Report for

City of
WILSONVILLE
in OREGON

Fred Meyer
Transportation Impact Study

Prepared by

DKS Associates
TRANSPORTATION SOLUTIONS

August 2008

City of Wilsonville
Exhibit C7
DB08-0023

DKS Associates
TRANSPORTATION SOLUTIONS

August 19, 2008

Steve Adams, P.E.
Deputy City Engineer
City of Wilsonville
29799 Town Center Loop East
Wilsonville, OR 97070

Subject: Wilsonville Fred Meyer Transportation Impact Study

P08015-009-000

Dear Steve,

DKS Associates is pleased to submit this traffic impact study for the proposed Fred Meyer development located on the northeast corner of Boones Ferry Road and Bailey Street in the City of Wilsonville, Oregon. One reproducible copy has been included for your use. Please feel free to call if you have any questions or comments regarding this study.

Sincerely,

DKS Associates
A Corporation

Scott M. Mansur

Scott Mansur, P.E., P.T.O.E.
Transportation Engineer

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CHAPTER 1: INTRODUCTION AND SUMMARY

This study evaluates the transportation impacts for the proposed Fred Meyer development located on the northeast corner of Boones Ferry Road and Bailey Street in the City of Wilsonville, Oregon. It also recommends mitigation measures to offset the impacts.

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The currently proposed development includes a 155,881 square-foot Fred Meyer building (which includes the Fred Meyer store as well as 10,100 square feet of additional tenant space[1]), six other buildings (which include 50,879 square feet of retail/office use and a 3,316 square-foot restaurant), and 60 residential apartment units.[2] The site has four access points to the public street system: two on SW Boones Ferry Road and two on SW Bailey Street.

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

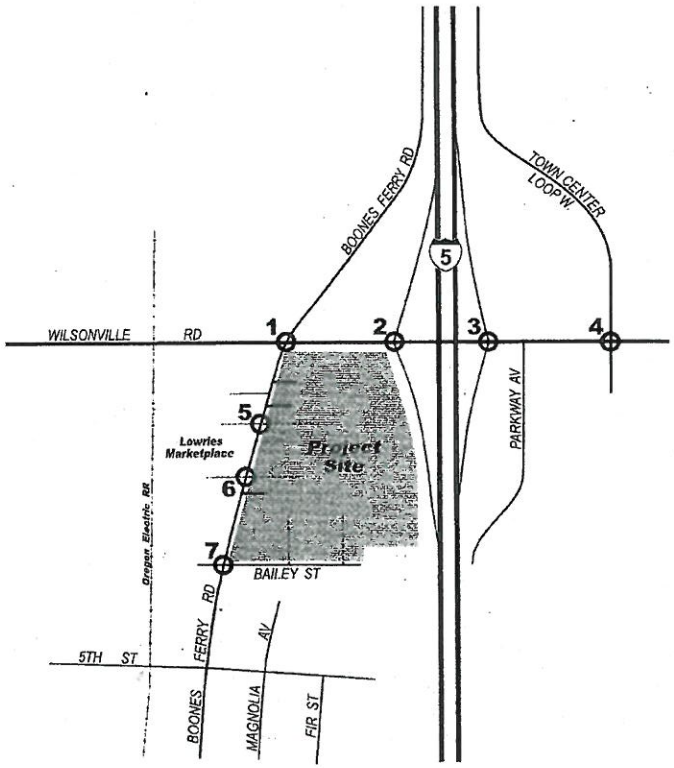
- Boones Ferry Road/Wilsonville Road
- I-5 Southbound Ramps/Wilsonville Road
- I-5 Northbound Ramps/Wilsonville Road
- Town Center Loop West/Wilsonville Road
- Boones Ferry Road/Fred Meyer north access
- Boones Ferry Road/Fred Meyer south access
- Boones Ferry Road/Bailey Street

Project traffic impacts were evaluated at the study intersections for the weekday PM peak hour. The impact analysis includes trip generation, trip distribution, PM peak hour project trips through the two City of Wilsonville I-5 interchange areas, and future traffic operating conditions. The analysis also accounts for developments in the area that have Stage II approval, including those under construction but not yet occupied. Recommended mitigations are then described and analyzed. Included in the mitigations section of Chapter 3 is a conceptual cross-section layout for Boones Ferry Road between Bailey Road and Wilsonville Road (see Figure 5).

Other issues addressed in this report include Saturday peak hour safety analysis and a project site evaluation (which addresses access location and spacing), sight distance, project frontage adjustments, traffic signal warrants, internal circulation, and parking. At the end of the report, a summary is presented of the recommended transportation mitigation measures that are expected to offset the negative transportation impacts of future traffic growth.

Table 1 lists important characteristics of the study area and proposed project.

[1] Tenant space within a Fred Meyer building is typically occupied by businesses providing additional goods or services, such as coffee shops or banks.
[2] Email from Christine McKelvey, Group Mackenzie, July 2, 2008.



LEGEND
1 - Study Intersection & Number
- Proposed Fred Meyer Driveway
- Existing Lowries Driveway
- Existing Driveway to be Removed

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NO SCALE

Figure 1
STUDY AREA

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TABLE 1: Study Area and Proposed Project Characteristics

Study Area	
Number of Study Intersections	7
Analysis Periods	Weekday PM Peak (4:00 p.m. to 6:00 p.m.) Saturday Midday Peak (11:00 a.m. to 1:00 p.m.)
Proposed Development	
Total Weekday PM Peak Hour Project Trips	1,255 (627 in, 628 out)
Non Pass-by[a] Weekday PM Peak Hour Project Trips	937 (468 in, 469 out)
Net New Weekday PM Peak Hour Project Trips	488 (244 in, 244 out)
Estimated Weekday PM Peak Hour Project Trips Through I-5/Wilsonville Road Interchange[b]	612 (768 new trips – 156 grandfathered trips)
Estimated Weekday PM Peak Hour Project Trips Through I-5/Elligsen Road Interchange	2
Vehicle Access Points	Four full access points: two on SW Boones Ferry Road and two on SW Bailey Street.
Project Vicinity	
Pedestrian Facilities	Sidewalks to be constructed along project frontage of Boones Ferry and Bailey Street with connection to Wilsonville Road.
Bicycle Facilities	Sidewalks and bike lanes on Boones Ferry Road and Wilsonville Road
Nearest Transit Stop	Boones Ferry Road (SMART Routes 1X and 203)

[a] Non-Pass-by project trips account for pass-by and internal trip reductions.
[b] The Wilsonville Road interchange area includes the Boones Ferry Road/Wilsonville Road intersection. Some of the new project trips that pass through this intersection are diverted trips.

Project Traffic Impact

To determine project impact at the study intersections, traffic operating conditions were analyzed at the study intersections during the weekday PM peak hour for the following four scenarios:

- Existing Conditions
- Existing plus Project
- Existing plus Stage II
- Existing plus Project plus Stage II

The study intersection operating conditions (assuming the existing roadway network) for the "Existing," "Existing plus Stage II," and "Existing plus Project plus Stage II" scenarios are listed in Table 2. Under existing conditions, all study intersections meet the City of Wilsonville LOS "D" standard and the Oregon Department of Transportation (ODOT) 0.99 volume-to-capacity (V/C) standard during the PM peak hour. With the addition of stage II traffic, both northbound and southbound ramps exceed operating standards. When project traffic is also added, all four study intersections on Wilsonville Road exceed operating standards. In addition, the two Fred Meyer development accesses on Boones Ferry Road operate below desired levels.

TABLE 2: Study Intersection Operating Conditions (PM Peak Hour)

Intersection[a]	Operating Standard	Existing Conditions			Existing + Stage II			Existing + Stage II + Project		
		Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C
Signalized										
Boones Ferry Rd / Wilsonville Rd	LOS D	36.0	D	0.77	44.5	D	0.89	>80	**F**	>1.0
I-5 SB Ramps / Wilsonville Rd	LOS D, 0.99 V/C	36.1	D	0.90	79.1	**E**	**>1.0**	>80	**F**	**>1.0**
I-5 NB Ramps / Wilsonville Rd	LOS D, 0.99 V/C	37.2	D	0.91	70.9	**E**	**>1.0**	>80	**F**	**>1.0**
Town Center Loop W / Wilsonville Rd	LOS D	37.7	D	0.80	51.2	D	0.94	56.2	**E**	0.97
Unsignalized										
Boones Ferry Rd / North Project Access	-	12.7	A/B	0.13	13.9	A/B	0.18	>50	A/F	>1.0
Boones Ferry Rd / South Project Access	-	11.9	A/B	0.14	12.4	A/B	0.15	>50	A/F	0.71
Boones Ferry Rd / Bailey St	LOS D	10.9	A/B	0.06	11.6	A/B	0.06	13.8	A/B	0.12

Signalized intersections:
Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Unsignalized intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

Planned Wilsonville Road Improvements

Due to capacity constraints at the I-5/Wilsonville Road interchange, improvements are planned that will provide additional capacity along Wilsonville Road between Boones Ferry Road and Town Center Loop West. Recently, the City has signed an intergovernmental agreement to construct the first phase of improvements, which will consist of a Wilsonville Road 6-lane enhanced alternative that focuses on ramp improvements and on adjustments to intersection lane configurations.

For the four study intersections on the Wilsonville Road corridor, a Synchro™ model of the improved Wilsonville Road cross-section was used to analyze intersection operating conditions for each of the three

future PM peak hour traffic scenarios (i.e., "Existing plus Project", "Existing plus Stage 2", and "Existing plus Project plus Stage 2"). The results of the analysis are listed in Table 3. As shown in the table, all four study intersections on Wilsonville Road comply with the City of Wilsonville LOS D operating standard for each of the three scenarios. The two I-5 ramps also meet the Oregon Department of Transportation (ODOT) 0.99 volume-to-capacity (V/C) standard.

TABLE 3: Future Operating Conditions of Wilsonville Road Intersections with Six-Lane Enhanced Alternative Improvements (PM Peak Hour)

Intersection	Operating Standard	Existing + Project + Improvements			Existing + Stage 2 + Improvements			Existing + Project + Stage 2 + Improvements		
		Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C
Signalized										
Boones Ferry Rd / Wilsonville Rd	LOS D	37.7	D	0.66	31.1	C	0.67	39.3	D	0.75
I-5 SB Ramps / Wilsonville Rd	LOS D	20.6	C	0.64	22.0	C	0.72	22.7	C	0.76
I-5 NB Ramps / Wilsonville Rd	LOS D	22.9	C	0.64	23.6	C	0.74	24.7	C	0.78
Town Center Loop W / Wilsonville Rd	LOS D	35.7	D	0.66	40.3	D	0.75	43.2	D	0.78

Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Project Impact Mitigations

To mitigate impacts at the north and south project accesses onto Boones Ferry Road, three Boones Ferry Road site frontage improvements are needed (these are in addition to the planned improvements to Boones Ferry Road that are shown on the Fred Meyer site plan):

- At the north Fred Meyer access, install a median along Boones Ferry Road to restrict movements to right-in/right-out for both the Lowries Marketplace and Fred Meyer developments; this will increase safety by removing turn lane needs at this access and will provide for better traffic flow (i.e. queuing spillback that impact Wilsonville Road). It will also accommodate turn lane placement and storage needs for the Boones Ferry Road/Wilsonville Road intersection's northbound approach traffic. Also, if desired, the north Fred Meyer access may be converted to a right-out only driveway and narrowed to one lane, which would allow additional space on the project site that could be used to increase a building pad size, the number of parking stalls, etc.
- Between the north and south Fred Meyer accesses, extend the second northbound through lane (which becomes a right turn lane at the Wilsonville Road intersection) to ensure approximately 600 feet of storage is provided for the northbound right turn lane at Wilsonville Road. This distance meets the short-term Fred Meyer needs and the long-term 20-year Wilsonville Road Interchange design needs.
- At the south Fred Meyer access, install a traffic signal to facilitate egress movements from the Lowries and Fred Meyer developments. There should also be two egress lanes (i.e., a right turn lane and a through-left lane). It is expected that warrants will be met in the near future due to the

addition of nearby developments. Installing the traffic signal with the Boones Ferry Road improvements will assure continuity between the improvements and the traffic signal construction. The signal should be coordinated with the Boones Ferry Road/Wilsonville Road signal. To enable the coordination, interconnect conduit and cable will need to be installed between the signals.

A conceptual layout of Boones Ferry Road that shows all improvements and mitigations is presented in Figure 5, which can be found in Chapter 3: Impact Analysis. The mitigated analysis results are listed in Table 4 for the north Fred Meyer access and the Boones Ferry Road/Bailey Street intersection and in Table 5 for both traffic control options at the south access (i.e., a traffic signal and four-way stop control). As shown in the tables, the three intersections have good operation levels and the two traffic control options for the south access are comparable to one another. The main benefits from the installation of the traffic signal are the ability to service platoon flow from the Boones Ferry Road/Wilsonville Road intersection and increased future capacity that will be available.

TABLE 4: Boones Ferry Road Mitigated Future Operating Conditions (PM Peak Hour)

Intersection	Operating Standard	Existing + Project + Stage II + Mitigated		
		Delay	LOS	V/C
Unsignalized – Two-way Stop Control				
Boones Ferry Rd / North Project Access	-	13.8	A/B	0.41
Boones Ferry Rd / Bailey St	LOS D	17.0	A/C	0.15

Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

TABLE 5: South Project Access Mitigated Future Operating Conditions (PM Peak Hour)

Traffic Control at South Project Access	Existing + Project + Mitigated		
	Delay	LOS	V/C
Signalized (Option 1)	22.0	C	0.49
Four-way Stop Control (Option 2)	20.1	C	0.75

Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Additional Project Oriented Transportation Mitigations

In addition to the Boones Ferry Road mitigations, the following project related measures would typically be required as conditions of approval if the project were approved:

Site Accesses

- The south Fred Meyer access on Boones Ferry Road should be aligned with the south Lowries Marketplace driveway (i.e., near Albertsons). In addition, regarding the Fred Meyer accesses on Bailey Street, the east access should be aligned with the driveway on the south side of the street and the west access should be located in a manner that it does not create conflicting turn movements with any nearby driveways on the south side of the street.
- The radius for the right-out movement at the north access on Boones Ferry Road should be designed to allow trucks to perform a right turn without encroaching on neighboring lanes.

Intersection Alignment

- Improvements to the Boones Ferry Road/Bailey Street intersection should be constructed to ensure that the east and west legs of Bailey Street are properly aligned (these legs currently are offset).

Sight Distance

- All proposed site driveways should meet American Association of State Highway and Transportation Officials (AASHTO) sight distance requirements[3], and prior to occupancy, sight distance at the access points will need to be verified, documented, and stamped by a registered professional Civil or Traffic Engineer licensed in the State of Oregon.
- The sight triangle at each driveway should be clear of objects (large signs, landscaping, parked cars, etc.) that could potentially limit vehicle sight distance.

Boones Ferry Road Adjustments

- The Fred Meyer development site frontage will require adjustments to accommodate the increased cross-section on Boones Ferry Road (as shown in Figure 5, which is found in Chapter 3: Impact Analysis). Adjustments at the southwest corner of the site may also be needed to ensure that the east and west legs of the Boones Ferry Road/Bailey Street intersection are properly aligned (currently, these legs are offset). Because the site plan does not show the curb locations on the west side of Boones Ferry Road or south side of Bailey Street, it is not clear what exact adjustments are needed.

Internal Circulation

- Site plan changes are recommended to convert the south access into the main access. One optional method for making the conversion is presented in Figure 8 (found in Chapter 5: Site Evaluation), which shows two conceptual changes: (1) realigning the internal roadways so that priority is given to vehicles coming and going to the south access and (2) installing four-way stop-control at the internal intersection near the south access.
- The site plan is not clear in the vicinity of the buildings, but it appears that the site would provide adequate pedestrian circulation. It should be ensured that the site indeed provides pedestrian access to the buildings and to the nearby crosswalks and paths (in particular, to the paths on the north side of the site that connect to Wilsonville Road).
- All sidewalks within the site should conform to ADA requirements.[4]

[3] *Geometric Design of Highways and Streets*, AASHTO, 2004; Case B1, p. 661.
[4] *ADA Accessibility Guidelines for Buildings and Facilities*, Department of Justice, January 1998.

Traffic Signal Warrants

- Though signal warrants are not met at any unsignalized study intersection for the "Existing plus Project plus Stage II" scenario, it was determined that the peak hour warrant will be met in the near future at the south Fred Meyer access; therefore, a traffic signal should be installed in conjunction with the Fred Meyer development. This will assure continuity between the Boones Ferry Road improvements and the traffic signal construction. The signal should be coordinated with the Boones Ferry Road/Wilsonville Road signal. To enable the coordination, interconnect conduit and cable will need to be installed between the signals.

Parking

- The proposed site provides only 885 parking stalls. This is not sufficient to meet City of Wilsonville code requirements, which specifies that a minimum of 962 stalls should be provided (based on the types of uses and the total building square footage of each use). During peak parking periods (such as holiday shopping periods), not meeting code requirements may cause parking demand to exceed the number of available stalls and oblige vehicles to park in adjacent commercial and/or residential areas; therefore, either 962 parking stalls should be provided to reduce potential off site parking impacts or a parking management plan should be prepared outlining how peak parking demand needs shall be met.
- The 138 bicycle parking spaces meet City code requirements and should be distributed throughout the development and should be located near building entrances in order to provide convenient access to each building.

CHAPTER 2: EXISTING CONDITIONS

The proposed Fred Meyer development is located on the northeast corner of Boones Ferry Road and Bailey Street in the City of Wilsonville, Oregon. The majority of the site is currently vacant, except for a church and a bank on the west edge. The church currently has one access to Boones Ferry Road and the bank has two accesses to Boones Ferry Road.

In consultation with City staff, seven existing study intersections were selected for analysis.

- Boones Ferry Road/Wilsonville Road
- I-5 Southbound Ramps/Wilsonville Road
- I-5 Northbound Ramps/Wilsonville Road
- Town Center Loop West/Wilsonville Road
- Boones Ferry Road/Fred Meyer north access
- Boones Ferry Road/Fred Meyer south access
- Boones Ferry Road/Bailey Street

The following sections summarize the current roadway network, traffic volumes, traffic operating conditions, collision history, and public transit service in the study area, with supporting detail (i.e. traffic counts and level of service calculations) provided in the appendix.

Roadway Network

Key characteristics of the study area roadways are listed in Table 6.

TABLE 6: Study Area Roadway Network Summary

Roadway	Wilsonville Classification[4]	Cross Section	Posted Speed	On-Street Parking	Sidewalks	Bike Lanes
Interstate-5 (I-5)	Freeway	6 Lanes	65 mph	No	No	No
Wilsonville Rd	Major Arterial	5 Lanes	25-35 mph	No	Yes	Yes
Boones Ferry Rd[a]	Major Collector	2 to 3 Lanes	35 mph	No	West Side	West side
Town Center Lp W[a]	Major Arterial	5 Lanes	35 mph	No	Yes	No
Bailey Street	Local Street	2 Lanes	Not Posted	No	South Side	No

[a] The City's *Bicycle and Pedestrian Master Plan*[6] designates the portions of Boones Ferry Road and Wilsonville Road adjacent to the Fred Meyer site as community walkways and bikeways.

PLANNED IMPROVEMENTS

The City of Wilsonville Transportation System Plan (TSP) identifies potential future improvements to the I-5 Wilsonville Road Interchange, which currently has insufficient capacity to meet the demand of future

[4] *City of Wilsonville Transportation Systems Plan*, Figure 4.8, Adopted by City Council on June 2, 2003.
[6] *Bicycle and Pedestrian Master Plan*, Alta Planning and Design, Adopted December 2006; replaces Chapter 5 of City of Wilsonville Transportation System Plan.

developments.[7] The City has signed an intergovernmental agreement to construct the first phase of improvements, which consists of a Wilsonville Road 6-lane enhanced alternative that focuses on ramp improvements and on adjustments to intersection lane configurations.

Existing Traffic Volumes

Traffic counts were conducted at study area intersections during the weekday PM and Saturday peak periods.[8] The existing PM peak hour traffic volumes are shown in Figure 2, and the Saturday peak hour traffic volumes are discussed later in Chapter 4: Weekend Safety Analysis. Detailed traffic counts are included in the appendix.

Existing Traffic Operating Conditions

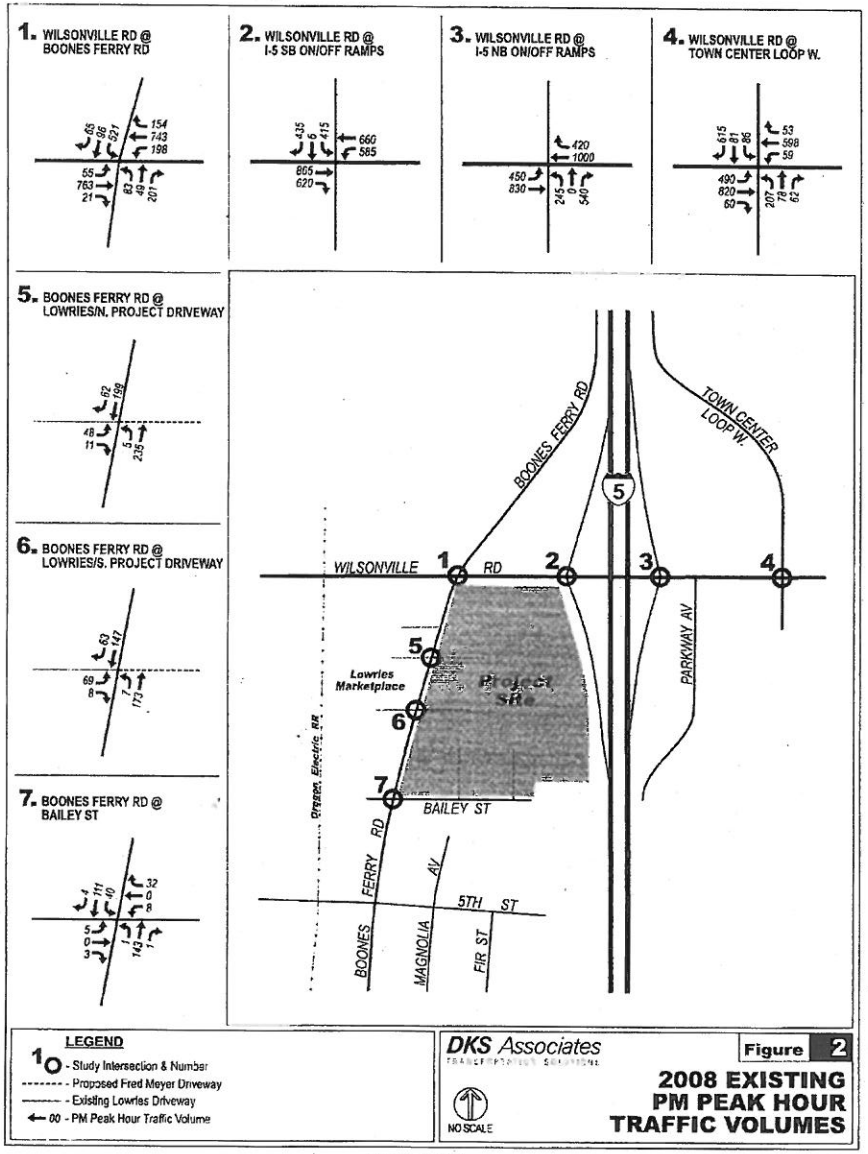
Existing traffic operating conditions were analyzed at the existing study intersections. Intersections are the focus of the traffic analysis because they are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinity. Before the analysis results of the study intersections are presented, discussion is provided for two important analysis issues: (1) intersection performance measures (definitions of typical measures) and (2) required operating standards (per roadway, as specified by the agency with roadway jurisdiction).

INTERSECTION PERFORMANCE MEASURES

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

- **Level of service (LOS):** A "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection.[9] LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity. This condition is typically evident in long queues and delays.
- **Volume-to-capacity (V/C) ratio:** A decimal representation (typically between 0.00 and 1.00) of the proportion of capacity that is being used (i.e., the saturation) at a turn movement, approach leg, or intersection. It is determined by dividing the peak hour traffic volume by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 1.00, congestion increases and performance is reduced. If the ratio is greater than 1.00, the turn movement, approach leg, or intersection is oversaturated and usually results in excessive queues and long delays.

[7] *City of Wilsonville Transportation Systems Plan*, Entranco, Adopted June 2, 2003; Tables 4.g and 4.k, Project C-30
[8] PM peak hour turn movement counts were collected at the study intersections from 4:00 p.m. to 6:00 p.m. on January 29, 2008; June 24, 2008; or July 1, 2008. Count dates are shown in detailed turn movement count sheets in appendix. Saturday peak hour counts were collected on July 12, 2008.
[9] A description of Level of Service (LOS) is provided in the appendix and includes a list of the delay values (in seconds) that correspond to each LOS designation.



REQUIRED OPERATING STANDARDS

All study intersections of public streets are required to meet the City of Wilsonville's operating standard. For peak periods, the City's minimum acceptable level of service (LOS) is LOS D.[10] It should be noted that while project driveways are not required to meet the City's LOS standard, it is still highly encouraged.

EXISTING OPERATING CONDITIONS

The existing traffic operating conditions at the study intersections were determined for the PM peak hour based on the *2000 Highway Capacity Manual* methodology[11] for signalized and unsignalized intersections. The conditions include the estimated average delay, level of service (LOS), and volume-to-capacity (V/C) ratio of each study intersection and are listed in Table 7. As shown in the table, all study intersections currently comply with the City of Wilsonville LOS D operating standard.

TABLE 7: Existing Operating Conditions (PM Peak Hour)

Intersection	Operating Standard	Existing Conditions		
		Delay	LOS	V/C
Signalized				
Boones Ferry Rd / Wilsonville Rd	LOS D	36.0	D	0.77
I-5 SB Ramps / Wilsonville Rd	LOS D, 0.99 V/C	36.1	D	0.90
I-5 NB Ramps / Wilsonville Rd	LOS D, 0.99 V/C	37.2	D	0.91
Town Center Loop W / Wilsonville Rd	LOS D	37.7	D	0.80
Unsignalized				
Boones Ferry Rd / North Project Access	-	12.7	A/B	0.13
Boones Ferry Rd / South Project Access	-	11.9	A/B	0.14
Boones Ferry Rd / Bailey St	LOS D	10.9	A/B	0.06

Signalized Intersections:
Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Unsignalized Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

EXISTING QUEUING OBSERVATIONS

Currently, the vehicle queues in the westbound through lanes on Wilsonville Road at the I-5 southbound ramp exceed the available storage.[12] Queues routinely spill back into the Wilsonville Road/Town Center Loop West intersection due to large demand of westbound left turning vehicles destined for I-5

[10] *City of Wilsonville Code*, City of Wilsonville Section 4.140, p.163.
[11] *Guidelines for the Preparation of Transportation Impact Analyses*, City of Salem, Effective December 28, 1994.
[12] Field observations by DKS Associates, May 2008.

southbound. The westbound through vehicle queues on Wilsonville Road at Town Center Loop West currently fill the existing storage to Rebekah Street.

Collision History

The collision histories of the study intersections were obtained for 2004 through 2006 from the Oregon Department of Transportation (ODOT) Crash Analysis and Reporting Unit. Based on the collision data and peak hour traffic counts, collision rates were estimated at the study intersections. A rate greater than or equal to 1.0 collision per million entering vehicles (MEV) generally indicates a higher than average collision rate. As shown in Table 8, none of the study intersections have collision rates above 1.0. The table also lists the breakdown of collisions by severity. As shown, between 2004 and 2006, most collisions caused property damage only, and there were no fatal collisions reported.

TABLE 8: Study Area Intersection Collisions (2005-2007)

Intersection	Collisions (by Severity)				Collision Per year	Collision Rate[b]
	Fatal	Injury	PDO[a]	Total		
Signalized Intersections						
Boones Ferry Rd / Wilsonville Rd	0	0	5	5	1.7	0.15
I-5 SB Ramps / Wilsonville Rd	0	3	8	11	3.7	0.29
I-5 NB Ramps / Wilsonville Rd	0	6	7	13	4.3	0.34
Town Center Lp W / Wilsonville Rd	0	5	5	10	3.3	0.30
Unsignalized Intersections						
Boones Ferry Rd / Bailey St	0	0	0	0	0.0	0.00

[a] PDO = Property damage only.
[b] Collision rate = average annual collisions per million entering vehicles (MEV); MEV estimates based on PM peak-hour traffic count.
[c] One collision at Bridge Street involved a bicyclist who was injured.

Public Transit Service

South Metro Area Rapid Transit (SMART) operates several fixed routes that serve Wilsonville and the surrounding area.[13] The SMART bus stop closest to the project site is located on Boones Ferry Road adjacent to the Lowries Marketplace; it is between the two proposed Fred Meyer access driveways. The bus stop includes a shelter and bus pullout. This stop services Route 204, which connects the east and west City limits. There is also a bus stop to the northwest of the project site at the Wilsonville Road/Boones Ferry Road intersection; this stop services Route 203.

[13] SMART operates several fixed routes that serve Wilsonville and make connections to TriMet in Portland, Cherriots in Salem, and Canby Area Transit. The main transfer locations are Commerce Circle (Route 203, which provides service within Wilsonville from the City Hall Park and Ride to Commerce Circle via Boones Ferry Road and 95th Avenue), Tualatin Park and Ride (Route 201), Barbur Blvd. Transit Center (Route 201), Salem Transit Center (Route 1X, which provides service throughout Wilsonville and connects to the Salem Transit Mall), and Canby Transit Center. In addition, Route 204 provides service on Wilsonville Road and Town Center Loop connecting the east and west city limits. SMART also operates a dial-a-ride system that operates on a demand-responsive basis; SMART Web Page: http://www.ridesmart.com.

CHAPTER 3: IMPACT ANALYSIS

This chapter reviews the impact that the proposed Fred Meyer would have on the study area transportation system in the City of Wilsonville. Although the development would generate traffic throughout the week, the weekday PM peak hour was the main period analyzed since this is when the greatest impact is expected (the sum of project traffic and traffic on adjacent streets is generally greatest during this period).

The PM peak hour analysis includes PM peak hour trip generation, trip distribution, capacity analysis of study intersections, and queuing analysis. First, the proposed development is described.

Proposed Development

The Fred Meyer development is located on the northeast corner of Boones Ferry Road and Bailey Street in the City of Wilsonville, Oregon. The project site is currently vacant except for two buildings: (1) an existing church building that will remain and may serve as a community center or retail space and (2) a U.S. Bank building that will be removed in conjunction with the development.

The proposed development includes a 155,881 square-foot Fred Meyer building (which includes the Fred Meyer store as well as 10,100 square feet of additional tenant space[14]), six other buildings (which include 50,879 square feet of retail/office use and a 3,316 square-foot restaurant), and 60 residential apartment units.[15] A site plan is included in the appendix. Compared to the proposed uses analyzed in the 2004 Fred Meyer traffic study[16], the current proposal has a Fred Meyer building that is 11,206 square feet smaller, a total of 41,879 more square feet of retail space (spread among six buildings instead of the previous four buildings), 2,684 less square feet of restaurant space, and 60 residential apartment units (no residential uses were included in the previous site plan).

The currently proposed site has four access points to the public street system: two on SW Boones Ferry Road and two on SW Bailey Street. The SW Boones Ferry Road accesses are on the west side of the development and would be aligned with the existing Lowries Marketplace driveways (see Figure 1, 2, or 3). The SW Bailey Street accesses are on the south side of the development and it is uncertain whether they are aligned with the existing apartment driveways. Based on the current site plan and the site location, the north driveway on Boones Ferry Road appears to serve as the development's main entrance.

Trip Generation

Trip generation is the method used to estimate the number of vehicles that are added to the site driveways and study intersections by the development during a specified period (i.e. such as the peak hour). The PM peak hour trip generation for the proposed retail and restaurant uses on the Fred Meyer site was performed using similar assumptions and methodology as the 2004 Fred Meyer traffic study[17]. Because residential units were not part of the previous study, new trip assumptions were made regarding the proposed 60 residential units.

[14] Tenant space within a Fred Meyer building is typically occupied by businesses providing additional goods or services, such as coffee shops or banks.
[15] Email from Christine McKelvey, Group Mackenzie, July 2, 2008.
[16] *The Fred Meyer Development Transportation Impact Study*, DKS Associates, November 2004.
[17] *The Fred Meyer Development Transportation Impact Study*, DKS Associates, November 2004.

Because the Fred Meyer development includes mixed-uses, its trip generation includes the calculation of many types of trips: total, internal, pass-by, diverted, and primary trips. In addition, Fred Meyer purchased the U.S. Bank pad (currently still in operation) and gas station pad (has already been removed). Both of these pads have grandfathered trips that will be subtracted from the Fred Meyer trip generation estimates to obtain the total number of net-new trips that are being added by the development to the street network. The methodology used and resulting estimates of each of these trips are explained in the following sections.

TOTAL TRIPS

Total trips include all trips made to and from each proposed land use (including between land uses) within the development. The land uses include the Fred Meyer store (including the attached tenant space), retail ("shopping center"), office, restaurant ("high turnover, sit-down"), and condos/apartments. To allow for flexibility of future conversion of the office space to retail use, the office space was analyzed as retail use (this is the worst-case trip impact). In addition, the project sponsor has not yet determined the type of apartments, condos, or townhomes that will be constructed; to provide flexibility for a future decision, the highest apartment/condo/townhome trip generation rate was assumed (this is the worst-case trip impact).

As in the 2004 study, the total trips were estimated using trip rates provided in the Institute of Transportation Engineers (ITE) *Trip Generation, 7th Edition*[18] manual as well as a Fred Meyer trip rate that was based on historical trip surveys of existing Fred Meyer stores[19]. The rates assume that each land use is a free-standing site. Because multi-use developments do not have free-standing land uses, the total trip generation is only a starting point for trip generation (i.e., internal trip reductions are necessary, in addition to pass-by and diverted trip reductions). The total trips for each proposed land use are shown in Table 9. In addition, Table 9 also shows that all the proposed land uses combined would generate a total of 1,255 (627 in, 628 out) PM peak hour trips.

TABLE 9: Total Trip Generation for the Fred Meyer Development (PM Peak Hour)

Land Use (ITE Code)	Size	Trip Rate	PM Peak Hour Trips		
			In	Out	Total
Fred Meyer and Tenant Space	155.7 KSF	4.95 trips/KSF[a]	386	385	771
Shopping Center (820)[b]	50.9 KSF	7.88 trips/KSF	192	209	401
High-Turnover (sit-down) Restaurant (932)	3.3 KSF	10.92 trips/KSF	22	14	36
Apartments/Condos/Townhouses[c]	60 units	0.78 trips/unit	27	20	47
Total Trips			**627**	**628**	**1,255**

3.73
11.15
0.52

[a] Fred Meyer trip rate based on surveyed Fred Meyer stores in Oregon and Washington.
[b] Office space analyzed as retail to allow for future conversion (retail is the higher trip rate).
[c] Residential apartment units analyzed using "Low-Rise Residential Condominium/Townhouse" (231) ITE trip rate, which is the highest rate for any type of apartment, townhouse, or condominium.

[18] *Trip Generation, 7th Edition*, Institute of Transportation Engineers, 2003.
[19] *Fred Meyers PM Peak Hour Trip Generation Summary*, DKS Associates, December 17, 2003.

373 × 50.9 189.857
11.15 × 3.3 36.795
0.52 × 60 31.2 = 257.852

INTERNAL TRIPS

Internal trips occur in multi-use developments and are specified as those trips taken between the different uses of the site. These trips are made by vehicles that stop at more than one use within the development (for example, a patron enters the site to shop at Fred Meyer and then continues to shop at one of the other retail pads). Internal trips make use of the private street and/or pedestrian path network of the development; therefore, internal trips do not impact public roads, public intersections, or site driveways and can be subtracted from the total trips to determine the number of driveway trips that the site generates.

Internal trips between the retail and restaurant land uses (i.e., all land uses except residential) were estimated at 10%, which is the same percentage used in the 2004 study. In addition, internal trips to and from the residential units were estimated using the ITE methodology specified in the *ITE Trip Generation Handbook*.[20] With the addition of the residential land use, the total internal capture increased from 10% to 12.5%. The total internal trips are listed in Table 10, and a diagram showing the internal capture rates and trips between the residential units and the remaining land uses is provided in the appendix.

TABLE 10: Internal Trip Generation for the Fred Meyer Development (PM Peak Hour)

Trip Type	PM Peak Hour Trips		
	In	Out	Total
Internal Trips between all Retail/Restaurant Uses (10% of Total trips)	60	60	120
Internal Trips to and from Residential Units[a]			
Residential Trip Ends	8	11	19
Retail/Restaurant Trip Ends	11	8	19
Total Internal Trips	**79**	**79**	**158**

[a] Internal trips originate and terminate in the development; therefore, the 19 internal residential trips (8 in, 11 out) are accounted for as 19 additional internal retail/restaurant trips (11 out, 8 in).

PASS-BY TRIPS

Pass-by trips are project trips made by vehicles already on the adjacent roadway (i.e., any roadway with access to the site). These vehicles do not consider the site as their primary destination; instead, they are stopping by on their way to another destination (e.g., Old Town).[21] Because these vehicles are already on the adjacent roadway, they are not considered new traffic to the street system; however, pass-by trips are new to the project driveways and therefore still impact those intersections used for site access due to the increased number of turn movements.

[20] *Trip Generation Handbook, 2nd Edition*, Institute of Transportation Engineers, June 2004; Chapter 7. This methodology consists of assuming internal capture rates, calculating unconstrained internal demand volumes, and estimating the balanced demand volumes between land use types. This methodology is based on the assumption that a land uses can only "give" a certain number of internal trips to another land use, which can in turn can only "receive" a certain number of internal trips. Balancing consists of assuming that the smaller of the "give" and "receive" amounts is the actual number of internal trips made.
[21] Some example land uses that typically attract high numbers of pass-by trips are fast-food restaurants and gas stations, where a significant number of vehicles stop by on their way to other destinations; in addition to these land uses, most other retail developments also attract pass-by trips.

11

15% Pass by

For the proposed Fred Meyer development, 15% of the retail and restaurant driveway trips[22] were assumed to be pass-by trips; this is the same percentage that was used in the 2004 study. In total, there are an estimated 160 (80 in, 80 out) pass-by trips. All of these trips access the site from Boones Ferry Road. The pass-by trips are listed in Table 11, which is included after the discussions of diverted and primary trips. A figure showing the pass-by trips broken down by turn movement at the study intersections is included in the appendix.

DIVERTED TRIPS

Diverted trips are project trips made by vehicles already in the project study area that must change their routes to access the site. Like pass-by trips, diverted trips do not consider the site as their primary destination; however, diverted trips have a greater impact than pass-by trips because they increase traffic volumes on the adjacent roadways and at critical study intersection movements. In addition, those trips diverted from Interstate-5 now enter the City of Wilsonville street system when they otherwise would not.

For the proposed Fred Meyer development, 42% of the retail and restaurant driveway trips[23] were assumed to be diverted trips; this is the same percentage that was used in the 2004 study. In total, there are an estimated 449 (224 in, 225 out) diverted trips. The diverted trips are listed in Table 11, which is presented following the discussion of primary trips. The trip distribution of the diverted trips is discussed in a later section of this chapter. A figure showing the diverted trips broken down by turn movement at the study intersections is included in the appendix.

PRIMARY TRIPS

Primary trips are the new trips added to the study area roadways by the proposed development; these are vehicles whose primary destination is the development. The primary trips make up the remaining driveway trips (i.e., all driveway trips that are not pass-by or diverted trips).

For the proposed Fred Meyer development, there are and estimated 488 (244 in, 244 out) primary trips; these are listed in Table 11. A figure showing the primary trips broken down by turn movement at the study intersections is included in the appendix.

TABLE 11: Driveway Trips for the Fred Meyer Development (PM Peak Hour)

Trip Type	PM Peak Hour Trips		
	In	Out	Total
Pass-by Trips (15% of Retail/Restaurant)	80	80	160
Diverted Trips (42% of Retail/Restaurant)	224	225	449
Primary Trips	244	244	488
Total Driveway Trips	**548**	**549**	**1,097**

[22] No residential driveway trips were considered to be pass-by trips.
[23] No residential driveway trips were considered to be diverted trips.

GRANDFATHERED TRIPS

Since the 2004 study was prepared, it is our understanding that the gas station and bank properties have been purchased by Fred Meyer. Because the uses will be removed in conjunction with site development (the U.S. Bank pad currently exists and will be removed and the gas station pad has already been removed), trips corresponding to these uses are considered "grandfathered" trips and should be subtracted from project trips when determining development impacts and fees.

The primary, pass-by, and diverted trips generated by the U.S. Bank and the gas station were documented in 2005 in a memorandum by DKS Associates[24] and correspond to the existing driveway volumes analyzed in the 2004 Fred Meyer Transportation Impact Study[25]. The grandfathered primary, pass-by, and diverted trips for the bank and gas station are shown in Table 12. It should be noted that since the U.S. Bank is still in operation, the bank trips were deducted in the added project traffic for future analysis scenarios since the existing counts included existing bank trips.

TABLE 12: Grandfathered Trips for the Fred Meyer Development (PM Peak Hour)

Trip Type	PM Peak Hour Trips		
	In	Out	Total
Grandfathered U.S. Bank Trips			
Pass-by Trips	8	8	16
Diverted Trips	46	52	98
Primary Trips	18	20	38
Total	**72**	**80**	**152**
Grandfathered Gas Station Trips			
Pass-by Trips	7	6	13
Diverted Trips	29	31	60
Primary Trips	6	7	13
Total	**42**	**44**	**86**
Total Grandfathered Trips (U.S. Bank and Gas Station)			
Pass-by Trips	15	14	29
Diverted Trips	75	83	158
Primary Trips	24	27	51
Total	**114**	**124**	**238**

TRIP GENERATION SUMMARY

The trip generation summary for the Fred Meyer development is listed in Table 13. As shown in the table, the proposed Fred Meyer development is expected to generate 1,255 (627 in, 628 out) total PM peak hour land use trips and 1,097 (548 in, 549 out) total PM peak hour driveway trips. The grandfathered trips that

[24] *Fred Meyers Transportation Issues Letter Review*, DKS Associates, April 19, 2005.
[25] *The Fred Meyer Development Transportation Impact Study*, DKS Associates, November 2004.

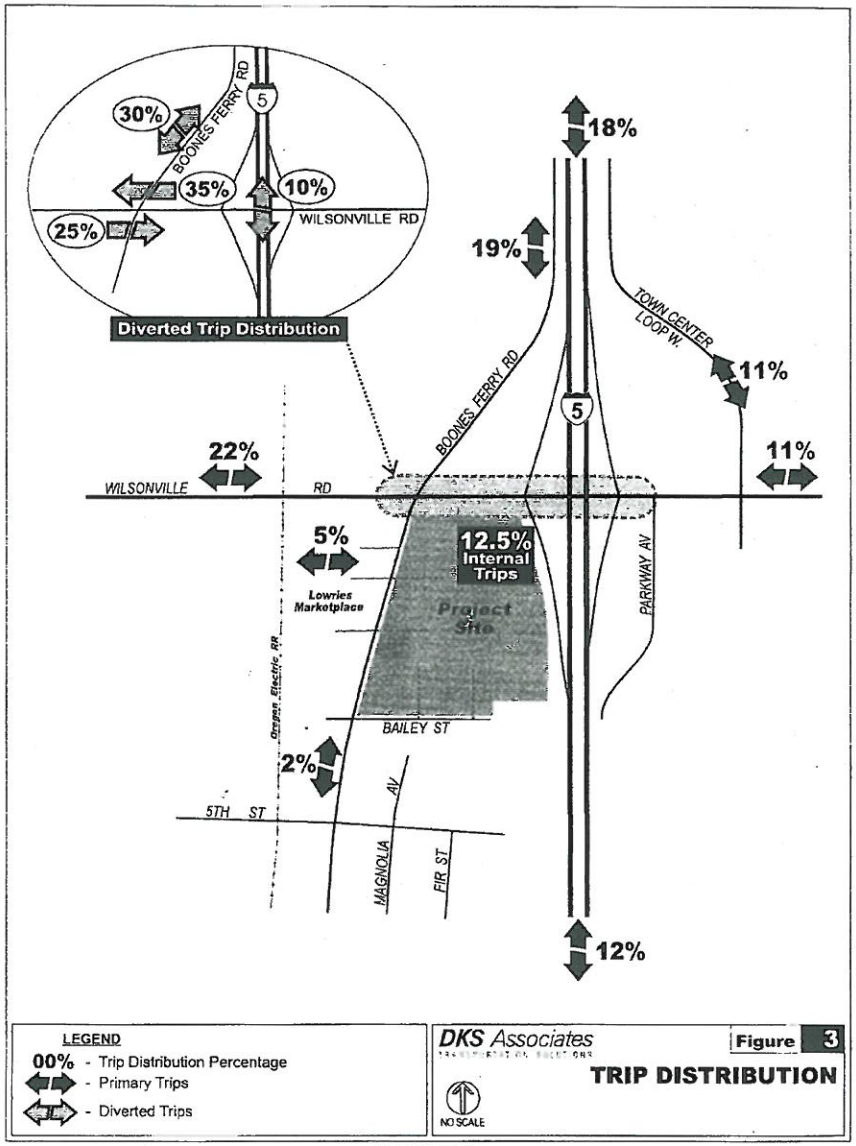
would be credited to the Fred Meyer development include 238 (114 in, 124 out) PM peak hour trips; this accounts for both the gas station and the U.S. Bank.

TABLE 13: Trip Generation Summary for the Fred Meyer Development (PM Peak Hour)

Trip Type	PM Peak Hour Trips		
	In	Out	Total
Proposed Fred Meyer Development Trips			
Total Internal Trips	79	79	158
Total Driveway Trips	548	549	1,097
Total Proposed Trips	**627**	**628**	**1,255**
Grandfathered Trips			
Total Grandfathered Trips	114	124	238

Trip Distribution

Trip distribution percentages used for routing project trips through the study area were based on the trip distribution assumptions used in the 2004 study, with the exception of one adjustment. This adjustment includes a 5% distribution of traffic to the Lowries Marketplace development, which is located across the street on the west side of Boones Ferry Road. The Lowries development was not constructed at the time the 2004 Fred Meyer traffic study was prepared. Figure 3 shows the trip distribution percentages used for the primary and diverted trips.



13

New Trips through City of Wilsonville Interchange Areas

The number of new PM peak hour trips that pass through the two Wilsonville I-5 interchange areas were estimated based on results from the trip generation and distribution. The two interchange areas are at Wilsonville Road (which includes the Boones Ferry Road/Wilsonville Road intersection) and at Elligsen Road. Both the primary and diverted trips that are added to the interchange areas are accounted for. As shown in Table 14, the Fred Meyer development would generate 768 total PM peak hour trips through the Wilsonville Road interchange area and 2 net new PM peak hour trips through the Elligsen Road interchange area.

Since the Fred Meyer development has purchased the gas station and bank pads, grandfathered trips through the interchange areas were estimated (in a previous memorandum[26]) and were deducted from the new project trips in order to determine net-new PM peak hour trips through the interchange areas. The resulting net-new PM peak hour trips through the I-5/Wilsonville Road and the I-5/Elligsen Road-Boones Ferry Road interchange areas are listed in Table 14. As shown in the table, the proposed Fred Meyer development would generate 612 net-new PM peak hour trips through the I-5/Wilsonville Road interchange area and 2 net-new PM peak hour trips through the I-5/Elligsen Road-Boones Ferry Road area.

TABLE 14: Net-New Fred Meyer Trips through Interchange Areas (PM Peak Hour)

Trip Type	PM Peak Trips through I-5 Interchange Areas	
	Wilsonville Road Area	*Elligsen Road*
Proposed Fred Meyer Trips		
Diverted Trips	314	N/A
Primary Trips	454	2
Total Fred Meyer Trips through Interchange	**768**	**2**
Grandfathered Trips		
Grandfathered Diverted Trips	-114	N/A
Grandfathered Primary Trips	-42	-0
Total Grandfathered Trips through Interchange	**-156**	**0**
Net-New PM Peak Trips through Interchange Area	**612**	**2**

Future Traffic Operating Conditions

Future traffic operating conditions, consisting of intersection performance and queuing, were analyzed at the study intersections to determine if the transportation network can support the additional development traffic. Intersections are the focus of the analysis because they are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinity. If City of Wilsonville operating standards are not met or expected queues exceed storage length at the study intersections, then mitigations are required to improve network performance.

[26] *Fred Meyers Transportation Issues Letter Review*, DKS Associates, April 19, 2005; see figures.

FUTURE ANALYSIS SCENARIOS

Future PM peak hour traffic operations were analyzed at the study intersections for three operating scenarios:

- Existing plus Project (includes Fred Meyer development traffic and removes the existing U.S. Bank traffic)
- Existing plus Stage II (includes traffic from other developments in the project vicinity that have Stage II approval and assumes continued operation of the U.S. Bank)
- Existing plus Project plus Stage II (includes traffic from Fred Meyer as well as from Stage II approved developments and removes the existing U.S. Bank traffic)

These operating scenarios include various combinations of three types of traffic: existing, project, and stage II traffic. Existing and project traffic have both been explained previously. Stage II traffic levels were estimated based on the list of currently approved Stage II developments, which was provided by City staff.[27] This list and the corresponding PM peak hour trip generation estimates for these developments are included in the appendix. The weekday PM peak hour traffic volumes used to analyze the "Existing plus Stage II" and the "Existing plus Project plus Stage II" scenarios are shown in Figure 4.

FUTURE ANALYSIS WITH EXISTING WILSONVILLE ROAD CROSS-SECTION

The first future scenario intersection analysis was performed assuming the existing cross-section on Wilsonville Road and the site frontage improvements along Boones Ferry Road (as shown on the current Fred Meyer site plan, which is included in the appendix). The analysis was performed using *2000 Highway Capacity Manual* methodology[28] for signalized and unsignalized intersections. For the four study intersections on the Wilsonville Road corridor, a Synchro™ model of the existing Wilsonville Road cross-section was used to analyze traffic operating conditions because it accounts for signal coordination and the resulting traffic flow patterns.

The intersection operating conditions for each of the three future PM peak hour traffic scenarios are listed in Table 15. As shown in the table, all four study intersections on Wilsonville Road exceed operating standards under the "Existing plus Project plus Stage II" scenario. Both northbound and southbound ramps also exceed operating standards under the "Existing plus Stage II" scenario. In addition, the two Fred Meyer development accesses on Boones Ferry Road operate below desired levels for the two scenarios that include project traffic (i.e., "Existing plus Project" and "Existing plus Project plus Stage II"). The detailed analysis output sheets corresponding with these results are included in the appendix.

[27] Email from Blaise Edmonds, City of Wilsonville, July 1, 2008 (see appendix for Stage II list).
[28] *Guidelines for the Preparation of Transportation Impact Analyses*, City of Salem, Effective December 28, 1994.

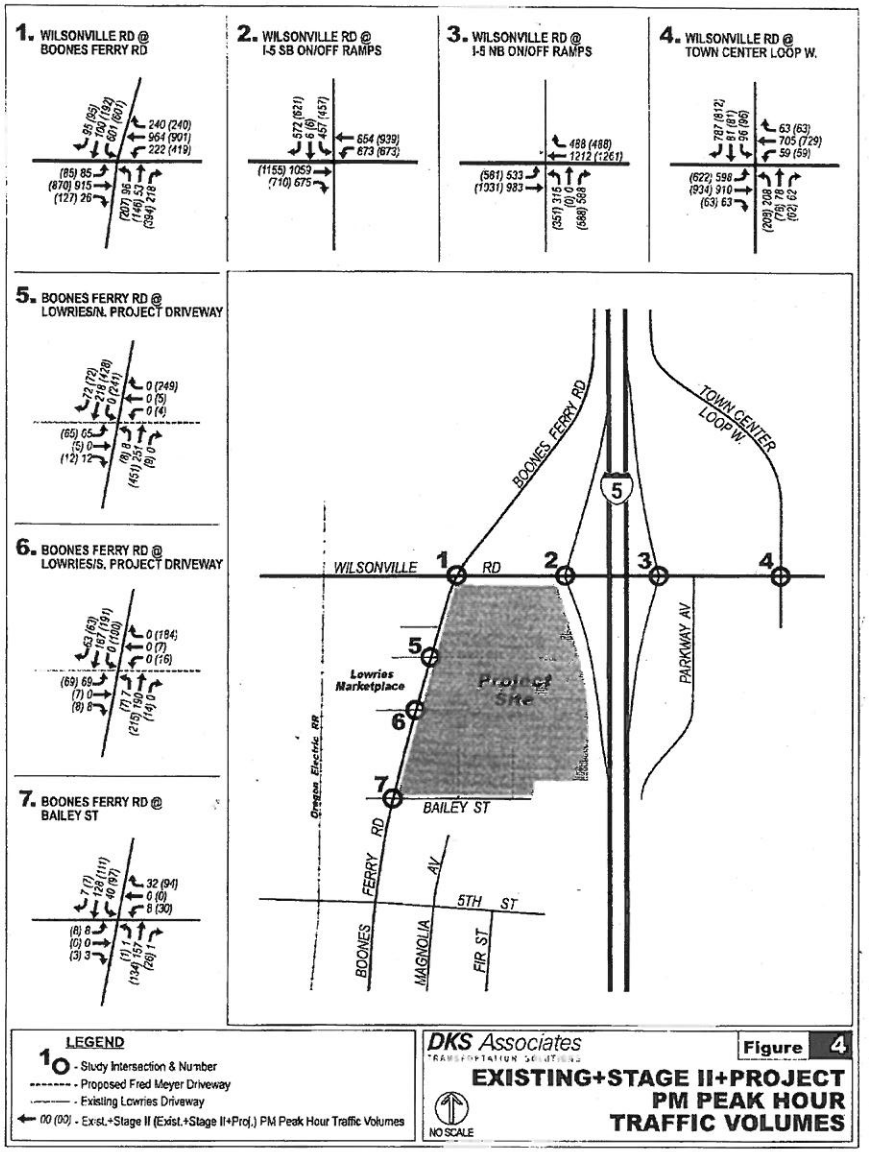


TABLE 15: Future Operating Conditions (PM Peak Hour)

Intersection	Operating Standard	Existing + Project			Existing + Stage II			Existing + Project + Stage II		
		Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C
Signalized										
Boones Ferry Rd / Wilsonville Rd	LOS D	36.0	D	0.77	44.5	D	0.89	>80	**F**	>1.0
I-5 SB Ramps / Wilsonville Rd	LOS D, 0.99 V/C	36.1	D	0.90	79.1	**E**	**>1.0**	>80	**F**	**>1.0**
I-5 NB Ramps / Wilsonville Rd	LOS D, 0.99 V/C	37.2	D	0.91	70.9	**E**	**>1.0**	>80	**F**	**>1.0**
Town Center Loop W / Wilsonville Rd	LOS D	37.6	D	0.80	51.2	D	0.94	56.2	**E**	0.97
Unsignalized										
Boones Ferry Rd / North Project Access	-	>50	A/F	>1.0	13.9	A/B	0.18	>50	A/F	>1.0
Boones Ferry Rd / South Project Access	-	>50	A/F	0.66	12.4	A/B	0.15	>50	A/F	0.71
Boones Ferry Rd / Bailey St	LOS D	12.6	A/B	0.12	11.6	A/B	0.06	13.8	A/B	0.12

Signalized intersections:
Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Unsignalized intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

FUTURE ANALYSIS WITH PLANNED WILSONVILLE ROAD CROSS-SECTION

Due to capacity constraints at the I-5/Wilsonville Road interchange, improvements are planned that will provide additional capacity along Wilsonville Road between Boones Ferry Road and Town Center Loop West. Recently, the City has signed an intergovernmental agreement to construct the first phase of improvements, which will consist of a Wilsonville Road 6-lane enhanced alternative that focuses on ramp improvements and on adjustments to intersection lane configurations.

For the four study intersections on the Wilsonville Road corridor, a Synchro™ model of the improved Wilsonville Road cross-section was used to analyze intersection operating conditions for each of the three future PM peak hour traffic scenarios (i.e., "Existing plus Project", "Existing plus Stage 2", and "Existing plus Project plus Stage 2"). The results of the analysis are listed in Table 16. As shown in the table, all four study intersections on Wilsonville Road comply with the City of Wilsonville LOS D operating standard for each of the three scenarios. The two I-5 ramps also meet the Oregon Department of Transportation (ODOT) 0.99 volume-to-capacity (V/C) standard.

TABLE 16: Future Operating Conditions of Wilsonville Road Intersections with Six-Lane Enhanced Alternative Improvements (PM Peak Hour)

Intersection	Operating Standard	Existing + Project + Imp			Existing + Stage II + Improvements			Existing + Project + Stage II + Imp		
		Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C
Signalized										
Boones Ferry Rd / Wilsonville Rd	LOS D	37.7	D	0.66	31.1	C	0.67	39.3	D	0.75
I-5 SB Ramps / Wilsonville Rd	LOS D	20.6	C	0.64	22.0	C	0.72	22.7	C	0.76
I-5 NB Ramps / Wilsonville Rd	LOS D	22.9	C	0.64	23.6	C	0.74	24.7	C	0.78
Town Center Loop W / Wilsonville Rd	LOS D	35.7	D	0.66	40.3	D	0.75	43.2	D	0.78

Delay = Average Stopped Delay per Vehicle (sec) V/C = Volume-to-Capacity Ratio of Intersection
LOS = Level of Service of Intersection **Bold Underlined** values do not meet standards.

QUEUING ANALYSIS

Queuing analysis was performed for the "Existing plus Project plus Stage II" scenario for both Wilsonville Road and Boones Ferry Road. These are discussed separately.

Wilsonville Road Queuing

The queuing analysis for Wilsonville Road was performed using SimTraffic™, which provides a system wide assessment of network performance and includes the estimation of the 95th percentile queue for each intersection approach movement. The 95th percentile queue length is the queue length at a given intersection movement that has only a 5% chance of being exceeded during the peak traffic hour. When compared with the movement's available storage length, queue blockage issues can be determined. The queuing analysis was performed assuming the construction of the Wilsonville Road 6-lane enhanced alternative, which focuses on ramp improvements and on adjustments to intersection lane configurations.

The Oregon Department of Transportation's access spacing criteria requires 1,320 feet between a freeway ramp and the nearest traffic signal. The City has a 1,000-foot access spacing requirement for major arterials, which applies to Wilsonville Road. The current spacing of traffic signals on Wilsonville Road adjacent to I-5 does not meet ODOT or City access spacing standards. Table 17 lists the available storage on Wilsonville Road.

Table 17 also lists the results of the vehicle queuing analysis based on the recommended improvements (see Chapter 1). At the northbound and southbound ramps, the available storage length satisfies the 95th percentile queues for each turn movement. At Boones Ferry Road, the storage lengths available for the northbound left turn and right turn movements are dependent upon Boones Ferry Road improvements as shown in Figure 5. For the northbound right turn lane, the expected queues with the addition of the Fred Meyer development show the need for a separate right turn lane with minimum queue storage of 300 feet; however, long-term needs required as part of the 20-year interchange area capacity needs will require approximately 600 feet of vehicle storage. This means that the northbound right turn lane would need to

extend past the north Fred Meyer access. For the northbound left turn lane, 300 feet of storage is needed to service expected queues (both with Fred Meyer traffic and long-term traffic needs).

TABLE 17: Wilsonville Road Queuing (Existing + Project + Stage II + Improvements)

Intersection on Wilsonville Road	Intersection Approach[a]	Available Vehicle Storage[b]	95th Percentile Queue[c] (PM Peak Hour)
Boones Ferry Road	EB Through	1,240 ft	400 ft
	WB Left	400 ft	275 ft
	WB Through	480 ft	450 ft
	NB Left	TBD[d]	300 ft
	NB Right	TBD[d]	300 ft[f]
I-5 Southbound Ramp	EB Through	500 ft	300 ft
	EB Right	500 ft	300 ft
	WB Left	420 ft	350 ft
	WB Through	420 ft	350 ft
	SB Left	400/975 ft[e]	250 ft
	SB Right	400/975 ft[e]	250 ft
I-5 Northbound Ramp	EB Left	420 ft	350 ft
	EB Through	420 ft	350 ft
	WB Through	625 ft	575 ft
	NB Left	360/760 ft[e]	225 ft
	NB Right	360/760 ft[e]	250 ft

[a] EB=Eastbound; WB=Westbound; NB=Northbound; SB=Southbound
[b] Available vehicle storage = distance from stop bar to upstream intersection crosswalk/stop bar
[c] 95th percentile queues are rounded to nearest 25 feet
[d] TBD = To be determined . . . the available storage lengths at these movements are dependent upon the improvements that are constructed in conjunction with the Fred Meyer site development.
[e] x/x = available turn lane storage/distance from stop bar to mainline freeway.
[f] It should be noted that the long-term right turn needs for this movement extend to 600 ft.

Boones Ferry Road Queuing

Queuing analysis was also performed for the unsignalized left turn movements at the study intersections on Boones Ferry Road (i.e., at the Fred Meyer site accesses and at Bailey Street) and assumes the Boones Ferry Road cross-section shown on the site plan and full site access at both Fred Meyer driveways on Boones Ferry Road.[29] The results of the analysis are shown in Table 18 and indicate a potential queuing conflict for the southbound left turn at the north Fred Meyer access. Because Wilsonville Road and the north Fred Meyer access are only separated by 370 feet, there is not enough space to install both a 300-foot northbound left turn lane at Wilsonville Road and a 175-foot southbound left turn lane at the north access; therefore, additional mitigation is required, including restricting the north access to right-in/right-out movements (additional details are provided in the Boones Ferry Road Mitigation section that follows).

[29] Analysis was performed using the John T. Gard unsignalized queue length calculation method: "Young Consultant's Award Paper: Estimation of Maximum Queue Lengths at Unsignalized Intersection". John T. Gard, ITE Journal, November 2001.

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TABLE 18: Boones Ferry Road Existing + Project + Stage II Queuing (PM Peak Hour)

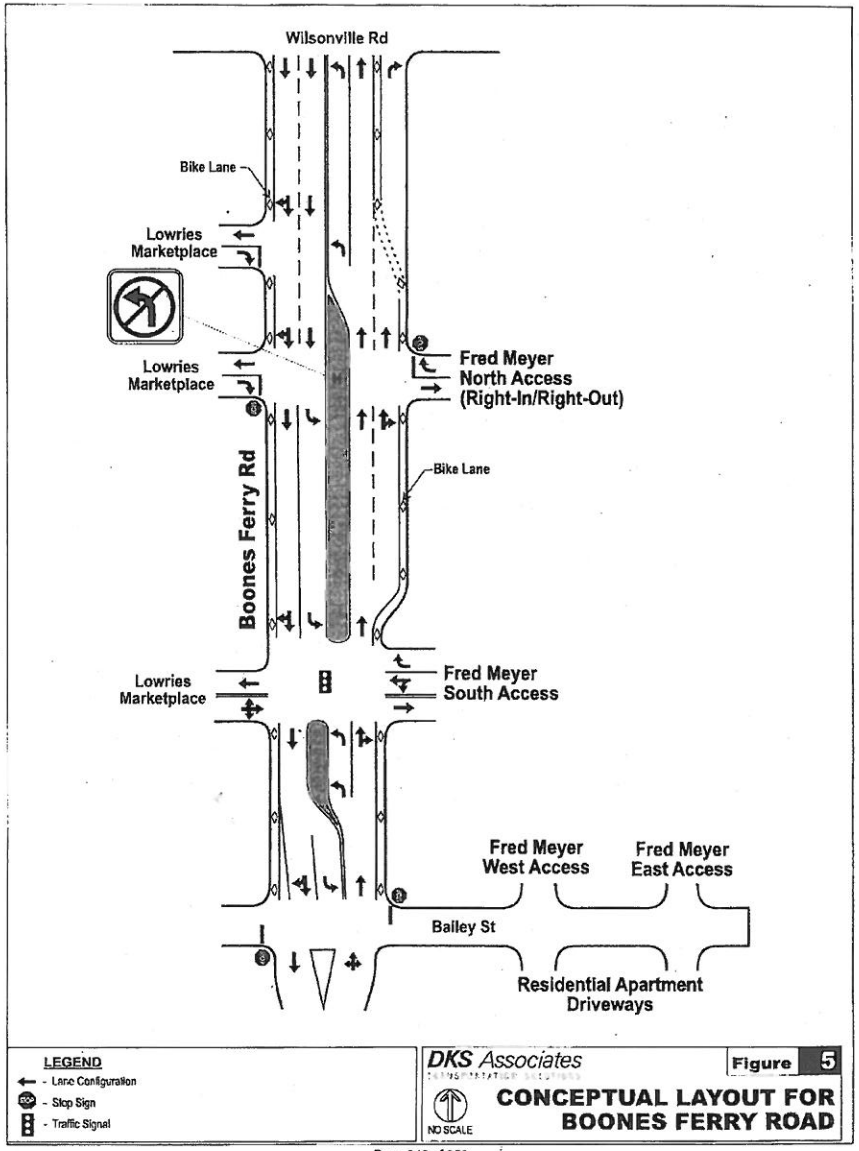
Section of Boones Ferry Road	Intersection Movement[a]	95th Percentile Queue (ft)[b] Peak Hour	Available Vehicle Storage
Between Wilsonville Road and North Fred Meyer Access	NB Left at Wilsonville Road	300 ft	
	SB Left at North Fred Meyer Access	175 ft	
	Total	[illegible]	[illegible]
Between North and South Fred Meyer Accesses	NB Left at North Fred Meyer Access	50 ft	
	SB Left at South Fred Meyer Access	150 ft	
	Total	200 ft	250 ft
Between South Fred Meyer Access and Bailey Street	NB Left at South Fred Meyer Access	50 ft	
	SB Left at Bailey Street	125 ft	
	Total	175 ft	400 ft

[a] EB=Eastbound; WB=Westbound; NB=Northbound; SB=Southbound
[b] 95th percentile queues are rounded to nearest 25 feet
[c] Total of left turn queue exceeds available storage.

BOONES FERRY ROAD MITIGATIONS

Mitigations are needed on Boones Ferry Road due to intersection operation and queuing impacts from the Fred Meyer development. Both the north and south Fred Meyer accesses are higher than the City's operating standards, and insufficient storage distance is available for the southbound left turn queues at the north access; therefore, cross-section and traffic control improvements are needed on Boones Ferry Road. A conceptual layout of Boones Ferry Road is presented in Figure 5. There are three mitigations:

- At the north Fred Meyer access, install a median along Boones Ferry Road to restrict movements to right-in/right-out for both the Lowries Marketplace and Fred Meyer developments; this will increase safety by removing turn lane needs at this access and will provide for better traffic flow (i.e., queuing spillback from Wilsonville Road). It will also accommodate turn lane placement and storage needs for the Boones Ferry Road/Wilsonville Road intersection's northbound approach traffic. Also, if desired, the north Fred Meyer access may be converted to a right-out only driveway and narrowed to one lane, which would allow additional space on the project site that could be used to increase a building pad size, the number of parking stalls, etc.
- Between the north and south Fred Meyer accesses, extend the second northbound through lane (which becomes a right turn lane at the Wilsonville Road intersection) to ensure approximately 600 feet of storage is provided for the northbound right turn lane at Wilsonville Road. This distance meets the short-term Fred Meyer needs and the long-term 20-year Wilsonville Road Interchange design needs.
- At the south Fred Meyer access, install a traffic signal to facilitate egress movements from the Lowries and Fred Meyer developments. There should also be two egress lanes (i.e., a right turn lane and a through-left lane). It is expected that warrants will be met in the near future due to the addition of nearby developments. Installing the traffic signal with the Boones Ferry Road improvements will assure continuity between the improvements and the traffic signal construction. The signal should be coordinated with the Boones Ferry Road/Wilsonville Road signal. To enable the coordination, interconnect conduit and cable will need to be installed between the signals.



These mitigations would improve the operations at the two Fred Meyer accesses (which are also Lowries Marketplace accesses) on Boones Ferry Road. Because left turns would be prohibited at the north access, all southbound Fred Meyer traffic and northbound Lowries Marketplace traffic would be required to access their respective developments from either the south access or from Bailey Street, thus increasing left turn volumes at these intersections. The adjusted traffic volumes resulting from the mitigations are shown in Figure 6. In addition, if the north access is converted to right-out only, then right turn volumes into the Fred Meyer development would also be shifted to the south access.

Intersection operations analysis was performed for the Boones Ferry Road intersections (i.e., at the two site accesses and at Bailey Street) for the mitigated conditions. Analysis results are shown in Table 19 for the north Fred Meyer access and the Boones Ferry Road/Bailey Street intersection. Table 20 lists the analysis results for both traffic control options at the south access (i.e., a traffic signal and four-way stop control). As shown in the tables, the three intersections have good operation levels and the two traffic control options for the south access are comparable to one another. The main benefits from the installation of the traffic signal are the ability to service platoon flow from the Boones Ferry Road/Wilsonville Road intersection and increase intersection capacity that would be provided.

TABLE 19: Boones Ferry Road Mitigated Future Operating Conditions (PM Peak Hour)

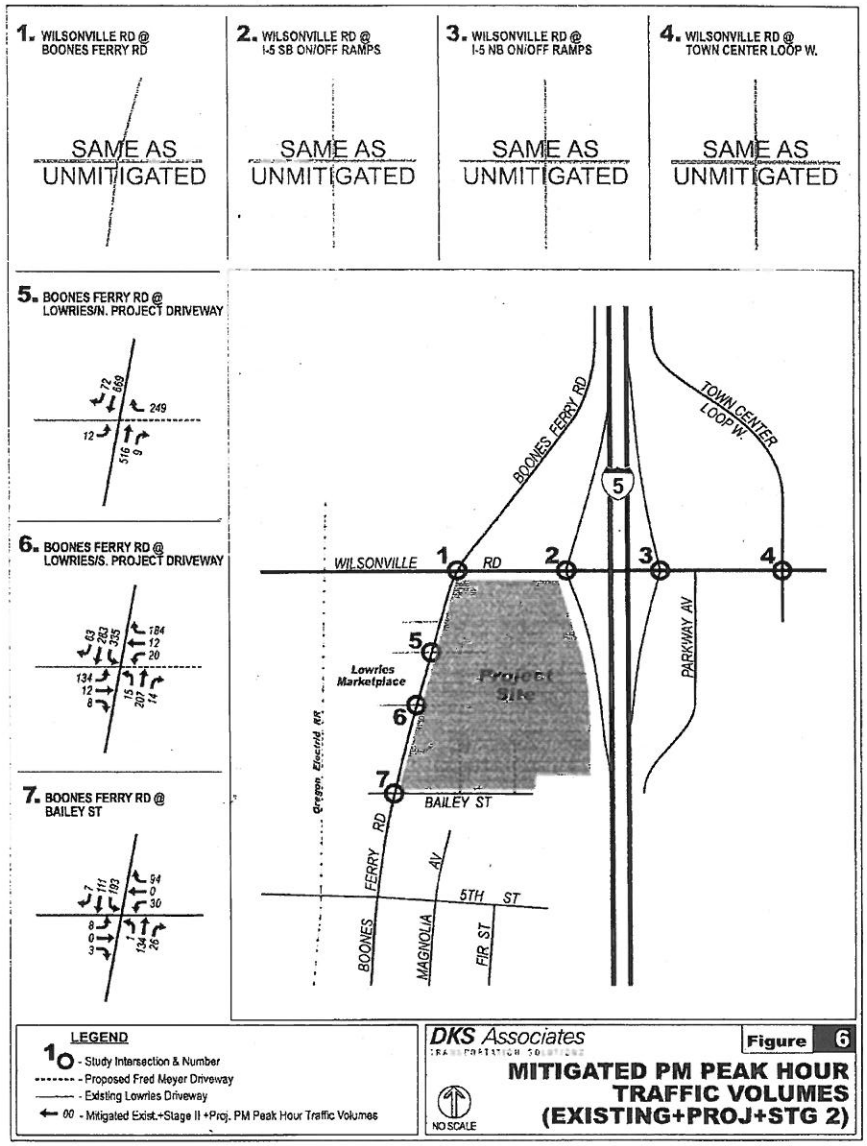
Intersection	Operating Standard	Existing + Proj + Stage II + Mitigated		
		Delay	LOS	V/C
Unsignalized – Two-way Stop Control				
Boones Ferry Rd / North Project Access	-	13.8	A/B	0.41
Boones Ferry Rd / Bailey St	LOS D	17.0	A/C	0.15

Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

TABLE 20: South Project Access Mitigated Future Operating Conditions (PM Peak Hour)

Traffic Control at South Project Access	Existing + Project + Mitigated		
	Delay	LOS	V/C
Signalized (Option 1)	22.0	C	0.49
Four-way Stop Control (Option 2)	20.1	C	0.75

Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.



Additional queuing analysis was performed for the mitigated conditions (which include the recommended traffic signal at the south Fred Meyer access). SimTraffic™ was utilized, and the results of the analysis are given in Table 21. As shown in the table, all queues are within the available storage; in other words, there are no longer any storage lane conflicts between left turn movements (i.e., available vehicle storage is greater than the sum of competing 95th percentile queues for every section of Boones Ferry Road). The traffic signal timing can be adjusted to ensure that queuing can be reduced at key movements.

TABLE 21: Mitigated Boones Ferry Road Ex. +Proj. + Stage II Queuing (PM Peak Hour)

Intersection on Boones Ferry Road	Intersection Approach[a]	Available Vehicle Storage[b]	95th Percentile Queue[c]
Wilsonville Road	NB Left	350 ft	300 ft
	NB Right	525 ft	600 ft[d]
South Fred Meyer Access	NB Left	175 ft	50 ft
	SB Left	275 ft	200 ft
Bailey Street	SB Left	150 ft	50 ft

[a] EB=Eastbound; WB=Westbound; NB=Northbound; SB=Southbound
[b] Available vehicle storage = distance from stop bar to upstream intersection crosswalk/stop bar
[c] 95th percentile queues are rounded to nearest 25 feet
[d] Based on long-term needs for this movement.

CHAPTER 4: WEEKEND SAFETY ANALYSIS

Since the peak hour for the proposed Fred Meyer development does not occur on a weekday, but instead occurs during the Saturday midday peak hour (11:00 a.m. and 1:00 p.m.), separate trip generation and intersection safety analysis was conducted to determine if there are any weekend safety related impacts. Because Saturday peak hour conditions may also be similar to other seasonal peak hours of operation, such as holiday shopping periods, there is further reason to analyze operations during this period.

The weekend analysis focuses on traffic operations (i.e., intersection analysis and queuing analysis) at the following five[30] weekend scenario study intersections:

- I-5 Southbound Ramps/Wilsonville Road
- I-5 Northbound Ramps/Wilsonville Road
- Boones Ferry Road/Fred Meyer north access
- Boones Ferry Road/Fred Meyer south access
- Boones Ferry Road/Wilsonville Road

The analysis at these intersections includes a determination of Saturday peak hour project trip generation and trip distribution, exiting traffic volumes, future (existing plus project) capacity analysis of study intersections, and queuing analysis.

Saturday Trip Generation and Trip Distribution

Saturday peak hour trip generation and trip distribution were estimated for the proposed Fred Meyer development using the same assumptions and methodology as the 2004 Fred Meyer traffic study[31].

TRIP GENERATION

In the 2004 study, it was determined that Saturday peak hour trip generation for a free-standing discount superstore (land use code 813) and shopping center (land use code 820) is approximately 30 percent higher than the weekday PM peak hour trip generation. In addition, the 2004 study determined that the reduction percentages for pass-by and diverted trips were found to be similar during both the weekday PM and Saturday peak hours. Therefore, to estimate Saturday peak hour project trips for the currently proposed site, the weekday PM peak hour trip generation estimates for all types of project trips (as discussed in Chapter 3) were increased by 30 percent.

Because the closure of the U.S. Bank building will correlate with the proposed Fred Meyer development, Saturday peak hour trip generation estimates for the bank were subtracted from the Fred Meyer development traffic to determine the overall traffic added by the development to the street network during the Saturday peak hour. The 2004 study did not include this subtraction, so new assumptions were made following the same methodology of comparing Saturday peak hour and weekday PM peak hour trip generation rates as found in the ITE *Trip Generation, 7th Edition*[32] publication. Based on the published ITE rates for a drive-in bank (land use code 912), Saturday peak hour trip generation is approximately

[30] Two of the PM peak hour study intersections are not included in the weekend analysis.
[31] *The Fred Meyer Development Transportation Impact Study*, DKS Associates, November 2004.
[32] *Trip Generation, 7th Edition*, Institute of Transportation Engineers, 2003.

20% less than the weekday PM peak hour trip generation; therefore, the weekday PM peak hour trips for the U.S. Bank were reduced by 20% to estimate the Saturday peak hour trips.

The estimated internal, driveway, and total trips for the proposed Fred Meyer development during the Saturday peak hour are listed in Table 22. Then in Table 23, the driveway trips are broken down by pass-by, diverted, and primary trips. In addition, Table 23 lists the U.S. Bank driveway trips and the total development trips that would be added to the street network during the Saturday peak hour.

TABLE 22: Saturday Peak Hour Trip Generation for the Fred Meyer Development

Trip Type	PM Peak Hour Trips		
	In	*Out*	*Total*
Fred Meyer Internal Trips	103	103	206
Fred Meyer Driveway Trips	712	713	1,425
Total Fred Meyer Trips	**815**	**816**	**1,631**

TABLE 23: Saturday Peak Hour Trips Added to Network

Trip Type	PM Peak Hour Trips		
	In	*Out*	*Total*
Fred Meyer Driveway Trips			
Pass-by Trips	104	104	208
Diverted Trips	291	292	583
Primary Trips	317	317	634
Total Fred Meyer Driveway Trips	**712**	**713**	**1,425**
U.S. Bank Trips			
Pass-by Trips	-6	-6	-12
Diverted Trips	-37	-42	-79
Primary Trips	-16	-16	-31
Total U.S. Bank Trips	**-58**	**-64**	**-122**
Total Trips Added to Network[a]	**654**	**649**	**1,303**

[a] Total trips added to network during Saturday peak hour = Fred Meyer driveway trips – Total U.S. Bank trips; however, all Fred Meyer driveway trips are added to the project driveways.

TRIP DISTRIBUTION

Saturday peak hour trip distribution was assumed to be the same as the weekday PM peak hour trip distribution. The weekday PM peak hour trip distribution is shown previously in Figure 3.

Saturday Peak Hour Traffic Volumes

Intersection turn movement counts were conducted at the five weekend scenario study intersections during the Saturday mid-day peak (11:00 a.m. to 1:00 p.m.). Based on the traffic counts, the Saturday peak hour at the study intersections occurs from approximately 12:00 p.m. to 1:00 p.m. and the associated traffic volumes are approximately 30 percent lower than typical weekday PM peak hour volumes. The Saturday peak hour traffic volumes are shown in Figure 7, and detailed traffic counts are included in the appendix.

Because it is assumed that the peak hour of operation at the proposed Fred Meyer development would coincide with the Saturday traffic peak hour, the Saturday peak hour project trips were added to the existing counts. The total (i.e., existing plus project) volumes were used for the Saturday peak hour safety analysis and are shown in Figure 7.

Saturday Traffic Operating Conditions

Saturday peak hour traffic operating conditions, consisting of intersection performance and queuing, were analyzed at the study intersections to determine if the planned transportation network (i.e., the existing network plus planned improvements at the I-5/Wilsonville Road interchange) would be able to safely accommodate the weekend peak hour development traffic. If City of Wilsonville operating standards are not met or expected queues exceed storage length at the study intersections, then mitigations are recommended to improve network safety and performance.

As in the PM peak hour future analysis, the Saturday peak hour future analysis (i.e., the "Existing plus Project" scenario) was performed assuming the site frontage improvements along Boones Ferry Road (as are shown on the site plan, which is included in the appendix) as well as the Boones Ferry Road mitigations. In addition, the analysis assumed the installation of the first phase of improvements to at the I-5/Wilsonville Road interchange (i.e., a 6-lane enhanced alternative, which focuses on ramp improvements and on adjustments to intersection lane configurations). A Synchro™ model of the Wilsonville Road improvements was used to provide a system wide assessment of traffic operating conditions for the four study intersections on the Wilsonville Road corridor. This model utilizes Highway Capacity Manual (HCM) methodologies and evaluates system level traffic operating conditions so as to account for queuing between intersections.

INTERSECTION OPERATIONS

Future Saturday peak hour traffic operations were analyzed at the study intersection for two operating scenarios:

- Existing Conditions
- Existing plus Project (includes Fred Meyer traffic and removes the existing U.S. Bank traffic)

The intersection operating conditions resulting from the analysis are listed in Table 24 and Table 25, and detailed analysis output is included in the appendix. As shown in the two tables, all study intersections comply with operating standards. In addition, at the south Fred Meyer access, a traffic signal would provide better service than four-way stop control.

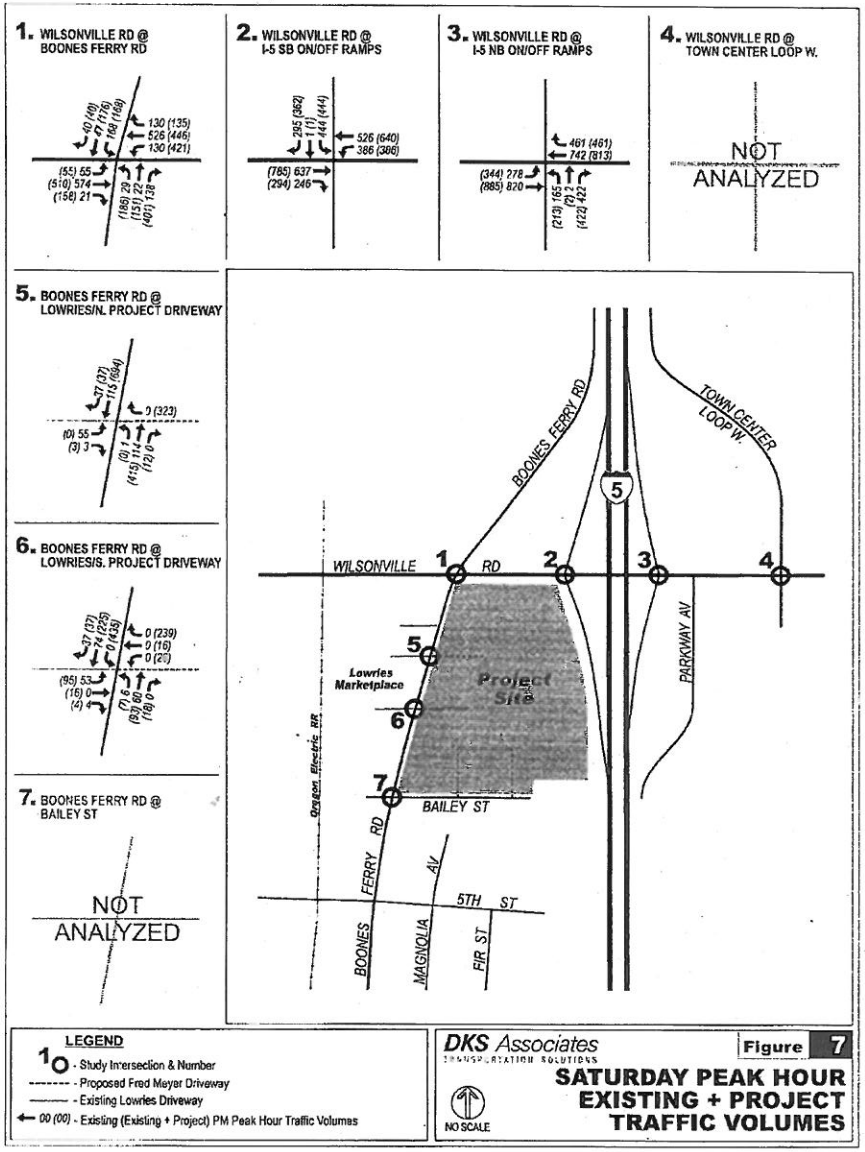


TABLE 24: Future Operating Conditions (Saturday Peak Hour)

Intersection	Operating Standard	Existing			Existing + Project + Mitigated		
		Delay	LOS	V/C	Delay	LOS	V/C
Signalized							
Boones Ferry Rd / Wilsonville Rd	LOS D	23.7	C	0.49	33.3	C	0.59
I-5 SB Ramps / Wilsonville Rd	LOS D	22.9	C	0.73	19.7	B	0.54
I-5 NB Ramps / Wilsonville Rd	LOS D	14.3	B	0.63	17.7	B	0.52
Unsignalized – Two-way Stop Control							
Boones Ferry Rd / North Project Access	LOS D	10.2	A/B	0.06	55.8	A/F	0.50
Boones Ferry Rd / South Project Access[a]	LOS D	9.8	A/B	0.08			

Signalized and Four-way Stop Control:
Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Two-way Stop Control:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

[a] The south Fred Meyer access currently has two-way stop control and is analyzed as such for the existing conditions. Mitigations recommend the south access be converted either to four-way stop control or to a traffic signal; both of these options were analyzed and the operating conditions are listed in the following table.

TABLE 25: South Project Access Mitigated Future Operating Conditions (Saturday Peak)

Traffic Control at South Project Access	Existing + Project + Mitigated		
	Delay	LOS	V/C
Signalized (Option 1)	10.2	B	0.54
Four-way Stop Control (Option 2)	22.7	C	0.88

Delay = Average Stopped Delay per Vehicle (sec) for All Movements
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

QUEUING

Queuing analysis was performed for the Saturday peak hour for the "Existing plus Project" scenario using SimTraffic™, which provides a system wide assessment of network performance and includes the estimation of the 95th percentile queue for each intersection approach movement. The 95th percentile queue length is the queue length at a given intersection movement that has only a 5% chance of being exceeded during the peak traffic hour. When compared with the movement's available storage length, queue blockage issues can be determined. The queuing analysis was performed assuming the Boones Ferry Road mitigations as well as the construction of the Wilsonville Road 6-lane enhanced alternative, which focuses on ramp improvements and on adjustments to intersection lane configurations.

The available storage on Wilsonville Road is listed in Table 26 along with the results of the Saturday peak hour vehicle queuing analysis, and the results of the queuing analysis for Boones Ferry Road are given in Table 27. As shown in the tables, the available storage is sufficient to meet the 95th percentile queues for all intersection approaches. In addition, a comparison of the Saturday and PM peak hour northbound right and left turn queues at Boones Ferry Road indicate that the PM peak hour queues are longer; therefore, no additional mitigations beyond those recommended based on the PM peak hour are needed on Boones Ferry Road.

TABLE 26: Wilsonville Road Queuing – Ex. + Proj. + Improvements (Saturday Peak Hour)

Intersection on Wilsonville Road	Intersection Approach[a]	Available Vehicle Storage[b]	95th Percentile Queue (Saturday Peak Hour)[c]
Boones Ferry Road	EB Through	1,240 ft	200 ft
	WB Left	400 ft	250 ft
	WB Through	480 ft	150 ft
	NB Left	TBD[d]	250 ft
	NB Right	TBD[d]	125 ft
I-5 Southbound Ramp	EB Through	500 ft	225 ft
	EB Right	500 ft	100 ft
	WB Left	420 ft	100 ft
	WB Through	420 ft	175 ft
	SB Left	400/975 ft[e]	200 ft
	SB Right	400/975 ft[e]	125 ft
I-5 Northbound Ramp	EB Left	420 ft	50 ft
	EB Through	420 ft	50 ft
	WB Through	625 ft	300 ft
	NB Left	360/760 ft[e]	125 ft
	NB Right	360/760 ft[e]	125 ft

[a] EB=Eastbound; WB=Westbound; NB=Northbound; SB=Southbound
[b] Available vehicle storage = distance from stop bar to upstream intersection crosswalk/stop bar
[c] 95th percentile queues are rounded to nearest 25 feet
[d] TBD = To be determined . . . the available storage lengths at these movements are dependent upon the improvements that are constructed in conjunction with the Fred Meyer site development
[e] x/x = available turn lane storage/distance from stop bar to mainline freeway