue M	11 th Street / 39 th Street Segments	
1 st Phase of Share-the-Road (STR) System	Complete STR System		
Central Avenue			

5.3 Aviation

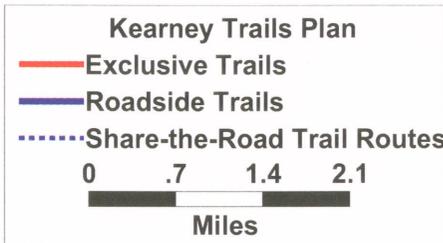
The Kearney airport has completed two recent plans for airport and air facilities development. These two plans are:

- 2001 Airport Property Development Plan
- 2002 Kearney Airport Master Plan

These plans include a complete set of improvement projects to the airport property. These airport property improvements will impact surrounding streets and highways. Development will create the need for new intersections with US Hwy. 30 and Cherry Avenue in response to the planned East Kearney Bypass. The UPRR spur will also need to be extended to accommodate runway extensions and industrial development. Industrial park development on airport property is planned for FY 2005 to FY 2010.



Source: THE KEARNEY PLAN
(RDG Planning & Design, 2003)



CITY OF KEARNEY	
<i>Transportation Plan Update</i>	
Kearney Trails Master Plan	
 <small>OLSSON ASSOCIATES ENGINEERS • PLANNERS • SCIENTISTS • SURVEYORS</small>	Figure 5-1

The 2002 Kearney Airport Master Plan describes about \$17 million in numerous airport projects and airport property developments. Major projects from that list (\$1,000,000+) include:

- Construct a new terminal building (2000-2005)
- Overlay runway 13/31 (2000-2005)
- Industrial park development (2005-2010)
- Overlay asphalt pavement on runway 18/36 (2010-2020)
- Construct access to Cherry Avenue (2010-2020)

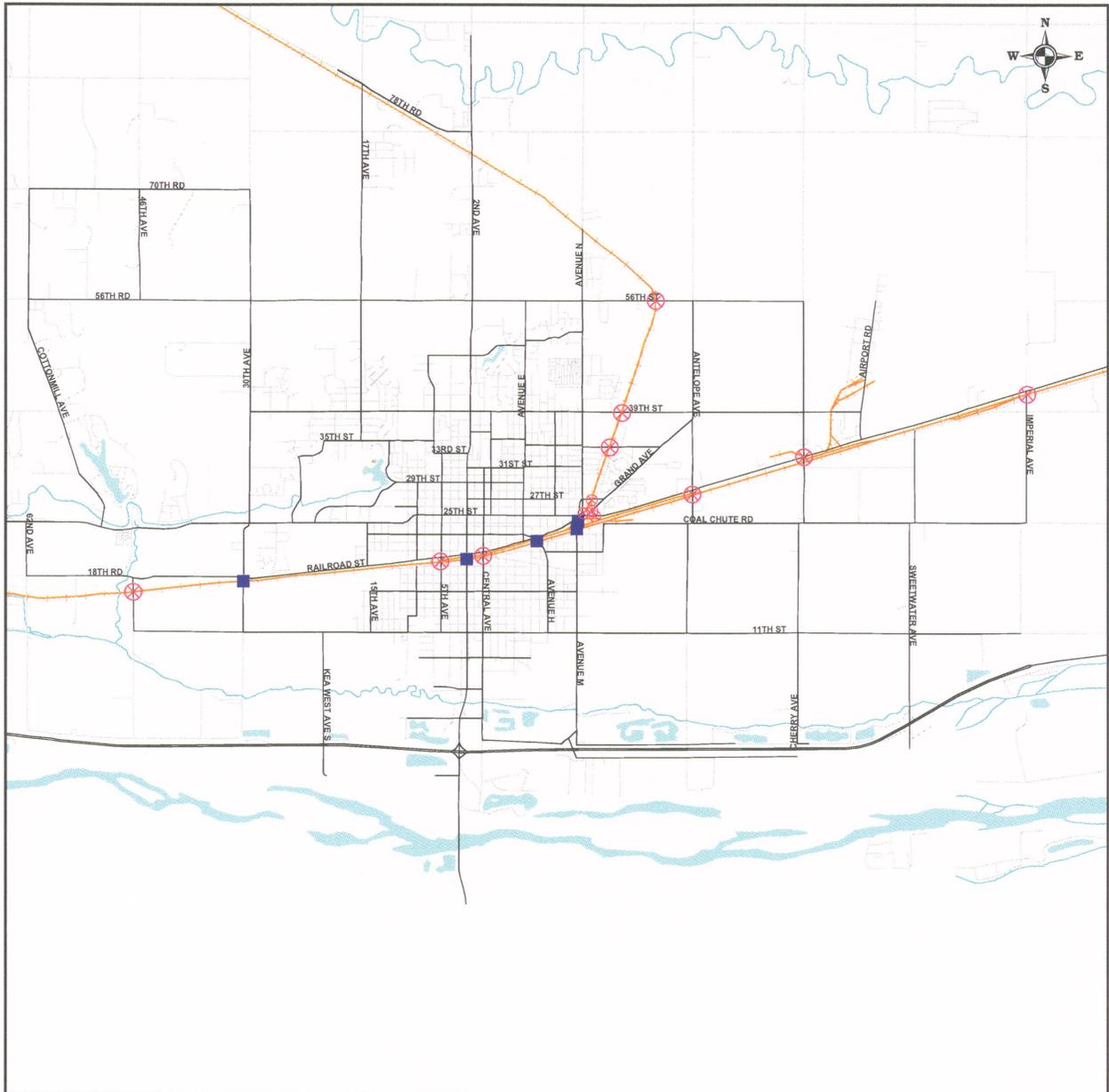
5.4 Railroads

The Union Pacific Railroad (UPRR) main line crosses east/west through the City of Kearney bisecting the town in two areas north and south of the tracks. A Union Pacific Spur currently runs from Kearney northwest to the City of Arnold, Nebraska. The spur begins near Avenue N and 25th Street and travels northeast, crossing 56th Street between Avenue N and Antelope Avenue. It is planned to abandon the spur from just south of 56th Street to the City of Arnold.

Within the limits of the study area, there are currently six at-grade and four grade-separated crossings of the UPRR main line and nine at-grade crossings of the UPRR spur. However, the existing at-grade crossing at Cherry Avenue will be replaced with a railroad viaduct as part of the Cherry Avenue interchange and east bypass project. The existing viaduct and at-grade railroad crossing locations in Kearney are illustrated in Figure 5-2.

On the west side of City, the 30th Avenue and the 2nd Avenue structures are about 2 miles apart with only one other at-grade crossing (5th Avenue) in that distance. The City has studied locations for another grade separation in this part of Kearney. These studies show there is need to facilitate north-south traffic flow to reduce delay caused by UPRR trains. UPRR estimates the number of trains will continue to increase to about 130 trains per day. These frequent and long trains will make existing at-grade crossings extremely unreliable for delivery of police, fire and ambulance services and nearly unusable for routine travel. General consensus exists concerning the need for an additional grade separation but not for the location.

The Federal Highway Administration recommends grade separations be considered when the crossing exposure (the product of the number of trains per day and the annual average daily traffic) exceeds 1,000,000. Two existing at-grade crossings are approaching this threshold: 5th Avenue (2002 AADT = 6310, exposure index at 130 trains = 820,300) and Central Avenue (2002 AADT = 6805, exposure index at 130 trains = 884,650). 25th Street (US Hwy. 30) crosses the UPRR Arnold Spur at two locations east of Avenue N. Due to the low train volume, a grade separation may not be feasible at this time at this location.



Existing Railroad Crossings

- ⊗ At-Grade Railroad Crossing
- Viaduct

0 .7 1.4 2.1

Miles

CITY OF KEARNEY	
<i>Transportation Plan Update</i>	
Existing Railroad Crossings	
 <small>OLSSON ASSOCIATES</small> <small>ENGINEERS • PLANNERS • ARCHITECTS • SURVEYORS</small>	Figure 5-2

As population in Kearney continues to grow, traffic delay associated with at-grade rail crossing will also continue to grow. Rail-highway crossing improvements should focus on reducing traffic delays and increasing the number of reliable alternative routes for emergency services. Increasing the number of grade-separation structures and reducing the number of at-grade crossings can accomplish these goals.

Mid-Term Projects (Six to 15 years):

- Railroad grade separation structure
 - Develop consensus for grade separation in southwest part of Kearney between 2nd Avenue and 30th Avenue.
 - Complete environmental studies and preliminary engineering
 - Complete final design
 - Complete construction
- Railroad grade separation structure
 - Develop consensus for new separation structures in the vicinity of 5th Avenue or Central Avenue.
 - Complete environmental studies and preliminary engineering
 - Complete final design
 - Complete construction
- Implement cost-effective elements of the Intelligent Transportation Systems plan to mitigate railroad-highway intersection delay.
- Develop plan for use of Intelligent Transportation Systems (ITS) to detect trains and route traffic around blocked at-grade crossings. ITS could also be used by emergency service dispatchers to provide optimal routing of vehicles to emergency locations.

Long-Term Projects (16 to 25 years):

- Railroad grade separation structure
 - Develop consensus for grade separation at Antelope Avenue
 - Complete environmental studies and preliminary engineering
 - Complete final design
 - Complete construction

5.5 Traffic Operations and Intelligent Transportation Systems

The Nebraska Department of Roads (NDOR) has installed and maintains 23 signals in the Kearney study area. The City owns 22 signals for a total of 45 signals. These traffic signal locations are illustrated in Figure 3-5.

All but three traffic signals use Type 170 controllers, which are commonly used by NDOR on state routes. The remaining signals operate with NEMA controllers. The three NEMA controllers are located at the intersection of 25th Street with 5th Avenue, Avenue E and Avenue G.

Two groupings of signals are fully or partially interconnected with wire communications and intended to provide coordinated progression between signals. However, time-based coordination is thought to be functioning along these corridors despite the presence of hardwire connection. These road segments are shown in Figure 3-5. Time-based coordination is being used because the communication wires on US Hwy. 30 (25th Street) between Avenue A and Avenue G are believed to be non-functional. There are also several other potential non-functioning or unreliable areas on 2nd Avenue due to past construction cuts or other possible damage. All other signals are operating on fixed-time-of-day timing plans. Cross streets have vehicle detection.

Both NDOR and the City perform traffic signal system maintenance. NDOR performs all maintenance of the traffic signal controllers including updating of timing plans. NDOR rates overall signal maintenance as “good” or better. NDOR has scheduled replacement of the NEMA traffic signal controllers. NDOR is also planning to change their standard from Type 170 to 2070 controllers.

The 2003 public opinion survey identified a number of common themes regarding traffic signals. These themes included:

- Need better signal coordination on 25th Street and on 2nd Avenue.
- Signal cycles seem too long, and there is no side-street green time.
- Need traffic signals at 39th Street and 11th Avenue and at 31st Street and Avenue E.
- Need signal modifications including left-turn arrows at: 25th Street and Avenue E; 25th Street and Avenue H; 2nd Avenue and K-Mart entrance (33rd Street).

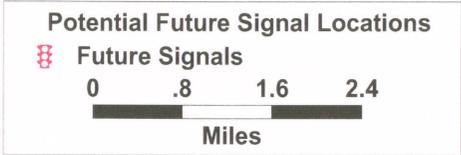
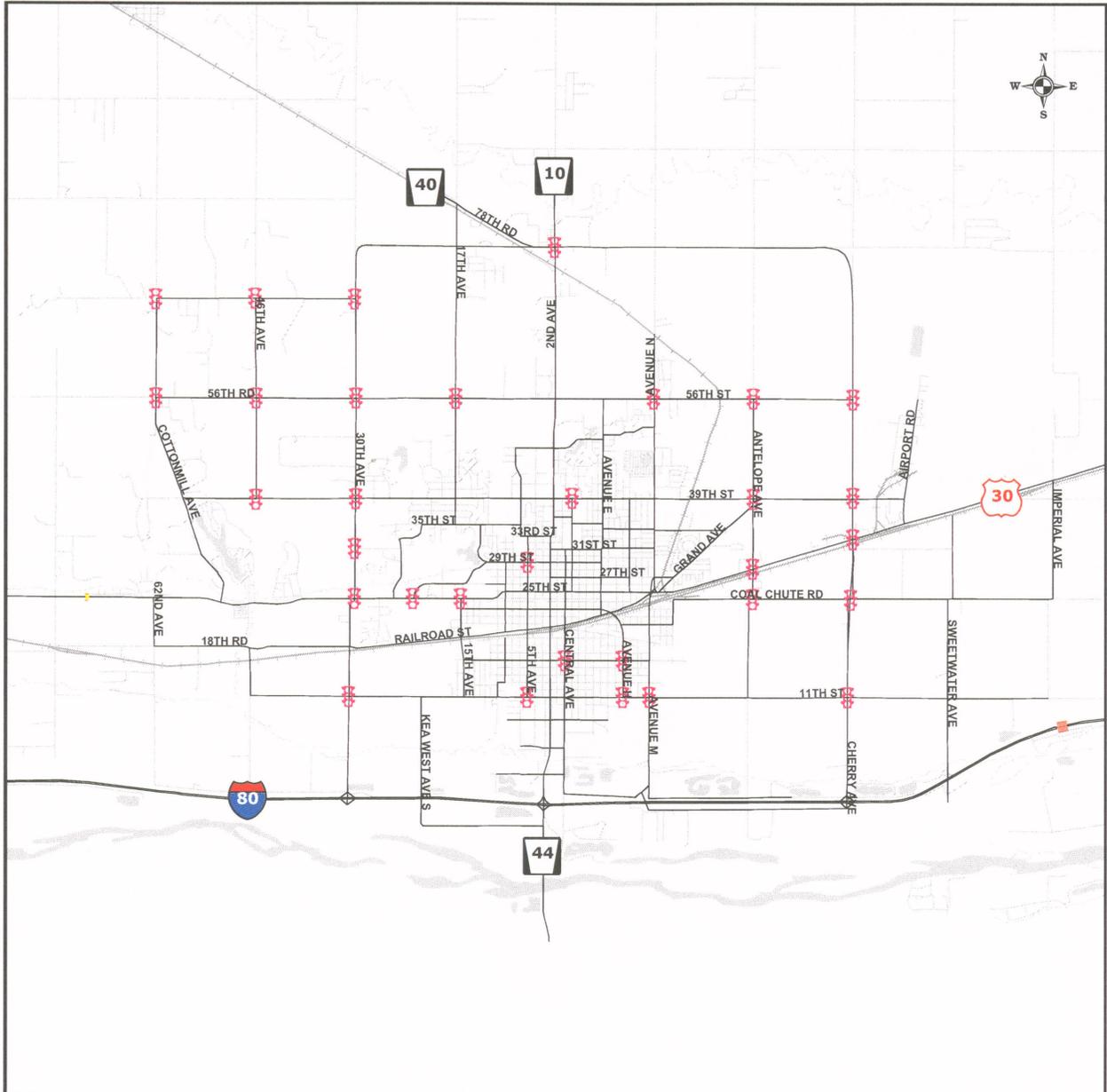
Traffic signal timing and coordination is one of the most cost-effective traffic improvements that can be made. According to the Institute of Transportation Engineers, updating timing plans can have a benefit to cost ratio ranging from 20:1 to 58:1 for fuel savings alone. Areas growing as fast as Kearney should consider upgrading traffic signal timing at least every three years. Timing and coordination upgrades would benefit traffic on 2nd Avenue, Hwy. 30 (24th/25th

Street) and 39th Street, especially where traffic signals are spaced one-quarter mile or closer.

Based on the public opinion survey and field review, some of the Kearney signalized intersections, such as 2nd Avenue and 25th Street, are throughout the day. Others are only busy during peak periods. These latter signals experience much less traffic during non-peak periods. There is a need for more traffic responsive signal systems. Traffic responsive signals can adapt to changing traffic and can be used for coordinated signals as well as isolated signals. Demand responsive, isolated signals are typically addressed by traffic detection on the cross street. Demand responsive, interconnected and coordinated signals require both main street and cross street detection and use of advanced control software.

An alternative to a traffic responsive traffic signal system is a centrally controlled traffic signal system. A central system allows a traffic technician to monitor signal operations from an operations center, commonly called a traffic operations center or TOC. The technician can monitor traffic signals; receive real-time alerts about signal performance and maintenance issues; perform remote diagnostics; and select peak, event or incident timing plans based on traffic conditions. The TOC traffic technician often uses supplementary systems such as traffic “system detectors,” traffic monitoring cameras, and dynamic message signs (DMS), to improve overall system performance and response. The City of Kearney could form their own TOC staffed with traffic technicians who could be available throughout the day and during special events. NDOR is planning a District Operations Center (DOC) in Grand Island. That center could serve as a backup to a City of Kearney TOC for emergencies and times when the City of Kearney TOC is not staffed. Under the proposed NDOR plan, the State of Nebraska TOC in Omaha would be the backup for the DOC in Grand Island.

Possible future traffic signal locations based strictly on planning level recommendations and expected travel patterns are illustrated in Figure 5-3. These assumptions also took into account the recommendations proposed in this report. These locations are by no means final and no traffic signal should be installed in the future without first conducting a signal warrant analysis. Generally, signals should be expected at all arterial/arterial intersections. Signal spacing standards of ½-mile along all highways and ¼-mile along other arterials and should be followed. Additionally, no more than two (ideal) or three signals per mile should be placed at intersections of major collectors and local roadways. Desirable signal spacing standards should be strictly adhered to with regard to any proposed/future signal locations.



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Planning Level Future Traffic Signal Locations	
 <small>OLSSON ASSOCIATES</small> <small>ENGINEERS • PLANNERS • ARCHITECTS • CONSTRUCTORS</small>	Figure 5-3

The Kearney public transportation system consists primarily of R.Y.D.E. Transportation. It may be possible to improve transit performance by providing priority at some traffic signal systems, especially during periods of peak demand. This strategy would need to be coordinated with City and NDOR staff for impacts to vehicle flow.

Several possible traffic signal improvement projects have been identified. These projects would reduce delay and improve overall efficiency on main arterial roadways in Kearney.

Recommended Short-Term Projects (Zero to Five years):

- Collect data and upgrade traffic signal timing plans on 2nd Avenue and on 25th Street. This includes coordination of signals. This will be completed as Phase II of this project.
- Upgrade NEMA controllers to NDOR standard Type 170 or 2070 controllers.
- Be an involved Stakeholder in NDOR District 4 District Operations Center functional requirements development and preliminary systems design.
- Conduct a feasibility study of City of Kearney Transportation Operations Center and Arterial Traffic Management System.
- Conduct a feasibility study of transit signal priority for R.Y.D.E. Transportation for both demand responsive and fixed route transit.
- Perform signal warrants analysis for new signal locations throughout Kearney.

Recommended Long-Term Projects (Six to 15 years):

- Upgrade traffic signal timing plans at least every three years.
- Upgrade traffic signal controllers to latest NDOR standard controller hardware and software.
- Design and build new warranted traffic signals.
- Design and build Kearney Traffic Operations Center, Arterial Traffic Management Systems, and Transit Signal Priority System in coordination with NDOR and RYDE. Possible sources of funding for this improvement include FTA and FHWA.

6.0 ACCESS MANAGEMENT POLICY

This chapter details the recommended access management guidelines to be adopted by the City of Kearney. Access management is characterized as the strategic provision of access along streets. It includes the systematic control of the location, spacing, design, and operation of street and driveway connections to a roadway. Access management should be a priority along all arterial streets. In addition, continuous collector roadway networks should be developed to supplement the arterial roadway system.

The following standards reflect criteria applicable to the location and design of access points and more than one criterion may apply to any condition. These standards are applicable to new development and should be utilized for existing areas and roadways to the greatest extent practicable. Consideration should be given to driveway consolidation, relocation and on-site connectivity where possible.

6.1 Traffic Signal Spacing

Future traffic signals on principal arterials should be planned for spacing at ½-mile intervals. All other arterial roadways should allow for signalized intersection spacing at no less than ¼-mile intervals per City standard.

6.2 Median Break Spacing

Median breaks, and allowances for them, are an important component of access management. The following guidelines should apply to the design and control of median breaks.

- No median breaks on arterial roadways should be allowed within 1,000 feet of an interchange.
- Full median break access can be allowed where traffic signals, if installed at some point in the future, would be adequately spaced from adjacent traffic signals.
- Non-signalized median breaks on divided principal arterials should be spaced at ¼-mile intervals and 1/8-mile intervals along other arterial roadways.

6.3 Private Driveways

A key access management issue is the location and type of access driveways on the street network. The guidelines listed below should be incorporated for all planned access drives. For existing driveways, consideration should be given to eliminate, consolidate and improve separation of drives to the extent possible. These guidelines will allow for safer and more efficient traffic flow.

- Direct driveway access should not be allowed on future principal arterial roadways.

- Residential driveway access should not be allowed on all arterial roadways and should be limited to the extent possible on collector roadways.
- Non-residential driveway access should not be allowed within an intersection influence area. An intersection influence area is defined as within 500 feet of an intersection along an arterial roadway, and within 300 feet of an intersection along a collector roadway.
- Spacing between driveways should be kept at a minimum of 300 feet and preferably 400 feet.
- Driveways that may potentially produce traffic volumes that would warrant signalization shall be located to satisfy the traffic signal spacing requirements.

6.4 Street Spacing

All future major arterial roadways should be planned for at no less than one-mile intervals. Future collector roadways should be planned for at ½-mile (no closer than 1/3-mile) spacing along primary roadways wherever possible throughout Kearney. This separation of future roadways will ensure that adequate spacing will exist between major intersections.

In addition, proposed major commercial access locations and other cross street approaches should be planned to accommodate a minimum of four lanes (one inbound and three outbound) in the event that signalization would be needed. This would allow for a left, through, and right-turn lane at the side street approaches.

7.0 RECOMMENDED TRANSPORTATION PLAN

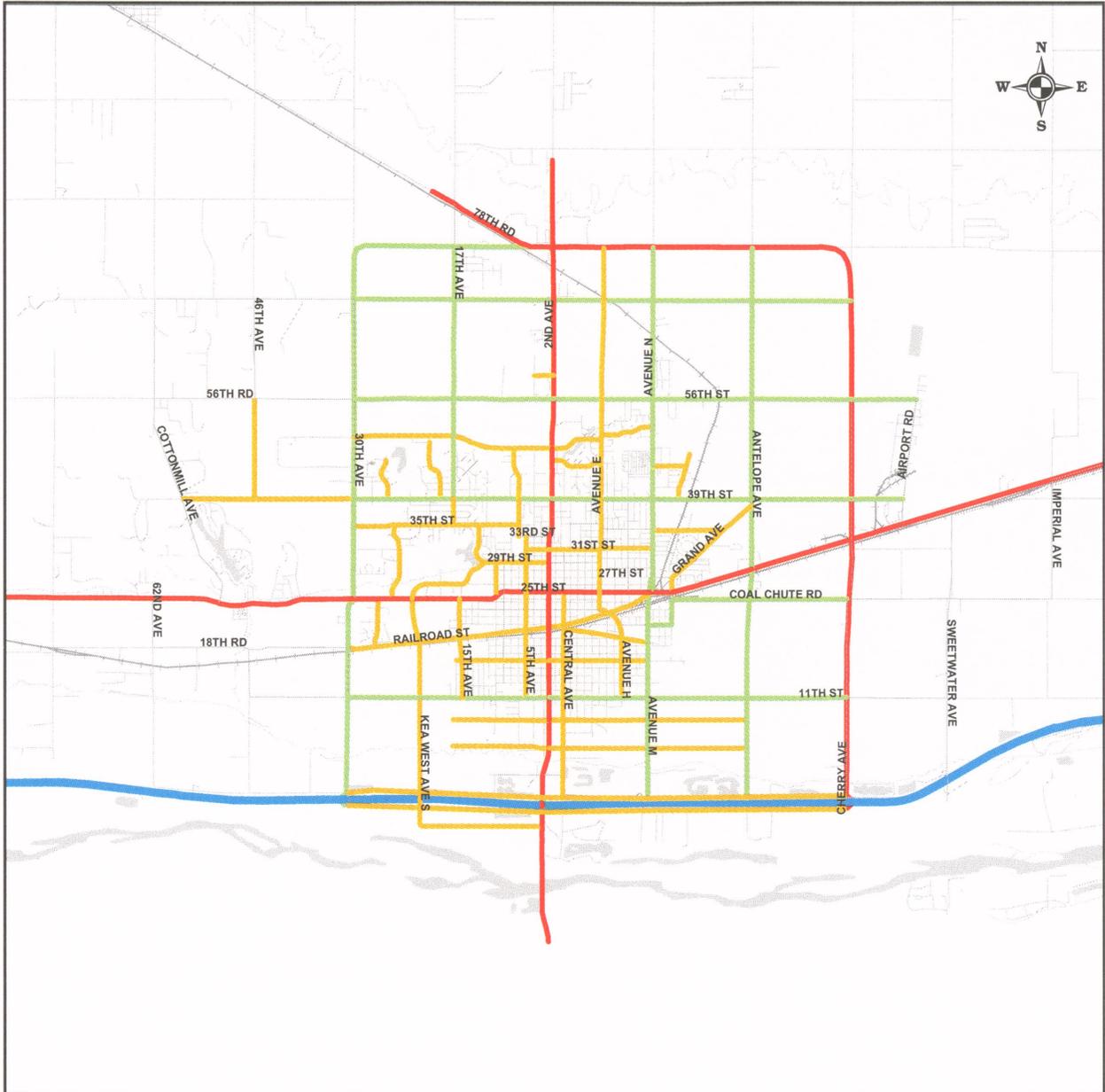
This chapter includes the recommended long-range transportation plan for the City of Kearney. The plan focuses on roadway, transit, and ITS improvements. Recommended trails and aviation improvements were summarized in Chapter 5.0 based on information obtained from the City's trails and airport master plans, respectively.

The recommended future functional classification map for the City is illustrated in Figure 7-1. The functional classification of several roadways has been upgraded based on projected traffic volume growth and the intended future function of the roadway. The roadway classification types used by the NDOR in the existing functional classification map have been maintained in the future map.

7.1 Long-Range Transportation Plan (LRTP)

Recommended transportation improvements have been identified and divided into short-term (0 – 5 years), mid-term (6 – 15), long-term (16 – 25 years) and on-going time frames. These improvements are summarized in Tables 7-1, 7-2, 7-3 and 7-4 and illustrated in Figures 7-2, 7-3 and 7-4. Opinions of cost are included for each recommendation. This opinion of cost includes cost of construction (based on 2004 prices), including special conditions that may exist for a particular project (ie. traffic signals, lighting, structures). Right-of-way costs are not accounted for in these opinions of cost. Recommendations with multiple locations have opinions of cost for one location only, unless otherwise noted.

Note that there are numerous recommendations regarding widening of existing 2-lane roadway sections, paving of gravel roadways and construction of new roadways. Although traffic volumes may not warrant such an improvement for many years, it is important that these corridors be included in the Transportation Plan for right-of-way preservation and to provide important planning information to the community.



Functional Classification

- Interstate
- Principal Arterial
- Minor Arterial
- Collector

0 .8 1.6 2.4
Miles

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<i>Transportation Plan Update</i>	
Future Functional Classification	
 <small>DLSSON ASSOCIATES ENGINEERS • PLANNERS • SCIENTISTS • SURVEYORS</small>	Figure 7-1

A list of immediate recommendations has also been identified as part of the transportation plan. This list is made up of projects from the short-term, mid-term, long-term and on-going recommendations lists. The list is compiled of projects that are either low-cost, important for improved operations and safety and/or recommended by City staff. It should be noted that no opinions of cost are included in this list. However, these opinions of cost can be found in Tables 7-1, 7-2 and 7-3. The following is a list of immediate recommendations that should be pursued by the City of Kearney:

- Conduct an access management study along the 24th/25th Street (Highway 30), 2nd Avenue (Highways 10 & 44) and all other urban and rural arterial roadways, especially in underdeveloped regions. The results of this study will provide potential capacity and safety improvements and develop a corridor access management plan.
- Complete geometric/stripping modifications to improve left-turn lane alignment and improve intersection operations. This improvement is needed at numerous intersections in the City of Kearney Roadway Network. Examples include: Hwy. 30/Avenue A, US Hwy. 30/Central Avenue, US Hwy. 30/Avenue E, 29th Street/5th Avenue and 16th Street/2nd Avenue.
- Close median openings where no left-turn lanes are provided. Alternative options include removing the median and constructing a 5-lane section or dividing the roadway and constructing left-turn lanes in the median. These openings exist along Highway 30 at the following locations: 3rd to 4th Avenues, Ave. B to Ave. D, Ave. I to Ave. L. A median opening without left-turn lanes also exists along 2nd Avenue between 35th and 37th Streets.
- Replace 8-inch ball signal heads with 12-inch ball heads along all arterial roadways. The intersections of 25th Street/5th Avenue and 25th Street/Avenue E were locations noted during the field review but others may exist.
- Re-stripe all existing 48' curb and gutter roadway sections currently striped for two-lane travel to 4-lane roadways. This will include removing existing on-street parking along these roadways.
- Implement speed limit recommendations from Phase II of the Kearney Transportation Plan Update project.
- Implement signal timing and related geometric improvement recommendations from Phase II of the Kearney Transportation Plan Update project.
- Geometric improvement of the Highway 30/UNK Drive intersection to reduce access points and driver confusion while improving safety.
- Upgrade traffic signal controllers at the intersections of 25th Street with 5th Avenue, Avenue E and Avenue G to Type 170 controller hardware and software.
- Re-stripe Central Avenue between 12th Street and 16th Street as a 3-lane section with two-way center left-turn lane.

**Table 7-1
Recommended Short-Term (0 - 5 years) Transportation Improvements**

Project Number	Location	Project Description
1.	24th/25 th Street (Highway 30), 2 nd Avenue (Highways 10 & 44) and all other urban and rural arterial roadways, especially in undeveloped regions	Access management study to determine potential capacity and safety improvements and develop a corridor access management plan. Opinion of Cost: \$25,000 - \$50,000
2.	This improvement is needed at numerous intersections in the City of Kearney Roadway Network. Examples include: <ul style="list-style-type: none"> • US Hwy. 30/Avenue A • US Hwy. 30/Central Avenue • US Hwy. 30/Avenue E • 29th Street/5th Avenue • 16th Street/2nd Avenue 	Geometric/Striping modification to improve left-turn lane alignment and improve intersection operations. Opinion of Cost: \$10,000 - \$50,000 (dependent on signal needs)
3.	This improvement is needed at numerous intersections in the City of Kearney Roadway Network. Examples include: <ul style="list-style-type: none"> • US Hwy. 30/15th Avenue • US Hwy. 30/Avenue I • 31st Street/Avenue E • 34th Street/Avenue E • 34th Street/Avenue N 	Intersection improvement to align the currently offset legs of an intersection. Opinion of Cost: \$200,000 - \$300,000 (dependent on signal needs)
4.	Along Highway 30 at the following locations: <ul style="list-style-type: none"> • 3rd to 4th Avenue, • Ave. B to Ave. D, • Ave. I to Ave. L Along 2 nd Avenue at <ul style="list-style-type: none"> • 35th to 37th Streets 	Close median openings where no left-turn lanes are provided. Alternative options include removing the median and constructing a 5-lane section or dividing the roadway and constructing left-turn lanes in the median. Opinion of Cost: \$25,000 - \$100,000
5.	Intersection of: <ul style="list-style-type: none"> • 39th Street/2nd Avenue 	Major grading work to improve profile at this intersection. Opinion of Cost: \$1,000,000

Project Number	Location	Project Description
6.	Cherry Avenue interchange and East Bypass	Construct the Interstate 80 interchange at Cherry Avenue in conjunction with an East Bypass (Cherry Avenue and 78 th Street) around Kearney. Opinion of Cost: \$40,000,000
7.	Intersections of: <ul style="list-style-type: none"> • 25th Street/5th Avenue • 25th Street/Avenue E (these locations were noted during the field review but others may exist)	Replace 8-inch ball signal heads with 12-inch ball heads along all arterial roadways. Opinion of Cost: \$20,000 (dependent on wiring needs and other upgrade needs)
8.	Intersection of: <ul style="list-style-type: none"> • 25th Street/2nd Avenue 	Extend the eastbound and westbound left-turn lanes through the 1 st and 3 rd Avenue intersections, respectively, to reduce stacking problems. Opinion of Cost: \$200,000
9.	Cottonmill Park and Rolling Hills developments	Expand a 2-lane, paved rural roadway into the Cottonmill Park and Rolling Hills developments. This would include extending 39 th Street west to Cottonmill Avenue and 46 th Avenue south to 39 th Street. Opinion of Cost: \$5,400,000
10.	17 th Avenue – 39 th to 48 th Street, 11 th Street – 30 th Avenue to Avenue M, Avenue M – 11 th Street to UPRR viaduct	Re-stripe 48' curb and gutter roadway sections from existing two-lane roadway to a four-lane roadway. <u>Cost estimate included is for all three locations.</u> Opinion of Cost: \$100,000 - \$300,000 (dependent on signal needs and type of pavement marking removed and installed)

Project Number	Location	Project Description
11.	Roundabout Project - Potential roundabout locations include: <ul style="list-style-type: none"> • 31st Street/Avenue E • 34th Street/Avenue E • 35th Street/6th Avenue • 35th Street/17th Avenue 	Identify intersections to be improved to a roundabout (similar to 33 rd St./Central Avenue) to improve capacity or reduce accidents. Such a project would likely qualify for STP funding through NDOR. Opinion of Cost: \$250,000
12.	City of Kearney Roadway Network	Implement speed limit recommendations from Phase II of the Kearney Transportation Plan Update project. Opinion of Cost: To be determined

**Table 7-2
Recommended Mid-Term (6 – 15 years) Transportation Improvements**

Project Number	Location	Project Description
1.	Coal Chute Road – Antelope Avenue to Imperial Avenue	Intersection improvement to align the currently offset north/south legs of the intersections. Opinion of Cost: \$100,000
2.	Kea West Road – Between 2 nd Avenue and I-80 overpass	Connect Kea West Avenue between 2 nd Avenue and the existing segment south of I-80 overpass. Opinion of Cost: \$2,300,000
3.	UPRR at the following location: <ul style="list-style-type: none"> • Railroad Street to 16th Street 	Construct a railroad viaduct over the tracks connecting 15 th and 17 th Avenues. Opinion of Cost: \$4,000,000
4.	Intersection of: <ul style="list-style-type: none"> • Hwy. 30/UNK Drive 	Major geometric improvement of the entrance/exit drives to reduce access points and driver confusion while improving safety. Opinion of Cost: \$300,000
5.	62 nd Avenue – from Hwy. 30 to 56 th Street	Connect rural paved, two-lane section along 62 nd Avenue from Hwy. 30 to 56 th Street. This will include re-construction of a Cottonmill Avenue/62 nd Avenue Intersection. Opinion of Cost: \$3,600,000
6.	Archway Roadway at Avenue M	Reconstruct the I-80 Frontage Road/Avenue M intersection north of the Avenue M overpass. This could be coordinated with a programmed overpass reconstruction project by NDOR. Opinion of Cost: \$300,000

Project Number	Location	Project Description
7.	11 th Street - from 30 th Avenue to 1 mile west of 62 nd Avenue	Construct a 2-lane paved, rural roadway section from 30 th to 62 nd Avenues to allow for future growth. Extend gravel roadway to 1 mile west of 62 nd Avenue to prepare for future growth. This extension would require two bridge structures. Opinion of Cost: \$2,500,000
8.	4 th Street at the following locations: <ul style="list-style-type: none"> • 6th to 17th Avenues • Central to Antelope Avenues 	Construct a 36' curb and gutter roadway section. <u>Cost estimate included is for both segments.</u> Opinion of Cost: \$4,500,000
9.	8 th Street at the following locations: <ul style="list-style-type: none"> • 7th to 17th Avenues • Avenue H to Antelope Avenue 	Construct a 36' curb and gutter roadway section. <u>Cost estimate included is for both segments.</u> Opinion of Cost: \$4,000,000
10.	56 th Street - from 2 nd Avenue to 30 th Avenue	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$4,400,000
11.	39 th Street - from RR spur to Airport Road	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$4,400,000
12.	Avenue M - from 11 th Street to interstate frontage roads	Construct a 48' curb and gutter roadway section. Opinion of Cost: 2,200,000
13.	50 th Street - from 17 th Avenue to 30 th Avenue	Construct a 36' curb and gutter roadway section. Opinion of Cost: \$2,000,000
14.	Hwy. 30 - from Antelope to Imperial Avenue	Widen Hwy. 30 to 4-lane roadway per NDOR standards. Opinion of Cost: \$10,500,000

Project Number	Location	Project Description
15.	Central Avenue - from 12 th to 16 th Streets	<p>Re-stripe as 3-lane section with two-way center left-turn lane.</p> <p>Opinion of Cost: \$19,000 (dependent on type of pavement marking removed and installed)</p>
16.	30 th Avenue interchange and West Arterial Loop	<p>Conduct environmental and feasibility studies for an Interstate 80 interchange at 30th Avenue in conjunction with a West Arterial Loop system (30th Avenue and 78th Street) around Kearney.</p> <p>Opinion of Cost: \$150,000</p>

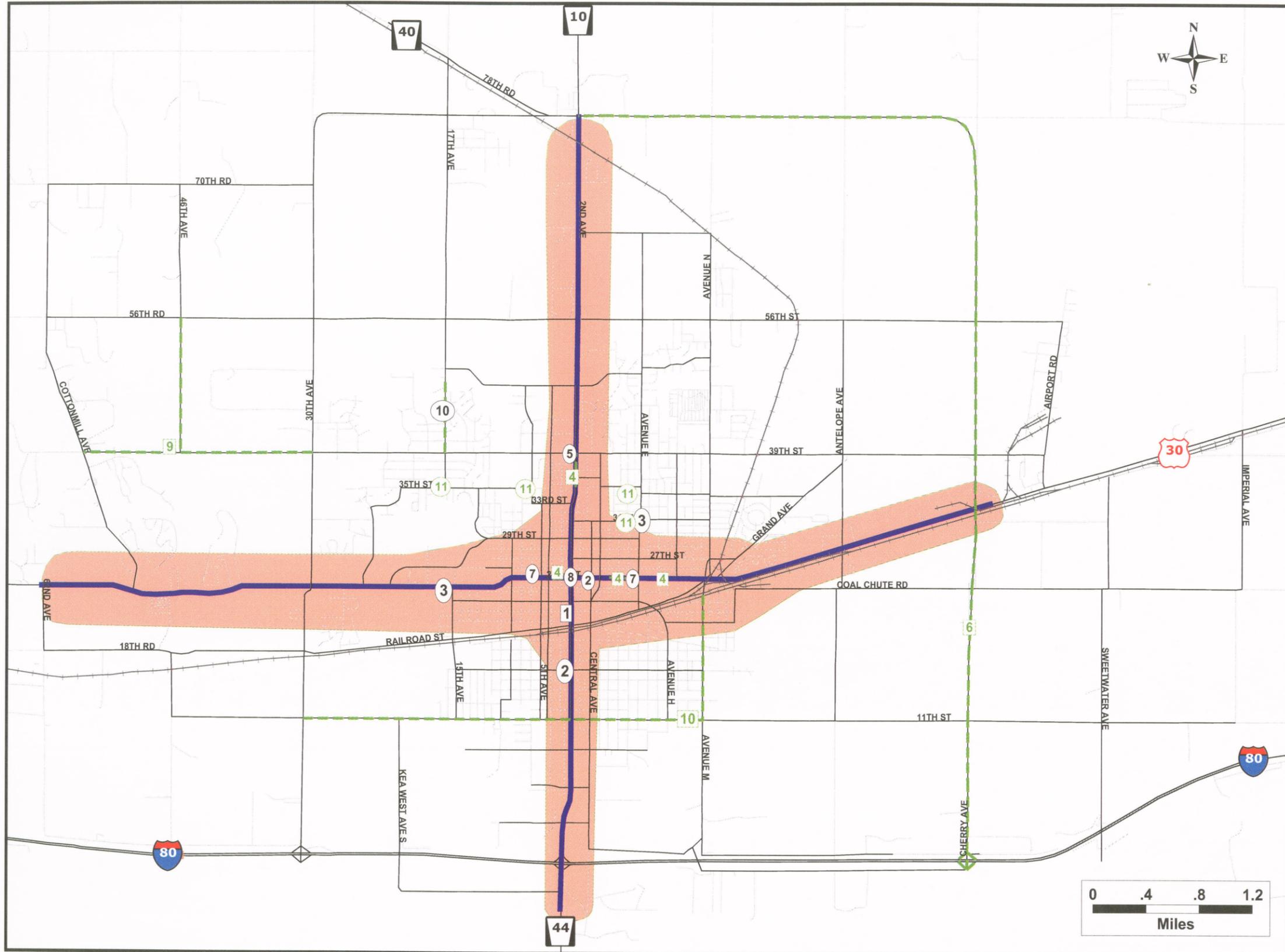
**Table 7-3
Recommended Long-Term (16 – 25 years) Transportation Improvements**

Project Number	Location	Project Description
1.	30 th Avenue interchange and West Arterial Loop	Design and construct the Interstate 80 interchange at 30 th Avenue in conjunction with a West Arterial Loop system (30 th Avenue and 78 th Street) around Kearney. Opinion of Cost: \$36,000,000
2.	Along Interstate 80 in south Kearney from 62 nd Avenue to Cherry Avenue	Construct a continuous frontage road system along the north and south sides of Interstate 80. Development along this road would need to be monitored and controlled due to environmental issues. Opinion of Cost: \$3,500,000
3.	Antelope Avenue - from Hwy, 30 to interstate frontage roads	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$2,750,000
4.	Kea West Avenue - from 11 th Street to Hwy. 30	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$2,200,000
5.	17 th Avenue - from 56 th to 78 th Streets	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$4,400,000
6.	62 nd Avenue - from Hwy. 30 to interstate frontage roads	Construct a 2-lane paved, rural roadway section. Opinion of Cost: \$2,250,000
7.	46th Avenue at the following locations: <ul style="list-style-type: none"> • 56th to 78th Streets • 18th Street to interstate frontage roads 	Construct a 2-lane paved, rural roadway section. <u>Cost estimate included is for both segments.</u> Opinion of Cost: \$5,400,000
8.	18 th Street - from 30 th Avenue to 62 nd Avenue	Construct a 2-lane paved, rural roadway section. Opinion of Cost: \$3,600,000

Project Number	Location	Project Description
9.	70 th Street - from 30 th Avenue to Cherry Avenue	Construct a 2-lane paved, rural roadway section. Opinion of Cost: \$9,250,000
10.	Avenue E - from 56 th Street to 78 th Street	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$3,300,000
11.	Avenue N - from Bel-Air Drive to 78 th Street	Construct a 48' curb and gutter roadway section. Opinion of Cost: \$2,200,000
12.	5 th /6 th Avenue - from 11 th to 48 th Streets.	Re-stripe as 3-lane section with two-way center left-turn lane. Opinion of Cost: \$160,000 - \$300,000 (dependent on signal needs and type of pavement marking removed and installed)
13	Avenue E – from Railroad Street to 56 th Street	Re-stripe as 3-lane section with two-way center left-turn lane. Opinion of Cost: \$150,000 - \$300,000 (dependent on signal needs and type of pavement marking removed and installed)
14.	UPRR at Antelope Avenue	Study, Design and Construct a UPRR viaduct at Antelope Avenue. Opinion of Cost: \$4,000,000
15.	Grand Avenue north of Highway 30	Reconstruct Grand Avenue with a smooth transition into Avenue Q to improve intersection spacing, roadway safety and overall traffic operations. Opinion of Cost: \$200,000
16.	UPRR at the following locations: <ul style="list-style-type: none"> • 5th Avenue • Central Avenue 	Conduct engineering and environmental studies for a new railroad viaduct. Opinion of Cost: \$120,000

**Table 7-4
On-Going Transportation Improvements**

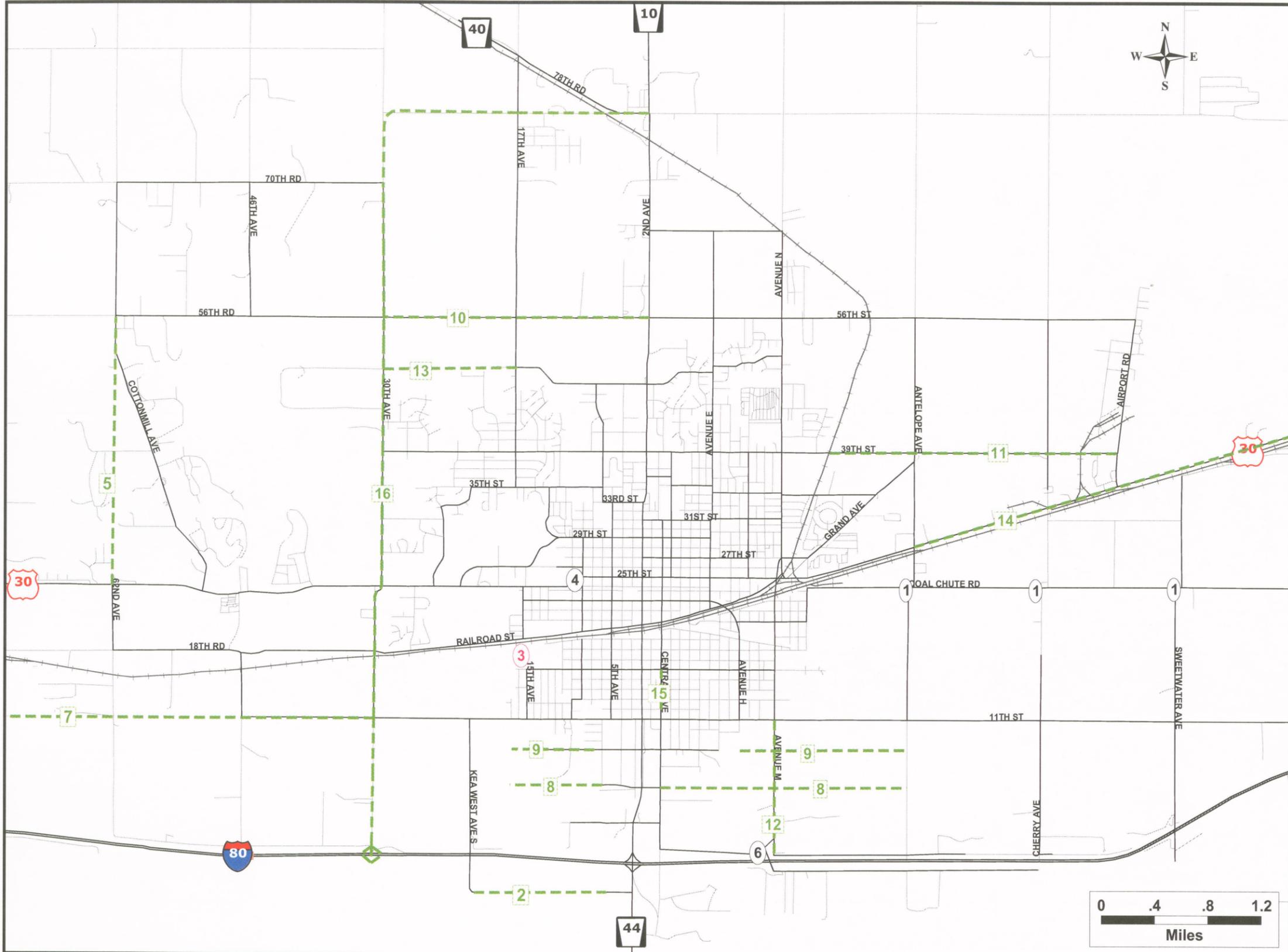
Project Number	Location	Project Description
1.	Intersections throughout Kearney that are along arterial or major collector roadways and serve large volumes of traffic (not limited to signalized intersections only). Examples include: <ul style="list-style-type: none"> • 24th Street/Univ. Drive • 39th Street/Avenue E 	Conduct peak-hour turn movement counts every 2-3 years to determine if geometric improvements are needed or if a signal or other traffic control improvements are warranted at that location.
2.	Intersections throughout Kearney that are along arterial or major collector roadways.	Construct traffic signals as required at intersections that satisfy signal warrants based on warrants outlined in the MUTCD.
3.	Traffic Signal Coordination	Update timing plans along 2nd Avenue, Hwy. 30, and other key arterial roadways at least every three years.
4.	24th/25 th Street (Highway 30), 2 nd Avenue (Highways 10 & 44) and all other urban and rural arterial roadways, especially in underdeveloped regions	Implement findings of the access management study along these corridors.
5.	Traffic Signal Controller Upgrade at all signalized intersections	Upgrade traffic signal controllers to latest NDOR standard controller hardware and software.
6.	Roundabout Projects	Based on success of previous projects, identify additional intersections to be improved to a roundabout to improve capacity or reduce accidents. Such a project would likely qualify for STP funding through NDOR.



- Legend:**
- 1 Access Management Study
 - 2 Intersection Improvements
 - 6 Roadway Improvements
 - 11 Potential Roundabout Improvement

Note:
Improvement numbers in this figure correspond to the detailed descriptions in Table 7-1.

CITY OF KEARNEY	
<i>Transportation Plan Update</i>	
Recommended Short-term Transportation Improvements	
 OLSSON ASSOCIATES <small>ENGINEERS • PLANNERS • SCIENTISTS • SURVEYORS</small>	Figure 7-2



Legend:

- ① Intersection Improvements
- ② --- Roadway Improvements
- ③ Railroad Viaduct

Note:
Improvement numbers in this figure correspond to the detailed descriptions in Table 7-2.

CITY OF KEARNEY	
<i>Transportation Plan Update</i>	
Recommended Mid-term Transportation Improvements	
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Legend:

- 1 --- Roadway Improvements
- 5 () Viaduct

Note:
Improvement numbers in this figure correspond to the detailed descriptions in Table 7-3.

CITY OF KEARNEY	
<i>Transportation Plan Update</i>	
Recommended Long-term Transportation Improvements	
 <small>OLSSON ASSOCIATES</small> <small>ENGINEERS • PLANNERS • SCIENTISTS • SURVEYORS</small>	Figure 7-4

In addition to the specific transportation recommendations, the following general transportation system recommendations are provided:

- Corridor preservation should be a priority for all future roadways classified as collector or above to ensure adequate right-of-way is reserved for future roadway construction and/or widening. Typically, at least 100 feet of right-of-way should be preserved for major arterial roadways, 80 feet of right-of-way for minor arterials and 66 feet of right-of-way for collector roadways. This will typically provide adequate width for the roadway, sidewalks/trails, utilities, and green space. However, more right-of-way may be needed in select locations. It is also a good practice to provide 120 feet of right-of-way within approximately 700 – 1000 feet on each approach of major arterial intersections to allow for dual left-turn lanes and exclusive right-turn lanes.
- Continuous collector roadway networks should be developed to supplement the arterial roadway system. In undeveloped areas, a collector roadway master plan should be developed to ensure dedication of right-of-way when development occurs and the ability to maintain continuity throughout the community.

7.2 Funding Evaluation

Various federal, state, and local funding sources could be considered for implementation of Kearney transportation improvements. Possible funding sources are discussed below:

- Federal Surface Transportation Program (STP) dollars. This program returns federal gas tax dollars to states on an annual basis. These funds can be used for improvements to any public roadway. The Nebraska Department of Roads allocates these funds to cities and counties and retains some for state use. It is expected this program will continue with the next federal transportation reauthorization legislation. Since Congress is debating Federal transportation funding, it is impossible to be sure of the outcome. All of the bills being considered by Congress include about 50% to 100% increase in most federal transportation funding categories.
- State Highway Dollars. The Nebraska Department of Roads collects state gas taxes for funding of improvements to the state highway system. These funds could be used for improvements to state highways in Kearney such as US Hwy. 30 and Nebraska Hwy. 10/44.
- Grade-Separation Dollars. The Nebraska Department of Roads collects a train-mile tax from railroads in the state. These funds are used to fund new grade-separation structures.
- Union Pacific Dollars. Union Pacific Railroad provides funding to communities closing at-grade highway-rail intersections. These funds could be used to construct new railroad grade-separation structures.
- State and Federal Airport Dollars: Funding generated from airport use taxes is available for airport maintenance and improvements.
- State and Federal Highway Safety Dollars: Funding is available for improvements at hazardous locations.
- Intelligent Transportation System (ITS) Dollars. Federal and state funds are frequently set aside for ITS projects to improve traffic and transit operations. Both FHWA and FTA administer these funds. Some state and local areas have obtained Congressional “earmarks” for specific ITS projects or programs.
- Transportation Enhancement Dollars: Federal programs exist for transportation enhancements such as trails.
- City Sales or Other Tax Dollars. The City has traditionally used some of its City taxes for transportation maintenance and operational improvements.
- Bonding Dollars. Many communities have used bonding to fund transportation improvements. A source of funding to repay the bonds is required.

As with most communities, the number of potential improvement projects far exceeds the funding that may be available for these improvements. Thus, it is critical that a recommended transportation plan be adopted so that available

funding sources can be explored and appropriate projects included in the State's Transportation Improvement Program (TIP).

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APPENDIX A

Public Survey Results

Complete List of Kearney Public Comments

Question 1: Identify the most important existing transportation system deficiencies (safety concerns, inadequate roadway capacity, roadway discontinuities, traffic signal progression, trails, transit, railroad crossings, etc.) in Kearney today. Be specific and note locations of roadways or intersections.

- No comment (6)
- No complaints

SIGNAL NEEDS

- Signal progression is insufficient along 2nd Avenue. Long queues and poor timing currently exist. (43)
- The M/N overpass needs light at the north exit and better signing describing lane uses. Need to get rid of stop sign on Avenue N going North. Traffic should not have to stop coming down off the overpass. (14)
- Need a stoplight at 5th Avenue and 29th Street because parked cars on 29th Street block sight distance. (7)
- Need left turn signals at 25th Avenue and Avenue E. (8)
- A signal should be located at 15th and Highway 30 for residents in mobile home and UNK pedestrian traffic. (3)
- Need left turn signals at 39th Street and Avenue E. (2)
- Need traffic light at Avenue E and 31st Street (2)
- East/West movements at 2nd Avenue and 29th Street is terrible. Movement delays on these approaches of 4-5 minutes. (2)
- The intersection of Highway 30 and Cottonmill Road should have speed bumps or a traffic light. The curves limit visibility and make it hard to see oncoming traffic. (2)
- The Hike and Bike trail that crosses 11th Street at the Yanney Park needs to have a Stop and Look and Wait sign or traffic signal. Witnessed to many near misses. (2)
- Left turn arrow needed at 56th Street and 2nd Avenue. (2)
- Need a pedestrian crosswalk with push button signal for children to cross at Avenue N and 34th Street.
- Traffic signal needed between 21st and 11th Street on Avenue E.
- Need 4-way stop or traffic lights at Central Avenue and 16th Street.
- The 25th Street and Central Avenue signal has stop bars on Central Avenue that need to be moved back at least 10 feet. Currently you have to move forward almost into intersection to make the light change.
- Signal is needed at Highway 30 and Country Club Lane.
- Left-turn arrow needed at 5th Avenue and 35th Street.
- Crosswalks on South 2nd Avenue by the motels.
- Trains at Peavey block intersections at 8 a.m. Should move trains in the middle of the night.

SAFETY CONCERNS

- Inadequate amount of traffic law enforcement (especially in enforcing speed limits. (7)
- Road at 2nd Avenue and 39th Street needs to be leveled from East to West. (6)
- Sight distance is restricted from the east at the intersection of 39th Street and Central Avenue due to shrubbery. (3)
- Additional lane is needed on Hwy 30 by Rolling Hills headed east due to dangerous curves and driver unfamiliarity with the roadway. (3)

- Safety concern is the NE Kearney “beltway” at 56th & Avenue N. They pass near Meadowlark, Sunrise, Northeast and Emerson schools where young children have to dodge traffic. **(2)**
- Need parking on only one side of Avenue E from Highway 30 to 56th Street. **(3)**
- Blind corner at 22nd Street and Avenue O needs a stop sign. Several accidents have occurred at this location in the past few years.
- Left-turn onto Highway 30 from Cherry or Antelope is very dangerous.
- At intersection of Railroad and Avenue I a sign blocks line of sight from the east.
- Intersection of 25th Street and Avenue I is not safe for westbound left-turners. A turn lane needs to be added due to lack of sight distance.
- 30th Avenue (north of Hwy 30) is very dangerous, especially when bikers/walkers are trying to use also.
- No speed limit posted on Avenue N going north of 56th Street by Eastbrooke. Many children live here and it is an accident waiting to happen because drivers are traveling very fast through this corridor.
- Speed limit along 56th Street once it reopens needs to be lowered.
- Excessive speeds by drivers on 35th Street. Could speed bumps be installed?
- On West 22nd Street between 9th and 12th Avenue there are no cross streets. This allows traffic to travel in excess of 35mph through the residential area and needs to be corrected.
- Need strobe lights or something similar on school crossing lights. People are not used to having these lights turn red especially during non-school hours.
- Excessive on-street parking throughout Kearney residential areas has become a safety concern.
- 9th Avenue and 25th Street is a confusing intersection.
- Pedestrian crosswalks needed along 11th Street.
- No east/west sidewalks all the way around the Emerson School Area. 27th Street, south side between Avenue D and Avenue E for instance.
- Pedestrian over or under crosswalks on Avenue E across from Emerson school.

CONSTRUCTION & IMPROVEMENTS

- At the intersection of 2nd Avenue and 48th Street no turn lanes exist to turn west from northbound or east from southbound. Also signal re-timing is needed there. **(6)**
- Manhole covers are rough and broken out and in need of maintenance throughout Kearney. Pot holes should be reported by police while on routes. **(3)**
- Extend the street west by the new water tower. **(4)**
- Need left-turn lanes on intersection of Highway 30 between Avenue N and 30th Avenue. **(3)**
- Widen interstate overpass at Kea Ave. and pave to Yanny Park and install paved road on south side of interstate connecting to arena road to divert traffic wanting to go west and also help w/arena event traffic flow. **(2)**
- Exclusive northbound/southbound exclusive right turn lanes at 39th Street and 2nd Avenue. **(2)**
- Exclusive east/west right-turn lanes at 39th Street and 17th Avenue. **(2)**
- A lane geometrics sign is needed on the mast arm at Avenue E, crossing Hwy. 30. The left-turn lane is not clearly marked.
- Stop sign on 39th St. on railroad tracks north of fairgrounds, put in crossing signals and smooth out crossing.
- Widen 30th Avenue north of Highway 30.
- Add a road connecting 17th Avenue and 2nd Avenue.

- Remove stop sign at the bottom of 5th Avenue by the Sertoma tennis courts. This will be a problem during the icy winter months.
- Remove stop signs for eastbound and westbound traffic at 17th and 35th.
- Keep stop signs for eastbound and westbound traffic at 17th and 35th after detours are ended.
- Level out the “hump” in the gravel parking lot at Baldwin. Approach was lowered with street, now hump can be graded out.

GENERAL COMMENTS

- Bypass around northern Kearney should run from Antelope Street on east and 78th on the north to pull truck traffic from residential streets. **(3)**
- 5th Avenue railroad crossing congestion due to trains stopping on tracks and is rough. **(4)**
- Drinking water faucets which are functional year round are needed every 1 to 2 miles along the trail from the college to Cottonmill Park.
- The bike way is too narrow under the railroad tracks. Two way traffic near impossible.
- Eliminate gravel roads throughout city, it makes Kearney look dumpy. **(3)**
- Too many semis in town.

Question 2: Please identify transportation system improvements (new roadways, widened roadways, new interchanges, overpasses, improved signal progression, new trails, improved transit service, better use of available technology, etc.) that should be considered as part of the transportation planning process to serve future traffic demand in Kearney.

- No Comment (31)
- No complaints

SIGNAL NEEDS

- Traffic light needed at Avenue E and 31st Street (2)
- Traffic light needed at Avenue N and base of 25th Street overpass. (2)
- Make the signals at 31st and Avenue A permanent and add left turn arrow. These lights have really improved traffic flow. (2)
- Left-turn signals at Hwy 30 Avenue E are needed.
- Need signal at 6th Avenue and 35th Street or one-way on 6th Avenue.
- Signal needed at 16th Street and Central Avenue because it is very busy and seems dangerous.

ADDITIONAL NEEDS

- Another interstate exit is needed off I-80. This is needed to eliminate congestion on current exit. (17)
- Look at creating secondary through routes between 30th-17th Ave/39th St. – 56th Street and a road from Airport Road (North end) west before subdivisions overtake these areas. Could move some traffic off 39th Street and may help in Industrial Development in that area. (8)
- Overpass is needed bad between 2nd and 30th Avenues. Overpass could be constructed around 15th Avenue. (6)
- Need additional means of egress from Rolling Hills/Equestrian Hill Subdivisions. Current single road presents a safety problem. (3)
- Improve trail systems and extend north of Kearney. (3)
- “Right turn lane only” signs needed at 2nd Avenue and 39th Street and has safety issues. (3)
- A new overpass should be constructed at Antelope Street. (2)
- Coal Shutte Road should be widened to four lanes and paved. (2)
- Pave the road on Avenue M (South of 11th & M to Archway Parkway). It currently has loose gravel and a fatality and several rollovers have occurred in the past few years. (2)
- Continue Country Club Lane to 39th Street. (2)
- Several areas through town where speed limits are not posted. (2)
- Need to fix 11th Street to handle heavy trucks. (Concrete is breaking in)
- Off-street parking at Ted Baldwin Field and sidewalk along 19th Avenue.
- Pave 9th Avenue, north of 13th Street to 14th Street.

GENERAL COMMENTS

- Questions whether railroad crossing at 5th Avenue should have closed, because emergency vehicle access is lost. The other available crossings are at 2nd and 30th Avenue. (3)
- 39th Street should not pinch down to 1 lane at fairgrounds. Overwhelming especially at peak. (3)
- Install an overhead east/west walkway on 29th Street and on either end of walkway place “Kearney....” Signs. (3)

- Retain 4-way stop at 35th Street and 6th Avenue. **(3)**
- Beltway traffic should be east of Glenwood corners 2 miles and then south to Hwy 30. Paving should be done for this because currently the gravel road is too rough.
- 11th Street and Central Avenue should go back to the 4-way stop that used to exist there.
- Lights should flash on I-80 when there's not an event at the Arena.
- Do not retain 4-way stop at 5th Avenue and 35th Street.
- Retain stop signs at 35th St. and 17th Avenue.
- Remove stop signs at 35th St. and 17th Avenue.
- Keep bicycles off of the streets or ticket the riders for non-compliance of traffic laws.
- Think Avenue M overpass would have been better if placed 5 or 6 blocks east of its current location.

Question 3: Please identify land use planning issues that should be addressed as part of the transportation planning process. Land use planning directly impacts the transportation system because land uses (stores, schools, parks, factories, etc.) create the need for trips to and from those uses via the transportation system. Be specific and note locations of land use or development-related issues.

- No comment (64)
- No complaints

COMMERCIAL

- 2nd Avenue is overdeveloped and this is leading to congestion along this corridor. Need to force development away from 2nd Avenue. (4)
- Encourage growth west and east on US 30 to alleviate traffic congestion on 2nd Avenue. (3)
- Need an additional grocery store or Wal-Mart in south/southwest Kearney to serve people near Yanni Park. (2)
- Property lots should be deeper along anticipated high traffic roads so if streets need to be widened there will be room to do so without building set backs. (2)
- City parking lots need more trees & grass to offset environmental conditions and improve aesthetics. (2)
- Keep businesses from developing on the beltway after it is constructed. Fremont did this and it caused major problems.
- Land development should be discouraged south of I-80 because of lack of roadway connections and isolation from the city.
- Too many little strip malls popping up all over town.
- Need a restaurant that serves breakfast in the north part of Kearney near Applebees.

RESIDENTIAL & AESTHETICS

- Confusing and curved layouts of cul-de-sacs in newer subdivisions keep traffic from flowing smoothly from peoples' homes. In the future a grid pattern should be followed that connect rather than terminate in dead ends and cul-de-sacs. (5)
- Short term housing should be located near the hospital for families with extended stay patients in the hospital.
- Proposed skate parks being built by Meadowlark is too far out of the city. It needs to be more central.
- Lakeview Drive should be and could be a beautiful drive, however the city has let volunteer trees, shrubs and weeds destroy it.
- Monitor neighboring compatibilities for land use – residential and feed lots may not go well together. (2)
- Improve aesthetics along 2nd Avenue and road to Arch.

GENERAL COMMENTS

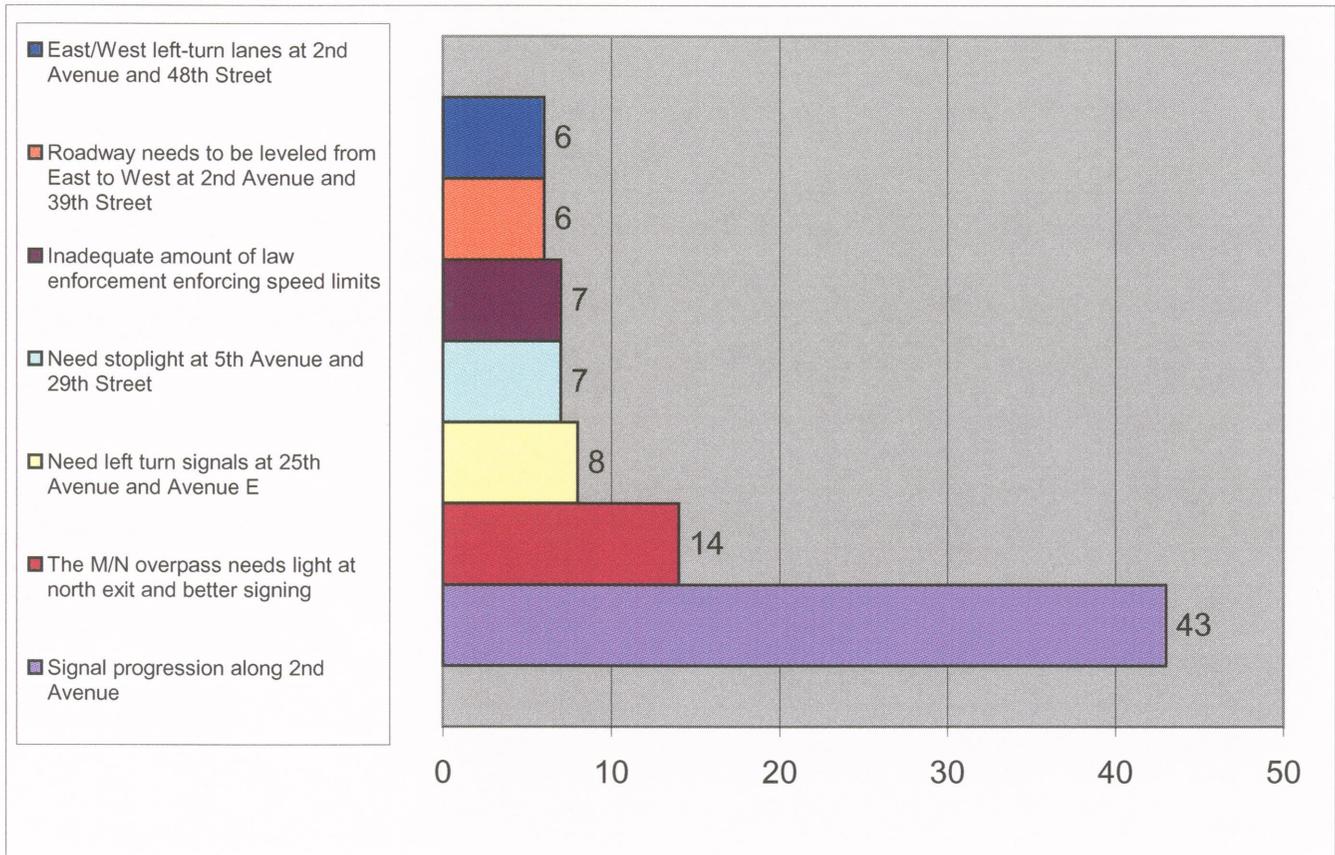
- 2nd Avenue should be returned to the use of the citizens of Kearney and commercial development should be added at Antelope and 78th Streets. (5)
- Need Industrial Parks mixed with low-income housing east of Kearney to provide easy access to jobs.
- Parking garages at hospital and UNK Campus.
- Public restrooms needed in the downtown area.
- Agricultural land north of 56th Street and east of Parklane Dr. should become residential not commercial.

ADDITIONAL COMMENTS AND QUESTIONS:

- State shouldn't control signals not being built at Avenue E with 31st Street and Avenue N and base of 25th Street overpass.
- Why did Kearney allow hospital to close Central Avenue and dump more traffic onto 2nd Avenue?
- Are there web sites available for public use to communicate with administration & council members?
- Don't include envelopes in water bill with automatic pays.
- Water the existing trees in downtown Kearney.
- Power lines along 39th Street need to be underground in case of a tornado. The lines will lay over onto 39th Street, making it impossible to use a main road.
- Difficult to recycle paper waste in paper bags when Wal-mart doesn't usually have paper sacks.
- 39th Street improvements are great!

City of Kearney Public Survey

Question 1: Identify the most important existing transportation system deficiencies (safety concerns, inadequate roadway capacity, roadway discontinuities, traffic signal progression, trails, transit, railroad crossings, etc.) in Kearney today. Be specific and note locations of roadways or intersections.

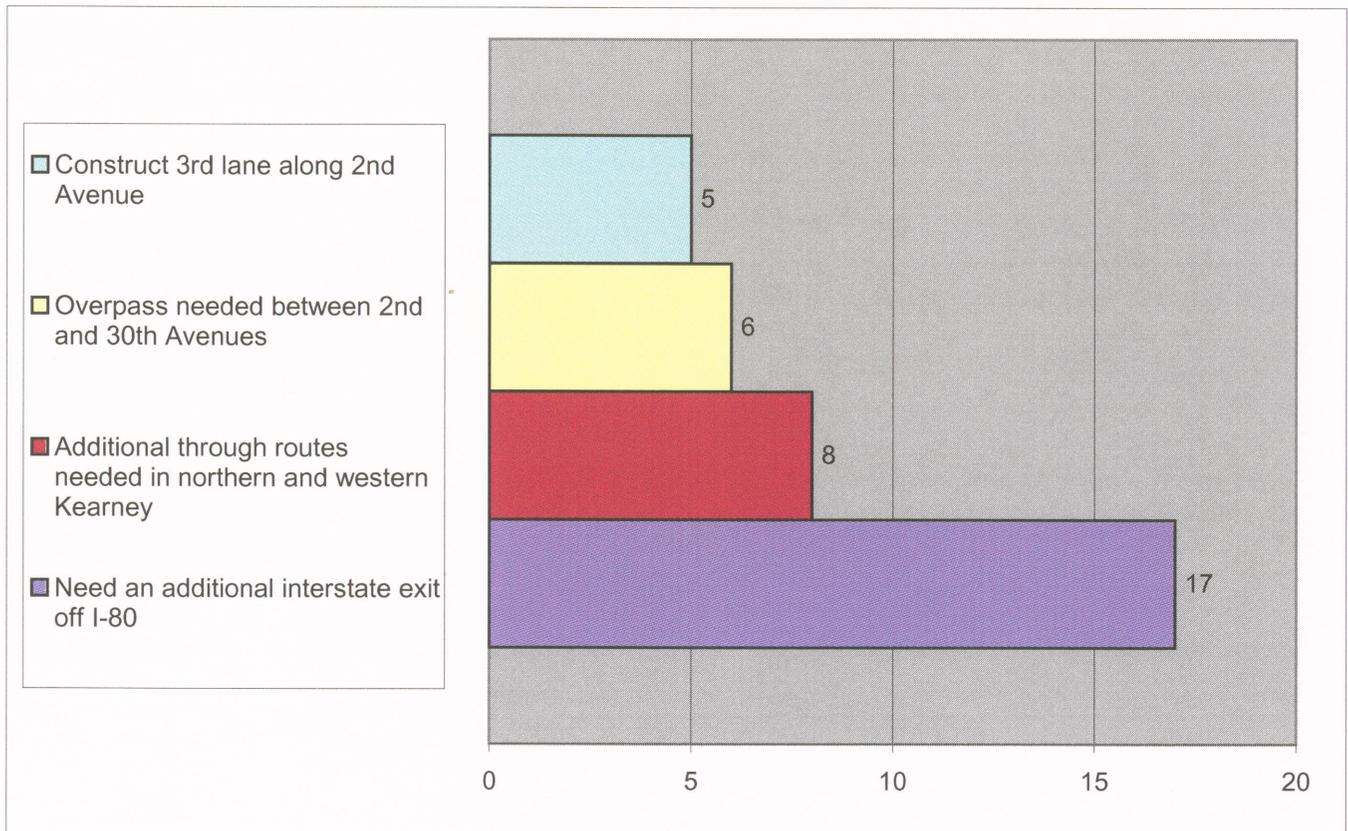


Other Common Responses (number of similar responses):

- No comment (6)
- A signal should be located at 15th and Highway 30 for residents in mobile homes and UNK pedestrian traffic. (3)
- Need traffic light at Avenue E and 31st Street (2)
- Need left turn signals at 39th Street and Avenue E. (2)
- East/West movements at 2nd Avenue and 29th Street is terrible. Movement delays on these approaches of 4 - 5 minutes. (2)
- The intersection of Highway 30 and Cottonmill Road should have speed bumps or a traffic light. The curves limit visibility and make it hard to see oncoming traffic. (2)
- The Hike and Bike trail that crosses 11th Street at the Yanney Park needs to have a Stop and Look and Wait sign or traffic signal. Witnessed many near misses. (2)
- Left turn arrow needed at 56th Street and 2nd Avenue. (2)
- Sight distance is restricted from the east at the intersection of 39th Street and Central Avenue due to shrubbery. (3)
- Additional lane is needed on Hwy 30 by Rolling Hills headed east due to dangerous curves and driver unfamiliarity with the roadway. (3)
- Need parking on only one side of Avenue E from Highway 30 to 56th Street. (3)
- Need left-turn lanes on intersection of Highway 30 between Avenue N and 30th Avenue. (3)
- Exclusive northbound/southbound exclusive right turn lanes at 39th Street and 2nd Avenue. (2)

City of Kearney Public Survey

Question 2: Please identify transportation system improvements (new roadways, widened roadways, new interchanges, overpasses, improved signal progression, new trails, improved transit service, better use of available technology, etc.) that should be considered as part of the transportation planning process to serve future traffic demand in Kearney.

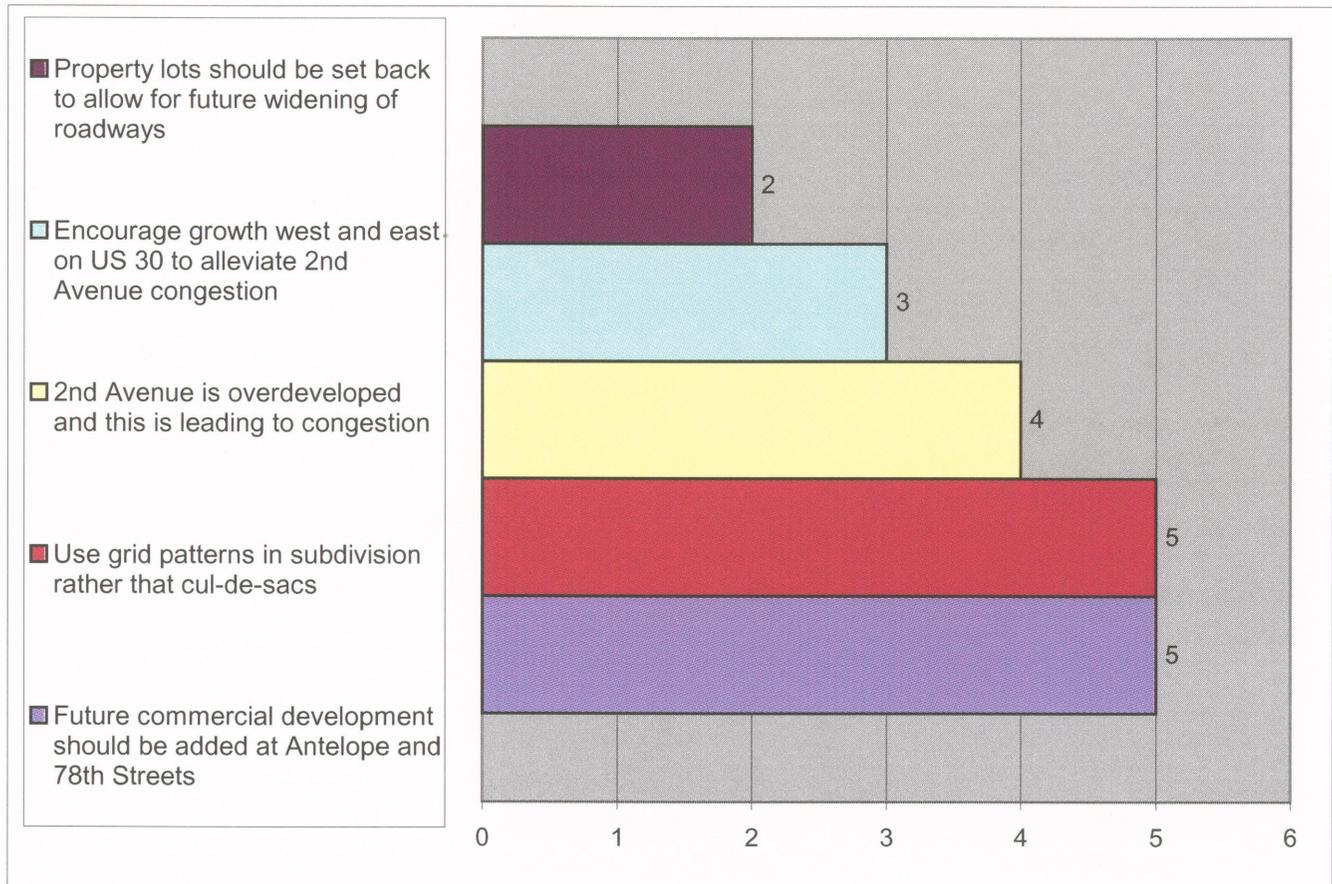


Other Common Responses (number of similar responses):

- No Comment (31)
- Need additional means of egress from Rolling Hills/Equestrian Hill Subdivisions. Current single road presents a safety problem. (3)
- Improve trail systems and extend north of Kearney. (3)
- "Right turn lane only" signs needed at 2nd Avenue and 39th Street and intersection has safety issues. (3)
- 39th Street should not pinch down to 1 lane at fairgrounds. Overwhelming, especially at peak. (3)
- Retain 4-way stop at 35th Street and 6th Avenue. (3)
- Traffic light needed at Avenue E and 31st Street (2)
- Traffic light needed at Avenue N and base of 25th Street overpass. (2)
- Make the signals at 31st and Avenue A permanent and add left turn arrow. These lights have really improved traffic flow. (2)
- A new overpass should be constructed at Antelope Street. (2)
- Coal Shutte Road should be widened to four lanes and paved. (2)
- Continue Country Club Lane to 39th Street. (2)
- Pave the road on Avenue M (South of 11th & M to Archway Parkway). It currently has loose gravel and a fatality and several rollovers have occurred in the past few years. (2)

City of Kearney Public Survey

Question 3: Please identify land use planning issues that should be addressed as part of the transportation planning process. Land use planning directly impacts the transportation system because land uses (stores, schools, parks, factories, etc.) create the need for trips to and from those uses via the transportation system. Be specific and note locations of land use or development-related issues



Other Common Responses (number of similar responses):

- No comment (64)
- Monitor neighboring compatibilities for land use – residential and feed lots may not go well together. (2)
- Need an additional grocery store or Wal-Mart in south/southwest Kearney to serve people near Yanni Park. (2)
- City parking lots need more trees & grass to offset environmental conditions and improve aesthetics. (2)
- Keep businesses from developing on the beltway after it is constructed. Fremont did this and it caused major problems.
- Land development should be discouraged south of I-80 because of lack of roadway connections and isolation from the city.
- Improve aesthetics along 2nd Avenue and road to Arch.
- Short term housing should be located near the hospital for families with extended stay patients in the hospital.
- Need Industrial Parks mixed with low-income housing east of Kearney to provide easy access to jobs.
- Parking garages at hospital and UNK Campus.
- Agricultural land north of 56th Street and east of Parklane Dr. should become residential not commercial.



APPENDIX B

Existing Transportation Conditions Technical Memorandum

MEMO



OLSSON ASSOCIATES

1111 Lincoln Mall
Lincoln, NE 68508
402-474-6311 FAX 402-474-5160

Date: 22 April 2004

To: City of Kearney

From: Shane King, EI

Re: City of Kearney Transportation Plan Update
OA Project No. 2003-0493

Cc: Mike Malone, File

INTRODUCTION

This memorandum documents the results of analyses conducted for existing traffic conditions as part of the City of Kearney Transportation Plan Update. The existing conditions evaluation included various data collection efforts and operational and safety analyses of the current transportation network. A summary of the analyses of the existing traffic conditions is included in the following sections of this memo. Existing conditions were reviewed in order to identify deficiencies in the transportation network. Suggestions for improvement as part of the transportation plan update are based in part, on existing deficiencies identified.

DATA COLLECTION

A comprehensive field review of existing traffic control devices, speed limits, roadway cross-sections, urban/rural classification, and functional classification were conducted as part of the data collection effort. Average Daily Traffic (ADT) counts were obtained from the Nebraska Department of Roads (NDOR). Maps summarizing the network data collection efforts are enclosed with this memo for the City's review. This data will later be used in finalizing the traffic model.

Other data collection efforts included time-travel studies (along the 2nd Avenue corridor) and 3-year accident data from the NDOR. The time-travel study will be documented at a later date during Phase II of this project. An accident summary is included in the Operations & Safety section of this memo.

EXISTING CONDITIONS OVERVIEW

Nebraska Highways 10 & 44 (2nd Avenue) serve as the only north/south principal arterial through the city. Most of this facility is a 4-lane median divided roadway with curb and gutter and sidewalks on both sides. 2nd Avenue is the only interchange connecting Kearney to Interstate 80 (I-80). This is a deficiency for a city of this size, to provide convenient access to I-80 and growth potential. U.S. Highway 30 (24th/25th

Street) is the sole east/west principal arterial. These two corridors have the highest ADTs in the city in the order mentioned. Six roadways are identified as north/south minor arterials, (see map) none of which run from one end of the city to the other. Four overpasses and two at-grade intersections at the railroad crossings connect the north and south parts of the city. Multiple minor arterials in the east/west direction connect drivers to both limits of the city.

OPERATIONS & SAFETY ANALYSIS

Intersection capacity analysis was not conducted as part of this task. However, field review and research of past studies/reports indicate that signalized intersections (specifically along the 2nd Avenue corridor) within the city generally operate at acceptable Levels of Service (LOS). [Good Samaritan Hospital Traffic Analysis, Olsson Associates & Interchange Justification & East Bypass Study-Interstate 80 & Cherry Avenue, Kirkham Michael].

Drive-throughs of the city and public input indicate a number of operational and circulation concerns:

- 2nd Avenue becomes very congested during peak periods of travel and drivers become impatient.
- At least some amount of driver confusion is present at the M/N overpass specifically at the north end. Additional signing may help this situation.
- 39th Street has steep grades at the intersection with 2nd Avenue. This can create sight distance issues and other safety concerns. This intersection has the highest accident rate in the city.
- Many routes are posted at a low speed (25 mph) including arterials. Traffic seems to exceed these and other speed limits in some locations.

Using the citywide accident data, analysis was conducted for intersections where good count data was available. The 1998 state average for urban intersections along a 4-lane highway is 1.04 accidents per million vehicles entering the intersection. Analysis indicates that the following intersections have accident rates that exceed statewide averages:

- 2nd Avenue & 39th Street
- 2nd Avenue & 11th Street
- 30th Avenue & 24th Street

It should be noted that a majority of the highest accident rates are along 39th Street. A clear trend emerged at the intersection of 2nd Avenue & 39th Street. 63 of the 103 accidents reported can be classified as rear-end. This may be due to long queues during peak periods and inattentive drivers. Also, the design of 39th Street as a 4-lane undivided section could contribute to the high accident rate. Table 1 on the following page provides a summary of the accident rates. (Boldface indicates signalized intersections.)

Table 1. Intersection Accident Rates

Intersection	ADT's	Number of Accidents (3yr)	Accident Rate
39th St. & 2nd Ave	42,005	103	2.24
39th St. & 17th Ave	13,565	30	2.02
29th St. & 5th Ave	10,423	20	1.75
27th St. & Ave N	10,055	15	1.36
11th St. & 2nd Ave	28,608	39	1.24
39th St. & Central Ave	15,512	20	1.18
24th St. & 30th Ave	14,145	17	1.10
39th St. & Ave N	13,575	15	1.01
39th St. & 11th Ave	17,786	19	0.98
25th St. & Ave E	31,045	31	0.91

IMPROVEMENTS SUGGESTED BY PUBLIC

Recommended improvements as part of this project will include both big picture planning efforts and small-scale roadway improvements. Some preliminary recommendations received from the public include:

- Implement a new interchange providing access to Kearney from I-80 as has been suggested by previous studies.
- Improve signal progression along 2nd Avenue and possibly widen this corridor.
- Eliminate at-grade railroad crossings.
- Construct an additional railroad overpass between 2nd & 30th Avenues. 17th Avenue has been identified as a possible location.
- Increase enforcement/awareness and/or conduct spot speed studies along arterials to determine if posted speeds should be increased.
- Additional arterial classifications in northern and western Kearney.
- Parking restriction on Avenue E from 25th to 56th Street.
- Conduct studies for new traffic signals, signal timing/phasing changes, and signing needs for the following intersections:
 - M/N Overpass (signal, signing)
 - Avenue E & 25th Street (left-turn phasing)
 - 5th Avenue & 29th Street (signal)
 - 15th Avenue & 24th Street (signal)
 - Avenue E & 31st Street (signal)
 - Avenue E & 39th Street (left-turn phasing)
 - 2nd Avenue & 29th Street (phasing)
 - 2nd Avenue & 56th Street (left-turn phasing)
 - 2nd Avenue & 39th Street (signing)
 - Avenue A & 31st Street (left-turn phasing)
- A number of intersections have been identified as possibly needing geometric changes. They are:
 - 2nd Avenue & 39th Street (lanes & intersection profile)
 - 2nd Avenue & 48th Street (east/west left turn lanes)
 - Cottonmill Road & Hwy 30 (curves limit sight distance)

- Bike/Pedestrian concerns:
 - Hike and Bike trail crossing at 11th Street at Yanney Park (signing)
 - Extend trails to the north
- Pave Avenue M south of 11th Street (serves as access to Archway).
- Land uses:
 - Commercial at Antelope & 78th Street
 - Develop along US-30 to relieve 2nd Avenue
 - Utilize grid pattern instead of cul-de-sacs in subdivisions

The merit of these recommendations will be evaluated, to the extent possible, during development of the new transportation plan. In addition, some of these recommendations, including signal progression along 2nd Avenue, will be studied further during Phase II of this project.

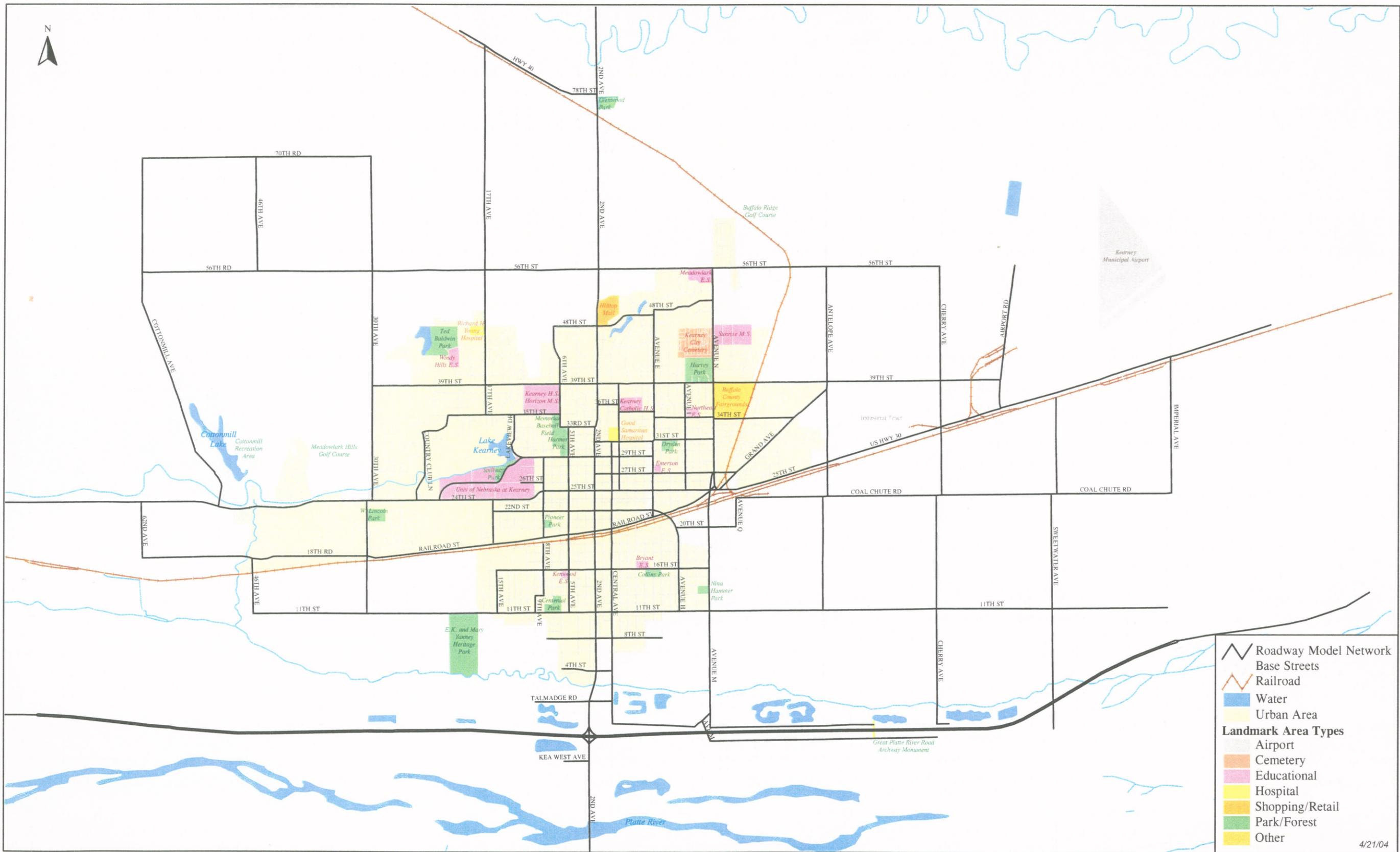
FUTURE BASE ROADWAY NETWORK

In order to assure that the roadway network being modeled under future scenarios is accurate, implemented improvements will be coordinated with existing and committed roadway improvement projects. Two maps have been attached which show the 2015 and 2030 Roadway Networks used for modeling that illustrate the improvements proposed by the City of Kearney. These projects are listed below.

- Improvements included in the 2015 Roadway Network include:
 - Interchange at Cherry Avenue and I-80
 - A 4-lane arterial bypass around the east and north sides of Kearney using the Cherry Avenue and tying into 78th Street
 - Widening 30th Avenue to 4-lane concrete roadway
 - Improve section of north 17th Avenue to 4-lane concrete roadway
 - Extension of two-lane concrete roadway to 48th Street west where it will tie into 17th Avenue
 - Improve existing gravel section of Antelope Avenue to 2-lane concrete roadway
 - Improve sections of 11th Street to 2-lane concrete roadway
- Improvements added for 2030 Roadway Network include:
 - Improve sections of 11th Street to 4-lane concrete roadway
 - Interchange at 30th Avenue and I-80
 - Construct and improve sections of south 30th Avenue to 4-lane concrete roadway

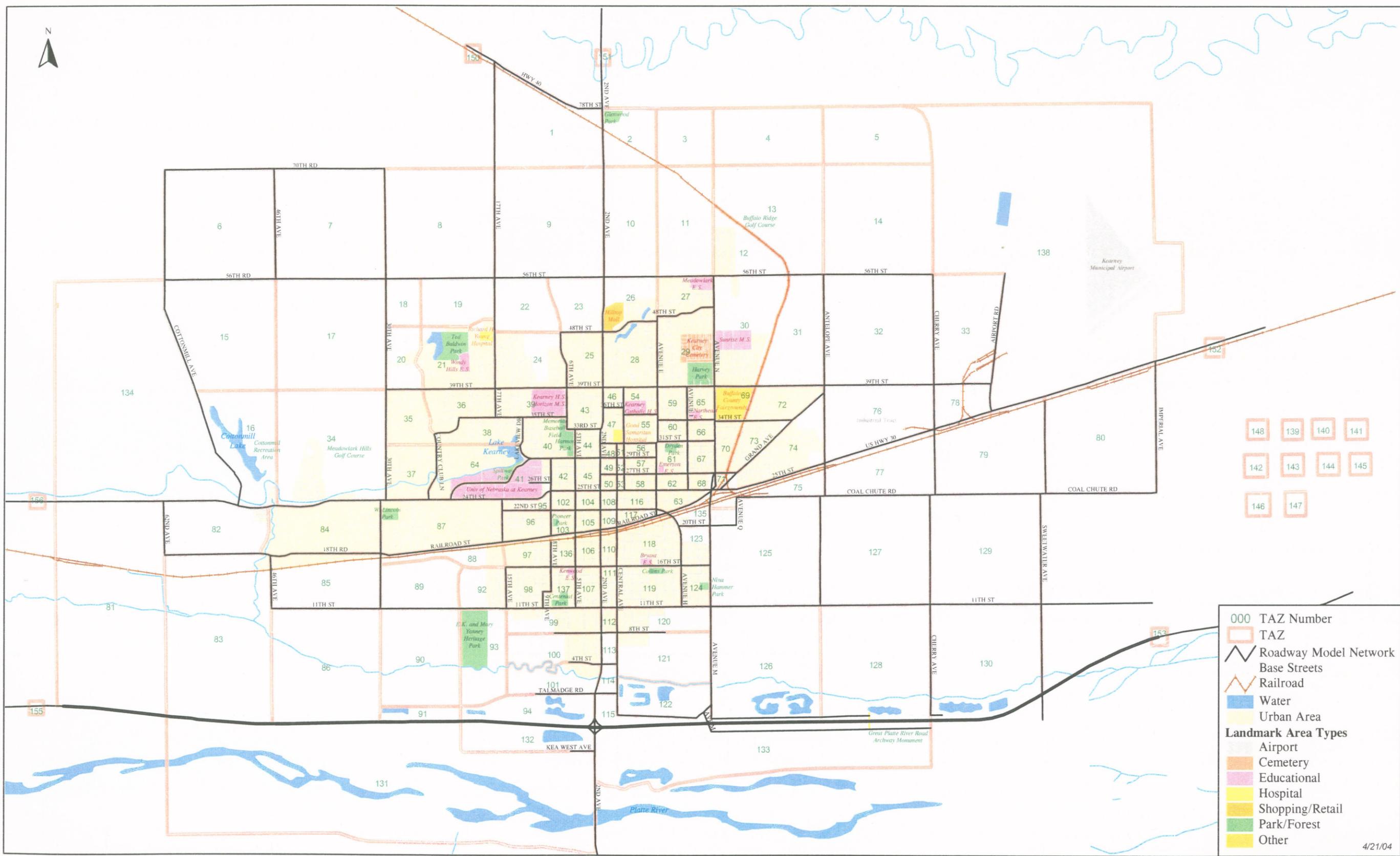
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STUDY AREA AND ROADWAY NETWORK - KEARNEY, NE



	Roadway Model Network
	Base Streets
	Railroad
	Water
	Urban Area
Landmark Area Types	
	Airport
	Cemetery
	Educational
	Hospital
	Shopping/Retail
	Park/Forest
	Other

TRAFFIC ANALYSIS ZONES - KEARNEY, NE



- 148
- 139
- 140
- 141
- 142
- 143
- 144
- 145
- 146
- 147

000 TAZ Number

TAZ

Roadway Model Network
Base Streets

Railroad

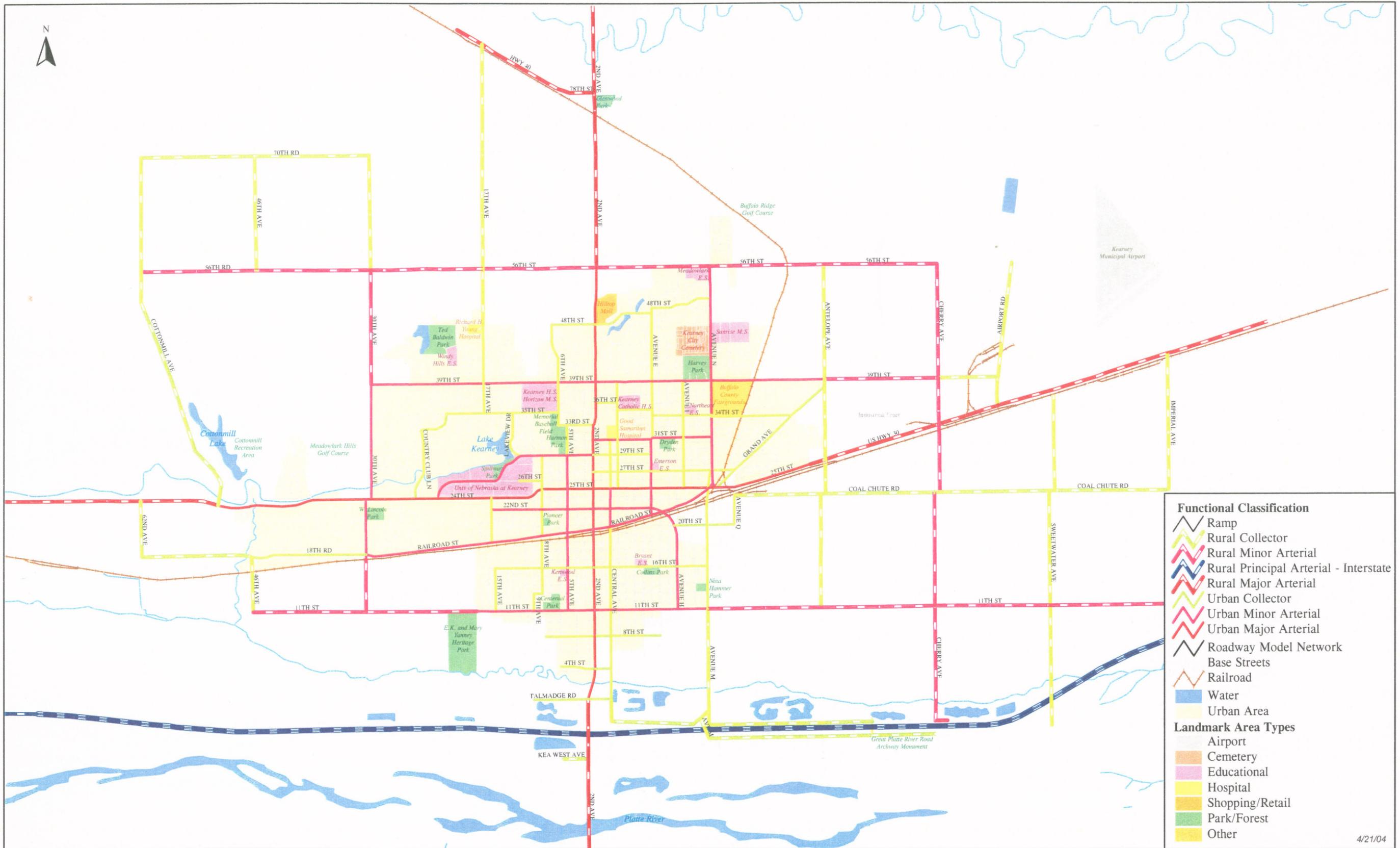
Water

Urban Area

Landmark Area Types

- Airport
- Cemetery
- Educational
- Hospital
- Shopping/Retail
- Park/Forest
- Other

FUNCTIONAL CLASSIFICATION - KEARNEY, NE



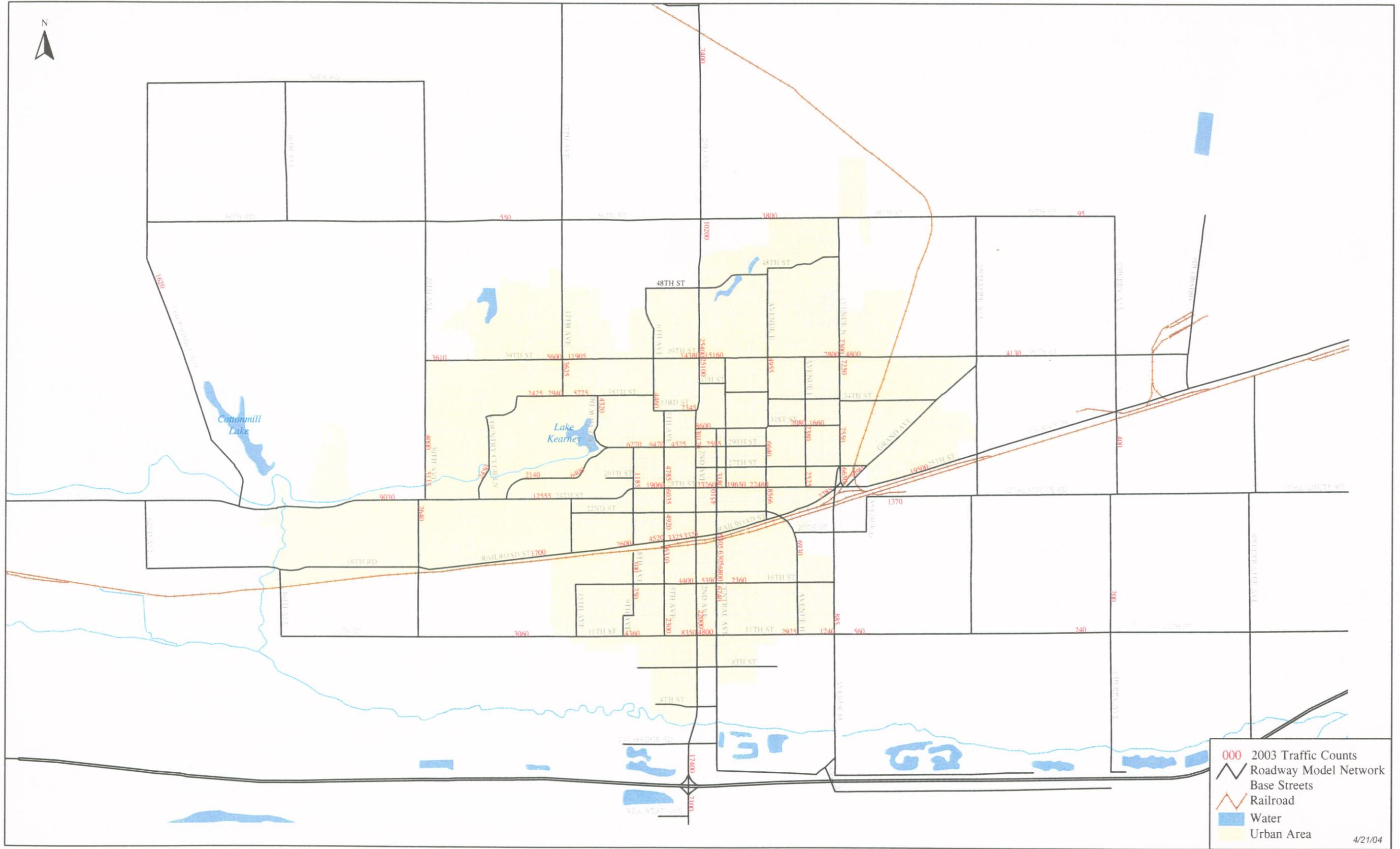
Functional Classification

- Ramp
- Rural Collector
- Rural Minor Arterial
- Rural Principal Arterial - Interstate
- Rural Major Arterial
- Urban Collector
- Urban Minor Arterial
- Urban Major Arterial
- Roadway Model Network
- Base Streets
- Railroad
- Water
- Urban Area

Landmark Area Types

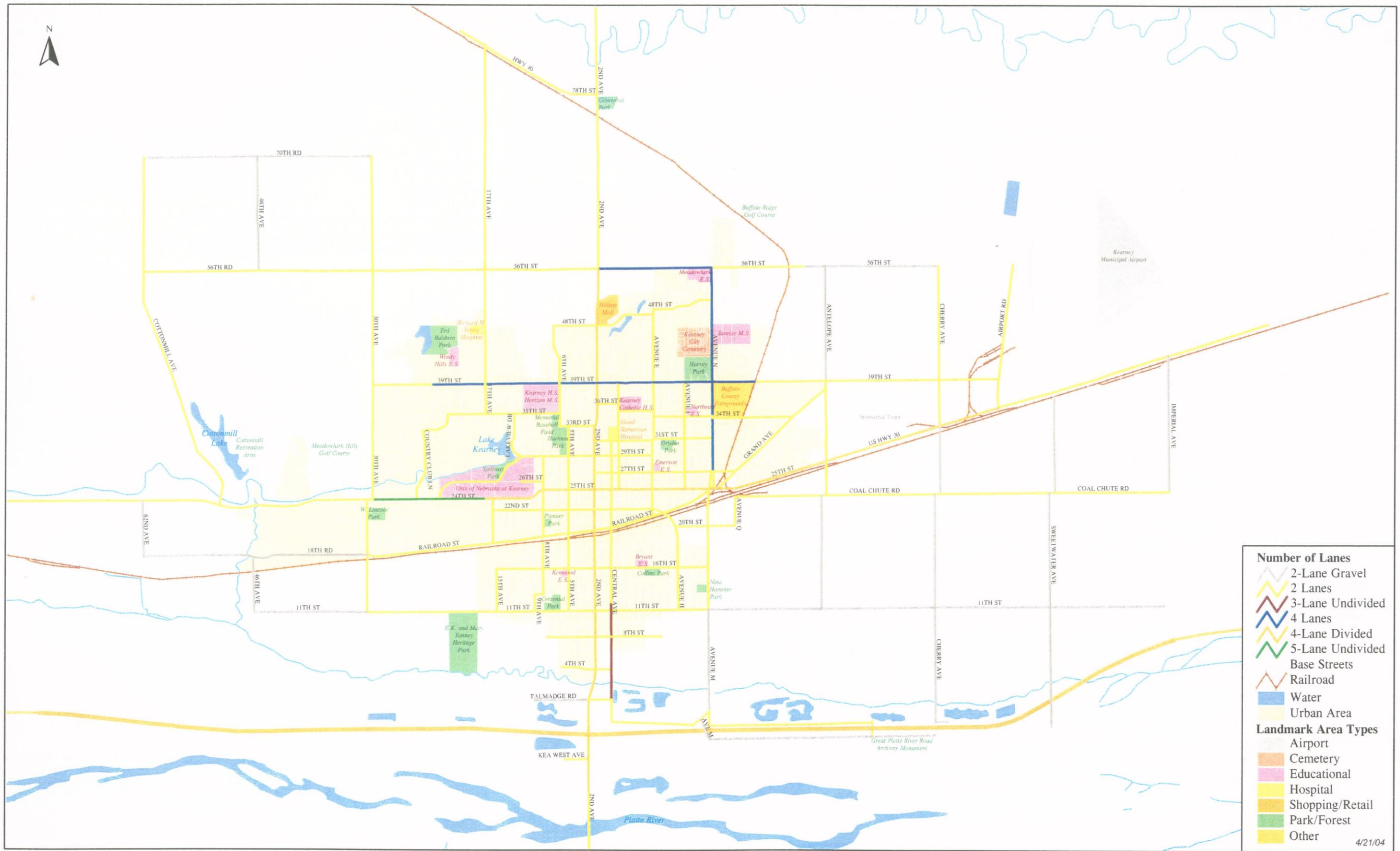
- Airport
- Cemetery
- Educational
- Hospital
- Shopping/Retail
- Park/Forest
- Other

2003 TRAFFIC COUNTS

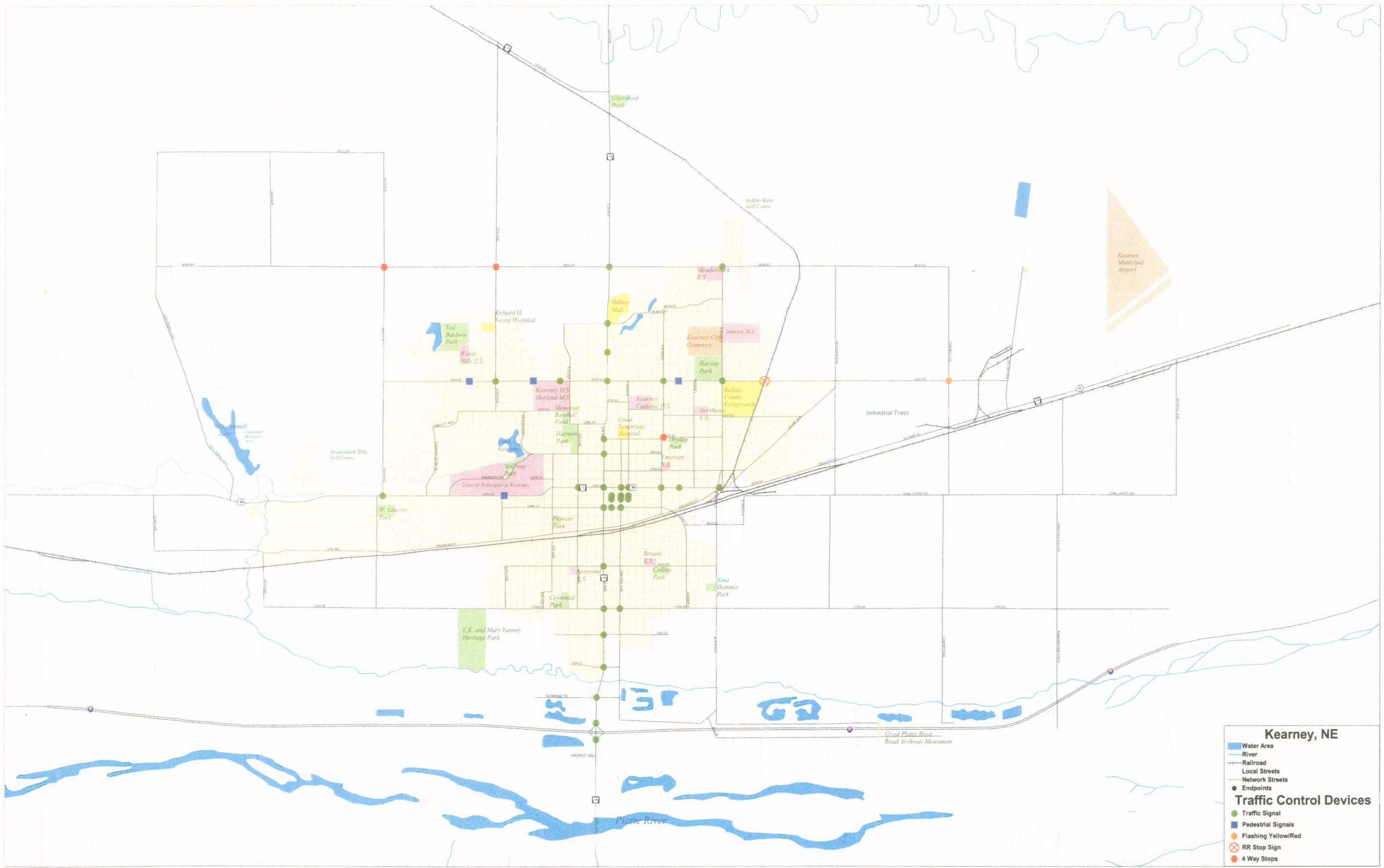


000 2003 Traffic Counts
 Roadway Model Network
 Base Streets
 Railroad
 Water
 Urban Area

NUMBER OF LANES - KEARNEY, NE



Number of Lanes	
	2-Lane Gravel
	2 Lanes
	3-Lane Undivided
	4 Lanes
	4-Lane Divided
	5-Lane Undivided
	Base Streets
	Railroad
	Water
	Urban Area
Landmark Area Types	
	Airport
	Cemetery
	Educational
	Hospital
	Shopping/Retail
	Park/Forest
	Other



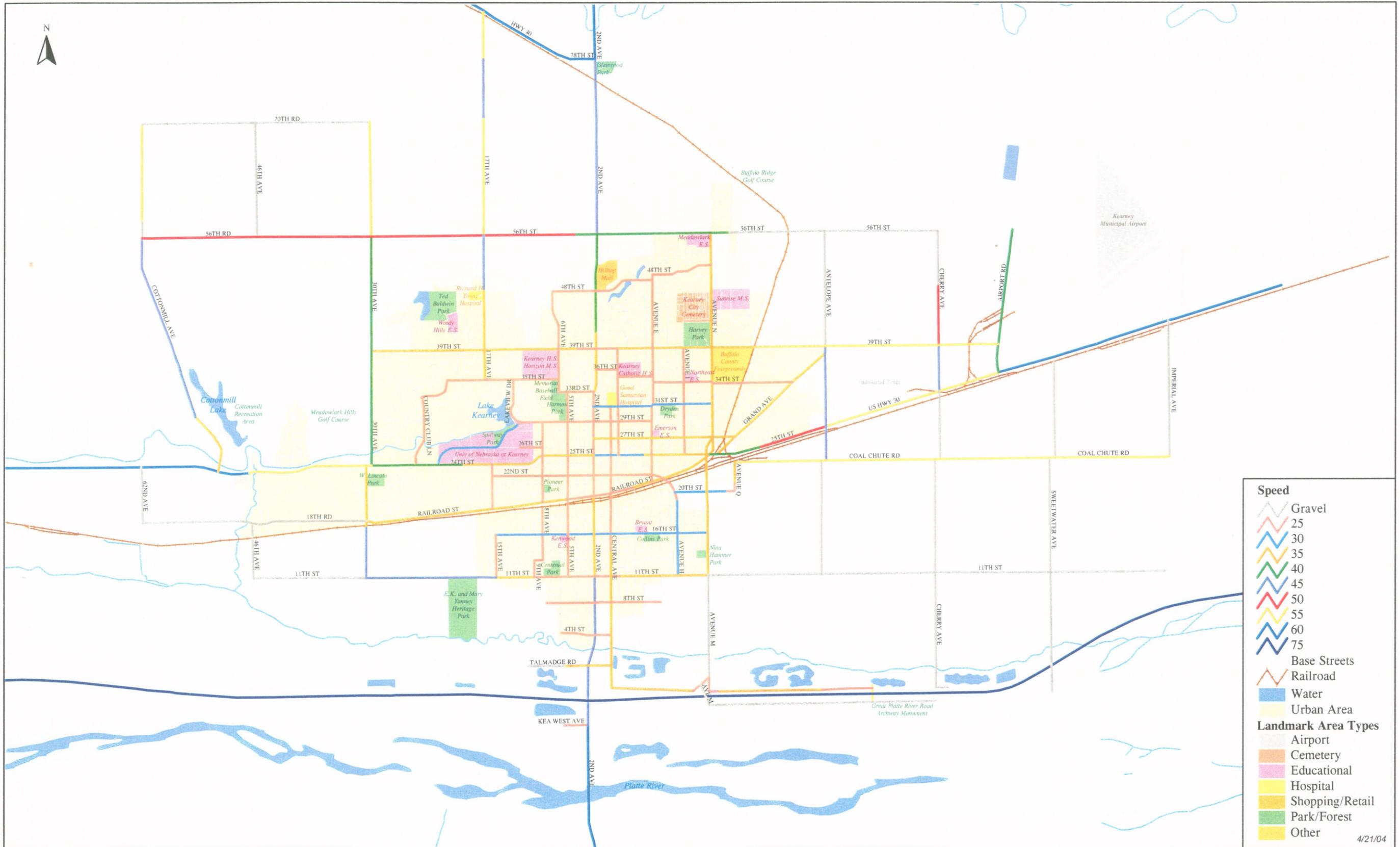
Kearney, NE

- Water Area
- River
- Railroad
- Local Streets
- Network Streets
- Endpoints

Traffic Control Devices

- Traffic Signal
- Pedestrian Signals
- Flashing Yellow/Red
- ⊗ RR Stop Sign
- 4 Way Stops

POSTED SPEED LIMIT - KEARNEY, NE



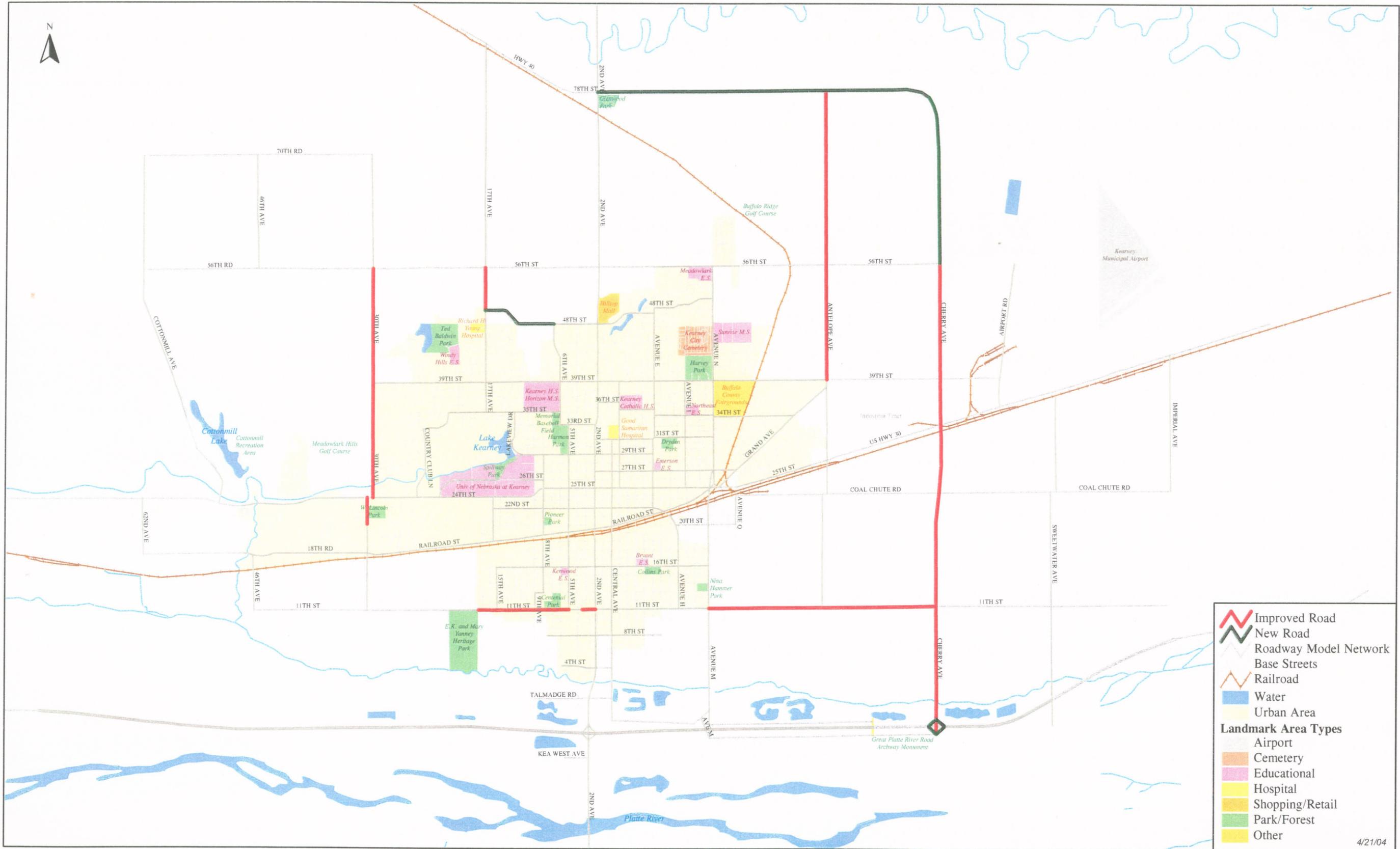
Speed

- Gravel
- 25
- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 75
- Base Streets
- Railroad
- Water
- Urban Area

Landmark Area Types

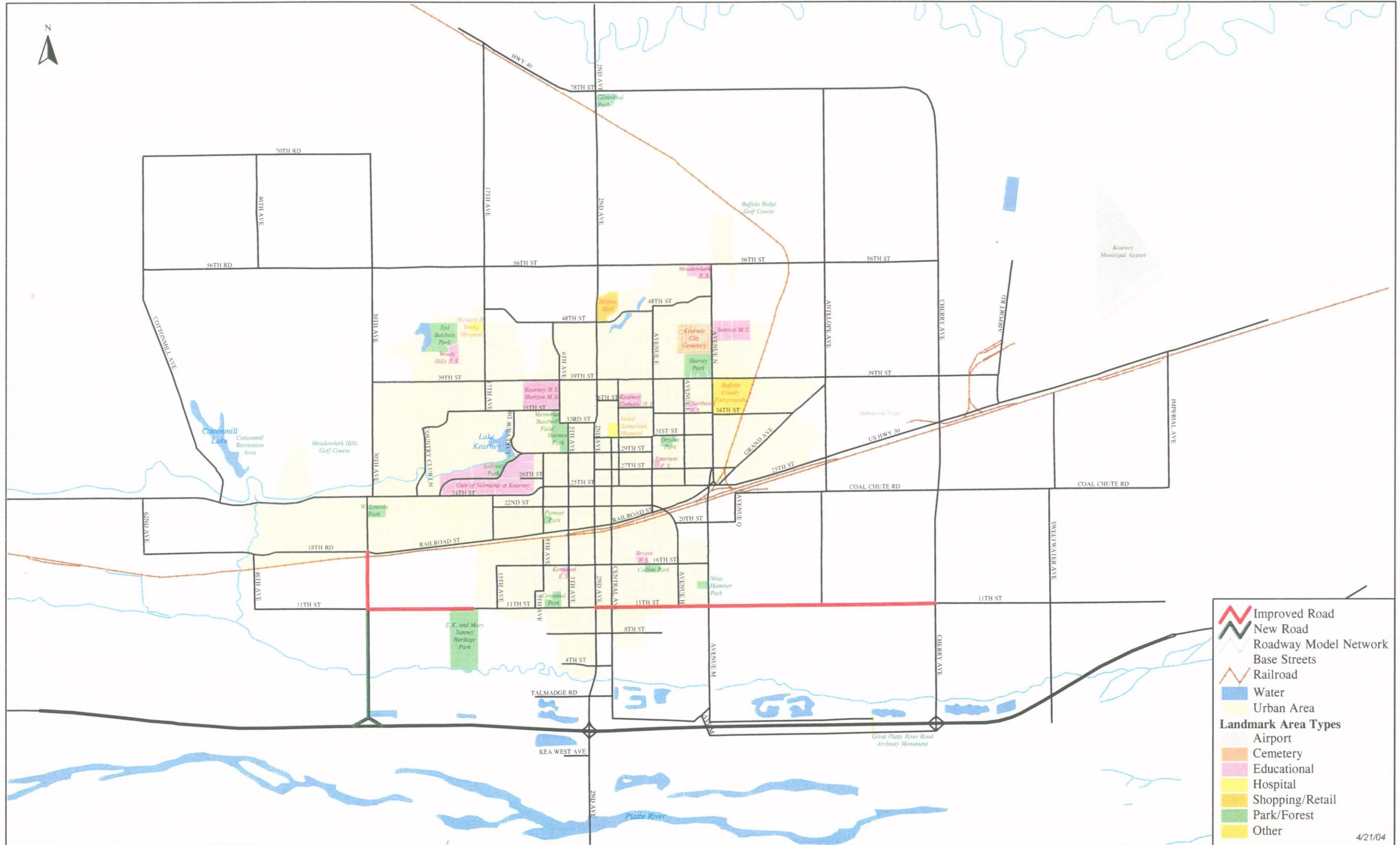
- Airport
- Cemetery
- Educational
- Hospital
- Shopping/Retail
- Park/Forest
- Other

2015 ROADWAY NETWORK -- IMPROVEMENTS/ADDITIONS TO 2003 NETWORK - KEARNEY, NE



- Improved Road
- New Road
- Roadway Model Network
- Base Streets
- Railroad
- Water
- Urban Area
- Landmark Area Types**
- Airport
- Cemetery
- Educational
- Hospital
- Shopping/Retail
- Park/Forest
- Other

2030 ROADWAY NETWORK -- IMPROVEMENTS/ADDITIONS TO 2015 NETWORK - KEARNEY, NE





APPENDIX C

Travel Demand Model Documentation Report

CITY OF KEARNEY
TRAVEL DEMAND MODEL DOCUMENTATION
JULY 2004

Prepared by Lima & Associates

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INTRODUCTION

The purpose of this report is to document the development and validation of the transportation model for the City of Kearney, Nebraska. The model was developed using the TransCAD transportation forecasting microcomputer software and was calibrated using the year 2003 transportation network and estimated 2003 socioeconomic data. This model was developed with the most recent release of TransCAD version 4.5. Figure 1 displays the model study area.

This section presents a brief description of the overall transportation demand modeling process: trip generation, trip distribution, trip assignment, and model calibration. The next section describes the development of the roadway network. Trip generation and trip distribution are discussed in detail in the third section. The fourth section describes the assignment of vehicle trips, and the final section presents the results of the model calibration and validation. A glossary of modeling terms is also included.

TRANSPORTATION MODELING PROCESS OVERVIEW

The transportation planning model is a representation of the Kearney area's transportation facilities and the travel patterns using these facilities. The traffic model contains inventories of the existing roadway facilities and of residential and non-residential units by traffic analysis zones (TAZs).

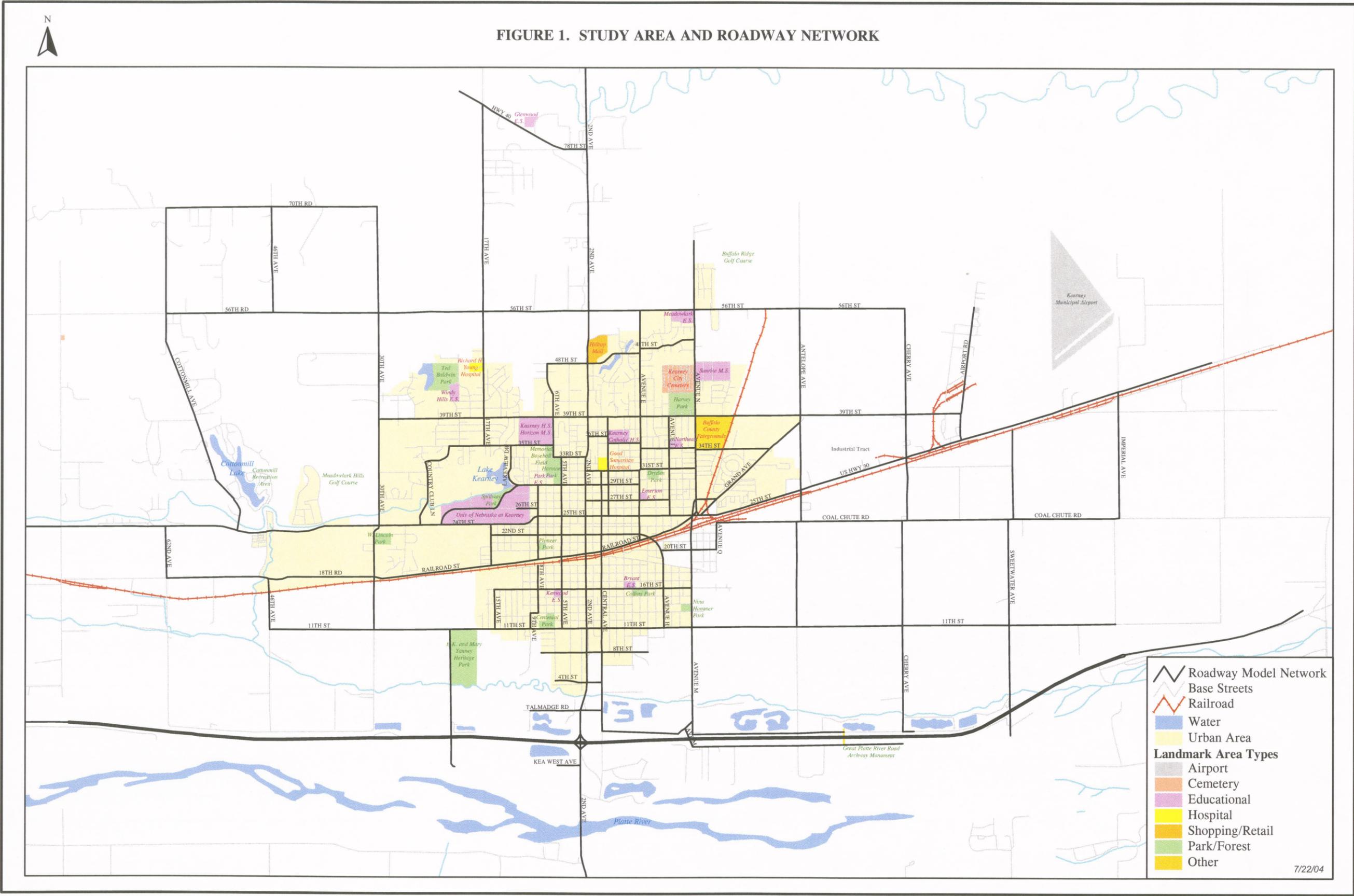
In general, the traffic model process consists of several steps including estimating the number of daily vehicle trips by TAZ from the socioeconomic inventory, distribution of vehicle trips by TAZ, and then assigning the vehicle trips to the street network. The traffic model assignments are then compared with current traffic counts. When the model matches the traffic counts within acceptable ranges of error the model can then be used to test future year scenarios. These scenarios may contain changes in numbers of housing units, employment centers, travel behavior patterns, or roadway improvements. The transportation planner or engineer, using the traffic-forecasting model can project future traffic volumes, which in turn can aid in making planning and project programming decisions.

The Kearney transportation modeling process included the following steps:

- Development of 2003 transportation roadway network
- Determination of 2003 land use data
- Trip generation - generation of vehicle trips
- Trip distribution - geographical distribution of vehicle trips between origin and destination zones
- Trip assignment - assignment of traffic volumes to specific network routes.

A brief description of each modeling step is given next.

FIGURE 1. STUDY AREA AND ROADWAY NETWORK



7/22/04

Transportation Model Development

Roadway Network Definition

The initial step in the travel demand modeling process was the development of the geographical roadway network comprised of nodes and links. A node is an intersection of two or more links such as an intersection of two street segments. A network link is a street segment between two nodes (A node and B node).

The 2003 Kearney TransCAD model network was created using the street center line that is available as part of the TransCAD software. The street center line file is comprised of a roadway network, however, no associated transportation data such as number of lanes, speeds, etc is included. Subsequently, the study team collected the necessary data in order to develop the model network parameters. The TransCAD model network database includes but is not limited to the following information:

- Roadway Functional Classification
- Link Distance
- Speed
- Daily Link Capacity
- Daily Traffic Volume (ground counts)
- Link Number of Lanes

As part of the model network development, streets classified as collector streets or higher were used to identify which streets to be included in the model. The model also included local streets and unpaved roads when necessary to “load” traffic to the model network. The street classifications are based on the National Functional Classification obtained from Nebraska Department of Roads (NDOR) for the City of Kearney and Platte County. Figure 2 illustrates the defined network based on the roadways’ functional classification.

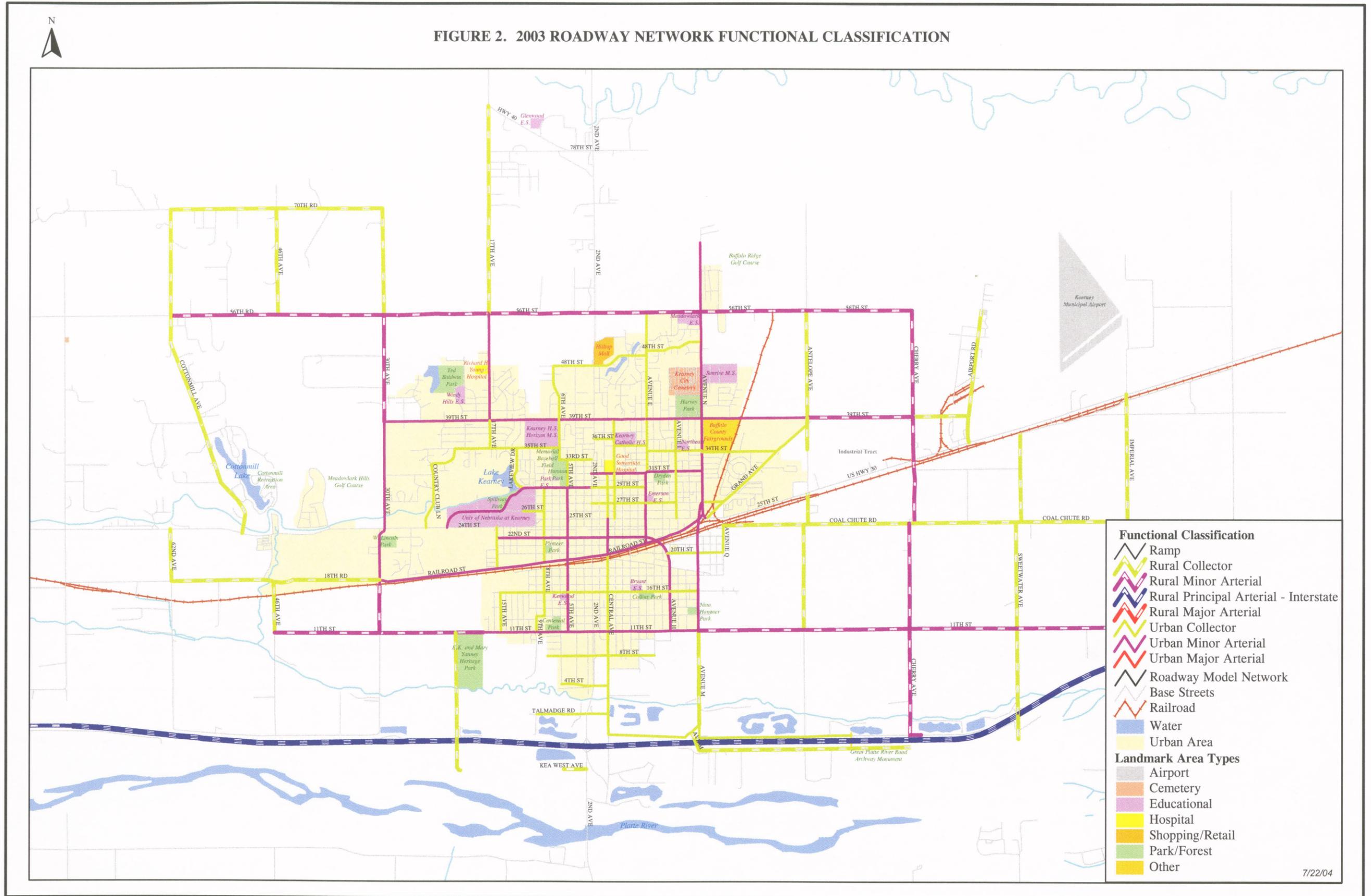
Land Use Data

Land use was developed for different categories and allocated to TAZs. The TAZs are generally bounded by either the roadway network or another geographic boundary. Within the model network, a TAZ is defined by a node called a centroid. For transportation modeling, it is assumed that all trips within a TAZ begin and end at the zone centroid. Each TAZ centroid is connected to a roadway link by centroid connectors, which represent the local streets feeding traffic to the major streets.

The Kearney model consisted of two zone types: internal and external. Internal zones were those zones central to the study area, and external zones were placed along roadways entering and leaving the Kearney model area.

The TAZs developed for the 2003 study were created using boundaries such as the roadway network, rail road, and water features. The TAZ boundary extends beyond the City limits to include possible growth beyond this area in the future. The transportation model and TAZ structure is roughly bounded by 78th Street to the north, Imperial Road to the east, I-80 and the Platte River to the south, and 62nd Avenue to the west.

FIGURE 2. 2003 ROADWAY NETWORK FUNCTIONAL CLASSIFICATION



7/22/04

Figure 3 shows the TAZ boundaries developed for this study. There are a total of 156 zones with the internals numbered from 1 to 138 and external zones numbered from 155 to 156. Several "extra" internal zones were created to allow for possible division of zones for future use. These "extra" zones are numbered from 139 to 149.

The estimated 2003 study area demographic data was developed using the 2000 Census data and collected by the study team for each TAZ. The socioeconomic data was also summarized by TAZ and by land use classifications. The socioeconomic classifications consisted of 13 separate categories.

Trip Generation

The final product of the trip generation phase is the total number of trips produced within and/or attracted to each TAZ. A trip is defined as a one-way trip between an origin and a destination.

The number of trips generated by a TAZ is a function of the residential and/or commercial land use characteristics. Residential land uses are generally referred to as "producers" of trips, commercial land uses are generally referred to as "attractors" of trips. Residential trip production is a function of the number of dwelling units. Commercial trip attraction is a function of non-residential employment data.

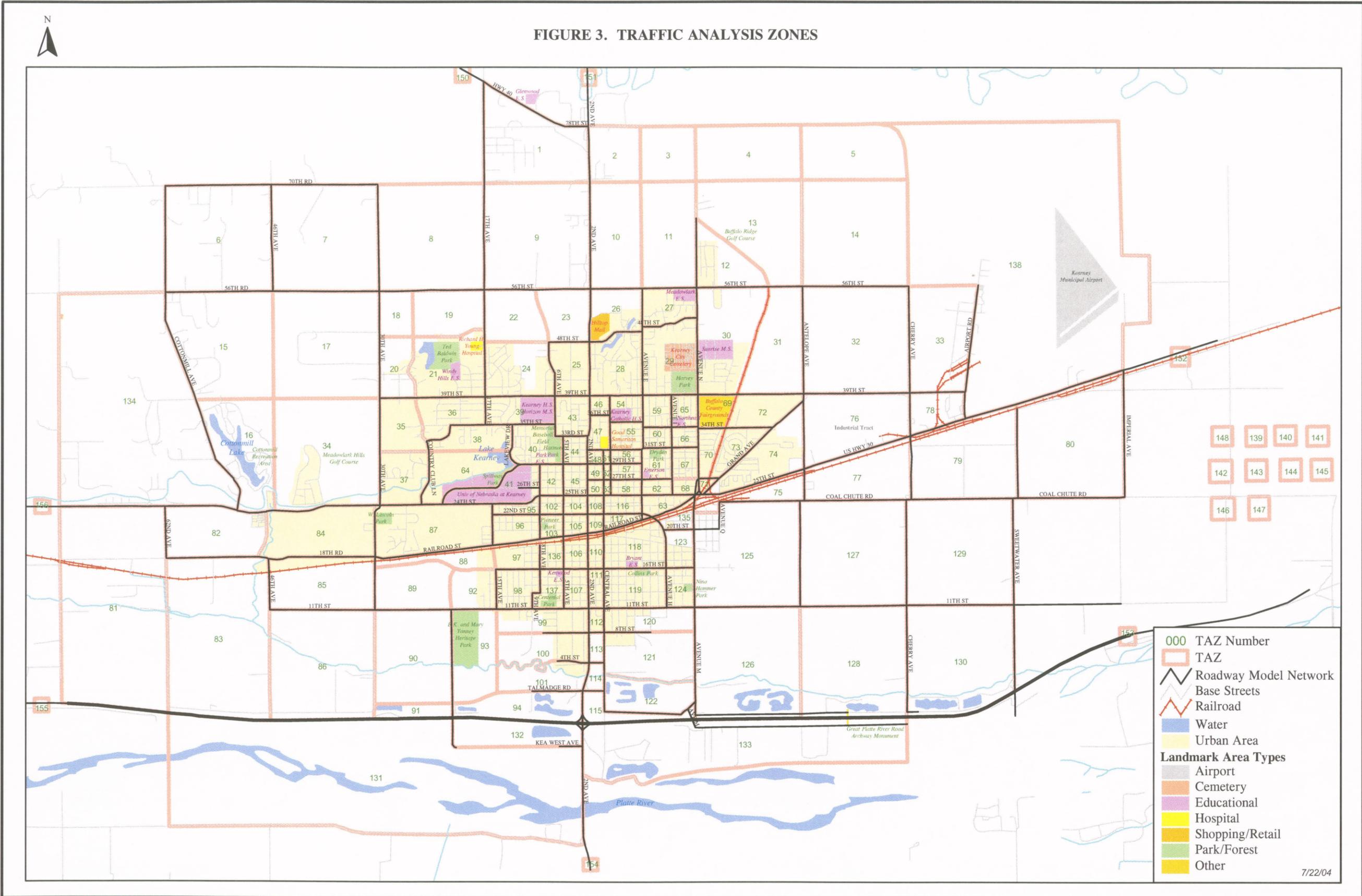
Trip Distribution

The final product of the trip distribution phase is a vehicle trip table specifying the number of vehicle trips that travel among all the TAZs. Trip tables are estimated for each of the trip purposes. The distribution of trips between TAZs (for example, zone I and zone J) are a function of the following variables:

- The number of trips produced in zone I
- The number of trips attracted to zone J
- The travel time between zone I and zone J
- The magnitude of the total "attractiveness" of all the zones in the network

The number of trips traveling between zone I and zone J are directly proportional to the total number of trips generated in zone I and the total number of trips attracted to zone J. For example, the total number of trips traveling between zones I and J increase as the number of residential trips increases in zone I. The number of trips between zones I and J are inversely proportional to the travel time between the two zones. The number of trips traveling between the two zones decreases as the travel time increases between the zones.

FIGURE 3. TRAFFIC ANALYSIS ZONES



7/22/04

Traffic Assignment

The traffic assignment phase allocates the trips to one specific network route based on the travel times between the various zones. The traffic assignment process includes the following:

- Computation of the minimum time paths between the TAZs based on free flow link speeds (i.e., posted speed limits)
- Initial assignment of the trips to the links which lie on the minimum time paths between the TAZs
- Computation of volume-to-capacity (v/c) ratios on the links after initial assignment
- Computation of travel times on the links as a function of the v/c ratio
- Reiteration of the assignment process until the traffic volumes on the links replicate the traffic ground counts

The final product of the traffic assignment process is the traffic volumes on each link in the network.

Model Calibration

The transportation model was calibrated and validated using the transportation network, socioeconomic estimates, and traffic counts for the year 2002. The 2002 counts in certain areas do not reflect the changes in travel pattern due to the completion of recent improvements, such as the overpass at N Street. Hence the model could differ substantially in those areas.

The series of calibration simulation runs involves the review of the assumptions used to construct the model. In the distribution portion of the simulation, the exponents to the distance function of the gravity model were examined. During the assignment portion of the simulation, the assumptions for link speeds, capacities, and delay parameters were studied. Between each run, different parameters were evaluated and necessary adjustments made so that the desired results (i.e., calibration) were reached. Before any adjustments to the Kearney model parameters were made, they were justified either through the collected travel pattern data, local knowledge of travel conditions, or by empirical knowledge of the study team. The model validation included review of several performance measures such as percent assignment error, root mean square error (RMSE), and screenline analysis.

ROADWAY NETWORK

The primary goal of this transportation planning model is to simulate the daily travel on the roadway network in the Kearney area. In order for this simulation to be effective, it was important to obtain all transportation related data for that period to create a "snapshot" of time. The simulation was to replicate a typical year 2003 weekday.

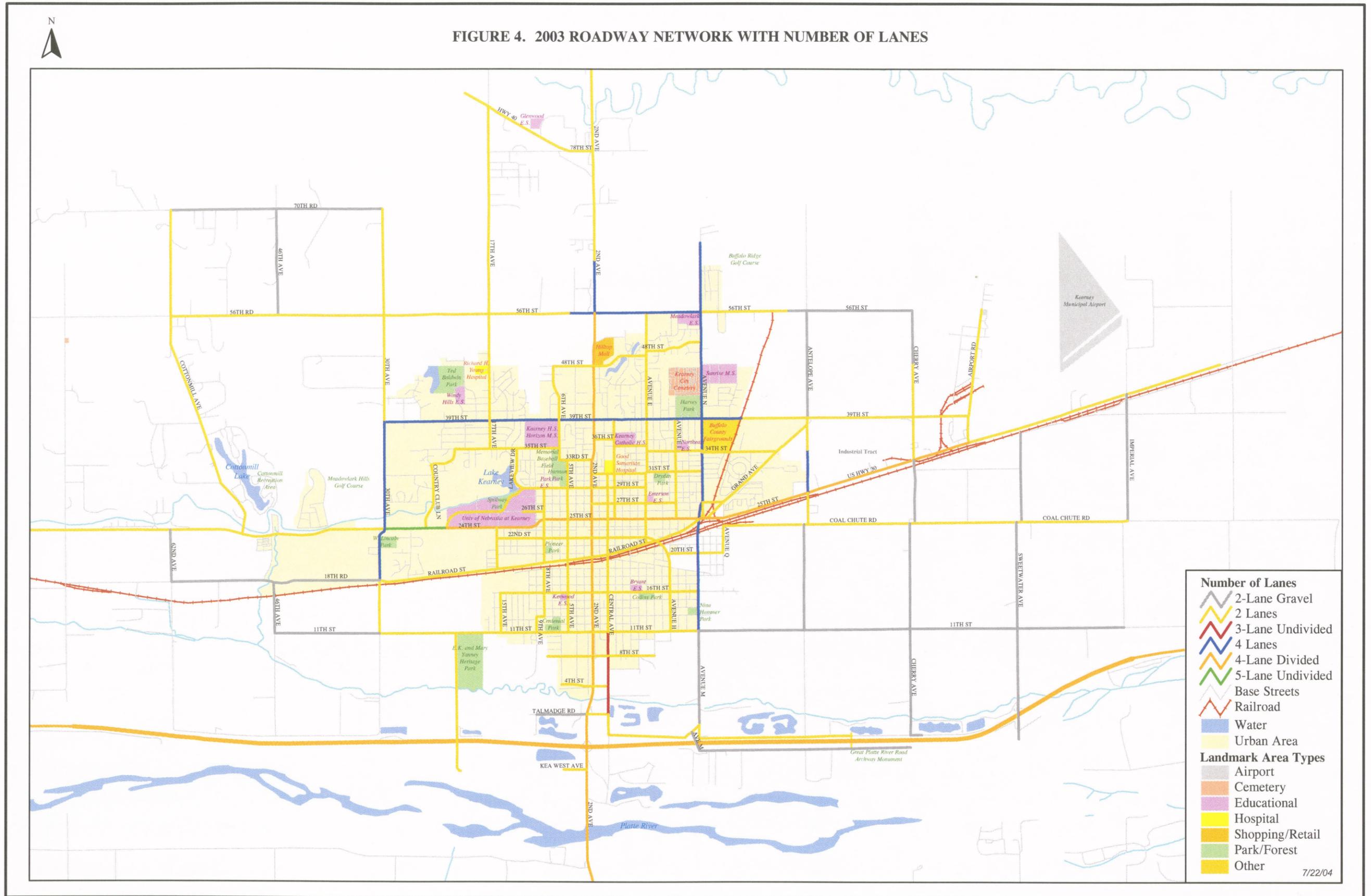
In coordination with the City of Kearney, the link attributes were populated in the network database, as shown in Table 1. Figure 4 illustrates the 2003 roadway network for the study area with the corresponding number of lanes.

TABLE 1. TRANSCAD LINK ATTRIBUTES

TransCAD Field	Network Link Attribute
Length	Link Distance (00.00 miles)
Dir	0 = Two-way Directional Link 1 or -1 = One-way Directional Link
AdjLength	Adjusted Link Distance for Centroid Connectors (00.00 miles)
StreetName	Street Name
Network	0 = Non Model Network 1 = Model Network
FunClass	Roadway Functional Classification (see Table 2)
_Lanes	Number of Directional Through Lanes
CLane	0 = No Center Two-way Left Turn Lane (TWLTL) 1 = TWLTL
_Speed	Directional Free Flow Speed (mph)
AreaType	1 = Rural 2 = Urban 3 = Central Business District (CBD) or Outlying Business District (OBD)
CountsXX	Daily Traffic Counts
_Parking	0 = No Parking 1 = On-Street Parking
Surface	0 = Unpaved 1 = Paved
_CapID	Used in determining Daily Capacity (FunClass & AreaType)
_Capacity	Directional Daily Capacity
_TravelTime	Directional Travel Time
Alpha	Volume Delay Function

Note: “_” represents directional AB and BA link attributes

FIGURE 4. 2003 ROADWAY NETWORK WITH NUMBER OF LANES



Roadway Link Capacity

Capacity is expressed in terms of vehicles per day for each link by direction. Due to the number of links contained in the Kearney model, it was not possible to complete individual capacity analyses on each link to find suitable capacities. Therefore, a global link capacity system was used which was based on functional classification, area type, and on-street parking. The capacities were based on *Highway Network Capacity Development Methodology*, Clark County Regional Transportation Commission, June 26, 1998, and also on the *Highway Capacity Manual*, Transportation Research Board, 2000.

The capacities are used for both model operation and network analysis. In the context of model operation, the capacities are used in conjunction with link speeds, link lengths, and link delay functions to derive a realistic travel speed to be used in the distribution of travel and the derivation of appropriate travel routes. In the context of network analysis, the capacities are used to identify deficiencies and recommend improvements. In both cases, it is desired that the capacities used in the model be as accurate and realistic as possible. Table 2 represents the capacities used for the model.

TABLE 2. ROADWAY LINK CAPACITIES

Model Identification Number	National Functional Classification Code ¹	Roadway Functional Classification	Directional Daily Lane Capacity (Level of Service E) by Area Type	
			Urban/Rural	CBD or OBD
1	01	Rural Principal Arterial	18,000	
2	02	Rural Major Arterial	11,500	
3	06	Rural Minor Arterial	10,500	
4	07	Rural Collector	8,000	
5	09	Rural Local	3,500	
6	15	Urban Major Arterial	10,500	9,500
7	16	Urban Minor Arterial	8,500	7,500
8	17	Urban Collector	6,500	6,000
9	19	Urban Local	3,500	3,100
10		Rural Ramps	14,000	

¹ National Functional Classification, NDOR, November 5, 1999

CDB = Central Business District. OBD = Outlying Business District

Note: Unpaved roads have directional daily capacities of 200. Roadway facilities with on-street parking were reduced in capacity by 10% per direction.

Turn Prohibitors and Penalties

In order to accurately reflect travel behavior for the study area, turn prohibitors and penalties were used in the model. Turn prohibitors are typically used where specific turning movements are not allowed or are physically restrained. Turn penalties are added delay for a specific movement due to unique intersection operations and driver behavior. In the Kearney model, both of these network characteristics were applied.

As part of the model calibration process, the at-grade rail crossings were reviewed to evaluate the impacts of travel routing through the transportation model. It was determined that adding minor additional delay at the rail crossings in the model produced unrealistic routing of the traffic flows. Although the rail crossings do have an impact on the traffic flows for short periods of time, over a 24-hour period, which the model is based on, the delays are minor. Subsequently, the rail delays were not incorporated in the model and the resulting traffic routing appears to represent existing traffic operations.

Volume Delay Function

Travel time on each individual link typically increases as the traffic volume on the link approaches capacity. The amount of travel time increase depends on the functional classification of the link as well as the region and the behavior of the drivers using that link. TransCAD offers the ability to update travel times iteratively based on link performance functions, which are mathematical descriptions of the relationships between travel time and v/c ratio.

The conical volume-delay function incorporated in TransCAD was used in the development of the Kearney model. The equation is as follows:

$$f(x) = 2 + \sqrt{\alpha^2(1-x)^2 + \beta^2} - \alpha(1-x) - \beta$$

where: $\beta = \frac{2\alpha - 1}{2\alpha - 2}$, $x = V/C$, and α is a constant larger than 1

During calibration analysis, link operating speeds were reviewed. This analysis was used in comparison with collected operating speeds to adjust the volume delay function. The base values used in the model calibration are shown in Table 3, but could vary in specific locations.

TABLE 3. Volume Delay Function Parameters

Model Identification Number	Roadway Functional Classification	α
1	Urban Principal Arterial	6
2	Urban Major Arterial	6
3	Urban Minor Arterial	6
4	Urban Collector	6
5	Urban Local	3
6	Rural Principal Arterial	6
7	Rural Minor Arterial	6
8	Rural Major Collector	6
9	Rural Minor Collector	6
10	Rural Local	3

TRIP GENERATION AND TRIP DISTRIBUTION

TRIP GENERATION

Trip generation for the Kearney travel demand model was accomplished using a trip rate model. Vehicle trips were generated based on socioeconomic variables, such as the number of dwelling units and a daily trip generation rate for each socioeconomic variable. Initial vehicle trip rates were obtained from the report *Trip Generation*, Institute of Transportation Engineers, 7th Edition, characteristics for the various land-use categories used in the trip generation analysis.

As can be seen from Table 4, trips rates applied in the model are generally comparable to ITE *Trip Generation* rates. Differences between these rates can be attributed to local variation.

As part of the models' trip generation estimates, most transportation planning models are stratified by multiple trip purposes. For the Kearney model, trips were estimated based on three trip purposes:

- Home-Based Work (HBW)
- Home-Based Other (HBO)
- Non-Home-Based (NHB)

When the gravity model is applied to the productions and attractions, different trip purposes allow for different travel characteristics. For example, the home-based work trip, which has a trip end at the home location, is different than a non-home based trip, which represents a work to shopping trip end. Typically, home-based work trips have longer trip lengths than home-based other or non-home-based work.

TRIP DISTRIBUTION

The purpose of trip distribution is to produce a trip table of the estimated number of trips from each TAZ to every other TAZ within the study area. Vehicle trip distribution for this study was estimated using the TransCAD Gravity Model program. The Gravity Model assumes that the number of trips between two zones is 1) directly proportional to the vehicle trips produced and attracted to both zones, and 2) inversely proportional to the travel time between the zones.

TABLE 4. TRIP GENERATION RATES

Model ID	Socioeconomic Description	Socioeconomic Type	Units	Model Daily Rate	ITE Daily Rate
1	Residential	Single Family	DU	9.50	9.57
2	Residential	Multi Family	DU	N/A	N/A
3	School	Elementary/Jr. High	Students	1.05	1.02
4	School	Sr. High	Students	1.80	1.79
5	School	College	Students	1.30	1.54
6	Commercial/Retail	Major Shopping Center	Employees	29.00	28.40
7	Commercial/Retail	Commercial/Retail	Employees	18.00	22.36
8	Commercial/Retail	Hotel/Motel	Rooms	7.00	8.92
9	Office	Office	Employees	9.00	3.32
10	Medical	Hospital	Beds	9.00	10.81
11	Medical	Medical Office	Employees	10.00	8.91
12	Ind/Man/Ware/Util	Warehousing	Employees	3.50	3.89
13	Ind/Man/Ware/Util	Industrial/Manufacturing	Employees	4.50	4.50

The Gravity Model formulation states that the number of trips between each zone is equal to:

$$T_{ij} = \frac{P_i A_j F_{ij}}{\sum (A_j F_{ij})}$$

where:

- T_{ij} = number of trips between zone i and zone j
- P_i = number of trips produced in zone i
- A_j = number of trips attracted to zone j
- F_{ij} = an empirically derived friction factor which is a function of the travel time between zone i and zone j

Friction factors express the effect that travel time has on the number of trips traveling between two zones. Vehicle trips were distributed for the three trip purposes.

The number of vehicles were calculated using the base year land use data and trip generation rates by trip purpose. Data from the external traffic zones were combined with the internal zone trips to create the total productions and attractions for the model. The productions and attractions were balanced to ensure that for each production generated by the model there was an attraction. Table 5 gives a summary of the vehicle trip productions and attractions by trip purpose for the whole study area.

TABLE 5. 2003 VEHICLE TRIP SUMMARY

Trip Purpose	Total Trips	Percent Trips
Home-Based Work	45,867	24%
Home-Based Other	89,293	47%
Non Home-Based	54,726	29%
Total Trips	189,305	100%

The percent of trips by trip purpose appear reasonable as compared to the report *Travel Estimation Techniques for Urban Planning*, NCHRP Report 365, 1998. Similarly with variation of trip generation rates, the breakdown of trip purpose is a function of the local travel behavior of the Kearney area.

The friction factors were created using the following gamma function:

$$F(c_{ij}) = ac_{ij}^{-b} e^{-c(c_{ij})}$$

where the parameters a, b, and c were initially used from the report *Travel Estimation Techniques for Urban Planning*. However, these parameters can vary by model size and local travel behavior. During the model calibration process, these values were further evaluated and checked for reasonability based on traffic count error analysis. The final values used are displayed in Table 6.

**TABLE 6. TRAVEL ESTIMATION TECHNIQUES FOR URBAN PLANNING
GAMMA FUNCTION PARAMETERS**

Trip Purpose	a	B	C
HBW	28,507	-2.9	0.60
HBO	139,173	-2.5	0.95
NHB	219,113	-2.7	1.00

VEHICLE TRIP ASSIGNMENT

The purpose of trip assignment is to assign vehicle trips to specific paths, or routes, in the transportation network. Trip assignment is a function of 1) the shortest travel time along paths between zones, and 2) the level of congestion of the links within those paths. Vehicle trips for the study area were assigned to the transportation network using the TransCAD Stochastic User Equilibrium Assignment Algorithm.

TransCAD provides several other traffic assignment methods. The User Equilibrium (UE) is a commonly used assignment method that is widely used in regional models. The UE uses an iterative process to achieve a convergence in which no travelers can improve their travel times by shifting routes. However, with the Stochastic User Equilibrium (SUE) method, assignments produce more realistic results from the UE method since SUE permits use of less attractive as well as the most attractive routes. Less attractive routes will have lower utilization, but will not have zero flow as they do under the UE method.

The SUE assignment reads in the vehicle origin-destination trip table and the roadway network and assigns the vehicle trip table to the network based on the modified equilibrium assignment method. The SUE assignment is premised on the assumption that travelers have imperfect information about the network paths and/or vary in their perceptions of network attributes. Equilibrium occurs when a trip in the system cannot be made by an alternate path without increasing the total travel time of all trips in the network.

The assignment process assigns both internal and external vehicle trips to the network. Internal vehicle trips are those trips with either an origin or a destination inside the study area. The gravity model described in the previous section produces an internal vehicle trip table. However, vehicle trips through the study area must also be assigned to the network. External-to-external trips are through trips, those with both an origin and destination outside of the study area.

The external-external vehicle trip table was developed using origin and destination data from comparable areas in Nebraska and local empirical knowledge.

The internal vehicle trip table is then added to the external trip table to give a total vehicle origin-destination table. This origin-destination table is then assigned to the regional network.

For this study, external TAZs are located at the following locations:

Zone 150 – State Highway 40 (West)	Zone 154 – State Highway 44 (South)
Zone 151 – State Highway 10 (North)	Zone 155 – I-80 (West)
Zone 152 – US Highway 30 (East)	Zone 156 – US Highway 30 (West)
Zone 153 – I-80 (East)	

MODEL CALIBRATION/VALIDATION

Calibration is an iterative process upgrading or adjusting entered data, program coefficients or parameters, and assumptions on successive simulation runs, until the volumes and traffic patterns produced by the model approximate known traffic counts within acceptable limits.

One source that was utilized for acceptable limits is the report *Calibration and Adjustment of System Planning Models*, Federal Highway Administration, December 1990. The primary premise behind these guidelines is that simulated model data should not significantly differ from actual count data to cause inappropriate under- or over-design of roadway facilities. However, the percent difference between modeled volumes and actual counts may be large, but is only significant in relation to its functional classification and the magnitude of the volume itself. The following performance measures were reviewed:

- Percent assignment error
- Root Mean Square error
- Coefficient of Determination; R^2

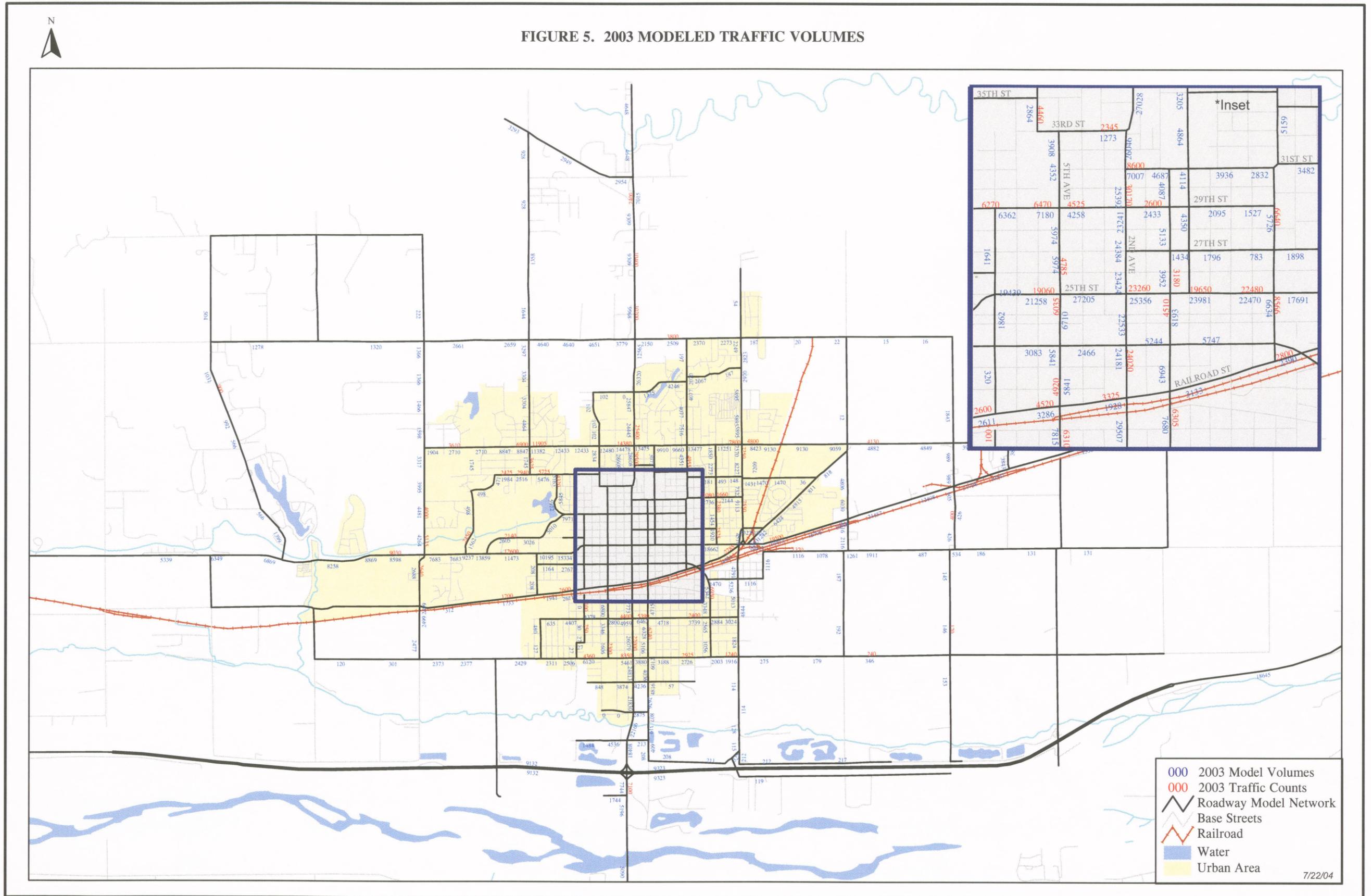
The assigned 2003 daily traffic volumes were compared with the counted daily traffic volumes for individual links. The comparison indicated the following: 1) the computed vehicle miles traveled (VMT) in the study area are approximately 482,869 per day, 2) the estimated vehicle hours traveled (VHT) in the study area are approximately 138,062 per day, and 3) the average daily speed on the network equated to approximately 32 miles per hour. The VMT, VHT, and do not include the centroid connectors. The average daily speed, in addition, does not include the interstate speed, since it would misrepresent the internal circulation average speed. The resulting traffic assignments volumes for the year 2003 are shown in Figure 5.

Percent Error of Traffic Assignment

The percent error of traffic assignment indicates the accuracy with which the transportation model replicates the actual traffic counts. Percent error is the difference between the assigned traffic volumes and the counted traffic volumes divided by the counted traffic volumes. Based on the report *Calibration and Adjustment of System Planning Models*, the following are suggested error limits:

- Freeways Less than 7 percent
- Principle Arterials Less than 10 percent
- Minor Arterials Less than 15 percent
- Collectors Less than 25 percent
- Frontage Roads Less than 25 percent

FIGURE 5. 2003 MODELED TRAFFIC VOLUMES



Since the Kearney model consists of different roadway functional classification, the above classifications were regrouped in order to provide a similar comparison with the model classifications. The computed percent error absolute value is given in Table 7 along with suggested error ranges.

TABLE 7. PERCENT ASSIGNMENT ERROR

Functional Class	Percent Error	
	Computed	Suggested Range*
Rural Principal Arterial	N/A	<10%
Rural Major Arterial	0.1%	<15%
Rural Minor Arterial	4.9%	<15%
Rural Collector	5.4%	<25%
Rural Local	N/A	N/A
Urban Principal Arterial	N/A	<10%
Urban Major Arterial	1.8%	<15%
Urban Minor Arterial	0.7%	<25%
Urban Collector	2.7%	<25%
Urban Local	N/A	N/A
Total Network	0.6%	<5%

*Source: *Calibration and Adjustment of System Planning Models*, Federal Highway Administration, December 1990.

As the table shows, the percent error of the traffic assignment for the network as a whole was 1.5 percent, which is within the recommended five percent error, an indication of how well the model is calibrated.

Root Mean Square Error

Another measure of the model's ability to assign traffic volumes is the percent RMSE. The RMSE measures the deviation between the assigned traffic volumes and the counted traffic volumes and is given as:

$$\% \text{ RMSE} = \frac{100 * \sqrt{\frac{\sum_j (\text{Model}_j - \text{Count}_j)^2}{(\text{Number of Counts} - 1)}}}{\left(\frac{\sum_j \text{Count}_j}{\text{Number of Counts}} \right)}$$

A large percent RMSE indicates a large deviation between the assigned and counted traffic volumes; whereas, a small percent RMSE indicates a small deviation between the assigned and counted traffic volumes. The percent RMSE by facility type is given in Table 8.

TABLE 8. PERCENT ROOT MEAN SQUARE ERROR

Functional Class	Percent RMSE
Rural Principal Arterial	N/A
Rural Major Arterial	8.00%
Rural Minor Arterial	42.86*%
Rural Collector	25.21%
Rural Local	N/A*
Urban Major Arterials	11.85%
Urban Minor Arterials	25.04%
Urban Collector	26.24
Urban Local	0%
Total Network	19.65%

* Only two counts available for comparison

Currently, there are no national guidelines for model verifications of RMSE. However, common engineering practice is that a model with a RMSE of 35% and lower is representative of a good model. National regional model summary statistics for the RMSE were obtained in order to provide a comparison with the Kearney model. Of the 18 regional models obtained, the RMSE ranged from a 22% to 50% with an average of approximately 44%. The Kearney model's RMSE is less than 20%, which is lower than the best RMSE from other regional areas.

Coefficient of Determination

Another tool to measure the overall model accuracy is the coefficient of determination or R^2 (see formula below). The R^2 , or 'goodness of fit' statistic shows how well the regression line represents the assignment data. The desirable R^2 is 0.88 or higher. A value of 1.00 is perfect, but even if traffic counts were compared against themselves, the daily variation would not allow for a regression coefficient of 1.00. The value of 0.96 achieved for the Kearney illustrates that the model validation is also very good.

$$r^2 = \left(\frac{n \sum (x_i y_i) - (\sum x_i)(\sum y_i)}{\sqrt{[n \sum x_i^2 - (\sum x_i)^2][n \sum y_i^2 - (\sum y_i)^2]}} \right)^2$$

where:

- x = counts
- y = model volumes
- n = number of counts

REFERENCES

1. Caliper Corporation, *Travel Demand Modeling with TransCAD Version 4.5*, 2002.
2. Federal Highway Administration, *Calibration and Adjustment of System Planning Models*, 1990.
3. Institute of Transportation Engineers, *Trip Generation, 6th Edition*, 1997.
4. Transportation Research Board, *NCHRP 365. Travel Estimation Techniques for Urban Planning*, 1998.

GLOSSARY

ADT:	Average Daily Traffic - average daily traffic volume as measured over a certain number of days.
Calibration:	The process of defining and adjusting model parameters until the model replicates the travel patterns exhibited in the study area.
Capacity:	The maximum number of vehicles or persons that can be carried past a point on a transportation system in a specified time.
Capacity Restraint:	The limiting of traffic movement on a link by applying a volume-to-capacity ratio (which measures congestion) based traffic assignment.
Centroid:	A representative node in the transportation network that is assumed to be the location of all trips generated to and from a zone.
Ground Count:	An actual traffic volume count.
Intra-zonal Trips:	Those trips occurring totally within a zone (TAZ).
Link:	An element in a transportation network representing a street section that connects two nodes.
Minimum Path:	The travel route between two points which yields the minimum travel time. This data is displayed in a matrix.
Network:	A system of links and nodes that describes a transportation system.
Network Coding:	The process of representing a real transportation system in terms of a network "model" used for computer processing.
Node:	A point on a highway network where links intersect, end or change direction.
Screenline	A screenline is an imaginary line of one or more line segments crossing a number of network links. Screenline analysis are used for calibration purposes.
TAZ:	Traffic Analysis Zone - a geographical area used as a basis for estimating socioeconomic variables and trip generation.

GLOSSARY (Continued)

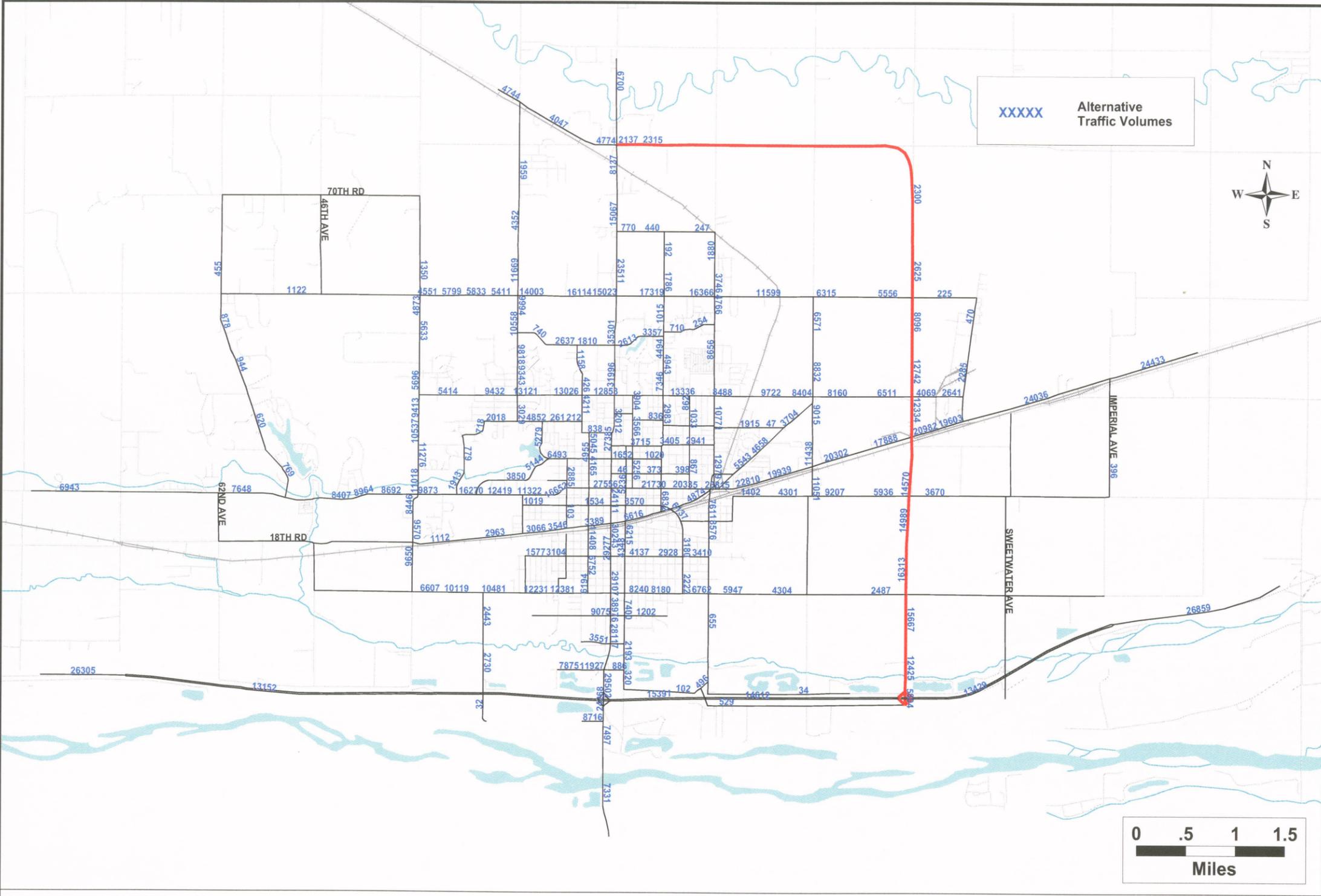
Travel Time:	The amount of time needed to travel between two points or places.
Frequency Distribution:	A table or graphical representation that shows the percentage of total trips within each travel time increment.
Trip Assignment:	A process that assigns trips to various paths or routes in a network.
Trip Distribution:	The process that estimates the number of trips traveling between geographical zones in a transportation network.
Trip Generation:	The process that estimates the number of trips generated by the land use within each zone.
Trip Table:	A table (matrix) which illustrates the number of trips from each zone to every other zone in the study area.
Validation:	Running the calibrated model(s) with the current socioeconomic data and comparing to the ground traffic counts.
VHT:	Vehicle hours of travel - the number of vehicles on a link, generally for a daily period, multiplied by the length of the time traveled, in hours. The VHT for a study area is the sum of the VHTs for each link.
VMT:	Vehicle miles of travel - the number of vehicles on a link, generally for a daily period, multiplied by the length of the link, in miles. The VMT for a study area is the sum of the VMTs for each link.



APPENDIX D

Alternative Traffic Volume Assignment Plots

XXXXX
Alternative
Traffic Volumes

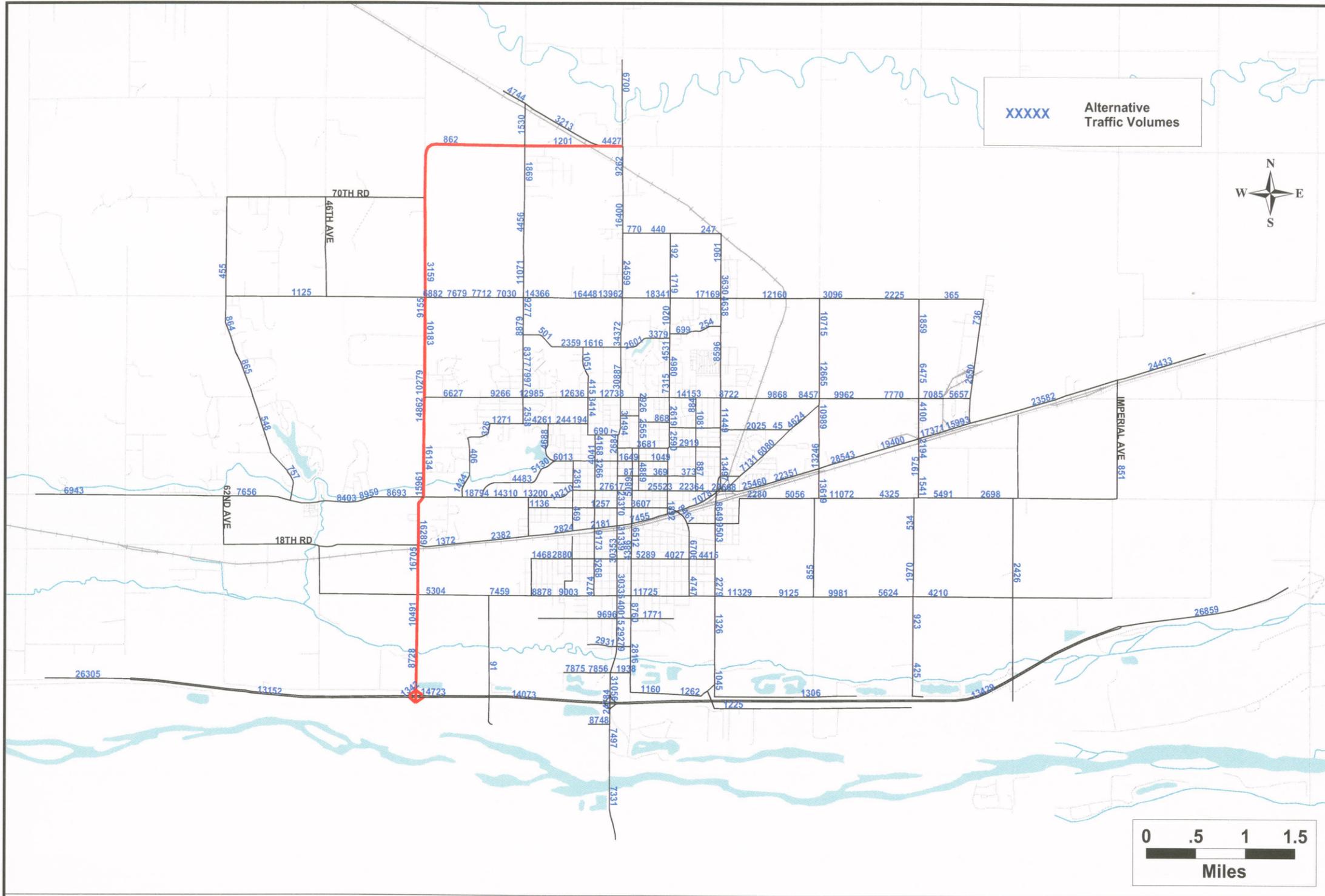


CITY OF KEARNEY
Transportation Plan Update
Alternative 1 Traffic Assignment
*Interchange at Cherry Ave
with East Bypass*



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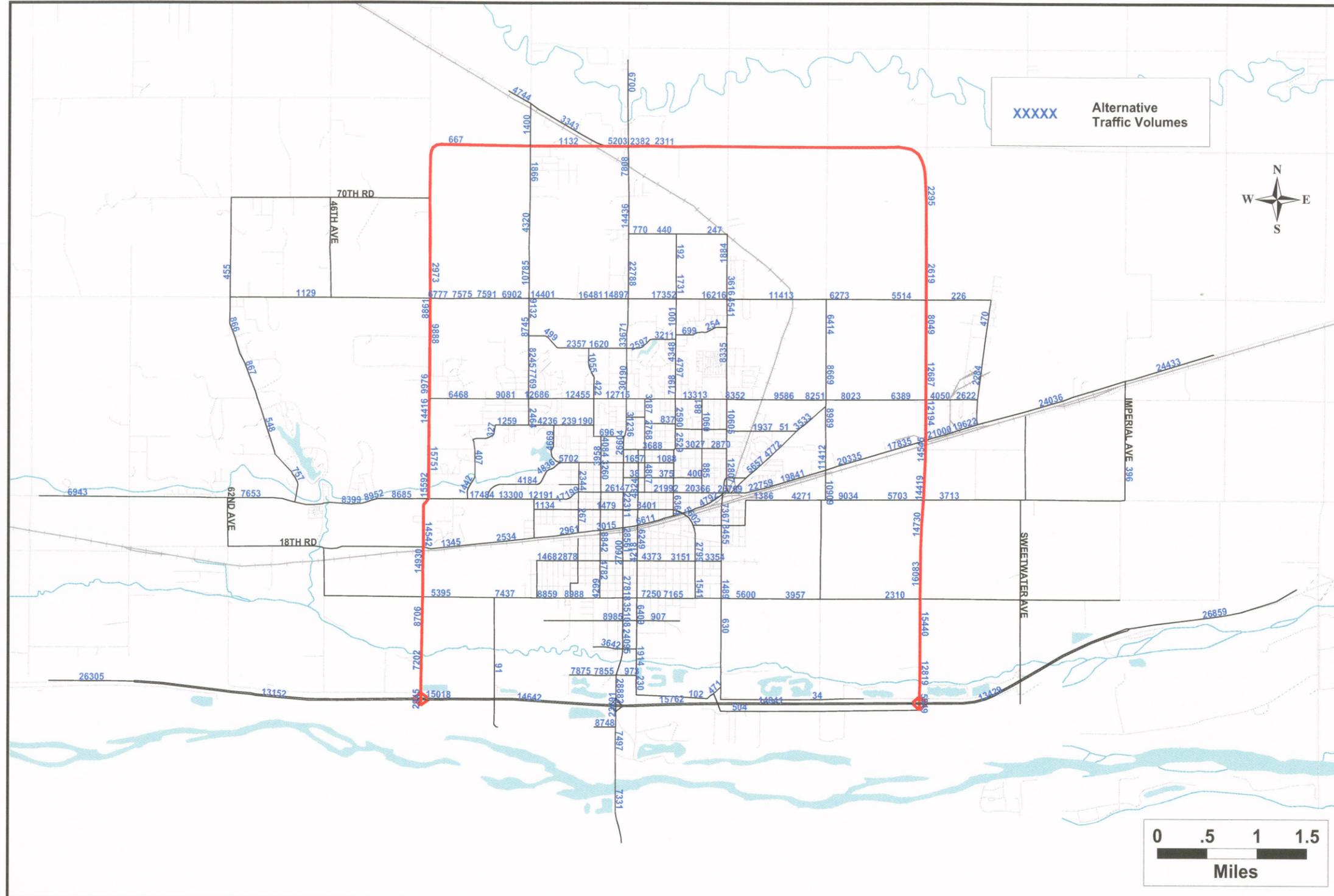
XXXXX
Alternative
Traffic Volumes



CITY OF KEARNEY
Transportation Plan Update
Alternative 2 Traffic Assignment
*Interchange at 30th Ave
with West Bypass*



XXXXX
Alternative
Traffic Volumes

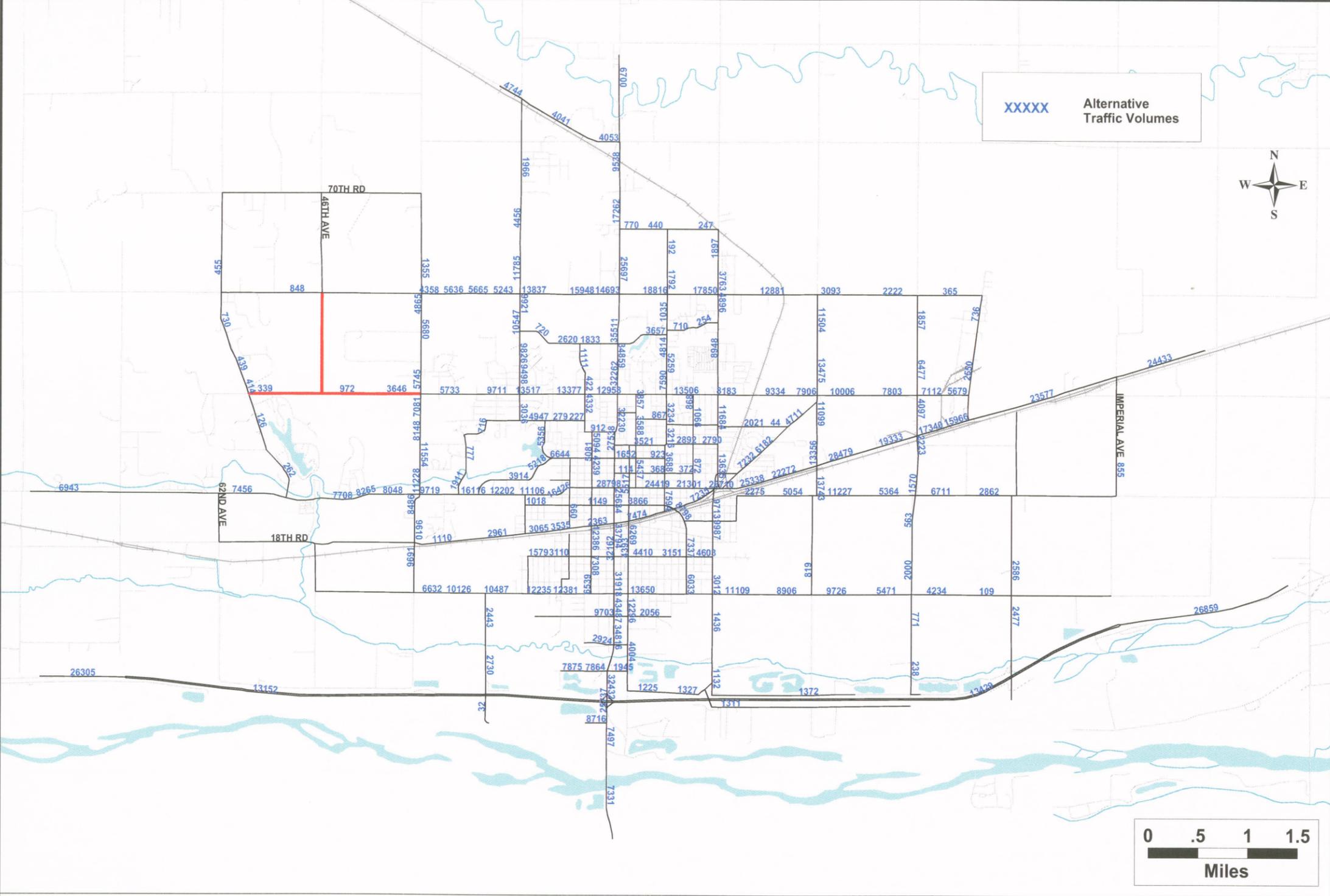


CITY OF KEARNEY
Transportation Plan Update
Alternative 3 Traffic Assignment
*Interchanges at Cherry Ave and 30th Ave
with East and West Bypass Roadways*



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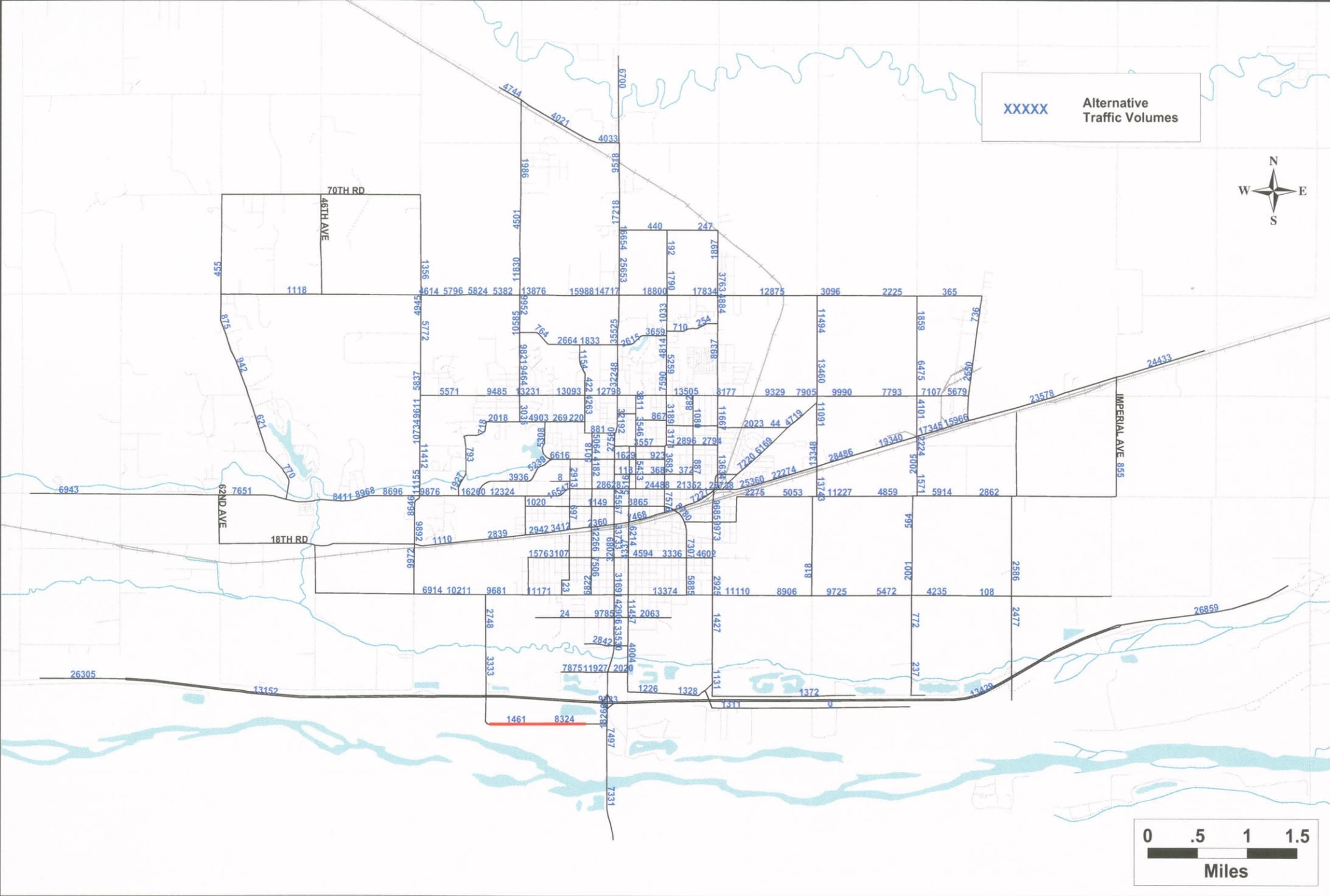
XXXXX
Alternative
Traffic Volumes



CITY OF KEARNEY
Transportation Plan Update
Alternative 4 Traffic Assignment
*Expansion of Roadway Network into
Cottonmill Park and Rolling Hills
Developments*



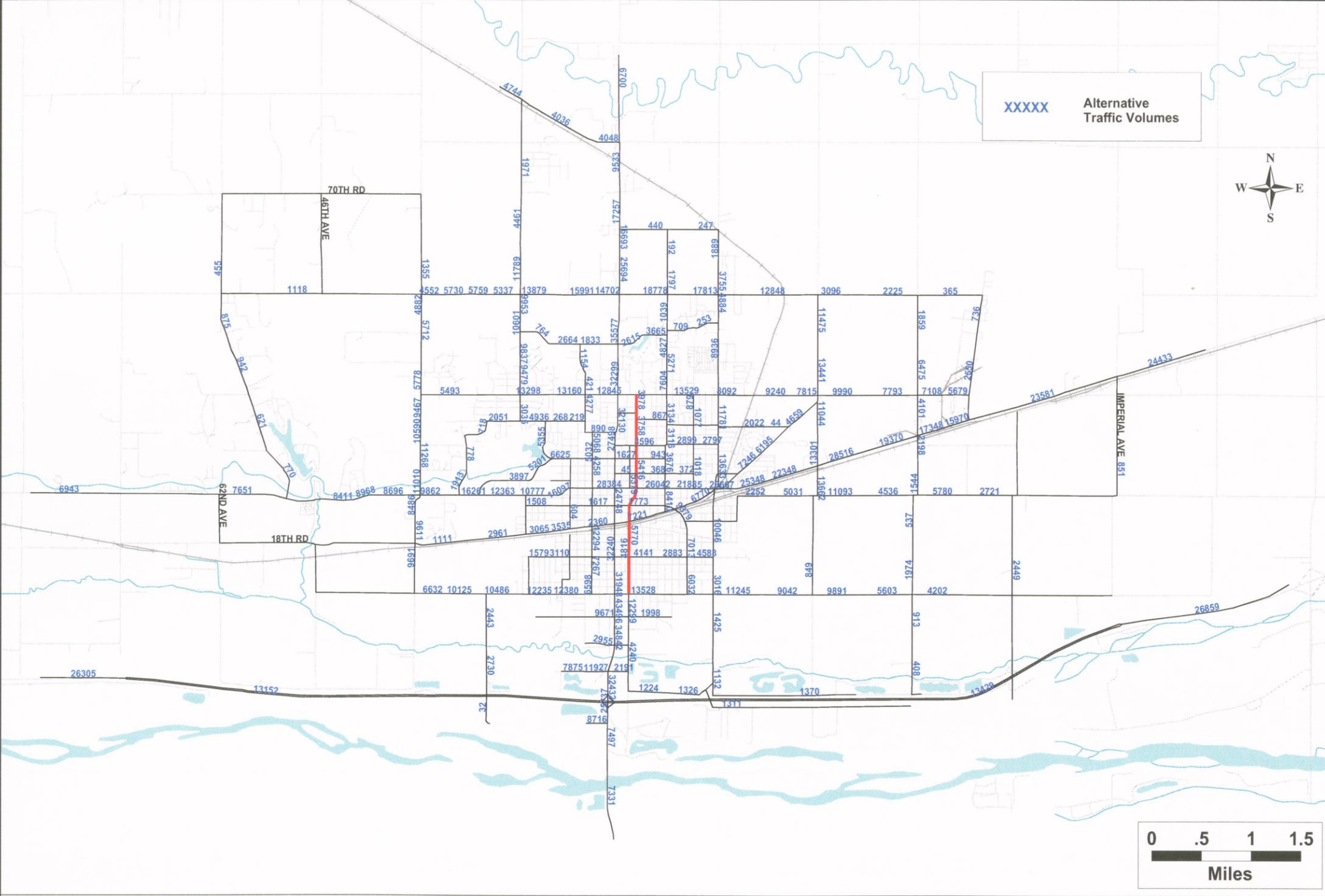
XXXXX
Alternative
Traffic Volumes



CITY OF KEARNEY
Transportation Plan Update
Alternative 5 Traffic Assignment
Connection of Kea West Ave



XXXXX Alternative Traffic Volumes

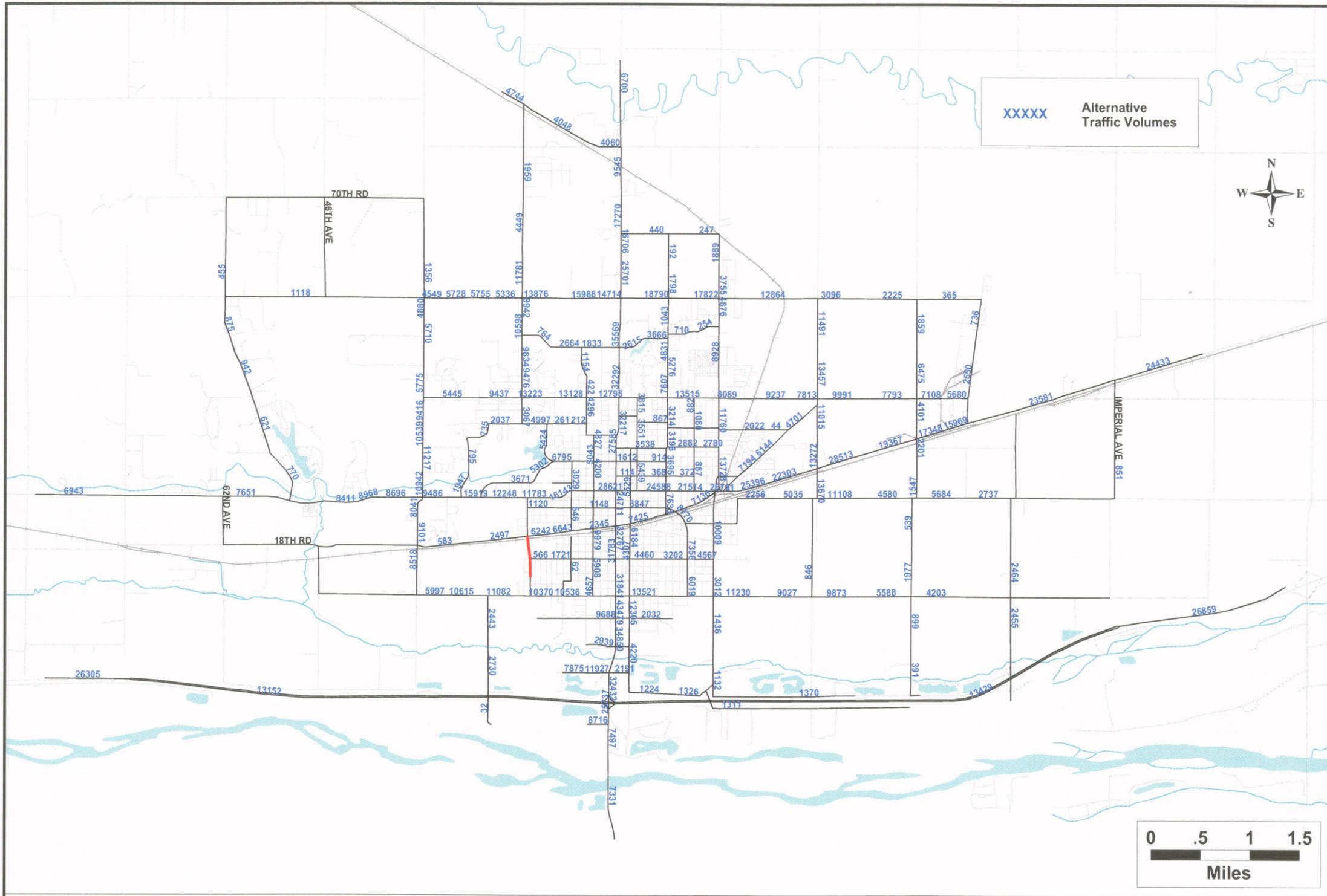


CITY OF KEARNEY
Transportation Plan Update
Alternative 6 Traffic Assignment
Central Ave / Avenue A Connection



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XXXXX
Alternative
Traffic Volumes

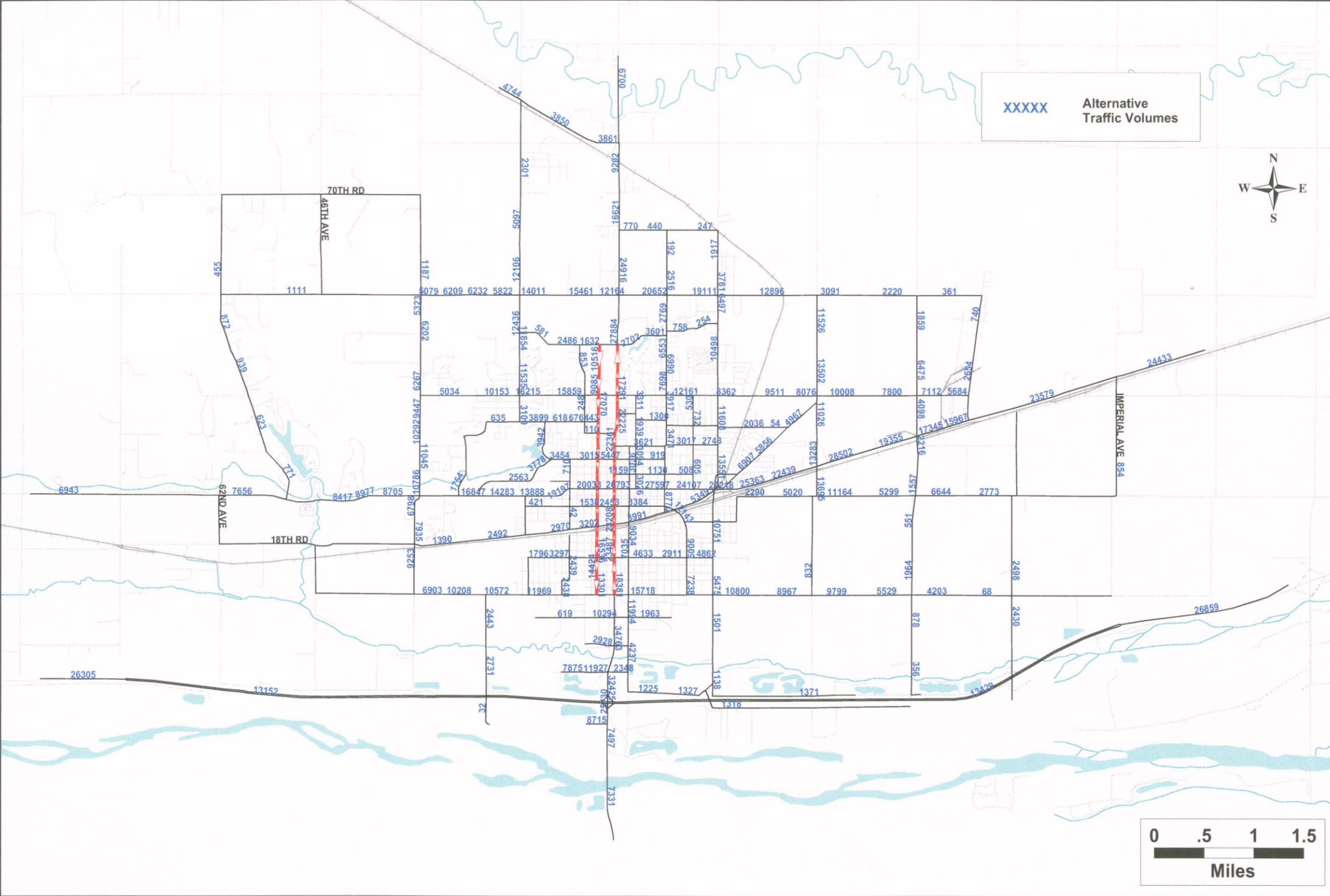


CITY OF KEARNEY
Transportation Plan Update
Alternative 7 Traffic Assignment
*Railroad Viaduct Connecting
15th and 17th Ave*



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XXXXX
Alternative
Traffic Volumes



CITY OF KEARNEY
Transportation Plan Update

Alternative 8 Traffic Assignment
2nd Ave and 4th Ave as a One-Way Pair

