

City of Chelan

Traffic Circulation Enhancement Study

Prepared for:
City of Chelan

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Introduction

Significant growth is anticipated to occur in the City of Chelan and the surrounding areas over the next 20 years. Much of the growth is the result of increased tourism and the numerous seasonal and recreational opportunities that exist around Lake Chelan. Due to the geographical constraints of the lake, slopes, and location of development, opportunities to provide new roadway or multi-modal connections are becoming limited, so efforts must be made to enhance the existing transportation infrastructure, while at the same time, evaluating possible future connections.

The Chelan Traffic Circulation Enhancement study was performed to develop traffic forecasts, analyze future traffic operations, and identify needed transportation alternatives to improve safety and mobility within the central core area of the City. The study evaluates several improvement alternatives and provides recommendations on the preferred alternative based on a set of evaluation criteria and the City's long-term objectives.

The study contains a technical analysis of existing and future transportation conditions and consists of the following elements: inventory of existing traffic conditions; traffic forecasting based on future land use and historical growth rates; identification and evaluation of several long-term improvement alternatives; and a summary of the findings and discussion of the recommended improvements.

Project Approach

The approach to completing the study involved several key steps. These steps included:

1. **Community and Agency Input:** Meetings with community stakeholders and the general public to identify key transportation issues and to obtain feedback on the identified improvement alternatives.
2. **Data Collection:** Collected and summarized existing land use and traffic data.
3. **Evaluation of Existing Traffic Conditions:** Evaluated existing traffic conditions and travel patterns.
4. **Identify Existing Deficiencies:** Identified locations in need of improvement.
5. **Develop Traffic Forecasts:** Developed traffic forecasts using historical traffic volumes and future development patterns.
6. **Evaluate Traffic Forecasts:** Evaluated future traffic conditions and travel patterns based on land use growth assumptions.
7. **Identify Future Needs:** Identified locations in need of improvement in the future based on forecast traffic volumes.
8. **Identify and Evaluate Improvement Alternatives:** Generated multiple improvement alternatives and evaluated each alternative to identify its impacts.
9. **Provide Improvement Project Recommendations:** Provided a final report summarizing the findings and recommendations of the study.

Study Area

This analysis focused on the central core area of the City of Chelan. Figure 1 details the extents of the study area. The study area includes the central business district of Chelan, US 97A from Navarre

Street to just west of the intersection with Woodin Avenue and Webster Avenue, and SR 150 from the US 97A junction to Gibson Avenue. Special attention was given to both SR 150 and US 97A within the CBD and along the lakeshore. The other major corridors that were evaluated in detail were Woodin Avenue and Columbia Street.

Public Involvement

The Traffic Circulation Enhancement Study implemented a public involvement process to solicit input from local agencies, jurisdictions, downtown property and business owners, downtown organizations, and the general public to help identify transportation issues and needs in downtown Chelan. The process was also used to review and obtain feedback on the proposed alternatives. The public involvement process was initiated at the beginning of the study process, prior to developing any improvement alternatives.

The public involvement process involved several components, as described below:

Project Steering Committee

A Project Steering Committee was formed that contained City staff, elected officials, and representatives of surrounding agencies and organizations. Three committee meetings were held to discuss existing transportation issues, provide feedback on the study objectives, develop evaluation criteria, and identify and review improvement alternatives. The committee members included representatives from the following organizations:

- City Staff
- City Council
- Chelan County
- WSDOT
- North Central RTPO
- Chamber of Commerce
- Chelan County PUD
- Port of Chelan
- Lake Chelan School District

Public Open Houses

Three public open houses were held over the course of the project. The meetings were scheduled and designed to provide opportunities for public comment and discussion on major elements of the project. Advance public notice was provided using available formats and methods such as announcements in the local newspaper, local radio interviews, and personal invitations to area property and business owners.

The first open house was held in February 2005 to share with the public the purpose of the project and to discuss possible improvements that would be analyzed. A second open house was held in April 2005 to review the results of the alternatives analysis and to brainstorm other possible solutions. A final meeting was held in October 2005 to review the recommended improvements and obtain public acceptance before taking the recommendations to City Council.

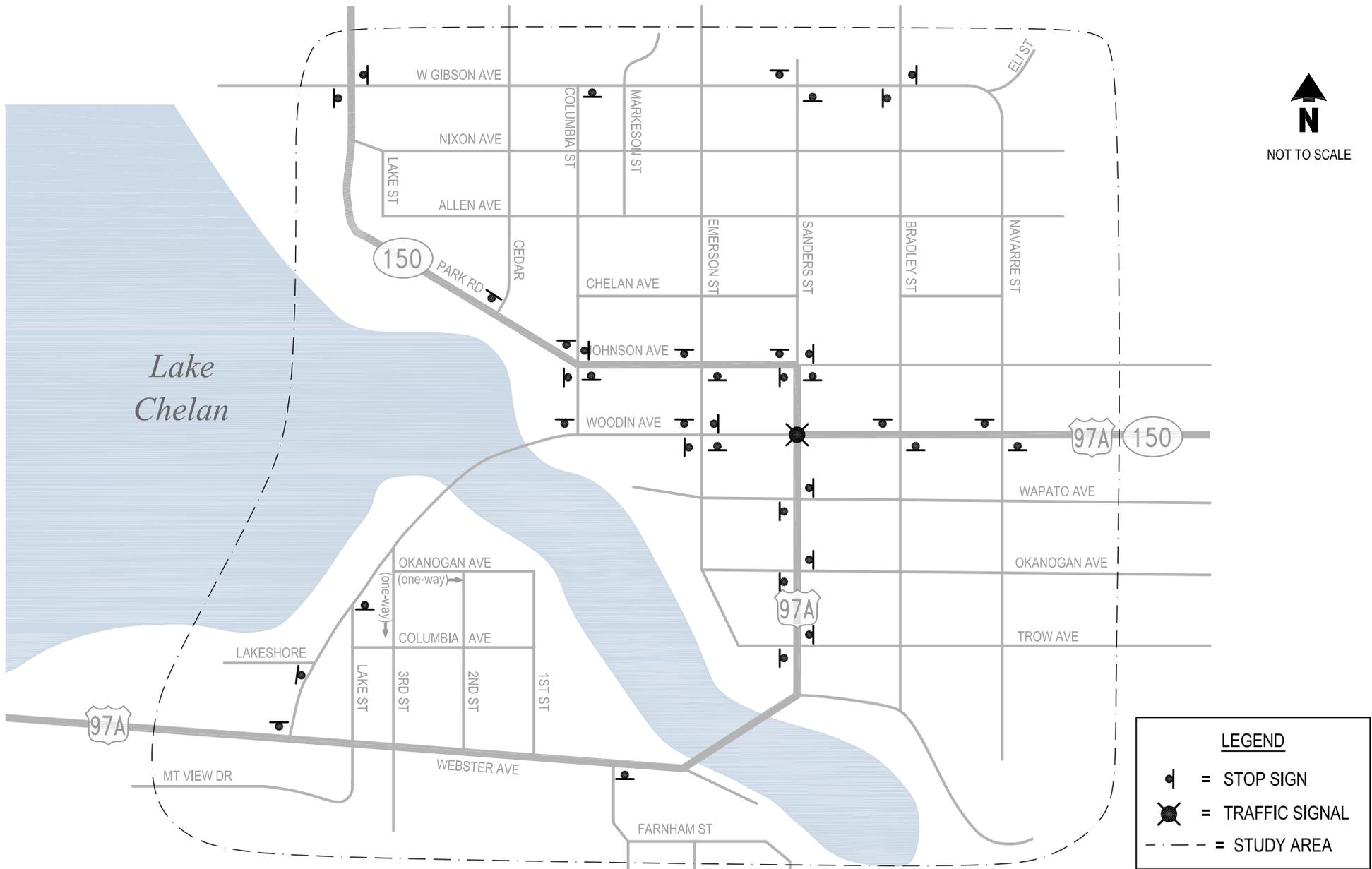


Figure 1
 Existing Study Area and Traffic Control
 Chelan Traffic Circulation Enhancement Study

Identified Issues and Concerns

Based on the comments received at the Project Steering Committee and public open house meetings, a list of issues and concerns was prepared. The main issues that were identified by the committee members and the general public included:

- Improvements of multi-modal transportation facilities
- Need for alternate route through downtown
- Lack of pedestrian and bicycle facilities along Park Road/SR 150/Manson Highway
- Coordination of improvements with the Lakeside Trail project
- Seasonal variations in traffic volumes
- Seasonal traffic congestion
- Intersection delays at Woodin/Columbia and Johnson/Columbia
- Need for additional parking
- Vehicle queuing along Woodin Avenue Bridge
- Traffic safety at the Emerson/Johnson intersection
- RV blocking issues along Park Road/SR 150/Manson Highway
- Business and driveway access along Park Road/SR 150/Manson Highway
- Impacts of expected development within and outside the City
- Traffic impacts of proposed Wal-Mart store
- Traffic circulation within the CBD
- Reduction of speed limits in the CBD
- Increased truck and RV traffic
- Transportation improvements should promote economic development within the City and Chelan Valley

Summary of Ideas Discussed

As a result of the Project Steering Committee meetings and public open houses, many ideas were discussed. These ideas generally represented possible solutions or improvement project alternatives. Many of the ideas listed below then were reviewed as part of the analysis (changes to the study parameters are listed in italics).

1. What would happen if development increased beyond the assumed growth rates? *The study should incorporate higher growth assumptions into the analysis.*
2. Peak seasonal traffic is not the defining condition that must be designed for. *Review the "average traffic" conditions (a blend of peak and off-peak conditions).*
3. More homes will convert to year-round occupancy in the future and therefore the year-round vacancy rates will decrease. *As a result, traffic is estimated to grow at a higher rate than the actual land use growth.*
4. What happens if Woodin Avenue is converted to a pedestrian only street from Columbia to Emerson? *Provided as alternative analysis.*
5. What happens if Columbia Street is closed from Woodin to Columbia? *Provided as alternative analysis.*
6. Oversize vehicle signage should be displayed along SR 97A (eastbound and westbound) and SR 150 to divert oversized vehicles from the downtown area.
7. The Campbell's delivery area should be relocated to eliminate vehicles blocking travel ways or pedestrian/bicycle paths.
8. The possible alternate route should include Columbia to Nixon or Gibson.
9. Alley accesses in the downtown area should be restricted to one way traffic and be used only for deliveries.

10. Alley accesses in the downtown area should be restricted to pedestrians only.
11. Phase the alternatives over time to lessen impacts to the community.
12. Review feasibility of a traffic signal at the intersection of SR 150 and Gibson Street if the alternate route is constructed.
13. Direct/restrict all North Shore traffic to the alternate route (will require enforcement). RV traffic will still be directed along Park Road/SR 150.
14. At SR 150 and Gibson provide a free right turn lane on westbound Gibson and an acceleration lane on SR 150 for merging traffic.
15. Designate the proposed alternate route as a truck route.
16. At the Johnson and Emerson intersection:
 - Consider 3 lanes on Johnson with a median pedestrian refuge.
 - Does this intersection warrant a signal?
 - Possible 4-way-stop with median pedestrian refuge.
 - Evaluate the possibility of a Roundabout. *Provided as
alternative analysis.*
17. What would be the impact of temporary street closures to traffic operations? *Provided as
alternative analysis.*
18. Designate Navarre to Gibson as the westbound alternate route to SR 150.
19. Provide a westbound right turn lane from SR 150/97A to Navarre.
20. Reduce speed limits within the downtown area.
21. Consider only a 4 feet wide bikeway along the Lakeside Trail – do we really need 12 feet?
22. Evaluate signal improvements at the intersection of Sanders and Woodin – protected left turn movements.

Existing Traffic Conditions

This section describes the existing roadways and traffic conditions in the City of Chelan. Understanding existing traffic conditions and travel patterns is essential for conducting an accurate and meaningful analysis. The existing travel patterns provide a foundation on which future assumptions are made and traffic forecasts are built. The existing traffic conditions also help to identify current and potential locations needing improvement. Following are descriptions of an average Weekday and Friday, PM peak hour traffic conditions, as well as a summary of the existing improvement needs in the study area.

Description of Area Roadways

The transportation system in the City of Chelan is primarily comprised of residential streets, arterials, and state highways. Many of the roadways provide sidewalks for pedestrians and on-street parking. The following section describes these roadways in greater detail and discusses their function within the City of Chelan.

State Routes

US 97A is Chelan's primary transportation connection to adjacent counties of Chelan, Okanogan, and Douglas. It also provides the primary connection to the communities along the west side of the Columbia River between Chelan and Wenatchee. The highway serves the regional economy by carrying through truck traffic and tourists from the south and east.

SR 150 (Johnson Avenue/Park Road/Manson Highway) connects to the mainline of US 97A and serves residential and recreational areas north and west of the City. The Washington State Department of Transportation (WSDOT) is responsible for the maintenance and operations of both SR 150 and US 97A in the study area. The State's priority for these roadways is the safe and efficient flow of people and goods through the study area, and not necessarily the circulation of traffic within the City of Chelan.

Central Business District Roadways

Johnson Avenue is a *Major Arterial* and is the primary east-west street in Chelan's CBD, carrying the highest traffic volumes. It is also referred to as SR 150 between Sanders Street and Columbia Street. The street carries four lanes of traffic within the CBD with parking and sidewalks on both sides of the street and left-turn pockets at Emerson. To the east of Sanders Street, the roadway serves both residential and school district traffic.

Woodin Avenue is a *Major Collector* and is a primary east-west street in Chelan's CBD, providing a primary connection to the southwest and US 97A via the Woodin Avenue Bridge. Within the CBD, Woodin Avenue serves as a circulation roadway with many pedestrian amenities to promote multi-modal uses and shopping at the small local retailers lining both sides of the roadway. The street contains diagonal parking, sidewalks and two travel lanes.

Columbia Street is a north-south street within the City of Chelan, connecting northern residential neighborhoods to the CBD and points south via Woodin Avenue. It serves as the primary connection between SR 150/Park Road and the Woodin Avenue Bridge.

Gibson Street is a *Minor Collector* east-west street serving the northern residential neighborhoods of Chelan. It provides a primary connection to points north and west via SR 150. The City of Chelan is responsible for the condition of this and other roadways in the CBD not under WSDOT jurisdiction.

A segment of **Sanders Street** (*Major Collector*) is designated as SR 150 north of Woodin Avenue and US 97A south of Woodin Avenue. Along with Columbia Street, it provides a primary north-south connection to the CBD and the residential areas to the north. Two to four travel lanes are provided for regional and local traffic. The roadway serves as the primary access across the Chelan River on the Dan Gordon Bridge and provides a key connection to the South Shore area. On-street parking is also provided along the corridor.

Emerson Street provides a secondary north-south connection with two travel lanes, diagonal parking and sidewalks on both sides of the street in the CBD. North and south of the CBD, Emerson Street carries local residential traffic.

Traffic Volumes

Existing traffic volumes in the City of Chelan were collected during August of 2004. The traffic data included average daily traffic counts (ADTs) and intersection PM peak hour turning movements at key locations within the study area. The counts were collected in August to account for the increased traffic in and around the City during the busy summer recreational season. Historical data indicates that the summer months have the highest traffic volumes within the City.

Average Daily Traffic Volumes

Average Daily Traffic (ADT) volumes were collected at four locations around the City of Chelan. These locations were on Park Road (SR 150) just north of Gibson Ave, US 97A east of Navarre Street, Woodin Avenue just south of the Woodin Avenue Bridge, and US 97A east of Farnham Street. Figure 2 illustrates the hourly volumes for each count location.

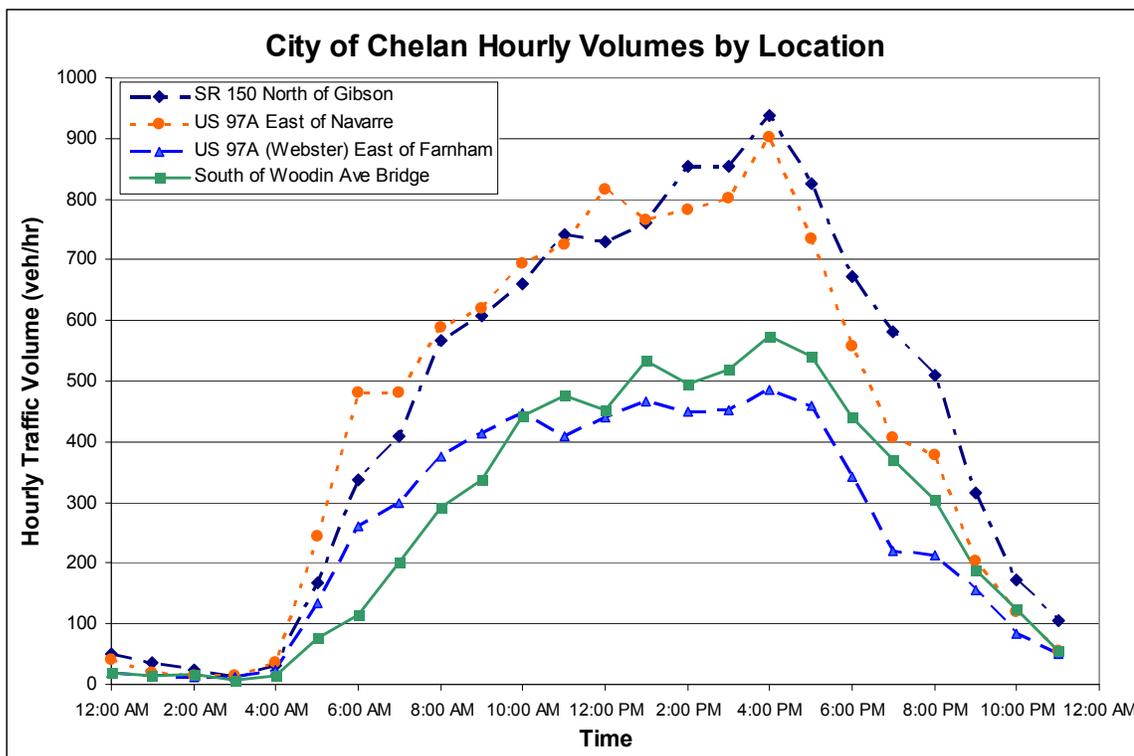


Figure 2. Hourly Variation of Traffic Volumes by Location

The daily traffic volumes indicate the SR 150 corridor typically has the highest number of vehicles as compared to the other state highway locations that were inventoried. The next highest daily count location was observed just east of Navarre Street along US 97A. Both locations represent traffic heading into and out of the Chelan CBD from the north and east. The Woodin Avenue Bridge and the Dan Gordon Bridge had the lowest daily traffic of all the daily count locations. These locations represented travel to and from the south shore of the lake.

Average Weekday PM Peak Hour Traffic Volumes

The daily traffic data indicates that the 4:00 to 5:00 PM time period had the highest traffic volumes at each count location. As a result, the weekday PM peak hour within the Chelan CBD occurs between 4:00 to 5:00 PM in the afternoon on a typical weekday. The peak hour is typically evaluated because it represents the time of day when traffic volumes are the greatest. Intersection turning movement counts for this timeframe were conducted on either a Tuesday, Wednesday, or Thursday to avoid influence from weekend travel patterns that may artificially inflate or decrease traffic volumes.

During a typical weekday PM peak hour, traffic volumes along segments of Woodin Avenue and US 97A carry up to 800 vehicles per hour. Sections of Park Road, Johnson Avenue, and Sanders Street (portions of SR 150) carry between 600 and 1,000 vehicles per hour in each direction. Other roadway segments in and around the study area carry less than 600 vehicles per hour. The PM peak hour traffic volumes within the study area are shown in Figure 3.

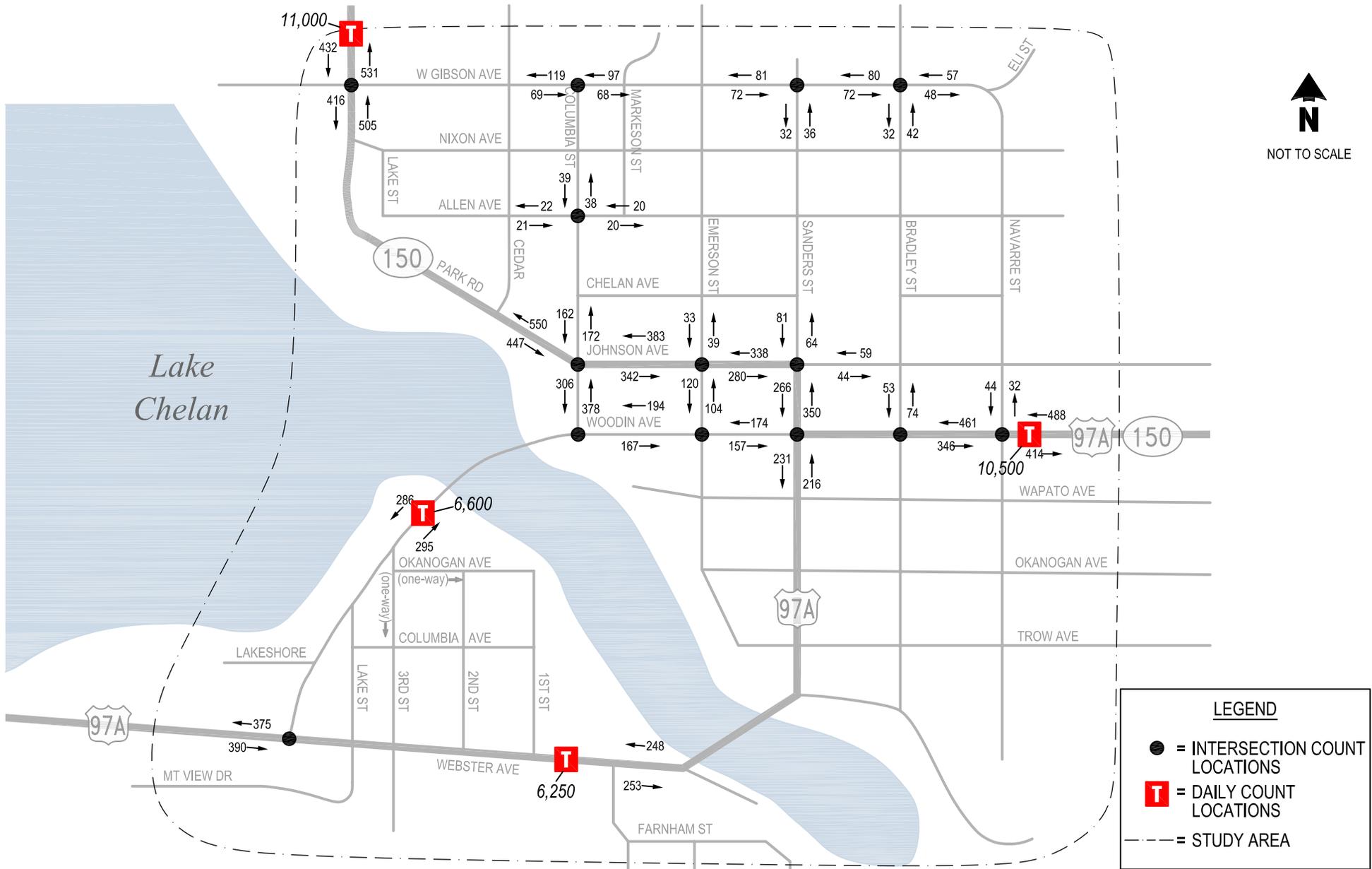
Average Friday and Seasonal PM Peak Hour Traffic Volumes

Based on data from the Woodin Avenue Bridge study, Friday PM peak hour counts were included in the analysis for comparison purposes. Where Friday traffic counts were not available, the weekday PM peak hour counts were adjusted to reflect the observed increase in traffic volumes on a Friday. The Friday traffic counts that were collected were noticeably larger than those taken on a Thursday. These counts revealed an 18 percent average increase in traffic volumes on the major routes in the City. This rate was applied to existing weekday PM peak hour volumes to estimate Friday PM peak hour traffic volumes for the operations analysis.

The Friday time period, combined with increased summer traffic, should provide a conservative estimate of traffic conditions in the City of Chelan associated with higher peak season traffic. The effect on traffic operations within the Chelan CBD from the increase in Friday and seasonal traffic volumes is discussed in the intersection operations analysis section.

CBD Travel Patterns

The City of Chelan is located at the intersection of two state highways (SR 150 & US 97A). It is estimated that many of the vehicle trips along both state highways travel through the City of Chelan and have endpoints external to the City. Table 1 illustrates the estimated number of weekday PM peak hour vehicle trips traveling through the CBD using either state highway route. These trips were calculated by tracing the percentage of through traffic along each route using the existing traffic count data. The estimated external travel patterns are illustrated in Figures 4, 5, and 6.



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Figure 3
2004 Daily & PM Peak Hour Traffic Volumes
Chelan Traffic Circulation Enhancement Study



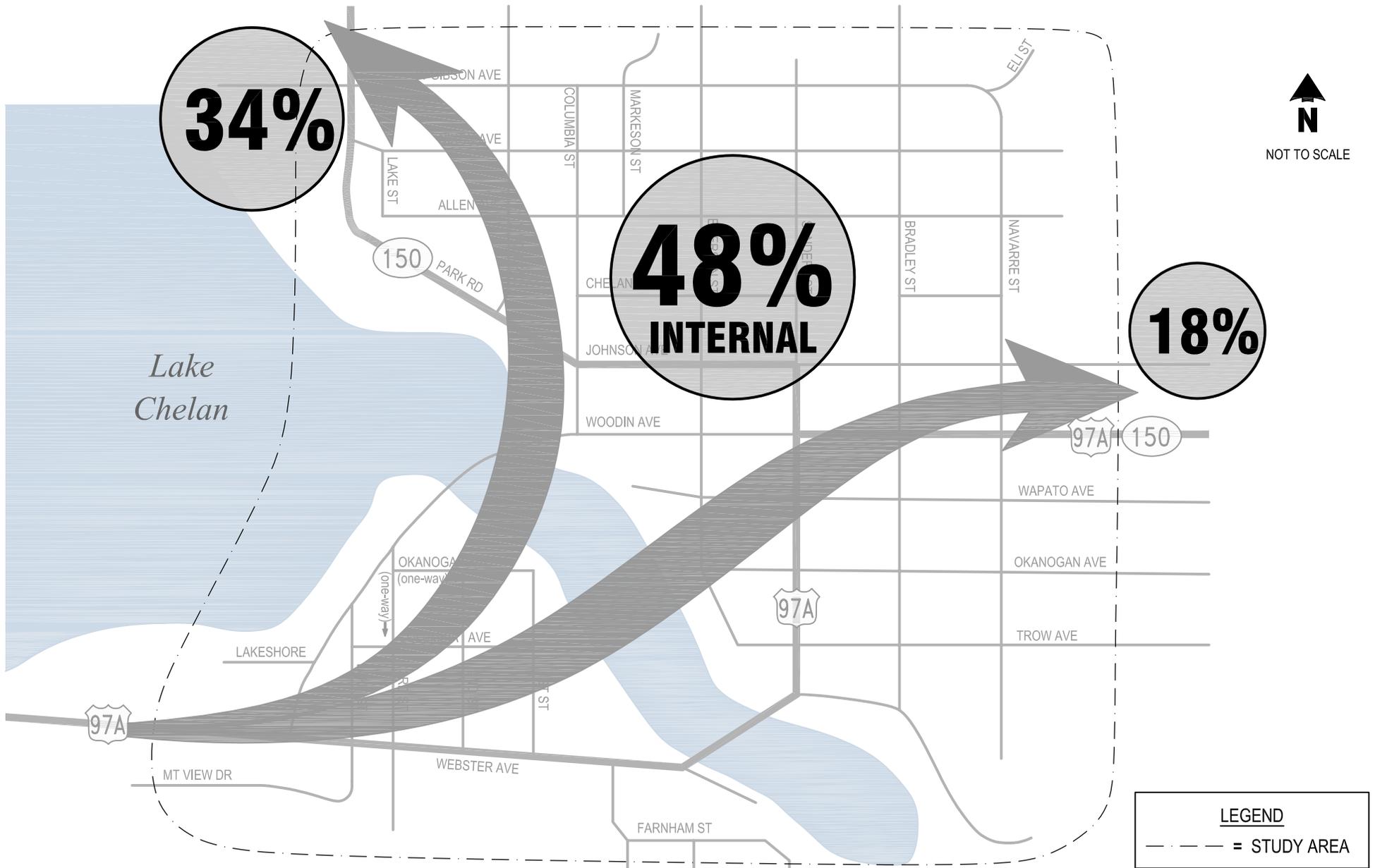
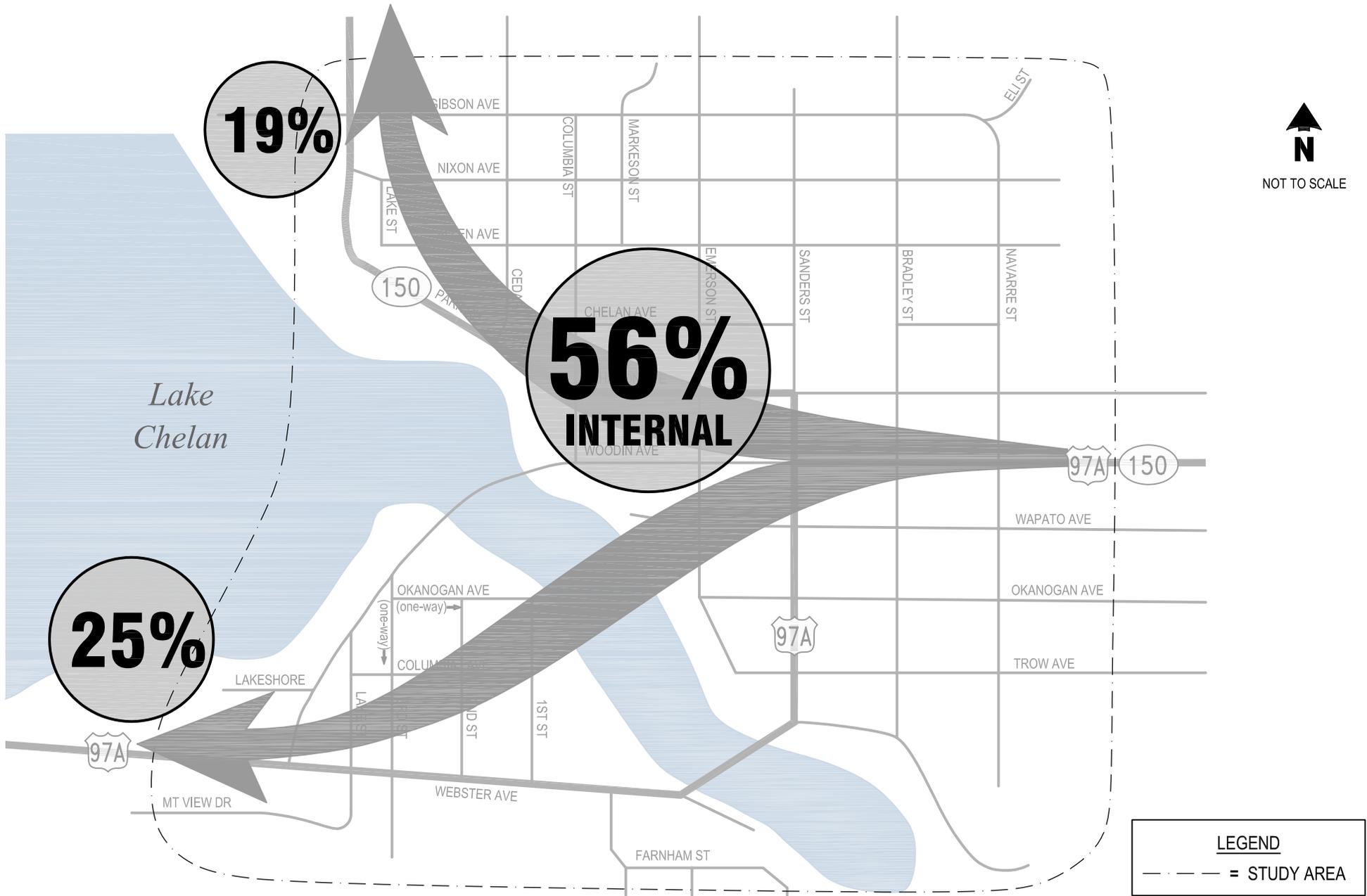


Figure 4

2004 Weekday PM Peak Hour External / Through Traffic - US 97A West

Chelan Traffic Circulation Enhancement Study



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Figure 5
 2004 Weekday PM Peak Hour External / Through Traffic - US 97A East
Chelan Traffic Circulation Enhancement Study



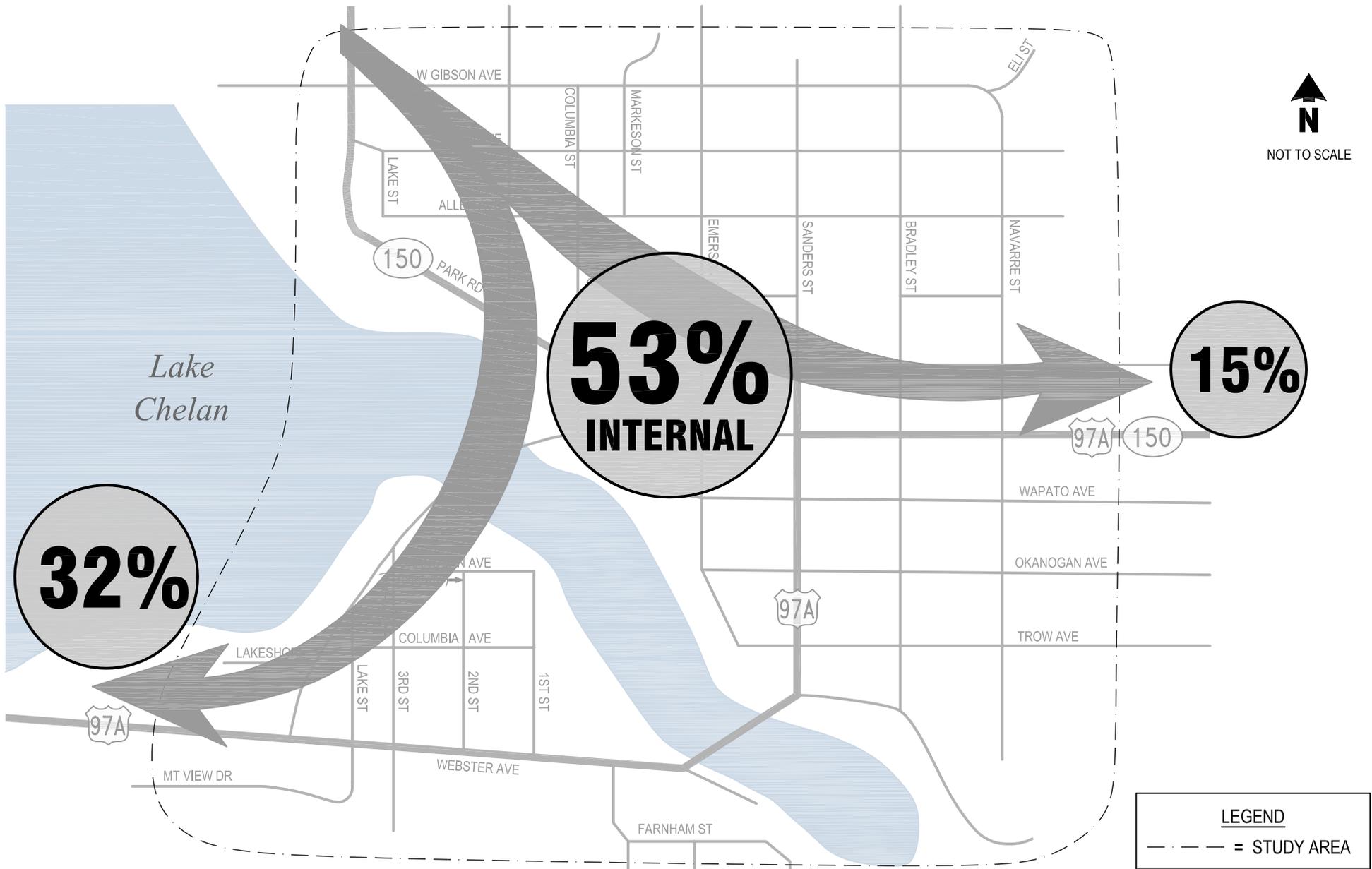


Figure 6

2004 Weekday PM Peak Hour External / Through Traffic - SR 150 North

Chelan Traffic Circulation Enhancement Study

Table 1. Estimated External Vehicle Trips Through Chelan's CBD

Origin	Destination	Percent Share of Origin	Estimated Through Vehicles ¹
US 97A - West	SR 150 North	34%	133
	US 97A East	18%	73
	Internal/Other	48%	184
US 97 - East	SR 150 North	19%	94
	US 97A West	25%	122
	Internal/Other	56%	272
SR 150 - North	US 97A West	32%	138
	US 97A East	15%	67
	Internal/Other	53%	227
Total Estimated Through Trips		48%	627

1. 2004 weekday PM peak hour traffic volumes.

As shown in Table 1, almost half of all vehicles entering Chelan during the weekday PM peak hour are through vehicle trips which do not begin or end within the study area. The remaining vehicle trips either begin or end within the study area. Approximately 56 percent of the vehicle trips entering the study area along US 97A at the eastern city limits are internal (have a destination within Chelan) to the study area. US 97A at the eastern city limits has the highest internal trip percentage with SR 150 at the northern city limits and US 97A at the western city limits having 53 and 48 percent internal trips, respectively. The existing travel patterns and amount of through traffic on each state highway was important to understand in order to develop estimates of future traffic volumes and review possible future roadway connections.

Intersection Operations

Intersection operations are evaluated based on the average delay experienced by motorists at an intersection. The average vehicle delay determines the intersection level-of-service (LOS). Results of the LOS evaluation provide a basis for determining where traffic operational deficiencies are occurring and what improvements might be necessary to improve operations. Intersection operations are described in terms of letter grades with LOS A representing good operation or little delay and LOS F representing very poor operation and high delays. A detailed explanation of LOS is included in Appendix A.

LOS Methodology and Adopted Standards

Intersection levels of service were evaluated for 14 study intersections based on procedures identified in the *2000 Highway Capacity Manual* (Transportation Research Board, 2000) and implemented with *Synchro 6.0* software. The HCM contains many methodologies and equations that analyze traffic conditions. The Manual is the industry standard in transportation research and its methodologies are widely used in the transportation field. Synchro 6.0 software is based on HCM methodologies and was used in the analysis of existing and future traffic conditions. The City of Chelan has adopted a LOS D standard for all intersections within the City as identified in their Comprehensive Transportation Plan.

Weekday PM Peak Hour Results

Existing weekday PM peak hour traffic operations are summarized in Table 2. Generally, the LOS analysis indicates there are no significant traffic operational deficiencies on an average weekday. All

intersections meet the adopted LOS standards. Each intersection is currently operating at an LOS C or better. Figure 3 illustrates 2004 weekday PM peak hour traffic volumes used in the analysis.

Friday PM Peak Hour Results

An LOS analysis was also conducted for seasonal Friday PM peak hour traffic conditions. The study intersections were evaluated using the increased seasonal Friday traffic volumes. The results of the Friday and weekday intersection operations analysis are provided in Table 2 for purposes of comparison.

Table 2. Chelan CBD Weekday and Friday PM Peak Hour LOS Comparison

Intersection	2004 Weekday			2004 Friday		
	LOS ¹	Delay ²	V/C ³ or WM ⁴	LOS	Delay	V/C or WM
Gibson Avenue/Park Road (SR 150)	B	14	WB	C	17	WB
Gibson Avenue/Columbia Street	A	10	NB	A	10	NB
Gibson Avenue/Sanders Street	A	9	NB	A	10	NB
Gibson Avenue/Bradley Street	A	10	WB	A	10	WB
Allen Avenue/ Columbia Street	A	10	WB	A	10	WB
Park Rd (SR150)/Johnson Ave/Columbia Street	C	20	EBR	E	37	EBR
Johnson Avenue (SR 150)/Emerson Street	C	18	NB	D	25	NB
Johnson Avenue (SR 150)/Sanders Street	B	13	NBL	C	15	NBL
Woodin Avenue (US 97A)/Bradley Street	C	18	SB	C	23	SB
Woodin Avenue (US 97A)/Navarre Street	C	16	SB	C	19	SB
Webster Avenue (US 97A)/Woodin Avenue	C	17	SBL	C	20	SBL
Woodin Avenue/Columbia Street	C	18	SBL	C	24	SBL
Woodin Avenue/Emerson Street	A	9	WB	A	10	WB
Woodin Avenue (US 97A)/Sanders Street	B	14	0.27	B	14	0.33

1. Level of service, based on 2000 Highway Capacity Manual methodology.

2. Average delay in seconds per vehicle.

3. Volume-to-capacity ratio reported for signalized intersections.

4. Worst movement reported for unsignalized intersections.

As Table 2 illustrates, average delay for the worst movement increases at all unsignalized intersections on Friday compared to a normal weekday. At the signalized intersection of Woodin Avenue/Sanders Street, average intersection delay improves slightly due to volumes increasing for a turning or through movement that operates very well. The all-way stop-controlled intersection of Johnson Avenue/Columbia Street is impacted by the increase in Friday traffic with the worst movement falling from LOS C to LOS E. The northbound approach at Emerson Street/Johnson Avenue also is noticeably impacted by the increased volume, but not to the extent that it needs immediate improvements based on current City policies.

Summary of Existing Deficiencies

According to LOS analysis of current traffic conditions, no immediate traffic circulation deficiencies exist during the weekday PM peak hour in Chelan's CBD. However, as mentioned previously, the intersection of Johnson Avenue/Columbia Street is especially impacted by the Friday increase in traffic. This intersection also serves as the connection between the two routes serving the South Shore (Woodin Avenue and Dan Gordon Bridges) as the major through routes in Chelan. As traffic volumes increase, this intersection will soon exceed capacity on average weekdays. A traffic signal is planned at this location as part of the City's TIP. This project will improve operations at the intersection.

Other Identified Issues

Other problem areas exist that are not addressed by standard engineering capacity analysis methods. The intersection operations analysis does not fully account for the interaction between closely spaced intersections, or sections of roadways. The LOS analysis provided assumes that each intersection is isolated. That is why LOS results should not be completely relied upon to identify a deficiency. The following list identifies other existing deficiencies not necessarily identified by the LOS analysis.

- Left-turns on and off of Park Road (especially RVs and boat trailers) cause operational and safety issues such as queuing and merging; interrupting the traffic stream. This is further aggravated by the many driveways along this section of roadway.
- The impact of pedestrian crossings on traffic operations, especially during peak times along SR 150. Several crossings along SR 150 occur at mid blocks and are not at intersections thereby creating a safety hazard. Conversely, as seasonal traffic and pedestrian volumes increase, the pedestrian/vehicular conflicts increase.
- Left-turns from Emerson Street onto Johnson Avenue are very difficult because of the width of the roadway, sight distance obstructed by parked vehicles, and high traffic volumes.
- Diagonal parking along Woodin Avenue interrupts traffic flow causing queuing, weaving, and other operational issues.
- The eastbound left-turn at the intersection of Columbia Street/Woodin Avenue has limited storage, that when exceeded can cause traffic to queue onto and across the Woodin Avenue Bridge.
- Queuing from all-way stop intersections on the state highways and major CBD arterials increases overall delay.

Land Use and Traffic Forecasts

The Traffic Circulation Enhancement Study was partially developed based on currently identified traffic issues, but was ultimately defined based on an evaluation of long-term traffic forecasts and development trends. To provide an understanding of the future transportation system needs within the central core area of the City, the study considered the needs of future land use growth.

Based on known historical traffic data, existing land use information, and known development activity, 20-year traffic forecasts were prepared to evaluate the improvement alternatives. The transportation improvement alternatives were identified based on an analysis of the future traffic volumes. The following section summarizes how the land use growth rates and traffic forecasts were developed. It also presents and discusses the resulting 20-year traffic volumes used in the analyses.

Land Use

Although the Traffic Circulation Enhancement Study focused on the central core area of the City, it took into account the existing and future land use on the north and south shores of Lake Chelan. Base year land use estimates were prepared using data compiled as part of the 2000 U.S. Census. This information was used as a base to measure and quantify the expected land use growth in the area. Future land use was estimated based on known and anticipated development activity. Data was provided by the City and County Planning Departments and was summarized by the number of residential plats expected to be permitted over the next 20 years. The land use information was reviewed by the Project Steering Committee and City staff for reasonableness.

Existing Land Uses

The Chelan CBD is generally located one to two blocks on either side of the Johnson and Woodin Avenue corridors. This area primary consists of many retail and commercial land uses. Sidewalks and well marked crosswalks exist in the CBD that provide safe pedestrian connections, especially along Woodin Avenue. Bulb-outs and curb extensions are also present in several locations, further enhancing pedestrian safety in the downtown core. Along the lakeshore, land is dedicated to resorts, park, marina, RV/campground, private residences, open space, and tourist activities. The Chelan CBD also is adjacent to the Chelan River and Riverwalk Park which borders both sides of the river from the Woodin Avenue Bridge to the Dan Gordon Bridge.

Outside of the CBD, other retail and commercial uses are interspersed throughout the single-family homes that border US 97A and SR 150. A fair amount of single-family homes in the Chelan area are seasonal homes, which are only occupied part of the year as a second home or vacation rental. This type of seasonal occupancy results in varying levels of traffic volumes throughout the year.

Archived data from the 2000 U.S. Census was used to approximate the number of existing households in the area and the average year round occupancy rate. Table 3 illustrates the total number of homes and corresponding occupancy rates for Year 2000 data. The data is summarized into three primary areas and focuses on residential land use only.

Table 3. 2000 U.S. Census Bureau Land Use Data

Region	Total Households	Occupied Households	Occupancy Rate
North Shore ¹	1,742	1,113	64%
South Shore ²	1,276	926	73%
East Chelan ³	833	729	88%

1. Census blocks generally east of Emerson Street and along the north shore of Lake Chelan.

2. Census blocks along south shore of Lake Chelan and southwest of Chelan River.

3. Northeast of Chelan River in Chelan County and generally east of Emerson Street.

The 2000 Census data in Table 3 indicates the north shore of Lake Chelan has the greatest number of existing households, but the lowest occupancy. This lower occupancy rate generally represents the large number of vacation homes and rental properties near Manson and Wapato Point. The area with the highest occupancy, but the least amount of existing homes, is the area east of the City.

Future Residential Development Trends

Development within and outside the City is expected to accelerate in the next several years as more homes and condominiums are built in the area. Planning data from the City of Chelan and Chelan County was provided to understand existing development trends. Each jurisdiction provided plat information over the last few years and their projections for the future.

The land use data provided by the City and County indicated that the number of new households is expected to increase 58 percent along the north shore, and approximately 73 percent along the south shore over the next 20 years. These future land use estimates are summarized in Table 4. The current occupancy rates are expected to increase slightly over the years as more seasonal residents “retire” to the area. This increase in occupancy has also been assumed as part of the future land use totals. As a result of the future land use data and assumptions, it is expected the annual growth rates along the north and south shores will be approximately 2.4 percent and 2.9 percent, respectively.

Table 4. Future Land Use Summary

Region	Existing		Occupancy	Household Growth	
	Households	Future Plats		20-Year Total ¹	Annual Rate
North Shore ²	1,742	1,015	64%	58%	2.4%
South Shore ³	1,276	935	73%	73%	2.9%

1. Future plats divided by existing households.

2. Census blocks generally east of Emerson Street and along the north shore of Lake Chelan.

3. Census blocks along south shore of Lake Chelan and southwest of Chelan River.

Commercial Activity

Commercial growth is likely to keep pace with the residential growth. For example, the Traffic Circulation Enhancement Study accounted for a new big-box retail center east of the City. The potential for more or larger retailers must be assumed because the increase in year-round residency will provide the demand for these types of commercial businesses. As a result, future traffic volumes were further increased, especially east of the City, to account for the expected growth in commercial activity.

Historical Traffic Data

The land use data that was assembled contained a “high level” synopsis of the general growth trends in the region. Since the data was not as detailed as is normally required when undertaking a traffic study, historical traffic data was also reviewed to check for reasonableness of the land use forecasts. As a result, traffic data from WSDOT historical traffic counts were reviewed to determine historical trends in traffic growth on both US 97A and SR 150 as they passed through the study area. Traffic counts dating from 1998 to 2004 were collected for eight locations along SR 150 and US 97A for the study.

Along US 97A, daily traffic volumes remained nearly constant in the late 90’s and through 2002. However, since Year 2003 a noticeable growth in traffic volumes has been recorded at count locations on the east side of town. The average yearly growth rate to the east over the last two years has been approximately 1.4 percent. However on the west side of town, the data indicates that no traffic volume growth has taken place over the last six years. Historical count data along SR 150

northwest of the City indicates an annual growth rate of approximately 1.8 percent per year. Table 5 summarizes the historical traffic count data. The traffic count growth rates shown in Table 5 were noted when determining the final annual growth rates used in developing the 20-year traffic forecasts.

Table 5. Historical Traffic Count Data (1998 to 2004)

State Route	Years of Data	Total Increase ¹	Annual Growth Rate
SR 150 - North Shore ²	5	500	1.8%
US 97A - South Shore ³	7	0	0.0%
US 97A - East of Town	7	300	1.4%

1. Increase in average daily traffic.

2. North of the lake and City of Chelan along SR 150.

3. South of the lake and City of Chelan.

The traffic count growth rates shown in Table 5 were noted when determining the final annual growth rates used in developing the 20-year traffic forecasts.

Estimated Annual Growth Rates

The final traffic volume growth rates used for each of the three external stations entering the central core area of Chelan are shown in Table 6. These growth rates are also illustrated graphically in Figure 7. The growth rates are a combination of the land use growth rates and the historical traffic count growth rates. The final annual growth rates were used to estimate Year 2024 traffic volumes along each roadway within the study area.

Table 6. Annual Growth Rates

External Station	Historical Traffic Count Growth Rate	Land Use Growth Rate	Final Annual Growth Rate
SR 150 - North Shore	1.8%	2.4%	2.7%
US 97A - South Shore	0.0%	2.9%	2.5%
US 97A - East of Town	1.4%	N/A	1.9%

Since traffic volumes were not increasing at the same rate as development along the south shore, the traffic volume growth rate was scaled back slightly to 2.5 percent from the future land use growth rate of 2.9 percent. Along the north shore, the traffic volume growth rate was increased due to the fact that more development is estimated to occur in that area. In addition, SR 150 provides the only access to this area, so the Project Steering Committee wanted the growth rate to be conservative. As a result, the final growth was increased from 2.4 percent to 2.7 percent.

The final annual growth rate used to develop the future traffic volumes range from 1.9 to 2.7 percent per year. Over 20 years, this is a cumulative increase in traffic volumes of approximately 50 to 80 percent. The total growth over 20 years represents a much larger increase in households than the area has ever experienced over the same time period.

Long-term (2024) PM Peak Hour Traffic Volumes

The annual growth rates at each external station to the study area were used as the basis to estimate Year 2024 PM peak hour traffic volumes. The existing traffic counts were increased using the final growth rates in Figure 7. The future traffic volumes were then assigned to the study area roadway network based on the existing travel patterns described in Figures 4 through 6. The resulting traffic forecasts are shown in Figure 8. Also included in the figure are the cumulative 20-year growth rates

along several of the key roadways. The resulting PM peak hour traffic forecasts were used in identifying and evaluating the long-term improvement projects.

The PM peak hour traffic along Park Road is estimated to have the highest overall growth in traffic of approximately 53 percent. The traffic volumes along the corridor are estimated to increase from 1,000 vehicles per hour (vph) in 2004 to just over 1,500 vph in 2024. East of Park Road/SR 150, along Johnson Avenue/SR 150, traffic volumes are also expected to rise considerably from 725 vph in 2004 to 1,080 by 2024. This represents a growth of approximately 49 percent.

Approaching the City along the south shore, US 97A is estimated to have a growth in traffic volumes of 40 percent, from 765 vph in 2004 to 1,140 vph in 2024. A large portion of that traffic is still projected to use the Woodin Avenue Bridge as the primary route into the City and towards the north shore. The PM peak hour traffic along the bridge is expected to increase by another 43 percent. The lowest growth in traffic volumes is expected to the east along US 97A. Traffic volumes are estimated to increase by 25 percent as US 97A heads out of town to the east.

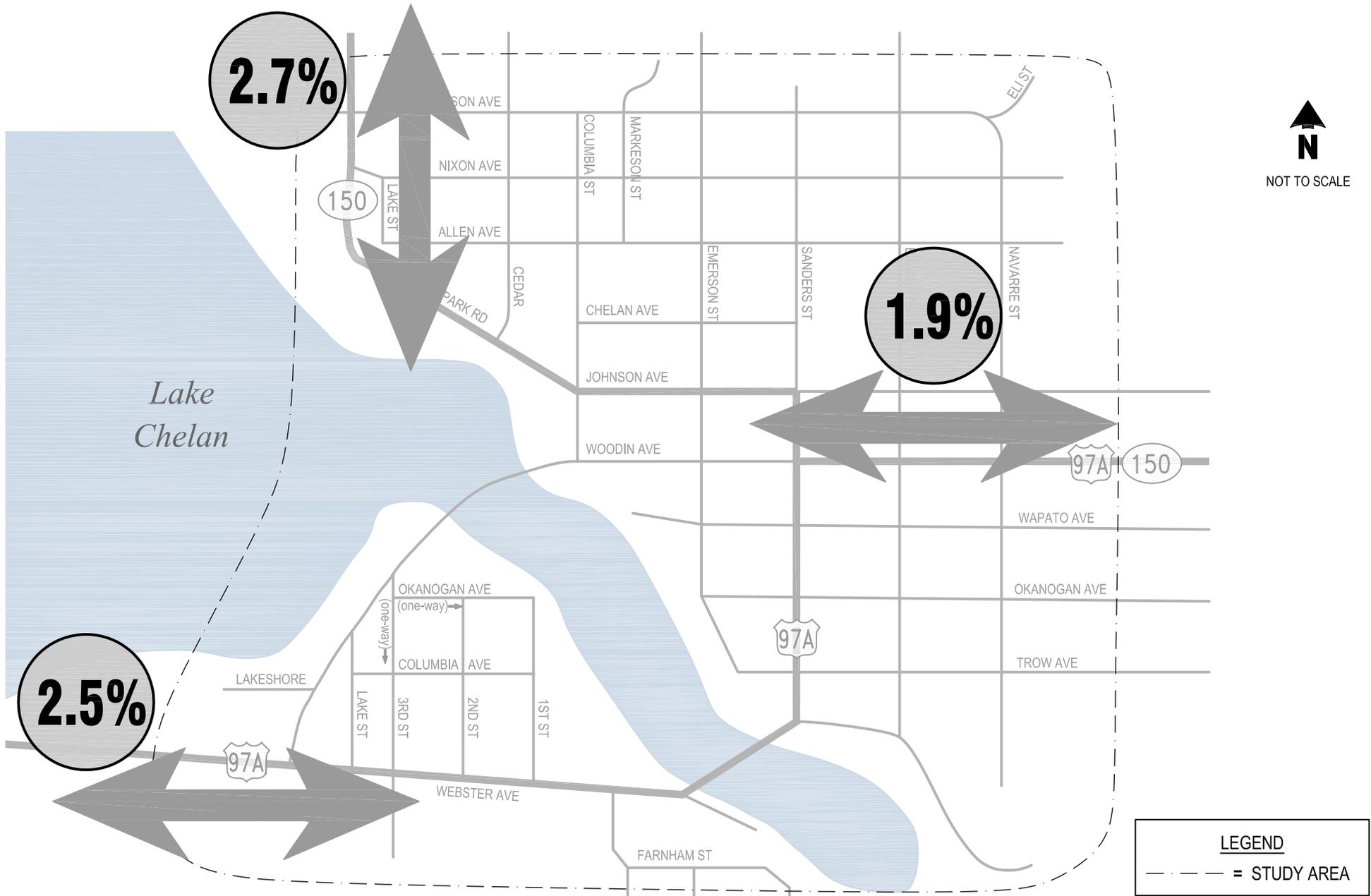
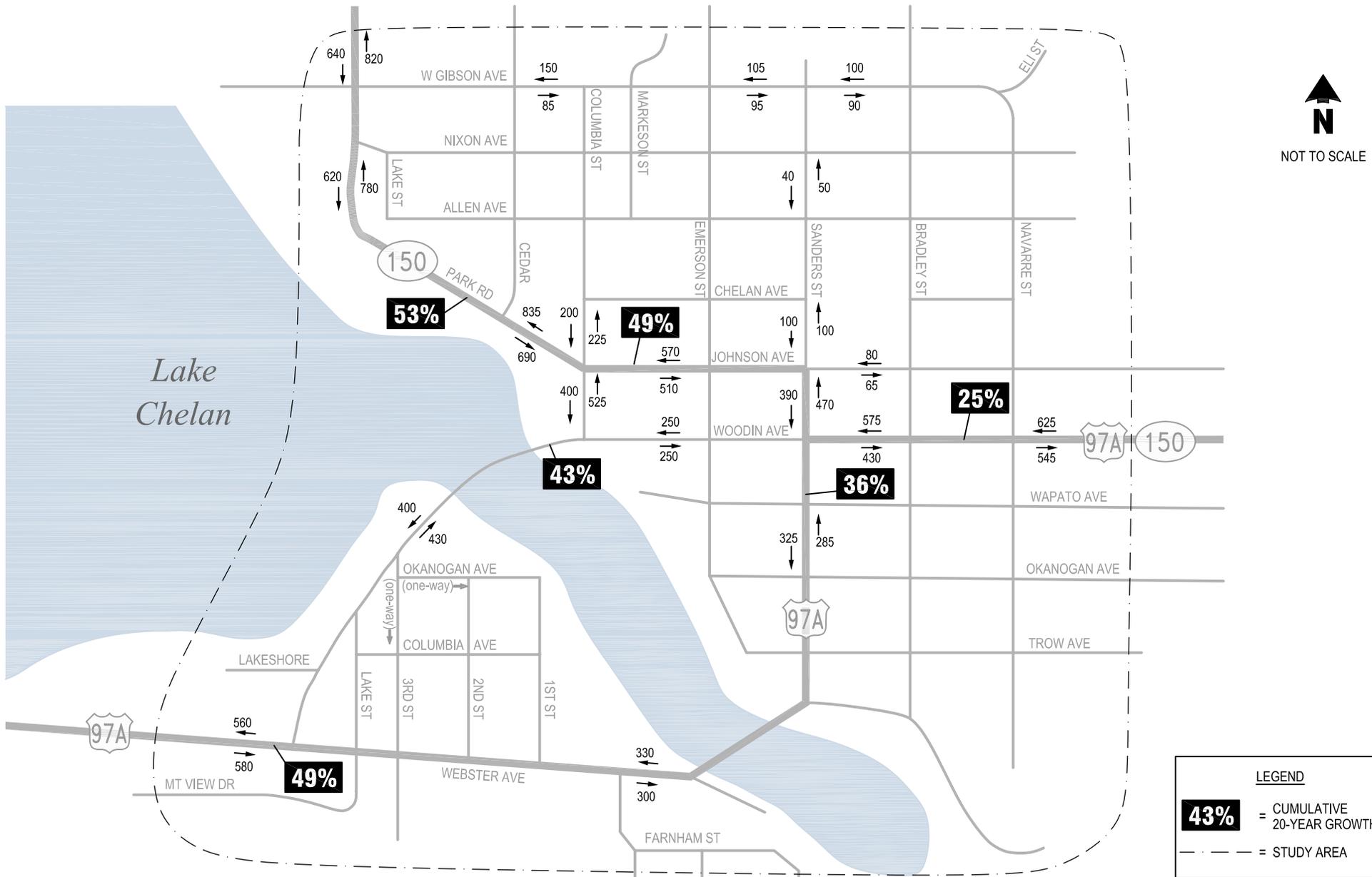


Figure 7
 Estimated Annual Growth Rates (2004-2024)
 Chelan Traffic Circulation Enhancement Study



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Figure 8
2024 Weekday PM Peak Hour Traffic Volumes
Chelan Traffic Circulation Enhancement Study



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Evaluation of No-Build Conditions

This section evaluates the forecast traffic volumes and provides a summary of future operations and locations where improvements are needed to maintain acceptable traffic operations. This analysis assumes no improvements have been made to the transportation system. The evaluation results have been summarized into three primary areas. These areas include the CBD roadways, roadways north of the CBD including SR 150 and Gibson Avenue, and roadways to the south of the CBD including Woodin Avenue and US 97A.

No-Build Traffic Operations

A level of service analysis was conducted for the 2024 horizon year similar to the analysis conducted for the existing traffic conditions. Table 7 summarizes the forecast intersection operations during the weekday PM peak hour in the City of Chelan. Existing 2004 intersection operations are also included for comparison.

Table 7. Chelan CBD Weekday PM Peak Hour LOS Comparison

Intersection	2004 Weekday			2024 Weekday		
	LOS ¹	Delay ²	V/C ³ or WM ⁴	LOS	Delay	V/C or WM
Gibson Avenue/Park Road (SR 150)	B	14	WBL	F	69	WBL
Gibson Avenue/Columbia Street	A	10	NB	B	11	NB
Gibson Avenue/Sanders Street	A	9	NB	A	10	NB
Gibson Avenue/Bradley Street	A	10	WB	B	11	WB
Allen Avenue/ Columbia Street	A	10	WB	A	10	WB
Park Rd (SR150)/Johnson Ave/Columbia St	C	18	EB	F	192	EB
Johnson Avenue (SR 150)/Emerson Street	C	18	NB	F	170	NB
Johnson Avenue (SR 150)/Sanders Street	B	12	NB	F	68	NB
Woodin Avenue (US 97A)/Bradley Street	C	18	SB	F	91	SB
Woodin Avenue (US 97A)/Navarre Street	C	16	SB	E	47	SB
Webster Avenue (US 97A)/Woodin Avenue	B	11	SB	D	30	SB
Woodin Avenue/Columbia Street	B	13	SB	E	45	SB
Woodin Avenue/Emerson Street	A	9	WB	B	13	EB
Woodin Avenue (US 97A)/Sanders Street	B	15	0.30	B	17	0.59

1. Level of service, based on 2000 Highway Capacity Manual methodology.

2. Average delay in seconds per vehicle.

3. Volume-to-capacity ratio reported for signalized intersections.

4. Worst approach reported for unsignalized intersections.

The results shown in Table 7 indicate that traffic operations will degrade significantly by Year 2024 if no improvements are constructed. Approximately half of all the intersections evaluated as part of this analysis fall below the City's adopted LOS D standard. In addition, this intersection operations analysis does not fully account for other operational deficiencies likely to occur such as vehicle queuing issues. As a result, the following section summarizes the key operational issues at each intersection, which does not meet the LOS D standard and proposes conceptual improvements that are needed to maintain acceptable operations.

Central Business District (CBD)

Chelan's CBD includes all streets and intersections along Johnson Avenue and Woodin Avenue from Columbia Street to Sanders Street. Within this area several intersections have been identified which do not meet existing operating standards. Often, the short blocks do not provide enough storage

space for vehicle queues caused by delays at adjoining intersections from the 20-year traffic forecasts. The specific locations are identified below.

Columbia Street/Johnson Avenue

The all-way stop control for the intersection of Columbia Street/Johnson Avenue is nearing capacity and by 2024 will not be able to accommodate the estimated future traffic volumes. This will result in long vehicle queues and delays. Installing a traffic signal at this intersection (as the City has planned) will increase capacity and improve operations at this intersection.

Emerson Street / Johnson Avenue Intersection

The worst average delay (170 seconds) in the CBD will be experienced by northbound vehicles at the intersection of Emerson Street/Johnson Avenue. This approach operates at LOS F and the 95th percentile queue length is approximately 225 feet. This queue is anticipated to extend to Woodin Avenue, filling the block with queued vehicles. A median treatment such as a two-way left-turn lane (TWLTL) would not reduce the delay sufficiently unless a significant amount of traffic is diverted from Johnson Avenue. Some form of intersection control such as a traffic signal or roundabout would be needed to mitigate the side street delay if traffic cannot be diverted from Johnson Avenue.

Columbia Street / Woodin Avenue Intersection

The southbound left-turn at the intersection of Columbia Street/Woodin Avenue is estimated to experience the next worst delay as shown in Table 7. The 95th percentile southbound queue would extend nearly 150 feet north, but is not anticipated to impact the Johnson Avenue intersection. Options for reducing the delay of the southbound left-turn are a median refuge along eastbound Woodin Avenue to allow motorists to make the turn in two stages. Controlling all approaches with stop signs or a traffic signal is also an option, but could further increase delays and queuing on Woodin Avenue.

Sanders Street/Johnson Avenue Intersection

The all-way stop-controlled intersection at Sanders Street/Johnson Avenue is forecast to operate with northbound delays averaging approximately 68 seconds per vehicle as shown in Table 7. The future traffic volumes along the northbound approach are anticipated to cause queuing issues and spill back into the Woodin Avenue/Sanders Street intersection. The 95th percentile queue is forecast to extend approximately 400 feet south, impacting the signal at Woodin Avenue. Mitigation options for this intersection are a traffic signal or roundabout.

US 97A

East of Sanders Street on US 97A, the minor street approaches on Bradley Street and Navarre Street are estimated to operate at LOS F and E, respectively. Along this section of roadway, a TWLTL should be considered in order to reduce side street delay and improve safety along the corridor. Other possibilities include eliminating left-turn access to and from these streets permanently or by time-of-day restrictions.

Park Road (SR 150/Manson Highway)

The estimated future traffic volumes along Park Road would increase delay at many of the driveways and local street approaches that line the corridor. Turning movements (from the two inner current travel lanes) from Park Road would impact the progression of forecasted through traffic along the corridor leading to increased weaving and last-second lane changing which could impact safety. A three-lane Park Road would provide a median refuge for left-turning vehicles on Park Road

(especially R.Vs and trailers) to wait for a gap without impacting progression. The TWLTL would also allow left-turns from minor approaches and driveways to turn in two-stages, reducing their delay and queue length. Auxiliary lanes (particularly along the Don Morse Park frontage and at northbound Gibson Avenue) for drop-off areas, right-turns, and acceleration would also be possible to further improve operations.

Gibson Avenue Intersection

Along Park Road, the greatest delay occurs at Gibson Avenue where the westbound approach is expected to operate at LOS F as shown in Table 7. Queuing is forecasted to increase to nearly 150 feet, but will not impact the adjoining intersection. Improvement options include closing the west approach to the intersection and reconnecting at Nixon Avenue via Cedar Street, restriping Park Road to three-lanes with a TWLTL, and restriping the east approach (RV/campground entry road) to allow exclusive left-turn and right-turn lanes. Please note that the RV entry road may be relocated within the Don Morse Park Master Plan to allow for greater internal queue lengths.

US 97A South Shore

There are no anticipated future operational problems along either Woodin Avenue or US 97A south of the CBD.

Summary of Future Deficiencies

The 20-year traffic forecasts within the City of Chelan will impact the existing transportation system if no improvements are completed. The intersection operations analysis does not always account for all the operational and safety problems that might arise due to the increased number of vehicles. A summary of the locations with capacity and operational problems are listed below.

- Westbound delay at Park Road/Gibson Avenue due to increased traffic volumes on Park Road/SR 150.
- Poor traffic progression and safety issues on the four-lane Park Road east of Columbia Street.
- Poor bicycle and pedestrian connectivity along Park Road and to the south shore area.
- Increased seasonal pedestrian/bicycle traffic and uncontrolled pedestrian crossings within the area.
- Excessive delay and vehicle queuing at the all-way stop of Columbia Street/Johnson Avenue.
- Excessive delays and vehicle queuing along Emerson Street at its intersection with Johnson Avenue. Queues are estimated to impact the Woodin Avenue/Emerson Street intersection.
- The combination of high traffic volumes and a wide roadway cross-section along Johnson Avenue is unfriendly to pedestrians.
- Capacity of the all-way stop at the Sanders Street/Johnson Avenue intersection is exceeded; causing excessive northbound queuing, which is anticipated to impact the traffic signal at Woodin Avenue.
- Long delays along the minor street approaches of the Bradley and Navarre Street intersections with US 97A.
- Excessive southbound delay and vehicle queuing at the Columbia Street/Woodin Avenue intersection.

Based on the list of future deficiencies, improvement alternatives were developed to address the locations in need of improvement. The next section describes each of the improvement alternatives that were evaluated and considered as part of this study effort.

Description of Improvement Alternatives

This section further details improvement alternatives outlined in the previous section. These alternatives are designed to improve the degraded traffic operations outlined therein and meet circulation goals for the City of Chelan.

Alternative 1: Improvements Consistent with Lakeside Trail Design

Alternative 1 involves reducing the travel lanes on Park Road/SR 150 from Columbia Street to Gibson Street from four to three travel lanes, including a center two-way left-turn lane (TWLTL) and some additional auxiliary lanes at key locations. These improvements are consistent with the preliminary design of the Lakeside Trail which is shown as part of Appendix C. The specific improvements that are part of Alternative 1 are described in Table 8 and shown in Figure 9.

Table 8. Alternative 1 - Summary of Improvements

Location	Improvement	Benefit
Park Road/ SR 150	Convert to 3-lane roadway with auxiliary lanes	Improved Safety and Progression
	Realign west approach of Gibson Ave with Nixon Ave (Don Morse Park entry relocation)	
	Install acceleration/deceleration lanes at Nixon Ave intersection	Reduce Delay and conflicts at Gibson Ave
CBD	Signalize Columbia St / Park Rd intersection and add turn lanes	Reduced Delay and Queuing
	Restrict left-turns at Emerson St / Johnson Ave intersection	
	Provide pedestrian median refuges at Emerson St / Johnson Ave intersection	Improve Vehicular and Pedestrian Safety at Emerson Street
	Provide median refuge for SB left-turns at Columbia St / Woodin Ave intersection	
Woodin Ave	Frontage improvements along Woodin Ave south of Woodin Avenue Bridge	Improve Pedestrian Safety Reduce Delay and Queuing
	Provide pedestrian crosswalk signage at the north end of the Woodin Avenue Bridge	
	Provide exclusive SB turn lanes at US 97A	

All along the lakefront adjacent to Park Road, the City is proposing to construct a multi-use pedestrian and bicycle trail which will use some of the existing right-of-way from approximately the LakeView Drive-In location to Columbia Street. North of the Lake View Drive-In, the trail will be located within Don Morse Park entirely. The trail is to continue south along the west side of Columbia Street and then southwest along the lake side of Woodin Avenue.

Other improvements along Park Road include realigning the approach to the intersection of Park Road/Gibson Avenue with Nixon Avenue. This would require constructing a new connection to Nixon and closing the west approach of Gibson Avenue. The auxiliary lanes along Park Road would include deceleration and acceleration lanes for southbound traffic at Nixon Avenue, and a southbound drop-off lane near the resort.

Within Chelan's CBD, only a few changes would be made. At the intersection of Columbia Street/Park Road, the west approach would be striped for three exclusive eastbound lanes: one left-turn lane, one through lane, and one right-turn lane. This would require that the east approach from Johnson Avenue be restriped to allow only one westbound through lane. The south approach on Columbia Street would be striped for an exclusive northbound left-turn lane, and a through lane, and a right-turn lane. A median planter or channelization could also be installed along Woodin Avenue at

the intersection with Columbia Street, allowing the southbound left-turn to make the turn in two stages; however, this would reduce some of the available parking spaces near the intersection.

Northbound and southbound left-turns would be restricted along Emerson Street at the intersection with Johnson Avenue. This would require constructing channelized right-turns only at the northbound and southbound Emerson Street approaches.

Woodin Avenue south of the bridge will have frontage improvements including curb, gutter, sidewalk, parking, stairway to Ruth Pingrey Memorial Park, and the multi-use trail. At the intersection with US 97A, exclusive southbound left and right-turn lanes would be striped.

Alternative 2: Construction of Alternate Route

Alternative 2 would construct all improvements included in Alternative 1, with the addition of an alternate route around Chelan's CBD. The alternate route would direct through traffic to Sanders Street and Gibson Avenue rather than follow SR 150 through the CBD. The specific improvements that are part of Alternative 2 are described in Table 9 and shown in Figure 10.

Table 9. Alternative 2 - Summary of Improvements

Location	Improvement	Benefit
Sanders St & Gibson Ave	Construct alternate route along Sanders St and Gibson Ave Reconstruct both corridors to include 3 lanes, curb, gutter, sidewalks on both sides, on-street parking (on Sanders), and bicycle lanes as available.	Reduce Traffic in CBD Improve Pedestrian Safety Improve access to driveways and minor street approaches
Park Road/ SR 150	Convert to 3-lane roadway with auxiliary lanes Realign west approach of Gibson Ave with Nixon Ave (Don Morse Park entry relocation) Install acceleration/deceleration Lanes at Nixon Ave intersection Add exclusive WB and SB turn lanes at Gibson Ave / Sanders St	Reduce Delay and Queuing Improve Safety and Progression Reduce conflicts at Gibson Avenue
CBD	Signalize Columbia St /Johnson St intersection and add turn lanes Install coordinated signal at Sanders St / Johnson Ave Provide median refuge for SB left-turns at Columbia St / Woodin Ave intersection	Reduced Delay and Queuing
Woodin Ave	Frontage improvements along Woodin Ave Exclusive SB turn lanes at US 97A	Improve Pedestrian Safety Reduce Delay and Queuing

Gibson Avenue and Sanders Street would both be reconstructed to 3-lanes with curb, gutter, and sidewalks. The three-lane roadway would include a travel lane in each direction and a center TWLTL. Bike lanes and on-street parking would also be included on Sanders Street while maintaining access to all private driveways. The SR 150 through movements (northbound left-turn and eastbound right-turn) would be uncontrolled at the intersection of Gibson Avenue/Sanders Street. At the intersection of Gibson Avenue/Park Road, exclusive westbound left- and right-turn lanes would be constructed along Gibson Avenue and a southbound left-turn lane would be constructed along Park Road/SR 150.

In Alternative 2, access to Johnson Avenue from Emerson Street would not need to be restricted due to the reduced traffic volume on Johnson Avenue. This would maintain a high level of mobility in the CBD without unreasonable delays on minor street approaches.

With the addition of the alternative route, a traffic signal would be added to the intersection of Sanders Street/Johnson Avenue. This signal would be coordinated with the existing signal at the Sanders Street/Woodin Avenue intersection, and the proposed signal at the Columbia Street/Johnson Avenue intersection.

Alternative 3: Reconstruction of Johnson Avenue to a Three-Lane Arterial

Alternative 3 includes all the improvements from Alternative 1, but will extend the three-lane roadway section along Johnson Avenue to its intersection with Sanders Street. This alternative would also construct two single-lane roundabouts on Johnson Avenue, one at Emerson Street and one at Sanders Street. The specific improvements that are part of Alternative 3 are described in Table 10 and shown in Figure 11.

Table 10. Alternative 3 - Summary of Improvements

Location	Improvement	Benefit
Park Road/ SR 150	Convert to 3-lane roadway with auxiliary lanes	Improved Safety Progression
	Realign west approach of Gibson Ave with Nixon Ave (Don Morse Park entry relocation)	Reduced Delay and conflicts at Gibson Ave
	Acceleration/deceleration lanes at Nixon Ave intersection Add WB & SB turn lanes at Gibson Ave / Sanders St intersection	
CBD	Signalize Columbia St / Park Rd intersection and add turn lanes	Reduce Delay and Queuing Improve Traffic Progression
	Construct two single-lane roundabouts with pedestrian refuges at Johnson Ave /Emerson St and Johnson Ave / Sanders St intersections	Improve Vehicular and Pedestrian Safety
	Construct median refuge for SB left-turns at Columbia St / Woodin Ave	
	Restripe Johnson Ave as a 3-lane roadway with bike lanes and pedestrian islands at roundabouts	
	Add SB left-turn lane and protected signal phase at Sanders St / Woodin Ave intersection	
Woodin Ave	Frontage improvements along Woodin Ave	Improve Pedestrian Safety
	Provide pedestrian crosswalk signage at the north end of the Woodin Avenue Bridge	Reduce Delay and Queuing
	Provide exclusive SB turn lanes at US 97A	

Each roundabout along Johnson Avenue should fit within the existing right-of-way and still allow trucks to negotiate safely. The roundabouts would also accommodate pedestrians by providing refuge islands between lanes entering and exiting the roundabout as shown in Figure 12. The roundabout at the intersection of Johnson Avenue/Sanders Street would include a slip lane for eastbound right-turns. The final design of these roundabouts would need to be approved by WSDOT. On-street parking and bike lanes would be maintained along both sides of Johnson Avenue. The roundabouts would be one lane only (18 feet wide) with a mountable inner curb for extra wide loads and would meet the WSDOT standards with a 100 feet radius, thus still allowing for freight and emergency vehicles to traverse through the facility.

This alternative would also include adding a southbound left-turn lane and a protected left turn phase to the existing signal at the Sanders Street/Woodin Avenue intersection. Sanders Street between Woodin Avenue and Johnson Avenue would be restriped for only one northbound lane entering the roundabout. A conceptual channelization drawing of all the improvements along Johnson Avenue is illustrated in Figure 12.

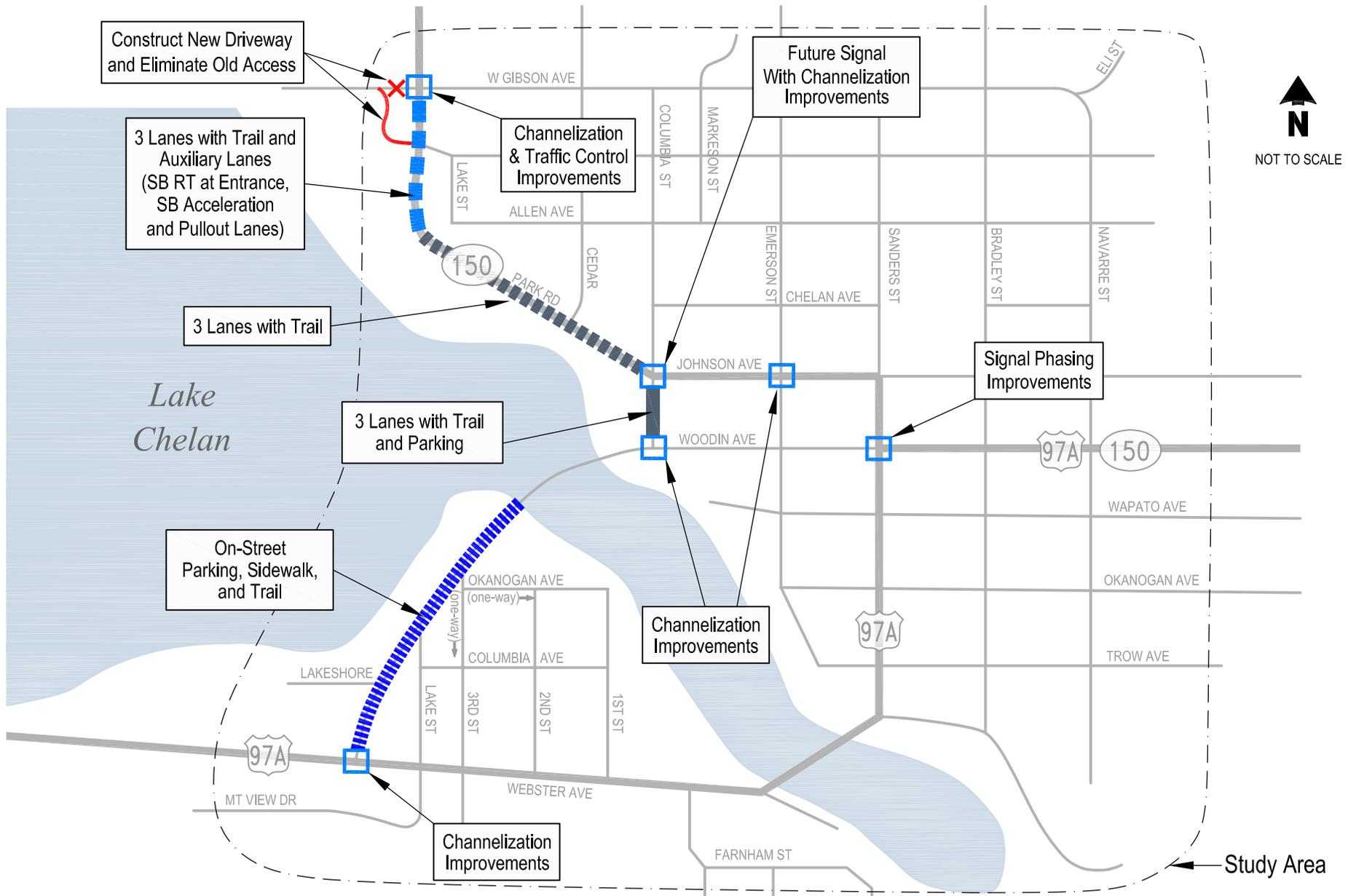


Figure 9
 Traffic Circulation Improvements - Alternative 1

Chelan Traffic Circulation Enhancement Study

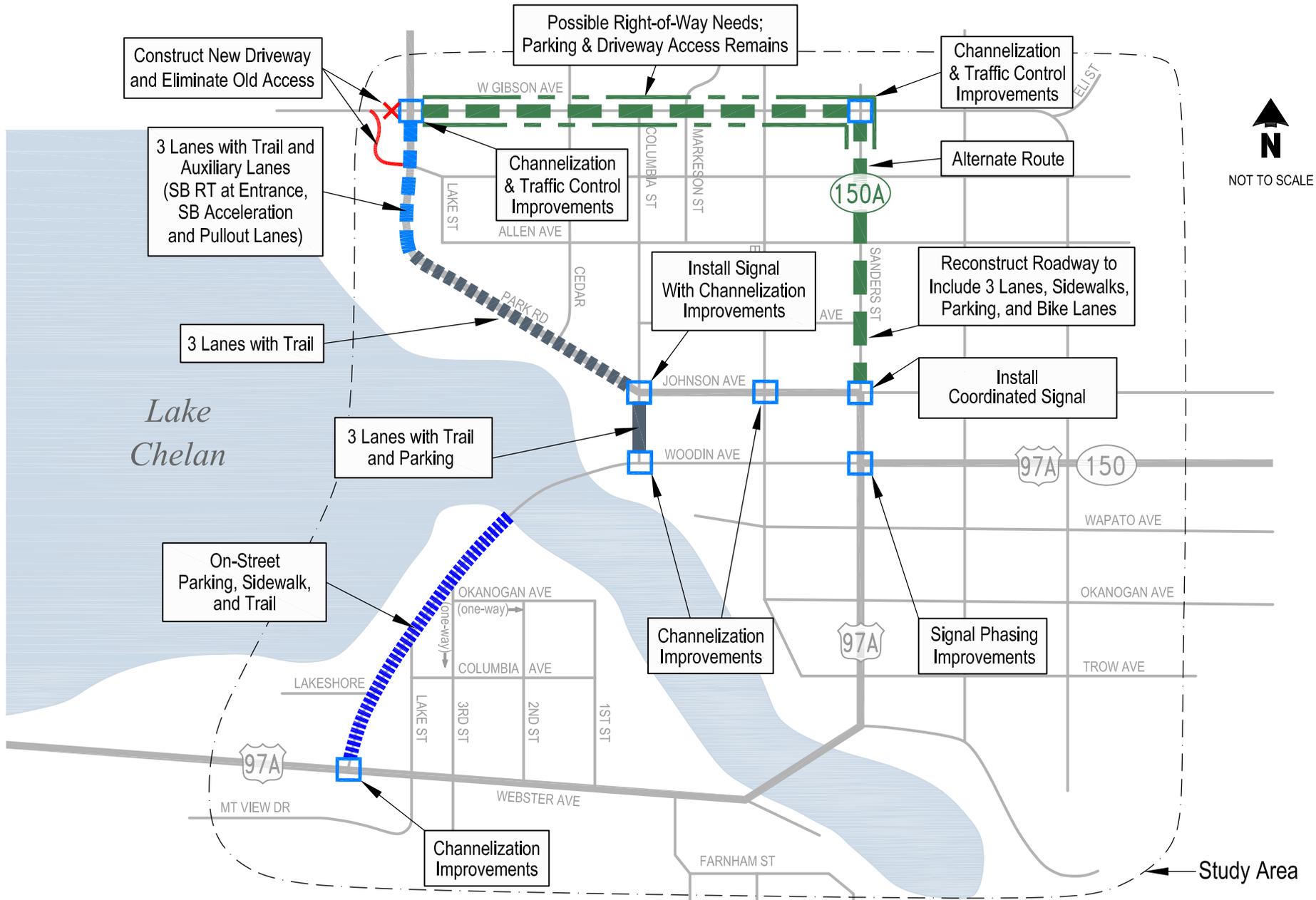


Figure 10
 Traffic Circulation Improvements - Alternative 2

Chelan Traffic Circulation Enhancement Study

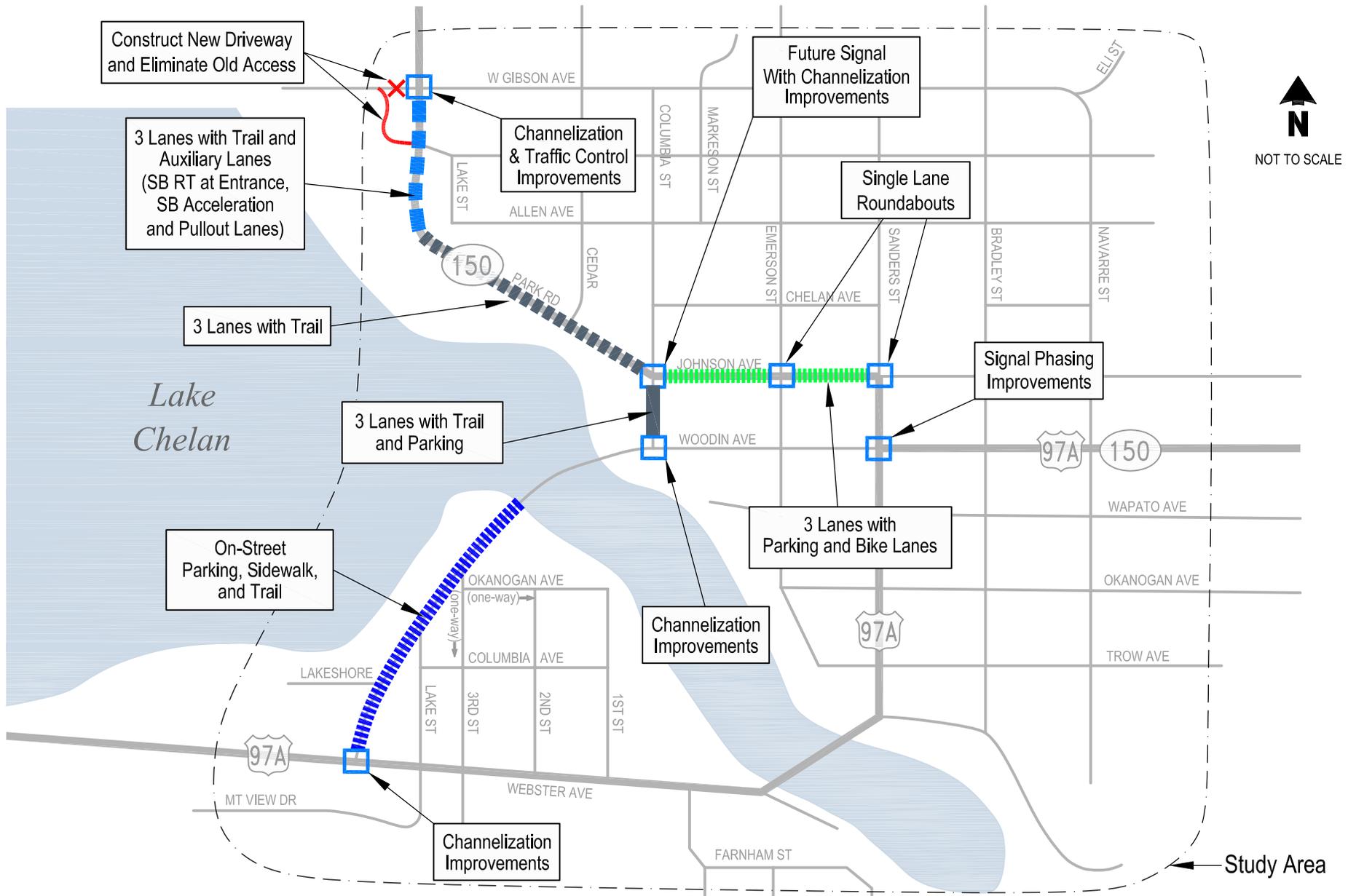


Figure 11
 Traffic Circulation Improvements - Alternative 3

Chelan Traffic Circulation Enhancement Study

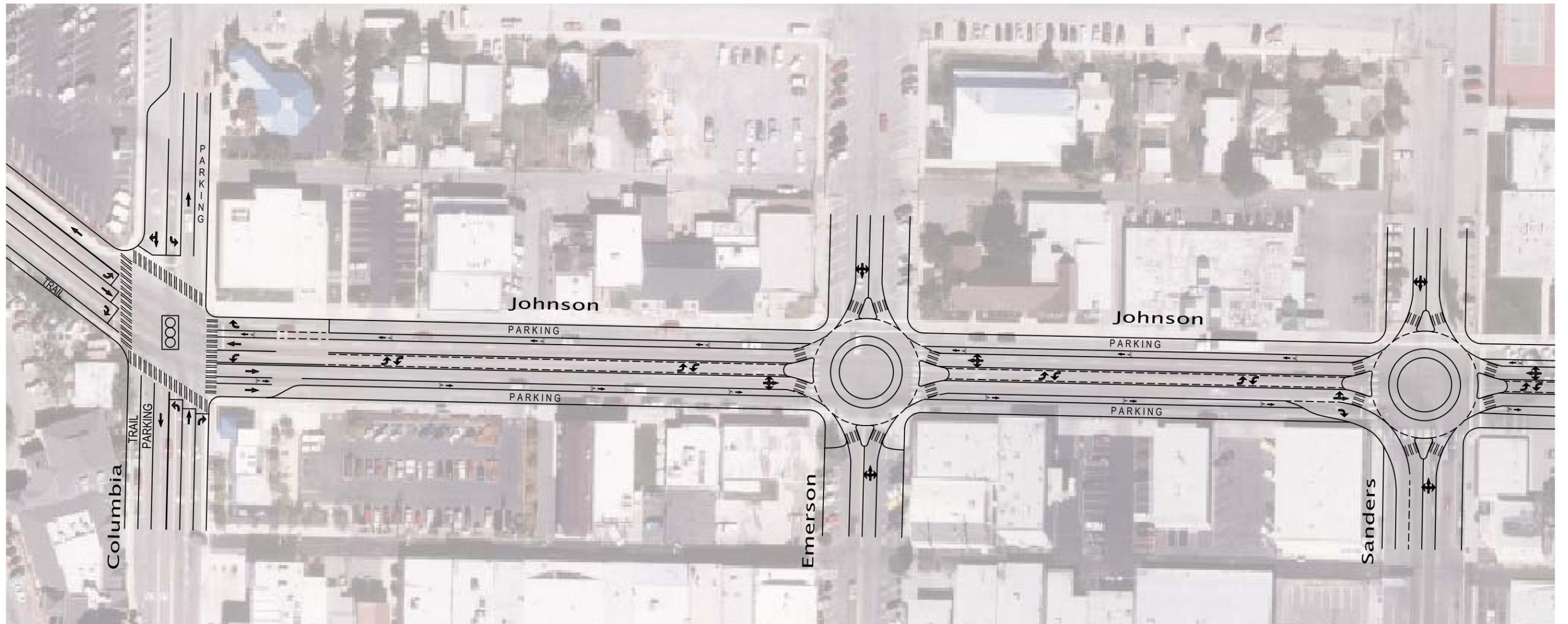


Figure 12
Johnson Avenue Channelization Concept
Chelan Traffic Circulation Enhancement Study

Other Improvements Considered and Evaluated

In order to generate realistic alternatives that would improve the traffic circulation in the City of Chelan, a wide variety of alternatives were initially considered. The following list summarizes some of the other options considered:

- Restricting all left-turns at the Woodin Avenue/Columbia Street intersection.
- Closing Columbia Street to vehicular traffic between Johnson Avenue and Woodin Avenue.
- Restricting Columbia Street to one-way traffic either northbound or southbound between Johnson Avenue and Woodin Avenue.
- Restricting the Woodin Avenue Bridge to one-way traffic either northbound or southbound.

These alternatives and their impacts are summarized as part of Appendix B.

Evaluation of Improvement Alternatives

This section of the report summarizes the results of the alternatives evaluation. A total of three alternatives were reviewed in detail. Comparison of the three build alternatives was completed to determine the recommended improvements.

Evaluation Criteria

A set of evaluation criteria were developed by the Project Steering Committee to evaluate each alternative. The criteria reviews the effect of the alternative on traffic circulation and operations, safety, pedestrian and bicycle connectivity, freight and truck mobility, tourism and regional economy, and relative cost of each improvement. Figure 13 displays the individual alternative scorings using a relative scale that defines how much the alternative improved or impacted the respective criterion. The alternatives were ranked by symbols indicating the amount of improvement or impact as compared to the existing infrastructure and each respective alternative. The symbols ranged from a notable impact to a notable improvement. The evaluation criteria are as follows:

Traffic Circulation and Operations

- Provides for Improvement in Intersection LOS
- Improves Travel Time
- Provides Alternative Route Options

Safety

- Addresses High Accident Locations
- Addresses Pedestrian and Bicycle Issues

Pedestrians and Bicycles

- Provides New Facilities
- Enhances Current Facilities
- Connectivity Enhancement

Freight Mobility

- Improves Regional / Local Freight and Goods Mobility

Tourism / Regional Economy

- Enhances Recreational Interfaces with the Transportation System
- Improves Recreational Access and Signage
- Parking
- Enhances Local Land Uses and Supports Business Development and Retention

Relative Cost

- Minimizes Cost for Right of Way Acquisition and Construction
- Funding Eligibility

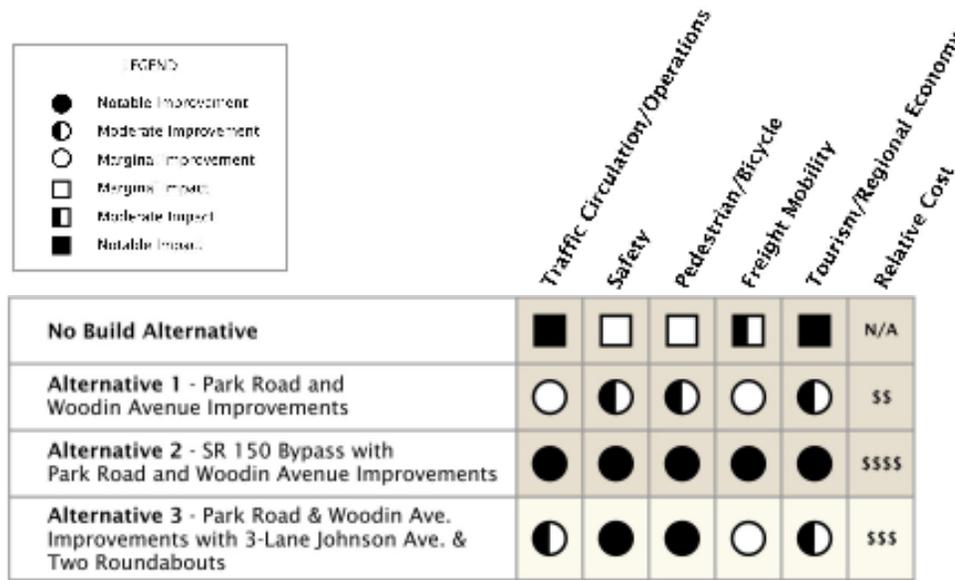


Figure 13. Comparison Matrix of Alternatives

The following describes the results of the alternatives evaluation and summarizes the findings by evaluation criteria.

Traffic Circulation and Operations

The traffic circulation and operations criterion compares the changes in the efficiency and operations of the study area roadways and intersections. It is based on the following items:

- Provides for Improvement in Intersection LOS
- Improves Travel Time
- Provides Alternative Route Options

The study intersections and roadways were analyzed using the 20-year traffic projections shown in Figure 14. This figure includes future traffic volume estimates with and without a new alternative route along Sanders Street and Gibson Avenue. The results of the intersection LOS and queuing analysis were compared between the no-build and each build alternative. The results of the LOS analysis are shown in Table 11 and Figure 15.

Alternative 1

Improvements included under Alternative 1 provide the following advantages and disadvantages relating to traffic circulation and operations.

- Promotes the progression of traffic along Park Road by providing a center two-way left-turn lane for vehicles turning left into and out of the numerous driveways and streets along the corridor.
- Reduces vehicle delay and queuing at the Park Road/Gibson Avenue intersection by realigning the west approach with Nixon Avenue.
- Reduces congestion, delay, and queuing by installing a traffic signal at the Columbia Street / Johnson Avenue intersection. The new traffic signal at the intersection improves operations from LOS F to LOS C during the PM peak hour.

- Allows for the construction of Phase 1 of the Lakeside Trail project from Gibson to the Woodin Avenue Bridge, providing for a 10 - 14 feet wide trail section for pedestrians and bicycles.
- Signal improvements at the Sanders/Woodin Avenue intersection.
- Reduces southbound left-turn delay at the Columbia Street/Woodin Avenue intersection by installing a median refuge. The southbound approach improves from LOS E to LOS C resulting in half the approach delay.
- Eliminates the left-turn and through movements on the Emerson Street approach at its intersection with Johnson Avenue by only allowing right turns out. Requires vehicles to take alternate routes, thereby impacting other intersections.
- The Sanders Street/Johnson Avenue intersection operates at LOS E. Vehicle queuing is a potential issue along the northbound approach.

Alternative 2

Improvements included under Alternative 2 provide the following advantages and disadvantages relating to traffic circulation and operations.

- Provides the same advantages as listed under Alternative 1.
- Reduces congestion within the CBD and along the Park Road and Johnson Avenue corridors by rerouting traffic along Sanders Street and Gibson Avenue. It is estimated that traffic on Johnson Avenue and Park Road would be reduced by approximately 30 percent with the new alternative route.
- The new traffic signal and rerouting of traffic caused by the alternative route improves operations at the Columbia Street/Johnson Avenue intersection from LOS F to LOS B during the 2024 PM peak hour.
- Provides better traffic circulation within and around the CBD and increases the amount of future roadway capacity.
- Reduces queuing and delay at the Sanders Street/Johnson Avenue intersection with installation of a new traffic signal.
- The operations improve at the Emerson Street/Johnson Avenue intersection from LOS F to LOS B in 2024 due to the reduction in traffic along Johnson Avenue.
- Average delay for the minor approaches along Gibson Avenue and Sanders Street increases by an average of approximately six seconds. The worst approach along this section of Gibson Avenue now operates at LOS C.
- Intersection of Park Road/Gibson Avenue operates at an LOS E due to the increased southbound left-turn movements from Park Road onto Gibson Avenue.
- Requires more roadway improvements, which spreads out traffic volumes due to other available route choices.
- Signal improvements at the Sanders Street/Woodin Avenue intersection.
- Eliminates the left-turn and through movements on the Emerson Street approach at its intersection with Johnson Avenue by only allowing right turns out. Requires vehicles to take alternate routes, thereby impacting other intersections.
- Requires a coordinated traffic signal at the intersection of Johnson Avenue/Sanders Street.

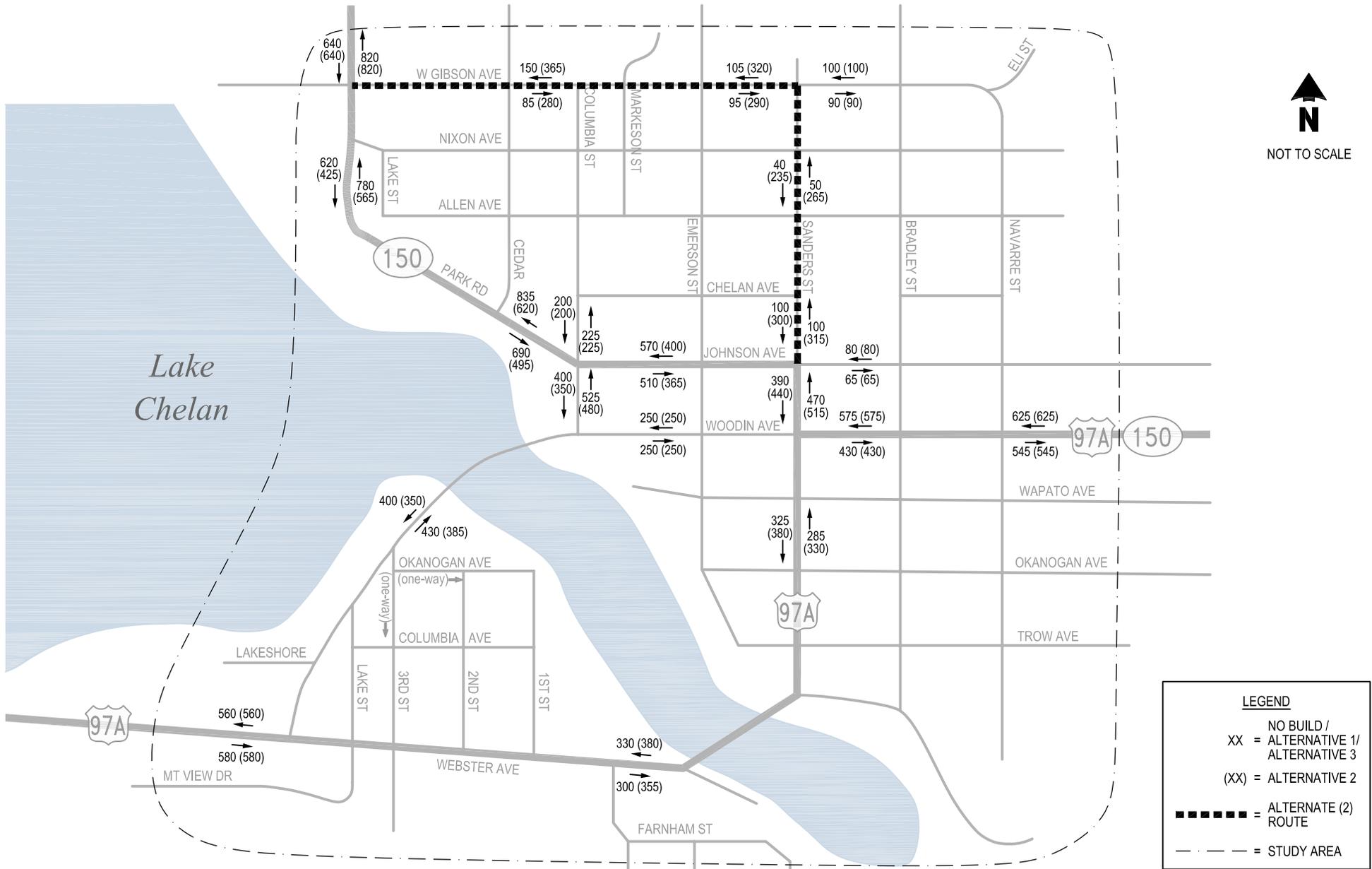
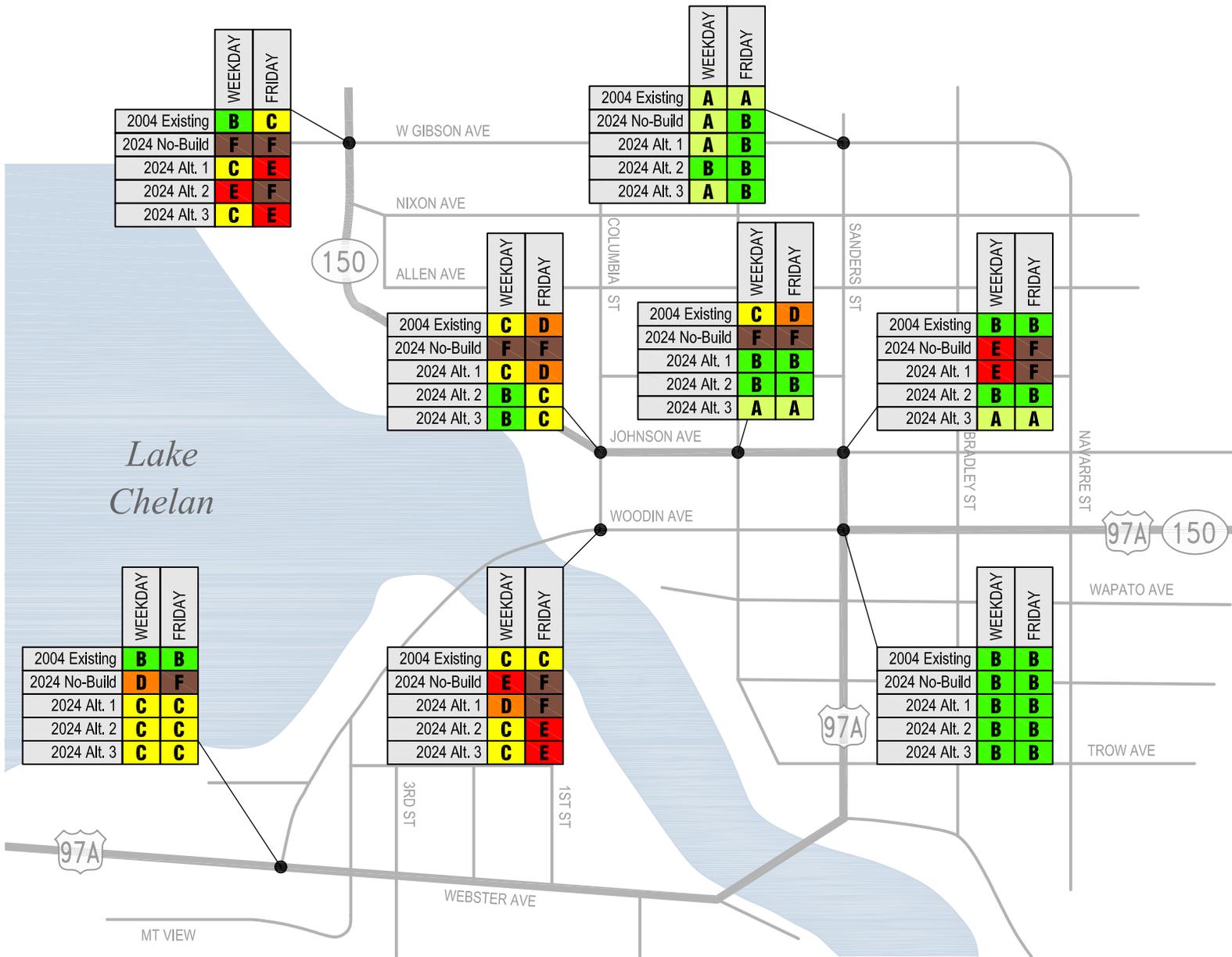


Figure 14
 2024 Weekday PM Peak Hour Traffic Volumes - Comparison of Alternatives
 Chelan Traffic Circulation Enhancement Study



NOT TO SCALE

Level of Service Examples

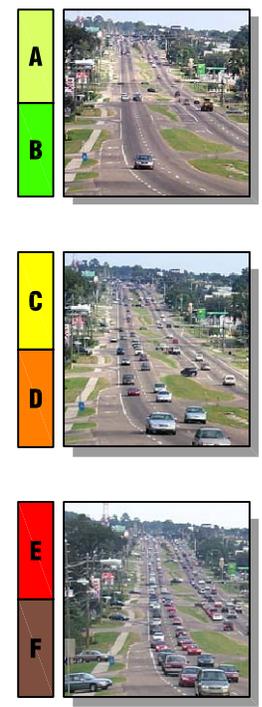


Figure 15
PM Peak Hour Intersection LOS - Future Alternative Comparison

Chelan Traffic Circulation Enhancement Study



Table 11. PM Peak Hour Intersection LOS - Comparison of Alternatives

Intersection	2004 Existing			2024 No-Build			2024 Alternative 1			2024 Alternative 2			2024 Alternative 3		
	LOS ¹	Delay ²	V/C ³ or WA ⁴	LOS	Delay	V/C or WA	LOS	Delay	V/C or WA	LOS	Delay	V/C or WA	LOS	Delay	V/C or WA
Gibson Avenue/Park Road (SR 150)	B	14	WB	F	69	WB	C	23	WB	E	41	WB	C	23	WB
Gibson Avenue/Columbia Street	A	9	NB	B	10	NB	B	10	NB	B	10	NB	B	10	NB
Gibson Avenue/Sanders Street	A	9	NB	A	9	NB	A	9	NB	B	13	NB	A	9	NB
Gibson Avenue/Bradley Street	A	9	WB	B	10	WB	B	10	WB	B	11	WB	B	11	WB
Allen Avenue/ Columbia Street	A	9	WB	A	9	WB	A	9	WB	A	9	WB	A	9	WB
Park Rd (SR150)/Johnson Ave/Columbia St	C	20	EBR	F	192	EB	C	23	0.90	B	14	0.71	B	16	0.81
Johnson Avenue (SR 150)/Emerson Street ⁵	C	18	NB	F	170	NB	B	12	NB	B	11	NB	A	9	SB
Johnson Avenue (SR 150)/Sanders Street ⁵	B	13	NBL	E	43	-	E	50	-	B	13	0.50	A	6	EB
Woodin Avenue (US 97A)/Bradley Street	C	18	SB	F	91	SB	F	91	SB	F	91	SB	F	94	SB
Woodin Avenue (US 97A)/Navarre Street	C	16	SB	E	47	SB	E	47	SB	E	47	SB	E	47	SB
Webster Avenue (US 97A)/Woodin Avenue	B	11	SB	D	30	SB	C	19	SB	C	19	SB	C	19	SB
Woodin Avenue/Columbia Street	C	18	SBL	E	45	SB	D	29	SB	C	24	SB	C	22	SB
Woodin Avenue/Emerson Street	A	9	WB	B	13	EB	B	14	EB	B	13	EB	B	13	EB
Woodin Avenue (US 97A)/Sanders Street	B	14	0.27	B	17	0.59	B	16	0.57	B	17	0.59	B	16	0.52

1. Level of service, based on 2000 Highway Capacity Manual methodology.

2. Average delay in seconds per vehicle.

3. Volume-to-capacity ratio reported for signalized intersections.

4. Worst approach reported for unsignalized intersections. All-way stop-controlled intersections reported as average of entire intersection.

5. Assumes a Roundabout under Alternative 3; evaluated using aaSIDRA 2.1 software.

Alternative 3

Alternative 3 includes all the improvements of Alternative 1, except that additional improvements are shown along the Johnson Avenue corridor. Only items unique to Alternative 3 are discussed below. These improvements provide the following advantages and disadvantages relating to traffic circulation and operations.

- Provides the same advantages as listed under Alternative 1.
- Improved intersection operations at the Johnson Avenue/Emerson Street intersection due to the installation of a roundabout. Preserve full access to and from Emerson Street.
- Retains parking on Johnson Avenue on both sides of the street.
- Provides enough capacity along SR 150 with well designed roundabouts.
- The roundabouts along Johnson Avenue are estimated to reduce queuing and delay at the intersection. The future analysis indicates that the average delay for through vehicles on SR 150 will be approximately three seconds at Emerson Street and six to eight seconds at Sanders Street.
- Extension of the three-lane roadway along Park Road to Gibson Avenue creates a more uniform cross-section through town.
- Promotes the progression of traffic along Johnson Avenue/SR 150 by providing a center two-way left-turn lane for vehicles turning left into and out of the numerous driveways and streets along the corridor.
- Roundabouts would slightly increase travel time for through vehicles traveling along Johnson Avenue because they would have to slow down and navigate each roundabout.
- Provides pedestrian refuges at each roundabout intersection for all pedestrian crossings.
- Allows for the construction of Phase 1 of the Lakeside Trail project.

Safety

The safety criterion assesses the safety enhancements provided by each of the proposed improvement alternatives. It is based on the following items.

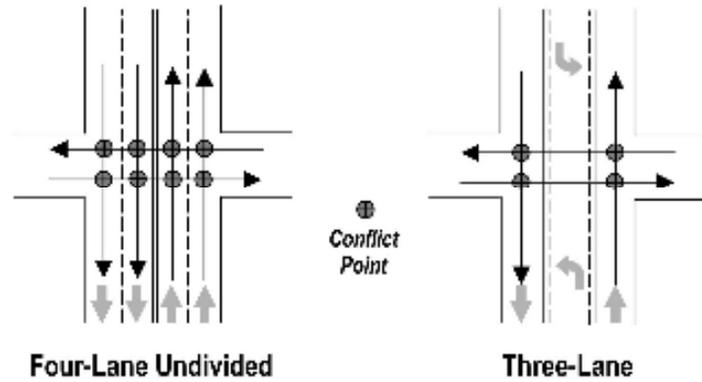
- Addresses High Accident Locations
- Addresses Pedestrian and Bicycle Issues

The primary objective is to identify improvement projects that increase safety for vehicles, pedestrians, and bicycles. While there are no significant existing safety problems within the Chelan CBD, some of the improvements do provide an overall safety benefit as compared to others.

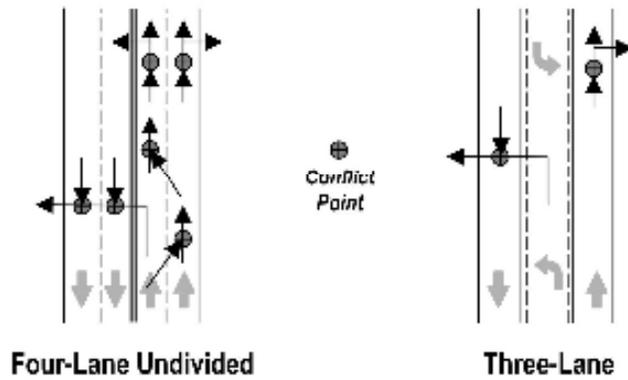
Alternative 1

Improvements included under Alternative 1 provide the following advantages and disadvantages relating to safety.

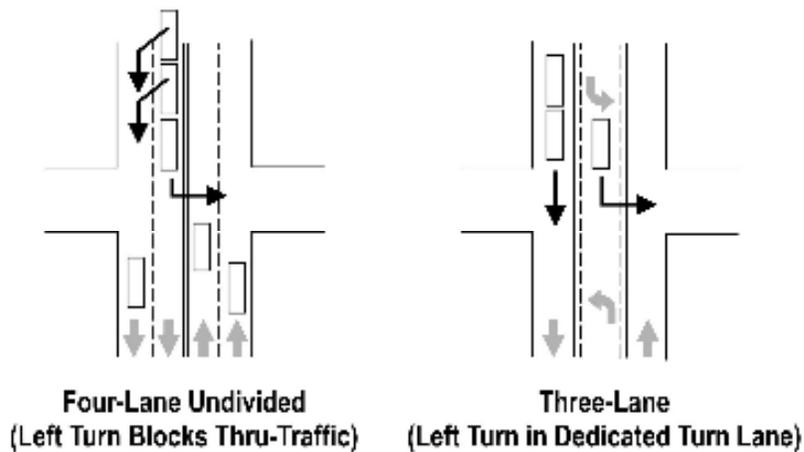
- Decreases the number of conflict points along the Park Road/SR 150 corridor relating to vehicles turning to/from the numerous driveways and street intersections. The following illustration depicts the conflict points for crossing traffic at intersections for a four-lane vs. a three-lane roadway.



The following illustration depicts the conflict points for left turning traffic for a four-lane vs. a three-lane roadway.



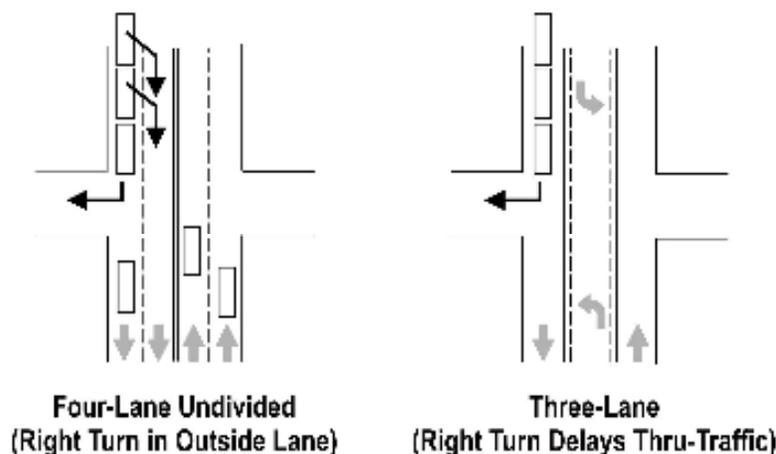
- Eliminates potentially dangerous last second lane changes along Park Road/SR 150 when vehicles are delayed behind another vehicle waiting to make a left-hand turn. The following illustration depicts such a scenario.



- Improves sight distance along Park Road/SR 150 by eliminating the situation where the vehicle in the inside lane hides the vehicle in the outside lane. See the following illustration below for an example.



- Auxiliary lanes along Park Road would further enhance safety and improve traffic flow along the corridor. This is accomplished by allowing vehicles to accelerate, decelerate, and stop outside of the flow of traffic.
- Improves pedestrian safety along Park Road by reducing the pedestrian's exposure to vehicles. The number of travel lanes, and overall distance crossed by the pedestrian is reduced, and their visibility to motorists is enhanced. Drivers on four-lane roadways often have obstructed views of pedestrians when vehicles are located in adjacent travel lanes and often vehicles in one lane may stop while vehicles in the adjacent lane may not stop because they have limited visibility of the pedestrian. A three-lane roadway would eliminate or minimize these concerns.
- Increases pedestrian and bicycle safety due to the incorporation of enhanced pedestrian and bicycle facilities such as the Lakeside Trail, bike lanes, sidewalks, curbing, landscape buffers, and refuge islands along Park Road, Johnson Avenue, and Woodin Avenue.
- Reduced travel speeds along the Park Road/SR 150 corridor due to slow vehicles and no second lane available for passing. Studies indicate that a lane reduction from four lanes to three lanes decreases speed by 3-5 miles per hour.¹ Slower moving vehicles dictate speeds along a three-lane roadway as there are no passing lanes for motorists to utilize. The following illustration shows how right turning movements impact the flow of traffic along four-lane vs. three-lane roadways. This could increase the number of rear-end collisions from vehicles following too closely.



¹ Proceedings of the 2003 Mid-Continent Transportation Research Symposium, Ames, Iowa, August 2003 by Iowa State University.

Alternative 2

Improvements included under Alternative 2 provide the same advantages and disadvantages relating to safety as Alternative 1, but include new pedestrian and bicycle facilities along the proposed alternative route.

- Provides the same advantages and disadvantages as listed under Alternative 1.
- Includes the construction of pedestrian and bicycle facilities along Sanders Street and Gibson Avenue corridors.
- Increases the number of vehicles traveling along both Sanders Street and Gibson Avenues creating more opportunities for collisions between pedestrians/bicyclists and vehicles.
- Encourages truck traffic along a minor collector roadway, which is currently predominantly residential land uses.

Alternative 3

Improvements included under Alternative 3 also provide the same advantages and disadvantages relating to safety as Alternative 1, but extends the three-lane roadway cross-section to the Johnson Avenue corridor.

- Provides the same advantages and disadvantages as listed under Alternative 1.
- Includes the construction of pedestrian refuges and bicycle facilities along Johnson Avenue.
- Decreases the number of conflict points along the Johnson Avenue corridor relating to vehicles turning to/from adjoining driveways.
- Improves pedestrian safety along Johnson Avenue by reducing the number of travel lanes and overall distance crossed by the pedestrian.
- Enhances pedestrian visibility to motorists with construction of median refuge islands at each roundabout approach.
- Provides improved pedestrian crossings at the Johnson Avenue/Emerson Street intersection.
- Reduced travel speeds along the Johnson Avenue corridor due to slow vehicles and no second lane available for passing. This could increase the number of rear-end collisions from vehicles following too closely.

Pedestrians and Bicycles

The pedestrian and bicycle criterion assesses the new or enhanced facilities provided by each of the proposed improvement alternatives. It is based on the following items.

- Provides New Facilities
- Enhances Current Facilities
- Connectivity Enhancement

In addition, the criterion reviews whether the improvements provide increased pedestrian and bicycle connectivity through the CBD.

Alternative 1

Improvements included under Alternative 1 provide the following advantages relating to pedestrian and bicyclists.

- Provides new and enhanced pedestrian facilities along the lakeshore with the completion of the Lakeside Trail.
- Incorporates enhanced pedestrian and bicycle facilities along Park Road/SR 150.

Alternative 2

Improvements included under Alternative 2 provide the same advantages and disadvantages relating to pedestrians and bicyclists as Alternative 1, but include new pedestrian and bicycle facilities along the proposed alternative route.

- Same advantages as Alternative 1.
- Includes the construction of pedestrian and bicycle facilities along Sanders Street and Gibson Avenue corridors.
- Provides for improved pedestrian and bicycle connectivity between the CBD and northern neighborhoods.

Alternative 3

Improvements included under Alternative 3 provide the same advantages and disadvantages relating to pedestrians and bicyclists as Alternative 1, but include improved pedestrian and bicycle facilities along the Johnson Avenue corridor.

- Same advantages as Alternative 1.
- Includes the construction of improved pedestrian and bicycle facilities along Johnson Avenue.
- Provides improved pedestrian crossing at the Johnson Avenue/Emerson Street intersection.
- Provides for improved pedestrian and bicycle connectivity within the CBD.

Freight Mobility

The freight and truck mobility criterion evaluates design enhancements or alternative routes to facilitate freight and truck mobility in the study area.

Alternative 1

Improvements included under Alternative 1 will generally provide overall freight mobility benefits due the operational improvements throughout the CBD. Some of the specific improvements include:

- Improves traffic operations along the Park Road/SR 150/Manson Highway corridor by providing a center two-way left-turn.
- Improves intersection operations at the Johnson Avenue/Columbia Avenue intersection.

Alternative 2

Construction of the proposed alternate route in Alternative 2 provides significant improvements to freight mobility by allowing trucks the opportunity to bypass traffic within the CBD. The new route provides:

- Same advantages as Alternative 1.
- Provides an alternative route for trucks to bypass the CBD.
- Reduces the number of vehicles along SR 150/Park Road to promote better freight mobility within the CBD.

Alternative 3

Improvements included under Alternative 3 will provide the same benefits as Alternative 1, except that freight mobility might be slightly impacted by the installation of roundabouts along Johnson Avenue.

- Same advantages as Alternative 1.
- Installation of roundabouts along Johnson Avenue would make the corridor more difficult to navigate by trucks and other large vehicles. Even though the design of the roundabouts would accommodate large vehicles, the roundabouts are still more difficult to navigate than a typical signal controlled intersection. Vehicles will need to observe slower speeds through the roundabouts.

Tourism and Regional Economy

The tourism and regional economy criterion evaluates design enhancements or alternative routes to support Chelan's important tourism based economy, while also supporting the regional economy. It is based on the following items:

- Enhances Recreational Interfaces with the Transportation System
- Improves Recreational Access and Signage
- Parking
- Enhances Local Land Uses and Supports Business Development, Retention, and Enhancement

Alternative 1

Improvements included under Alternative 1 will generally better facilitate tourism while supporting the local and regional economy by the operational improvements throughout the CBD and the construction of the Lakeside Trail. The specific improvements include:

- Improves traffic operations along the Park Road/SR 150 corridor by providing a center two-way left-turn to facilitate better access to the businesses and park properties along both sides of the corridor.
- Provides new and enhanced pedestrian facilities along the lakeshore with the completion of the Lakeside Trail. This better facilitates recreational and tourist activities between the lakeshore and the CBD businesses.
- Improves intersection operations within the CBD to support better circulation and access to businesses.

Alternative 2

Construction of the proposed alternate route in Alternative 2 supports the regional economy by allowing traffic to bypass the CBD. Farm-to-market goods are able to be shipped more quickly because the new route reduces the overall delay along City streets. The alternative offers the following advantages and disadvantages:

- Same advantages as Alternative 1.
- Promotes better traffic circulation within the CBD by offering an alternate route to bypass possible recreational traffic during the busy summer months and weekends.

- Facilitates the farm-to-market goods movement through the City by improving operations and traffic circulation along Johnson Avenue and Park Road/SR 150 with the reduction of total traffic volumes.
- Diverts vehicles away from the CBD and may reduce the amount of exposure some retail shops depend on from pass-by traffic.

Alternative 3

Improvements included under Alternative 3 will provide the same benefits as Alternative 1, except that the roundabouts along Johnson Avenue could slightly impact the freight and goods movement by slowing travel speeds and regional economy which depends on the progression of traffic along the SR 150 corridor.

- Same advantages as Alternative 1.
- Improves traffic operations at the minor street approaches along Johnson Avenue. This will provide better traffic circulation and access to the businesses in the CBD.
- Provides new and enhanced pedestrian facilities along and across Johnson Avenue with the reduction to three-lanes. This better facilitates recreational, commercial, and tourist activities within the CBD.
- Installation of roundabouts along Johnson Avenue could impact the movement of farm-to-market goods between regional destinations and the communities along the north shore of the lake. The roundabouts would need to be designed to facilitate trucks.

Relative Cost

The relative cost criterion evaluates the financial costs to construct the alternatives as compared to each other. In addition, some improvements are more likely to be funded from alternative sources depending upon the overall benefits, impacts, and costs. The evaluation is based on the following items:

- Minimizes Cost for Right of Way Acquisition and Construction
- Funding Eligibility

Alternative 1

Each of the alternatives evaluated included many of the improvements described in Alternative 1. Therefore this alternative will be the least expensive alternative of the three. It also has the most likely funding sources already available due to the support and conceptual design of the Lakeside Trail.

Alternative 2

Construction of the proposed alternate route in Alternative 2 will be a very expensive project. It will require reconstruction of the Sanders Street and Gibson Avenue corridors. Some right-of-way will need to be acquired along Sanders Street (of the property north of the alley between Gibson and Nixon Avenues and potentially at the intersection) to provide sidewalks, bike lanes, improved curve radius, and on-street parking along both sides of the street. Combined with the costs of the improvements that are consistent with Alternative 1, this becomes the most expensive project of the three. However, this project would be able to be funded at the regional or state level due to the fact it supports the entire north shore of the lake and constructs an alternate route for traffic to follow.

Alternative 3

Improvements included under Alternative 3 will be in addition to the improvements shown in Alternative 1. However, improving the Johnson Avenue corridor will be much less expensive than the improvements described in Alternative 2. Little, if any, right-of-way will be needed along Johnson Avenue for the construction of roundabouts and conversion to three-lanes. Alternative 3 would be more expensive than Alternative 1, but less expensive than Alternative 2. However, it is likely the most difficult to fund as it does not provide more roadway capacity and will cost almost twice the amount of Alternative 1. Local and regional funding partnerships will need to be explored, as well as economic development grants that promote the revitalization of downtown commercial districts.

Evaluation of Other Improvements

Other specific modifications to Chelan's transportation system were evaluated individually and the results are summarized as part of Appendix B. Many of the modifications resulted in vehicle queues that impacted adjacent intersections. In addition, the level-of-service analysis often indicated acceptable intersection operations of LOS C or better, but with long vehicle queues. In many situations, the long vehicle queues impacted adjacent intersection operations because many of the CBD blocks are short and the storage capacity is quickly consumed.

A brief summary of the evaluation results for several key modifications are described below:

- **Columbia Street Closure:** Closing Columbia Street to vehicles between Johnson Avenue and Woodin Avenue and converting it to a pedestrian corridor resulted in a significant amount of traffic switching to Emerson Street causing large queues at the intersections with Johnson and Woodin Avenue.
- **One-Way Streets:** Partially restricting access or creating one-way streets at specific locations impacted the surrounding roadway network. For many of these options the level-of-service analysis indicated good operations of LOS C or better, but with long queues. The excessive vehicle queuing is estimated to impact adjacent intersection operations and create more delay and congestion in the CBD. One-way street conversions were reviewed for the Woodin Avenue Bridge and Columbia Street corridors.

More information on the evaluation and results of the other specific improvements in the CBD are provided in Appendix B.

Summary of Evaluation Results

The alternatives evaluation highlighted that each of the improvement alternatives are feasible. However the more important question is which alternative has the broader support of the community. Figure 14 provides a comparison of each alternative based on each evaluation criterion. Following is a summary of the findings:

- **Public Support** - Comments and feedback from the public meetings indicated there was strong support for Alternatives 1 and 3. The community was in favor of creating the lakeside trail and making spot improvements within the CBD. While a number of the public supported Alternative 2, the property owners and neighborhood residents along the Gibson Avenue and Sanders Street corridors did not support the construction of an alternate route through their neighborhood.
- **Traffic Circulation and Operations** – Each of the alternatives provides moderate to significant improvement in intersection and roadway traffic operations as compared to the

no-build scenario. Alternative 2 provides the highest level of traffic operations due to construction of the alternate route and providing more circulation options within the CBD.

- **Safety** – Each alternative is expected to increase safety along the Park Road/SR 150 corridor by the creation of a center two-way left-turn lane and the Lakeside trail. These improvements better separate pedestrians and bicycles from vehicular traffic and create a left-turn storage lane for vehicles turning in/out of the numerous driveways along the corridor. Alternatives 2 and 3 provide significant safety improvements with the construction of more pedestrian and bicycle facilities within the CBD. Alternative 2 reconstructs the Sanders Street and Gibson Avenue corridors to urban design standards, while Alternative 3 modifies the Johnson Avenue corridor with construction of two roundabouts, pedestrian refuge islands, and a dedicated center two-way left-turn lane.
- **Pedestrians and Bicycles** – The new Lakeside trail is common to each of the alternatives and provides enhanced pedestrian and bicycle connectivity to the CBD. Similar to the safety enhancements, Alternatives 2 and 3 provide the most significant pedestrian and bicycle improvements. While Alternative 2 focuses improvements along the Sanders Street and Gibson Avenue corridors, Alternative 3 focuses on the Johnson Avenue corridor. Each alternative provides better pedestrian crossings, sidewalks, bike lanes, on-street parking, and a reduction in roadway cross-section.
- **Freight Mobility** – Better freight mobility will only be accomplished by providing additional capacity on existing roadways or by the construction of new routes through the CBD. Alternative 2 provides the highest level of mobility for freight and trucks because it decreases vehicle volumes along Park Road/SR 150 and provides an alternate route between the north shore and the CBD.
- **Tourism and Regional Economy** – Tourism and the regional economy is enhanced by each of the alternatives. Alternative 2 improves tourism and the regional economy the most by constructing the Lakeside trail and building an alternate route through the CBD. The new route improves the regional economy by making it easier to bypass congestion in the CBD and more quickly move freight and goods from/to the north shore. The Lakeside trail, which is common to each alternative, enhances tourism by creating a trail that connects the CBD with the parks and resorts along the lake.
- **Relative Cost** – The total costs of each alternative vary widely. Alternative 1 costs the least because it provides the fewest improvements. Alternative 2 is the most expensive alternative due to the reconstruction of the Sanders Street and Gibson Avenue corridors. It will also require the purchase of additional right-of-way along Gibson Avenue and Sanders Street. Alternative 3 would cost less than Alternative 2 and more than Alternative 1, but provide the most overall benefit to the community and address the major circulation issues and challenges within the CBD.

Preferred Alternative

After reviewing the main objectives of the study and comments received at each of the three public meetings, **Alternative 3 was identified as the preferred alternative.** The improvements that comprise Alternative 3 are shown in Figure 11. Appendix C includes some conceptual design drawings of the Park Road/SR 150 corridor with the lakeside trail. The preferred alternative provides significant improvements within the CBD for vehicles, pedestrians, and bicyclists and is anticipated to meet the future travel demands within the City for the next 20 years.

While Alternative 2 provided the most significant improvements as compared to the evaluation criterion (see Figure 13), it did not have the public or political support necessary for it to become the preferred alternative. Instead, Alternative 3 was chosen because it focuses improvements on the existing arterials within the CBD. While the preferred alternative does not add significant roadway capacity within the CBD, it does better manage the existing transportation infrastructure for all modes of travel. It focuses improvements along the SR 150 corridor (Johnson Avenue and SR 150/Park Road) to better accommodate pedestrians and bicyclists, while also facilitating easier access to/from the adjoining businesses and properties with the conversion of the corridor to a three-lane arterial. The reconstructed corridor will include a center two-way left-turn lane and auxiliary lanes at specific locations to accommodate access to the numerous driveways intersecting the corridor. Included with these improvements will be the creation of the Lakeside trail to increase pedestrian and bicycle connectivity between the lake shore and the CBD.

The following highlights the major benefits of the preferred alternative:

- Accommodates expected development growth within and around the City of Chelan for the next 20 years.
- Improves traffic operations at the study intersections and along the SR 150 corridor, with LOS C or better operations during the average weekday PM peak hour.
- Provides enhanced pedestrian and bicycle facilities along the lakeshore and Park Road/SR 150 and Johnson Avenue corridors.
- Increases safety for vehicles, pedestrians, and bicyclists by providing greater separation between each mode of travel along Park Road/SR 150 and Johnson Avenue.
- Provides refuge for left turning vehicles and improves driveway access along Park Road and Johnson Avenue.
- Promotes slower vehicle speeds along the Park Road/SR 150 and Johnson Avenue corridors.
- Improves sight distances and visibility of pedestrians along Park Road/SR 150 and Johnson Avenue by reducing the roadway cross-section.
- Provides improved pedestrian crossings along Johnson Avenue.
- Promotes increased tourism with enhanced pedestrian facilities between the CBD and lakeshore.
- Improvements can take place in phases and can be timed according to when funding becomes available. The improvements do not need to be constructed all at one time.
- Overall design and construction costs are expected to be lower than constructing an alternative route around the CBD.

These improvements are recommended for completion by the year 2024. These are long-term improvements and should be constructed in a logical progression and grouped to minimize the impact to interim traffic conditions in the City of Chelan.

Additional Study Improvements

As a result of the public process and the study analyses, a number of pedestrian improvements were recommended to address pedestrian issues within the City and to provide a better multimodal system within Chelan. The City's current pedestrian/bicycle system is limited to uncontrolled crossings and the Riverwalk trail system. A short separated pedestrian trail is located along the southern side of SR 150 along the north end of the RV/campground located adjacent to Don Morse Park. The improvements listed below are intended to provide a safer pedestrian environment and increase driver awareness.

Table 12. Pedestrian Improvement Projects

Project	Construction Year	Estimated Cost	Funding Source¹
1. Columbia Street/Johnson Avenue (SR 150) – Signalize intersection and re-striping.	2006	503,000	SCP
2. SR 150 at Gibson Avenue – Pedestrian Crossing Improvements (overhead and side arm signals with advanced LED signage)	2006	125,500	PSMP
3. SR 150 at Nixon Avenue – Pedestrian Crossing Improvements (overhead and side arm signals with advanced LED signage)	2006	125,500	PSMP
4. Bradley Street/97– Pedestrian Crossing Improvements (overhead and side arm signals with advanced LED signage)	2006	113,000	PSMP
• Phase 1 – Bradley Street and Highway 97 intersection			
5. Bradley Street – Pedestrian crossing improvements and sidewalks on Bradley Street to Sayles Avenue to connect Riverwalk pedestrian/bikeway from grade school to high school	2006		PSMP
• Phase 2 – Bradley Street (Woodin Avenue to Okanogan Avenue)		121,000	
• Phase 3 – Bradley Street (Okanogan Avenue to Sayles Avenue)		132,000	
6. Gibson Avenue Pedestrian Improvements – from SR 150 to Sanders Street, install curb ramps and pedestrian crossings for improved safety and transit accessibility	2006	229,000	SCP
7. Lakeside Trail Phase 1 – Gibson Avenue to the Old Woodin Avenue Bridge	2006	715,550	Enhancement

1. Transportation Improvement Board Funding Programs; SCP – Small Cities Program; PSMP – Pedestrian Safety Mobility Program. Enhancement Funding through NCRTPPO and/or statewide funding under WSDOT.

Additional improvements recommended though the public involvement efforts included:

- Adding directional and oversize vehicle signage needed on SR 150 and SR 97A to advise through traffic to use the Dan Gordon Bridge.
- Advance signage for the crosswalk at the north end of the Woodin Avenue Bridge to increase driver awareness and pedestrian safety.
- Channel pedestrian crossings on SR 150 along the Don Morse Park frontage to the Columbia SR 150 intersection to increase pedestrian safety.
- Provide a two way left turn lane on Woodin Avenue from Bradley Street intersection through the Navarre Street intersection to improve traffic operations.
- Redesign the Don Morse Park entry ways to provide off street queuing areas for park destination traffic.
- Provide improved pedestrian facilities within the entire City for enhanced pedestrian safety.

- Roundabouts at both the Emerson Street/Johnson Avenue and Sanders Street/Johnson Avenue should include an entry feature, such as art or landscaping to provide more streetscape within the Central Business District.
- Work with Chelan County and the North Central Regional Transportation Planning Organization to analyze another roadway (north of the City) connecting to the Manson/north shore area to enhance regional circulation.
- A transportation corridor study should be completed for the SR 150 route to Manson to enhance traffic operations within the corridor.
- The SR 150/No See Um Road intersection should be analyzed for possible improvements.
- Provide better signage in the Central Business District for parking areas.
- As development occurs in the Chelan area, have new development construct roadway improvements to mitigate their impacts to the system.

Appendix A: LOS Definitions

Intersection Level of Service

Unsignalized Intersections

Unsignalized intersection level of service (LOS) criteria can be reduced into two intersection types: all-way stop-controlled and two-way stop-controlled. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s). This is because the performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. With this in mind, total average vehicle delay (i.e. average delay of all movements) for a two-way, stop-controlled intersection should be viewed with discretion. Table 1 shows LOS criteria for unsignalized intersections (both all-way and two-way, stop-controlled).

Table A-1 Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Total Delay (sec/veh)
A	≤ 10
B	>10 and ≤ 15
C	>15 and ≤ 25
D	>25 and ≤ 35
E	>35 and ≤ 50
F	>50

Signalized Intersections

Signalized intersection LOS is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically, LOS criteria are stated in terms of average delay per vehicle during a specified time period (for example, the PM peak hour). Vehicle delay is a complex measure based on many variables, including signal phasing (i.e. progression of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. Table 2 shows LOS criteria for signalized intersections, as described in the *Highway Capacity Manual* (Transportation Research Board, Special Report 209, 2000).

Table A-2 Level of Service Criteria for Signalized Intersections

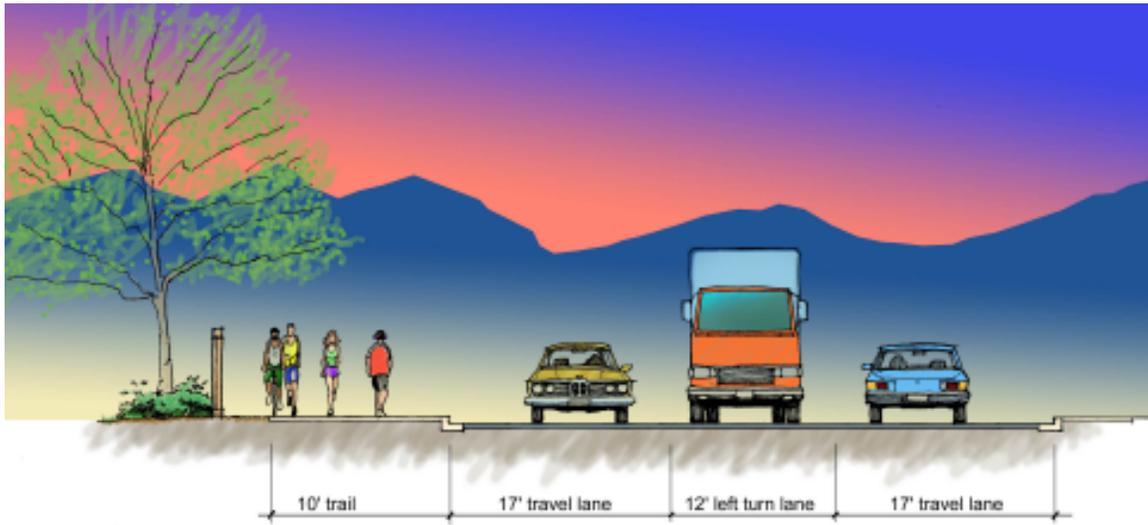
LOS	Control Delay Per Vehicle (Seconds)	General Description (Signalized Intersections)
A	≤ 10	Free Flow
B	>10 and ≤ 20	Stable Flow (slight delays)
C	>20 and ≤ 35	Stable Flow (acceptable delays)
D	>35 and ≤ 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 and ≤ 80	Un stable flow (intolerable delay)
F	> 80	Forced flow (jammed)

Appendix B: Evaluation of Improvements

Chelan CBD Circulation Options - Future 2024 PM Peak Hour									
Intersection Locations	Alternative #	1	2	3	4	5	6	7	
		Three-Lane Johnson Street Roundabout at Emerson Roundabout at Sanders (Assumed for all options)	Left-Turn Restrictions @ Woodin&Columbia	Pedestrian-Only Street on Columbia between Johnson and Woodin	One-Way Columbia Street Northbound between Johnson and Woodin	One-Way Columbia Street Southbound between Johnson and Woodin	One-Way Woodin Avenue Bridge Northbound	One-Way Woodin Avenue Bridge Southbound	
	Locating Maps	THREE-LANE JOHNSON STREET WITH ROUNDABOUTS AT EMERSON/JOHNSON AND SANDERS/JOHNSON							Legend
Columbia St and Johnson Ave (SR 150)		Facilities > Single EB and WB thru lanes > EB and WB left and right-turn lanes > Install traffic signal Technical Issues > EB vehicle queue extends beyond Cedar St > NB queue extends nearly to Woodin Ave	Facilities > Install traffic signal > Install advance signage Technical Issues > Increased EB thru volumes > EB vehicle queues extend beyond Cedar St	Facilities > Close south approach to intersection > Install traffic signal > Install advanced signage Technical Issues > EB vehicle queues extend beyond Cedar St	Facilities > Close approach lanes and change channelization > Install traffic signal > Install advanced signage Technical Issues > EB queues block Cedar St > NB queues extend to Woodin Ave	Facilities > Close NB approach to intersection > Install traffic signal > Install advanced signage Technical Issues > WB queues extend to Emerson	Facilities > Install traffic signal > Install advanced signage Technical Issues > EB queues extend past Cedar St	Facilities > Install traffic signal > Install advanced signage Technical Issues > WB queues exceeds storage, impacting Emerson	 Turning Movement Restriction
Columbia St and Woodin Ave		Facilities > Add median refuge along Woodin for SB lefts Technical Issues > Excessive SB left-turn delay > Remove 2 parking stalls	Facilities > Install advance signage > Minor channelization adjustments Technical Issues > Improves intersection operations > Provides additional ROW wider sidewalks, bike lanes, etc.	Facilities > Close north approach to intersection > Close EB left-turn lane > Provide advance signage Technical Issues > Improves intersection operations > Provides a pedestrian plaza along Columbia St and additional parking along Woodin Ave	Facilities > Close SB approach to intersection > Install advance signage Technical Issues > Improves intersection operations > Allows room for more on-street parking, trail, and pedestrian amenities	Facilities > Close EB left-turn lane > Install advance signage Technical Issues > Improves intersection operations > Allows room for more on-street parking, trail, and pedestrian amenities	Facilities > Close SB right and WB thru lanes > Install advance signage > Add median refuge along Woodin for SB lefts Technical Issues > Excessive SB left-turn delay > Remove 2 parking stalls	Facilities > Close EB approach lanes > Install advanced signage Technical Issues > Improves intersection operations	 One-Way or Redirected Traffic
Emerson St and Johnson Ave (SR 150)		Facilities > Construct single-lane roundabout Technical Issues > Preliminary design needed > Provides a pedestrian refuge island for NB and SB approaches > Accommodate large vehicles/trucks	Facilities > Construct single-lane roundabout Technical Issues > Increased volume from re-routed traffic > NB and WB queuing exceeds storage, impacting Woodin and Sanders	Facilities > Construct single-lane roundabout Technical Issues > Increased volume from re-routed traffic > NB and WB queuing exceeds storage, impacting Woodin and Sanders	Facilities > Construct single-lane roundabout Technical Issues > Increased volume from re-routed traffic > EB queuing exceeds storage, impacting Columbia	Facilities > Construct single-lane roundabout Technical Issues > Increased volume from re-routed traffic > NB and WB queuing exceeds storage, impacting Woodin and Sanders	Facilities > Construct single-lane roundabout Technical Issues > Provides enough capacity for increased thru traffic > Slight Increase in EB queue	Facilities > Construct single-lane roundabout Technical Issues > WB queue exceeds storage, impacting Sanders	 Overall Intersection Level of Service
Emerson St and Woodin Ave		Facilities > No Proposed Improvements Technical Issues > No Issues	Facilities > No Proposed Improvements Technical Issues > Increased volume from re-routed traffic > Increased SB and EB delay and queuing > Interaction with parking to cause additional delay	Facilities > No Proposed Improvements Technical Issues > Increased volume from re-routed traffic > Increased EB delay and queuing > Interaction with parking to cause additional delay	Facilities > No Proposed Improvements Technical Issues > Increased volume and SB queuing from re-routed traffic > Interaction with parking to cause additional delay	Facilities > No Proposed Improvements Technical Issues > Increased volume from re-routed traffic > EB delay and increased queuing > Interaction with parking to cause additional delay	Facilities > No Proposed Improvements Technical Issues > Reduced WB volume improves intersection operations	Facilities > No Proposed Improvements Technical Issues > Reduced EB volume improves intersection operations	 Street Closed or Improved
Sanders St and Johnson Ave (SR 150)		Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > Preliminary design needed > Provides pedestrian refuge islands > Accommodate large vehicles/trucks > Parking remains on Sanders	Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > Minor increase in traffic > Satisfactory Operations (low delay) > Parking remains on Sanders	Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > Minor increase in traffic > Satisfactory Operations (low delay) > Parking remains on Sanders	Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > Minor increase in traffic > Satisfactory Operations (low delay) > Parking remains on Sanders	Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > Minor increase in traffic > Satisfactory Operations (low delay) > Parking remains on Sanders	Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > Provides enough capacity for increased EB right turns slight increase in EB queue > Parking remains on Sanders	Facilities > Construct single-lane roundabout and EB Right-Turn slip lane Technical Issues > NB queue extends to Woodin > Parking remains on Sanders	 Intersection Noted or Area of Interest
Sanders St (SR 150, US 97A) and Woodin Ave (SR 150)		Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Revise signal timing to assure SB vehicle queues do not spill back into roundabout	Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Possible minor traffic volume increase handled by signal optimization	Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Traffic volume increase handled by signal optimization	Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Traffic volume increase handled by signal optimization	Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Traffic volume increase handled by signal optimization	Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Traffic volume increase handled by signal optimization	Facilities > Exclusive SB left-turn and thru lane to match roundabout > Add NB right-turn pocket Technical Issues > Traffic volume increase handled by signal optimization	 Good Operations Acceptable Operations Unacceptable Operations
Overall Rating			 Queuing impacts adjacent intersection operations	 Queuing impacts adjacent intersection operations and causes poor LOS	 Queuing impacts adjacent intersection operations	 Queuing impacts adjacent intersection operations and causes poor LOS		 Queuing impacts adjacent intersection operations	

Appendix C: Park Road and Lakeside Trail
Conceptual Designs

Figure C-1. Proposed Cross Section of Park Road / SR 150



Chelan Lakeside Trail - Phase 1 Urban Trail Cross Section

Figure C-2. Conceptual Design and Channelization of Park Road / SR 150

