

Prepared for



McNary High School

Transportation Impact Analysis



Prepared by



February 2019



117 Commercial St NE
Suite 310
Salem, OR 97301
503.391.8773
dksassociates.com

February 19, 2019

John Shirley, AIA
Anderson Shirley Architects, Inc.
695 Commercial Street SE, Suite 5
Salem, OR 97301

Subject: McNary High School Renovation Transportation Impact Analysis

P18032-000

Dear John,

DKS Associates is pleased to submit this transportation impact analysis for the proposed McNary High School renovation and addition located at 595 Chemawa Road N in Keizer, Oregon. Please feel free to call if you have any questions or comments regarding this study.

Sincerely,
DKS Associates

A handwritten signature in blue ink, appearing to read "Scott M. Mansur".

Scott Mansur, P.E., PTOE
Transportation Engineer



TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND SUMMARY	3
Project Traffic Impact.....	4
Project Mitigation Summary	6
CHAPTER 2: EXISTING CONDITIONS.....	8
Project Site	8
Study Area Roadway Network	8
Existing Traffic Volumes and Operations	9
Intersection Performance Measures	11
Collision History.....	13
Pedestrian and Bicycle Activity	14
Public Transit Service	14
Parking and Site Circulation Observations.....	15
Parking Survey	17
Planned Improvement Projects.....	18
CHAPTER 3: IMPACTS	20
Proposed Development	20
Trip Generation.....	20
Trip Distribution.....	21
Future Traffic Conditions.....	23
Site Plan Review.....	27
Claggett Street Sensitivity Analysis.....	32
Queuing Analysis.....	32
CHAPTER 4: PROJECT MITIGATION SUMMARY.....	34

LIST OF FIGURES

Figure 1: Study Area	3
Figure 2: Study Area	8
Figure 3: 2018 Existing Traffic Volumes, Lane Geometries, and Traffic Control	10
Figure 4: Study Area Crash Diagram (2014 – 2016)	13
Figure 5: Project Trip Traffic Volumes and Trip Distribution.....	22
Figure 6: 2020 Background Traffic Volumes	24
Figure 7: 2020 Total Traffic Volumes	25
Figure 8: Safe Routes to School Map.....	29

LIST OF TABLES

Table 1: Study Area and Proposed Project Characteristics	4
Table 2: Existing Study Intersection Operations (A.M. and Midday Peak Hours).....	5
Table 3: 2020 Background and Total Operations (A.M. and Midday Peak Hours).....	6
Table 4: Study Area Roadway Characteristics	9
Table 5: Existing Study Intersection Operations (A.M. and Midday Peak Hours).....	12
Table 6: Study Intersection Collisions (2014 - 2016)	14
Table 7: Parking Space Utilization.....	17
Table 8: City of Keizer Planned Transportation Improvement Projects.....	19
Table 9: Local and National Trip Generation Rate Comparison.....	21
Table 10: McNary Existing and Proposed Trip Generation	21
Table 11: 2020 Background and Total Operations (A.M. and Midday Peak Hours)	26
Table 12: City of Keizer Parking Requirements	31
Table 13: Vehicle Parking Demand and Proposed Supply	31
Table 14: Bicycle Parking Demand	32
Table 15: Sensitivity Analysis Intersection Operations for Claggett Street.....	32
Table 16: AM Peak Hour 95 th Percentile Queuing on Celtic Way	33

CHAPTER 1: INTRODUCTION AND SUMMARY

This study evaluates the transportation impacts for Salem-Keizer School District’s plan to modernize, add classrooms, and improve the site circulation and parking at McNary High School, located in Keizer. The building expansion is planned north and south of the existing school building and two new parcels of land will be bought and leased by the School District to provide additional sports fields and more parking for students. The purpose of this study is to gain approval from the City of Keizer to construct the desired improvements. This report documents the evaluation of existing transportation conditions, trip generation and distribution, future conditions, and transportation impacts within the study area. The purpose of this report is to determine mitigation measures to offset the traffic impacts from the proposed project.

The study area for the project is shown in Figure 1 and was determined based on discussions with City staff. Within the study area, there are five study intersections where traffic operations are analyzed:

- Lockhaven Drive/Celtic Way
- Lockhaven Drive/River Road
- Chemawa Road/Celtic Way
- Chemawa Road/River Road
- River Road/Claggett Street

Project traffic impacts were evaluated at the study intersections for the weekday a.m. and midday peak hours. The impact analysis includes trip generation, trip distribution, and future traffic operating conditions at the study intersections. Following the analysis, recommended mitigations are described and analyzed.

This report also includes a project site evaluation that addresses access issues (e.g., location and spacing), sight distance, internal circulation, and parking. At the end of the report, a summary of the recommended transportation mitigation measures that are expected to offset the negative transportation impacts of future traffic growth is presented. Table 1 lists important characteristics of the study area and proposed project.

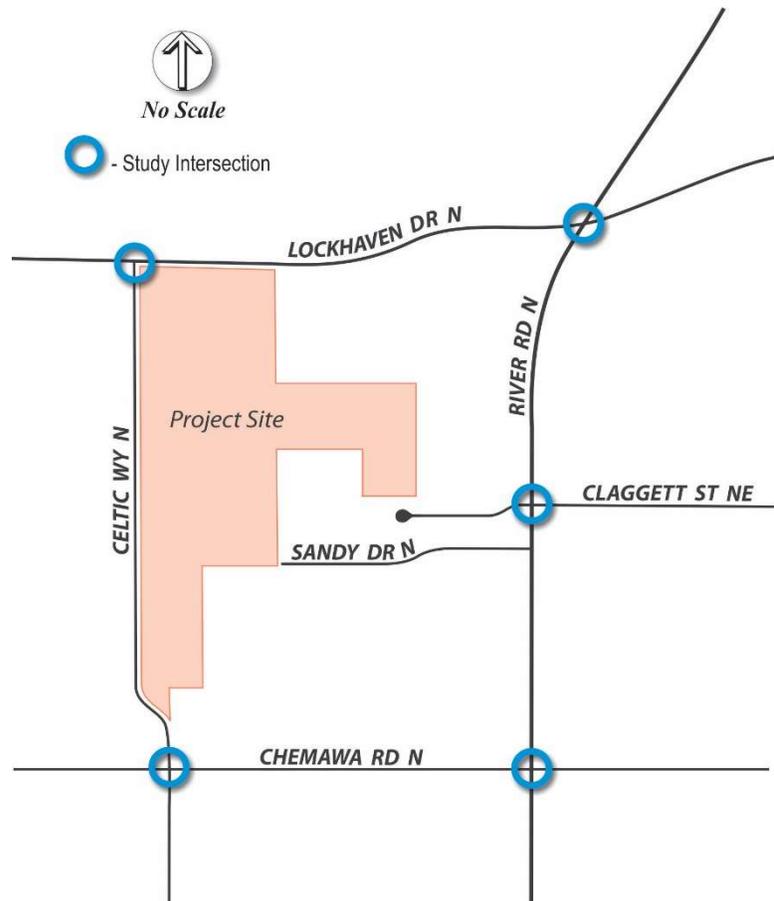


Figure 1: Study Area

Table 1: Study Area and Proposed Project Characteristics

Characteristics	Information
Study Area	
Number of Study Intersections	Five
Analysis Periods	Weekday a.m. peak hour (one hour within 7-9 a.m.) Weekday midday school peak hour (one hour within 2-4 p.m.)
Proposed Development	
Existing Size and Land Use	High School with 2,050 students
Future Size and Land Use	High School with 2,200 students
Additional Project Trips (based on 150 student increase)	81 (49 in, 32 out) a.m. peak hour trips 42 (15 in, 27 out) midday school peak hour trips
Vehicle Access Points	Full access intersections at Lockhaven Drive /Celtic Way (TWSC) and Chemawa Road /Celtic Way (Signalized)
Other Transportation Facilities	
Pedestrian Facilities	Sidewalks are available adjacent to developed properties and along upgraded roadways.
Bicycle Facilities	Marked bike lanes on Lockhaven Drive, River Road, and Chemawa Road
Nearest Transit Stop	Bus stops for Cherriots Route 14 are located on Lockhaven Drive at the Lakefair Place intersection and on Chemawa Road at the Celtic Way intersection. Route 14 travels at approximately 30-minute headways throughout the day. Bus stops for Cherriots Routes 9 and 19 are located on River Road at the Claggett Street intersection. Route 9 travels at approximately 30 -minute headways throughout the day and Route 19 travels at 15-minutes headways.

Project Traffic Impact

To determine project impact at the study intersections, traffic operating conditions were analyzed during the a.m. and midday peak hours for the following scenarios:

- 2018 Existing
- 2020 Background (includes background growth and traffic from approved developments in the project vicinity that are not yet constructed)
- 2020 Total (includes background traffic plus project trips from the 150-student increase in high school enrollment)

The 2020 scenario was selected for analysis since it is the anticipated year of opening for the high school expansion. The analysis of this year was also coordinated with Salem-Keizer School District staff. For future 2020 background volumes, a 1.2% annual growth was applied to all study area roadways. For future 2020 total volumes, trip generation was performed for the proposed school using local rates. Traffic signal timing information was provided by City of Salem staff for the traffic signals at study intersections since the City of Salem maintains the City of Keizer’s traffic signals. This signal timing information was used in the existing and future traffic analysis.

2018 Existing Operating Conditions

The existing traffic operations at the study intersections were determined for the a.m. and midday peak hours using *2000 Highway Capacity Manual* methodology¹ for signalized and the *2010 Highway Capacity Manual* methodology² for unsignalized intersections. The level of service (LOS) and volume to capacity (v/c) ratio of each study intersection are listed in Table 2. As shown, all the study intersections meet the City standards.

Table 2: Existing Study Intersection Operations (A.M. and Midday Peak Hours)

Intersection	Operating Standard	A.M. Peak		Midday Peak	
		LOS	v/c	LOS	v/c
Two-Way Stop Controlled					
Lockhaven Drive/Celtic Way	LOS E	A/C	0.42	A/C	0.43
Signalized					
Lockhaven Drive/River Road	v/c ≤ 1.0	D	0.86	D	0.85
River Road/Claggett Street	LOS D	A	0.43	A	0.46
Chemawa Road/River Road	v/c ≤ 0.95	D	0.77	D	0.74
Chemawa Road/Celtic Way	LOS D	D	0.81	D	0.52

Signalized intersections:

LOS = Level of Service of Intersection

v/c = Volume-to-Capacity Ratio of Intersection

Two-Way Stop Controlled intersections:

LOS = Level of Service of Major Street/Minor Street

v/c = Volume-to-Capacity Ratio of Worst Movement

2020 Traffic Operating Conditions

The future intersection operations were analyzed for the peak hours using *2000 Highway Capacity Manual* methodology signalized intersections and *2010 Highway Capacity Manual* methodology for unsignalized intersections.

¹ *2000 Highway Capacity Manual*, Transportation Research board, 2000.

² *2010 Highway Capacity Manual*, Transportation Research board, 2010.

Intersection operating conditions for the 2020 Background and Total traffic scenarios are listed in Table 3. As shown, all study intersections would meet applicable City operating standards for all peak hours and scenarios.

Table 3: 2020 Background and Total Operations (A.M. and Midday Peak Hours)

		2020 Background				2020 Total			
Intersection	Operating Standard	A.M. Peak		Midday Peak		A.M. Peak		Midday Peak	
		LOS	v/c	LOS	v/c	LOS	v/c	LOS	v/c
Two-Way Stop Controlled									
Lockhaven Dr/ Celtic Way	LOS E	A/C	0.43	A/C	0.43	A/C	0.48	A/C	0.46
Signalized									
Lockhaven Dr/ River Rd	v/c ≤ 1.0	D	0.87	D	0.86	D	0.89	D	0.87
River Rd/ Claggett St	LOS D	A	0.44	A	0.47	A	0.44	A	0.48
Chemawa Rd/ River Rd	v/c ≤ 0.95	D	0.79	D	0.76	D	0.80	D	0.76
Chemawa Rd/ Celtic Way	LOS D	D	0.82	D	0.55	D	0.85	D	0.58

Signalized intersections:

LOS = Level of Service of Intersection
v/c = Volume-to-Capacity Ratio of Intersection

Two-Way Stop Controlled intersections:

LOS = Level of Service of Major Street/Minor Street
v/c = Volume-to-Capacity Ratio of Worst Movement

Project Mitigation Summary

To preserve study area roadway performance and provide safe access to the updated McNary High School, it is recommended that the following additional transportation mitigation measures be performed. These project-related measures would typically be required as conditions of approval if the project were approved and should be coordinated with City of Keizer staff:

Sight Distance

- Prior to occupancy, sight distance at the existing access points will need to be verified, documented, and stamped by a registered professional Civil or Traffic Engineer licensed in the State of Oregon.

Pedestrian and Bicycle Access

- It is recommended that some pedestrian crossing treatments (ramps, signage, etc.) be installed where the path from the Claggett Street cul-de-sac meets the bus-only road near the northeast corner of the main building to provide a safe crossing for pedestrians.
- It is recommended to construct all sidewalks to meet ADA requirements.

Bus Loading and Access

- Bus only signage will need to be provided on site for areas where bus-only circulation occurs.

Parent Drop-off/Pick-up Areas

- It is recommended that signage be installed that prohibits parent pick-up/drop-off in the parking lot off Claggett Street and that the curb of the cul-de-sac be used for loading/unloading. It is also recommended that sidewalk be installed on the east side of that parking lot, connecting the cul-de-sac to the proposed sidewalk shown on the site plan.

Parking

- Based on 2,200 high school students, it is recommended that a minimum of 506 parking stalls be provided to meet the estimated typical demand.
- Based on 2,200 high school students, it is recommended that a minimum of 18 bicycle parking spaces be provided per the City code and current estimated demand.

CHAPTER 2: EXISTING CONDITIONS

This chapter documents existing study area conditions, including the project site, roadway network, existing traffic volumes, existing traffic operating conditions, collision history, pedestrian and bicycle activity, transit service, and planned improvements. Supporting details (i.e. traffic counts and level of service calculations) are provided in the appendix.

Project Site

McNary High School is currently located between Chemawa Road and Lockhaven Drive in Keizer, Oregon. This site is accessed via Celtic Way, which connects Chemawa Road (to the south) to Lockhaven Drive (to the north) and runs in front of the existing school building. The Chemawa Road/Celtic Way intersection is signalized, and the Lockhaven Drive/Celtic Way intersection is a stop-controlled intersection with Celtic Way being the minor street stopped approach. The Salem-Keizer School District’s desire is to modernize the campus for new and expanded educational facilities for up to 2,200 students and to improve the existing site circulation and parking. The new buildings and classrooms are proposed to be added north and south of the existing school building and two new parcels of land will be either purchased or leased by the Salem Keizer School District to provide additional sports fields and more parking for students and events. Currently, there are 2,050 students enrolled at McNary High School. Classes start at 7:30 a.m. each morning except on Thursdays, when classes begin at 8:05 a.m. School releases at 2:20 pm every day.

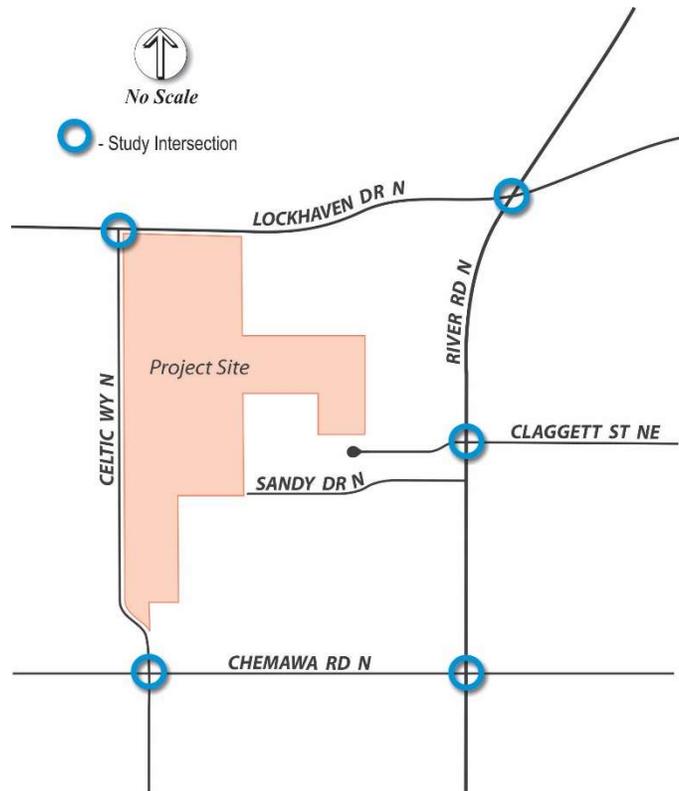


Figure 2: Study Area

Study Area Roadway Network

Key study area roadways are listed in Table 4 along with their functional classification and other important roadway characteristics. The functional classification for City of Keizer streets are based on the City of Keizer Transportation System Plan³ (TSP). Three of the main functional classes are local (more access but less mobility), collector (balanced access and mobility), and

³ City of Keizer Transportation System Plan, Kittelson & Associates, Revised June 2014.

arterial (less access but more mobility). The primary roadways in the immediate vicinity of the project site are Celtic Way, Lockhaven Drive, River Road, and Chemawa Road.

Table 4: Study Area Roadway Characteristics

Roadway	Functional Classification	Cross Section	Posted Speed	On-Street Parking	Sidewalks	Bike Lanes
Lockhaven Drive	Minor Arterial	3 lanes	35 mph	No	Yes	Yes
River Road	Major Arterial	5 lanes	35 mph	No	Yes	Yes
Chemawa Road	Minor Arterial	2 lanes	30 mph	No	Yes	Yes
Celtic Way	Local Street	2 lanes	15 mph	No	Partial ^a	No
Claggett Street	Local Street	2 lanes	25 mph	Yes	Yes	No

^a Sidewalks are only present on the east side of Celtic Way

Existing Traffic Volumes and Operations

Existing intersection operations analysis was performed for the study area intersections to ensure that the transportation network reaches desired performance levels (agencies often specify intersection performance thresholds as required operating standards). Intersections are the focus of the analysis because they are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinity.

Due to the joint consideration of commuter and school peak traffic, intersection operations were analyzed for the a.m. and midday peak hours. The midday peak period coincides with the High School release time. In consultation with City of Keizer staff⁴, the following five existing study intersections were selected:

- Lockhaven Drive/Celtic Way
- Lockhaven Drive/River Road
- Chemawa Road/Celtic Way
- Chemawa Road/River Road
- River Road/Claggett Street

Traffic counts were collected⁵ for the a.m. and midday peak periods. The peak hour traffic volumes are shown in Figure 3. The detailed two-hour traffic counts are included in the appendix. Traffic signal timing information was provided by City of Salem staff⁶ for the traffic signals at Lockhaven Drive/River Road, Chemawa Road/River Road, and River Road/Claggett Street since the City of Salem maintains the City of Keizer traffic signals. This signal timing information was used for the intersection operational analysis. Before the analysis results of the study intersections are presented, discussion is provided for two important analysis issues:

⁴ Phone conversation with Shane Witham, City of Keizer, February 7, 2018.

⁵ Traffic counts were collected on March 8, 2018 by All Traffic Data during the morning and midday peak periods.

⁶ Traffic signal timing data was provided by Eric Destival, City of Salem on April 5, 2018.

intersection performance measures (definitions of typical measures) and required operating standards (as specified by the agency with roadway jurisdiction).

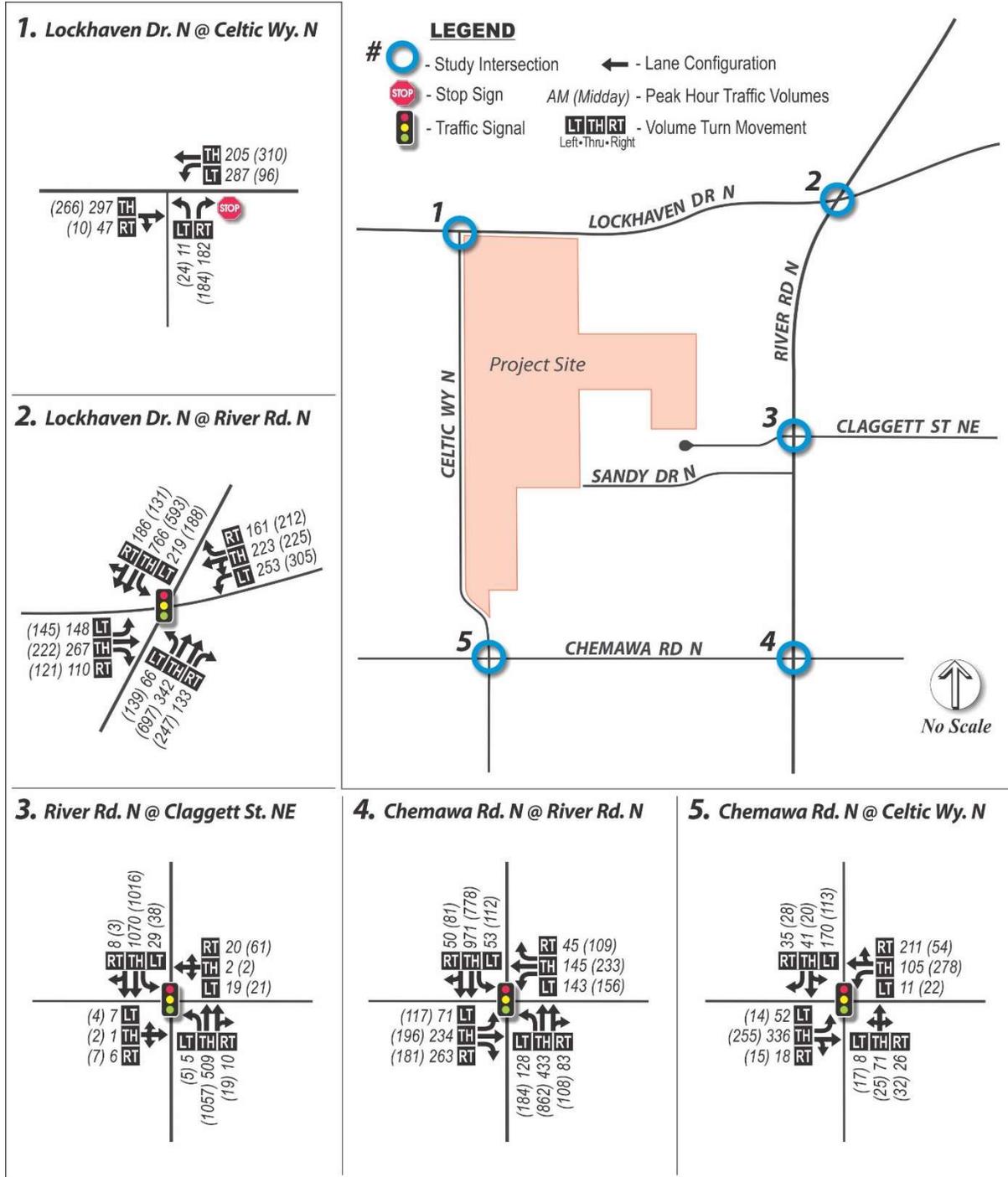


Figure 3: 2018 Existing Traffic Volumes, Lane Geometries, and Traffic Control

Intersection Performance Measures

Level of service (LOS) ratings and volume-to-capacity (v/c) ratios are two commonly used performance measures that provide a good picture of intersection operations. In addition, they are often incorporated into agency mobility standards.

- **Level of service (LOS):** A “report card” rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity. This condition is typically evident in long queues and delays.
- **Volume-to-capacity (v/c) ratio:** A decimal representation (typically between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. It is determined by dividing the peak hour traffic volume by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 0.95, congestion increases, and performance is reduced. If the ratio is greater than 1.00, the turn movement, approach leg, or intersection is oversaturated and usually results in excessive queues and long delays.

Required Operating Standards

The City of Keizer has jurisdiction for all study area intersections; therefore, City operating standards⁷ apply and are required to be met. City standards state that LOS D is the minimum acceptable standard for signalized intersections and LOS E for all-way stop-controlled intersections. For intersections of two arterial roadways (i.e. Chemawa Road/River Road), the minimum acceptable standard is a v/c ratio of 0.95 or less. For intersections within the Chemawa Interchange Overlay Zone (i.e. Lockhaven Road/River Road), the alternative standard is a v/c ratio of 1.0 or less.

Existing Operating Conditions

The existing traffic operations at the study intersections were determined for the a.m. and midday peak hours using *2000 Highway Capacity Manual* methodology⁸ for signalized intersections and *2010 Highway Capacity Manual* methodology⁹ for unsignalized intersections. The level of service (LOS) and volume to capacity (v/c) ratio of each study intersection are listed in Table 5. As shown, all intersections currently meet City operating standards.

⁷ Chapter 4, *City of Keizer Transportation System Plan*, Kittelson & Associates, Revised June 2014.

⁸ *2000 Highway Capacity Manual*, Transportation Research Board, 2000.

⁹ *2010 Highway Capacity Manual*, Transportation Research Board, 2018.

Table 5: Existing Study Intersection Operations (A.M. and Midday Peak Hours)

Intersection	Operating Standard	A.M. Peak		Midday Peak	
		LOS	v/c	LOS	v/c
Two-Way Stop Controlled					
Lockhaven Drive/Celtic Way	LOS E	A/C	0.42	A/C	0.43
Signalized					
Lockhaven Drive/River Road	v/c ≤ 1.0	D	0.86	D	0.85
River Road/Claggett Street	LOS D	A	0.43	A	0.46
Chemawa Road/River Road	v/c ≤ 0.95	D	0.77	D	0.74
Chemawa Road/Celtic Way	LOS D	D	0.81	D	0.52

Signalized intersections:

LOS = Level of Service of Intersection

v/c = Volume-to-Capacity Ratio of Intersection

Two-Way Stop Controlled intersections:

LOS = Level of Service of Major Street/Minor Street

v/c = Volume-to-Capacity Ratio of Worst Movement

It should be noted that long delays and queuing at the Lockhaven Drive/Celtic Way intersection were observed during the morning peak hour due to poor internal site circulation (see below). However, the queues last only for a brief period of time and the operations meet the City's operating standard over the peak hour.



Eastbound queues at the Lockhaven Drive/Celtic Way intersection during the AM peak hour

Collision History

The collision histories of the study intersections were obtained for 2014 - 2016 from the Oregon Department of Transportation (ODOT) Crash Analysis and Reporting Unit. Between 2014 and 2016, there were a total of 92 crashes at the five study intersections. One fatal injury crash occurred at the Chemawa Road/River Road intersection, in which a pedestrian was struck while walking on the roadway during nighttime (dark) conditions. There were also four Injury A crashes, two of which involved pedestrians. The pedestrian collisions, which occurred at River Road/Claggett Street and Chemawa Road/Celtic Way, were a result of the right-turning vehicles failing to yield to the pedestrians crossing the roadway. The other two Injury A crashes occurred at Lockhaven Drive/River Road and Chemawa Road/River Road, and were a head-on collision and a rear-end collision, respectively.

Based on the collision data and peak hour traffic counts, collision rates were estimated at the study intersections. ODOT publishes critical crash rates which represent the 90th percentile crash rates for specific types of intersections and roadway classifications across the state. If the collision rate exceeds the 90th percentile crash rate, this may indicate a safety concern and further investigation is warranted.

Table 6 shows the breakdown of collisions by severity, the 90th percentile crash rate, and the collision rate. The total number of crashes experienced at an intersection is typically proportional to the number of vehicles entering it; therefore, a crash rate describing the frequency of crashes per million entering vehicles (MEV) is used to evaluate safety performance.

As shown, the Lockhaven Drive/River Road and Chemawa Road/River Road collision rates were both above the ODOT 90th percentile crash rate. Of the 36 collisions at the Lockhaven Drive/River Road intersection, 28 collisions (78%) were rear-end. Of the 38 collisions at Chemawa Road/River Road, 30 collisions (79%) were rear-end.

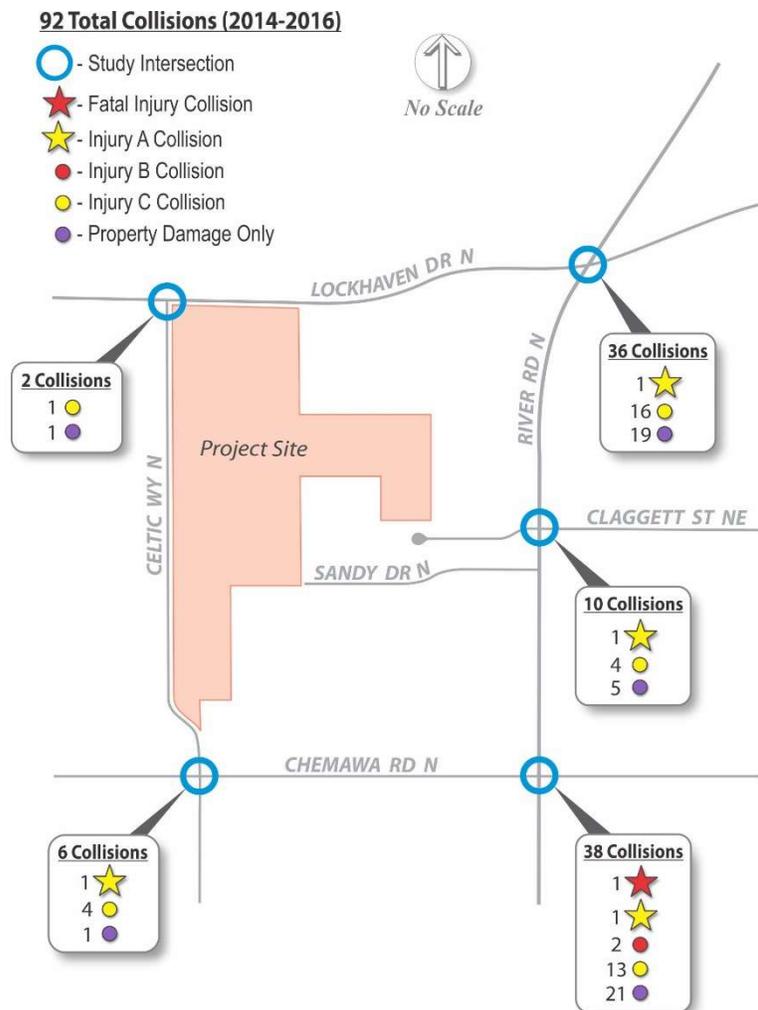


Figure 4: Study Area Crash Diagram (2014 – 2016)

Table 6: Study Intersection Collisions (2014 - 2016)

Intersection	Collisions (by Severity)				90 th Percentile Crash Rate ^b	Collision Rate ^c
	Fatal	Injury	PDO ^a	Total		
Lockhaven Drive/Celtic Way	0	1	1	2	0.293	0.205
Lockhaven Drive/River Road	0	17	19	36	0.860	1.02
Chemawa Road/Celtic Way	0	5	1	6	0.860	0.628
Chemawa Road/River Road	1	16	21	38	0.860	1.11
River Road/Claggett Street	0	5	5	10	0.860	0.409

Bold and **Highlighted** cells indicate the collision rate is above the 90th percentile crash rate

^a PDO = Property damage only.

^b 90th Percentile Crash Rates from Analysis Procedure Manual, Exhibit 4-1

^c Collision rate = average annual collisions per million entering vehicles (MEV); MEV estimates based on p.m. peak-hour traffic count.

Pedestrian and Bicycle Activity

Pedestrian activity was high both before and after school hours. In the morning, most pedestrians were observed to enter campus using the MacArthur Street pedestrian access located west of the school parking lot. This pedestrian connection connects the school with the adjacent neighborhood. Approximately 133 pedestrians were observed using this pedestrian connection in the morning. Many pedestrians also entered campus at the Chemawa Road/Celtic Way intersection. According to the collected traffic count data, over 100 pedestrian crossings were observed at this intersection.

During the after school peak hour, most pedestrians either left campus via the signalized intersection at Chemawa Road/Celtic Way or the pedestrian access at MacArthur Street. About 150 pedestrian crossings were observed at the Chemawa Road/Celtic Way intersection. Many pedestrians were also observed to be leaving campus via the MacArthur Street pedestrian access. A small number of pedestrian crossings, 13, were observed also at the Lockhaven Drive/Celtic Way intersection after school.

Bicycle activity was observed to be low. During the morning peak hour, no bicyclists were observed crossing any of the Celtic Way intersections and only one was seen at the MacArthur Street access. During the after school peak hour, 2 bicyclists were observed at both Celtic Way intersections.

Public Transit Service

Salem-Keizer Transit (Cherriots) provides public transportation services within the Salem-Keizer Urban Growth Boundary (UGB). There is currently one transit line (Route 14) that provides

service to Lockhaven Drive and Chemawa Road near the high school. Route 14 travels in a loop and has half-hour headways throughout the day, including the a.m. and midday peak hours. Cherriots Route 9 and Route 19 provide service to River Road at Claggett Street. Route 9 has half-hour headways throughout the day and Route 19 has 15-minute headways throughout the day. The nearest transit stop is located approximately ¼ mile from the high school.

Parking and Site Circulation Observations

Observations were also performed during the a.m. and midday peak hours on April 5th and April 6th of 2018. Morning observations were made on Friday, April 6th, to capture a typical start time of 7:30 a.m. The purpose of these site visits was to observe the vehicle circulation and parking issues on site prior to the start of school and after school release. The following issues were observed:

- During the morning, students cut through the parking lot and walked through drive aisles to get to school building entrances. There are no designated walkways though the school parking lot to the school entrances (see photo below).



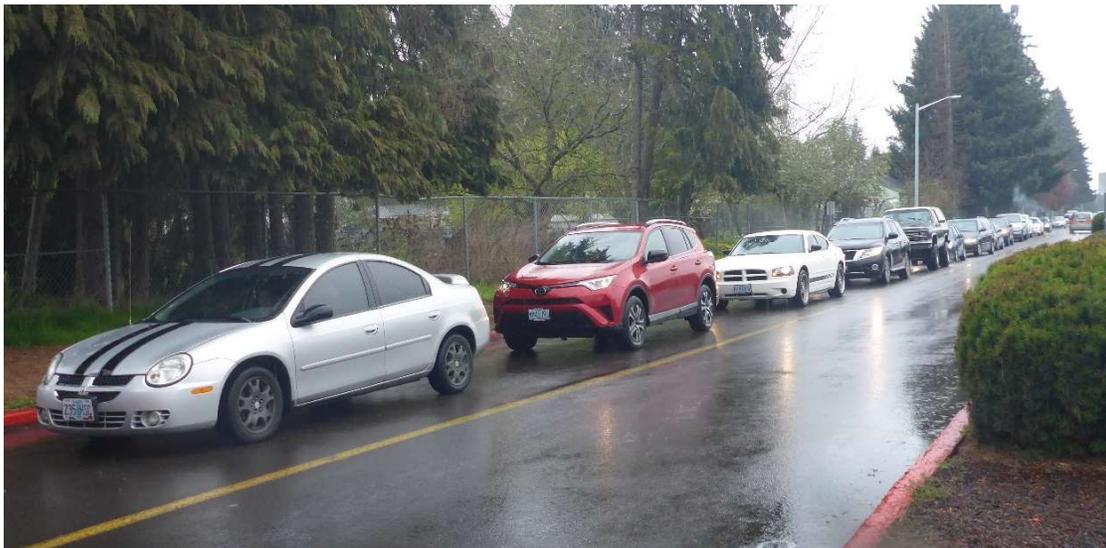
Students cut through parking lot during the morning.

- Vehicles were observed to cut through the parking lot diagonally through unoccupied parking stalls instead of using the designated aisles, causing unpredictable vehicle behavior.
- After school was released in the midday at 2:20 p.m., cars were already queuing from the front of school entrance back onto Celtic Way (see photo below). Because of the long queues and congestion on-site, cars were observed to pick-up or drop-off students on the south leg of Delight Street so as to avoid waiting in line.



Parent Pick-up vehicles start to queue before school is released in the midday.

- By 2:30 pm, vehicles attempting to exit the site at the signalized Chemawa Road/Celtic Way intersection queue back into the parking lot (see below). School buses are intermixed with this traffic creating numerous conflict points with students walking from school buildings to parked vehicles and the pathway connection to MacArthur Street. It took approximately 3-5 minutes for a school bus to travel from the bus loading area in front of the Gymnasium to the Chemawa Road/Celtic Way intersection.



Vehicles queue at Chemawa Road/Celtic Way signal after school hours.

Parking Survey

Three parking space utilization surveys were conducted at 7:45 a.m., 10 a.m., and 2 p.m. on a typical school day. The results of the surveys are shown in the table below. “Cars parked illegally” refers to the vehicles that are parked in the no parking areas located at the ends of the parking stall aisles (see photo below) or adjacent to school buildings that are signed for no parking. Cars parked on “MacArthur Street” refers to the number of vehicles that were found to park on MacArthur Street, which is adjacent to the west side of the parking lot and provides pedestrian connection to the site. Parking that occurs here is likely due to students that do not have parking passes to the on-site lot. If additional parking were available these students would likely park on-site.

Table 7: Parking Space Utilization

Location	Estimated Capacity, Typical School Day					
	7:45 am		10 am		2 pm	
	Spaces Used/ Spaces Available	Percent Occupied	Spaces Used/ Spaces Available	Percent Occupied	Spaces Used/ Spaces Available	Percent Occupied
On-Site						
Student Parking	293 / 320	92%	313 / 320	98%	210 / 320	66%
Staff/Visitor Parking	105 / 165	64%	136 / 165	82%	113 / 165	68%
Handicap Spaces	3 / 10	30%	0 / 10	0%	5/10	50%
Cars Parked Illegally	5	-	7	-	0	-
Off-Site						
MacArthur Street	10	-	14	-	14	-
Total	416/495	84%	470/495	95%	342/495	70%

As shown, shortly after the start of school (7:45 a.m.), there is approximately 92% of the student parking spaces being occupied. By 10 a.m., there are even fewer parking spaces available for students which cause some students to park illegally on-site or park in the adjacent neighborhood (see photos below). Based on the parking survey, there appears to be sufficient staff/visitor parking and handicap parking spaces throughout the day.

The estimated parking demand rate for McNary high school is calculated by summing the number of parking spaces (including illegal and off-site parking) and dividing by the number of enrolled students. In the morning, the peak parking demand rate is 0.23 spaces per student.



Vehicles are parked illegally on-site.



Vehicles are parked on MacArthur Street during the day adjacent to the school.

Planned Improvement Projects

There is one transportation improvement project in the project study area that is identified in the Chapter 9 of the City's Transportation System Plan (TSP)¹⁰. This planned project is summarized in Table 8 and is financially unconstrained (no funding has been identified). Since there is no funding identified, this improvement was not assumed for future transportation analysis scenarios.

¹⁰ Chapter 9, City of Keizer Transportation System Plan, Kittelson & Associates, June 2009.

Table 8: City of Keizer Planned Transportation Improvement Projects

Intersection	TSP Project Number and Description
Lockhaven Road/River Road	<p>TSP Medium Priority Project R4 The improvements identified will convert the westbound approach to dual left-turn lanes, single through lane, and separate right-turn lane and change the split phasing to protected left-turn phasing on Lockhaven Drive.</p>

CHAPTER 3: IMPACTS

This chapter reviews the impacts that the proposed modernization and classroom additions to the McNary High School campus would have on the study area transportation system. Analysis was performed for the a.m. and midday (school release period) peak hours to capture impacts during the peak school periods.

The impact analysis discusses the proposed additions to the high school, project trip generation, trip distribution, safe routes to school, future operating conditions of study intersections (including project impacts and mitigations), and a site plan and circulation review.

Proposed Development

The recently approved Salem-Keizer School District School Bond includes the modernization and expansion of McNary High School to serve up to 2,200 students. McNary High School is located at 595 Chemawa Road in Keizer, Oregon, and is currently zoned public. The high school is surrounded by single family and medium density residential zoning.

The Salem-Keizer School District desires to modernize existing buildings and add more school classroom space to accommodate up to 2,200 students and improve the site circulation and parking. The proposed additions are assumed to be constructed and occupied by the fall of 2020. There are currently 2,050 students enrolled at McNary High School, so an additional capacity of 150 students is proposed. Classes start at 7:30 a.m. each morning except on Thursdays, when classes begin at 8:05 a.m. School releases at 2:20 pm every day.

Trip Generation

Trip generation is the method used to estimate the number of vehicles that are added to the site driveways and roadway network by the proposed project during a specified period (i.e., such as a peak hour or an entire day). Trip generation is performed by multiplying trip rates by land use size (in this case the number of students). National trip generation rates are provided in the Institute of Transportation Engineers (ITE) *Trip Generation, 10th Edition*.

Because local peak hour trip generation data is available for the existing McNary High School based on the recent traffic counts taken at the project driveways, a comparison was made between local trip rates and ITE trip rates for the a.m. and midday peak hours. Table 9 shows the comparison.

Table 9: Local and National Trip Generation Rate Comparison

Source	Students	Peak Hour Trip Rate per Student	
		A.M.	Midday
Local Data			
McNary High School	2,050	0.54 ^a	0.28 ^a
ITE National High School Data (ITE Code)			
High School (530)	-	0.52	0.33

^a Trip rates based on traffic counts that were collected on March 8, 2018.

^b N/A = Not Available

As shown, the local rate is more conservative in the AM peak hour but less in the midday peak hour. The local rates were used for this study since they represent local conditions and travel characteristics. Table 10 shows the estimated trip generation for the existing number of students (2,050), additional 150 students, and total future number of students (2,200) at McNary High School using local trip rates. The additional 150 students created a total of 81 (49 in, 32 out) A.M. peak hour trips and 42 (15 in, 27 out) Midday peak hour trips. Only the proposed trip generation was added to the existing counts for the 2020 Total scenario. The existing counts already included the existing trip generation.

Table 10: McNary Existing and Proposed Trip Generation

Peak Hour	Number of Students	Trip Rate	Trips Generated
Existing Trip Generation			
A.M.	2,050	0.54 (60% in, 40% out)	1,107 (668 in, 439 out)
Midday		0.28 (35% in, 65% out)	568 (199 in, 369 out)
Proposed Trip Generation			
A.M.	150	0.54 (60% in, 40% out)	81 (49 in, 32 out)
Midday		0.28 (35% in, 65% out)	42 (15 in, 27 out)
Total Trip Generation			
A.M.	2,200	0.54 (60% in, 40% out)	1,188 (713 in, 475 out)
Midday		0.28 (35% in, 65% out)	616 (216 in, 400 out)

Trip Distribution

Trip distribution for the proposed high school was based on existing school trip distribution from traffic counts and a select zone analysis on the Salem-Keizer Area Transportation System (SKATS) model. The trip distribution for the school is shown in Figure 5. Applying the trip distribution to the trips generated by the additional 150 students at the high school yields the project trips also shown in Figure 5.

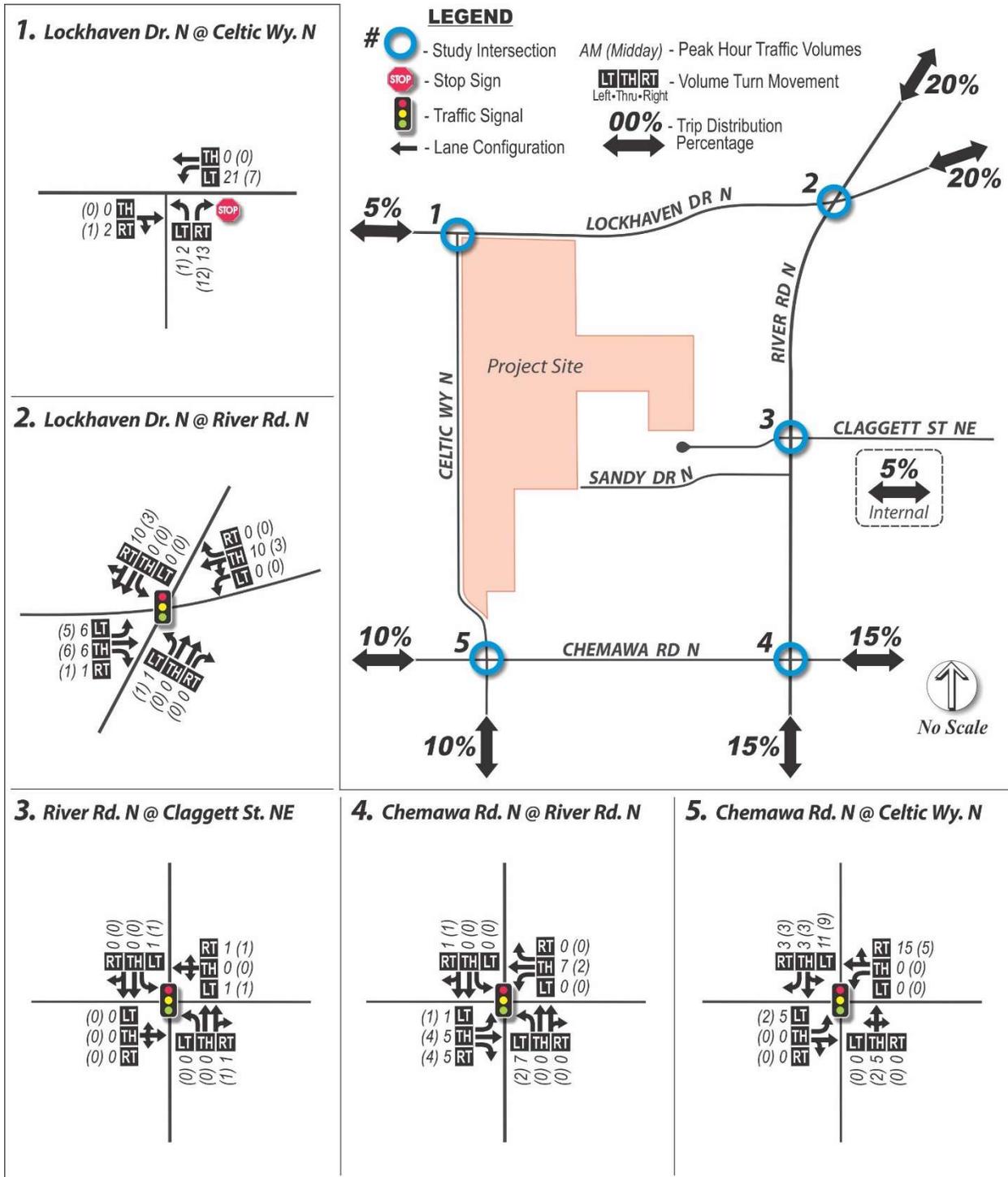


Figure 5: Project Trip Traffic Volumes and Trip Distribution

Future Traffic Conditions

Future traffic operating conditions were analyzed at the study intersections to determine if the transportation network can support the additional proposed school trips. When City of Keizer operating standards are not met, mitigations are required to improve network performance.

Future Analysis Scenarios

Future a.m. and midday peak hour traffic operations were analyzed at the study intersections for the following two scenarios:

- 2020 Background (includes background growth and traffic from approved developments in the project vicinity that are not yet constructed)
- 2020 Total (includes background traffic plus project trips from the 150-student increase in high school student enrollment)

The 2020 horizon year was selected for analysis since it is the anticipated year of occupancy for the proposed modernization and classroom expansion.

2020 Traffic Volumes

The 2020 Background and 2020 Total traffic volumes were estimated for the study intersections.

- **2020 Background** traffic volumes were developed by adding two years of background growth to the existing 2018 traffic counts. The future background growth on study area roadways was based on growth data from the SKATS model, resulting in an average yearly growth of 1.2%. DKS coordinated with the City and determined that there are approved developments in the project vicinity that are not yet constructed. However, the background growth calculated accounts for these developments.
- **2020 Total** traffic volumes were developed by combining the 2020 Background traffic volumes with the proposed school peak hour project trips (Table 10).

The a.m. and midday peak hour traffic volumes are shown in Figure 6 for the 2020 Background scenario and Figure 7 for the 2020 Total scenario.

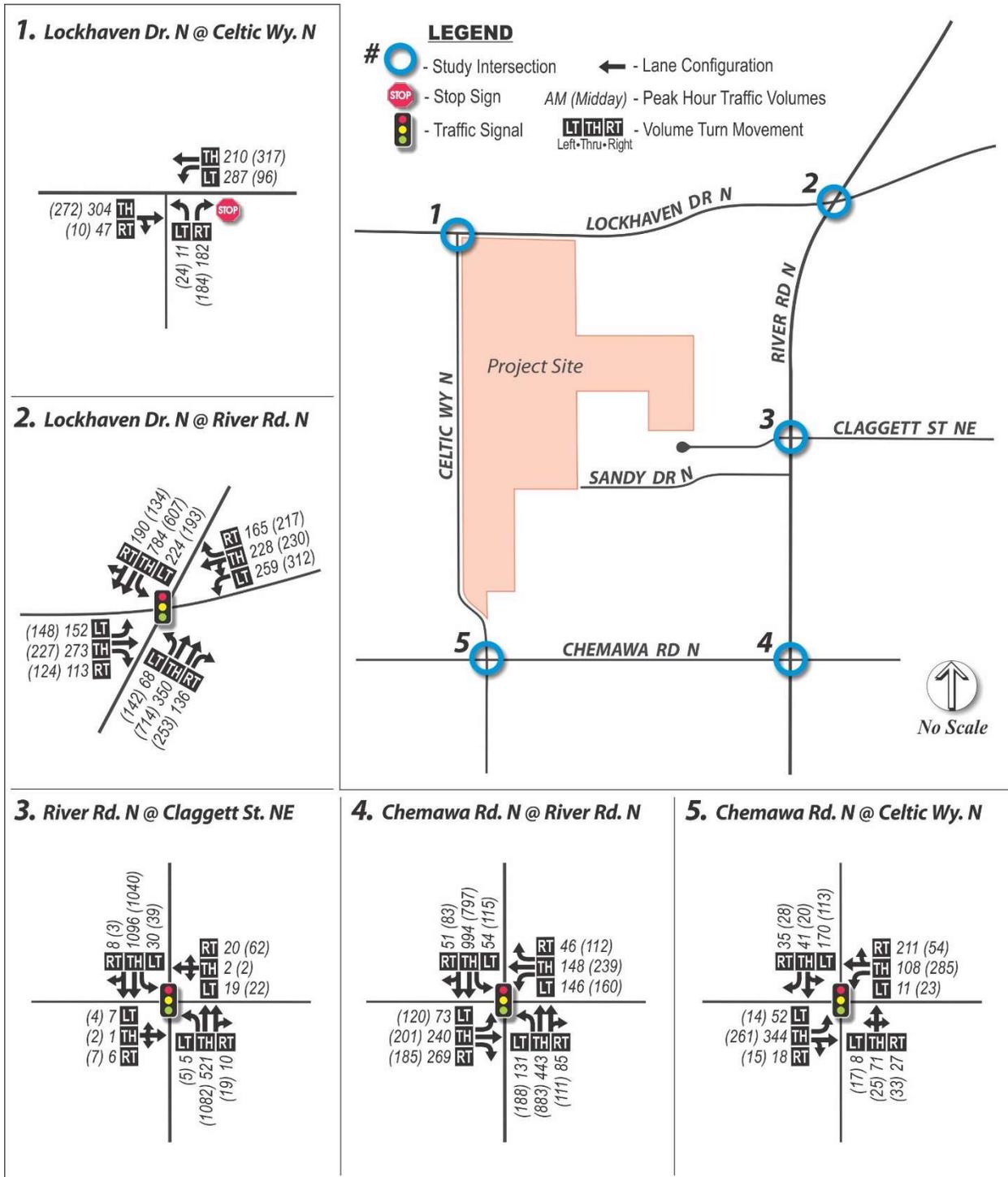


Figure 6: 2020 Background Traffic Volumes

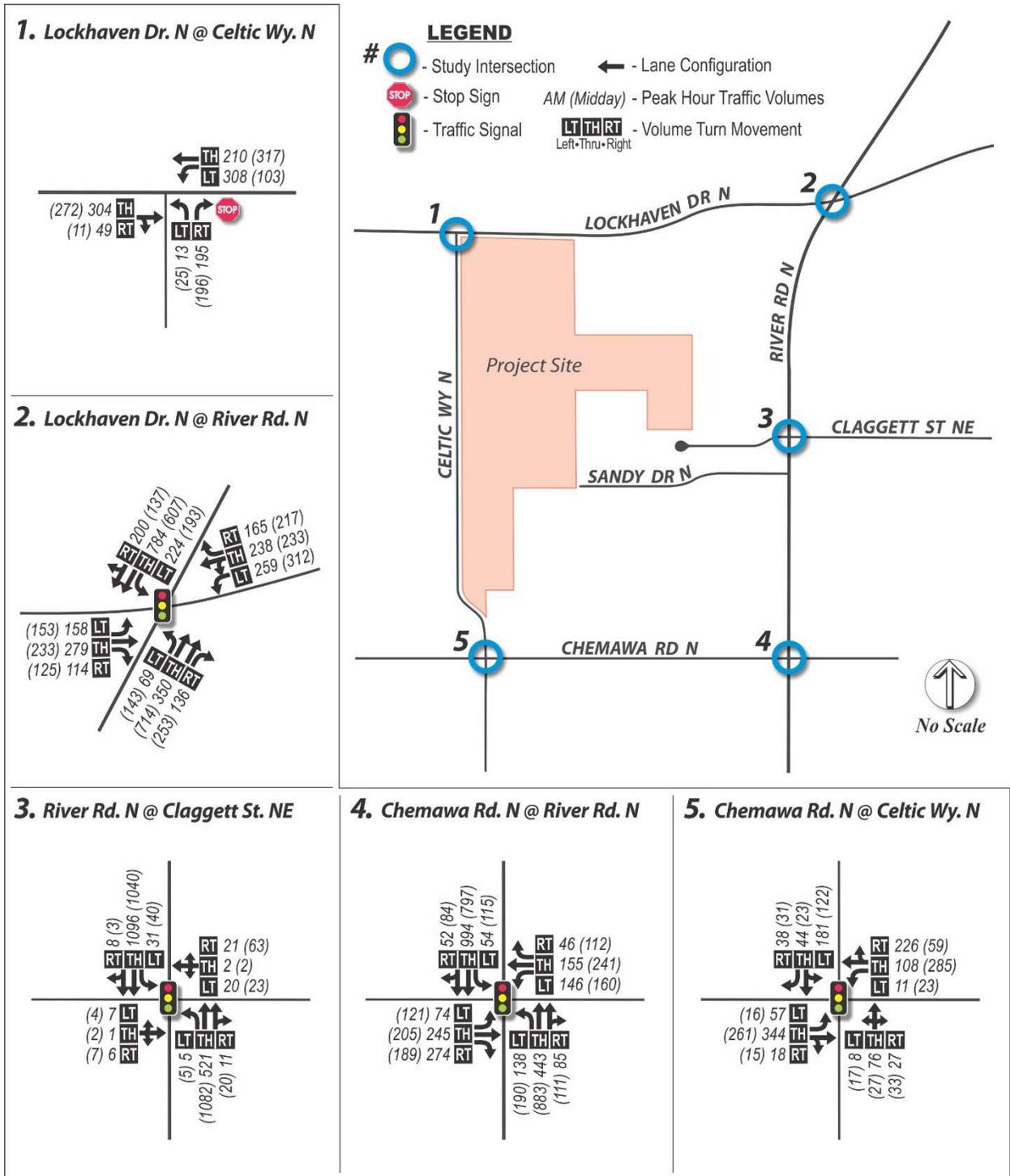


Figure 7: 2020 Total Traffic Volumes

2020 Traffic Operating Conditions

The future intersection operations were analyzed for the peak hours using *2000 Highway Capacity Manual* methodology for signalized intersections and the *2010 Highway Capacity Manual* methodology for unsignalized intersections.

Intersection operating conditions for the 2020 Background and Total traffic scenarios are listed in Table 11. As shown, all study intersections would meet applicable City operating standards for all peak hours and scenarios.

Table 11: 2020 Background and Total Operations (A.M. and Midday Peak Hours)

		2020 Background				2020 Total			
Intersection	Operating Standard	A.M. Peak		Midday Peak		A.M. Peak		Midday Peak	
		LOS	v/c	LOS	v/c	LOS	v/c	LOS	v/c
Two-Way Stop Controlled									
Lockhaven Dr/ Celtic Way	LOS E	A/C	0.43	A/C	0.43	A/C	0.48	A/C	0.46
Signalized									
Lockhaven Dr/ River Rd	v/c ≤ 1.0	D	0.87	D	0.86	D	0.89	D	0.87
River Rd/ Claggett St	LOS D	A	0.44	A	0.47	A	0.44	A	0.48
Chemawa Rd/ River Rd	v/c ≤ 0.95	D	0.79	D	0.76	D	0.80	D	0.76
Chemawa Rd/ Celtic Way	LOS D	D	0.82	D	0.55	D	0.85	D	0.58

Signalized intersections:

LOS = Level of Service of Intersection
v/c = Volume-to-Capacity Ratio of Intersection

Two-Way Stop Controlled intersections:

LOS = Level of Service of Major Street/Minor Street
v/c = Volume-to-Capacity Ratio of Worst Movement

Site Plan Review

The site plan provided by the project sponsor was reviewed to evaluate site access, circulation, and internal facilities. There were numerous iterations of the original site plan, however, the site plan evaluated in this report is the current preferred alternative. This site plan provides many modifications from the original site plan to improve traffic and pedestrian flow, parking and safety. These improvements include separating bus traffic from parent/student traffic, providing additional parking, reducing congestion at site driveways by providing more efficient internal circulation for students, removing or improving pedestrian-vehicle conflict areas on-site, and providing clear pedestrian pathways to/from the school entrances. The following section includes the identification of other on-site project modifications or improvements.

Access Spacing

There are two existing site accesses, one on Chemawa Road and one on Lockhaven Drive. A new parking lot and potential drop off area has been proposed off Claggett Street adjacent to The Arbor at Avamere Court. This connection will provide access to a 33-stall parking lot and athletic fields along with a pedestrian pathway to the school. The three points of access to the school are expected to provide enhanced site access to the school. The existing driveways experience delay in the peak 15-minute period due to congestion from the internal High School circulation. As previously discussed, the addition of a new parking lot, relocation of bus loading, and improved parent, student and staff parking circulation should improve delay and congestion at the school access points.

Both the roadways of Lockhaven Drive and Chemawa Road are classified as minor arterials in the City TSP. For arterial streets, the City of Keizer has access spacing standards providing guidance as to how close driveways can be located to intersecting streets. The standard¹¹ is based on the posted speed limit and indicates that the distance must be less than 150 feet between the existing school driveways and other driveways or public street intersections. For the Lockhaven Drive/Celtic Way intersection, the nearest intersecting street, Newberg Drive, is located approximately 250 feet to the west. For the Chemawa Road/Celtic Way driveway, the nearest intersecting street, Robindale Drive, is located approximately 400 feet to the east. Both driveways meet the City's access spacing standard.

Sight Distance

During a field observation visit¹², the preliminary sight distance at the existing site driveways appear to have sufficient sight distance. With the planned expansion, sight distance will need to be considered with fence or landscaping changes that may affect sight distance. Prior to occupancy, sight distance at the existing access points will need to be verified, documented, and stamped by a registered professional Civil or Traffic Engineer licensed in the State of Oregon to assure no landscaping or other objects are constructed within the sight distance triangle.

¹¹ Table 4.3, City of Keizer Transportation System Plan, Kittelson & Associates, April 2009.

¹² Field observation visit was conducted on April 5th, 2018.

Pedestrian and Bicycle Access and Circulation

The site plan provided by the project sponsor shows pathways and sidewalks connecting the school entrance to the various pedestrian and bicycle site entry points. The proposed pathway connecting Chemawa Road to the front of the school building starts at Chemawa Road/Celtic Way intersection and continues north to the school bus loop. A raised pedestrian crosswalk is shown on the site plan at the existing crossing of the parking lot to the front of the school building. At the other end of the parking lot, the site plan shows a raised crosswalk connecting the pedestrian access at MacArthur Street to the existing sidewalk, which continues to the front of the school building. Raised crosswalks slow vehicle speeds and improve pedestrian visibility and safety. There is a total of 4 raised crosswalks proposed.

In addition, other sidewalks and crosswalks are shown to provide safe pathways to the school's main entrance from Lockhaven Drive and from the proposed new parking lot off Claggett Street. It is recommended to construct all sidewalks to meet ADA requirements.

It is recommended that pedestrian crossing treatments (ramps, signage, etc.) be installed where the path from the Claggett Street cul-de-sac meets the bus-only road near the northeast corner of the main building (assuming this would not impact the SPED bus drop off area).

Safe Routes to School

DKS evaluated the pedestrian and bike connectivity to/from the high school within the walking boundary, a 1.5 mile-radius of the high school. The City of Keizer recently constructed urban street improvements to Chemawa Road that included new sidewalks and bike lanes on both sides and a new traffic signal at Chemawa Road/Celtic Way intersection. The new signal provides signalized school crossings for students living on the south side of Chemawa Road. The walking boundary and safe routes to and from adjacent neighborhoods were identified and are shown in Figure 8. The walking zone for the high school is up to a 1.5-mile radius, unless there is a "hazard", such as a major highway or body of water. Any students outside of the walking boundary or within the hazard areas will be provided school bus service by the School District per their policy.

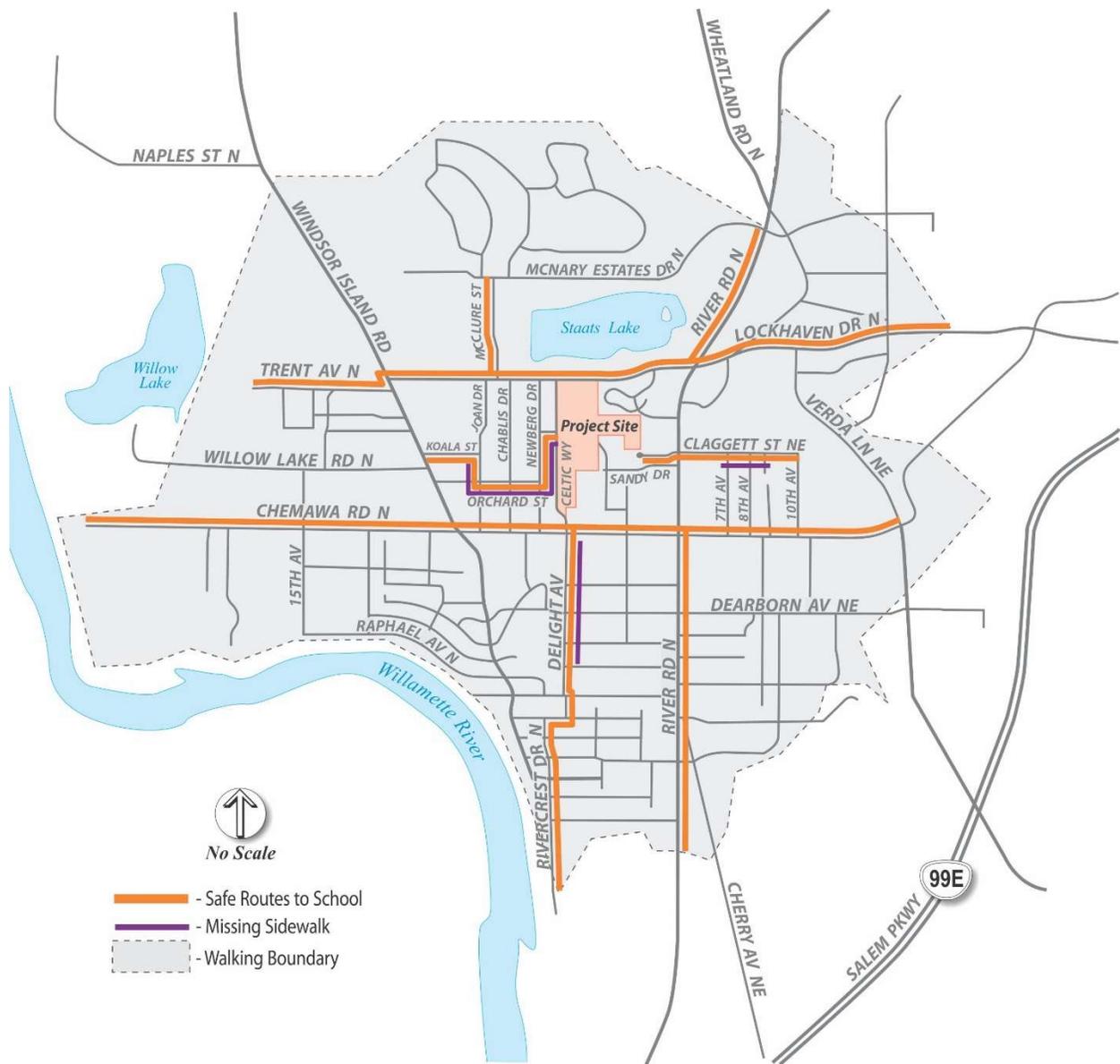


Figure 8: Safe Routes to School Map

For pedestrians and bicyclists to the west of the high school, the Chemawa Road and Lockhaven Drive roadways provide safe routes to the school via sidewalks and bike lanes. For those to the south of the high school, Rivercrest Drive/Delight Street and River Road are the encouraged routes to school. Missing sidewalk has been identified in the neighborhoods west and south of the site along the safe routes to school described above. Because of the low volume of traffic, sidewalk infill is not critical at this time, but should be considered a priority by the City for future sidewalk infill projects.

There is fewer housing to the east of McNary High School as there are many commercial developments on either side of River Road. For pedestrian and bicyclists who wish to walk or bike to school, Chemawa Road, Claggett Street, and Lockhaven Drive provide adequate

facilities. Some missing sidewalk is identified on Claggett Street for 950 feet. This segment of sidewalk on Claggett Street should be considered for future sidewalk infill projects. To the north, pedestrian and bicyclists are encouraged to take River Road, Lockhaven Drive, or McClure Street to get to the high school where bicycle lanes currently exist. The school district and City should partner together to request safe routes to school grants for sidewalk infill that is available through ODOT¹³.

Bus Loading and Access

The proposed site plan shows two new bus-only loading/unloading areas, one located to the south of the school (regular school buses only) and the other located on the north side (SPED school buses only). There is approximately 1,215 feet of proposed bus loading curb space. Bus circulation on-site is mostly separated from the other vehicles by providing two-way, bus-only travel around the east side of the school away from the parking lots. The internal roadways provide adequate capacity for school buses to exit, enter, and load/unload on site. Signage indicating these areas as bus-only will need to be provided on site. A raised pedestrian crossing has been provided between the bus loading area and the front door of the school to facilitate a safe connection to the school.

Parent Drop-Off/Pick-Up Area

The site plan shows three proposed parent drop-off/pick-up areas. Two are located along the west side of the school building at the school entrance and one is located along the proposed, raised island in the parking lot. There is a total of 565 feet of proposed curb space available for parent loading along with 1,215 feet for bus loading (250% increase in loading area) that will improve delays and congestion related to parent loading. Today, there is approximately 500 feet of combined curb space for both parent pick-up/drop-off and school bus loading/unloading. It is anticipated that some parents may pick-up/drop-off students at the parking lot off Claggett Street which will also improve internal circulation and congestion. It is recommended that signage be installed that prohibits parent pick-up/drop-off in the Claggett Street parking lot and that the curb of the cul-de-sac be used for loading/unloading. It is also recommended that sidewalk be installed on the east side of the parking lot, connecting the cul-de-sac to the proposed sidewalk shown on the site plan.

Vehicle Parking

For high schools, City of Keizer Code requires a minimum of one vehicular parking stalls per classroom as well as 1 space for every 10 students and 1 space per 350 square feet of administrative office. The updated school has 111 classrooms planned, 2,200 students, and 7,874 feet of administrative office; therefore, it would need 354 parking stalls to meet City of Keizer code. The site plan currently shows that 587 parking stalls will be provided on the site, 92 additional parking stalls than the 495 parking stalls that currently exist. The proposed site plan shows sufficient parking to meet the City's parking requirements. Table 12 summarizes the parking requirements.

¹³ <https://www.oregon.gov/ODOT/Programs/Pages/SRTS.aspx>

Table 12: City of Keizer Parking Requirements

Land Use	Students	Proposed Parking	City Standards			
			Stalls (based on classroom size)	Stalls (based on students)	Stalls (based on administrative office SF)	Total
High School	2,200	587 stalls	111	220	23	354

According to the existing parking demand survey that was conducted on a typical school day and was described earlier in the existing conditions section, the peak parking demand rate was calculated to be 0.23 spaces per student based on parking observations (this demand calculation included illegally parked vehicles and students parked along MacArthur Street). Given the 2,200-student capacity, the estimated parking demand for the high school would be 506 parking stalls. The breakdown of the demand for students and staff/visitor stalls is shown in Table 13 below. The proposed site plan provides sufficient parking to meet the existing demand of the high school. It is recommended that a sufficient number of parking stalls be allocated for student parking to meet the demand (0.16 vehicles per student) to avoid students parking illegally or off-site.

Table 13: Vehicle Parking Demand and Proposed Supply

Number of Students (2018)		Number of Stalls Occupied	Demand Rate	Number of Students (2020)	Future Demand
2,050	Total	470	0.23	2,200	506
	Student	334	0.16		352
	Staff/Visitor	136	0.07		154
Proposed Vehicle Parking					587

Bicycle Parking

City of Keizer Code also requires that bicycle parking be calculated at 5% of required automobile parking spaces, which would equate to 18 bicycle parking spaces.

A survey of existing bicycle parking was taken of the site, and approximately 16 bicycles were parked in 56 of the available parking stalls. Using the existing number of students and number of bicycle stalls occupied, a demand rate was calculated. This rate was used to approximate future demand assuming 2,200 students.

Table 14 on the next page shows the future bicycle parking demand to be 18 bicycle parking stalls, same as the City code requirements. The site plan shows a total of 36 bicycle parking stalls, meeting both the current demand of the high school and the City Code requirements.

Table 14: Bicycle Parking Demand

Number of Students (2018)	Existing Parking Demand	Number of Stalls Available	Demand Rate (stalls per student)	Number of Students (2020)	Future Parking Demand
2,050	16 Stalls	56	0.0078	2,200	18 Stalls
City Code Requirement					18 Stalls
Proposed Bicycle Parking					36 Stalls

Claggett Street Sensitivity Analysis

The main parking lot provides enough parking to meet student and staff/visitor parking demand as discussed previously. Therefore, no trips were assumed to use the Claggett Street access. However, the following provides a sensitivity analysis that assumes that 5% of the total expected student enrollment (2,200 students) will use the Claggett Street site access to park or for parent loading. The number of trips added to the River Road/Claggett Street intersection during the AM peak hour would be 60 trips (36 in, 24 out) and 31 trips (11 in, 20 out) during the Midday peak hour.

Operations for the intersection of River Road/Claggett Street are shown below for both the 2020 Total and the 2020 Sensitivity Analysis with the added trips. As shown, minimal impacts to the intersection are expected during both peak hours with the added school related trips on Claggett Street.

Table 15: Sensitivity Analysis Intersection Operations for Claggett Street

		2020 Total				2020 Sensitivity Analysis			
Intersection	Operating Standard	A.M. Peak		Midday Peak		A.M. Peak		Midday Peak	
		LOS	v/c	LOS	v/c	LOS	v/c	LOS	v/c
River Rd/Claggett St	LOS D	A	0.44	A	0.47	A	0.46	A	0.48

Signalized intersections:

LOS = Level of Service of Intersection

v/c = Volume-to-Capacity Ratio of Intersection

Queuing Analysis

Queuing analysis was performed for the AM and midday peak hours through traffic simulations performed in SimTraffic™ and using the 2020 Total Traffic volumes. The queuing analysis was performed to determine the 95th percentile southbound queues on Celtic Way at the Chemawa Road signal. The 95th percentile queue is the queue length for a given intersection movement that has only a 5% chance of being exceeded during the peak traffic hour.

Table 16: AM Peak Hour 95th Percentile Queuing on Celtic Way

Intersection	Movement	Available Storage (feet)	95th Queue Length (feet)
Lockhaven Dr/Celtic Way	NBL	815	85
	NBR	60	90
	WBL	730	120
Chemawa Rd/Celtic Way	SBL	630	525
	SBR	120	125
	EBL	110	90

CHAPTER 4: PROJECT MITIGATION SUMMARY

To preserve study area roadway performance and provide safe access to the updated McNary high school, it is recommended that the following additional transportation mitigation measures be performed. These project-related measures would typically be required as conditions of approval if the project were approved and should be coordinated with City of Keizer staff:

Sight Distance

- Prior to occupancy, sight distance at any new or modified access points will need to be verified, documented, and stamped by a registered professional Civil or Traffic Engineer licensed in the State of Oregon.

Pedestrian and Bicycle Access

- It is recommended that some pedestrian crossing treatments (ramps, signage, etc.) be installed where the path from the Claggett Street cul-de-sac meets the bus-only road near the northeast corner of the main building to provide a safe crossing for pedestrians.
- It is recommended to construct all sidewalks to meet ADA requirements.

Bus Loading and Access

- Bus only signage will need to be provided on site for areas where bus-only circulation occurs.

Parent Drop-off/Pick-up Areas

- It is recommended that signage be installed that prohibits parent pick-up/drop-off in the parking lot off Claggett Street and that the curb of the cul-de-sac be used for loading/unloading. It is also recommended that sidewalk be installed on the east side of that parking lot, connecting the cul-de-sac to the proposed sidewalk shown on the site plan.

Parking

- Based on 2,200 high school students, it is recommended that a minimum of 506 parking stalls be provided to meet the estimated typical demand.
- Based on 2,200 high school students, it is recommended that a minimum of 18 bicycle parking spaces be provided per the City code and current estimated demand.