Purpose and Need

Introduction

State Highway 20 (SH 20) is a major east-west highway facility in the rapidly growing northern Tulsa area. State Highway 20 is primarily a 2-lane rural arterial highway between US Highway 75 and Interstate 44, with the exception of the urbanized area of Claremore, where SH 20 is a 4-lane highway. In recent years, improvements in north-south highway facilities have made this corridor an attractive area for new residential development, especially for residents with jobs to the south in the Tulsa urbanized area. Growing population is placing increasing demands on the area transportation system.

The purpose of this study is to determine how to most effectively improve mobility, reduce congestion, accommodate demand, and reduce accidents in the State Highway 20 corridor. A summary of the existing and projected future conditions of the transportation system in the State Highway 20 corridor will be presented. This will support the purpose of this study and identify the need for transportation improvements. The performance of the area transportation system will be discussed in terms of the relationship between transportation demand and supply in the State Highway 20 corridor.

Transportation Demand

The demand for transportation services is reflected in traffic volumes observed on roadways. Current average daily traffic volumes on SH 20 and other major study area highways are shown in Figure B1, entitled *EXISTING TRAFFIC VOLUMES*. Traffic volumes on SH 20 range from 6,000 vehicles per day at the western end of the study area to 18,800 vehicles per day in central Claremore. Traffic volumes are generally higher in urban areas than in segments between urban areas. Higher traffic

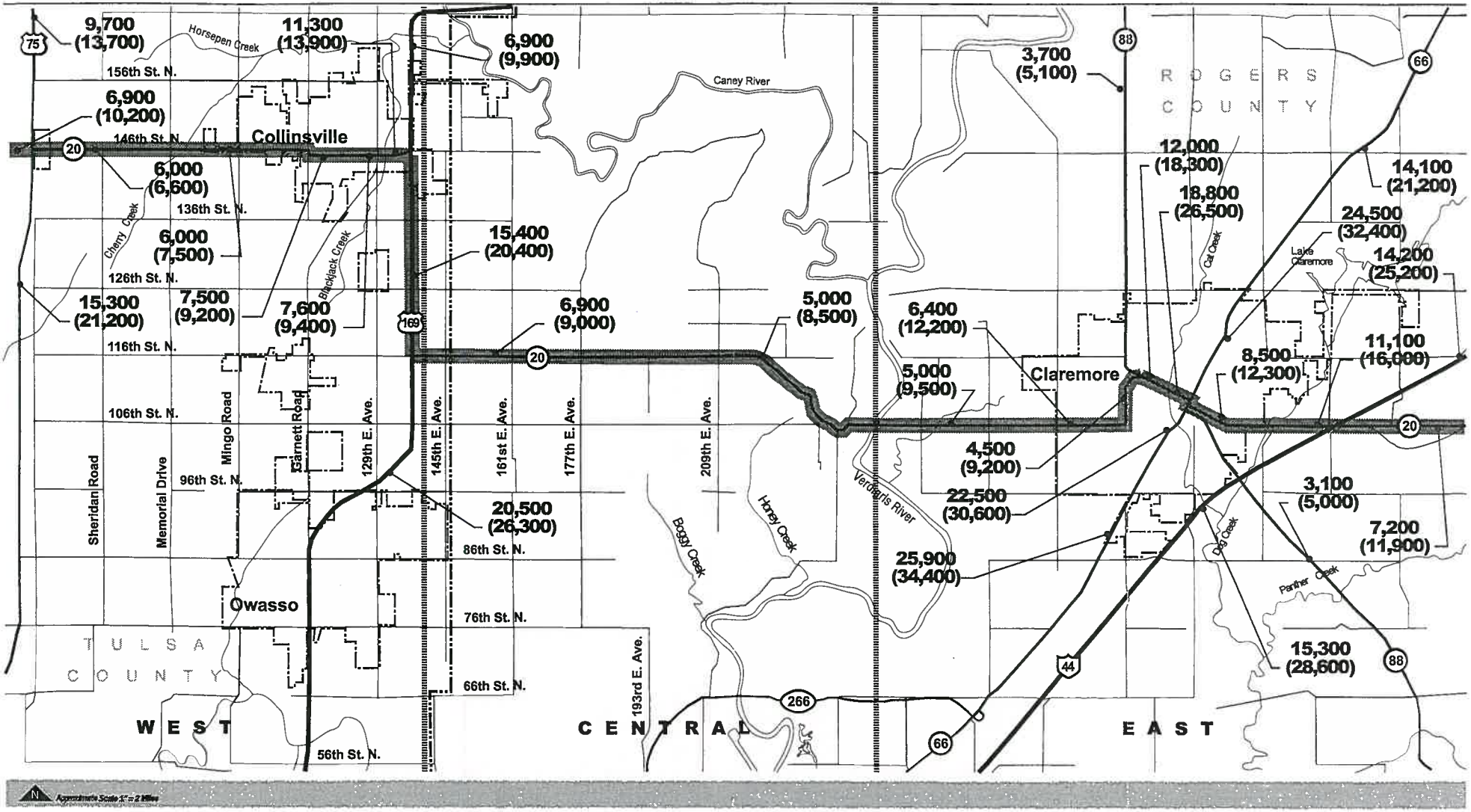

Figure B1 **Existing Traffic Volumes (Projected 2020 Traffic Volumes) Vehicles per Day**

Existing State Highway 20

Source: Oklahoma Department of Transportation, Indian Nations Council of Governments, City of Claremore

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volumes that exist on the north-south highways serving Tulsa than those on the east-west sections of SH 20 reflect high volumes of commuter traffic to and from Tulsa.

The Oklahoma Department of Transportation collected turning movement counts at four major intersections along SH 20 in the study corridor, which are shown in Table B1, entitled *TURNING PATTERNS*. At each of these locations, vehicles making each possible type of turn and through movement were counted for sixteen (16) hours by hour and by vehicle type. Turning movement counts provide insight into general patterns of traffic movement. Although turning movement counts neither yield the detailed information on origins and destinations that driver interviews provide nor represent average daily traffic volumes as shown in Figure B1, the data confirmed many assumptions about travel patterns in the SH 20 corridor.

Table B1 shows that, at every location, turning movements to or from the south were higher than turning volumes to or from the north. Relatively low through volumes on SH 20, except in Claremore where heavy cross-town traffic obscures this pattern, suggest that the majority of traffic on SH 20 is using the route to feed to the north-south highways. Figure B1 shows higher traffic volumes south of SH 20 than north of SH 20. Hourly breakdowns of the traffic counts indicate that as much as two-thirds of traffic on these north-south highways is headed south in the morning and north in the afternoon and evening. All of this evidence indicates a strong pattern of commuter traffic to and from Tulsa.

The Indian Nations Council of Governments (INCOG) maintains a travel demand model that describes existing traffic volumes on the road network throughout the Tulsa metropolitan area and may be used to make predictions about future traffic conditions. Regional travel demand models are used for planning purposes to make relative comparisons between transportation alternatives. Because they focus on simulating travel patterns on a regional scale, the traffic volumes they predict in localized areas are not used for design purposes. The Oklahoma Department of Transportation normally combines the results of regional travel demand models with other tools to develop design traffic volumes used to determine the engineering characteristics of a new or upgraded facility.

This model was developed in conjunction with the Oklahoma Department of Transportation (ODOT) and is based on methods used throughout the United States for forecasting future travel patterns. Predictions are based on population and employment projections, existing traffic volumes, the existing street network, assumptions about future roadway improvements, and assumptions about the type and location of future traffic-generating land development such as housing, shopping centers, and industrial parks.

Population projections by the Oklahoma Department of Commerce - State Data Center indicate that the Tulsa Metropolitan Area will have an increase of twenty-two percent (22%) by the year 2020, which is an annual growth rate of less than one percent (0.66%). The City of Claremore is expected to increase by fifteen (15%) during the same time-period.

Table B1
TURNING PATTERNS
State Highway 20 Corridor Study

Movement	Vehicles Observed	Percent
SH 20 at US 75		
SH 20 to/from South	6,732	43%
SH 20 to/from North	1,205	8%
SH 20 through	2,089	13%
US 75 through	5,697	36%
Total Vehicles Observed	15,723	100%
US 169 at 116th Street		
SH 20/116th Street to/from South	5,634	28%
SH 20/116th Street to/from North	1,169	6%
116th Street through	2,376	12%
US 169 through	10,912	54%
Total Vehicles Observed	20,091	100%
SH 20 at SH 66 (1)		
SH 20 to/from South	9,381	26%
SH 20 to/from North	8,867	25%
SH 20 through	8,207	23%
SH 66 through	9,505	26%
Total Vehicles Observed	35,960	100%
SH 20 at I-44 (2)		
SH 20 to/from South	1,877	8%
SH 20 to/from North	605	3%
SH 20 through	7,122	31%
I-44 through	13,328	58%
Total Vehicles Observed	22,932	100%

Source: ODOT Turning Movement Counts, 1997.
(1) SH 20 is defined as Will Rogers Boulevard, Third Street, and Patti Page Boulevard.
(2) I-44 through traffic based on traffic counts collected by Oklahoma Turnpike Authority.

The travel demand model is able to estimate how much traffic volumes are likely to increase in the future. According to ODOT traffic counts, traffic volumes on SH 20 in the western end of the study area have increased by approximately 76 percent over the last twenty (20) years. Likewise, traffic volumes on SH 20 on the eastern end of the study area have increased by approximately 58 percent over the same period. Based on assumptions about future land use and growth in the northern Tulsa area, INCOG expects traffic volumes to increase along SH 20 on average by about 50 percent in the twenty-two (22) years between now and 2020. Figure B1 shows projected traffic volumes for the year 2020 in parentheses below the existing traffic volumes.

Localized changes in the variables used in the travel forecasting process, such as new residential or commercial developments and the travel changes they induce, cause some segments of the road network to increase more than others. Burgeoning residential development in the SH 20 corridor and the influx of new residents it brings, especially those with jobs in Tulsa, suggest that traffic volumes will continue to increase and that travel patterns now observed will continue to intensify along SH 20 between now and 2020.

Supply of Transportation Facilities

In the supply and demand relationship that defines the performance of a transportation system, supply includes the transportation facilities that comprise the highway network and any public transportation services. Within the State Highway 20 corridor, transportation facilities consist of the hierarchical network of Interstate highways, US highways, state highways, local arterial streets, and collector and local residential streets. Controlled-access highways, such as Interstates and some US highways, provide long-distance, high-speed through travel service with limited access points to and from the local street network. Divided and undivided US and state highways, with or without frontage roads, provide access to local streets and adjacent property. Local streets are primarily used for short-distance, low-speed travel and property access.

The transportation system within the State Highway 20 corridor is dominated by major north-south highways radiating from the City of Tulsa, which is located about fifteen (15) miles to the south. From west to east, these north-south highways are listed as follows: US Highway 75 is a 4-lane divided highway with mostly at-grade intersections in the study area, but with a grade-separated diamond interchange at State Highway 20. US Highway 169 is a 4-lane divided limited-access highway with grade-separated interchanges at approximately one (1) mile intervals throughout the study area. State Highway 66 (SH 66) is a 4-lane highway running southwest to

northeast through Claremore. Outside Claremore, SH 66 is a 4-lane divided highway with mostly at-grade intersections. Through central Claremore, SH 66 is a 4-lane undivided highway with signalized intersections at major cross streets. State Highway 88 (SH 88) is a 2-lane highway running southeast to northwest through Claremore. In Claremore, SH 88 shares an alignment with SH 20 along Will Rogers Boulevard. The Will Rogers Turnpike (Interstate 44) is a 4-lane limited-access toll highway running southwest/northeast east of Claremore. Figure B2, entitled *STATE HIGHWAY 20 CORRIDOR TRANSPORTATION SYSTEM* indicates the number of lanes and roadway type for the roads in the study corridor.

Existing Roadway Capacities

The ability of a roadway to supply transportation services is measured by its capacity. The capacity of a section of highway is the maximum rate at which vehicles can be reasonably expected to travel that section under the prevailing roadway, traffic, and control conditions. Capacity is expressed as the number of vehicles per day (vpd) that a given segment of roadway can accommodate. The capacity of a longer section of roadway is limited by the point with the lowest capacity.

Many factors influence the actual capacity of a roadway. The number of lanes and the type of access control are major determinants. Roadways on which vehicles are allowed to freely make right and left turns typically have lower capacities than roadways of similar size with turning restrictions in the form of central medians, left-turn lanes, right-turn lanes, or grade-separated interchanges. When vehicles slow or stop to make a turn, they impede the progress of vehicles behind them and thereby reduce capacity. Table B2, entitled *ESTIMATED DAILY CAPACITIES OF ROADWAY TYPES*, illustrates the estimated daily capacities of the various roadway types in the study area. These capacities are derived from INCOG and are normally for urban metropolitan areas. ODOT has estimated the capacity rate for 2-lane undivided collectors in rural areas at 7,200 vpd.

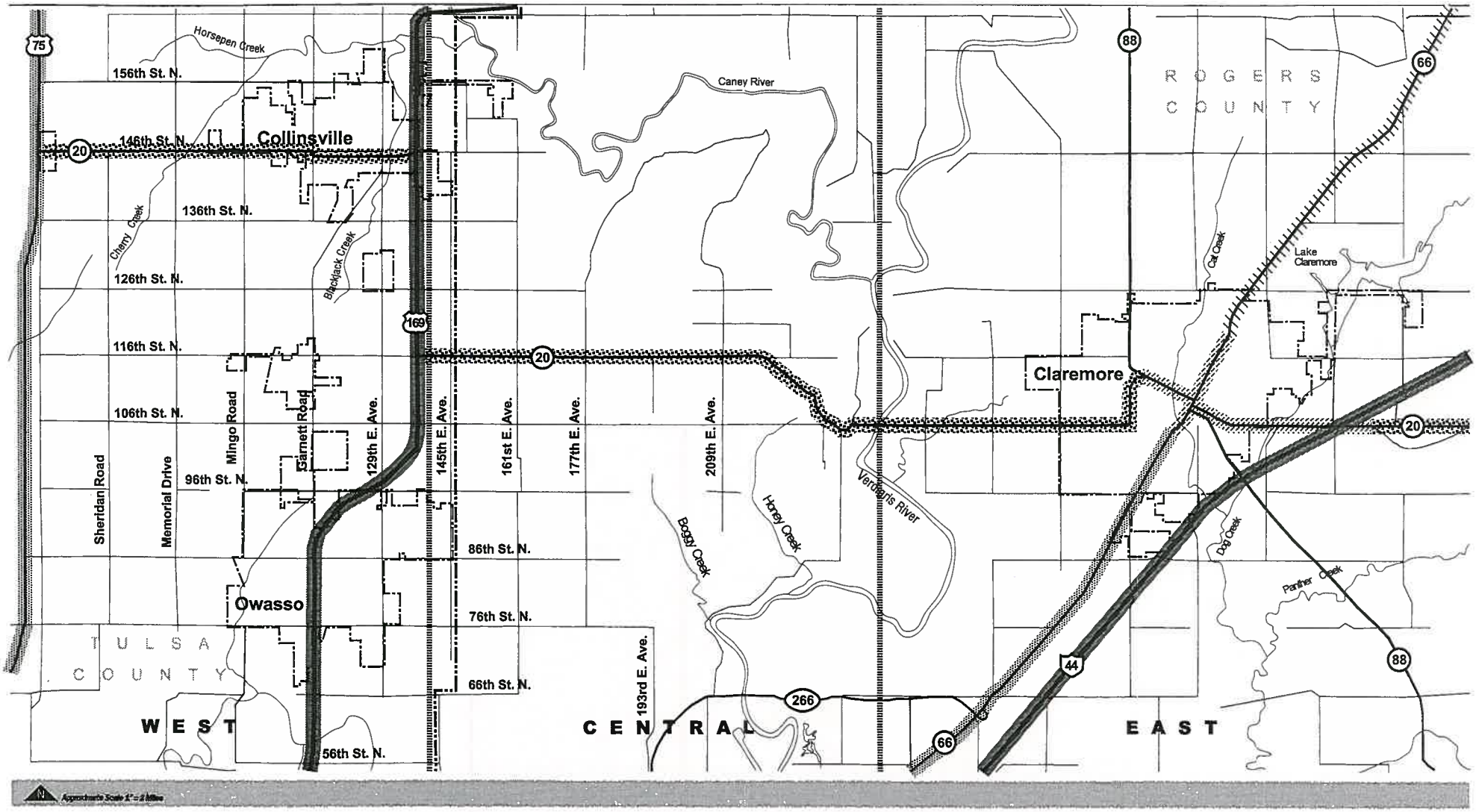

Figure B2 **State Highway 20 Corridor Transportation System**

- 2-Lane Undivided
- 4-Lane Undivided
- 4-Lane Divided
- 4-Lane Controlled-Access

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Table B2
ESTIMATED DAILY CAPACITIES OF ROADWAY TYPES
State Highway 20 Corridor Study

Number of Lanes	Functional Classification	Access Control	Estimated Capacity
4-lane	Freeway	Fully Controlled (no turns)	52,000 vpd
6-lane	Divided Arterial	Restricted Left-Turns Only	38,000 vpd
4-lane	Divided Arterial	Restricted Left-Turns Only	26,000 vpd
5-lane	Undivided Arterial	Uncontrolled (turns permitted)	24,000 vpd
4-lane	Undivided Arterial	Uncontrolled (turns permitted)	22,000 vpd
2-lane	Undivided Collector	Uncontrolled (turns permitted)	10,000 vpd

Source: Indian Nations Council of Governments, 1997.

Need for Action

When transportation demand in the form of traffic volume exceeds supply in the form of transportation system capacity, performance suffers. Performance is discussed below in terms of two principal indicators: congestion and accident experience.

Congestion

Congestion occurs when traffic volumes on a roadway approach the capacity of the roadway. Congestion is measured by a qualitative measure known as Level of Service (LOS). Level of Service can be used to describe general operating characteristics along long segments of a roadway or at specific intersections. Level of Service describes the general operating conditions of a roadway at peak travel periods and is directly related to the traffic volume to capacity ratio or the duration of delay. Level of Service is given a letter designation from A to F, with LOS A representing very good operating conditions and LOS F representing very poor operating conditions with lengthy delays and heavy congestion. As a practical consideration, LOS D is generally considered the limit of acceptable operations, with LOS C or better the desirable condition.

Table B3 shows the results of an intersection LOS analysis for each of the intersections for which ODOT collected turning movement counts in Fall 1997.

Table B3
INTERSECTION LEVEL OF SERVICE (LOS)
State Highway 20 Corridor Study

Location	Signalized or Unsignalized	Existing Traffic A.M. Peak	Existing Traffic P.M. Peak	2020 No-Build A.M. Peak	2020 No-Build P.M. Peak
SH 20 at US 75 Southbound Ramps	Unsignalized	A	A	A	A
SH 20 at US 75 Northbound Ramps	Unsignalized	A	C	A	F
116th Street (SH 20) at US 169 Southbound Ramps	Unsignalized	A	A	A	A
116th Street (SH 20) at US 169 Northbound Ramps	Unsignalized	A	A	A	B
106th Street at US 169 Southbound Ramps	Unsignalized	A	A	A	A
106th Street at US 169 Northbound Ramps	Unsignalized	A	A	A	A
Will Rogers Blvd. (SH 20) at J.M. Davis Blvd.	Signalized	C	E	F	F
Will Rogers Blvd. (SH 20) at Lynn Riggs Blvd. (SH 66)	Signalized	D	F	F	F
Patti Page Blvd. (SH 20) at Lynn Riggs Blvd. (SH 66)	Signalized	B	C	E	F
Patti Page Blvd. At J. M. Davis Blvd.	Unsignalized	B	B	D	E
SH 20 at Interstate 44 Entrance	Unsignalized	A	A	C	F

Source: INCOG Travel Demand Model expanded by Wilbur Smith Associates, 1998.

At each of the unsignalized intersections, stop sign traffic controls provide acceptable LOS. These favorable conditions are due in part to the fact that SH 20 has already been upgraded to a 4-lane cross-section with left-turn lanes in each of these areas. At US 75 and at Interstate 44, traffic conditions are expected to deteriorate to LOS F for northbound left-turns onto SH 20 by 2020. These deficiencies will probably be able to be corrected by installing traffic signals.

Traffic delays at the junction of SH 20 and SH 66 in Claremore are substantially more severe. During the afternoon peak hour, the intersections of Will Rogers Boulevard with J. M. Davis and Lynn Riggs Boulevards currently operate at unacceptable LOS E or F. By 2020, conditions are expected to worsen substantially, deteriorating beyond

the capabilities of the recently installed signals to maintain safe and efficient traffic flow.

The INCOG travel demand model also provides measures of effectiveness describing the existing and future general performance of the road network throughout the study area. Measures of effectiveness (MOEs) include the total daily vehicle-miles of travel (VMT) driven by all vehicles in the area on an average day, and the total daily vehicle-hours of travel (VHT) representing the total time spent driving in the study area on a typical day. The average travel speed in miles per hour (m.p.h.) is the VMT divided by the VHT. Measures of effectiveness may be calculated for the entire Tulsa Metropolitan Area road network or any part of it. Table B4, entitled *MEASURES OF EFFECTIVENESS*, presents the MOEs for SH 20 and the study area as a whole.

Table B4
MEASURES OF EFFECTIVENESS
State Highway 20 Corridor Study

	Existing Traffic	2020 Traffic	Percent Change
State Highway 20			
Vehicle-Miles of Travel (VMT)	163,500	246,000	50%
Vehicle-Hours of Travel (VHT)	3,400	7,200	109%
Average Speed (VMT/VHT)	47.8	34.4	-28%
Total Study Area			
Vehicle-Miles of Travel (VMT)	778,000	1,141,600	47%
Vehicle-Hours of Travel (VHT)	15,800	26,800	69%
Average Speed (VMT/VHT)	49.2	42.7	-13%

Source: INCOG Travel Demand Model expanded by Wilbur Smith Associates, 1997.

Although the total mileage traveled is projected to increase at about the same rate on SH 20 as on the rest of the road network in the study area, the time spent driving on SH 20 is expected to more than double while that on other roads increases at a slower rate. Average speed on SH 20 is projected to decline at more than twice the rate of the road network as a whole between now and 2020.

Projected deterioration of levels of service and measures of effectiveness between now and 2020 both indicate a need for capacity-enhancing improvements in the SH 20 corridor. SH 20 currently operates at or near capacity in Collinsville, in Claremore,

and near Owasso. Increasing commuter traffic is expected to result in larger areas of congestion and longer travel times.

Accident Experience

The Oklahoma Department of Transportation maintains records of all traffic accidents that occur along highways under its jurisdiction. These records are used to identify locations on the roadway network with excessively high accident rates or other safety problems. Table B5, entitled *ACCIDENT SUMMARY (1994-1996)*, summarizes accident experience over the most recent three (3) years for which data is available. In the last three (3) years, there have been 380 accidents along SH 20 in the study area, with more than three (3) out of four (4) accidents in the Claremore area. Forty percent of accidents resulted in personal injury. There were three (3) fatalities on SH 20 during this period.

Table B5
ACCIDENT SUMMARY (1994-1996)
State Highway 20 Corridor Study

	West Sub-Area	Central Sub-Area	East Sub-Area	Total Study Area
Fatal Accidents	0	1	2	3
Injury Accidents	20	18	111	149
Property Damage Only	19	26	183	228
Total Accidents	**39**	**45**	**296**	**380**
Fatalities	0	1	2	3
Injuries	46	30	200	276

Source: Oklahoma Department of Transportation, 1997.

Table B6, entitled *ACCIDENT RATE SUMMARY (1994-1996)*, shows how accident rates on segments on SH 20 compare to statewide averages of other Oklahoma highways with similar characteristics. Every segment of SH 20, except the segment it shares with 4-lane divided US 169, has an accident rate higher than the statewide average for at least one (1) type of accident. In addition, when accidents happen along SH 20, they tend to be more severe than on most other roads. The portion of SH 20 along Will Rogers and Patti Page Boulevards through Claremore experienced more than six (6) times as many injury accidents as similar urban 4-lane roadways throughout the state. Rural

portions of SH 20 west of Collinsville and between Claremore and US 169 experienced more than three (3) times as many injury accidents as similar rural 2-lane roadways throughout the state.

Table B6
ACCIDENT RATE SUMMARY (1994-1996)
State Highway 20 Corridor Study

Segment	Accidents	SH 20 Segment Accident Rate	State Average Accident Rate	Rate Ratio
Fatal Accidents				
US 75 to	0	0.0	3.0	0.0
Mingo Road to	0	0.0	1.9	0.0
US 169 to	0	0.0	1.1	0.0
116th Street to	2	9.3	3.0	**3.1**
Club House Road to	0	0.0	1.9	0.0
Will Rogers Boulevard to	0	0.0	1.3	0.0
J.M. Davis Boulevard to Interstate 44 Entrance	1	33.1	1.0	**33.0**
Injury Accidents				
US 75 to	11	167.4	49.0	**3.4**
Mingo Road to	9	128.4	102.6	**1.3**
US 169 to	2	11.8	18.9	0.6
116th Street to	38	176.9	49.0	**3.6**
Club House Road to	10	256.0	102.6	**2.5**
Will Rogers Boulevard to	41	825.9	128.8	**6.4**
J.M. Davis Boulevard to Interstate 44 Entrance	38	1,258.3	183.6	**6.9**
Property Damage Only Accidents				
US 75 to	10	152.2	104.0	**1.5**
Mingo Road to	9	128.4	276.1	0.5
US 169 to	7	41.2	46.9	0.9
116th Street to	33	153.6	104.0	**1.5**
Club House Road to	15	383.9	276.1	**1.4**
Will Rogers Boulevard to	88	1,772.8	346.0	**5.1**
J.M. Davis Boulevard to Interstate 44 Entrance	66	2,185.4	495.1	**4.4**

Note: Accident Rates are Expressed in Accidents per 100,000,000 Vehicle-Miles Traveled.
Source: Oklahoma Department of Transportation, 1997.

Because of the high accident rates along SH 20 in the study area, the Oklahoma Department of Transportation has designated the study segment as a "critically high crash-rated segment." Notoriety as a "critically high crash-rate segment" indicates that a highway segment ranks among a small minority of the least safe highways in the state in terms of accident experience. The conditions along SH 20 are especially serious due to the large factors by which more severe accident types exceed statewide average rates, as compared to the less severe accident types.

The high number of accidents along SH 20 can be primarily attributed to high traffic volumes, congestion, and roadway geometric deficiencies, such as sharp curves, skewed intersections, etc. When roadways operate in congested conditions, the risk of collisions increases because vehicles travel closer together, have less freedom for accident avoidance, and provide fewer opportunities for drivers to conduct maneuvers, such as left turns, right turns, and lane changes, as safely as would be possible in less congested conditions. Improvements that increase capacity and correct substandard roadway geometric conditions would eliminate some of the factors that contribute to the serious accident experience in the SH 20 corridor.

Facility Requirements

SH 20, from US 169 to Salina, Oklahoma, has been identified in the 1995 Oklahoma Statewide Intermodal Transportation Plan as a Transportation Improvement Corridor. This designation means it is recommended to acquire 4-lane right-of-way whenever reconstructing these facilities, even if traffic justifies building only 2-lane facilities. This protects the right-of-way from development and will allow the construction of a 4-lane facility when future traffic volumes dictate. In the SH 20 study area, future traffic volumes warrant the entire 4-lane construction at this time.

The Oklahoma Department of Transportation and the American Association of State Highway and Transportation Officials have established geometric design criteria to safely and efficiently accommodate forecasted traffic demand and anticipated levels of service. Within the rural areas of the Study Corridor, the geometric design of the highway would include 4-lanes separated by a median, a design speed of approximately 70 miles per hour, and a maximum grade of 3 percent. Driveways would be allowed throughout the highway, but median openings would be spaced at approximately every half-mile.

Should the preferred route be a bypass alternative of Collinsville or Claremore then purchase of right-of-way for a fully controlled access facility would be implemented. Initially, only the mainline would be constructed, which would consist of 4-lanes

separated by a median, a design speed of about 70 miles per hour, and a maximum grade of 3 percent. In the future, when traffic justifies, frontage roads and interchanges could be constructed. This would protect the corridor for future highway improvements and appropriate land use planning by purchasing right-of-way and access rights for an ultimate fully controlled access facility.

Within the urbanized areas of Collinsville and Claremore along the existing highway facility, the geometric design would have a design speed of approximately 40 miles per hour, except in the central business districts. The highway improvements would include 4- or 5-lanes undivided, depending on location. The 4-lane alternative would allow some on-street parking, but 5-lanes would not allow parking.

Conclusion/Purpose and Need Statement

The Summary of Public Comments for the *2020 Foresight* plan reports that widening of SH 20 is the third most-requested transportation improvement in the Tulsa Metropolitan Area. In addition to the presence of substandard roadway geometric conditions, congestion and accident experience both indicate a need for changes that improve mobility in the SH 20 corridor. Highway improvements are the most reasonable option for improving mobility in the SH 20 corridor. Unless additional east-west capacity is created in the study area, traffic volumes, congestion, travel times, and accident rates will continue to increase between now and 2020.

Therefore, the goal of this study is to provide an improved state highway that meets the need of safely and efficiently accommodating the existing and future traffic demand within the study corridor of this growing suburban area. Traffic need is defined as not only the number of vehicles but also the most economical and improved network possible for transporting people, commerce, and communities.