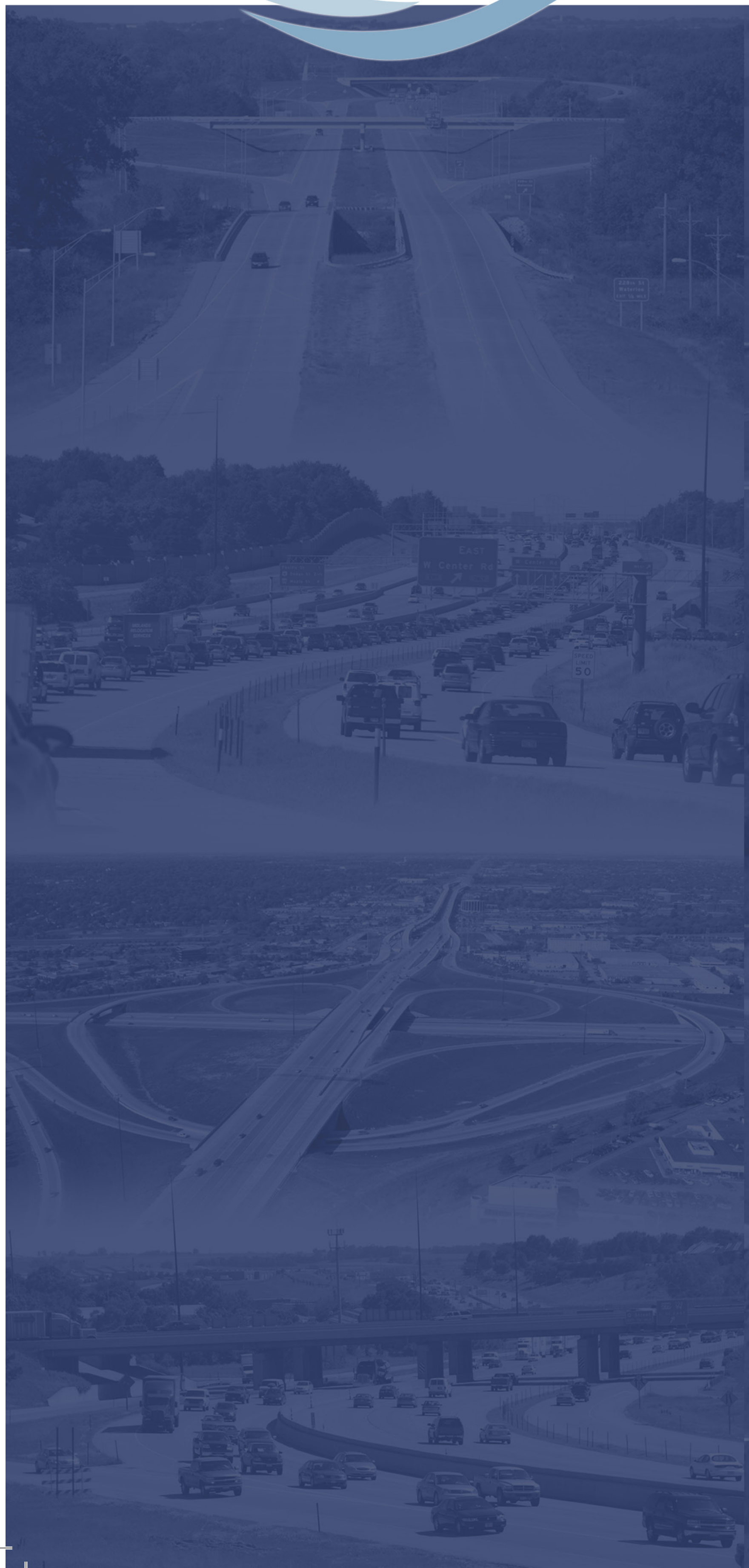
Final Report



Omaha-Council Bluffs Metro Beltway Feasibility Study

March 2010

HDR

FELSBURG HOLT & ULLEVIG

Project Sponsors:

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EXECUTIVE SUMMARY

As the Omaha-Council Bluffs metropolitan area (metro) continues to grow, the demands on the transportation system grow with it. Over the last 20 years the metro area has pushed out beyond the current freeway system and rising congestion levels indicate the need for additional transportation infrastructure to serve future needs. Transportation investment has become less proactive and more reactionary over the past 20 years. Maintaining the current transportation network is a significant challenge given the dwindling funding resources. As such, planning for the future and providing a transportation system that meets the demands is challenging.

Based upon these factors, it was prudent for the Metropolitan Area Planning Agency (MAPA) to investigate a possible need for a new high capacity roadway system to serve growth and reduce congestion in the metro area. To ensure the study met the expectations and needs of the metro area a Steering Committee comprised of key local agency representatives was established. The Steering Committee provided oversight and guidance for study activities. Additionally, stakeholder meetings were held to provide information about study activities and gather input from interested groups in the community.

Does the Omaha-Council Bluffs metro area need a beltway?

ES-1 Study Purpose

The purpose of this study was to address the question: *Does the Omaha-Council Bluffs metro area need a limited access, high speed transportation corridor near the outer limits of the metro area to serve present and future transportation needs?* In addition to addressing this key question, the study also addressed the following questions:

- If a beltway would be beneficial, generally where should it be located?
- Are there alternative improvements other than a beltway? For example, new radial freeway connections, enhancements to the existing arterial system or significant enhancements to transit.
- Would land use development patterns have an impact on the location and type of facility needed? Do these land use patterns affect alternatives to a beltway?
- What are the economic impacts of the transportation alternatives?

These broad questions can be addressed from many perspectives. The key measures used in this study included traffic service, economic impacts, socio-economic impacts and engineering. Note the purpose of this study was not to identify and recommend a single solution. Instead the purpose was to identify feasible solutions and provide guidance for moving forward with future steps beyond this study.

ES-2 Study Process

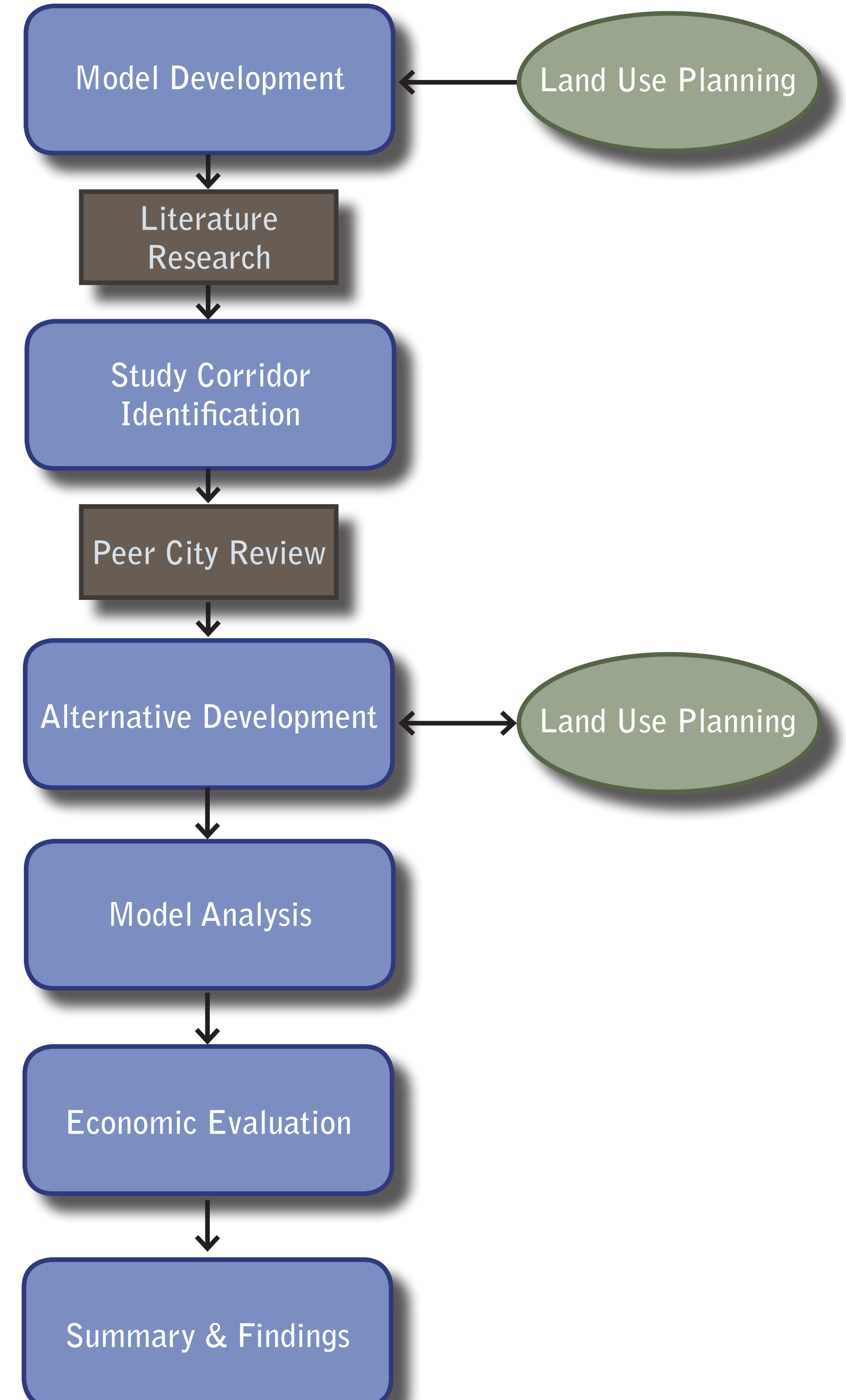
A systematic study process was implemented to assess the need for a beltway. This process was developed to answer not only the central question of a beltway, but also to look at the opportunities and benefits of other plausible transportation alternatives. Additionally, the influence of land use development policies on the various alternatives was evaluated to determine how land use contributes to the findings. The flow chart in **Figure ES-1** identifies the key elements of the study.

A travel demand model was the primary tool used to evaluate the transportation impacts of the study alternatives. A travel demand model is a detailed computer model that uses information such as roadway networks, population, employment data and land use forecasts to calculate the expected demands for transportation facilities. These demands along with other travel information from the analysis can be aggregated to provide operational measures such as travel time, congestion levels and average speeds.

ES-3 Is There a Problem?

Initially an evaluation was conducted to determine how the metro transportation system will operate in the future when the current Long Range Transportation Plan projects are complete. Note, this test included the assumption that the Long Range Plan would be fiscally constrained and that no illustrative or extra projects would be completed during this time. It was determined that if only the projects listed in the current transportation plan are completed by 2035, the future metro transportation system will see a significant decrease in overall system performance compared to current conditions. Transportation model findings show that average travel speed on freeways and highways will drop by 20%. Additionally, whereas 1 in 17 miles of freeways and highways are over capacity today, that will increase to 1 in 5 miles by 2035. In terms of travel time, an average 20 minute trip will take approximately 25 minutes. In financial terms, it is estimated that, on average, each household in the metro area will incur $727 of additional direct costs annually (2008 dollars). These additional costs would be due to additional time spent driving in congestion, fuel consumption and other vehicle costs. Over a one-year period these costs amount to an additional $296 million in direct user costs for metro area residents.

Figure ES-1 Study Flow Chart



Additionally, a peer city review was performed to compare the Omaha/Council Bluffs metro area to other similarly sized cities in the United States. Nine similarly sized urbanized areas from around the country were selected for the comparison. Freeway travel statistics were compared and it was notable that the Omaha/Council Bluffs metro area ranked 8th or 9th in every category of comparison. Although there are multiple factors that influence these statistics, this comparison did indicate the metro area may be underserved by freeway facilities.

Based upon these evaluations it is clear the planned transportation improvements will not adequately address the future transportation needs, therefore, more improvements will be necessary to meet future demand.

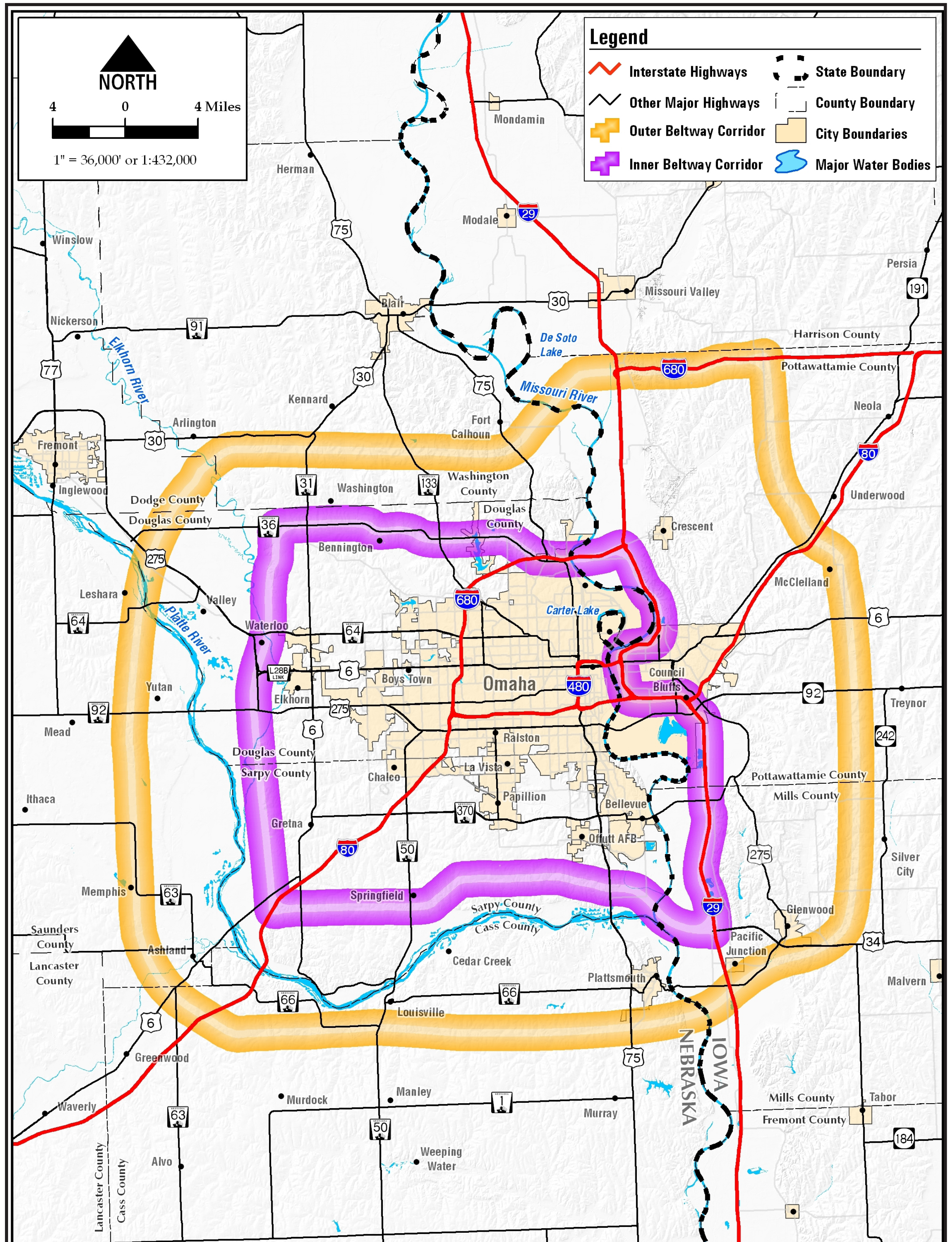
ES-4 Beltway Alternatives

In order to provide a more comprehensive evaluation of the benefits a beltway might provide the metro area, it was determined that two concepts should be developed and evaluated. These two concepts represented an inner and outer range of plausible future beltways. Specific alignments were not determined. Rather two-mile wide bands that represent an area where a beltway may fit were identified. Efforts were made to avoid and minimize impacting properties and natural resources to the extent possible when identifying the two-mile bands. Both the inner and outer beltway bands are outside the current metro urban area as shown in **Figure ES-2**.

Beltway Transportation Performance

Each of the beltway alternatives were analyzed in the travel demand model as four-lane freeways. The characteristics of the four-lane freeway are similar to those of I-29 north and south of the Omaha metro area. Analysis showed that the potential beltways would relieve traffic demand on key corridors. The future average daily traffic on I-80, for example, shows a moderate volume reduction with either the inner or outer beltway. Evaluation measures used to compare transportation alternatives showed improvements under both beltway scenarios, with reduced system-wide delay and congestion.

Figure ES-2 Outer and Inner Beltway Corridors



> Both beltway systems relieve traffic volumes on key corridors, with reduced delay and congestion throughout the transportation network

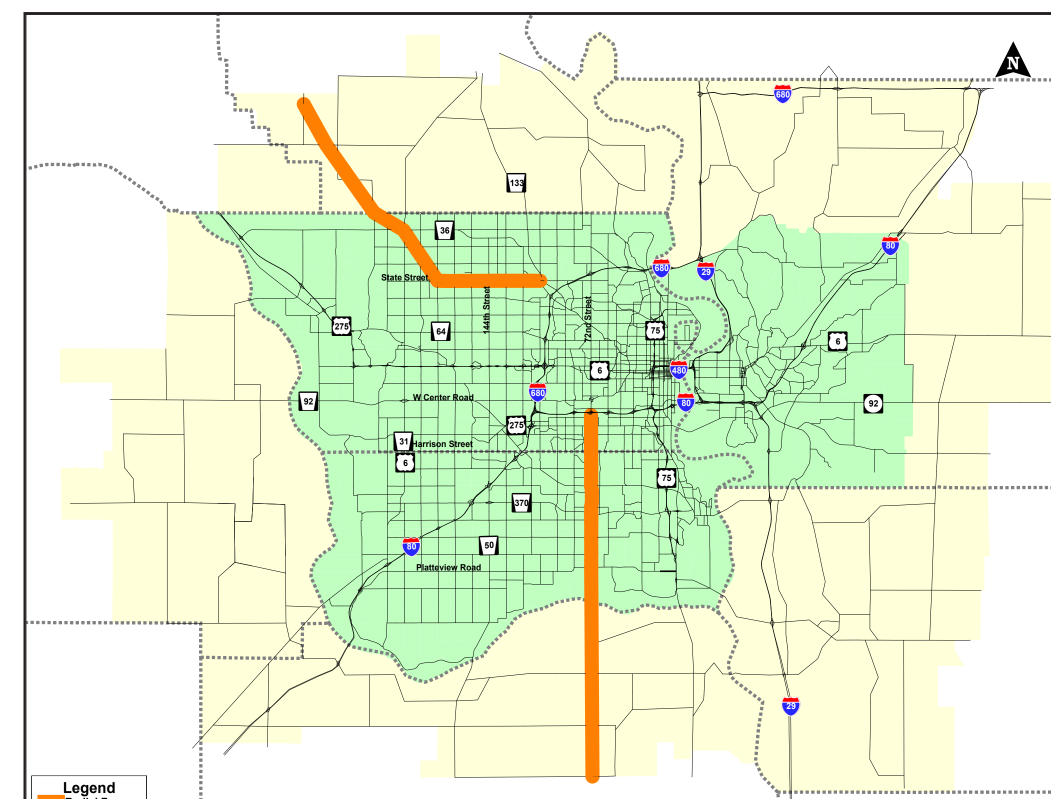
ES-5 What Other Transportation Alternatives were Considered?

In order to answer the study questions, it was desirable to consider other plausible alternatives to a beltway. In addition to testing beltway alternatives, a variety of non-beltway transportation alternatives were evaluated including:

- A radial freeway system
- An enhanced arterial network ('super arterials')
- Enhanced transit system

These transportation alternatives are shown in **Figures ES-3**, **ES-4**, and **ES-5**. The radial freeways would be a method for providing improved access

Figure ES-3 Radial Freeways



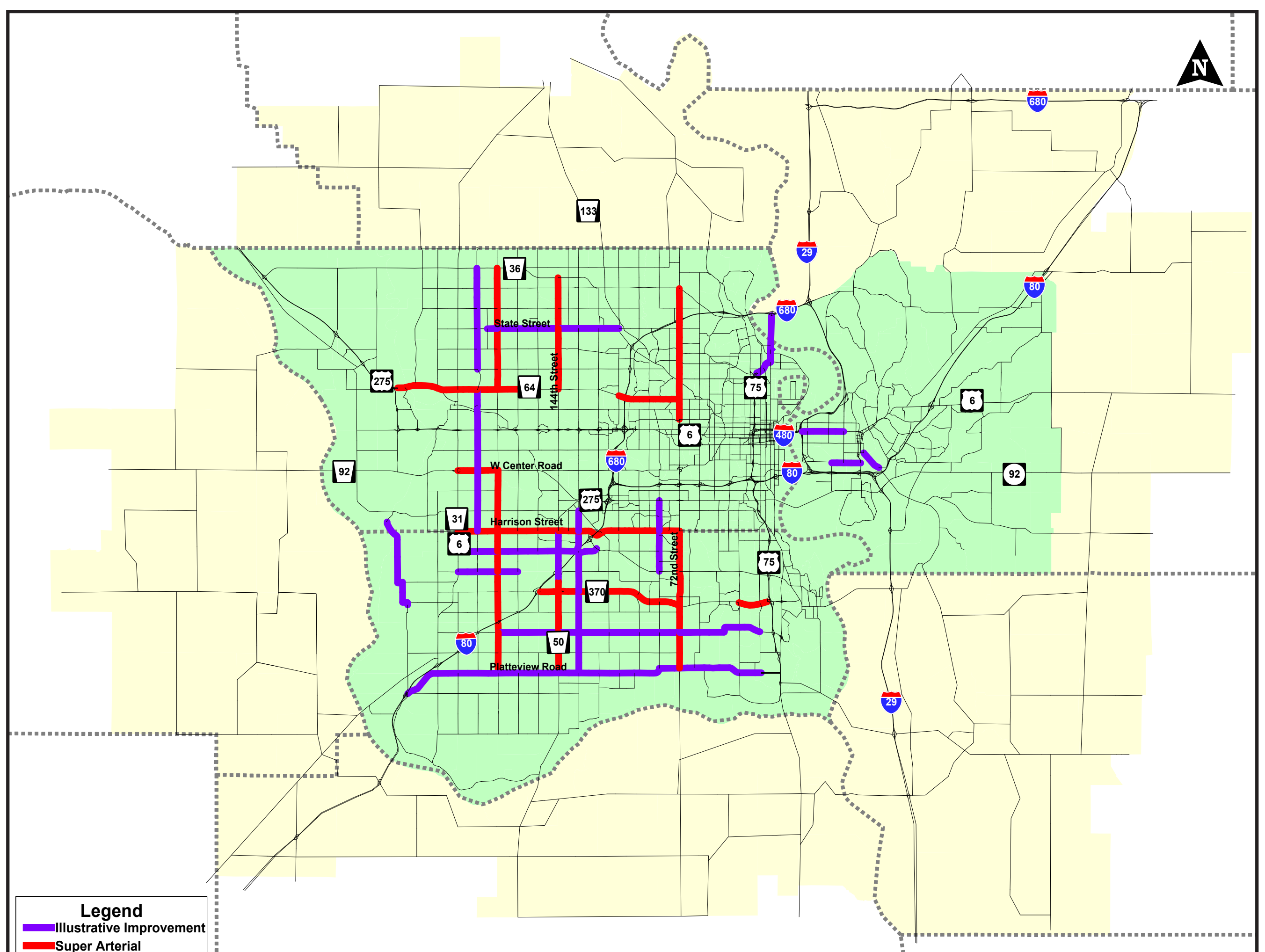
to growth areas in the southern and northwestern metro areas. The super arterials network would provide more six-lane roadways throughout the metro area. The transit alternative was derived based upon comparisons to other cities in which ridership levels are substantial. Cities such as this have rail transit as a component of their transit system. As such this study assumed a significant light rail transit system approach.

Alternatives Performance

Similar to what was done for the two beltway alternatives, these three non-beltway alternatives were evaluated for their benefits to the overall transportation system's performance. The radial freeway network produced marginal benefits. The enhanced arterial network showed slightly better improvements to the transportation system than that of the beltways.

The assumed transit ridership was 5% of all system wide trips, which would represent a ten fold increase of existing transit ridership in the metro area. Note that dramatically different development patterns than the *status quo* would be necessary to realize this level of ridership, which would entail political pressure and redevelopment costs. Assuming such levels would be achieved through a significant light rail investment, the transportation system benefits would be approximately twice that of a beltway alternative.

Figure ES-4 Super Arterials



Transportation Alternative Feasibility and Probable Construction Costs

A range of probable construction costs were calculated for each alternative. The cost estimates were developed for comparative purposes and were based on typical ranges for such improvements around the Midwest. The estimates were used for the economic analysis:

- Outer Beltway: $1,300 - 1,500
- Inner Beltway: $700 - 800
- Radial Freeways: $600 - 700
- Super Arterials: $1,300 - 1,500
- Transit: $2,400 - 2,600

Note: Total estimated construction costs in millions of 2008 dollars.

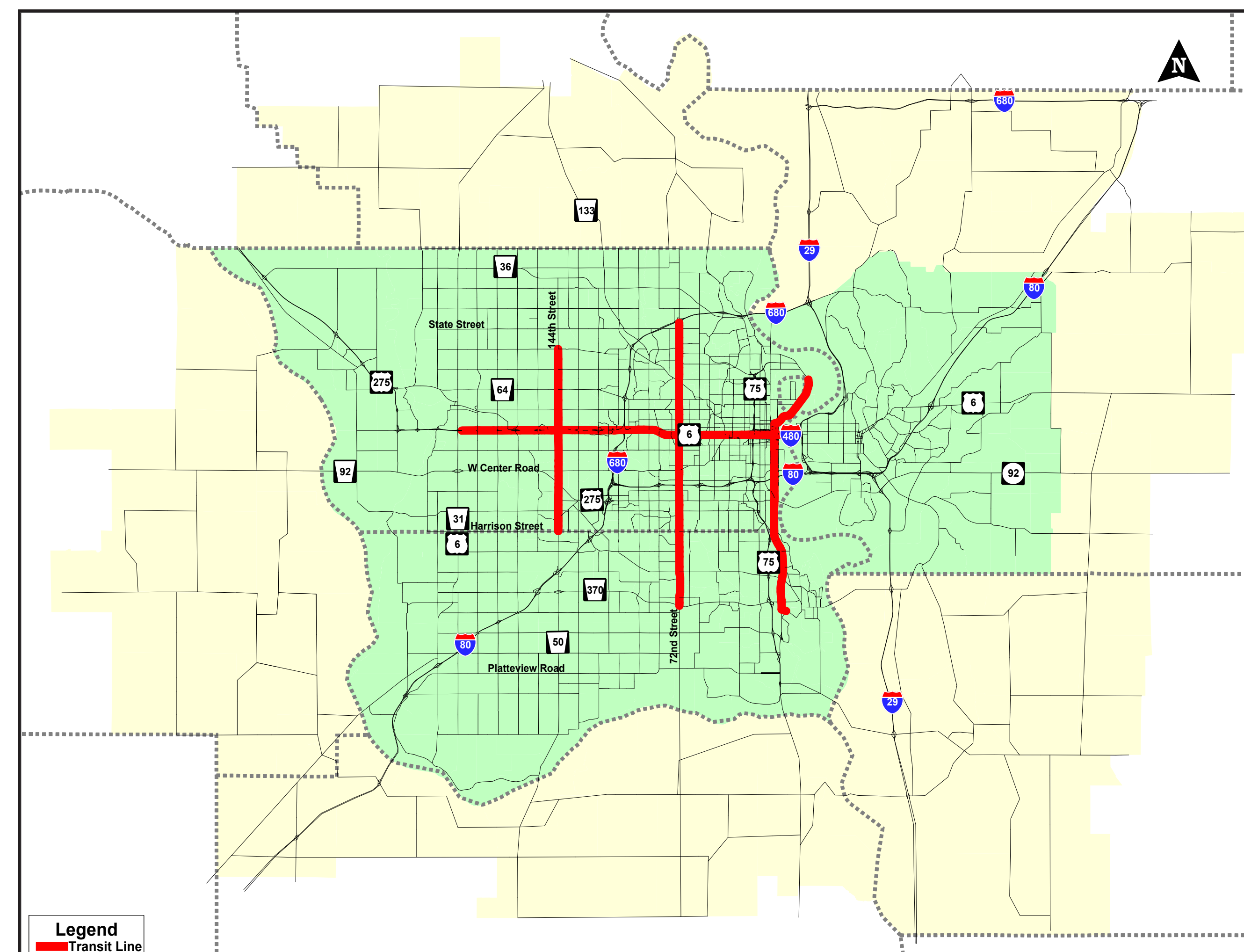
Widening existing major arterials and major transit system improvement do yield substantial transportation system improvements

ES-6 How does Land Use Affect the Transportation Alternatives?

The initial comparisons between transportation alternatives were made based upon the currently planned future land use patterns. While this is an effective basic comparison method, it does not address how the alternatives would perform if land use and demographic trends change in the future. In order to address this issue, testing was conducted on the effects alternative land use development practices would have on the various transportation alternatives.

Three land use scenarios were defined for consideration (targeted density, transit oriented, sprawl) to compare to the assumed future land use (status quo). The

Figure ES-5 Transit Option



assumed future land use is based upon the projected population growth and comprehensive plans of the jurisdictions in the study region which plans for about 3 units per acre. Under the targeted density land use scenario, emphasis is given to infill development and creating focused mixed use areas including office, retail and residential uses within walking distance of neighborhood amenities in new areas. This development density is about 5 units per acre. The transit oriented land use scenario assumed denser development along proposed rail transit lines which approaches 12 units per acre. The sprawl scenario assumed the region develops in a less dense, semi-rural pattern with low population density of one unit per three acres.

Land Use Scenario Performance

Combining the land use with the transportation alternatives resulted in a total of 15 alternative combinations that were evaluated. It was determined through the alternatives testing that increasing land use densities would have a positive effect on transportation service.

ES-7 What are the Economic Impacts of the Alternatives?

A transportation financial analysis was conducted to determine the merit of undertaking the different alternatives. This type of analysis shows if an investment option is worthwhile by determining if the economic benefits (reduced congestion, improved travel time, job creation, etc.) are greater than the economic costs (construction costs, yearly operating expenses, etc.). The economic evaluation showed that most all of the transportation alternatives would be worthwhile undertakings (benefit-cost is greater than one). Although transit improvements at our assumed level yielded the highest value of benefits, the cost to achieve that level were also significant. The highest benefit cost ratio was achieved when targeted density was coupled with an inner beltway improvement.

While most alternatives show some economic benefit, the inner beltway shows the highest economic benefits

ES-8 Summary & Conclusions

The study showed that the transportation system will degrade substantially with a continuation of current development policies and transportation improvement approach. Unless residents of the metro area plan on absorbing an additional $300 million per year in added direct transportation costs, due to increased travel times and additional congestion, something needs done above and beyond the current plans.

This study concludes that altering land use practices to increase densities in new development and promote infill will have a positive impact on the transportation system. Such an approach will also have significant payback beyond transportation.

Additionally it was shown that substantial benefits can be derived by significantly enhancing transit ridership. Levels of 5% to 7% of all trips on transit occur in some major metro areas that emphasize transit and have policies to support it. Such a level would represent a ten fold increase over current ridership levels in the metro area.

Nevertheless, Land use and transit investment cannot replace investment in the roadway system. Even in cities that enjoy high transit ridership, the vast majority of travel still takes place using personal vehicles. An inner beltway system was determined to have a role in the future roadway network.

Through a combination of additional roadway capacity, refined land use policies, and transit investment, the Omaha-Council Bluffs metro area can remain a community in which transportation is not a negative, and for which transportation has a positive impact on the regional economy.

ES-9 Future Steps

The Omaha-Council Bluffs Metro Beltway Feasibility Study provides a considerable amount of information for use in taking future steps to plan for transportation system improvements in the metropolitan area. The study has demonstrated that a multi-faceted approach will be needed to meet future transportation needs for the region. Logical next steps for moving ahead include:

- Regional land use policies should be revised to require more efficient use of land including higher density residential and commercial development.
- A comprehensive transit study should be conducted to test transit opportunities in greater detail and establish reasonable goals and objectives for transit service in the region.
- The inner beltway corridors should be added to the Long Range Transportation Plan to provide the opportunity for initial planning studies that follow Federal guidelines.

Ultimately, the purpose in further studying the beltway corridors is to identify preferred locations and preserve the corridors for the future need. If corridor locations are not protected, it will be difficult to provide an integrated transportation system approach for the future built environment.

The transportation system of the future will benefit from a comprehensive approach of revised land use policies, transit emphasis, and roadway improvements including an inner beltway

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CHAPTER 1 INTRODUCTION

As the Omaha-Council Bluffs metropolitan area (metro) continues to grow, the demands on the transportation system grow with it. Over the last 20 years the metro area has pushed out beyond the current freeway system and rising congestion levels indicate the need for additional transportation infrastructure. Omaha is also a centrally located transportation crossroad in our nation. Interstates 80 and 29 are key transportation corridors that serve trucking, warehousing and farming industries which are key sectors of our Midwest economy. Reliable transportation is a critical element to our regional and national markets. Also, from a community perspective, efficient transportation is a quality of life issue for residents.

Transportation investment has become less proactive and more reactionary over the past 20 years. Maintaining the current transportation network is a significant challenge given the dwindling funding resources. As such, planning for the future and providing a transportation system that meets the demands is challenging. Planning an efficient and integrated transportation system requires a long range perspective.

The regulations and costs involved in constructing new or expanded transportation facilities are significant. Careful planning is necessary to achieve solutions that are both technically effective and financially feasible. It is imperative that solutions be identified that support the efficient movement of people and goods that is so critical to a vibrant 21st Century economy.

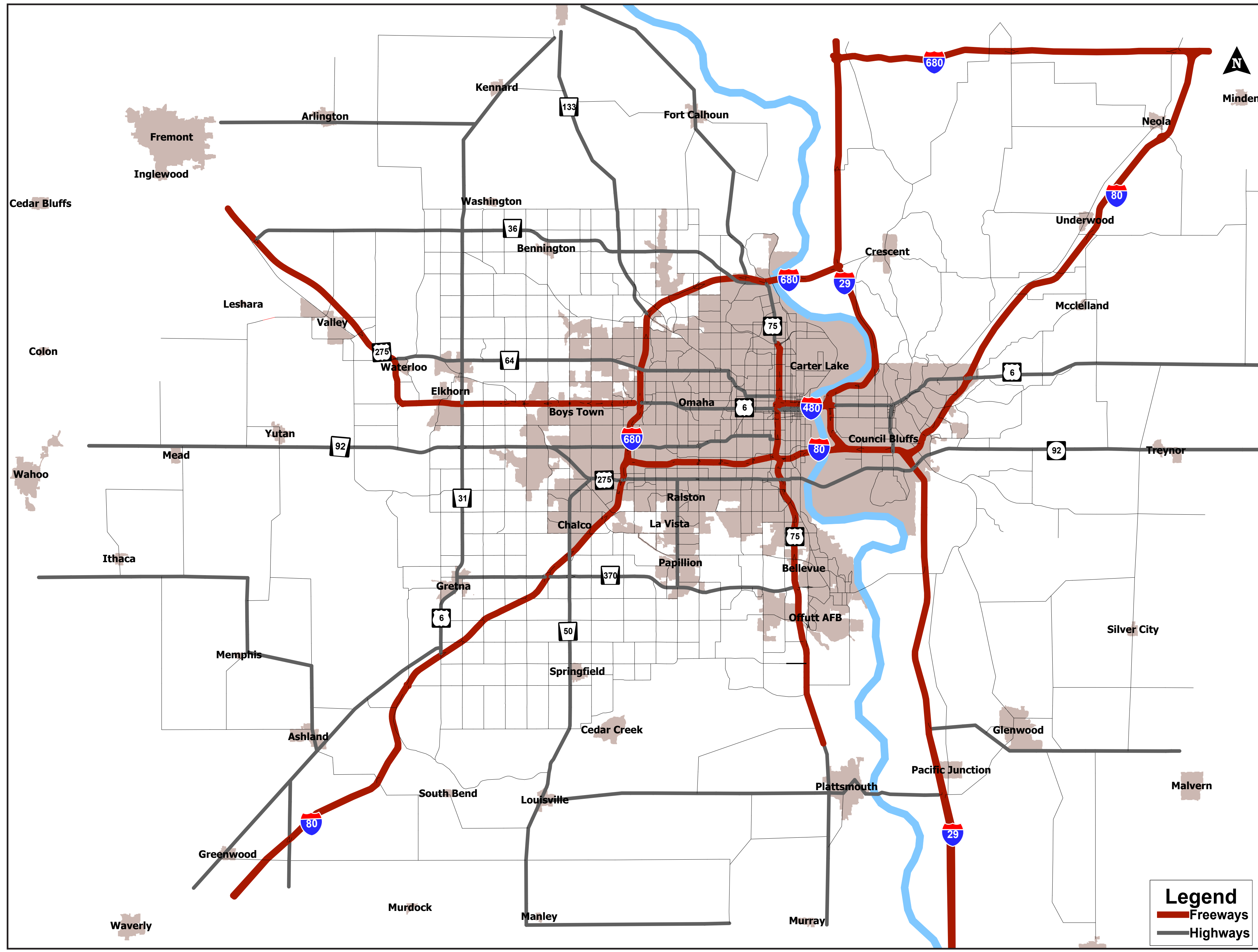
Based upon these factors, it was prudent for the Metropolitan Area Planning Agency (MAPA) to investigate a possible need for a new high capacity roadway system to serve growth and reduce congestion in the metro area.

An optimally functioning roadway network consists of a balance of local streets, minor arterials, major arterials and free flowing freeways. The existing freeway system in the metro area as shown in **Figure 1-1** includes:

- I-80
- I-480
- I-680
- I-29
- US 6 – West Dodge Expressway
- US 75 – Kennedy Freeway & North Freeway

Over the years the metro area has expanded beyond this system and existing freeways are experiencing significant recurring congestion impacting both local and inter-state transportation. The purpose of this study was to determine the possible need for and feasibility of a new, free flowing roadway facility in the outer regions of the metro area.

Figure 1-1 Existing Freeway System



1-1 Study Purpose

The purpose of this study was to address the question: *Does the Omaha-Council Bluffs metro area need a limited access, high speed transportation corridor near the outer limits of the metro area to serve present and future transportation needs?* In addition to addressing this key question, the study was also to address the following questions:

- If a beltway was beneficial, generally where would it be located?
- Are there alternative improvements to a beltway? For example a partial beltway, new radial connections, enhancements to the existing arterial system or significant enhancements to transit.
- Would land use development intensities have an impact on the location and type of facility needed? Do these land use patterns affect alternatives to a beltway?
- What are the economic impacts of the transportation alternatives?

These broad questions can be addressed from many perspectives. The key measures used in the study were traffic service, economic impacts, socio-economic impacts and engineering. Also note the purpose of this study was not to identify and recommend a single solution. Instead the purpose was to identify feasible solutions and provide guidance for moving forward with future next steps beyond this study.

1-2 Study Process

A systematic study process was implemented to assess the need for an outer beltway. This process was developed to answer not only the central question of an outer beltway, but also to look at the opportunities and benefits of other plausible transportation alternatives. Additionally, the influence of land use development policies on the various alternatives was evaluated to determine how land use contributes to the findings. The flow chart in **Figure 1-2** identifies the key elements of the study.

1-3 Report Outline

The remainder of the report is presented in the following order:

- **Chapter 2 – Existing Conditions**: Includes an assessment of how the transportation system is performing today.
- **Chapter 3 – Future Base Conditions**: Provides an assessment of how the transportation system will perform in the future with the implementation of the current Long Range Transportation Plan
- **Chapter 4 – Beltway Alternatives**: Provides an assessment of two beltway corridors including approximate locations, costs, impacts, and operations.
- **Chapter 5 – Transportation Alternatives and Land Use Scenarios**: Provides an assessment of alternative transportation improvements including radial freeways, enhanced arterials and a transit alternative. Alternative land use development is also tested.
- **Chapter 6 - Economic Feasibility**: Describes the economic analysis conducted to examine the economic worthiness of the various transportation networks and land use alternatives.
- **Chapter 7 – Financing Options**: Includes a summary of funding options for consideration.
- **Chapter 8 – Literature and Peer City Review**: Includes a summary of technical papers researched for this study and a comparative assessment between the Omaha-Council Bluffs metro and similar sized cities in the U.S.
- **Chapter 9 – Community Outreach and Stakeholder Involvement**: A summary of activities engaging the stakeholders and community members.
- **Chapter 10 – Summary and Findings**: Includes study findings and recommendations for future activities.
- **Appendix** – Additional documentation not included in the report chapters.

Does the Omaha metro area need a limited access, high speed transportation corridor to serve present and future transportation needs?

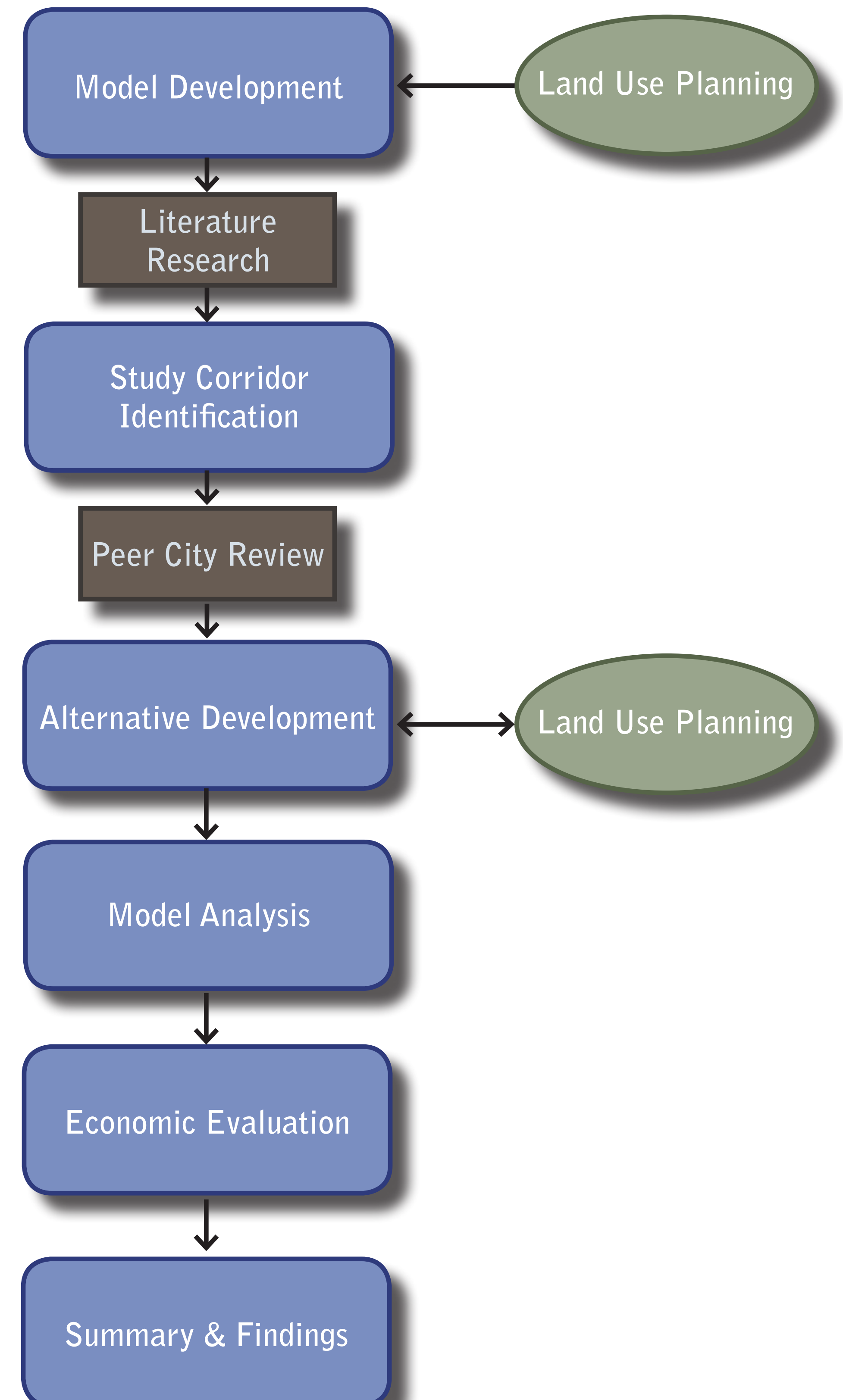
1-4 Study Steering Committee

The study was conducted under the direction of a Steering Committee made up of representatives from the funding agencies which included: MAPA, Nebraska Department of Roads, Iowa Department of Transportation, City of Omaha, City of Council Bluffs, Douglas County and Sarpy County. The Steering Committee met periodically during the study process to receive study updates and provide direction and feedback to the study team.

1-5 Study Stakeholders

A stakeholders group including representatives from counties, cities and other interested groups in the MAPA area was kept informed on study happenings. All totaled there were 43 groups or agencies included as stakeholders for the study.

Figure 1-2 Study Flow Chart



CHAPTER 2 EXISTING CONDITIONS

2-1 Overview

The first step in evaluating or predicting future transportation conditions at a metro area scale is to prepare a base or existing model that accurately replicates current volumes and network characteristics. Ideally, a travel demand model for year 2008 would be the baseline for an existing conditions analysis, but 2004 is MAPA's current calibrated model. The existing 2004 model includes Douglas and Sarpy Counties in Nebraska and the western third of Pottawattamie County in Iowa. MAPA's 2004 travel demand model was used as a baseline for the existing conditions assessment; however, the beltway transportation alternatives involve future roadways that extend beyond the outer limits of the current MAPA model. In order to conduct the existing and future conditions evaluations, the 2004 base model was expanded to include areas where beltway alternatives would likely be tested. Once the expanded model was completed network measures were summarized for comparison to future model scenarios.

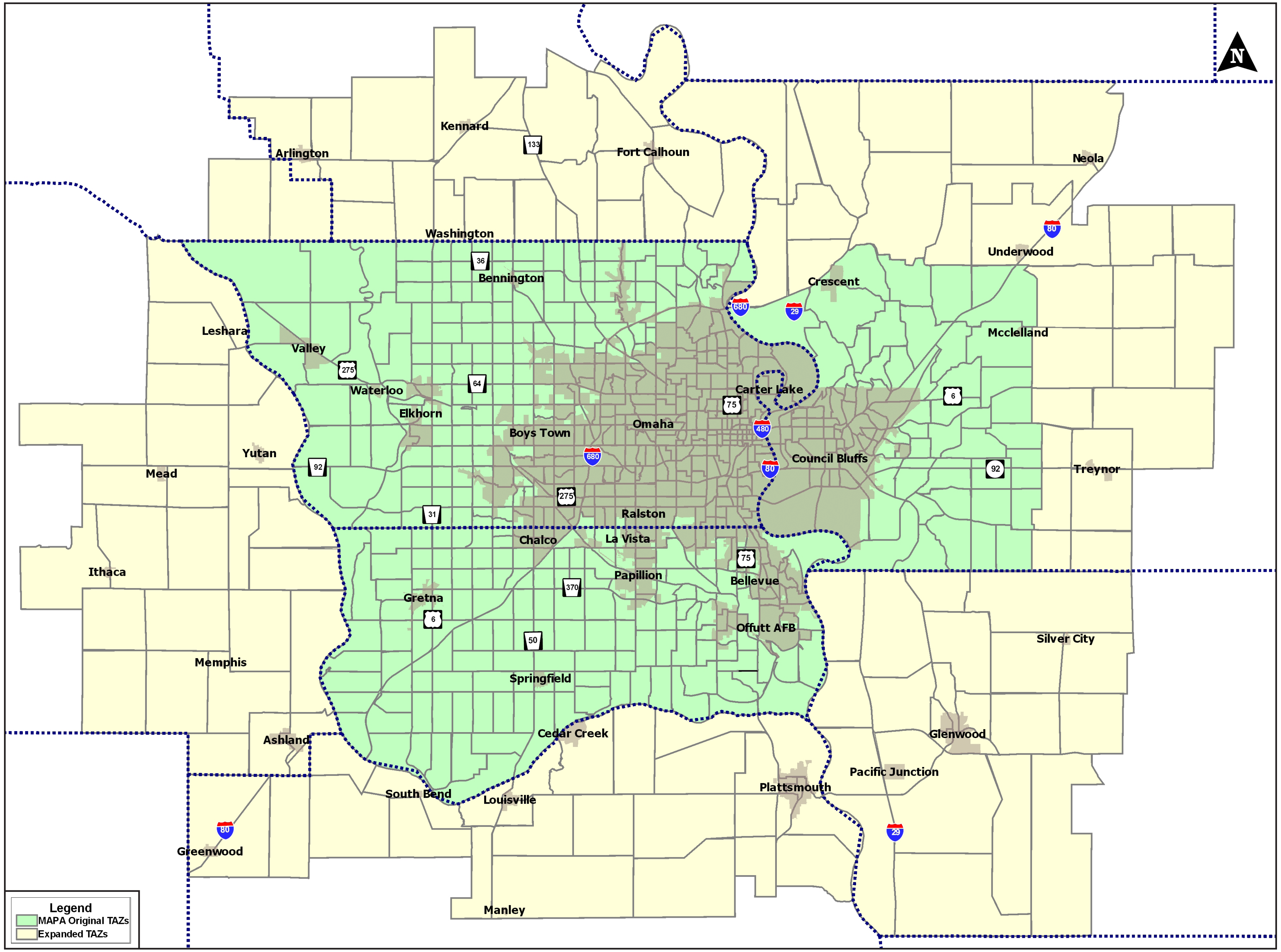
2-2 MAPA Model and Expansion

The model is comprised of numerous traffic analysis zones (TAZs) that represent a smaller geographic area within the overall coverage of the model. In the travel demand model, each TAZ is quantified with data including households, average household income, and employees (retail and non-retail). Trip making calculations are then performed based on the number of productions (homes) and attractions (employment) by TAZ.

The model network generally consists of roadways classified as major collectors or higher. Other local streets and access points are represented in the form of centroid connectors that attach socioeconomic data of an analysis zone to roadways in the network. The modeled roadways are characterized with attributes such as speed, capacity, and functional classification.

For the purposes of this study, the 2004 travel demand model network was expanded outwards so that a larger geographic area could be modeled. This included the addition of 132 new TAZs to the periphery of the current model boundaries, bringing the total number of TAZs to 862 as shown in **Figure 2-1**.

Figure 2-1 2004 Model TAZs



2-3 Existing Network Statistics

The Omaha region's current (year 2004) high capacity corridors, which are defined as existing freeways, limited access highways, 6+ lane arterials, are shown in **Figure 2-2**. Since this graphic is based on year 2004 conditions, the segment of N-50 south of I-80, and an additional segment of N-31 north of Gretna, had not yet been reconstructed to expressway standards.

Daily roadway capacities are established for every roadway link in the model. Individual link capacities are dependent on the roadway cross section (number of lanes) and side friction (level of adjacent access). As the volume on a given segment of roadway increases, it approaches capacity, which is associated with congested conditions.

In **Figure 2-3**, roadway links with congestion are shown in red. This illustrates roadway corridors that are essentially at or beyond their limitations to serve the amount of vehicles traveling the corridor. The traffic volumes and capacities are based on daily traffic volume assignments from the MAPA travel demand model. Congested corridors in the existing conditions assessment include regional routes such as I-80, the Kennedy Freeway, 72nd Street, and Dodge Street.

The 2004 travel demand model network contains 2.5 million daily trips, producing nearly 18 million vehicle miles of travel (VMT), and 485,000 vehicle hours of travel (VHT). The existing conditions assessment also shows 309 lane-miles of roadway links over capacity. Lane miles are measured with a one mile segment of a four-lane arterial equivalent to four lane-miles.

Existing Conditions Analysis:
2,500,000 Daily Trips
17,886,800 Vehicle Miles Traveled (VMT)
484,400 Vehicle Hours Traveled (VHT)
309 lane-miles of roadway links over capacity

Figure 2-2 2004 High Capacity Corridors

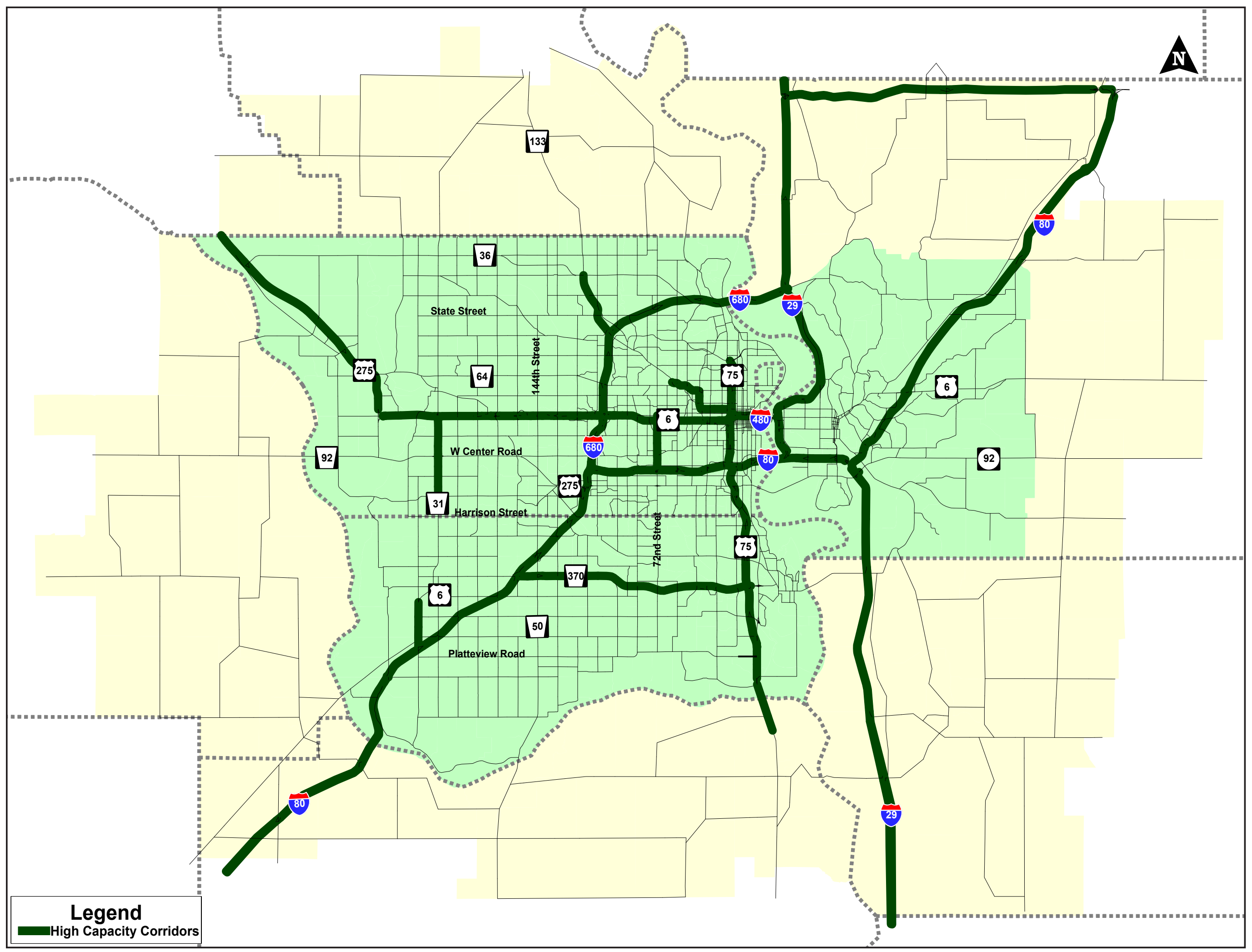
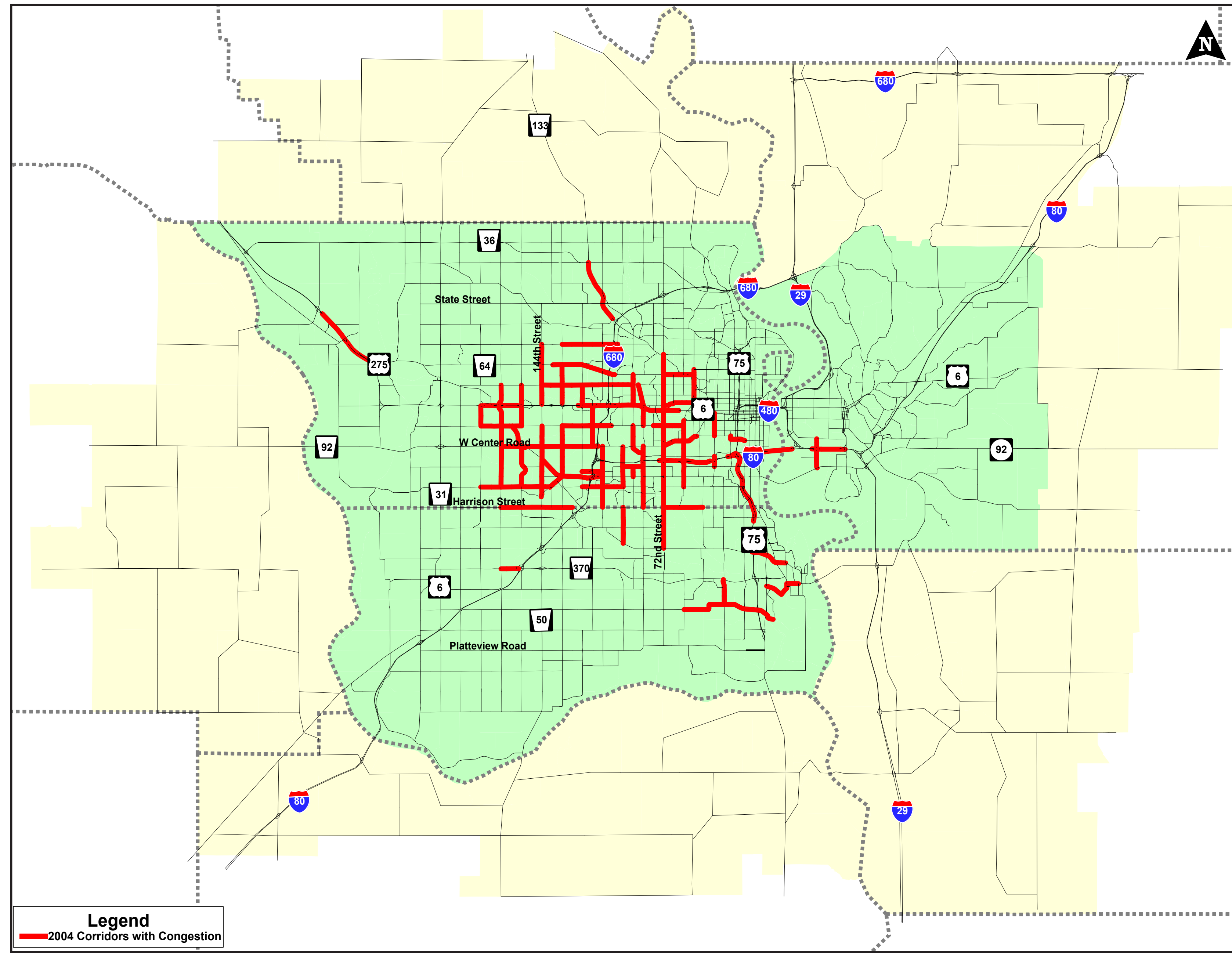


Figure 2-3 2004 Corridors with Congestion



CHAPTER 3 FUTURE BASE CONDITIONS

MAPA is a designated metropolitan planning organization and as such is responsible for conducting the planning process in cooperation with state and local governments. The planning process ultimately directs the expenditure of funds for specific transportation projects. The Long Range Transportation Plan (LRTP) describes goals and objectives for the region, policies to help the region make progress toward the goals, and actions to support the policies, including implementation of specific transportation investments.

3-1 LRTP Base Model Development

The MAPA LRTP is updated on a 5-year cycle, which revisions made to the LRTP transportation improvements according to changes in transportation priorities, funding availability, and conformance with national, state and local transportation policy. The most recently approved MAPA LRTP reflects a future horizon year of 2030. For purposes of this study, the 2030 LRTP improvements were used with socioeconomic data that reflects land use projections for the year 2035. Early testing and preliminary travel demand model runs showed the need for significant transportation improvements in the year 2035, and as such 2035 became the future horizon year for this study.

The LRTP Base model was developed to serve as the baseline for comparison between the future beltway alternatives and any other alternatives identified for consideration. The difference between the LRTP Base model network compared to the 2004 network include all roadway capacity related projects that have been constructed from year 2004 to 2008, as well as projects in the 2030 LRTP.

The model network for the LRTP Base covers additional geographic areas in the same way that the 2004 MAPA model was expanded. Since the expanded model roadways are outside of MAPA's transportation planning area, the local counties in these areas were contacted and planned improvements to state highways or major roadways in these areas were noted. The capacity-related roadway improvements in the expanded network (outside of the LRTP) are identified in the **Appendix**.

Figure 3-1 depicts the roadway links in the metro area that will be improved as part of the LRTP and the improvement projects in the expanded area outside of the original MAPA model area. These improvements amount to 807 lane-miles of additional roadway in the metro area for the LRTP Base model, which is a 15% increase over the 2004 model network.

The high capacity corridors for the LRTP Base are shown in **Figure 3-2**. This graphic includes future freeways, limited access highways and 6+ lane arterials. As compared to **Figure 2-2**, no new freeway miles are planned. The increase in high capacity corridors comes from 39 more miles of limited access highways and 33 more miles of 6+ lane arterials.

Figure 3-1 Roadway Improvements Between 2004 and 2035

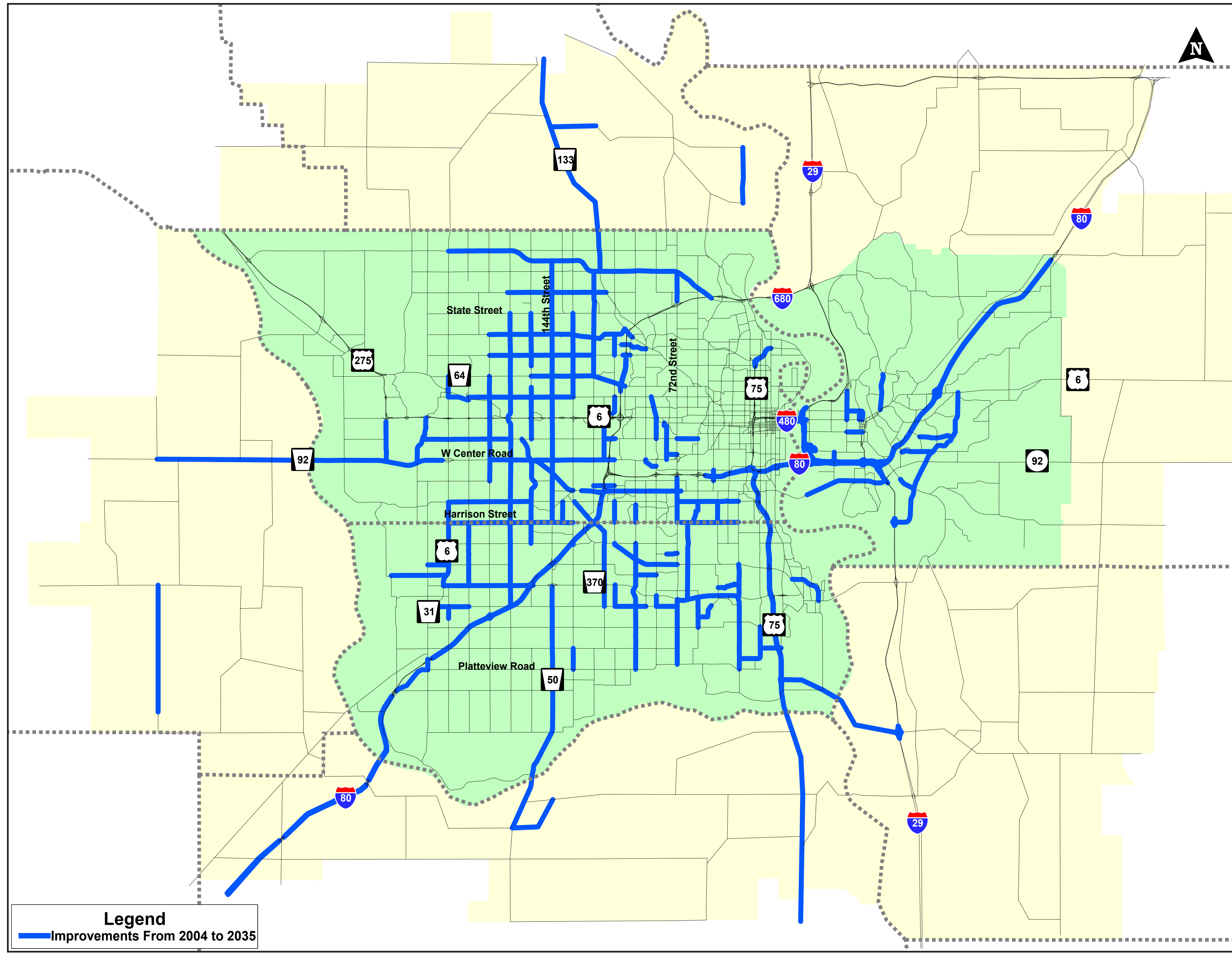
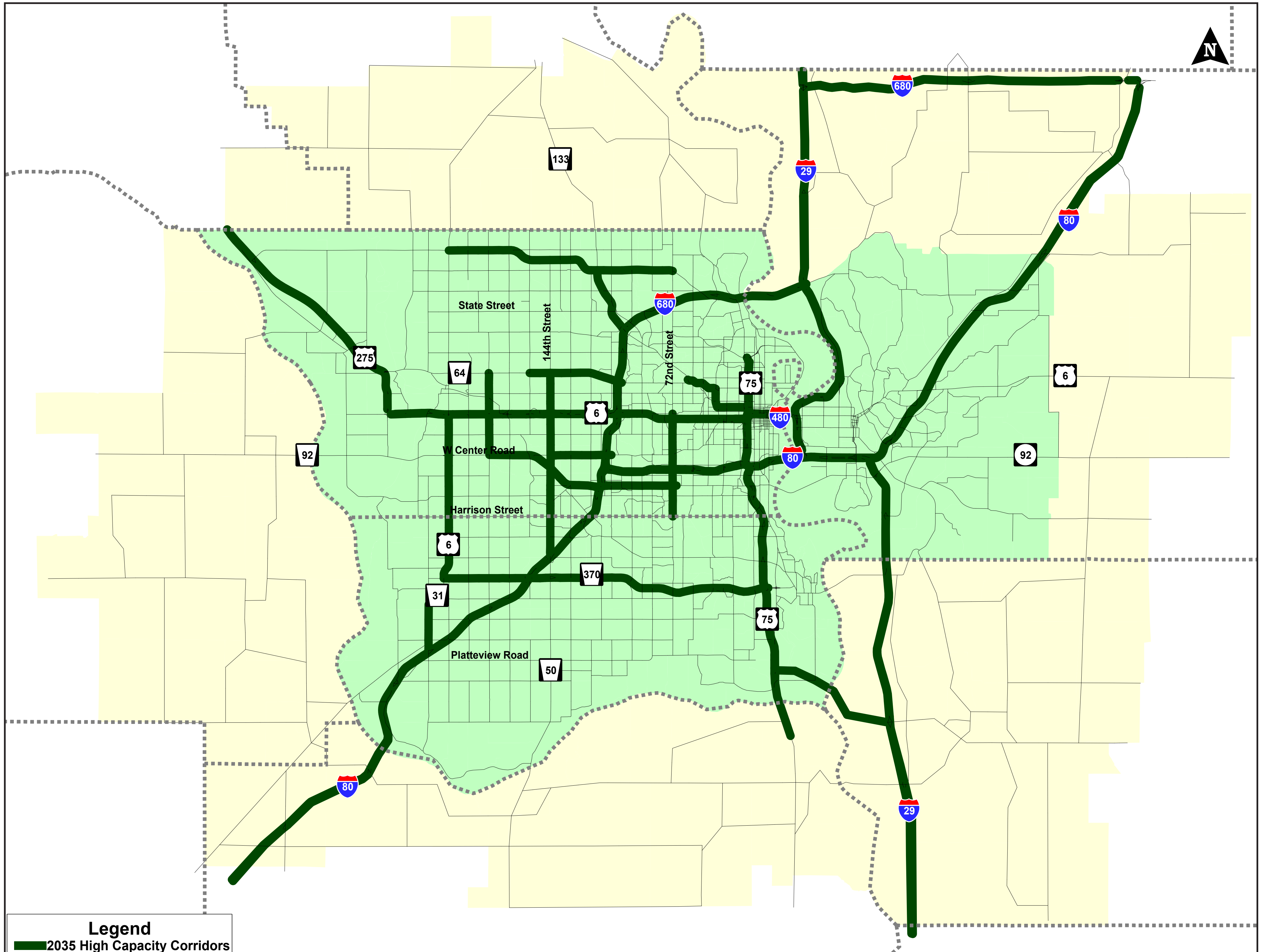


Figure 3-2 2035 High Capacity Corridors



3-2 LRTP Base Model Findings

The LRTP base model provides an indication of the future transportation system performance. In the future, drivers in the metro area will spend more time in their cars and drive further distances to complete their everyday trips. From the year 2004 to year 2035, the average trip time and average trip length will increase by 1.2 times.

The transportation measures selected for evaluating and comparing alternatives were:

- Total trip ends
- Total vehicle miles traveled
- Total vehicle hours
- Average congested speed
- Total delay
- Lane-Miles of links over capacity

These traffic service factors allowed for both a quantification of the resulting traffic service for 2035 and a reference point from which to compare alternative scenarios. The first comparison that was made was with the 2004 network in order to determine changes in transportation service if only the LRTP is implemented by 2035. **Table 3-1** provides the summary of 2004 and LRTP Base findings for the entire model network.

The comparison between 2004 and 2035 indicates the total number of daily trips will be 1.5 times greater while the number of vehicle-miles traveled will be 1.8 times greater in 2035. The largest and most alarming increases are in total delay and lane-miles of over-capacity roadway links. In terms of the travel demand model, total delay represents the additional

Table 3-1 All Roadway Links Measures

	2004	2035 LRTP Base
Total Trip Ends	2,458,322	3,793,463
Total VMT (Veh-Miles)[1]	17,886,782	32,194,995
Total VHT (Veh-Hrs)[2]	484,415	915,720
Average Congested Speed (MPH)[3]	34.9	32.8
Total Delay (Hours)[4]	89,516	233,599
Lane-Miles of Links Over Capacity[5]	308.9	887.2

[1] *VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
[2] *VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] *Congested Speed = Length/Congested Travel Time*
[4] *Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)*
[5] *Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9*

amount of time an average driver spends in their vehicle because they are not traveling at the ideal (free-flow) speed. Total delay in the metro will increase from an estimate of 89,516 hours of delay each day to 233,599 hours of delay, 2.6 times as great as 2004. The number of lane-miles of roadway links over capacity increases from 308.9 miles to 887.2 miles, nearly 2.9 times greater in 2035 (assuming a volume to capacity ratio greater than 0.9 is "capacity"). Note that these statistics were compiled for the entire model network.

Another way to test the model data is to summarize and compare only the high capacity corridors. Considering that the high capacity corridors would be the facilities most impacted by a beltway or other transportation improvements, the high capacity corridor summary was developed. **Table 3-2** provides the summary of 2004 and LRTP Base findings for high capacity corridors. For this test, two comparison data points were added:

- Lane-miles of high capacity corridors
- Percentage of high capacity corridors over capacity

With the implementation of the LRTP for 2035, there will be 1.5 times more lane-miles of high capacity corridors than in 2004. Total vehicle miles traveled on these corridors is expected to be 2.1 times greater and vehicle hours of travel will be 2.5 times greater. Average travel speed is predicted to decrease by 7 MPH, decreasing from 45.5 MPH to 38.5 MPH. Total delay is shown to be 4.5 times greater while the number of lane-miles of roadway links over capacity is expected to be 5.5 times greater. Finally, though the LRTP will be adding about 500 lane-miles of high capacity corridors in the year 2035, 22 percent of high capacity corridors will be congested (over capacity), 3.7 times greater than 2004.

Table 3-2 High Capacity Corridor Measures

	2004	2035 LRTP Base
Lane-Miles of High Capacity Corridors	972	1,448
Total VMT (Veh-Miles) of High Capacity Corridors[1]	7,162,118	15,489,223
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	148,271	374,483
Average Congested Speed (MPH) of High Capacity Corridors[3]	45.5	38.5
Total Delay (Hours) of High Capacity Corridors[4]	22,671	100,707
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	57.3	315.9
Percentage of Corridors Over Capacity	6%	22%

[1] *VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
[2] *VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] *Congested Speed = Length/Congested Travel Time*
[4] *Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)*
[5] *Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9*

3-3 LRTP Base Summary

Despite the investment of more than $3.2 billion in an upgraded roadway system for the metro area, the adopted LRTP scenario shows significant deterioration in traffic service over that of today. This planned investment will not be sufficient to maintain even a status quo system performance. Comparing 2004 model results to the LRTP Base indicates total delay in the metro area will be 2.6 times more than that of today and the miles of congested roadway will be 2.9 times greater. In financial terms, each metro area household will incur an additional $727 of direct user costs annually (travel time, vehicle operating costs, user perceived accident costs in 2008 dollars). These additional user costs amount to $296 million annually for metro area residents.

In a general sense, a 20-minute average trip will increase to 25 minutes by 2035. In the perspective of an average household making ten trips per day (to and from work or school is two trips), that household would be spending 50 minutes more per day in their vehicles.

With just LRTP improvements, each metro area household will incur an additional $727 of direct user costs annually in the future

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CHAPTER 4 BELTWAY ALTERNATIVES

As shown in **Chapter 3**, even under the LRTP improvements, there will be more congestion in the future. The focus of this chapter is the development and evaluation of alternative beltway corridors to determine if the implementation of a beltway system will ease congestion in the future. The chapter is comprised of two primary parts. The first section describes the identification of outer and inner corridors for study, including consideration for facility type, environmental features and a statement of probable construction costs. The second section summarizes the travel demand model evaluation performed to compare the beltway options to the current LRTP.

4-1 Beltway Corridor Identification

There are numerous constraints around the Omaha-Council Bluffs metropolitan area that must be factored into the identification of potential beltway corridors. These constraints include geographic features such as major rivers and the Loess Hills; demographic elements which include existing development patterns and a variety of different governmental jurisdictions; and environmental constraints such as floodplains and floodways, wetlands, and other sensitive environmental resources.

4-1-1 Study Area

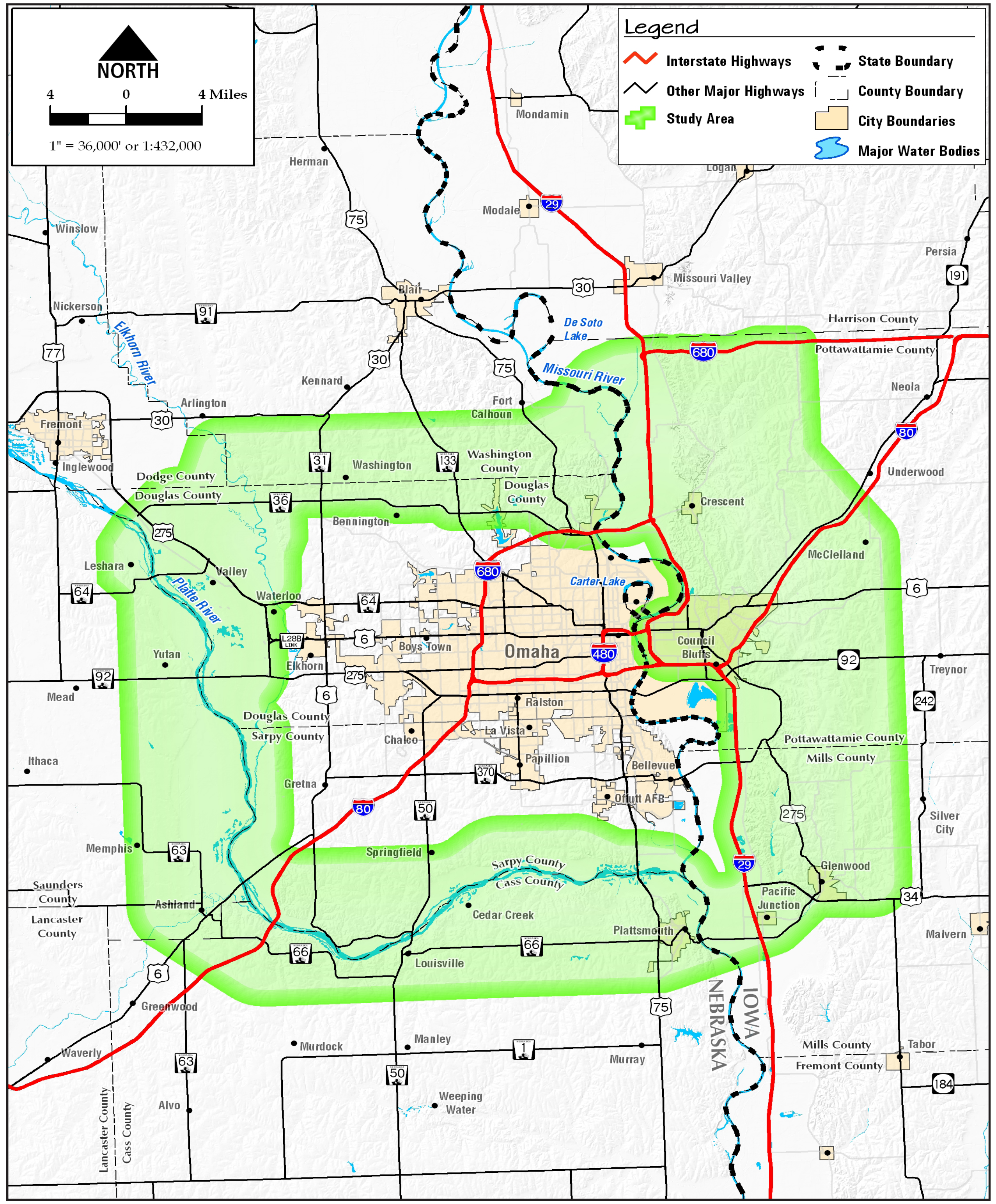
Due to existing development patterns within the metropolitan area, the "inner" limits for construction of a beltway are constrained by existing development patterns and the location of major highways and rivers. This inner boundary of the study area must be far enough away from densely populated areas to provide an opportunity for the construction of a freeway facility. The "outer" boundary of the study area is determined by the practical limitation of how far away from the metro area a beltway could be constructed and still be considered an attractive and efficient alternative to the existing roadway network. The study area, shown in **Figure 4-1** defines the inner and outer limits of this beltway feasibility study. In some instances, the boundary is an existing highway or interstate segment.

4-1-2 Beltway Corridors

In order to answer the question if a beltway around the entire metropolitan area is feasible, it was determined that identification of a specific alignment is not necessary at this stage of evaluation. Rather, wide corridors within the study area were established to determine the feasibility of a beltway segment located within that specific corridor.

In order to provide a comparison and evaluation of beltway corridors, it was determined that each beltway segment should consist of an "inner"

Figure 4-1 Beltway Study Area



corridor and an "outer" corridor. The width of the corridor identified and evaluated was determined to be two miles. If the corridor is on or along an existing highway or interstate, this width would allow for some flexibility in either using the existing roadway right-of-way, or when necessary, altering the alignment to avoid or minimize property and environmental impacts. Likewise, when the corridor is independent from an existing highway or interstate, a corridor width of two miles provides additional flexibility in selecting an alignment that minimizes impacts and compliments the surrounding roadway network. In some locations, particularly in the northwest corner of the study area, the corridor width increases to provide more flexibility in the location of river crossings and avoidance of sensitive environmental resources.

Each segment of the beltway corridor was developed with "logical termini" in mind. In essence, that means each segment of the beltway would begin or end at the intersection with a major highway or interstate. This assumption creates an independent utility for the various beltway segments, should the future analysis indicate that certain segments have a higher priority or more benefit than another as well as accommodate sequenced construction of any new roadway facilities.

4-1-3 Outer Beltway Corridor

The location of the outer and inner beltway corridors are shown in Figure 4-2. The North Segment begins at the crossing of N-36, just east of the interchange with US 275 and continues to the north and east, connecting with the I-29 and I-680 north interchange. The total length of this North Segment of the outer beltway is approximately 30 miles from the crossing of N-36 to the interchange of I-29 and I-680 north.

The Eastern Segment of the outer beltway was defined as where it connects with I-29 on the north and south ends of the metro area. With that definition, the Eastern Segment follows I-680 east for 8 miles to the interchange with Pottawattamie County Road L-34. The corridor continues to the south, intersecting with US 34 then curves to the southwest and ties in with the southern US 34 and I-29 interchange. The total length of this corridor from I-680 on the north to the connection with I-29 on the south is 41 miles.

The South Segment of the outer beltway would begin at the south US 34 interchange with I-29 and continue to the southwest, with a new crossing of the Missouri River south of Plattsmouth. The corridor continues to the west, over to a connection with I-80 between the N-63 and N-66 interchanges with I-80. The total length of the South Segment of the outer beltway corridor is 30 miles.

The West Segment begins at the connection to I-80 and continues to the northwest, crossing US 6 and the BNSF Railway. The corridor continues north where it widens, requiring a new crossing over the Platte River. The West Segment, from the connection to I-80 up to N-36 is 30 miles in length.

4-1-4 Inner Beltway Corridor

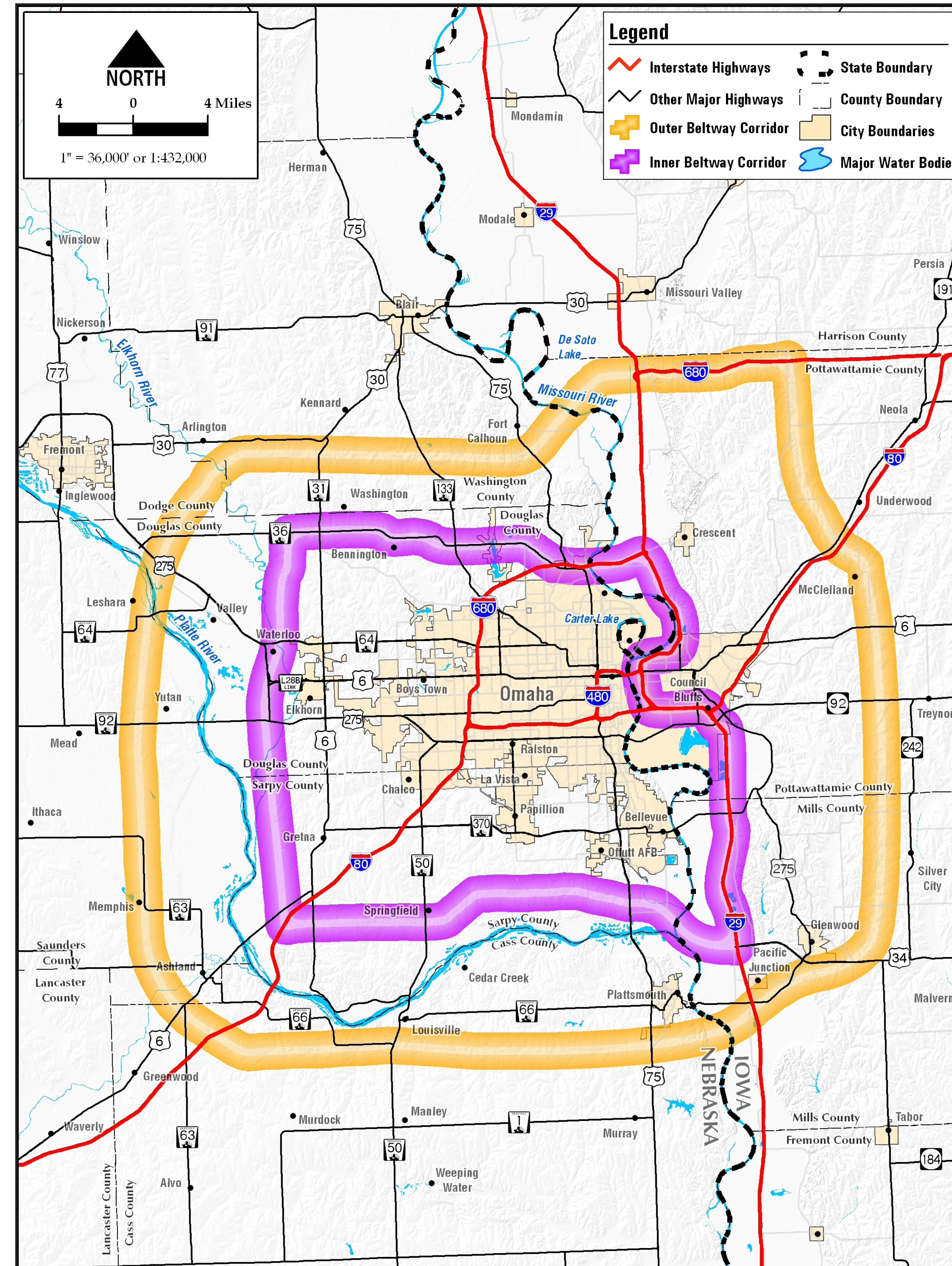
The location of the inner beltway corridors are also shown in Figure 4-2. Beginning with the North Segment of the inner beltway, the corridor runs along the existing alignment of N-36. The Nebraska Department of Roads has identified segments of the N-36 corridor to be widened to a four-lane, rural expressway. If this portion of N-36 is incorporated into a beltway, the proposed improvements should be constructed as a limited access expressway or freeway. The corridor ties into I-680 between the 48th Street and 72nd Street interchanges, and continues east to the interchange with I-29 in Iowa. The total length of this corridor is 15 miles. This North Segment of the inner beltway would then continue for approximately 5 miles along I-680 to the interchange with I-29.

The topographic and environmental constraints created by the Loess Hills restricts the options for potential corridors on the east side of the metro area. With over $1.0 billion of improvements programmed for the Council Bluffs interstate system over the next decade, the I-29 corridor from the southern interchange with I-680 to the northern interchange with US 34 was determined to represent the "inner beltway" option. The improved geometrics and additional capacity planned for the interstate through Council Bluffs will likely accommodate future traffic demands, even if it is incorporated into a regional beltway system.

A new highway connection from I-29 to US 75 (Kennedy Freeway) is programmed to begin construction in 2010 by the Nebraska Department of Roads and the Iowa Department of Transportation. This project begins at the existing northern interchange with US 34 and extends west and north across the Missouri River to intersect with US 75, south of Platteview Road. Since this project is not currently planned to be constructed to freeway standards, additional investment will be required. Continuing westward, the corridor is generally centered on the alignment for the Platteview Road/Pflug Road expressway as identified in the Sarpy County Transportation Plan. The western terminus of the South Segment is at the connection with I-80. The total length of this segment of the inner beltway is 26 miles.

US Highway 6/N-31, from I-80 through the intersection with N-64 (West Maple Road) has recently been widened to provide a four-lane highway, with some segments designed to expressway standards. However, through the communities of Gretna and Elkhorn, the cross section is reduced to a four-lane urban arterial with multiple access locations provided. Development along this highway corridor precludes any opportunity to bypass these communities, limiting the effectiveness of a high-speed, high capacity facility for the entire length. As a result, the inner beltway corridor for this west segment is defined as a two-mile wide corridor along the east side of the Platte River, from I-80 to N-92. The corridor then ties into the existing US 275 segment from N-92 to N-64. The corridor then widens to the north to provide more flexibility in selecting an alignment that will minimize environmental impacts while crossing the Elkhorn River and connecting to the North Segment. The West Segment of the inner beltway corridors ends at the connection to N-36, with a total length of 24 miles.

Figure 4-2 Outer and Inner Beltway Corridors



4-1-5 Facility Type

In order to provide the level of service to attract regional and long distance trips through the metro area, it was determined that a freeway facility must be provided. A freeway is a high speed, high capacity roadway with limited access. Typical interchange spacing can range from one to three miles in urban areas and three to six miles in rural areas.

For purposes of this beltway feasibility study, a four-lane divided freeway was assumed to be constructed within the two-mile wide inner and outer corridors identified. Where the corridor overlaps with existing highway segments, it was assumed that the roadway would be reconstructed to provide a consistent cross section and limited access control. For segments that overlap with portions of the interstate, it was assumed no additional improvements would be necessary.

Figure 4-3 provides an example of the typical section for a similar freeway constructed in the metro area. This type of facility was used for determination of construction costs, property and environmental impacts. A four-lane freeway section with a total right-of-way width of 300 feet was used for all of the beltway corridor segments, with the exception of where the interstate system overlaps with the beltway.

Figure 4-3 Freeway Typical Section

4-1-6 Roadway and Environmental Features

In order to determine conceptual level construction costs and environmental impacts associated with the various segment of an inner and outer beltway, significant roadway features that would have an impact on construction costs were identified. These roadway features include such items as system interchanges that provide a connection with existing highways and interstates, and service interchanges that provide a local connection with highways and principal arterial streets. Locations of major river or stream crossings were also identified, along with railroad, pipeline and transmission line crossings.

A variety of environmental features are present within each corridor segment. Since a specific alignment has not been established, the potential impacts to sensitive environmental features were identified based upon a 300 feet wide corridor footprint, representing the amount of right-of-way required for construction of a freeway facility. These features included such items as wetlands, floodplains, floodways, historic sites and impacts to both urban and rural property. It is assumed that if a particular corridor is determined to be feasible, a more detailed corridor and alignment study would be conducted to determine which environmental resources could be avoided or minimized.

4-1-7 North Segments

Outer Beltway - North

The beginning of the north segment for the outer beltway corridor is defined as beginning at the crossing of N-36 on the west end of the study area, as shown in **Figure 4-4**. Due to the rural nature of this area, a total of four service interchanges were identified, including the highways of N-31 and N-133. Depending upon the final alignment of a specific beltway within this two-mile wide corridor, the UPRR rail line that runs east/west on the south side of US 30 may be crossed once or even multiple times, requiring grade separation structures. For purposes of this analysis, it was determined that there is enough flexibility in the beltway corridor defined to provide opportunities to avoid crossing the railroad tracks. River crossings would also be required for the Elkhorn River, the Missouri River and the Boyer River. This corridor also passes through the proposed location of Dam Site #3 in Washington County, along the Big Papillion Creek. If the dam is constructed, bridges would be required to span the width of the water basin. In addition, a total of 31 acres of wetlands could potentially be impacted, along with 400 acres of floodplain.

Inner Beltway - North

The corridor identified for the north segment of the inner beltway, also shown in **Figure 4-4** begins on N-36, a few miles to the west of N-31, and extends to the east until it ties into I-680, in between the 72nd Street and 48th Street interchanges. Along this corridor, it is anticipated that service interchanges would be provided at the crossings with N-31, N-133, as well as at four other locations, generally spaced between 2 and 3 miles apart. A system interchange, with high speed, direct access to I-680 is desirable, but may be difficult to construct due to the proximity of the adjacent interchanges. A total of four major stream crossings will be required along this corridor, including the Big Papillion Creek, Thomas Creek and the Little Papillion Creek, north of Glenn Cunningham Lake. Along this corridor, a total of six floodplains are crossed, impacting approximately 35 acres.

4-1-8 East Segments

Outer Beltway – East

The eastern segment of the outer beltway corridor begins with an east/west segment of I-680, from the northern interchange with I-29, continuing approximately 8 miles to the east. **Figure 4-5** indicates the location of the corridor. Additional improvements to this section of the beltway would not be required, with the exception of a system interchange at the connection with I-680. Additional system interchanges would be required at the crossing of I-80 and at the southern end of the east segment, at the connection with I-29 at the southern interchange with US 34. A total of seven service interchanges would be provided along this 41 mile corridor, with most spaced between two and six miles. This eastern beltway corridor crosses over six active rail lines, which would all require the construction of grade separation structures. There are no major river crossings required on this segment of the beltway corridor, however, the corridor does cross several major streams, many of them multiple times. A total of 6 historic sites were identified as located within this beltway corridor.

Inner Beltway - East

As previously discussed, the eastern segment of the inner beltway corridor would be located on the I-29 alignment, from the northern interchange with I-680, to the southern interchange with US 34, as shown in **Figure 4-5**. With the programmed improvements identified for the I-29 corridor through Council Bluffs, additional upgrades to the interstate system are not anticipated.

4-1-9 South Segments

Outer Beltway - South

The southern segment for the outer beltway corridor, as shown in **Figure 4-6**, begins at the south interchange of I-29 and US 34, and extends westward to an ultimate connection with I-80 between the N-63 and N-66 interchanges. A new bridge over the Missouri River, south of Plattsmouth would be necessary and system interchanges would be provided at the connections with I-29 and with I-80. In addition, four service interchanges would be constructed along the corridor. A large number of underground pipelines are located to the south of Plattsmouth, 17 oil and gas pipelines cross this corridor. This southern segment of the outer beltway is approximately 30 miles in length crossing the Missouri River and approximately ten named streams as well as 16 acres of wetlands and 101 acres of floodplain.

Inner Beltway - South

The corridor identified for the south segment of the inner beltway begins at the north interchange of I-29 and US 34. The corridor follows the planned new highway connection from I-29 west to US 75, which includes a new bridge over the Missouri River. This south segment extends westerly in southern Sarpy County to a connection with I-80. System interchanges are anticipated at each end of this segment, along with nine service interchanges along the length of the corridor. This beltway corridor crosses four named streams as well as the Missouri River, 11 acres of wetlands and 66 acres of floodplain.

4-1-10 West Segments

Outer Beltway – West

The western segment of the outer beltway corridor is located primarily in Saunders County, and stretches from the connection with I-80 north across the Platte River to a connection with N-36 in northwestern Douglas County. The corridor is shown in **Figure 4-7**. System interchanges would be provided at both ends of the corridor, as well as with US 275. Six additional service interchanges would be located throughout the length of this segment. Four overpasses for county and local roads would be required, along with the closure or rerouting of 30 roads. Four railroad grade separations would also be necessary. This segment of the outer beltway corridor crosses the floodplains of Salt Creek and Wahoo Creek, but remains west of the floodplain limits of the Platte River until it crosses the river on the north end of the corridor, with potential impacts to 283 acres of floodplains and 35 acres of wetland impacts.

Inner Beltway - West

The western corridor for the inner beltway begins at the connection to I-80 and extends to the north along the east side of the Platte River, across the Elkhorn River and connects with N-36 to the east of N-31. System interchanges would be provided at the connections on both ends, as well as with US 275 northwest of Waterloo. In addition, six service interchanges would be provided along the 24.1 mile corridor. Four railroad grade separation structures would be necessary to span the active rail lines in this area. Due to the meandering alignment of the Elkhorn River, this inner beltway corridor would cross the river twice. As a result, major portions of this corridor are located within the Platte River and Elkhorn River floodplains with a total of 673 acres of floodplain being potentially impacted which represents 77% of all right-of-way required.

Figure 4-4 North Segment of Inner and Outer Beltway Corridors

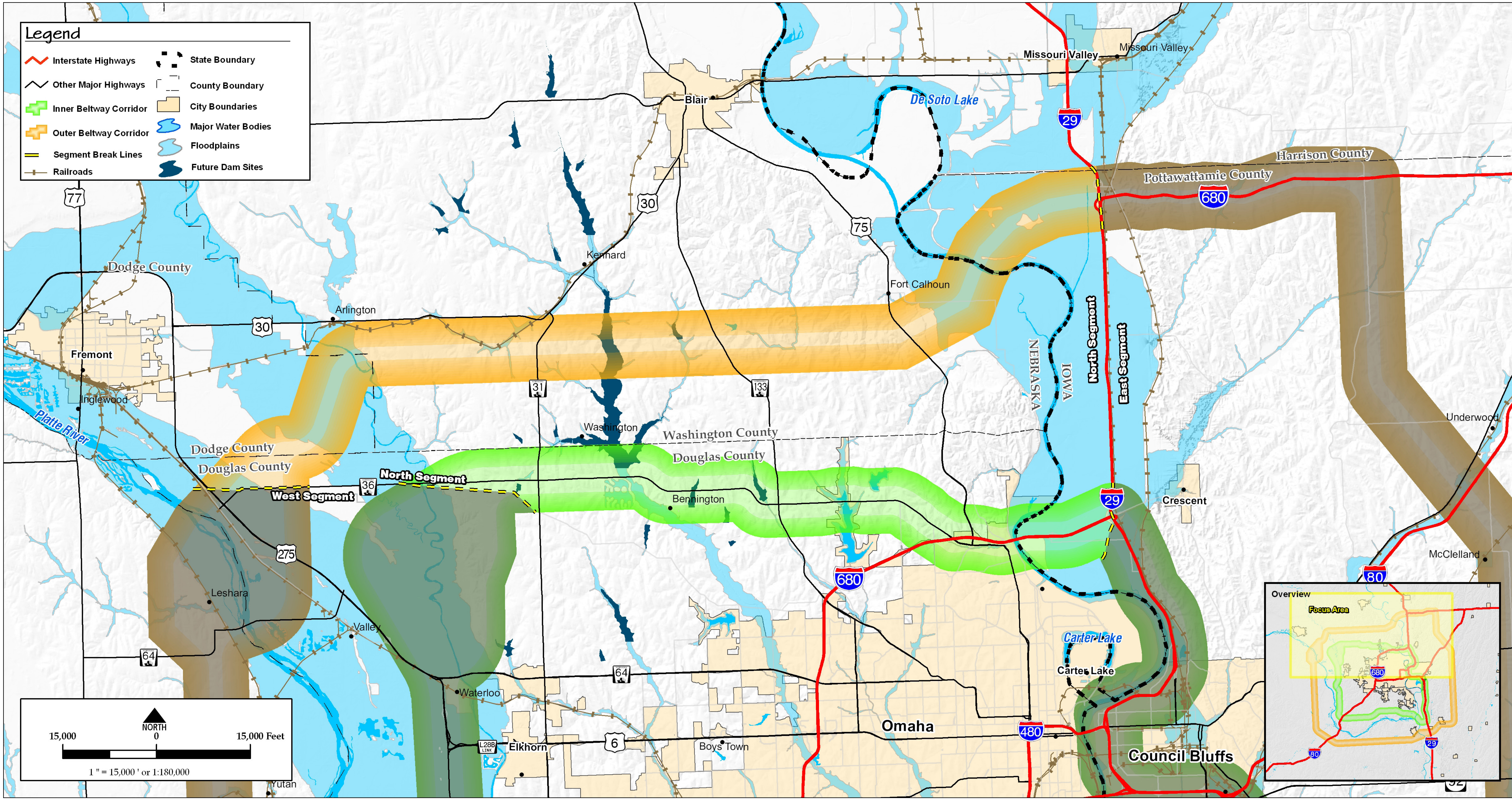


Figure 4-5 East Segment of Inner and Outer Beltway Corridors

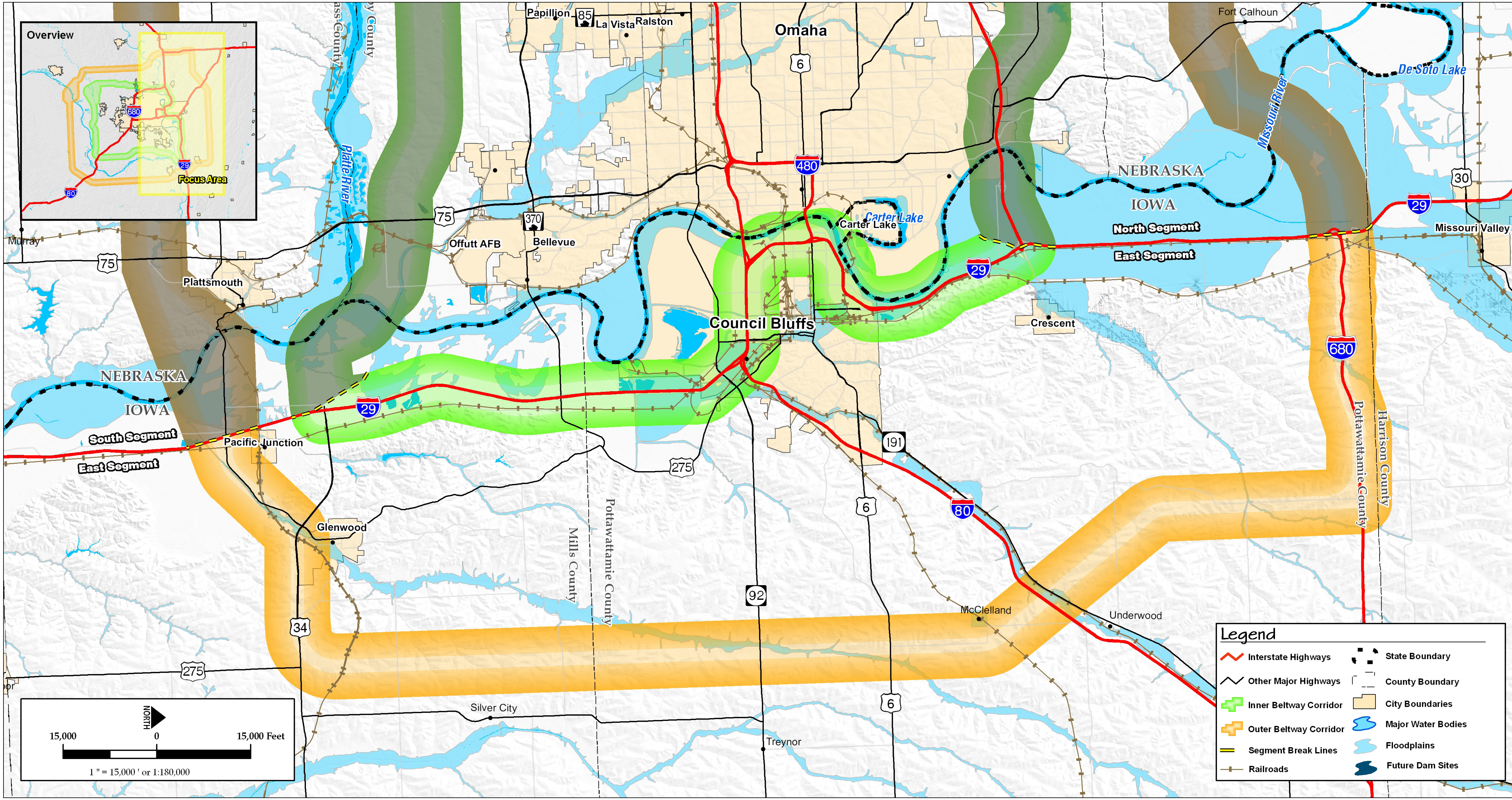


Figure 4-6 South Segment of Inner and Outer Beltway Corridors

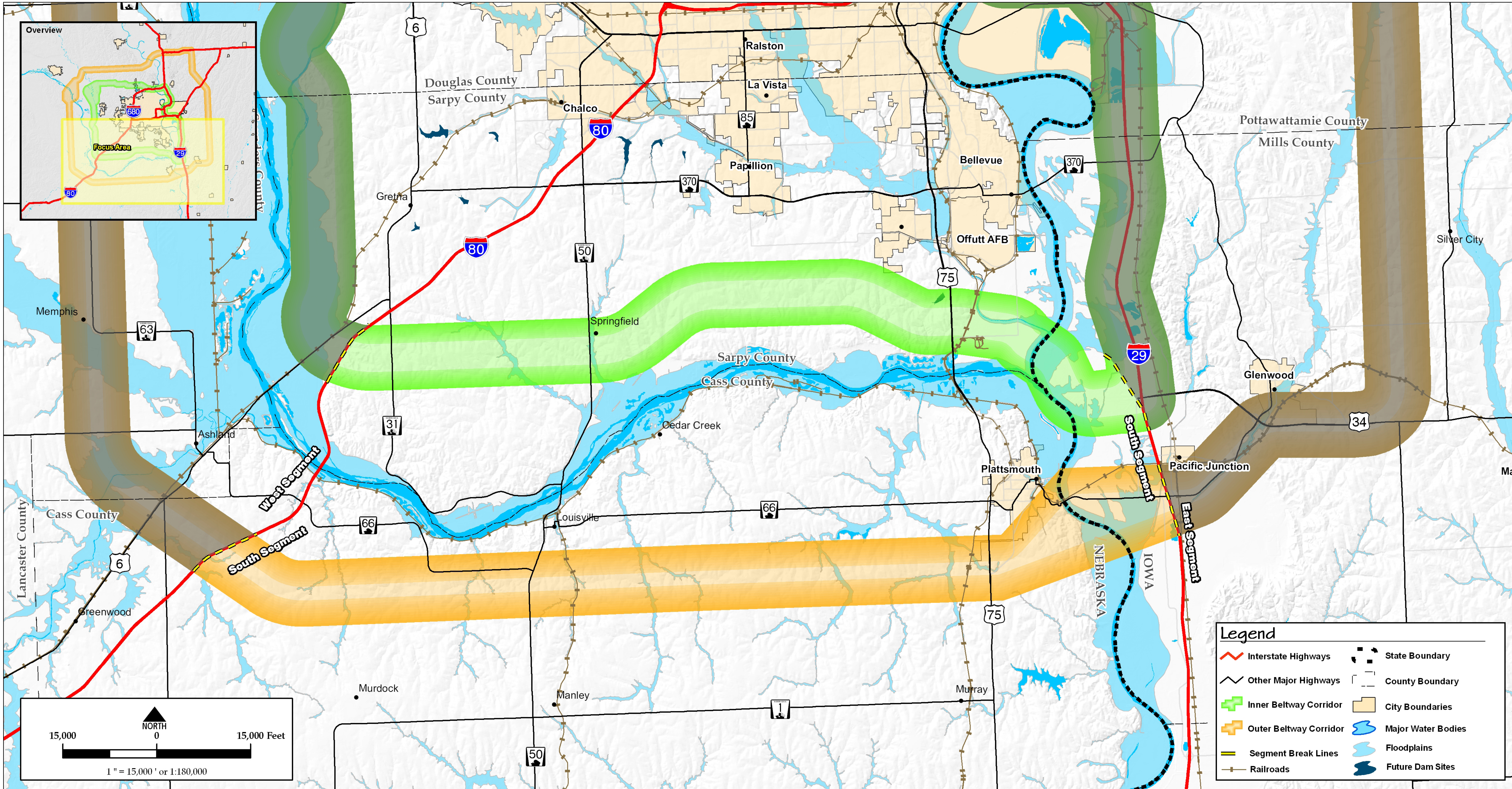
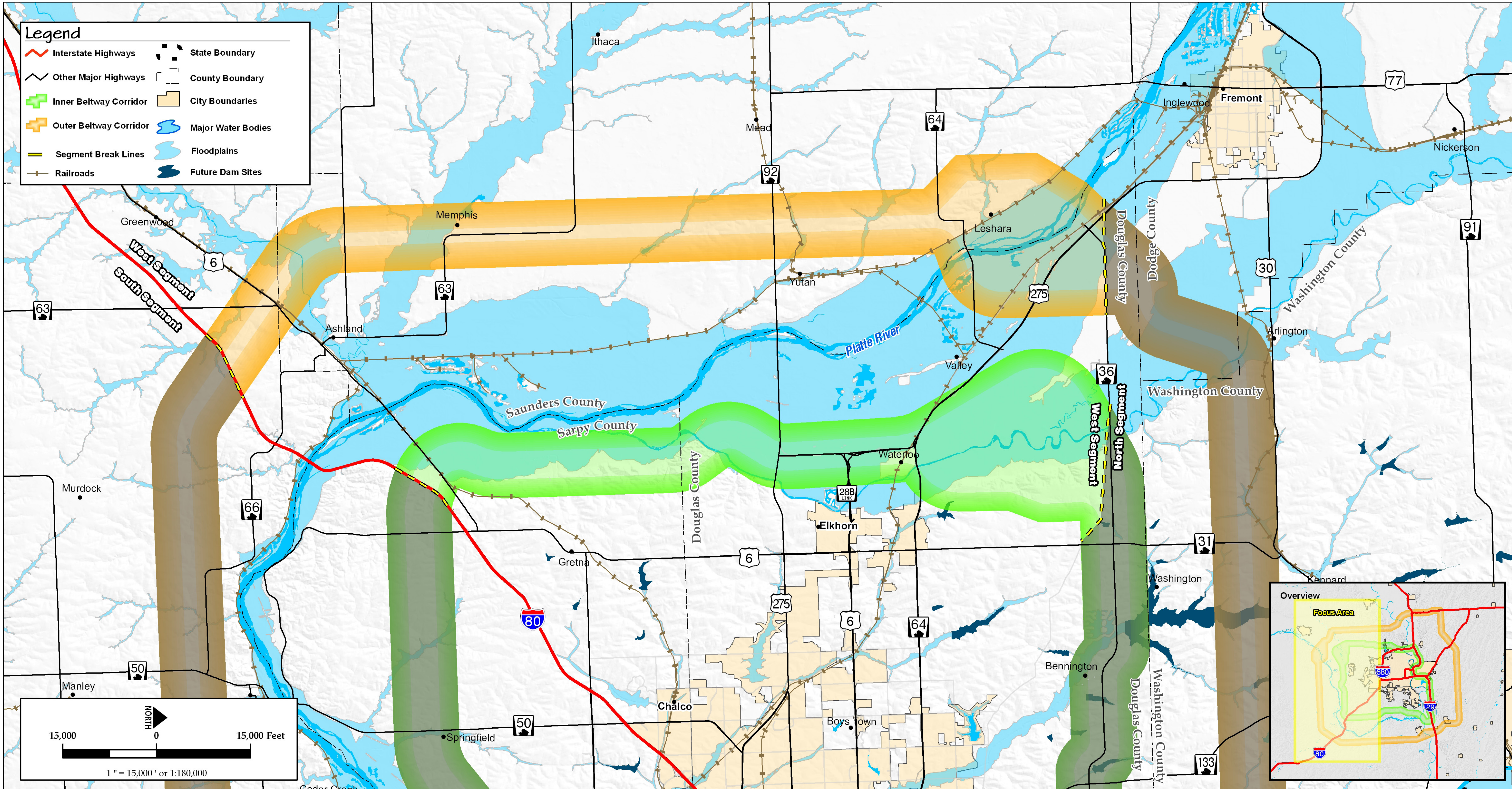


Figure 4-7 West Segment of Inner and Outer Beltway Corridors



4-1-11 Statement of Probable Construction Costs

Estimated quantities were calculated based on the typical section previously described. A conceptual grade line was established to aid in the calculation of earthwork and pavement quantities, however, a specific beltway alignment that shifts through a corridor to avoid or minimize property and environmental impacts was not developed for this level of study. It is assumed that during preliminary and final design, specific alignments would be identified with greater detail and accuracy. The purpose of this portion of the study is to provide planning level detail regarding potential construction costs for the various beltway segments.

Table 4-1 summarizes the statement of probable cost for the outer beltway, by each of the four segments. This statement of probable costs is based on the most recent bid prices from the Nebraska Department of Roads. The distance covered by the outer beltway corridors is about double the length of the inner beltway corridors. In addition to the longer segments on each of the north, south and west legs, an additional 41 miles is included for the east segment. The 131 miles included with the outer beltway corridors has a probable cost estimate between $1.35 and $1.45 billion.

The probable construction costs for the north, south and west segments of the inner beltway, covering a total distance of 65 miles, is approximately between $700 and $800 million as shown in **Table 4-2**. This is a total project cost, which includes an estimate for right-of-way acquisition, preliminary and final design services and construction administration.

Table 4-1 Outer Beltway Summary of Probable Costs

Outer Beltway Segment	Length (mi.)	Total Cost (mil)
North	30	$310 - 340
East	41	$430 - 450
South	30	$320 - 340
West	30	$290 - 320
TOTAL	**131**	**$1,300 - 1,500**

Table 4-2 Inner Beltway Summary of Probable Costs

Inner Beltway Segment	Length (mi.)	Total Cost (mil)
North	15	$170 - 210
East	--	--
South	26	$330 - 360
West	24	$200 - 230
TOTAL	**65**	**$700 - 800**

4-2 Transportation Performance

Given the estimated beltway alignments and characteristics described previously, the two beltway alternatives were coded into the LRTP Base model network as independent scenarios. The travel demand for, and attraction of, both an outer and inner beltways in the metro area could then be assessed by comparing the results to the LRTP Base model.

4-2-1 Beltway Travel Demand Model Development

Each of the beltway alternatives is represented in the travel demand model as four-lane freeways. The characteristics of the four-lane freeway are similar to those of I-29 north and south of the Omaha metro area.

Outer Beltway

The travel demand model network of the outer beltway alternative includes the LRTP Base roadway improvements plus the construction of the four- lane outer beltway. Specific interchange locations were identified for the corridor (locations noted in section 4-1). **Figure 4-8** shows a schematic of the outer beltway.

Inner Beltway

The travel demand model network of the inner beltway alternative includes the LRTP Base roadway improvements plus the construction of the four- lane inner beltway. Interchange locations were selected for the corridor as noted in section 4-1. I-29 overlaps with the eastern segment of the inner beltway. An assumption was made that the model characteristics of this link of the inner beltway would remain unchanged from the LRTP Base model network. Similarly, I-680 overlaps with a portion of the inner beltway from N-36 to I-29. Again the assumption was made to leave the model link characteristics the same as the LRTP Base network. **Figure 4-9** shows a schematic of the inner beltway.

Figure 4-8 Outer Beltway Schematic

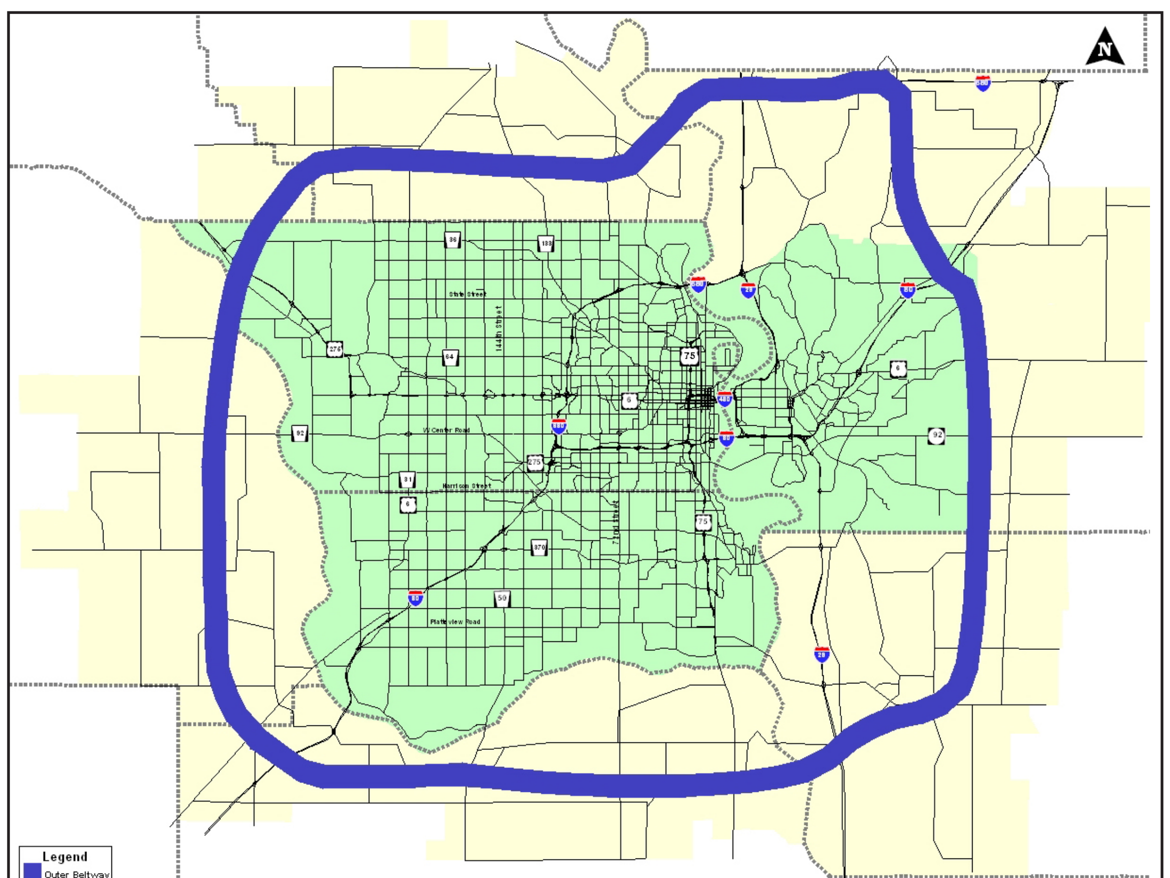
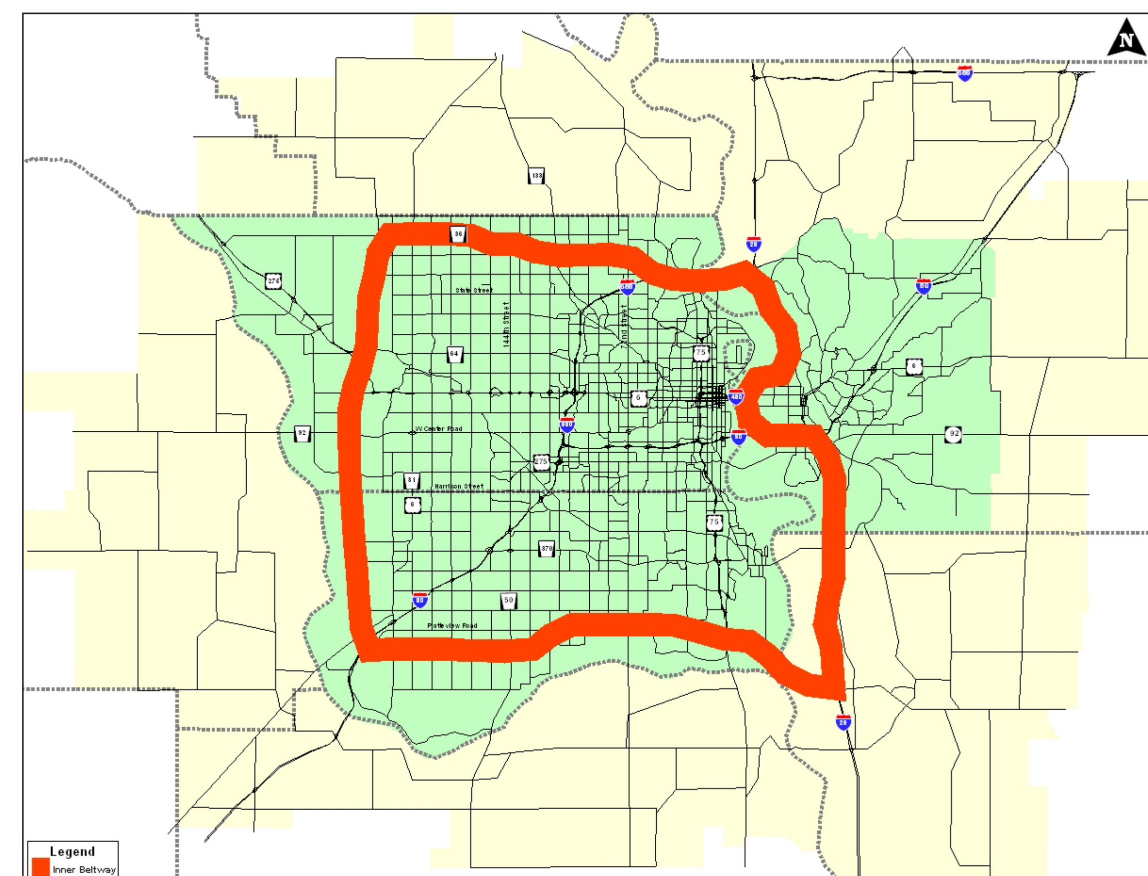


Figure 4-9 Inner Beltway Schematic



4-2-2 Beltway Future Daily Volumes

The results from the travel demand models include projections of future year daily traffic volumes. Figure 4-10 illustrates the results for the outer beltway scenario. The outer beltway travel demand model daily volumes are all below the two-way capacity of 80,600 vehicles per day. The daily projected volumes are the lowest on the east segment, ranging between 3,400 to the northeast between I-80 and I-680, and 17,300 just south of Iowa Highway 92. The south segment of the outer beltway shows daily volumes ranging from 22,700 to 31,600. On the west segment, the forecasts hover around 20,000. The highest volumes for the outer beltway are around 40,000. These volumes are at the north segment overlap with I-680.

The travel demand model assignments for the inner beltway are notably higher than the outer beltway as shown in Figure 4-11. The east segment, which coincides with I-29, shows future volumes ranging from 29,100 to as high as 138,300 in the overlap section of I-29/I-80 in Council Bluffs. Future volumes as high as 60,000 are seen on the south segment of the inner beltway just east of 72nd Street. On the west segment, the future volumes show a wide range between 20,000 and 50,000 with the highest volumes just north of US-6. The north segment overlaps with Nebraska Highway 36 and I-680, and future volumes range between 26,000 to 52,000. None of the forecasted volumes for the inner beltway resulted in volumes greater than the assigned model capacity, including the I-29/I-80 overlap section.

Figures 4-10 and 4-11 show forecast volumes for both beltway scenarios and the LRTP Base. These figures show that the potential beltways relieve traffic volumes on key corridors, spread over several routes in the metro. The future ADT on I-80, for example, shows a slight volume reduction with either the inner or outer beltway. Regardless, I-80 is still an attractive commuter route, even with a beltway in place. What is actually happening in the model is a significant volume does "transfer" from I-80 or I-680 to a beltway, but the transferred volume from the existing routes is replaced by vehicles on the arterial street system. This happens because trips are attracted to the shortest travel time path.

Figure 4-10 Outer Beltway Future Daily Volumes

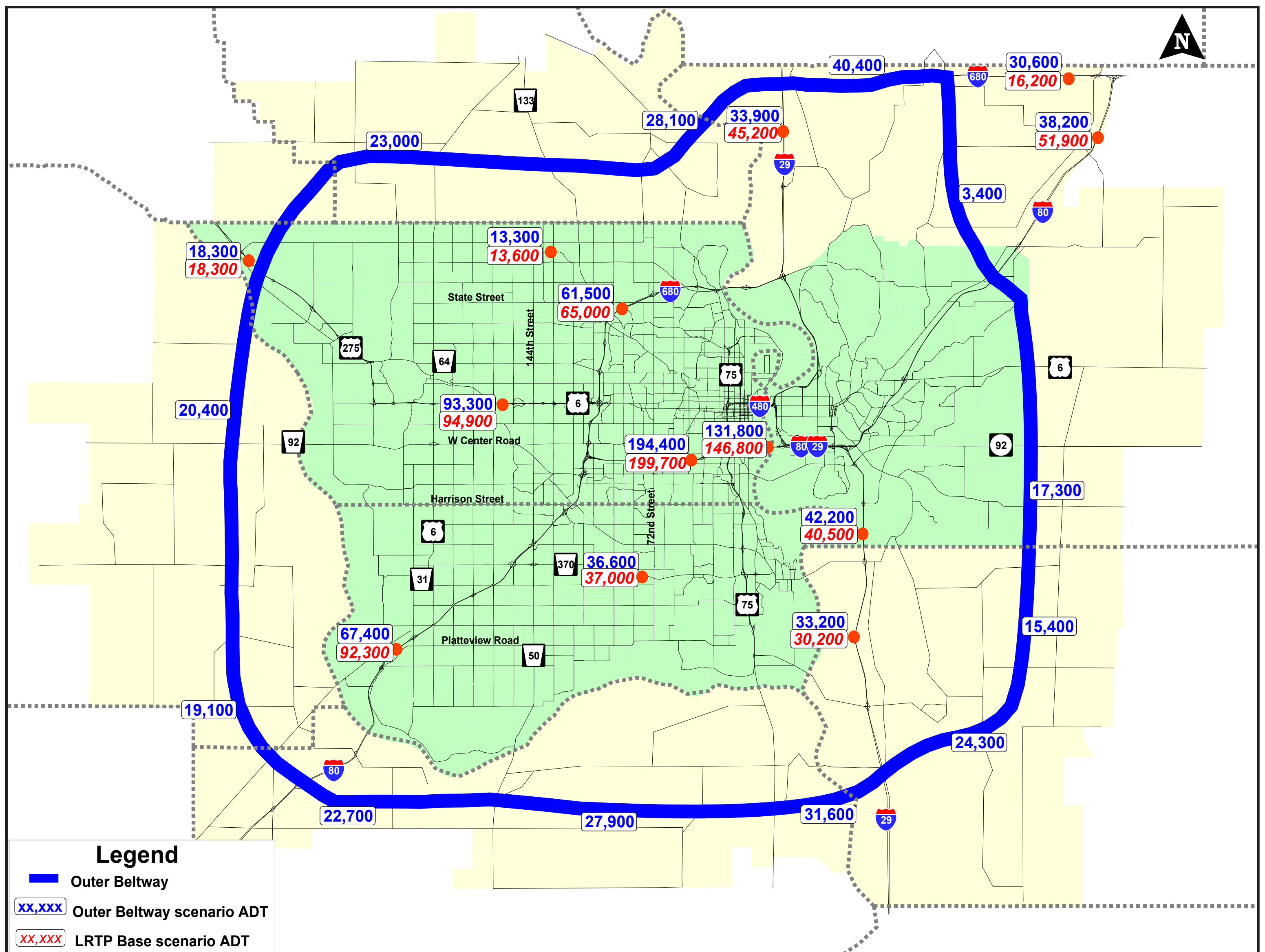
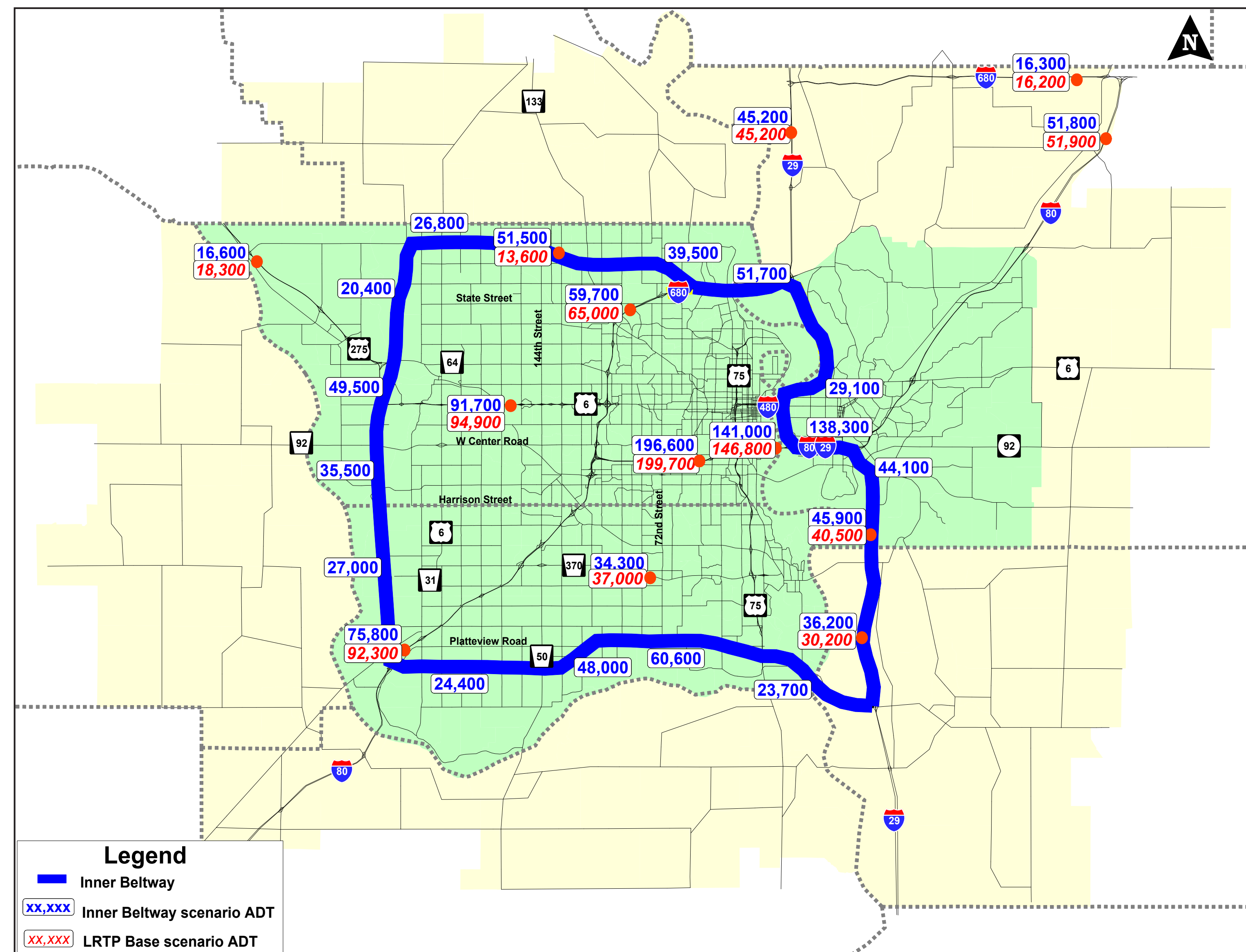


Figure 4-11 Inner Beltway Future Daily Volumes



4-2-3 Beltway Performance

All Roadway Links

Table 4-3 provides the summary of the 2004 and Future Base findings compared to the outer and inner beltways for the entire model network.

Outer Beltway Performance

When comparing the outer beltway travel demand model results to those of the LRTP Base, the total vehicle miles travel increases (3.5%). This finding is reasonable in that drivers are willing to travel further outward in the metro area as a trade-off for an uncongested, high-speed facility. In the outer beltway alternative, the average driver was able to increase their travel speed 1.4%, and spend less overall time traveling (-0.9%). In the outer beltway model scenario, the total delay for the region as a whole also decreased compared to the LRTP Base (-8.1%). This decrease in delay may be attributed to vehicles utilizing an outer beltway where the ideal or free-flow speed is achievable, instead of driving along the congested arterial routes in the metro area.

Another telling measure is the reduction of lane-miles of links over capacity. The outer beltway scenario reduced the number of lane-miles of links over capacity by 9.8% when compared to the LRTP Base which amounts to 87 lane-miles of roadway. Note, a one mile segment of a four-lane arterial would be equivalent to four lane-miles.

Inner Beltway Performance

The results of the inner beltway travel demand scenario are similar to the outer beltway when comparing to the LRTP Base on a regional scale. The total vehicle miles traveled increased (+3.8%), which is a higher increase than the outer beltway scenario. Although the inner beltway is located in closer proximity to the more dense portions of the metropolitan area, the inner beltway also attracts a greater number of users than the outer beltway, which may explain an overall higher number of vehicle miles. Just like the outer beltway, the inner beltway reduced vehicle hours traveled (-0.9%) and increased average travel speed (+1.4%) compared to the LRTP Base network. In the inner beltway scenario, the total delay was reduced (-7.2%). The inner beltway also resulted in 121 fewer lane-miles of links over capacity when compared to the LRTP Base (-13.7%). This reduction in over capacity links and total system delay may be associated with the inner beltway providing relief to several of the already congested roadways in the core of the arterial street system.

High Capacity Corridors

Table 4-4 provides the summary of 2004 and LRTP Base findings compared to the outer and inner beltways for the high capacity corridors. The high capacity corridor data is a subset of the measures provided in **Table 4-3**. High capacity corridors are categorized as freeways, expressways, and arterials with six or more lanes.

Outer Beltway Performance

The outer beltway scenario would increase the number of lane-miles of high capacity corridors by 37.3% as compared to the LRTP Base network. With the addition of the outer beltway, the average travel speed increased significantly (+7.8%). Additionally, the outer beltway would reduce the percentage of corridors over capacity by 8%. Based upon these findings it can be concluded that the outer beltway would provide a significant alternative to the existing high-capacity corridors for regional and perhaps freight movement throughout the metro area.

Inner Beltway Performance

The inner beltway does not add as many lane-miles of new high capacity roadway to the transportation system as the outer beltway does. Significant sections of the inner beltway alignment do overlap existing highway or freeway corridors. The inner beltway would result in a 20.0% increase in lane-miles of high capacity corridors as compared to the LRTP Base condition. Regardless, the average travel speed on the inner beltway scenario high capacity corridors increases even more than the outer beltway scenario. An increase in travel speed of 8.8% over the LRTP Base condition is expected. Also, the inner beltway scenario provides 59 fewer lane-miles of links over capacity and 7% fewer high-capacity corridors over capacity than the 2035 LRTP Base.

Overall, the inner beltway supplies additional high-capacity corridors that may alleviate congestion on other regionally significant roadways. In turn this would allow for faster and less congested travel for trucks and transportation users wishing to by-pass the metro area.

Table 4-3 All Roadway Links Measures

	2004	2035 Base Land Use				
		LRTP Base	Outer Beltway		Inner Beltway	
			Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Total Trip Ends	2,458,322	3,793,463	3,793,463	0.0%	3,793,463	0.0%
Total VMT (Veh-Miles)[1]	17,886,782	32,194,995	33,336,005	3.5%	33,431,177	3.8%
Total VHT (Veh-Hrs)[2]	484,415	915,720	907,684	-0.9%	907,595	-0.9%
Average Congested Speed (MPH)[3]	34.9	32.8	33.2	1.4%	33.2	1.4%
Total Delay (Hours)[4]	89,516	233,599	214,745	-8.1%	216,692	-7.2%
Lane-Miles of Links Over Capacity	308.9	887.2	799.9	-9.8%	765.9	-13.7%

*[1] VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
*[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] Congested Speed = Length/Congested Travel Time
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)

Table 4-4 High Capacity Corridor Measures

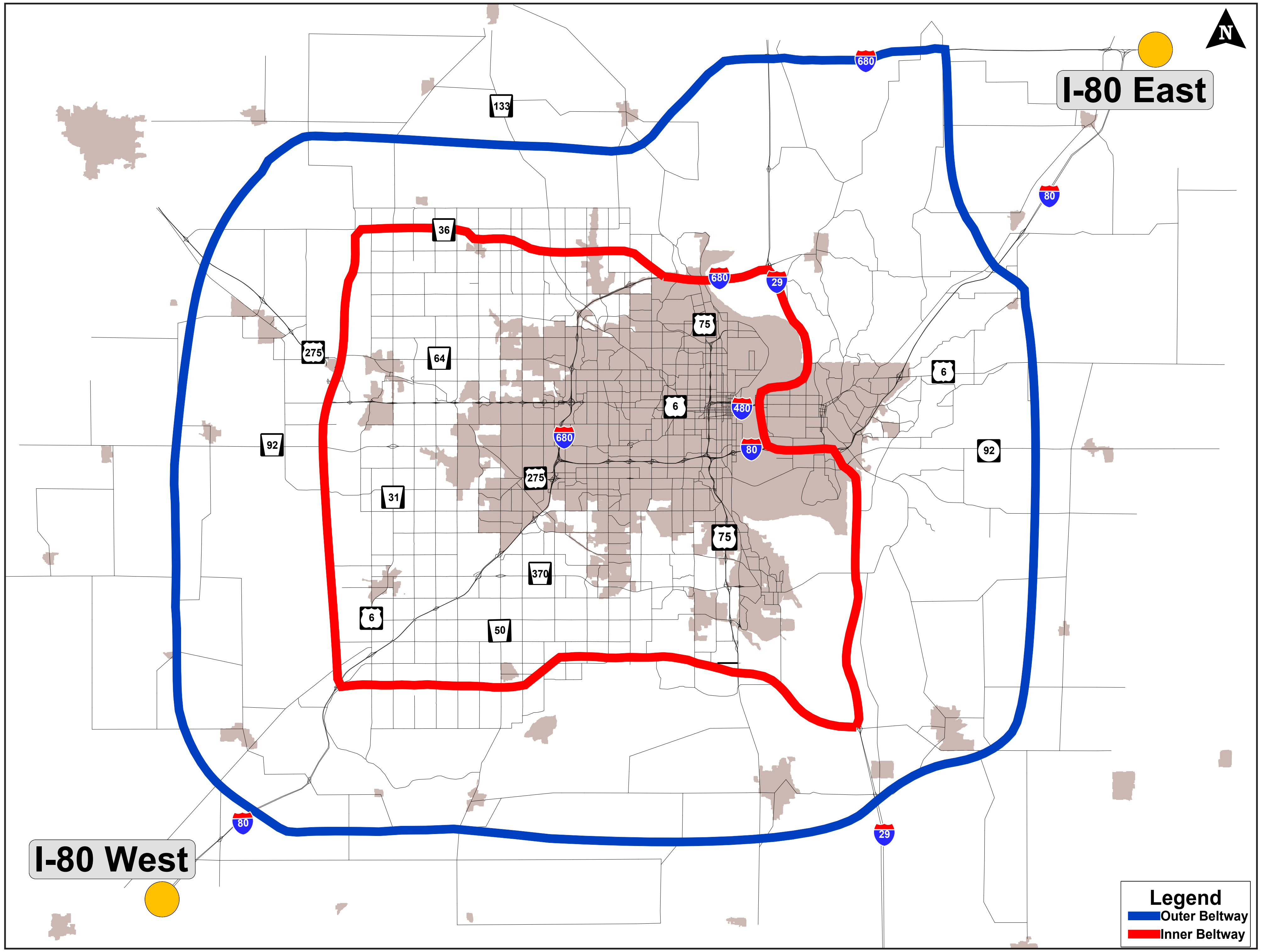
	2004	2035 Base Land Use				
		LRTP Base	Outer Beltway		Inner Beltway	
			Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Lane-Miles of High Capacity Corridors	972	1,448	1,989	37.3%	1,738	20.0%
Total VMT (Veh-Miles) of High Capacity Corridors[1]	7,162,118	15,489,223	17,269,381	11.5%	17,286,315	11.6%
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	148,271	374,483	384,055	2.6%	386,735	3.3%
Average Congested Speed (MPH) of High Capacity Corridors[3]	45.5	38.5	41.5	7.8%	41.9	8.8%
Total Delay (Hours) of High Capacity Corridors[4]	22,671	100,707	86,278	-14.3%	91,791	-8.9%
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	57.3	315.9	280.2	-11.3%	256.8	-18.7%
Percentage of Corridors Over Capacity	6%	22%	14%		15%	

*[1] VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
*[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] Congested Speed = Length/Congested Travel Time
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)
[5] Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9

4-2-4 Freight Consideration

According to the US Department of Commerce, the US Gross Domestic Product (GDP) is expected to grow, on average, almost 3 percent per year between now and 2035, resulting in an even greater demand for freight transportation. Portions of the outer or inner beltway can serve as a bypass route for freight movement. The I-80 corridor traverses the metro area, with existing truck percentages ranging from 36% in the rural area, to 6% in the urban area. A travel time analysis was conducted for the route along I-80, from west of Highway 63 in Nebraska, to east of the I-80/680 merge in Iowa. The points shown in Figure 4-12 were used as the external points for this analysis. The travel time comparison shows a time savings of 7% between these points for the future transportation system with the outer beltway, as compared to the LRTP Base. With the inner beltway in place, a time savings of 2% for this truck route may be expected.

Figure 4-12 Freight Travel Time Analysis External Points



CHAPTER 5 TRANSPORTATION ALTERNATIVES AND LAND USE SCENARIOS

A key element of this Beltway Feasibility Study was to investigate other alternatives that could also improve transportation. The other alternatives that were identified for comparison to the beltway alternatives include non-beltway transportation networks and a transit alternative. Additionally, land use scenarios were investigated to determine the effect land use could play on the entire range of alternatives.

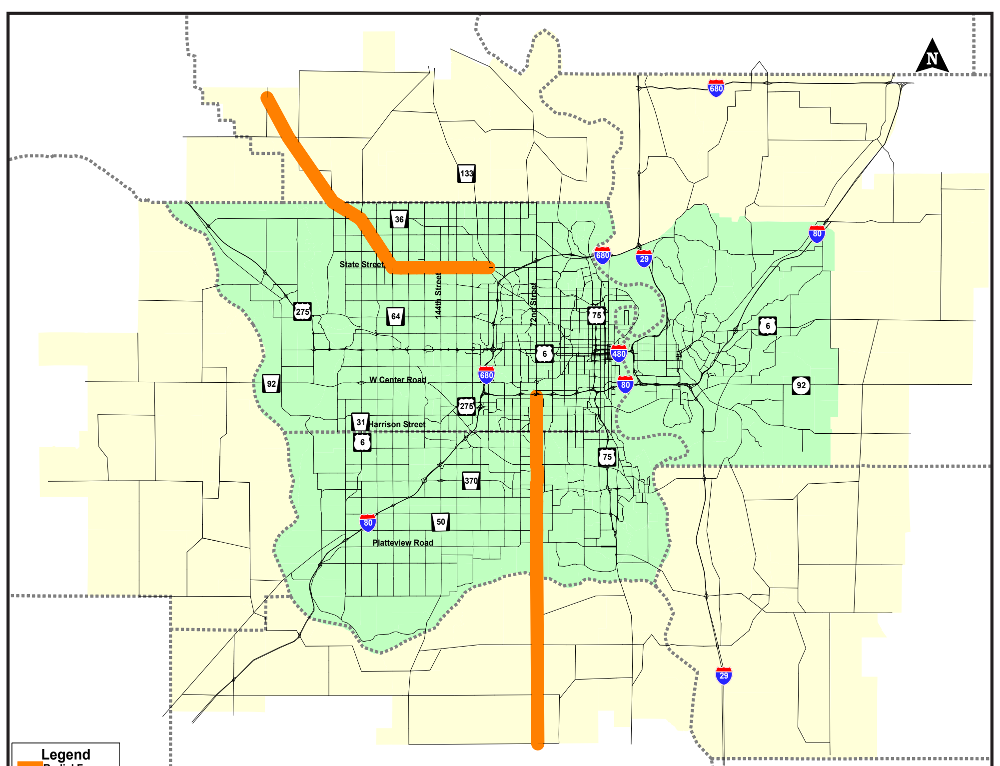
This chapter provides the summary of these alternative evaluations and provides direct comparison to the beltway alternatives.

5-1 Other Roadway Alternative Options

Radial Freeway

When reviewing the freeway network in the metro area it was clear that an outer beltway would connect and serve the growing areas of the community. Another method for providing improved access to these growth areas is to provide direct freeway connections or radial freeways to the areas where no freeways or expressways exist. The two areas of need were a centrally located north-south link serving the southern metro area and a northwesterly link serving the northwestern areas of the metro.

Figure 5-1 Radial Freeways



This concept alternative included the LRTP base roadway improvements plus the construction of the two identified four-lane freeway facilities. Note that these freeway facilities have been identified for testing purposes only. In the built up areas of the metro area these alternatives may not be feasible, however, for the purposes of the study the testing of the alternatives was necessary.

The first freeway facility for the concept was a south radial that would begin at I-80 in the vicinity of 72nd Street and continue south for 21 miles. The second freeway facility was a northwesterly radial that would connect to I-680 in the vicinity of Blair High Road and continue to the northwest a distance of approximately 19 miles. The radial freeway locations are shown in **Figure 5-1**.

For comparative purposes and to support an economic analysis an estimate of probable construction cost was prepared and is shown in **Table 5-1**. Costs are in 2008 dollars.

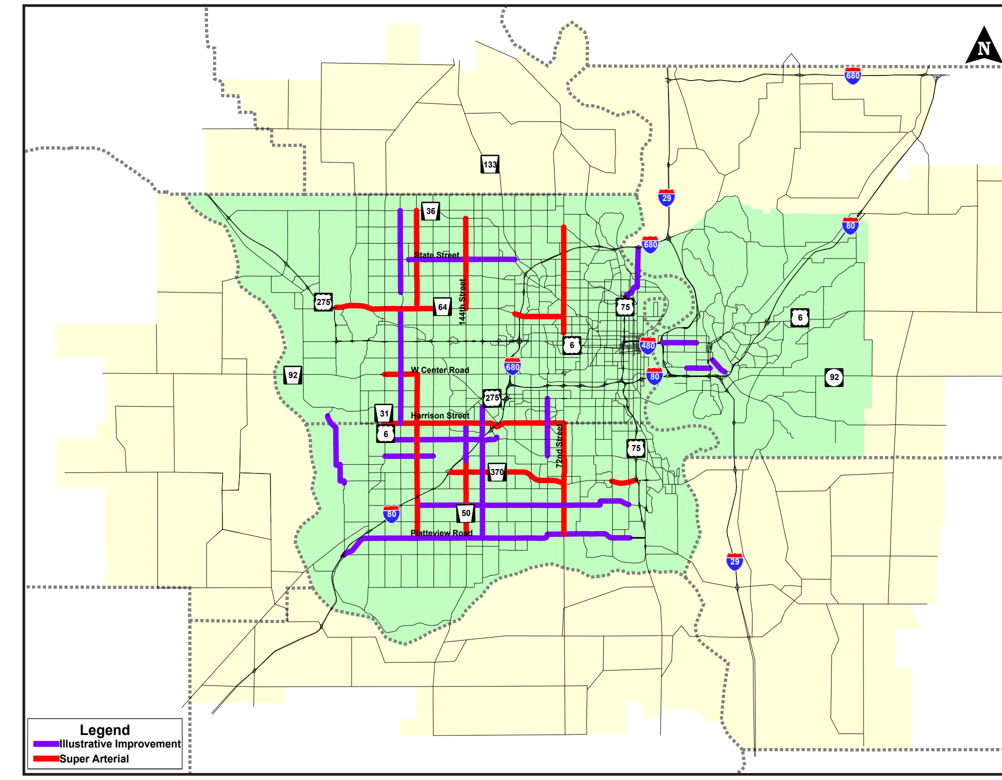
Table 5-1 Radial Freeways Summary of Probable Costs

Description	Length (mi.)	Avg. Cost/ Mile (mil)	Total Cost (mil)
South (72nd Street)	21	$18	$340-400
Northwest	19	$15	$260-300
TOTAL	**40**	**$16.5**	**$600-700**

Super-Arterials Network

Another alternative method to provide congestion relief would be to consider creating a "super" arterial network to provide the capacity that a beltway or radial freeway system would provide. This scenario also includes the LRTP base roadway improvements plus the construction of projects identified as "illustrative" in the LRTP and other six-lane "super arterials" in the metro area as defined by the study team. Illustrative projects serve as a placeholder in the LRTP, and provide the basis for programming the project on the condition that the project will only be constructed if funding is available. Corridors identified as super arterials are assumed to be improved to six-lane arterial streets. In some cases the super arterials are extensions of currently planned six-lane facilities and in other cases the super arterials are corridors with improvements above and beyond the LRTP improvements. The super arterial network can be seen in **Figure 5-2**.

Figure 5-2 Super Arterials



Again, for comparative purposes and to support the economic analysis an estimate of probable construction cost was prepared and is shown in **Table 5-2**. Costs are in 2008 dollars.

Table 5-2 Super Arterials Summary of Probable Costs

Description	Length (mi.)	Avg. Cost/ Mile (mil)	Total Cost (mil)
Super Arterials	72.7	$11	$760-810
Illustrative LRTP	82.5	$7.5	$590-640
TOTAL	**155.2**	**$9.0**	**$1,300-1,500**

Alternative Roadways Performance

The radial freeway and super arterials alternatives were coded into the expanded MAPA model network as independent scenarios. The travel demand and attraction for both network alternatives could be assessed by comparing the results to the 2035 Expanded Base MAPA model. The radial freeways were coded with the same characteristics as the beltway alternatives and the super arterials networks were coded consistent with other six-lane facilities in the model.

From an attraction standpoint the radial freeways were able to draw some volumes. The south radial had daily volumes as high as 80,000 near I-80. Near the City of Papillion the volume was 30,000 daily and south of Capehart Road the volume dropped below 10,000.

The northwest radial freeway carried 68,000 vehicles on the east-west segment in the vicinity of I-680 and the volume dropped to 20,000 for the northwesterly segment.

From the perspective of relieving congestion or volumes on the existing freeway system neither the radial freeway or the super arterials alternative had much affect in reducing demand. Note that from a system perspective, both of these alternatives are suited for improving local area travel rather than relieving interstate freeway demand or freight needs.

Tables 5-3 and 5-4 provide the summary of travel demand findings for the 2004 and 2035 Expanded Base, the outer and inner beltway as well as the radial freeways and super arterials alternatives for all roadway links and the high capacity corridors.

Radial Freeways Performance

When comparing the radial freeway to the other alternatives there were no summary measures that proved to be better than either the inner or outer beltway alternatives. A key measure that shows the radial freeway alternative provides limited operational benefits is the reduction in lane-miles of links over capacity showing only a 3.5% reduction for all links and 2.0% reduction for high capacity corridor links.

Super Arterials Performance

When comparing the super arterials to the other alternatives there are some findings of interest. Comparing all roadway links the super arterials alternative provides the greatest increase in congested speed, the largest decrease in total delay and the highest reduction in lane-miles of over capacity links.

When comparing the super arterials to the other alternatives for the high capacity corridors only, the results show this alternative provides the most significant increase in lane-miles of high capacity corridors, the greatest increase in vehicle-miles traveled and vehicle-hours traveled, as well as

Table 5-3 All Roadway Links Measures

	2004	2035 Base Land Use						2035 Base Land Use			
		LRTP Base	Outer Beltway		Inner Beltway			Radials		Super Arterials	
			Measures	% Change from LRTP Base	Measures	% Change from LRTP Base		Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Total Trip Ends	2,458,322	3,793,463	3,793,463	0.0%	3,793,463	0.0%		**3,793,492**	**0.0%**	**3,793,463**	**0.0%**
Total VMT (Veh-Miles)[1]	17,886,782	32,194,995	33,336,005	3.5%	33,431,177	3.8%		**32,531,002**	**1.0%**	**32,714,947**	**1.6%**
Total VHT (Veh-Hrs)[2]	484,415	915,720	907,684	-0.9%	907,595	-0.9%		**911,628**	**-0.4%**	**903,095**	**-1.4%**
Average Congested Speed (MPH)[3]	34.9	32.8	33.2	1.4%	33.2	1.4%		**33.0**	**0.8%**	**33.5**	**2.1%**
Total Delay (Hours)[4]	89,516	233,599	214,745	-8.1%	216,692	-7.2%		**230,910**	**-1.2%**	**210,195**	**-10.0%**
Lane-Miles of Links over Capacity[5]	308.9	887.2	799.9	-9.8%	765.9	-13.7%		**856.3**	**-3.5%**	**687.5**	**-22.5%**

*[1] VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
*[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] Congested Speed = Length/Congested Travel Time
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)
[5] Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9

Table 5-4 High Capacity Corridor Measures

	2004	2035 Base Land Use					2035 Base Land Use			
		LRTP Base	Outer Beltway		Inner Beltway		Radials		Super Arterials	
			Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Lane-Miles of High Capacity Corridors	972	1,448	1,989	37.3%	1,738	20.0%	**1,684**	**16.2%**	**2,210**	**52.6%**
Total VMT (Veh-Miles) of High Capacity Corridors[1]	7,162,118	15,489,223	17,269,381	11.5%	17,286,315	11.6%	**16,731,551**	**8.0%**	**18,822,549**	**21.5%**
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	148,271	374,483	384,055	2.6%	386,735	3.3%	**394,253**	**5.3%**	**461,109**	**23.1%**
Average Congested Speed (MPH) of High Capacity Corridors[3]	45.5	38.5	41.5	7.8%	41.9	8.8%	**40.5**	**5.2%**	**38.4**	**-0.3%**
Total Delay (Hours) of High Capacity Corridors[4]	22,671	100,707	86,278	-14.3%	91,791	-8.9%	**103,273**	**2.5%**	**111,602**	**10.8%**
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	57.3	315.9	280.2	-11.3%	256.8	-18.7%	**309.7**	**-2.0%**	**306.1**	**-3.1%**
Percentage of Corridors Over Capacity	6%	22%	14%		15%		**18%**		**14%**	

*[1] VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
*[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] Congested Speed = Length/Congested Travel Time
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)
[5] Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9

the greatest increase in total delay (+10.8%). For comparison, the beltway alternatives provide reductions in total delay for the high capacity corridors (-14.3% Outer, -8.9% Inner).

5-2 Transit Option

A transit alternative was developed for testing to determine what impact transit may have in the performance of the transportation system. The transit alternative identified to achieve meaningful transit ridership for the purposes of this study was a light rail transit system. However, should transit become a preferred strategy, more detailed study will need to be completed to determine the most cost effective transit strategy to achieve significant increases in ridership levels.

Whereas in the other transportation alternatives the travel demand model was coded for the new roadways, a transit alternative could not be directly coded into the model. As such, an assumed ridership was developed and the corresponding trips adjusted to represent people on an enhanced transit system.

The spine of this alternative system would run along the Dodge corridor from downtown to 204th Street. Spines would run north-south to serve Eppley Airfield and Offutt Air Force Base. Spines would also run along 72nd Street and 144th Street with logical termini at retail centers.

The transit lines, as shown in **Figure 5-3**, total 50 miles of a light rail system. It is assumed this transit system would be in its own right-of-way.

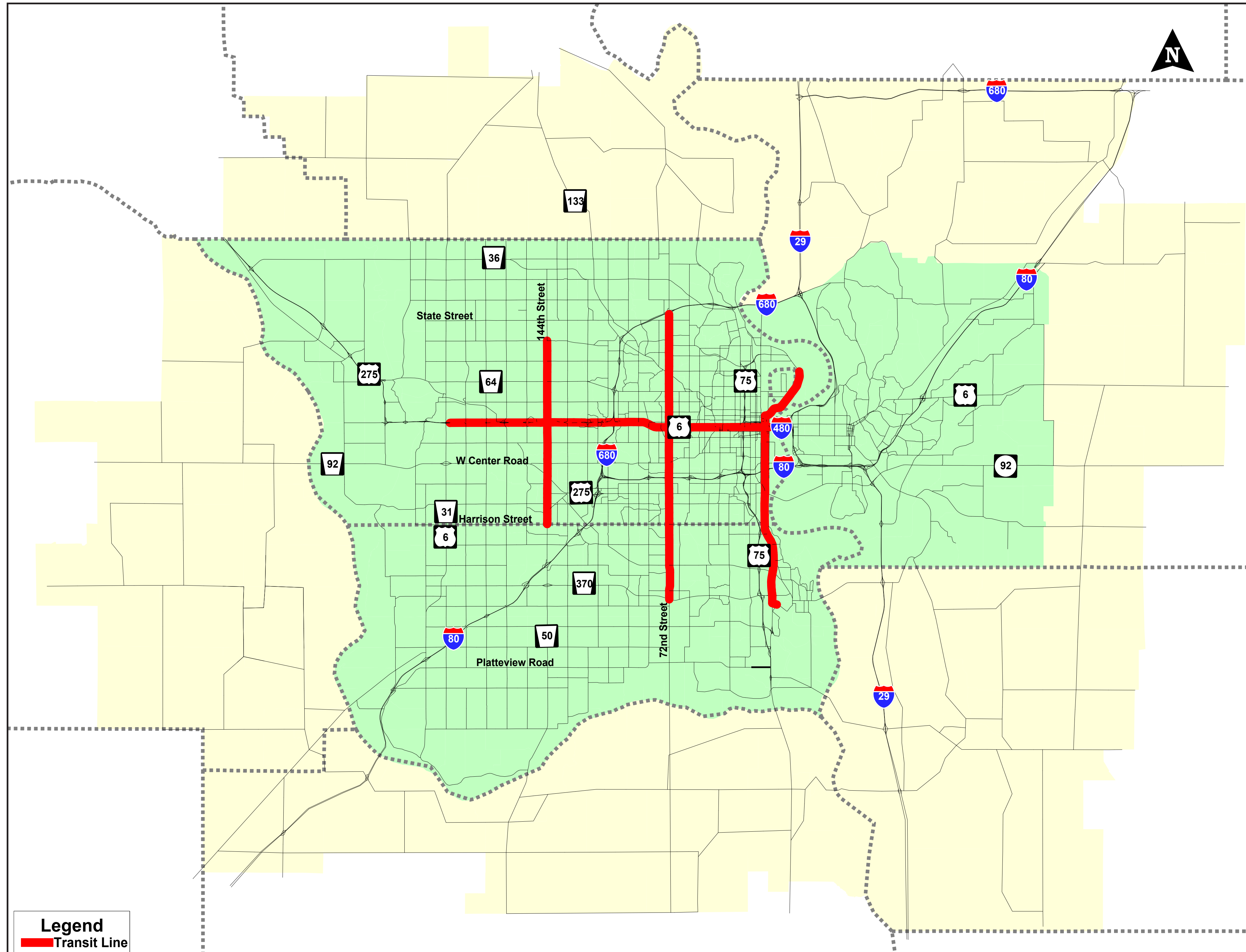
For comparative purposes and to support the economic analysis an estimate of probable construction cost was prepared as shown in **Table 5-5**. Costs for light rail systems range from $25 million to $100 million per mile. For purposes of this study the per mile estimate of light rail cost was identified as approximately $50 million per mile in 2008 dollars which yields an estimate of about $2.5 billion dollars for this light rail system.

Table 5-5 Transit Option Summary of Probable Costs

Description	Length (mi.)	Avg. Cost/ Mile (mil)	Total Cost (mil)
Light Rail Transit System	50	$50	$2,400-2,600

A transit system such as this would require special bus feeder routes and other modifications to the existing transit system. Additionally, such a strategy would entail dramatically different development patterns than exist today. For the purposes of this study it is assumed that these changes would take place to support the development of such a light rail transit system.

Figure 5-3 Transit Option



Transit Performance

This scenario includes the LRTP base roadway improvements plus the construction of 50 miles of light rail within the metro area. To predict travel demand changes, a base assumption was set that a 5% reduction in regional vehicular trips would be realized (5% mode split). With a year 2005 bus ridership rate of 0.5% in the metro, a future mode split of 5% is a significant, ten-fold, increase. The travel demand model network was modified in an independent scenario to generate 5% fewer trips through a systematic reduction of productions and attractions along the light rail corridors and anticipated feeder zones.

Note some items to consider with the results:

- The targeted mode split of 5% would put the Omaha area in the company of cities like Portland, Oregon and Seattle, Washington; cities with significant transit ridership.
- The evaluation was not conducted with a transit model. MAPA's model does not have a transit component and therefore the methods used to adjust the travel demand model resulted in trips being removed from the model to estimate the mode change.
- The trips that were removed from the model are trips that would be made on the light rail system. Note that in the evaluation there is no delay or time components associated with transit. Delays would be incurred in the transit system that are not accounted for in this evaluation.

Tables 5-6 and 5-7 provide the summary of travel demand findings for all of the transportation alternatives including the transit alternative.

The results for all roadway links and the high capacity corridors only are consistent for the transit alternative. Transit has the highest reduction in vehicle-miles of travel and vehicle-hours of travel as well as the most reduction in total delay and lane-miles of links over capacity. It is important to note the analysis was completed without the benefit of a transit model that could capture the delays and costs

Table 5-6 All Roadway Links Measures

	2004	2035 Base Land Use										2035 Base Land Use	
		LRTP Base	Outer Beltway		Inner Beltway		Radials		Super Arterials		Transit	
			Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Total Trip Ends	2,458,322	3,793,463	3,793,463	0.0%	3,793,463	0.0%	3,793,492	0.0%	3,793,463	0.0%	**3,605,567**	**-5.0%**
Total VMT (Veh-Miles)[1]	17,886,782	32,194,995	33,336,005	3.5%	33,431,177	3.8%	32,531,002	1.0%	32,714,947	1.6%	**30,773,555**	**-4.4%**
Total VHT (Veh-Hrs)[2]	484,415	915,720	907,684	-0.9%	907,595	-0.9%	911,628	-0.4%	903,095	-1.4%	**836,977**	**-8.6%**
Average Congested Speed (MPH)[3]	34.9	32.8	33.2	1.4%	33.2	1.4%	33.0	0.8%	33.5	2.1%	**33.4**	**1.8%**
Total Delay (Hours)[4]	89,516	233,599	214,745	-8.1%	216,692	-7.2%	230,910	-1.2%	210,195	-10.0%	**190,156**	**-18.6%**
Lane-Miles of Links over Capacity[5]	308.9	887.2	799.9	-9.8%	765.9	-13.7%	856.3	-3.5%	687.5	-22.5%	**653.7**	**-26.3%**

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*[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] Congested Speed = Length/Congested Travel Time
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)
[5] Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9

Table 5-7 High Capacity Corridor Measures

	2004	2035 Base Land Use										2035 Base Land Use	
		LRTP Base	Outer Beltway		Inner Beltway		Radials		Super Arterials		Transit	
			Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Lane-Miles of High Capacity Corridors	972	1,448	1,989	37.3%	1,738	20.0%	1,684	16.2%	2,210	52.6%	**1,448**	**0.0%**
Total VMT (Veh-Miles) of High Capacity Corridors[1]	7,162,118	15,489,223	17,269,381	11.5%	17,286,315	11.6%	16,731,551	8.0%	18,822,549	21.5%	**15,012,480**	**-3.1%**
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	148,271	374,483	384,055	2.6%	386,735	3.3%	394,253	5.3%	461,109	23.1%	**346,826**	**-7.4%**
Average Congested Speed (MPH) of High Capacity Corridors[3]	45.5	38.5	41.5	7.8%	41.9	8.8%	40.5	5.2%	38.4	-0.3%	**39.7**	**3.0%**
Total Delay (Hours) of High Capacity Corridors[4]	22,671	100,707	86,278	-14.3%	91,791	-8.9%	103,273	2.5%	111,602	10.8%	**82,914**	**-17.7%**
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	57.3	315.9	280.2	-11.3%	256.8	-18.7%	309.7	-2.0%	306.1	-3.1%	**243.5**	**-22.9%**
Percentage of Corridors Over Capacity	6%	22%	14%		15%		18%		14%		17%	

*[1] VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
*[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] Congested Speed = Length/Congested Travel Time
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)
[5] Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9

associated with transit usage. The methodology utilized resulted in vehicular trips simply being removed from the network, when in actuality they would become transit trips with associated delays, costs, etc.

5-3 Land Use Scenarios

Land use practices and transportation systems are the framework of the urban and suburban environment. The relationship between the two is so interrelated that planning for one without the other can result in the failure of both. Understanding the implications that each has on the other can fundamentally alter the form and function of urban and suburban areas.

In order to understand the implications of land use on the transportation alternatives, several land use scenarios were developed. This section summarizes the land use scenario development and provides a summary of the travel demand modeling results based upon the land use scenarios developed.

5-3-1 Background

Since the 1950s, conventional land use policy, based on low density separation of uses, has coincided with a transportation system that serves widely separated land uses and a population housed at relatively low densities. As a result, a transportation system based on moving the automobile has become the norm in most American cities. An auto-oriented transportation system also makes low density separated land uses possible by offering access and large areas of land for buildings and surface parking.

Today, for environmental, economic, and social reasons, there is an increasing interest in using less land for development and creating multi-modal transportation systems. Due to the transportation/land use relationship, in order to bring about these changes, both systems must be changed. For the auto-oriented transportation system to become multi-modal, it must accommodate automobiles, public transit, bicycles, and pedestrians. This requires a higher density mix of uses to allow transit to work efficiently and pedestrians and bicyclists accessibility to meet their daily needs. Higher density, mixed land uses work most efficiently when the transportation system provides access for all users to prevent traffic congestion and parking problems. Simply changing transportation policy will not be effective because transit is not sustainable at low densities and pedestrians and bicyclists cannot easily cover long distances. Similarly, changing land use without broadening transportation options will result in traffic congestion and parking shortages.

5-3-2 Overview of Process

As part of this Feasibility Study, MAPA requested the study team evaluate how significant changes to land use practices might affect the need for a beltway or an alternate roadway system improvement. To predict future land use practices, the study team reviewed current land use patterns and assessed development and demographic trends that will likely impact future land use and, by extension, transportation needs.

Several sources were consulted through the course of the evaluation. Metro area city and county comprehensive plans were used to establish a baseline vision of the land use and transportation network for the region. To supplement the comprehensive plans, census data and other national resources were consulted to offer more current perspectives on local and national trends. Finally, conversations with local planning officials and a variety of developers offered insights from professionals involved in the growth and development of the region.

5-3-3 Comprehensive Plans

To establish a baseline of land use patterns, transportation and demographics for the metro area, all available city and county comprehensive plans were reviewed. Comprehensive plans are the official jurisdictional record of area population, land use practices, transportation system function and recommendations for expected future development. A list of the plans and the year in which they were published is provided in **Table 5-8**. The detail and age of the comprehensive plans vary greatly. Recently published plans included the 2035 test year, but older plans may not have. In these cases, the assumption was that basic trends and patterns would continue and more current population projections were drawn from the most recent data available.

Table 5-8 Comprehensive Plan Summary List

Municipality	Year
Saunders County	2004
Ashland	1997
Yutan	2005
Cass County	1998
Plattsmouth	2004
Mills County	2002
Glenwood	2001
Pottawattamie County	2003
Council Bluffs	1994
Council Bluffs ETJ	2001
Carter Lake	2006
Sarpy County	2005
Springfield	2001
Gretna	1997
Papillion	2002
La Vista	2006 update
Bellevue	2006
Washington County	2005
Blair	2004
Fort Calhoun	2006
Douglas County	2006
Valley	2005
Bennington	2000
Omaha	1997

5-3-4 Future Trends

Overall, the population of the study area is expected to grow to 967,189 in 2035, an increase of approximately 32%. Future population is expected to concentrate in the cities and towns and decrease in the rural areas. All comprehensive plans call for contiguous, incremental growth according to the established street pattern. Particularly in the more rural counties, non-farm growth is encouraged to stay within existing towns and extra territorial jurisdictions (ETJs). In unincorporated areas of the counties, there is the desire to preserve agricultural land for agricultural uses and discourage non-farm uses in areas zoned for agriculture.

Historically, Omaha and Douglas County have been the center of the metro area's population growth. However, by many, the metro area inside I-680 is considered "built out" and by 2025, all of Douglas County in the Papio Basin is expected to be built out. Based on the limited amount of growth area remaining in Douglas County and following recent growth patterns, the majority of new residential development is expected to be focused in the south and west portions of the metro area, particularly Sarpy County. In Sarpy County, growth beyond 10 years is somewhat constrained by sewer service. Limited municipal sewer service is available outside the Papio Basin, so widespread suburban density or higher growth will require the construction of sewer treatment and conveyance. Further into the future, additional growth centers are expected in the Wahoo and Yutan areas in Saunders County. In Iowa, the majority of Pottawattamie County residential growth is expected to the east of Council Bluffs, with the Loess Hills Preservation Area limiting the amount of dense growth.

Demographic Trends

Nationwide, household demographics are changing. In 1970, 44% of all households had children; 17% were single person. In 2006, 35% of all households had children; 26% were single person. By 2037, 27% of all households will have children; and 26% will be single person. Omaha's households reflect these demographic trends. In 1990, 28% of households were made up of a married couple and children; 25% were single person households. By 2006, 23% of Omaha households were made up of a married couple and children; 28% were single person households. Housing preferences are expected to change as households become smaller, with demand for the typical suburban single family residential lots falling off as demand for smaller residential units picks up.

The majority of today's new housing development in the metro area is conventional suburban style subdivisions. To a lesser extent, conventional housing developers have begun to offer some smaller, denser options in typical subdivisions. Relatively few housing developers in the metro area have begin to build residential products specifically for one and two person households. Increasingly for these home buyers, location is considered more important than space, and functional, well-designed space is preferred over large quantities of space. Environmentally friendly options, including an in-town location to cut down on driving are becoming more popular. Because of these changes in demand and the availability of several large centrally located sites, between the I-680 loop and downtown, commercial and residential infill projects are expected to make up a much more significant portion of the local development in the next 10 years than in the previous 10 years.

As the center of the metro area, the City of Omaha supports higher density development to reduce infrastructure costs and ease service provision, including transit. Under current land use policies, Omaha's 2040 goal is to increase the average density from approximately 3.20 to 3.75 units per acre. The increase in density will be accomplished through targeted infill and redevelopment and by increasing the density of new development on the edges of the city. The City's land use plan also identifies mixed use areas that are designated for higher density development. These demographic and development trends as well as public perception of transportation needs point to changes in land use patterns and transportation preferences. When planning for the future, the implications of these changes on transportation infrastructure demands should be taken into account.

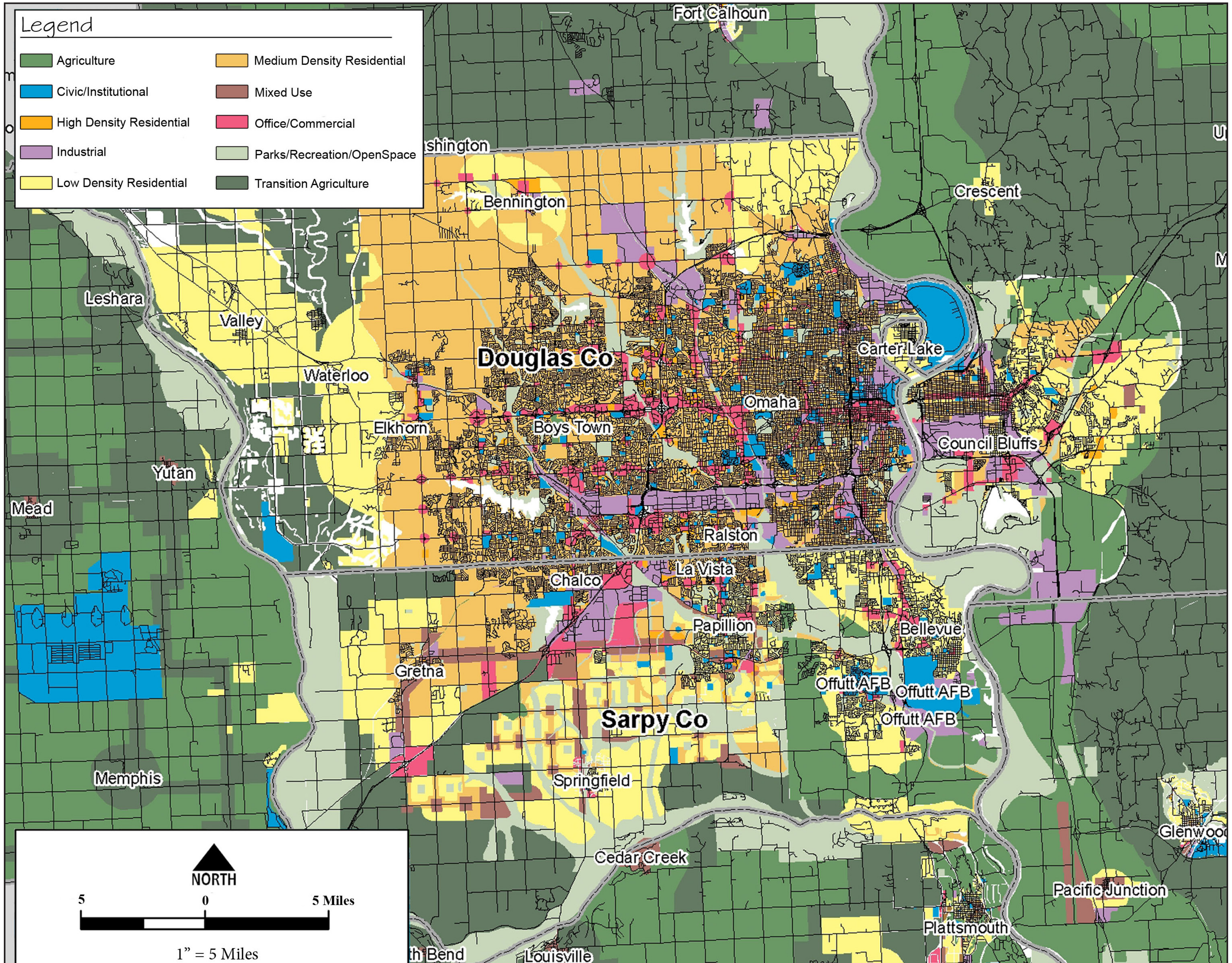


Figure 5-4 Future Land Use Map

5-3-5 Land Use Alternatives

The assumptions and methods used for testing traffic conditions and need for an outer loop beltway according to alternative land use scenario are explained below.

Status Quo

Under the status quo scenario, land use patterns and densities follow the regions's comprehensive plans. Comprehensive plans throughout the region do not use standardized land use designations, so to merge future land use maps from varying jurisdictions, the following standardized land uses were used to create one consolidated future land use map.

- Parks/Recreation/Open Space
- Agriculture
- Transitional Agriculture – Primarily agricultural in nature, but likely to experience some degree of development because of location near a city or highway. This designation is also used to indicate land that has been designated for low intensity or conservation development.
- Low Density Residential – Residential development ranging from small acreage (1-2 acres) to 3 units per acre.
- Medium Density Residential – Residential development ranging from four to eight units per acre
- High Density Residential – Residential development over eight units per acre
- Mixed Use – Areas designated for residential, retail and commercial uses. Small town centers are generally designated mixed use.
- Office/Commercial
- Industrial
- Civic/Institutional

The map shown in **Figure 5-4** is a compiled regional future land use map.

Targeted Density

The targeted density scenario is based on existing comprehensive plans, with adjustments to density and mix of land uses. As household size decreases and populations age, it is expected that smaller housing units at higher densities will become more popular. Nationwide development trends also show increased popularity in mixed-use areas including office, retail, and residential uses within walking distance. The targeted density scenario is described below.

- Douglas, Sarpy, and Omaha comprehensive plans identify the location of mixed use centers. The size, location, and number of the centers in this scenario are the same as identified in the comprehensive plans.
- The overall density of all mixed-use centers is set at five residential units per acre. This density is slightly higher than Omaha's traditional neighborhoods like Dundee, and accounts for other uses such as commercial and office.
- Future population growth is predicted to be focused in these mixed use centers.
- The population of areas east of I-680 will remain stable or experience some infill growth. Current or proposed redevelopment plans (Aksarben Village, Midtown Crossing, Riverfront Place, Wall Street Tower, etc) population growth was estimated to account for the impact of these projects, resulting in no net population loss inside of I-680.
- Population not accommodated in mixed use centers is distributed around existing small towns in the metro area.

Figure 5-5 Targeted Density Land Use Map

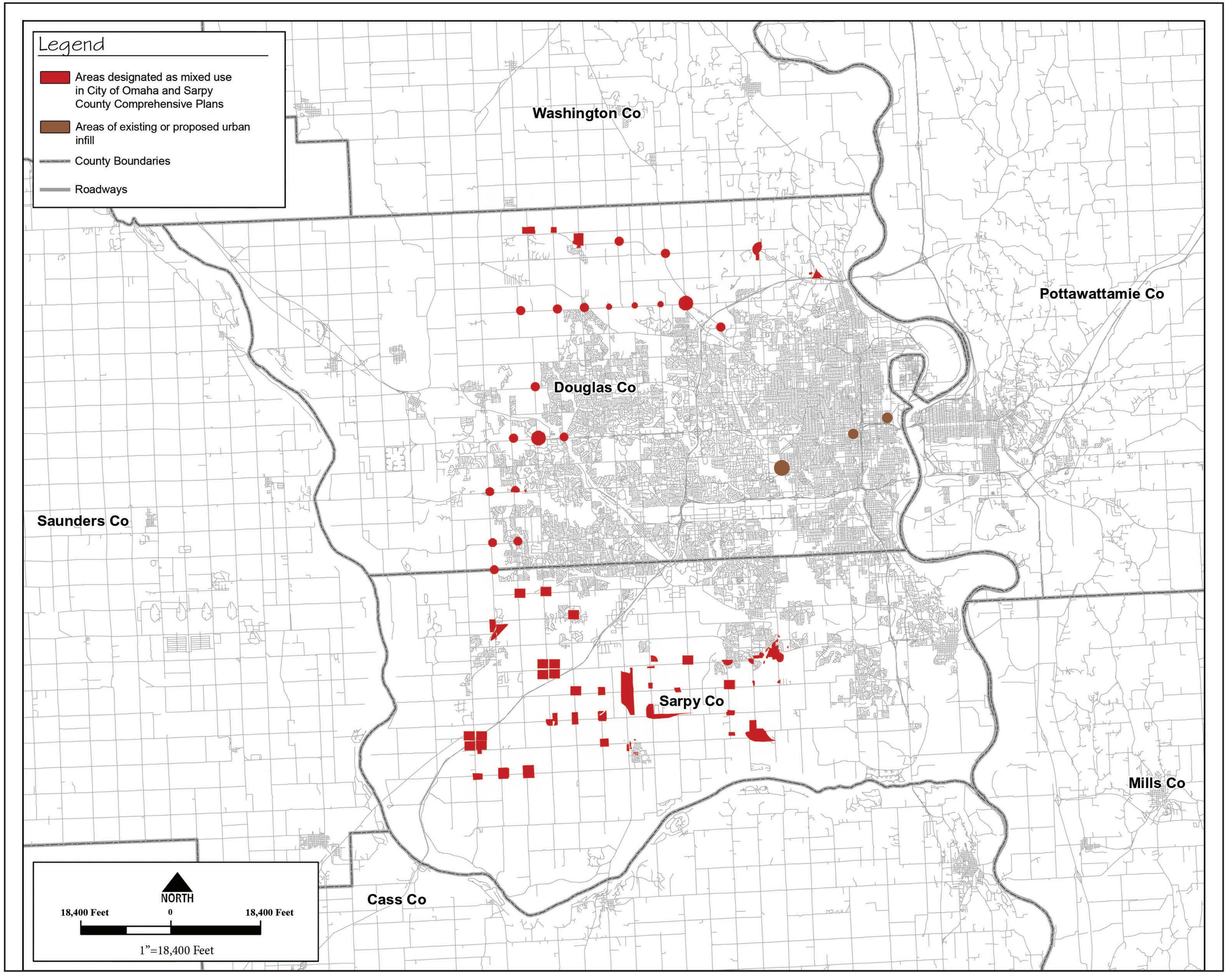
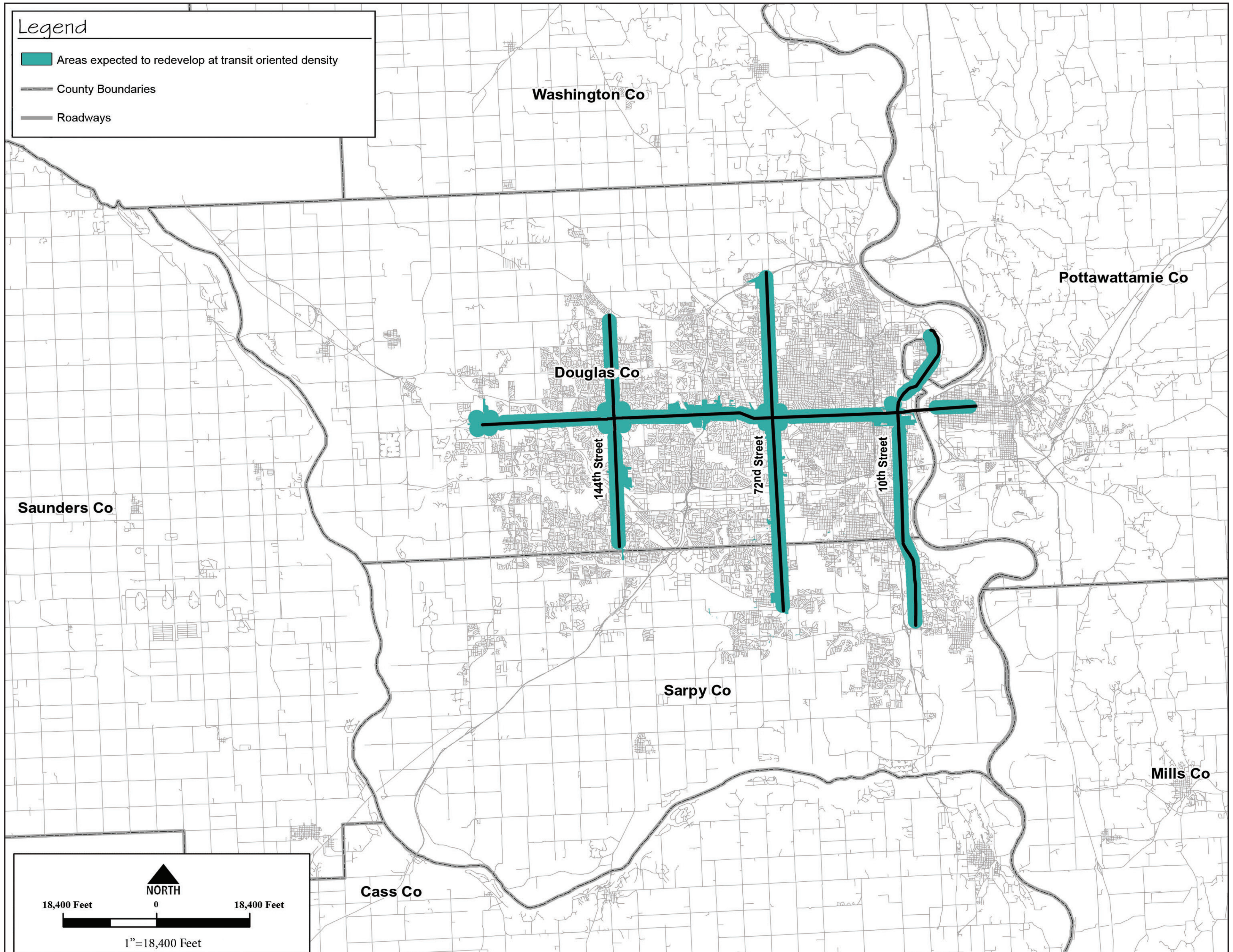


Figure 5-6 Transit Oriented Land Use Map



Transit Oriented

Metro Area Transit (MAT) provides bus service for a large part of the metro area. However, as a region, the metro is not considered transit oriented. There is increasing interest in transit service in response to higher gasoline prices, concerns over automobile emissions effects on climate change, and improving the overall accessibility of the region. Under the transit oriented scenario, light rail lines reshape development in the metro based on the following assumptions:

- 50 miles of light rail transit, with stops located approximately every mile.
- Within ¼ mile of the transit stops, extensive redevelopment would occur creating high density mixed use nodes.
- Mixed use nodes will have an overall residential density of 12-units per acre. Mixed use nodes include residential, retail, and office uses. (Twelve units per acre around transit stops is conservative, in Chicago, similar areas range from 15 to 30 units per acre. Twelve units per acre density is similar to a typical garden style apartment.)
- Growth within the urbanized areas of Douglas, Sarpy, and Pottawattamie Counties is concentrated within a ¼ mile radius of transit stops. Areas farther away from transit stops were assigned less growth.
- Population projections for areas outside existing urbanized areas were not changed. It is assumed that people choosing to live in a semi-rural/exurban environments will not desire to live along a transit line.

The land use along these corridors as they exist today do not match what it would need to be to get this level of transit-oriented development on these corridors in the future. The extensive redevelopment required to meet these high densities would incur significant costs, which are not included in the analysis of this scenario.

Sprawl

The previous two scenarios assume a denser, more urban future for the metro. While not expected, the region could develop in a less dense, more suburban or semi-rural pattern, commonly referred to as 'sprawl.' Under this scenario:

- All new residential growth is assumed to be in three acre lots to accommodate private wells and septic systems.
- Roughly 450 people per square mile can be housed at this density. This assumes all land fully develops at this density. No land remains rural or undeveloped.
- Growth is distributed contiguously from the existing urbanized area with slightly more focused along major transportation corridors including, I-80, Hwy 6, I-29, Hwy 92, Hwy 75, and Hwy 34.
- The density and populations of areas within the existing urbanized areas of the metro, area already platted, or areas with obvious environmental constraints were not changed.

Figure 5-7 Sprawl Land Use Map

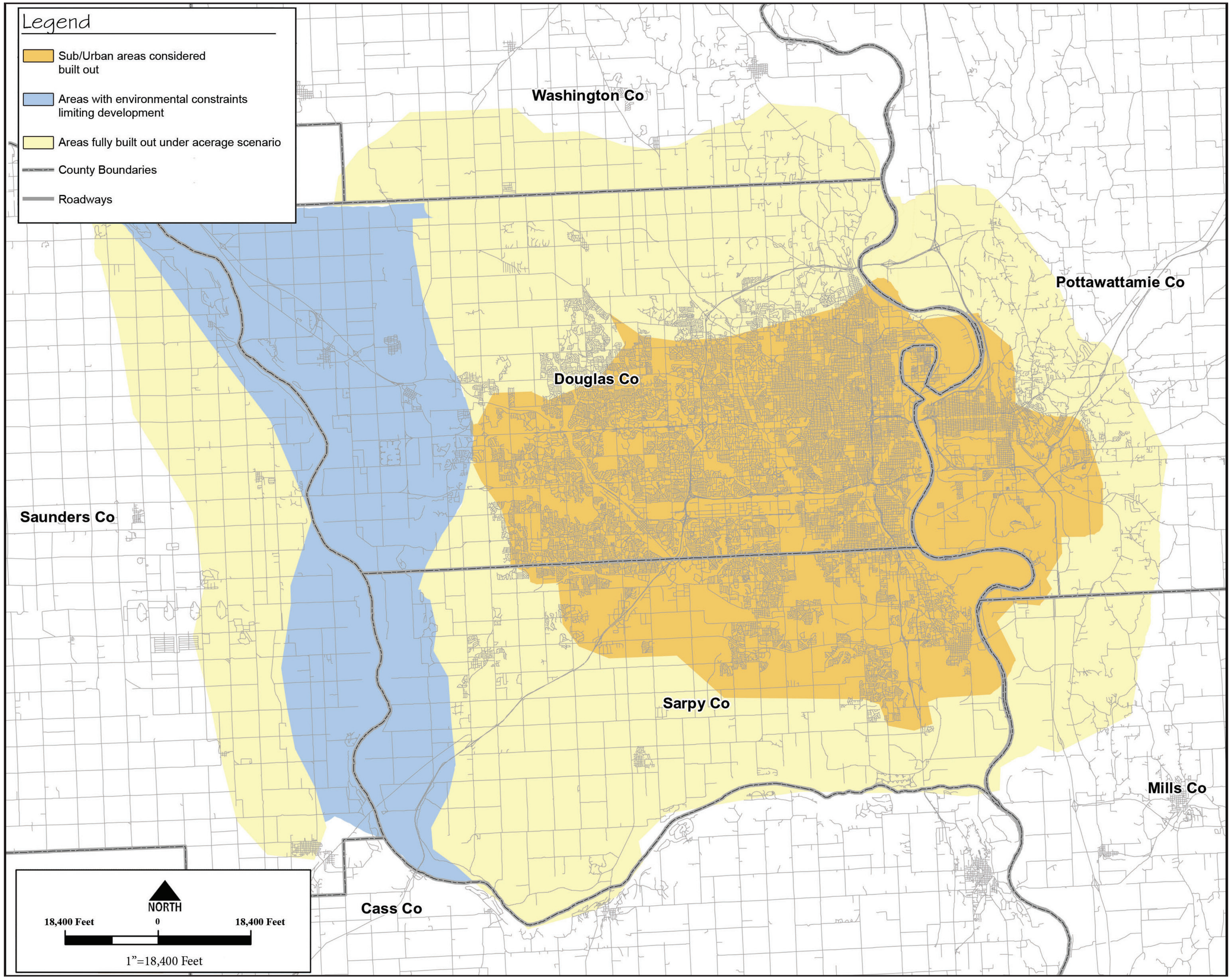


Figure 5-8 Alternatives Matrix Development

Transportation Network	Land Use: 2035 Base Land Use	Targeted Density	Transit Oriented	Sprawl
LRTP Base	A 1	2	3	4
Outer Beltway	B			
Inner Beltway	C			
Radials	D			
Super Arterials	E			
Transit	F			

Figure 5-9 Full Alternatives Matrix

Transportation Network	Land Use: 2035 Base Land Use	Targeted Density	Transit Oriented	Sprawl
LRTP Base	A1	A2	A3	A4
Outer Beltway	B1	B2	B3	B4
Inner Beltway	C1	C2	C3	C4
Radials	D1	D2	D3	D4
Super Arterials	E1	E2	E3	E4
Transit	F1	F2	F3	F4

Figure 5-10 Final Alternatives Matrix

Transportation Network	Land Use: 2035 Base Land Use	Targeted Density	Transit Oriented	Sprawl
LRTP Base	A1	A2		A4
Outer Beltway	B1	B2		B4
Inner Beltway	C1	C2		
Radials	D1	D2		
Super Arterials	E1	E2		E4
Transit	F1		F3	

5-3-6 Land Use Scenarios Travel Demand Model Performance Results

In order to test the influence land use could have on the transportation alternatives, additional demand models were prepared. A matrix of test conditions was developed to support selection of model runs. The test matrix is shown in Figure 5-8. The six rows represent the transportation network alternatives noted as alternatives "A" through "F" and the four columns represent the land use scenarios (numbered 1 – 4). Each matrix box represents a possible combination of transportation and land use alternatives that could be modeled and evaluated.

Thus far in the report, analysis has been summarized for the 2035 expanded base land use scenario (see column "1" in Figure 5-9). A1 represents the base condition that was summarized in Chapter 3. This is the scenario that all other transportation networks were compared to. B1 and C1 are the outer and inner beltways that were summarized in Chapter 4. D1, E1 and F1 are the other alternatives that were summarized earlier in this chapter. In Figure 5-8 the matrix is fully annotated and shows the full matrix of alternatives that could be tested. However, to meet the purposes of the study, it was not necessary to model and test all 24 cases.

Some of the transportation / land use combinations are highly unlikely or not plausible. For instance, testing the LRTP base with a transit oriented land use makes little sense. Likewise testing a transit transportation network with a sprawl land use condition is illogical. In all, nine transportation / land use combinations were eliminated from the matrix. The final alternatives matrix is shown in Figure 5-10.

Tables 5-9 and 5-10 provide the summary of travel demand findings for targeted density, transit oriented and sprawl land use scenarios. Note as in previous summary tables, all of the alternatives are compared directly to the LRTP base (A1).

> The targeted density land use improved the results of all transportation alternatives tested

The summary tables contain considerable data to review and compare. For detailed comparisons of all the transportation model findings, summary tables are included in the appendix. Note that several expected outcomes were realized with the land use evaluation:

- The targeted density land use improved the results of all transportation alternatives tested (LRTP base, outer and inner beltways, radials and super arterials).
- The transit oriented land use tests resulted in better system performance for the outer beltway and transit transportation networks as compared to targeted density land use.
- The sprawl land use scenario caused significant increases in vehicle-miles traveled, total vehicle-miles and total delay for the tested transportation networks (LRTP base, outer beltway, super arterials).

Based upon the testing it is clear that land use has a dramatic affect on the transportation system. Land use objectives and goals need to be closely coordinated with transportation so that as goals or policies change, both transportation and land use can respond appropriately to the benefit of the metro area.

Also, note that the transportation system comparison is only one part of the evaluation. An economic evaluation was also conducted utilizing all of the transportation model data as inputs into a detailed benefit-cost analysis. This evaluation can be found in Chapter 6.

Table 5-9 All Roadway Links Measures

	2004		2035 Base Land Use										
		A1 - LRTP Base	B1 - Outer Beltway		C1 - Inner Beltway		D1 - Radials		E1 - Super Arterials		F1 - Transit	
			Measure	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Total Trip Ends	**2,458,322**	**3,793,463**	3,793,463	0.0%	3,793,463	0.0%	3,793,492	0.0%	3,793,463	0.0%	3,605,567	-5.0%
Total VMT (Veh-Miles)[1]	**17,886,782**	**32,194,995**	33,336,005	3.5%	33,431,177	3.8%	32,531,002	1.0%	32,714,947	1.6%	30,773,555	-4.4%
Total VHT (Veh-Hrs) [2]	**484,415**	**915,720**	907,684	-0.9%	907,595	-0.9%	911,628	-0.4%	903,095	-1.4%	836,977	-8.6%
Average Congested Speed (MPH) [3]	**34.9**	**32.8**	33.2	1.4%	33.2	1.4%	33.0	0.8%	33.5	2.1%	33.4	1.8%
Total Delay (Hours) [4]	**89,516**	**233,599**	214,745	-8.1%	216,692	-7.2%	230,910	-1.2%	210,195	-10.0%	190,156	-18.6%
Lane-Miles of Links over Capacity[5]	**308.9**	**887.2**	799.9	-9.8%	765.9	-13.7%	856.3	-3.5%	687.5	-22.5%	653.7	-26.3%

	2004	2035 Base Land Use	2035 Targeted Density Land Use									
			A2 - LRTP Base		B2 - Outer Beltway		C2 - Inner Beltway		D2 - Radials		E2 - Super Arterials	
		A1 - LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Total Trip Ends	**2,458,322**	**3,793,463**	3,747,306	-1.2%	3,747,305	-1.2%	3,747,305	-1.2%	3,747,307	-1.2%	3,747,305	-1.2%
Total VMT (Veh-Miles)[1]	**17,886,782**	**32,194,995**	31,846,436	-1.1%	32,912,668	2.2%	33,048,223	2.7%	32,154,542	-0.1%	32,357,221	0.5%
Total VHT (Veh-Hrs) [2]	**484,415**	**915,720**	904,841	-1.2%	895,767	-2.2%	895,874	-2.2%	900,506	-1.7%	892,012	-2.6%
Average Congested Speed (MPH) [3]	**34.9**	**32.8**	32.9	0.2%	33.3	1.6%	33.3	1.6%	33.1	1.0%	33.6	2.4%
Total Delay (Hours) [4]	**89,516**	**233,599**	229,696	-1.7%	210,634	-9.8%	212,339	-9.1%	226,968	-2.8%	206,459	-11.6%
Lane-Miles of Links over Capacity[5]	**308.9**	**887.2**	865.5	-2.4%	775.6	-12.6%	736.3	-17.0%	825.4	-7.0%	651.4	-26.6%

	2004	2035 Base Land Use	2035 Transit Oriented Land Use		2035 Sprawl Land Use					
			F3 - Transit		A4 - LRTP Base		B4 - Outer Beltway		E4 - Super Arterials	
		A1 - LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Total Trip Ends	**2,458,322**	**3,793,463**	3,595,481	-5.2%	3,822,844	0.8%	3,822,844	0.8%	3,822,844	0.8%
Total VMT (Veh-Miles)[1]	**17,886,782**	**32,194,995**	29,955,031	-7.0%	34,570,607	7.4%	36,126,838	12.2%	35,077,040	9.0%
Total VHT (Veh-Hrs) [2]	**484,415**	**915,720**	817,633	-10.7%	983,746	7.4%	972,849	6.2%	970,978	6.0%
Average Congested Speed (MPH) [3]	**34.9**	**32.8**	33.6	2.5%	32.0	-2.3%	32.6	-0.5%	32.8	0.0%
Total Delay (Hours) [4]	**89,516**	**233,599**	184,117	-21.2%	257,436	10.2%	231,732	-0.8%	234,034	0.2%
Lane-Miles of Links over Capacity[5]	**308.9**	**887.2**	598.0	-32.6%	992.6	11.9%	886.7	-0.1%	774.0	-12.8%

[1] *VMT: Vehicle Miles of Travel (VMT) = Length * Flow*
[2] *VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow*
[3] *Congested Speed = Length/Congested Travel Time*
[4] *Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed)*
[5] *Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9*

Table 5-10 High Capacity Corridors Measures

	2004	2035 Base Land Use										
		A1 - LRTP Base	B1 - Outer Beltway		C1 - Inner Beltway		D1 - Radials		E1 - Super Arterials		F1 - Transit	
			Measure	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Lane-Miles of High Capacity Corridors	**972**	**1,448**	1,989	37.3%	1,738	20.0%	1,684	16.2%	2,210	52.6%	1,448	0.0%
Total VMT (Veh-Miles) of High Capacity Corridors[1]	**7,162,118**	**15,489,223**	17,269,381	11.5%	17,286,315	11.6%	16,731,551	8.0%	18,822,549	21.5%	15,012,480	-3.1%
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	**148,271**	**374,483**	384,055	2.6%	386,735	3.3%	394,253	5.3%	461,109	23.1%	346,826	-7.4%
Average Congested Speed (MPH) of High Capacity Corridors[3]	**45.5**	**38.5**	41.5	7.8%	41.9	8.8%	40.5	5.2%	38.4	-0.3%	39.7	3.0%
Total Delay (Hours) of High Capacity Corridors[4]	**22,671**	**100,707**	86,278	-14.3%	91,791	-8.9%	103,273	2.5%	111,602	10.8%	82,914	-17.7%
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	**57.3**	**315.9**	280.2	-11.3%	256.8	-18.7%	309.7	-2.0%	306.1	-3.1%	243.5	-22.9%
Percentage of Corridors Over Capacity	**6%**	**22%**	14%		15%		18%		14%		17%	

	2004	2035 Base Land Use	2035 Targeted Density Land Use									
			A2 - LRTP Base		B2 - Outer Beltway		C2 - Inner Beltway		D2 - Radials		E2 - Super Arterials	
		A1 - LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Lane-Miles of High Capacity Corridors	**972**	**1,448**	1,448	0.0%	1,989	37.3%	1,738	20.0%	1,684	16.2%	2,210	52.6%
Total VMT (Veh-Miles) of High Capacity Corridors[1]	**7,162,118**	**15,489,223**	15,459,739	-0.2%	17,146,465	10.7%	17,226,524	11.2%	16,622,481	7.3%	18,773,130	21.2%
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	**148,271**	**374,483**	373,171	-0.4%	381,080	1.8%	384,541	2.7%	391,337	4.5%	458,288	22.4%
Average Congested Speed (MPH) of High Capacity Corridors[3]	**45.5**	**38.5**	38.7	0.4%	41.7	8.2%	42.0	9.1%	40.7	5.7%	38.5	0.0%
Total Delay (Hours) of High Capacity Corridors[4]	**22,671**	**100,707**	100,219	-0.5%	85,424	-15.2%	90,775	-9.9%	102,426	1.7%	110,322	9.5%
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	**57.3**	**315.9**	312.7	-1.0%	270.5	-14.4%	247.9	-21.5%	307.9	-2.5%	289.3	-8.4%
Percentage of Corridors Over Capacity	**6%**	**22%**	22%		14%		14%		18%		13%	

	2004	2035 Base Land Use	2035 Transit Oriented Land Use		2035 Sprawl Land Use					
			F3 - Transit		A4 - LRTP Base		B4 - Outer Beltway		E4 - Super Arterials	
		A1 - LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base	Measures	% Change from LRTP Base
Lane-Miles of High Capacity Corridors	**972**	**1,448**	1,448	0.0%	1,448	0.0%	1,989	37.3%	2,210	52.6%
Total VMT (Veh-Miles) of High Capacity Corridors[1]	**7,162,118**	**15,489,223**	14,772,960	-4.6%	16,267,511	5.0%	18,773,397	21.2%	19,675,002	27.0%
Total VHT (Veh-Hrs) of High Capacity Corridors[2]	**148,271**	**374,483**	339,376	-9.4%	389,718	4.1%	407,291	8.8%	476,840	27.3%
Average Congested Speed (MPH) of High Capacity Corridors[3]	**45.5**	**38.5**	40.3	4.5%	38.2	-0.9%	41.2	7.0%	38.2	-0.8%
Total Delay (Hours) of High Capacity Corridors[4]	**22,671**	**100,707**	79,412	-21.1%	104,030	3.3%	87,213	-13.4%	114,061	13.3%
Lane-Miles of Links Over Capacity of High Capacity Corridors[5]	**57.3**	**315.9**	190.5	-39.7%	301.6	-4.5%	268.1	-15.1%	277.8	-12.1%
Percentage of Corridors Over Capacity	**6%**	**22%**	13%		21%		13%		13%	

*[1] VMT: Vehicle Miles of Travel (VMT) = Length * Flow* *[2] VHT: Vehicle Hours of Travel (VHT) = Congested Travel Time * Flow* *[3] Congested Speed = Length/Congested Travel Time*
[4] Total Delay = (VMT/Free Flow Speed - VMT/Congested Speed) *[5] Lane-Miles of Links over Capacity: Sum of non-connector links with Max V/C (AB or BA) > 0.9*

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CHAPTER 6 ECONOMIC FEASIBILITY

This chapter describes the economic analysis that was conducted to examine the economic worthiness of the various transportation networks and land use alternatives. The different alternatives were evaluated and provided a ranking against one another by comparing Benefit-Cost Ratio, Net Present Value and Rate of Return. Transportation investment brings with it both benefits and costs. From an economic and financial perspective, the most desirable infrastructure investments are those whose benefits exceed their total costs. In performing an assessment of the potential benefits relative to costs, the outcome aids in identifying the most desirable alternatives that create a net positive social gain.

6-1 Description of Alternatives

The benefit-cost analysis was performed on 15 different alternatives that were based on six transportation networks and four land use scenarios. **Figure 6-1** provides a matrix representation of the alternatives. The six transportation network scenarios analyzed in the study as described in **Chapter 5** were:

Figure 6-1 Alternatives Matrix

Transportation Network \ Land Use	Base Land Use	Targeted Density	Transit Oriented	Sprawl
LRTP Base	A1	A2		A4
Outer Beltway	B1	B2		B4
Inner Beltway	C1	C2		
Radials	D1	D2		
Super Arterials	E1	E2		E4
Transit	F1		F3	

- **LRTP Base:** This scenario includes roadway improvements outlined in the MAPA Long Range Transportation Plan, and other projects planned in the areas outside of the MAPA travel demand model transportation study area.
- **Outer Beltway:** This scenario includes the LRTP base roadway improvements plus the construction of a 4-lane freeway at the outer limits of the metro area.
- **Inner Beltway:** This scenario includes the LRTP base roadway improvements plus the construction of a 4-lane freeway facility closer in to the built environment.
- **Radials:** This scenario includes the LRTP base roadway improvements plus the construction of two 4-lane freeway facilities.
- **Super Arterials:** This scenario includes the LRTP base roadway improvements plus the construction of projects identified as 'illustrative' in the LRTP and other 6-lane "super arterials" in the metro area.
- **Transit:** This scenario includes the LRTP base roadway improvements plus the construction of approximately 50 miles of light rail within the metro area. Additionally, this scenario includes a regional reduction of 5 percent of all vehicular trips in the expanded network (5 percent mode split).

In addition to the transportation network scenarios, four land use scenarios are considered as well. The land use scenarios, in combination with the transportation network scenarios, form the alternatives that were analyzed within the benefit-cost analysis framework. The four land use scenarios were:

- Base Land Use
- Targeted Density
- Transit Oriented Development
- Sprawl

See report Section 5-3-5 for the description of the land use scenarios.

Alternative A1, a combination of the LRTP base expanded transportation network scenario and LRTP base land use scenario, forms the base case, to which all other alternatives were compared. The analytical approach assumes that the base case is the preferred alternative unless it is demonstrated that another alternative can return benefits in excess of the costs.

6-2 Benefit-Cost Analysis

Benefit-Cost Analysis evaluates the fundamental merit of undertaking possible investment. The basic idea is straightforward. An investment option is worthwhile if its economic benefits exceed its economic costs.

Benefit-Cost Analysis accounts for both the negative and positive economic effects of an investment, regardless of the source of the funding. On one side, Benefit-Cost Analysis treats all negative effects as costs. In addition to a project option's capital outlays, the analysis accounts for the cost of capital interest; yearly operating expenses; and the costs of maintenance to keep capital assets in good shape. On the other side, Benefit-Cost Analysis treats positive effects as benefits. The principal categories of benefits considered in this study are:

- Travel Time Savings
- Vehicle Operating Cost Savings
- Emission Savings
- Accident Savings

Of these four categories, three (travel time costs, vehicle operating costs, and accident costs) are composed of costs that users value directly either fully or partially, and one (emission costs) consist of external costs not valued directly by highway users. Directly valued user costs are called "internal" costs and those costs not valued directly by users are called "external" costs. Internal costs are assumed to be priced into users' driving decisions, while external costs are those borne by non-users.

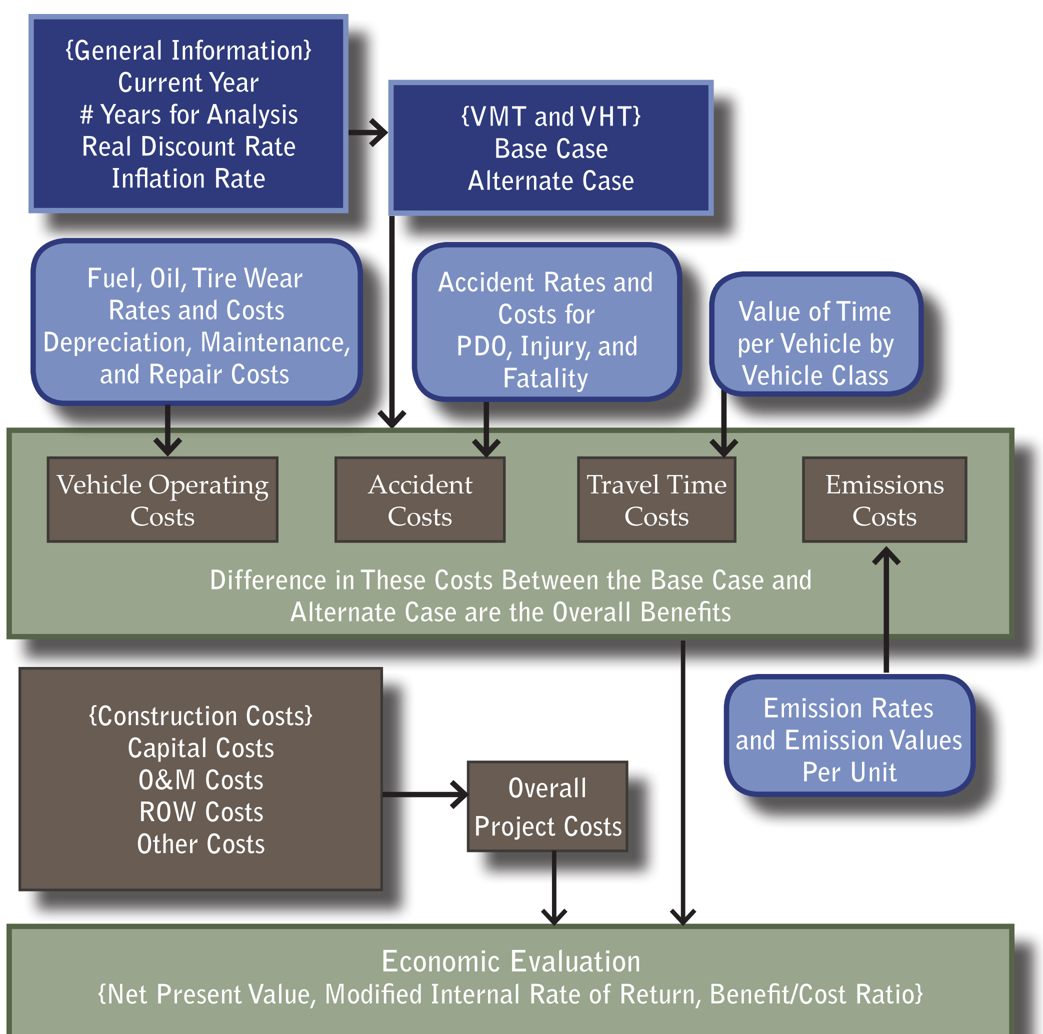
6-2-1 Measuring Benefit from Transportation Improvements

This section presents the structure and logic diagrams that describe the economic benefit sub-models that are integrated into the larger benefit-cost model. **Figure 6-2** provides a brief overview as to how, on a strategic level, all cost savings elements, contribute to aggregate annual savings expected to be derived from the implementation of a project alternative. The "base case" is the pre-project implementation scenario while the "alternative case" is the scenario after a project alternative has been implemented.

6-2-2 Network Traffic Data

The existing and forecasted network traffic data forms the foundation of this analysis. Traffic data was supplied by the project team for 2004 and for a 2035 forecast year, based on MAPA's regional travel demand model for each of the transportation network and land use alternatives. As benefits and costs are analyzed in an annual fashion, annual traffic data are required inputs. For this analysis, traffic is assumed to grow in a linear fashion between 2004 and the 2035 forecast year for the base case (Alternative A1) and all of the other alternatives. Following 2035, traffic is assumed to grow at 50% of its average annual growth in the previous period (2004 to 2035), until the final year of analysis for each of the alternatives. All alternatives consider benefits for 30 years of operations, following the completion of construction.

Figure 6-2 Logic Diagram for Estimating Transportation Benefits



6-2-3 Project Capital and O&M Costs

Five distinct build alternatives are considered in this analysis:

- Outer Beltway
- Inner Beltway
- Radials
- Super Arterials (includes LRTP & Illustrative)
- Transit

Construction Costs for each alternative were provided by the project team, and include right-of-way, materials, labor, utilities, preliminary engineering, and construction engineering. Annual operations and maintenance (O&M) costs for highway alternatives and transit were calculated based on high level assumptions from previous benefit-cost analysis conducted by HDR. All alternatives assume a construction start date of 2020, with various construction durations, depending on the alternative. The various durations are a function of the annual funding availability. For purposes of this evaluation a reasonable funding range for new or additional projects could be from $20 million to $100 million annually. This analysis assumed the $100 million annual funding scenario and **Table 6-1** shows the construction duration as well as a summary of capital cost for each build alternatives. While a range of possible construction costs were given for each segment of the inner and outer beltway alternatives in **Chapter 4**, for ease of comparison, a single value for each alternative was used in economic analysis.

6-2-4 Economic Impact Assessment Methods

In addition to the benefit-cost analysis, an economic impact assessment was conducted for the Beltway project alternatives. This section provides a primer on economic impact analysis. Key terminology and concepts are defined and explained in non-technical language. The section also includes a brief presentation of the IMPLAN® economic impact modeling system.

Typically, economic impact analysis involves the estimation of three distinct effects: direct effect, indirect effect, and induced effect. The direct effect represents the initial expenditures (construction expenditures, in this case) that are received by businesses located in the study area, such as the purchase of materials for the construction project. The indirect effect represents the impact of the additional business spending that is generated as these businesses sell more output and in turn purchase additional inputs from their suppliers. The induced effect represents the increase in economic activity – over and above the direct and indirect effects – associated with increased labor income that accrue to workers and is spent on household goods and services purchased from businesses within the study area. The total economic impact is the sum of these direct, indirect and induced effects.

To measure the direct, indirect and induced effects of construction expenditures associated with the various build scenarios we used IMPLAN®, an input-output based economic impact assessment system originally developed by the U.S. Forest Service – and now maintained by the Minnesota IMPLAN Group, Inc. The model data files include transaction information (intra-regional and import/export) for 440 different industrial sectors (corresponding to four and five digit North American Industry Classification System (NAICS) codes), and data on 21 different economic variables – including employment, output, and employee compensation. The model was populated with the most recent (2007) data available for the Omaha – Council Bluffs Metropolitan Statistical Area (MSA).

During the analysis, several adjustments were made to help ensure that all impact estimates were truly incremental and specific to the study area:

- Social Accounting Matrix (SAM) multipliers, used for estimating direct, indirect and induced effects, were modified with regional purchase coefficients (RPCs) to ensure that imports were not counted. Therefore only the impacts to the regional economy are measured. SAM multipliers inform IMPLAN on how a dollar spent on a given project impacts other industries through historically observed relationships. These multipliers capture transfers between institutions (such as between households and the government) as well as all commodity flows.
- Households were the only institutions considered when building SAM multipliers. As a result, induced effects are based on the income of the residents of the Omaha – Council Bluffs metropolitan area solely.
- Because all build alternatives have multi-annual construction periods, total construction costs were divided by the number of years of the construction period to obtain average annual construction costs. Therefore, total employment impacts reflect the average number of jobs created over the construction period.

Table 6-1 Summary of Project Capital Cost and Dates

Alternative		Construction Start Year	Construction Duration	Construction End Year	Total Cost[1,2]
B1	Outer Beltway	2020	13	2033	**$1,400**
C1	Inner Beltway	2020	7	2027	**$750**
D1	Radials	2020	6	2026	**$660**
E1	Super Arterials	2020	13	2033	**$1,400**
F1	Transit	2020	24	2044	**$2,500**

[1] *Estimates include ROW, Materials, Labor, Utilities, Preliminary Engineering, Construction Engineering*
[2] *Costs represented in millions of 2008 dollars.*

6-3 Economic Analysis Results

Table 6-2 provides a summary of the key metrics from the economic analysis:

- Present Value of Total Benefits
- Present Value of Total Costs
- Net Present Value
- Rate of Return
- Benefit-Cost Ratio

In order to provide a level comparison between the alternatives, all costs and benefits are discounted to year 2008 dollars. Therefore total costs (and benefits) which occur further in the future will be valued less than those which occur now. The alternative order is listed based upon the benefit-cost factor; highest to lowest.

6-3-1 Benefit-Cost Outcomes

Overall, Alternative B4 (Outer Beltway, Sprawl Land Use) provides the greatest level of total benefits, as well as the highest net present value. This alternative has the third most expensive capital costs, at $1.39 billion, though is only marginally more expensive than LRTP + Illustrative and Super Arterials set of alternatives. Alternative B4 provides an overall benefit-cost ratio of 4.7, or $4.7 of benefits for each dollar expended on the project. This is the fourth largest benefit-cost ratio, behind Alternatives B2, C2 and C1.

Both Alternatives C1 and C2 (Inner Beltway) provide high benefit cost ratios, 5.9 and 6.8 respectively. The present value of net benefits for each of these alternatives is in line with the total benefits for the outer beltway Alternatives (B1 and B2), however the inner beltway has significantly lower capital costs than the Outer Beltway alternative (approximately 50%). Therefore, in the case of B1 and C1, a similar level of benefit can be received at a lower cost, resulting in a greater benefit-cost ratio for these alternatives. Note that both B2 and C2 provide nearly identical benefit-cost ratios.

Both Alternatives A2 and A4 have no transportation network spending associated with them, above what is assumed for Alternative A1. As a result, there are no economic impacts from these alternatives. Additionally, none of the financial metrics (NPV, IRR, and B/C ratio) as there are no costs to assess relative to the benefits. Benefits, however were calculated for both of these alternatives, though A4 (base transportation network and sprawl land use) shows negative total benefits.

Table 6-2 Summary of Results by Alternative

Alternative		Present Value of Total Benefits	Present Value of Total Costs	Net Present Value	Benefit-Cost Ratio
C2	Inner Beltway - Targeted Density	$3,002	$447	$2,542	6.8
C1	Inner Beltway - Base Land Use	$2,576	$447	$2,128	5.9
B4	Outer Beltway - Sprawl	$3,563	$778	$2,761	4.7
B2	Outer Beltway - Targeted Density	$2,500	$778	$1,694	3.2
B1	Outer Beltway - Base Land Use	$2,253	$778	$1,481	3.0
D2	Radials - Targeted Density	$932	$355	$582	2.7
F3	Transit - Transit Oriented	$3,234	$1,313	$1,853	2.4
E2	Super Arterials - Targeted Density	$1,935	$880	$1,035	2.2
D1	Radials - Base Land Use	$769	$355	$413	2.2
E1	Super Arterials - Base Land Use	$1,671	$880	$776	1.9
E4	Super Arterials - Sprawl	$436	$880	-$309	0.6
A4	LRTP Base - Sprawl	-$1,231	$0	N/A	N/A
A2	LRTP Base - Targeted Density	$236	$0	N/A	N/A
A1	LRTP Base - Base Land Use	$0	$0	N/A	N/A

Note: All monetary values in millions of 2008 dollars; if N/A, alternative has no costs.

6-4 Economic Analysis Summary

In general, all of the alternatives that include a capital investment in the transportation network yield a benefit-cost ratio greater than 1, except for Alternative E4. Therefore, from an economic perspective, nearly all of the alternatives prove to be economically worthwhile undertakings. Several factors should be considered along with the financial metrics from the benefit-cost analysis:

- The availability of funding and budget constraints on the total project costs may be key decision criteria. For example, while Alternative F1 provides a high level of total benefits ($3.4 billion over 30 years), it also carries the highest up front capital cost. By comparison Alternative D1 provides a benefit-cost ratio of 2.2, lower than many of the other alternatives; however it also has the lowest overall costs. If budgetary constraints lead to the selection of a lower cost alternative, D1 still proves to be an economically worthwhile investment.

From an economic perspective, nearly all of the alternatives prove to be economically worthwhile undertakings

- The timing of benefits may be worth consideration. Discounting takes into account that benefits accrued in later years are worth less than benefits received nearer to the present day. However, their may be local or political pressure for alternatives which deliver benefits sooner rather than later. For example, while Alternatives B1 and C1 provide a similar level of total benefits, Alternative B1 requires 13 years to construction compared to Alternative C1 which requires only 7 years. Though the overall level of benefits for each alternative is similar, users of the transportation network will begin to realize the benefits of Alternative C1 6 years earlier than those of B1.

These financial metrics help to justify an alternative's economic worthiness; however it is important to use them in conjunction with other available information in selecting the optimal project alternative.

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CHAPTER 7 FINANCING OPTIONS

The amount of investment required for the transportation improvements evaluated in this study range from a low of $660 million to a high of $2.5 billion. These costs would be in addition to the $3.23 billion for projects identified in the MAPA 2030 Long Range Transportation Plan, which may be challenging to finance given the current transportation funding mechanisms. The purpose of this chapter is to identify potential funding strategies that may be applicable to the transportation alternatives evaluated in this study.

It is unlikely that the entire beltway, or even prioritized segments of the beltway, would be constructed with the current funding programs. In order to finance the construction of additional transportation projects such as those identified in this study, a variety of funding mechanisms would be required. Options that have been successfully used in other states include bonding, GARVEE bonds, State Infrastructure Banks, Transportation Development Districts, Transportation Utility Fees and Public/Private Partnerships. Another mechanism that may be applicable for funding some parts of the improvements could be through the Transportation Infrastructure Finance and Innovation Act (TIFIA), which can provide up to one-third of a major project's cost, if the project is determined to be of national or regional significance.

Both Nebraska and Iowa are generally "pay as you go" states and have resisted the need to use bonds or other sources of borrowing against future transportation revenue streams. However, with the increases in highway construction costs over the last several years, bonds may become a more attractive financing mechanism for certain types of projects.

In 2006, the Iowa Department of Transportation conducted a study of current Road Uses Tax Funds (RUTF) and identified a number of potential enhancements to existing funding revenue sources and innovative finance mechanisms that are being used in other states. The following sections provide brief descriptions of a number of methods for adjusting existing revenue sources and innovative financing techniques, some of which would require specific legislation to be permitted in Nebraska or Iowa.

The National Cooperative Highway Research Program (NCHRP) published a report in December 2006 entitled Future Financing Options to Meet Highway and Transit Needs. This report assesses the viability of a range of conventional and innovative options for financing investments and operations of highway and transit systems. This report summarizes current traditional and innovative financing mechanisms used around the country. A summary of the findings from that report are provided in **Table 7-1**.

Should policy makers increase funding for current infrastructure programs through increased user fees (gas taxes, motor vehicle taxes, etc.) or other mechanisms, the outlook for funding could change considerably. In such a

Table 7-1 Candidate Revenue Sources

	Modes						Yield
	Highway/Bridge		Transit		Scope		
Specific Revenue Tool	Preservation, Maintenance	New Capacity	Operations, Maintenance	Capital	Program	Project	Potential Yield[1]
Fuel Taxes							
Motor fuel excise (per gallon) tax	X	X		X	X		H
Indexing of the motor fuel tax (can be indexed to inflation or to other factors)	X	X		X	X		H
Sales tax on motor fuel[2]	X	X		X	X		H
Petroleum franchise or business taxes	X	X		X	X		H
Vehicle Registration and Related Fees							
Vehicle registration and license fees	X	X			X		H
Vehicle personal property taxes	X	X			X		M
Excise tax on vehicle sales dedicated to transportation	X	X			X		H
Tolling, Pricing, and Other User Fees							
Tolling new roads and bridges		X	X	X		X	M
Tolling existing roads	X	X	X	X		X	L
HOT lanes, express toll lanes, truck toll lanes		X	X	X		X	M
VMT fees	X	X	X	X	X		H
Transit fees (fares, park-and-ride fees, other)			X		X		H
Container fees, customs duties, etc.		X			X	X	M
Beneficiary Charges and Local Option							
Dedicated property taxes	X	X	X	X	X		H
Beneficiary charges / value capture (impact fees, tax increment financing, mortgage recording fees, lease fees)		X		X		X	L
Permitting local option taxes for highway improvements							
Local option vehicle or registration fees	X	X			X	X	M
Local option sales taxes	X	X			X	X	H
Local option motor fuel taxes	X	X			X	X	M
Permitting local option taxes for transit							
Local option sales taxes			X	X	X	X	H
Local option income or payroll tax			X	X	X	X	M
Other Dedicated Taxes							
Dedicate portion of state sales tax	X	X	X	X	X		H
Miscellaneous transit taxes (lottery, cigarette, room tax, rental car fees, etc.)			X	X	X	X	L
General Revenue Sources							
General Revenue[3]	X	X	X	X			H

[1] Potential Yield; H = High, M = Medium, L = Low.,
[2] In some states, revenues from sales taxes on motor fuel are not dedicated or only partially dedicated to fund transportation needs.
[3] For purposes of this report, the leveraging of tax subsidies through tax credit bonds and investment tax credits is treated effectively as producing revenue from general fund sources for transportation.

Source: NCHRP 20-24(49) - Future Financing Options to Meet Highway and Transit Needs.

scenario, some or possibly the entire beltway could potentially be funded through federal or state funding programs.

Current Funding Sources

The majority of revenue devoted to financing transportation improvements in Nebraska and Iowa includes the motor fuel tax, vehicle sales tax, vehicle registration and motor carrier fees. These revenue sources are used to fund the transportation programs in Iowa and Nebraska. Although adjustments to them would increase revenue to the IDOT and NDOR programs, it will likely require a variety of funding mechanisms for large, special projects such as those discussed in this report. The following sections briefly describe some innovative financing tools that have been successfully used in other states and municipalities. Some financing methods, such as tolling and congestion pricing were not included as they may not be applicable options given the population density and traffic conditions in the Omaha/Council Bluffs metro area.

Local Option Sales Tax (LOST)

Communities in Iowa and Nebraska have the ability to levee a local option sales tax to help pay for street improvements and other capital improvement projects. In Iowa, the maximum LOST is 1% and in Nebraska it is 1.5%. An increase in the local rate requires a vote of the citizens. Unfortunately, most communities in both states have already maximized their sales tax rate, leaving little room to generate revenue for large, special projects. The respective state legislatures would be required to amend the current law in order to increase the maximum local option sales tax.

Revenue Bonds

Currently, the Nebraska Department of Roads has the authority to sell up to $50 million in revenue bonds to fund transportation projects. While this bonding authority has rarely been used, it does provide an option to fund a particular project that addresses an urgent need. It may also be a good option when construction costs are escalating annually at a high rate and interest on the bonds is considerably lower. There has been some discussion in the Nebraska Legislature about raising the limit on the bonding authority.

GARVEEs and FRANs

Grant Anticipation Revenue Vehicles (GARVEEs) and Federal Reimbursement Anticipation Notes (FRANs) are specialized debt instruments that are used to finance transportation infrastructure projects. They are bonds that are issued to generate construction funds for transportation projects that are secured and repaid by future federal grants. Either financing approach can provide resources for states or local governments as a way to accelerate transportation system improvements.

State Infrastructure Banks

State Infrastructure Banks (SIBs) are state-run revolving loan funds that make loans, provide credit enhancements, and offer other forms of non-grant assistance to surface transportation projects. Any private or public entity may apply for SIB credit assistance, as long as the project to be financed is eligible. The amount of assistance that can be provided depends on the size of the state's SIB. State SIBs vary widely in size, from under $1 million to more than $1 billion.

Transportation Infrastructure Finance and Innovation Act (TIFIA)

TIFIA provides federal credit assistance to major transportation investments of critical national importance. Several types of projects are eligible for TIFIA financing, including major highway trade corridors, intermodal facilities and transit and passenger rail facilities with regional and national benefits. Under this program, the federal credit assistance that may be applied is limited to one-third of an eligible project's total cost.

Transportation Development District

A Transportation Development District (TDD) is a transportation project development tool, governed by state statute, which is available for use by local communities and property owners. Many states have legislation that allows for the creation of a TDD, which is considered a political subdivision. It is designed to facilitate specific public transportation improvements through the collection of taxes and the borrowing of funds. A TDD is very similar in nature to the local option sales tax, but has geographical jurisdiction that may incorporate several counties and municipalities. The revenue of a TDD (most frequently sales tax) can only be used for public transportation and transportation-related improvements.

Transportation Utility Fees

A transportation utility fee is a fee collected on residences and businesses within a city's corporate limits tied to the use and consumption of the transportation system. Utility fees are collected from all development, both existing and new. The fees are based on trip generation estimates for specific land uses. The transportation utility fee is typically added to an existing county or utility collected tax or rate bill.

Public-Private Partnerships

Public-private partnerships (PPPs) are contractual agreements formed between a public agency and a private sector entity that allow for greater private sector participation in the delivery and financing of transportation projects. There are many different PPP structures, and the degree to which the private sector assumes responsibility – including financial risk – differs from one application to another. Additionally, different types of PPPs lend themselves to the development of new facilities and others to the operation or expansion of existing assets. This funding mechanism is typically used on only a small number of large transportation projects such as tollways on heavily traveled corridors. It may be difficult to identify a specific project or projects in the metro area that could be financed through a PPP.

Summary

The level of investment required for any of the transportation systems addressed in this report must be in addition to the $3.2 billion of transportation improvements identified in the MAPA 2030 Long Range Transportation Plan. With the current highway legislation SAFETEA-LU set to expire in 2009, there is great uncertainty about the revenue sources that will be established to fund transportation projects and how much they will generate. Simply increasing revenue to keep up with inflation in the construction industry will do little to satisfy the current funding shortfall.

It is likely that a major transportation project like the construction of a regional beltway around the Omaha-Council Bluffs metropolitan area will require the use several current funding sources as well as some new and innovative techniques that have been successful around other parts of the country. It may be difficult to identify the most applicable financing options without further project definition. The best options will depend upon the type of transportation infrastructure to be constructed, the location of the proposed improvements and the traffic volume anticipated to use the facility. Several of the funding mechanisms identified in this report would require new state laws or modifications of existing state laws.

Of the funding mechanisms discussed, the following warrant further evaluation for the construction of major transportation projects such as discussed in this study:

- Revenue Bonds
- Transportation Infrastructure Finance and Innovation Act
- Transportation Development District
- Public/Private Partnerships

CHAPTER 8 LITERATURE AND PEER CITY REVIEW

A literature review was conducted to determine how other metropolitan areas in the United States have addressed the need, impacts and financing of full or partial beltway systems. An extensive amount of information was compiled, ranging from newspaper articles to in-depth studies. A summary of each of the articles or studies was developed and provided to the Steering Committee for their review and is included in the **Appendix**. The information was separated into the following categories:

- Economic Impacts
- Transportation Finance
- Land Use

8-1 Economic Impacts

Although an economic analysis was specifically conducted for this beltway study, many of the articles researched addressed the economic impacts associated with beltways or highway bypasses of communities. Most of these articles addressed the growth and development patterns in the communities that have had a highway bypass and effects on downtown business districts that were located on the old highway route. While many of these studies may not be applicable to the entire metropolitan area, certain segments of the beltway may have similar effects on the smaller communities on the outskirts of the study area. The consensus of the studies indicated that both positive and negative factors of a highway bypass are common. Some of the articles researched that pertained to this study included:

- **Summary of Highway Bypass Studies**
  Dennis Leong, Wisconsin Department of Transportation
  Glen Weisbrod, Economic Development Research Group

- **Sprawl Costs: Economic Impacts of Unchecked Development**
  Robert W. Burchell, Anthony Downs, Sahan Mukherji

- **Economic Impact of Freeway Bypass Routes in Medium Size Cities**
  Margaret Collins, Glen Weisbrod, Economic Development Research Group

The following excerpts summarize some of the key findings from the **Economic Impact of Freeway Bypass Routes in Medium Size Cities:**

> *The wide range of highway bypass studies carried out around the country provides a generally consistent story. They indicate new highways bypassing the central business district of a community are seldom either devastating or the savior of the area. The locational shift in traffic can cause some existing businesses to close up or relocate, but it can also create some new business opportunities.*
>
> *The positive benefits of bypassing downtown areas commonly include the removal of heavy truck traffic from central areas and the opening up of additional industrial sites along the new route, thus attracting new investment from outside of the region. The negative impacts include increases in sprawled, low density commercial and residential development entailing high environmental and infrastructure costs.*
>
> *A new bypass route without supporting infrastructure seldom ignites a development explosion. In the absence of water and sewer services, local interchanges and local access roads, bypasses around small cities usually do not facilitate sprawled development in outlying areas. In the longer term, outer beltway bypasses can be expected to have profound effects on development patterns, but in smaller cities this impact could take 20 or more years.*
>
> *A new interstate highway corridor can open up sites for industrial development to attract investment from outside of the region. Proactive planning by local authorities can catalyze industrial development in the vicinity of interchanges. Regional planning controls can be important to prevent sprawl and overdevelopment of retail space, although in practice such controls require significant effort and are not always in place.*
>
> *Outer beltways entail both benefits and costs for inner cities. Cities cannot always compete with open space ("green field") sites for new industrial and commercial development when those businesses are seeking large lots. Cities must continue to reinvest in and upgrade their infrastructure and buildings to continue to attract new industrial, office and commercial development.*

8-2 Transportation Finance

Many of the sources identified during the literature research were referenced for the previous chapter which described a variety of common and innovative funding options for transportation projects. A few of the relevant articles and studies researched included:

- **Beltway Planners Have a New One: Private Money**
  Timothy J. Gibbons, The Times-Union

- **Completing Transportation Projects: Innovative Transportation Financing in the 21st Century**
  Reed F. Morris, NCSL Transportation Program

- **Future Financing Options to Meet Highway and Transit Needs**
  Cambridge Systematics, Inc., Mercator Advisors LLC, Alan E. Pisarski, Martin Wachs

The following text summarizes the key findings from **Future Financing Options to Meet Highway and Transit Needs:**

> *In addition to traditional methods, the significant gap-closing potential of other emerging revenue strategies at all levels of governments has been demonstrated. The most successful programs to date have blended a menu of funding tools that complement and, in some cases leverage, the traditional sources. Longer-term, fuel taxes will be vulnerable to fuel efficiency improvements and penetration of alternative fuels and propulsion systems for motor vehicles. Further, continuing reliance on more use of fossil fuel will likely run counter to long-term environmental and energy needs and policies. Several recent national policy studies have recommended shifting to nonfuel-based revenue sources such as VMT fees over the next 15 to 20 years. Current innovations in tolling and pricing can help lead the way to this transition.*
>
> *The key finding from Phase 1 is that a large gap exists between investment needs for the nation's highway and transit systems and the revenues available to fund those investments. The key finding of Phase 2 is that a wide menu of current and emerging funding options are available to Federal, state, and local governments to help close the funding gap. The key finding of Phase 3 is that closing the funding gap is possible but will require a concerted effort at all levels of government. A critical review of current and emerging funding options suggests that:*
>
> - *Fuel and vehicle taxes provide all of the revenues going into the Highway Trust Fund (HTF) and have consistently provided about 75 percent of current state highway revenues over the last 25 years. They are likely to continue to be the mainstay of Federal and state funding programs for at least the period of this study. Assuring that they keep up with needs, including the inflation of costs, must be a centerpiece of any short-term effort to close the funding gap.*
> - *Tolling, especially in the most congested urban corridors, is becoming an increasingly important capacity expansion tool.*
> - *Dedicated state and local taxes such as sales taxes and beneficiary fees have proven very effective for state and local government use for both highway and transit programs and should be considered more widely.*
> - *State and local governments continue to rely on general fund appropriations to support surface transportation needs. The use of existing and emerging finance tools and public private partnerships (PPP) can play an important role in raising additional investment capital and advancing project delivery.*

8-3 Land Use

Articles and studies have explored the relationship between land use and transportation for decades. There is strong evidence to support the relationship between the two. As a result, many regional and local planning agencies, federal agencies and state departments of transportation have taken measures to incorporate "Smart Growth" policies into their planning efforts. Articles and studies that address this issue include:

- **Smart Growth and the Transportation - Land Use Connection: What Does the Research Tell Us?**
  Susan Handy, Department of Environmental Science and Policy, University of California, Davis

- **Do Highways Matter? Evidence and Policy Implications of Highways' Influence on Metropolitan Development**
  Marlon G. Boarnet, Departments of Urban and Regional Planning and Economics and Institute of Transportation Studies, University of California, Irvine and Andrew F. Haughwout, Federal Reserve Bank of New York

- **Beltways: Boon, Bane or Blip? Factors Influencing Changes in Urbanized Area Traffic**
  D.T. Hartgen and D.O. Curley, University of North Carolina, Center for Interdisciplinary Transportation Studies

Some of the findings from **Beltways: Boon, Bane or Blip?** are relevant to the discussion about a potential beltway around the Omaha-Council Bluffs metro area. A brief summary of findings from the study include the following excerpts:

> *Do beltways increase sprawl and traffic congestion? Over the past 30 years many (but not all) major US urbanized areas have completed or initiated circumferential roadways, but all cities have also increased in geographic area, population, employment and commuting, wealth, and road system capacity. These factors cloud clear relationships between beltway construction, sprawl, transit service, and traffic congestion.*
>
> *This study reviews the aggregate (urbanized area) changes in traffic density by road class, against measures of size, economic activity, transit service and use, and roadway investment for the 65 largest US urbanized areas, from 1990 to 1997, using stepwise regression. Cities are classified according to their extent of beltway completion and road additions in 1990 and 1998.*
>
> *After extensive testing and review of elasticities, the study concludes that urbanized areas with no or partial belt have actually grown faster in area, population and employment than cities with largely complete or completed beltways. The single most important factor influencing the growth of traffic in urbanized areas is the growth of employment. Beltway construction is a secondary factor in increasing freeway traffic.*
>
> *There is some limited evidence that beltways actually reduce overall traffic and slow its growth rate, by diverting traffic from lower systems.*
>
> *Population density was found to positively influence traffic congestion: generally, the greater the density the greater the city's traffic congestion. As a city spreads, its increasing geographic area actually helps to alleviate traffic congestion by providing a larger road network. Transit ridership can serve as a modest factor in reducing VMT on higher systems, but transit service is positively correlated with VMT on the lower systems. Finally, the level of traffic on lower systems was found to be quite uniform nationwide, and independent of city size or major road construction. In short, the paper concludes that if urbanized areas want economic growth they must be prepared to accept the increased traffic that will come with it.*

8-4 Peer City Review

A Peer City review was conducted to determine the number of cities with metropolitan populations similar to the Omaha/Council Bluffs area that have full or partial beltways. The review indicated that there are 58 metropolitan areas with populations between 500,000 and 1.5 million (based on 2000 census data). The information summarized in **Table 8-1** was broken down by 250,000 increments of population to provide a better indication of the numbers by population ranges.

A further analysis of the metro areas with partial beltways was conducted to determine how many beltway segments are provided. The results are summarized in **Table 8-2**. Forty-three of the 58 metropolitan areas in the study were identified as having partial beltways. Several of these communities had geographic constraints that kept them from developing full circumferential beltways, such as rivers, mountains or oceans. However, in many cases, the traffic demand isn't high enough to warrant the construction of the other segments of the beltway.

Table 8-1 Summary of Cities with Full or Partial Beltway Systems

Population (thousands)	No. of Cities	No Beltway	Partial Beltway	Full Beltway
500 – 750	32	11	21	0
750 - 1,000	10	2	7	1
1,000 - 1,250	11	0	10	1
1,250 - 1,500	5	0	5	0
Percentages		**22%**	**74%**	**4%**

Source: 2000 US Census Data

Table 8-2 Summary of Cities with Partial Beltway Systems

Population (thousands)	No. of Cities with Partial Beltway	One Leg	Two Legs	Three Legs
500 – 750	21	15	4	2
750 - 1,000	7	4	1	2
1,000 - 1,250	10	2	6	2
1,250 - 1,500	5	2	2	1
Percentages		**54%**	**30%**	**16%**

Source: 2000 US Census Data

8-5 Freeway Travel Statistics

Nine urbanized areas from around the country that were determined to have at least one leg of a freeway outer beltway or bypass were selected for comparison to the Omaha/Council Bluffs metro area. The urbanized areas were of a similar size, ranging from a low population of 376,000, to a high of 856,000. The freeway travel statistics selected were provided by the most recent Highway Statistics for Urbanized Areas, published by the FHWA in 2005. A summary of this information is provided in **Table 8-3**.

This comparison highlights several important features of the freeway system in and around the metro area. Out of the ten urbanized areas selected, the Omaha/Council Bluffs metro area ranks ninth in the number of freeway miles, freeway lane miles, percent of miles serving as freeways and the percent of Daily Vehicle Miles of Travel (DVMT). Note, the metro area ranks 8th in freeway DVMT.

Although there are multiple factors that influence these statistics, this comparison does indicate the metro area may be underserved by freeway facilities.

Table 8-3 Comparison of Freeway Travel Statistics - Peer Cities

Urbanized Area (Population, thousands)	Freeway Miles		Freeway Lane Miles		Freeway DVMT		% of Miles that are Freeways		% of DVMT[1] Served by Freeways	
	Miles	Rank	Miles	Rank	DVMT	Rank	%	Rank	%	Rank
Oklahoma City, OK (856)	143	2	748	1	9,243	1	3.2	4	34.1	4
Springfield, MA (587)	95	5	460	4	5,489	4	2.9	6	37.8	3
Tulsa, OK (575)	152	1	743	2	6,958	2	4.6	1	33.3	6
Albuquerque, NM (573)	64	7	329	8	4,664	7	2.5	7	32.1	7
Omaha, NE (571)	56	**9**	291	**9**	3,591	**8**	2.2	**9**	27.2	**9**
Knoxville, TN (483)	63	8	341	7	5,136	6	2.1	10	31.3	8
Youngstown, OH (444)	84	6	354	6	2,476	10	3.2	4	25.7	10
Des Moines, IA (394)	50	10	259	10	3,375	9	2.3	8	33.9	5
Harrisburg, PA (390)	97	3	421	5	5,487	5	4.6	1	47.0	2
Little Rock, AR (376)	97	3	497	3	6,071	3	3.6	3	51.6	1

[1] DVMT = Daily Vehicle Miles Traveled
Source: FHWA Highway Statistics 2005

The Omaha-Council Bluffs metro area ranks below peer cities in several key freeway travel statistics

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CHAPTER 9 COMMUNITY OUTREACH AND STAKEHOLDER INVOLVEMENT

This chapter summarizes the actions taken to provide study information to stakeholders and the public during the performance of this study.

9-1 Steering Committee

A Steering Committee was formed to oversee and guide the study team in the performance of the Omaha-Council Bluffs Metro Beltway Feasibility Study. This Steering Committee had representatives from:

- Metropolitan Area Planning Association
- Nebraska Department of Roads
- Iowa Department of Transportation
- City of Omaha, Nebraska
- City of Council Bluffs, Iowa
- Douglas County, Nebraska
- Pottawattamie County, Iowa
- Sarpy County, Nebraska

Meetings were held with the Steering Committee or approved committee subsets at key decision points in the study process. Progress updates were provided periodically through the course of the study to keep the committee apprised of progress, activities and findings.

63 percent of metro area residents think that a beltway would have a "positive" impact on the metro area

9-2 Stakeholders

An informational meeting was held August 1, 2007 to introduce the Stakeholders and Elected Officials to the study. The invitations were sent by mail to the following:

Stakeholder Groups

- Cass County
- Douglas County
- Mills County
- Pottawattamie County
- Sarpy County
- Saunders County
- Washington County
- Joslyn Castle Institute for Sustainable Communities
- Lower Platte Alliance
- Metropolitan Omaha Builders Association
- NE Department of Economic Development
- NE Innovation Zone
- Omaha by Design
- Papio Creek Watershed Partnership

Stakeholder Elected Officials

- Cass County Board
- Mills County Board
- Pottawattamie County Board
- Saunders County Board
- Washington County Board
- City of Arlington
- City of Ashland
- City of Bellevue
- City of Bennington
- City of Blair
- City of Crescent
- City of Fort Calhoun
- City of Glenwood
- City of Gretna
- City of Honey Creek
- City of Kennard
- City of Louisville
- City of McClelland
- City of Memphis
- City of Mineola
- City of Pacific Junction
- City of Papillion
- City of Plattsmouth
- City of South Bend
- City of Springfield
- City of Valley
- City of Washington
- City of Waterloo
- City of Yutan

A total of 23 persons attended the Stakeholder Informational Meeting where information was provided about the study process, goals and objectives and feedback was solicited.

9-3 Public Survey #1

One of the initial tasks of the study was to conduct a public perception survey to determine if there is public interest for a beltway or other major transportation improvements. A phone survey questionnaire instrument was developed and implemented in the Omaha-Council Bluffs metro area. Through a series of 9 questions 752 respondent's opinions on the current and future state of traffic congestion in the metro area was gathered as well as their views on the construction of a beltway. The sample size ensured a margin of error of not more than plus or minus 5 percentage points at the 95 percent confidence level.

Survey #1 highlights:

- **Current Traffic Congestion** - Approximately 63 percent of metro area residents rate the current level of traffic congestion as "medium" while 21 percent rate congestion as "high".
- **Future Traffic Congestion** - Approximately 42 percent of metro area residents think that traffic congestion will "worsen significantly" in the future while 39 percent think it will "worsen some".
- **Improving Congestion** - Approximately 27 percent of metro area residents think that a beltway would "best improve traffic conditions in the metro area," additionally, 27 percent also think that "improved transit" would improve traffic conditions.
- **Will a beltway help?** - Approximately 63 percent of metro area residents think that a beltway would have a "positive" impact on the metro area and 66 percent were "in favor of the construction of a beltway or some portion of a beltway" around the Omaha-Council Bluffs metro.

9-4 Public Survey #2

A second public survey was designed to obtain public opinion about transportation in the metro area. The second survey was conducted in the fall of 2009, when the study was substantially complete. Through responses to a series of 16 questions, respondents gave opinions on the current and future state of traffic congestion in the Omaha-Council Bluffs metropolitan area as well as their views on the construction of a beltway in the metro area. There were three questions that remained exactly the same from the first public survey and one question was modified slightly to adjust the future year from 50 years to 20 years in the future. The remaining questions were new.

Survey #2 highlights:

- **Current Traffic Congestion** - Consensus seems to exist in both surveys that traffic congestion is currently at moderate levels. Survey #2 shows approximately 64 percent of metro area residents rate the current level of traffic congestion as "medium" while 20 percent rate congestion as "high".
- **Future Traffic Congestion** - Survey #1 asked residents about congestion 50 years into the future. This question changed slightly for survey #2 and asked respondents to predict future traffic levels in 20 years. 47 percent of respondents suggested that traffic congestion would "worsen some", and 38 percent believed that traffic congestion would "worsen significantly".
- **Will a beltway help?** - In survey #1 across the whole target population, 32 percent of sampled residents were aware of the MAPA Beltway Feasibility Study. This is compared to survey #2, where 38 percent of the whole target population were aware of the MAPA Beltway Feasibility Study. When asked in the first survey of the study, 67 percent stated "yes" in favor of construction of a beltway or some portion of a beltway around the Omaha-Council Bluffs metropolitan area. Compared to survey #2, where 76 percent replied "yes" in favor of construction of a beltway or some portion of a beltway around the Omaha/Council Bluffs metropolitan area. This shows that as the study has progressed, the public is not only more aware of the study, but also more in support of the construction of a beltway.
- **Will improved land use practices help?** - The whole target population from survey #2 responded "yes" with 57 percent in support of altering land use practices to help limit increases in transportation congestion. However, a contrary response was found with 57 percent of sampled residents who would like to move to a less dense housing area in the future.
- **How should improvements be paid for?**- 63 percent believe if current funding for roadway improvement projects is not sufficient to build the roadways needed to limit congestion, they would be in favor of seeking additional methods for funding transportation projects other than the gasoline tax.
- **What role should transit play?** - 57 percent responded that they would utilize transit routes, if they were available, now or in the future to serve their daily commutes instead of driving their personal vehicle.

9-5 Public Outreach

A variety of methods were used to share information about the study with the public and interested organized groups. Early on a presentation was developed to educate groups about the study. This initial presentation was provided to the following 16 groups during the first six months of the study.

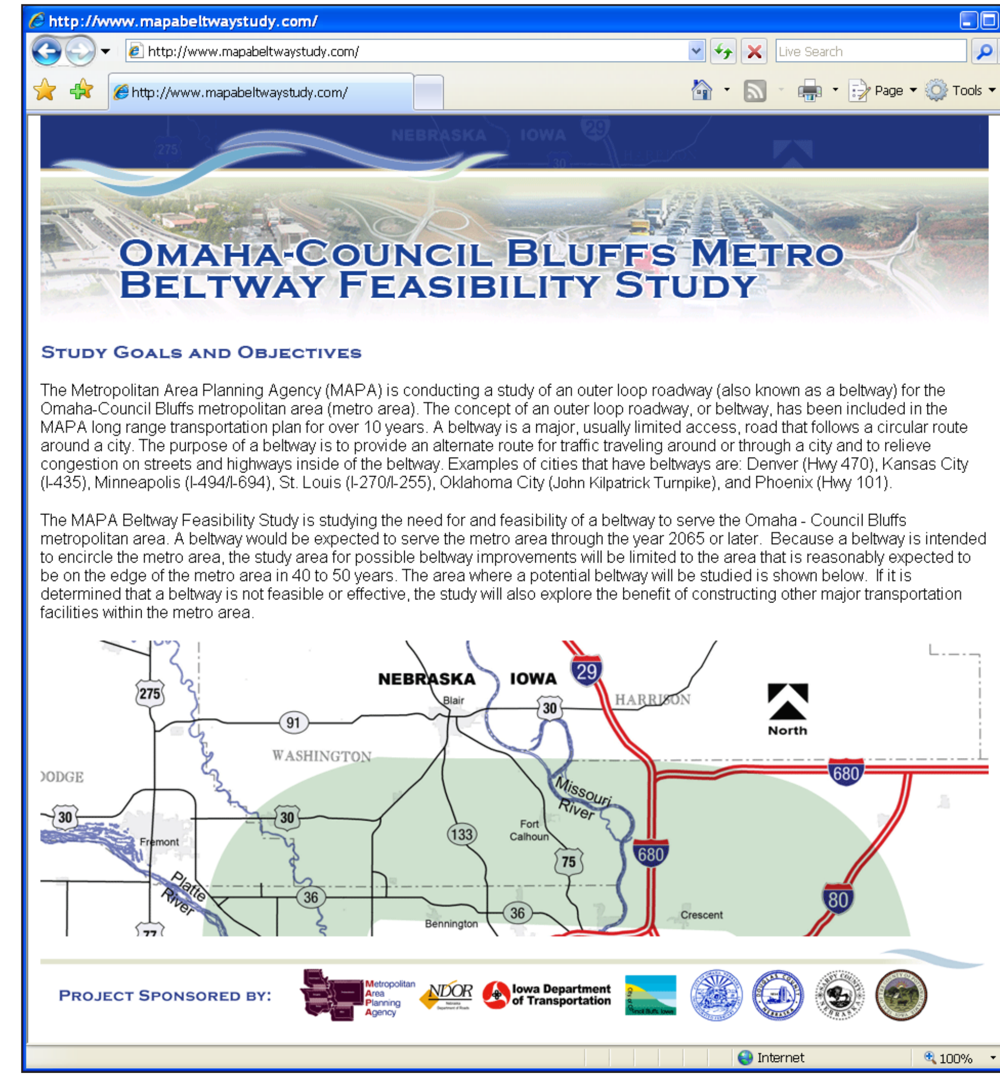
- MAPA Board
- NDOR Highway Commission
- Washington County Planning Commission
- Washington County Board
- Omaha Chamber Transportation Committee
- The Lund Company
- Sarpy County Board
- Stakeholders Meeting
- River City Regents Tips Club
- Omaha By Design
- City of Bellevue
- Congressman Lee Terry
- IDOT District 4
- Douglas County Board
- Millard Rotary Club
- ACEC Nebraska Transportation Meeting

Status update presentations on the study were later provided to three groups:

- Transportation Technical Advisory Committee
- ASCE Nebraska Transportation Conference
- Omaha Businessmen's Association

A project website was established to share study information. The website (www.mapabeltwaystudy.com) includes a summary of study goals and objectives, a study area map, a summary of the public survey findings and contact information for submitting comments or questions. The project website is shown in **Figure 9-1**.

Figure 9-1 Study Website



CHAPTER 10 SUMMARY AND FINDINGS

10-1 Is a Beltway Needed?

The purpose of this study was to address the question: Does the Omaha-Council Bluffs metro area need a limited access, high speed transportation corridor near the outer limits of the metro area to serve present and future transportation needs? This question is the central issue of the study, however, to answer the question a series of issues were considered in the study in order to provide an answer that is sensitive to the many interdependent issues. In order to answer the main study question it was also necessary to address the following questions:

- If a beltway was beneficial, generally where would it be located?
- Are there alternative improvements to a beltway? For example a partial beltway, new radial connections, enhancements to the existing arterial system or significant enhancements to transit.
- Would land use development intensities have an impact on the location and type of facility needed? Do these land use patterns affect alternatives to a beltway?
- What are the economic impacts of the transportation alternatives?

10-1-1 Is There a Problem?

Initially an evaluation was conducted to determine how the metro transportation system will operate in the future when the current LRTP is complete. It was determined that if only the projects listed in the LRTP are completed by 2035, the future metro transportation system will see a significant decrease in overall system performance compared to current conditions. Transportation model findings show that an average 20 minute trip will take approximately 25 minutes. In financial terms, it is estimated that, on average, each household in the metro area will incur $727 of additional direct costs annually (2008 dollars). These additional costs were due to additional time spent driving in congestion, fuel consumption, tire wear, etc. Over a one year period these costs amount to an additional $296 million in direct user costs for metro area residents. Based upon these evaluations it is clear the planned transportation improvements will not adequately address the future transportation needs, therefore, more improvements will be necessary to meet future demand.

10-1-2 Where would a Beltway be Located?

Two beltway concepts were developed for use in the study. Specific alignments were not identified but rather two-mile wide bands were identified that represent an area where a beltway may fit. Efforts were made when identifying the corridors to avoid and minimize impacting properties and natural resources to the extent possible. Both the outer and inner beltway bands were outside the current metro urban area as shown in **Figure 10-1**.

10-1-3 What Transportation Alternatives were Considered?

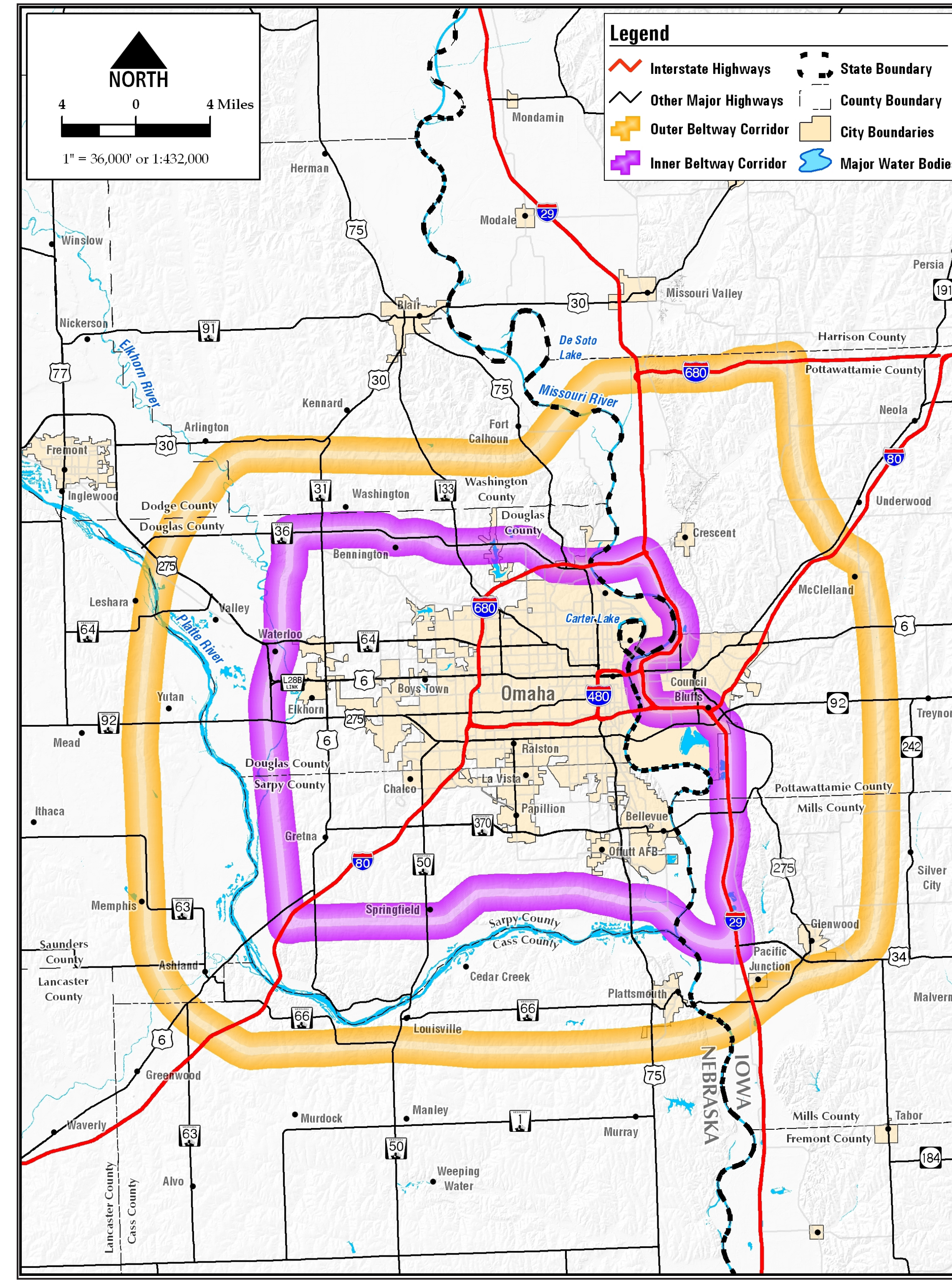
In order to answer the study questions it was desirable to consider other plausible alternatives to a beltway. In addition to testing beltway alternatives, a variety of non-beltway transportation alternatives were evaluated including:

- A radial freeway system
- An enhanced arterial network
- A light rail transit system

These alternatives were directly compared to the beltway alternatives. It was determined that a radial freeway system and enhanced arterial network would provide less relief than the beltway alternatives. The transit evaluation indicated substantial transportation benefits could be achieved if the ridership level could meet the assumed 5% level, which is a ten-fold increase over current ridership levels in the metro area. Note that there are significant obstacles to this alternative; however, for the purposes of this study the evaluation provided useful comparative data.

Freight movement through the metro area was considered for the two beltway alternatives. When the travel time between external points of the metro area were measured relative to the LRTP Base, a 7% and 2% time savings were found for the outer and inner beltways respectfully.

Figure 10-1 Outer and Inner Beltway Corridors



10-1-4 How does Land Use Affect the Transportation Alternatives?

Testing was conducted on the affects alternative land use development practices would have on the various transportation alternatives. Three land use alternatives were defined for consideration (Targeted Density, Transit Oriented, Sprawl). Combining the land use with the transportation alternatives resulted in a total of 15 alternative combinations that were evaluated as shown in **Figure 10-2**.

It was determined through the alternatives testing that increasing land use densities would have a positive affect on transportation service. Based upon the results of the study evaluations, it is clear that targeting densities and increasing transit service in the metro area would be a beneficial practice.

10-1-5 How do Economics Affect the Alternatives?

The economic evaluation shows that most all of the transportation alternatives would be worthwhile undertakings (benefit-cost is greater than 1) – meaning the benefit of reducing congestion in the future will be greater than the cost to do so for nearly all the alternatives tested. The economic evaluation also indicates that the inner and outer beltway alternatives have the highest benefit-cost ratio of all the alternatives. The ratio was even higher when the land use density was increased.

Figure 10-2 Final Alternatives Matrix

Transportation Network \ Land Use	2035 Base Land Use	Targeted Density	Transit Oriented	Sprawl
LRTP Base	A1	A2		A4
Outer Beltway	B1	B2		B4
Inner Beltway	C1	C2		
Radials	D1	D2		
Super Arterials	E1	E2		E4
Transit	F1		F3	

10-1-6 Conclusions

The study showed that the transportation system will degrade substantially with the continuation of current development policies and transportation improvement approach. Given the extent of degradation between today and 2035 under the currently programmed LRTP, it is not surprising that a single alternative or strategy cannot provide the full solution.

This study concludes that altering land use practices to increase densities in new development and promote infill will have a positive impact on the transportation system. The trend of future generations is to infill and densify, however, this does not diminish the need for high capacity transportation facilities. Even in cities with high transit usage, the vast majority of travel still takes place by auto. There are needs that have been building for decades in the metro area that cannot be reversed through land use policy changes alone.

Additionally it was shown that substantial benefits can be derived by significantly enhancing transit ridership. Levels of 5% to 7% of all trips on transit occur in some major metro areas that emphasize transit and have policies to support it. Such a level would represent a ten fold increase over current ridership levels in the metro area.

Nevertheless, land use and transit investment cannot replace investment in the roadway system. Even in cities that enjoy high transit ridership, the vast majority of travel still takes place using personal vehicles. An inner beltway system was determined to have a role in the future roadway network.

Through a combination of additional roadway capacity, refined land use policies, and transit investment, the Omaha-Council Bluffs metro area can remain a community in which transportation is not a negative, and for which transportation has a positive impact on the regional economy.

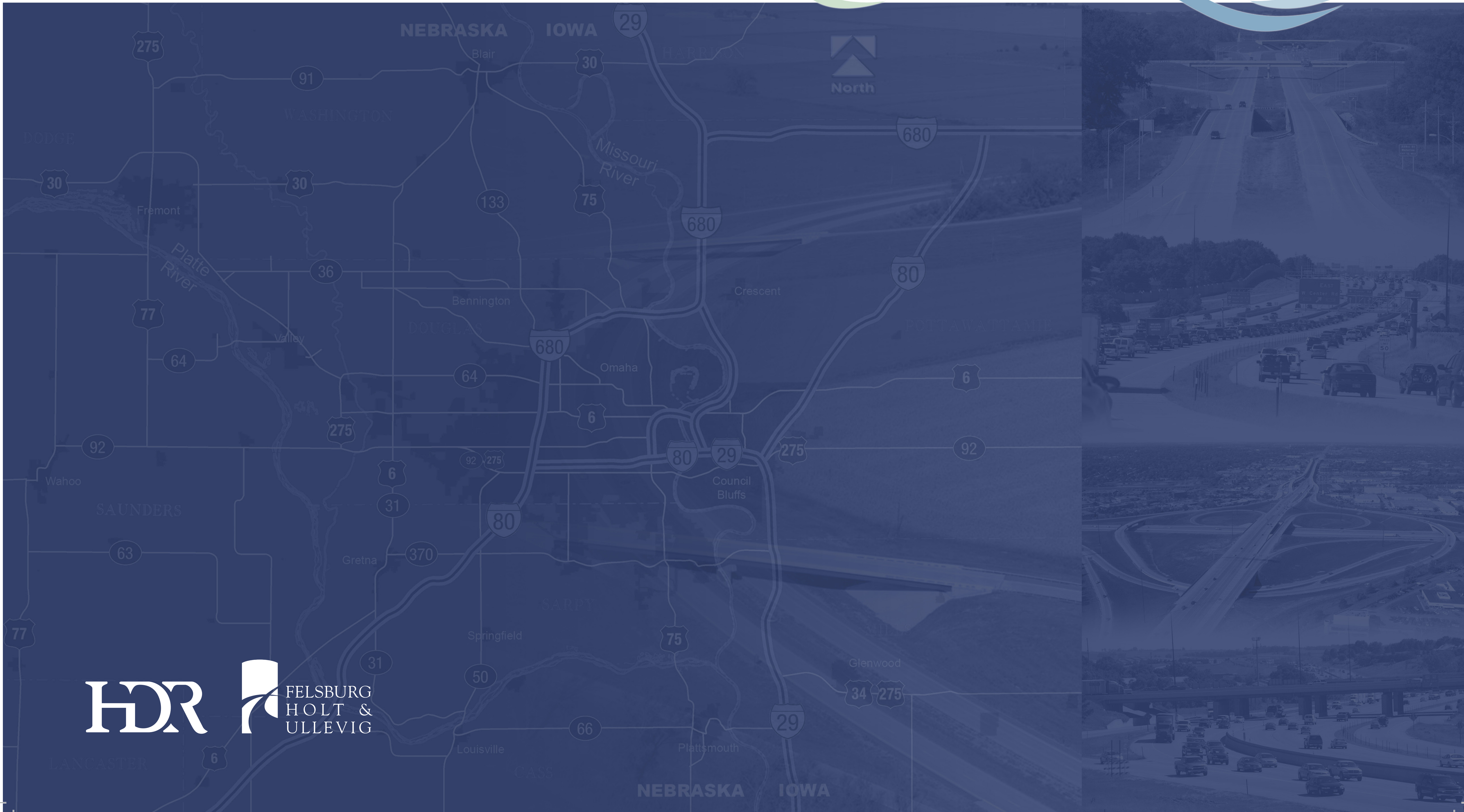
10-2 Future Steps

The Omaha-Council Bluffs Metro Beltway Feasibility Study provides a considerable amount of information for use in taking future steps to plan for transportation system improvements in the metropolitan area. The study has demonstrated that a multi-faceted approach will be needed to meet future transportation needs for the region. Logical next steps for moving ahead include:

- Regional land use policies should be revised to require more efficient use of land including higher density residential and commercial development.
- A comprehensive transit study should be conducted to test transit opportunities in greater detail and establish reasonable goals and objectives for transit service in the region.
- The inner beltway corridors should be added to the Long Range Transportation Plan to provide the opportunity for initial planning studies that follow Federal guidelines.

Ultimately, the purpose in further studying the beltway corridors is to identify preferred locations and preserve the corridors for the future need. If corridor locations are not protected, it will be difficult to provide an integrated transportation system approach for the future built environment.

The transportation system of the future will benefit from a comprehensive approach of revised land use policies, transit emphasis, and roadway improvements including an inner beltway



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