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CITY OF MILWAUKIE  
PLANNING DEPARTMENT



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ENGINEERING**

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March 23, 2016

Robert Hixson  
Clackamas County Department of Transportation and Development  
150 Beaver Creek Road  
Oregon City, OR 97045

RE: *Sight Distance Analysis at 5945 SE Harmony Road*

Dear Robert,

This letter describes the results of our analysis of sight distance at the shared right-in, right-out access serving the proposed self-storage facility at 5945 SE Harmony Road in Clackamas County, Oregon.

The letter details the results of our sight distance measurements, speed data collection and associated analysis. It also includes a design modification request as allowed in Section 170.1 of the Clackamas County Roadway Standards.

***Sight Distance at the Shared Right-In, Right-Out Driveway Location***

Sight distance was measured for three distinct design vehicle movements at the shared driveway location on Harmony Road. These included measurement of Intersection Sight Distance (ISD) for passenger vehicles exiting the driveway onto Harmony Road, ISD for trucks exiting the driveway onto Harmony Road, and Stopping Sight Distance (SSD) for westbound vehicles turning into the site access from Harmony Road.

Stopping sight distance was measured from the position of the rear of a stopped vehicle waiting within the travel lane on SE Harmony Road, intending to make a westbound right turn into the shared access driveway. The measurements used an object height of 2.0 feet above the roadway within the westbound travel lane and an oncoming westbound driver's eye height of 3.5 feet above the roadway. The available stopping sight distance was measured to be 434 feet.

In order to determine the minimum required intersection sight distances and stopping sight distance for the shared access driveway, speed data was collected for westbound vehicles at the limits of sight distance. The actual measurements were made at a position approximately 485 feet east of the centerline of the shared access. Speed data was collected for 100 free-flowing vehicles during a mid-week day, and data collection was observed by Clackamas County staff to ensure that the collected data was collected in accordance with the standards established by Clackamas County and the American Association of State Highway and Transportation Officials.

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Based on the collected speed data, the 85<sup>th</sup> percentile speed of westbound vehicles on SE Harmony Road was measured to be 36 mph. Over the braking distance for westbound vehicles, there is a downhill grade of up to 3.5 percent. Based on these factors, the minimum required stopping sight distance for safety was calculated to be 275 feet. The measured available stopping sight distance of 434 feet is well in excess of the minimum required. Accordingly, the proposed site access can operate safely with respect to westbound vehicles entering the site and no sight distance mitigations are recommended for the future right-turn movement from SE Harmony Road into the site.

For passenger cars, intersection sight distance was measured from a position within the shared driveway 14.5 feet behind the edge of the traveled way, with a driver's eye height of 3.5 feet above the driveway surface elevation. The measurements were made to an oncoming driver's eye height of 3.5 feet above the roadway within the oncoming (westbound) travel lane on SE Harmony Road. The available intersection sight distance was measured to be 420 feet. Based on the measured 85<sup>th</sup> percentile speed of westbound traffic, the minimum intersection sight distance required to ensure minimal interruptions to the flow of through traffic was calculated to be 400 feet. Since the available intersection sight distance is in excess of the minimum required, passenger vehicles can turn from the shared driveway onto SE Harmony Road westbound without unduly impacting the flow of westbound through vehicles. No sight distance mitigations are recommended for future right-turn movements by passenger vehicles turning westbound onto SE Harmony Road.

For trucks, intersection sight distance was measured from a position within the shared driveway 14.5 feet behind the edge of the traveled way, with a driver's eye height of 7.6 feet above the driveway surface elevation. The measurements were made to an oncoming driver's eye height of 3.5 feet above the roadway within the oncoming (westbound) travel lane on SE Harmony Road. The available intersection sight distance was measured to be 263 feet, as limited by low branches on the trees immediately east of the shared driveway on the north side of the roadway. With clearing of the low branches, it is anticipated that sight distance for trucks can be improved to 585 feet. Based on the measured 85<sup>th</sup> percentile speed of westbound traffic, the minimum intersection sight distance required to ensure minimal interruptions to the flow of through traffic when trucks turn onto SE Harmony Road was calculated to be 610 feet.

The available intersection sight distance for trucks is marginally less than the minimum required by AASHTO and the Clackamas County Roadway Standards. Accordingly, it is anticipated that when heavy vehicles turn from the driveway onto SE Harmony Road, some additional delay to westbound through traffic may reasonably be anticipated. It should be noted, however, that the available intersection sight distance is well in excess of the minimum required stopping sight distance. Accordingly, trucks can safely exit the driveway and turn onto SE Harmony Road. The measured intersection sight distance for trucks was approximately 25 feet short of the desired minimum intersection sight distance. As vehicles approach the driveway at 36 mph, they will cover this distance in 0.5 seconds. Accordingly, the additional delay that would be anticipated in association





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with the limited truck intersection sight distance is 0.5 seconds when trucks are entering the roadway at the same time as vehicles are approaching at the limits of sight distance. This extremely small increase in potential delays to through traffic will have a negligible impact on operation of the adjacent roadway and the site access intersection.

### ***Request for Design Modification***

Section 170.1.2 of the Roadway Standards contains a list of conditions identifying when a modification may be requested. Since the driveway is located at the extreme west end of the subject property, the available intersection sight distance is at its maximum at the shared driveway location. Accordingly, there is no possible location for the driveway where all ISD minimums specified by the county can be satisfied. This specification therefore cannot be met without "undue hardship." Moreover, stopping sight distance (SSD) for the driveway can be achieved, indicating that the driveway can operate safely, and intersection sight distance for passenger cars is also available, indicating that most vehicles entering SE Harmony Road from the shared access will not unduly impact the flow of through traffic, and the potential impacts on through traffic that can occur when trucks turn onto SE Harmony Road are extremely minimal. For these reason, subsection (c.) of 170.1.2 is met, indicating that the County may grant a modification.

Per Section 170.1.1, the request for a design modification should include four items. These items are listed below, with the response to each following.

### ***Desired Modification***

The requested modification is to allow the use of the Modified ISD for trucks as provided in Section 240.7, despite the traffic volumes on SE 130<sup>th</sup> Avenue and the subject driveway not conforming to the traffic volume criteria in Table 2-5. Specifically, it is requested that the stopping sight distance for the 85<sup>th</sup> percentile of traffic speeds as measured in our speed study conducted on March 10, 2016 be used as the applicable standard, with the provision that truck intersection sight distance shall be improved to the maximum extent possible through clearing of the tree limbs and vegetation currently obstructing sight lines for truck eye heights of up to 7.6 feet.

### ***Reason for the Request***

The subject property is adjacent to SE Harmony Road and has no other site frontage. An existing access driveway onto SE Harmony Road is located on the adjacent parcel to the west. The maximum achievable sight distance for any location along the frontage of the subject property is at the extreme west end of the property, since this location maximizes the distance to the crest vertical curve to the east. Accordingly, providing an improved, shared access driveway on the property line achieves the maximum possible sight distance for the subject property.



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***Comparison between Standard & Modification, for Performance, Function, Maintainability, Safety, etc.***

At the 85<sup>th</sup> percentile speed of 36 mph, the minimum required stopping distance for safety is 275 feet. This includes the distance travelled as drivers see and react to potential conflicts as well as the distance necessary for braking. The available sight distance to the east for trucks entering the roadway from the site access currently does not meet this minimum. However, sight lines are restricted by low tree limbs and associated vegetation within the frontage of the subject property. With trimming of low limbs and vegetation, intersection sight distance well in excess of the minimum required for safety is attainable.

With clearing of low limbs and associated vegetation from the trees on the north side of SE Harmony Road immediately east of the shared driveway location, adequate intersection sight distance for passenger cars and single-unit trucks will be available. Accordingly, these vehicles will not significantly impact the flow of westbound through traffic along SE Harmony Road when exiting from the shared driveway. For tractor-trailer trucks, intersection sight distance to the east will be approximately 25 feet short of the desired minimum. Based on the speed of approaching traffic, it is anticipated that large trucks exiting the driveway as vehicles approach from the limits of sight distance may result in an added delay to westbound through traffic of up to 0.5 seconds. This impact to through traffic is minimal and essentially negligible.

Approval of the requested modification will have no negative impacts on the safety or maintainability of the shared driveway intersection on SE Harmony Road, and will have negligible impacts on the performance and function of SE Harmony Road.

***References to Regionally or Nationally Accepted Specifications & Standards, Record of Successful use by other Agencies, etc.***

The sight distance requirements in Section 240 of the Roadway Standards are based upon the sight distance standards in the 2011 AASHTO manual. This manual provides nationally-accepted standards for roadway design, including sight distance. The premise of the requested Design Modification is to accept the maximized truck ISD attainable at the shared access driveway upon clearing of vegetation within the frontage of the subject property and in excess of the minimum required SSD rather than the full truck ISD.

The AASHTO Manual contrasts SSD to ISD by stating that, "Intersection Sight Distance criteria for stop-controlled intersections are longer than stopping sight distance to ensure that the intersection operates smoothly. Minor road vehicle operators can wait until they can proceed safely without forcing a major road operator to stop." This indicates that providing ISD allows the major street traffic to flow smoothly and without interruptions.





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Additionally, "If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance operations, intersection sight distances that exceed stopping sight distances are desirable along the major road." Thus, the minimum requirement for safe operation of a proposed intersection or driveway is that SSD be available in each direction to ensure that oncoming vehicles have sufficient reaction time and space to stop to avoid collisions.

Lancaster Engineering has an extensive experience in evaluating sight distance in virtually all City, County, and State agencies in the Portland Metro area. Most jurisdictions require that ISD standards be met when feasible, with many (including Washington County) adhering to ISD standards as strictly as possible. Still, in each jurisdiction there have been instances where it was not possible to provide the full ISD in each direction and SSD standards were used as an alternative minimum standard to ensure safe operation.

In this instance, since truck intersection sight distance nearly matching the sight distance required for relatively uninterrupted flow of through traffic is attainable, it is anticipated that approval of the requested modification will result in no negative impacts to safety, and only negligible impacts to the flow of through traffic.

## Summary & Conclusions

At the proposed new driveway location, the minimum intersection sight distance specified by the County for trucks entering the roadway from the shared site access is not available. However, the speed study conducted on March 10, 2016 confirms that the necessary stopping sight distance required for safe operation of the shared driveway is attainable for all movements and all vehicle types. Because truck intersection sight distance cannot reasonably be improved to achieve County standards, a Design Modification is recommended. Since adequate stopping sight distance is attainable, this modification is allowed by *Clackamas County Roadway Standards* and supported by *A Policy on Geometric Design of Highways and Streets* and will allow safe operation of the driveway.

The shared driveway location allows for stopping sight distances to be achieved in all cases without the necessary lines of sight crossing other properties. Therefore, no sight distance easements are necessary to accommodate safe operation of the driveway upon approval of the requested design modification. Interruptions to the flow of through traffic will also be minimized under the proposed design modification, since adequate intersection sight distance is already available for passenger vehicles and intersection sight distance for trucks will be improved to the maximum extent possible

*le*

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by appropriate clearing of tree limbs and associated vegetation within the frontage of the subject property.

If you have any questions or concerns regarding this analysis, please don't hesitate to contact us.

Sincerely,

*[Handwritten signature of Michael Ard]*

Michael Ard, PE  
Senior Transportation Engineer

p. 503.248.0313  
e. mike@lancasterengineering.com



EXPIRES 12/31/17

## APPENDIX

**5945 SE Harmony Road - WB Speed Data (Sorted)**

Speed Ranking    Speed (mph)

100	45
99	44
98	42
97	39
96	39
95	38
94	38
93	38
92	38
91	38
90	37
89	37
88	36
87	36
86	36
85	36
84	35
83	35
82	35
81	35
80	35
79	35
78	35
77	34
76	34
75	34
74	34
73	34
72	34
71	34
70	34
69	33
68	33
67	33
66	33
65	33
64	33
63	33
62	33
61	33
60	33
59	33
58	33
57	33

**<-- 85th Percentile Speed**



56	33
55	33
54	33
53	33
52	32
51	32
50	32
49	32
48	32
47	32
46	32
45	32
44	32
43	32
42	32
41	32
40	31
39	31
38	31
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20	30
19	30
18	30
17	30
16	30
15	30
14	29
13	29
12	28
11	28
10	28

9	28
8	28
7	28
6	27
5	27
4	27
3	26
2	25
1	22

## Sight Distance Analysis Worksheet - 5945 SE Harmony Road

Stopping Sight Distance	Reaction Distance	Braking Distance
Travel Speed      36 mph	Travel Speed      36 mph	Travel Speed      36 mph
Reaction Time     2.5 seconds	Travel Speed      52.9 fps	Acceleration      11.2 ft/sec <sup>2</sup>
Acceleration     11.2 ft/sec <sup>2</sup>	Reaction Time     2.5 seconds	Grade (percent)   -3.50%
Grade (percent)  -3.50%	<b>Reaction Distance    132.3 feet</b>	<b>Braking Distance    138.1 feet</b>

Distance	Required*	Measured*	Adequate?	Notes
ISD	270.4	434	Yes	
SU Truck ISD	396.9	420	Yes	
WB Truck ISD	502.7	263	No	Truck ISD can increase to 585' with clearing of vegetation
	608.6	263	No	Truck ISD can increase to 585' with clearing of vegetation

\* All distances are in feet. Required sight lines are rounded up to the nearest 5-foot interval within the accompanying report.

The only sight distance requirement not projected to be met with clearing of vegetation is truck ISD for tractor-trailer trucks. Based on the projected deficiency of 25 feet, delays of up to 0.5 seconds may be expected when tractor-trailer trucks enter SW Harmony Road while vehicles are approaching westbound at the limits of sight distance.





**KITTELSON & ASSOCIATES, INC.**

TRANSPORTATION ENGINEERING / PLANNING

610 SW Alder Street, Suite 700, Portland, OR 97205 P 503.228.5230 F 503.273.8169

October 29, 2007

Project #: 8905.0

Mr. Robert Hixson  
Clackamas County  
9101 SE Sunnybrook Blvd.  
Clackamas, OR 97015

Mr. Zachary Weigel  
City of Milwaukie  
6101 SE Johnson Creek Blvd.  
Milwaukie, OR 97206

***RE: Transportation Impact Analysis for Harmony Road Self Storage***

Dear Robert & Zach:

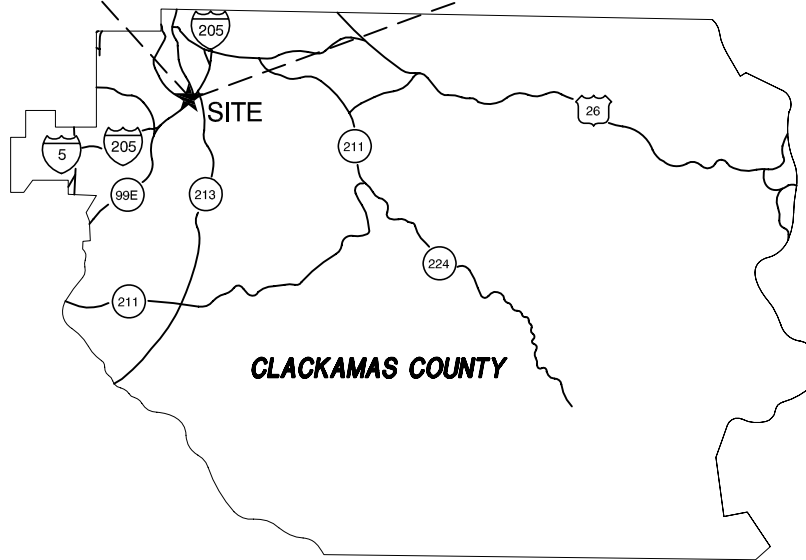
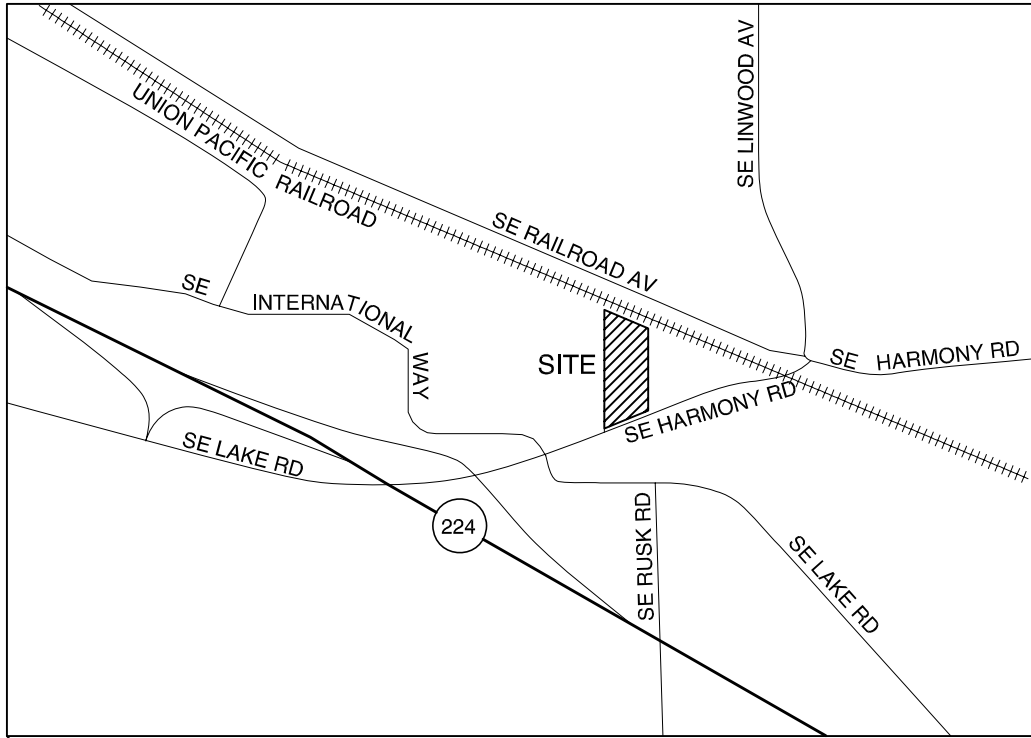
HT Investment Properties proposes to develop a self-storage facility on SE Harmony Road east of SE International Way in Milwaukie, Oregon. A site vicinity map is provided in Figure 1. Under the proposal, the 2.96-acre site, currently zoned Manufacturing (M), would be changed to Business Industrial (BI). Under the BI zoning, a self-storage facility would be allowed as a conditional use. The zone change is proposed to be contingent on approval and development of the self-storage facility. If the conditional use for the self-storage facility is not approved, the zoning would revert back to manufacturing.

Kittelison & Associates, Inc. (KAI) reviewed the traffic implications of the proposed rezone as they relate to the Oregon Transportation Planning Rule (TPR). The proposed zone change and conditional use is expected to decrease the weekday daily and peak hour trip generation potential of the overall site and, as a result, does not trigger a full transportation impact analysis of long-term future conditions. This report summarizes the analysis assumptions, methodology, and findings as well as a summary demonstrating the proposed rezone's compliance with the TPR.

KAI also reviewed the traffic impacts of the proposed self-storage facility, based on the scope of work identified in consultation with the City of Milwaukie, Clackamas County, and the Oregon Department of Transportation (ODOT). This report identifies the key assumptions, methodology, and findings of the analysis.



(NO SCALE)



**SITE VICINITY MAP  
MILWAUKIE, OREGON**

**FIGURE  
1**

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## **TPR ANALYSIS FOR PROPOSED ZONE CHANGE**

Oregon Statewide Planning Goals and the Oregon Administrative Rules (OAR) establish the parameters under which a rezone may be approved. OAR Chapter 660-012, the Transportation Planning Rule (TPR), establishes criteria under which a rezone's transportation impacts must be evaluated. If a proposed rezone is expected to result in an increase in traffic beyond that which would occur through development under the existing zoning, an operational analysis is required to assess whether the rezone will "significantly affect" the transportation needs.

The first step in assessing a given rezone's potential transportation impact is to compare the trip generation potential of the site assuming a reasonable "worst case" development scenario under the existing and proposed zoning. If the trip generation potential increases under the proposed zoning, additional analysis is required. Conversely, if the trip generation potential is reduced, the traffic impacts of site development are also reduced and no additional operational analysis is required to satisfy the TPR. The following sections document the study site's trip generation potential under the existing and proposed zoning.

### **Trip Generation Comparison for Potential Land Use Scenarios**

In order to evaluate the potential traffic impacts of the proposed zone change, potential development scenarios were estimated for the project site under existing and proposed zone designations. Chapter 19.30 of the Milwaukie zoning code identifies allowable land uses under the M and BI zone designations. The reasonable worst case land use scenarios were estimated with assistance from the project team, as reported in the *Harmony Road Zone Analysis* (Reference 1) conducted by the project team. The report is being submitted with the application for this project. Based on a review of allowed uses, it was determined that the reasonable worst case scenario under existing M zoning would be a combination of manufacturing and office uses.

As was noted previously, the proposed rezone would be contingent upon development of the proposed self-storage facility as described in this report. If the self-storage facility is not approved and developed, the land will revert back to Manufacturing zoning. Therefore, the reasonable worst case development scenario under the proposed rezone would be the planned 100,000-square-foot self-storage facility.

Trip generation estimates for the office and manufacturing land uses were developed based on observations from similar land uses, as summarized in the standard reference manual, *Trip Generation*, (Reference 2), published by the Institute of Transportation Engineers (ITE). In order to estimate trip generation at the proposed mini-storage facility, a trip generation study was conducted at three similar facilities in the Milwaukie area. Trip counts were conducted on a mid-week day during the a.m. and p.m. peak periods (7:00-9:00 a.m. and 4:00-6:00 p.m.). Table 1 shows the "worst-case" trip generation under each zoning scenario as well as the net trip change between the existing and proposed zoning scenarios.



**Table 1**  
**Weekday Trip Generation Estimates, Reasonable Worst Case Development Scenarios**

Land Use	ITE Code	Size	Daily Trips	AM Peak Hour			PM Peak Hour*		
				Total	In	Out	Total	In	Out
<b>Existing Manufacturing Zone</b>									
Manufacturing	140	25,000	100	20	15	5	20	10	10
General Office	710	75,000	820	115	100	15	110	20	90
<b>Total</b>			<b>920</b>	<b>135</b>	<b>115</b>	<b>20</b>	<b>130</b>	<b>30</b>	<b>100</b>
<b>Business Industrial - Proposed Conditional Use</b>									
Mini-Storage		450 units	80	5	<5	<5	10	5	5
<b>Net Trips</b>									
<b>Difference (Existing – Proposed Conditional Use)</b>			-850	-130	-110	-20	-120	-25	-100

As shown in Table 1, the proposed zone change, subject to the planned development of a 100,000-square-foot self-storage facility on the site, would significantly decrease the trip generation potential of the site compared to the existing zoning. *Traffic counts and calculations from the trip generation study are provided in Appendix "A".*

### Transportation Planning Rule Compliance

OAR Section 660-12-0060 of the TPR sets forth the criteria for evaluating plan and land use regulation amendments. Table 2 below summarizes the criteria in Section 660-012-0060 and their applicability to the proposed rezone application.

**Table 2**  
**Summary of Criteria in OAR 660-012-0060**

Criterion	Description	Applicable?
1	Describes how to determine if a proposed land use action results in a significant impact.	See response below
2	Describes measures for complying with Criterion #1 where a significant impact is determined.	No
3	Describes measures for complying with Criteria #1 and #2 without assuring that the allowed land uses are consistent with the function, capacity and performance standards of the facility	No
4	Determinations under Criteria #1, #2, and #3 are coordinated with other local agencies.	See response below
5	Indicates that the presence of a transportation facility shall not be the basis for an exception to allow development on rural lands.	No
6	Indicates that local agencies should credit developments that provide a reduction in trips.	No
7	Outlines requirements for a local street plan, access management plan, or future street plan.	No
8	Provides guidelines for mixed-use, pedestrian-friendly neighborhood	No

As noted in Table 2, there are eight criteria that apply to Plan and Land Use Regulation Amendments. Of these, Criteria #1 and #4 are applicable to the proposed land use action and Criterion #1(C) conveys the most significant aspect of the proposed land use as it relates to TPR; the reduction in site trip generation potential. The specific elements of the criterion are provided below in italics with our response shown in standard font.

*(1) Where an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation would significantly affect an existing or planned transportation facility, the local government shall put in place measures as provided in section (2) of this rule to assure that allowed land uses are consistent with the identified function, capacity, and performance standards (e.g. level of service, volume to capacity ratio, etc.) of the facility. A plan or land use regulation amendment significantly affects a transportation facility if it would:*

*(a) Change the functional classification of an existing or planned transportation facility (exclusive of correction of map errors in an adopted plan);*

**Response:** The proposed rezone will not require changes to the functional classification of existing or planned transportation facilities, will not require a change to the standards implementing the comprehensive plan, and will not significantly affect a transportation facility as measured at the end of the planning period identified in the adopted transportation system plan.

*(b) Change standards implementing a functional classification system; or*

**Response:** The proposed rezone will not require changes to the standards implementing the functional classification system;

*(c) As measured at the end of the planning period identified in the adopted transportation system plan:*

*(A) Allow land uses or levels of development that would result in types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;*

**Response:** The proposed rezone will not allow land uses or levels of development that would result in types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility.

*(B) Reduce the performance of an existing or planned transportation facility below the minimum acceptable performance standard identified in the TSP or comprehensive plan; or*

**Response:** The proposed rezone will not reduce the performance of an existing or planned transportation facility below the minimum acceptable performance standard identified in the TSP or comprehensive plan.

*(C) Worsen the performance of an existing or planned transportation facility that is otherwise projected to perform below the minimum acceptable performance standard identified in the TSP or comprehensive plan.*

**Response:** The proposed rezone will lower the reasonable “worst-case” trip generation potential of the site and therefore reduce the impact of potential site development scenarios as it relates to transportation facilities.

*(4) Determinations under sections (1)-(3) of this rule shall be coordinated with affected transportation facility and service providers and other affected local governments.*

**Response:** The project team is coordinating the assessment of the proposed rezone with the City of Milwaukie, Clackamas County, and ODOT.

## **TRAFFIC IMPACT ANALYSIS**

This section identifies the traffic impacts associated with the proposed self-storage facility.

### **Project Description**

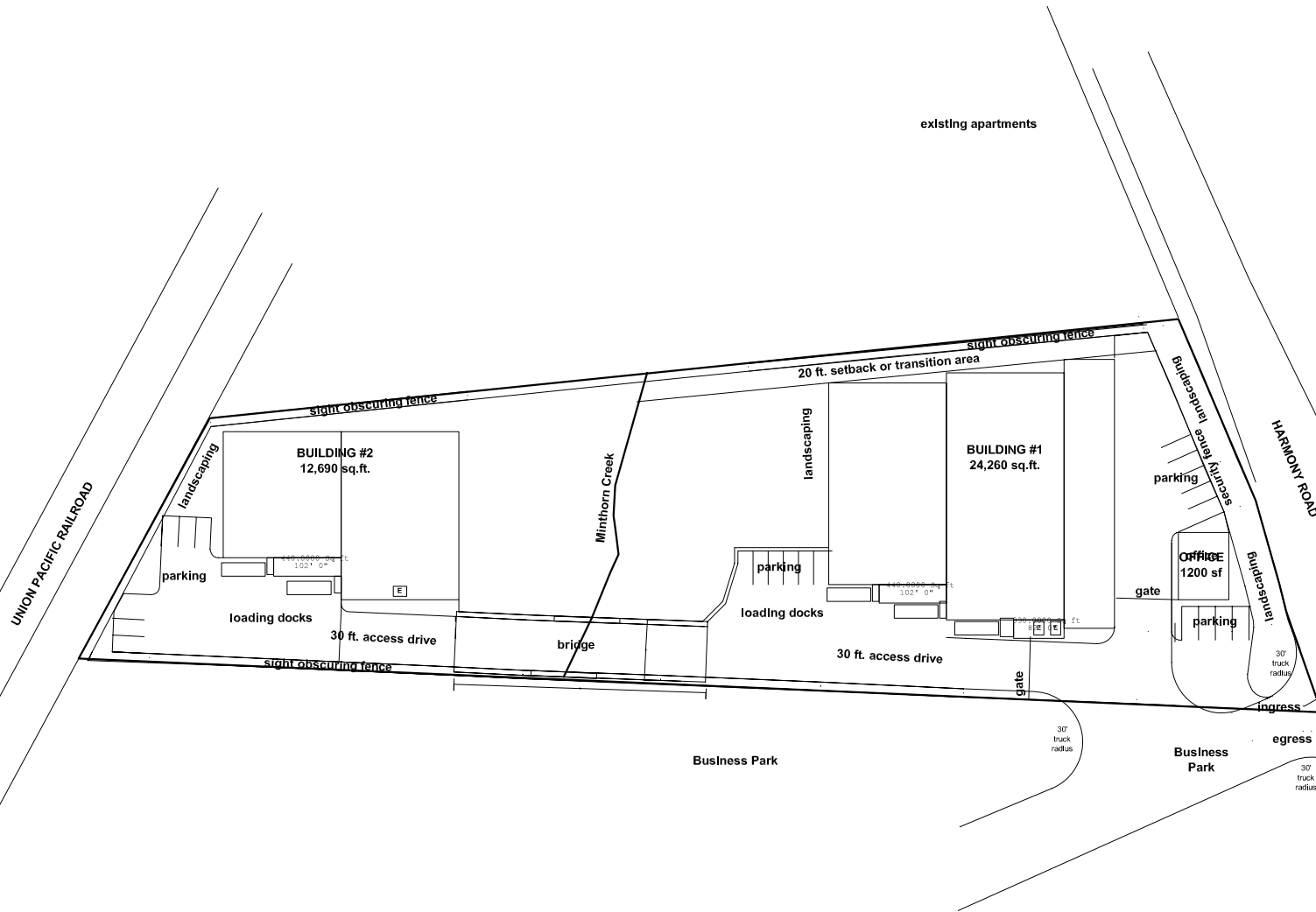
The project is proposed to include approximately 100,000 square feet of self-storage space, including 450 units. The proposed site plan is shown in Figure 2. As the site plan shows, access is proposed via a right-in/right-out driveway on SE Harmony Road. The International Way Business Park, located directly west of the project site, currently has a right-out driveway on SE Harmony Road. The proposed project would augment this driveway to allow right turn ingress movements and would provide a single shared access point for the business park and the self-storage facility. This analysis addresses the following transportation issues:

- Year 2007 existing land use and transportation system conditions within the site vicinity;
- Planned developments and transportation improvements in the study area;
- Forecast year 2009 background traffic conditions during the weekday a.m. and p.m. peak hours;
- Trip generation and distribution estimates for the proposed development;
- Forecast year 2009 total traffic conditions with full build-out of the site during the weekday a.m. and p.m. peak hours;





H:\profile\8905 - Milwaukie Mini Storage\dwgs\figs\8905Fig01.dwg Oct 30, 2007 - 11:21am - csemier Layout Tab: Fig02



PROPOSED SITE PLAN  
MILWAUKIE, OREGON

FIGURE  
2

- An evaluation of the proposed site access, including Clackamas County access regulations;
- A review of on-site traffic operations and circulation; and,
- Conclusions and recommendations.

### **Scope of the Analysis**

This analysis determines the transportation-related impacts associated with the proposed office building and was prepared in accordance with City of Milwaukie transportation impact analysis requirements. The study intersections and overall study area for this project were selected based on direction provided by staff from the City of Milwaukie and Clackamas County. Operational analyses were performed at the following intersections:

- SE International Way/SE Harmony Road
- SE Linwood Ave/SE Harmony Road
- Proposed site driveway/SE Harmony Road

### **Intersection Levels of Service**

All level-of-service analyses described in this report were performed in accordance with the procedures stated in the *2000 Highway Capacity Manual* (Reference 3). *A description of level of service (LOS) and the criteria by which they are determined is presented in Appendix "B." Appendix "B" also indicates how LOS is measured and what is generally considered the acceptable range of LOS.*

To ensure that the analyses were based on a reasonable worst-case scenario, the peak 15-minute flow rates were used in the evaluation of all intersection levels of service. For this reason, the analyses reflect conditions that are only likely to occur for 15 minutes out of each average peak hour. Traffic conditions during typical weekday hours are expected to operate under better conditions than those described in this report.

### **Signalized Intersections**

The SE International Way/SE Harmony Road and SE Linwood Avenue/SE Harmony Road intersections are signalized. LOS analyses for signalized intersections are based on the average control delay per vehicle entering the intersection. The City of Milwaukie requires that LOS "D" or better be maintained at signalized intersections. Signal timing information used in the analysis of this intersection was based on field observations during typical weekday peak hours.

### **Unsignalized Intersections**

Level-of-service analyses in this report for two-way stop-controlled intersections are based on the intersection's ability to accommodate the most difficult, or critical, approach as overall intersection level of service is not defined by the *2000 Highway Capacity Manual*. The City of Milwaukie considers unsignalized intersections to be operating acceptably as long as the intersection operates at LOS "D" or better.

**EXISTING CONDITIONS**

The existing conditions analysis identifies site conditions and the current operational and geometric characteristics of roadways within the study area. The purpose of this section is to provide a basis of comparison for future conditions.

The site of the proposed self-storage facility was visited and inventoried several times, most recently in September 2007. Information was collected regarding site conditions, adjacent land uses, existing traffic operations, and transportation facilities in the study area.

**Site Conditions & Adjacent Land Uses**

The site is currently occupied by a single-family home and a 4,000 square foot light industrial cabinet shop. A second single family home at the site was demolished in July of 2007. Each property has a dedicated full-access driveway onto SE Harmony Road (total of three driveways). The International Way Business Park is located to the west and has a right-out only driveway onto SE Harmony Road. The proposed development site is bordered to the north by a railroad line and SE Railroad Avenue. An apartment complex is located to the east of the site.

**Transportation Facilities**

The site is located on SE Harmony Road near Highway 224 (see Figure 1). Table 3 provides a summary of the facilities in the immediate vicinity of the project site. The existing lane configurations and traffic control devices at the study intersections are shown in Figure 3.

**Table 3  
 Existing Transportation Facilities and Roadway Designations**

Roadway	Classification	Cross Section	Speed Limit	Side-walks	Bike Lanes	On-Street Parking
SE Harmony Road	Major Arterial	2-3 lanes	40 mph	Partial <sup>1</sup>	Yes	No
SE Linwood Avenue	Minor Arterial	3 lanes	40 mph	Yes	Yes	No
SE Lake Road	Minor Arterial	2 lanes	40 mph	No	Yes	No
SE Railroad Avenue	Collector	3 lanes	40 mph	Partial <sup>2</sup>	No	No
SE International Way	Local	2 lanes	25 mph	Partial <sup>3</sup>	No	No

<sup>1</sup>Sidewalks only provided on north side and east of subject property.  
<sup>2</sup>Sidewalks only provided on north side  
<sup>3</sup>Sidewalks only provided in front of the International Way Business Center

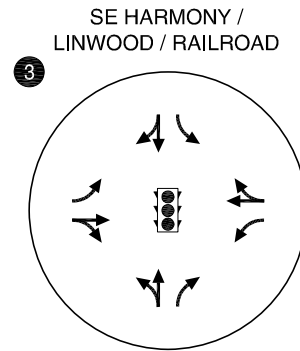
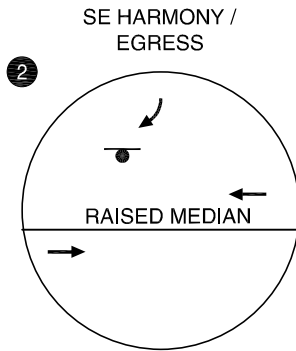
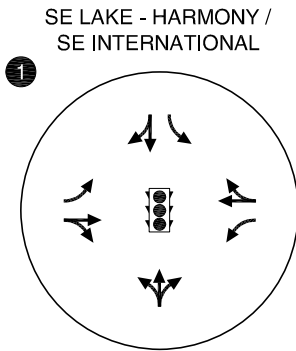
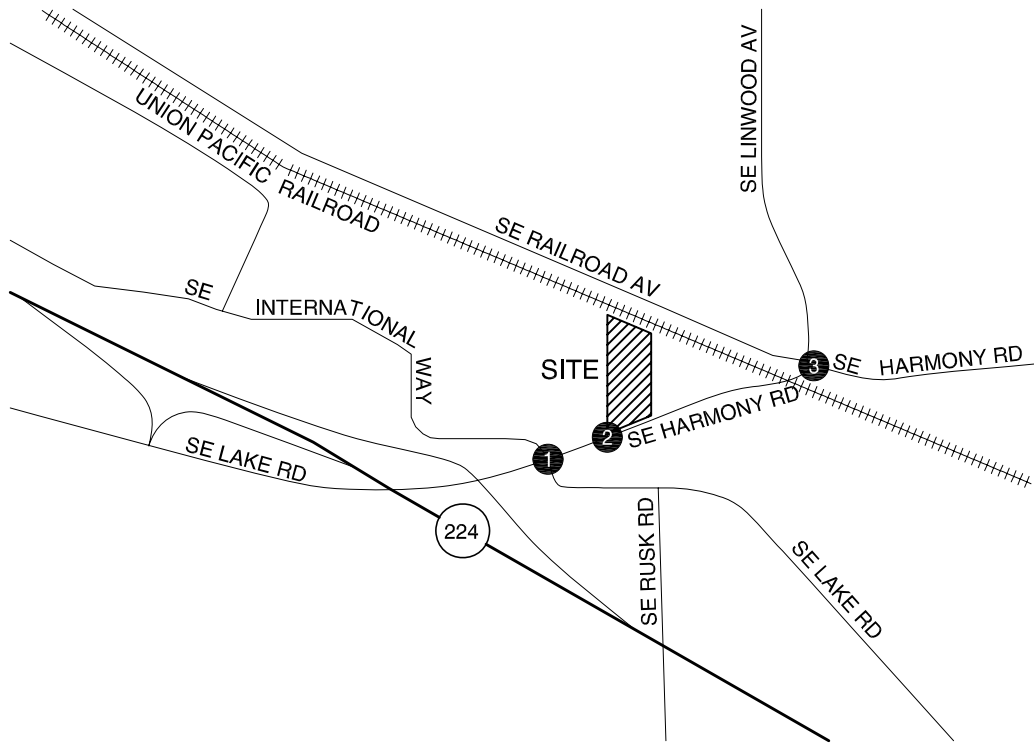
**Pedestrian and Bicycle Conditions**

Both of the signalized intersections have pedestrian crossing signals. Partial sidewalks are provided along the north side of SE Harmony Road, but in several locations are inaccessible due to overgrown foliage. There are currently no sidewalks along the site frontage. Field observations within the site vicinity revealed very low levels of pedestrian activity and bicycle activity along the study roadways.





(NO SCALE)



LEGEND

- STOP SIGN
- TRAFFIC SIGNAL

EXISTING LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES MILWAUKIE, OREGON

FIGURE 3

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## Transit Facilities

TriMet provides the following transit service in the site vicinity.

- Route 28-Linwood provides service between Milwaukie Transit Center and Clackamas Town Center. The route travels along SE Linwood Road and SE Harmony Road, with the nearest bus stop to the proposed development site at the intersection of SE Linwood Road/SE Harmony Road, approximately 1000 feet away. Service is provided on weekdays between approximately 6:30 a.m. and 7:30 p.m., nearly once every hour. There is no Saturday, Sunday, or holiday service.
- Route 29-Lake/Webster Rd also provides service between Milwaukie Transit Center and Clackamas Town Center. The route travels along SE Lake Road and south along SE Webster Road before traveling back north along SE Johnson Road and SE 82<sup>nd</sup> Avenue. The nearest bus stop is located at the SE Lake Road/SE Harmony Road intersection, approximately 500 feet from the proposed development site. Service is provided on weekdays between approximately 6:00 a.m. and 8:00 p.m., nearly once every hour. There is no Saturday, Sunday, or holiday service.
- Route 152-Milwaukie also provides service between Milwaukie Transit Center and Clackamas Town Center. The route travels along SE International Way and SE Lake Road. The nearest bus stop is shared with Route 29, and is located at the intersection of SE Lake Road/SE Harmony Road, approximately 500 feet from the proposed development site. Service is provided between approximately 6:45 a.m. and 5:15 p.m. at intervals of an hour and a half. There is no Saturday, Sunday, or holiday service.

All three of these routes provide access to the Milwaukie Transit Center, which provides connections to a wide variety of bus routes serving most of the region.

## Traffic Volumes and Existing Peak Hour Operations

Manual turning movement counts were obtained at the study intersections on mid-week days in August 2007. These counts were conducted during the weekday morning (7:00 a.m. to 9:00 a.m.) and evening (4:00 p.m. to 6:00 p.m.) peak periods for the SE International Way/SE Harmony Road and site egress/SE Harmony Road intersections. Turning movement counts at SE Linwood Avenue/SE Harmony Road were collected in April 2006<sup>1</sup> and applied to this study. A historical examination of traffic volumes was performed which found that volumes in the area decreased between 2002 and 2006. In order to provide a conservative analysis, a one-percent annual growth rate was applied to the volumes at this intersection.

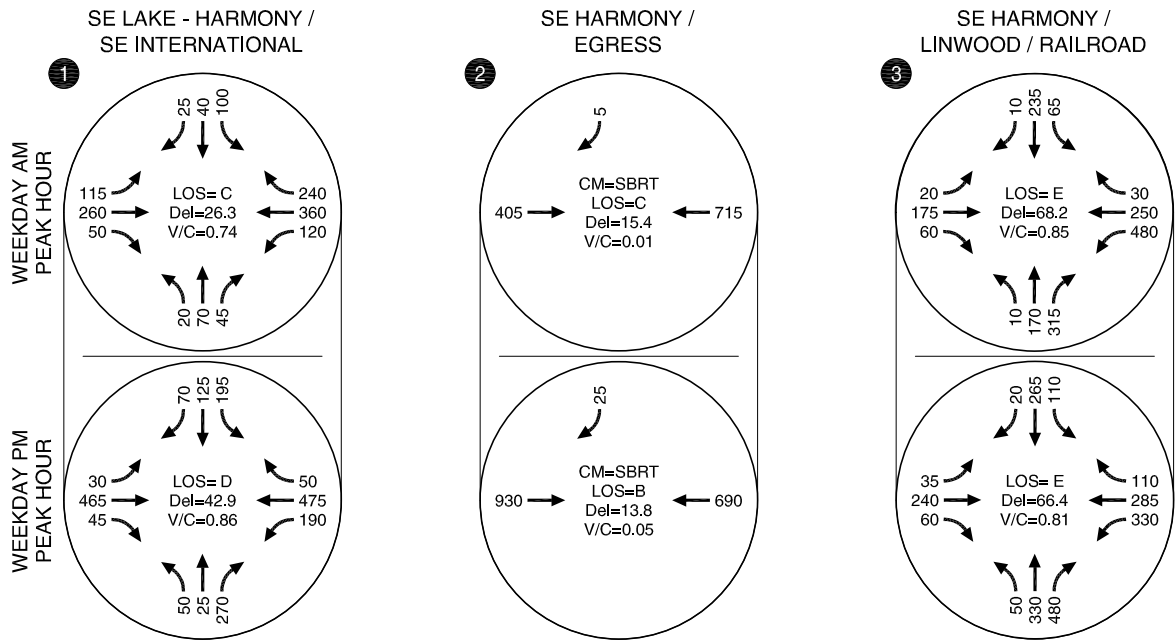
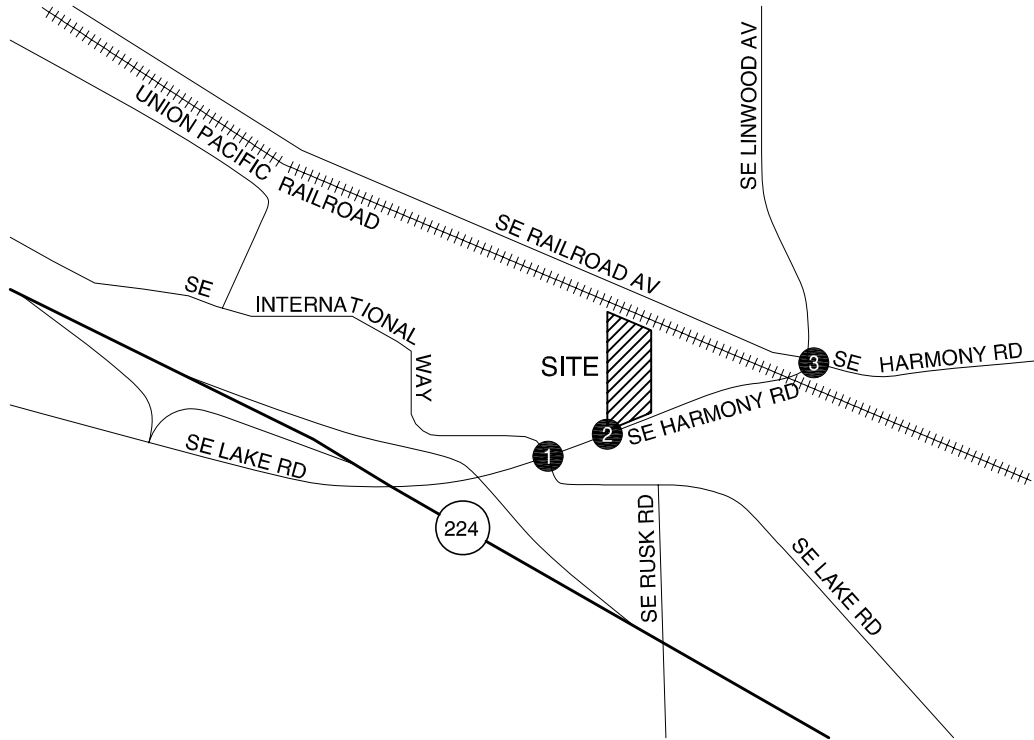
The turning movement counts from the weekday a.m. and p.m. peak hours were summarized and rounded to the nearest five vehicles per hour. The weekday morning peak hour was found to occur between 7:15 and 8:15 a.m., and the evening peak hour was found to occur between 4:10 and 5:10 p.m. Figure 4 summarizes the results of the intersection analysis for the three study intersections.

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<sup>1</sup> Use of these counts was approved by Clackamas County staff via email on October 23, 2007.



(NO SCALE)



**LEGEND**

CM = CRITICAL MOVEMENT (UNSIGNALIZED)  
 LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)  
 Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

**2007 EXISTING TRAFFIC CONDITIONS  
 WEEKDAY AM & PM PEAK HOURS  
 MILWAUKIE, OREGON**

**FIGURE  
 4**

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As shown in the figure, the SE International Way/SE Harmony Road intersection and the site access operate acceptably during both weekday a.m. and p.m. peak hours. The SE Linwood Avenue/SE Harmony Road intersection operates at LOS "E" during the weekday a.m. and p.m. peak hours. *Appendix "C" includes the year 2007 existing conditions analysis worksheets.*

#### *SE Linwood Avenue/SE Harmony Road*

The existing LOS "E" at the SE Linwood Avenue/SE Harmony Road intersection in part reflects a geometric constraint at the intersection. The unconventional intersection alignment precludes simultaneous northbound and southbound left-turn movements; as such, the signal utilizes split phasing for the northbound and southbound approaches, on an unusually long cycle length (up to 175 seconds).

In addition to the LOS "E" identified above, a major rail line crosses the northbound approach to the intersection approximately 20 feet south of the stop bar. The rail line is used by scheduled Amtrak passenger trains and multiple unscheduled freight trains on a daily basis. Depending on the speed of passing trains, the grade crossing gates can be closed for durations ranging from approximately one minute to three to five minutes. The rail crossing was not incorporated in the analysis.

Multiple field observations indicate that the crossings are not frequent during the weekday peak periods. Recent counts at the rail crossing identified three trains crossing during the weekday a.m. peak period (7:00 to 9:00 a.m.) and one train crossing during the weekday p.m. peak period (4:00 to 6:00 p.m.). The first two trains reported during the morning count occurred during the actual system peak hour, while the third morning train and the evening train were outside of the peak hour analysis period.

It is recognized that the reported train passage during the traffic count period represent only one day of field conditions and that variation occurs daily. During the course of three separate site visits, trains were observed to have caused extensive queuing along Harmony Road on one occasion and minimal train-related queuing was observed on the other two occasions.

#### **Crash History**

A five-year (2002-2006) crash history of the study intersections was obtained from the ODOT. There were no crashes reported during the analysis period at any of the study intersections. *Appendix "D" includes the crash data summary reports from ODOT.*

#### **TRANSPORTATION IMPACT ANALYSIS**

The transportation impact analysis identifies how the study area's transportation system will operate upon full build-out of the proposed development. The impact of traffic generated by the proposed self storage facility during typical weekday peak hours was examined as follows:

- Planned developments and transportation improvements in the site vicinity were identified and reviewed;



- Background traffic conditions (without site development) for the year 2009 were analyzed for the study intersections;
- Future peak hour site-generated trips were estimated for build-out of the proposed project;
- Site-generated traffic from proposed project were added to the background traffic volumes to evaluate year 2009 total traffic operations at the study intersections; and,
- Site access and circulation were examined.

### **2009 Background Traffic Volumes**

The background traffic analysis identifies how the study area's transportation system will operate in the year the proposed self storage facility will be completed and occupied. The 2009 background traffic volumes include approved or in-process developments. Based on information obtained during a recent project in the area, the following approved/in-process projects were identified for inclusion in background conditions:

- Sunnybrook Office Development;
- Clackamas Town Center expansion;
- Causey Village; and,
- Clackamas Community College.

City staff did not identify any other developments for inclusion in the analysis.

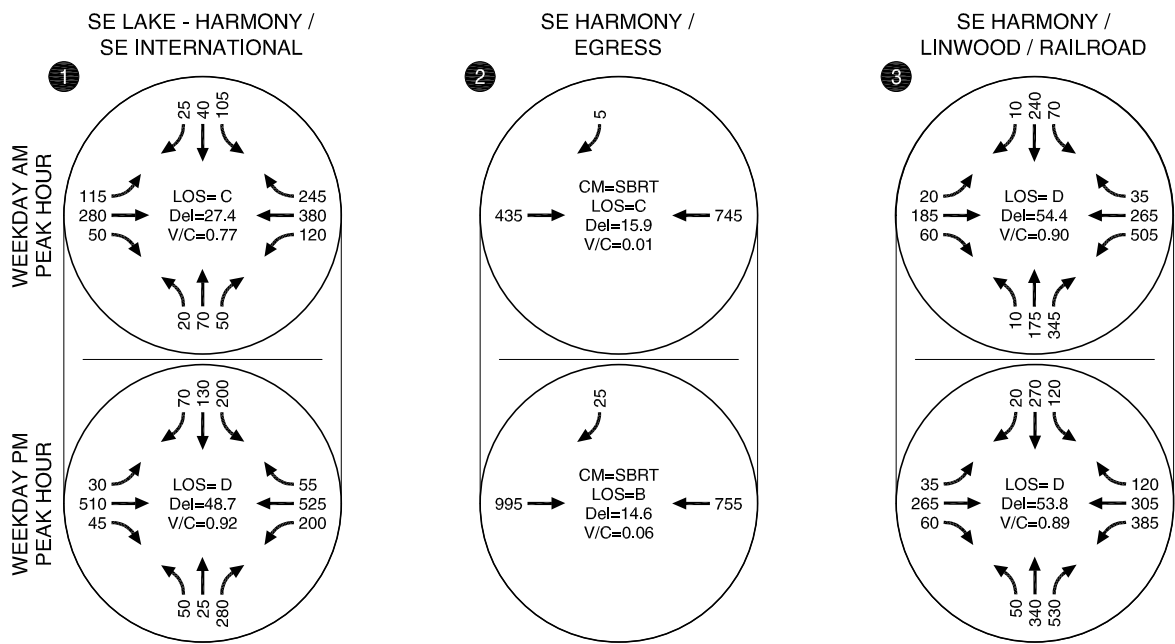
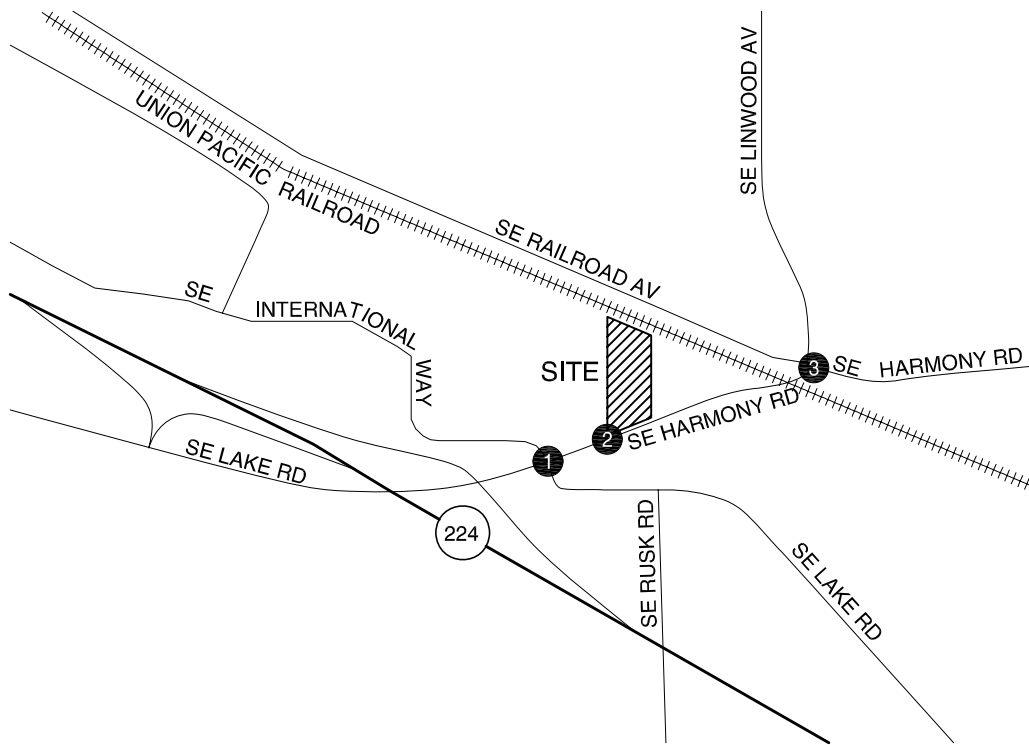
In addition to the increased traffic resulting from the identified in-process developments, traffic growth in the area was estimated based on a review of historic volumes at the study intersections. The historic volumes revealed that peak hour traffic volumes have been generally constant over the last several years, with a slight increase at the SE International Way/SE Harmony Road intersection which appear to be directly related to the International Way business park. A slight decrease in traffic at the SE Linwood Avenue/SE Harmony Road intersection has occurred. Although the review revealed generally stable or declining traffic volumes, a one-percent annual growth rate was applied to the 2007 traffic volumes in order to reflect a conservative analysis. *Appendix "E" contains the historic traffic volumes used in this analysis.*

### **Planned Transportation Improvements**

The SE Harmony/Linwood/Railroad intersection is planned to be modified with installation of a northbound right-turn overlap phase. This change was incorporated in the analysis. In addition, the analysis shows that reducing the overall traffic signal cycle length from 175 to 130 seconds would result in acceptable level of service and volume-to-capacity ratio. The resulting weekday a.m. and p.m. peak hour traffic volumes and intersection operations for 2009 background conditions are summarized in Figure 5.



(NO SCALE)



**LEGEND**

- CM = CRITICAL MOVEMENT (UNSIGNALIZED)
- LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
- Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
- V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

**2009 BACKGROUND TRAFFIC CONDITIONS  
WEEKDAY AM & PM PEAK HOURS  
MILWAUKIE, OREGON**

FIGURE  
**5**

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As indicated in the figure, the study intersections are all forecast to operate acceptably during the weekday a.m. and p.m. peak hours with the planned improvements at the SE Harmony Road/SE Linwood Road intersection. Appendix "F" contains the year 2009 background level-of-service worksheets.

**Proposed Development Plan**

The project is proposed to include an approximately 100,000-square-foot mini-storage facility with approximately 450 storage units. Access is proposed to be via a right-in/right-out driveway on SE Harmony Road which will incorporate the existing right-out driveway serving the International Way Business Park directly west of the project site<sup>2</sup>. A secondary ingress will be via a right-in driveway on SW International Way, under an access easement from the business park.

**Trip Generation**

As described earlier, trip generation estimates for the proposed mini-storage facility were developed from traffic counts conducted at three existing self-storage facilities in Milwaukie, Oregon. Mid-weekday counts were conducted during the weekday a.m. and p.m. peak periods (7:00-9:00 a.m. and 4:00-6:00 p.m.). Peak hour trip generation rates were developed as a function of the number of storage units at each site. Weekday daily trip generation was estimated based on the relationship of daily to peak hour trips, as summarized in the standard reference manual, *Trip Generation* (Reference 3). The trip generation estimate for the proposed mini-storage facility is summarized in Table 4. The table also shows the estimated trip generation for the existing land uses, based on data summarized in *Trip Generation*.

**Table 4  
 Estimated Weekday Trip Generation**

Land Use	ITE Code	Size	Daily	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out
Proposed Land Use									
Mini-Warehouse		450 units	80*	4	2	2	8	4	4
Existing Land Uses									
Single Family Home	210	2 homes	20	2	0	2	2	2	0
Light Industrial	110	4,000 s.f.	28	4	3	1	4	1	3
<b>Total</b>			<b>48</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>3</b>	<b>3</b>
Net Change									
Incremental Trips			32	-2	-1	-1	2	1	1

\* A reduction to the ITE daily total trips was applied to match those measured for the a.m. and p.m. peak hours

<sup>2</sup> At the time that the International Way Business Park access was developed, there was not sufficient property width to provide a two-way driveway. The Harmony Road Mini Storage development proposes conversion of this driveway to allow right-in/right-out movements.

As Table 4 shows, the proposed redevelopment of the site is estimated to result in only slight changes in site-generated traffic during typical weekday a.m. and p.m. peak hours.

### **Trip Distribution**

The trip distribution pattern for the site was estimated based on roadway facilities in the area, existing travel patterns, and the location and type of surrounding developments. Figure 6 shows the estimated trip distribution pattern. The trips were assigned to the study intersections according to the estimated distribution pattern, as shown in Figure 6. Figure 6 also illustrates anticipated re-routing of traffic entering the International Way Business Park; these trips currently utilize the driveway on SE International Way but with the development would be able to enter via the right-in/right-out driveway on SE Harmony Road. This new ingress opportunity is estimated to reduce westbound right turns at the SE Harmony/SE International Way intersection by approximately ten vehicles during the weekday a.m. peak hour and by approximately five vehicles during the weekday p.m. peak hour.

### **2009 Total Traffic Conditions**

The total traffic conditions analysis forecasts how the study area's transportation system will operate with the inclusion of traffic from the proposed mini-storage facility and the re-routing of trips to the new driveway. The site-generated trips at the study intersections (Figures 7 and 8) were added to the 2009 background traffic volumes (Figure 5) to arrive at the total traffic volumes as shown in Figure 9. As indicated in the figure, the total traffic analysis determined that all of the study intersections will continue to operate acceptably upon site build-out during both the weekday a.m. and p.m. peak hours. Some intersection operations improved slightly due to the re-routed business park trips. *Appendix "G" contains the 2009 total traffic level-of-service worksheets.*

### **Sensitivity Analysis**

A sensitivity analysis was conducted to analyze traffic impacts using an alternative trip generation estimate requested by ODOT. The alternative trip generation estimate is based on building square footage instead of storage units and results in a higher trip estimate. Under this approach, the net new trips generated by the proposed development site is estimated to be two trips during the weekday a.m. peak hour, and nine trips during the weekday p.m. peak hour. The analysis found that each of the study intersections will operate acceptably under the alternative trip generation estimate. *Appendix "H" contains the sensitivity analysis level-of-service worksheets.*

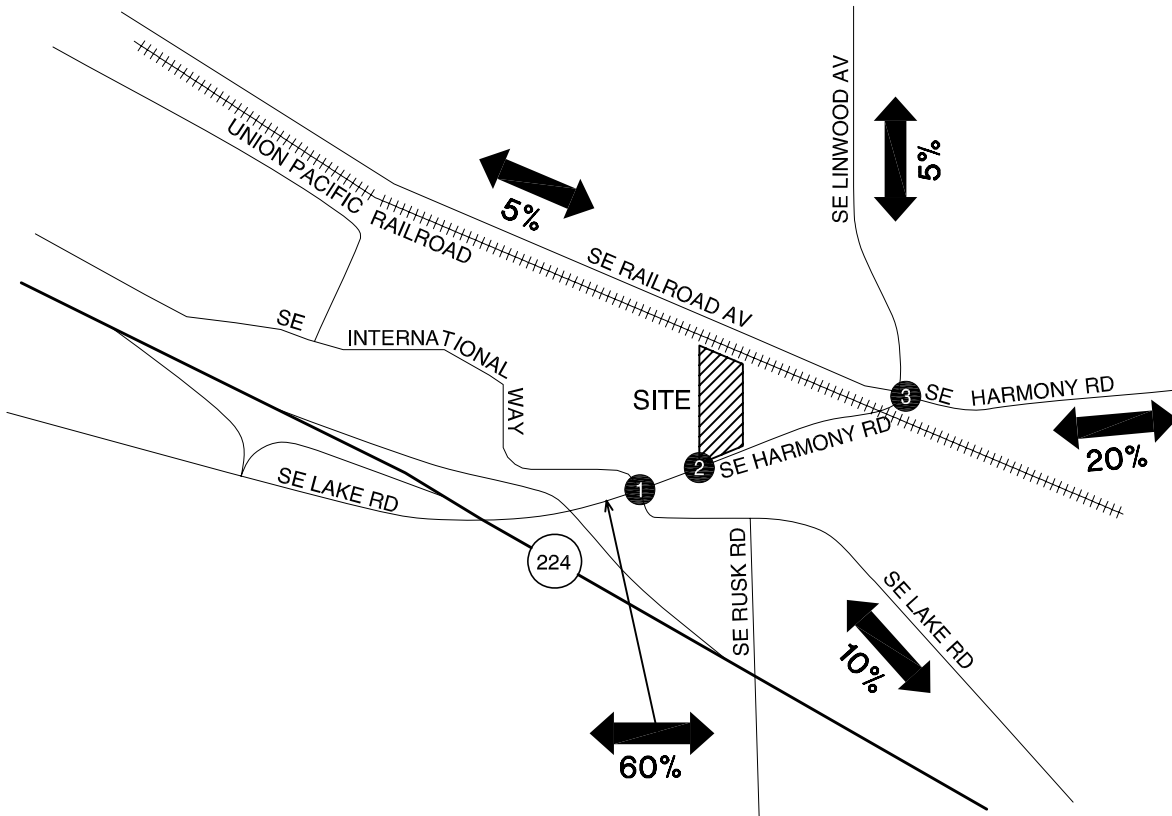
## **CLACKAMAS COUNTY ACCESS MANAGEMENT PLAN**

As described above, access to the site is proposed via a right-in/right-out driveway on SE Harmony Road. Under the proposed site plan, an existing right-out driveway serving the International Way Business Park will be modified to provide right-in/right-out access to both the existing business park and the proposed self-storage facility. This section addresses access spacing, intersection operations, including queuing, and sight distance.





(NO SCALE)



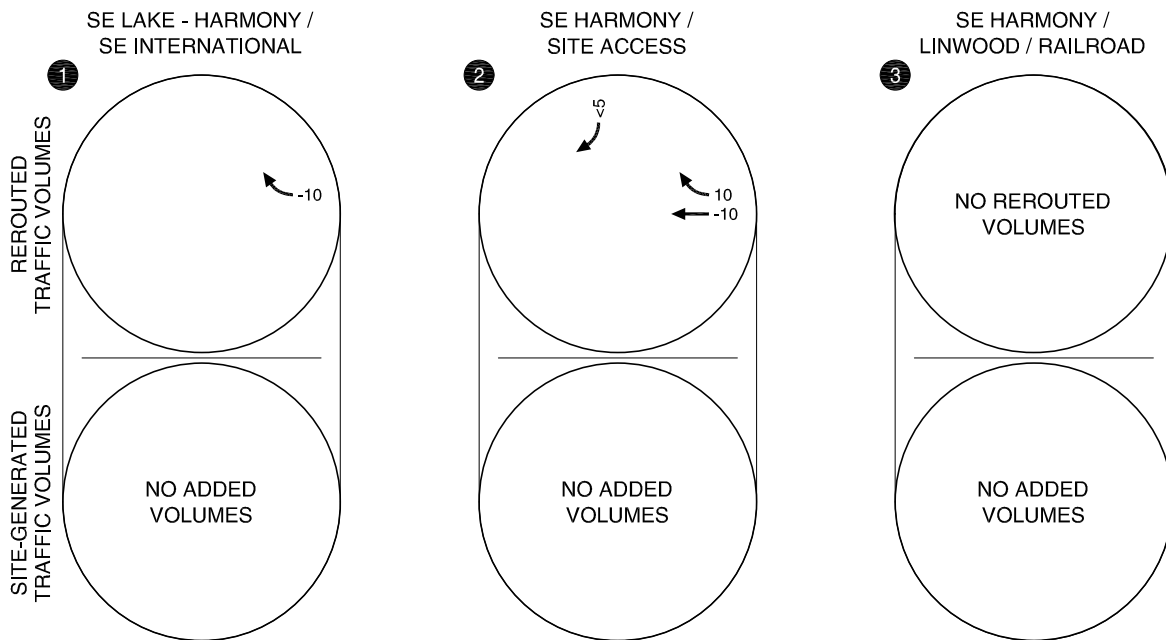
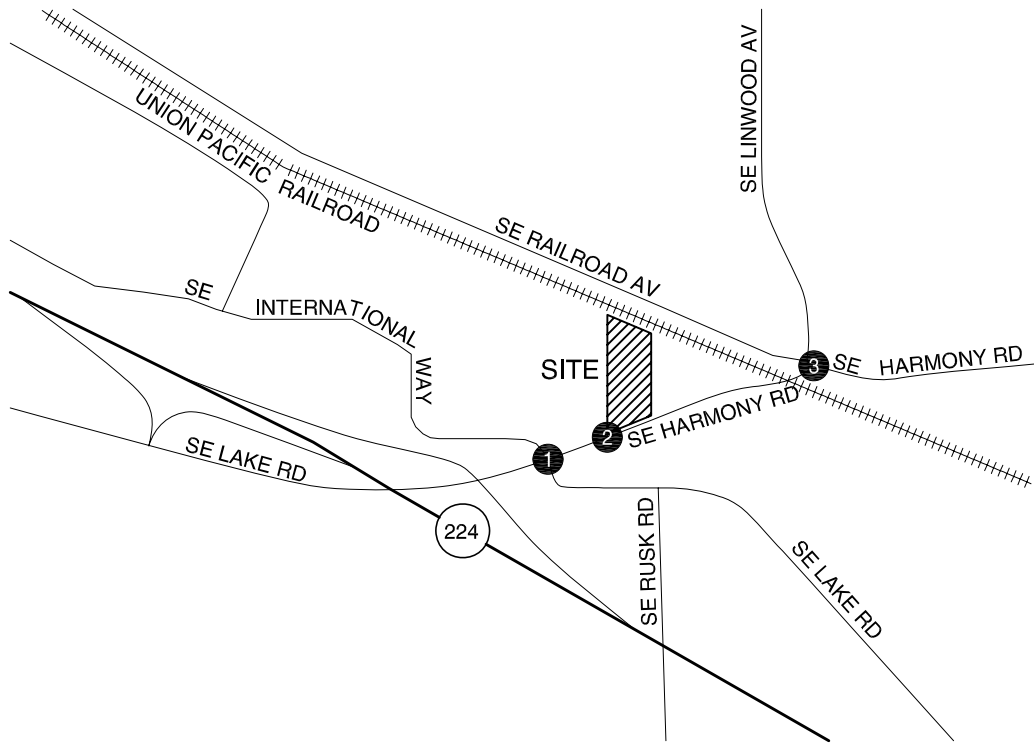
ESTIMATED TRIP DISTRIBUTION PATTERN  
MILWAUKIE, OREGON

FIGURE  
6

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(NO SCALE)



NOTE: TRAFFIC VOLUMES HAVE BEEN ROUNDED TO THE NEAREST FIVE TRIPS

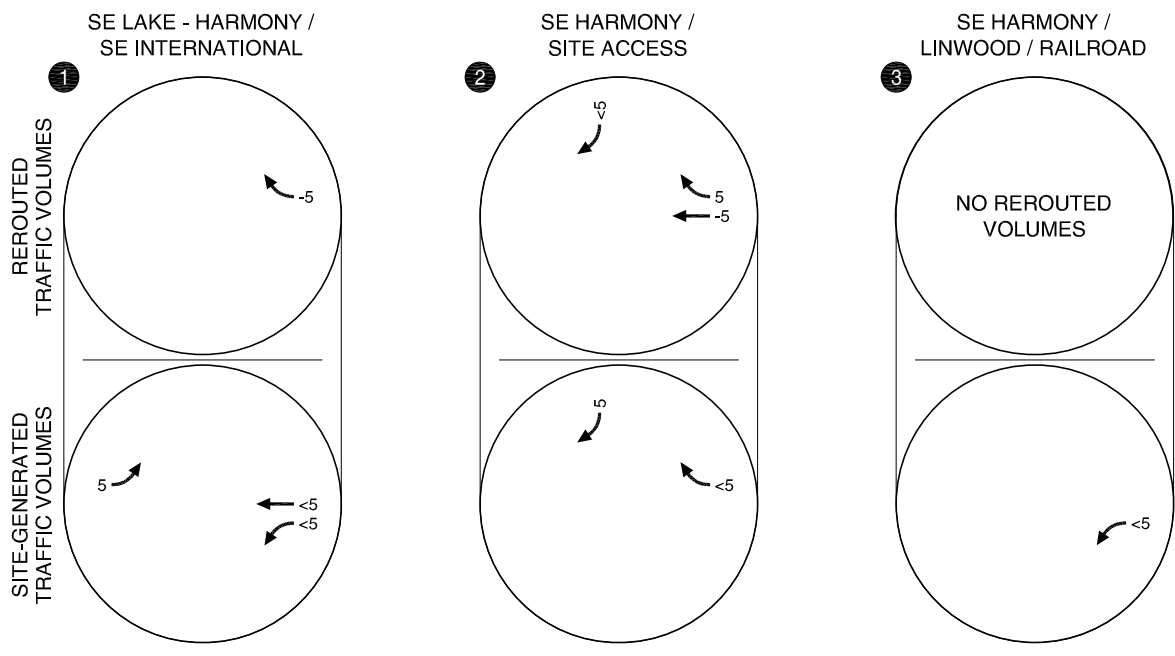
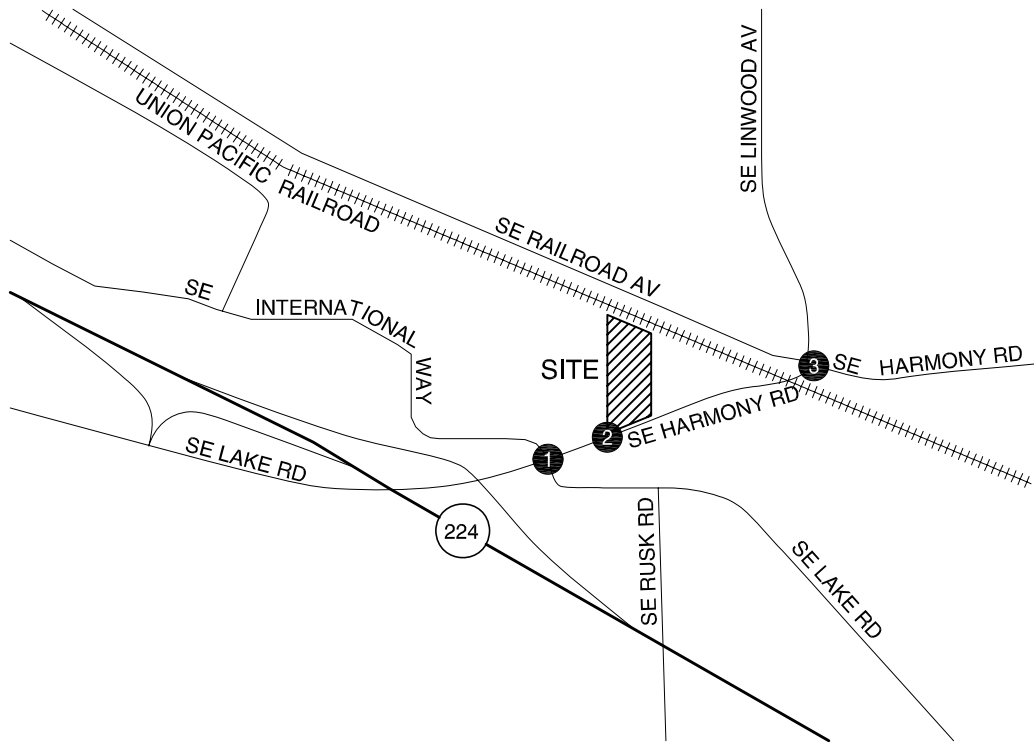
**SITE-GENERATED AND REROUTED BUSINESS PARK TRAFFIC VOLUMES  
WEEKDAY AM PEAK HOUR  
MILWAUKIE, OREGON**

FIGURE  
**7**

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NOTE: TRAFFIC VOLUMES HAVE BEEN ROUNDED TO THE NEAREST FIVE TRIPS

**SITE-GENERATED AND REROUTED BUSINESS PARK TRAFFIC VOLUMES  
WEEKDAY PM PEAK HOUR  
MILWAUKIE, OREGON**

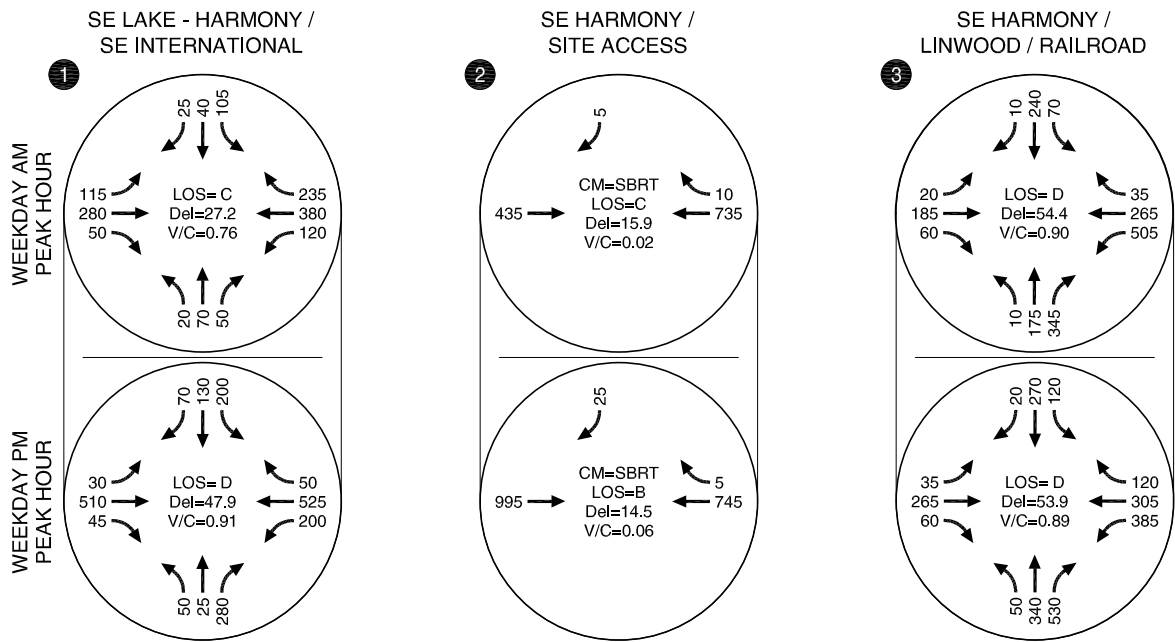
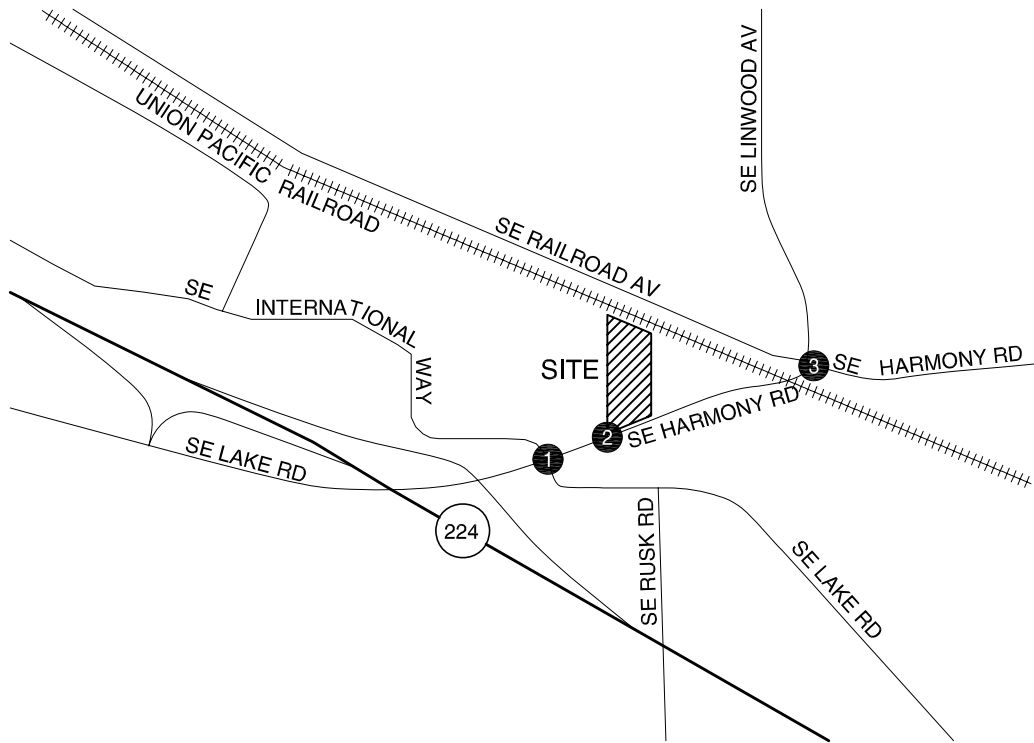
FIGURE

**8**

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**LEGEND**

CM = CRITICAL MOVEMENT (UNSIGNALIZED)  
 LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)  
 Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

**2009 TOTAL TRAFFIC VOLUMES  
 WEEKDAY AM & PM PEAK HOURS  
 MILWAUKIE, OREGON**

**FIGURE  
 9**

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### **Intersection Operations/Queuing**

As shown in Figure 9, the proposed driveway is expected to operate acceptably under 2009 total traffic conditions during both weekday a.m. and p.m. peak hours.

Queuing at the SE Harmony/SE International Way intersection has been identified as a concern by Clackamas County staff. Because of the very slight increase in traffic volumes associated with the proposed project, no measurable impacts on queuing are expected to result from the project. However, some slight benefits may be realized by allowing ingress to the International Way Business Park via the right-in/right-out driveway on SE Harmony Road.

A more significant improvement will result from the removal of conflicting left-turn movements that are currently allowed at the three existing site driveways.

### **Access Spacing**

Clackamas County classifies SE Harmony Road as a major arterial. According to Table V-5 of the Clackamas County Comprehensive Plan, driveways on these facilities should be located to provide 400 feet spacing, except where no other alternatives exist. Figure 10 illustrates the existing access spacing along SE Harmony Road. Figure 10 shows the three driveways currently along the site frontage on SE Harmony Way, resulting in access spacing of 98 feet, 27 feet, 32 feet, and 177 feet (west to east, center-line to center-line).

Figure 11 depicts the proposed access plan, which would close the three existing full-access driveways and modify the existing right-out driveway serving the International Way Business Park so that it would provide right-in/right-out access to the self-storage and the business park. As the figure shows, the proposed access plan would improve access spacing to 312 feet along the site frontage. Further, this plan would remove conflicting left turn movements that are currently permitted at the three private driveways serving the site.

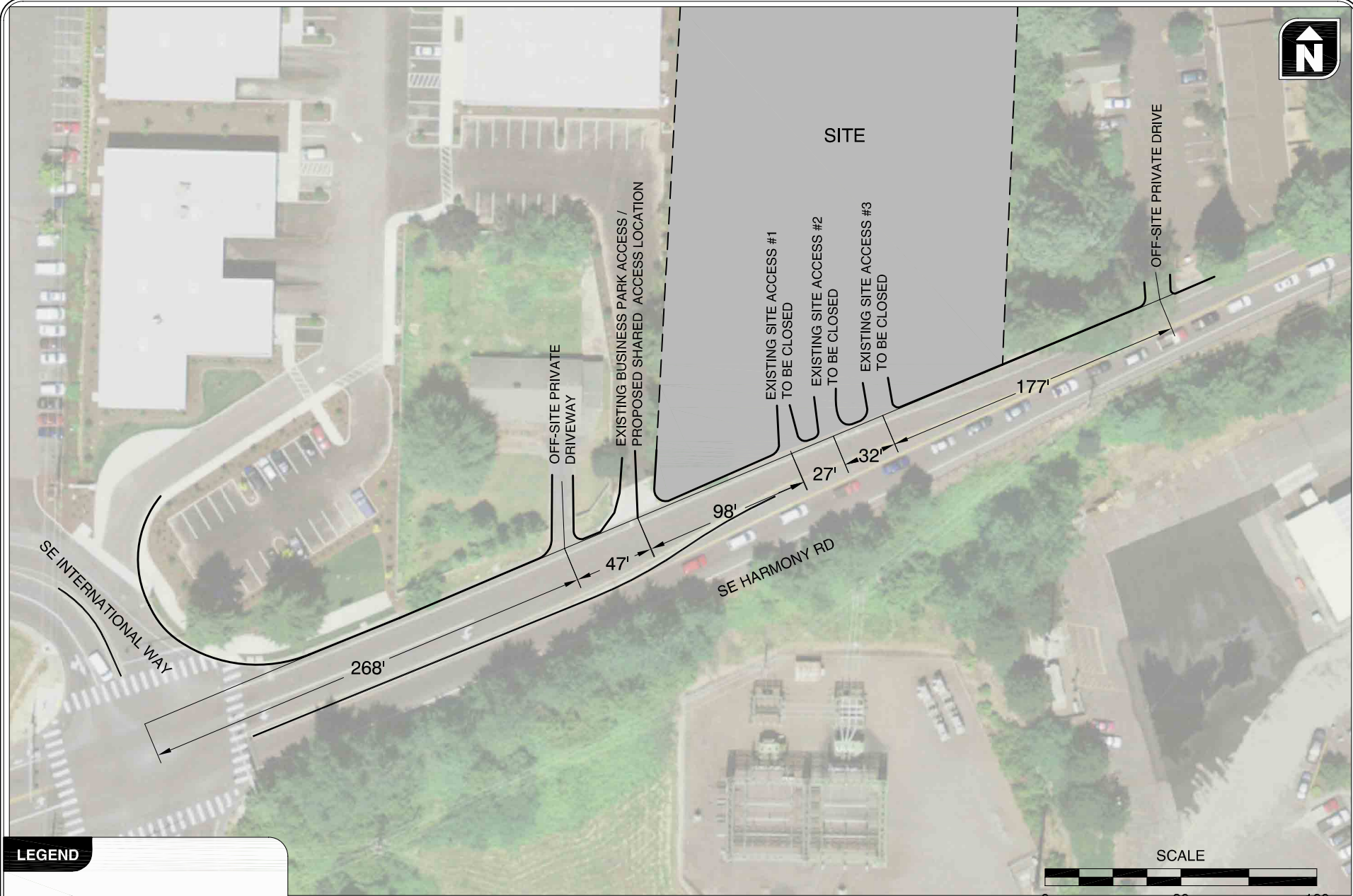
### **Sight Distance**

Intersection and stopping sight distance were evaluated at the proposed SE Harmony Road access. The sight distance evaluation was conducted according to the standard manual *A Policy on Geometric Design of Highways and Streets* (commonly referred to as the *Green Book*) published by the American Association of State Highway and Transportation Officials (AASHTO, Reference 4).

A speed study was conducted on SE Harmony Road to determine the 85<sup>th</sup> percentile travel speed. The speed study was conducted approximately 800 feet east of SE International Way for a 24-hour period in October 2007. The 85<sup>th</sup> percentile speed was found to be 37 miles per hour (mph) for westbound vehicles approaching the site. Table 5 summarizes the AASHTO guidelines according to travel speeds of 37 miles per hour as well as measured sight distances at the proposed driveway. The measured sight distances assume the removal of brush along the roadway frontage of the proposed development site.

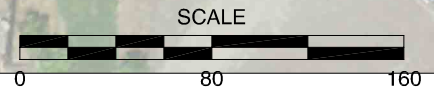


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**LEGEND**

- - - - SITE BOUNDARY
- — — EXISTING RAISED MEDIAN



EXISTING ACCESS SPACING ON HARMONY ROAD MILWAUKIE, OREGON

FIGURE 10

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**LEGEND**

- - - - - SITE BOUNDARY
- — — — — EXISTING RAISED MEDIAN

PROPOSED ACCESS SPACING ON HARMONY ROAD MILWAUKIE, OREGON

FIGURE 11

**Table 5  
 Sight Distance Calculations at Existing Right-Out on SE Harmony Road**

Vehicle	Intersection Sight Distance			Stopping Sight Distance		
	AASHTO	Measured	Adequate?	AASHTO	Measured <sup>1</sup>	Adequate?
Passenger Car <sup>2</sup>	355'	540'	Yes	270'	460'	Yes
Single Unit Truck <sup>3</sup>	465'	560'	Yes	270'	460'	Yes
Combination Truck <sup>3</sup>	575'	560'	No	270'	460'	Yes

<sup>1</sup> Measured from 3.5' driver's eye height to 2.5' fender height  
<sup>2</sup> Measured from 3.5' driver's eye height to 3.5' driver's eye height  
<sup>3</sup> Measured from 7.5' driver's eye height to 3.5' driver's eye height

As shown in Table 5, the existing right-out only access meets AASHTO requirements for both intersection and stopping sight distances for passenger cars and single-unit trucks. For combination trucks, 560 feet of intersection sight distance is available where 575 feet is considered desirable.

AASHTO also identifies the minimum sight distance as equal to the stopping sight distance for approaching vehicles. The calculated minimum stopping sight distance is 270 feet. The measured intersection sight distance of 560 feet is greater than the minimum sight distance standard identified by AASHTO and is therefore sufficient according to AASHTO standards.<sup>3</sup> Further, vehicle counts revealed only one combination truck using the driveway during the weekday a.m. and p.m. peak hours. Therefore, for the vast majority of traffic, AASHTO's "desired" sight distance is available. *The speed study report and sight distance calculations are provided in Appendix "I"*

**FINDINGS & CONCLUSION**

The analysis described in this report resulted in the following key findings and recommendations:

**TPR Compliance**

- Comparing allowed uses, the proposed zone change and conditional use application results in a reduction of site trip generation potential from approximately 920 daily trips (under current zoning) to approximately 80 daily trips, with the proposed conditional use self-storage facility. The application is estimated to reduce peak period trips by approximately 130 and 125 trips during the a.m. and p.m. peak hours, respectively.

**Existing Conditions**

- The SE International Way/SE Harmony Road intersection and the site access operate acceptably during both weekday a.m. and p.m. peak hours. The SE Linwood Avenue/SE

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<sup>3</sup> The AASHTO *Green Book*, page 651, states that "if the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions."

Harmony Road intersection operates at LOS "E" during the weekday a.m. and p.m. peak hours.

- Based on ODOT data, there were no reported crashes at the study intersections over the most recent five-year period for which data are available.

## **2009 Future Conditions**

- The study intersections are all forecast to operate acceptably during the weekday a.m. and p.m. peak hours under 2009 background conditions, with planned installation of a northbound right-turn overlap phase and assumed signal timing changes at the SE Harmony/Linwood/Railroad intersection.
- The proposed development is estimated to result in only minor changes in weekday trip generation when compared to the existing single family homes and industrial building on-site. Weekday trips are estimated to increase by approximately 30 daily trips, with a.m. peak hour trips declining slightly (approximately two trips) and p.m. peak hour trips increasing slightly (approximately two trips).
- The study intersections are all forecast to operate acceptably during the weekday a.m. and p.m. peak hours under 2009 total traffic conditions. Total volumes include site-generated trips and re-routed traffic resulting in the International Way Business Park vehicles using the new right-in access on SE Harmony Road.
- The proposed project is not expected to have a measurable impact on intersection queuing. However, removal of the left-turn movements at the existing site driveways will eliminate conflicting movements that currently can exacerbate queuing conditions. Further, some out of direction travel to the International Way Business Park will be reduced due to the new shared right-in access on SE Harmony Road.

## **Access Management**

- The proposed access plan will result in closure of three full access driveways and will bring access spacing closer to Clackamas County desired standards.
- Adequate sight distance will be available at the proposed site driveway for passenger vehicles, single-unit trucks, and combination trucks, according to AASHTO standards.

Based on the analysis and findings documented in this report, the proposed zone change, contingent on the approval and development of the proposed self-storage facility, can be approved without negatively impacting the transportation system.

## **Recommendations**

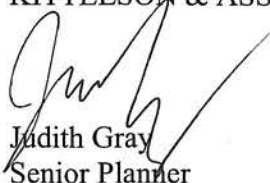
- Remove existing vegetation along the site frontage to improve sight lines at the proposed shared access driveway.




- Approval of the proposed zone change should be subject to a "trip cap" equivalent to the proposed 450-unit mini storage facility (80 daily trips, 5 a.m. peak hour trips, 10 p.m. peak hour trips)

We look forward to discussing this project with you at the earliest opportunity.

Sincerely,  
KITTELSON & ASSOCIATES, INC.

  
Judith Gray  
Senior Planner

  
Conor Semler  
Transportation Analyst

### References

1. LandDesignNW, *Harmony Road Zone Analysis*, 2007.
2. Institute of Transportation Engineers. *Trip Generation*, Seventh Edition. 2003
3. Transportation Research Board. *Highway Capacity Manual*. 2000
4. American Association of State Highway and Transportation Officials. *A Policy on Geometric Design of Highways and Streets*, 2004.

### Appendices

- A. Traffic Count and Trip Generation Count Data
- B. Description of Level-of-Service Methods and Criteria
- C. 2007 Existing Conditions Analysis Worksheets
- D. Crash Data
- E. Historic Traffic Counts
- F. 2009 Background Conditions Analysis Worksheets
- G. 2009 Total Traffic Conditions Analysis Worksheets
- H. Sensitivity Analysis Worksheets
- I. Speed Study Report & Sight Distance Calculations

