CHAPTER 11

STREETS AND HIGHWAYS

The street and highway system constitutes the foundation of the region's overall transportation infrastructure, enabling the movement of people and goods. While the roadway system primarily serves the movement of automobiles, Central Oklahoma's public transportation and freight movements are also heavily dependent on an efficient street and highway network. Additionally, the viability of non-motorized transportation options, such as walking and bicycling, are heavily influenced by the makeup, condition and configuration of this network. The street and highway system plays a major role in supporting and realizing the region's transportation goals.

CURRENT FACILITIES AND TRANSPORTATION NEEDS

Central Oklahoma is truly a crossroads for the nation's transportation systems. Two of the most important interstate highways, I-40, which runs from Los Angeles to Raleigh, North Carolina, and I-35, which runs all the way from Mexico to Canada, meet in downtown Oklahoma City. The addition of I-44 that runs from Wichita Falls, Texas, to St. Louis, Missouri, as well as I-240 and I-235 reinforces Central Oklahoma's status as an important national transportation hub.

In 2010:

- 201 linear miles of interstates, freeways, and expressways
- 59 linear miles of turnpikes
- 1,899 linear miles of arterials

In addition to serving automobile and truck traffic, the street and highway system provides the foundation for all modes of transportation, including providing the infrastructure upon which public and private transit services are operated and provides direct access to the region's airports, trucking terminals, freight and passenger rail services, and recreational trails.

Central Oklahoma's abundance of street and highway infrastructure has resulted in some of the lowest congestion levels for a region of its size. However, forecasted population and employment growth will make it difficult to maintain the level of movement the region currently enjoys.

ENCOMPASS 2040 BASE NETWORK AND ALTERNATE TRANSPORTATION NETWORKS

As part of Encompass 2040, an assessment of the future regional transportation system was conducted in an effort to mitigate the growing street and highway needs. The analysis was performed by reviewing 2040 roadway travel conditions under a variety of transportation funding scenarios, known as alternates. The transportation system impacts of each alternate were simulated using the regional travel demand model (RTDM). Additional base network and alternate network components can be viewed in Table 11.1. (on page 91)

BASE NETWORK

In order to calibrate the RTDM and have a baseline for evaluating future transportation system performance, a base network was developed for the analysis. For Encompass 2040, the base network included all regional streets and fixed transit routes as they existed in 2010.

ALTERNATE 1: PRESENT + COMMITTED NETWORK

The Present + Committed Network included all existing roadways and transit routes with improvements implemented since the 2010 base year, as well as those for which funding was committed through December 2016. This network—sometimes referred to as a "no build" network—would complete all projects underway, with future transportation funding focused on maintenance of the existing system. This network, referred to as Alternate 1, became the foundational network against which all other alternate networks would be compared. See Figure 11.1 (On page 88)

ALTERNATE 2: IMPROVED TRANSPORTATION NETWORK

Alternate 2 included all existing roadways and transit routes, the Present + Committed Network (Alternate 1), as well as future transportation improvements (Figure 11.2). These improvements included:

- Roughly 220 transportation projects submitted by local governments during the Encompass 2040 call for projects, including sidewalk and biking components,
- Long-range projects on the State Highway System (interstates, U.S. highways and state highways) provided by the Oklahoma Department of Transportation (ODOT),
- New OCARTS area turnpikes to be constructed by the Oklahoma Turnpike Authority as part of Driving Forward OK (SW Kilpatrick Turnpike extension and NE Oklahoma County loop),

- Roadway improvements to close gaps identified by ACOG staff, and
- Phase one improvements at the Santa Fe Station Intermodal Hub scheduled for completion in 2017, and the Oklahoma City downtown modern streetcar scheduled to open in 2018.

Alternate 2 was ultimately approved by the Intermodal Transportation Policy Committee on August 11, 2016 as the recommended 2040 street and highway network for the OCARTS area. The alternate proved to provide superior level of service over Alternate 1, while remaining financially constrained. See Table 11.2 for alternate network comparisons. (on page 92)

A listing and detailed map of all proposed street and highway projects can be found in Chapter 13 - The Adopted Plan.

ALTERNATE 3: IMPROVED TRANSPORTATION NETWORK + REGIONAL TRANSIT

The Alternate 3 Network included all existing roadways and transit routes, the Present + Committed Network (Alternate 1), future transportation improvements (Alternate 2), as well as regional commuter rail, bus rapid transit, and feeder bus routes identified by the 2014 Central Oklahoma Commuter Corridors Study and the 2005 Regional Fixed Guideway Study. The Alternate 3 Network was considered illustrative, due to the lack of dedicated funding sources to implement new regional high capacity transit improvements. See Figure 11.3.

SCENARIOS: LINKING LAND USE AND TRANSPORTATION

Each alternate network was modeled using two potential land use patterns for the region in 2040.

- Scenario 1: continued the region's historical trend of outward growth with no new zoning initiatives.
- Scenario 2: focused on growth that would encourage infill, nodal, and downtown development within communities, which would be more supportive of future regional transit.

The 2040 land use scenarios have demonstrated that the region has potential to gain more transportation efficiencies if it develops in a pattern like Scenario 2, however this pattern is dependent on future land use decisions made at the local level.

EVALUATION OF ALTERNATE STREET AND HIGHWAY NETWORKS

Table 11.2 provides a summary of the travel conditions projected for each alternate street and highway network in the year 2040, as compared to 2010 base year conditions. Evaluation factors included each network's ability to meet projected daily transportation demand, network performance in terms of congested road miles and speed, and estimated costs to implement each alternate.

Descriptions of the major evaluation factors are described below.

Congested Road Miles

In order to determine potential congestion levels for the alternate street and highway networks, the traffic volumes for the forecast year were assigned to each of the four alternates individually. After each alternate assignment, the 24-hour non-directional capacities based on level of service (LOS) E, were applied to derive volume-to-capacity (V/C) ratios for individual links on the networks. Full capacity is represented by a V/C ratio of 1.0. Thus, a roadway segment was considered moderately congested if its V/C ratio was greater than 0.69 and seriously congested if the V/C ratio was above 0.99. The purpose of this analysis was to provide a picture of the anticipated congestion levels in the year 2040 using different improvement scenarios. With the aid of these detailed modeling results, local planners, engineers, and elected officials could focus on the individual congested locations to propose localized improvements without losing sight of regional mobility and network continuity goals.

Vehicle Miles of Travel

Daily vehicle miles of travel (VMT) is an indicator of the usage of streets and highways over a 24-hour period by the traveling public. The VMT estimates were generated by the transportation modeling software, which sums the assigned volume multiplied by the associated street segment distance. Separate estimates were evaluated for freeway and non-freeway facilities. The VMT estimates were also used to project estimates of vehicle emissions, crashes, and road user costs in the calculation of benefit-cost analysis for each of the three alternates.

Vehicle Hours of Travel

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

FIGURE 11.1: ALTERNATE 1 PROJECTS

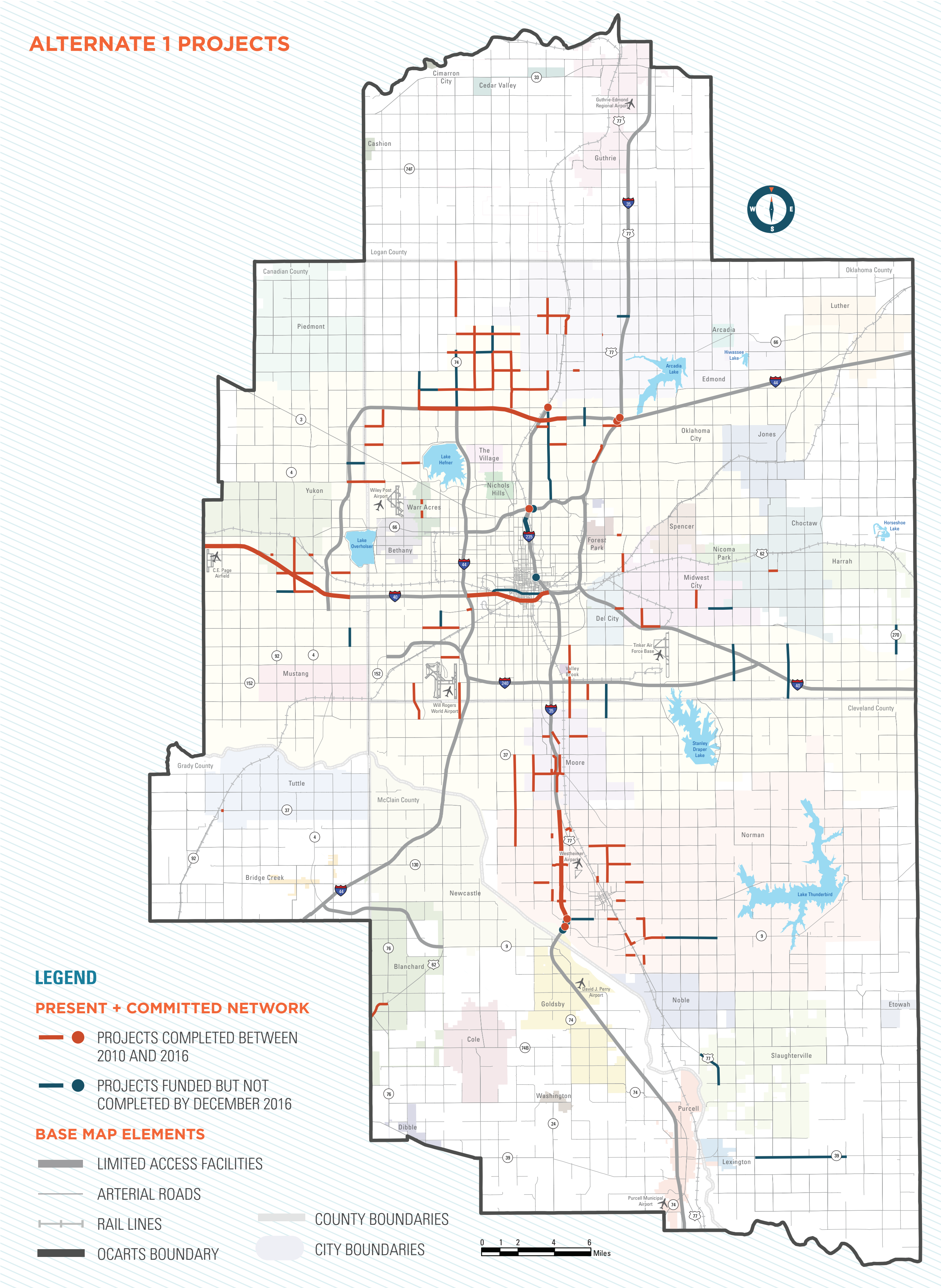


FIGURE 11.2: ALTERNATE 2 PROJECTS

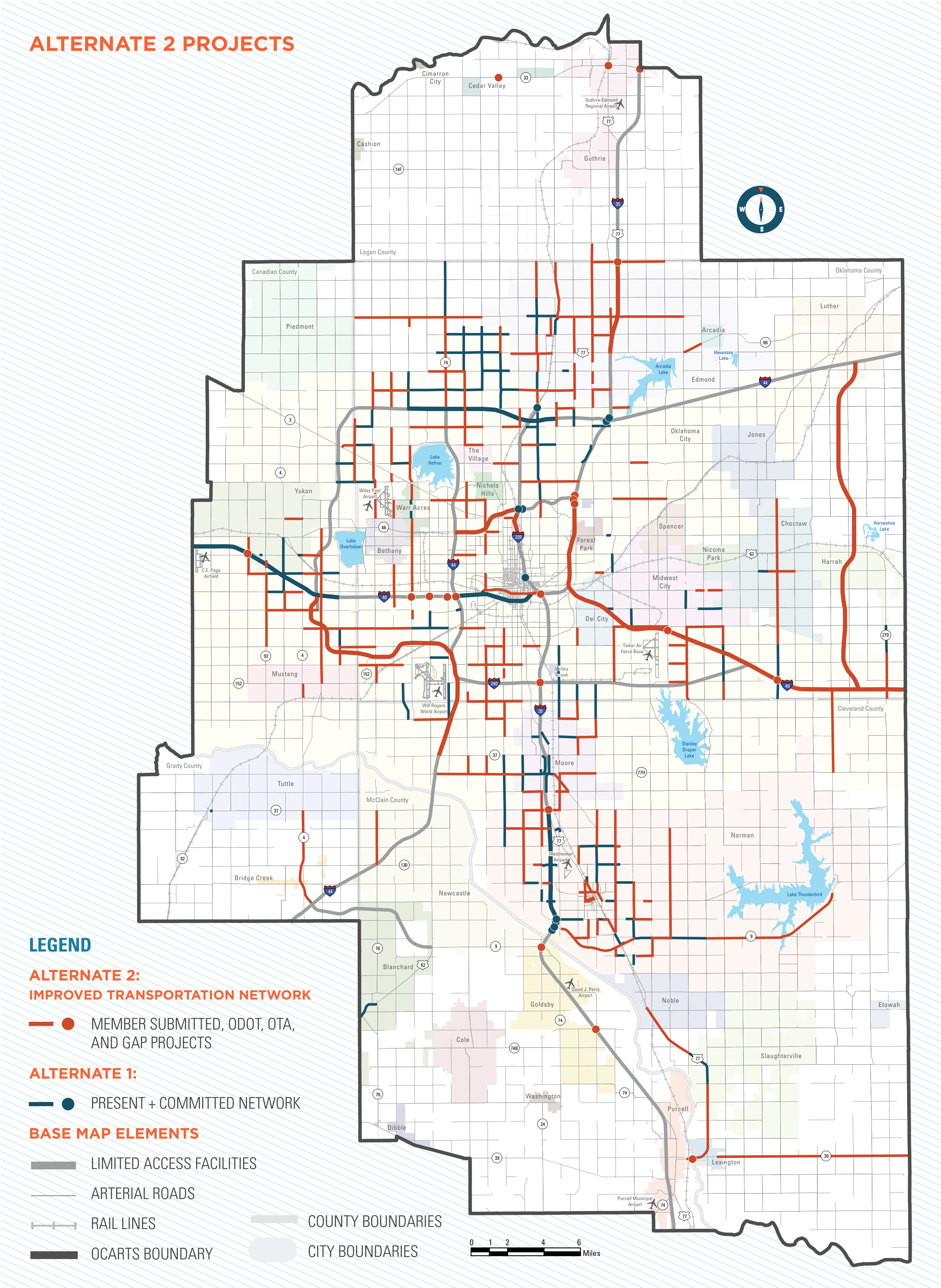
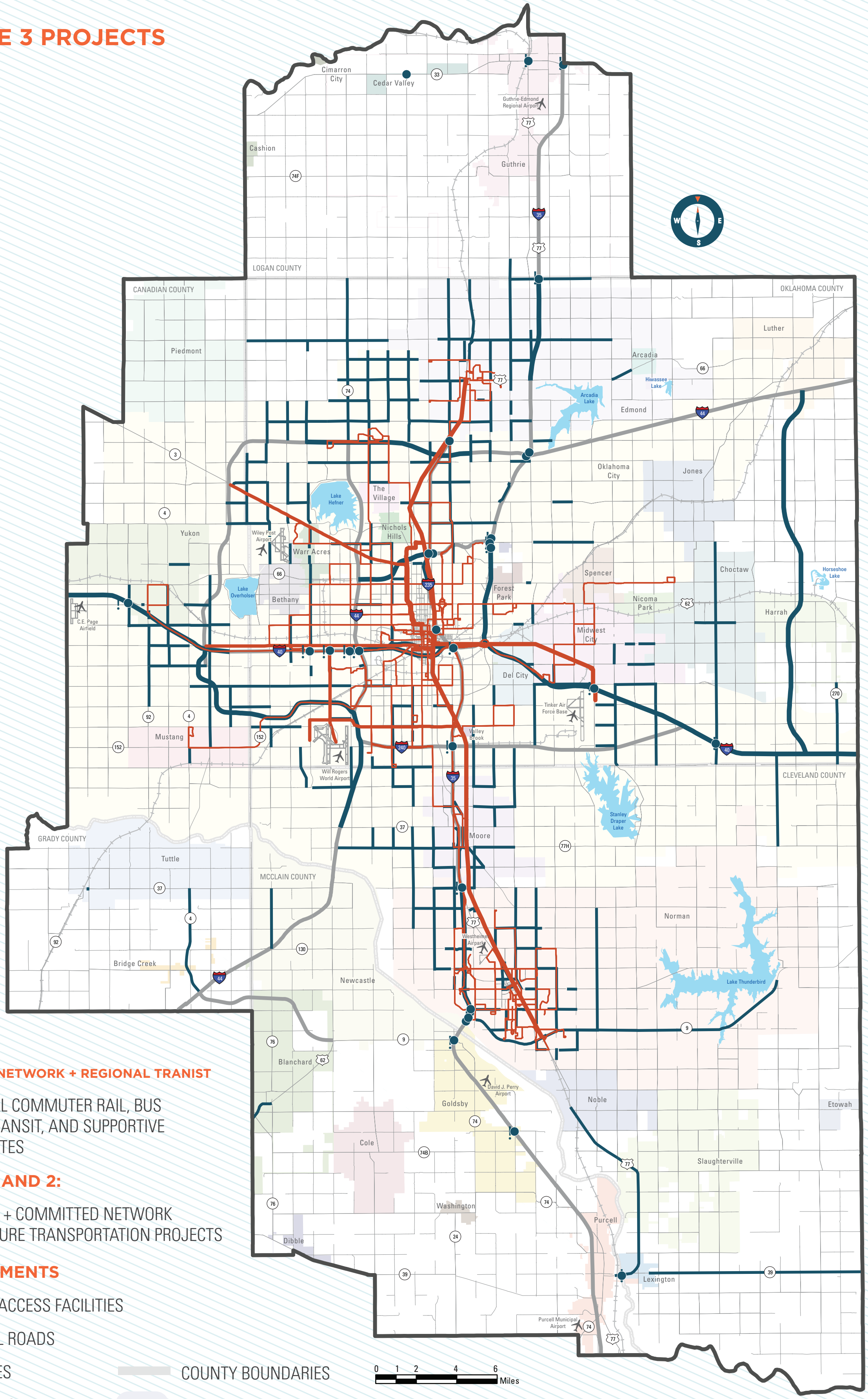


FIGURE 11.3: ALTERNATE 3 PROJECTS

ALTERNATE 3 PROJECTS



LEGEND

ALTERNATE 3:

TRANSPORTATION NETWORK + REGIONAL TRANIST

REGIONAL COMMUTER RAIL, BUS RAPID TRANSIT, AND SUPPORTIVE BUS ROUTES

ALTERNATES 1 AND 2:

PRESENT + COMMITTED NETWORK AND FUTURE TRANSPORTATION PROJECTS

BASE MAP ELEMENTS

LIMITED ACCESS FACILITIES

ARTERIAL ROADS

RAIL LINES

OCARTS BOUNDARY

COUNTY BOUNDARIES

CITY BOUNDARIES

TABLE 11.1: BASE NETWORK AND ALTERNATE NETWORK COMPONENTS

ALTERNATIVE COMPONENTS	BASE NETWORK	ALTERNATE 1	ALTERNATE 2	ALTERNATE 3
BASE STREET NETWORK (2010)	•	•	•	•
BASE FIXED TRANSIT ROUTES (2010)	•	•	•	•
PRESENT + COMMITTED PROJECTS (2010-2016)		•	•	•
ODOT 8-YEAR CONSTRUCTION WORK PLAN (THROUGH 2016)		•	•	•
ENCOMPASS 2040 MEMBERS PROJECT			•	•
LONG-RANGE ODOT PROJECTS			•	•
GAP PROJECTS (IMPROVEMENTS THAT CLOSE GAPS IN THE NETWORK)			•	•
OTA TURNPIKES			•	•
DOWNTOWN OKLAHOMA CITY STREETCARS			•	•
ITS INTEGRATED CORRIDOR MANAGEMENT (RAMP METERING AND DMS)			•	•
ITS ADAPTIVE SIGNAL CONTROL (COORDINATED NETWORK OF SIGNALS)			•	•
SIGNALIZATION AT CRITICAL LOCATIONS (STOP SIGN CONVERSION)			•	•
REGIONAL TRANSIT (2030 FIXED GUIDEWAY STUDY VISION)				•
0.3 – 0.47% TRANSIT MODE SHARE	•	•	•	
1.0% TRANSIT MODE SHARE				•

Average Speeds

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

Other Evaluation Measures

In addition to the factors reflected in Table 11.2, the alternate street and highway networks were evaluated in terms of the recommended plan's effect on a number of environmental and social impacts, including an environmental justice analysis of the potential impacts to low income and minority populations, and their cost effectiveness (benefit-cost ratio). Information can be found in Chapter 12 – Protecting Human Health and the Environment, and Chapter 14 – Financial Strategies, Revenues and Cost, respectively.

STREET AND HIGHWAY CHALLENGES

The street and highway network will continue to be the transportation backbone in the year 2040. Indeed, the level of service the driving public demands will be predicated on the region's ability to construct and maintain the street and highway system. Like most transportation modes identified in this report, adequate funding will continually have to be pursued. Even if funds are readily available, it is clear from the Encompass 2040 process, that the region will be unable to build its way out of congestion. As a result, the Plan addresses the need to look at a more comprehensive approach focusing on land use practices to decrease the demand for the automobile and to continue to diversify the region's transportation options.

TABLE 11.2: ALTERNATE COMPARISON

RTDM NETWORK EVALUATION [1]	2010 BASE NETWORK	ALTERNATE 1 SCENARIO 1	ALTERNATE 1 SCENARIO 2	ALTERNATE 2 SCENARIO 1 [10]	ALTERNATE 2 SCENARIO 2	ALTERNATE 3 SCENARIO 1	ALTERNATE 3 SCENARIO 2
DEMOGRAPHIC DATA							
Population	1,142,338	1,595,168	1,595,168	1,595,168	1,595,168	1,595,168	1,595,168
Employment	601,839	875,402	875,402	875,402	875,402	875,402	875,402
DAILY TRANSPORTATION DEMAND							
Vehicle Miles of Travel	30,266,000	45,299,000	44,321,000	46,550,000	45,517,000	45,997,000	44,927,000
Vehicle Miles of Travel Per Person	26	28	28	29	29	29	28
Vehicle Hours of Travel	853,000	1,503,000	1,474,000	1,415,000	1,389,000	1,398,000	1,371,000
Vehicle Trips	4,165,000	5,896,000	5,976,000	5,858,000	5,928,000	5,788,000	5,851,000
Transit Ridership	15,700	22,800	26,200	22,900	26,600	91,100	108,900
SYSTEM PERFORMANCE							
Congested Road Miles	289	647	626	308	297	295	290
Average Overall Speed (mph)	35	30	30	33	33	33	33
Average Freeway Speed (mph)	45	40	40	44	44	44	44
Average Arterial Speed (mph)	35	25	25	29	29	29	29
Average Trip Length (miles)	7.27	7.68	7.42	7.95	7.68	7.95	7.68
Average Trip Length (minutes)	12.29	15.3	14.8	14.49	14.06	14.49	14.06
Daily Hours of Delay	138,000	454,000	425,000	366,000	340,000	349,000	322,000
Delay per Trip (minutes)	1.99	4.62	4.27	3.75	3.45	3.62	3.31
Daily Crashes[2]	76	68	67	58	56	57	55
Daily Injuries[2]	37	33	33	28	27	28	27
Daily Fatalities[2]	0.3	0.3	0.3	0.2	0.2	0.2	0.2

TABLE 11.2: ALTERNATE COMPARISON *continued*

RTDM NETWORK EVALUATION [1]	2010 BASE NETWORK	ALTERNATE 1 SCENARIO 1	ALTERNATE 1 SCENARIO 2	ALTERNATE 2 SCENARIO 1 [10]	ALTERNATE 2 SCENARIO 2	ALTERNATE 3 SCENARIO 1	ALTERNATE 3 SCENARIO 2
ENVIRONMENTAL [3]							
Carbon Monoxide Emissions (tons/day)	564	116	113	111	109	110	107
Hydrocarbon Emissions (tons/day)	97	11	11	10	10	10	10
Nitrogen Oxide Emissions (tons/day)	107	16	16	15	15	15	15
Daily Fuel Consumption (gallons)[4,5]	1,211,000	824,000	806,000	787,000	770,000	778,000	760,000
ESTIMATED COST [6]							
Street & Highway Construction	-	830,684,733	830,684,733	3,562,712,478	3,562,712,478	3,562,712,478	3,562,712,478
Street & Highway Maintenance	-	5,368,593,180	5,368,593,180	5,217,983,029	5,217,983,029	5,217,983,029	5,217,983,029
Transit	-	1,037,094,247	1,037,094,247	1,278,549,300	1,278,549,300	3,640,889,269	3,640,889,269
Bicycle & Pedestrian	-	-	-	272,513,112	272,513,112	272,513,112	272,513,112
Total [7]	**-**	**7,236,372,160**	**7,236,372,160**	**10,331,757,919**	**10,331,757,919**	**12,694,097,888**	**12,694,097,888**
BENEFIT COST RATIO (COMPARING ALTERNATE 2 AND ALTERNATE 3 TO ALTERNATE 1) [8]							
Road User Cost Savings/construction Costs (Annual)	N/A	N/A	N/A	5.30	5.56	5.11	5.21
DAILY COST SAVINGS							
Daily Road User Cost Savings	N/A	N/A	N/A	2,434,000	2,581,000	3,351,000	3,413,000
Daily Crash Cost Savings - Property Damage [9]	N/A	N/A	N/A	133,000	147,000	147,000	160,000
Daily Crash Cost Savings - Injuries [9]	N/A	N/A	N/A	602,000	604,000	649,000	654,000
Daily Crash Cost Savings - Fatalities [9]	N/A	N/A	N/A	87,000	88,000	94,000	95,000
TOTAL DAILY COST SAVINGS	**N/A**	**N/A**	**N/A**	**3,257,000**	**3,420,000**	**4,241,000**	**4,321,000**

1) Refer to alternate network assumptions matrix for additional information | **2)** 2040 crashes were based on a 42% decline in crash rate from 1980 to 2010 | **3)** Vehicle emissions were calculated using EPA MOVES2014a model | **4)** Fuel consumption was based on current 25 miles per gallon and EPA requirement of 54.5 miles per gallon by 2025 | **5)** For Alternate 2 and Alternate 3, an additional 7% was removed because of ITS | **6)** Refer to financially feasibility documents for additional information on estimated plan costs **7)** Estimated total Encompass 2040 revenue is $10,423,315,000 | **8)** Cost Benefit Ratio = Annual Road user costs saved/annual construction costs., **Ex: Alternate 2 Scenario 1**; For every dollar spent on construction, $5.30 was saved in road user costs., **Road User Costs include (2040):** Auto operating costs of $0.85 per mile; Hourly wage costs of $15.00 per hour; Turnpike Tolls of $0.15 per mile; Crash costs (See 7). **Construction Costs include (2040):** Road construction + ROW costs + Maintenance; Transit costs; Bike/pedestrian costs | **9)** 2010 Average auto crash costs are from the National Safety Council (NSC); Fatality Cost: $1,410,000 * 1.5 inflation factor = $2,115,000; Injury Cost: $78,900 * 1.5 inflation factor = $118,350; Property Damage Cost: $8,900 * 1.5 inflation factor = $13,350 | **10)** Recommended Alternate for Encompass 2040