ABERNETHY PLACE MIXED-USE DEVELOPMENT
TRAFFIC IMPACT STUDY

OREGON CITY, OREGON

DATE:
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PREPARED FOR:
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EXECUTIVE SUMMARY

1. The proposed Abernethy Place Mixed-Use Development will include the construction a 99-room hotel, 131 apartment units, 9,500 square-feet of retail space, and a 2,500 square-foot coffee shop located at 1737 Washington Street in Oregon City, Oregon.

2. The trip generation calculations show that the proposed development is projected to generate a net new total of 159 site trips during the morning peak hour and 151 site trips during the evening peak hour.

3. Based on the operational analysis, all study area intersections are projected to operate acceptably per Oregon City code standards through 2022 either with or without the addition of site trips from the proposed development.

4. Based on the crash analysis, the intersection of 14th Street at Main Street was identified as having a high crash rate. It is recommended that the intersection be converted to all-way stop control to address this safety concern. It is recommended that concurrent with conversion to all-way stop control the eastbound and westbound approaches on 14th Street be converted to have a shared left/through lane and a shared through/right lane. Additionally, it is recommended that the westbound approach to Highway 99E be converted to have a shared left/right turn lane and a dedicated right-turn lane. With these improvements in place, it is anticipated that the safety of the intersection will be improved while maintaining acceptable operation of the affected intersections.

5. It should be noted that the city's Transportation System Plan includes an alternative improvement that could address safety concerns at the intersection of 14th Street and Main Street, consisting of conversion of 14th Street to one-way eastbound from OR-99E to John Adams Street and conversion of 15th Street to one-way westbound from Washington Street to OR-99E. This alternative treatment would likely necessitate installation of a new traffic signal for the intersection of Highway 99E at 15th Street.

6. Intersection sight distance is adequate at the site access intersections. No sight distance mitigation is recommended.

7. Based on the left-turn lane warrant analysis, installation of a northbound left-turn lane on Washington Street at the site access is recommended for safe operation of the new site access.

8. Since the westbound 14th Street approach to Main Street currently meets left-turn lane warrants, it is recommended that a northwest-bound left-turn lane be provided even if the intersection is not converted to all-way stop control.

9. Due to insufficient main and side-street traffic volumes, traffic signal warrants are not projected to be met for any of the unsignalized stop-controlled study intersections under any of the analysis scenarios.

10. The proposed site access intersection at Washington Street can be constructed to meet the minimum access spacing standards required by the Oregon City Municipal Code.

11. Based on the proportionality analysis, it was determined that a requirement to construct a left-turn lane serving the site access would be proportionate to the impacts of the proposed development. However, a requirement for construction of safety improvements at the intersection of 14th Street and Main Street would not proportionate to the impacts of the development. If the city desires to require mitigation from the proposed development, it may therefore be appropriate to request a proportionate share payment based on the impacts of the proposed development rather than requesting construction of the recommended improvements.

PROJECT DESCRIPTION & LOCATION

INTRODUCTION

The proposed Abernethy Place Mixed-Use Development will include the construction a 99-room hotel, 131 apartment units, 9,500 square-feet of retail space, and a 2,500 square-foot coffee shop located at 1737 Washington Street in Oregon City, Oregon. The proposed development will take access to the nearby transportation system via three points of access: the intersections of Abernethy Road at Washington Street, a proposed site access driveway onto Washington Street, and a shared access driveway onto Washington Street at the existing Amtrak station entrance.

This report addresses the impacts of the proposed development on the nearby street system. Based on correspondence with City of Oregon City staff, the report conducts safety and capacity/level-of-service analyses at the following intersections:

1. Interstate 205 (I-205) southbound ramps at McLoughlin Boulevard (OR-99E);
2. I-205 northbound ramps at OR-99E;
3. 15th Street at OR-99E;
4. 14th Street at OR-99E;
5. 14th Street at Main Street;
6. 7th Street at Washington Street;
7. 14th Street at Washington Street;
8. 15th Street at Washington Street;
9. Abernethy Road at Washington Street;
10. Proposed site access at Washington Street;
11. Amtrak station access at Washington Street;
12. Prairie Schooner Way at Washington Street;
13. Clackamas River Drive at Washington Street; and
14. Trails End Highway (OR-213) at Clackamas River Drive.

The purpose of this study is to determine whether the transportation system in the vicinity of the site is capable of safely and efficiently supporting the existing and proposed uses and to determine any mitigation that may be necessary to do so. Detailed information on traffic counts, trip generation calculations, safety analyses, and level-of-service calculations is included in the appendix to this report.

LOCATION DESCRIPTION

The project site is located northwest of Washington Street, north of 17th Street, and southeast of the Amtrak railroad tracks in Oregon City, Oregon. The subject site is located within a mixed-use area with the Oregon City Amtrak Rail Station to the northeast, the End of the Oregon Trail Interpretive Center to the southeast, a power substation and other industrial land-uses to the west, and a mix of smaller residential/commercial/industrial land-uses to the south.

The subject site includes seven tax lots; lots 601, 900, 1000, 1100, 1200, 1300, 1301; which encompass an approximate total of 4.1 acres. All seven lots are zoned as *Mixed Use Downtown*

(MUD) and are currently developed and utilized by several industrial and commercial service land-uses.

VICINITY STREETS

OR-99E is classified by the Oregon Department of Transportation (ODOT) as a Regional Highway south and a District Highway north of I-205 and by the City of Oregon City as a Major Arterial. The roadway has a varying cross-section of four to eight travel lanes and has a posted speed of 40 mph north and 30 mph south of 14th Street. On-street parking is permitted along both sides of the roadway at marked locations south of 14th Street. Curbs, sidewalks, and bicycle lanes are intermittently provided along both sides of the roadway.

Main Street is classified by the City of Oregon City as a Collector. The roadway has a two-lane cross-section with on-street parking permitted along both sides of the roadway south of 15th Street where either adequate roadway width is provided or spaces are marked. Bicycle lanes are provided along both sides of the roadway north while sharrows are marked within vehicle travel lanes south of 15th Street. Curbs and sidewalks are provided along both sides of the roadway south of 15th Street while only partially provided to the north.

Washington Street is classified by the City of Oregon City as a Minor Arterial north and a Local Street south of 5th Street. The roadway has a varying cross-section between two to six travel lanes and has a posted speed which varies between 25 mph and 35 mph within the study area. On-street parking is permitted along both sides of the roadway south of 11th Street while bicycle lanes are provided along both sides to the north. Curbs and sidewalks are provided along both sides of the roadway south and intermittently provided north of Abernethy Road.

OR-213 is classified by ODOT as a District Highway and by the City of Oregon City as an Expressway. The roadway has a varying cross-section between four to seven travel lanes and has a posted speed of 45 mph north and 55 mph south of Prairie Schooner Way. Bicycle lanes or shoulders are provided along both sides of the roadway. Curbs and sidewalks are intermittently provided along both sides of the roadway.

Clackamas River Drive is classified by the City of Oregon City as a Minor Arterial. The roadway has a two-lane cross-section north of the roundabout at Washington Street, and a four-lane cross-section to the south with two southbound travel lanes, a two-way left-turn lane, and a northbound travel lane. It has a posted speed of 40 mph north and 30 mph south of S Melinda Street. Bicycle lanes are provided along both sides of the roadway while curbs and sidewalks are intermittently provided.

Prairie Schooner Way is classified by the City of Oregon City as a Minor Arterial. The roadway has a five-lane cross-section, with two eastbound and three westbound travel lanes. Curbs and bicycle lanes are provided along both sides of the roadway.

Abernethy Road is classified by the City of Oregon City as a Minor Arterial. The roadway has a three-lane cross-section, with one travel lane and a center two-way left-turn lane, and has a posted speed of 35 mph. Bicycle lanes are provided along both sides of the roadway while curbs and sidewalks are intermittently provided along both sides.

15th Street is classified by the City of Oregon City as a Collector. The roadway has a two-lane cross-section and has a posted speed of 25 mph. On-street parking is permitted along both sides of the roadway east of Washington Street where adequate roadway width is available. Curbs and sidewalks are intermittently provided along both sides of the roadway.

14th Street is classified by the City of Oregon City as a Collector west and Local Street east of Washington Street. The roadway has a four-lane cross-section between OR-99E and Main Street, with two travel lanes in each direction, and a two-lane cross-section east of Main Street. On-street parking is permitted along both sides of the roadway east of Washington Street. Curbs and sidewalks are provided along both sides of the roadway.

7th Street is classified by the City of Oregon City as a Major Arterial. The roadway has a three-lane cross-section, with one travel lane in each direction and a center turn lane. On-street parking is permitted along the north side of the roadway between John Adams Street and John Quincy Adams Street. Curbs and sidewalks are provided along both sides of the roadway.

STUDY INTERSECTIONS

The I-205 southbound ramps intersection at OR-99E is a three-legged intersection that is controlled by a traffic signal. The northbound approach has three through lanes and one channelized right-turn lane that operates under yield control. The southbound approach has three through lanes and one left-turn lane served by protected phasing. The westbound approach has two left-turn lanes and one right-turn lane served by permitted/overlapping phasing. One crosswalk is marked across the eastern intersection leg.

The I-205 northbound ramps intersection at OR-99E is a three-legged intersection that is controlled by a traffic signal. The northbound approach has three through lanes and one right-turn lane served by permitted/overlapping phasing. The southbound approach has three through lanes and one left-turn lane served by protected phasing. The westbound approach has one left-turn lane and one channelized right-turn lane that operates under yield control. One crosswalk is marked across the eastern intersection leg.

The intersection of 15th Street at OR-99E is a three-legged intersection that is stop-controlled for the westbound approach of 15th Street. The northeast-bound approach has one through lane and one shared through/right-turn lane. The southwest-bound approach has three through lanes. The northwest-bound approach has one right-turn lane. One crosswalk is marked across the southeastern intersection leg.

The intersection of 14th Street at OR-99E is a three-legged intersection that is controlled by a traffic signal. The northeast-bound approach has one through lane and one shared through/right-turn lane. The southwest-bound approach has two through lanes and a left-turn lane served by flashing-yellow-arrow phasing. The northwest-bound approach of 14th Street has one left-turn lane and one right-turn lane served by permitted/overlapping phasing. Crosswalks are marked across all intersection legs.

The intersection of 14th Street at Main Street is a four-legged intersection that is two-way stop-controlled for the northeast-bound and southwest-bound approaches of Main Street. The northeast-bound approach has one shared left-turn/through lane and one right-turn lane. The southwest-bound and northwest-bound approaches each have one shared lane for all turning movements. The southeast-bound approach has one left-turn lane and one shared through/right-turn lane. Crosswalks are marked across all intersection legs.

The intersection of 7th Street at Washington Street is a four-legged intersection that is controlled by a traffic signal. The northeast-bound and southwest-bound approaches of Washington Street each have one left-turn lane and one shared through/right-turn lane. The northeast-bound and southwest-bound approaches operate under split phasing. The southeast-bound and northwest-bound approaches of 7th Street each have one through lane and one right-turn lane served by permitted/overlapping phasing. Left-turns from 7th Street onto Washington Street are prohibited. Crosswalks are marked across all intersection legs.

The intersection of 14th Street at Washington Street is a four-legged intersection that is controlled by a traffic signal. The northeast-bound and southwest-bound approaches of Washington Street each have one left-turn lane served by flashing-yellow-arrow phasing, one shared through/right-turn lane, and a bicycle lane to the right of the outermost standard travel lane. The northwest-bound approach has one shared lane for all turning movements. The southeast-bound approach has one shared left-turn/through lane and one right-turn lane. Crosswalks are marked across all intersection legs.

The intersection of 15th Street at Washington Street is a four-legged intersection that is controlled by a traffic signal. The northeast-bound and southwest-bound approaches of Washington Street each have one left-turn lane served by flashing-yellow-arrow phasing, one shared through/right-turn lane, and a bicycle lane to the right of the outermost standard travel lane. The northwest-bound and southeast-bound approaches each have one shared lane for all turning movements. Crosswalks are marked across all intersection legs.

The intersection of Abernethy Road at Washington Street is a four-legged intersection that is controlled by a traffic signal. The northeast-bound approach has one left-turn lane served by permitted phasing, one through lane, one right-turn lane, and a bicycle lane situated between the through and right-turn lanes. The south-westbound approach has one left-turn turn lane served by permitted phasing, one shared through/right-turn lane, and a bicycle lane to the right of the outermost standard travel lane. The northwest-bound approach has one left-turn lane served by permitted phasing and one shared through/right-turn lane. The southeast-bound approach has one shared lane for all turning movements. Crosswalks are marked across all intersection legs.

The Amtrak station/End of the Oregon Trail Interpretive Center access intersection on Washington Street is a four-legged intersection that is two-way stop-controlled for the two driveway approaches. The northeast-bound and southwest-bound approaches of Washington Street each have one left-turn lane, one shared through/right-turn lane, and a bicycle lane to the right of the outermost standard travel lane. The northwest-bound and southeast-bound approaches each have one shared lane for all turning movements. A crosswalk is marked across the southwestern intersection leg while sidewalks are in place across the northwestern and southeastern legs.

The intersection of Prairie Schooner Way at Washington Street is a three-legged intersection that is controlled by a traffic signal. The northeast-bound approach has one through lane, one shared through/right-turn lane, and a bicycle lane to the right of the outermost standard travel lane. The southwest-bound approach has two through lanes, one left-turn lane served by flashing-yellow-arrow phasing, and a bicycle lane to the right of the outermost standard travel lane. The westbound approach of Prairie Schooner Way has two left-turn lanes, one right-turn lane served by permitted/overlapping phasing, and a bicycle lane to the right of the outermost standard travel lane. Crosswalks are marked across the northeastern and southeastern intersection legs.

The intersection of Clackamas River Drive at Washington Street is a three-legged round-about intersection. The northeast-bound approach of Washington Street has one shared through/U-turn lane and one free-flowing channelized right-turn lane. The southwest-bound approach has one shared left-turn/through/U-turn lane. The northwest-bound approach has one shared left-turn/right-turn/U-turn lane. Crosswalks are marked across all intersection legs.

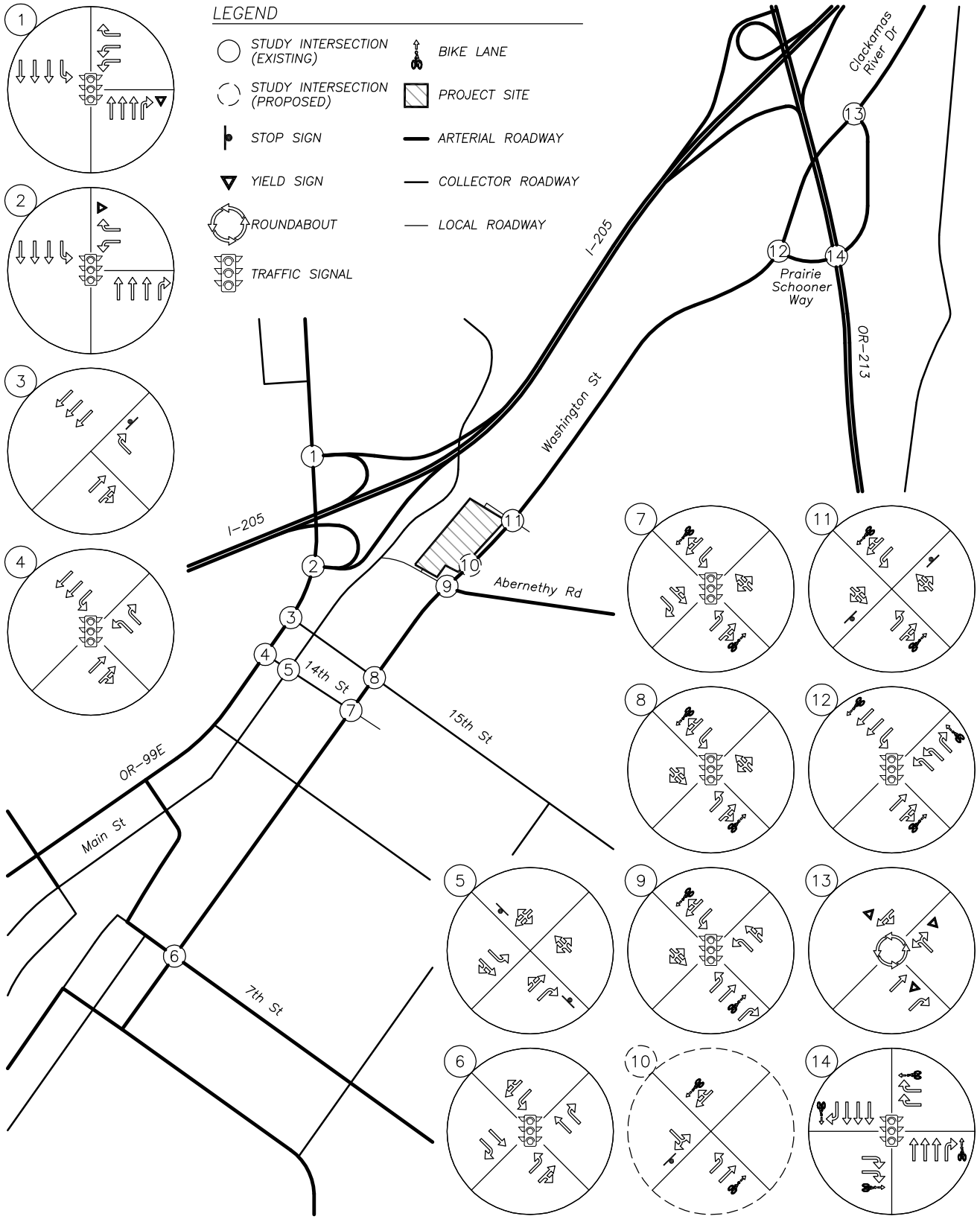
The intersection of OR-213 at Clackamas River Drive is a four-legged intersection that is controlled by a traffic signal. The northbound and southbound approaches of OR-213 each have three through lanes, one channelized right-turn lane that operates without stop/yield/signal controls, and a bicycle lane to the right of the outermost standard travel lane. The eastbound and westbound approaches of Prairie Schooner Way and Clackamas River Drive, respectively, each have two right-turn lanes and a bicycle lane to the right of the outermost standard travel lane. Crosswalks are marked across the eastern and western intersection legs.

A vicinity map displaying the project site, vicinity streets, and the study intersections with their associated lane configurations is shown in Figure 1 on page 10.

TRAFFIC COUNTS

Traffic counts were conducted at the study intersections on Thursday January 26th, 2017 from 7:00 AM to 9:00 AM and on Wednesday, January 25th, 2017 from 4:00 PM to 6:00 PM. Data was used from each intersection's respective morning and evening peak hours.

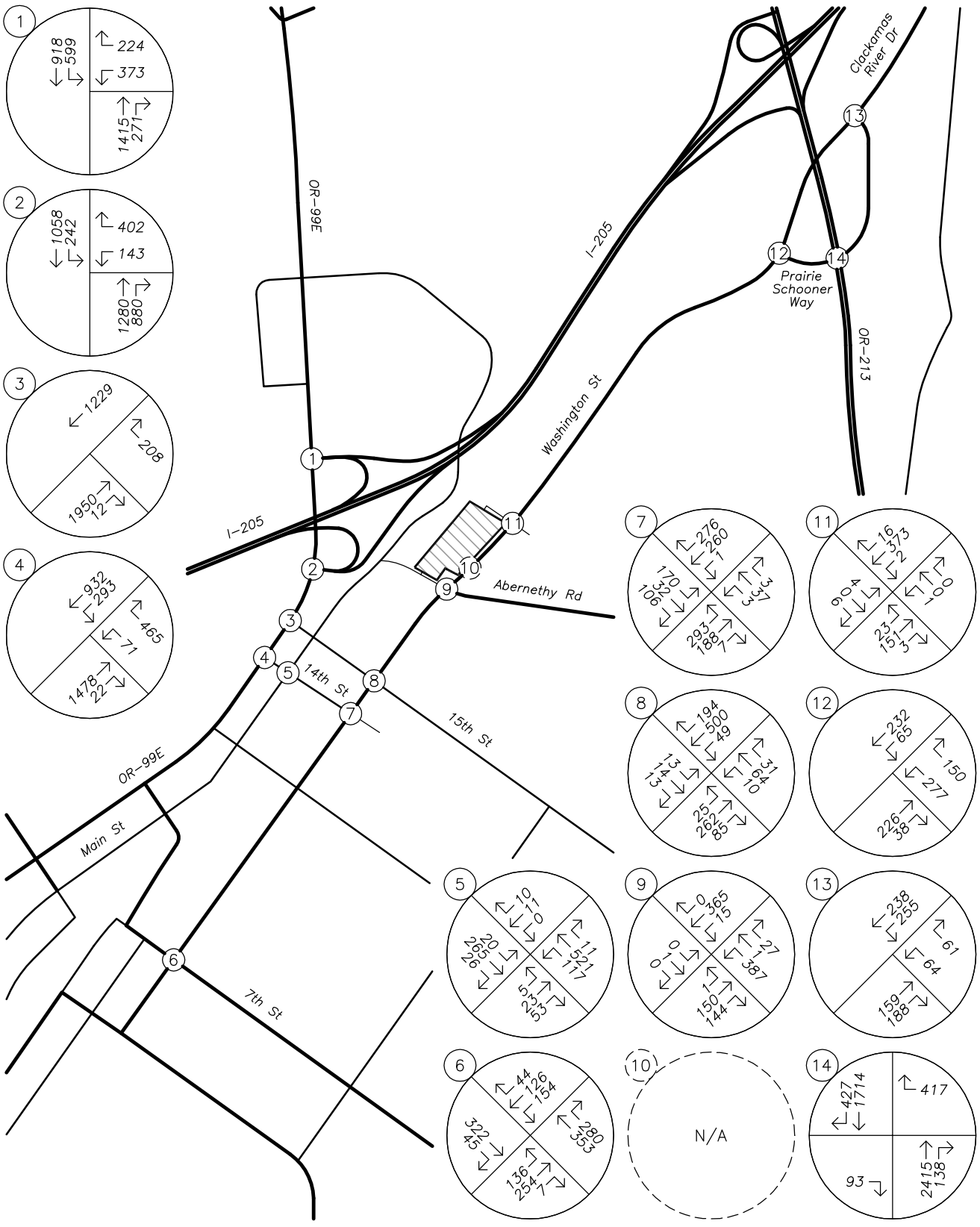
Figures 2 and 3 on pages 11 and 12 show the existing morning and evening peak hour traffic volumes at the study intersections, respectively.



VICINITY MAP

no scale

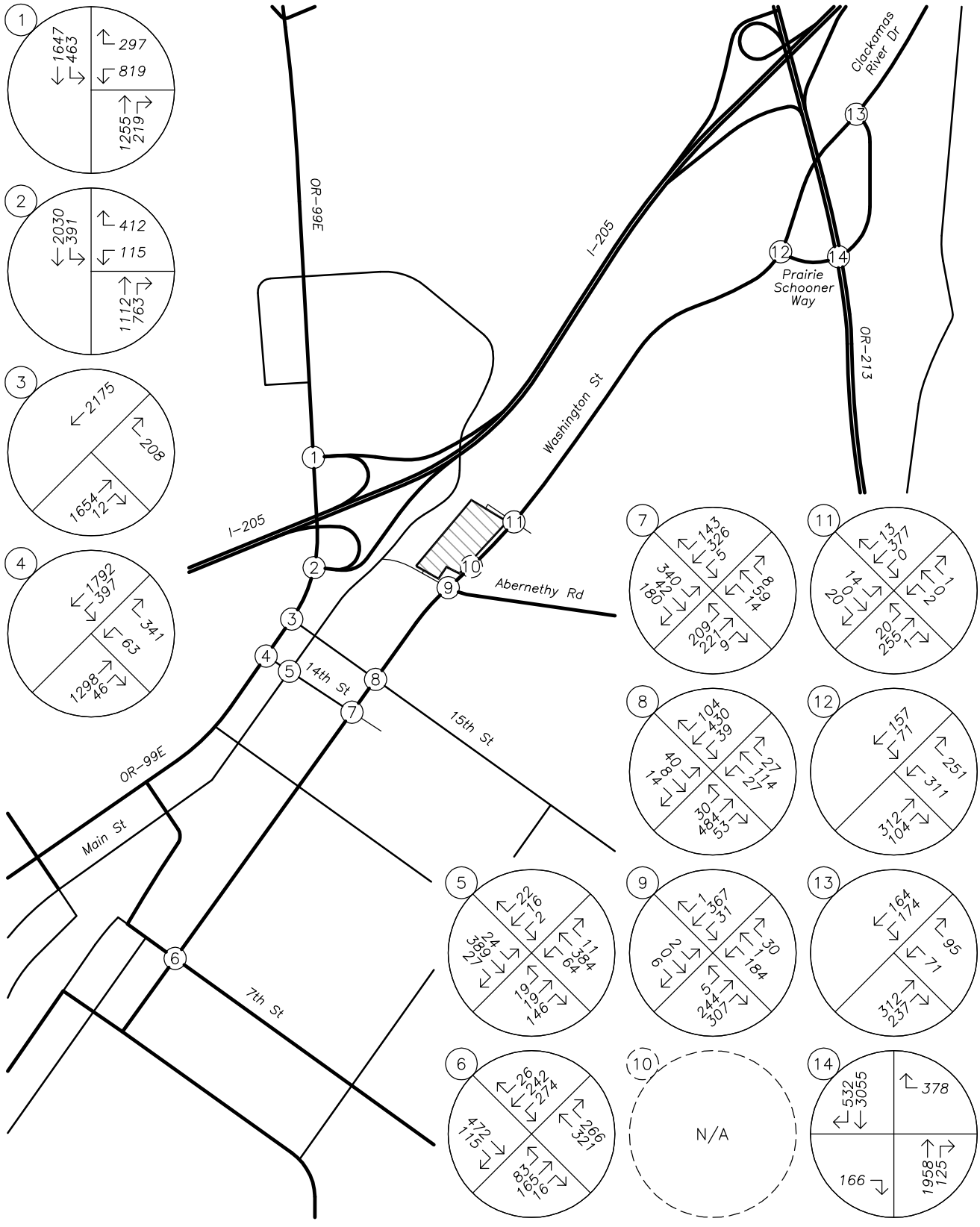
FIGURE 1



TRAFFIC VOLUMES
Existing Conditions
AM Peak Hour

no scale

FIGURE 2



TRAFFIC VOLUMES
Existing Conditions
PM Peak Hour

no scale

FIGURE 3

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SITE TRIPS

TRIP GENERATION

The proposed Abernethy Place Mixed-Use Development will include the construction of a 99-room hotel, 131 apartment units, 9,500 square-feet of retail space, and a 2,500 square-foot coffee shop. To estimate the number of trips that will be generated by the proposed development, trip rates from the *TRIP GENERATION MANUAL* were used. Data from land-use code 220, *Apartments*, land-use code 310, *Hotel*, land-use code 820, *Shopping Center*, and land-use code 936, *Coffee/Donut Shop without Drive-Through Window*, were used to estimate the proposed development's trip generation based on the number of rooms for the hotel, dwelling units for the apartment, and square-footage of gross floor area for the retail space and coffee shop.

Internal Trip Generation

Given the variety of land-uses that are proposed for development within the project site (including hotel, residential, retail, and restaurant land-uses), some trips generated by this development will likely be shared/internally captured by the proposed uses within the site and will not impact the nearby transportation system. Using the National Cooperative Highway Research Programs (NCHRP) Report 684, *Enhancing Internal Trip Capture Estimation for Mixed-Use Development*, internal capture rates for the proposed development were calculated for each land-use during the morning and evening peak hours.

According to Report 684, the proposed development is expected to internally capture approximately 9 percent of site trips during the morning peak hour and 28 percent of site trips during the evening peak hour. Due to the limited variety of on-site retail and restaurant uses, the calculated internal capture rate during the evening peak hour was manually reduced to 20 percent for the evening peak hour in order to maintain a conservative analysis.

Pass-by Trip Generation

Some of the proposed land-uses are expected to attract pass-by/diverted trips to the site. Pass-by trips are trips that leave an adjacent roadway to patronize a land-use and then continue in their original direction of travel. Similar to pass-by trips, diverted trips are trips that divert from a nearby roadway not adjacent to the site to patronize a land-use before continuing to their original destination. Pass-by trips do not add additional trips to the transportation system; however, they do add additional turning movements at site access intersections. Diverted trips may add additional turning movements at other nearby intersections. Pass-by trip rates were determined using data provided in the *TRIP GENERATION HANDBOOK*, 3rd Edition[1]. For the purposes of this analysis, pass-by and diverted trips were accounted for as the following:

- The proposed retail space has a pass-by trip rate of 34 percent of external trips generated based on data provided for land-use code 820 of the *TRIP GENERATION HANDBOOK*, 3rd Edition.

[1] Institute of Transportation Engineers (ITE), *TRIP GENERATION HANDBOOK*, 3rd Edition, 2014.

- The proposed coffee shop will utilize a pass-by/diverted trip rate of 82 percent for the morning peak hour and 73 percent for the evening peak hour. The calculated pass-by/diverted trip rates for the coffee shop are based on a trip generation study conducted at Starbucks facilities throughout Washington State in 2002.

Since the total number of pass-by trips which could be generated by the proposed uses exceeds the reasonable number of site trips that would be expected to divert from Washington Street, additional trips were treated as diverted-linked trips and drawn from through traffic traveling along Abernethy Road and the northbound travel lanes along Highway 99E. It is assumed that no more than five percent of the through traffic along Washington Street will enter the site as pass-by trips. An additional five percent of the through traffic along Abernethy road was assumed to divert to the site, and the remaining diverted trips were drawn from the northbound through traffic along OR-99E.

Trip Generation Analysis Results

The trip generation calculations show that the proposed development is projected to generate a net new total of 159 site trips during the morning peak hour and 151 site trips during the evening peak hour. The trip generation estimates of the proposed development are summarized in Table 2 below.

It should be noted that the development is proposed to occur in two phases. Phase 1 will consist of the 99-room hotel, while phase 2 will consist of all other proposed uses. Development of Phase 1 (prior to Phase 2) will result in a net increase of 52 trips during the morning peak hour and 59 trips during the evening peak hour, since the internal capture rates will not apply when only one use is located on the site. Development of Phase 2 will result in a net addition of 107 additional trips during the morning peak hour and 92 trips during the evening peak hour, resulting in the total projected site trips previously described.

Detailed trip generation and internal capture calculations as well as the Starbucks trip generation study are included in the technical appendix to this report.

Table 2 - Proposed Development Trip Generation Summary									
	ITE Code	Size	Morning Peak Hour In	Morning Peak Hour Out	Morning Peak Hour Total	Evening Peak Hour In	Evening Peak Hour Out	Evening Peak Hour Total	Weekday Total
Phase 1									
Hotel	310	99 units	31	21	52	30	29	59	808
Phase 1 + Phase 2									
Apartments	210	131 units	13	54	67	53	28	81	872
Internal Capture		*9% (20%)*	*1*	*5*	*6*	*11*	*6*	*17*	*174*
Net New Trips			12	49	61	42	22	64	698
Hotel	310	99 units	31	21	52	30	29	59	808
Internal Capture		*9% (20%)*	*3*	*2*	*5*	*6*	*6*	*12*	*162*
Net New Trips			28	19	47	24	23	47	646
Retail Space	820	9,500 sq.ft.	6	3	9	17	18	35	406
Internal Capture		*9% (20%)*	*1*	*0*	*1*	*3*	*4*	*7*	*81*
Pass-by Trips		*34% (34%)*	*1*	*1*	*2*	*5*	*5*	*10*	*110*
Net New Trips			4	2	6	9	9	18	215
Coffee Shop	936	2,500 sq.ft.	138	133	271	51	51	102	165
Internal Capture		*9% (20%)*	*12*	*12*	*24*	*10*	*10*	*20*	*33*
Pass-by Trips		*82% (73%)*	*101*	*101*	*202*	*30*	*30*	*60*	*96*
Net New Trips			25	20	45	11	11	22	36
Total Trip Generation			**188**	**211**	**399**	**151**	**126**	**277**	**2,251**
Total Internal Capture			***17***	***19***	***36***	***30***	***26***	***56***	***450***
Total Pass-by Trips			***102***	***102***	***204***	***35***	***35***	***70***	***206***
Total Net New Trips			**69**	**90**	**159**	**86**	**65**	**151**	**1,595**

* AM Peak Hour (PM Peak Hour and Weekday)

TRIP DISTRIBUTION

The directional distribution of primary site trips to/from the project site was estimated based on locations of likely trip destinations, locations of major transportation facilities in the site vicinity, and existing travel patterns at study intersections.

The following trip distribution was estimated and used for analysis:

- Approximately 30 percent of primary trips will travel to/from the north along OR-213;
- Approximately 15 percent of primary trips will travel to/from the east along Abernethy Road;
- Approximately 12 percent of primary trips will travel to/from the north along OR-99E;
- Approximately 10 percent of primary trips will travel to/from the southeast along 7th Street;
- Approximately 9 percent of primary trips will travel to/from the southwest along Washington Street;
- Approximately 6 percent of primary trips will travel to/from the northeast along Interstate 205 (I-205);
- Approximately 5 percent of primary trips will travel to/from the northeast along Clackamas River Drive;
- Approximately 5 percent of primary trips will travel to/from the southeast along 15th Street;
- Approximately 4 percent of primary trips will travel to/from the southwest along Main Street;
- Approximately 2 percent of primary trips will travel to/from the southwest along OR-99E; and
- Approximately 2 percent of primary trips will travel to/from the southwest along I-205.

The proposed development is planned to have three points of access to the subject site from Washington Street: the west leg of the intersection of Abernethy Road at Washington Street, a proposed site access on Washington Street approximately 200 feet northeast of Abernethy Road, and at the existing Amtrak Station access driveway. Based on the site layout, primary trips to and from the site are anticipated to utilize site access points as follows:

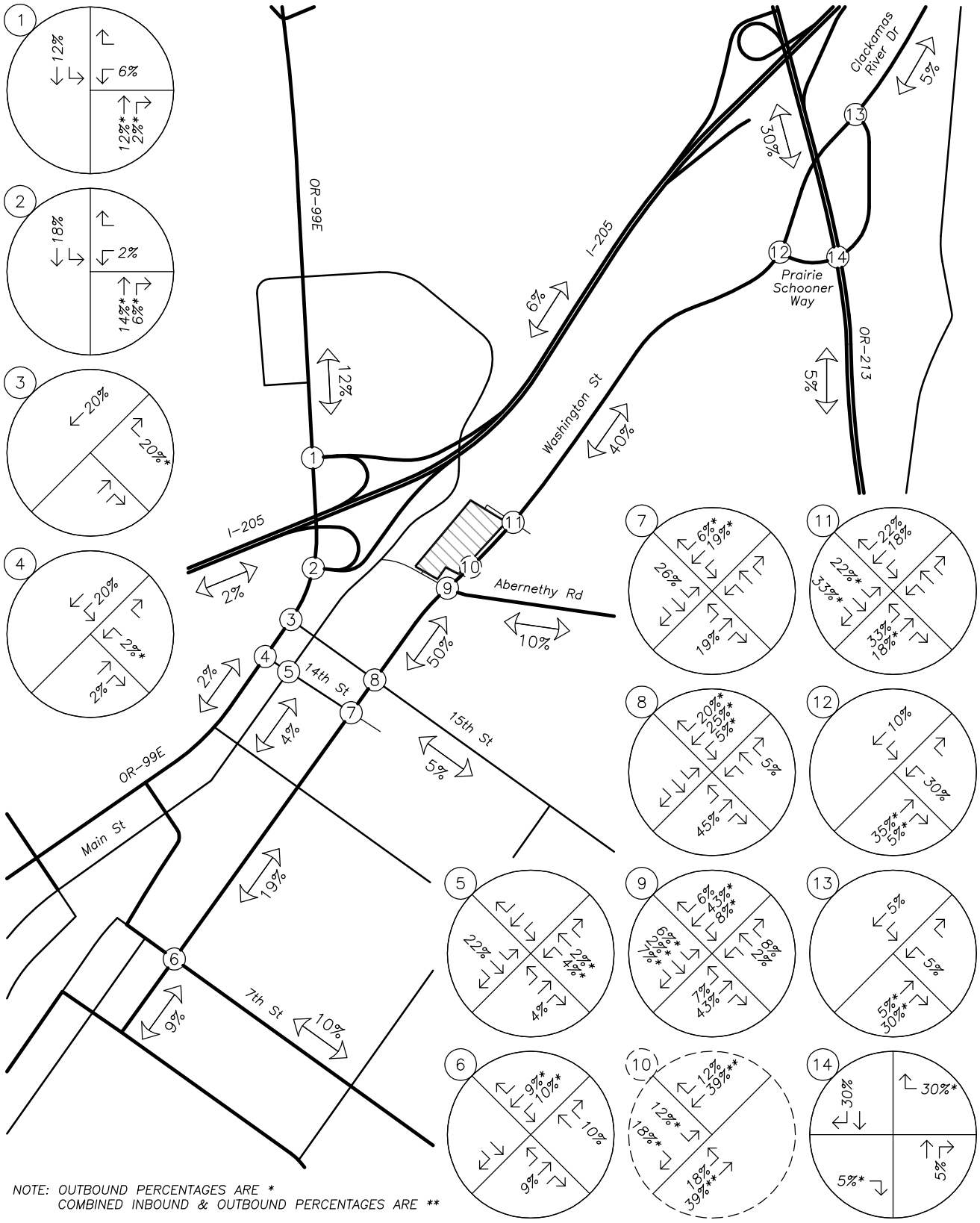
- Approximately 15 percent of primary trips will utilize the access at the intersection of Abernethy Road at Washington Street;
- Approximately 30 percent of primary trips will utilize the proposed access along Washington Street; and
- Approximately 55 percent of primary trips will utilize the Amtrak access along Washington Street.

The trip distribution percentages utilized for the primary site trips generated by the proposed development are shown in Figure 4 on page 18.

The proposed mixed-use building, which will include a coffee shop and retail space, is located within the northeastern section of the project site. Since only these two land-uses are expected to generate pass-by trips, it is anticipated that pass-by trips to and from the site will utilize site access points as follows:

- Approximately 50 percent of pass-by trips will utilize the proposed access along Washington Street; and
- Approximately 50 percent of pass-by trips will utilize the Amtrak access along Washington Street.

The trip assignment for primary site trips generated by the proposed development are shown in Figure 5 on page 19 for the morning peak hour and in Figure 6 on page 20 for the evening peak hour. The trip assignment for pass-by site trips generated by the proposed coffee shop and retail space are shown in Figure 7 on page 21 for the morning peak hour and in Figure 8 on page 22 for the evening peak hour. The total site trip assignment of trips generated by the proposed development are shown in Figure 9 on page 23 for the morning peak hour and in Figure 10 on page 24 for the evening peak hour.

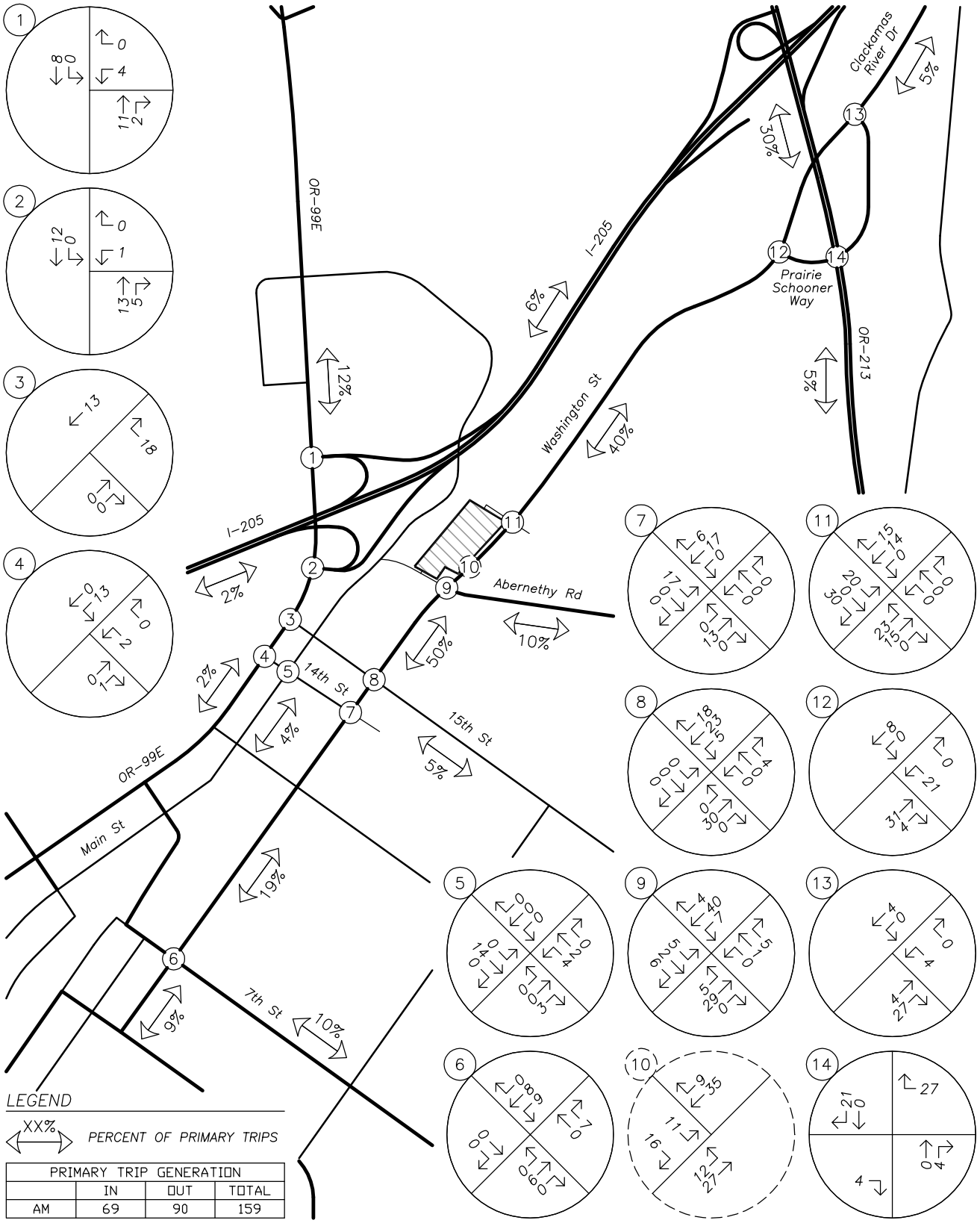


NOTE: OUTBOUND PERCENTAGES ARE *
COMBINED INBOUND & OUTBOUND PERCENTAGES ARE **

SITE TRIP DISTRIBUTION
Inbound & Outbound Percentages – Primary Trips
AM & PM Peak Hours

no scale

FIGURE 4

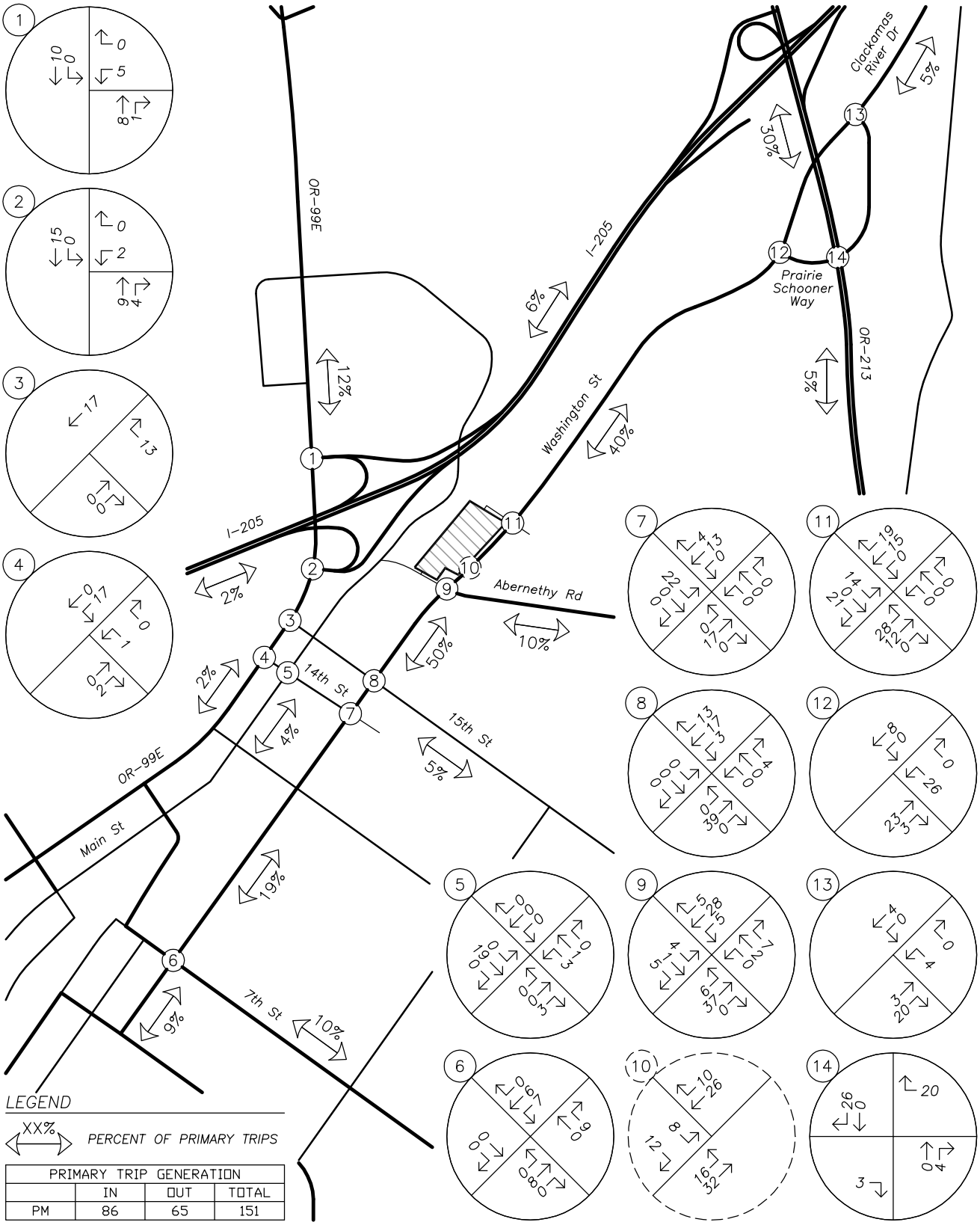


PRIMARY TRIP GENERATION			
	IN	OUT	TOTAL
AM	69	90	159

SITE TRIP DISTRIBUTION & ASSIGNMENT
Proposed Development Plan – Primary Site Trips
AM Peak Hour

no scale

FIGURE 5

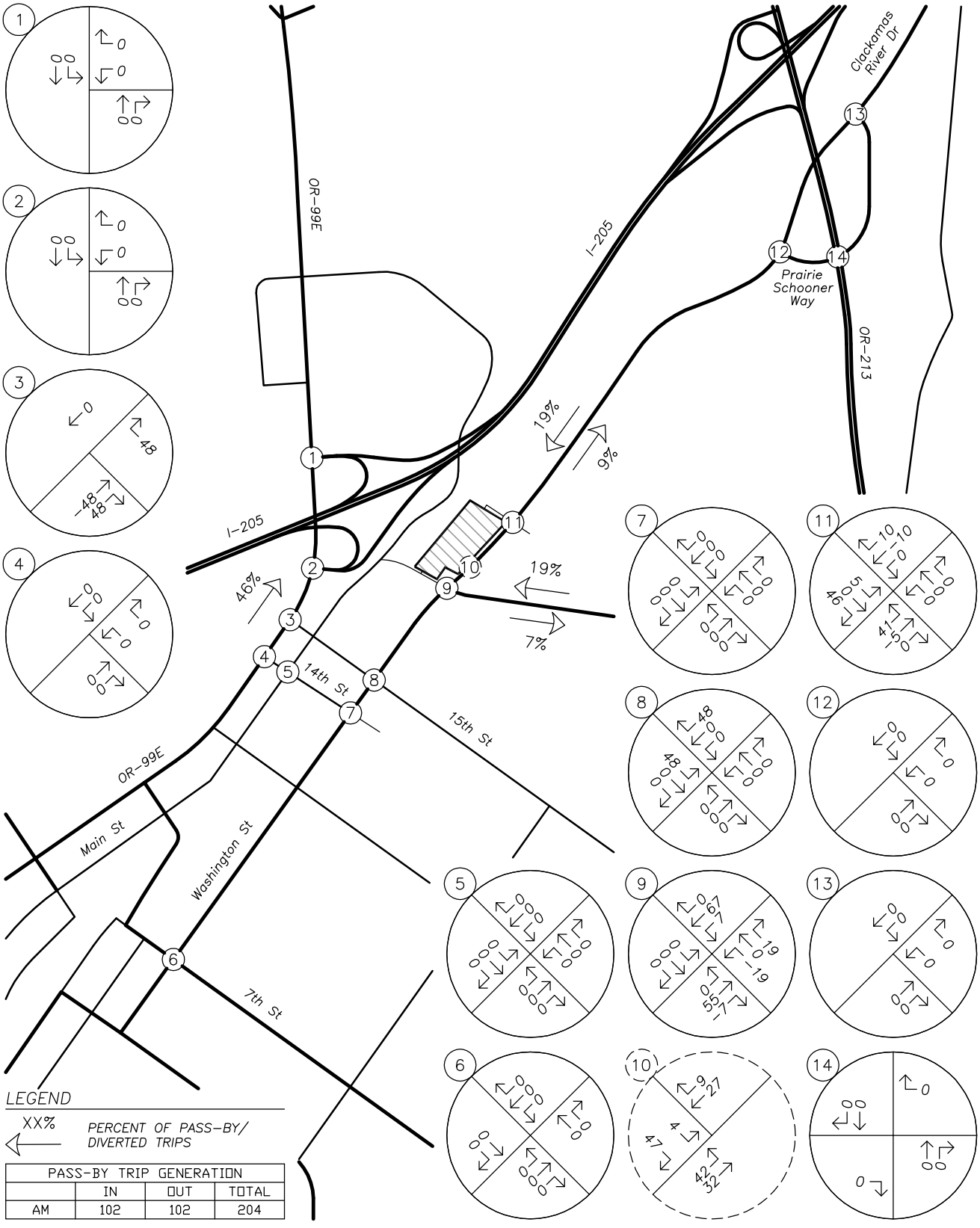


PRIMARY TRIP GENERATION			
	IN	OUT	TOTAL
PM	86	65	151

SITE TRIP DISTRIBUTION & ASSIGNMENT
Proposed Development Plan – Primary Site Trips
PM Peak Hour

no scale

FIGURE 6

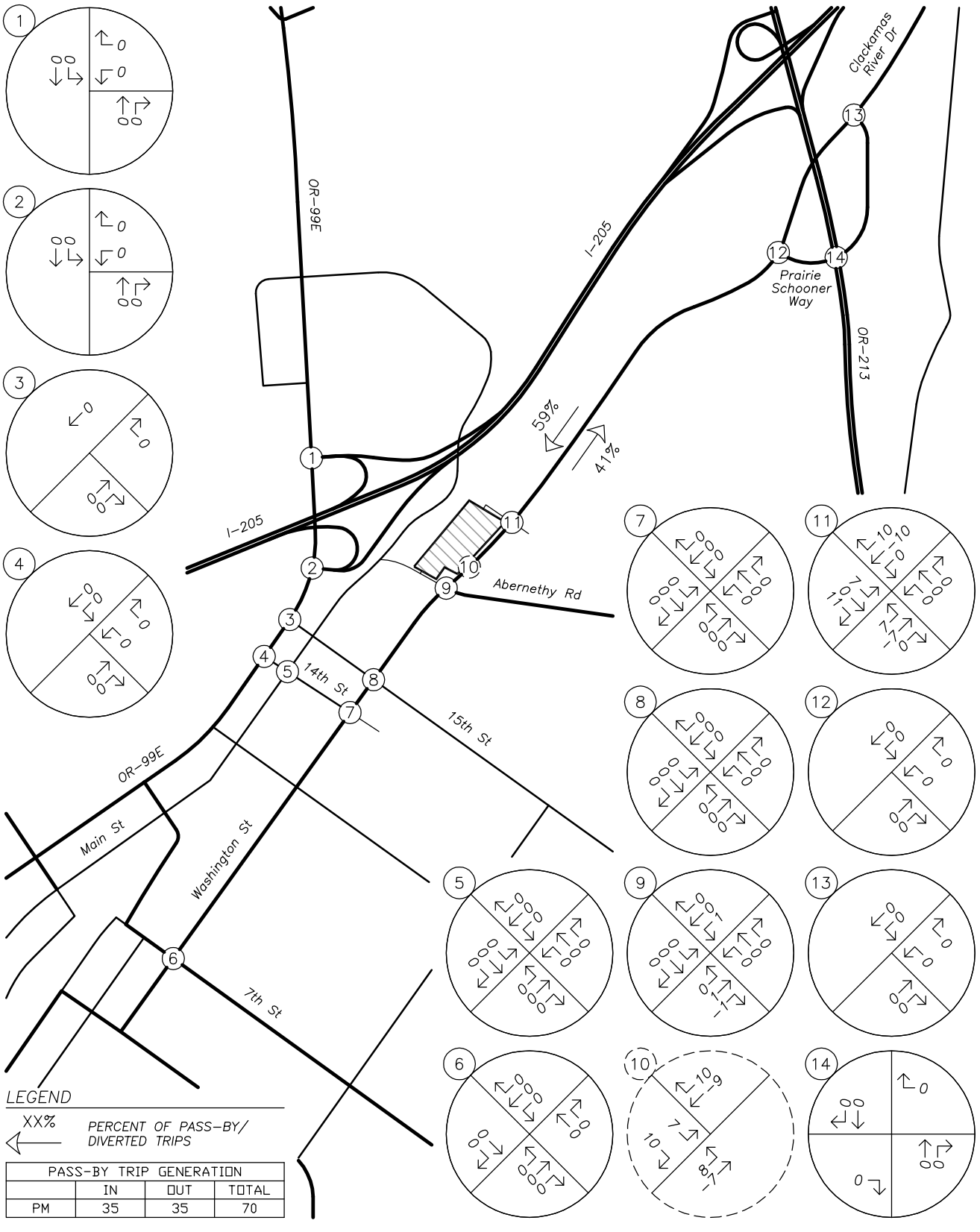


PASS-BY TRIP GENERATION			
	IN	OUT	TOTAL
AM	102	102	204

SITE TRIP DISTRIBUTION & ASSIGNMENT
Proposed Development Plan – Pass-by Site Trips
AM Peak Hour

no scale

FIGURE 7

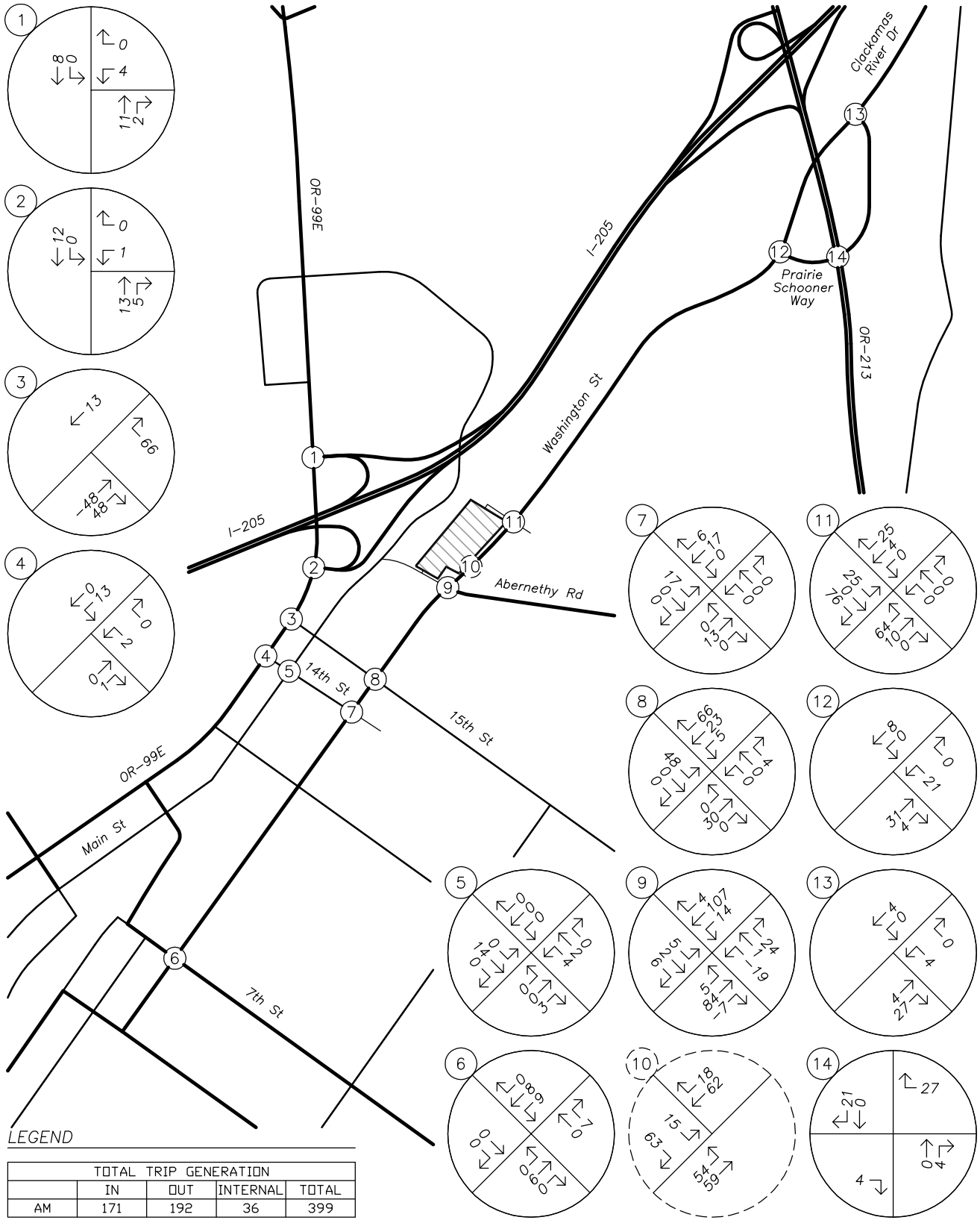


PASS-BY TRIP GENERATION			
	IN	OUT	TOTAL
PM	35	35	70

SITE TRIP DISTRIBUTION & ASSIGNMENT
Proposed Development Plan – Pass-by Site Trips
PM Peak Hour

no scale

FIGURE 8

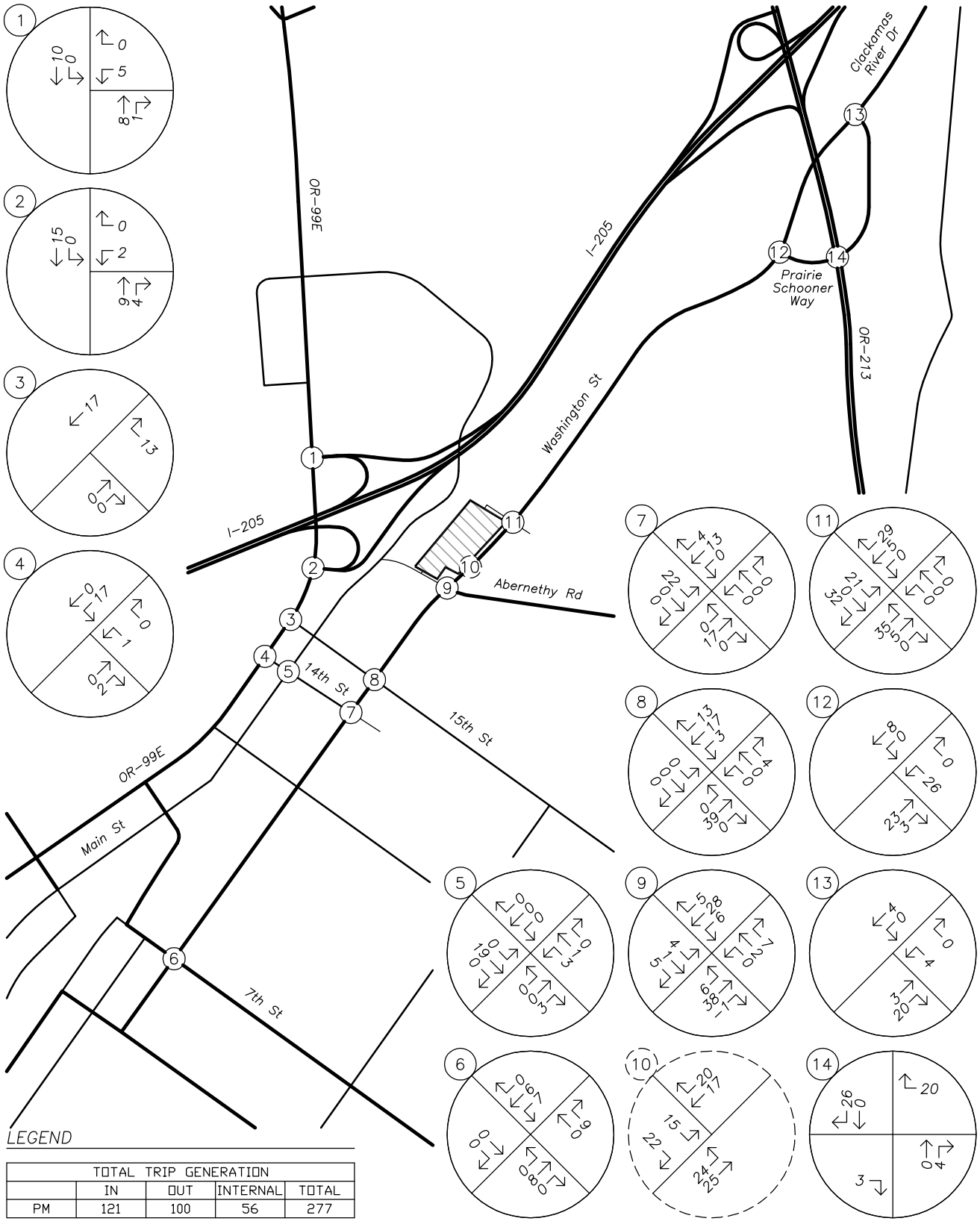


TOTAL TRIP GENERATION				
	IN	OUT	INTERNAL	TOTAL
AM	171	192	36	399

SITE TRIP DISTRIBUTION & ASSIGNMENT
Proposed Development Plan – Total Site Trips
AM Peak Hour

no scale

FIGURE 9



TOTAL TRIP GENERATION				
	IN	OUT	INTERNAL	TOTAL
PM	121	100	56	277

SITE TRIP DISTRIBUTION & ASSIGNMENT
Proposed Development Plan – Total Site Trips
PM Peak Hour

no scale

FIGURE 10

OPERATIONAL ANALYSIS

BACKGROUND VOLUMES

To provide analysis of the impact of the proposed development on the nearby transportation facilities, an estimate of future traffic volumes is required.

In order to calculate the future traffic volumes for non-ODOT facilities, a compounded growth rate of two percent per year for an assumed build-out condition of five years was applied to the measured existing traffic volumes to approximate year 2022 background conditions.

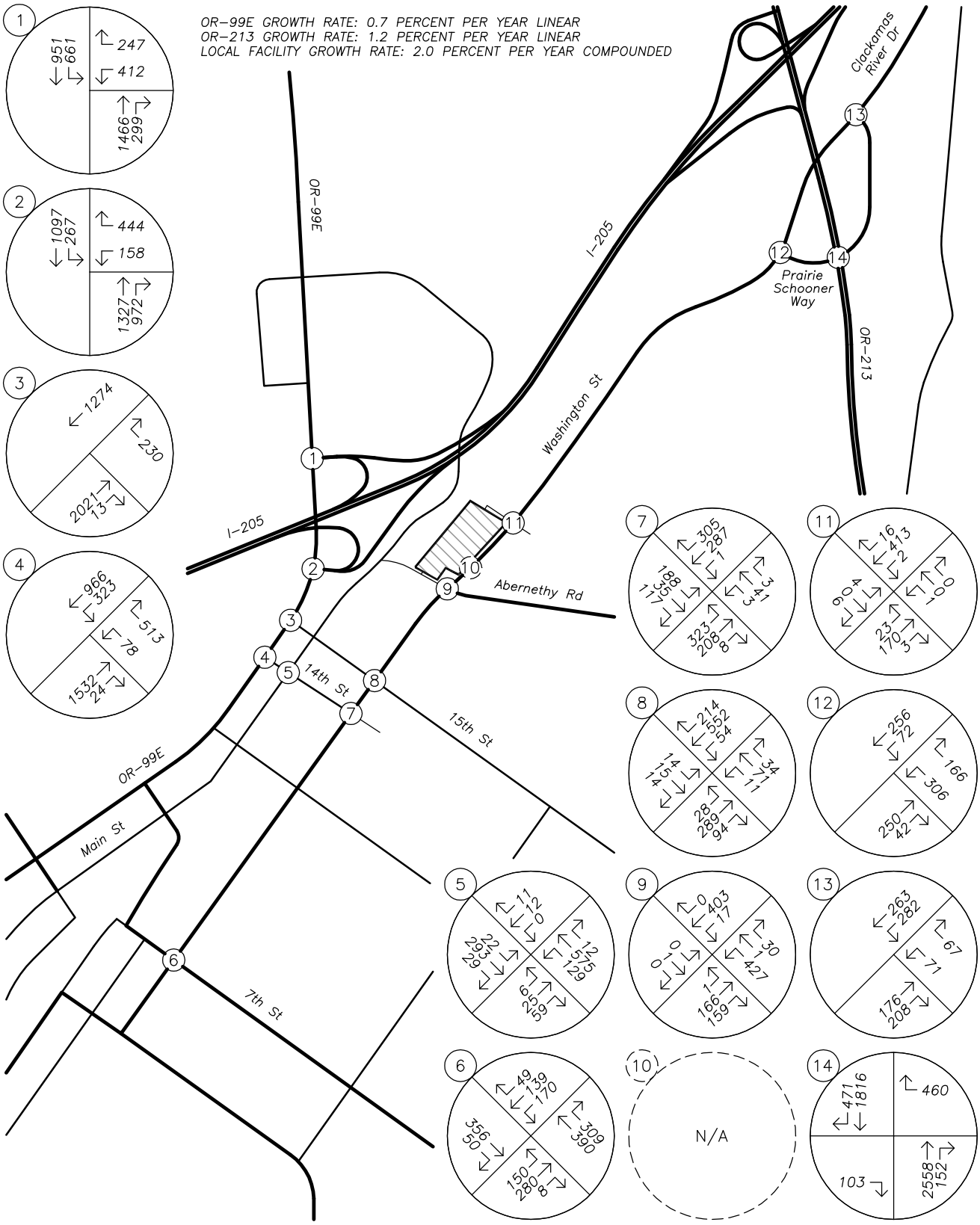
To estimate the future traffic volumes for ODOT facilities, a linear growth rates of 0.7 percent per year and 1.2 percent per year were calculated for the traffic volumes along OR-99E and OR-213, respectively, using ODOT's 2035 Future Volume Tables. This growth rate was applied to the measured existing traffic volumes over a five-year period to determine year 2022 background traffic volumes for the through traffic traveling along both ODOT roadways. A compounded growth rate of two percent per year for an assumed build-out condition of five years was applied to all other turning movement traffic volumes at study intersections along these ODOT roadways.

Figure 11 on page 26 and Figure 12 on page 27 show the projected year 2022 background traffic volumes at the study intersections during the morning and evening peak hours, respectively.

BACKGROUND VOLUMES PLUS SITE TRIPS

Peak hour trips calculated to be generated by the proposed development, as described earlier within the *Site Trips* section, were added to the projected year 2022 background traffic volumes to obtain the expected 2022 background volumes plus site trips.

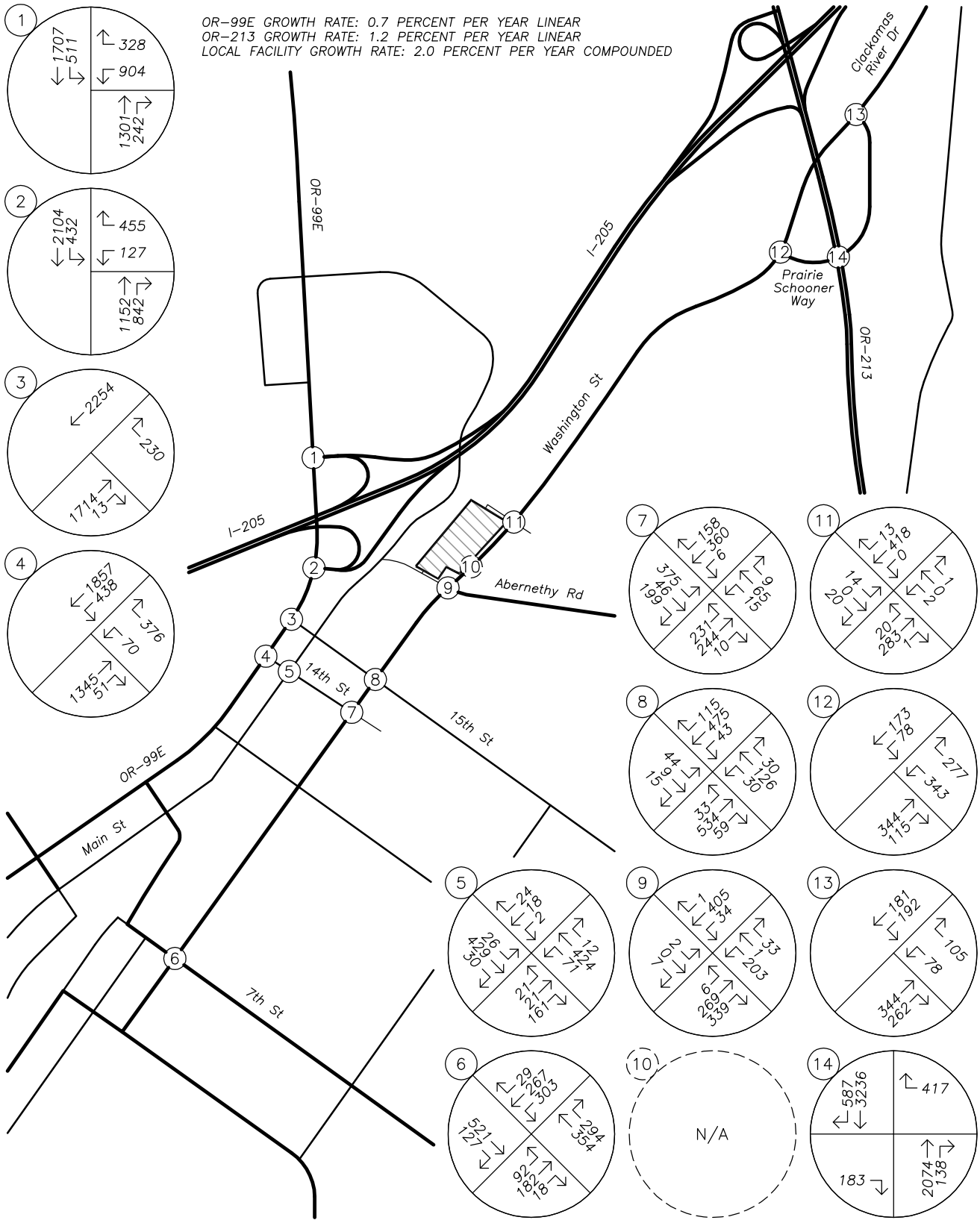
Figure 13 on page 28 and Figure 14 on page 29 show the projected year 2022 peak hour background traffic volumes plus proposed development site trips at the study intersections during the morning and evening peak hours, respectively.



TRAFFIC VOLUMES
Year 2022 Background Conditions
AM Peak Hour

FIGURE 11

PAGE 26

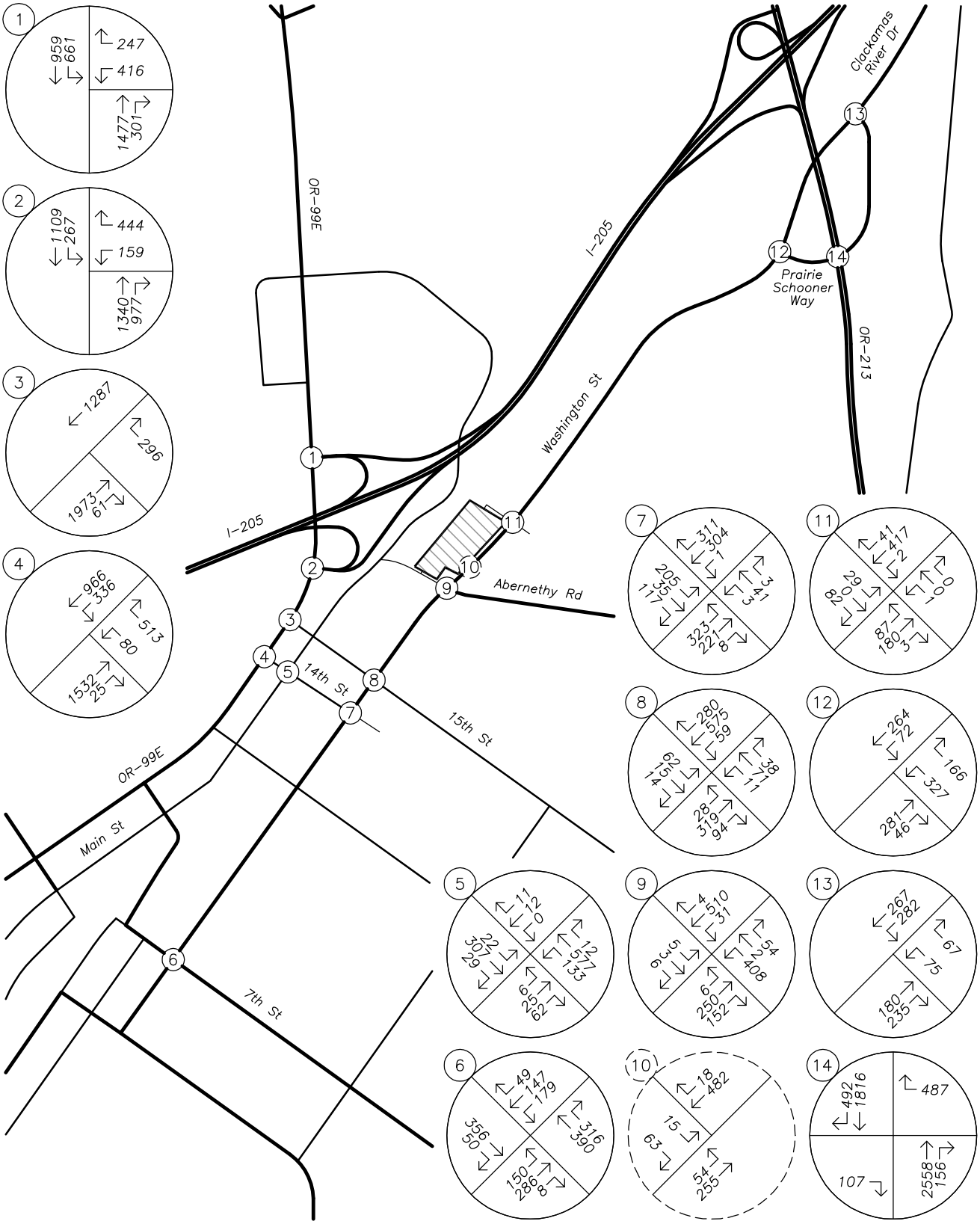


TRAFFIC VOLUMES
Year 2022 Background Conditions
PM Peak Hour

no scale

FIGURE 12

PAGE 27

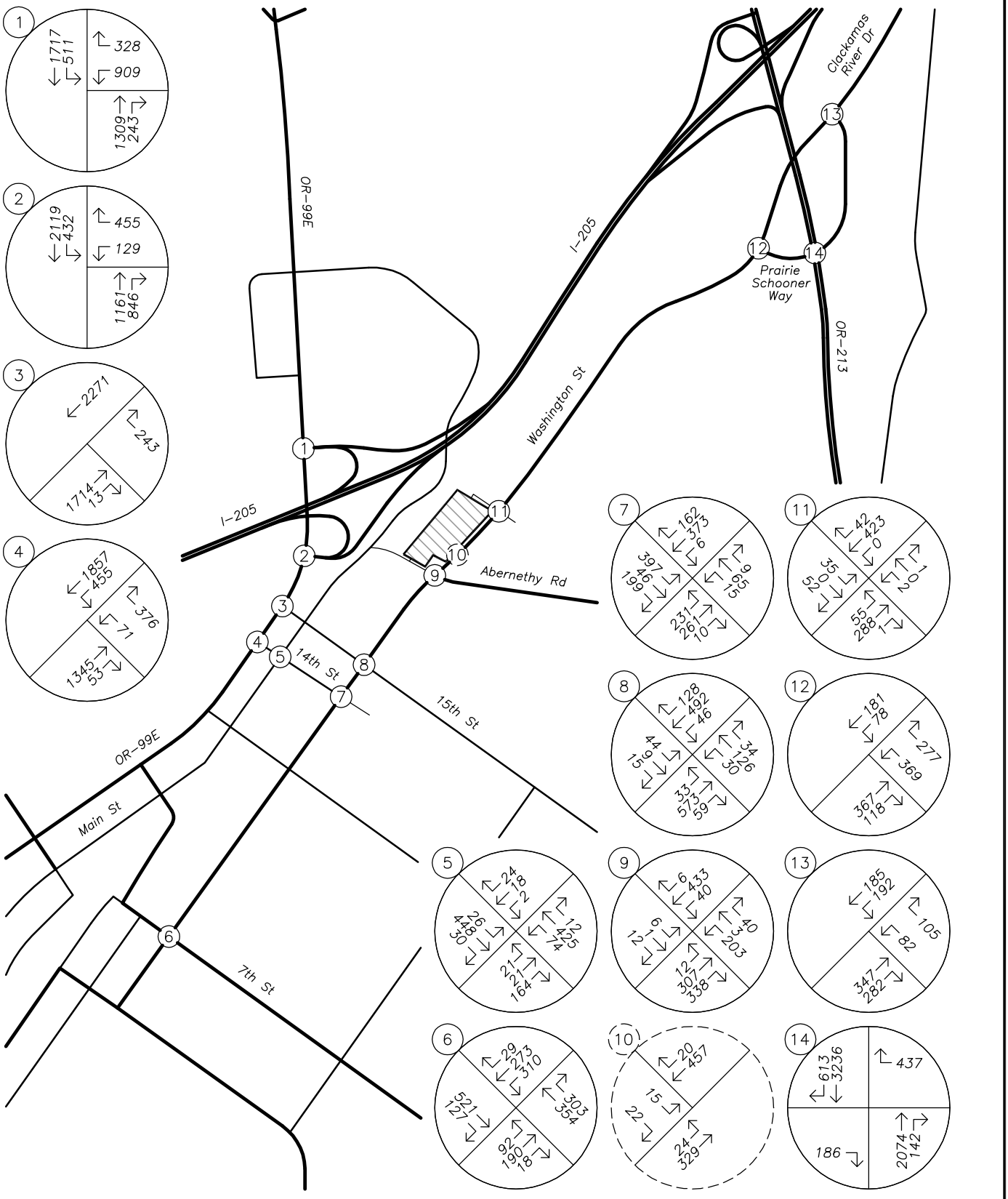


TRAFFIC VOLUMES
Year 2022 Background Conditions plus Site Trips
AM Peak Hour

no scale

FIGURE 13

PAGE 28



TRAFFIC VOLUMES
Year 2022 Background Conditions plus Site Trips
PM Peak Hour

no scale

FIGURE 14

CAPACITY ANALYSIS

A capacity and delay analysis was conducted for each of the study intersections. The analysis was conducted according to the signalized and unsignalized intersection analysis methodologies in the *HIGHWAY CAPACITY MANUAL* (HCM). The level-of-service (LOS) of an intersection can range from LOS A, which indicates very little or no delay experienced by vehicles, to LOS F, which indicates a high degree of congestion and delay. The v/c ratio is a measure that compares the traffic volumes (demand) against the available capacity of an intersection.

Per Section 12.04.205 of the *Oregon City Municipal Code*, the following minimum acceptable operation standards apply when evaluating traffic impacts associated with the proposed land uses:

- For intersections within the Regional Center, a maximum v/c ratio of 1.10 is permissible during the peak hour, provided that during the second hour the v/c ratio is 0.99 or less. For signalized intersections, these standards apply to the intersection as a whole. For unsignalized intersections, these standards apply to the major-street approaches only. There is no performance standard for unsignalized minor street approaches.
- For intersections outside the Regional Center but designated on the Arterial and Throughway Network, a maximum v/c ratio of 0.99 shall be maintained. This standard applies to signalized intersections as a whole, and to the major-street approaches at unsignalized intersections. There is no performance standard for unsignalized minor street approaches.
- Signalized intersections located outside the Regional Center (Downtown Community Plan) boundaries and not designated on the Arterial and Throughway Network shall operate at LOS D or better for the intersection as a whole, no approach shall operate worse than LOS E, and the intersection shall operate with a v/c ratio no higher than 1.0 for the sum of critical movements.
- Unsignalized intersections located outside the Regional Center (Downtown Community Plan) boundaries and not designated on the Arterial and Throughway Network shall operate at LOS E or better for all approaches serving more than 20 peak hour vehicles. LOS F will be tolerated at movements serving no more than 20 vehicles during the peak hour.
- Until the City adopts new performance measures that identify alternative mobility targets, the City exempts proposed development that is permitted, either conditionally, outright, or through a detailed development master plan approval from compliance with the above mobility standards for identified intersections, including the intersections of OR-99E at the I-205 eastbound and westbound ramp terminals.

According to the City of Oregon City's Downtown Community Plan, the Regional Center encompasses all of the study intersections operating under City jurisdiction, except for Clackamas River Drive at Washington Street. Clackamas River Drive is, however, designated on the Arterial and Throughway Network.

The I-205 southbound ramps intersection at OR-99E is projected to operate with a v/c ratio of 1.02 during the morning peak hour and a v/c ratio of 0.98 during the evening peak hour under year 2022 background conditions. With the addition of site trips from the proposed development, the

intersection is projected to continue to operate with a v/c ratio of 1.02 during the morning peak and the v/c ratio is projected to increase to 0.99 during the evening peak hour.

The I-205 northbound ramps intersection at OR-99E is projected to operate with a v/c ratio of 0.90 during the morning peak hour and a v/c ratio of 0.81 during the evening peak hour under year 2022 background traffic conditions. With the addition of site trips from the proposed development, the intersection is projected to operate with a v/c ratio of 0.91 during the morning peak hour and 0.81 during the evening peak hour.

Under year 2022 background conditions the intersection of 15th Street at OR-99E is projected to operate with a v/c ratio of 0.85 during the morning peak hour and 0.71 during the evening peak hour. With the addition of site trips from the proposed development the intersection is projected to operate with a v/c ratio of 0.95 during the morning peak hour and 0.71 during the evening peak hour.

The intersection of 14th Street at OR-99E operates with a v/c ratio of 0.96 or less during the morning peak hour and 0.85 or less during the evening peak hour for all analysis scenarios.

The intersection of 14th Street at Main Street currently operates at LOS C with v/c ratios of 0.20 during the morning peak hour and 0.26 during the evening peak hour. Under year 2022 background conditions, the intersection is projected to operate at LOS E with a v/c ratio of 0.29 or less during the morning peak hour and at LOS E with a v/c ratio of 0.32 or less during the evening peak hour, regardless the addition of proposed development trips.

The intersection of 7th Street at Washington Street operates at LOS C with v/c ratios or 0.72 or less during the morning peak hour and 0.75 or less during the evening peak hour for all analysis scenarios.

The intersection of 14th Street at Washington Street is projected to operate at LOS C with v/c ratios of 0.86 or less during the morning peak hour and 0.89 or less during the evening peak hour through year 2022 background conditions. Upon build-out of the proposed development, the intersection is projected to operate at LOS D with v/c ratios of 0.90 during the morning peak hour and 0.95 during the evening peak hour.

The intersection of 15th Street at Washington Street operates at LOS B with v/c ratios of 0.79 or less during the morning peak hour and 0.64 or less during the evening peak hour for all analysis scenarios.

The intersection of Abernethy Road at Washington Street operates at LOS B with a v/c ratio of 0.82 or less during the morning peak hour and at LOS A with a v/c ratio of 0.55 or less during the evening peak hour for all analysis scenarios.

Upon build-out of the proposed development, the proposed site access intersection at Washington Street is projected to operate at LOS B with v/c ratios of 0.32 during the morning peak hour and 0.31 during the evening peak hour.

The Amtrak station access intersection at Washington Street currently operates at LOS B with a v/c ratio of 0.25 during both the morning and evening peak hours. Under year 2022 background

conditions, the intersection is projected to operate at LOS C with v/c ratios of 0.28 or less during the morning peak hour and 0.30 or less during the evening peak hour, regardless the addition of proposed development trips.

The intersection of Prairie Schooner Way at Washington Street operates at LOS A with a v/c ratio of 0.39 or less during the morning peak hour and at LOS B with a v/c ratio of 0.46 or less during the evening peak hour for all analysis scenarios.

The intersection of Clackamas River Drive at Washington Street operates at LOS B with v/c ratios of 0.62 or less during the morning peak hour and at level of service A with v/c ratios of 0.44 or less during the evening peak hour for all analysis scenarios.

The intersection of OR-213 at Clackamas River Drive operates at LOS B with v/c ratios of 0.84 or less during the morning peak hour and 0.90 or less during the evening peak hour for all analysis scenarios.

The v/c, delay, and LOS results of the capacity analysis are shown in Tables 3 and 4 for the morning and evening peak hours. Detailed calculations as well as tables showing the relationship between delay and LOS are included in the appendix to this report.

Based on the results of the operational analysis, all intersections are projected to operate acceptably per Oregon City standards through year 2022 either with or without the addition of site trips from the proposed development.

The intersections operating under ODOT jurisdiction are also projected to meet ODOT's respective performance standards, with the exception of OR 99-E at the I-205 ramp terminals. However, these intersections are specifically exempted from operational standards pursuant to OCMC 12.04.205(D).

Table 3 - Capacity Analysis Summary						
	Morning Peak Hour			Evening Peak Hour		
	LOS	Delay	V/C	In	Out	Total
1. I-205 SB Ramps at OR-99E						
Existing Conditions	D	40	0.95	C	28	0.91
2022 Background Conditions	D	52	1.02	D	36	0.98
2022 Background plus Site Conditions	D	53	1.02	D	37	0.99
2. I-205 NB Ramps at OR-99E						
Existing Conditions	C	21	0.78	B	17	0.71
2022 Background Conditions	C	27	0.90	B	20	0.81
2022 Background plus Site Conditions	C	27	0.91	B	20	0.81
3. 15th St at OR-99E						
Existing Conditions	D	32	0.82	C	21	0.68
2022 Background Conditions	E	42	0.85	C	24	0.71
2022 Background plus Site Conditions	F	76	0.96	D	26	0.71
4. 14th St at OR-99E						
Existing Conditions	C	23	0.90	B	15	0.80
2022 Background Conditions	C	27	0.96	B	17	0.83
2022 Background plus Site Conditions	C	28	0.96	B	18	0.85
5. 14th St at Main St						
Existing Conditions	D	35	0.20	D	30	0.26
2022 Background Conditions	E	46	0.28	E	39	0.30
2022 Background plus Site Conditions	E	49	0.29	E	41	0.32
6. 7th St at Washington St						
Existing Conditions	C	20	0.65	C	21	0.68
2022 Background Conditions	C	22	0.71	C	24	0.74
2022 Background plus Site Conditions	C	23	0.72	C	24	0.75
7. 14th St at Washington St						
Existing Conditions	C	25	0.78	C	26	0.80
2022 Background Conditions	C	31	0.86	C	34	0.89
2022 Background plus Site Conditions	D	36	0.90	D	38	0.95
8. 15th St at Washington St						
Existing Conditions	B	11	0.66	B	11	0.58
2022 Background Conditions	B	11	0.70	B	13	0.62
2022 Background plus Site Conditions	B	17	0.79	B	14	0.64
9. Abernethy Rd at Washington St						
Existing Conditions	B	13	0.70	A	7	0.49
2022 Background Conditions	B	16	0.76	A	8	0.53
2022 Background plus Site Conditions	B	18	0.82	A	8	0.55

Table 4 - Capacity Analysis Summary (Continued)						
	Morning Peak Hour			Evening Peak Hour		
	LOS	Delay	V/C	In	Out	Total
10. Site Access at Washington St						
2022 Background plus Site Conditions	B	15	0.32	B	15	0.31
11. Amtrak Station Access at Washington St						
Existing Conditions	B	15	0.25	B	14	0.25
2022 Background Conditions	C	16	0.27	C	15	0.28
2022 Background plus Site Conditions	C	23	0.29	C	18	0.30
12. Prairie Schooner Way at Washington St						
Existing Conditions	A	9	0.33	B	10	0.38
2022 Background Conditions	A	9	0.36	B	11	0.43
2022 Background plus Site Conditions	A	10	0.39	B	11	0.46
13. Clackamas River Dr at Washington St						
Existing Conditions	B	11	0.55	A	8	0.39
2022 Background Conditions	B	12	0.62	A	9	0.43
2022 Background plus Site Conditions	B	13	0.62	A	9	0.44
14. OR-213 at Clackamas River Dr						
Existing Conditions	B	10	0.77	B	11	0.84
2022 Background Conditions	B	12	0.83	B	14	0.89
2022 Background plus Site Conditions	B	12	0.84	B	14	0.90

Although not recommended in conjunction with the proposed development, it should be noted that according to Oregon City's Transportation System Plan (TSP), there is an identified project which would improve intersection operation at the intersection of OR-99E and the I-205 southbound ramps. The proposed improvement consists of installation of a second southbound left-turn lane, as well as providing a second eastbound receiving lane to accommodate the added turn lane. With installation of the additional turn lane, the intersection would be projected to operate with v/c ratios below 0.85 during the morning and evening peak hours either with or without the addition of site trips from the proposed development.

SAFETY ANALYSIS

CRASH DATA ANALYSIS

Using data obtained from the ODOT's Crash Analysis and Reporting Unit, a review of the most recent available five years of crash history (from January 2011 to December 2015) at the study intersections was performed. The crash data was evaluated based on the number of crashes, the type of collisions, the severity of the collisions, and the resulting crash rate for the intersection. Crash rates provide the ability to compare safety risks at different intersections by accounting for both the number of crashes that have occurred during the study period and the number of vehicles that typically travel through the intersection. Crash rates were calculated using the common assumption that traffic counted during the evening peak period represents 10 percent of average daily traffic (ADT) at the intersection. Crash rates in excess of one to two crashes per million entering vehicles (CMEV) may be indicative of design deficiencies and therefore require a need for further investigation and possible mitigation.

I-205 Southbound Ramps Intersection at OR-99E

The I-205 southbound ramps intersection at OR-99E had 47 reported crashes during the analysis period. The crashes consisted of 25 rear-end collisions, 19 turning-movement collisions, one fixed-object collision, one collision involving a pedestrian, and one collision involving a bicyclist. Of the crashes reported, 20 were classified as "Property Damage Only" (*PDO*), 20 were classified as "Possible Injury – Complaint of Pain" (*Injury C*), six were classified as "Non-Incapacitating Injury" (*Injury B*), and one was classified as "Incapacitating Injury – Bleeding, Broken Bones" (*Injury A*). The crash rate at the intersection was calculated to be 0.55 CMEV.

Three of the reported crashes at the intersection involved a pedestrian, bicyclist, or was classified as an *Injury A* collision. The crash involving a pedestrian occurred when the driver of a westbound right-turning passenger car failed to yield right-of-way to a pedestrian who was utilizing some form of conveyance other than walking while in an intersection crosswalk. The driver of the vehicle had conducted a right-turn after coming to a stop at the intersection. The pedestrian sustained injuries consistent with *Injury B* classification while the driver of the vehicles was uninjured. The crash involving a bicyclist occurred when the driver of a westbound right-turning passenger car struck a southbound bicyclist who was traveling on the roadway shoulder against the flow of traffic. The bicyclist had disregarded the traffic signal and had entered the intersection illegally. The bicyclist sustained injuries consistent with *Injury B* classification while the driver of the vehicle was uninjured. The crash which resulted in injuries consistent with *Injury A* classification occurred when the driver of a northbound passenger car disregarded the traffic signal and collided with a westbound left-turning passenger car. The driver of the northbound vehicle sustained injuries while the other driver was uninjured.

I-205 Northbound Ramps Intersection at OR-99E

The I-205 northbound ramps intersection at OR-99E had 42 reported crashes during the analysis period. The crashes consisted of 28 rear-end collisions and 14 turning-movement collisions. Of the crashes reported, 23 were classified as *PDO*, 17 were classified as *Injury C*, one was classified as *Injury B*, and one was classified as *Injury A*. The crash rate at the intersection was calculated to be 0.48 CMEV.

One of the reported crashes at intersection was classified as an *Injury A* collision. The crash occurred when the driver of a westbound right-turning vehicle was following too close and rear-ended another passenger car that had stopped at the intersection. The driver of the vehicle that was rear-ended sustained injuries while the other driver was uninjured.

15th Street at OR-99E

The intersection of 15th Street at OR-99E had 20 reported crashes during the analysis period. The crashes consisted of 14 rear-end collisions, five turning-movement collisions, and one collision involving a bicyclist. Of the crashes reported, six were classified as *PDO*, 12 were classified as *Injury C*, one was classified as *Injury B*, and one was classified as *Injury A*. The crash rate at the intersection was calculated to be 0.27 CMEV.

One of the reported crashes at the intersection was classified as an *Injury A* collision. The crash occurred when the driver of a northwest-bound right-turning passenger car failed to yield right-of-way to a bicyclist crossing through the intersection. The driver of the passenger car had proceeded through the intersection after stopping, however had their vision obscured by some roadside obstruction. The bicyclist sustained injuries while the driver of the vehicle was uninjured.

14th Street at OR-99E

The intersection of 14th Street at OR-99E had 49 reported crashes during the analysis period. The crashes consisted of 24 turning-movement collisions, 23 rear-end collisions, and two collisions involving bicyclists. Of the crashes reported, 15 were classified as *PDO*, 25 were classified as *Injury C*, and nine were classified as *Injury B*. The crash rate at the intersection was calculated to be 0.68 CMEV.

Two of the reported crashes at the intersection involved a bicyclist. One of the bicycle related crashes occurred when the driver of a southwest-bound left-turning passenger car was struck by a bicyclist who disregarded the traffic signal and had entered the intersection illegally. The driver of the vehicle was uninjured while the bicyclist sustained injuries consistent with *Injury B* classification. The second bicycle related crash occurred when the driver of a northeast-bound right-turning passenger car failed to yield right-of-way to a bicyclist. The driver of the vehicle was uninjured while the bicyclist sustained injuries consistent with *Injury B* classification.

14th Street at Main Street

The intersection of 14th Street at Main Street had 30 reported crashes during the analysis period. The crashes consisted of 21 angle-type collisions, six turning-movement collisions, two collisions involving bicyclists, and one collision involving a pedestrian. Of the crashes reported, 15 were

classified as *PDO*, 11 were classified as *Injury C*, and four were classified as *Injury B*. The crash rate at the intersection was calculated to be 1.46 CMEV.

Based on the calculated crash rate being in excess of one crash per million entering vehicles, additional investigation regarding the safety of the intersection is appropriate. It was noted that Oregon City's Transportation System Plan includes a recommendation to convert this intersection to all-way stop control as mitigation for the high incidence of crashes at the intersection. The intersection crash history shows five or more crashes per year that are susceptible to correction by installation of all-way stop control for each of the three most recent years analyzed (2013, 2014 and 2015). Accordingly, all-way stop control is both warranted and recommended based on the crash history. No other specific safety mitigations are recommended based on the crash history. A more detailed discussion of this potential safety mitigation including operational and queuing impacts is provided on page 40.

7th Street at Washington Street

The intersection of 7th Street at Washington Street had nine reported crashes during the analysis period. The crashes consisted of four angle-type collisions, four turning-movement collisions, and one rear-end collision. Of the crashes reported, five were classified as *PDO* and four were classified as *Injury C*. The crash rate at the intersection was calculated to be 0.25 CMEV.

14th Street at Washington Street

The intersection of 14th at Washington Street had nine reported crashes during the analysis period. The crashes consisted of four turning-movement collisions, three rear-end collisions, one fixed-object collision, and one angle-type collision. Of the crashes reported, four were classified as *PDO* and five were classified as *Injury C*. The crash rate at the intersection was calculated to be 0.32 CMEV.

15th Street at Washington Street

The intersection of 15th Street at Washington Street had 20 reported crashes during the analysis period. The crashes consisted of ten turning-movement collisions, six angle-type collisions, three rear-end collisions, and one collision involving a bicyclist. Of the crashes reported, nine were classified as *PDO*, nine were classified as *Injury C*, and two were classified as *Injury B*. The crash rate at the intersection was calculated to be 0.80 CMEV.

One of the reported crashes at the intersection involved a bicyclist. The crash occurred when the driver of a southeast-bound left-turning passenger car failed to yield right-of-way to a bicyclist. The driver of the passenger car had their vision obscured by some roadside obstruction. The bicyclist sustained injuries consistent with *Injury C* classification while the driver of the vehicle was uninjured.

Abernethy Road at Washington Street

The intersection of Abernethy Road at Washington Street had no reported crashes during the analysis period.

Amtrak Station Access at Washington Street

The Amtrak station access intersection at Washington Street had no reported crashes during the analysis period.

Prairie Schooner Way at Washington Street

The intersection of Prairie Schooner Way at Washington Street had three reported crashes during the analysis period. All three crashes were turning-movement collisions, two of which were classified as *PDO* while one was classified as *Injury B*. Since the intersection was recently constructed near the end of year 2012, the crash rate was calculated to be 0.23 CMEV based on three years of complete crash history.

Clackamas River Drive at Washington Street

The intersection of Clackamas River Drive at Washington Street had two reported crashes during the analysis period. One of the crashes was a rear-end collision while the other was a turning-movement collision. Both crashes were classified as *PDO*. Since the intersection was recently constructed near the end of year 2012, the crash rate was calculated to be 0.17 CMEV based on three years of complete crash history.

OR-213 at Clackamas River Drive

The intersection of OR-213 at Clackamas River Drive was recently reconstructed near the end of year 2012. Prior to reconstruction, the intersection allowed full turning-movements for all approaches. Currently, the intersection allows only right-in/right-out movements for the minor-street approaches while bi-directional traffic along the major-street is separated by a raised median.

Since significant changes to traffic controls had occurred at the intersection, it's reasonable to assume that crash patterns have also significantly changed. Prior to reconstruction of the intersection, over a duration of two years (between 2011 and 2012) a total of 19 crashes were reported at the intersection. After construction was completed, over a duration of three years (between 2013 and 2015) a total of 15 crashes were reported. Based on this information, on average 9.5 crashes per year had occurred at the intersection prior to reconstruction while 5.0 crashes per year had occurred after construction had ended. In order to more accurately assess safety at the intersection, only three years of crash data between years 2013 and 2015 was reviewed instead of five years.

Based on the three years of crash history, the intersection had 15 reported crashes during the analysis period. The crashes consisted of eight rear-end collisions, two turning-movement collisions, two overturning collisions, one angle-type collision, one fixed-object collision, and one sideswipe collision. Of the crashes reported, four were classified as *PDO*, eight were classified as *Injury C*, and three were classified as *Injury B*. The crash rate at the intersection was calculated to be 0.22 CMEV.

Based on the detailed crash data for the study intersections, it is recommended that the intersection of 14th Street at Main Street be converted to all-way stop control. No other specific mitigations are recommended for the study area intersections based on the crash history.

SIGHT DISTANCE

Sight distance was examined for the proposed site access intersection along Washington Street. The proposed access will be located at/near the existing driveway access that currently serves tax lot 1300 of the project site. Intersection sight distance was measured and evaluated in accordance with the standards established in *A Policy on Geometric Design of Highways and Streets*[2]. According to AASHTO, the driver's eye is assumed to be 15 feet from the near edge of the nearest travel lane of the intersecting street and at a height of 3.5 feet above the approach street pavement. The major-street approaching vehicle driver's eye-height is assumed to be 3.5 feet above the cross-street pavement.

The posted speed along Washington Street changes between 25 mph and 35 mph at the proposed access location; 25 mph to the southwest of the proposed access and 35 mph to the northeast. Based on the posted speeds along Washington Street, the minimum required intersection sight distances for maintaining relatively uninterrupted traffic flow along the roadway are 280 feet for northeast-bound approaching vehicles and 390 for southwest-bound approach vehicles. At the proposed site access, intersection sight distance was measured to be in excess of 700 feet to the northeast and 378 feet to the southwest, limited by a crest in the vertical curvature of the roadway.

Based on the detailed analysis, adequate sight distance is available for the proposed site access intersection. No sight distance mitigation is necessary or recommended.

WARRANT ANALYSIS

Left-turn lane and traffic signal warrants were examined for the study intersections where such treatments would be applicable.

A left-turn refuge lane is primarily a safety consideration for the major street, removing left-turning vehicles from the through traffic stream. The left-turn lane warrants used were developed from the National Cooperative Highway Research Project's (NCHRP) Report 457. Turn lane warrants were evaluated based on the number of advancing and opposing vehicles as well as the number of turning vehicles, the travel speed, and the number of through lanes.

Left-turn lane warrants are project to be met for the following two intersection approaches:

- Northeast-bound approach at the intersection of 14th Street at Main Street under existing conditions during the morning and evening peak hours.
- Northwest-bound approach at the site access intersection at Washington Street under year 2022 build-out conditions during the morning peak hour.

The intersection of 14th Street at Main Street is included within Oregon City's TSP and is planned for conversion to all-way stop control in the short-term. Typically, conversion of an intersection to all-way stop control means that the left-turn lane warrants are no longer applicable. However, based on

[2] American Association of State Highways and Transportation Officials (AASHTO), *A Policy on Geometric Design of Highways and Streets*, 6th Edition, 2011.

the operational analysis of intersection operation under all-way stop control it is recommended that a northwest-bound left-turn lane be provided at the intersection even under all-way stop control in order to ensure that all approaches will continue to operate within capacity.

Traffic signal warrants were examined for unsignalized stop-controlled study intersections to determine whether the installation of any new traffic signal will be warranted at the intersections upon completion of the proposed development and change in zoning. Due to insufficient main and side-street traffic volumes, traffic signal warrants are not projected to be met for any of the unsignalized stop-controlled study intersections under any of the analysis scenarios.

CIRCULATION AND CONNECTIVITY ANALYSIS

The proposed development is immediately adjacent to Washington Street, which provides connections to the greater street network for motor vehicles, pedestrians and bicycles.

Motor vehicle connectivity was described in detail in the description of the study area as well as the operational analysis provided for study area intersections. The proposed development site has adequate safe access for motor vehicle transportation modes.

Continuous sidewalks are provided along the east side of Washington Street in the site vicinity while intermittent sidewalks are available along the west side. It is anticipated that continuous sidewalks will be provided along the site frontage concurrent with development of the site. Sidewalks are also provided along both sides of most other roadways in the site vicinity.

Washington Street has continuous bike lanes in place on both sides of the roadway. Abernethy Road also has bike lanes in both directions southeast of the subject property. In addition to these major streets, local streets in the immediate site vicinity generally carry motorized traffic at speeds and volumes that allow bicycles to safely share the roadway.

In addition to the typical transportation modes described above, it should be noted that the subject property is also immediately adjacent to the Oregon City Amtrak station, which provides connectivity by rail to Salem, Albany, Eugene and beyond to the south, and to Portland, Vancouver, Kelso/Longview, Tacoma, Seattle and more to the north.

Within the subject property, motor vehicle speeds and volumes are projected to be low. Sidewalks and crosswalks will be provided internal to the site for access to the proposed buildings both from the adjacent street sidewalks and from the parking areas within the site. The proposed site plan adequately accommodates the circulation of pedestrians, bicycles and motor vehicles within the site.

Based on the analysis of connectivity and circulation for all modes, the surrounding transportation infrastructure is adequate for safe travel for pedestrians, bicycles, and motor vehicles.

ACCESS SPACING STANDARDS

The proposed development will either construct a new access near or utilize an existing access driveway, which currently serves tax lot 1300 of the project site, located along Washington Street. In

order to assess whether access spacing standards can be met at the proposed access location, code section 12.04.195 – *Spacing Standards* from Oregon City's municipal code was referenced.

According to Table 12.04.195.B – *Minimum Driveway Spacing Standards*, the *"minimum distance from a street corner to a driveway of all uses and minimum distance between driveways for uses other than single and two-family dwellings"* along Minor Arterial roadways shall be 175 feet. The nearest driveways/public roadways to the project site along northwestern side of Washington Street are the Amtrak station access immediately to the northeast and an automotive repair shop's driveway approximately 75 feet to the southwest. The project site has approximately 520 feet of frontage along Washington Street, 245 feet of which could have a site access built while satisfying City access spacing standards. Therefore, a proposed site access may be constructed along Washington Street while meeting Oregon City standards.

MITIGATION ANALYSIS

Although the operational analysis did not demonstrate the need for any operational mitigation in order to meet city standards, the high historical crash rate for the intersection of 14th Street at Main Street is indicative of the need for safety mitigation.

In conformance with the city's Transportation System Plan, the intersection was identified as a candidate location for conversion to all-way stop control. Providing all-way stop control would be expected to reduce the frequency of the reported crash types. However, introduction of stop signs along 14th Street could also result in increased queue lengths. Given the short distance between Main Street and OR-99E along 14th Street, special consideration of the potential capacity and queuing impacts of all-way stop control is appropriate at this location.

Based on the operational analysis, conversion to all-way stop control absent other improvements would be projected to result in eastbound queues on 14th Street backing up onto OR-99E. Installation of eastbound and westbound left-turn lanes along 14th Street at Main Street was also determined to be insufficient to mitigate queueing and capacity concerns along the 14th Street corridor with stop control at Main Street.

In order to improve operation and reduce queue lengths, two additional improvements are recommended in conjunction with conversion to all-way stop control. The first is to convert the eastbound and westbound approaches on 14th Street at Main Street to each have a shared left/through lane and a shared through/right lane. This lane configuration provides two eastbound lanes in which through traffic can queue, significantly increasing the available eastbound queue storage between Main Street and OR-99E. With two receiving lanes, the eastbound storage is sufficient to accommodate platoons of vehicles making southbound left turns from OR-99E onto 14th Street. This improvement thus ensures that acceptable operation can be maintained during the evening peak hour, when eastbound volumes are highest on 14th Street.

The second improvement addresses operation during the morning peak hour. Even with two westbound lanes provided along 14th Street, long queues would be projected to develop in the right lane since most eastbound drivers turn right onto OR-99E. Introduction of all-way stop control would limit the number of vehicles that could enter OR-99E during the green indication, since

vehicles that currently could be served may be stuck at the stop sign at Main Street. In order to balance traffic volumes between the two eastbound lanes and maximize the number of vehicles that can enter OR-99E during each green indication, it is recommended that the westbound approach on 14th Street to OR-99E be converted to have a shared left/right turn lane and a dedicated right turn lane.

A Synchro/SimTraffic analysis was conducted for the proposed improvements, including conversion to all-way stop control for safety as well as reconfiguration of the intersection approaches on 14th Street as described.

Based on the operational analysis, the intersection of Highway 99E at 14th Street is projected to operate at level of service C and with a v/c ratio of 0.94 during the morning peak hour under year 2022 traffic conditions with the addition of site trips from the proposed development and the proposed safety, queuing, and capacity improvements in place. During the evening peak hour, the intersection is projected to operate at level of service C with a v/c ratio of 0.91.

Under year 2022 traffic conditions with the addition of site trips from the proposed development and the proposed safety, capacity and queuing improvements in place, the intersection of 14th Street at Main Street is projected to operate at level of service C during the morning peak hour, with a v/c ratio of 0.72 for the critical approach. During the evening peak hour, the intersection is projected to operate at level of service C, with a v/c ratio of 0.54 for the critical movement. Notably, the v/c ratio for the eastbound 14th Street approaches is projected to be less than 0.50 during both the morning and evening peak hours.

Based on the queuing analysis, the average queue length projected on the eastbound 14th Street approach to Main Street was projected to be 70 feet during the morning peak hour and 84 feet during the evening peak hour. Observation of the queueing simulation showed that although the available queue storage eastbound often filled, the queues immediately clear following each cycle of the traffic signal at OR-99E, and the queues of southbound vehicles turning left from OR-99E onto 14th Street also clear regularly. Additionally, although westbound queues develop during the morning peak hour on 14th Street approaching Main Street, the queues do not extend to Washington Street and result in congestion on the local street network.

Based on the analysis, installation of all-way stop control can be recommended as a safety mitigation for the intersection of 14th Street at Main Street provided that the eastbound and westbound approaches on 14th Street approached Main Street are converted to each have a shared left/through lane and a shared through/right lane, and the westbound 14th Street approach to OR-99E is converted to have a shared left/right lane and a dedicated right-turn lane at the signal.

It should also be noted as an alternative to the above-recommended improvements that the city's Transportation System Plan also includes an alternative improvement consisting of conversion of 14th Street to one-way eastbound from OR-99E to John Adams Street and conversion of 15th Street to one-way westbound from Washington Street to OR-99E. This option would result in more significant changes to trip routing within the study area. It would also likely necessitate installation of a new traffic signal at the intersection of Highway 99E and 15th Street, since this would become the intersection that accommodates westbound left-turns onto OR-99E. Although this alternative

improvement can be considered by the city and ODOT, the associated impacts and costs are well beyond what can reasonably be expected as mitigation for development of the subject property.

PROPORTIONALITY ANALYSIS

In order to determine the relative impacts of the proposed development at locations requiring mitigation, a proportionality analysis was prepared. Generally, any requested mitigation must have a logical connection or "nexus" to the proposed development, and the requested mitigation must be roughly proportional to the impacts of the proposed development.

For this project, two primary mitigations were recommended based on the safety analysis. These consist of installation of a northbound left-turn lane at the site access and a collection of improvements near the intersection of 14th Street and Main Street to improve safety while maintaining acceptable operation of the impacted intersections.

The northbound left-turn lane recommended at the site access serves site traffic and is located along the site frontage. Accordingly, there is a logical nexus between the proposed development and the safety mitigation. Since the access will serve exclusively site traffic, it is reasonable to request that the improvement be funded by the proposed development.

The improvements intended to address existing safety concerns at the intersection of 14th Street and Main Street are not directly contiguous to the site, and the proposed development is not causing the safety problem since it is occurring under existing conditions. However, the site will add trips through the intersection. Accordingly, there is also a logical nexus between this improvement need and the proposed development.

In order to assess the proportionate impacts of the proposed development on the intersection, traffic volumes were considered for existing and year 2022 conditions. These volumes were compared to the projected number of site trips added to the intersection under Phase 1 development of the 99-room hotel as well as at full site build-out. Currently, the intersection accommodates 1,062 entering vehicles during the morning peak hour and 1,123 entering vehicles during the evening peak hour. Under year 2022 background plus site trips conditions, the intersection is projected to accommodate 1,196 entering vehicles during the morning peak hour and 1,265 entering vehicles during the evening peak hour.

Based on the site trip generation and distribution, Phase 1 of the proposed development would be projected to add 8 site trips to the intersection during the morning peak hour and 10 site trips during the evening peak hour. At full site build-out, the development is projected to add 23 trips to the intersection during the morning peak hour and 26 trips during the evening peak hour in total.

The added trips from Phase 1 are projected to represent less than one percent of the traffic passing through the intersection under year 2022 conditions, and the total impact from Phases 1 and 2 is projected to represent two percent of the traffic passing through the intersection.

Often, proportionality analysis is conducted not based on the total intersection volumes as compared to the site traffic volumes, but instead on the portion of the projected traffic increase that is

attributable to the proposed development. In this case, it is probably not appropriate to assess relative impacts in this manner, since the historical safety problem is entirely attributable to existing traffic rather than the projected traffic increases. Nevertheless, if the proportionality analysis were conducted based on only the projected increase in trips, the proposed development would represent 6% of the increase during the morning peak hour and 7% of the increase during the evening peak hour for Phase 1. The cumulative impact of Phases 1 and 2 would represent 17% of the increased traffic volumes during the morning peak hour and 18% of the increase during the evening peak hour.

Based on this analysis, it is reasonable to conclude that the proposed development should not be solely responsible for the costs associated with the recommended safety improvements for the intersection of 14th Street at Main Street. If the city desires to require mitigation from the proposed development, it may therefore be appropriate to request a proportionate share payment based on the impacts of the proposed development rather than requesting construction of the recommended improvements.

CONCLUSIONS

Based on the operational analysis, all study area intersections are projected to operate acceptably per Oregon City code standards through 2022 either with or without the addition of site trips from the proposed development.

Based on the crash analysis, the intersection of 14th Street at Main Street was identified as having a high crash rate. It is recommended that the intersection be converted to all-way stop control to address this safety concern. It is recommended that concurrent with conversion to all-way stop control the eastbound and westbound approaches on 14th Street be converted to have a shared left/through lane and a shared through/right lane. Additionally, it is recommended that the westbound approach to Highway 99E be converted to have a shared left/right turn lane and a dedicated right-turn lane. With these improvements in place, it is anticipated that the safety of the intersection will be improved while maintaining acceptable operation of the affected intersections.

It should be noted that the city's Transportation System Plan includes an alternative improvement that could address safety concerns at the intersection of 14th Street and Main Street, consisting of conversion of 14th Street to one-way eastbound from OR-99E to John Adams Street and conversion of 15th Street to one-way westbound from Washington Street to OR-99E. This alternative treatment would likely necessitate installation of a new traffic signal for the intersection of Highway 99E at 15th Street.

Intersection sight distance is adequate at the site access intersections. No sight distance mitigation is recommended.

Based on the left-turn lane warrant analysis, installation of a northbound left-turn lane on Washington Street at the site access is recommended for safe operation of the new site access.

Since the westbound 14th Street approach to Main Street currently meets left-turn lane warrants, it is recommended that a northwest-bound left-turn lane be provided even if the intersection is not converted to all-way stop control.

Due to insufficient main and side-street traffic volumes, traffic signal warrants are not projected to be met for any of the unsignalized stop-controlled study intersections under any of the analysis scenarios.

The proposed site access intersection at Washington Street can be constructed to meet the minimum access spacing standards required by the Oregon City Municipal Code.

Based on the proportionality analysis, it was determined that a requirement to construct a left-turn lane serving the site access would be proportionate to the impacts of the proposed development. However, a requirement for construction of safety improvements at the intersection of 14th Street and Main Street would not proportionate to the impacts of the development. If the city desires to require mitigation from the proposed development, it may therefore be appropriate to request a proportionate share payment based on the impacts of the proposed development rather than requesting construction of the recommended improvements.