136 Interchange Area Management Plan

Sutherlin, Oregon

Oregon Department of Transportation

Table of Contents

Table of Figures

Table of Tables

Appendices

Acronyms

ADT	Average Daily Traffic
AMP	Access management plan
EIS	Environmental Impact Statement
BLI	Buildable Lands Inventory and Economic Opportunity Analysis
CBD	Central Business District
EB	Eastbound
I-5	Interstate 5
IAMP	Interchange Area Management Plan
ITS	Intelligent Transportation Systems
HCM	Highway Capacity Manual (Transportation Research Board)
HDM	Highway Design Manual (ODOT)
LOS	Level of service
NB	Northbound
OAR	Oregon Administrative Rule
ODOT	Oregon Department of Transportation
OHP	Oregon Highway Plan
OR	Oregon Route
OTC	Oregon Transportation Commission
PAC	Project Advisory Committee
SB	Southbound
SFR	Single-family residential
SMC	Sutherlin Municipal Code
STIP	State Transportation Improvement Program (ODOT)
TAC	Transportation Advisory Committee (Sutherlin)
TDM	Transportation Demand Management
TPAU	Transportation Planning and Analysis Unit (ODOT)
TSM	Transportation System Management
TSP	Transportation System Plan
UGB	Urban growth boundary
V/C	volume to capacity
WB	Westbound

1. Executive Summary

This Interchange Area Management Plan (IAMP) accomplishes the following:

- It identifies a preferred interchange design concept that is intended to fulfill the long-range needs of Sutherlin consistent with the city's long-range land use and transportation plans;
- It provides an access management plan for Oregon Highway 138/W. Central Avenue in the vicinity of the interchange;
- It identifies additional streets that help enhance local circulation; and
- It specifies amendments of the Sutherlin Transportation System Plan and Oregon Highway Plan.

Key items identified in the IAMP are:

- The existing interchange configuration is obsolete and inadequate to serve planned development of Sutherlin.
- The Project Advisory Committee and Transportation Advisory Committee selected a preferred interchange design (a question not resolved adequately in the Sutherlin TSP).
- The analysis determined where the ramp terminals will need to be located to achieve design standards and accommodate traffic that can be expected if or when Sutherlin's development fills out to its current urban growth boundary.
- The analysis verified that the intersection of Highway 138 with Park Hill Lane, which essentially serves as the ramp terminal for the southbound I-5 ramps, will need to be signalized within a few years and that signalization of this intersection will provide adequate operations for several years' growth.
- The analysis verified the need to widen Highway 138 between Comstock Road and Fort McKay Road to five lanes as prescribed in the TSP. Depending on the rate of development, the need for widening from three lanes to five lanes could be anywhere from about 10 years to 30 years from now.
- The IAMP provides an access management plan that, while not meeting full access management spacing standards, moves in the direction of those standards and is substantially better than what exists today. Implementation of access management changes will help protect the capacity of the interchange by allowing the ramp terminals to operate efficiently and improve safety by reducing conflicts at nearby local streets and driveways.
- Based on the analysis, the IAMP developed a reasonable location (across from the existing Dakota Street) for the intersection of the planned collector street serving the area south of Highway 138 and west of I-5. According to the TSP, this planned collector is intended to connect eventually with Interchange 135.
- The IAMP includes a local street system for the city and developers to implement to improve local circulation. The local street system will be implemented in connection with development and redevelopment of the area or when access restrictions are implemented by

ODOT in connection with improvements to Highway 138 between Comstock Road and Fort McKay Road.

- The analysis of future traffic for the IAMP was based on the forecasts in the TSP. Through an analysis of various planning documents, we discovered that the amount of future development potential in west Sutherlin is subject to considerable interpretation. Certain materials from the TSP planning process suggest the TSP may have overestimated future traffic. The Buildable Lands Inventory (BLI) suggests that much of the commercially designated land is impacted by wetlands and may not be developable, thus leading to a lack of adequate commercial land. The BLI states there is an excess of industrially designated lands.)
- Most management measures that can extend the life of the existing or planned facilities by limiting traffic growth are under the authority of the city of Sutherlin rather than ODOT.
- Because there are inadequate resources statewide and locally for state system modernization as well as local transportation infrastructure, ODOT and the city of Sutherlin recognize ODOT's limited ability to plan and fund a modernization project at Interchange 136. However, both parties agree that the process and plan results within the IAMP are necessary for future development and funding opportunities when available. ODOT intends to continue safety and other improvements that preserve the Interchange 136 physical structure.

2. Introduction

2.1 Purpose of an Interchange Area Management Plan

An Interchange Area Management Plan (IAMP) is a planning document used to help protect the long-range investment of an interchange. It is required for new or substantially modified interchanges according to the Oregon Administrative Rules (OAR 734-051-0155). New interchanges are very costly and it is in the interest of the state, local governments, and the citizens to ensure that the interchange functions as it was designed for as long a time period as possible. The Oregon Highway Plan (OHP) policies further direct Oregon Department of Transportation (ODOT) to plan and manage interchange areas for safe and efficient operation.

Development of an IAMP is part of the planning process intended to assess limitations, identify long-range needs and identify recommended improvements to the interchange. This process includes identifying necessary improvements to the local street network in the vicinity of the interchange to ensure consistency with operational standards. One of the cited benefits of an IAMP for local governments is using it to "balance the relationship between land use and the existing and planned transportation system to benefit the community, businesses, and traveling public."

2.2 Purpose of the Interchange 136 IAMP

2.2.1 Problem Statement

The City of Sutherlin in Douglas County has a 2008 population of 7,795 people[1]. The interchange and roadways in the project area have operational, geometric, and structural deficiencies. The existing deficiencies will be exacerbated by traffic increases resulting from development in the area. The Transportation System Plan (TSP) identifies a need to provide an interchange with increased capacity to serve the adopted land use plan for the area.

The City of Sutherlin and ODOT Region 3 identified the need to prepare an IAMP for Interchange 136 (Elkton-Sutherlin Highway). The Interchange 136 IAMP is intended to be adopted by the City of Sutherlin and the Oregon Transportation Commission (OTC).

2.2.2 Operational and Safety Deficiencies

The configuration of the interchange, particularly as related to the southbound ramps, combined with traffic volume increases that have occurred with development in the west part of Sutherlin, results in operational and safety deficiencies. Some of these were previously identified in the City of Sutherlin Transportation System Plan (TSP). The operational and safety deficiencies are:

- Access points are located closer to ramp terminals than prescribed by ODOT standards and contribute to traffic conflicts, loss of interchange efficiency and potential safety problems.
- There is insufficient capacity at key locations along Oregon Highway 138 (OR 138) to accommodate traffic from planned development.
- With only modest development consistent with adopted plans in the vicinity of the interchange or more distant areas of the west part of Sutherlin, the intersection of OR 138 with Park Hill Lane (which serves as an extension of the southbound ramp terminal) will fail to meet ODOT mobility standards without signalization.

2.2.3 Structural and Geometric Deficiencies

The original interchange, constructed decades ago, used different design standards and practices than those used today. When compared to current standards, the interchange exhibits numerous deficiencies. Substantial improvements were made in 2005 and 2006 when the mainline bridge was replaced and modifications were made to the northbound ramps. The principal geometric and structural deficiencies are:

- The southbound ramps use a “gull-wing” configuration that is no longer a standard design.
- Some ramps do not meet design current standards or achieve minimum standards rather than the higher “desirable” standard. A more thorough discussion can be found in Appendix A.

[1] Portland State University Population Research Center

2.3 Goals and Objectives

The goals of the Interchange 136 IAMP are to develop a plan for improvements that can be implemented over time to:

- Improve safety and operations of the interchange.
- Protect the investment in I-5 and the interchange and maintain the function of the interchange.
- Provide better accessibility to the cities of Sutherlin and Elkton that are consistent with the adopted local comprehensive land use and transportation plans.

The objectives of the IAMP are to:

- Develop concepts to improve safety and increase capacity of the interchange and roadways to address existing and future needs.
- Evaluate the need for capacity improvements based on the adopted, comprehensive land use plans of Sutherlin, the Sutherlin TSP, the OHP, and the appropriate level-of-service standards.
- Develop an access management plan that provides for safe and acceptable operations on the transportation network and that move in the direction to meet the access spacing standards prescribed in the OHP.

2.4 Interchange Function

Interchange 136 serves multiple users. The intended function of Interchange 136 is to safely and efficiently accommodate current and future traffic demands generated by population and employment growth in the region. It provides access to and from the City of Sutherlin, serving local trips by residential and commercial/industrial users. It also serves non-local traffic, such as traffic connecting from distant locations, such as the Oregon Coast, along OR 138 with I-5. In addition, it serves commuter traffic between Roseburg, Elkton and Sutherlin.

Interchange 136 is an urban, service interchange between I-5 and OR 138. In contrast to a freeway-to-freeway or "system" interchange, a service interchange connects a freeway or controlled-access freeway to a lower level roadway such as an arterial or collector street network. It serves commercial and non-commercial uses.

2.4.1 Interchange Configuration

The configuration of the interchange is a standard diamond for the northbound ramps and a gull wing for the southbound ramps. The interchange is a unique configuration since the southbound ramp terminal directly intersects with Park Hill Lane, which intersects with OR 138. A more usual configuration would have both ramp terminals intersect directly with the crossroad.

2.4.2 Roadway Classification

Interchange 136 connects I-5 with OR 138, which is classified by the Oregon Highway Plan (OHP) as a Regional Highway. In the Sutherlin TSP, OR 138 is classified as an Urban Minor Arterial.

The function of a regional highway is to provide connections and links to regions within the state, and between small urbanized areas and larger population centers through connections and links to Freeways, Expressways, or Statewide Highways. The roadway classification is important because it dictates the spacing standards between roadways and the volume-to-capacity (v/c) ratio for the facility. As a regional highway inside an urban growth boundary, the maximum v/c ratio for peak hour operating conditions through a planning horizon for state highway sections located outside the Portland metropolitan area is 0.85. OR 138 is not classified as a freight route in the OHP.

2.5 Planning/Management Area

2.5.1 Planning Area

The Planning Area includes OR 138 and W. Central Avenue between Fort McKay Road to Hawthorne Street and includes Park Hill Lane from Duke Road to Highway 138. Because of the unique configuration of Sutherlin, OR 138 is the only connection between the portions of the city east and west of I-5. To address the impact of development on the interchange, OR 138, and W. Central Avenue, the analysis considered potential development in Sutherlin with special emphasis on land west of I-5 within the city's urban growth boundary (UGB). Figure 1 illustrates the interchange and the features in the immediate area.

2.5.2 Zoning

On the west side of Sutherlin, the City of Sutherlin's UGB includes all land with the current city limits plus some of the surrounding area currently subject to county zoning. Adjacent to, but just beyond the UGB, the Sutherlin Comprehensive Plan designates Urban Growth Areas (UGA) that could be added within the UGB in the future. Figure 2 illustrates current zoning, city limits, UGB and key features of the IAMP Planning Area. The main zoning designations within the IAMP Planning Area are residential, commercial and industrial. The principal residential areas are designated R-1, Low Density Residential. The commercial land is zoned C-3, Community Commercial. Industrial land is zoned M1, Industrial Light, or M2, Industrial Heavy.

According to the Sutherlin Comprehensive Plan, the Community Commercial zoning designation, "…is intended to accommodate a full range of heavy retail and service commercial uses and tourist-oriented commercial uses. It has generally been applied to areas where uses of these types exist. Future tourist-oriented uses are encouraged to locate at or near the I-5/Highway 138 interchange, while heavier commercial uses are intended for the Central Avenue corridor between I-5 and the CBD." (Sutherlin Comprehensive Plan, p. 66)

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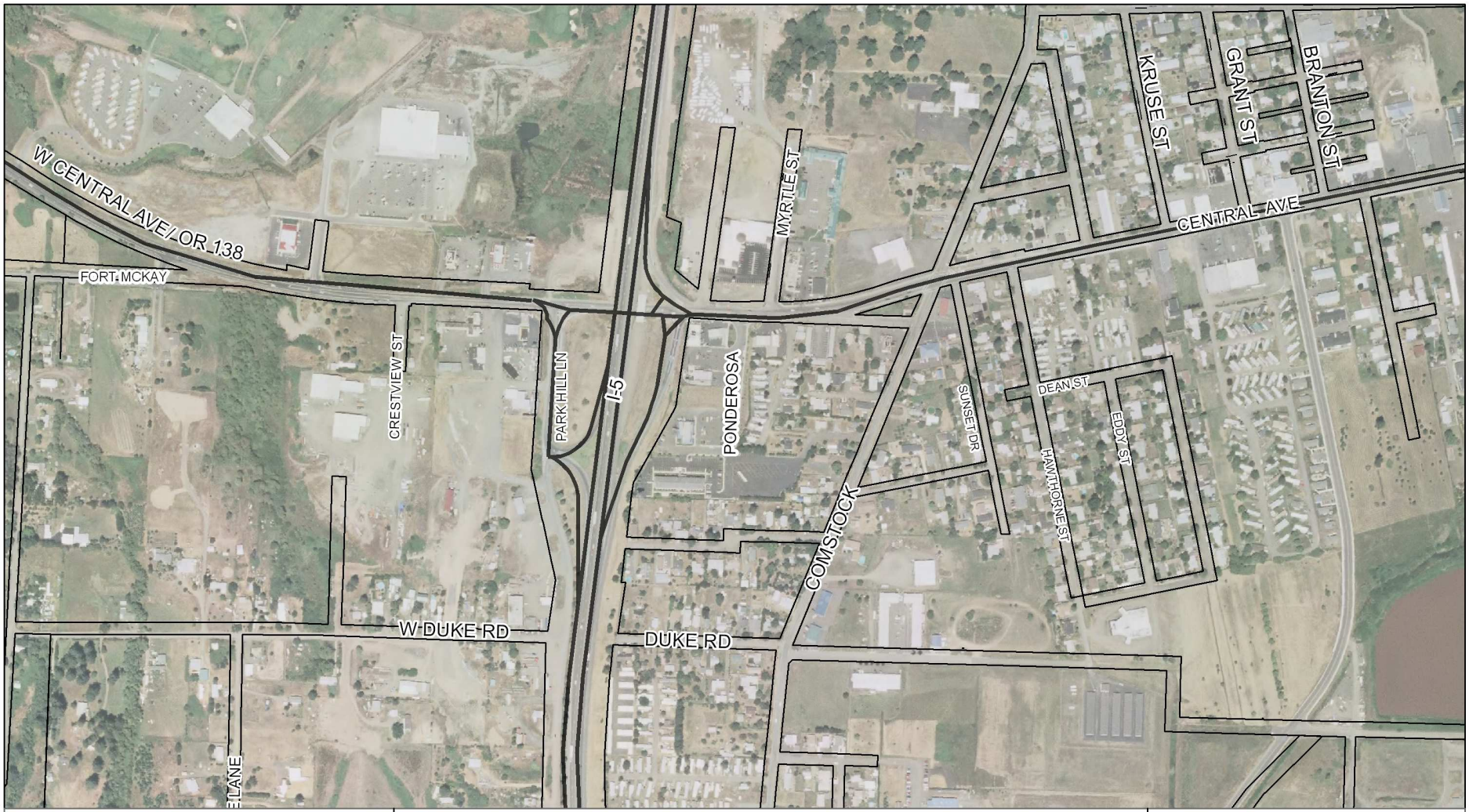

Sutherlin IC 136 IAMP

Figure 1

Project Vicinity

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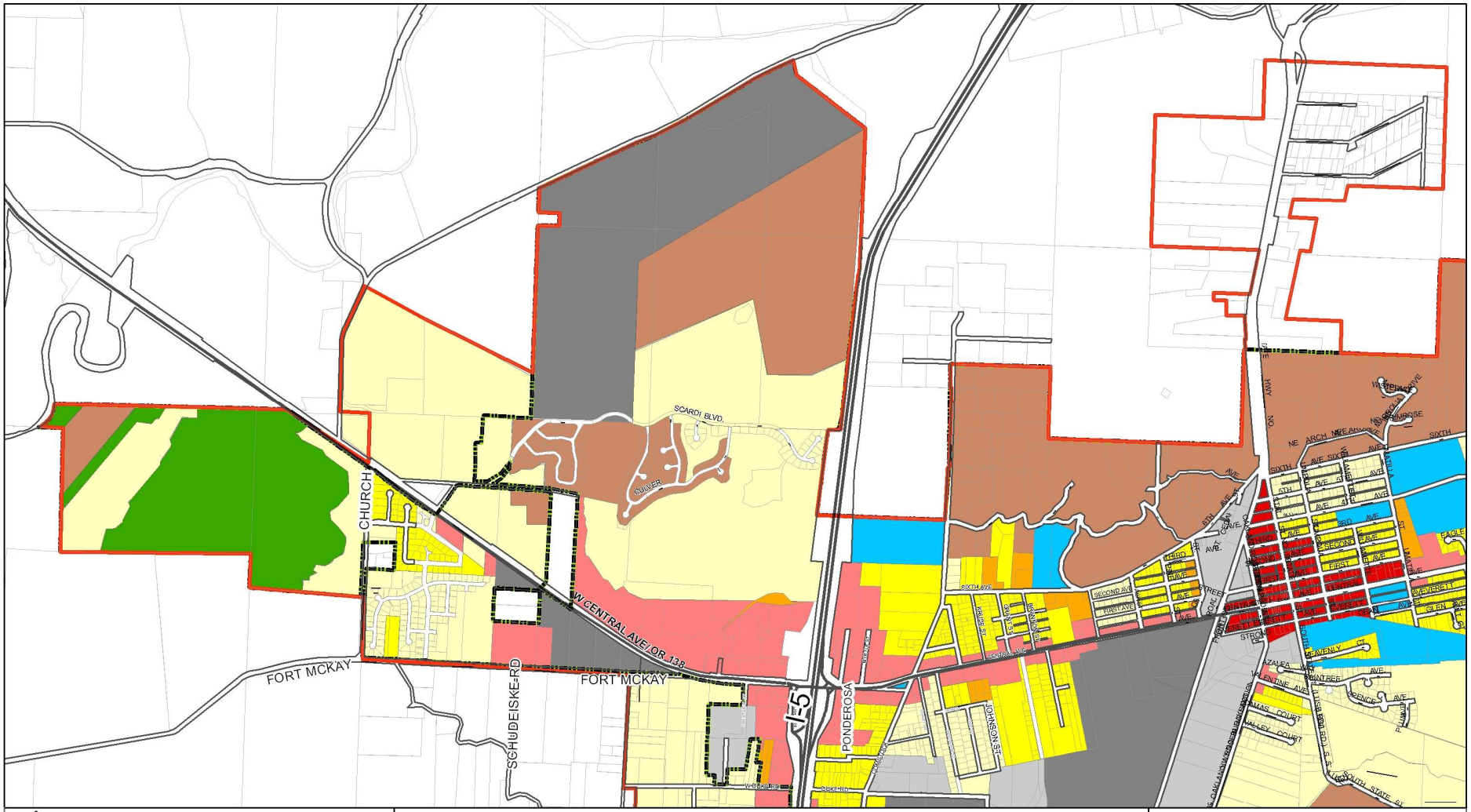

Sutherlin IC 136 IAMP

Figure 2

City Zoning and Boundaries

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3. Existing Conditions: Operations and Safety

3.1 Operational Standards

Operational analyses were conducted for the interchange area for the existing, future no-build, and future build alternatives. The analyses are compared against operational standards applicable to the area. Operational standards specified in the OHP and HDM vary from a v/c ratio of 0.65 to 0.90. For evaluating operations of the existing configuration (including existing and future no-build analyses) the OHP standards are most appropriate; requiring a v/c ratio of 0.85 for ramp terminals or intersections along OR 138/W. Central Avenue. When evaluating capacity improvements, such as interchange alternatives, the HDM operational standards are used. The HDM specifies a v/c of 0.75 for Regional Highways in cities such as Sutherlin and applies to the intersections along OR 138/W Central Avenue.

3.1.1 Existing Operational Conditions

The existing conditions operational analysis shows free flow along the OR 138/W. Central Avenue corridor as well as minimum delay for most side streets. The TSP indicated that the northbound off-ramp approach experienced significant delays when it operated as a stop-controlled intersection. Subsequent to the adoption of the TSP, the intersection was signalized. Table 1 summarizes the existing conditions operational results including the signalization of the northbound ramp terminal.

Table 1: Intersection Operational Analysis-Existing Conditions

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]	D.C. Std.[3]
Interchange 136 Analysis Area						
OR 138 @ Fort McKay Road[5,6]	NB L/R	0.11	B	0.85	0.75	0.90
OR 138 @ Dakota Street[4]	SB L/R	0.24	B	0.85	0.75	0.90
OR 138 @ Park Hill Lane[5,7]	NB L	0.25	D	0.85	0.75	-
Park Hill Lane @ SB Ramp Terminal[5]	WB L	0.03	A	0.85	0.75	-
	NB T/R	0.14	B	0.85	0.75	-
W. Central Avenue @ NB Ramp Terminal[8]	Overall	0.50	A	0.85	0.75	-
W. Central Avenue @Ponderosa Drive[4]	NBL/R	0.17	B	0.85	0.75	-
W. Central Avenue @ Myrtle Street[4]	SBL/R	0.24	C	0.85	0.75	0.90
W. Central Avenue @ Comstock Road[5]	SB L/T/R	0.30	C	0.85	0.75	-
	NB L/T/R	0.28	C	0.85	0.75	-

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right

Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)
3. Operational standards for Douglas County roadway facilities (Source: Sutherlin Transportation System Plan)
4. Data from June 2006, seasonally adjusted volumes
5. Existing conditions data from 2005 Sutherlin TSP
6. 2005 Sutherlin TSP models this intersection with volumes on 4-legs
7. This is a non-conventional intersection that precludes standard analysis techniques.

8. Subsequent to the adoption of the TSP, this intersection was improved with the addition of turn lanes and signalization. The traffic operations of the improved, signalized intersection reported in this table are from "Northwest Sutherlin Rezoning Traffic Impact Analysis," prepared by Lancaster Engineering, August 2007.

3.1.2 Safety

A safety analysis was conducted to determine if there were any significant documented safety issues within the analysis area and to recommend measures at specific locations or general strategies for improving overall safety.

Documented crashes between the years 2003 and 2005 were summarized by location for each of the study intersections. After sorting crashes by location, intersection crash rates were calculated. Table 2 shows the ADT that was determined for each intersection and the calculated crash rates. For intersection crash rate or segment crash rate calculations, and crash details see Appendix A.

Table 2. Study Area Intersection Crash Rates

Intersection	ADT	3-Year Crash Rate
OR 138 at Park Hill Lane	18,890	0.15
West Central Avenue at NB ramp terminal	20,740	0.09
West Central Avenue at Ponderosa Drive	8,980	0.10
West Central Avenue at Comstock Road	10,720	0.60

The safety analysis showed that none of the intersections in the study area has a crash rate significantly greater than that of the surrounding area. The ODOT 2005 5-year Comparison of State Highway Crash Rates shows an average crash rate of 1.94 for an Urban Minor Arterial (OR 138). As a rule of thumb, intersections with crash rates of 1.0 or above are potentially problematic and are candidates for further investigation. As Table 2 shows, all of the intersection crash rates are well below both of the thresholds.

3.1.3 Geometric Issues

As described above, the existing interchange is a conventional standard diamond configuration for northbound I-5, but a non-standard, unique gull-wing configuration for southbound I-5. With the recent reconstruction of the I-5 mainline bridge over OR 138, significant improvements were made, particularly for southbound I-5, but several substandard features exist, including less deceleration distance, curves with smaller radii, less shy distance, and lower design speeds than desirable. A more comprehensive explanation can be found in Appendix A.

4. Future Conditions: Operations and Safety

4.1 Future Conditions

The analysis of future conditions is based on the traffic volumes predicted in the Sutherlin TSP. At the time of its development, the TSP was generally assumed to correspond with year 2025, but additional analysis suggests those volumes may not occur until 2027 or later. The analysis of future traffic operations is based on what is referred to as "TSP Future Year (2027) Volumes."

Further discussion of the rate of growth and future traffic volumes is found in Appendix B, Appendix C and in Section 10.2.

Future analyses evaluated two no-build alternatives, which in this case refer to retaining the current interchange configuration, and build alternatives based on three different interchange concepts.

The two no-build alternatives consisted of

- A three-lane cross-section for OR 138/W. Central Avenue; and
- A five-lane cross-section along OR 138/W. Central Avenue.

The build alternative concepts consisted of

- A folded diamond,
- A standard diamond, and
- A standard diamond with loop ramp for westbound OR 138/W. Central Avenue traffic to access southbound I-5 (TSP Preferred Concept).

The analysis of all future analyses (no-build and build) includes the following system improvements and assumptions:

- Signalized intersections in the immediate vicinity of the interchange include:
  - W. Central Avenue and Comstock Road (currently unsignalized, but included in the TSP),
  - Northbound ramp terminal (currently signalized), and
  - Southbound ramp terminal (currently unsignalized, but included in the TSP).
- The northbound ramp terminal remains in its current location
- Optimized signal timing and cycle lengths.

4.2 Analysis of No-Build Scenarios

The operational analysis of future no-build scenarios considered two cross-sections for OR 138/W. Central Avenue. These two analyses were used to verify the need for a five-lane cross-section for OR 138/W. Central Avenue, a project included in the TSP. These scenarios were used to predict when it would be necessary to move from a three-lane cross section to a five-lane cross section. The five-lane no-build scenario was also used as the basis upon which different interchange configurations were analyzed.

As indicated in the analysis of the existing conditions (summarized in Table 1), the key intersections in the vicinity of the interchange are the intersection of Park Hill Lane with OR 138 on the west side of the interchange and the intersection of the northbound ramp with W. Central Avenue on the east side of the interchange. Failure of either of these two intersections to meet the ODOT mobility standards would adversely impact the interchange and would trigger the need for widening of OR 138/W. Central Avenue. The southbound ramp terminal is technically

where the ramps intersect Park Hill Lane rather than the intersection of Park Hill Lane with OR 138, but practically, the intersection of Park Hill Lane and OR 138 is the more important intersection. Its traffic volumes are significantly higher, congestion is more severe, and delays are longer.

The discussion of the no-build scenarios below focuses on the predicted operations at OR 138 with Park Hill Lane and the intersection of the northbound ramps with W. Central Avenue. Information on the operations at other intersections further from the interchange, including the intersection of Ft. McKay Road with OR 138, and the intersection of W. Central Avenue with Comstock Road can be found in Appendix A.

As described above, one focus of the analysis of no-build conditions was to assess the need for the widening of OR 138/W. Central Avenue from three lanes to five lanes, a project included in the TSP. As indicated in Table 3, the three-lane cross-section analysis shows traffic operations at both ramp terminals are very poor. With TSP future year traffic volumes, both ramp terminals fail to meet both the OHP and HDM mobility standards and both are calculated to exceed the capacity of the intersections. Simply put, more traffic desires to use both intersections than either can accommodate. The result will be long queues as more and more traffic backs up at both intersections, adversely impacting the entire interchange even with both intersections being signalized.

Table 3. Traffic Operations Analysis Results for Three-Lane Scenario using TSP Future Year (2027) Traffic Volumes

Intersection	Signalized Intersection Performance	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]
Interchange 136 Analysis Area					
OR 138 @ Park Hill Lane	**Overall**	**1.01**	**E**	0.85	0.75
W. Central Avenue @ Northbound Ramp Terminal	**Overall**	**1.19**	**F**	0.85	0.75

Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)

Based on the failure of a three-lane section for OR 138 to achieve either the OHP or HDM mobility standards, the second no-build scenario was analyzed based on a five-lane cross-section for OR 138. It is described as a no-build scenario because it retains the existing interchange configuration.

Table 4 summarizes the traffic operations for the two key intersections for the future no build five-lane cross-section. The results for the five-lane cross-section show improved operations over the three-lane cross-section. Though both intersections are predicted to meet OHP mobility standards, the five-lane no-build alternative is predicted to fail to meet the HDM mobility standard. The HDM mobility standard requires of v/c ratio less than or equal to 0.75.

Table 4. Traffic Operations Analysis Results for Five-Lane Scenario using TSP Future Year (2027) Traffic Volumes

Intersection	Signalized Intersection Performance	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]
Interchange 136 Analysis Area					
OR 138 @ Park Hill Lane	**Overall**	0.84	B	0.85	0.75
W. Central Avenue @ Northbound Ramp Terminal	**Overall**	0.80	B	0.85	0.75

Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)

4.3 Analysis of Build Scenarios

Because both the three-lane and five-lane no-build scenarios described in Section 4.2 failed to achieve the HDM mobility standards, three alternative interchange concepts were evaluated.

Alternative interchange concepts include a folded diamond, a standard diamond, and the TSP Preferred Concept, which is a standard diamond with an additional loop ramp for southbound I-5 traffic. All three concepts were analyzed for their ability to accommodate forecast TSP future year traffic volumes. Since the Baseline Future analyses indicated that three lanes would be inadequate to meet forecast TSP future year traffic demands, the analyses of all three new interchange concepts were based on a five-lane facility for OR 138/W. Central Avenue from Fort McKay Road to Comstock Road.

Like the no-build scenarios, the build scenarios assume signalization of both ramp terminals. In addition to the base system improvements made for the no-build future analyses, the build alternatives include the following additional attributes:

- Five lanes are provided on W. Central Avenue and OR 138 from Comstock Road to Fort McKay Road.
- Replacement of the existing gull-wing configuration of the southbound ramps, which currently allows the southbound ramps to connect with Park Hill Lane, with a conventional ramp configuration where the southbound ramp terminal intersects with OR 138.
- Elimination of the connection from the southbound ramp to W. Duke Road via Park Hill Lane.
- Construction of a new frontage road that runs parallel with I-5 to the west and connects OR 138 to W. Duke Road and to Interchange 135.
- A supplemental right-turn lane is provided westbound at the on-ramp to I-5 northbound.
- A supplemental right-turn lane is provided eastbound at the on-ramp to I-5 southbound.
- Separate lanes are provided for left turns and right turns as the off-ramps approach the ramp terminals.
- Dual left-turn lanes are provided at the intersection of the northbound off-ramp at W. Central Avenue.
- Longer cycle lengths are used for the traffic signals at the ramp terminals (80 seconds to 120 seconds).

Each of the three interchange concepts is discussed below with a summary following. The traffic operations analyses of the three interchange concepts are summarized in Table 5.

4.3.1 Folded Diamond Concept

The folded diamond concept is illustrated in Figure 3. The folded diamond interchange configuration is most like the existing interchange. Unlike the existing gull wing interchange, the southbound ramp terminal is relocated to intersect with OR 138.

Figure 3 illustrates the lane configurations used in the traffic operations analysis; it is not drawn to scale. Additional information on the lane configurations and traffic volumes is contained in Appendix C.

Figure 4 illustrates the folded diamond concept overlaid on an aerial photograph of the interchange. This figure is drawn to scale and shows the preliminary centerline of the new ramps.

Figure 5 illustrates the configuration of OR 138 between the ramp terminals under the folded diamond concept. This figure illustrates the turn lanes, storage distances and tapers between the ramp terminals.

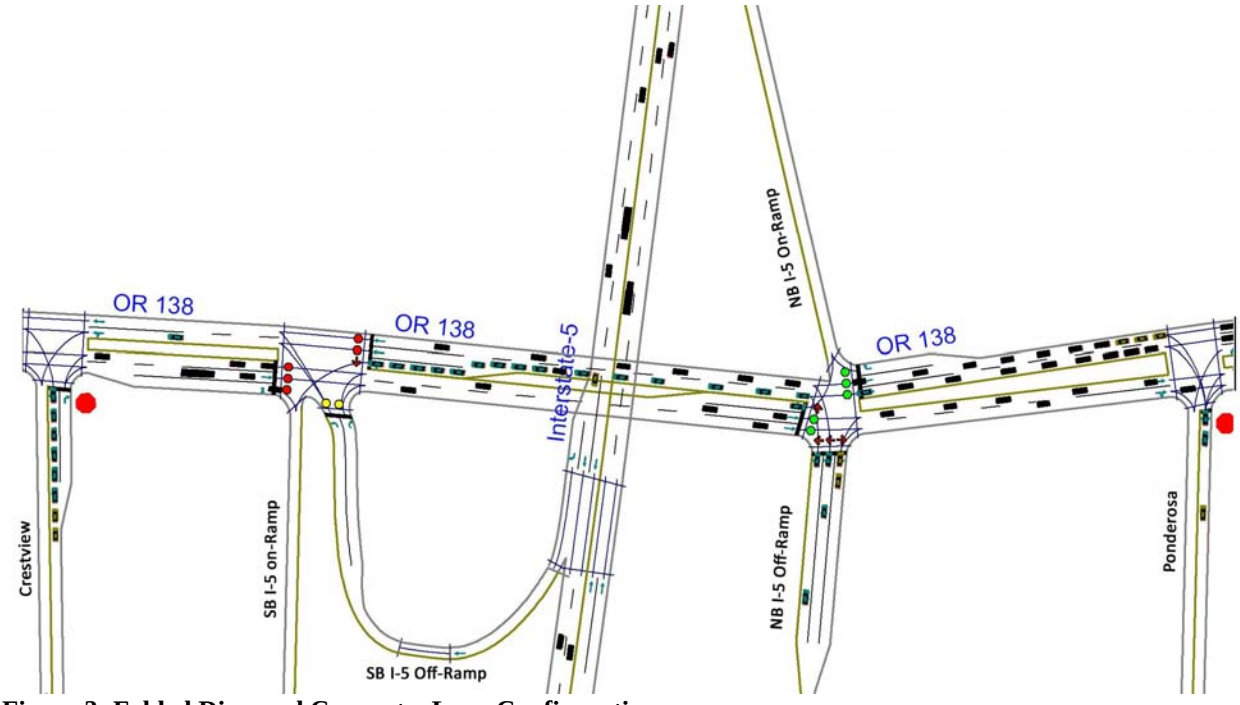
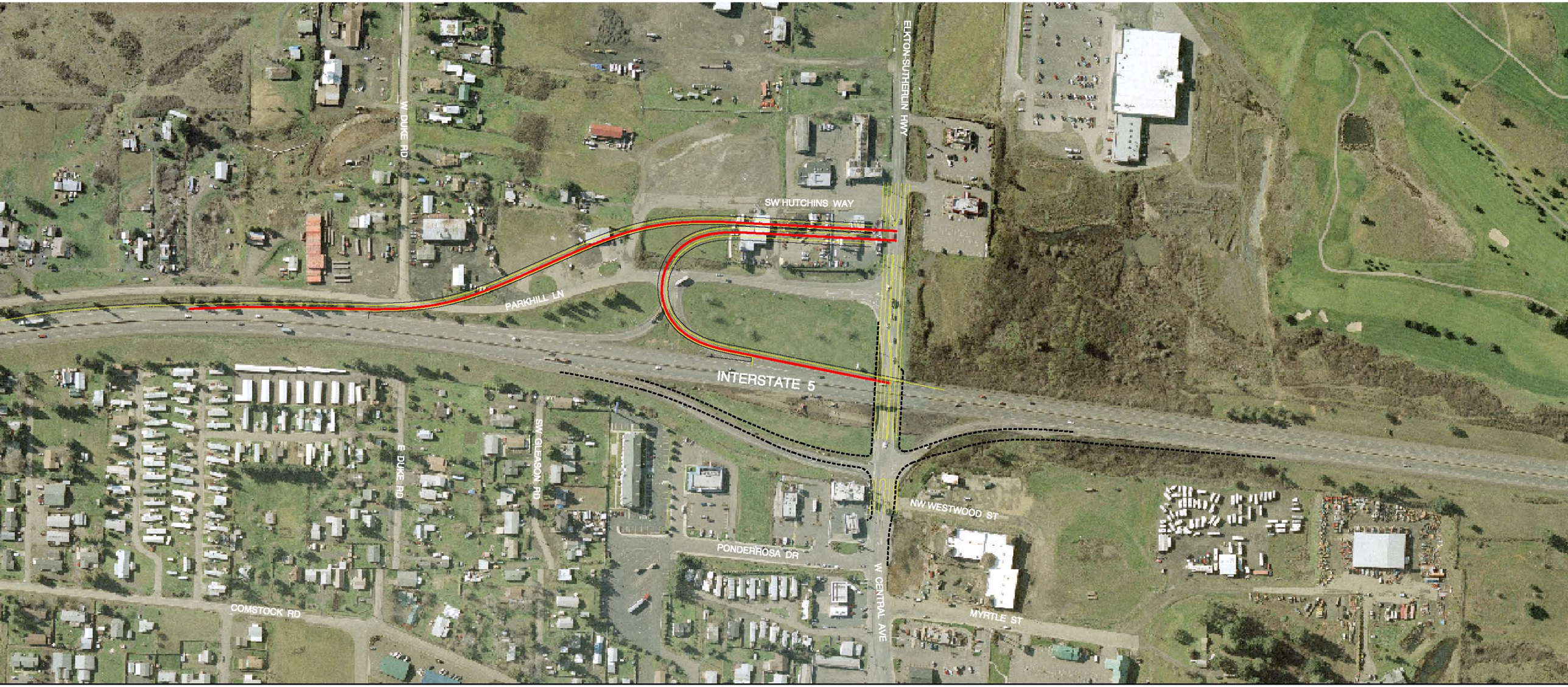


Figure 3: Folded Diamond Concept – Lane Configurations

The folded diamond concept showed acceptable traffic operations using TSP future year traffic volumes and meets both OHP and HDM standards.



SCALE 0 100 200 300 400 FEET

FOLDED DIAMOND CONCEPT

PRELIMINARY CONCEPT ONLY

Approximate Pavement Only.
No Slope Information Or
Right-Of-Way Is Shown

CONCEPTUAL DESIGN ONLY NOVEMBER 17, 2008

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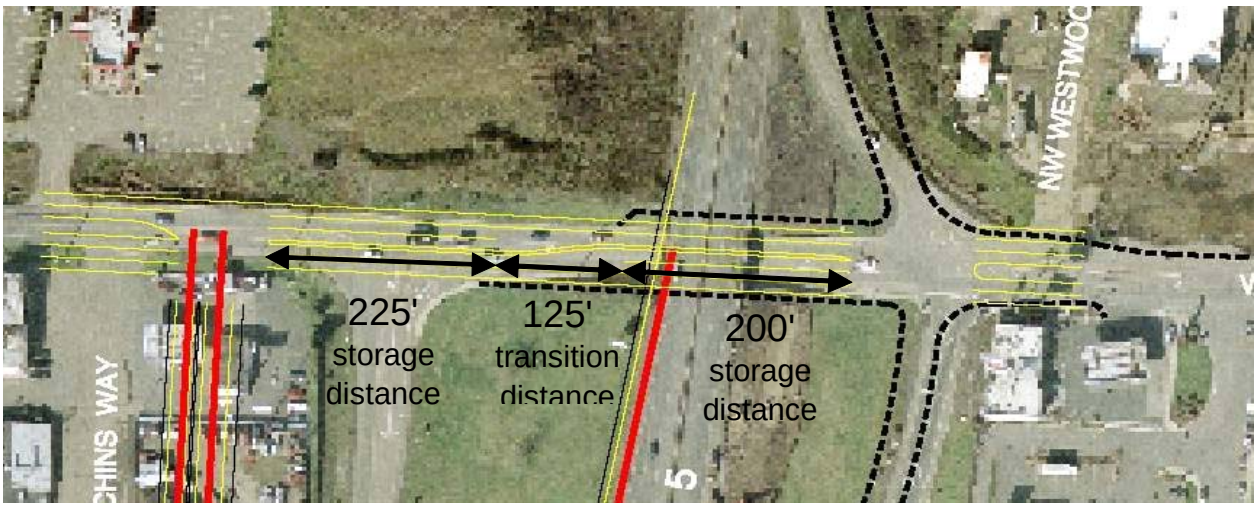
Figure 5. Folded Diamond Concept – Ramp Terminal Area



4.3.2 Standard Diamond Concept

The current interchange configuration uses a standard diamond configuration for the northbound ramps. This concept repeats that configuration for the southbound ramp terminal.

The standard diamond concept is shown in Figure 6. Like the Figure 3 in the preceding section, this is an illustration and is not to scale. Additional information on the lane configurations and traffic volumes is contained in Appendix C.

Figure 7 illustrates the standard diamond concept overlaid on an aerial photograph of the interchange. This figure is drawn to scale and shows the preliminary centerline of the new ramps.

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Figure 8 illustrates the configuration of OR 138 between the ramp terminals under the standard diamond concept. This figure illustrates the turn lanes, storage distances and tapers between the ramp terminals.

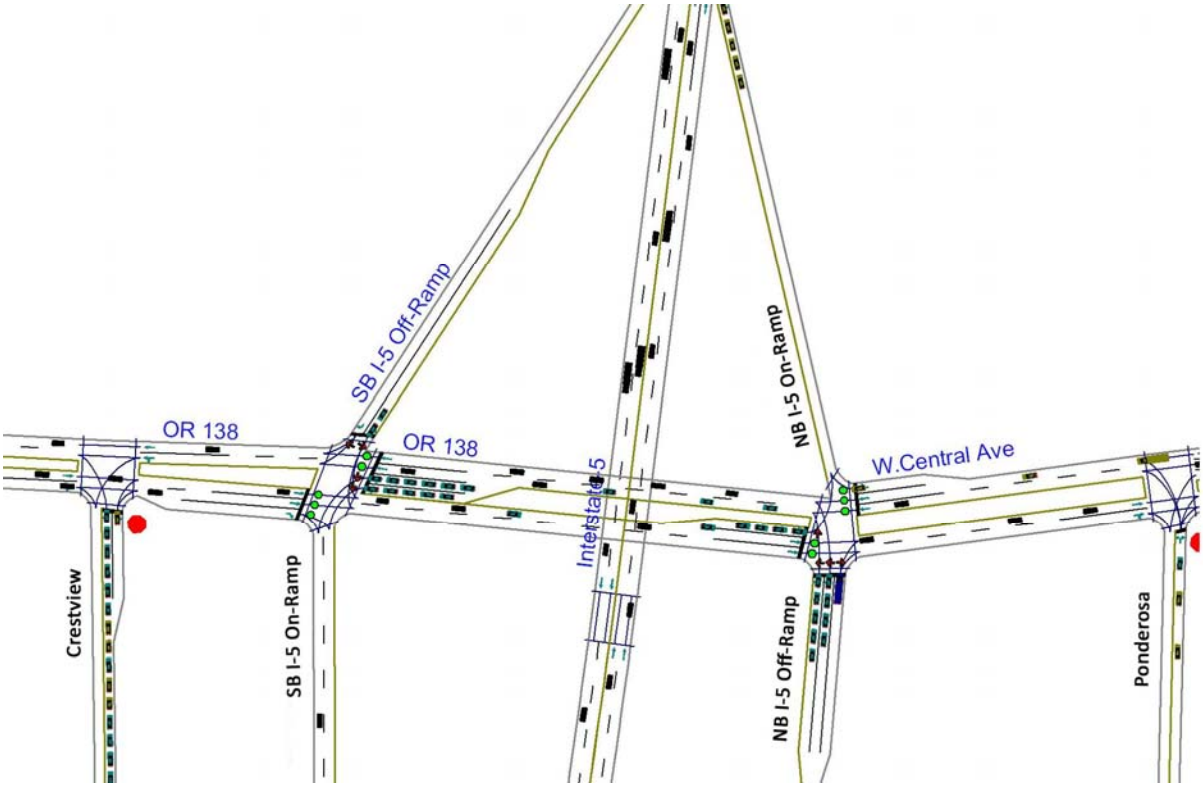

Figure 6: Standard Diamond Concept – Lane Configurations

The standard diamond concept is also predicted to meet both OHP and HDM operational standards using future year 2027 traffic volumes.

STANDARD DIAMOND CONCEPT

PRELIMINARY CONCEPT ONLY
Approximate Pavement Only.
No Slope Information Or
Right-Of-Way Is Shown

CONCEPTUAL DESIGN ONLY NOVEMBER 17, 2008

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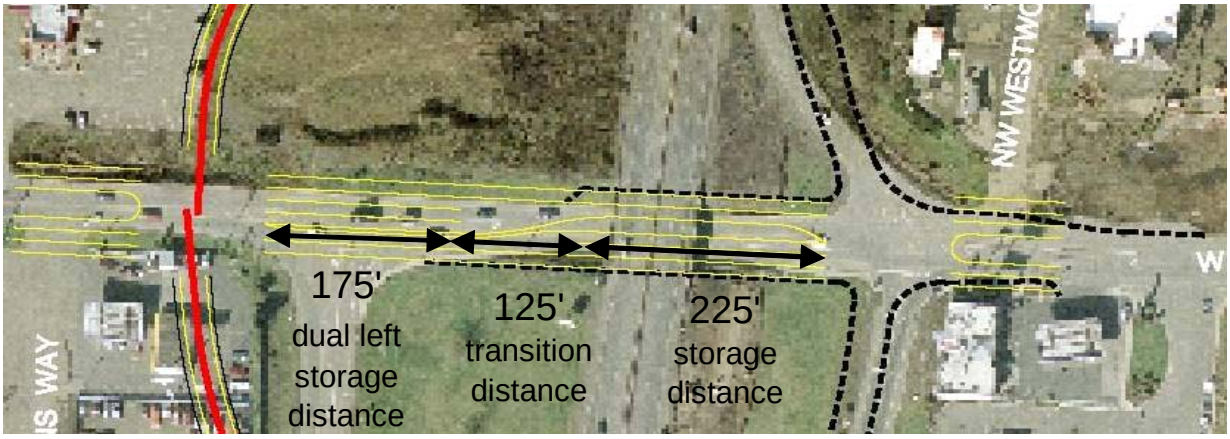
Figure 8:Standard Dimond Concept – Ramp Terminal Area



4.3.3 TSP Preferred Concept

The TSP preferred concept takes its name from the interchange design identified in the TSP. It is similar to the standard diamond, but includes a supplemental loop ramp that provides for movements for westbound traffic to southbound I-5. This concept eliminates the need for left turns from OR 138 at the SB ramp.

The TSP preferred concept is illustrated in Figure 9. Like the Figures 3 and 6, the illustration indicates the lane configurations, but it is not to scale. Additional information on the lane configurations and volumes is contained in Appendix C.

Figure 9 illustrates the TSP preferred concept overlaid on an aerial photograph of the interchange. This figure is drawn to scale and shows the preliminary centerline of the new ramps.

Figure 10 illustrates the configuration of OR 138 between the ramp terminals under the TSP preferred diamond concept. This figure illustrates the turn lanes, storage distances and tapers between the ramp terminals.

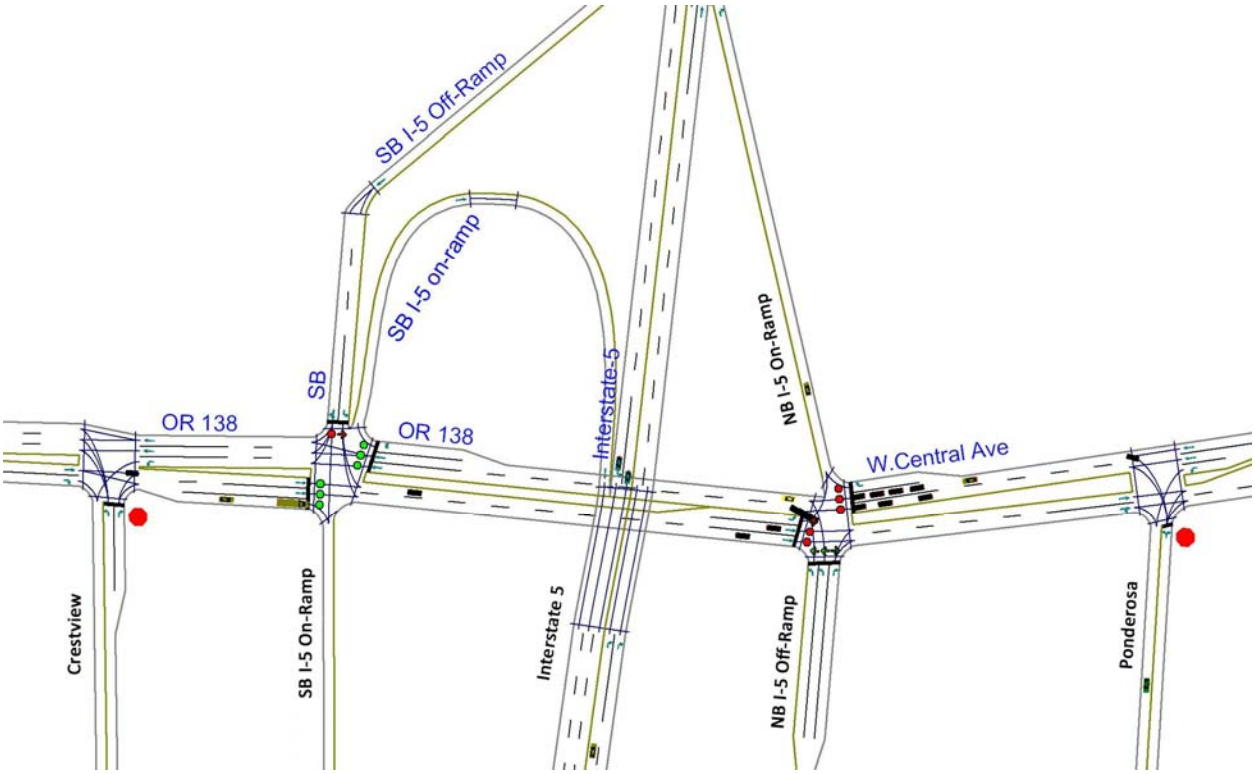


Figure 9: TSP Preferred Concept – Lane Configuration

The TSP preferred concept is also predicted to meet both OHP and HDM operational standards using future year 2027 traffic volumes.

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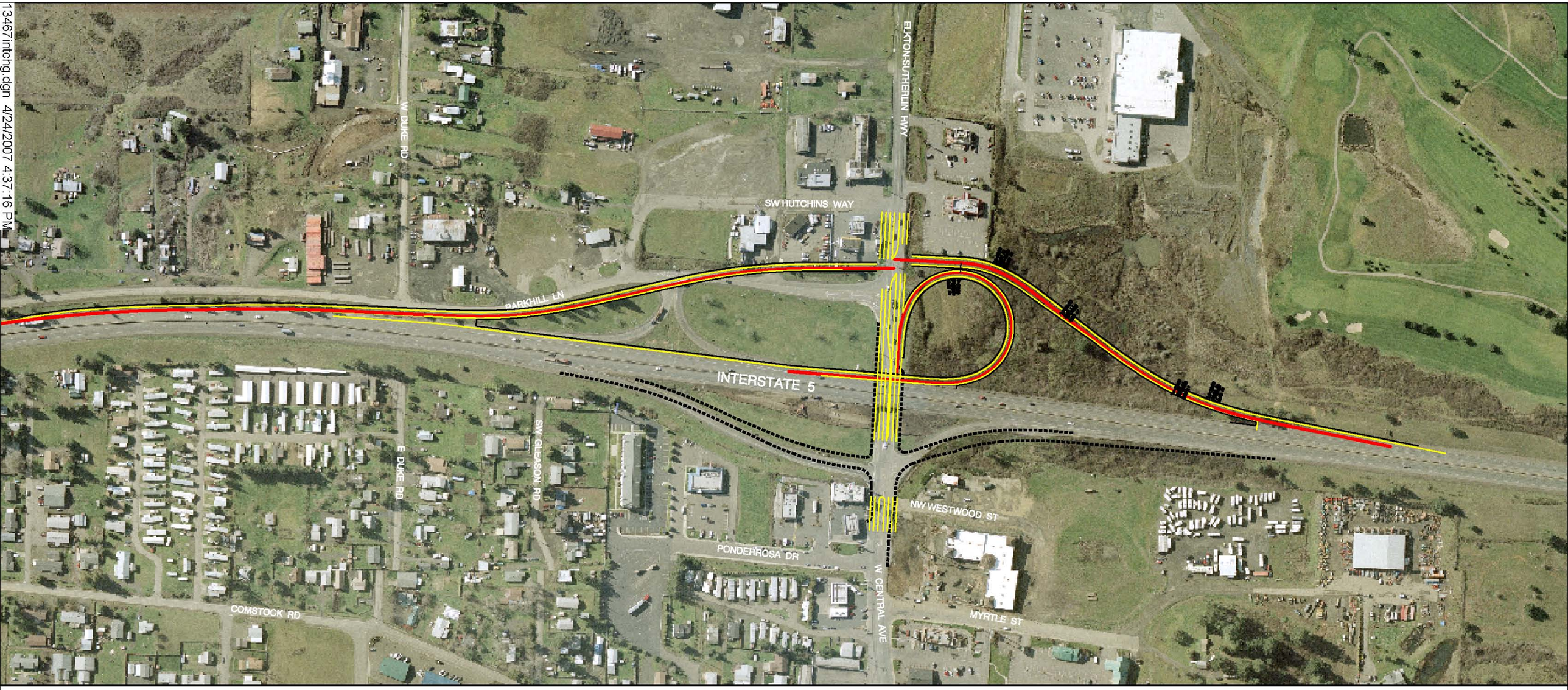

SCALE 0 100 200 300 400 FEET

STANDARD DIAMOND WITH LOOP RAMP CONCEPT

PRELIMINARY CONCEPT ONLY
Approximate Pavement Only.
No Slope Information Or
Right-Of-Way Is Shown

CONCEPTUAL DESIGN ONLY NOVEMBER 17, 2006

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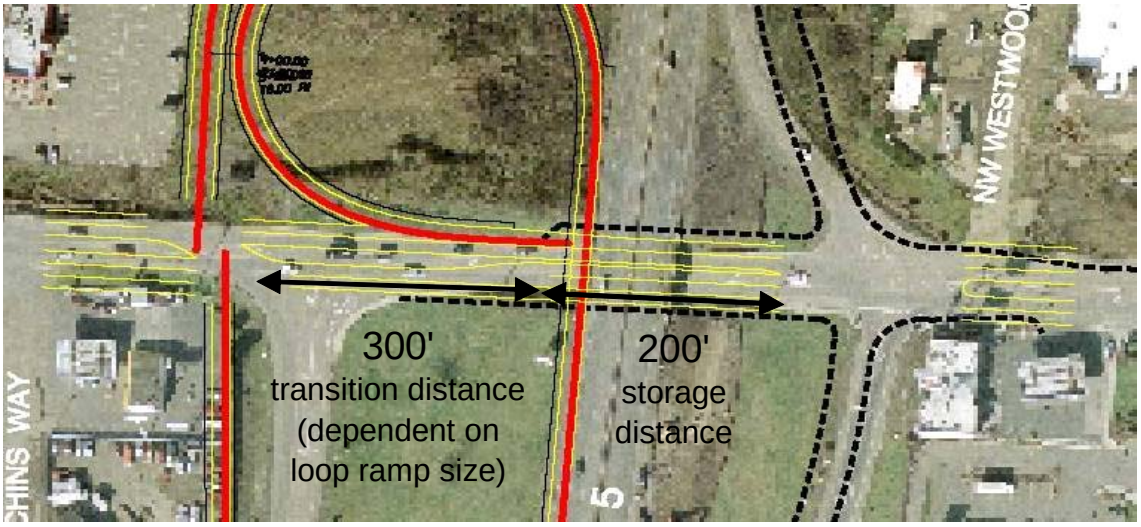
Figure 11. TSP Preferred Concept – Ramp Terminal Area



4.3.4 Traffic Operations of Ramp Terminals for all Build Concepts

Table 5 summarizes the traffic operations analysis results for the three concepts. In all cases, the concepts met the operational standards of both the OHP and HDM.

Table 5. Traffic Operations Analysis Results for Three Build Alternatives using TSP Future Year (2027) Traffic Volumes

Intersection	**Folded Diamond**		**Standard Diamond**		**Standard Diamond with Loop Ramp - "TSP Preferred Concept"**	
	v/c ratio	**LOS**	**v/c ratio**	**LOS**	**v/c ratio**	**LOS**
SB Ramp Terminal	0.71	C	0.63	C	0.42	A
NB Ramp Terminal	0.65	C	0.65	C	0.63	D

Note: Both ramp terminals are signalized for all concepts.

4.3.5 Queue Storage Requirements of Ramp Terminals

Providing sufficient capacity to accommodate vehicles at signalized intersection is important to assure efficient operation of intersections. Typically, the length of turn lanes is designed to accommodate the 95 percentile queue during peak hour traffic conditions.

Only minor differences were calculated for the queue storage among the three interchange design concepts. The length of turn lanes needed to accommodate the 95 percentile queue was one of the factors used to determine the spacing between the ramp terminals and, specifically, the location of the southbound ramp terminal illustrated in Figures 4, 6, and 8.

Details on the queuing and lengths needed for each lane at the ramp terminals can be found in Appendix D.

4.3.6 Merge/Diverge Analysis

The performance of the ramp terminals is usually the critical factor in determining how well an interchange functions. Another important factor may be the operations of the merge movements, where the on-ramps merge with the mainline, and the diverge movements, where traffic on the mainline takes the off-ramp.

A merge/diverge analysis was conducted for the northbound and southbound on/off-ramps of I-5. This analysis utilizes TSP future year traffic volumes and is based on Analysis Procedures Manual (TPAU, April 2006). The analysis looks at multiple segments in the merge and diverge sections. All segments were analyzed and the highest v/c ratios are shown in Table 6.

The merge analysis looks at two different segments:

- Merge influence area, and
- Downstream basic freeway segment.

The diverge analysis looks at four different segments:

- Downstream freeway leg,
- Ramp flow,
- Freeway flow upstream of the diverge point, and
- Flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane.

More details on these analyses are provided in Appendix C.

Table 6. Merge/Diverge Analysis Results using TSP Future Year Traffic Volumes

	V/C ratio of merge and diverge movements with I-5 mainline			
	No Build	**Folded Diamond**	**Standard Diamond**	**TSP Preferred**
Interchange 136 Analysis Area				
NB On-ramp (merge)	0.35[1]	0.35[1]	0.35[1]	0.35[1]
NB Off-ramp (diverge)	0.43[2]	0.40[2]	0.40[2]	0.40[2]
SB On-ramp (merge)[3]	0.56[1]	0.56[1]	0.56[1]	0.57[1]
SB Loop On-ramp (merge)[3]	NA	NA	NA	0.47[1]
SB Off-ramp (diverge)	0.44[2]	0.44[2]	0.44[2]	0.44[2]

Notes:

1 Value shown is for merge influence area; the volume to capacity of the downstream basic freeway segment is less than value shown.

2 Controlling v/c ratio is shown. Four v/c ratios were considered: downstream freeway leg capacity, ramp flow capacity, freeway flow upstream of the diverge capacity, and flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane capacity.

3 Note that the TSP preferred concept has two southbound on-ramp merges. The no-build and each of the other build scenarios, the folded diamond concept and the standard diamond concept, has only one on-ramp to southbound I-5.

For the no-build and all build scenarios, the merge and diverge movements meet the OHP and HDM operational standards. With regard to mainline I-5 operations and the merge and diverge movements, there is essentially no difference among the alternatives.

4.4 Other Considerations Relating to Interchange Redesign Concepts

4.4.1 Geometric Differences

Geometric differences are evident among the concepts. The folded diamond concept avoids any construction in the northwest quadrant of the interchange. The standard diamond concept requires additional width at the southbound ramp terminal to accommodate dual left-turn lanes for the westbound to southbound I-5 movement. The TSP preferred concept involves two new ramps in the northwest quadrant of the interchange.

4.4.2 TSP Compatibility

All three concepts appear to be compatible with the TSP. All three concepts retain the basic five-lane section for the OR 138/W. Central Avenue corridor, but all assume additional lanes will be required for right turns at the ramp terminals.

4.4.3 Safety Issues

All three concepts are likely to be an improvement over the existing, non-standard configuration for the southbound ramp terminals. Current design standards would be expected to provide superior performance from a safety standpoint. There is likely to be little difference among the concepts.

4.4.4 Bicyclist/Pedestrian Issues

The Oregon Revised Statues require accommodations for bicyclists and pedestrians for all new and reconstructed street and highway projects. Sidewalks and bicycle lanes would be a standard provision with a new interchange.

Two issues may require special attention. High-speed turn movements, such as those associated with right-turn lanes or free-flow ramps, are difficult for pedestrians and bicyclists needing to cross them. Such designs are not preferred from a bicyclist or pedestrian standpoint. All three concepts utilize supplemental right-turn ramps that would cause concern. The TSP Preferred Concept utilizes a free-flow ramp for the westbound to southbound I-5 movement. This ramp would be least desirable from a bicyclist/pedestrian standpoint. Dual turn lanes, such as proposed with the standard diamond configuration, are also difficult. ODOT generally does not allow crosswalks on the receiving street where dual turn lanes are used. Crosswalks are still allowed on the approach side even when dual turn lanes are used.

4.4.5 Right-of-Way Issues

The amount of right of way required to accommodate any of the interchange concepts may be greater than people realize. Based on the traffic operations analysis performed and the conclusion that supplemental right-turn lanes will be needed at the approaches to the ramp terminals to accommodate TSP future year volumes. ODOT's design standards are considerably different from those used with the original design of Interchange 136. Even the lowest design speeds typically used by ODOT require larger curves and longer transitions than used in the past. Better identification of right-of-way issues will be needed during the preliminary engineering and right-of-way phases following the identification of an interchange project and its inclusion in a future State Transportation Improvement Program (STIP).

4.4.6 Signal and Intersection Spacing Issues

The analysis of existing conditions confirmed that the current intersection spacing along the corridor does not meet ODOT access spacing standards. The likely location of the signalized ramp terminals is similar for all three of the interchange concepts, so complying with basic driveway and intersection spacing requirements is similar among the concepts. The efficiency and safety of all three concepts would benefit from implementing access management changes. None of the concepts offers advantages over the others with respect to intersection spacing and the level of difficulty of implementing good spacing is the same for the three concepts.

4.4.7 Other Street Improvements

As indicated above, all three concepts require elimination of Park Hill Lane between OR 138 and W. Duke Road. This section of Park Hill Lane is too close to the mainline of I-5 to allow a modern interchange with sufficient distance between the ramp terminals to be constructed.

Since Park Hill Lane currently provides the principal access from OR 138 to W. Duke Road and the land to the south, a substitute connection would be required. A new frontage road or collector road that extends from OR 138 to W. Duke Road, located far enough west of the interchange to meet ODOT access spacing standards, is a key requirement of all three concepts.

All three interchange concepts also benefit from a well-connected local street system. The implementation of local street system improvements would also be essentially the same for all three concepts. The local circulation network is discussed in greater detail in Section 7.

5. Evaluation and Selection of a Preferred Interchange Concept

All three of the interchange concepts were evaluated based on several factors discussed in the previous section. The most important included their ability to meet the HDM mobility standards with future TSP traffic volumes, to meet modern design standards, and to be compatible with the recently reconstructed I-5 bridge and the recent improvements to the northbound ramps on the east side of the interchange. Operational results are discussed in the Future Conditions Alternative Interchange Concepts section above. A summary of advantages and disadvantages for each concept are shown in Table 7, while a summary of concept cost estimates is shown in Table 8. More details of the concepts and evaluation can be found in Appendix D.

Table 7. Interchange Concept Advantages and Disadvantages

Concept	Advantages	Disadvantages
Common to all build alternatives	• Modern Design • I-5 SB off-ramp meets standards • Eliminates gull wing configuration involving an intersection with Park Hill Lane prior to intersecting with OR 138 • Improved, longer SB I-5 on-ramp acceleration distance • Supplemental right-turn lanes • Longer merge distance • Meets mobility standards	• Requires construction of a new "frontage road" to replace Park Hill Lane • Right-of-way impacts to SW quadrant
Folded Diamond	• Minimal right-of-way impacts to NW quadrant	• Limited potential for expansion to increase capacity • Not compatible with loop ramp to facilitate westbound to southbound I-5 movement
Standard Diamond	• Compatible with Loop ramp to facilitate westbound to southbound I-5 movement	• Right-of-way impacts to NW quadrant
TSP Preferred Concept (Standard Diamond with loop ramp)	• Loop ramp meets standards and provides longer merge distance than existing condition • Phased implementation is possible	• Right-of-way impacts to NW quadrant

Table 8. Cost Estimate Summary

Interchange Concept	Project Component	2007 Estimated Cost (Millions)
Folded Diamond	Interchange construction cost[1]	$3.2
Standard Diamond	Interchange construction cost[1]	$3.3
TSP Preferred Concept (standard diamond with supplemental loop ramp	Interchange construction cost[1]	$5.4

1 Includes engineering and construction costs, but not right-of-way or relocation.

The three build concepts were evaluated by the Project Advisory Committee (PAC) and the Transportation Advisory Committee (TAC). The selection criteria used during the process included the need to meet Highway Design Manual operational standards, an ability to provide future capacity and possible phased implementation, and limited ROW impacts.

At their meetings on March 8, 2007 the PAC and the TAC both selected the TSP Preferred Concept as their preference for the ultimate interchange configuration. Because the TSP Preferred Concept is the standard diamond plus an additional loop ramp, the committees identified the standard diamond concept as an appropriate initial project as part of phased implementation of the TSP Preferred Concept.

6. Development Assumptions and Traffic Growth

6.1 Transportation System Plan

The TSP, prepared in 2005, was generally based on the adopted Sutherlin Comprehensive Plan. The TSP's assumptions accounted for build out of the areas within the city's urban growth boundary (UGB). The city staff also assumed that substantial development would occur on land outside the city's UGB.

These development assumptions, combined with more recent information discussed below, suggest that the traffic volumes forecast in the TSP may be too high for a twenty-year planning horizon. By some estimates, the traffic volumes in the TSP may be 1/3 higher than is likely in twenty years. The need for certain improvements may not occur until a later date than suggested in the TSP. Further discussion can be found in Appendix B and Appendix F.

6.2 Buildable Lands Inventory

The Sutherlin Buildable Lands Inventory and Economic Opportunities Analysis (BLI) was completed in June 2005. Unlike the TSP, the BLI assessed only land within the UGB. In addition, it considered the implications of constraints, including terrain (hillsides) and wetlands.

Among other conclusions, the BLI's authors concluded that there was a deficit of vacant residential land, which led to a private developer's application in 2006 for a UGB expansion to add residential land to the city. The BLI did not provide a specific recommendation for the number of acres needed for residential development to accommodate 5500 new residents predicted in the BLI. The new residences could be accommodated on existing vacant land or on existing partially-vacant parcels or on land added to the UGB.

The BLI also noted a deficit of commercial land and a deficit of land for public and semi-public uses such as parks, schools, and government facilities. On the other hand, the BLI identified a surplus of industrial land. Further discussion can be found in Appendix B and Appendix F.

Based on the information from the BLI, the Comprehensive Plan, and trip generation rates derived from the Institute of Transportation Engineers' *Trip Generation*, we developed trip generation estimates for lands in west Sutherlin (west of I-5). These estimates are presented in Table 9 and represent development consistent with the BLI assumptions.

Table 9: Traffic Generation Potential of Available Developable Land in the West Sutherlin Area

Land Use	Acres	Trip Rate	Inbound PM Peak Hour Trips	Outbound PM Peak Hour Trips
Low Density Residential	250	1 trip/dwelling; 4 dwelling/acre	640	360
High Density Residential	3	0.6 trip/dwelling 12 dwellings/acre	14	7
Commercial	12	56 trips/acre	336	336
Light Industrial	6	3 trips/acre	3	15
Heavy Industrial	40	3 trips/acre	24	96
Industrial Park	200	3 trips/acre	120	480
Total			1137	1294

6.3 Alternative Development Scenarios

Based upon a review of the information in the BLI and the city's development code, there appear to various development scenarios that could produce either more traffic or less traffic than calculated for the TSP. Scenarios that could produce less traffic include those where wetlands constraints preclude development or where the UGB is not expanded as in the BLI. Scenarios that could produce greater traffic volumes include those where certain allowed commercial development occurs on land designated for industrial use or where UGB expansions occur.

Developing commercial establishments with high traffic characteristics on land designated for industrial use is a significant possibility in Sutherlin because both the city's M-1 and M-2 zoning designations allow restaurants and lumber or building material sales. Fast food restaurants and home improvement superstores, which appear to be allowed in these zoning categories, are among the uses that produce high traffic volumes.

More detailed discussion of development assumptions used in the TSP, the BLI, and various land use scenarios and their traffic impacts can be found in Appendix B and Appendix F.

7. Preserving Interchange Operations

The goal of an IAMP is to help protect the investment in an interchange and extend its operational life for the long term. Preserving or extending the operational life of an interchange can be accomplished through access management and the development of an interconnected local street system, and through the use of management measures, particularly those that preclude previously unplanned development.

The IAMP identifies solutions to resolve the problems and issues described in greater detail in Section 2. Specifically, the IAMP deals with issues of inadequate capacity of the interchange to accommodate planned development and to address issues relating to geometric deficiencies and access points closer to the interchange than is appropriate.

7.1 Access Management

Access management seeks to maximize the effective capacity and improve operations at the interchange by minimizing the conflicts from traffic operations at nearby driveways and intersections with nearby streets. Located close to an interchange, excess driveways and local streets reduce safety and capacity of ramp terminals.

Access management must balance the competing needs of traffic capacity and safety for I-5 and local access needs. The Oregon Highway Plan (OHP) devotes an entire section to the discussion of access management. More detailed requirements, action definitions, and the access spacing standards for state highways are specified in Oregon Administrative Rule (OAR) 734-051 (Division 51): Highway Approaches, Access Control, Spacing Standards, and Medians[2]. Ideally, a project will include provisions by which access within the project limits can be made fully compliant with Division 51. In many instances, however, access needed for existing development will not allow these standards to be met. When the requirements and standards cannot be met, progress toward meeting the applicable standards must be demonstrated.

Ideally, the first intersection allowing full movements is located not less than 1320 feet from an interchange ramp terminal. Under ODOT's access management rules, approach roads less than 1320 feet, but at least 750 feet, from the ramp terminal are limited to right-in, right-out movements.

The access management plan described in this section was prepared based on the TSP preferred concept though it could be applied equally well to either of the other interchange concepts. It does not meet the ideal specifications summarized above, but it does demonstrate progress toward those standards.

7.2 Circulation Plan with Enhanced Local Street Network

The development of an interconnected local street network is also part of the solution to transportation in the vicinity of the interchange. An interconnected local street system helps motorists complete their trips without going through the interchange area and provides improved access to businesses and residences in the area where access management changes are made.

The TSP includes several policies that support an enhanced local street network. The following are among the goals and policies that support an enhanced local street system:

- Goal 3. Enhanced Livability, Objective D. "Manage transportation system for adequate and efficient operations.

- Goal 4. Street System, Objective A. "Develop a street classification system to provide an optimal balance between mobility and accessibility for all transportation modes consistent with street function," and

[2] A complete copy of Division 51 can be found online at:
http://www.oregon.gov/ODOT/HWY/ACCESSMGT/docs/DIVISION_51.pdf

- Goal 4. Street System, Objective F. "Balance the needed street function for all travel modes with the adjacent land uses through context-sensitive design and streetscape design techniques."

The TSP currently lacks specific local street system projects to enhance connectivity in the vicinity of the interchange. This is remedied by the inclusion of specific projects in the TSP as specified in Section 10 of this document.

The access management plan expands upon and reinforces some of the street network recommendations included in the adopted TSP. One of the key streets identified in the TSP is a collector street intended to replace Park Hill Lane that currently serves as the principal connection between OR 138 and W. Duke Road. As explained in a previous section, the existing Park Hill Lane between OR 138 and W. Duke Road must be abandoned to allow the construction of a new, modern interchange recommended to replace the current gull wing interchange configuration. As discussed below, the intersection of OR 138 and Dakota Street has been identified as the recommended connection for the new collector that would extend to W. Duke Road. This could also be a logical route to extend a collector road south to Interchange 135, a project included in the TSP.

The local road network is fairly well developed and interconnected on the east side of I-5, but is limited on the west side. There is only one route that connects the east and west sides in the vicinity of Interchange 136, OR 138/W. Central Avenue. As discussed in Appendix B, significant growth is anticipated to occur near the interchange in the future. The current system will necessitate the majority of the traffic that travels between east and west Sutherlin to use OR 138/W. Central Avenue and compromise the function of the proposed interchange.

To protect the function of the interchange, and enhance mobility, a series of local road improvements are needed as shown in Figure 9. Many improvements are identified for the west side of Sutherlin to provide connectivity. Though some consolidation of driveways can occur prior to the development of an improved local street network, improved connectivity may allow further consolidation of approaches to OR 138. Consolidation of approaches will allow the maximum capacity to be gained for the interchange design. It will also increase the safety along OR 138 by reducing the number of conflict points in the vicinity of the interchange. The local street system helps move in the direction of compliance with OAR's access management spacing standards.

Appendix C identifies signal warrants at Dakota Street to be met in the future. The consolidation of accesses to the Dakota Street extension will increase the likelihood of this location meeting signal warrants in the future. After consolidation, the signal will help traffic move safely and efficiently between the northwestern and southwestern quadrants or to the east of the interchange. The signal, however, will need to meet warrants as well as gain approval from the State Traffic Engineer prior to installation.

The local street system will also help support the construction of one of the Sutherlin TSP's projects, a collector street parallel with I-5 extending from OR 138 to Interchange 135. The northerly connection with OR 138 would be Dakota Street, which, as indicated above, is anticipated to be a signalized intersection. The alignment of the new collector street might

follow Park Hill Lane, but might follow a different route depending on future analysis. In either case, this new collector street would allow some traffic originating in or destined for the western portion of Sutherlin to avoid Interchange 136 completely, relying upon Interchange 135 for trips to and from Roseburg or I-5 south. The local street system reinforces and takes advantage of this planned TSP project.

7.3 Access Management Plan

The actions for access points within the interchange influence area and details regarding the access management plan are presented in Table 10 and Figures 12, 13, 14 and 15. The plan provides actions for both the west and east sides of the interchange.

The implementation of the access management plan will occur over a long period of time. To provide a timeline for the plan, the actions have been categorized into short-, medium- and long-term. The timeline is not absolute or indicative of a specific sequence of the actions, but can be thought of in these terms:

- Short-term: These actions are likely to occur prior to a major interchange improvement project designed to increase its capacity or address geometric issues. The most likely reason for implementing these actions will be the development or redevelopment of the parcels. A change of use, with or without rezoning, may be sufficient to trigger a change in access. Another possible reason for undertaking the short-term actions include a roadway improvement project initiated by the city or by ODOT, including projects that have not been identified previously, such as a safety improvement.
- Medium-term: These actions are likely to occur concurrently with an interchange improvement project. If the actions identified as short-term actions have not been implemented prior to the initiation of the interchange improvement project, it is assumed that the short-term actions will also be undertaken in connection with the interchange project.
- Long-term: These actions are likely to occur after the interchange improvement project has been completed. The long-term actions are principally based on the need to change access control to reduce safety problems resulting from traffic growth in the interchange area and Sutherlin in general. Depending upon the rate of growth in the community and how much traffic growth occurs before the planned interchange improvement project is constructed, some or all of the projects listed in the long-term category may need to be implemented concurrently with the interchange project.

General policies throughout the planning area include:

- Encourage redevelopment opportunities that consolidate access points.
- Encourage sharing of access points between adjacent properties.
- Offset driveways at proper distances to minimize the number of conflict points between traffic using the driveways and through-traffic.
- Provide driveway access via local roads where possible.
- Enforce access management spacing standards to the extent possible.
- Minimize driveway widths.

- When traffic signals are installed, interconnect them with adjacent signals to create a coordinated timing system.

A traffic evaluation may be required for development or redevelopment of parcels in the study area. Any required study should address access points and potential safety issues. The access standards are further discussed in the following section. The traffic evaluation may result in a possible need for access control (including restrictions that prohibit certain movements). Near the interchange right-in/right-out restrictions are typical. Under certain circumstances left-in movements may also be appropriate where turn restrictions are applied. In order to increase accessibility to/from intersections with restricted movements u-turns or alternative routes may be necessary in combination with the restrictions.

Access management actions for the west side of the interchange include reduction and/or consolidation of access points and occasional turning movement restrictions either in conjunction with the interchange project or as redevelopment occurs.

Minimal access management actions are identified for the east side of the interchange influence area. These actions include alternative connections between Myrtle Street and Comstock Road as well as Ponderosa Drive and Comstock Road. Access management actions for the east side of the interchange include reduction and/or consolidation of access points and occasional turning movement restrictions either in conjunction with the interchange project or as redevelopment occurs.

Table 10: Access Actions by Individual Approach

Approach #	Short-term Action Pre-Interchange	Medium-term Action Concurrent with Interchange Improvement Project	Long-term Action Post-Interchange
1	No Action	No Action	No Action
2 (Dakota St)	-Extend south of OR 138 to provide access to approach 14 -Signalize this intersection and interconnect to nearby signals, when warrants are met[3] - See Circulation Plan for related projects	- Same as Short-term.	Same as Short-term
3 (Crestview St)	-Close approach when intermediate access is established (see approach 32)	Same as Short-term	-When traffic volume increases cause operational or safety problems, restrict turning movements to allow only right-ins and right-outs (see approach 32).
4 (SW Hutchins St)	-Close and combine with parcels if development opportunity arises; consider joint access at approach 32.	-If not closed in short-term, close access in connection with interchange project and provide alternative access.	Same as Medium-term
5 (Park Hill Ln)	-No Action	-Close intersection in conjunction with interchange improvements. For alternative access see approach 2.	Same as Medium-term
6 (Northbound ramp terminal)	No Action	No Action	No Action
7 (Ponderosa Dr)	No Action	-See Project #5 on Circulation Plan (Figure 12)	-When traffic volume increases cause operational or safety problems, restrict turning movements to allow only right-ins and right-outs
8 (Myrtle St)	No Action	-See Project #6 on Circulation Plan (Figure 12)	-When traffic volume increases cause operational or safety problems, restrict turning movements to allow only right-ins and right-outs

[3] See Appendix C or OAR 734-20-(400-500) for more details

9	-Upon property redevelopment, close approach and provide access via Ponderosa Drive.	Same as Short-term	-If redevelopment does not occur as discussed in short-term actions, restrict access to right-in, right-out only
10 (Old Comstock Rd alignment)	-Restrict access to right-in. Full access gained from Comstock Road.	Same as Short-term	Same as Short-term
11 (Comstock Rd)	Signalize this intersection and interconnect to nearby signals, when warrants are met[4]	Same as Short-term	Same as Short-term
12 (Sunset Dr)	No Action	-See Circulation Plan for related projects	-When traffic volume increases cause operational or safety problems, restrict turning movements to allow only right-ins and right-outs
13 (Hawthorne St)	No Action	No Action	No Action
14	-Close access. Access to be gained from Dakota extension (see approach 2)	Same as Short-term	Same as Short-term
15	-See Project #2 on Circulation Plan (Figure 12)	- Close approach when intermediate access is established (see approach 32)	Same as Medium-term
16	-Close approach at such time as reasonable alternative access becomes available from approach 32, by means of cross-easement or consolidation of parcels, or other redevelopment	Same as Short-term	Same as Short-term
17	See Project #2 on Circulation Plan (Figure 12)	- Close approach when intermediate access is established (see approach 32). Future access to be taken from approach 32, may require a cross-easement serving adjacent properties	Same as Medium-term
18	-Close approach at such time as reasonable alternative access is available to Comstock Road; see Project #5 on Circulation Plan (Figure 12)	Same as Short-term	Same as Short-term

[4] See Appendix C or OAR 734-20-(400-500) for more details

19	-Close approach at such time as reasonable alternative access is available to Comstock Road via Ponderosa (see Project #5 on Circulation Plan, Figure 12)	Same as Short-term	Same as Short-term
20	-Close approach at such time as reasonable alternative access is available to Comstock Road (see Project #6 on Circulation Plan, Figure 12)	Same as Short-term	Same as Short-term
21	-As redevelopment occurs, access should be gained from Comstock Road	Same as Short-term	Same as Short-term
22	-As redevelopment occurs, access should be gained from Hawthorne Street	Same as Short-term	Same as Short-term
23	-Combine with approach 24 -When traffic volume increases cause operational or safety problems, restrict combined approach to right-in, right-out	Same as Short-term	Same as Short-term
24	-Combine with approach 23 -When traffic volume increases cause operational or safety problems, restrict combined approach to right-in, right-out	Same as Short-term	Same as Short-term
25 (W. Duke Road)	No Action	No Action	No Action
26 (SW Hutchins Way)	No Action	No Action[5]	No Action
27	No Action	-Close approach in conjunction with interchange improvements. Alternative access will be dependent on the final design of the interchange improvement project	Same as Medium-term
28	-Close approach in conjunction with redevelopment	-If not closed due to redevelopment, close approach in conjunction with interchange improvements.	Same as Medium-term
29	No Action	No Action	No Action
30	No Action	No Action	No Action
31	No Action	No Action	No Action

[5] Depending on final design of the ramps, changes to Park Hill Lane may require closure of this access.

32	-Provide an intermediate access point for properties north and south of OR 138. For related short-term actions, see approaches 3, 15, and 17.	Same as Short-term	-When traffic volume increases cause operational or safety problems, restrict turning movements to allow only right-ins and right-outs
Not Illustrated	Reservations of access not being used are not illustrated on Figures 10 and 11. These reservations of access are assumed to be cancelled when alternative access becomes available as shown in this plan.		

The access management actions in this plan are based on current property ownership and existing property boundaries and access points, and building configurations. Should the property boundaries change in the future due to consolidation, land use changes, redevelopment or specific design decisions related to roadway improvement projects, the access management plan may need to be modified.

Consistent with the adopted access management spacing standards in the Oregon Highway Plan (OHP) and Oregon Administrative Rules (OAR) 734-051 (Highway Approaches, Access Control, Spacing Standards and Medians), the following policies are adopted for OR 138 in Sutherlin:

> *Policy: Where modifications of the actions specified in Table 10 of the IAMP are necessary, the access must move in the direction of the access standards as prescribed in OAR 734-051 (Highway Approaches, Access Control, Spacing Standards and Medians).*
>
> *Policy: A future land partition or subdivision is not sufficient justification to create an additional access point beyond what is currently allowed or is provided for in this plan.*

Where ODOT has jurisdiction relating to access, ODOT has final authority to implement an access management strategy, though the City of Sutherlin may be consulted about such changes. The actions listed in this plan shall not prevent the reconstruction of approaches as necessary to meet City or ODOT standards.

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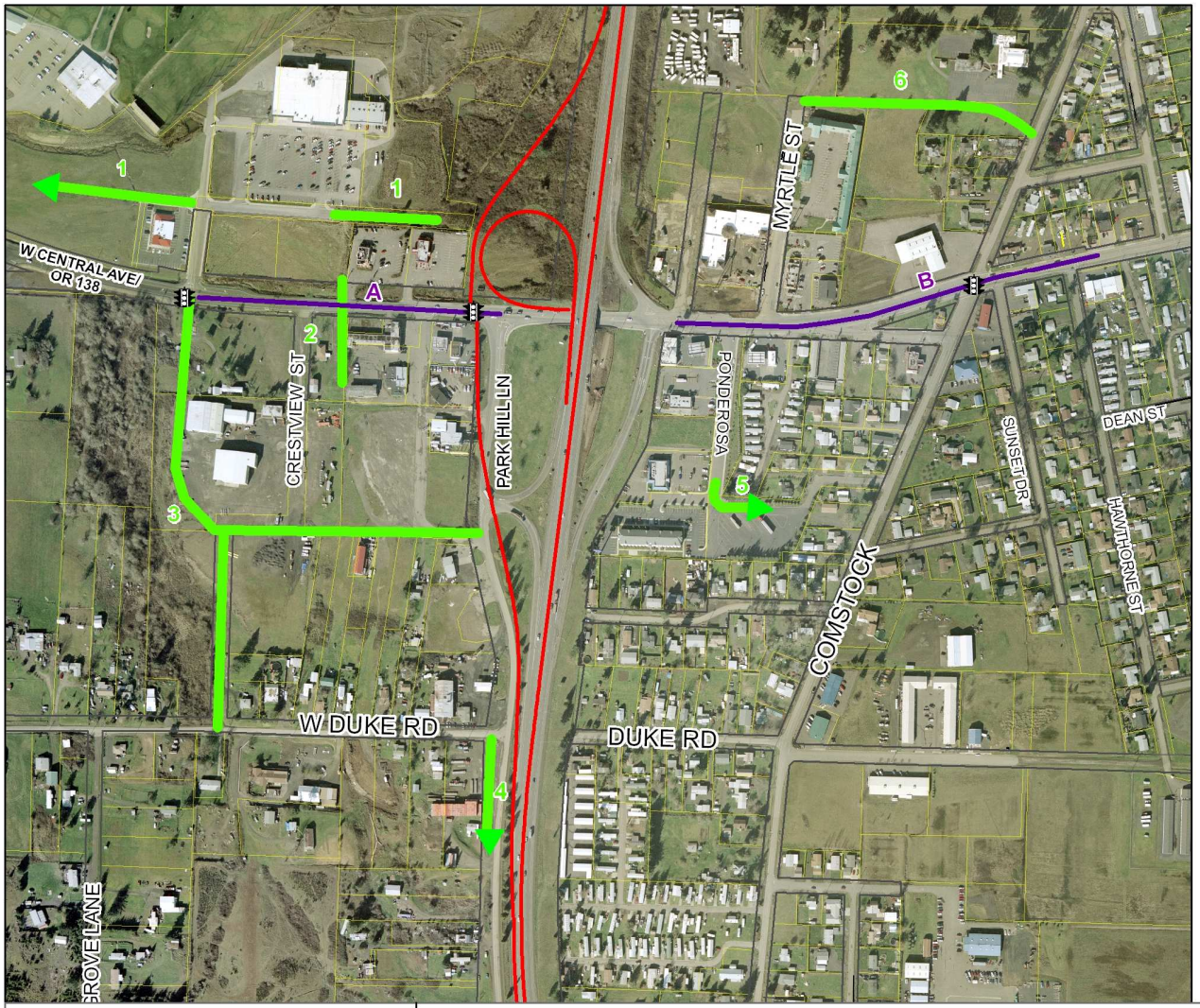

Legend

1. Extend service road to the east along back of parcels fronting OR 138. Additionally, extend service road to the west to OR 138 at Fort McKay Road or to Dovetail Lane.
2. Create new intermediate access (either local street or shared driveway) serving multiple parcels north and south of OR 138. Initially, this is expected to be a full-movement intersection, but may be restricted to right-in, right-out when traffic volumes increase causing operational or safety problems.
3. Extend Dakota Street south to connect with W. Duke Road or to Park Hill Lane or both. This new street will substitute for Park Hill Lane that must be abandoned in connection with the planned interchange improvement project.
4. Develop new collector street between W. Duke Road and Interchange 135. This new street is a recommended project in the Sutherlin Transportation System Plan. The alignment will need to be determined based on further study. It will not necessarily follow the alignment of Park Hill Lane as shown in this figure.
5. Develop a connection from Ponderosa Drive to Comstock Road.
6. Develop new local street to provide alternative access between Myrtle Street and Comstock Road north of W. Central Avenue.

A. Implement access management plan on the west side of the interchange as described in Figure 13.
B. Implement access management plan on the east side of the interchange as described in Figure 14.

N

500 250 0 500 Feet

GIS Data Source: City of Sutherlin

Legend

Future Signal

Sutherlin IC 136 IAMP

Figure 12

Circulation Plan with Enhanced Local Street Network

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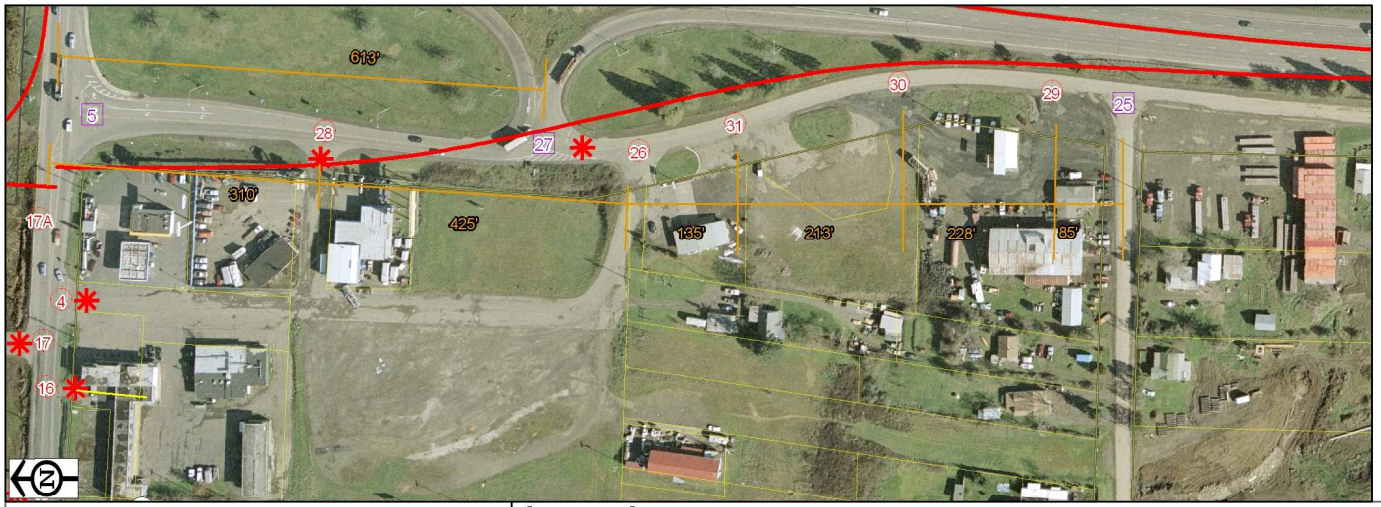

Interchange 136 Vicinity (Not to Scale)

150 75 0 150 Feet

GIS Data Source: City of Sutherlin

Legend

- Parcels
- Private Driveway with Approach Number
- Public/Private Road with Approach Number
- Future Signal
- New Access
- Preferred Alternative
- S — Retain intersection, but restrict turn movements as required for traffic operations and safety
- Consolidate or close in connection with development or redevelopment. Restrict turn movements as required for traffic operations and safety. Provide alternative access, if possible.

Sutherlin IC 136 IAMP

Figure 13

Access Actions - Westside

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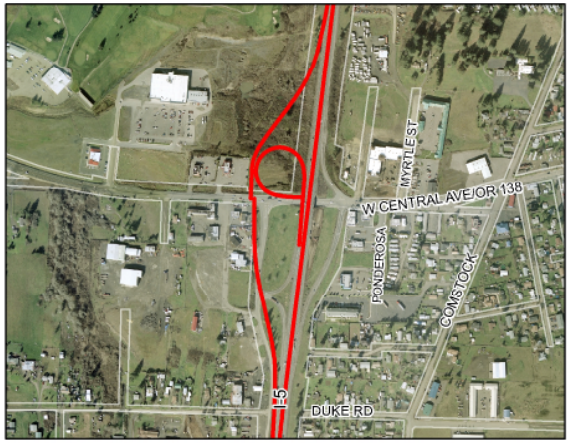

Interchange 136 Vicinity (Not to Scale)

100 50 0 100 Feet

GIS Data Source: City of Sutherlin

Legend

- Parcels
- Private Driveway with Approach Number
- Public/Private Road with Approach Number
- Future Signal
- New Access
- Preferred Concept
- (S) Retain intersection, but restrict turn movements as required for traffic operations and safety
- * Consolidate or close in connection with development or redevelopment. Restrict turn movements as required for traffic operations and safety. Provide alternative access, if possible.

Sutherlin IC 136 IAMP

Figure 14

Access Actions - Eastside

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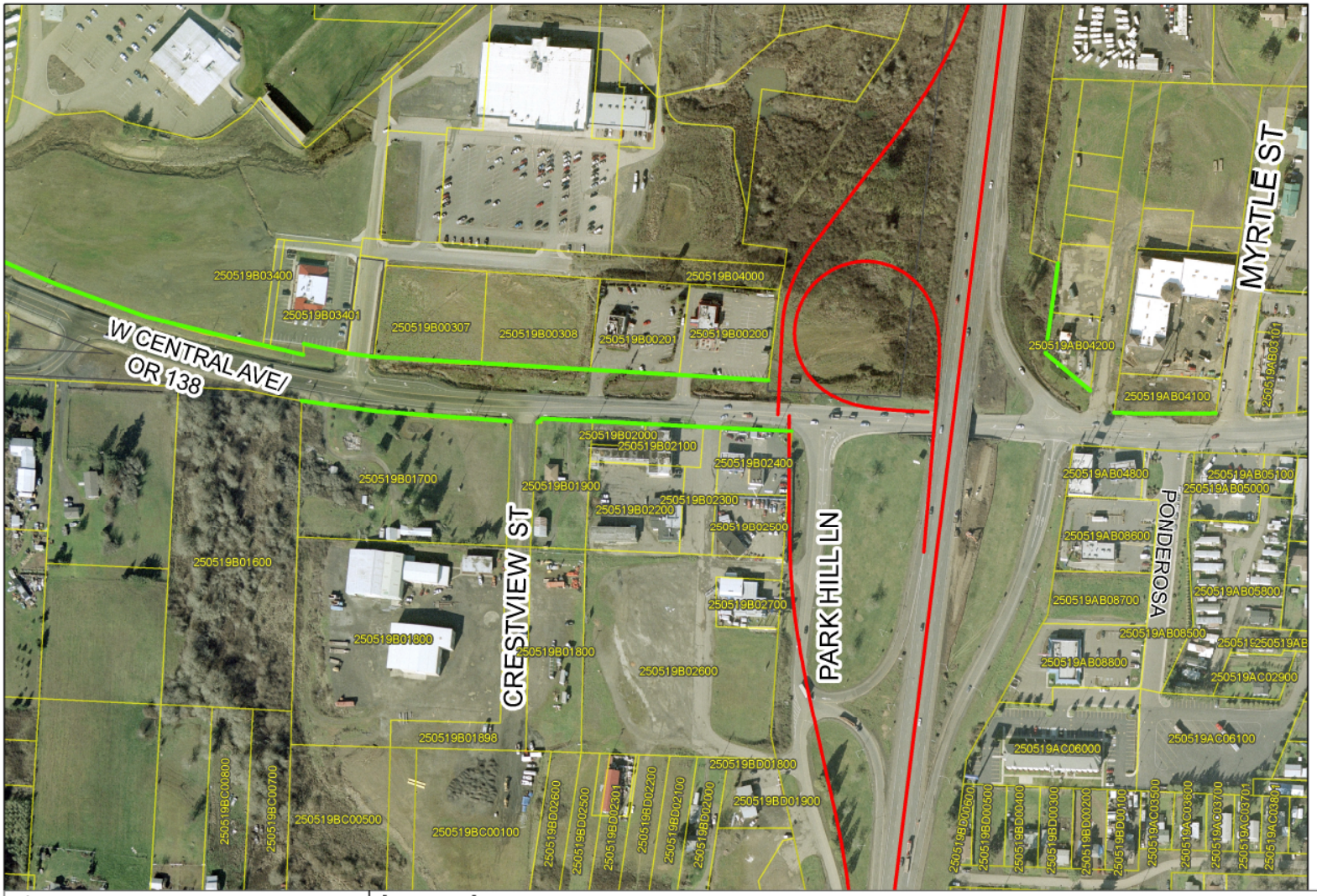

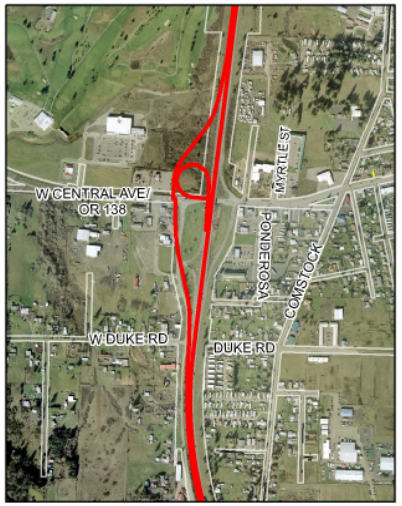

Interchange 136 Vicinity (Not to Scale)

300 150 0 300 Feet

GIS Data Source: City of Sutherlin

Legend

- Access Control Line
- Parcels
- Preferred Concept

Sutherlin IC 136 IAMP

Figure 15

Access Control and Parcel Details

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8. Other Management Strategies

A variety of other management strategies were also evaluated for their potential to reduce traffic impacts and preserve the capacity of the interchange. The toolkit of potential management actions includes strategies that:

- Provide travel options to reduce the number of trips or vehicles on the road;
- Improve system efficiency and reduce delays; and
- Guide land use development to result in fewer trips in the interchange area.

Many management actions are most applicable when applied throughout a region or in a large urban area. A positive impact may be produced by some even if applied only in Sutherlin or in the study area.

8.1 Recommended Management Measures

In addition to the implementation of an enhanced local street system and access management as discussed in the previous section, other management measures were recommended. These include the use of Transportation Demand Management (TDM) measures; the application of Transportation System Management (TSM) measures, and the possible inclusion of the Sutherlin area interchanges in Intelligent Transportation Systems (ITS) or ramp metering if such systems are implemented in the Roseburg area.

TSM strategies focus on maximizing use of the operational efficiency of the system. TSM measures have long been standard operating practice of ODOT and TSM measures are assumed to be included when any signals are designed and constructed at the interchange or on OR 138. This includes signal interconnect, and optimized signal timing.

TDM strategies that encourage the use of carpools, vanpools, bicycling and walking should be implemented, especially in areas with high employment levels or high residential densities where such developments occur. A Transportation Management Association (TMA) would be useful to promote travel options, coordinate shared rides, obtain grants, advocate for transit service, and provide incentives to participants. Sutherlin may wish to establish a mechanism by which employers of a certain size are required to participate in a TMA, or provide incentives to employers who choose to participate in a TMA.

Congestion on I-5 is not predicted for the next 20 years based on TSP traffic analysis. However, it is possible that the rate and type of development may occur differently than anticipated, and congestion may become an issue on the freeway. While an ITS or ATMS program would not be reasonable to employ in just the Sutherlin area in the foreseeable future, the Sutherlin area interchanges might be included as part of a Roseburg region implementation. The ultimate decision about the employment of ramp metering, ITS, and ATMS would belong to ODOT.

8.2 Candidate Measures for Possible Future Implementation

After careful consideration, the City of Sutherlin rejected other management measures, at least for now. Some of the management measures evaluated as part of the study included the establishment of a "trip cap" or "trip budget" or changes to zoning that would limit the traffic impact of future development.

The practice of limiting trips, or placing "trip caps" or "trip budgets" involves permitting development projects based on the number of trips each will generate, in the context of development within a specified area. This method is typically employed in areas with a combination of significant congestion, capacity constraints, and few options for maintaining traffic flow.

Using a trip budget program could provide a measure of flexibility for developers while limiting the total impact of development. A development that did not use all the allowable traffic generation potential of its land might be able to pass on its unused traffic potential to an adjacent development that could be allowed to generate more traffic. As long as the total traffic generation from the area remained within limits, the interchange operations would be protected.

Ultimately, the city rejected the concept of implementing a trip cap or trip budget at this time. Among the reasons cited were the administrative burdens associated with keeping track of trips related to proposed development; concern that a trip budget would stifle development needed for growth and economic diversification; and the importance of other issues currently requiring the city's attention.

Another concept that was evaluated during the course of the study was the possibility of altering the allowed uses in some zoning categories. To address the possibility that industrially zoned land in interchange area could become a hub for high-generation land uses, such as fast food restaurants and building materials retail stores, restrictions to exclude these high traffic generators were discussed. The city also rejected these management measures, principally because they could require the city to compensate property owners for reduced development potential and property value. There was also concern that eliminating some ancillary uses could adversely affect the ability of the city to attract some highly desirable industrial development.

While not permanently rejecting the concept of new management measures involving trip caps or development restrictions to extend the functional life of an interchange improvement, the city thinks it lacks the resources to implement and administer such management measures at this time. The city remains open to the idea of implementing any such measures once an interchange improvement project has advanced to the development phase.

9. Priorities and Timing of Improvement Needs

9.1 State Priorities

Improvements to Interchange 136 are not currently listed in the STIP. Advancing the interchange improvements described in this IAMP is likely to be difficult given the funding conditions and the state's investment policy. The OHP contains the following language:

It is the policy of the State of Oregon to place the highest priority for making investments in the state highway system on safety and managing and preserving the physical infrastructure.

With regard to modernization, the OHP provides the following language:

Give priority to modernization projects that improve livability and/or address critical safety problems and high levels of congestion.

With regard to preservation, the OHP provides the following language:

Maintain Statewide Highways at a higher condition than Regional and District Highways, and invest in thicker pavement on designated freight routes.

As described in other sections of this report, there are certain elements of the existing Interchange 136 design that are substandard. However, these have not resulted in high crash rates that could support a claim of significant safety problems. This could change with increases in traffic volumes, but the overall conclusion is that safety is not as a major argument for advancing interchange improvements.

Based on the analysis performed for this study, the performance of the southbound ramp terminal will eventually fall below mobility standards. However, relatively low volumes of traffic in comparison to that of larger metropolitan areas, suggests it will be difficult to demonstrate "high levels of congestion" needed to advance a modernization project.

Another difficulty faced by Sutherlin in promoting the advancement of improvements at Interchange 136 is OR 138's classification as a Regional Highway, which according to state policy has a lower priority than a Statewide Highway.

The city's inability or current lack of willingness to impose new management measures on property owners beyond the current specifications of the Sutherlin Municipal Code and Sutherlin Comprehensive Plan is a disincentive for the state to expend substantial resources for this interchange.

9.2 Timing of Need for Improvements

As summarized in Section 6 and discussed in detail in Appendix D, the development potential of west Sutherlin and the impact of traffic from new development is highly dependent on what land is ultimately developable and the type of development that actually occurs. Key factors include the possible expansion of the urban growth boundary and limitations on development imposed by wetlands or hillside constraints. In addition, Sutherlin's development code allows a fairly high degree of flexibility with regard to development on land designated for industrial use.

Finally, the rate of development is dependent on economic and demographic factors that are determined on a scale far beyond Sutherlin's influence. Appendix C presents the results of a

sensitivity analysis that illustrates the effect of different growth rates on the need to implement various capacity-increasing improvements, particularly the widening of OR 138/W. Central Avenue from three lanes to five lanes at the interchange. Depending on the rate of growth, a major interchange modernization project that includes expanding OR 138/W. Central Avenue to five lanes could occur as soon as 2014. On the other extreme, a slow growth rate in line with historical trends for traffic on OR 138 at the west city limit could result in delaying major improvements to beyond year 2030.

Table 11 summarizes the information in Appendix C and presents the year at which future traffic volume reaches the levels at which the OHP mobility standards are no longer met. Five different growth rates are provided in Table 11. The rates range from the historical growth rate at the low end to the TSP growth rate at the high end. The middle rate is that associated with the BLI and is derived from the land use assumptions and trip generation rates described in Table 9. Two other rates are included that bracket the BLI rate, one higher and one lower. Note that the growth rates for the northbound and southbound ramp terminals are different. This reflects the greater potential for growth in the western part of Sutherlin than in the east part of the city.

Table 11. Year When Volume Reaches Maximum Allowable According to OHP Mobility Standards by Various Growth Rates and Various Interchange Configurations

Intersection	**Growth Scenario**	**Annual Rate (percent)**	**3-Lane Cross Road [1]**	**5-Lane Cross Road [2]**	**5-Lane Cross Road with Supplemental Right Turn Lane [3]**	**5-Lane Cross Road with Loop Ramp [4]**
NB Ramp Terminal	Historical	1.6	2030>[5]	2030>	2030>	n/a
		3.7	2021	2030>	2030>	n/a
	BLI	4.6	2018	2030>	2030>	n/a
		5.4	2015	2030>	2030>	n/a
	TSP	6.4	2014	2030>	2030>	n/a
SB Ramp Terminal	Historical	2.7	2030>	2030>	2030>	2030>
		4.4	2022	2030>	2030>	2030>
	BLI	5.4	2017	2030	2030>	2030>
		6.4	2015	2026	2030>	2030>
	TSP	7.4	2014	2023	2030	2030>

[1] A 3-lane cross road provides for one through lane in each direction plus a left turn lane for each approach at each ramp terminal. A folded-diamond configuration for the southbound ramp terminal eliminates left turns for the eastbound approach.
[2] A 5-lane cross road provides for two through lanes in each direction plus a left turn lane for each approach at each ramp terminal. A folded-diamond configuration for the southbound ramp terminal eliminates left turns for the eastbound approach.
[3] At the northbound ramp, the supplemental right turn lane refers to a lane added to accommodate the right turn for the westbound approach to the northbound on-ramp. At the southbound ramp, the supplemental right turn lane refers to a lane added to accommodate the right turn for the eastbound approach to the southbound ramp.

[4] The loop ramp, which is part of the TSP's Preferred Interchange Concept, eliminates left turns for westbound traffic to the southbound ramp. It replaces that with a loop ramp. A loop ramp is not a feature of the northbound ramp terminal.
[5] 2030> indicates the year calculated is beyond year 2030.

Among all the potential improvements that could be made in the vicinity of Interchange 136, the improvement most likely to be needed first is a project to signalize the intersection of Park Hill Lane and OR 138. Because the current interchange is actually a gull wing configuration, this intersection is not technically the southbound ramp terminal, though the vast majority of traffic using the southbound on- and off-ramps uses this intersection. Justification for signalization might be based on development impacts or traffic safety. In any case, signalization must be based on meeting applicable signal warrants and approval by the State Traffic Engineer based on established criteria.

A modernization project to replace the existing gull wing configuration and improve ramp designs could be expected to improve safety and traffic operations. As discussed above, the improvement could have a useful life of several to many years depending on the rate of growth.

Once OR 138/W. Central Avenue is widened to five lanes it is predicted to provide adequate operation at the ramp terminals for many years. For most growth rate scenarios, this would prove adequate beyond year 2030. Adding supplemental right turn lanes to accommodate movements from eastbound OR 138 to southbound I-5 and from westbound W. Central Avenue to northbound I-5 would increase capacity further, extending the useful life beyond year 2030.

Adding the supplemental loop ramp for the westbound W. Central Avenue to southbound I-5 movement is another way to increase capacity of the northbound ramp terminal. This improvement would also extend the life of the interchange beyond 2030.

10. Implementation

As of December 2008, a potential modernization project to upgrade Interchange 136 is not a funded project. No project to improve this interchange is included in the current STIP. The adoption of an IAMP is a requirement for interchanges undergoing significant modification. To implement the TSP preferred interchange concept identified in this study requires adoption of an IAMP.

The inclusion of projects in the City's TSP, including the identification of the TSP Preferred Concept for Interchange 136 in this IAMP, is not to be relied upon as the basis for development approval as specified in OAR 660-12-060.[6]

The elements adopted by the City and the OTC as part of this IAMP are specified below. Some actions are to be adopted by the OTC as a "facility plan" that implements the OHP. Other actions are adopted by the City of Sutherlin. Each subsection specifies which agency is responsible.

10.1 Access Management

Adoption of the Access Management Plan is a state responsibility.

"Access Management Plan" from Section 7 of this document is adopted, including Table 10 and Figures 12, 13, 14 and 15 and explanatory materials.

10.2 OHP Policy Statement

Adoption of the OHP is a state responsibility. Adopting a new policy statement describing the priorities associated with potential interchange improvements is a state responsibility.

The following policy statements are added to the Investment Policies and Scenarios section of the OHP:

> *The highest priority for investments by the State to interchange 136 shall be directed toward critical safety problems and maintaining the interchange's existing physical infrastructure.*

10.3 Amend TSP Chapter 2 TSP Goals and Objectives

The TSP is a locally-adopted plan and is thus a responsibility of the City of Sutherlin. Amendment of the TSP Goals and Objectives is also a city responsibility.

Additional policy language is adopted for Chapter 2: TSP Goals and Objectives.

[6] A complete copy of OAR 660 can be found at:
http://arcweb.sos.state.or.us/rules/OARS_600/OAR_660/660_tofc.html

To implement the local circulation plan, which supports and enhances the development of an improved, interconnected local street network, the following TSP amendments are adopted as additional "objectives" under "Goal 4. Street System:"

I. Develop a new local street or shared private driveway with an east-west orientation to enhance access to properties north of West Central Avenue between Comstock Road and Myrtle Street.

J. Develop a new local street or shared private driveway with an east-west orientation to enhance access to properties south of West Central Avenue between Comstock Road and Ponderosa Street.

K. Develop a new collector street extending southward from the intersection of OR 138 and Dakota Street to West Duke Road and eventually to Interchange 135 as a substitute for Park Hill Lane (which must be disconnected to allow development of an interchange improvement project meeting modern design standards).

L. Support ODOT's efforts to implement an access management plan, especially along OR 138 and West Central Avenue between Comstock Road and Dakota Street, to protect the operations and function of Interchange 138.

10.4 Amend TSP Chapter 7 Street Network Plan

The TSP is a locally-adopted plan and is thus a responsibility of the City of Sutherlin. Amendment of the TSP Street Network Plan is also a city responsibility.

To provide clarity and additional information produced in this study, Chapter 7: Street Network Plan is amended as follows:

The adopted 2005 TSP (page 7-5) includes the following description related to the **Vicinity of I-5 Exit 136 Interchange at Oregon Highway 138/Central Avenue:**

<u>I-5 Interchange</u>: IAMP needed at this interchange to study
- *Improvements to I-5 on- and off-ramps*
- *Park Hill (sic) Lane and Frontage Road access*
- *Analysis of land uses around interchange*

Now that the IAMP has been undertaken, the "study" described in the TSP has been completed. The TSP is amended by deleting the preceding reference and replacing it with an actual "project." The Street Network Plan is amended with a revised project description as follows:

<u>I-5 Interchange</u>: Modernization project consisting of:
- *Disconnect Park Hill Lane between OR 138 and W. Duke Road*
- *Replace existing gull wing interchange configuration for the southbound on- and off-ramps with a modern diamond interchange configuration compatible with a supplemental loop ramp to serve westbound OR 138 to southbound I-5 traffic*

- *Construct or upgrade appropriate streets between OR 138 and W. Duke Road that serves as a substitute for Park Hill Lane*
- *Implement access management along OR 138 and W. Central Avenue consistent with the Access Management Plan*

The adopted 2005 TSP (page 7-5) includes six streets under the caption **West of I-5**. For clarity, the Street Network Plan is amended to include a seventh street project as follows:

> *Dakota Street Extension: Construct a new collector street from the intersection of OR 138 and Dakota Street south to W. Duke Street and eventually to Interchange 135 that provides access for development in the area and serves as a substitute for Park Hill Lane. Provide for signalization of the intersection of OR 138 and Dakota Street when signal warrants are met.*

The adopted 2005 TSP (pages 7-6 through 7-9) lists nine streets under the caption **East of I-5**. For clarity, the Street Network Plan is amended to add two new street projects as follows:

> *Comstock Road to Ponderosa Street Connection: Construct a new local street or shared private driveway south of and parallel to W. Central Avenue to serve parcels along W. Central Avenue near Interchange 136. This street should help provide additional access to properties and help minimize impacts from possible access restrictions needed to protect the function of the interchange.*
>
> *Comstock Road to Myrtle Street Connection: Construct a new local street or shared private driveway north of and parallel to W. Central Avenue to serve parcels along W. Central Avenue near Interchange 136. This street should help provide additional access to properties and help minimize impacts from possible access restrictions needed to protect the function of the interchange.*

10.5 Amend TSP Chapter 13 TSP Financial Plan

The TSP is a locally-adopted plan and is thus a responsibility of the City of Sutherlin. Amendment of the TSP Financial Plan is also a city responsibility.

The adopted 2005 TSP also includes a financial plan. Table 13-1 (page 13-2) includes twenty specific roadway projects. The table includes the project name, cost, primary funding responsibility and the city funding percentage and city share of project costs.

During the development of this IAMP, the interchange improvement concepts were developed to a higher level of detail than was undertaken for the TSP. Updated cost estimates were also prepared. The updated cost estimates are included in the TSP capital improvement project list. In addition, the PAC and TAC recognized the potential for the TSP preferred interchange concept to be implemented in phases, beginning with a standard diamond with a loop ramp as a second phase.

It is also recognized that funding sources originally listed in the TSP may have been too specific, especially in relation to ODOT's anticipated long-range funding shortfall. "Unknown" is now listed as one of the potential funding partners.

During the development of the IAMP, the need for local street projects and an extension of Dakota Street were also identified.

To account for the updated costs and added projects described above, the following changes to the TSP Financial Plan and Table 13-1 are adopted as follows:

Deletions from the original Table 13-1 from the TSP are shown using ~~strikethrough~~. Additions are designated in **bold** font.

Table 13-1 Capital Improvements List & Potential Funding Partners

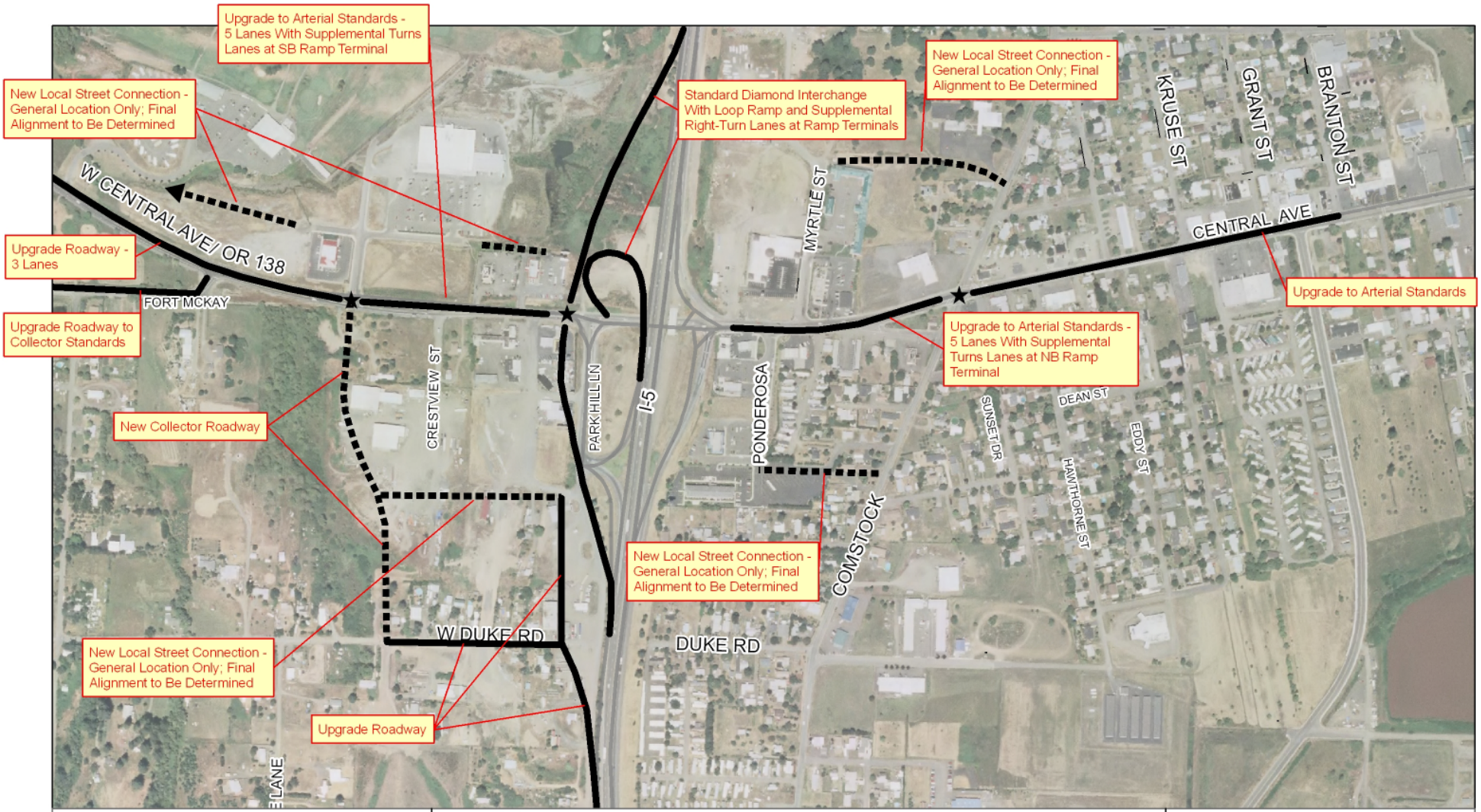
Project Name	**Cost**	**Potential Funding Partners** [1]
Stearns Lane - Improvement and realignment	$8,269,952	County/Developer
Dovetail Lane improvement	$2,439,293	City/Developer
Dovetail Lane-new connection east	$8,092,857	City/Developer
Dovetail Lane-new connection west	$6,026,051	City/Developer
Church Road - improvement	$1,432,090	City
Fort McKay Road - Improvement	$3,635,487	County
New collector (Church to Plat M)	$5,356,799	County
Plat M Road - Upgrade and new collector to South interchange	$9,181,152	County
N Calapooia St (improvement/realignment)	$2,549,354	City/~~State~~ **Unknown**
Duke - Hastings Avenue improvement	$2,355,822	County
New east/west parkway (Southside Parkway)	$13,829,512	City
E Central Avenue- Comstock to east city limit	$4,635,362	~~State~~ **Unknown**
Waite Street improvements	$1,081,698	City
E 4th Avenue - State Street to Jade Street	$4,056,261	City
W 6th Avenue and RR overpass	$13,302,848	City/~~State~~ **Unknown**
New - Hawthorne-W Central at Sherman	$4,687,012	City
E 6th Avenue improvements (missing sections)	$2,163,611	City/Developer
Oregon Highway 138 Ft McKay to Comstock	$3,406,698	~~State~~ **Unknown**
Oregon Highway 138 Ft McKay to Church	$3,229,927	~~State~~ **Unknown**
Connection from New Parkway to Central	$1,506,566	City
~~I-5 Interchange- west side at Oregon 138~~	~~$2,192,667~~	~~State~~
I-5 Interchange – Upgrade on west side to standard diamond[2]	**4,300,000**[3]	**Unknown**
I-5 Interchange – Add supplemental loop ramp to standard diamond[4]	**1,900,000**[5]	**Unknown**
Dakota Street Extension from OR 138 to W. Duke Road	**1,500,000**[6]	
Comstock to Ponderosa Connection	**300,000**[7]	**City/Developer**
Comstock to Myrtle Connection	**450,000**[7]	**City/Developer**

Total Roadway Improvements	**$109,688,352**	
Pedestrian improvements	**$6,620,789**	
Personal Electric Vehicle additional multi-use paths	**$3,939,515**	
Grand Totals	**$120,248,656**	

Footnotes:

1 Potential funding partners lists possible participants and does not represent a commitment to participate. Funding arrangements will need to be negotiated when more is know about project costs and benefits and the sources of funds that may become available.
2 A standard diamond interchange was recognized by the PAC and TAC as a potential first phase of the TSP preferred interchange concept. This is a replacement description and cost for the project listed above and in the original Table 13-1
3 Project cost is based on the construction cost estimate cited in Appendix D for the standard diamond concept plus an assumed right-of-way acquisition and relocation cost of $1.0 million.
4 Adding a supplemental loop ramp to serve the westbound Central Avenue to southbound I-5 movement would convert the standard diamond configuration to the TSP preferred interchange concept. This might be constructed as a second phase of interchange improvements.
5 As described in Appendix D, the cost of the TSP preferred concept was estimated to cost $1.9 million more than the standard diamond concept.
6 The cost of a collector road constructed on a new alignment is based on an assumed cost of $6.0 million per mile.
7 The cost of a local street constructed on a new alignment is based on an assumed cost of $3.0 million per mile.

Adding the new projects described above and specified in the revised version of Table 13-1 alters the street network in the vicinity of Interchange 136. Figure 16 shows the revised street network with the addition of the local projects and the Preferred Interchange Concept. Facilities for bicyclists and pedestrians will be enhanced in the vicinity of the interchange by projects included in the original TSP project list as well as the new local road connections added with the IAMP. Figure 17 shows the new streets that will include enhanced sidewalks in the interchange area and indicates bike lanes along OR 138 in the interchange area as included in the original TSP.


Upgrade to Arterial Standards - 5 Lanes With Supplemental Turns Lanes at SB Ramp Terminal
New Local Street Connection - General Location Only; Final Alignment to Be Determined
Standard Diamond Interchange With Loop Ramp and Supplemental Right-Turn Lanes at Ramp Terminals
New Local Street Connection - General Location Only; Final Alignment to Be Determined
KRUSE ST
GRANT ST
BRANTON ST
W CENTRAL AVE/ OR 138
MYRTLE ST
CENTRAL AVE
Upgrade Roadway - 3 Lanes
FORT MCKAY
Upgrade to Arterial Standards
Upgrade Roadway to Collector Standards
Upgrade to Arterial Standards - 5 Lanes With Supplemental Turns Lanes at NB Ramp Terminal
CRESTVIEW ST
PARK HILL LN
I-5
PONDEROSA
DEAN ST
SUNSET DR
EDDY ST
New Collector Roadway
HAWTHORNE ST
COMSTOCK
New Local Street Connection - General Location Only; Final Alignment to Be Determined
W DUKE RD
DUKE RD
New Local Street Connection - General Location Only; Final Alignment to Be Determined
Upgrade Roadway
E LANE
490 245 0 490 Feet
GIS Data Source: City of Sutherlin
Legend
Road Upgrades
Future Road
New Traffic Signal
Sutherlin IC 136 IAMP
Figure 16
TSP with IAMP Projects in Vicinity of Interchange

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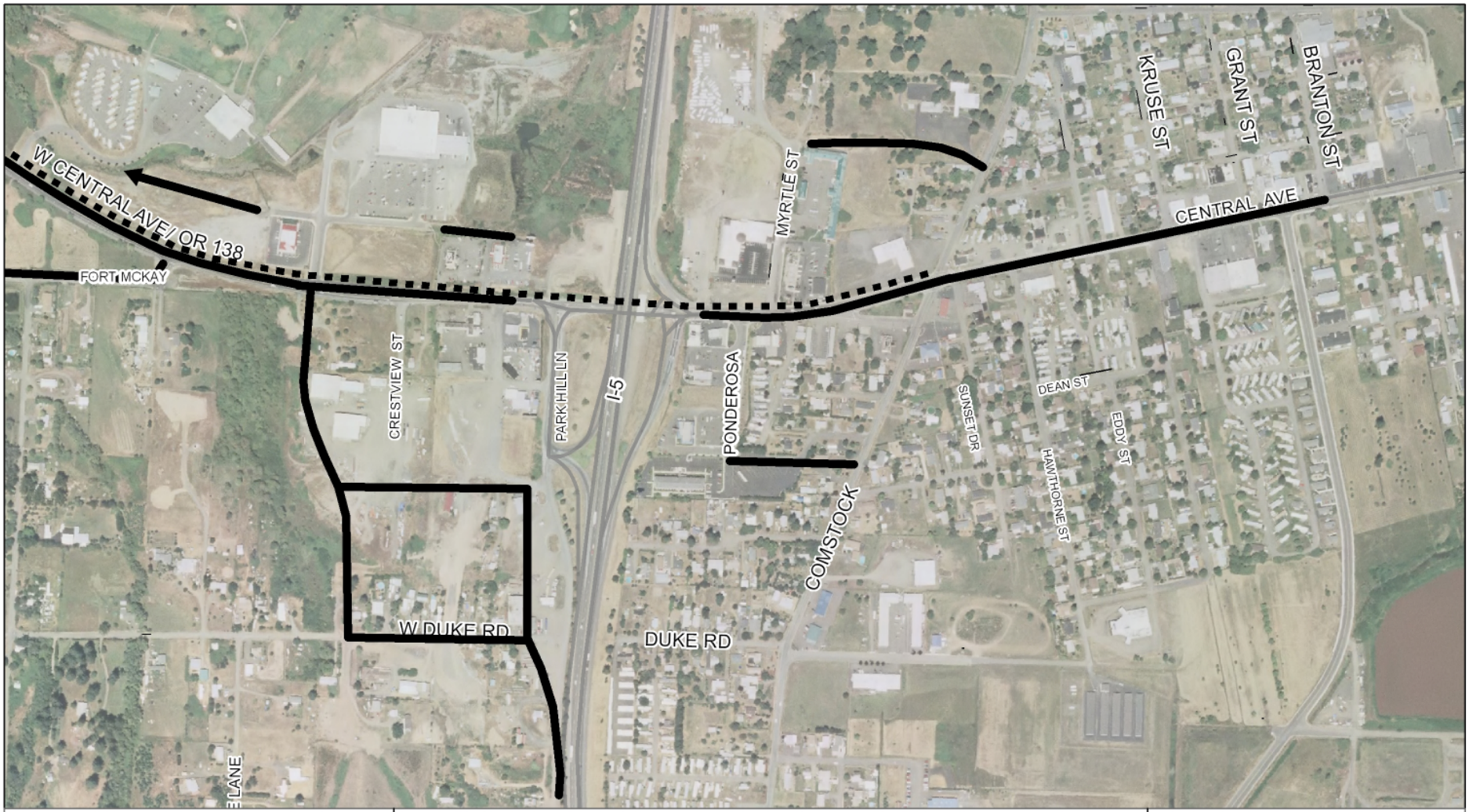

500 250 0 500 Feet

GIS Data Source: City of Sutherlin

Legend

New or Upgraded Sidewalks in Connection w/Street Projects

Arterial Street with Bike Lanes (both directions)

Sutherlin IC 136 IAMP

Figure 17

Planned Bikes Lanes & New or Upgraded Pedestrian Facilities in Connection w/Street Projects

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10.6 Amend Sutherlin Municipal Code

The Sutherlin Municipal Code (SMC) includes the Development Code that regulates land use activities in the City and is thus a responsibility of the City of Sutherlin. Amendment of the SMC is also a city responsibility.

Upon adoption of the IAMP, the findings for TPR compliance for future zone changes within the Interchange 136 influence area may be deferred until time of development pursuant to Development Code Section 4.8.110(C)(2). At time of development, compliance with OAR 660-012-0060 (1) (c) may be demonstrated by showing that the most intensive use and density allowed by the development will not exceed the peak hour trips allowed by Table 9 of the IAMP. The City may issue a finding of "no significant affect" when it places a condition of approval that limits uses within the zone to those in Table 9 of the IAMP and identifies funding.

Sutherlin Development Code[7] allows any agency with access jurisdiction to require applicant to prepare a traffic study for the development proposal. The City of Sutherlin will further protect the integrity of the interchange facility by adding a condition of approval that applicant(s) agree to participate in a LID that consists of identified improvements in the IAMP.

To provide clarity and additional guidance on how to implement the provisions of this study, amendments to the SMC are enacted as follows (deletions are indicated by ~~strikeouts~~; additions are in **bold and underlined**):

CHAPTER 3 DESIGN STANDARDS

Section 3.2 Access and Circulation

3.2.100 Purpose. The purpose of this chapter is to ensure that developments provide safe, efficient and functional access and circulation, for pedestrians and vehicles. Section 3.2.110 provides standards for vehicular access and circulation. Section 3.2.120 provides standards for pedestrian access and circulation. Standards for transportation infrastructure improvements within the public right-of-way are provided in section 3.5.

3.2.110 Vehicular Access and Circulation.
A. Intent and Purpose.
1. The intent of this section is to manage vehicle access to development through a connected street system with shared driveways, where practicable, and circulation systems that allow multiple transportation modes and technology, while preserving the flow of traffic in terms of safety, roadway capacity, and efficiency. Access shall be managed to maintain an adequate "level of service" and to maintain the "functional classification" of roadways [See Transportation System Plan adopted November 2006 **and amended in April 2009**]. Major roadways, including highways, arterials, and collectors, serve as the primary system for moving people and goods. "Access management" is a primary concern on these roads. Local streets and alleys provide

[7] Sutherlin Development Code Sections 3.2.110(D)

access to individual properties. If vehicular access and circulation are not properly designed, these roadways will be unable to accommodate the needs of development and serve their transportation function. This section balances the right of reasonable access to private property with the right of the public to safe and efficient travel.
2. To achieve this policy intent, county and local roadways have been categorized in the comprehensive plan by function and classified for access purposes based upon their level of importance and function. (See section 3.5, Infrastructure Standards) Regulations apply to these roadways for the purpose of reducing traffic accidents, personal injury, and property damage attributable to access systems, and to thereby improve the safety and operation of the roadway network. The regulations are also intended to protect the substantial public investment in the transportation system, facilitate economic development, and reduce the need for expensive remedial measures. These regulations also further the orderly layout and use of land, protect community character, and conserve natural resources by promoting well-designed road and access systems and discouraging the unplanned **development, such as developments that generate more traffic than assumed in the Transportation System Plan, or the** subdivision of land **designated for agricultural use in the Comprehensive Plan**.

D. Traffic Study Requirements. The city or other agency with access jurisdiction may require a traffic study prepared by a traffic engineer to determine access, circulation and other transportation requirements **including identification of projects needed to implement the Transportation System Plan or other projects needed to mitigate for traffic impacts resulting from development that exceeds assumptions from the Transportation System Plan.** (See also, section 3.5, Infrastructure.)

3.5.110 Transportation Standards.
A. Purpose. The purpose of this section is to implement the Transportation System Plan (**including the Interchange Area Management Plan, which was incorporated into the TSP in April 2009)** and protect the ~~City's~~ investment **of the City, the County, and ODOT** in the public street system. Upon dedication of streets to the public, the City accepts maintenance responsibility for the street. Failure to meet City standards may place an undue maintenance burden on the public, which may be only marginally benefited by the street improvement. Variances to street standards must be evaluated in this context.
B. Development Standards. No development shall occur unless the development has frontage onto or approved access from a public street, in conformance with the provisions of section 3.2, Access and Circulation, and the following standards are met:
1. Private streets shall not be permitted, except as approved by a PUD. In approving a private street as part of a PUD, the city must find that construction of a public street is impracticable, and the street will be constructed to a standard that approximates the city standards for public streets, except as modified to address physical site constraints. The city shall not be responsible for maintaining or improving any private street.
2. Streets within and/or adjacent to a development shall be improved in accordance with the comprehensive plan, transportation system plan and the provisions of this section, as determined by the city.
3. Development of new streets, and additional street width or improvements planned as a portion of an existing street, shall be improved in accordance with this section, and public streets shall be dedicated to the applicable City, County or ~~County~~ **ODOT** jurisdiction.

CHAPTER 4 DEVELOPMENT APPLICATIONS AND REVIEW PROCEDURES

Section 4.8 Zoning District Map Amendments

4.8.100 Purpose. The purpose of this section is to provide standards and procedures for legislative and quasi-judicial amendments to the zoning district map. These will be referred to as "zoning map amendments." Map amendments may be necessary from time to time to reflect changing community conditions, needs and desires, to correct mistakes, or to address changes in the law.

4.8.110 Approval Procedures

C. Criteria for Amendment. The planning commission shall approve, approve with conditions or deny an application for a quasi-zoning map amendment based on all of the following criteria.
1. Demonstration of compliance with all applicable comprehensive plan policies and map designations. Where this criterion cannot be met, a comprehensive plan amendment shall be a prerequisite to approval;
2. Demonstration that the most intense uses and density that would be allowed, outright in the proposed zone, considering the sites characteristics, can be served through the orderly extension of urban facilities and services, including a demonstration of consistency with OAR660-012-0060~~; and~~ **. The determination of consistency with OAR 660-012-0060 can be deferred to development review pursuant to 4.3.120 for those zone changes that are located within the approved interchange 136 IAMP area and do not require a comprehensive plan amendment**; and

Section 4.3 Development Review and Site Plan Review

4.3.120 Development Review Approval Criteria. Applications for development review shall be conducted as a Type I procedure, as described in section 4.2.120. Prior to issuance of building permits, the following standards shall be met:
A. The proposed land use is permitted by the underlying zoning district (chapter 2);
B. The land use, building/yard setback, lot area, lot dimension, density, lot coverage, building height and other applicable standards of the underlying zoning district and any overlay zone are met (chapter 2);
C. All applicable building and fire code standards are met; ~~and~~
D. Approval shall lapse, and a new application shall be required, if a building permit has not been issued within one (1) year of development review approval**; and**
E. Traffic impacts from the proposed development are consistent with the traffic impacts for the subject parcel prescribed in Table 9 of the Interchange Area Management Plan or the development will mitigate for the increased traffic beyond that described in Table 9 of the Interchange Area Management Plan. Those zone changes within the Interchange 136 IAMP area that deferred compliance with OAR 660-012-0060 must demonstrate consistency with OAR 660-012-0060.

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Appendix A: Transportation Facilities and Existing Operations

This document was originally published as “Technical Memorandum #3: Transportation Facilities and Existing Operations” in November 2006.

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Purpose and Approach

The purpose of this technical memorandum is to summarize the existing transportation facilities and operations in the vicinity of Interchange 136 in Sutherlin. The roadway facilities in the area of this interchange include: OR 138 and W. Central Avenue between Fort McKay Road and Hawthorne Street and Park Hill Lane from Duke Road to OR 138. This memorandum presents operations for the following intersections:

- OR 138/Fort McKay Road
- OR 138/Park Hill Lane
- Park Hill Lane/SB Ramp Terminal
- W. Central Avenue/NB Ramp Terminal
- W. Central Avenue/Ponderosa Drive
- W. Central Avenue/Myrtle Street
- W. Central Avenue/Comstock Road
- OR 138/Dakota Street

The information provided in this technical memorandum draws upon and supplements information provided in the City of Sutherlin Transportation System Plan (TSP) prepared by Parsons Brinckerhoff dated July 2005.

Traffic Operations

Traffic Volume Data Collection

Traffic volume data for the majority of the study area intersections is from the Sutherlin TSP. In addition to those intersections presented in the TSP, the intersections of OR 138/ Dakota Street, W. Central Avenue/Ponderosa Drive, and W. Central Avenue/Myrtle Street have been added for this analysis.

The TSP counts were collected in September of 2004. Count data for the additional intersections of OR 138/Dakota Street, OR 138/Ponderosa Drive, and OR 138/Myrtle Street were collected in June of 2006.

Traffic Count Processing and Analysis Methodology

The existing conditions traffic operation analysis includes seasonally adjusted 30th highest hour traffic volumes (30 HV), peak hour factor (PHF) and heavy vehicle (truck/bus) traffic inputs.

Seasonal Factors

Transportation Planning and Analysis Unit (TPAU) methodology requires analysis of the 30 HV. This is accomplished by seasonally adjusting the count data based on

representative automatic traffic recorder (ATR) information. The ATR stations agreed upon for the TSP include Roseburg (10-005) and Oakland (10-007) for the I-5 mainline and ramps, and Brockway (10-006) for all other roads.

According to the 2005 TSP, seasonal factors range from 1.0031 to 1.0045 for counts collected in July/August. For all other non-freeway counts conducted in other months, a factor of 1.07 to 1.09 was applied. Freeway data collected in September was factored by 1.18.

The June 2006 counts collected for this analysis are for non-freeway/ramp terminal intersections. Using ATR 10-006 (for non-freeway and ramps as presented in the TSP) and following the TPAU methodology, a 30 HV factor of 1.07 is calculated for the June 2006 counts.

This factor is applied to the common peak hour for the system. The common peak hour, as identified in the TSP, is from 4:45-5:45 PM. See **Figure 1** for 30 HV for study area intersections.

Peak Hour Factor

The PHF, as defined for this analysis, is the analysis hour divided by four times the maximum 15-minute volume during the analysis hour. The PHF for the analysis area ranged from 0.84 to 0.97 according to the TSP. The PHF for the 2006 additional intersection counts is assumed as 0.92, the default in Synchro, as 15-minute data was not provided.

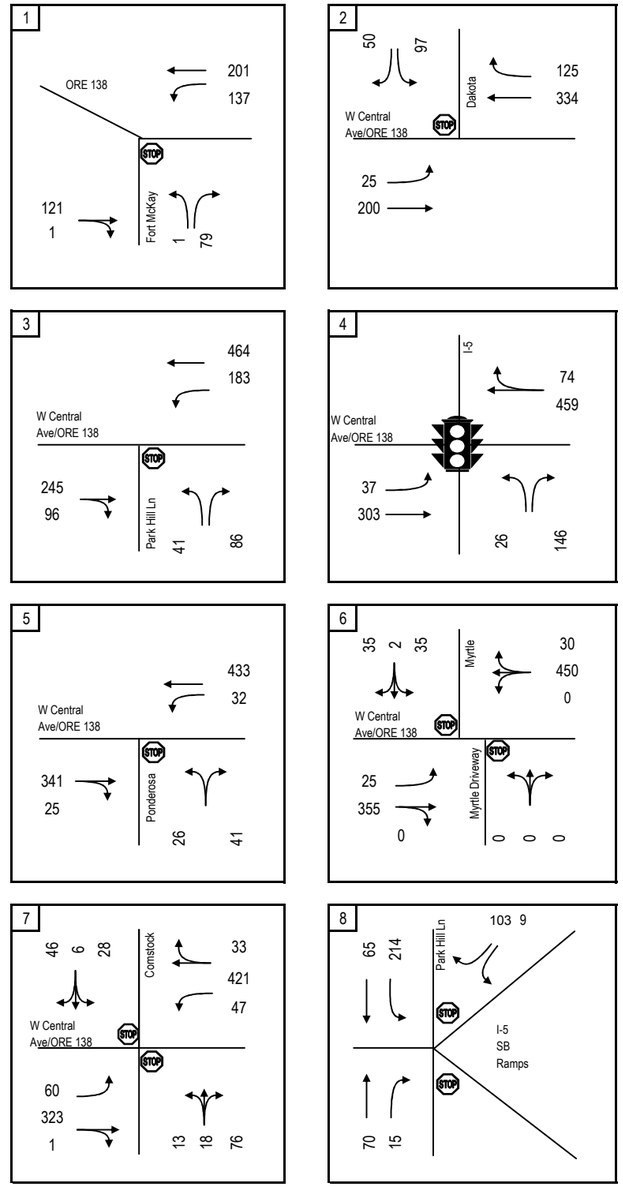
Heavy Vehicle Volumes

The heavy vehicle traffic volumes from the TSP for the common peak hour range between 2 percent and 33 percent. At the 2006 additional intersection count locations the heavy vehicle traffic volumes range from 0 percent to 8 percent.

Traffic Operations Standards

Transportation engineers have established various standards for measuring traffic capacity and quality of service of roadways at intersections. A comparison of traffic volume demand to intersection capacity is one method of evaluating how well an intersection, roadway segment, or merge/diverge segment is operating. This comparison is presented as a volume-to-capacity (v/c) ratio. A v/c ratio of less than 1.0 indicates that the volume is less than capacity. When it is closer to 0.0, traffic conditions are generally good with little congestion and low delays for most intersection movements. As the v/c ratio approaches 1.0, traffic becomes more congested and unstable with longer delays.

ODOT applies two sets of operational standards (mobility standards) to different types of projects. For planning projects the applicable mobility standards are found in Table 6 of the 1999 Oregon Highway Plan (OHP). For project design, the applicable mobility standards are specified in Table 10-1 of the 2003 Highway Design Manual (HDM).



Aerial photo not to scale

Photo Source: City of Sutherlin

Legend

0 Intersections Analyzed in IAMP

Traffic Signal

Stop Sign

Sutherlin IC 136 IAMP

Figure 1

Existing Lane Configurations, Traffic Control and Traffic Volumes

Mobility standards are dependent on the roadway classification and area type and apply during peak operating conditions through the planning horizon year, which is year 2027. Both are presented in terms of v/c ratios, and they are shown in **Table 1**.

Douglas County and the City of Sutherlin also have mobility standards presented in terms of v/c ratios. County standards can be found in the Douglas County TSP (2001). County and City standards can both be found in the City of Sutherlin TSP. However, when a County/City roadway intersects with an ODOT facility the County/City roadway mobility standards are superseded by ODOT mobility standards.

Another standard for measuring traffic capacity and quality of service of roadways at intersections is level of service (LOS). At both stop-controlled and signalized intersections, LOS is a function of control delay, which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Six standards have been established ranging from LOS A where there is little or no delay, to LOS F, where there is delay of more than 50 seconds at unsignalized intersections, or more than 80 seconds at signalized intersections.

Table 1 Analysis Area Roadway Inventory

	Roadway/Highway Name	Jurisdiction[8]	ODOT Functional Classification[7]	City/County Functional Classification[8]	Posted Speed[8]	Lanes[6]	OHP Mobility Standard[1,2]	HDM Mobility Standard[1,3]	City/ County Operational Standard[1]
	I-5 (Pacific Highway No. 1)	ODOT	Interstate Hwy, NHS[9], FR[10]	-	65	4	0.70	0.65	-
	I-5 Ramp terminal Intersections	ODOT	Interstate Hwy, NHS[9], FR[10]	-	-	1	0.85[4]	0.65	-
	OR 138/W. Central Avenue (Elkton-Sutherlin Highway)	ODOT	Regional Hwy	Arterial	20, 30, 40[5]	2	0.85	0.75	-
Interchange 136	Fort McKay Road	Douglas County	-	Major Collector	55	2	-	-	0.90[8]
	Park Hill Lane	ODOT/City of Sutherlin[11]	-	Regional Hwy/Local Street	-	2	0.85[4]	0.65	0.90[8]
	Ponderosa Drive	City of Sutherlin	-	Local Street	-	2	-	-	0.90[8]
	Myrtle Street	City of Sutherlin	-	Local Street	-	2	-	-	0.90[8]
	Dakota Street	City of Sutherlin	-	Local Street	-	2	-	-	0.90[8]

Notes:
1. Values shown are volume to capacity (v/c) ratios.
2. Source: 1999 Oregon Highway Plan (OHP), Table 6. Standards apply to planning projects through the planning horizon (2027).
3. Source: 2003 Highway Design Manual (HDM), Table 10-1. Standards apply to project design through the planning horizon (2027).
4. Operational standard for interchange ramp terminals shall be the smaller of 0.85 or the value of the v/c for the crossroad. (Source: 1999 OHP).
5. 40mph-W. of Crestview, 30 mph-between Crestview and Comstock, 20 mph-E of Comstock (school zone)
6. Field Observation (7/18/06)
7. Source: 1999 Oregon Highway Plan (OHP)
8. Source: City of Sutherlin Transportation System Plan.
9. NHS: National Highway System
10. FR: Freight Route
11. Park Hill Lane south of the I-5 southbound ramp terminal is City jurisdiction, north of the southbound ramp terminal to OR 138 is ODOT jurisdiction

It should be noted that, although delays can sometimes be long for some movements at a stop-controlled intersection, the v/c ratio may indicate that there is adequate capacity to process the demand for that movement. Similarly at signalized intersections, some movements, particularly side street approaches or left turns onto side streets, may experience longer delays because they receive only a small portion of the green time during a signal cycle but their v/c ratio may be relatively low. For these reasons it is important to examine both v/c ratio and LOS when evaluating overall intersection operations. Both are evaluated in the analyses that follow. It should be noted that all of the roadway jurisdictions use v/c, not LOS, as a measure of performance. When roadways under County/City jurisdiction intersect with an ODOT facility, the ODOT v/c ratio mobility standards apply.

Analysis Procedures

All of the intersection operations were evaluated using the methodology outlined in the 2000 Highway Capacity Manual (HCM). Synchro modeling software was used to generate the HCM reports from which the v/c ratios and 95 percentile queues were derived. All Synchro output sheets can be found in **Appendix A**. The Highway Capacity Software (HCS) tool was used to conduct freeway merge and diverge analyses.

Traffic Operations Analysis Results-Existing Conditions

Intersections

This section summarizes the traffic operations analysis conducted for the study area intersections under existing (seasonally adjusted) traffic volume conditions.

Table 2 summarizes the results for all analysis area intersections and also presents agency operational standards to enable comparison with intersection results. **Table 3** summarizes queuing on critical approach legs at the same intersections. Critical movements at unsignalized intersections are typically the minor street left turns or, in the case of single-lane approaches, the minor street approaches. These movements are required to yield to all other movements at the intersection and thus are subject to the longest delays and have least capacity. Left turns from the major street are also subject to delays since motorists making these maneuvers must also yield to on-coming major street traffic. Bold numbers in Table 2 represent v/c ratios that exceed the mobility standards and approaches with the longest queue.

Table 2. Existing 30th Highest Hour Traffic Operations Analysis Results

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]	D.C. Std.[3]
Interchange 136 Analysis Area						
OR 138 @ Fort McKay Road[5,6]	NB L/R	0.11	B	0.85	0.75	0.90
OR 138 @ Dakota Street[4]	SB L/R	0.24	B	0.85	0.75	0.90
OR 138 @ Park Hill Lane[5]	NB L	0.25	D	0.85	0.75	-
Park Hill Lane @ SB Ramp Terminal[5]	WB L	0.03	A	0.85	0.75	-
	NB T/R	0.14	B	0.85	0.75	-
W. Central Avenue @ NB Ramp Terminal[5]	**NB L**	**1.04**	**F**	0.85	0.75	-
W. Central Avenue @Ponderosa Drive[4]	NBL/R	0.17	B	0.90	0.85	-
W. Central Avenue @ Myrtle Street[4]	SBL/R	0.24	C	-	-	0.90
W. Central Avenue @ Comstock Road[5]	SB L/T/R	0.30	C	0.85	0.75	-
	NB L/T/R	0.28	C	0.85	0.75	-

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
*-Non-conventional intersection configuration precludes standard analysis techniques
Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)
3. Operational standards for Douglas County roadway facilities (Source: Sutherlin Transportation System Plan)
4. Data from June 2006, seasonally adjusted volumes
5. Existing conditions data from 2005 Sutherlin TSP
6. 2005 Sutherlin TSP models this intersection with volumes on 4-legs

Table 3. Existing 30th Highest Hour 95th Percentile Queues

Intersection	Movement	95% Queue
Interchange 136 Analysis Area		
OR 138 @ Fort McKay Road[3, 4]	NB T/L	25
OR 138 @ Dakota Street[2]	SB L/R	25
OR 138 @ Park Hill Lane[3]	NB L	25
	NB R	25
	WB L	25
Park Hill Lane @ SB Ramp Terminal[1,3]	NB L/T	25
	WB L	25
W. Central Avenue @ NB Ramp Terminal[3]	**NB L**	**275**
	NB R	25
W. Central Avenue @Ponderosa Drive[2]	NB L/R	25
W. Central Avenue @ Myrtle Street[2]	NB L/T/R	0
	SB L/T/R	**25**
W. Central Avenue @ Comstock Road[3]	NB L/T/R	25
	SB L/T/R	**50**

Notes:
1. No queuing information presented in TSP
2. Data from June 2006, seasonally adjusted volumes
3. Existing conditions data from 2005 Sutherlin TSP
4. 2005 Sutherlin TSP models this intersection with volumes on 4-legs

Most analysis area intersections currently operate with acceptable v/c ratios, queuing and levels of service. One key intersection stands out as failing to meet ODOT mobility standards. The northbound ramp terminal does not meet mobility standards and drivers experience long delays and substantial queuing. According to the TSP, this intersection meets preliminary signal warrants using year 2004 traffic volumes. The recent construction project at the interchange includes signalization of this intersection.

I-5 Merge/Diverge Analysis

A merge/diverge analysis was conducted for the northbound and southbound on/off-ramps of I-5. This analysis utilizes 2004 volumes in conjunction with the growth rates from the Sutherlin TSP to arrive at '2006' existing volumes. As identified in the TSP, a 2.7% growth factor is used for intersections west of I-5, while a 1.6% factor is used east of I-5.

Analyses were conducted using HCM methodology for each of the merge and diverge segments for the entrance and exit ramps at the interchange under (2006) existing 30th highest hour traffic volume conditions. The analyses showed that traffic operations at each of the ramp merge and diverge sections meet the OHP mobility standard for interstate freeways. Results of this analysis are provided in **Appendix B**.

Safety Summary-Existing Conditions

A safety analysis was conducted to determine if there were any significant documented safety issues within the analysis area and to recommend measures at specific locations or general strategies for improving overall safety.

The safety analysis included a review of crash history data supplied by the ODOT Crash Analysis and Reporting Unit for the period between January 1, 2003 and December 31, 2005, which are the three most recent full years for which crash data is available. It should be noted that the crashes listed are only the crashes reported. The calculated crash rates from the analysis area roadways are compared to statewide averages.

The process for analyzing the safety data provided was to determine the location and frequency of crashes occurring in the study area. Crashes were totaled by segment and by intersection. After being summarized and placed into the appropriate segment, crash rates for each roadway segment and intersection influence area were calculated and compared to statewide averages.

Calculation of Crash Rates

The crash rates were calculated from ODOT-provided crash data. For a crash to be considered associated with an intersection, it must occur within 0.05 mile (265 feet) of the intersection. Beyond this region, crash data is placed in the segment category. It should be noted that this analysis only accounts for those crashes that were reported. In

Oregon, legally reportable crashes are those involving death, bodily injury or damage to any one person's property in excess of $1,000 (August 31, 1997 thru December 31, 2003) or $1,500 (after January 1, 2004).

Intersection and segment crash rates were calculated using the following equations.

$$rate_{\text{int}} = \frac{(Crashes \cdot 1{,}000{,}000)}{(365 \cdot Years \cdot ADT)} \quad \text{and} \quad rate_{segment} = \frac{(Crashes \cdot 1{,}000{,}000)}{(365 \cdot Years \cdot Length \cdot ADT)},$$

where

$Rate_{int}$ = Crash rate per Million Entering Vehicles (MEV)

$Rate_{segment}$ = Crash rate per Million Vehicle Miles Traveled (MVMT)

Crashes = Number of crashes during the time segment

Years = Number of years being studied

ADT = Average Daily Traffic volume

Length = Length of roadway segment being studied (for segment rates).

The number of crashes was determined from ODOT crash data. At intersections, the sum of all PM peak hour entering volumes from each leg was multiplied by ten to estimate an intersection Average Daily Traffic (ADT). For roadway segments the ADT was determined from the TSP. Crash rates were then calculated for the entire three-year study period.

Crashes are also coded by severity as follows:

- Kill-Fatal Injury
- INJA-Incapacitating Injury, includes bleeding and broken bones
- INJB-Non-incapacitating Injury
- INJC-Possible injury, complaint of pain
- PDO-Property Damage Only

Intersection Crashes

Documented crashes between the years 2003 and 2005 were summarized by location for each of the study intersections. After sorting crashes by location, intersection crash rates were calculated. **Table 4** shows the ADT that was determined for each intersection and the calculated crash rates.

Table 4. Study Area Intersection Crash Rates

Intersection	ADT	3-Year Crash Rate
OR 138 at Park Hill Lane	18,890	0.15
OR 138 at NB ramp terminal	20,740	0.09
OR 138 at Ponderosa Drive	8,980	0.10
OR 138 at Comstock Road	10,720	0.60

The safety analysis showed that none of the intersections in the study area has a crash rate significantly greater than that of the surrounding area. The ODOT 2005 5-year

Comparison of State Highway Crash Rates shows an average crash rate of 1.94 for an Urban Minor Arterial (OR 138). As a rule of thumb, intersections with crash rates of 1.0 or above are potentially problematic and are candidates for further investigation. As **Table 4** shows, all of the intersection crash rates are well below both of the thresholds.

The total number of crashes along OR 138 is 24. The primary types of crashes along this roadway are turning and rear end. Thirteen of these crashes occurred at intersections (7-PDO, 5-INJC, and 2-INJB). There are no apparent crash patterns. Turning crashes are indicative of an access point, either roadway or driveway, and may be attributed to inadequate gaps in traffic, too many access points along a roadway, or driver inattention. Rear end crashes are typical of congested areas and are frequently caused by vehicles that are stopped to make a left-turn when no left-turn lane is provided or following too closely.

Four crashes occurred along Park Hill Lane between W Duke Road and OR 138 resulting in 2 PDO, 1 INJC, and 1 INJA. The primary type of crash is turning. There are no apparent crash patterns.

Eight crashes occurred on Interstate 5 (I-5) resulting in a crash rate of 0.26. The crashes occurred along I-5 between the northbound and southbound on-ramps of Interchange 136 and include crashes at the ramp merge points. The primary types of crash include angle and rear end. The angle crashes are primarily due to merge type maneuvers, while the majority of rear end crashes are caused by following too closely. The ODOT 2005 5-year Comparison of State Highway Crash Rates shows an average crash rate of 0.51 for I-5. The segment crash rate is below the threshold for I-5. Of the eight crashes, 7 were PDO and one was INJC. There are no apparent crash patterns.

Physical Features Summary-Existing Conditions

Access Management

Access Management is the careful planning of the location, design, and operation of driveways, median openings, interchanges, and street connections. Roads serve two primary purposes. One is mobility and the other is access. Mobility is the efficient movement of people and goods. Access is getting those people and goods to specific properties. A roadway designed to maximize mobility typically does so in part by managing access to adjacent properties. A good example of this is a freeway. A motorist can typically expect interruption-free, efficient travel over a long distance using a freeway. The number of access points is restricted to only freeway interchanges every few miles because this type of roadway primarily serves a mobility function. At the other extreme are local residential streets that provide easy and plentiful access to adjacent properties. This type of roadway primarily serves an access function.

Most state roads serve a function somewhere between the freeway and the local road. One of the responsibilities of ODOT is to ensure that the design of each state road

properly balances access and mobility. Access Management is a primary means used to provide this balance. Access Management is also means of increasing safety along street corridors. Allowing more access locations along streets increases the number of potential conflict points between vehicles entering or exiting the approach and vehicle traveling along the main street. This can lead to increased vehicle delay and a corresponding decrease in level of service, as well as a reduction in roadway safety.

Applicable Access Management Standards

The OHP outlines the requirements for access management for state facilities and the surrounding roadways. The standards apply to distances between the centerlines of adjacent public or private accesses onto the highway (on the same side of the road).

Table 5 shows the requirements for OR 138, classified as a regional highway.

Table 5: Access Spacing Standards For Regional Highways

Posted Speed	Rural		Urban			
	Expressway	Other	Expressway	Other	UBA	STA
REGIONAL HIGHWAYS[1, 2]						
40 & 45	5,280	750	2,640	750	630	
30 & 35		600		600	425	[3]
≤ 25		450		450	350	[3]

References:
1,2 Notes 1 and 2 accompanying Table 14 of the OHP
3 Note 4 accompanying Table 14 of the OHP
All measurements are presented in feet

Source: 1999 OHP Table 14, Appendix C, page 193 and Table 15, Appendix C, page 194 and associated amendments

Procedures of Application for Variance

The Oregon Administrative Rules (OAR) Chapter 734 Division 51, commonly referred to simply as Division 51, governs the permitting, management, and standards of approaches to state highways to ensure safe and efficient operation of the state highways. Section 734-051-0135 directs how requests for deviations from the access management spacing standards are submitted and the process of review of those requests.

Existing Access Points

As part of this technical report, a general comparison of the access spacing with the adopted access standards was performed. The existing accesses in the vicinity of Interchange 136 are presented in **Figure 2**. None of the access locations meet ODOT access spacing standards in the Interchange 136 study area.

East of I-5, eight public accesses and seven private accesses onto OR 138/W. Central Avenue are located within ¼ mile of Interchange 136. Distances to each of the access points are shown in **Figure 2** and can be compared to the ODOT spacing standard of 600 feet between I-5 and Comstock Road and 450 feet east of Comstock Road.

Access #	Bus./Owner Name	Pub/Private	Side of Road	Permit #	Access Width	Dist btw	Owner	Property Address	Tax Lot no.
138-W. Central Avenue									
1	Fort McKay	Public	South		50	570			
14	Residence	Private	South		40	463	HELMBOLDT, RICHARD (DEC'D) TRS	1776 W CENTRAL AVE	25051B01700
2	Dakota	Public	North	06A 35349	40	585			
3	Crestview	Public	South		115	315			
15	Taco Bell	Private	North	06A 30682	30	193	WITHERS, DAN L & GAIL A	1625 W CENTRAL AVE	250519B00201
16	Parking Lot/Budget Inn	Private	South	06A 29593	25	115	YARBROUGH, DARWIN & CATHY J	135 HUTCHINS ST	250519B02100
17	Dairy Queen	Private	North	06A 14978	35	359	PETERMAN, BERNARD G & JUDY H	1621 W CENTRAL AVE	250519B00200
4	SW Hutchins	Public	South		65	299	YARBROUGH, DARWIN & CATHY J	No Situs Address	250519B02300
5	Park Hill	Public	South		210	498			
	Park Hill	Public	North		--	498			
6	NB Ramps	Public	South		45	145			
	NB Ramps	Public	North		--	373			
18	Chevron	Private	South	06A 35339	45	98	SHIRTCLIFF HOLDINGS LLC	1484 W CENTRAL AVE	250519AB04800
7	Ponderosa	Public	South		80	113	ROBINSON, LEIGH & IONA TR OF &	No Situs Address	250519AB08500
19	76 Gas	Private	South	06A 35144	35	103	WEST CENTRAL SERVICES INC	1436 W CENTRAL AVE	250519AB05000
8	Myrtle	Public	North		50	133			
9	Myrtle/Driveway	Private	South	06A 13584	30	100	ROWNTREE, MONTE & JEAN C TRS	1392 W CENTRAL AVE	250519AB05100
20	Smitty's Mini Mart (shared)	Private	North		35	370	E L B H VENTURES LLC	No Situs Address	250519AB02901
20	McDonald's					-	MCDONALD'S CORPORATION	1379 W CENTRAL AVE	250519AB03101
10	Central	Public	South		60	185			
10a	Central Extension RT	Public	South		20	343			
21	Vacant Lot	Private	North	06A 20240	25	210	NO GIS DATA Available		250519AB03000
11	Comstock	Public	North		95	205			
	Comstock	Public	South			95			
12	Sunset	Public	South		35	143			
22	Residence	Private	South		20	113	BENNETT, ARTHUR E & SHIRLEY C	1272 W CENTRAL AVE	250519AB07800
23	Mr. Cash	Private	North		30	98	KNIGHT, D & C;MCKNIGHT, S A &M L	1257 W CENTRAL AVE, SPACE 1	250519AB01400
13	Hawthorne	Public	South		45				
24	Po-Man's	Private	North		45		KNIGHT, D & C;MCKNIGHT, S A&M L	1269 W CENTRAL AVE	250519AB01500
Park Hill Lane (from south to north)									
25	W. Duke Road	Public	West		70	85			
29	Smalley Truck Repair	Private	West		80	227.5	SMALLEY, GRANVEL C & JOAN	1625 W DUKE RD	250519BD03000
30	Smalley Truck Repair	Private	West		135	212.5	SMALLEY, GRANVEL C & JOAN	1625 W DUKE RD	250519BD03000
31	Curves	Private	West		150	135	FENTON, MEREDITH C & BARBARA A	325 PARK HILL LN	250519BD01900
26	SW Hutchins St.	Public	West		70	425	FENTON, MEREDITH C & BARBARA	No Situs Address	250519BD01800
27	I-5 SB Ramp Terminal	Public	East		125	613			
28	Unnamed Street	Public	West		70	310	YARBROUGH, DARWIN & CATHY J	No Situs Address	250519B02600
5	OR 138	Public	both						

380 190 0 380 Feet

GIS Data Source: City of Sutherlin

Legend

- Public/Private Road
- Private Driveway
- Parcels

Sutherlin IC 136 IAMP

Figure 2

Existing Access Inventory
Interchange 136

Of the seven private access points, four are non-permitted. The non-permitted accesses include the shared access of Smitty's Mini Mart and McDonalds, a residence, Mr. Cash and Po-Man's.

Some of the access points east of I-5 have potential alternative access to OR 138. Alternate access possibilities exist at: Chevron and 76 Gas/Subway (access via Ponderosa Drive or driveway south of Myrtle Street), Smitty's Mini Mart and McDonald's (access via Myrtle Street), and the vacant lot and Mr. Cash (access via Comstock Road). The driveway across from Myrtle Street and access to Po-Man's on the east side of I-5 have no other access options in addition to access from OR 138. Further evaluation of access spacing, including an assessment of potential for changes, will be conducted in a subsequent task. *No access changes are proposed at this time*.

West of I-5, five public accesses and four private accesses onto OR 138/W. Central Avenue are located within ¼ mile of Interchange 136. Distances to each access point are shown in **Figure 2** and can be compared to the ODOT spacing standard of 600 feet between I-5 and Crestview Street and 750 feet west of Crestview Street.

On the westside of the interchange, there is one non-permitted private access across from Dakota Street. Potential alternative access to this property could be gained from Crestview Street.

There are potential alternative access possibilities for other three private properties as well, including: Taco Bell and Dairy Queen (access via Dakota Street and parallel road to OR 138) and Budget Inn (access via Hutchins Way). Further evaluation of access spacing, including an assessment of potential for changes, will be conducted in a subsequent task. *No access changes are proposed at this time.*

Park Hill Lane is an ODOT facility between the I-5 off/on-ramps and OR 138. In this section of roadway there is one unnamed street and it does not meet ODOT spacing standards. South of the I-5 ramps, along Park Hill Lane (not under ODOT jurisdiction), there are 2 public and 3 private accesses. Spacing for Park Hill Lane can be seen in **Figure 2.**

Interchange ramp configurations and deficiencies

Basis of Review

An evaluation of the existing interchange configuration and features was performed based on a review of partial plans for the "I-5: Sutherlin-Roseburg Sec. Design-Build Project" that is currently under construction. The project does not include a complete reconstruction of the interchange, so many of the non-standard elements were pre-existing conditions. The review was limited to Sheet Nos. 32 through 37, which include profile and superelevation data for new alignments, but which do not contain horizontal curve data or lane width labels.

Interchange Ramp Configuration and Deficiencies

The I-5 Interchange at the Elkton-Sutherlin Highway (Route No. OR 138) is a "depressed" interchange, meaning the I-5 mainline is on a structure over the OR 138 cross road. The northbound ramps are a traditional diamond configuration, and the southbound side is a folded diamond with a southbound exit loop ramp in the southwest quadrant. The folded diamond configuration is an accepted interchange type, but standard practice in Oregon is to avoid exit loops on depressed interchanges because they require deceleration on downgrades to reach the low design speeds on loop ramps.

The loop ramp also contains a pre-existing intersection with a frontage road (Park Hill Lane) prior to the cross road intersection, which is a non-standard feature that affects other standards like the required deceleration distance for the loop. This frontage road intersection in the loop ramp and subsequent intersection with the cross road at 600 feet spacing do not meet the ODOT standard for access control to a minimum distance of 1320 feet from the centerline of the ramp.

The ramp terminal spacing is normally measured along the cross road between the nearest edges of travel lanes on the off ramps, but in this case is measured between the northbound off-ramp and the frontage road that carries the southbound off-ramp traffic. This distance was scaled at approximately 450 feet, which is less than the low-speed minimum 510 feet for the 5-lane cross road. The terminal spacing consists of storage and taper lengths for the left turn lanes, sight distance for the bridge, and truck off-tracking space at the intersections, which should be evaluated based on the actual design speed of OR 138.

Southbound Exit Ramp

The southbound exit ramp width meets the standard 26 feet. The plans show this ramp tangent deceleration length ("T") exceeds the minimum of 450 feet for a 25 mph loop design speed, but is less than the 745-foot length required for high truck volumes. The non-standard intersection within the loop ramp, however, requires a stop condition for left turns to southbound Park Hill Lane. This is a low-volume movement but results in a configuration for which the appropriate deceleration distance is not provided. The main loop ramp appears to meet minimums for a 25 mph design speed with appropriate leading spiral and degree-of-curvature. The ramp profile and superelevation were not reconstructed with the current project. The pre-existing frontage road intersection within the loop curve is non-standard.

Southbound Entrance Ramp

The reviewed project plans showed no work on the southbound entrance ramp, but the pavement appears to have adequate width. The acceleration length is less than the desirable length of 750 feet, and the striped taper length is less than the standard 300 feet.

Northbound Entrance Ramp

The northbound entrance ramp is a single-lane ramp section with standard pavement width plus 2 feet "shy" distance adjacent to guardrail. The plans show the ramp widens to a 2-lane configuration at the intersection with OR 138. The main ramp curve length of spirals and degree-of-curvature correspond to the design speed of 50 mph, superelevation rate, and the maximum labeled profile grade. The ramp terminal intersection with OR 138 is acceptable. However, the length of the ramp intersection tangent does not extend to the intersection radius point as is standard practice in Oregon. The parallel acceleration lane is less than desirable but exceeds the minimum for ramp design speeds of 50 mph and higher. The pavement taper length appears to be somewhat less than the standard 300 feet.

Northbound Exit Ramp

The northbound exit ramp is a single-lane ramp. The plans show the ramp widens to a 2-lane ramp configuration at the intersection with OR 138. The main ramp curve degree-of-curvature and length of spirals corresponds to the ramp design speed, superelevation rate, and the maximum labeled profile grade. The tangent deceleration length ("T") exceeds the minimum of 215 feet but is less than the 315-foot standard length for high truck volumes. The ramp terminal curve does not provide spirals on either end, which is the least desirable option in Oregon practice. The terminal curve superelevation rate is non-standard.

Fixed Route Transit-Existing Conditions

The Blue Route operated by Umpqua Transit is currently configured to provide regional service and will remain that way for the foreseeable future. The Blue Route has three scheduled stops in Sutherlin, all of which are east of I-5 on Central Avenue, and travel is one-way eastbound.

Summary of Planned and Programmed Projects-Existing Conditions

Two projects identified in the Sutherlin TSP have been implemented or are currently under construction. A left-turn lane was added on OR 138 at Fort McKay Road. A signal at the intersection of the I-5 NB ramp and OR 138 is being constructed in connection with the bridge replacement project. Both projects were included in the ODOT 2004-2007 State Transportation Improvement Program.

Other projects included in the Sutherlin TSP have not yet been programmed for construction. Planned system improvements from the Sutherlin TSP that are within the Interchange Management Study Area (IMSA) are described below:

Roadway

- OR 138: Five-lane roadway and arterial upgrades from Fort McKay Road to N. Comstock Road to provide adequate capacity and traffic operation along this segment of OR 138/Central Avenue.
- I-5 Interchange: IAMP needed at this interchange to study: Improvements to I-5 on- and off-ramps; Park Hill Lane and Frontage Road access; Analysis of land uses around interchange.

Bicycle Facilities

- OR 138/Central Avenue: Add bike lanes from the west city limit through the City to the east city limit to connect to the County bikeway system.

Pedestrian Facilities

- OR 138/Central Avenue: Add sidewalks from the west city limit through the City to the east city limit.
- Comstock Road: Add sidewalks from W. 6th Avenue to Page Avenue.

Appendix B: Future Land Use Assumptions

This document was originally published as “Technical Memorandum #4: Future Land Use Assumptions” in September 2007

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Purpose and Approach

The purpose of this technical memorandum is to review development assumptions related to the 2005 Sutherlin Transportation System Plan (TSP) and the 2005 Sutherlin Buildable Lands Inventory and Economic Opportunities Analysis (BLI) prepared by ECONorthwest and dated June 2005.

Secondarily, this technical memorandum is intended to assess whether the traffic volumes from the TSP represent a reasonable build-out condition of land within the IAMP study area.

Future TSP Development Assumptions

The TSP was generally based on the adopted Sutherlin Comprehensive Plan. The TSP's assumptions accounted for build out of the area within the city's urban growth boundary (UGB). In addition, city staff assumed that substantial development would occur outside the city's UGB. The city staff's assumptions are documented in the planning director's September 28, 2004 letter to the consultant team's project manager.

In preparing the development assumptions, city staff made a series of assumptions about the density of development, including some adjustment for residential development on hillside terrain. It appears few, if any, adjustments were made to account for wetlands. Some redevelopment of existing underutilized parcels was also assumed. Substantial industrial growth was assumed in the industrial park in the northwest portion of the city based on the Sutherlin and Douglas County Comprehensive Plans.

The most significant assumption was the allocation of more than 1400 dwelling units to areas outside, but adjacent to, the UGB. These included parcels between the then-current UGB and Stearns Lane; west of Church Road between Ford's Pond and Fort McKay Road; south of Fort McKay Road and west of Plat M Street; and south of W. Duke Road.

BLI Development Assumptions

The BLI, which was conducted in 2005, was designed to fulfill guidelines of the Department of Land Conservation and Development (DLCD) to provide sufficient land for planned growth. The BLI included two key components: an assessment of population and employment growth and an analysis of the amount of land available within the then-current UGB to accommodate that growth.

The BLI forecasts a year 2025 population of 12,878, a figure that represents an average annual growth rate of 2.7 percent. Year 2025 employment is forecast to be 5,140, which represents an annual growth rate of 3.1 percent. Employment is further categorized into different land use types.

Unlike the analysis of development potential for the TSP, the BLI assessed only the land within the UGB. The BLI included a comprehensive assessment of developed, underutilized, and buildable parcels. The BLI also considered the "constraints" related to

terrain (hillsides) and wetlands. The BLI relied upon data from the county's geographic information system. According to the BLI, constraints were identified for more than 40 percent of the vacant and partially vacant lands within the UGB. This led the authors of the BLI to conclude that there was a deficit of land to accommodate residential, commercial and institutional uses associated with forecast population and employment growth. According to the BLI there is an excess of industrial land with more land available than is likely to be needed to accommodate likely industrial employment.

In the fall of 2006, the city processed an application to expand the UGB to add 213 acres of residential land north of the golf course. This process relied upon the BLI for justification for the expansion of the UGB to increase the supply of residential land.

Comparison of TSP and BLI Assumptions

The key differences between the TSP and BLI assumptions are the geographic area of coverage and the impact of wetlands constraints.

The TSP was based on very significant residential development outside the current UGB and assumed almost full development of parcels even if preliminary analysis indicated the presence of wetlands.

In accordance with DLCD guidelines, the BLI considered only lands inside the UGB at the time the study was conducted. One of the conclusions of the BLI was that an additional 328 acres of residential land will be needed to accommodate a 20-year growth rate of 2.7 percent. The BLI calculated that about 40 percent of the vacant or partially vacant land was constrained and was, therefore, not available for development.

Other conclusions from the BLI included the following; 1) the city has a surplus of industrial land; 2) some office uses will probably locate on industrial land; 3) the city has a deficit of commercial land (which is calculated to be approximately 100 acres; and 4) the city has a deficit of land for public uses. Details can be found in Chapter 5 of the Sutherlin BLI.

Methodology for Assessing TSP Traffic Volumes

Our assessment of land use and transportation impacts was a three-step process. The first was to evaluate approximate development potential by land use category. The second involved approximating the peak hour traffic generation potential of those areas. The third step involved comparing the trip generation potential with the traffic growth indicated in the Sutherlin TSP.

Residents of Sutherlin have observed that "anyone in the west part of Sutherlin must go through the interchange." It is evident from the road network and the travel patterns that this statement is true. It became clear during preparation of Technical Memorandum #3 that virtually all the land within the UGB to the west of I-5 contributed to traffic problems at the interchange. Reviewing the TSP forecasts of traffic entering the study area from Fort McKay Road and OR 138 is key to assessing the future transportation needs at the interchange.

Land Use Assessment

Based on the road network and travel patterns, we reviewed the land use and development potential for the entire western part of Sutherlin, not just the portion within the study area. For our assessment, we used the Sutherlin UGB, including the late 2006 expansion totaling 213 acres of residential land.

We based our evaluation primarily on the Comprehensive Plan designations, but also reviewed information in the BLI, and conducted a visual assessment of the project area, and visual interpretation of aerial photographs. For land within the city limits, we also reviewed the city's zoning map. Land outside the current city limits, but within the UGB is currently covered by county zoning. In assessing development potential we assumed that all land within the UGB would eventually be developed under city zoning. For land not already developed, it was further assumed that zoning would be made consistent with the Comprehensive Plan designations.

Table 1 summarizes the acreage available for development by comprehensive plan designation and zoning. Note that the totals include land added during late 2006 to the UGB in the area bounded by I-5, Scardi Boulevard, the industrial park and Stearns Lane. Land outside the UGB is not included. Note that the acreage estimates are only vacant or partially vacant land. It does not include land in the study area that is already developed. It also excludes land identified in the BLI as having wetlands constraints.

Figure 1 illustrates the approximate size and location of major undeveloped or underdeveloped areas assumed to be developable in this analysis. Areas with significant wetlands constraints are assumed to be undevelopable and are not shown. Figure 1 differentiates between low- and high-density residential uses because trip generation rates are significantly different depending on density. Figure 1 shows only one commercial category because all commercial land in the study area is designated the same. Figure 1 does not differentiate between different categories of industrial land because there is so much overlap in allowed uses between the allowable uses in these zoning districts.

TABLE 1: AVAILABLE DEVELOPABLE LAND IN THE WEST SUTHERLIN AREA

Land Use	Comprehensive Plan Designation	Zoning	Approximate Acres Available for Development in Area
Low Density Residential	RL, RLH	R-1	250
High Density Residential	RA, RM	R-3	3
Commercial	CC	C-3	12
Light Industrial	LI	M-1	6
Heavy Industrial	HI	M-2	40
Industrial Park	CG	M-2	200

Sources: Plan designations were taken from Comprehensive Plan Map 6-2 Plan Designation (RL-Residential Low-density, RLH-Residential Low-density hillside, RA-Residential High-density, RM-Residential medium-density, CC-Community Commercial, LI-Light Industrial, HI-Heavy Industrial, CG-Industrial Park)
City of Sutherlin Zoning information was provided from Sutherlin GIS data

The zoning of the areas identified as representing high development potential included:

- C-1, Commercial Downtown,
- C-3, Commercial Community,
- M-1, Light Industrial,
- M-2, Heavy industrial, and
- R-1, Low-density Residential, and
- R-3, High-density Residential.

Land designated for residential use is found throughout the western portion of Sutherlin. The largest portion (approximately 200 acres) is within the area added to the UGB in 2006. We assessed the development potential of low-density residential lands on a visual assessment of aerial photos of some recent developments in west Sutherlin. Our conclusion was that residential development appears to have a density of approximately four dwelling units per acre. This figure is substantially lower than the maximum allowed by the Comprehensive Plan, which allows for a maximum of 7 units per acre of single family housing. Not all of the land designated for residential development in the Comprehensive Plan has the same density potential, but four units per acre was assumed to be reasonable on an areawide basis considering some areas have hillside constraints while other areas will be developed with smaller lots and may approach the maximum of 7 units per acre specified in the Comprehensive Plan.

Substantial vacant or underdeveloped land in the immediate vicinity of the interchange is designated for commercial development with a designation of C-3. Much of the land with commercial designation on the north side of OR 138 appears to be designated as wetlands. In keeping with the methodology used in the BLI, this was considered unavailable for development, thus reducing the acreage available to approximately 12 acres as shown in Table 1. The C-3 designation allows a wide range of commercial land uses including all the uses listed in C-1, Commercial Downtown, and then expands on the allowed uses with other general commercial uses, such as automotive repair, community buildings, hotel, motel, library, etc. Commercial Downtown zoning allows high-volume traffic generators such as fast food restaurants, convenience stores and banks.

Trip Generation Potential of Developable Lands

Trip generation rates are readily available for many specific uses in the Institute of Transportation Engineers' publication *Trip Generation.* Typically this publication is used for specific developments about which details, such as building size, are clearly established. For some uses, other variables, such as employees or acreage, are also used as the basis for estimating future trips. In most cases, building size in thousands of square feet has the widest applicability and the greatest number of studies.

Using the land use assumptions described in the preceding section, we applied assumptions about the density of development and calculated traffic potential based on trip generation rates derived from *Trip Generation.*

Residential development is probably the easiest to calculate once the density is determined. As stated above, we found that recent developments in west Sutherlin have been at a density of approximately 4 dwelling units per acre. The PM peak hour trip rate is 1, with 64 percent entering and 36 percent exiting.

In the commercially designated areas, we assumed a combination of the most common types of land use. For the Commercial Community land available for development both north and south of OR 138, we assumed development would include uses similar to those that have recently been added in the area. For commercially designated land, we selected a combination of uses that included retail uses (e.g. shopping center and specialty retail) and service oriented uses (e.g. fast-food restaurant, bank, or a high turnover restaurant). The size of buildings was calculated based on the total parcel size and a percentage of lot coverage that accounts for on-site parking, drive aisles, landscaping, storm drainage, and other typical requirements of a site. Building size was assumed to be approximately 25 percent of the parcel size.

Trip rates calculated for industrial land were based on typical rates for light industrial, manufacturing, and warehousing. We used the BLI's total industrial employment growth (717 employees over twenty years) as the basis for our industrial employment assumptions in the study area. We assumed all industrial land, including the 200 acre industrial park in the northwest portion of the UGB, would be developed at a uniform employment density of 3 employees per acre. This calculation assumes that industrial lands in the western portion of Sutherlin satisfy the entire increase in industrial employment described in the BLI - approximately 700 new industrial sector employees during the next twenty years. Note also that an employment density of 3 employees per acre is fairly low and densities of 5 to 10 employees per acre or even higher are possible.

Table 2 summarizes the traffic generation potential of the development assumptions presented in Table 1.

TABLE 2: TRAFFIC GENERATION POTENTIAL OF AVAILABLE DEVELOPABLE LAND IN THE WEST SUTHERLIN AREA

Land Use	Acres	Trip Rate	Inbound PM Peak Hour Trips	Outbound PM Peak Hour Trips
Low Density Residential	250	1 trip/dwelling; 4 dwelling/acre	640	360
High Density Residential	3	0.6 trip/dwelling 12 dwellings/acre	14	7
Commercial	12	56 trips/acre	336	336
Light Industrial	6	3 trips/acre	3	15
Heavy Industrial	40	3 trips/acre	24	96
Industrial Park	200	3 trips/acre	120	480
Total			1137	1294

As shown in Table 2, residential areas have more inbound trips than outbound trips as people return home at the end of their work day; commercial trips are balanced with the same number going to and leaving the establishments; and industrial trips are predominately outbound trips as workers leave industrial sites. Table 2 represents the growth potential of new developments summarized in Table 1.

Comparison of TSP Traffic Volumes with Trip Generation from Land Use Assumptions

The forecasts of daily traffic on key facilities including OR 138 both east and west of I-5 and on Fort McKay Road were provided in the TSP. In addition, the Synchro files used by the consultant responsible for preparation of the TSP were provided. The Synchro files included the forecast peak hour traffic volumes at most key intersections in the study area. The difference between the TSP's peak hour volumes and recent traffic counts defines the traffic growth attributable to development in the TSP.

Using the peak hour volumes forecast in the TSP and recent counts we were able to compute the expected traffic growth at key points:

- Fort McKay Road west of OR 138;
- OR 138 west of Fort McKay Road;
- A future "north leg" for the intersection of Fort McKay Road and OR 138;
- Crestview Street south of OR 138; and
- Dakota Street north of OR 138.

These five locations account for most of the traffic generated by development in the entire western portion of Sutherlin. Some traffic generated in the area never leaves the area, such as trips from the residential area to the nearby grocery store, but a substantial portion of the traffic goes through the interchange, either to get onto I-5 or passing through to the eastern portion of Sutherlin.

Table 3 summarizes the traffic at these key locations and compares the 2004 traffic volumes with the future year volumes presented in the TSP. The difference represents the amount of traffic attributable to growth assumptions in the TSP.

TABLE 3: PM PEAK HOUR TRAFFIC VOLUMES AT KEY LOCATIONS IN THE WEST SUTHERLIN AREA IN YEAR 2004 AND FUTURE TSP

Location	Direction	2004	TSP Future Year	Difference Attributable to Growth
OR 138 west of Ft. McKay	Inbound	202	770	568
	Outbound	122	776	654
Ft. McKay south of OR 138	Inbound	138	612	474
	Outbound	80	414	334
North leg of OR 138/Ft. McKay Intersection	Inbound	0	210	210
	Outbound	0	194	194
Dakota north of OR 138	Inbound	150	310	160
	Outbound	147	295	148
Crestview south of OR 138	Inbound	<5	184	184
	Outbound	<5	675	675
Total	Inbound	500	2086	1596
	Outbound	359	2354	2005

Inbound trips are headed to the homes and businesses served by these streets and away from the interchange.
Outbound trips are headed away from homes and businesses served by these streets and toward the interchange.

The total inbound and outbound traffic volumes cited in Table 3 are directly comparable to the total inbound and outbound volumes cited in Table 2. This analysis suggests that the growth represented by the TSP is substantially greater than that from the BLI even after accounting for the 2006 expansion of the UGB that added approximately 200 acres of residential development. It is important to note that the BLI considers a substantial amount of commercially designated land to be unavailable for development because of wetlands constraints. Combining inbound and outbound traffic, development associated with the BLI is only 67 percent of the total growth associated with the growth forecast in the TSP. Looking at the total future traffic volume, the volumes associated with the BLI represent 73 percent of the volumes associated with the TSP.

Using these comparisons, we concluded that the traffic volumes forecast in the TSP are likely on the "high side" of a reasonable growth expectation for a 20-year planning horizon. Twenty years' growth based on the BLI is predicted to be about one-third less than predicted for 2025 in the TSP.

Alternative Development Scenarios

As indicated above, both the BLI and 2005 TSP indicate very significant growth in traffic volumes related to new development. The assumptions for both are subject to interpretation. More development or different development could occur than indicated in either.

As indicated in the discussion of zoning, there is potential for different types of development that may legally and logically occur within most land use categories. Precise details, such as building size or number of employees, are needed to calculate the actual number of trips generated by a particular development.

It is instructive to see the range of trips generated by different uses. Table 4 illustrates the relative trip generation rate of a variety of land uses. Samples of uses are grouped according to the typical number of PM peak hour trips that would be generated. Except for a single-family house, all other uses are listed according to their trip generation per thousand square feet of building area.

TABLE 4: COMPARISON OF TRIP GENERATION POTENTIAL OF VARIOUS LAND USES

Trip Generation (Based on PM Peak Hour Trip Generation Rates)	Land Use Category
Very High	Bank
	Fast Food Restaurant
	Convenience Store
High	Supermarket
	Pharmacy
Moderate	Shopping Center
	Free-standing Discount Superstore
	Specialty Retail Store
	Home Improvement Store
Low	Office Building
	Single-Family Home
Very Low	Furniture Store
	Manufacturing, Warehousing
	Heavy Industrial

Rates are based on trips per thousand square feet, except for single family home, which is per dwelling unit.

As indicated in the previous section, our development scenario included a combination of uses for the approximately 12 acres developable as commercial properties. For the commercially designated land, we assumed shopping center trip rates for most of the land. We did not include a supermarket or pharmacy in our development scenario and assumed only a small amount of the commercial land would be developed as banks or fast food restaurants.

More Intense Development of Wetland Constraint Areas

Substantial additional acreage of commercial land beyond the 12 acres listed in Table 2 was considered undevelopable because it was listed in the BLI as being constrained because of wetlands designation. Some of this commercially designated land may, in fact, be developable because it is determined not to be wetlands. Alternatively,

development may be accommodated on some sites if mitigation, such as the creation of substitute wetlands, is done on other sites.

An increase in the amount of developable commercially designated land above the 12 acres listed in Table 2 could cause a substantial increase in the total amount of traffic in the western portion of Sutherlin and at the interchange.

More Intense Development without Rezoning

A different development scenario could easily produce more trips than calculated in our development scenario. Substituting additional uses that fall into the "very high" or "high" categories would increase trips. Several additional fast food restaurants, another supermarket and a pharmacy would measurably increase trips in the area. Since a wide variety of uses are allowed in the Commercial Community District, this would not even require a zone change.

It is also worth noting that Sutherlin's Light Industrial District (M-1) and Heavy Industrial District (M-2) allow certain uses that produce high volumes of traffic and are usually associated with commercial zoning categories. Uses allowed in Sutherlin's M-1 and M-2 districts include the following: "restaurant," "plumbing, heating, electrical or paint contractors storage, repair or sales shop," and "lumber or building materials sales, retail." It appears that any of these uses could be developed on land designated for industrial use in the Comprehensive Plan and zoned either M-1 or M-2 without a requirement that the land be rezoned. Any such development has the potential for generating more traffic than assumed.

It is also possible, though perhaps somewhat unlikely, that another development scenario would produce fewer trips than our development scenario. Substituting generators from Table 4 that fall into the "low" or "very low" categories, such as offices or furniture stores, would reduce the total number of peak hour trips. Again, many such substitutions could be made without a zone change.

More Intense Development Involving Rezoning

An even greater traffic impact would occur if rezoning of some or all of the industrially designated land were to occur. As indicated in Table 1, considerable developable land that feeds traffic into the interchange area is zoned for industrial use. From Table 4, we can see that industrial land falls into the very low trip generation category. While changing a portion to residential use is estimated to have modest impacts, rezoning of land from industrial categories to almost any commercial designation will generate substantially more traffic.

Another factor that needs to be taken into account is the difference in traffic patterns during the PM peak hour. Most commercial uses produce approximately equal volumes of entering and exiting traffic during the PM peak hour. Industrial uses and office uses predominately have exiting traffic as workers head home at the end of their work day. Residential areas tend to have heavier volumes of traffic returning home in the late

afternoon. These differences in inbound and outbound travel can also have significant impacts on individual intersections.

It is also important to note that all of the industrial growth predicted for twenty years in the BLI was assumed to occur in the west portion of Sutherlin. If any of this industrial employment growth were to occur in other areas of Sutherlin, it could reduce the traffic volumes predicted in Table 2. On the other hand, the industrial land in west Sutherlin has a substantially greater capacity than the employment levels assumed in Table 2. This is one of the reasons why the authors of the BLI concluded that Sutherlin had an excess of industrial land.

More Development Based on a UGB Expansion

Like any development scenario that includes rezoning to a higher intensity use, an expansion of the UGB represents another development scenario that has significant potential for increasing traffic at the interchange. The inclusion of substantial development outside the current UGB was the principal reason that the traffic forecasts developed in the TSP were so high.

If the UGB were expanded, the traffic impacts would depend on the quantity of and type of development. Substantial increase in the amount of traffic could result from expanding beyond the development assumptions in the BLI.

Note that in Table 2 the land assumed to be developed for residential use includes the 200+ acre UGB expansion adopted in late 2006.

Conclusions

Based upon an independent analysis of the developable lands in the western portion of the Sutherlin UGB and the BLI, it was determined that the traffic volumes predicted for the TSP appear to be on the high side. Based on the BLI and the 200+ acre expansion of the UGB adopted in 2006, a reasonable growth rate for traffic would appear to be about one-third lower than used for the TSP.

Alternative development scenarios could significantly increase the traffic from the western portion of Sutherlin. Such increases have potential to negatively impact the interchange, using capacity that would otherwise be available for future development beyond the twenty-year planning horizon.

Development scenarios of particular concern from a traffic standpoint include those that increase the number of high trip generation commercial uses; allow rezoning of industrial land to commercial uses; or provide for an expansion of the UGB.

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Figure 1. Approximate Size and Location of Major Areas Available for Development by Land Use Category

Note: Boundaries are only approximate. Parcels with significant wetlands constraints are assumed to be undevelopable and are excluded.

Appendix C: Future Year Baseline and Alternative Interchange Concepts

This document was originally published as "Technical Memorandum #5: Future Year Baseline and Alternative Interchange Concepts" in September 2007.

Prepared for

Oregon Department of Transportation, Region 3

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Purpose and Approach

The Sutherlin Transportation System Plan (TSP), adopted in 2005, recommended that the existing interchange be upgraded and that an Interchange Area Management Plan be adopted.

This technical memorandum summarizes future year transportation operations for the existing configuration of Interchange 136 and three different interchange concepts.

The three new interchange concepts are:

- A folded diamond,
- A standard diamond, and
- A diamond with an additional loop ramp.

The diamond with an additional loop for the westbound traffic to southbound I-5 was the Preferred Alternative in the 2005 Sutherlin TSP. This alternative is referred to throughout Technical Memorandum #5 as the "TSP Preferred Concept." Illustrations of these concepts are contained elsewhere in this memorandum.

Data presented in Technical Memorandum #5 builds on the existing conditions presented in Technical Memorandum #3, which contains information on existing (year 2006) traffic operations, safety, and the geometry of the roads in the study area.

Future Traffic Volume Forecasts

The initial analyses of future conditions as described in this memorandum are based upon the future year traffic volume forecasts in the 2005 Sutherlin TSP. The target year for the TSP's future year traffic volumes was 2025. As discussed in Technical Memorandum #4, there is evidence to suggest that the future year traffic volumes in the TSP may be too high for a twenty-year planning horizon and that such volumes may not occur for several years beyond 2025. Further information is provided in Technical Memorandum #4. These traffic volumes are referred to as "TSP future year traffic volumes."

Whether or not the TSP future year traffic volumes are achieved in twenty years, the TSP's future year traffic volumes represent a good estimate for selecting the ultimate interchange concept to replace the existing, unique configuration that exists today. A subsequent section of this technical memorandum discusses the implications of different growth rates on construction of various incremental improvements to the interchange.

The "design hour volume" was used in the analysis of traffic operations for year 2006 as described in Technical Memorandum #3 and for future conditions as described in this memorandum. The design hour volumes are based on a year's 30th highest hour volumes (30 HV), which are somewhat higher than the average weekday peak hour volumes.

Technical Memorandum #3 provides details regarding the traffic count processing and analysis methodology at study area intersection, as well as traffic count details, seasonal

adjustment factors, peak hour factors, and heavy vehicle factors. Technical Memorandum #4 provides information on land use and the amount of development allowed by the Sutherlin Comprehensive Plan.

Three intersections not included in the 2005 TSP were added for the IAMP. They were analyzed using current traffic volumes (reported in Technical Memorandum #3) and future year traffic volumes. Current traffic volumes for these intersections were factored up using the same growth rates used in the TSP (of 2.7 % per year for intersections west of I-5, and 1.6% for intersections east of I-5). The results of this adjustment were balanced with the TSP future year traffic volumes from the adjacent intersections.

The intersections taken directly from the TSP are:

- OR 138 @ Fort McKay Road
- OR 138 @ Park Hill Lane
- W. Central Avenue @ NB Ramp Terminal
- W. Central Avenue @ Comstock Road

The intersections not included in the TSP, but included in this analysis are

- OR 138 and Dakota Street,
- W. Central Avenue and Ponderosa Drive, and
- W. Central Avenue and Myrtle Street.

Traffic Operations Analysis and Procedures

The 2005 TSP identifies the need to upgrade OR 138/W. Central Avenue to a five-lane facility between Fort McKay Road and Comstock Road. The replacement of the I-5 bridge at IC 136 undertaken in 2006 includes various improvements, including a widening of OR 138/W. Central Avenue from a two-lane section to three lanes with turn lanes at the ramp terminals. The 2006 construction project was not intended to be the ultimate solution to the interchange capacity and operations issues, but was intended to be compatible with the ultimate solution.

Using TSP future year traffic volumes, key points addressed in this study are:

- A comparison of three-lane and five-lane configurations of OR 138/W. Central Avenue and an estimate of how long a three-lane section will likely be adequate.
- A comparison of three interchange configuration concepts: Folded Diamond, Standard Diamond, and TSP Preferred Concept.
- An analysis of how each interchange configuration effects merge/diverge movements on the mainline of I-5.

All of the intersection operations were evaluated using the methodology outlined in the *2000 Highway Capacity Manual* (HCM). Synchro analysis software was used to generate the HCM reports from which the v/c ratios were derived. This report presents 95th percentile queuing and delay results that have been generated by SimTraffic simulation software. The SimTraffic results were derived from the average of five

randomly seeded simulation model runs. LOS results were then calculated based on the delay from SimTraffic simulation. While Synchro provides HCM volume to capacity results, SimTraffic simulation can more accurately represent the impact of nearby intersections to delay and queuing. Synchro (HCM) looks at each intersection in isolation. All Synchro and SimTraffic output sheets can be found in Appendix A. The freeway merge and diverge analyses was performed in accordance with the methodology prescribed in ODOT's Analysis Procedures Manual. The equations used for the merge and diverge analyses can be found in Appendix D.

Baseline Future Conditions

The initial analysis of baseline future conditions was based on TSP future year traffic volumes and the existing configuration of the interchange. The existing interchange configuration is a standard diamond for northbound I-5 and a gull-wing for the southbound ramps. This unique configuration, which is not a standard design, was discussed in more detail in Technical Memorandum #3. This existing configuration was used as the basis for assessing the three-lane and five-lane scenarios for OR 138/West Central Avenue.

Future baseline scenario one assumes a three-lane configuration for OR 138/W. Central Avenue. Future baseline scenario two is a five-lane OR 138/W. Central Avenue facility as proposed in the 2005 Sutherlin TSP.

Corridor

Four corridor intersections are identified in the 2005 TSP as meeting preliminary signal warrants. According to the TSP, the intersections of Comstock Road, NB ramp terminal and Park Hill Lane were predicted to meet preliminary signal warrants under year 2004 traffic conditions. Another intersection, OR 138 and Fort McKay Road, was predicted to meet preliminary signal warrants by 2025, the target year assumed for the TSP.

There are four remaining unsignalized intersections in the study area, each of which was analyzed using ODOT's preliminary signal warrant analysis procedures. Using TSP future year traffic volumes, we assessed the remaining four intersections and determined that two of the four would meet preliminary signal warrants with the TSP future year traffic volumes. The preliminary signal warrants for interruption of Continuous Traffic (Case B) were met at the intersections of Dakota Street and Crestview Street. The intersections of Ponderosa Drive and Myrtle Street are not predicted to meet preliminary signal warrants using the TSP future year traffic volumes. Signal warrants for Dakota Street and Crestview Street are presented in Appendix B.

It is important to note that the actual traffic volumes at Dakota Street and Crestview Street are highly dependent on the exact nature of development that occurs along OR 138 in the study area. It is also important to consider that the traffic volumes on these streets will depend on the locations at which access is provided. More consideration of these issues will occur with development of an access management plan in a subsequent portion of this planning effort.

Finally, one should be cautious in interpreting preliminary signal warrants. They are appropriate for planning purposes, but installation of traffic signals requires a detailed engineering analysis using more traffic data and specific procedures. Meeting warrants prescribed in the *Manual on Uniform Traffic Control Devices* (MUTCD) does not mandate installation of a signal. The State Traffic Engineer is the final authority for approval for installation of a signal on state highways. Additional details can be found in OAR 734-20-(400-500).

Ramp Terminals

The ramp terminals are the key locations for assessing the adequacy of a three-lane and a five-lane facility in the OR 138/W. Central Avenue corridor. The three-lane and five-lane scenarios are discussed below. Both scenarios were analyzed using TSP future year traffic volumes.

Three-Lane Facility

The analysis of the three-lane facility assumes signalization at both ramp terminals. The interchange configuration retains the existing gull-wing configuration for the southbound ramps of I-5. Park Hill Lane is also assumed to retain its connection south to W. Duke Road. The configuration of the interchange with the three-lane cross-section between the ramp terminals is illustrated in Figure 1. Note that supplemental right-turn lanes were included for both on-ramps.

Table 1 summarizes the operations for the ramp terminals for the three-lane scenario. The volume-to-capacity (v/c) ratios calculated to exceed 1.0 are highlighted in bold in Table 1. Note that the v/c ratio cannot, in reality, exceed 1.0. When the v/c ratio is calculated to exceed 1.0, it is an indication that the intersection does not have adequate capacity. For reference, Table 1 also provides the mobility standards from the Oregon Highway Plan (OHP) and the Highway Design Manual (HDM). These mobility standards are also expressed as v/c ratios. More information and an explanation of these is contained in Technical Memorandum #3.

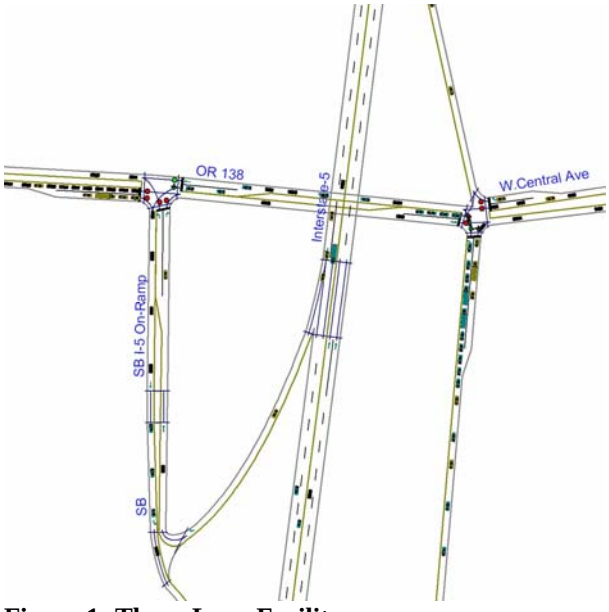

Figure 1: Three-Lane Facility

Table 1. Traffic Operations Analysis Results for Three-Lane Scenario using TSP Future Year Traffic Volumes

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]
Interchange 136 Analysis Area					
OR 138 @ Park Hill Lane	**Overall**	**1.01**	**E**	0.85	0.75
W. Central Avenue @ NB Ramp Terminal	**Overall**	**1.19**	**F**	0.85	0.75

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)

Table 2 summarizes the 95th percentile queues that are calculated to develop during the design hour.

Table 2. Queuing Results-Three-Lane Scenario using TSP Future Year Traffic Volumes

Intersection	Critical Movement	95th Percentile Queue (ft)	Storage Length (ft) [1]
Interchange 136 Analysis Area			
OR 138 @ Park Hill Lane	EBR	**225**	150
	WBL	**150**	100
	NBL	**150**	150
	NBR	175	325
W. Central Avenue @ NB Ramp Terminal	EBL	**150**	100
	WBR	**125**	100
	NBL	**1150**	975
	NBR	**300**	200

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
1. Synchro Input from 2005 TSP

As indicated in Table 1, traffic operations at both ramp terminals are very poor. With TSP future year traffic volumes, both ramp terminals fail to meet both the OHP and HDM mobility standards and both are calculated to exceed the capacity of the intersections. Simply put, more traffic desires to use both intersections than either can accommodate. The result will be long queues as more and more traffic backs up as it approaches the interchange. As shown in Table 2, the 95th percentile queues exceed the storage capacity for most movements.

More details, including the lane configurations and traffic volumes used in the analysis of the three-lane scenario are included in Appendix C.

Five-Lane Facility

The analysis of the five-lane facility assumes signalization at both ramp terminals. The interchange configuration retains the existing gull-wing configuration for the southbound ramps of I-5. Park Hill Lane is also assumed to retain its connection south to W. Duke Road. The configuration of the interchange with the five-lane cross-section between the

ramp terminals is illustrated in Figure 2. Note that supplemental right-turn lanes were included for both on-ramps.

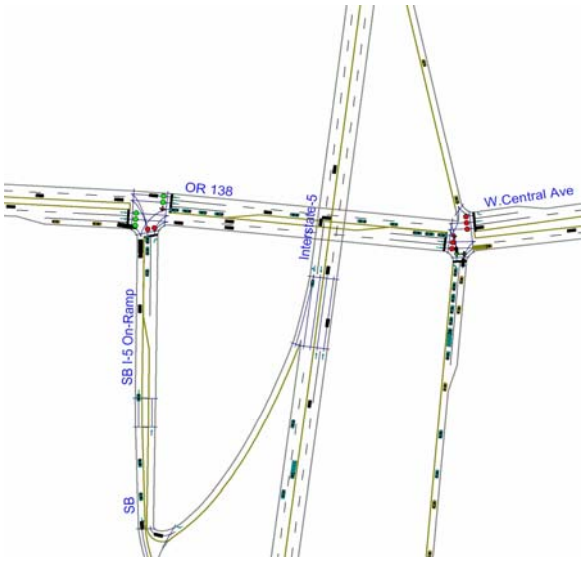

Figure 2: Five-Lane Facility

Table 3 summarizes the operations for the ramp terminals using TSP future year traffic volumes. The results for the five-lane configuration show improved operations at the ramp terminals over the three-lane scenario. Though both ramp terminals are predicted to meet OHP mobility standards, the five-lane section in this scenario is predicted to fail to meet the HDM requirement of v/c ratio less than or equal to 0.75.

Table 3. Traffic Operations Analysis Results-Five-Lane Scenario using TSP Future year Traffic Volumes

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]	D.C. Std.[3]
Interchange 136 Analysis Area						
OR 138 @ Park Hill Lane	**Overall**	0.84	B	0.85	0.75	-
W. Central Avenue @ NB Ramp Terminal	**Overall**	0.80	B	0.85	0.75	-

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)
3. Operational standards for Douglas County roadway facilities (Source: Sutherlin Transportation System Plan)

Table 4 summarizes the 95th percentile queues that are calculated to develop during the design hour. The 95th percentile queues are noticeably shorter than with the three-lane scenario. The addition of a lane in each direction along OR 138/W. Central Avenue results in fewer movements exceeding storage capacity. This is an improvement over the three-lane facility.

Table 4. Queuing Results-Five-Lane Scenario using TSP Future Year Traffic Volumes

Intersection	Critical Movement	95th Percentile Queue (ft)	Storage Length (ft) [1]
Interchange 136 Analysis Area			
OR 138 @ Park Hill Lane	EBR	**200**	150
	WBL	**150**	100
	NBL	125	150
	NBR	100	325
W. Central Avenue @ NB Ramp Terminal	EBL	**150**	100
	WBR	**125**	100
	NBL	425	975
	NBR	**250**	200

1. Synchro Input from 2005 TSP

Merge/Diverge Analysis

A merge/diverge analysis was conducted for the northbound and southbound on/off-ramps of I-5. This analysis utilizes TSP future year traffic volumes and is based on Analysis Procedures Manual (TPAU, April 2006). The analysis looks at multiple segments in the merge and diverge sections. All segments were analyzed and the highest v/c ratios are shown in Table 5.

The merge analysis looks at two different segments:

- Merge influence area, and
- Downstream basic freeway segment.

The diverge analysis looks at four different segments:

- Downstream freeway leg,
- Ramp flow,
- Freeway flow upstream of the diverge point, and
- Flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane.

Equations used for this analysis are provided in Appendix D.

Table 5. Baseline Merge/Diverge Analysis Results using TSP Future Year Traffic Volumes

Intersection	V/C
Interchange 136 Analysis Area	
NB Off-ramp	0.43[2]
NB On-ramp	0.35[1]
SB Off-ramp	0.44[2]
SB On-ramp	0.56[1]

Notes:
1 Value shown is for merge influence area; the volume to capacity of the downstream basic freeway segment is less than value shown.
2 Controlling v/c ratio is shown. Four v/c ratios were considered: downstream freeway leg capacity, ramp flow capacity, freeway flow upstream of the diverge capacity, and flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane capacity.

Baseline Future Conclusions

The Baseline Future analyses focused on TSP future year traffic with the existing configuration for IC 136.

Preliminary signal warrants were evaluated for the study area intersections with the TSP future year traffic volumes. The 2005 TSP indicates warrants will be met at the intersections of Comstock Road, Park Hill Lane, NB ramp terminal, and Fort McKay Road with TSP future year traffic volumes. The additional analysis undertaken for this report indicates that TSP future year traffic volumes will likely cause preliminary warrants to be met at two additional intersections: OR 138 at Dakota Street and at Crestview Street.

The TSP future year traffic volumes were analyzed for two different scenarios for OR 138/W. Central Avenue: a three-lane facility and a five-lane facility. The operational results for the three-lane facility indicate that traffic volumes will cause failure at both the ramp terminals using TSP future year traffic volumes. A five-lane facility will meet OHP operational standards at the intersections of Park Hill Lane and the NB ramp terminal using TSP future year traffic volumes, however, traffic volumes are forecast to be high enough that the NB ramp terminals will not meet HDM standards.

The merge/diverge analysis indicates adequate operations where entrance and exit ramps intersect with the I-5 mainline. The poorest performance predicted for the merge/diverge analysis is at the southbound on-ramp, which is predicted to operate at a v/c ratio of 0.56.

Alternative Interchange Concepts

Alternative interchange concepts include a folded diamond, a standard diamond, and the TSP Preferred Concept, which is a standard diamond with an additional loop ramp for southbound I-5 traffic. All three concepts were analyzed for their ability to accommodate forecast TSP future year traffic volumes. Since the Baseline Future analyses indicated that three lanes would be inadequate to meet forecast TSP future year traffic demands, the analyses of all three new interchange concepts were based on a five-lane facility for OR 138/W. Central Avenue from Fort McKay Road to Comstock Road.

All three concepts do away with the gull-wing configuration currently used for the southbound ramp terminal. This gull-wing configuration has the southbound ramp terminal connecting with Park Hill Lane. This configuration allows relatively direct access to I-5 from W. Duke Road and from OR 138. All three concepts eliminate the W. Duke Road connection via Park Hill Lane. To replace this connection, a new "frontage road" parallel with I-5 is assumed to connect OR 138 to W. Duke Road and eventually to IC 135. This is consistent with the TSP, which provides for a new collector road west of I-5. Details of the location and design of this frontage road or collector road will be refined in a subsequent part of this planning effort.

Certain attributes are common to all three alternative interchange concepts. These include the following:

- Five lanes are provided on W. Central Avenue and OR 138 from Comstock Road to Fort McKay Road.
- Signalization is provided at both ramp terminals.
- A supplemental right-turn lane is provided westbound at the on-ramp to I-5 northbound.
- A supplemental right-turn lane is provided eastbound at the on-ramp to I-5 southbound.
- Separate lanes are provided for left turns and right turns as the off-ramps approach the ramp terminals.
- Dual left-turn lanes are provided at the intersection of the northbound off-ramp at W. Central Avenue.
- Longer cycle lengths are used for the signals at the ramp terminals (80 sec to 120 sec).
- Park Hill Lane no longer connects OR 138 to W. Duke Road.
- A new frontage road runs parallel with I-5 to the west and connects OR 138 to W. Duke Road and to IC 135.

Based on the TSP, certain other transportation system changes were assumed to be in place for the evaluation of alternative interchange concepts. The key system changes were:

- Signalization of the intersection of W. Central Avenue and Comstock Road.

- Signalization of the intersection of OR 138 and Fort McKay Road and the addition of a northbound left-turn lane and eastbound right-turn lane.

According to the TSP, preliminary traffic signal warrants met at both intersections.

For the evaluation of interchange concepts, the other study area intersections were assumed to be unsignalized. This assumption could be reconsidered in a subsequent part of this planning effort. The intersections assumed to be unsignalized for the analysis of interchange concepts showed high v/c ratios. In several instances, the v/c ratios are high enough that there are limited or no safe gaps for turning or crossing movements. Motorist may choose alternative routes if such are available. A lack of acceptable gaps may result in motorists accepting shorter or unsafe gaps resulting in more crashes.

The unsignalized intersections with high v/c ratios will be investigated in a subsequent phase of this study to determine whether they meet preliminary signal warrants and the potential for turn restrictions, closures, or whether they can be combined with other intersections to limit the number of intersections and signals. For the purposes of analyzing alternative interchange design concepts, the unsignalized intersections were treated the same for each concept.

Folded Diamond

The folded diamond concept is shown in Figure 3. Additional information on the lane configurations and volumes is contained in Appendix C.

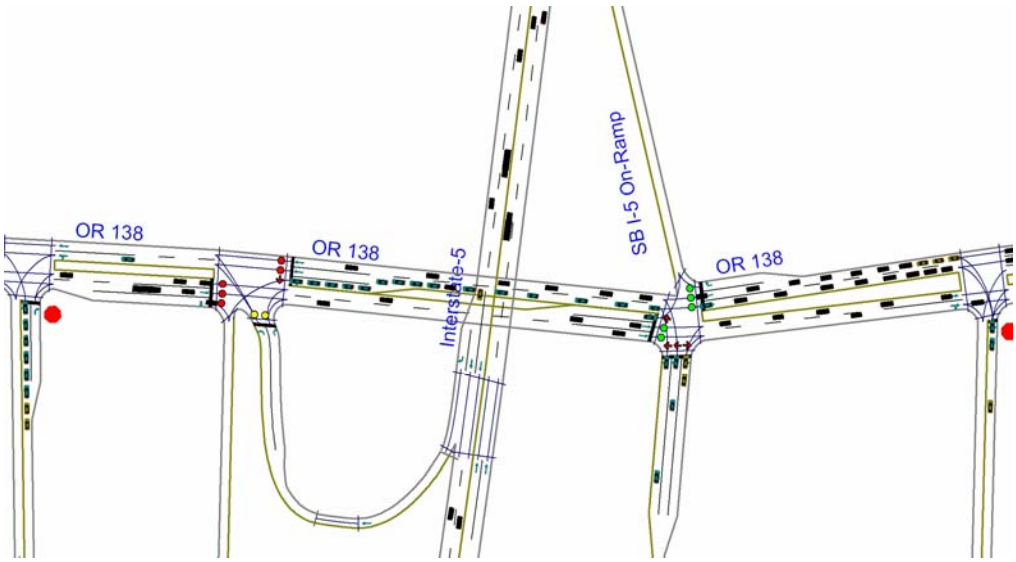

Figure 3: Folded Diamond Concept

Table 6 shows the predicted operations for all nine intersections in the study area using TSP future year traffic volumes. For the four signalized intersections, the operations are given for the overall intersection. For the five unsignalized intersections, the operations for the critical movements are presented.

Table 7 presents the expected 95th percentile queues for the signalized intersections using TSP future year traffic volumes.

Table 6. Traffic Operations Analysis Results-Folded Diamond Concept using TSP Future Year Traffic Volumes

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]
Interchange 136 Analysis Area					
OR 138 @ Fort McKay Road	Overall	0.89	C	0.85	0.75
OR 138 @ Dakota Street [3]	SBL	**2.02**	F	0.85	0.75
	SBR	0.30	F	0.85	0.75
OR 138@ Crestview Street [3]	NBL	**1.58**	F	0.85	0.75
	NBR	0.97	F	0.85	0.75
OR 138 @ Frontage Road [3]	NBL	**1.96**	F		
OR 138 @ SB Ramp Terminal	Overall	0.71	C	0.85	0.75
W. Central Avenue @ NB Ramp Terminal	Overall	0.65	C	0.85	0.75
W. Central Avenue @ Ponderosa Drive [3]	NBL/R	0.55	F	0.85	0.75
W. Central Avenue @ Myrtle Street [3]	SBL/T/R	**1.26**	F	0.85	0.75
W. Central Avenue @ Comstock Road	Overall	0.70	B	0.85	0.75

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)
3. See the discussion on page 12 about the treatment of unsignalized intersections in this analysis, the consequences, potential solutions, and the need for subsequent analyses.

Table 7. Queuing Results-Folded Diamond Concept using TSP Future Year Traffic Volumes

Intersection	Critical Movement	95th Percentile Queue (ft)
Interchange 136 Analysis Area		
OR 138 @ Fort McKay Road	EBL	225
	WBL	300
	NBL/T	125
	SBL	25
OR 138 @ SB Ramp Terminal	EBR	225
	WBL	150
	NBL	100
	NBR	100
W. Central Avenue @ NB Ramp Terminal	EBL	150
	WBR	125
	NBL	225
	NBR	175
W. Central Avenue @ Comstock Road	EBL	175
	WBL	50
	NBL	175
	SBL	50

The results of the analysis using TSP future year traffic volumes shows adequate operations at the ramp terminals in the design year, meeting both OHP and HDM standards. However, the inner-most through lane in the east and west directions between the ramp terminals functions as a de facto left turn lane due to the large volume of left-turns at both terminals onto I-5. The extra lane in each direction provides capacity for the mainline through-traffic to bypass the left-turn queue.

The intersection of Comstock Road and OR 138 is expected to operate well, continuing to meet both OHP and HDM standards in the design year.

On the west side of the interchange, the intersection of OR 138 and Fort McKay Road will not meet HDM standards in the design year. Multiple modifications were made to this intersection in an attempt to meet HDM design standards.

At the unsignalized intersections in the study area (Dakota Street, Crestview Street, Frontage Road, Ponderosa Drive, and Myrtle Street), mainline traffic will experience acceptable operations with modest delays only for traffic making left turns onto the side streets. Traffic entering from the side streets, particularly motorists seeking to make left turns will experience significant delays. Our analysis of the corridor using the Synchro/SimTraffic software did not account for the potential for motorists to conduct a two stage left-turn from the side street. A center two-way left-turn lane, as proposed in the TSP, could allow this maneuver. This is not a maneuver with which many motorists are comfortable. The issue of a center two-way left turn lane may also be revisited during development of an access management plan later in this planning effort.

Merge/Diverge Analysis

The analysis of merge and diverge movements for the I-5 ramps was conducted using the identical methodology described for the Future Baseline conditions on page 9. The results of the merge/diverge analysis of the folded diamond concept are presented in Table 8.

Table 8. Folded Diamond Merge/Diverge Analysis Results using TSP Future Year Traffic Volumes

Intersection	V/C
Interchange 136 Analysis Area	
NB Off-ramp	0.40[2]
NB On-ramp	0.35[1]
SB Off-ramp	0.44[2]
SB On-ramp	0.56[1]

Notes:
1 Value shown is for merge influence area; the v/c ratio of the downstream basic freeway segment is less than value shown.
2 Controlling v/c ratio is shown. Four v/c ratios were considered: downstream freeway leg capacity, ramp flow capacity, freeway flow upstream of the diverge capacity, and flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane capacity.

Standard Diamond

The standard diamond concept is shown in Figure 4. Additional information on the lane configurations and volumes is contained in Appendix C.

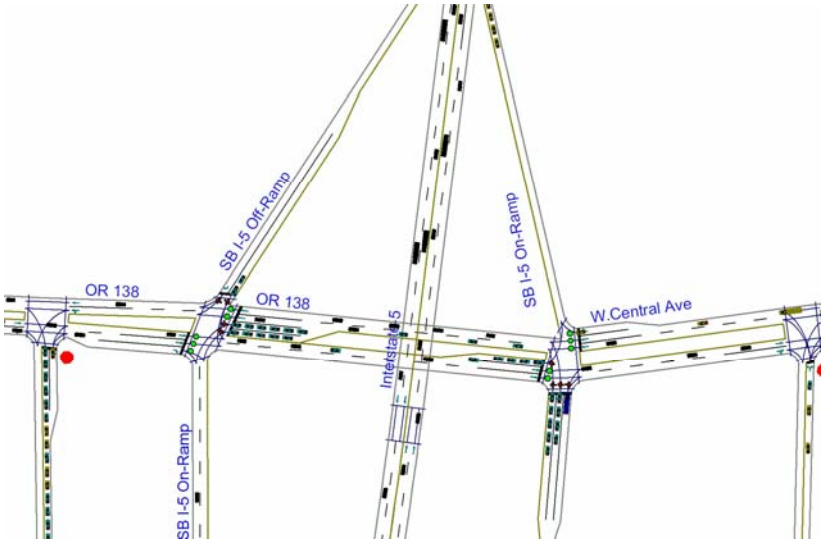

Figure 4: Standard Diamond Concept

Table 9 shows the predicted operations for all nine intersections in the study area using TSP future year traffic volumes. Note that four intersections are evaluated as signalized intersections. Five are assumed to be unsignalized. For the signalized intersections, the operations are given for the overall intersection. For the unsignalized intersections, the operations for the critical movements are presented.

Table 10 presents the expected 95th percentile queues for the signalized intersections of the standard diamond using TSP future year traffic volumes.

Table 9. Traffic Operations Analysis Results-Standard Diamond Concept using TSP Future Year Traffic Volumes

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]
Interchange 136 Analysis Area					
OR 138 @ Fort McKay Road	Overall	0.81	C	0.85	0.75
OR 138 @ Dakota Street [3]	SBL	**2.02**	F	0.85	0.75
	SBR	0.30	F	0.85	0.75
OR 138 @ Crestview Street [3]	NBL	**1.59**	F	0.85	0.75
	NBR	0.97	F	0.85	0.75
OR 138 @ Frontage Road [3]	NBL	**1.92**	F	0.85	0.75
OR 138 @ SB Ramp Terminal	Overall	0.63	C	0.85	0.75
W. Central Avenue @ NB Ramp Terminal	Overall	0.65	C	0.85	0.75
W. Central Avenue @ Ponderosa Drive [3]	NBL/R	0.55	F	0.85	0.75
W. Central Avenue @ Myrtle Street [3]	SBL/T/R	**1.26**	F	0.85	0.75
W. Central Avenue @ Comstock Road	Overall	0.70	B	0.85	0.75

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)
3. See the discussion on page 12 about the treatment of unsignalized intersections in this analysis, the consequences, potential solutions, and the need for subsequent analyses.

Table 10. Queuing Results-Standard Diamond Concept using TSP Future Year Traffic Volumes

Intersection	Critical Movement	95th Percentile Queue (ft)
Interchange 136 Analysis Area		
OR 138 @ Fort McKay Road	EBL	225
	WBL	200
	NBL/T	100
	SBL	50
OR 138 @ SB Ramp Terminal	EBR	225
	WBL	150
	SBL	275
	SBR	225
W. Central Avenue @ NB Ramp Terminal	EBL	150
	WBR	150
	NBL	200
	NBR	175
W. Central Avenue @ Comstock Road	EBL	175
	WBL	50
	NBL	150
	SBL	50

The results of the analysis using TSP future year traffic volumes shows adequate operations at the ramp terminals in the design year, meeting both OHP and HDM standards. However, the inner-most through lane in the east and west directions between the ramp terminals functions as a de facto left turn lane due to the large volume of left-

turns at both terminals onto I-5. The extra lane in each direction provides capacity for the mainline through-traffic to bypass the left-turn queue.

Operations for all intersections other than the ramp terminals are predicted to be very similar to operations predicted for the folded diamond concept. Traffic volumes are very similar and the configuration and traffic control at these intersections are the same as for the folded diamond concept. The conclusions and summary described on page 14 also apply to the standard diamond concept.

Merge/Diverge Analysis

The analysis of merge and diverge movements for the I-5 ramps was conducted using the identical methodology described for the Future Baseline conditions on page 9. The results of the merge/diverge analysis of the standard diamond concept are presented in Table 11.

Table 11. Standard Diamond Merge/Diverge Analysis Results using TSP Future Year Traffic Volumes

Intersection	V/C
Interchange 136 Analysis Area	
NB Off-ramp	0.40[2]
NB On-ramp	0.35[1]
SB Off-ramp	0.44[2]
SB On-ramp	0.56[1]

Notes:
1 Value shown is for merge influence area; the volume to capacity of the downstream basic freeway segment is less than value shown.
2 Controlling v/c ratio shown. Four volume to capacity ratios considered: downstream freeway leg capacity, ramp flow capacity, freeway flow upstream of the diverge capacity, and flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane capacity.

TSP Preferred Concept

The TSP Preferred Concept is shown in Figure 5. It is similar to the standard diamond, but includes a supplemental loop ramp that provides for movements for westbound traffic to southbound I-5. This concept eliminates the need for left turns from OR 138 at the SB ramp terminal. Additional information on the lane configurations and volumes is contained in Appendix C.

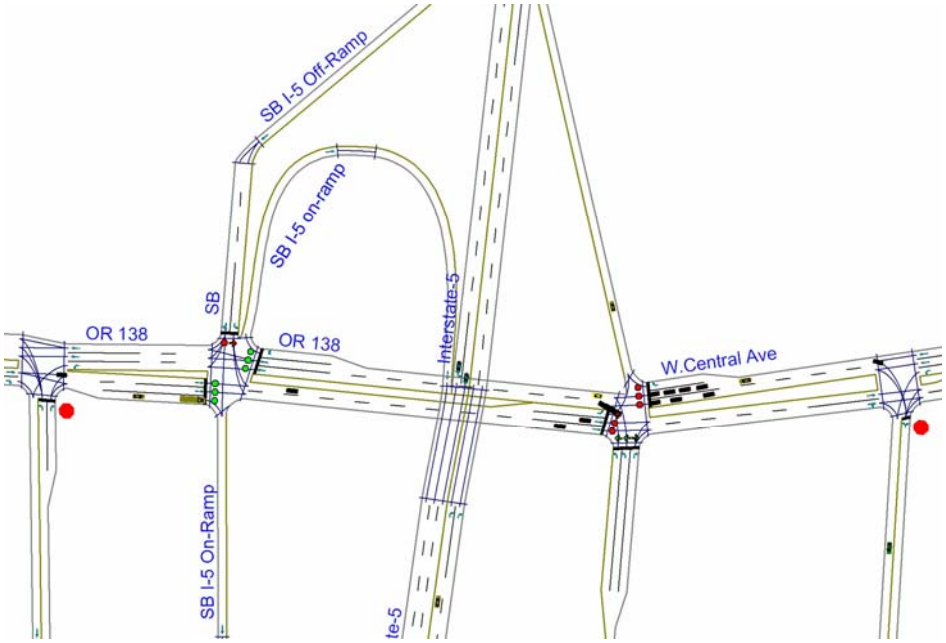

Figure 5: TSP Preferred Concept

Table 12 shows the predicted operations for all nine intersections in the study area using TSP future year traffic volumes. Note that four intersections are evaluated as signalized intersections. Five are assumed to be unsignalized. For the signalized intersections, the operations are given for the overall intersection. For the unsignalized intersections, the operations for the critical movements are presented.

Table 12. Traffic Operations Analysis Results-TSP Preferred Concept using TSP Future Year Traffic Volumes

Intersection	Critical Movement	v/c Ratio	LOS	OHP Std.[1]	HDM Std.[2]
Interchange 136 Analysis Area					
OR 138 @ Fort McKay Road	Overall	0.85	C	0.85	0.75
OR 138 @ Dakota Street [3]	SBL	**2.02**	F	0.85	0.75
	SBR	0.30	F	0.85	0.75
OR 138 @ Crestview Street [3]	NBL	**1.59**	F	0.85	0.75
	NBR	0.97	F	0.85	0.75
OR 138 @ Frontage Road [3]	NBL	**2.28**	F	0.85	0.75
OR 138 @ SB Ramp Terminal	Overall	0.42	A	0.85	0.75
W. Central Avenue @ NB Ramp Terminal	Overall	0.63	D	0.85	0.75
W. Central Avenue @ Ponderosa Drive [3]	NBL/R	0.50	F	0.85	0.75
W. Central Avenue @ Myrtle Street [3]	SBL/T/R	**1.11**	F	0.85	0.75
W. Central Avenue @ Comstock Road	Overall	0.69	B	0.85	0.75

NB-Northbound, SB-southbound, EB-eastbound, WB-westbound
L-Left, T-Through, R-Right
Notes:
1. 1999 Oregon Highway Plan Mobility Standards (Table 6)
2. 2003 ODOT Highway Design Manual Mobility Standards (Table 10-1)
3. See the discussion on page 12 about the treatment of unsignalized intersections in this analysis, the consequences, potential solutions, and the need for subsequent analyses.

Table 13 presents the expected 95th percentile queues for the signalized intersections of the TSP Preferred Concept using TSP future year traffic volumes.

Table 13. 30th Highest Hour Queuing Results-TSP Preferred Concept using TSP Future Year Traffic Volumes

Intersection	Critical Movement	95th Percentile Queue (ft)
Interchange 136 Analysis Area		
OR 138 @ Fort McKay Road	EBL	325
	WBL	275
	NBL/T	150
	SBL	25
OR 138 @ SB Ramp Terminal	EBR	100
	WBR	75
	SBL	225
	SBT/R	50
W. Central Avenue @ NB Ramp Terminal	EBL	175
	WBR	150
	NBL	175
	NBR	125
W. Central Avenue @ Comstock Road	EBL	175
	WBL	50
	NBL	150
	SBL	50

The results of the analysis using TSP future year traffic volumes shows adequate operations at the ramp terminals in the design year, meeting both OHP and HDM standards. However, the inner-most through lane in the eastbound direction between the ramp terminals functions as a de facto left turn lane due to the large volume of left-turns at the I-5 northbound ramp terminal. The extra lane in the eastbound direction provides capacity for the mainline through-traffic to bypass the left-turn queue. Since there are no left turns at the southbound ramp, due to the presence of the loop ramp, both through lanes in the westbound direction are not subject to interference from long left-turn queues.

Operations for all intersections other than the ramp terminals are predicted to be very similar to operations predicted for the folded diamond concept. Traffic volumes are very similar and the configuration and traffic control at these intersections are the same as for the folded diamond concept. The conclusions and summary described on page 14 also apply to the standard diamond concept.

Merge/Diverge Analysis

The analysis of merge and diverge movements for the I-5 ramps was conducted using the identical methodology described for the Future Baseline conditions on page 9. The results of the merge/diverge analysis of the standard diamond concept are presented in Table 14. Note that the results are different from both the folded diamond concept and the standard diamond concept because there are two southbound on-ramps.

Table 14. TSP Preferred Concept Merge/Diverge Analysis Results using TSP Future Year Traffic Volumes

Intersection	V/C
Interchange 136 Analysis Area	
NB Off-ramp	0.40[2]
NB On-ramp	0.35[1]
SB Off-ramp	0.44[2]
SB Loop On-ramp	0.47[1]
SB On-ramp	0.57[1]

Notes:
1 Value shown is for merge influence area; the v/c ratio of the downstream basic freeway segment is less than value shown.
2 Controlling v/c ratio is shown. Four v/c ratios were considered: downstream freeway leg capacity, ramp flow capacity, freeway flow upstream of the diverge capacity, and flow rate entering lanes 1 and 2 immediately upstream of the deceleration lane capacity.

Conclusions Relating to Traffic Operations of Interchange Redesign Concepts

Three concepts were analyzed for their ability to accommodate TSP future year traffic volumes.

A summary of the alternative analysis results is shown in Table 15. A comparison of alternatives provides the following key points:

- All three interchange concepts can be designed to meet both OHP and HDM mobility standards using TSP future year traffic volumes. To meet mobility standards, additional lanes, such as the supplemental right-lanes at the ramp terminals will likely be needed.
- There are no significant differences in the operations between concepts at non-ramp terminal intersections. Therefore, the results of analyses for these intersections is not included in Table 15. Note that the intersection of Fort McKay Road and OR 138 will fail to meet HDM standards for the design year in all concepts. Also note that subsequent phases of this project will involve analyses of intersections in the corridor including combining minor approaches, signal warrant analyses, and access management.

Table 15. Future Year Traffic Operations Concept Comparison using TSP Future Year Traffic Volumes

Intersection	Critical Movement	No Build Three-Lane		No Build Five-Lane		Folded Diamond		Standard Diamond		TSP Preferred		OHP Std.[1]	HDM Std.[2]
		v/c Ratio	LOS	v/c Ratio	LOS	v/c Ratio	LOS	v/c Ratio	LOS	v/c Ratio	LOS		
Interchange 136 Ramp Terminals													
OR 138 @ Park Hill Lane[1]	Overall	**1.01**	**E**	0.84	B	na	na	na	na	na	na	0.85	0.75
OR 138 @ SB Ramp Terminal[1]	Overall	na	na	na	na	0.71	C	0.63	C	0.42	A	0.85	0.75
W. Central Avenue @ NB Ramp Terminal	Overall	**1.19**	**F**	0.80	B	0.65	C	0.65	C	0.63	D	0.85	0.75

Notes:
na = not applicable. This intersection was not analyzed as part of this specific concept.
[1] The intersection of Park Hill Lane and OR 138 exists with the current interchange configuration that has a gull-wing configuration for the southbound ramp terminal. This intersection is "replaced" by a new intersection referred to as OR 138 and the SB ramp terminal in all build concepts.

Other Considerations Relating to Interchange Redesign Concepts

Geometric Differences

Geometric differences are evident among the concepts. The folded diamond concept avoids any construction in the northwest quadrant of the interchange. The standard diamond concept requires additional width at the southbound ramp terminal to accommodate dual left-turn lanes for the westbound to southbound I-5 movement. The TSP Preferred Concept involves two new ramps in the northwest quadrant of the interchange.

TSP Compatibility

All three concepts appear to be compatible with the TSP. All three concepts retain the basic five-lane section for the OR 138/W. Central Avenue corridor, but all assume additional lanes will be required for right turns at the ramp terminals.

Safety Issues

All three concepts are likely to be an improvement over the existing, non-standard configuration for the southbound ramp terminals. Current design standards would be expected to provide superior performance from a safety standpoint. There is likely to be little difference among the concepts.

Bicyclist/Pedestrian Issues

The Oregon Revised Statues require accommodations for bicyclists and pedestrians for all new and reconstructed street and highway projects. Sidewalks and bicycle lanes would be a standard provision with a new interchange.

Two issues may require special attention. High-speed turn movements, such as those associated with right-turn lanes or free-flow ramps, are very difficult for pedestrians and bicyclists needing to cross them. Such designs are not preferred from a bicyclist or pedestrian standpoint. All three concepts utilize supplemental right-turn ramps that would cause concern. The TSP Preferred Concept utilizes a free-flow ramp for the westbound to southbound I-5 movement. This ramp would be least desirable from a bicyclist/pedestrian standpoint. Dual turn lanes, such as proposed with the standard diamond configuration, are also difficult. ODOT generally does not allow crosswalks on the receiving street where dual turn lanes are used. Crosswalks are still allowed on the approach side even when dual turn lanes are used.

Right-of-Way Issues

The amount of right of way required to accommodate any of the interchange concepts may be greater than many people realize. Based on the traffic operations analysis performed and the conclusion that supplemental right-turn lanes will be needed at the approaches to the ramp terminals to accommodate TSP future year volumes. ODOT's design standards are considerably different from those used with the original design of IC

136. Even the lowest design speeds typically used by ODOT require larger curves and longer transitions than used in the past. Better identification of right-of-way issues will follow the completion of preliminary geometric analysis of the interchange concepts.

Signal and Intersection Spacing Issues

As indicated in Technical Memorandum #3, the current intersection spacing along the corridor does not meet ODOT access spacing standards. More attention will be paid to this issue during development of an access management plan. Consolidation of minor approaches will be considered and preliminary signal warrant analyses will be performed during development of an access management plan.

Other Street Improvements

As indicated above, all three concepts require elimination of Park Hill Lane and its connection from OR 138 and W. Duke Road. A new frontage road or collector road that extends from OR 138 to W. Duke Road and, ultimately, to IC 135 is a key requirement of all three concepts. This collector is consistent with the TSP.

Implications of Alternative Rates of Growth

This section of Technical Memorandum #5 is intended to explore the implications of various growth rates. As described above, the initial analysis was performed using the forecasts provided in the 2005 Sutherlin TSP.

As described in the preceding section, each of the three alternative design concepts can be shown to meet the OHP and HDM mobility standards using the TSP future year traffic volumes. This traffic volume probably represents a maximum level for the interchange, and likely serves as a good value for an ultimate interchange design.

As identified in Technical Memorandum #4, the 2005 Sutherlin TSP future volume projections appear to be high. The methodology used to forecast future traffic volumes in the TSP included growing existing traffic volumes by applying a historical area traffic growth (2.7% on the west of the interchange, 1.6% on the east the interchange) as well as adding trips generated by the build-out of the nearby land uses. This methodology in the TSP resulted in volumes at the ramp terminals increasing at annual rates of 7.4% (SB ramp terminal) and 6.35% (NB ramp terminal). Similar annual growth rates were calculated for nearby intersections near the interchange. These annual growth rates are significantly higher than the historical trend.

This suggests that the ultimate interchange, whether it is a standard diamond, a folded diamond, or the preferred concept from the TSP, may not be needed for a period significantly longer than twenty years.

Ramp Terminal Capacity

In simple terms, the capacity of a facility is the maximum hourly volume at which vehicles can reasonably be expected to traverse an intersection under prevailing roadway, traffic and control conditions. Many factors influence the capacity of an intersection, including the ramp terminals. Critical factors include the number of lanes on each approach, the presence of lanes dedicated to individual movements, type of traffic control (signalization or stop-control), and the traffic volume making each turning movement or through movement. The percentage of trucks, the presence of pedestrians, lane width, grades, on-street parking and many other attributes are also factors in determining the capacity of an intersection.

Table 16 presents the approximate maximum volume of entering traffic that allows for acceptable operations of the ramp terminals using various configurations. The northbound and southbound ramp terminals at Interchange 136 have different traffic patterns with different percentages of turns, so the capacities of the northbound and southbound ramp terminals are slightly different. The most critical factors in determining capacity are the number of lanes and the lanes dedicated to particular movements. The allowable volume reported in Table 16 is not the ultimate capacity of the interchange

ramp terminal, but the number of vehicles that can traverse the intersection while meeting the mobility standard specified in the OHP.

Table 16. Maximum Allowable Entering Volume for Various Ramp Terminal Configurations

Ramp Terminal and Configuration	Maximum Allowable Entering Volume [1]
Northbound Ramp Terminal	
3-Lane Cross Road	1900 [2]
5-Lane Cross Road with dual Left-Turn Lanes for off-ramp	3200 [2]
5-Lane Cross Road with dual Left-Turn Lanes for off-ramp and with Supplemental Right-Turn Lane for the westbound to northbound on-ramp	3500 [2,3]
Southbound Ramp Terminal	
3-Lane Cross Road	1900 [2]
5-Lane Cross Road	2600 [2]
5-Lane Cross Road with Supplemental Right-Turn Lane for the eastbound to southbound on-ramp	3100 [2,3]
5-Lane Cross Road with Loop Ramp (TSP Preferred Concept)	3800 [4]
5-Lane Cross Road with Loop Ramp (TSP Preferred Concept) and Supplemental Right-Turn Lane	4300 [3]

[1] Maximum allowable entering volume is the maximum hourly volume that allows the OHP mobility standard to be met.

[2] Maximum allowable entering volume is approximately the same for both a folded diamond and a standard diamond at this ramp terminal.

[3] The increased capacity of the supplemental right-turn lane is actually higher than indicated, but the modest volume of traffic forecast to make this turn limits its value to that indicated.

[4] A loop ramp, which is part of the TSP Preferred Concept, is compatible only with a standard diamond configuration. It is not compatible with a folded diamond configuration.

Comparison of Traffic Growth and Need for Capacity Improvements

A more comprehensive comparison of the TSP and BLI assumptions is provided in Technical Memorandum #4. The difference between the two documents is the definition of boundaries: the TSP looked at the Sutherlin area as a whole while the BLI analyzes areas only within the urban growth boundary (UGB) as it existed at the time. As a result, the BLI shows only 73% of the total growth shown in the TSP. This is equivalent to an approximate 5.4% and 4.6% annual growth rate for the NB and SB ramp terminals, respectively.

The rate at which growth occurs has a direct impact on the date at which the interchange ramp terminals will no longer operate at the prescribed mobility standards in the OHP. In other words, the growth rate determines how long a facility provides good operations before a new project is needed to increase capacity.

Table 17 presents the year at which future traffic volume reaches the levels at which the OHP mobility standards are no longer met. Five different growth rates are provided in Table 17. The rates range from the historical growth rate at the low end to the TSP growth rate at the high end. The middle rate is that associated with the BLI. Two other rates are included that bracket the BLI rate, one higher and one lower. Note that the growth rates for the northbound and southbound ramp terminals are different. This reflects the more rapid growth anticipated in the western part of Sutherlin.

Table 17. Year When Volume Reaches Maximum Allowable According to OHP Mobility Standards by Various Growth Rates and Various Interchange Configurations

Intersection	Growth Scenario	Annual Rate (percent)	3-Lane Cross Road [1]	5-Lane Cross Road [2]	5-Lane Cross Road with Supplemental Right Turn Lane [3]	5-Lane Cross Road with Loop Ramp [4]
NB Ramp Terminal	Historical	1.6	2030>[5]	2030>	2030>	na
		3.7	2021	2030>	2030>	na
	BLI	4.6	2018	2030>	2030>	na
		5.4	2015	2030>	2030>	na
	TSP	6.4	2014	2030>	2030>	na
SB Ramp Terminal	Historical	2.7	2030>	2030>	2030>	2030>
		4.4	2022	2030>	2030>	2030>
	BLI	5.4	2017	2030	2030>	2030>
		6.4	2015	2026	2030>	2030>
	TSP	7.4	2014	2023	2030	2030>

[1] A 3-lane cross road provides for one through lane in each direction plus a left turn lane for each approach at each ramp terminal. A folded-diamond configuration for the southbound ramp terminal eliminates left turns for the eastbound approach.
[2] A 5-lane cross road provides for two through lanes in each direction plus a left turn lane for each approach at each ramp terminal. A folded-diamond configuration for the southbound ramp terminal eliminates left turns for the eastbound approach.
[3] At the northbound ramp, the supplemental right turn lane refers to a lane added to accommodate the right turn for the westbound approach to the northbound on-ramp. At the southbound ramp, the supplemental right turn lane refers to a lane added to accommodate the right turn for the eastbound approach to the southbound ramp.
[4] The loop ramp, which is part of the TSP's Preferred Interchange Concept, eliminates left turns for westbound traffic to the southbound ramp. It replaces that with a loop ramp. The loop ramp is not a feature of the northbound ramp terminal.
[5] 2030> indicates the year calculated is beyond year 2030.

When interpreting Table 17, it is important to note that changing from a 3-lane section for Highway 138/W. Central Avenue to a 5-lane section must occur at the earlier date specified for the two ramp terminals. For example, using the growth rate associated with the BLI, the widening of Highway 138/W. Central Avenue would need to occur in 2017, rather than 2018. On the other hand, the addition of a supplemental right turn lane may be undertaken at separate times for the two ramp terminals. Using the TSP growth rate, for example, the southbound ramp terminal would benefit from the addition of a supplemental right turn lane in 2023. The northbound ramp terminal is predicted to operate acceptably until 2030, even with the TSP growth rates, without the addition of a supplemental right-turn lane.

Conclusions

The traffic analysis performed using TSP future year traffic volumes clearly showed that the existing interchange configuration, which features a gull-wing configuration for the southbound ramp terminal, fails even with a three-lane section for Highway 138/W. Central Avenue.

The traffic analysis performed using TSP future year traffic volumes showed that the existing configuration can meet OHP mobility standards, but not HDM standards, with a five-lane section for Highway 138/W. Central Avenue.

The traffic analysis using TSP future volumes confirmed that the intersections of Highway 138 with Fort McKay, Highway 138 with the southbound ramp terminal, and the intersection of W. Central Avenue with Comstock meet preliminary signal warrants as predicted in the TSP. In addition, the intersections of Highway 138 with Crestview and Dakota Streets were predicted to meet preliminary signal warrants.

Three interchange design concepts were evaluated: a folded-diamond, a standard diamond, and the TSP Preferred Concept (a standard diamond with a loop ramp for the westbound to southbound movement at the southbound ramp terminal). All three concepts were found to meet applicable mobility standards using TSP future year traffic volumes with a five-lane cross-section for Highway 138/W. Central Avenue. A folded-diamond and a standard diamond have approximately the same capacity. The TSP Preferred Concept has greater capacity.

Depending upon the rate of growth, both ramp terminals are likely to meet OHP mobility standards for a period of five to ten years with a three-lane cross-section for Highway 138/W. Central Avenue, after which five lanes are likely to be needed to achieve OHP mobility standards. Unless the extraordinarily high growth rate predicted in the TSP occurs, a five-lane cross-section for Highway 138/W. Central Avenue and signalized ramp terminals are likely to satisfy traffic demand at the ramp terminals through year 2030.

Appendix D: Interchange Design Concepts and Future Physical Features Description

This document was originally published as "Technical Memorandum #6: Interchange Design Concepts and Future Physical Features Description" in August 2007.

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Introduction and Background

The configuration of Interchange 136 (IC136) was one of the key issues not resolved in the 2005 Sutherlin TSP. The Interchange Area Management Plan (IAMP) for IC 136 builds upon the work completed for the Sutherlin TSP. As part of the IAMP process for IC 136, three design concepts are evaluated for the interchange. The three design concepts include:

- Folded Diamond Concept
- Standard Diamond Concept
- TSP Preferred Concept (Standard Diamond with an additional loop ramp)

The existing gull-wing configuration for the southbound ramp terminal has multiple deficiencies and is inadequate to handle future year traffic. See Technical Memorandum #3 for details.

Recent construction has occurred on OR 138/W. Central Avenue. The construction provides adequate space beneath the I-5 Bridge for OR 138/W. Central Avenue to operate as a 5-lane facility. Currently, the section between the ramp terminals is only striped as a 3-lane facility. Additionally, the Interstate 5 (I-5) Bridge over OR 138/W. Central Avenue was widened in the southbound direction.

Concepts Considered

The differences between design concepts focus on the southbound ramp alignments. All concepts would leave the standard diamond alignment for the northbound ramps. There is no proposed change relating to the general location of the northbound ramp terminal. Some modifications, including the construction of separate turn lanes, may be required. The existing northbound ramp configuration design concerns are discussed in detail in Technical Memorandum #3.

All concepts are designed for the ultimate interchange configuration. This provides a 5-lane facility for OR 138/W. Central Avenue in the vicinity of the ramp terminals. Additionally the ramp terminals will have supplemental right-turn lanes for vehicles approaching the ramp terminal from either direction. Specifically, a supplemental right-turn lane is provided for westbound traffic from W. Central Avenue to the northbound on-ramp. Likewise, a supplemental right-turn lane is provided for traffic from eastbound OR 138 to the southbound on-ramp.

The 5-lane section provides two lanes of traffic in each direction with the center lane shared by adjacent intersections to provide storage for the left-turn movements (back to back left-turn storage). The section of roadway that is not available for storage is called the transition distance. There are standards for transition distances which are needed to prevent opposing vehicles from attempting to occupy the same space and potentially resulting in a collision. This is of specific concern between the ramp terminals where large volumes of vehicles are attempting to enter I-5.

The alternative to back to back left-turn lanes is side by side left-turn lanes. This configuration would remove the potential conflict area, but would require additional width that is not available under the I-5 overpass.

Mobility standards, stated in the Highway Design Manual and used for this IAMP, require a maximum volume to capacity ratio of 0.75 within the twenty year planning horizon. All concepts meet mobility standards. More details regarding mobility standards and supplemental right-turn lanes are provided in Technical Memorandum 5.

A list of concept advantages and disadvantages common to all alternatives are shown in **Table 1**, a detailed description of each concept is presented below. All concepts will require a new frontage road connection between W. Duke Road and OR 138/W. Central Avenue. Further refinement of the location of the frontage road connection will be included in a subsequent Technical Memorandum and in the final IAMP.

Table 1. Common Interchange Concept Advantages and Disadvantages

Advantages	Disadvantages
• Modern Design • I-5 SB off-ramp meets standards • Eliminates frontage road intersection prior to OR 138/W. Central Avenue • Longer SB I-5 on-ramp acceleration distance • Supplemental right-turn lanes • Longer merge distance • Meets mobility standards	• Requires construction of a new "frontage road" to replace Park Hill Lane • Right-of-way impacts to SW quadrant

The following geometric and access management standards were considered in the creation of the design concepts.

The geometric standards used as the basis for developing the design concepts in this document were generally consistent with the HDM. Two key issues that would require design exceptions are:

- Using a design speed of 25 mph for curved ramps, and
- Using a design speed of 35 to 40 mph for OR 138/W. Central Avenue.

These design speeds seem reasonable for this location given the existing constraints and the planned use and development in the area. Design exceptions would need to follow the process outlined in the HDM in advance of or during the design process.

The designs are conceptual at this time. There is potential for the need of a slightly larger footprint to provide adequate superelevation rates for the ramps. Higher speeds or additional storage on OR 138/W. Central Avenue, or greater off-ramp speeds (folded diamond), will potentially result in the need for the southbound ramp terminal to shift further to the west.

Access management standards for IC 136, as presented in the August 2006 Amendment of the 1999 Oregon Highway Plan (OHP) include an influence area along OR 138/W. Central Avenue to the east and west of the interchange ramp terminals to be included in analysis: 1320 feet (OHP Table 17-dimension 'Y' for urban roadway). Access Management will be described in more detail in Technical Memorandum #7.

Folded Diamond Concept

The folded diamond concept for the southbound ramp terminal is a modern style interchange with single lane ramps that flare out to provide multiple turn lanes at a signalized intersection with OR 138/W. Central Avenue. This design configuration removes the connection to Park Hill Lane and moves the ramp terminal west, as shown in **Figure 1**, to provide acceptable design distances.

The curved I-5 SB off-ramp uses a 25 mph design speed and terminates at the signalized intersection with OR 138/W. Central Avenue. For this concept the I-5 SB on-ramp is longer than the existing ramp. The extra length is a function of the new SB off-ramp design and the removal of the Park Hill Lane connection. The new on-ramp design will provide uninterrupted flow onto I-5 and a greater distance to accelerate to freeway speeds on the rolling terrain.

The southbound ramp terminal location is a function of two design elements: the design speed of the off-ramp, which requires a certain minimum curvature of the ramp, and the distance required to accommodate turning vehicles at both ramp terminals. The total distance between ramp terminals is the sum of the storage requirements for the westbound left-turns from OR 138/W. Central Avenue to southbound I-5, transition between the ramp terminals, and complementary left-turn storage distance at the northbound ramp terminal. The storage distance for each left-turn bay is planned to accommodate the design year 95-percentile queue. This left-turn queue distance is anticipated to be approximately 225 feet at the southbound ramp terminal (westbound left turn) and 200 feet at the northbound ramp terminal (eastbound left-turn) with a transition distance between the back to back left-turn lanes of approximately 125 feet. A transition distance of 125 feet is an estimate for planning purposes, longer transitions are desirable. The 125 feet transition distance will require a design exception; the actual transition distance is to be determined in final design. Left-turn distances and transition can be seen in **Figure 2**.

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Figure 1. Folded Diamond Concept

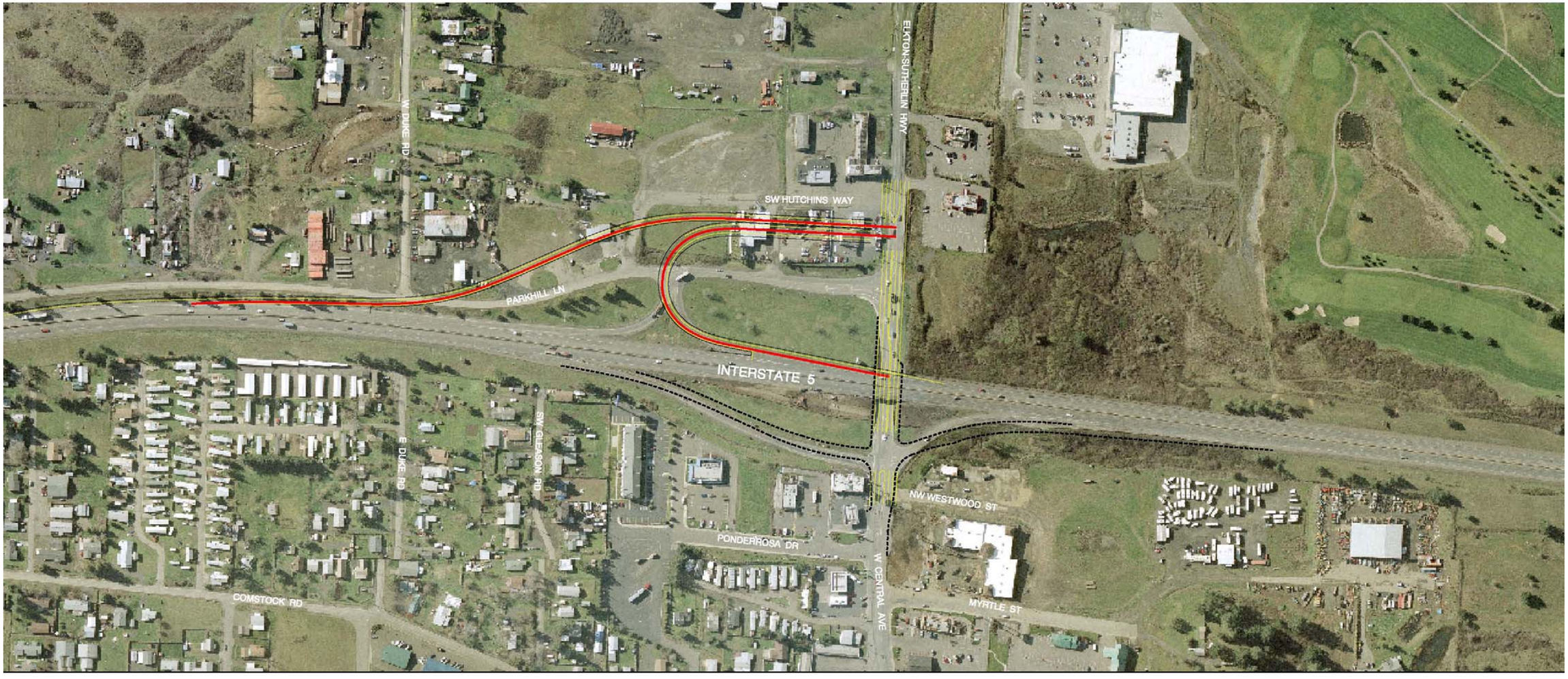
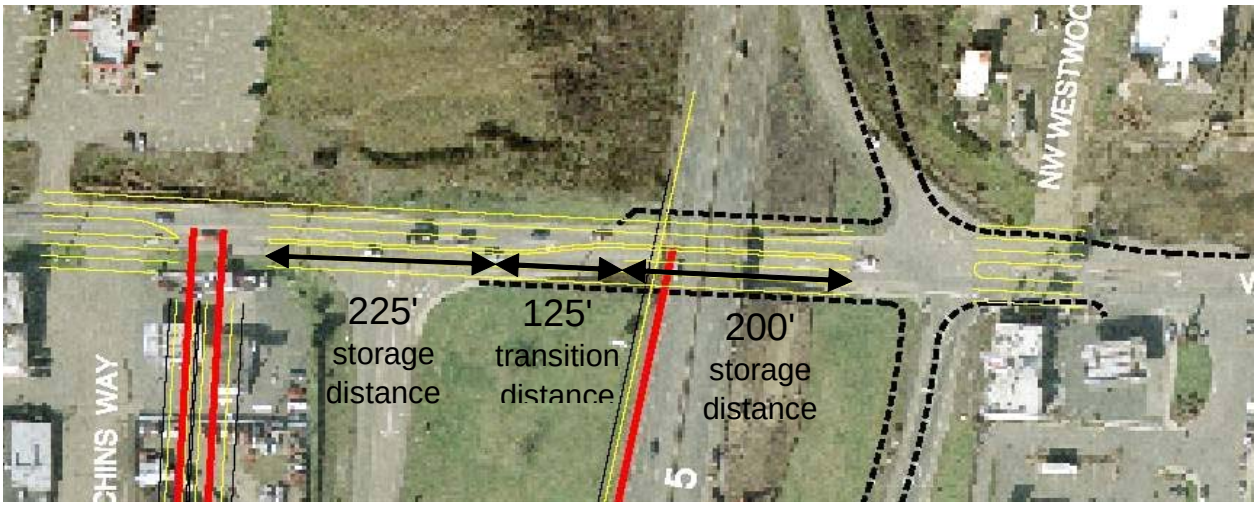


Figure 2: Folded Diamond left-turn bays and transition distances



Standard Diamond Concept

The standard diamond concept for the southbound ramp terminal is a modern style interchange with single lane ramps that flare out to multiple turn lanes at a signalized intersection with OR 138/W. Central Avenue. Like the folded diamond concept, this design configuration removes the connection to Park Hill Lane and moves the ramp terminal west, as shown in **Figure 3**, to provide acceptable design distances.

The I-5 off-ramp uses a 55 mph design speed and terminates at the signalized intersection with OR 138/W. Central Avenue. For this concept the southbound I-5 on-ramp is longer than the existing ramp. The extra length is facilitated by the removal of the Park Hill Lane connection. The new on-ramp will provide uninterrupted flow onto I-5, a greater distance to accelerate to freeway speeds on the rolling terrain, and a longer merge distance than the existing configuration.

The key design element that influences the southbound ramp terminal location is the storage requirement and transition distance for the back to back left-turns between the ramp terminals. For this concept, dual westbound left-turn bays are included to provide adequate storage at the southbound ramp terminal while fitting within the constraints of the I-5 overpass. The storage distance for the left-turn bay at each terminal is planned to accommodate the design year 95-percentile queue. This left-turn queue distance is anticipated to be approximately 175 feet at the southbound ramp terminal (westbound dual left turn bays each 175 feet) and 225 feet at the northbound ramp terminal (eastbound left-turn) with a transition distance between the back to back left-turn lanes of approximately 125 feet. A transition distance of 125 feet is an estimate for planning purposes, longer transitions are desirable and likely needed due to the dual left-turn lane at the southbound ramp terminal. A longer transition distance will result in a greater space between the ramp terminals than what is shown. The actual transition distance is to be determined in final design. Left-turn distances and transition can be seen in **Figure 4**.

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Figure 3. Standard Diamond Concept

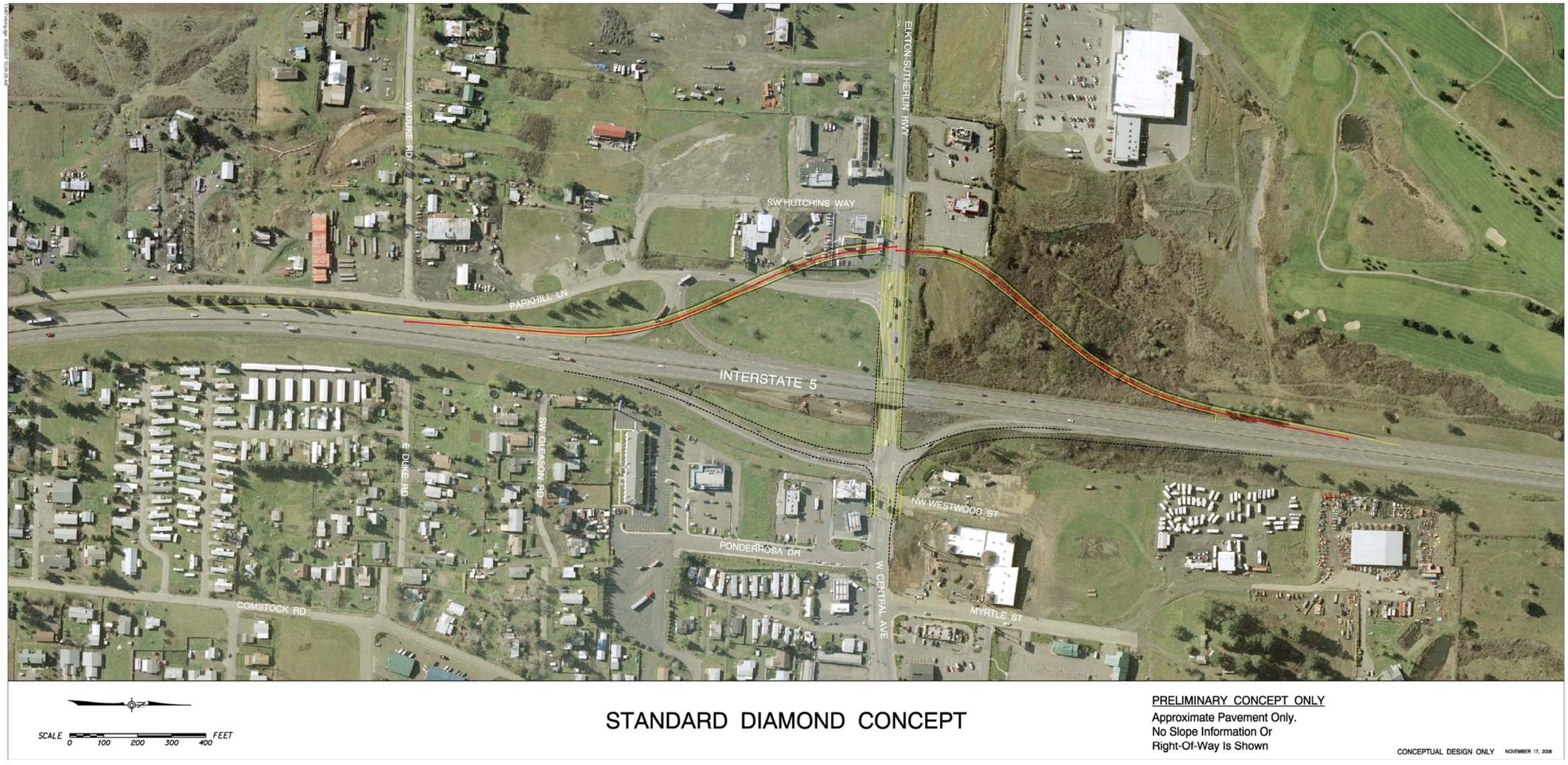
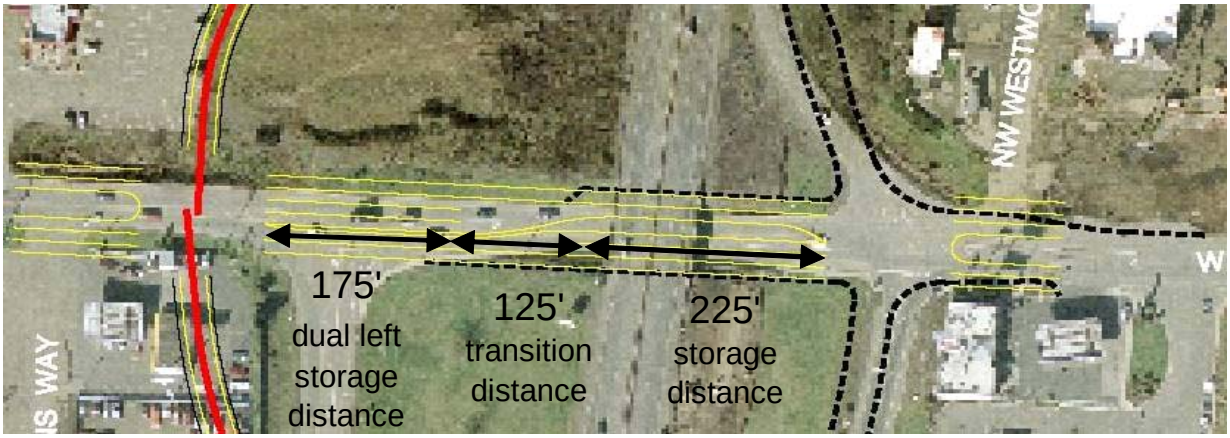


Figure 4: Standard Diamond left-turn bays and transition distances



Standard Diamond Concept with an Additional Loop Ramp

This concept is very similar to the standard diamond concept described above, but adds a loop ramp for westbound OR 138/W. Central Avenue traffic wanting to access southbound I-5. The loop ramp avoids the need for left turn lanes for the westbound to southbound I-5 traffic at this ramp terminal. If city growth patterns create a need, the implementation of the loop ramp can extend the life of the southbound ramp terminal. Like the other concepts, this design configuration removes the connection to Park Hill Lane and moves the ramp terminal west, as shown in **Figure 5**, to provide acceptable design distances.

The I-5 off-ramp uses a 55 mph design speed and terminates at the signalized intersection with OR 138/W. Central Avenue. For this concept the I-5 on-ramp for eastbound traffic (located in southwestern quadrant) is longer than the existing ramp. The extra length is facilitated by the removal of the Park Hill Lane connection. The new on-ramp will provide uninterrupted flow onto I-5, a greater distance to accelerate to freeway speeds on the rolling terrain, and a longer merge distance than the existing configuration.

The loop ramp will be located in the northwestern quadrant of the interchange and serve westbound traffic wanting to access southbound I-5. It has a 25 mph design speed and a longer merge distance than the existing on-ramp. The advantage of this concept is the potential for phased implementation; a standard diamond interchange could be constructed initially and the loop ramp could be added at a later date.

The addition of the loop ramp could change the transition distance from that shown for the standard diamond in **Figure 4**. See **Figure 6** for storage distance associated with the Standard Diamond with loop ramp concept.

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Figure 5. Standard Diamond with Loop Ramp Concept

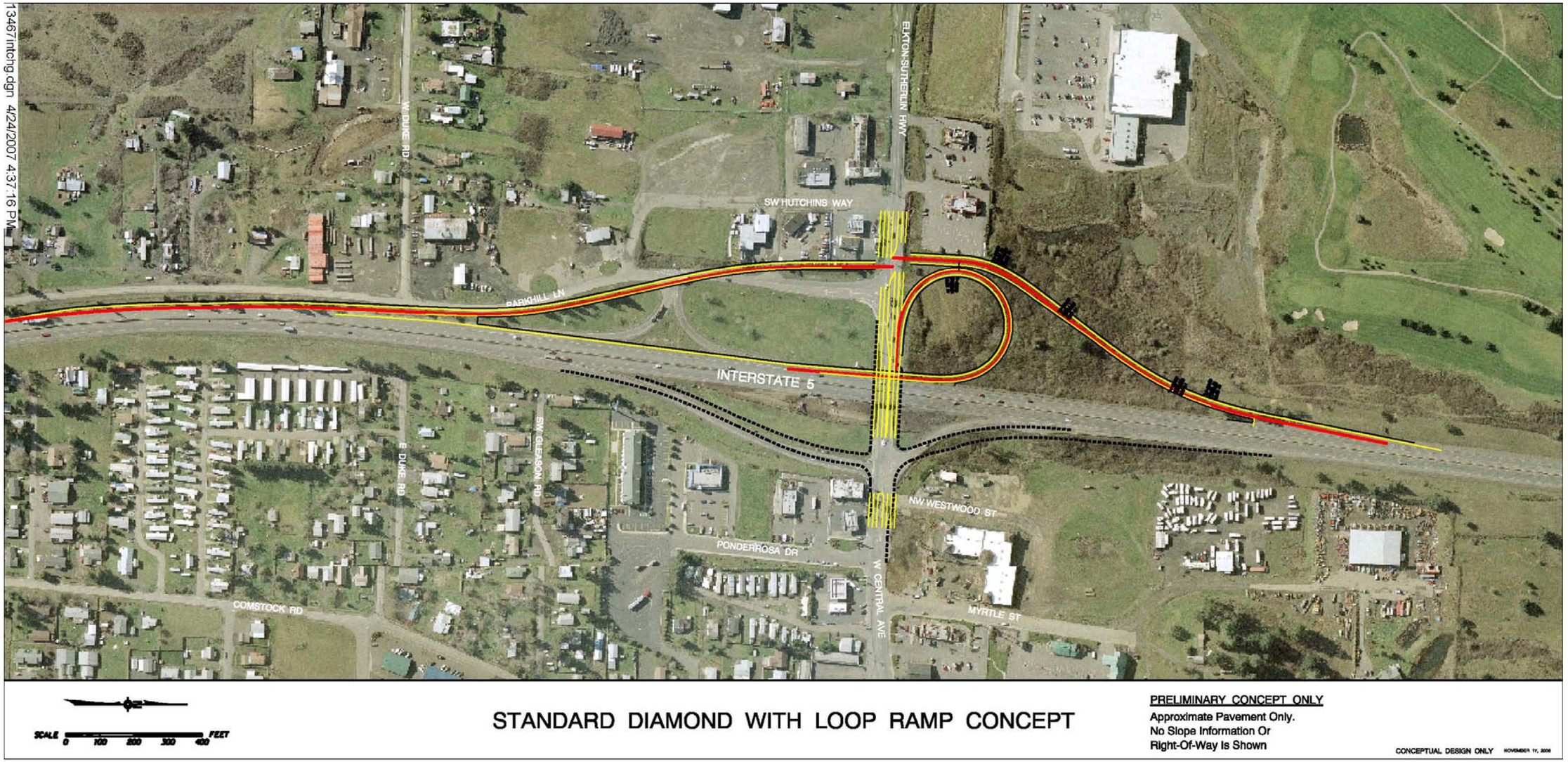
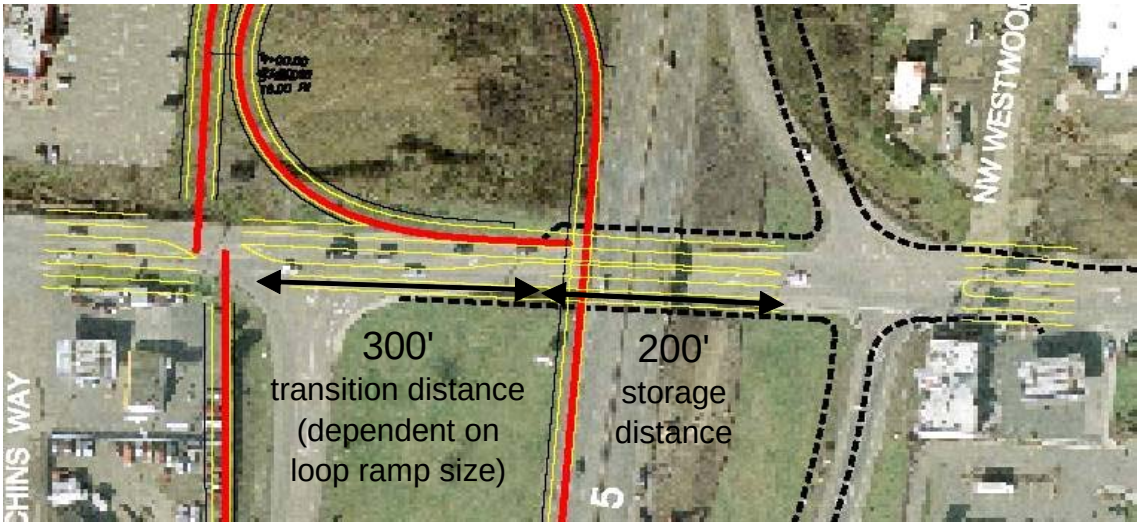


Figure 6: Standard Diamond with loop ramp left-turn bays and transition distances



Summary of Concepts

There are many elements that are common to all the concepts. A comparison of the advantages and disadvantages between the alternatives is provided in **Table 2**.

Table 2. Interchange Concept Advantages and Disadvantages

Concept	Advantages	Disadvantages
Common to all alternatives	• Modern Design • I-5 SB off-ramp meets standards • Eliminates frontage road intersection prior to OR 138/W. Central Avenue • Longer SB I-5 on-ramp acceleration distance • Supplemental right-turn lanes • Longer merge distance • Meets mobility standards	• Requires construction of a new "frontage road" to replace Park Hill Lane • Right-of-way impacts to SW quadrant
Folded Diamond	• Minimal right-of-way impacts to NW quadrant	• Limited potential for expansion to increase capacity • Not compatible with loop ramp to facilitate westbound to southbound I-5 movement
Standard Diamond	• Compatible with Loop ramp to facilitate westbound to southbound I-5 movement	• Right-of-way impacts to NW quadrant
Standard Diamond with loop ramp	• Loop ramp meets standards and provides longer merge distance than existing condition • Phased implementation is possible	• Right-of-way impacts to NW quadrant

Conceptual Cost Estimates

Rough-order-of-magnitude cost estimates were developed for each conceptual alignment, which were intended to differentiate the concepts by approximating the relative costs of each. The cost estimates were based on unit prices and quantity take-offs, existing information and comparable project costs. However, the estimates were meant to be highly generalized and actual project costs may differ.

Costs shown in **Table 3** are in 2007 dollars and include engineering, construction and contingencies (right-of-way, environmental mitigation, business/residential relocation and utilities are excluded). Year 2027 costs are also presented in **Table 3** and assume a 5% per year inflation rate. Detailed cost estimate worksheets are provided in **Appendix A**.

Table 3. Cost Estimate Summary

Interchange Concept	Project Component	2007 Estimated Cost (Millions)	2027 Estimated Cost (Millions)
Folded Diamond	**Total Project Cost**	$3.2	$8.3
Standard Diamond	**Total Project Cost**	$3.3	$8.6
Standard Diamond with optional Loop ramp	**Total Project Cost**	$5.4	$14.2

There is a large monetary difference between the cost of the Standard Diamond Concept and the Standard Diamond with optional Loop ramp Concept. The difference is only partially due to the cost of construction of the loop ramp. In addition to the loop ramp construction other mobility standards will need to be met, including a minimum distance between successive on-ramps. As such, another large construction cost that is included in the estimate for the Standard Diamond with optional Loop ramp is the relocation of the existing on-ramp further south to meet the mobility standards.

Conclusions

The Project Advisory Committee (PAC) and the Transportation Advisory Committee (TAC) have had an opportunity to review the design concepts. At the meeting on March 8, 2007 the committees selected the Preferred Concept as their preference for the ultimate interchange configuration. Because the Preferred Concept is the Standard Diamond plus an additional loop ramp, the committees identified the Standard Diamond concept as an appropriate initial project as part of phased implementation of the Preferred Concept.

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SUMMARY - BID SCHEDULE - CONCEPTUAL COST ESTIMATE

Sutherlin Alt 1. - Standard Diamond

SECTION	REFERENCE NAME/PHONE	COUNTY	SHEET
Based on drawing alt 1	David Evans and Associates,Inc.		
Project Name: Sutherlin IAMP	(503) 223-6663	Douglas	1 of 1
KIND OF WORK	**LENGTH**	**DATE**	**NAME**
Grading, Structure, Paving, Signal, Illumination	3,600'	April, 2007	Russ Montgomery

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL	Section Totals
	Mobilization and Traffic Control					**$ 343,800**
	Mobilization	LS	1	$ 166,900	$ 166,900	
	Temp. Protection and Direction of Traffic	LS	1	$ 166,900	$ 166,900	
	Erosion Control	LS	1	$ 10,000	$ 10,000	
	Roadwork					**$ 474,000**
	Construction Surveying Work	LS	1	$ 50,100	$ 50,100	
	Removal of Structures and Obstructions	LS	1	$ 50,100	$ 50,100	
	Clearing and Grubbing	LS	1	$ 7,800	$ 7,800	
	Embankment in Place	yd3	18,000	$ 12	$ 216,000	
	Excavation	yd3	12,500	$ 12	$ 150,000	
	Retaining Wall	ft2		$ 100	$ -	
	Drainage and Sewers					**$ 147,500**
	Drainage incl. WQ	ft2	118,000	$ 1.25	$ 147,500	
	Bases					**$ 291,900**
	Aggregate Base (16" depth)	ton	15,500	$ 15	$ 232,500	
	Subgrade Stabilization	yd2	3,300	$ 18	$ 59,400	
	Wearing Surface					**$ 254,400**
	Asphalt Concrete (8" depth)	ton	6,100	$ 40	$ 244,000	
	Sidewalk and ramps	yd2	520	$ 20	$ 10,400	
	Permanent Traffic Control and Guidance Devices					**$ 482,950**
	Concrete Barrier	ft		$ 60	$ -	
	Guardrail	ft	1,050	$ 25	$ 26,250	
	Illumination	each	25	$ 9,900	$ 247,500	
	Signal	each	1	$ 200,000	$ 200,000	
	Striping	ft2	2,300	$ 4	$ 9,200	
	Right-of-Way Development and Control					**$ 18,500**
	Fence, Type 1	ft	3,700	$ 5	$ 18,500	
	Subtotal:				**$ 2,013,050**	
	10% - Engineering:				$ 201,300	
	50% - Contingencies:				$ 1,006,500	
	Subtotal: 2007 Value				**$ 3,220,850**	
	cumulative inflation @ approx. 5% per year	years	20		$ 5,325,050	
	Program Cost: (Excluding R/W & Utilities)				**$ 8,545,900**	

SUMMARY - BID SCHEDULE - CONCEPTUAL COST ESTIMATE

Sutherlin Alt 2. - Folded Diamond

SECTION		REFERENCE NAME/PHONE	COUNTY	SHEET
Based on drawing alt 2		David Evans and Associates, Inc.		
Project Name	Sutherlin IAMP	(503) 223-6663	Douglas	1 of 1
KIND OF WORK		**LENGTH**	**DATE**	**NAME**
Grading, Structure, Paving, Signal, Illumination		4,300'	April, 2007	Russ Montgomery

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL	Section Totals
	Mobilization and Traffic Control					**$ 333,800**
	Mobilization	LS	1	$ 161,900	$ 161,900	
	Temp. Protection and Direction of Traffic	LS	1	$ 161,900	$ 161,900	
	Erosion Control	LS	1	$ 10,000	$ 10,000	
	Roadwork					**$ 491,000**
	Construction Surveying Work	LS	1	$ 48,600	$ 48,600	
	Removal of Structures and Obstructions	LS	1	$ 48,600	$ 48,600	
	Clearing and Grubbing	LS	1	$ 9,800	$ 9,800	
	Embankment in Place	yd3	5,000	$ 12	$ 60,000	
	Excavation	yd3	27,000	$ 12	$ 324,000	
	Retaining Wall	ft2		$ 100	$ -	
	Drainage and Sewers					**$ 141,250**
	Drainage incl. WQ	ft2	113,000	$ 1.25	$ 141,250	
	Bases					**$ 282,600**
	Aggregate Base (16" depth)	ton	15,000	$ 15	$ 225,000	
	Subgrade Stabilization	yd2	3,200	$ 18	$ 57,600	
	Wearing Surface					**$ 243,200**
	Asphalt Concrete (8" depth)	ton	5,800	$ 40	$ 232,000	
	Sidewalk and ramps	yd2	560	$ 20	$ 11,200	
	Permanent Traffic Control and Guidance Devices					**$ 444,925**
	Concrete Barrier	ft	425	$ 60	$ 25,500	
	Guardrail	ft	425	$ 25	$ 10,625	
	Illumination	each	20	$ 9,900	$ 198,000	
	Signal	each	1	$ 200,000	$ 200,000	
	Striping	ft2	2,700	$ 4	$ 10,800	
	Right-of-Way Development and Control					**$ 16,000**
	Fence, Type 1	ft	3,200	$ 5	$ 16,000	
	Subtotal:				**$ 1,952,775**	
	10% - Engineering:				$ 195,300	
	50% - Contingencies:				$ 976,400	
	Subtotal: 2007 Value				**$ 3,124,475**	
	cumulative inflation @ approx. 5% per year	years	20		$ 5,165,725	
	Program Cost: (Excluding R/W & Utilities)				**$ 8,290,200**	

SUMMARY - BID SCHEDULE - CONCEPTUAL COST ESTIMATE

Sutherlin Alt 3. - Standard Diamond with Loop Ramp

SECTION		REFERENCE NAME/PHONE	COUNTY	SHEET
Based on drawing alt 3		David Evans and Associates, Inc.		
Project Name	Sutherlin IAMP	(503) 223-6663	Douglas	1 of 1
KIND OF WORK		**LENGTH**	**DATE**	**NAME**
Grading, Structure, Paving, Signal, Illumination		5,650'	April, 2007	Russ Montgomery

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL	Section Totals
	Mobilization and Traffic Control					**$ 565,800**
	Mobilization	LS	1	$ 277,900	$ 277,900	
	Temp. Protection and Direction of Traffic	LS	1	$ 277,900	$ 277,900	
	Erosion Control	LS	1	$ 10,000	$ 10,000	
	Roadwork					**$ 1,260,200**
	Construction Surveying Work	LS	1	$ 83,400	$ 83,400	
	Removal of Structures and Obstructions	LS	1	$ 83,400	$ 83,400	
	Clearing and Grubbing	LS	1	$ 13,400	$ 13,400	
	Embankment in Place	yd3	50,500	$ 12	$ 606,000	
	Excavation	yd3	24,500	$ 12	$ 294,000	
	Retaining Wall	ft2	1,900	$ 60	$ 114,000	
	Type "F" Coping	ft	220	$ 300	$ 66,000	
	Drainage and Sewers					**$ 181,250**
	Drainage incl. WQ	ft2	145,000	$ 1.25	$ 181,250	
	Bases					**$ 366,300**
	Aggregate Base (16" depth)	ton	19,500	$ 15	$ 292,500	
	Subgrade Stabilization	yd2	4,100	$ 18	$ 73,800	
	Wearing Surface					**$ 305,200**
	Asphalt Concrete (8" depth)	ton	7,400	$ 40	$ 296,000	
	Sidewalk and ramps	yd2	460	$ 20	$ 9,200	
	Permanent Traffic Control and Guidance Devices					**$ 643,725**
	Concrete Barrier	ft	220	$ 60	$ 13,200	
	Guardrail	ft	2,325	$ 25	$ 58,125	
	Illumination	each	36	$ 9,900	$ 356,400	
	Signal	each	1	$ 200,000	$ 200,000	
	Striping	ft2	4,000	$ 4	$ 16,000	
	Right-of-Way Development and Control					**$ 22,000**
	Fence, Type 1	ft	4,400	$ 5	$ 22,000	
	Subtotal:				**$ 3,344,475**	
	10% - Engineering:				$ 334,400	
	50% - Contingencies:				$ 1,672,200	
	Subtotal: 2007 Value				**$ 5,351,075**	
	cumulative inflation @ approx. 5% per year	years	20		$ 8,846,925	
	Program Cost: (Excluding R/W & Utilities)				**$ 14,198,000**	

Appendix E: Committees and Public Involvement

Prepared for

Oregon Department of Transportation, Region 3

3500 NW Stewart Parkway

Roseburg, Oregon 97470

Prepared by

David Evans and Associates, Inc.

2100 SW River Parkway

Portland, Oregon

December 2008

Committees

During development of this Interchange Area Management Plan, two committees were utilized: the Project Advisory Committee (PAC) and the Transportation Advisory Committee (TAC).

The PAC, which is composed of key staff members from the Oregon Department of Transportation, the Oregon Department of Land Conservation and Development, the City of Sutherlin, and Douglas County, was established specifically to guide this study. The committee provided guidance on both technical issues and policy issues.

The TAC is a standing committee of the City of Sutherlin that provides advice and guidance on all manner of transportation issues facing the City.

The PAC met on the following dates:

- September 25, 2006
- November 20, 2006
- March 8, 2007
- June 12, 2007

The TAC met on the following dates:

- September 25, 2006
- November 20, 2006
- March 8, 2007
- June 12, 2007
- July 10, 2008

Public Meetings

A public meeting was conducted on November 20, 2006 to introduce the project, present the goals and objectives, and the preliminary analysis of existing and future conditions. The meeting included presentations and an open house format to answer questions of attendees.

A public open house aimed at those with frontage along OR 138 and W. Central Avenue was conducted on June 26, 2007. The open house featured access management proposals intended to meet or move toward the access management standards prescribed in Division 51.

Planning Commission Meetings

The Sutherlin Planning Commission conducted a public meeting and recommended action by the City Council at a meeting on October 21, 2008.

Public Hearings and Council Action

The local adoption process for the IAMP must follow the process prescribed by the City of Sutherlin. Public hearings are required before adoption by the City Council. Council action is scheduled for December 8, 2008.

Appendix F: Questions and Answers - Development Assumptions and Traffic Forecasting

Prepared for

Oregon Department of Transportation, Region 3

3500 NW Stewart Parkway

Roseburg, Oregon 97470

Prepared by

David Evans and Associates, Inc.

2100 SW River Parkway

Portland, Oregon

December 2008

1. What is the source of the baseline traffic forecast data used in the IAMP? Are the IAMP 2030 volumes based on the 2005 TSP forecast?

Because the future traffic volumes forecast in the 2005 TSP represent the highest growth scenario, they were used to select the ultimate interchange configuration, develop the access management plan, and the management measures. The IAMP does not specify when TSP volumes will be met. The IAMP also did not assume any particular growth rate, but rather identified five different growth rates scenarios, which are in Table 11.

2. Did the 2005 TSP overestimate traffic growth?

TSP volumes are based on assumptions that development would occur both inside and outside of the UGB as it existed at the time. The documentation of the growth assumptions for the TSP is incomplete. It appears that some land inside the UGB as it existed at the time did not represent "full build-out." At the same time, it is evident that some of the land outside the UGB was assumed to develop. Some of the land outside the UGB at the time of TSP adoption has been added with the expansion of the UGB, but some land assumed to develop in the TSP remains outside the UGB.

3. The IAMP acknowledges that the TSP forecast is substantially higher than the BLI. The BLI is approximately 73% of the TSP forecast. How were the two documents used in IAMP analysis?

Because the 2005 TSP volumes represent the highest growth scenario, they were used to select the ultimate interchange configuration, develop the access management plan, and the management measures. The IAMP makes no assumptions about when the 2005 TSP volumes may be realized, though they are referred in the IAMP as "TSP 2027 traffic volumes" because the TSP is where they originated. The IAMP performed a sensitivity analysis (shown in Table 11) to show that the need for various improvements is dependent upon the rate of which growth occurs.

Based on the BLI (finished after TSP), we conclude that the TSP's predicted traffic volumes are likely too high. The BLI suggests that the UGB has less land than needed for residential and commercial uses, but an excess of land for industrial uses. For our analysis of the traffic potential represented by the BLI, we assumed full development of residential land and commercial land (excluding land impacted by wetlands). For industrial land, we assumed only the amount of development that was consistent with the industrial employment assumptions in the BLI. The BLI assumes that industrially designated lands are used at very low intensity or that large portions are vacant even twenty years from now. See Table 9 of the IAMP for assumptions.

Assuming residential land within the UGB is built out, commercial land is built out, and industrial land is built out only to the extent to which it serves traditional industrial uses (manufacturing, warehousing, etc., but NOT “big box” retail building supply stores and restaurants), we estimate that the TSP volumes may be about 27% high.

4. Since the 2005 TSP volumes are likely 27% higher than the BLI and they were used to select the ultimate interchange configuration does that mean that no interchange improvements are needed within 20 years?

No, even if the TSP volumes are "too high" that does not mean there is no need for improvements. Table 11 shows the "BLI" growth scenario reaches the ODOT "mobility standard" at the Northbound ramp terminal in 2017 with a three-lane crossroad and in 2030 with a five-lane crossroad. This is based on traffic volumes from development consistent with the BLI and a uniform annual growth rate for twenty years. It should be clear from this table that significant improvements will be required to serve the planned growth within the Sutherlin UGB. Events that could make the need greater or require improvements sooner include: expansion of the UGB, higher densities of residential development, wetland mitigation projects that allow development to occur on parcels that were assumed in the BLI to be "off limits" due to wetlands, allowing non-traditional industrial development (such as large retail building supply stores) to occur on the industrially zoned land, rezoning to more intense uses, or success in getting more industrial development to occur in Sutherlin than predicted in the BLI . Things that could delay the need for improvements at the interchange include: a slower growth in all sectors, a moratorium on development for non-transportation reasons (e.g. a water supply shortage), a complete lack of industrial employment.

5. Is the IAMP traffic forecast over inflated since it used for the ultimate interchange configuration? Are the needed improvements identified "over inflated?"

The IAMP does not present a specific forecast - it presents five growth scenarios. The TSP traffic volume forecast is simply the highest of those we examined. The deficiency analysis and mitigation are not "over inflated" - the deficiencies and mitigation are tied to specific traffic volumes, not to specific years.

6. Does the IAMP assume 7.4% annual growth rate at the SB terminal and 6.4% at NB terminal as shown in Table 11?

The IAMP did not "assume" particular growth rates at the ramp terminal - rather it calculated the traffic volumes at the ramp terminals based on the land use assumptions and traffic that would result based on various factors including densities, trip generation rates, and traffic patterns. Table 11 shows that the ramp terminals have traffic increases at different rates due to different traffic patterns.