TECHNICAL MEMORANDUM

TO:	Brandon Goldman, City of Ashland
FROM:	Anne Sylvester, PTE
DATE:	November 19, 2013
PROJECT #:	0722.01
SUBJECT:	Final Future Conditions Report for Normal Avenue Neighborhood Plan

1. INTRODUCTION

The purpose of this memo is to summarize the analysis of future 2038 traffic conditions in the Normal Avenue Neighborhood Plan study area. The location of this study area and its surrounding street system is illustrated in Figure 1. Analysis is based on the draft Neighborhood Plan (dated June 25, 2013) including both recommended land uses, densities and locations, as well as proposed multimodal transportation infrastructure within the study area. Analysis also reflects recommendations in the City's Transportation System Plan (TSP) Update including the extension of Normal Avenue from the existing at-grade rail crossing north and east to intersect East Main Street. The TSP also recommends improvements to active (bicycle and pedestrian) transportation facilities.

This memorandum is built on the analysis of existing transportation facilities and operating conditions that was prepared by myself and documented in a Technical Memorandum dated September 5, 2012. Please refer to that report for a discussion of existing traffic volumes, operating performance for existing streets, intersections, transit, bicycle and pedestrian facilities, and recent multimodal safety experience and considerations.

This memo includes six major sections, as described below:

- Section 1 is this introduction.
- Section 2 presents an Executive Summary of the key findings, conclusions and recommendations of the study
- Section 3 describes the existing Normal Avenue Neighborhood Plan study area.
- Section 4 highlights characteristics of the anticipated 2038 baseline transportation system. This baseline transportation system includes development within the Neighborhood Plan area as anticipated under existing Comprehensive Plan designations and includes an extension of Normal Avenue from its current northern terminus to a new intersection with E. Main Street. The section also includes a brief summary of existing conditions at intersections that were added to the study area after completion of the Existing Conditions Analysis documented in the September, 2012 memorandum.

- Section 5 focuses on the future traffic conditions associated with Neighborhood Plan development in the study area including proposed land uses and densities, along with the proposed transportation networks for vehicles, bicycles and pedestrians. The section includes key findings and conclusions, and presents recommendations for transportation improvement to maximize operations and enhance safety.
- Section 6 documents the analysis of Multimodal Levels of Service (MMLOS)

2. EXECUTIVE SUMMARY

2.1 Key Findings and Conclusions

Key findings and conclusions from the analysis of the multimodal transportation system within and affected by development of the Normal Avenue Neighborhood Plan are as follows:

- Drawing on the conclusions in the "*Existing Transportation Conditions Technical Memorandum"* (dated September 5, 2012) as augmented by additional current traffic data, all eight study area intersections are currently performing within their applicable mobility standards during the PM peak hour (the primary analysis time period).
- The assessment of 2038 PM peak hour traffic operations at study area intersections indicates that while community growth will increase the level of delay experienced at each location, all intersections will meet their applicable mobility standards. In certain locations, expected traffic queues will exceed available vehicle storage creating limited impacts on through traffic movement. The most significant impact is expected to occur in the westbound left turn lane at the intersection of Ashland Street with Tolman Creek Road.
- Development of the Normal Avenue Neighborhood Plan is expected to generate the following magnitude of trips (total inbound and outbound):

Phase	Daily	AM Peak	PM Peak
Phase 1	1,946	139	172
Phase 2	1,156	87	112
Total	3,102	226	284

- With development of either Phase 1 or 2 of the Neighborhood Plan, in the 2038 PM peak hour all study area intersections are expected to meet their applicable mobility standards. Traffic queuing impacts are expected to be similar to those described for 2038 base conditions, with a lesser impact associated with westbound left turns at the intersection of Ashland Street and Tolman Creek Road.
- With Phase 1 development, approximately 1,000 vehicles per day are expected to use Normal Avenue, and approximately 1,200 vehicles per day with Phase 2 development. This is significantly lower than the volume range recommended for an Avenue street classification.
- Access spacing for internal streets shown on the current Normal Avenue Neighborhood plan meets both current city standards and the spacing recommendations of the recently adopted Transportation System Plan.
- Traffic operations analysis for Phases 1 and 2 was based on the assumption that a public crossing would not be provided on Normal Avenue where it currently intersects the CORP rail

line. Thus, all traffic was assumed to use either E. Main or Clay Streets to enter or leave the neighborhood. This restriction did not result in significant adverse impacts to surrounding streets or intersections.

- Existing pedestrian facilities vary considerably throughout the study area ranging from excellent along Walker Avenue in the vicinity of the existing schools to very poor along E. Main Street where is there is limited shoulder space and relatively high speeds.
- Bicycle facilities also vary considerably throughout the study area ranging from poor on E. Main and Clay Streets where no facilities are present and shoulder widths are narrow, to excellent along the northern part of Walker Avenue where there are existing bicycle lanes.
- Transit service is currently provided only along Ashland Street and Tolman Creek Road (RVTD Route 10). Service is provided on a half-hourly basis and transit amenities are minimal.
- With development of the Normal Avenue Neighborhood Plan, it is anticipated that urban scale improvements would be made to E. Main Street. These changes would improve the multimodal LOS analysis results for E. Main Street for bicycle and pedestrian facilities to excellent.

2.2 Recommendations

- E. Main Street cross-section – at a minimum this street should be constructed to include: two 11-foot travel lanes, two 6-foot bike lanes (or a 6-foot shoulder along the north side of the street), a 5 to 8-foot planting strip on the south side of the street to buffer the sidewalk from vehicular traffic, and a 6 to 10-foot sidewalk, also along the south side of the street. The shoulder along the north side of E. Main Street is recommended until such time as the adjacent property is included within the UGB and developed. A 12-foot center turn lane should be considered as a safety enhancement and/or to meet longer-term travel needs as future conditions warrant.
- Access locations onto E. Main Street should be limited, where possible to local or collector street intersections. All access locations should meet the City's minimum spacing requirements. Additionally, all access locations onto E. Main Street should meet the intersection and stopping sight distance requirements associated with its existing speed.
- As the property along E. Main Street is urbanized, the City should request that ODOT perform a speed zoning study with the goal of reducing the existing 40 mph posted speed to a lower limit. Consideration should be given to speeds in the range of 25 to 30 mph.
- Normal Avenue should be reclassified from its current TSP designation as an Avenue to a Neighborhood Collector with the recommended cross-section and multimodal improvements that accompany this designation.
- Stop signs should be installed on side streets at all intersections along E. Main Street, except if and where roundabouts are chosen as the preferred means of intersection traffic control. A decision on appropriate traffic control should be made as street improvements are developed.
- Stop sign warrant analysis should be conducted along the New Normal Avenue through the heart of the project to identify any locations appropriate for side street stop sign control. Consideration should also be given to either stop or yield signs where sight distance is limited.

- While not necessary as a traffic mitigation measure for potential project impacts along E. Main Street or elsewhere, provision of a public crossing of the CORP rail line would benefit the neighborhood by providing an alternative multimodal route to a variety of destinations throughout the City and should be considered over the long-term. When such a crossing is installed, traffic volumes at the intersection of Normal and Ashland Streets should be monitored to determine when signalization of this location is warranted.
- It is recommended that the City consider extending north/south left turn channelization on Tolman Creek Road at Ashland Street in the future if and when the need for additional vehicle storage becomes apparent.

3. STUDY AREA

The study area for evaluating future transportation conditions for the Normal Avenue Neighborhood Plan includes two primary areas of focus. The first is the Normal Avenue Plan area itself, referred to in this report as the project area. This area includes both the alignment of Normal Avenue between the Central Oregon and Pacific Railroad right-of-way and E. Main Street, and all other local streets within the Plan area that provide access to individual properties. The proposed street system for the project area is illustrated in Figure 2. This report documents the analysis of this internal street system focusing on several key questions:

- Whether the proposed street classification and cross-section is consistent with anticipated travel demand as the project area builds out.
- When an enhanced public crossing of the existing limited crossing of the Central Oregon and Pacific Railroad at Normal Avenue will need to be improved. Until such time as this improvement is made traffic circulation to/from the plan area will largely focus on E. Main and Clay Streets.

The second focus area includes eight key intersections located on the streets surrounding the project area. Existing traffic control and lane channelization at these intersections is documented in Figure 3. Analysis of these intersections was conducted to identify any potential future 2038 impacts associated with the Plan. These intersections include:

- Ashland Street at Walker Avenue (included in TSP Update)
- Ashland Street at Normal Avenue
- Ashland Street at Clay Street
- Ashland Street (Oregon Highway 66) at Tolman Creek Road (included in TSP Update)
- East Main Street at Walker Avenue (included in TSP Update)
- East Main Street at Existing School Bus Access Road
- East Main Street at Clay Street
- East Main Street at Tolman Creek Road

4. TRANSPORTATION ANALYSIS FOR BASELINE CONDITIONS

This section identifies the relevant traffic operational performance standards that apply to study area intersections under the jurisdiction of either the Oregon Department of Transportation or the City of Ashland. These standards form the basis for determining the quality of traffic performance on the local street system and for quantitatively measuring the impact of developing the study area in a manner consistent with the Normal Avenue Neighborhood Plan.

4.1 Intersection Operational Standards

4.1.1 *ODOT Facilities*

One intersection in the Normal Avenue study area is under the jurisdiction of ODOT – OR 66 (Ashland Street) at Tolman Creek Road. OR 66 is designated as a District Highway from its intersection with Tolman Creek Road eastward through the I-5 interchange.

ODOT uses volume-to-capacity (v/c) ratio standards to assess traffic operations at intersections on state highway facilities. Table 6 of the Oregon Highway Plan (OHP) and Table 10-1 of the Oregon Highway Design Manual (HDM) provide the maximum v/c ratios for all signalized and unsignalized intersections outside of the Portland Metro area. The OHP ratios are used to evaluate existing and future no build conditions, while the HDM ratios are used to evaluate transportation system improvements on state highways. Based on its classification as a District Highway, the signalized intersection of OR 66 at Tolman Creek Road has an OHP v/c standard of 0.95 (based on revisions to the OHP adopted by the Oregon Transportation Commission in December of 2011 which became effective on January 1, 2012)[1]. Its relevant HDM v/c ratio is 0.80.

4.1.2 *City of Ashland Facilities*

The remaining seven intersections in the study area are all under the jurisdiction of the City of Ashland. Based on discussion included in the TSP, the following operational standards were used:

- Level of service (LOS) D at signalized and all-way stop-controlled intersections if the v/c ratio is not higher than 1.00 for the sum of critical movements.
- LOS E for the poorest operating approach at two-way stop-controlled intersections. Approaches operating at a LOS F where a traffic signal is not warranted were also identified in the TSP.

A summary of the relevant operational standards for the seven City intersections in the Normal Avenue study area is presented in Table 1 below.

[1] It should be noted that the TSP used the OHP v/c standards that were in place prior to the OTC's action in December of 2011. Consequently the v/c threshold cited in the TSP is 0.90.

Table 1. Operational Threshold for City Intersections

Intersection	Traffic Control	Threshold	Intersection	Traffic Control	Threshold
E. Main Street @ Walker Avenue *	TWSC	LOS "E"	E .Main Street @ Clay Street	TWSC	LOS "E"
Ashland Street @ Walker Avenue *	Signal	LOS "D"	E. Main Street @ Tolman Creek Road	TWSC	LOS "E"
Ashland Street @ Normal Avenue	TWSC	LOS "E"			

* Intersection included in TSP

4.2 Synopsis of Existing Traffic Volumes and Operational Analysis

The September 25, 2012 Existing Conditions Technical Memorandum documents much of the existing multimodal transportation system in the study area. However, during development of the future conditions analysis two additional intersections were identified for inclusion to evaluate both the potential impacts of growth and the possible need for improvements. These intersections included:

- Ashland Street at Clay Street
- East Main Street at Existing School Bus Access Road (east of Walker Avenue)

Additionally, new turning movement traffic count data became available for the intersection of Ashland Street at Tolman Creek Road. Traffic count data at all three locations was seasonally adjusted prior to operations analysis based on the procedures outlined in the project's Methodology and Key Assumptions Technical Memorandum (dated June 27, 2013). These procedures are consistent with the requirements of ODOT's Analysis Procedures Manual (APM).

Operational analysis at these three locations focused on the PM peak hour. Additionally, the afternoon school peak hour (3 to 4 PM) was also evaluated at the intersection of E. Main Street with the Bus Access Road. Traffic count data and operations analysis worksheets are included in Appendix A. Key findings and conclusions from this analysis are summarized below which indicates that existing performance standards are currently being met at all locations.

Table 2. 2012 PM Peak Hour Operations Analysis Summary

Intersection	Operating Standard	Traffic Control	Worst Movement	PM Peak Hour		
				V/C [1]	Delay [2]	LOS [3]
Ashland Street at Clay Street	LOS D	Stop	SBL	0.10	14.0	B
OR 66/Ashland Street at Tolman Creek Road	V/C= 0.95	Signal		0.56	19.4	B
E. Main Street at Bus Access	LOS E	Stop	NB	0.02	12.3	B
E. Main Street at Bus Access – School PM	LOS E	Stop	NB	0.08	14.7	B

[1] Volume-to-Capacity ratio of a signalized intersection or Worst Movement of an unsignalized intersection.
[2] LOS = Level-Of-Service using 2000 Highway Capacity Manual (HCM) methodology.
[3] Average Control Delay for an entire signalized intersection or the worst movement of an unsignalized intersection.

4.3 2038 Baseline Traffic Volumes

Traffic forecasts for the Normal Avenue study area were developed for 2038 at the eight study area intersections and along key streets within the study area. The purpose of these forecasts was to assess roadway improvement needs and functional classification designations for conditions with and without the Neighborhood Plan. Future year traffic volume forecasts were prepared using the following steps and are presented in Figure 4.

- RVCOG and ODOT provided RVMPOv3.1 travel model output for 2038 including daily and PM peak hour trips. This model output represents the latest growth and network assumptions available for the Ashland area. Both 2006 and future 2038 model runs were obtained to assess the traffic volume growth potential on study area streets.
- The expected traffic growth was post-processed using the procedures identified in the APM to develop intersection level turning movement projections. This method uses the existing traffic volumes as a starting point since these have already been adjusted to reflect the 30th highest hour[2]. Consistent with the analysis conducted for existing conditions, intersection level turning movements and operations analysis at most locations have been conducted only for the 2038 PM peak hour (4:15 to 5:15 PM). For the intersection of E. Main Street with the Bus Access Road, analysis was also conducted for the afternoon school peak hour (3:00 to 4:00 PM).

An assessment of potential traffic volume growth along Normal Avenue was also conducted to form the basis of comparison with build-out of the Neighborhood Plan (discussed in the next section). In the 2038 RVMPO travel model, Normal Avenue is expected to be extended to E. Main Street. However, the model also assumes that Normal Avenue would be a lower order facility than Walker or Clay Streets. Projected traffic volumes along Normal Avenue are expected largely to consist of locally-generated traffic. No significant volume of through traffic was projected.

4.4 Findings and Conclusions

4.4.1 *Intersection Operations Analysis Results*

Synchro 8 software was used to evaluate the performance of both signalized and unsignalized intersections in the study area. Table 3 summarizes 2038 PM peak hour operational performance for study area intersections assuming Comprehensive Plan land use designations. These results incorporate the intersection geometry and traffic control features illustrated in Figure 3 and the projected 2038 PM peak hour traffic volumes in Figure 4.

As indicated in Table 3, all study area intersections are expected to meet their applicable mobility standard. Detailed traffic operational worksheets can be found in Appendix B.

[2] See *"Existing Transportation Conditions Technical Memorandum"*, Parametrix, September 5, 2012.

Table 3. 2038 Baseline PM Peak Hour Operations Analysis Summary

Intersection	Operating Standard	Traffic Control	Worst Movement	PM Peak Hour		
				V/C [1]	Delay [2]	LOS [3]
Ashland Street at Walker Avenue	LOS D	Signal		0.59	15.1	B
Ashland Street at Normal Avenue	LOS E	Stop	SB	0.44	30.5	D
Ashland Street at Clay Street	LOS E	Stop	SBL	0.24	18.6	C
OR 66/Ashland Street at Tolman Creek Road	V/C= 0.95	Signal		0.84	37.9	D
E. Main Street at Walker Avenue	LOS E	Stop	NB	0.34	22.1	C
E. Main Street at Bus Access Road	LOS E	Stop	NB	0.03	15.0	C
E. Main Street at Bus Access Road – School PM	LOS E	Stop	NB	0.10	17.8	C
E. Main Street at Clay Street	LOS E	Stop	NB	0.31	20.6	C
E. Main Street at Tolman Creek Road	LOS E	Stop	NB	0.36	13.0	B

[1] Volume-to-Capacity ratio of a signalized intersection or Worst Movement of an unsignalized intersection.
[2] LOS = Level-Of-Service using 2000 Highway Capacity Manual (HCM) methodology.
[3] Average Control Delay for an entire signalized intersection or the worst movement of an unsignalized intersection.

4.4.2 *Traffic Queuing Analysis Results*

Table 4 summarizes 2038 baseline PM peak hour traffic queuing analysis results at the two signalized study area intersections. Worksheets are included in Appendix C.

Queuing results for the signalized intersection of Ashland Street at Walker Avenue show that for both left turn movements (eastbound and westbound) along Ashland Street there is sufficient space to meet expected vehicle queuing demand. At the intersection of OR 66/Ashland Street with Tolman Creek Road three of the existing left turn lanes do not have sufficient space to accommodate expected traffic queues during the 2038 PM peak hour without impacting other traffic. In the north and southbound directions, a two to three vehicle spillover into the through lane is expected for certain signal cycles during the PM peak hour. A more significant queuing problem would occur with the westbound left turn lane where queuing demand extends beyond available space in the designated left turn lane, spilling back into a two-way left turn lane and impacting access to/from existing driveways, particularly along the south side of the street east of Tolman Creek Road.

Table 4. 2038 Baseline PM Peak Hour Intersection Traffic Queuing

Intersection	Movement	Existing Vehicle Storage	PM Peak Hour Vehicle Queue
Ashland Street at Walker Avenue[1]	EB Left	100 ft	75 ft
	WB Left	100 ft	72 ft
OR 66/Ashland Street at Tolman Creek Road[1]	NB Left	100 ft	129 ft
	SB Left	100 ft	153 ft
	EB Left[2]	185 ft	161 ft
	WB Left[3]	225 ft	306 ft

[1] Traffic queuing calculated using Synchro 8 traffic operations software.
[2] Existing storage space includes two-way left turn lane. EB left has only 185 feet to first driveway.
[3] Existing storage space includes two-way left turn lane. WB left has only 225 feet to first driveway.

5. FUTURE TRANSPORTATION ANALYSIS WITH NORMAL AVENUE NEIGHBORHOOD PLAN

5.1 2038 Build Traffic Volumes

Traffic forecasts for the Normal Avenue study area were developed for 2038 "build" conditions at the same eight study area intersections and along key streets within the study area. Future year traffic volume forecasts were prepared using the following steps:

- Similar to the development of traffic forecasts for the 2038 baseline conditions, RVCOG and ODOT provided RVMPOv3.1 travel model output for daily and PM peak hour trips. This model run excluded growth in the Transportation Analysis Zones (TAZs) that represent the Normal Avenue Plan area. This allowed creation of a 2038 "Build" assignment to which project-generated traffic could be manually assigned for greater detail and sensitivity.
- The expected traffic growth from the Build conditions model was post-processed using the procedures identified in APM to develop non-project intersection level turning movement projections.
- Normal Avenue Plan trip generation estimates were prepared for AM and PM peak hours and daily conditions using the most recent rates published by the Institute of Transportation Engineers (ITE) in the "Trip Generation" manual, 9th Edition, as appropriate for the assumed land use types. Two phases of development were evaluated. An internal trip capture reduction of 5 percent was assumed and applied to all trips.
- Select zone loads were obtained from the regional model for the two TAZs (#745 and 750) that cover the Normal Avenue study area. These were used to develop trip distribution assumptions to manually assign project traffic to the surrounding street system.
- AM, PM peak hour and daily project traffic for the two phases were assigned to the internal and surrounding street system to illustrate the potential growth in volumes that could occur on any give street segment during these time periods. These assignments were used in two ways. First to assess the level of traffic expected on internal roads to check consistency with classifications and proposed street cross-sections. Second, to form the base for developing future turning movement projections at the eight study area intersections external to the site. For the latter, only PM peak hour volumes were used.

The following sections describe the development of trip generation analysis, document the distribution assumptions for project area trips, and present future traffic volumes and analysis results for Phases 1 and 2.

5.1.1 *Normal Avenue Neighborhood Plan Trip Generation*

This section summarizes the process used to estimate future auto trips that would use the internal road system in the project area and would impact the surrounding eight key study area intersections. Trip generation estimates were developed using rates for comparable land uses as published in the ITE manual, an authoritative reference to the travel-making characteristics of a wide variety of land use types throughout the United States. The trip generation rates shown below in Table 5 were chosen as they represented the best fit for the types of land uses that are envisioned in the project area.

Table 5. Normal Avenue Trip Generation Rates

Plan Description	ITE Code	Land Use	Units	Daily		AM Peak		PM Peak	
				In	Out	In	Out	In	Out
NA-01	210	Single Family Residential	dus	4.76	4.76	0.19	0.56	0.63	0.37
NA-02/03	221	Low Density Multi-Family	dus	3.3	3.3	0.12	0.35	0.34	0.24

Source: Trip Generation, 9th Edition, Institute of Transportation Engineers, 2012.
Note: du means dwelling unit.

The trip generation rates illustrated in this table are expressed per individual dwelling unit. These rates are then multiplied by the total number of dwelling units for each land use type and adjusted to reflect the potential that some of the generated trips will remain within the neighborhood and not use the surrounding street system. Table 6 illustrates the total estimated trips for the Normal Avenue Neighborhood study area. A total of 973 daily trips (one-way) could be expected with build-out of Phase 1, with a further 578 daily trips (one-way) with build-out of Phase 2. A total of 1,551 one-way trips per day is estimated with build-out of the entire neighborhood plan for a total of 3,100 daily trips.

Table 6. Normal Avenue Trip Generation Estimates

Plan Description	Land Use	Net Acres	Units per Acre	Dwelling Units	Daily		AM Peak		PM Peak	
					In	Out	In	Out	In	Out
Phase 1										
NA-01	Single Family Residential	1.47	5	7	35	35	1	4	5	3
NA-02	Low Density Multi-Family	14.65	10	147	482	482	17	52	48	35
NA-03	High Density Multi-Family	10.28	15	154	508	508	19	54	51	37
Sub-Totals		26.40	308		1,025	1,025	37	110	104	75
				Less Internal (5%)	*(52)*	*(52)*	*(2)*	*(6)*	*(4)*	*(3)*
				Net Trip Ends	**973**	**973**	**35**	**104**	**100**	**72**
Phase 2										
NA-01	Single Family Residential	11.73	5	59	280	280	10	33	37	21
NA-02	Low Density Multi-Family	5.89	10	59	193	193	7	20	20	15
NA-03	High Density Multi-Family	2.73	15	41	135	135	5	14	14	10
Sub-Totals		20.35		159	608	608	22	67	71	46
				Less Internal (5%)	*(30)*	*(30)*	*(0)*	*(2)*	*(3)*	*(2)*
				Net Trip Ends	**578**	**578**	**22**	**65**	**68**	**44**

The generated trips in Table 5 were further disaggregated into specific geographic sub-areas for use in developing a refined estimate of how traffic in the neighborhood would use the available street system. These sub-areas or Transportation Analysis Zones (TAZs) are illustrated in Figure 5. Trip generation estimates for each of the project area TAZs is presented in Appendix D. It should be noted that the project-related trips in Table 5 reflect only vehicle trips. Trip generation analysis conducted using ITE rates does not require development or application of mode split assumptions as is common with areawide travel demand modeling. Accordingly, no bicycle, pedestrian or transit trips are included in numbers presented in Table 6.

5.1.2 *Normal Avenue Neighborhood Plan Trip Distribution*

The next step in the analysis process was to distribute project-related traffic for the two development phases to the internal and surrounding street system. This process was based on the directional distribution of traffic observed in the RVMPO travel demand model for the two analysis zones (#745 and #750) that constitute the Normal Avenue project area. Trip distribution calculations were conducted for each project area TAZ using the assumptions illustrated in Figure 6.

Using the trip estimates in Table 5 and the trip distribution assumptions in Figure 6, the potential growth in traffic volumes that could occur on any given street segment can be determined. This information will be used in two ways. First, to assess the level of traffic expected on internal roads to check consistency with street classifications and proposed street cross-sections. Second, to form the base for developing future turning movement projections at the eight study area intersections external to the site. This information will then be used to determine the project's long-term impact and the potential need for mitigation.

5.2 Phase 1 Findings and Conclusions

5.2.1 *Phase 1 Traffic Volumes*

The estimates of growth in traffic volume for various street segments in the project area were used to prepare future (2038) PM peak hour turning movement projections at the eight study area intersections. Figure 7 illustrates both the assumed land uses for Phase 1 of development and the internal street system expected to be in place (based on the June 25, 2013 plan). Generally, it is anticipated that the initial development in the Normal Avenue neighborhood will occur within the eastern portions of the property. As illustrated in Figure 7, the initial plan showed access to be available both from Clay Street (via two east/west Neighborhood Streets) and from E. Main Street (via two north/south Neighborhood Streets and the northerly extension of Normal Avenue, a designated city avenue). The most recent plan (as reflected in Figure 2) would only include two north/south connections to E. Main Street. This change would not affect turning movement projections at study area intersections.

Figure 8 presents 2038 intersection turning movement projections for the PM peak hour including both 2038 background traffic growth and Phase 1 of development in the Normal Avenue project area. Figure 11 illustrates projected PM peak hour Phase 1 traffic volumes on the streets accessing the Normal Avenue neighborhood.

5.2.2 *Intersection Operations Analysis Results*

Table 7 summarizes 2038 PM peak hour operational performance for study area intersections assuming build-out of Phase 1 of the Normal Avenue Plan. These results incorporate the intersection geometry and traffic control features illustrated in Figure 3 and the projected 2038 PM peak hour traffic volumes in Figure 8.

As indicated in Table 7, all study area intersections are expected to meet their applicable mobility standard. Detailed traffic operational worksheets can be found in Appendix E.

Table 7. 2038 Normal Avenue Plan Phase 1, PM Peak Hour Operations Analysis Summary

Intersection	Operating Standard	Traffic Control	Worst Movement	PM Peak Hour		
				V/C [1]	Delay [2]	LOS [3]
Ashland Street at Walker Avenue	LOS D	Signal		0.61	16.0	B
Ashland Street at Normal Avenue	LOS E	Stop	SB	0.55	38.2	E
Ashland Street at Clay Street	LOS E	Stop	SBL	0.20	17.8	C
OR 66/Ashland Street at Tolman Creek Road	V/C= 0.95	Signal		0.87	42.6	D
E. Main Street at Walker Avenue	LOS E	Stop	NB	0.38	24.1	C
E. Main Street at Bus Access Road	LOS E	Stop	NB	0.03	16.4	C
E. Main Street at New Normal Avenue	LOS E	Stop	NB	0.14	20.0	C
E. Main Street at Clay Street	LOS E	Stop	NB	0.36	23.2	C
E. Main Street at Tolman Creek Road	LOS E	Stop	NB	0.42	13.5	B

[1] Volume-to-Capacity ratio of a signalized intersection or Worst Movement of an unsignalized intersection.
[2] LOS = Level-Of-Service using 2000 Highway Capacity Manual (HCM) methodology.
[3] Average Control Delay for an entire signalized intersection or the worst movement of an unsignalized intersection.

5.2.3 *Traffic Queuing Analysis Results*

Table 8 summarizes 2038 PM peak hour traffic queuing analysis results for Phase 1 of the Normal Avenue Plan at the two signalized study area intersections. Worksheets are included in Appendix F.

Similar to the results from analysis of the 2038 PM peak baseline condition, queuing results for the signalized intersection of Ashland Street at Walker Avenue show that for both left turn movements (eastbound and westbound) along Ashland Street there is sufficient space to meet expected vehicle queuing demand. At the intersection of OR 66/Ashland Street with Tolman Creek Road three of the existing left turn lanes do not have sufficient space to accommodate expected traffic queues with Phase 1 traffic during the 2038 PM peak hour without impacting other traffic. In the north and southbound directions, a two to three vehicle spillover into the through lane is expected for certain signal cycles during the PM peak hour. In the westbound left turn lane queuing demand is expected to extend beyond available space in the designated left turn lane, spilling back into a two-way left turn lane and potentially impacting access to/from existing driveways.

Table 8. 2038 Normal Avenue Plan Phase 1, PM Peak Hour Intersection Traffic Queuing

Intersection	Movement	Existing Vehicle Storage	PM Peak Hour Vehicle Queue
Ashland Street at Walker Avenue[1]	EB Left	100 ft	82 ft.
	WB Left	100 ft	78 ft.
OR 66/Ashland Street at Tolman Creek Road[1]	NB Left	100 ft	155 ft.
	SB Left	100 ft	187 ft.
	EB Left[2]	185 ft	168 ft.
	WB Left[3]	225 ft	247 ft.

[1] Traffic queuing calculated using Synchro 8 traffic operations software.
[2] Existing storage space includes two-way left turn lane. EB left has only 185 feet to first driveway.
[3] Existing storage space includes two-way left turn lane. WB left has only 225 feet to first driveway.

5.2.4 *Evaluation of Internal Streets*

Figures 2 and 12 illustrate the internal street, bicycle and pedestrian systems for the Normal Avenue Neighborhood Plan. As indicated in Figure 2, the internal street system follows an hierarchical structure which uses Normal Avenue as its primary backbone. Normal Avenue would ultimately run north/south, connecting E. Main Street on the north with Ashland Street on the south. This connection would require approval of a public railroad crossing of the existing CORP rail line.

Normal Avenue is supported by a system of Neighborhood Streets, running both north/south (generally parallel to Normal Avenue) and east/west (connecting Normal Avenue to various subareas in the development and to individual properties). In addition to neighborhood streets, there is also a system of alleyways or "rear lanes" providing back access to properties fronting on public open space, and shared space streets that provide for mixed mode travel with no separation between cars, pedestrians and bicyclists. The idea of shared space streets originated in The Netherlands where these are referred to as "woonerfs or living streets". On shared space streets pedestrians and cyclists would have legal priority over motorists with a goal of calming and reducing speeds.

As shown in Figure 12, the bicycle network in the Plan area includes streets with bike lanes (primarily E. Main Street adjacent to the project), streets without bike lanes (including Normal Avenue and the neighborhood street system), shared space streets, multi-use paths, and the Ashland Central Bike Path. The pedestrian system also shown in Figure 12 includes an extensive system of streets with adjacent sidewalks, shared use streets, multi-use paths and the Ashland Central Bike Path. It should be noted that these two figures show the bicycle and pedestrian systems at full build-out. With Phase 1 development, improvements would be largely confined to the eastern portion of the Plan area (see Figure 7).

The Ashland Transportation System Plan designates Normal Avenue as a City Avenue in its functionally classified hierarchy of streets. The City's *"Handbook for Planning and Designing Streets"* defines an Avenue as a street that provides *"concentrated pedestrian, bicycle, transit and motor vehicle access from neighborhoods to neighborhood activity centers and boulevards. Avenues are similar to boulevards, but are designed on a smaller scale… A 2-lane or 3-lane configuration can be used depending on the number of trips generated by surrounding existing and future land uses."* Avenues are expected to carry between 3,000 and 10,000 daily vehicle trips, speeds would be controlled to 20-25 mph, and bike lanes, on-street parking, planting strips and sidewalks would all be provided.

Traffic volumes for daily and PM peak hourly conditions with Phase 1 development were estimated for Normal Avenue a short way south of E. Main Street, where the maximum traffic volume on this facility is expected to occur. Traffic volume estimates were based on the trip generation and trip assignment process described above, resulting in an estimate of approximately 90 vehicles during the PM peak hour. Review of travel model output indicates that there would be little demand for cut-through traffic movement on Normal Avenue between Ashland and E. Main Streets, thus minimizing non-project traffic on the plan area street system if and when a continuous Normal Avenue connection might be made. Approximately 1,000 vehicles were estimated on a daily basis at this same location, representing a low end for the Avenue street classification. It is recommended that this street be reclassified as a Neighborhood Collector between Ashland and E. Main Streets. This classification has a recommended service volume of 1,500 to 5,000 vehicles per day.

It should be noted that the Plan does not propose that bike lanes be included on Normal Avenue which is inconsistent with its existing functional designation, but generally acceptable given the low traffic volumes that this street is expected to carry. A reclassification of the street from Avenue to Neighborhood Collector would eliminate this inconsistency. City standards state that "*bicycle Lanes* *should be provided on streets designated as neighborhood collectors when the average daily traffic is over 3000, and/or when actual travel speeds exceed 25 mph"*. Since Phase 1 (and full build-out volumes as described later in this report) would generate less than 3,000 vehicles per day along Normal Avenue, consistency with the Neighborhood Collector classification could be achieved. Street design should encourage travel speeds of 25 mph or less.

The proposed multi-use path connection along the east side of an existing street from Normal Avenue to the north edge of the project area will ultimately provide access to the Bear Creek Greenway. When complete, the Greenway will connect to many destinations in central Jackson County. The presence of sidewalks and trails throughout the development provide for convenient and safe pedestrian movement, linking to destinations within the Plan area, as well as outside.

5.2.5 *Access Management Considerations*

As noted in the TSP, spacing requirements for public roadways and private driveways can have a profound impact on transportation system operations, safety and land development. Access management strategies and implementation require careful consideration to balance the need for access to developed land with the need to ensure movement of traffic in a safe and efficient manner. Access management generally becomes more stringent as the functional classification level of roadways and the corresponding importance of mobility increase.

The Ashland TSP identifies a minimum driveway access spacing of 300 feet for boulevards like Ashland and E. Main Streets, 100 feet for avenues like Walker Avenue, Clay Street and Tolman Creek Road, and 75 feet for lower order streets such as those that could be developed internal to the Normal Avenue Neighborhood Plan area. However, these spacing standards have not yet been codified. Current standards, as adopted in the Municipal Code (18.92.080 Parking, Access and Circulation Design) are as follows:

- Distance between driveways:
  - On arterial streets – 100 feet
  - On collector streets – 75 feet
  - On residential streets – 50 feet
- Distance from intersections:
  - On arterial streets – 100 feet
  - On collector streets – 50 feet
  - On residential streets – 35 feet

OR 66 east of Tolman Creek Road is under ODOT jurisdiction and state highway access spacing standards apply. ODOT and the City of Ashland have an agreement that OR 66 within the city limits is subject to the minimum spacing standards typically applied to District Highways. OR 66 within the City is subject to a minimum access spacing standard of 300 feet. The public roadway spacing standards is 1 mile for boulevards and ¼ mile for avenues. The City currently does not have minimum public roadway spacing standards for neighborhood collectors or neighborhood streets.

The proposed alignment of Normal Avenue through the Plan area is largely consistent with the ¼ mile (1,320 feet) spacing standard for avenues in relation to the existing alignment of Clay Street which is also a designated avenue. The exception would be at the north end near E. Main Street where Normal Avenue makes a transition eastward as it approaches E. Main Street to avoid wetlands and minimize impact to an existing stream. At its proposed Main Street intersection, Normal Avenue would be approximately 1,000 feet west of Clay Street. Neighborhood streets are located roughly 300 to 500 feet apart and are supported by shared space streets and rear lanes. Redesignation of Normal Avenue as a Neighborhood Collector would meet this spacing standard.

As development plans for the project area become more refined it will be important to ensure that there is adequate spacing between the proposed Normal Avenue intersection with E. Main Street and the neighborhood street intersection proposed immediately to the east. As shown currently in Figure 2, there is at least 300 feet between these two intersections which is consistent with TSP recommendations and exceeds current city code. Additionally it will be important that adequate intersection and stopping sight distance is provided at each intersection onto E. Main Street. Consideration should be given to reviewing existing sight distance at the intersection of E. Main Street with Clay Street to ensure that appropriate distance is available to maximize safety.

5.2.6 *Railroad Crossing*

The existing road crossing of the CORP tracks at Normal Avenue is a stop-controlled, private crossing intended to serve a limited number of single family homes on large lots. In order to connect Normal Avenue as a public street between the Plan area and Ashland Street, a formal rail crossing permit application must be submitted and approved. If approved, then it is likely that enhanced rail crossing protection devices will be required and must be installed as a part of the public street improvement project. This is an expensive undertaking as it is likely that crossing gates with flashers and warning devices would be required. As a part of the Normal Avenue Plan future traffic conditions analysis, the need for a Normal Avenue extension including upgraded rail crossing was evaluated.

The primary factors considered in this evaluation focused on whether there would be a significant degradation of traffic operations along E. Main or Clay Streets, or at any of the study area intersections that could be avoided by making the proposed road extension. The results of PM peak hour intersection traffic operations analysis indicates that, with one exception, all study area intersections would operate acceptably without the improved rail crossing and Normal Avenue street connection in place. Accordingly, developing a public rail crossing as a traffic impact mitigation measure is not necessary. However, it is desirable to ultimately improve this crossing and connect Normal Avenue to the south to provide for additional connectivity and circulation. In the interim, the viability of adding a bicycle and pedestrian connection across the railroad at this location should be explored.

5.3 Phase 2 Findings and Conclusions

Figure 9 illustrates both the assumed land uses for Phase 2 of development and the internal street system expected to be in place. Generally, it is anticipated that build-out of the Normal Avenue neighborhood will occur within the western and southern portions of the property. As illustrated in Figure 9, access will be available both from Clay Street (via two east/west Neighborhood Streets) and from E. Main Street (via two north/south Neighborhood Streets and the northerly extension of Normal

Avenue). If a public crossing of the existing CORP rail line is permitted and constructed, access would also be available to/from the south via an improved Normal Avenue connection.

Figure 10 presents 2038 intersection turning movement projections for the PM peak hour including 2038 background traffic growth and both phases of development in the Normal Avenue project area. Figure 11 illustrates projected PM peak hour Phase 2 traffic volumes on the streets accessing the Normal Avenue neighborhood.

5.3.1 *Intersection Operations Analysis Results*

Synchro 8 software was used to evaluate the performance of both signalized and unsignalized intersections in the study area. Table 9 summarizes 2038 PM peak hour operational performance for study area intersections assuming build-out of both Phases 1 and 2 of the Normal Avenue Plan. These results incorporate the intersection geometry and traffic control features illustrated in Figure 2 (with the addition Normal Avenue and other local street connections to E. Main Street) and the projected 2038 PM peak hour traffic volumes in Figure 10.

As indicated in Table 9, all study area intersections are expected to meet their applicable mobility standard. Detailed traffic operational worksheets can be found in Appendix G.

Table 9. 2038 Normal Avenue Plan Phase 2, PM Peak Hour Operations Analysis Summary

Intersection	Operating Standard	Traffic Control	Worst Movement	PM Peak Hour		
				V/C [1]	Delay [2]	LOS [3]
Ashland Street at Walker Avenue	LOS D	Signal		0.63	17.0	B
Ashland Street at Normal Avenue	LOS E	Stop	SB	0.55	38.3	E
Ashland Street at Clay Street	LOS E	Stop	SBL	0.20	17.8	C
OR 66/Ashland Street at Tolman Creek Road	V/C= 0.95	Signal		0.88	45.3	D
E. Main Street at Walker Avenue	LOS E	Stop	NB	0.41	25.3	D
E. Main Street at Bus Access Road	LOS E	Stop	NB	0.18	21.2	C
E. Main Street at Bus Access Road – School PM	LOS E	Stop	NB	0.27	23.9	C
E. Main Street at New Normal Avenue	LOS E	Stop	NB	0.17	20.0	C
E. Main Street at Clay Street	LOS E	Stop	NB	0.39	25.1	D
E. Main Street at Tolman Creek Road	LOS E	Stop	NB	0.46	14.2	B

[1] Volume-to-Capacity ratio of a signalized intersection or Worst Movement of an unsignalized intersection.
[2] LOS = Level-Of-Service using 2000 Highway Capacity Manual (HCM) methodology.
[3] Average Control Delay for an entire signalized intersection or the worst movement of an unsignalized intersection.

5.3.2 *Traffic Queuing Analysis Results*

Table 10 summarizes 2038 PM peak hour traffic queuing analysis results for Phase 2 of the Normal Avenue Plan at the two signalized study area intersections. Worksheets are included in Appendix H.

Similar to the results from analysis of the 2038 PM peak baseline condition, queuing results for the signalized intersection of Ashland Street at Walker Avenue show that for both left turn movements (eastbound and westbound) along Ashland Street there is sufficient space to meet expected vehicle queuing demand. At the intersection of OR 66/Ashland Street with Tolman Creek Road three of the existing left turn lanes do not have sufficient space to accommodate expected traffic queues during the 2038 PM peak hour without impacting other traffic. In the north and southbound directions, a two to three vehicle spillover into the through lane is expected for certain signal cycles during the PM peak hour. In the westbound left turn lane queuing demand is expected to extend beyond available space in the designated left turn lane, spilling back into a two-way left turn lane and potentially impacting access to/from existing driveways.

Table 10. 2038 Normal Avenue Plan Phase 2, PM Peak Hour Intersection Traffic Queuing

Intersection	Movement	Existing Vehicle Storage	PM Peak Hour Vehicle Queue
Ashland Street at Walker Avenue[1]	EB Left	100 ft	90 ft.
	WB Left	100 ft	78 ft.
OR 66/Ashland Street at Tolman Creek Road[1]	NB Left	100 ft	155 ft.
	SB Left	100 ft	203 ft.
	EB Left[2]	185 ft	168 ft.
	WB Left[3]	225 ft	247 ft.

[1] Traffic queuing calculated using Synchro 8 traffic operations software.
[2] Existing storage space includes two-way left turn lane. EB left has only 185 feet to first driveway.
[3] Existing storage space includes two-way left turn lane. WB left has only 225 feet to first driveway.

5.3.3 *Evaluation of Internal Streets*

Full build-out of the Plan area would occur with Phase 2 development. This development is largely focused on the western portion of the study area (see Figure 9 for the additional streets that would serve Phase 2 land development).

Traffic volumes for daily and PM peak hourly conditions with both Phases 1 and 2 were estimated for New Normal Avenue south of E. Main Street. Based on the estimate of trip-making with this additional development, an estimate of approximately 110 vehicles during the PM peak hour would use Normal Avenue somewhat south of E. Main Street. This equates to approximately 1,200 daily vehicles at the same location, representing a low end for the Avenue street classification. It should also be noted that the Normal Avenue Neighborhood Plan does not propose that bike lanes be included on Normal Avenue which is inconsistent with its functional designation, but generally acceptable given the low traffic volumes that this street is expected to carry. However, as discussed under the evaluation of Phase 1 traffic, reclassification of Normal Avenue as a Neighborhood Collector is recommended. This reclassification would be consistent with the daily traffic volumes projected for the street and would not require bicycle lanes.

A proposed multi-use path provides necessary connections to/from the schools located west of the project area along Walker Avenue, offering a safer and more pleasant travel route for young people than using the proposed E. Main Street bike lanes. The presence of sidewalks and trails throughout the development provide for convenient and safe pedestrian movement, linking to destinations within the Plan area, as well as outside.

5.3.4 *Access Management*

With development of the Phase 2 street system another neighborhood street connection to E. Main Street is proposed at the western edge of the project area. Based on the street alignment illustrated in Figure 2, there does not appear to be any spacing conflicts with other nearby street connections including both Walker Avenue to the west and New Normal Avenue to the east. As development plans for this area become more refined it will be important to ensure that adequate intersection and stopping sight distance is provided at E. Main Street.

5.3.5 *Railroad Crossing*

The findings, conclusions and recommendations presented under the Phase 1 discussion would not change with the addition of Phase 2 traffic.

5.3.6 *Evaluation of Improvement Alternatives*

To further explore the movement of neighborhood traffic to/from the project area, several alternatives to the proposed Neighborhood Plan transportation system were evaluated. Specifically, these alternatives were intended to respond to the following questions:

- <u>If traffic to/from the project area were to adversely impact the Bus Access Road intersection on E. Main Street, what would be the impact of moving this traffic to another location?</u> The location selected for a "sensitivity" analysis was a new intersection on E. Main Street with a northerly extension of existing Normal Avenue. In evaluating this improvement option, it was assumed that project-related traffic that would have used the Bus Access Road would be reassigned to the Existing Normal Avenue Extension. Traffic operations analysis conducted for this scenario indicates that both intersections would operate acceptably within the City's adopted mobility standards.
- <u>What would be the traffic impacts of providing a multimodal street connection across the CORP rail line?</u> To answer this question a redistribution of the traffic volumes assumed to use E. Main Street and Tolman Creek Road was made to place this traffic on Normal Avenue just north of Ashland Street. Traffic operations analysis was then conducted for the intersections of Ashland Street with Normal Avenue, Clay Street and Tolman Creek Road. Based on this analysis, all intersections are expected to operate within the relevant mobility standards. However, the southbound left turn onto Ashland Street from Normal Avenue is expected to operate at LOS E. If any significant volume of additional traffic were to divert to this location, LOS F for this movement may be experienced. Traffic signal warrant analysis was also conducted and it is expected that warrants for signalization would be met. Thus, if a public rail crossing is developed on Normal Avenue, consideration should be given to signalizing the intersection of Normal Avenue with Ashland Street.
- <u>Are there other intersection improvement options to the traditional stop sign-controlled intersections either existing or proposed along E. Main Street?</u> The traffic operations analysis conducted in this report assumes that existing lane channelization would be maintained along E. Main Street (e.g., one travel lane in each direction with no left turn lanes). Analysis was conducted of the potential for developing single lane roundabouts along this street including the intersections of E. Main with the Bus Access Road, New Normal Avenue and Clay Street. Analysis results indicates that all locations would operate at LOS A during the 2038 PM peak hour including full neighborhood built-out. This operational performance is better than the performance with stop signs, since roundabouts utilize the full capacity of an intersection more efficiently. Roundabouts require that traffic slow down, typically to 18 or 20 mph, to negotiate the intersection. This can have a traffic calming effect on overall traffic movement along the street. Roundabouts have a substantial benefit in terms of safety with lower crash rates and reduced crash severity. Additionally, roundabouts typically require less linear right-of-way than streets with other types of traffic control in locations where left-turn channelization is provided.

The table below summarizes a comparison between expected future PM peak hour traffic performance with a side street stop sign and with a single lane roundabout.

	2038 PM Peak with Side Street Stops			2038 PM Peak with Roundabouts		
Location	V/C	Delay	LOS	V/C	Delay	LOS
E. Main Street @ Bus Access Road	0.03	16.4	C	0.44	6.8	A
E. Main Street @ New Normal Avenue	0.14	20.0	C	0.41	6.7	A
E. Main Street @ Clay Street	0.36	23.2	C	0.55	8.0	A

Note: V/C means volume-to-capacity ratio, LOS means level of service.

Appendix I includes intersection analysis worksheets for each of these improvement alternatives.

5.4 Recommended Street Improvements and Traffic Control

5.4.1 *E. Main Street Recommended Cross-section*

E. Main Street is currently designated as a city Boulevard. Ashland's "*Handbook for Planning and Designing Streets*" identify a range of cross-sectional improvements for boulevards, largely depending on anticipated traffic volumes. The recommended cross-section for E. Main Street between Walker Avenue and Tolman Creek Road is as follows:

- 2038 PM peak hour traffic analysis indicates that each existing or proposed intersection along this street will operate acceptably with a single lane in each direction. Left turn channelization should be considered for its safety benefits, but is not necessary to ensure that mobility standards are met. At a minimum E. Main Street would be constructed to include: two 11-foot travel lanes, two 6-foot bike lanes (or a 6-foot shoulder along the north side of the street), a 5 to 8-foot planting strip on the south side of the street to buffer the sidewalk from vehicular traffic, and a 6 to 10-foot sidewalk, also along the south side of the street. The shoulder along the north side of E. Main Street is recommended until such time as the adjacent property is included within the UGB and developed. A 12-foot center turn lane should be considered as a safety enhancement and/or to meet longer-term travel needs as future conditions warrant.
- Access locations onto E. Main Street should be limited, where possible, to local or collector street intersections. All access locations should meet the City's minimum spacing requirements.
- All access locations onto E. Main Street should meet the intersection and stopping sight distance requirements associated with its speed.
- As the property along E. Main Street is urbanized, the City should request that ODOT perform a speed zoning study with the goal of reducing the existing 40 mph posted speed to a lower limit. Consideration should be given to speeds in the range of 25 to 30 mph.

5.4.2 *Normal Avenue Reclassification*

Due to the relatively low level of traffic expected to use Normal Avenue through the project area, it is recommended that the street be reclassified from its current TSP designation as an Avenue to a Neighborhood Collector with the recommended cross-section and multimodal improvements that accompany this designation.

5.4.3 *Traffic Control*

Traffic control recommendations are segregated into three groups: those affecting E. Main Street, those that are internal to the project area, and other locations.

E. Main Street Traffic Control

All side streets approaching E. Main Street are lower order facilities (e.g., Avenues, Neighborhood Collectors or local streets). Consequently each of these streets should be stop sign-controlled at its intersection with E. Main Street. The exception would be for any location where a roundabout is developed to serve intersecting traffic. A decision on appropriate traffic control should be made as street improvements are developed.

Internal Streets

Stop sign warrant analysis should be conducted along the New Normal Avenue through the heart of the project to identify any locations appropriate for side street stop sign control. Consideration should also be given to either stop or yield signs where sight distance is limited.

Other Locations

If and when a public crossing of the CORP rail line is provided along Normal Avenue, traffic volumes should be monitored to determine when signalization at Ashland Street is warranted.

5.4.4 *Public Railroad Crossing on Normal Avenue*

While not necessary as a traffic mitigation measure for potential project impacts along E. Main Street or elsewhere, provision of a public crossing of the CORP rail line would benefit the neighborhood by providing an alternative route to a variety of destinations throughout the City. Of particular importance would be the connection to active transportation facilities such as the Central Bike Path and the bicycle and pedestrian infrastructure along Ashland Street. A public crossing at this location would also have safety and convenience benefits by providing an alternative means of access to the neighborhood, particularly if an incident should reduce or limit accessibility along E. Main or Clay Streets.

5.4.5 *Other*

It is recommended that the City consider extending north/south left turn channelization on Tolman Creek Road at Ashland Street in the future if and when the need for additional vehicle storage becomes apparent.

6. MULTIMODAL LEVEL OF SERVICE ANALYSIS

This section summarizes a qualitative multimodal level of service analysis that was conducted for the streets in the study area based on procedures recently developed by ODOT[3]. This analysis differs from the quantitative assessment conducted for the City's Transportation System Plan and updated for the Normal Avenue Plan existing conditions analysis. For the qualitative analysis data was collected to gain an understanding of both the existing and proposed multimodal transportation system and its performance for pedestrians, bicyclists, transit users and motorists.

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[3] Oregon Department of Transportation, *"Qualitative Multimodal Level of Service Supplement"*, January 2013.

The results of multimodal level of service analysis for roadway segments is shown in Table 11 and summarized below. Analysis results for intersections are shown in Table 12, and back-up documentation of data used in both assessments is included in Appendix J. In addition to this analysis, it should be noted that the City's Central Bike Path runs east/west through the project area along the south side of the existing CORP rail tracks between Tolman Creek Road and A Street. This path is a significant component of the City's non-motorized transportation system, connecting the Normal Avenue Neighborhood to the broader community and significantly enhancing opportunities for the use of active transportation modes in the study area.

Table 11. Summary of Qualitative Multimodal Level of Service Analysis for Street Segments

	Travel Mode			
Street Segments	**Pedestrian**	**Bicycle**	**Transit**	**Auto**
Existing and 2038 Baseline				
Ashland Street				
Walker Avenue to Tolman Ck Road	Fair	Good	Fair	Good (1)
E. Main Street				
Walker Avenue to Tolman Ck Road	Very Poor	Poor	N/A	Excellent
Walker Avenue				
E. Main Street to Iowa Street	Excellent	Excellent	N/A	Excellent
Iowa Street to Ashland Street	Good	Good	N/A	Excellent
Clay Street				
E. Main Street to Ashland Street	Fair	Poor	N/A	Good (2)
Tolman Creek Road				
E. Main Street to Ashland Street	Good	Good	N/A	Good (1)
2038 with Neighborhood Plan				
Ashland Street				
Walker Avenue to Tolman Ck Road	Fair	Good	Fair	Good (1)
E. Main Street				
Walker Avenue to Tolman Ck Road	**Excellent**	**Excellent**	N/A	Excellent
Walker Avenue				
E. Main Street to Iowa Street	Excellent	Excellent	N/A	Excellent
Iowa Street to Ashland Street	Good	Good	N/A	Excellent
Clay Street				
E. Main Street to Ashland Street	Fair	Poor	N/A	Good (2)
Tolman Creek Road				
E. Main Street to Ashland Street	Good	Good	N/A	Good (1)

(1) Significant congestion at intersection of Ashland Street and Tolman Creek Road. Intersection also exceeds signalized critical crash rate.
(2) No crash data but perception of hazard on Clay at E. Main due to speed.

As indicated in Table 11, existing pedestrian facilities vary considerably throughout the study area ranging from excellent along Walker Avenue in the vicinity of the existing schools to very poor along E. Main Street where is there is limited shoulder space and relatively high speeds. Bicycle facilities also vary considerably throughout the study area ranging from poor on E. Main and Clay Streets where no facilities are present and shoulder widths are narrow, to excellent along the northern part of Walker Avenue where there are existing bicycle lanes. Transit service is currently provided only along Ashland Street and Tolman Creek Road (RVTD Route 10). Service is provided on a half-hourly basis and transit amenities are minimal. Pedestrian access along Ashland Street is very good, but limited along Tolman

Creek Road. Overall the transit level of service was rated as fair. Auto levels of service are largely derived from the intersection traffic operations analysis that is documented earlier in this report. Generally, operations are good except for the intersection of Ashland Street with Tolman Creek Road where growing traffic volumes will cause LOS to significantly degrade over time.

With development of the Normal Avenue Neighborhood Plan, it is anticipated that urban scale improvements would be made to E. Main Street. Consistent with the Boulevard designation in the City's *"Handbook for Planning and Designing Streets"* it is anticipated that E. Main Street would ultimately be constructed to include: two 11-foot travel lanes, one 12-foot median, two 6-foot bike lanes, two 5 to 8-foot planting strips on either side of the street to buffer the sidewalk from vehicular traffic, and two 6 to 10-foot sidewalks. It is also anticipated that the City will seek a speed reduction from the existing 40 mph designation to a 25 to 30 mph range consistent with the City's street standards. These changes would improve the multimodal LOS analysis results for E. Main Street for bicycle and pedestrian facilities to excellent. A more detailed discussion of the rating process and results is presented below.

Table 12 presents a summary of the results of qualitative multimodal level of service analysis for intersections. As indicated in the table, existing pedestrian and bicycle crossings of side streets along Ashland Street are rated as Good due to existing traffic control and the presence of crosswalks. Existing crossings of side streets along E. Main Street are rated as Good at Walker Avenue and the future Normal Avenue due to the presence (or likely future presence) of stop-sign traffic control and crosswalks. The intersections with Clay Street and Tolman Creek Road were rated as Fair due to the lack of crosswalks.

Table 12. Summary of Qualitative Multimodal Level of Service Analysis for Intersections

Travel Mode	Along Ashland Street at Side Street Crossings of:			
	Walker	**Normal**	**Clay**	**Tolman Creek**
Existing and 2038 Baseline				
Pedestrian Facilities	Good	Good	Good	Good
Bicycle Facilities	Good	Good	Good	Good
2038 with Neighborhood Plan				
Pedestrian Facilities	Good	Good	Good	Good
Bicycle Facilities	Good	Good	Good	Good
	Along East Main Street at Side Street Crossings of:			
	Walker	**Normal**	**Clay**	**Tolman Creek**
Existing and 2038 Baseline				
Pedestrian Facilities	Good	N/A	Fair	Fair
Bicycle Facilities	Good	N/A	Fair	Fair
2038 with Neighborhood Plan				
Pedestrian Facilities	Good	Good	Fair	Fair
Bicycle Facilities	Good	Good	Fair	Fair
	Crossings of Ashland Street at:			
	Walker	**Normal**	**Clay**	**Tolman Creek**
Existing and 2038 Baseline				
Pedestrian Facilities	Fair	Poor	Poor	Fair
Bicycle Facilities	Fair	Poor	Poor	Fair
2038 with Neighborhood Plan				
Pedestrian Facilities	Fair	Poor	Poor	Fair
Bicycle Facilities	Fair	Poor	Poor	Fair

Crossings of Ashland Street were rated as Fair at Walker Avenue and Tolman Creek Road due to the presence of traffic signal control with pedestrian buttons and signal heads (which is positive) and the long crossing distance (which is negative). Crossings of Ashland Street at Normal Avenue and Clay Street were rated as Poor since there are no traffic control devices, crosswalks or median refuges.

6.1 Data Sources

For the Ashland Street, E. Main Street and Tolman Creek Road segments, the data was taken exclusively appendices and support memoranda prepared for the recently adopted Transportation System Plan (TSP). This data was spot checked on Google Earth to ensure that it was both current and accurate. Data was updated where necessary.

For the Clay Street and Walker Avenue segments, Google Earth and other resources were used to determine the values needed to populate the tables. The TSP indicated that there is no transit on these roads and this was confirmed b a check on the RVTD website. To determine pavement conditions, the pavement as viewed on Google Earth supplemented by photos of roadway segments earlier in the project, was compared to locations where a pavement rating was provided. Where pavement condition seemed similar based on visual inspection, a location was scored the same as the other roadways. It should be noted that all of the roadways with a pavement rating in the TSP had the same score.

For the intersection table, crossing width was assumed to be the number of lines on the cross street. The analysis addresses both travel along Ashland and E. Main Streets, as well as crossings of Ashland Street.

6.2 Determining the Multimodal Assessment for Segments

6.2.1 *Pedestrian System*

Factors incorporated into the evaluation were abstracted from ODOT qualitative multimodal level of service guidance and include the following:

- *"<u>Outside travel lane width</u>: Wider travel lanes are rated better than narrower travel lanes because of the increased separation between pedestrians and motorized vehicles.*
- *<u>Bicycle lane/shoulder width</u>: The presence of bicycle lanes or shoulders creates a buffer between traffic and wider facilities are rated better than narrower or nonexistent facilities.*
- *<u>Presence of buffers (landscape or other)</u>: The presence of buffers that separate pedestrians from traffic result in an improved rating. Wider buffers are rated better than narrower or nonexistent buffers.*
- *<u>Sidewalk/path presence and effective width</u>: The presence of sidewalks/paths versus shoulders or no facilities is a significant consideration with wider facilities rated better than narrow or nonexistent facilities.*
- *<u>Volume and speed of motorized traffic in the adjacent travel lane</u>: The speed and volume of motorized traffic in the adjacent travel lane affect the pedestrian experience with lower volumes and slower travel speeds rated better than higher volumes and faster travel speeds."*

Evaluation findings and conclusions:

- <u>Ashland Street</u> – was given a score of Fair because it has sidewalks with bike lane/shoulder to serve as a buffer but no planter buffer and fairly high vehicle volumes and speeds in the outside lane.

- E. Main Street – was given a score of Very Poor because it has no sidewalks and very little shoulder space with high speeds and volumes. With the Normal Avenue Neighborhood Plan, pedestrian amenities would be significantly improved along E. Main Street resulting in an excellent rating.
- Walker Avenue (E. Main to Iowa) – was given a valuation of Excellent because it has sidewalks, bike/shoulder space and some areas with planter buffers. It also has low speeds.
- Walker Avenue (Iowa to Ashland) – was given a score of Good because it has sidewalks with bike /shoulder space and low speeds. It did not receive an excellent because the southbound sidewalk/path is an unimproved area that has been turned into a trail by common usage.
- Clay Street – was given an assessment of Fair because it has partial sidewalks with planter buffer and low speeds, but it also has areas without sidewalks and has only partial (and narrow) bike/shoulder width.
- Tolman Creek Road – was given a valuation of Good because it has a southbound sidewalk and decent bicycle/shoulder space in both directions along with relatively low speeds. However, it does not provide a northbound sidewalk or path area along much of the length of this roadway. However, the portions of the road without sidewalks are currently undeveloped which mitigated the overall rating given to the road.

6.2.2 *Bicycle System*

Factors incorporated into the evaluation included:

- *"Bicycle lane presence and effective width: The presence of bike lanes is a significant consideration, with wider facilities rated better than narrow or nonexistent facilities.*
- *Shoulder presence and width: Shoulders serve bicyclists in the absence of bike lanes, and wider facilities are rated better than narrower or nonexistent facilities.*
- *Outside travel lane width: Wider outside travel lanes are rated better than narrower travel lanes because of the increased separation between bicyclists and motorized vehicles.*
- *Pavement Condition: Poor pavement conditions or obstacles such as sewer grates affect the bicycling experience with good quality pavement rated better than poor pavement conditions.*
- *On Street Parking: The presence and utilization of on-street parking affects the bicyclist experience, with no parking or low utilization rated better than high utilization and turnover rates.*
- *Volume, type, and speed of motorized traffic in the adjacent travel lane: The volume and type of motorized vehicles (i.e., more or less large trucks) in the adjacent travel lane affect the bicycling experience as do travel speeds. Conditions with lower volumes, fewer trucks, and slower travel speeds are rated better than higher volumes, more trucks, and faster travel speeds."*

Evaluation findings and conclusions:

- Ashland Street – received a score of Good because it had 6-foot bike lanes with wide outside travel lanes, a good pavement score and very low truck percentage. It does not score as excellent because it has fairly high vehicle volumes and speeds.
- E. Main Street – received a score of Poor because it has no official bike lanes (only a relatively narrow shoulder), moderate vehicle volumes and relatively high speeds. It also has a high truck percentage (7 percent). It did not warrant a Very Poor designation because there are 4-foot shoulders and fairly wide travel lanes, with a good pavement conditions. With the Normal

Avenue Neighborhood Plan, bicycle amenities would be significantly improved along E. Main Street resulting in an excellent rating.

- Walker Avenue (E. Main to Iowa) – was given an assessment of Excellent because it has bike lanes, low travel speeds, and good pavement conditions.
- Walker Avenue (Iowa to Ashland) – was given a score of Good because it has bike lanes, low travel speeds and good pavement condition, but has heavily utilized on-street parking along the west side of the street.
- Clay Street – this received an assessment of Poor because it has no bike lanes and does have areas of on street parking that conflict with bike movement, as well as areas with little or no paved shoulder space. However, it does have low travel speeds and some areas with shoulders.
- Tolman Creek Road – was given a score of Good because it has 6-foot bike lanes with low travel speeds and a low truck percentage with a good pavement condition. The volume is fairly high, which kept it from being assessed as excellent.

6.2.3 *Transit System*

Factors incorporated into the evaluation included:

- *"Service frequency and reliability: Shorter headways and arrival reliability are rated better than longer headways and unreliable arrival times.*
- *Bus speed/travel times: Faster average speeds and shorter travel times are rated better than slower speeds and longer travel times.*
- *Bus stop features: The presence of shelters, benches, and lighting is rated better than stops with no amenities.*
- *Pedestrian network: The quality of the pedestrian facilities serving transit stops affects the transit user's experiences. Bus stops connected to a network of streets with sidewalks are rated better than those with no pedestrian facilities."*

Within the study area only Ashland Street and Tolman Creek Road currently have transit service. Based on the data from the TSP (and verified on RVTD's website), the transit service on each street appears essentially the same and is provided on half-hourly headways. Most stops are designated by signs only, although there is a shelter with bench on the east (northbound) side of Tolman Creek Road at Abbott Street with a crosswalk to connect it with the residential development on the west side of the street. Service is provided on a half-hourly basis. Existing transit service was rated as Fair.

E. Main, Walker and Clay have no transit service and, accordingly, were not evaluated.

6.2.4 *Auto System*

Factors incorporated into the evaluation included:

- *"Volume-to-capacity (v/c) ratios: The prime consideration for the auto mode is based on the quantitative evaluation of demand (volume) versus roadway capacity with lower v/c ratios rated better than higher v/c ratios.*
- *Delay: Primarily considered at unsignalized locations with high side-street delays, shorter delays are rated better than longer delays.*
- *Safety: Roadway conditions that provide for a decreased likelihood of crashes were rated better than conditions with an increased likelihood of crashes."*

Generally, traffic operations within the study area range from good to excellent with minimal delays and no significant safety problems. One exception is the intersection of Ashland Street with Tolman Creek

Road which currently exceeds the citywide critical crash rate for signalized intersections. While existing traffic levels of service (expressed as volume-to-capacity ratios and average vehicle delay) are good, the Ashland/Tolman intersection will worsen substantially in the future and exceed the ODOT operational standard.

6.3 Determining the Multimodal Assessment for Intersections

Multimodal level of service evaluation at intersections focused largely on pedestrian and bicycle movement. Key factors that were incorporated into the evaluation include: the presence and type of traffic control, crossing width and whether a median island was present to serve as a refuge. Each of these criteria was assessed as follows:

6.3.1 *Pedestrian Facilities*

Factors incorporated into the evaluation included:

- *"<u>Traffic control</u>: The presence of a traffic signal or all-way STOP control stops pedestrians by stopping traffic. Intersections with a traffic signal or all-way STOP control with crosswalks are rated better than locations with only two-way STOP control, and/or locations without crosswalks.*
- *<u>Crossing width</u>: The number of approach lanes at an intersection determines the amount of pedestrian exposure and the intersection crossing time. Fewer travel lanes to be crossed is rated better than more travel lanes because it reduces pedestrian exposure and crossing time.*
- *<u>Median islands</u>: The presence of a median island is rated better than no islands because it reduces crossing time and allows two-stage crossings at unsignalized locations."*

Evaluation findings and conclusions:

- <u>Crossings of Side Streets along Ashland Street</u> – Generally rated as Good as all locations include either signals or side-street stop signs which require traffic to stop before proceeding. Both types of traffic control devices provide protection for pedestrian crossings. Additionally, all intersections along Ashland Street presently include crosswalks.
- <u>Crossings of Side Streets along E. Main Street</u> – Generally rated as Good at Walker Avenue which includes a side-street stop sign and a crosswalk. Generally Fair at Clay and Tolman Creek Road since there are stop signs but there are no existing crosswalks. In the future when Normal Avenue is extended to intersect with E. Main Street, it is assumed that this location will be stop controlled with a crosswalk. Accordingly, it is given a Good rating.
- <u>Crossings of Ashland Street</u> – The crossings of Ashland Street at both Walker Avenue and Tolman Creek Road are controlled by traffic signals which provide a relatively safe pedestrian environment. However the crossing distance is long (five vehicular travel lanes plus bicycle lanes which resulted in an overall rating of Fair. The crossings at Normal Avenue and Clay Streets have no protection or pedestrian refuge. Accordingly, they are rated as Poor.

6.3.2 *Bicycle Facilities*

Factors incorporated into the evaluation included:

- *"<u>Traffic control</u>: The presence of a traffic signal or all-way STOP control benefits bicyclists trying to cross the major roadway by stopping traffic. Signalized or all-way STOP traffic control is rated better than crossings with only two-way STOP control.*

- *Crossing width: Fewer travel lanes to be crossed is rated better than more travel lanes because it reduces bicyclist exposure and crossing time. "*

Since the evaluation factors for bicycle crossings are virtually the same as for pedestrians, the results are also the same.