Final Report for

North Redmond US 97 Interchange Area Management Plan

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CHAPTER 1: EXECUTIVE SUMMARY

The report presents the Interchange Area Management Plan for the proposed new North Redmond interchange with US 97 located at milepost 119. The Interchange Area Management Plan (IAMP) presents recommendations to sustain this new interchange as land in Redmond and the surrounding area continues to develop, by implementing effective local street connectivity and access management strategies.

Plan Goals and Objectives

Project Goal

The goal of this project was to develop a North Redmond US 97 IAMP for the interchange area that describes existing traffic and land use patterns in the interchange area, identifies potential safety and traffic congestion issues, and proposed policies and implementing measures that would insure safe and efficient operation of the interchange over the 20-year planning horizon, and potentially beyond.

The IAMP was developed in partnership with affected property owners in the interchange area, the City of Redmond, Deschutes County, and the Oregon Department of Transportation (ODOT), and other stakeholders, including interchange users. The public-at-large and any interested local business operations within the study area were notified of public meetings related to this project, and they were provided opportunities to participate outside of the formal project committee process.

Study Objectives

Objectives were identified to achieve the project goal:

1. The preparation of the IAMP shall involve affect property owners in the interchange area, the City of Redmond, Deschutes County, The Oregon Department of Transportation (ODOT), and other stakeholders, including interchange users.
2. The IAMP shall evaluate local transportation, environmental, and land use conditions.
3. The IAMP shall identify needed transportation improvements within the Interchange Study Area and propose alternatives that conform to current design standards and accommodate the long-term capacity needs of the local transportation system.
4. The IAMP shall be developed in accordance with the provisions and the policies of the Oregon Highway Plan and other relevant state transportation laws.
5. The IAMP shall include policies and implementing measures that preserve the functionality of the interchange areas.

Relevant Plans and Standards

A comprehensive review was made of relevant federal, state, regional and city plans and standard that are applicable to the plan for North Redmond interchange. The primary transportation standards that were applied in developing and evaluating strategies for the interchange area were drawn from the Oregon Highway Plan standards related to mobility and the Oregon Administrative Rules related to Access Management. The first standard measures the long-term

forecasted traffic volumes compared to the design facility capacity, as summarized in Table 1.A. For US 97, which is a statewide freight route, the mobility standard, as measured by the ratio of forecasted volume-to-capacity, varies from 0.70 to 0.75 depending on the facility posted speeds.

Table 1.A Maximum Volume-to-Capacity Ratios from the 1999 Oregon Highway Plan

Highway Category	**Inside Urban Growth Boundary**	
	Non-MPO outside of STAs where non-freeway speed limit <45 mph	Non-MPO where non-freeway speed limit > 45 mph
Statewide (NHS) Freight Routes	0.75	0.70
District/Local Interest Roads	0.85	0.80

Policies 3A and 3C of the 1999 Oregon Highway Plan establish access management objectives for state highways and interchange areas based on facility type and set standards for spacing of approaches. These standards have also been adopted as part of OAR 734-051, which provides the regulatory basis for implementation. Table 1.B below shows the applicable access management spacing standards for state facilities in the study area.

Table 1.B: Access Spacing Standards for Statewide Highways (measured in feet)

Posted Speed (mph)	**Rural**		**Urban**	
	Expressway (at-grade only)	**Other**	**Expressway** (at-grade only)	**Other**
> 55	5280	1320	2640	1320
50	5280	1100	2640	1100
40 & 45	5280	990	2640	990
30 & 35		770		7701
< 25		550		5503

With some design elements of the proposed project still unknown, it was assumed the North Redmond interchange would resemble a non-freeway interchange with a two-lane crossroad. The proposed locations of any new street connections within interchange areas were evaluated in accordance with the applicable Highway Design Manual standards.

Other plans and documents reviewed included:

- Oregon Transportation Plan
- Oregon Rail Plan
- Statewide Transportation Improvement Program
- Transportation Planning Rule
- Traffic Control (OAR 734-020)
- Railroad Regulations
- City of Redmond Comprehensive Plan

[1] Access spacing standards in urban areas for facilities with posted speeds of 35 mph or less may be reduced pending OTC approval of proposed *Oregon Highway Plan* amendments. Proposed spacing standards would be 720 feet (30 & 35 mph) and 520 feet (≤25 mph).

- City of Redmond Transportation System Plan
- Redmond Urban Reserves Studies
- Deschutes County Comprehensive Plan
- Deschutes County Transportation System Plan
- For a complete presentation of the background plans and studies, refer to Appendix 1.

Existing Land Use and Transportation Issues

Geographic Boundaries

The geographic boundaries for the IAMP, as illustrated in Figure 1.1, include O'Neil Highway (OR 370) / NW Pershall Road to the north, NE 17th Street/NE Negus Way to the east, NW Kingwood Avenue to the south, and NW 22nd Street to the west. Assuming the proposed interchange connecting US 97 to the US 97 Reroute is located between NW Spruce Avenue and NW Quince Avenue, these boundaries would include an area approximately ¾-mile beyond the physical limits of the interchange. While this distance would be adequate for the management of access to the crossroad (i.e. US 97 south of the interchange and Canal Boulevard north of the interchange), there is need to control the creation of new intersections on the mainline (i.e. US 97 north of the interchange and the US 97 Reroute to the south) outside of the study area for a radius of 2 miles.[2]

The travel forecasts that were developed as part of this study encompass a larger scope than the explicit boundaries noted above for detailed operational analysis and access management review. The entire City of Redmond, including the current urban limits, and the pending Urban Growth Boundary additions are contained within the travel demand model developed for local transportation studies. The expected long-term development associated with this larger Redmond urban area were be the basis for developing future year travel forecasts that were used within the focused study area noted above for the assessing the performance of the proposed interchange facilities.

Study Area Land Uses

Within the study area, there are lands both inside and outside of the City of Redmond urban growth boundary. Lands outside of the urban growth boundary (northern and eastern areas of study limits) maintain rural zoning and development patterns, consisting of a variety of agricultural uses. Within the urban growth boundary, most lands are zoned for either commercial, residential, light industrial, or park/open space uses. The commercial lands tend to surround the US 97 corridor in the middle of the study area with residential lands between this commercial corridor and the eastern and western urban growth boundaries. To the southeast of the study area, there is a significant amount of industrial land, but only about 22 acres of light industrial land lie within the study limits. All of the park/open space lands are located to the west of US 97, with most of it

Land Use Summary

Land Use	Percent of IAMP Area
Agricultural	43%
Commercial	16%
Industrial	1%
Parks/Public Facilities	7%
Residential	33%

[2] OAR 734-051-0125 , *Access Management Spacing Standards for Approaches in an Interchange Area*

assigned to Dry Canyon. Most of the land within the IAMP study area is zoned for agricultural uses, with the second largest group allowing residential development, as summarized in Table 1.C. There appears to be a significant amount of commercial property surrounding the proposed interchange area (between NW Spruce Avenue and NW Quince Avenue) that is currently vacant.

Existing Access Conditions

The existing public and private access approaches to US 97 within the study area were mapped and compared to applicable standards. A total of 80 approaches to the state highway were identified, including both sides, compared to 14 that would be allowed based on standards. Refer to Table 3.C and Figure 3.5 for more details. Substantial modifications to the current access and local circulation system would be required to comply with standards.

A similar analysis was done for the local city street facilities to compare the driveway spacing and intersection spacing with city standards. It was found that the majority of these cases do meet the city spacing standards. Notable exceptions include Maple Avenue and Negus Way, both minor arterials with a preferred spacing of ¼-mile, which have several intersecting city streets less than 500 feet apart.

Crash Analysis

State, county and city streets within the study area were evaluated to identify locations where reported vehicle crashes are excessive compared to statewide averages. The most significant finding was that the rural segment near O'Neil Highway Junction with US 97 has exceeded statewide average crash rates for the past three years of reported data (2001 to 2003). The last year crash rate was two times the statewide average. A closer review of the crash data suggested that it is concentrated at the intersection of US 97 and O'Neil Highway, and is not representative of the half-mile segment around that location. Solutions for reducing the reported crashes should concentrate on the intersection design and traffic control elements.

Existing Roadway Performance

Traffic data for 2005 were evaluated to determine how well the existing road intersections and segments perform compared to state and local standards. Three locations on US 97 were identified that fell below standards:

- US 97 / O'Neil Highway
- US 97 / Maple Avenue
- US 97 / Kingwood Avenue

All three are unsignalized intersections where the side street approaches must wait for gaps in highway traffic. In each case, the 2005 volume-to-capacity ratio was over 1.0, which is significantly above the 0.70 to 0.75 standard for this area. Two of these locations are planned to have traffic signal controls installed, based on current capital improvement plans. However, there are no identified improvements at US 97 / O'Neil Highway.

All of the city and county intersections within the study area operated within the acceptable performance ranges. Refer to Table 3.K for more details.

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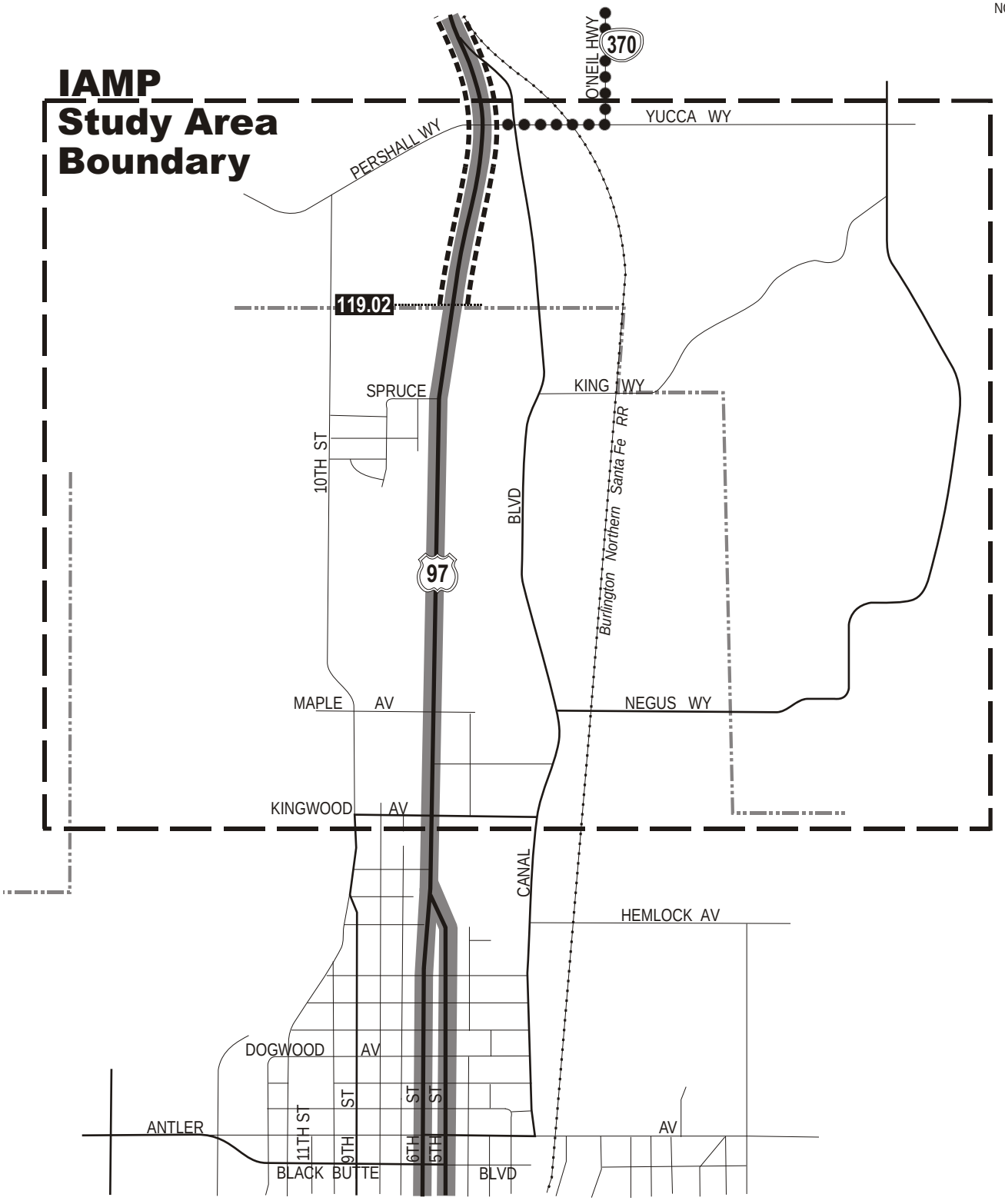
NO SCALE



LEGEND

- ●●●● - District
- ▬▬ - Statewide NHS with Freight Route
- ▬ ▬ ▬ - Expressway
- ·-·-· - Urban Growth Boundary (UGB)
- ····· 000.00 - Milepost Indicator

Figure 1.1
STATE HIGHWAY FUNCTIONAL CLASSIFICATIONS AND SEGMENT DESIGNATIONS

Future Forecasts and Needs Analysis

Land use growth in the City of Redmond and nearby communities is expected to more than double the existing number of household and employees over the next 20 years. The growth projection, show more than 11,000 new dwelling units and 10,000 new jobs within the greater Redmond area, as shown in Table 1.C below.

Table 1.C: Assumed Household and Employment Quantities

	Households	Retail Employees	Other Employees
Base Year 2000	7,418	2,330	5,492
Future Year 2025	18,356	4,969	13,040
Growth	147%	113%	137%

ODOT's Transportation Planning Analysis Unit prepared travel forecasts based on these growth assumptions, and this information was used to develop future traffic volumes for this study. Table 1.D shows how trips will grow over the next 20 years. Trips that start or end (or both) within Redmond are growing about two times faster than through trips within the community. The annual growth rate for all trips is 4.5 percent.

Table 1.D: Redmond Area Model Trip Types, PM Peak Hour

	Redmond Based Trips	Through Trips	Total Trips
Base Year 2000	8,409	1,005	9,414
Future Year 2025	18,390	1,670	20,060
Avg. Annual Growth Rate	4.8%	2.6%	4.5%

The 2025 travel volumes were applied to the city street system, which included the planned US 97 Re-Route and several additional local improvements:

- US 97 Reroute
- US 97 Interchange at Milepost 119 (near existing Quince Ave.)
- Maple Avenue extension across Dry Creek Canyon
- Quince Avenue extension
- Highland / Glacier couplet (OR 126)
- 9th Street extension

Refer to Figure 4.7 for more details on the assumed street and highway improvements by 2025.

Future 2025 Performance and Deficiencies

The North Redmond / US 97 interchange area, as proposed, would operate within standards. No deficiencies were identified. A worst-case scenario was evaluated to test the ability of the interchange design concept to serve higher travel demands. The planned commercial uses were assumed to be 30 percent higher than is typical for current zoning, and the performance analysis showed that the planned interchange could also serve that higher intensity level.

Several other highway locations and city locations outside of the immediate interchange area are expected to drop below minimum standards. These include:

- The intersection on US 97 at O'Neil Highway;
- The intersection on Maple Avenue at 9th Street; and
- The intersection on US 97 at Kingwood Avenue.

The latter two locations can be addressed through alternative traffic controls solutions; however, the US 97 at O'Neil Highway most likely would require a more significant improvement, given its rural location and high travel speeds on the highway.

Access / Intersection Spacing

In conjunction with the construction of the US 97 Reroute and the new interchange, a strategic access management plan needs to be implemented to help address the non-compliant accesses onto US 97 and affected city and county streets within the management area. An access zone system was developed to match the highway characteristics and standards required by ODOT with the access needs of the adjoining land uses. This system prescribes the spacing methods and procedures for reaching compliance within the interchange area.

Table 1.E: Access Deficiencies by Zone*

Access Management Zone	Existing Number of Access Points	Allowed Number of Access Points
1	7	0
2A	10	0
2B	10	1
3	41	10
4	15	30
5	22	0
6	N/A	0

* Includes existing access points only. Refer to Figure 4.11 for illustration of zone locations.

In summary, the access management zone system works in combination with the recommended local connectivity plan to reduce non-compliant access near the interchange, and provide appropriate new access where allowed by standards. The six-zone system described in Chapter 4, would enact access changes as summarized in Table 1.E.

Signal Spacing

As land around the interchange develops, provision of access and installation of traffic signal controls will be closely coordinated to ensure effective traffic mobility and to enhance traffic safety. The recommended IAMP plan must include a traffic signal control map that identifies the expected locations and spacing between traffic signals.

Local Connectivity

When planning for future streets to enhance local connectivity in the IAMP area, consideration should be given to the following deficiencies.

- Improving East-West Connectivity
- Providing Access to Lands Surrounding the US 97 Interchange

- Reducing Access Points to US 97 to the North of the Interchange.

Refer to Chapter 4, for more details about the constraints, issues and challenges in addressing each of these areas. Other issues identified that would be addressed through the IAMP included proper roadway design guidelines for truck traffic, enhancement of non-motorized vehicle connections, and notations about existing right-of-way constraints.

The Interchange Area Management Plan

The US 97 Redmond Reroute IAMP addresses the needs and issues identified in Chapter 4. The full plan is presented in Chapter 5 of this report. The elements of the IAMP are dividing into the following sections:

- **Transportation Facility Improvements** – these evaluations consider the proper improvements to the three locations identified as falling below the desired mobility standard by the horizon year (2025).
- **Local Connectivity Plan** – this plan (illustrated in Figure 5.4) is a conceptual plan that would be implemented by ODOT through the adoption of this IAMP, and the City of Redmond by incorporation into its TSP, to provide alternative circulation patterns and local access routes for lands within the influence area of the interchange.
- **Access Management Plan** – the six-zone access management strategy formed in Chapter 4 was defined for implementation. The plan provides priorities about when access changes are made, and which agency (or party) would be responsible for the improvements.
- **Land Use Alternatives** – The proposed interchange design was evaluated with average land development densities and a worst-case development scenario based on adopted land use plans and zoning to determine if 'travel demand management' techniques might be required for this case.
- **Implementing Code Amendments** – As land develops to urban levels within the IAMP, a system of circulation elements and access measures need to be implemented to realize the vision of this plan. The necessary amendments to the city development code are attached in Appendix 7.
- **Cost Estimates** – The preliminary cost estimates for improvement recommended by the IAMP are presented.

Transportation Facility Improvements

The four locations within the study area not expected to provide acceptable peak period performance with the proposed build project were identified in Chapter 4. An improvement has been identified for each of the four locations made for the preferred solution based on the goals and objectives of this study. The recommendations are summarized below:

- **US 97 at O'Neil Highway** – A range of options considered for this location included turn restrictions, re-aligning side street approaches, and constructing a grade-separated overpass. The IAMP proposes restricting turning movements to right-in and right-out as an interim improvement after local connectivity has been enhanced to provide parallel

routes to US 97 (see the Local Connectivity Plan), with the long-range improvement being the construction of an overpass with no connection to US 97.

- **Relocation of King Way** – Because of the close proximity of the connection of King Way to North Canal Boulevard to the northbound off-ramp to the US 97 Reroute, and concern with the existing at-grade railroad crossing on King Way, in the long-term the IAMP recommends, as part of the Local Street Connectivity Plan, that King Way be relocated to the north on a new alignment, that will include a grade separated overcrossing of the railroad, approximately ¼ mile north of the interchange.
- **US 97 at Kingwood Avenue** – In the long-term, when warranted, the IAMP proposes that the City install traffic signal controls at this intersection, with improvements to the approaches on all legs to separate left-turning traffic movements.
- **Maple Avenue at 9th Street** – In the long-term, when warranted, the IAMP proposes that the City install traffic signal controls at this intersection, with improvements to the approaches on all legs to separate left-turning traffic movements.

Traffic Signal Plan

The US 97 Redmond Reroute IAMP created a future traffic signal plan to guide the orderly installation of traffic signals within the IAMP area, especially along US 97 (6th Street) and North Canal Boulevard north of the proposed interchange, where poor progression of traffic due to inadequate signal spacing could impact long-term safety and operations at the proposed interchange ramp terminals. The Traffic Signal Plan is to be adopted by the City of Redmond and incorporated into their TSP (Appendix 8).

Figure 5.3 displays a map of future traffic signal locations within the IAMP area to be used in evaluating potential conflicts with future proposals for traffic signals on the study area streets. Near the interchange, this includes:

- North Canal Boulevard / New Collector Street (re-aligned King Way)
- US 97 Interchange Ramp Terminals
- US 97 Business Route at extension of Quince Avenue
- US 97 Business Route at new extension of Oak Avenue
- US 97 Business Route at Maple Avenue/Negus Way
- US 97 Business Route at Kingwood Avenue

Signal spacing generally is 1,300 feet apart with some exceptions of lesser distances near the interchange, including the ramp terminals themselves. Figure 5.3 identifies the locations of all currently planned traffic signals (there are currently no existing traffic signals) in the IAMP area, along with a future signal on US 97 (6th Street) between Maple Avenue and Quince Avenue (at Oak Avenue) that is anticipated to be constructed soon by an adjacent development and the recommended signal at the intersection of Maple Avenue and 9th Street.

Local Connectivity Plan

Chapter 4 of the IAMP highlighted three areas where local connectivity was in need of improvement, including:

- Improving east-west connectivity;
- Providing access to lands surrounding the US 97 interchange; and
- Reducing access points to US 97 to the north of the interchange.

In response to these needs, the IAMP developed a local connectivity plan that builds on existing and planned streets in the IAMP area. This plan not only improves overall connectivity throughout the northern end of the City, but provides the ability to eliminate direct approaches to US 97 and Canal Boulevard, while maintaining accessibility to individual properties in the corridor. Figure 5.4 displays the local connectivity plan. The Local Street Connectivity Plan is to be adopted by the City of Redmond and incorporated into their TSP (Appendix 8).

Access Management Plan

A key element of the IAMP related to the long-range preservation of operational efficiency and safety of the proposed interchange is the management of access to the interchange crossroads (US 97/6th Street and Canal Boulevard), as well as to the mainline (US 97 and the Reroute). Because access points introduce a number of potential vehicular conflicts on a roadway and are frequently the causes of slowing or stopping vehicles, they can significantly degrade the flow of traffic and reduce the efficiency of the transportation system. However, reducing the overall number of access points and providing greater separation between them can minimize the impacts of these conflicts.

Implementation of the access management plan in the IAMP is to occur over a long period of time. A number of the properties within the IAMP area were developed based on prior approvals of access locations to the subject roadways and some elements of the Access Management Plan depend on the presence of new public streets that can not be constructed until funds are made available. Therefore, the Access Management Plan has prioritized and categorized all access management recommendations into short-range, medium-range, and long-range actions, where the short-range actions are to be executed during the construction of the interchange; and the medium and long-range actions are to be executed as needed funds become available or as opportunities arise during property development or redevelopment.

To provide a basis for decision-making during the development of the Access Management Plan, an access management strategy was established. The strategy requires ODOT and/or the City to:

1. Restrict all access from abutting properties to the interchange and interchange ramps (ODOT).
2. Meet, or move in the direction of meeting, ODOT's adopted access management spacing standards for access to interchange crossroads (City).
3. Meet, or move in the direction of meeting, the City of Redmond's adopted access management guidelines on US 97 (6th Street) from a point 1,320 feet from the southbound interchange ramp terminal to Kingwood Avenue (southern boundary of IAMP area). This would require access spacing of at least 800 feet between adjacent

driveways and/or streets on the same side of the roadway and ½-mile between adjacent intersections (City).

4. In line with the recommendation evaluate and possibly consider jurisdictional transfer of Canal Boulevard from O'Neil Highway to the new North Redmond interchange from Deschutes County and City of Redmond to the Oregon Department of Transportation, meet, or move in the direction of meeting ODOT's adopted access management spacing standards for access to District Highways (City).
5. Meet ODOT's adopted access management spacing standards for an Expressway for interchange mainlines in the long-term (ODOT).
6. Purchase all abutting property access rights to US 97 (6th Street) and Canal Boulevard within 1,320 feet of the proposed interchange ramp terminals. Where accesses are allowed to remain within this area under the short-range action plan, access rights should be acquired with a temporary allowance to retain access until such time as reasonable alternate access becomes available (ODOT).
7. In attempting to meet access management spacing standards, exceptions may be allowed to take advantage of existing property boundaries and existing or planned public streets, and to accommodate environmental constraints (City).
8. Replace private approaches with public streets, where feasible, to provide consolidated access to multiple properties (City).
9. Ensure all properties impacted by the project are provided reasonable access to the transportation system (ODOT and City).
10. Align approaches on opposite sides of roadways where feasible to reduce turning conflicts (City).
11. Short-range actions shall accommodate existing development needs, unless property is to be purchased by ODOT (ODOT and City).

Using this strategy, an action plan for each approach to the interchange mainline and crossroad was developed, as shown in Table 5.A.

- The short-range actions should be implemented during the construction of the interchange.
- The medium-range actions are to be completed within 5 to 10 years, and
- The long-range actions are to be implemented over the 20-year planning period as funding becomes available or as opportunities arise through property development.

The long-range action plan has also been illustrated in Figure 5.5 to aid in the interpretation of the actions in Table 5.A.

Land Use Alternatives

Aside from the improvements noted in the previous section, the proposed interchange improvements and surrounding transportation system was demonstrated to operate within acceptable levels by 2025 based on adopted land use plans and zoning.

A further sensitivity test was made for the commercially zone areas to evaluate if the planned system could serve more intense uses than are typically built on this type of zoning. An

alternative 'worst-case' land use evaluation was made where development around the interchange would generate about 30 percent more traffic than is typical for suburban development. It was found that even with these higher traffic generation levels that the system would continue to operate within acceptable ranges (see Table 5.C for details). Therefore, no further mitigations or limiting land use ordinances related to development levels should be required for this case.

However, the City of Redmond recently extended their Urban Growth Boundary (UGB) to include all properties north of its existing city boundary, west of US 97, to Pershall Way. Redmond also adopted an Urban Reserve Area (URA) that includes all land east of US 97 to O'Neil Way. In expanding its UGB, rather than annex and rezone the area being brought into the UGB for urban use, and having to do the TPR analysis for adequacy of the transportation system, Redmond opted to not annex the area and with the concurrence of Deschutes County had the UGB rezoned to a new Urban Holding Zone – 10 Acre Minimum (UH-10). This action first put a temporary hold on future development within the UGB until it was annexed and rezoned, and it also deferred the TPR analysis to a subsequent date. Redmond also adopted amendments to its development regulations requiring master plans be prepared for properties requesting annexation and rezoning to the City.

Consequently, by the City expanding its UGB without designating the urban zoning for the area and doing the required TPR analysis, a significant amount of land was added to the UGB that could, in the future, be annexed to the city and developed with urban intensity uses. And without a land use plan for the area, it is impossible to determine the magnitude of this action on the proposed US 97 Redmond Reroute Interchange.

To address this unknown within the context of the IAMP, the City of Redmond is required to amend its development regulations to require master plans prepared for properties adjacent to US 97 show as an element of their plan no direct access to US97 (Appendix 7). In addition, for an area defined as the "Highway Area Plan", or HAP (Appendix 8), adjacent to US97, the City is to prepare an area plan (A.K.A. master plan) that will establish a land use plan along US 97 that based on traffic analysis of the plan will not result in the planned land use exceeding the capacity of the interchange during the plan period.

Implementing Ordinances and Memorandum of Understanding

As land develops to urban densities within the interchange area, compliance will be required with the access management and circulation plans developed through the IAMP process. As part of the adoption of the IAMP, a number of amendments will be made to the City of Redmond Comprehensive Plan, Transportation System Plan (TSP) and development codes to reflect the amendments contained in Appendix 7 and actions outlined in the Memorandum of Understanding (MOU) in Appendix 8. In brief, they are as follows:

Comprehensive Plan Chapter 14 (Urbanization) –

- Master plans to be consistent with the Local Street Connectivity Plan (Figure 5.4),
- Property annexed to relinquish all direct access rights to the highway, and
- Incorporate access management strategy for US 97 (6th Street) and North Canal Boulevard.

Transportation System Plan –

- Identify phased improvement at US 97 and O'Neil Highway to include right-in/right-out and a grade separated overcrossing,
- Identify need for signals at US 97 (6th Street) and Kingwood Avenue, and NW Maple and 9th Street,
- Access spacing requirements for US 97 (6th Street) and North Canal Boulevard,
- Local Street connectivity (Figure 5.6) and access closures (Table 5.A and Figures 5.5a-5.5c), and
- Signal Plan for US 97 Business (6th Street) and North Canal Boulevard (Figure 5.3).

Development Codes –

- Master plans shall show direct access to local street, not the State highway, be consistent with the Local Street Connectivity Plan, and relinquish all direct access to the highway, and
- Adopt access management spacing standards for US 97 (6th Street) and North Canal Boulevard consistent with the Oregon Highway Plan for highways classified as "Statewide" and "District" within an urban area.

Memorandum of Understanding –

In moving the US 97 Reroute into the construction phase, it was determined that the original agreement between ODOT and the City needed to be revised to incorporate changes to the project, and consummate in an MOU their agreement on long-term transportation and land use issues as they relate to the US 97 Reroute. This agreement, No. 23704, has been incorporated into the IAMP by reference and is included as Appendix 8. In general the MOU between ODOT and the City of Redmond:

- Identifies the US 97 Reroute, Phase 1, as the first phase of a long-term solution for US 97 through Redmond;
- Sets forth that US 97 through Redmond will be managed as an Expressway facility from the O'Neil Junction through the Reroute Phase 1, and future phases consistent with the recommendations of the US 97 Redmond Refinement Plan;
- Requires the City to adopt the Access Management Plan for the US 97 Reroute and all the recommendations contained in the IAMP including amendments to Redmond's comprehensive Plan, TSP, and development codes as enumerated above.

Cost Estimate

Planning-level cost estimates for all recommended improvement alternatives were calculated to aid in the identification of needed funding. Cost estimates included the fundamental elements of roadway construction projects, such as the roadway structure, bridge structures, curb and sidewalk, earthwork, retaining walls, right of way, pavement removal, and traffic signals. The estimated costs are shown below in Table 1.F, with work sheets showing assumed unit costs for construction elements provided in the Appendix 5.

For the purposes of providing these estimates, it was assumed that 40% of the road-miles within the County and City would be classified as collectors, with the remaining 60% classified as local streets. All costs are in 2006 dollars and do not reflect the added cost of inflation. Note that the recommended installation of a traffic signal at the US 97/Kingwood Avenue intersection has not been included as it is already listed in the City's CIP to be constructed when warranted, with an estimated cost of $375,650. When considering needed funding to construct the identified improvements below, it should be recognized that landowners typically construct local streets as development occurs.

Table 1.F: Planning-Level Cost Estimates for Recommended Improvement Alternatives

Alternative		Estimated Cost
US 97/O'Neil Highway		
	Restrict turn movements to r-in/r-out	$225,000
	Offset intersection approaches	$1.4 million
	Construct overpass	$3.2 million
Maple Ave/9th St signalization*		$220,000
Expanded Public Street Network		
	City collectors	$9.9 million
	City local streets	$13.4 million
	County collectors**	$13.4 million
	County local streets***	$21.2 million

* Assumes intersection geometry will be improved through projects already planned in the City CIP.
** Includes $5.9 million in "High-Priority" Streets.
*** Includes $3.8 million in "High-Priority" Streets.

Prioritization of Improvements

The improvement alternatives recommended as part of the IAMP have been prioritized into short, medium, and long-range actions, as shown in Table 1.G, to provide guidance for future implementation and funding. Short-range actions represent immediate needs and should be implemented at the time of interchange construction. Medium-range actions represent improvements that are not required immediately, but should be given priority over improvements identified as long-range actions. Assuming all improvements are planned for construction within a 20-year period, medium-range actions should be considered for implementation within 5 to 10 years. Long-range actions typically represent improvements of lower priority or requiring higher levels of funding. These improvements should be planned for construction within 10 to 20 years. The improvements listed in Table 1.G have also been illustrated in a Transportation Improvements Map (Figure 5.6) for the IAMP area.

It should be recognized that this prioritization of projects is not intended to imply that projects of higher priority must be implemented before projects of lower priority. Should opportunities arise, through private land development or other means, to construct specific projects earlier than the estimated time frame provided by this list, those resources should be utilized.

Table 1.G: Transportation Improvement Prioritization

Short-Range Improvements (At the time of interchange construction)
· Short-range actions from access management plan.
Medium-Range Improvements (5 to 10 years)
· Construct "High-Priority" public streets according to adopted Local Connectivity Plan.
· US 97/O'Neil Highway intersection improvements (right-in/right-out restrictions).
· US 97 (6th St.)/Kingwood Ave.: Construct separate left turn lanes on Kingwood Ave. and install traffic signal.
· Maple Ave./9th St.: Construct separate left turn lanes on Maple Ave. and install traffic signal.
· Medium-range actions from access management plan.
Long-Range Improvements (10 to 20 years)
· Construct remainder of new public streets according to adopted Local Connectivity Plan.
· Long-range actions from access management plan.
· US 97 (6th St.)/Quince Ave.: Construct separate left turn lanes on Quince Ave. and install traffic signal.
· US 97/O'Neil Highway intersection improvements (grade-separated crossing over US 97).
· King Way Realignment (grade-separated crossing over BNSF).

Note: Medium and long-range improvements could be constructed sooner than anticipated as opportunities arise through private property development or other means.

CHAPTER 2: PLAN GOALS, OBJECTIVES, AND EVALUATION CRITERIA

This chapter describes the presents the goals and objectives for the plan, as well as evaluation criteria to measure the effectiveness of proposed strategies. A policy framework was identified based on reviews and summary of the applicable state and local plans, policies, regulations, and design standards (see Appendix 1 for details). This policy framework was used to develop the project goals, objectives and evaluation criteria that are presented in the following sections.

Recommended Goals & Objectives

Project Goal

The goal of this project is to develop a North Redmond US 97 IAMP for the interchange area that describes existing traffic and land use patterns in the interchange area, identifies potential safety and traffic congestion issues, and proposed policies and implementing measures that will insure safe and efficient operation of the interchange over the a 20-year planning horizon, and potentially beyond. The IAMP was developed in partnership with affected property owners in the interchange area, the City of Redmond, Deschutes County, and the Oregon Department of Transportation (ODOT), and other stakeholders, including interchange users. The public-at-large and any interested local business operations within the study area will be notified of public meeting related to this project, and be provided opportunities to participate outside of the formal project committee process.

Objectives and Evaluation Criteria

The Project Goal will be met if the following objectives are achieved. A bulleted list of evaluation criteria follows each objective.

1. The preparation of the IAMP shall involve affect property owners in the interchange area, the City of Redmond, Deschutes County, The Oregon Department of Transportation (ODOT), and other stakeholders, including interchange users.
    - The IAMP incorporates input and guidance from the Project Management Team (PMT).
    - The IAMP reflects, to the extent possible, the input of local property owners, interchange users, and other stakeholders, as gathered through public comments.

2. The IAMP shall evaluate local transportation, environmental, and land use conditions.
    - The IAMP identifies and addresses existing and foreseeable issues related to land use, mobility, accessibility, and safety within the analysis area of the planned interchange.
    - The IAMP describes the roadway network, right-of-way, access control and land parcels in the Interchange Study Area. It also evaluates local street access, circulation, connectivity, and the potential effect of local land use designations on the interchange.
    - The IAMP includes inventory maps summarizing the existing conditions within the Interchange Study Area.
    - The IAMP identifies and either complies with or amends the policy direction from the City and County comprehensive plans, zoning codes, Transportation System Plans, and any relevant corridor plans.

3. The IAMP shall identify needed transportation improvements within the Interchange Study Area and propose alternatives that conform to current design standards and accommodate the long-term capacity needs of the local transportation system.
    - The IAMP identifies and prioritizes the transportation improvements, land use, and access management plans needed to maintain acceptable traffic operations in the Interchange Study Area for the 20-year planning horizon, with the potential for remaining capacity to serve beyond the planning horizon.
    - The IAMP includes a Transportation Improvements Map showing the opportunities to improve operations and safety within the Interchange Study Area.
    - The IAMP identifies and describes up to three alternatives for the Interchange Area and evaluates how each would protect the safe and efficient operation of the interchange. The evaluation identifies how each alternative meets the provisions of OAR 734-051-0155 and other applicable state laws. A preferred alternative is selected and recommended for adoption.

4. The IAMP shall be developed in accordance with the provisions and the policies of the Oregon Highway Plan and other relevant state transportation laws.
    - The IAMP meets the minimum level of service / mobility standards and other requirements identified in state transportation plans, such as the Oregon Transportation Plan, 1999 Oregon Highway Plan (OHP).
    - The IAMP implements the OHP's Policy 3C criteria, which requires the planning and management of grade-separated interchange areas to ensure safe and efficient operation between connecting roadways.
    - The IAMP satisfies the requirements for interchange area management plans in OAR 734-051-0155 and other state rules, including OHP policies and standards, ODOT Division 51 interchange spacing standards, the 2003 Highway Design Manual and the Oregon Transportation Commission's OTIA conditions for interchanges.

5. The IAMP shall include policies and implementing measures that preserve the functionality of the interchange areas.
    - The IAMP identifies future land use conditions and induced effects, and identifies needed land protection measures.
    - The IAMP includes short, medium and long-range actions to improve and maintain roadway operations and safety in the Interchange Study Area. These actions may include local street network improvements, driveway consolidations, shared roadways, access management, traffic control devices, and / or local land use actions.
    - The IAMP includes amendments to Redmond and Deschutes County's Comprehensive Plans, Zoning Ordinances, Transportation System Plans, and other official documents as necessary to implement the recommended alternative for the Interchange Study Area.
    - The IAMP identifies likely funding sources and requirements for the construction of the infrastructure and facility improvements as new development is approved.
    - The IAMP identifies partnerships for the cooperative management of future projects and establishes a process for coordinated review of land use decisions affecting transportation facilities.
    - A draft version of the IAMP is reviewed by the Redmond and Deschutes County Planning Commissions, as well as the Redmond City Council and the Deschutes County Board of Commissioners. A final draft of the IAMP is adopted by the City Council and Board of Commissioners.

CHAPTER 3: EXISTING LAND USE AND TRANSPORTATION CONDITIONS

This chapter provides an inventory and evaluation of existing land uses and transportation facilities within the IAMP study area, which can be used to identify areas needing improvement and can act as a baseline for assessment of future conditions. This includes identification and description of existing land uses, area streets, traffic controls, and property access, as well as an analysis of the crash history, access management deficiencies, intersection capacity, and potential land development.

Study Area Land Uses

The selected geographic boundaries for the IAMP include O'Neil Highway (OR 370)/NW Pershall Way to the north, NE 17th Street/NE Negus Way to the east, NW Kingwood Avenue to the south, and NW 22nd Street to the west. This area is illustrated in Figure 3.1, which shows all existing streets and property zoning within the study area boundaries.

Within this area, there are lands both inside and outside of the City of Redmond urban growth boundary. Lands outside of the urban growth boundary (northern and eastern areas of study limits) maintain rural zoning and development patterns, consisting of a variety of agricultural uses. Within the urban growth boundary, most lands are zoned for either commercial, residential, light industrial, or park/open space uses. The commercial lands tend to surround the US 97 corridor in the middle of the study area with residential lands between this commercial corridor and the eastern and western urban growth boundaries. To the southeast of the study area, there is a significant amount of industrial land, but only about 22 acres of light industrial land lie within the study limits. All of the park/open space lands are located to the west of US 97, with most of it assigned to Dry Canyon.

Figure 3.1 displays the locations of different land use zones in the study area and also provides total acreages for each zone type and identifies lands currently undeveloped. Most of the land within the IAMP study area is zoned for agricultural uses, with the second largest group allowing residential development, as summarized in Table 3.A. There appears to be a significant amount of commercial property surrounding the proposed interchange area (between NW Spruce Avenue and NW Quince Avenue) that is currently vacant.

Table 3. A: Land Use Summary

Land Use	Percent of IAMP Area
Agricultural	43%
Commercial	16%
Industrial	1%
Parks/Public Facilities	7%
Residential	33%

A comparison of future growth and development assumptions in the IAMP study area from the Redmond urban transportation demand model and the recently completed buildable lands inventory conducted by EcoNorthwest was provided by Winterbrook Planning. From this comparison, it was discovered that the estimated growth in residential development was approximately 30% higher in the transportation demand model, with much of the additional housing found in the areas around the urban growth boundary. The estimates for employment growth were much closer, with the buildable lands inventory projecting less than 5% more growth in this area than the transportation demand model. A memorandum describing this comparison is attached as Appendix 2.

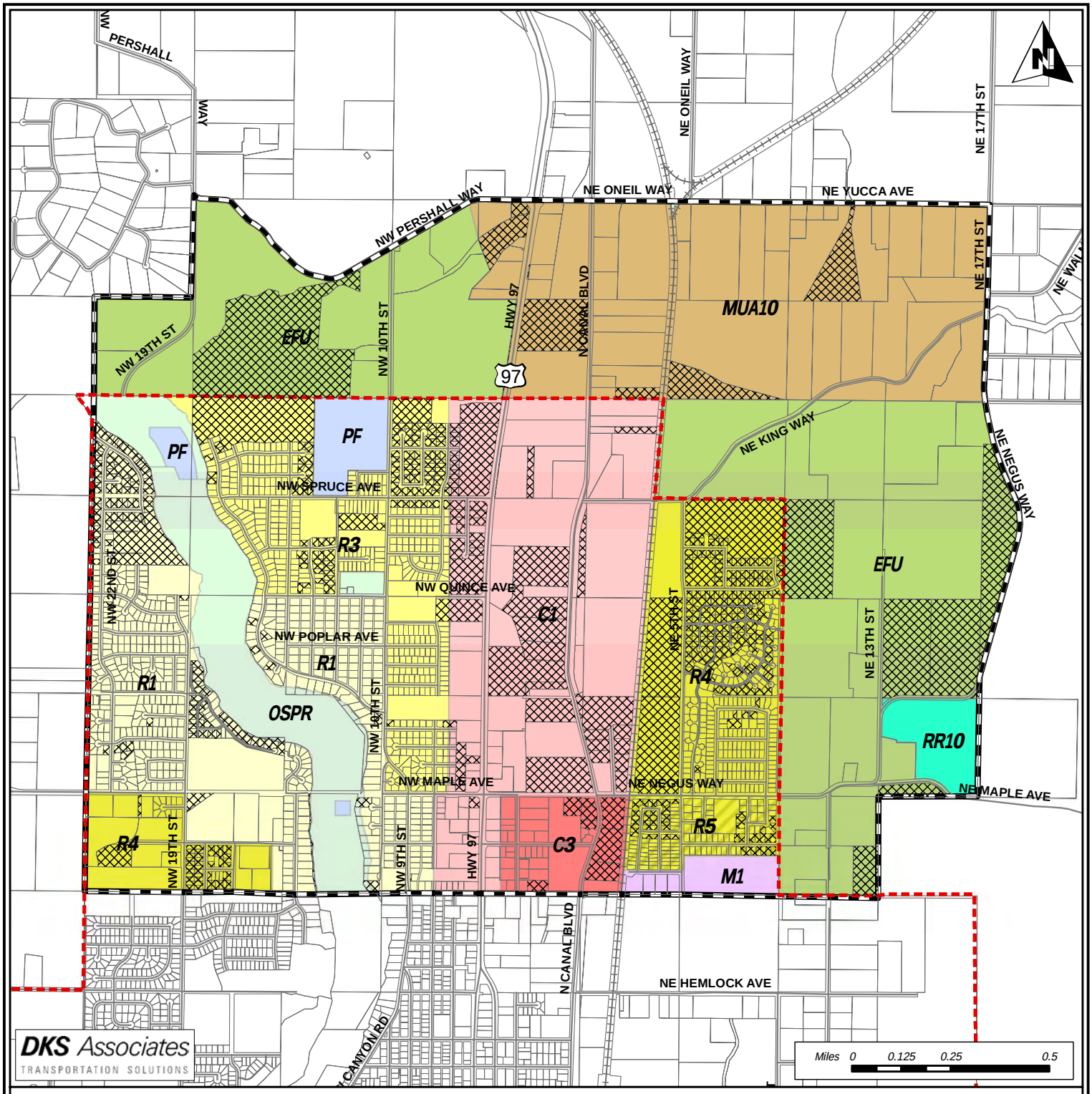


FIGURE 3-1
ZONING AND LAND USE

US 97 NORTH INTERCHANGE
AREA MANAGEMENT PLAN

Zoning

- Strip Service Commercial - 347.3 ac.
- Special Service Commercial - 50.4 ac.
- Exclusive Farm Use - 644.2 ac.
- Light Industrial - 21.8 ac.
- Multi-Use Agricultural - 397.3 ac.
- Parks and Open Space - 133.5 ac.
- Public Facilities - 32.4 ac.
- Residential 1 - 289.6 ac.
- Residential 3 - 208.1 ac.
- Residential 4 - 227.3 ac.
- High Density Residential - 40.5 ac.
- Rural Residential 10 - 28.8 ac.

- VACANT PROPERTIES
  Does not include vacant City-owned.
- RAILROAD
- EXISTING STREETS
- IAMP STUDY AREA
- PARCELS
- URBAN GROWTH BOUNDARY

Study Area Street Network

Within the study area, there are roadways within the jurisdiction of the Oregon Department of Transportation (ODOT), Deschutes County, and the City of Redmond, ranging in functional classification from major arterials to local streets. Figure 3.3 displays the study area street network and identifies the assigned functional classification of each roadway. For the purposes of the IAMP, the roadways maintaining a functional classification of collector or higher were selected. These roadways are listed below in Table 3.B.

Table 3.B: Study Area Roadways

ODOT Jurisdiction		
Roadway	**Limits**	**Functional Classification**
US 97	O'Neil Highway - NW Kingwood Avenue	major arterial
O'Neil Highway	US 97 - NE Yucca Avenue	rural collector
Deschutes County Jurisdiction		
Roadway	**Limits**	**Functional Classification**
NW Pershall Way	NW 19th Street - US 97	rural collector
NW 10th Street	Redmond UGB - NW Pershall Way	rural collector
N Canal Boulevard	Redmond UGB - O'Neil Highway	rural collector
NE Yucca Avenue	O'Neil Highway - NE 17th Street	rural collector
NE King Way	Redmond UGB - NE 17th Street	rural collector
NE 17th Street	NE Negus Way - NE Yucca Avenue	rural collector
NE Negus Way	Redmond UGB - NE 17th Street	rural collector
City of Redmond Jurisdiction		
Roadway	**Limits**	**Functional Classification**
NW Kingwood Avenue	NW 9th Street - US 97	minor collector
NW Kingwood Avenue	US 97 - N Canal Boulevard	major collector
NW Maple Avenue	NW 22nd Street - NW 4th Street	minor arterial
NE Negus Way	N Canal Boulevard - Redmond UGB	minor arterial
N Canal Boulevard	NW Kingwood Avenue - NW Maple Avenue	minor arterial
N Canal Boulevard	NW Maple Avenue - Redmond UGB	major collector
NW 9th Street	NW Kingwood Avenue - NW Maple Avenue	minor collector
NW 10th Street	NW Maple Avenue - Redmond UGB	major collector
NW 19th Street	NW Jackpine Avenue - NW Quince Avenue	major collector
NW Quince Avenue	NW 10th Street - US 97	major collector
NE King Way	N Canal Boulevard - Redmond UGB	major collector

With these roadways identified as the primary means of circulation through the area, key intersections along these routes were selected for capacity analysis. Through a field inventory, the existing lane configurations and traffic controls at each intersection were documented and have been displayed in Figure 3.4. From this figure, it can be seen that there are no signalized intersections within the study area and, with the exception of US 97, all roadways are currently limited to two lanes with no separate turning lanes available at intersections.

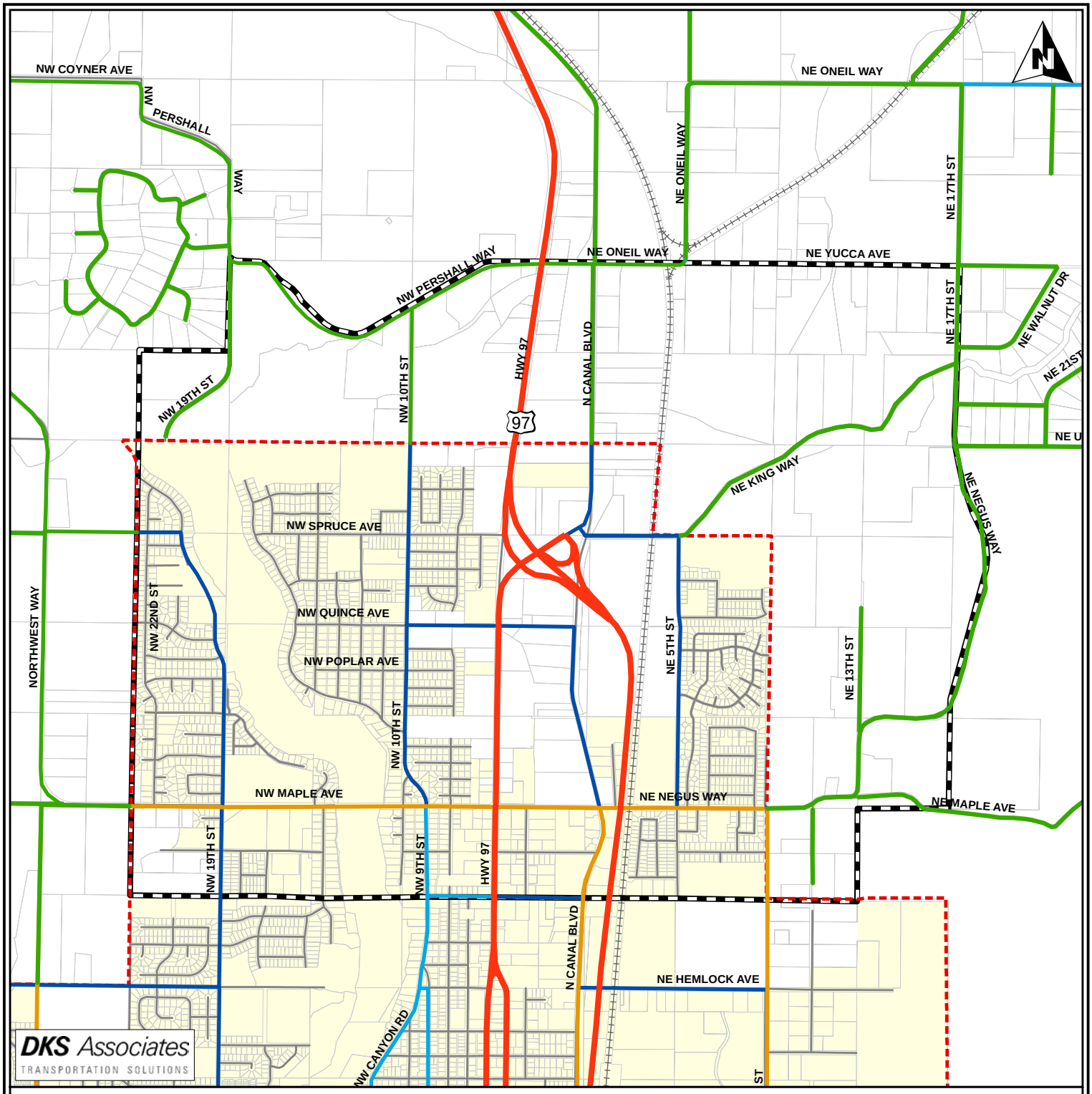


FIGURE 3-3
STUDY AREA ROADWAY CLASSIFICATION

US 97 NORTH INTERCHANGE
AREA MANAGEMENT PLAN

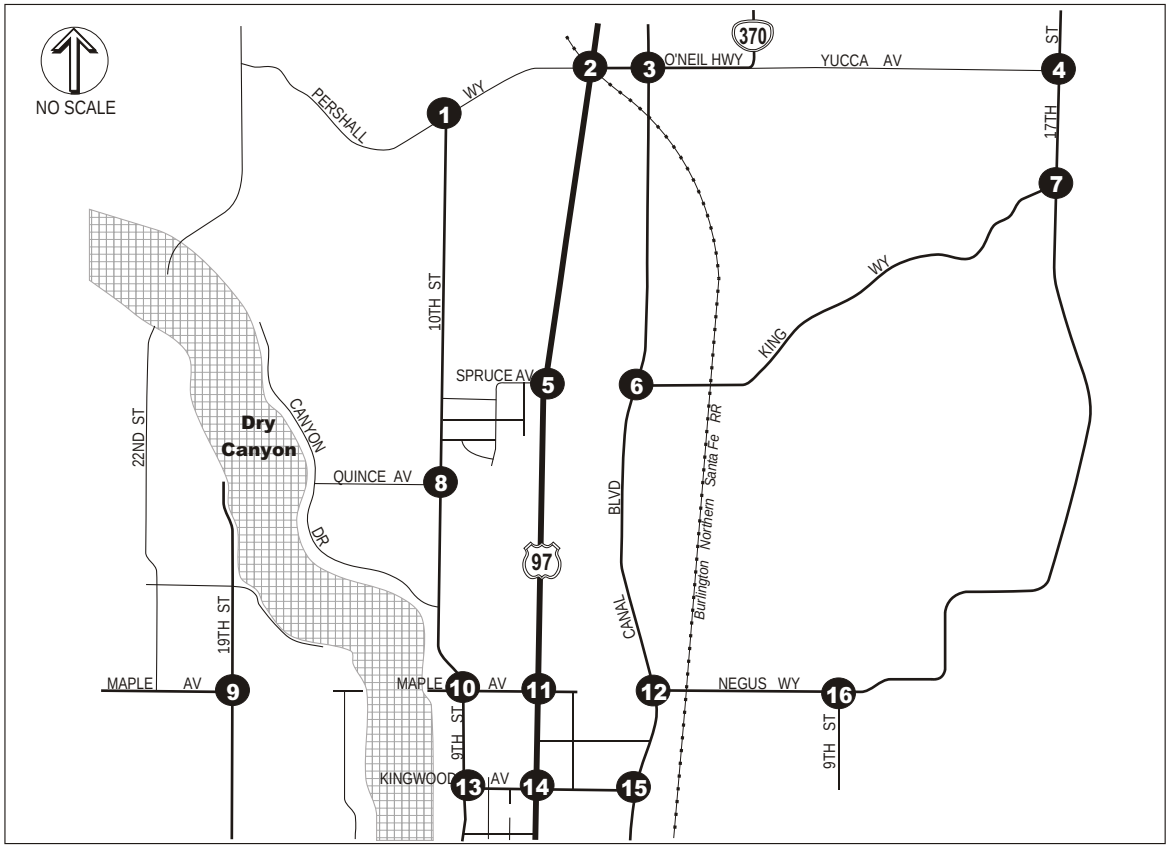
Functional Classification

- MAJOR ARTERIAL
- MINOR ARTERIAL
- MAJOR COLLECTOR
- MINOR COLLECTOR
- RURAL COLLECTOR - DESCHUTES CO.
- LOCAL STREET

- RAILROAD
- PARCELS
- STREAMS
- CITY OF REDMOND
- URBAN GROWTH BOUNDARY

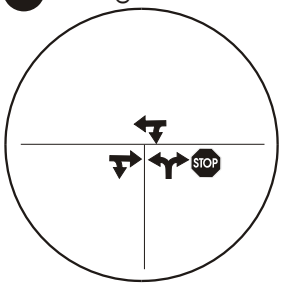
- IAMP STUDY AREA

Miles 0 0.125 0.25 0.5

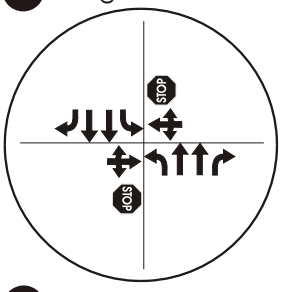


DKS Associates
TRANSPORTATION SOLUTIONS

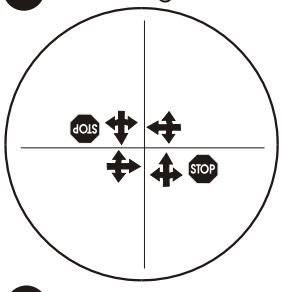
1 10TH ST@ PERSHALL WY



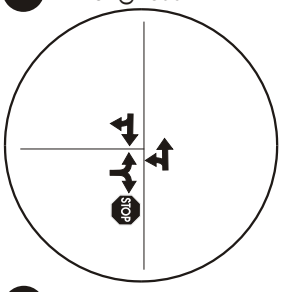
2 US 97 @ O'NEIL HWY



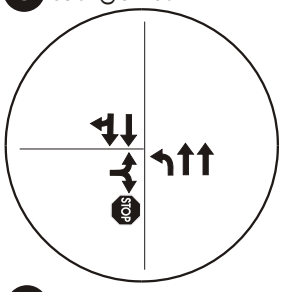
3 CANAL BLVD @ O'NEIL HWY



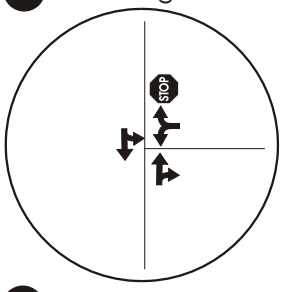
4 17TH ST @ YUCCA AV



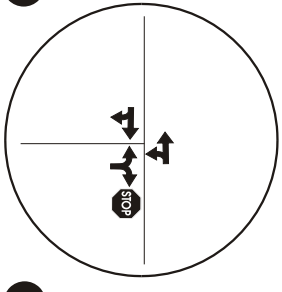
5 US 97 @ SPRUCE AV



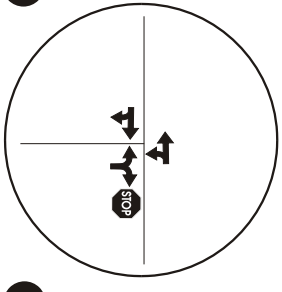
6 CANAL BLVD @ KING WY



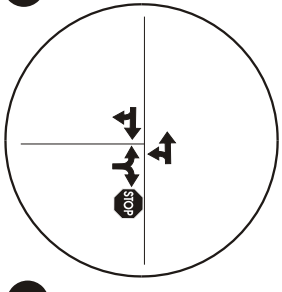
7 KING WY @ 17TH ST



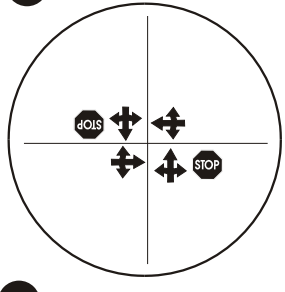
8 10TH ST @ QUINCE AV



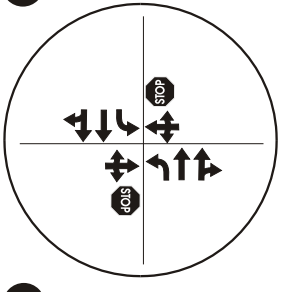
9 19TH ST @ MAPLE AV



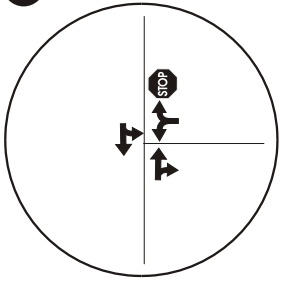
10 9TH ST @ MAPLE AV



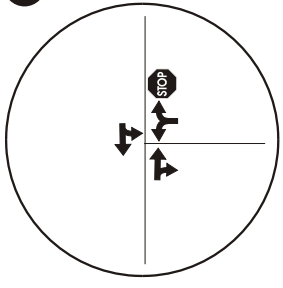
11 US 97 @ MAPLE AV



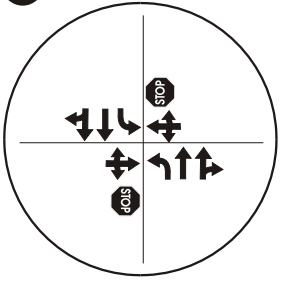
12 CANAL BLVD @ NEGUS WY



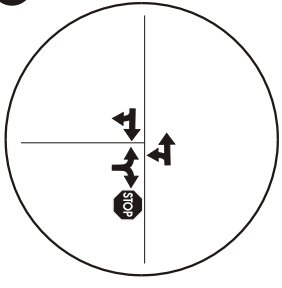
13 9TH ST @ KINGWOOD AV



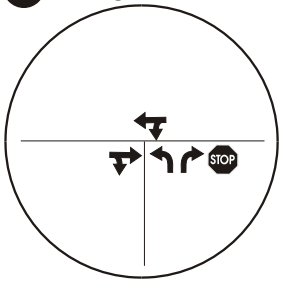
14 US 97 @ KINGWOOD AV



15 CANAL BLVD @ KINGWOOD AV



16 9TH ST @ NEGUS WY



LEGEND

- 0 - Study Intersection Number
- ← - Lane Configuration
- STOP - Stop Sign Controlled Intersection

Figure 3.4

EXISTING INTERSECTION CONTROL AND LANE CONFIGURATION

Existing Access Conditions

Access to US 97

A physical inventory of existing approaches to US 97 was collected through the study area, with descriptive information recorded for each approach indicating the approach's location, how the approach has been constructed and how it is currently being used. This physical inventory was compiled into Table 3.A., which is attached in Appendix 3. In addition, the individual approaches are shown in Figure 3.5.

Using this information, a comparison of existing conditions to ODOT's access management spacing standards was made to evaluate areas needing improvement. However, ODOT's access management spacing standards for US 97 through this area vary, as the highway passes through both rural and urban areas, contains a change in posted speeds, and maintains an expressway designation at the northern end. Therefore, in comparing existing conditions to the desired conditions, the study area was divided into sections according to changes triggered by urban growth boundaries, expressway designations, and posted speeds.

Tables 3.C provides the results of this investigation, displaying the number of approaches found in these sections for each side of US 97 and comparing the average approach spacing per section to the applicable access management spacing standard. While this level of analysis cannot be used to identify potential improvements to approach spacing, it does reflect the degree to which the spacing standards are being met and provides an indication of the extent of improvements needed. The rightmost column in the table indicates the number of driveway or public street approaches that would be allowed to fully comply with access spacing standards.

Table 3.C: US 97 Existing Approach Spacing

Highway Segment	Number of Approaches	Segment Length (feet)	Average Approach Spacing (feet)		Number of Approaches to Meet Standard
			Actual	Standard	
West Side of Highway					
MP 118.52 (O'Neil Hwy) - MP 119.02 (North UGB)	9	2640	293	5280	1
MP 119.02 (North UGB) - MP 119.75 (posted speed change)	9	3854	428	1320	3
MP 119.75 (posted speed change) - MP 120.27 (Kingwood Ave)	17	2745	161	990	3
East Side of Highway					
MP 118.52 (O'Neil Hwy) - MP 119.02 (North UGB)	8	2640	330	5280	1
MP 119.02 (North UGB) - MP 119.75 (posted speed change)	20	3854	193	1320	3
MP 119.75 (posted speed change) - MP 120.27 (Kingwood Ave)	17	2745	161	990	3

The table shows that the average approach spacing experienced within sections of US 97 is much shorter than the adopted standards require, indicating that a significant amount of improvement would be necessary if the standards were to be met. It should be recognized that these figures include public

approaches to US 97, which in some cases, would make it very difficult to meet the spacing standards without significant realignments.

Access to City Streets

In addition to assessing existing access conditions to US 97, the City's arterial and collector streets within the study area were examined as well to identify current access density in comparison to what the City access management guidelines recommend.

The City of Redmond Transportation System Plan has adopted access management guidelines for arterials, collectors, and local streets. These standards were applied to evaluate access and intersection spacing for the collector and arterial systems within the study area. The collector streets that were evaluated include NW 19th Street, NW 10th Street, NW Kingwood Avenue and NW 9th Street, while the arterials include NE Negus Way, N Canal Boulevard (between Kingwood Avenue and Negus Way), and NW Maple Avenue.

Tables 3.D and 3.E show the driveway and intersection spacing for the various City collectors and arterial streets within the study area and compare them with the adopted guidelines. As can be seen from these tables, the average access spacing on the collector streets is very close to meeting the recommended minimum approach spacing shown. However, most of the arterials examined appear to serve far too many approaches to meet these guidelines, mainly due to the high number of public street intersections.

Access to County Roads

As noted in Chapter 2, Deschutes County does not maintain adopted access management spacing standards, but does have general policies indicating that access points to arterials and collectors should be limited.

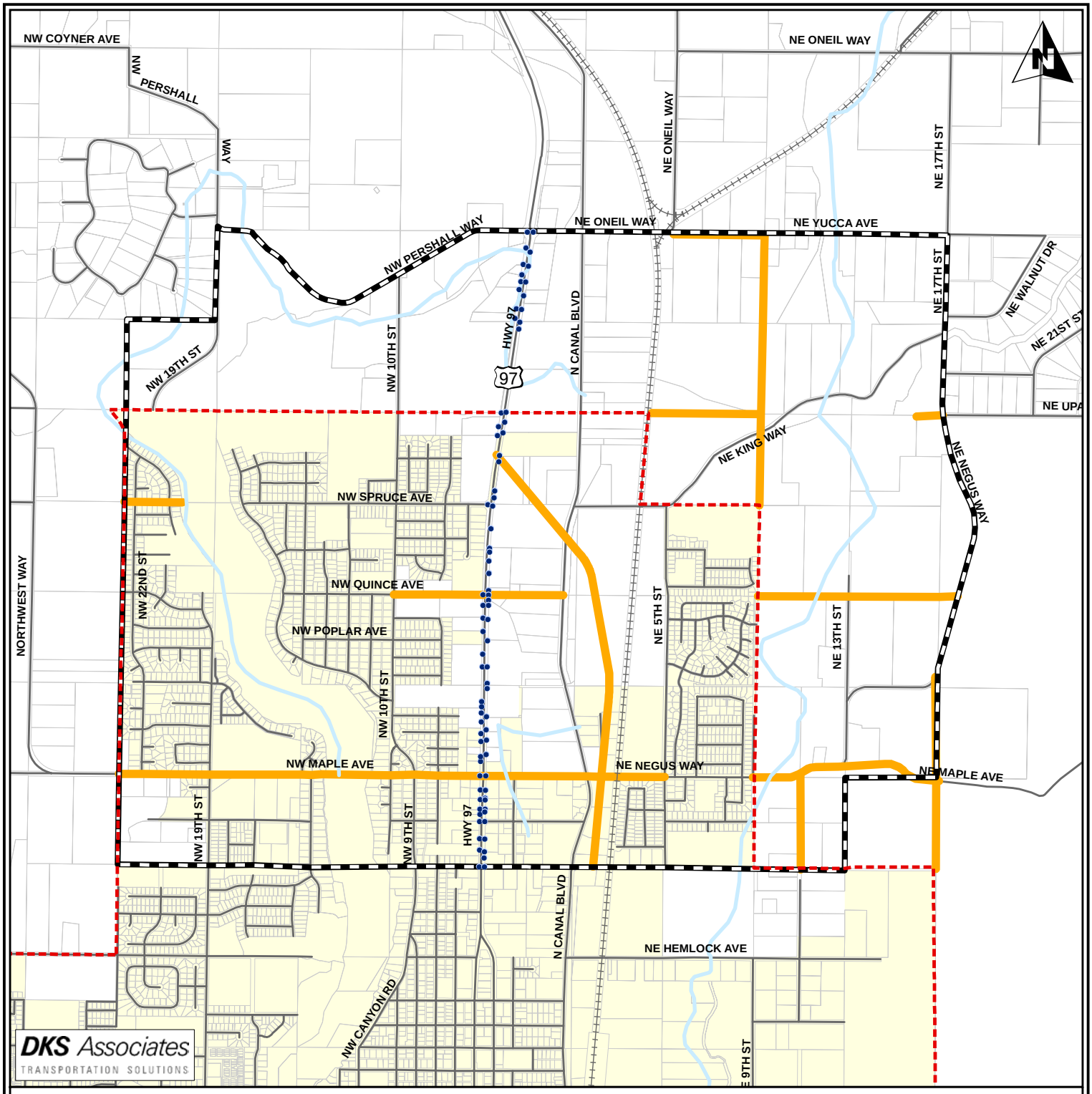


FIGURE 3-5
ROADWAYS AND APPROACHES

US 97 NORTH INTERCHANGE
AREA MANAGEMENT PLAN

Legend

- PUBLIC AND PRIVATE APPROACHES
- EXISTING STREETS
- COMMITTED STREETS
- IAMP STUDY AREA
- RAILROAD
- PARCELS
- STREAMS
- CITY OF REDMOND
- URBAN GROWTH BOUNDARY

Miles 0 0.125 0.25 0.5

Table 3.D: Intersection Spacing on City Streets

Roadway	Length (feet)	Direction	Intersection Spacing		Intersection Spacing (feet)*	Meets Stan–dards?
			Number of Intersection	Average Intersection Spacing (feet)		
Major Collectors						
19th Street (Maple Ave to Quince Ave)	2,600	Northbound	3	865	330	Yes
		Southbound	9	290	330	No
10th Avenue (Maple Ave to Spruce Ave)	3,800	Northbound	9	425	330	Yes
		Southbound	5	760	330	Yes
Kingwood Avenue (US 97 to N Canal Blvd.)	1,280	Eastbound	1	1280	330	Yes
		Westbound	2	640	330	Yes
Minor Collectors						
Kingwood Avenue (9th St. to US 97)	960	Eastbound	3	320	330	No
		Westbound	1	960	330	Yes
9th Street (Maple Ave. to Kingwood Ave.)	1,320	Northbound	2	660	330	Yes
		Southbound	2	660	330	Yes
Minor Arterials						
Negus Way (Canal Blvd to 9th St.)	2,500	Eastbound	5	500	1/4 mile	No
		Westbound	5	500	1/4 mile	No
N Canal Boulevard (Kingwood Ave. to Negus Way)	1,350	Northbound	1	1350	1/4 mile	Yes
		Southbound	2	675	1/4 mile	No
Maple Avenue (West UGB to 19th St.)	1,200	Eastbound	1	1,200**	1/4 mile	Yes
		Westbound	2	600	1/4 mile	No
Maple Avenue (9th St. to 4th St.)	1,450	Eastbound	4	365	1/4 mile	No
		Westbound	3	485	1/4 mile	No

* Source: City of Redmond Transportation System Plan, 2000.
** Segment Shorter than Desired Spacing

Crash Analysis

The last five years (1999 – 2003) of available crash data for the US 97 study corridor was obtained from the ODOT Crash Analysis and Reporting Unit to analyze current conditions. To identify potential deficiencies, crash rates for sections of US 97 were compared to statewide average crash rates for similar facilities. Sections experiencing higher crash rates than the statewide average were investigated further to see if crash patterns could be mitigated through countermeasure implementation.
This analysis was supplemented by reviewing ODOT's Safety Priority Index System listing for locations in the study corridor ranked among the state's top 10% of hazardous locations. The Safety Priority Index System (SPIS) is a method developed by ODOT for identifying hazardous locations on state highways. The SPIS score is based on three years of crash data and considers crash frequency, crash rate, and crash severity. ODOT bases its SPIS on 0.10-mile segments to account for variances in how crash locations are

reported. This information is a general comparison of the overall safety of the highway based on crash information for all sections throughout the state.

Crash rates identifying the number of crashes per million vehicle-miles traveled for specified sections of US 97, as well as statewide average crash rates for various facility types, were obtained from ODOT's 2003 State Highway Crash Rate Tables1. Highway sections analyzed in these tables are categorized by area type and functional classification to provide a basis for comparison between various facilities. For this analysis, US 97 was classified as a non-freeway principal arterial, and the study corridor was separated into "Rural Area", "Suburban Area", and "Urban City" categories. Pre-established highway sections within these categories are provided in the crash rate tables with crash rates calculated for each section, as well as for groups of contiguous sections within the same area type.

Rural Areas

Within the study corridor, the lands outside of the urban growth boundary (O'Neil Highway to approximately ¼-mile north of Spruce Avenue) fall under the Rural Area category. North of the Redmond urban growth boundary (UGB), Table 3.F shows the section from the O'Neil Highway to the Redmond UGB experiencing a significantly higher crash rate than the statewide average for Rural Areas over the last three years. However, it should be noted that this section is only ½-mile long and that crash rates for sections of less than one mile in length often appear to be much higher than warranted, especially when they include a significant intersection, such as the one on US 97 at O'Neil Highway.

Table 3.E: US 97 5-year Crash Rate Comparison for Statewide Rural Areas

Section Limits (Milepost)	Section Description	Crashes per Million Vehicles				
		2003	2002	2001	2000	1999
	Statewide Average Rate	0.72	0.72	0.85	0.82	0.8
118.52 - 119.02	O'Neil Hwy - Redmond UGB	**1.47**	**0.88**	**2.08**	0.61	-

Note: Bold and boxed type indicates the crash rate is greater than the statewide average.

Through an examination of individual crashes over the last five years, it was noted that about 45% of the crashes in this section occurred at the US 97/O'Neil Highway intersection and that if this intersection were removed from the section, the crash rates for three of the five years would drop well below the statewide average rate. During the remaining two years (2001 & 2002), there are fewer than five crashes per year, with most of the crashes appearing to be related to motorists driving too fast under icy conditions. Investigating further, it was found that the crash rates for other sections greater than one mile long in the same Rural Area between Madras and Redmond were approximately the same as, or much lower than, the statewide average and that the crash rate for this entire Rural Area as a whole was significantly lower. It should also be noted that no top 10% SPIS locations were found between the O'Neil Highway and the north Redmond UGB.
Considering this information, it does not appear that this section of US 97 is actually experiencing an above average rate of crashes. Therefore, no countermeasures for crash reduction are recommended.

[1] *2003 State Highway Crash Rate Tables (January 2005)*. Retrieved April 4, 2005, from Oregon Dept. of Transportation Web site: http://www.oregon.gov/ODOT/TD/TDATA/car/docs/2003shcrt.pdf

Suburban Areas

Suburban Areas represent lands between urban growth boundaries and city limits. Table 3.G shows that the area approximately between Spruce Avenue and Maple Avenue falls within this category and that it experiences crash rates well below the statewide average. In addition, there are no top 10% SPIS locations within this section. Therefore, no countermeasures are proposed for crash reduction.

Table 3.F: US 97 5-year Crash Rate Comparison for Statewide Suburban Areas

Section Limits (Milepost)	Section Description	Crashes per Million Vehicles				
		2003	2002	2001	2000	1999
	Statewide Average Rate	1.34	1.51	1.44	1.52	1.64
119.02 - 119.98	Redmond UGB - North City Limits	-	0.11	0.23	0.36	0.74

Urban Cities

Within the study corridor, the only area classified under the Urban Cities category is the segment from the Redmond city limits (just north of Maple Avenue) to Kingwood Avenue. Note that the predetermined section from the crash rate tables includes an additional 0.15 miles from Kingwood Avenue to the beginning of the couplet. Looking at Table 3.H, it appears that this section experienced a crash rate higher than the statewide average only during the last year. However, much like the rural section between the O'Neil Highway and the Redmond UGB previously discussed, this section is less than one mile in length and may have reported crash rates that are heavily influenced by individual intersections. Therefore, identifying high crash locations within the city limits of Redmond by reviewing these crash rates may not be an effective approach.

Table 3.G: US 97 5-year Crash Rate Comparison for Statewide Urban Cities

Section Limits (Milepost)	Section Description	Crashes per Million Vehicles				
		2003	2002	2001	2000	1999
	Statewide Average Rate	3.15	2.88	3.59	3.46	3.8
119.98 - 120.42	Redmond N. City Limits - Begin Couplet	**3.28**	2.29	3.01	2.33	1.89

Note: Bold and boxed type indicates the crash rate is greater than the statewide average.

To supplement this analysis, ODOT's SPIS listings for this area were reviewed to identify any locations with ratings in the state's top 10%. Because SPIS scores are calculated for 0.10-mile segments, the exact location of the problem is not identified by ODOT, but engineering judgment can be used to make a reasonable estimate. Through examination of this list, it was found that the intersection of US 97 at Kingwood Avenue was rated within the top 10%.

The four-way intersection on US 97 at Kingwood Avenue maintains stop-control on the east and west Kingwood Avenue approaches and is located within a tangent, five-lane, 45-mph section of the highway. When examining the individual crashes that have occurred here over that last five years, it appears that the high SPIS rating is probably due to a single crash that actually occurred about 100 feet south of the intersection, resulting in two fatalities. This crash, a head-on collision, occurred around 3:00 p.m. on a clear August Wednesday afternoon. No apparent cause of the crash was provided. Given that this area is on a tangent segment of roadway and a 14-foot-wide median lane is separating the northbound and

southbound traffic, it does not appear any countermeasures are needed. Excluding this crash, which should not be related to the US 97/Kingwood Avenue intersection, the number of remaining crashes does not appear to be unusually high. Signalization of this intersection could mitigate most of these crashes, but the quantity of crashes would not be enough to warrant the installation. Therefore, no countermeasures are recommended at this time.

In addition to the analysis conducted along US 97, another set of crash data (2000-2004) covering the city and county arterial and collector system within the study area was obtained from the ODOT Crash Analysis and Reporting Unit and categorized based on the types and severity of crashes for the various roadway sections. The results are displayed in Table 3.I.

Table 3.H: Collision Data for Non-State Study Area Roadways (2000-2004)

Roadway	Crash Severity			Type of Collision				Total Crashes
	Fatal	Injury	Property Damage Only	Turning	Angle	Rear-end	Fixed / Other object	
NW Maple Ave: NW 22nd St - NW 4th St	0	3	2	4	1	0	0	5
NE Negus Way: N Canal Blvd - Redmond UGB	0	0	0	0	0	0	0	0
N Canal Blvd: NW Kingwood Ave - NW Maple Ave	0	0	3	3	0	0	0	3
NW Pershall Way: NW 19th St - US 97	0	0	4	1	0	2	1	4
O'Neil Hwy: US 97 - NE Yucca Ave	0	4	1	2	1	2	0	5
NE Yucca Ave: O'Neil Hwy - NE 17th St	0	0	0	0	0	0	0	0
NW 10th St: NW Pershall Way - NW Maple Ave	0	0	0	0	0	0	0	0
NW 9th St: NW Maple Ave - NW Kingwood Ave	0	0	0	0	0	0	0	0
NE King Way: N Canal Blvd - NE 17th St	0	1	0	0	1	0	0	1
NE 17th St: NE Negus Way - NE Yucca Ave	0	0	0	0	0	0	0	0
NE Negus Way: Redmond UGB - NE 17th St	0	0	0	0	0	0	0	0
NW Kingwood Ave: NW 9th St - N Canal Blvd	0	5	5	8	1	1	0	10
N Canal Blvd: NW Maple Ave - O'Neil Hwy	0	6	2	2	0	1	5	8
NW 19th St: NW 22nd St - NW Jackpine Ave	0	0	0	0	0	0	0	0

Source: ODOT PRC Reports, Crash Analysis and Reporting Unit.

From examining this table, it is seen that, overall, the occurrence of crashes on the City and County roadways has been relatively low, with only two of the roadway segments analyzed averaging more than one crash per year and half of the segments experiencing no crashes at all. Note that four of the five crashes occurring on NW Maple Avenue and nine of the ten crashes occurring on NW Kingwood Avenue, were located at the intersections with US 97. Also of note is that all three of the crashes on N Canal Boulevard between NW Kingwood Avenue and NW Maple Avenue occurred at the intersection with NW Larch Avenue. North of NW Maple Avenue, three of the eight crashes on N Canal Boulevard occurred at the intersection with NE Negus Way and four others involved fixed object collisions.

Operational Analysis

Traffic Volumes

Traffic volume data for the study area was collected from the Oregon Department of Transportation (ODOT) Traffic Volume Tables, the Automatic Traffic Recorder (ATR) located 1.7 miles south of Redmond, and recent turn movement counts collected in 2005. From this data, it was found that the average daily traffic volume on US 97 ranges from approximately 19,200 vehicles per day near the O'Neil Highway to as much as 25,500 vehicles per day at NW Maple Avenue, with trucks making up less than 10% of the total volume.

New manual turn movement counts were collected during the weekday p.m. peak period (4:00 – 6:00 p.m.) in July and August of 2005 at many of the study intersections to supplement counts previously obtained in the same year for other studies. According to several traffic studies previously completed by ODOT and data from the ATR south of Redmond, the 30th highest hour of annual traffic (30 HV) on US 97 occurs during a weekday p.m. peak hour in the summer. All manual counts collected were adjusted to represent weekday p.m. peak hour volumes in August by applying a seasonal factor, which was calculated using data from the ATR that related monthly traffic volumes to the annual average daily volume.

Traffic volumes during the 30 HV for the year 2005 at study area intersections are displayed[2] in Figure 3.6. From this figure, it can be seen that northbound volumes along US 97 are typically higher than southbound volumes during this period and that volumes on the City and County roads are very low, only exceeding 200 vehicles per hour in any one direction on N Canal Boulevard between NE Negus Way and NW Kingwood Avenue.

Study Area Roadway Performance

Study intersections within the IAMP area were analyzed through the use of a Synchro model that was created using field inventory data, aerial photos, and the traffic volume data shown in Figure 3.6. From this analysis, intersection levels of service and volume to capacity ratios were obtained using Highway Capacity Manual[3] methodologies for unsignalized intersections for comparison with the applicable jurisdiction's adopted performance standards. ODOT has designated US 97 as a Statewide Highway on the National Highway System, with an additional Freight Route designation. Performance standards for this facility have been adopted by ODOT in the 1999 Oregon Highway Plan[4] (OHP). Table 6 in Policy 1F of the OHP displays the maximum allowable volume to capacity ratios for the 30 HV in areas outside of the Portland Metropolitan Area. Relevant sections are presented in Table 3.J.

[2] Note that the volumes shown in Figure 3.6 have been balanced to reduce discrepancies between intersections.
[3] *Highway Capacity Manual*, Transportation Research Board, Washington, D.C., 2000.
[4] *1999 Oregon Highway Plan*, Oregon Department of Transportation, 1999.

Table 3.I: Maximum Volume to Capacity Ratios from the 1999 Oregon Highway Plan

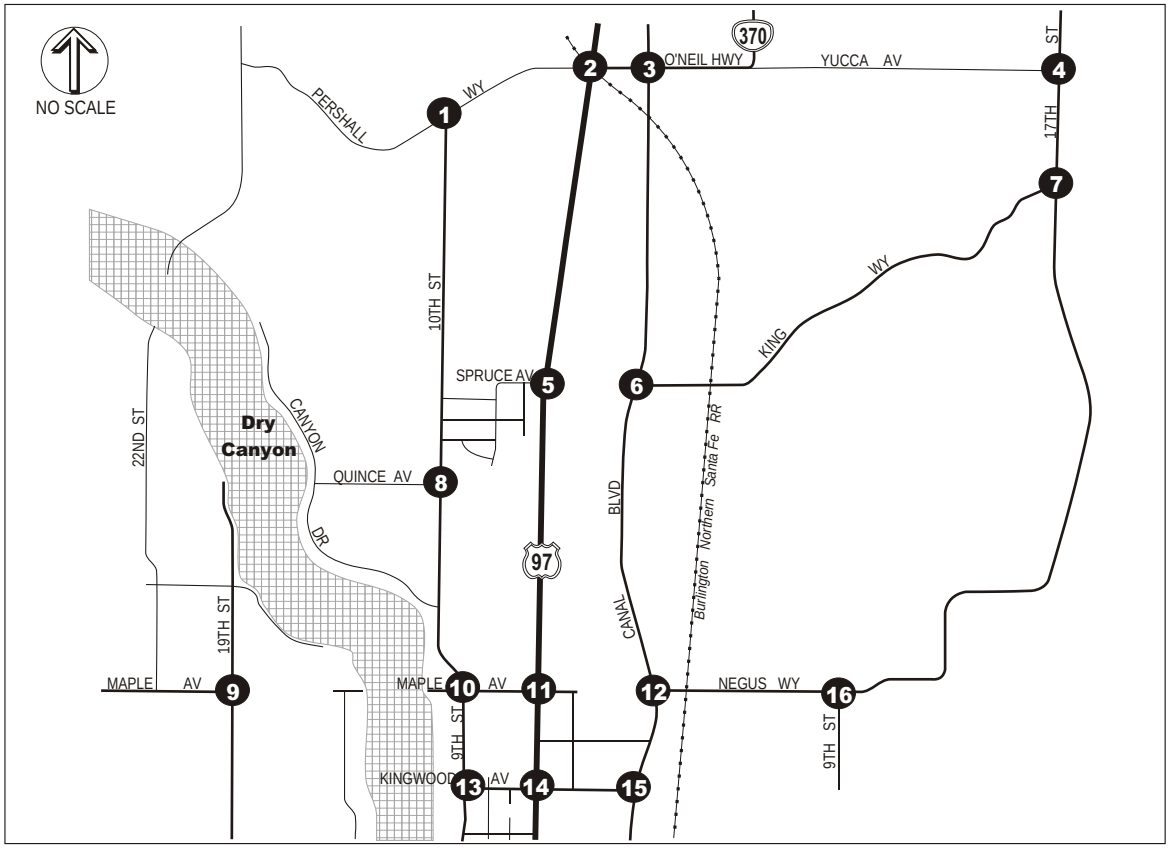
Highway Category	Inside Urban Growth Boundary	
	Non-MPO outside of STAs where non-freeway speed limit <45 mph	Non-MPO where non-freeway speed limit > 45 mph
Statewide (NHS) Freight Routes	0.75	0.70
District/Local Interest Roads	0.85	0.80

At unsignalized intersections (all study area intersections are unsignalized), these standards are applicable only to movements that are not required to stop. For other movements at unsignalized intersections that are required to stop or otherwise yield the right of way, the standards for District/Local Interest Roads shall be applied for areas within urban growth boundaries and a maximum volume to capacity ratio of 0.80 shall be applied for areas outside of urban growth boundaries.

All non-state roadways within the Redmond UGB are under the jurisdiction of the City of Redmond. The City has adopted standards for performance of City streets requiring operation of level of service "E" or better during the peak 15 minutes of the peak hour of the average weekday. A lesser standard is allowed at unsignalized intersections with low volume minor street approaches, requiring operation at a volume to capacity ratio less than 0.90 and a 95th percentile vehicle queue less than four vehicles during the peak hour.

For non-state roadways outside of the Redmond UGB, which are under the jurisdiction of Deschutes County, the Deschutes County Transportation System Plan includes a goal to maintain a level of service of "D" or better during the peak hour throughout the County arterial and collector road system over the next 20 years.

Table 3.K shows the existing operational analysis for the study area unsignalized intersections and compares the results to the applicable performance standards. Note that the results shown represent the critical movement at each intersection (usually a stop-controlled movement, such as a side-street left turn or crossing movement). As can be seen from this table, none of the intersections on City or County roadways fail to operate within acceptable standards. For the intersections under ODOT jurisdiction, the intersection on O'Neil Highway at N Canal Boulevard is currently operating well, but along US 97, only the intersection at NW Spruce Ave is meeting adopted performance standards.



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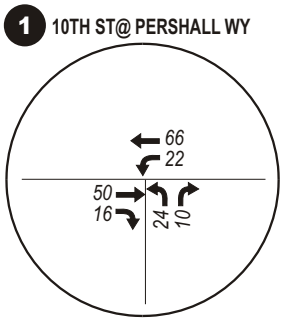
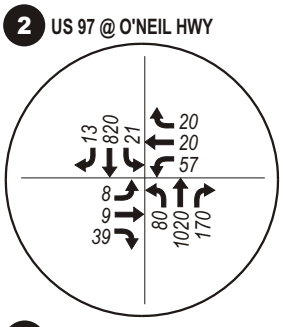
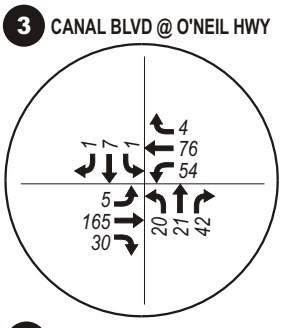
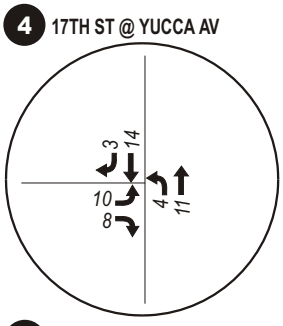
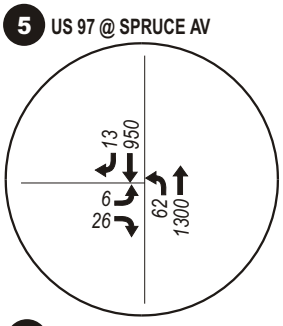
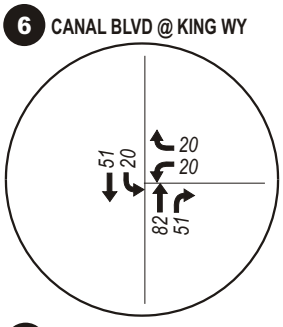


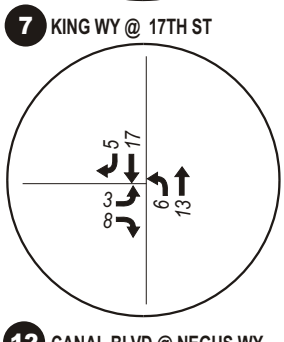


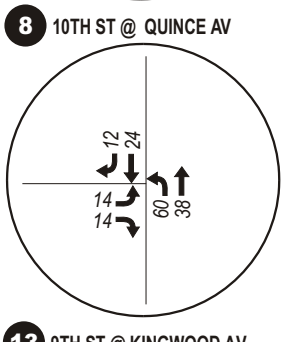


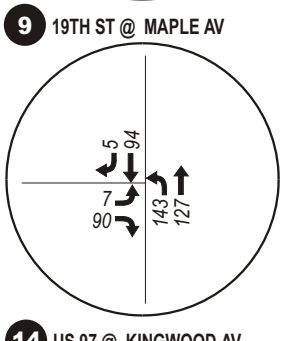


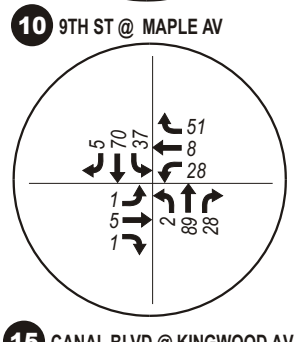


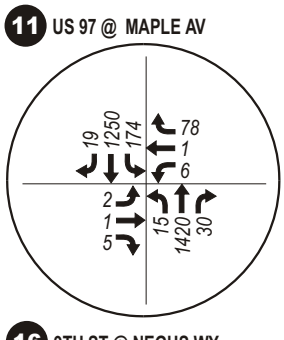


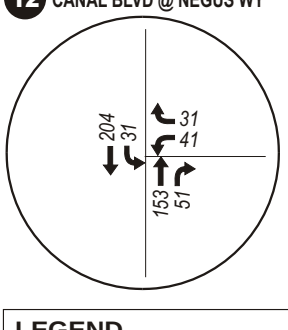


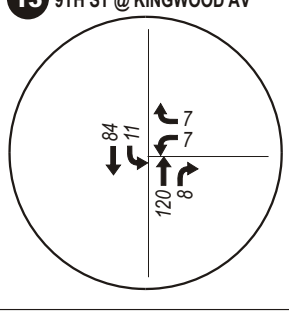


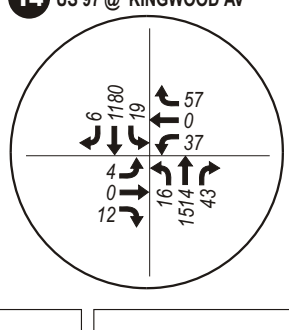


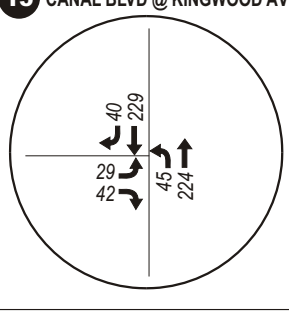


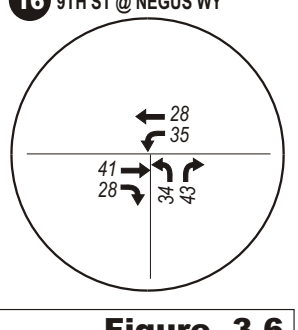












LEGEND

0 - Study Intersection Number

← *00* - Traffic Volume

Figure 3.6

2005 30TH HIGHEST HOUR TRAFFIC VOLUME

Table 3.J: 2005 30th Highest Hour Volume Intersection Operations

Intersection	Volume to Capacity Ratio		Level of Service		Performance Standard Met?
	measured	required	measured	required	
ODOT Facilities – Volume to Capacity Ratio Determines Performance Standard					
US 97 / O'Neil Hwy	>1.0 (WB)	0.80	F (WB)	E	No
US 97 / Spruce Ave	0.15 (EB)	0.80	C (EB)	E	Yes
US 97 / Maple Ave	>1.0 (WB)	0.80	F (WB)	E	No
US 97 / Kingwood Ave	>1.0 (WB)	0.80	F (WB)	E	No
O'Neil Hwy / Canal Blvd	0.14 (NB)	0.80	B (NB)	E	Yes
City of Redmond Facilities – Level of Service Determines Performance Standard					
Canal Blvd / Kingwood Ave	0.19 (SB)	-	B (EB)	E	Yes
Canal Blvd / King Way	0.10 (NB)	-	A (WB)	E	Yes
Canal Blvd / Negus Way	0.15 (WB)	-	B (WB)	E	Yes
Quince Ave / 10th St	0.05 (NB)	-	A (EB)	E	Yes
Maple Ave / 9th St	0.19 (SB)	-	B (SB)	E	Yes
Maple Ave / 19th St	0.12 (EB)	-	A (EB)	E	Yes
Kingwood Ave / 9th St	0.09 (NB)	-	A (WB)	E	Yes
Negus Way / 9th St	0.09 (EB)	-	A (WB)	E	Yes
Deschutes County Facilities – Level of Service Determines Performance Standard					
Yucca Ave / 17th St	0.03 (EB)	-	A (EB)	D	Yes
17th St / King Way	0.02 (NB)	-	A (NB)	D	Yes
Pershall Way /10th St	0.06 (NB)	-	A (NB)	D	Yes

Note: (XX) = critical movement

Because of the changing nature of US 97 through the IAMP area, additional analysis was conducted to better reflect operating conditions, including multi-lane highway capacity analysis for a section from NW Spruce Avenue to NW Maple Avenue. All analysis conducted was in accordance with Highway Capacity Manual methodologies. The results of the analysis, provided in Table 3.L, show that this section of US 97 is operating well under capacity during the 30 HV in 2005, and meets ODOT's adopted performance standard requiring operation at or below a volume to capacity ratio of 0.70.

Table 3.K: 2005 30th Highest Hour Volume Multi-lane Highway Analysis

Location	Measured V/C Ratio	Required V/C Ratio
US 97 Southbound: Spruce Ave. to Maple Ave.	0.42	0.70
US 97 Northbound: Spruce Ave. to Maple Ave.	0.45	0.70

CHAPTER 4: FUTURE TRAVEL FORECASTS AND NEEDS ANALYSIS

The travel demand model for the City of Redmond, prepared by ODOT's Transportation Planning Analysis Unit, was used to develop future traffic volumes for the year 2025 throughout the study area street network. Using these volumes, along with the future street network resulting from planned projects through 2025, the transportation system was evaluated and deficiencies were identified through the use of the same analysis procedures previously employed for the existing conditions. This chapter presents the future volumes at study area intersections, describes key assumptions and refinements used in the model development, and discusses the ability of the transportation system to accommodate forecasted growth.

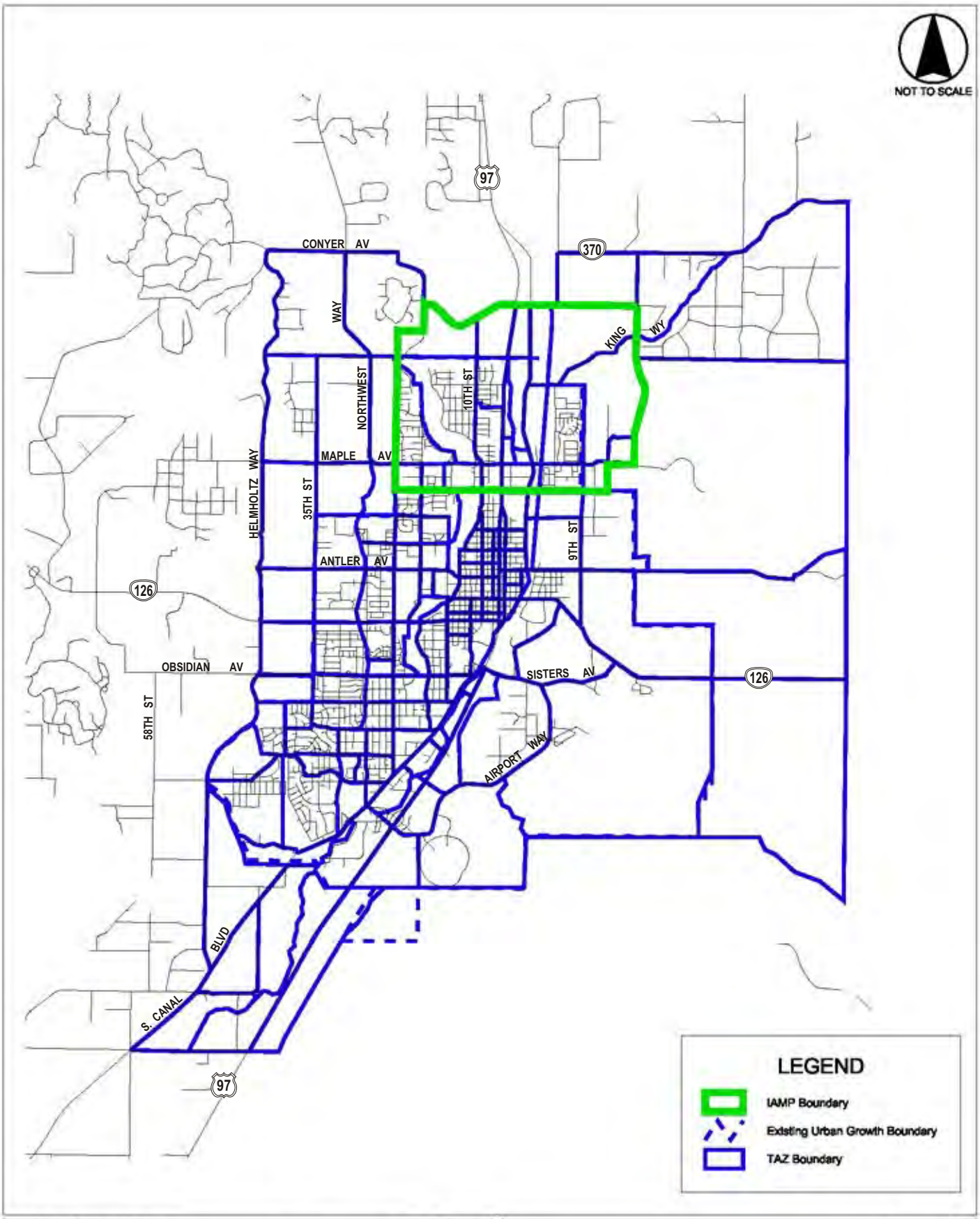
Model Assumptions

The City of Redmond travel demand model is divided into 148 small, internal geographic areas called Transportation Analysis Zones (TAZ) and eight external stations containing information related to base and future year households and employment. TAZs serve as the places where individual trips begin or end. External stations are similar to TAZs, but are located around the perimeter of the model area and represent origins and destinations associated with large geographic areas beyond the limits of the model. The creation of the internal TAZs was primarily based on aggregations of census blocks. Figure 4.1 displays the model TAZ network against the existing transportation system through the City of Redmond.

Trip generation associated with each TAZ is based on household characteristics, such as household size and number of workers, and trip purposes, such as home-based trips (e.g. home to work, school, shopping, and recreation) or non-home-based trips. Therefore, the number of trips generated during a given scenario is primarily dependent on the assumed quantity and locations of housing and employment. Table 4.A presents the total number of households and employees (separated into retail and other) assumed to be present within the model area for the base year 2000 and future year 2025 scenarios and compares them to show the growth experienced over this planning period. Also, Figures 4.3, 4.4, and 4.5 show the growth in housing and employment by TAZ within the model area. It should be noted that a buildable lands inventory was recently completed to provide an updated forecast of future trip patterns in the City of Redmond. This work is being incorporated into the City's Comprehensive Plan and will be used in future transportation planning efforts.

Table 4.A: Assumed Household and Employment Quantities

	Households	Retail Employees	Other Employees
Base Year 2000	7,418	2,330	5,492
Future Year 2025	18,356	4,969	13,040
Growth	147%	113%	137%



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Sources:
Oregon Department of Transportation
Deschutes County

Figure 4.1
REDMOND AREA MODEL
TRANSPORTATION ANALYSIS ZONE SYSTEM

The generated trips calculated from this information are distributed between TAZs in consideration of each TAZ's trip production and relative attractiveness. The attractiveness of a TAZ as a destination is determined by travel times from origin TAZs and the types of employment and number of households contained within the potential destination TAZ. Origins and destinations can be associated with either TAZs or external stations. When associated with TAZs, these trips are considered to be internal trip ends. External trip ends occur at the external stations surrounding the model area. Identifying the locations of trip ends as internal or external provides an understanding of the nature of travel during the modeled time period. For example, trips with internal origins and destinations indicate travel contained entirely within the model area, while trips with external origins and destinations indicate travel only passing through the model area (see Figure 4.2).

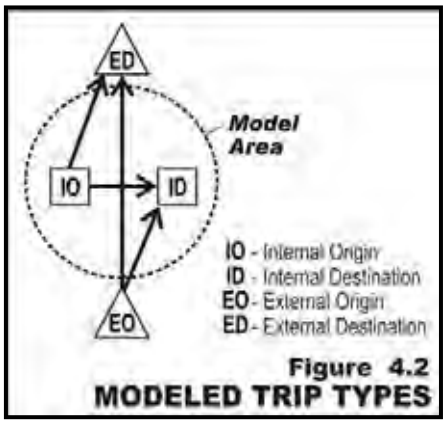


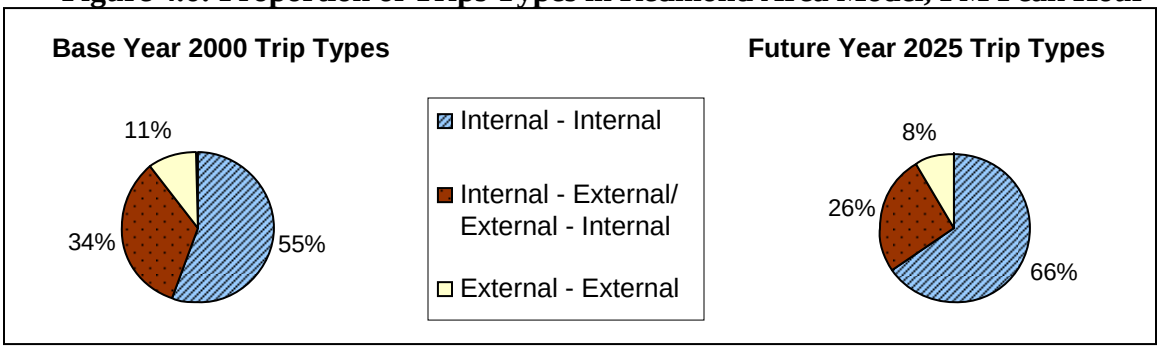
Figure 4.2
MODELED TRIP TYPES

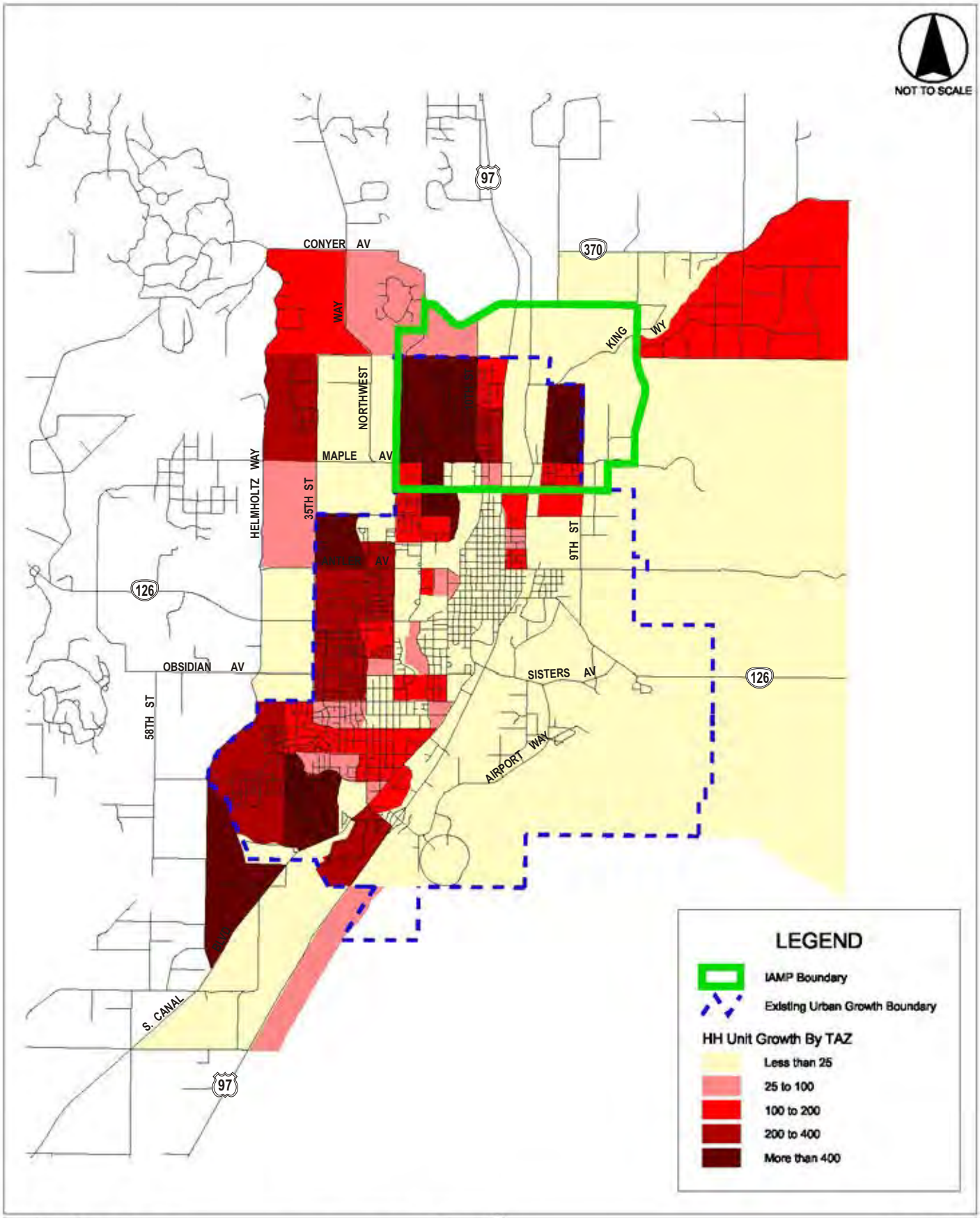
Table 4.B and Figure 4.6 display the assumed number of trips associated with internal and external origins and destinations in the base year 2000 and future year 2025 model scenarios. As shown in Figure 4.6, the travel demand model assumes a majority of trips occurring during the p.m. peak hour have both internal origins and destinations, while a minority of the trips has both external origins and destinations. Furthermore, the growth in local trips (internal – internal) is anticipated to exceed the growth in through traffic (external – external), with an annual growth rate more than two times the growth rate of any other trip type.

Table 4.B: Redmond Area Model Trip Types, PM Peak Hour

	Trip End Locations (origin – destination)			
	Internal – Internal	Internal – External/ External – Internal	External – External	Total Trips
Base Year 2000	5,235	3,174	1,005	9,414
Future Year 2025	13,100	5,290	1,670	20,060
Growth	150%	67%	66%	113%
Avg. Annual Growth Rate	6.0%	2.7%	2.6%	4.5%

Figure 4.6: Proportion of Trips Types in Redmond Area Model, PM Peak Hour





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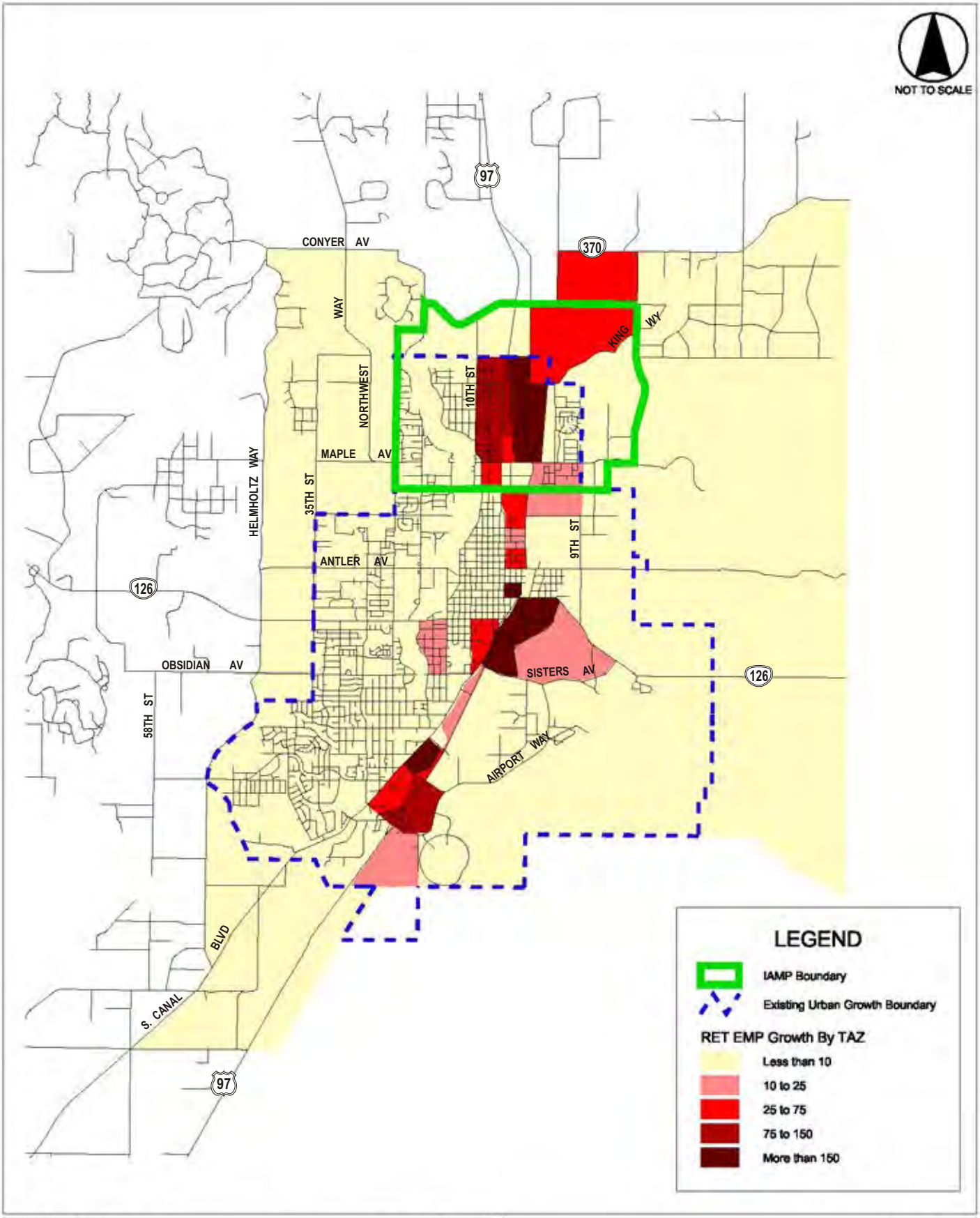
Sources:
Oregon Department of Transportation
Deschutes County

Figure 4.3
REDMOND AREA MODEL
HOUSEHOLD GROWTH FROM 2000 TO 2025



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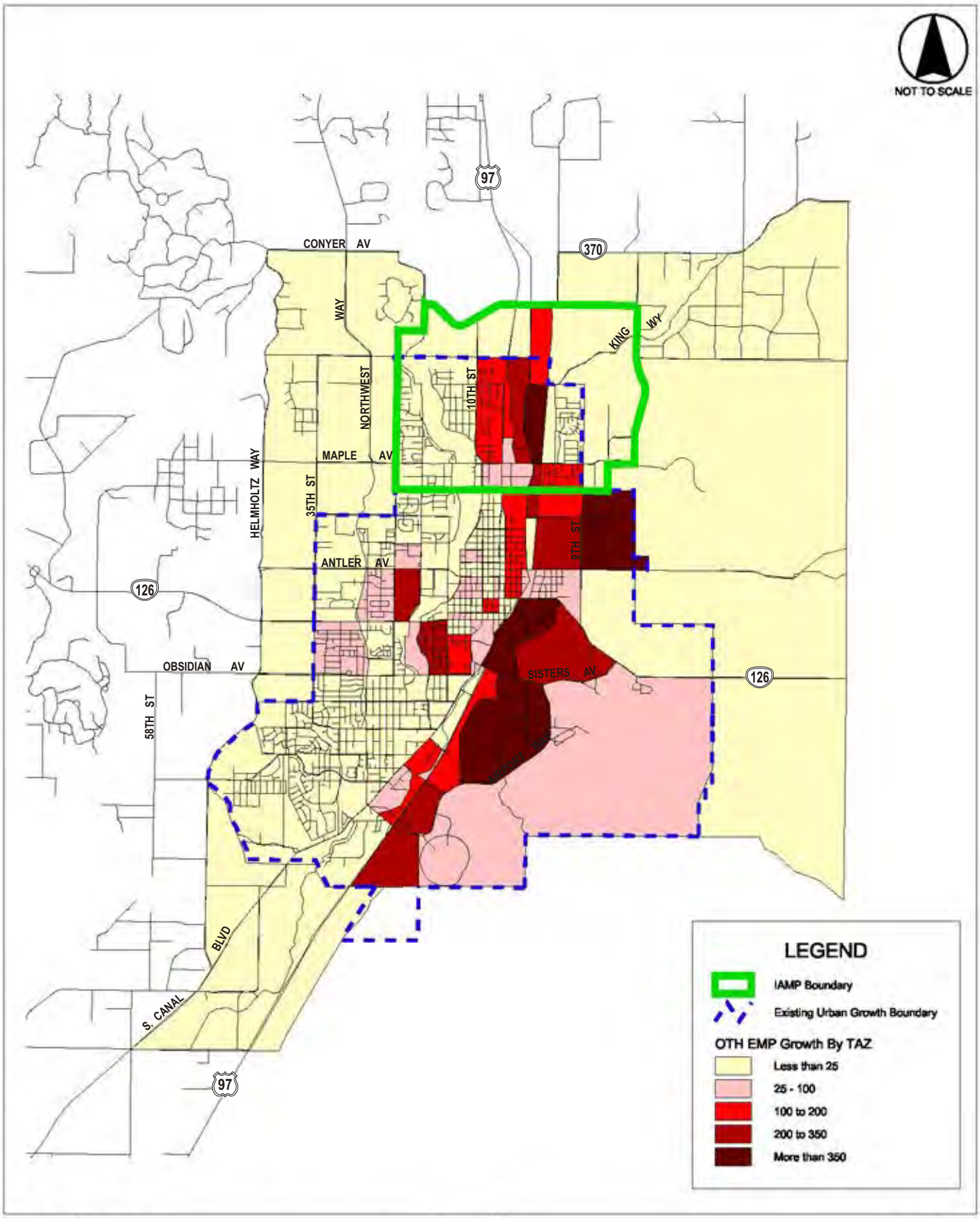
Sources:
Oregon Department of Transportation
Deschutes County

Figure 4.4
REDMOND AREA MODEL RETAIL
EMPLOYMENT GROWTH FROM 2000 TO 2025



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Sources:
Oregon Department of Transportation
Deschutes County

Figure 4.5
REDMOND AREA NON-RETAIL
EMPLOYMENT GROWTH FROM 2000 TO 2025

Model Network Refinement

The base year 2000 and future year 2025 model scenarios included different street networks, with the base year network closely resembling the existing transportation system and the future year network reflecting conditions planned to exist according to the City of Redmond's Transportation System Plan. Figure 4.7 provides a side-by-side comparison of the networks associated with these scenarios.

Prior to forecasting future volumes, the future year 2025 network was refined to better provide for the needs of this study. Refinements made to the network are listed below.

- Refinement of the US 97 Reroute north interchange area to more accurately reflect the current design;
- Quince Avenue extension from 10th Street to Canal Boulevard;
- Right-in/right-out connection to west side of US 97 Reroute at Larch Avenue;
- Right-in/right-out connection to east side of US 97 Reroute at Hemlock Avenue;
- Right-in/right-out connection to both sides of US 97 Reroute at Antler Avenue;
- Removed centroid connectors from US 97 Reroute and replaced them to local streets to reflect appropriate access restrictions;
- Extended 19th Street to Quarry Road;
- Removed centroid connection from TAZ paralleling east side of US 97 north of Quarry Road and reconnected to 19th Street extension; and
- Added diamond interchange on US 97 at Quarry Road.

Future Year Forecasts

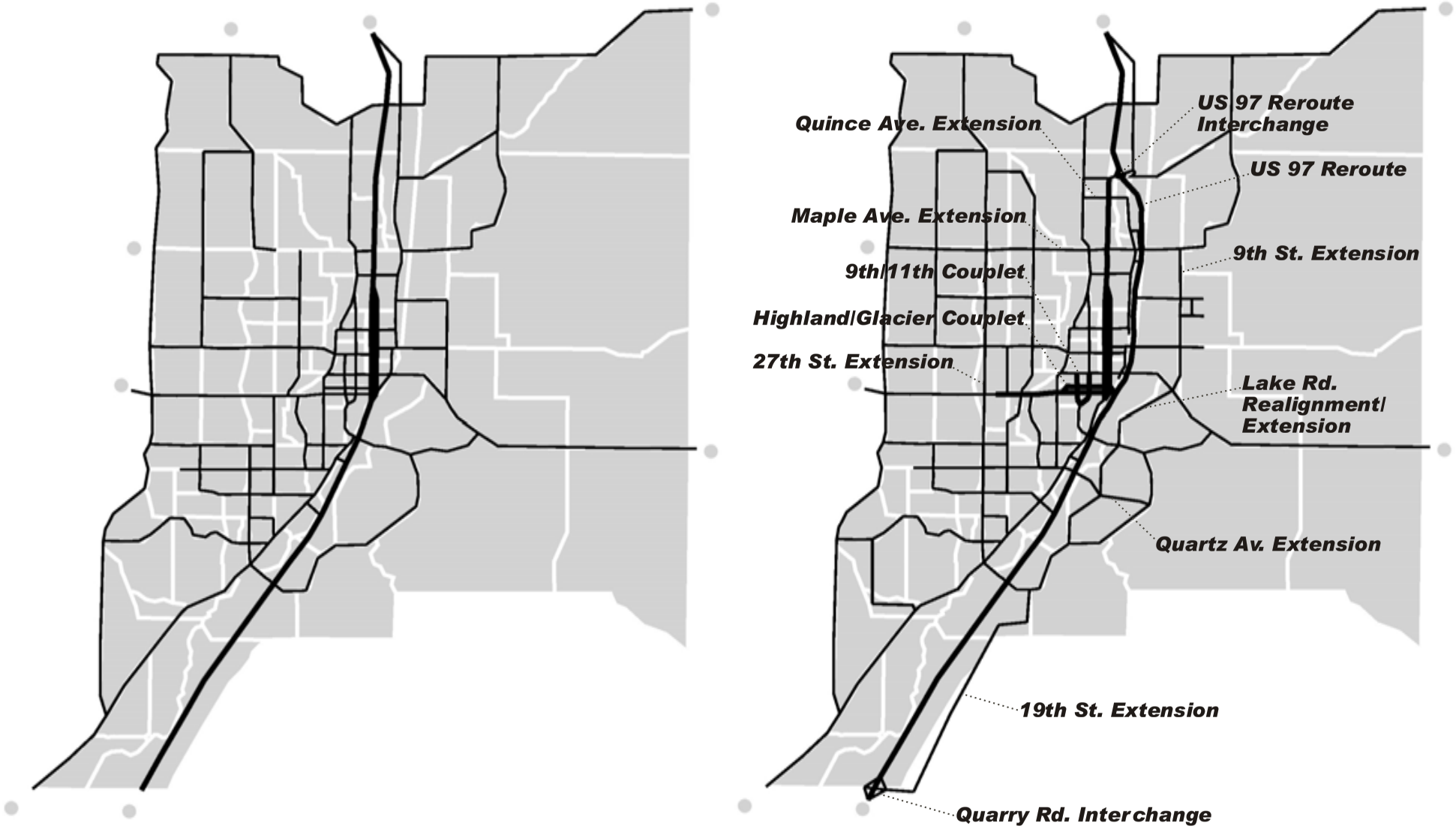
Using the Redmond travel demand model, future year traffic volumes were forecast for streets within the study area. Because the model forecasts average month traffic conditions, a seasonal factor must be applied to these volumes to reflect conditions during the design hour (equivalent to the 30th highest hour of the future year). However, because the growth between the base year model (2000) and future year model (2025) was applied to 2005 volumes that had already been adjusted with a seasonal factor, no further adjustments were necessary to reflect conditions in the desired design hour.

Turn movement volumes at study area intersections were primarily obtained through application of a post-processing technique where the incremental differences between the future and base year volumes from the model were added to the seasonally adjusted volumes collected in the field. Additional refinement was required for some intersections where the geometry was modified between the base and future years to ensure forecasted turning movements were consistent with the future year street network. For some movements experiencing extreme or unrealistic changes, a different post-processing technique was applied that included factoring the collected turn movement volumes under existing conditions by the ratio of the future model forecast volume to the base year model volume.

Because of the impact of the US 97 Reroute on north-south travel choices, screenlines were drawn along the major north-south routes in the study area (10th Street, US 97, Canal Boulevard, and the US 97 Reroute) to track north-south volume growth and trip distribution. This technique was used to aid in the assignment of future trips in a corridor where a major facility did not exist in the base year model, making a direct comparison of base and future year conditions difficult.

Base Year 2000 Network

Future Year 2025 Network
(Indicating Key Projects)



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TRANSPORTATION SOLUTIONS

Source: Oregon Department of Transportation

NO SCALE

LEGEND
- TAZ
- 2-Lane Roadway
- Multi-Lane Roadway

Figure 4.7
REDMOND AREA MODEL BASE & FUTURE YEAR STREET NETWORKS

Additional refinements to the forecasted volumes were made to account for the potential trips generated by a proposed Wal-Mart store to be located east of US 97 and north of Maple Avenue. By comparing the trips generated by the TAZs encompassing the approximate area to be developed by the Wal-Mart to the estimated trips generated by the Wal-Mart (as shown in the traffic impact study1), it was found that the proposed Wal-Mart would generate nearly three times the trips forecasted by the model for that property. Therefore, the trips associated with the subject property from the model were removed from the 2025 forecast and replaced with the trips from the proposed Wal-Mart store.

Figure 4.8 displays the forecasted turning movement volumes at study intersections for the year 2025. In addition to the post-processing procedures described above, these values have been balanced to produce reasonable volume fluctuations between adjacent study intersections. The degree of change allowed in traffic volumes between intersections was dependant on the distance between intersections and the quantity and quality of potential destinations and origins located between them.

Compared to the traffic volumes collected in 2005 (displayed in Figure 3.6), the most significant changes in the IAMP area occur on US 97, Maple Avenue, and 19th Street. The addition of the US 97 Reroute appears to have a significant effect on US 97 south of the new US 97/US 97 Reroute interchange, where forecasted volumes for 2025 are actually lower than current volumes experienced in 2005, with reductions ranging from 30 to 50% (approximately 800 to 1,400 vehicles per hour). However, to the north of the US 97 Reroute, traffic volumes on US 97 within the study area are projected to increase by approximately 25% (more than 525 vehicles per hour) over current volumes.

On the City street network, Maple Avenue is significantly impacted following the extension across Dry Canyon and the connection to Negus Way via a grade separated crossing of the US 97 Reroute. With these improvements in place, Maple Avenue will become an attractive east-west route providing connectivity between US 97, the residential properties to the west, and the employment opportunities to the east. To the west of US 97, traffic volumes are projected to increase on Maple Avenue to more than seven times current levels (increase of nearly 1,000 vehicles per hour), while to the east of the US 97 Reroute, an increase of approximately five times current levels (increase of over 600 vehicles per hour) is projected.

In addition, there is significant growth on 19th Street within the IAMP area, with traffic volumes increasing by more than two times current levels (increase of more than 570 vehicles per hour). This growth may be a result of increased housing, as illustrated in Figure 4.3.

Despite being severed by the proposed US 97 Reroute, Canal Boulevard also shows some significant growth north of Maple Avenue (approximately 45%). This growth is most likely the result of new development on properties between US 97 and Canal Boulevard that are currently vacant (see projected employment growth in Figures 4.4 and 4.5).

Positive growth also occurs on other local streets such as 10th Street, King Way, and 17th Street, but total traffic volumes in 2025 will remain relatively low (less than 500 vehicles per hour).

[1] Wal-Mart Traffic Impact Study conducted by Kittelson & Associates, Inc., 2005.

Assumed Future Street Network

As previously described, the future year 2025 travel demand model was refined to account for planned transportation projects in the area that would influence travel choices and change system capacity. To analyze system operations under this scenario, the Synchro model that was used to perform the operational analysis of study area intersections was updated to account for these projects and included several additional refinements of smaller scale that would not have impacted the route choice provided by the travel demand model. Such refinements typically included modifying lane configurations for streets and intersections undergoing improvements and installing traffic signals where they do not exist today. New traffic signals were installed in accordance with planned projects and a listing of intersections in the City Transportation Capital Improvement Plan (CIP) that are noted as being signalized when warranted. These intersections include:

- US 97 at Maple Avenue;
- US 97 at Kingwood Avenue;
- US 97 at Quince Avenue; and
- NW 19th Street at Maple Avenue.

Intersections on this list were assumed to be signalized by 2025 where the analysis of the unsignalized condition found operations failing to meet the applicable agency mobility standard and mitigation through other means did not appear feasible. An illustration of assumed traffic controls and lane configurations at study intersections is provided in Figure 4.9.

Future 2025 Operations

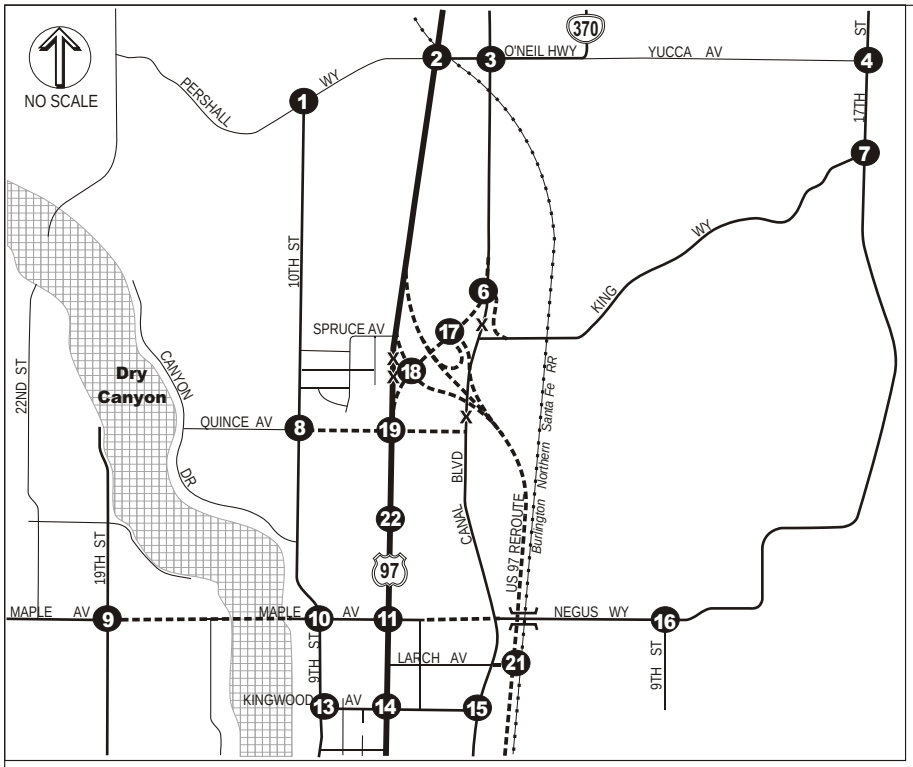
An operational analysis of the US 97 corridor and study area intersections for the design hour (future 30th highest hour of annual traffic, referred to as DHV) in 2025 was conducted for the IAMP area using the assumed lane configurations and traffic controls shown in Figure 4.9 and the forecasted traffic volumes documented in Figure 4.8. The analysis methodologies employed and corresponding results are discussed below.

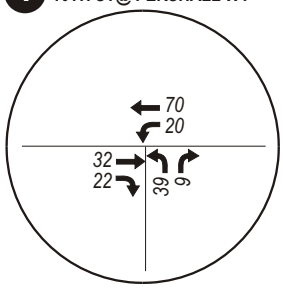
Performance Standards

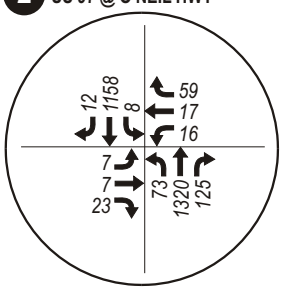
ODOT has designated US 97 as a Statewide Highway on the National Highway System, with an additional Freight Route designation. North of the Redmond urban growth boundary, US 97 also maintains an expressway designation. Within the IAMP area, ODOT also owns O'Neil Highway, which has been designated as a District Highway. Performance standards for these facilities have been adopted by ODOT in the 1999 Oregon Highway Plan2 (OHP). While these performance standards were amended in August of 2005, the changes made did not affect the study area, as all state highways within it operate with posted speeds of 45 mph or greater. Table 6 in Policy 1F of the OHP displays the maximum allowable volume to capacity ratios for the 30 HV in areas outside of the Portland Metropolitan Area. Sections from that table relevant to the study area are presented below in Table 4.3.

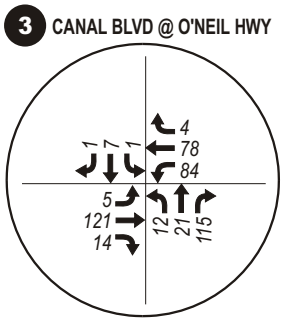
[2] *1999 Oregon Highway Plan*, Oregon Department of Transportation, 1999.

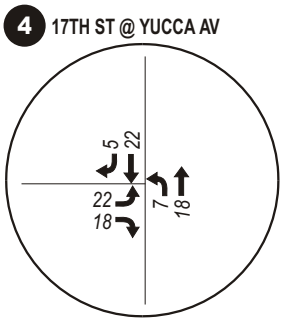
DKS Associates
TRANSPORTATION SOLUTIONS

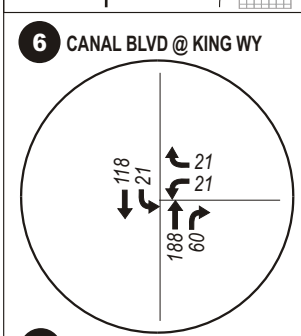


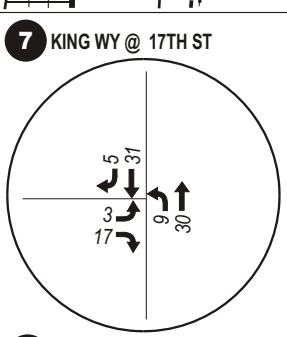


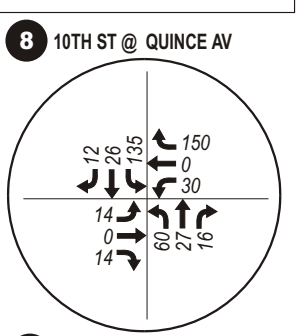


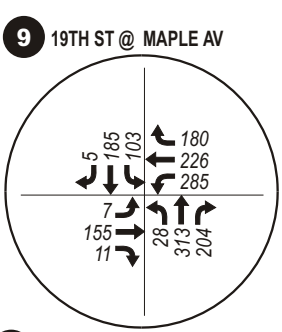


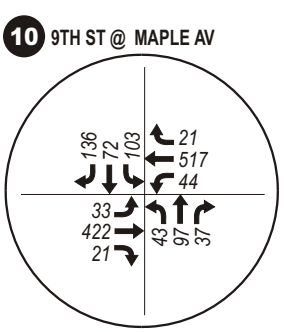


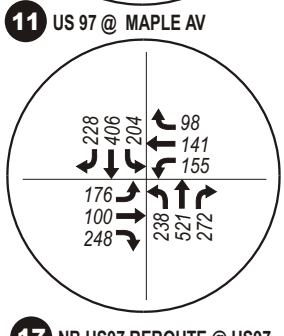


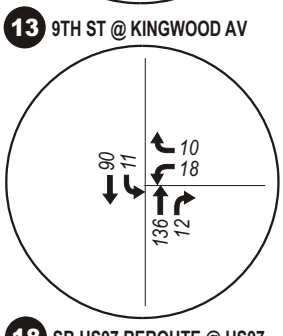


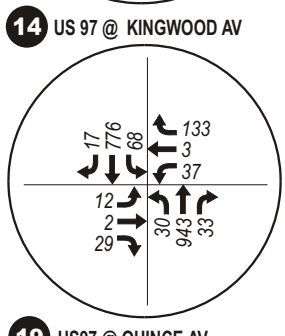


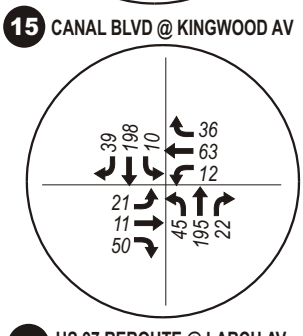


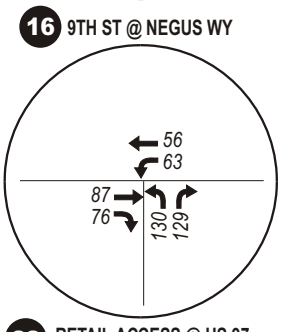


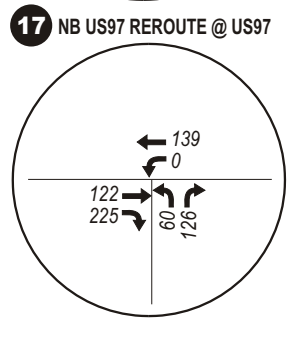


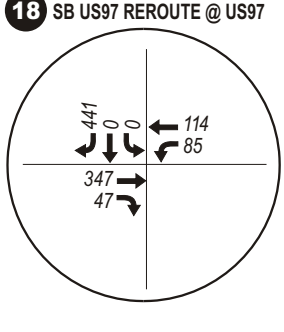


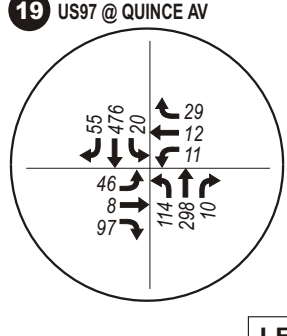


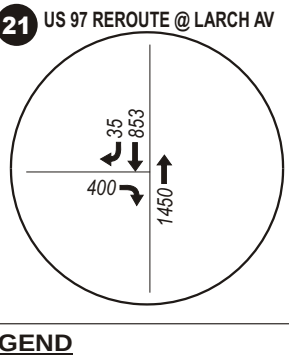


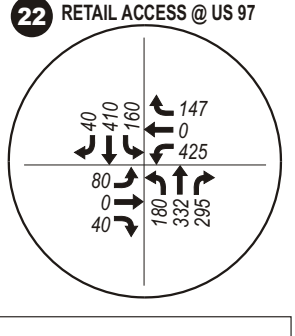








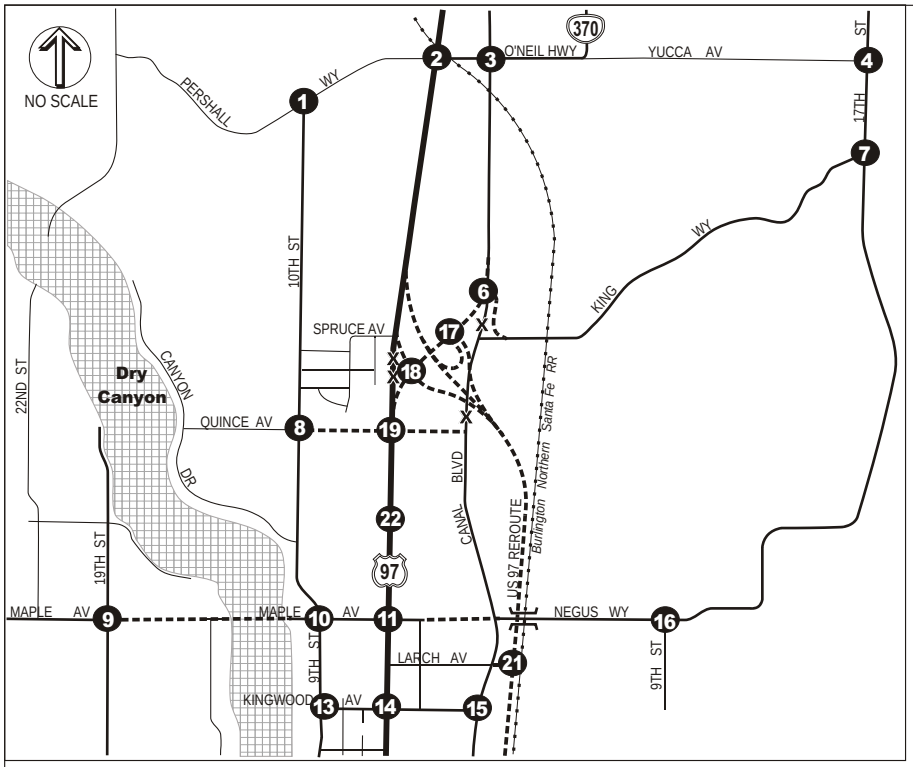


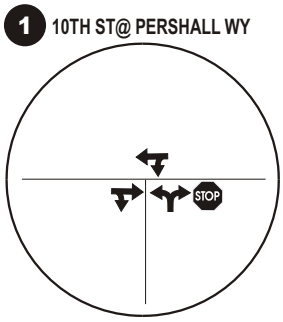


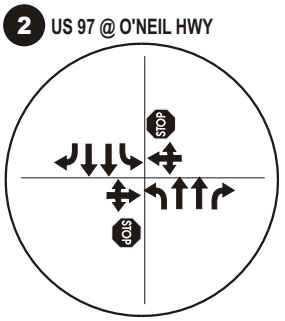
LEGEND

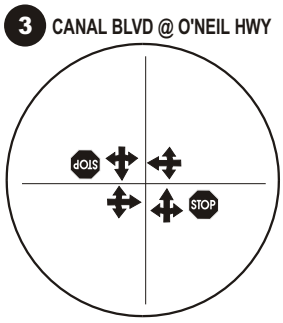
0 - Study Intersection Number
---- - Planned Roadways
X - Remove Roadway
00 - Traffic Volume

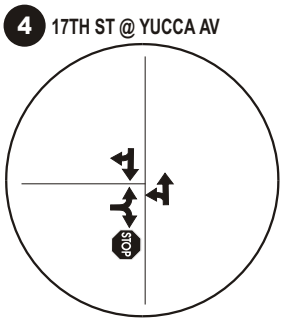
Figure 4.8
2025 NO BUILD DESIGN HOUR TRAFFIC VOLUMES

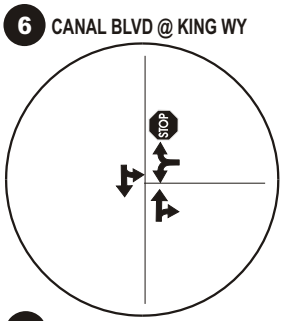


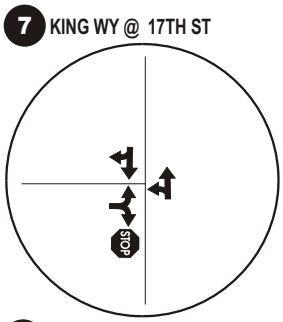


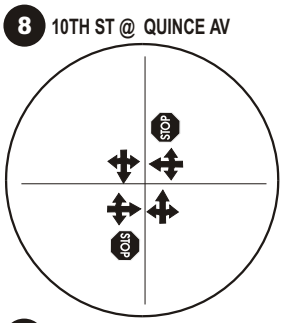


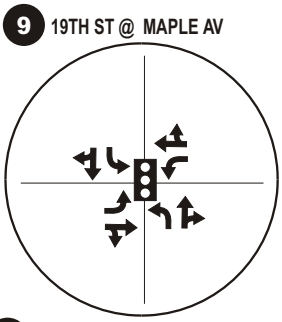


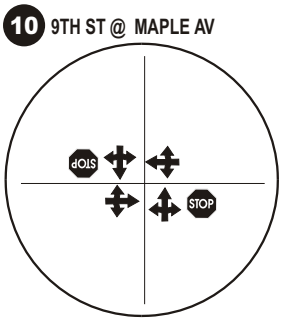


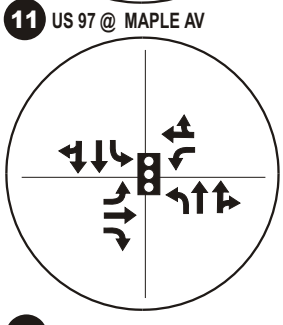


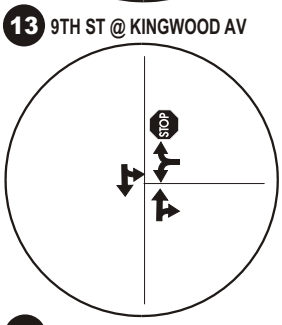


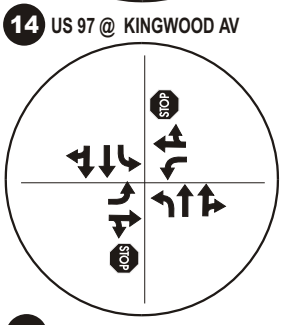


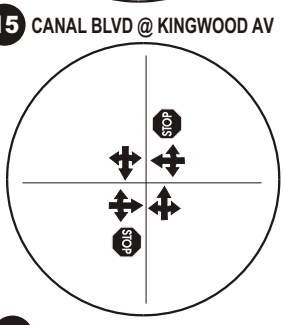


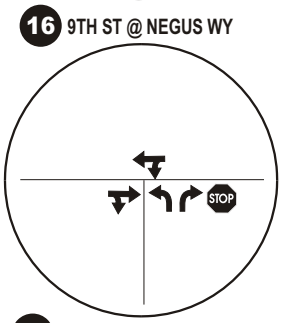


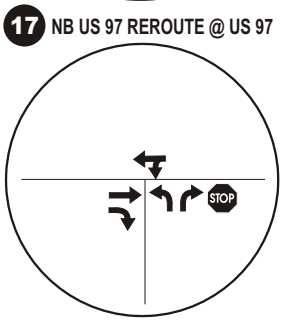


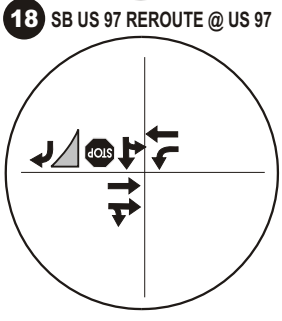


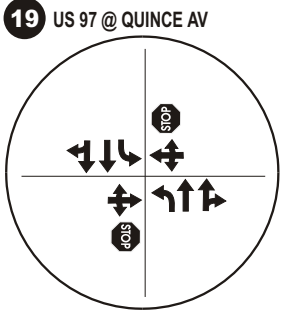


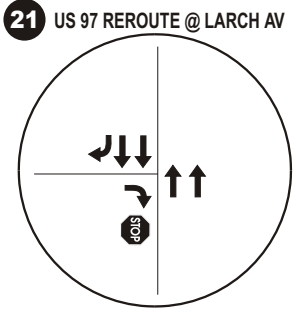












LEGEND

- 0 - Study Intersection Number
- ---- - Planned Roadways
- X - Remove Roadway
- ← - Lane Configuration
- STOP - Stop Sign Controlled Intersection
- Signalized Intersection

Figure 4.9

2025 ASSUMED INTERSECTION CONTROL AND LANE CONFIGURATIONS

Table 4.C: Maximum Volume to Capacity Ratios Outside Metro*

Highway Category	Land Use Type/Speed Limits	
	Inside Urban Growth Boundary	Outside Urban Growth Boundary
	Non-MPO where non-freeway speed limit > 45 mph	Rural Lands
Statewide Expressways	0.70	0.70
Statewide (NHS) Freight Routes	0.70	0.70
District/Local Interest Roads	0.80	0.75

* Source: 1999 Oregon Highway Plan, Table 6 (Policy 1F), as amended August 2005.

At unsignalized intersections, these standards are applicable only to movements that are not required to stop. For other movements at unsignalized intersections that are required to stop or otherwise yield the right of way, the standards for District/Local Interest Roads shall be applied for areas within urban growth boundaries and a maximum volume to capacity ratio of 0.80 shall be applied for areas outside of urban growth boundaries.

All non-state roadways within the Redmond UGB are under the jurisdiction of the City of Redmond. In addition, as ODOT and the City have formed an agreement that would transfer ownership of the existing US 97 alignment from the new interchange to Veteran's Way (section by-passed by the Reroute) following the construction of the interchange, the study intersections along this corridor were assumed to be under City jurisdiction by 2025 as well. The City has adopted standards for performance of City streets requiring operation of level of service "E" or better during the peak 15 minutes of the peak hour of the average weekday. A lesser standard is allowed at unsignalized intersections with low volume minor street approaches, requiring operation at a volume to capacity ratio less than 0.90 and a 95th percentile vehicle queue less than four vehicles during the peak hour.

For non-state roadways outside of the Redmond UGB, which are under the jurisdiction of Deschutes County, the Deschutes County Transportation System Plan includes a goal to maintain a level of service of "D" or better during the peak hour throughout the County arterial and collector road system over the next 20 years.

Intersection Operations

Study intersections within the IAMP area were analyzed through the use of the updated Synchro model that was used to examine existing conditions, along with the traffic volume data shown in Figure 4.8. From this analysis, intersection levels of service and volume to capacity ratios were obtained using Highway Capacity Manual3 methodologies for signalized and unsignalized intersections for comparison with the applicable jurisdiction's adopted performance standards. The results of this analysis are shown below in Table 4.4, and further illustrated in Figure 4.10. It should be noted that for unsignalized intersections, the operation of the critical movement (usually stop-controlled) is often of most interest. Therefore, the results provided in Table 4.4 for these intersections show the volume to capacity ratios and levels of service for the critical movements only.

[3] *Highway Capacity Manual*, Transportation Research Board, Washington, D.C., 2000.

When comparing this table to Table 3.H, which displays the results of the existing conditions analysis, it is noticed that operations at the intersections on US 97 at Maple Avenue and Kingwood Avenue have been improved, with US 97 at Maple Avenue meeting the City's adopted performance standards. Factors in the improved operations of these intersections included signalization and the addition of turn lanes at Maple Avenue, adding separate left turn lanes on the Kingwood Avenue approaches, and the drop in traffic volumes along US 97 resulting from the construction of the Reroute.

The intersection on US 97 at O'Neil Highway is left as the only intersection on state facilities failing to meet ODOT's performance standards. There are no planned projects to mitigate this intersection and the side-street volumes on O'Neil Highway and Pershall Way appear to be too low to justify signal installation on a high-speed, rural expressway. If safety becomes a concern at this location, the appropriate mitigation may be to offset the east and west approaches or restrict turning movements to right-in/right-out only. However, it should be recognized that issues such as topography, proximity to the proposed interchange, and availability of alternate routes may impact the decision on how to best mitigate this intersection.

While the intersection on US 97 at Kingwood Avenue will not meet the City's preferred performance standard, it may meet the lesser standard requiring operation at a volume to capacity ratio less than 0.90 and a 95th percentile vehicle queue less than four vehicles. The installation of a traffic signal "when warranted" is listed in the City CIP as a future project, but the side-street volumes on Kingwood Avenue appear to be too low to satisfy the signal warrants provided in the Manual on Uniform Traffic Control Devices4. As future development patterns surrounding this intersection may differ from those assumed in the City-wide demand model used, creating localized impacts to side-street volumes, this intersection should be monitored to note if side-street volumes increase enough to warrant signalization.

Also on the City street network, the intersection on Maple Avenue at 19th Street required mitigation including signalization and turn lanes in accordance with planned projects in the City's CIP calling for capacity improvements and a traffic signal. The only City intersection, other than US 97 at Kingwood Avenue, shown to be failing is on Maple Avenue at 9th Street. There is a project listed in the City CIP for this intersection calling for capacity improvements, but it appears a traffic signal may be necessary to meet the adopted performance standard.

Very little change is noticed in the operation of County intersections from the existing condition to the future condition, with all locations operating well within adopted performance standards.

Highway/Interchange Operations

In addition to analyzing the operations at study area intersections, US 97 and the new US 97 Reroute were also examined from O'Neil Highway to Larch Avenue. This included capacity analysis of the highway segments between O'Neil Highway and the new interchange and between the new interchange and Larch Avenue, as well as an analysis of the merging and diverging movements to and from the interchange ramps. All analysis conducted was in accordance with Highway Capacity Manual methodologies.
The results of the analysis, provided in Table 4.E, show that US 97 and the US 97 Reroute will operate well within ODOT's adopted performance standards throughout the study area.

[4] *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, Washington, D.C., 2003, p. 4C-1.

Table 4.D: 2025 No Build Design Hour Intersection Operations

	Intersection	Volume to Capacity Ratio		Level of Service		Performance Standard Met?
		Measured	required	measured	required	
	ODOT Facilities – Volume to Capacity Ratio Determines Performance Standard					
U	US 97 / O'Neil Hwy	>1.0 (EB)*	0.80	F (EB/WB)	E	No
U	US 97 / NB US 97 Reroute	0.14 (NB)	0.85	A (NB)	E	Yes
U	US 97 / SB US 97 Reroute	0.14 (EB)	0.85	A (WB)	E	Yes
U	US 97 Reroute / Larch Ave	0.76 (EB)	0.80	D (EB)	E	Yes
U	O'Neil Hwy / Canal Blvd	0.22 (NB)	0.80	B (NB)	E	Yes
	City of Redmond Facilities – Level of Service Determines Performance Standard					
U	US 97 / Quince Ave	0.40 (EB)	0.80	C (EB)	E	Yes
S	US 97 / Wal-Mart Access	0.59	0.70	D	E	Yes
S	US 97 / Maple Ave	0.69	0.70	C	E	Yes
U	US 97 / Kingwood Ave	0.72 (WB)	0.80	F (WB)	E	No
U	Canal Blvd / Kingwood Ave	0.30 (WB)	-	C (WB)	E	Yes
U	Canal Blvd / King Way	0.15 (NB)	-	B (WB)	E	Yes
U	Canal Blvd / Negus Way	0.71 (WB)	-	D (WB)	E	Yes
U	Negus Way / Canal Blvd	0.36 (SB)	-	C (SB)	E	Yes
U	Quince Ave / 10th St	0.27 (WB)	-	B (EB/WB)	E	Yes
U	Maple Ave / 9th St	4.57 (SB)	-	F (NB/SB)	E	No
S	Maple Ave / 19th St	0.90	-	D	E	Yes
U	Kingwood Ave / 9th St	0.10 (NB)	-	B (WB)	E	Yes
U	Negus Way / 9th St	0.25 (NB)	-	B (NB)	E	Yes
	Deschutes County Facilities – Level of Service Determines Performance Standard					
U	Yucca Ave / 17th St	0.06 (EB)	-	A (EB)	D	Yes
U	17th St / King Way	0.03 (EB)	-	A (EB)	D	Yes
U	Pershall Way /10th St	0.09 (NB)	-	B (NB)	D	Yes

Notes: (XX) = critical movement

S = signalized intersection * EB approach has no capacity

U = unsignalized intersection

Table 4.E: 2025 No Build Design Hour Multi-lane Highway & Ramp Analysis

Location	Direction of Travel	Measured V/C Ratio	Required V/C Ratio
O'Neil Hwy to North Interchange	Southbound	0.36	0.70
	Northbound	0.46	0.70
Off-ramp Diverge to Old US 97	Southbound	0.22	0.70
On-ramp Merge from Old US 97	Northbound	0.24	0.70
Off-ramp Diverge to Old US 97	Southbound	0.36	0.70
On-ramp Merge from Old US 97	Northbound	0.41	0.70
North Interchange to Larch Ave.	Southbound	0.27	0.70
	Northbound	0.44	0.70

Future 2025 Deficiencies

Traffic Operations

As previously discussed, and illustrated in Figure 4.10, most of the study area intersections are projected to operate within adopted performance standards in 2025. In addition, the US 97 Reroute and US 97 north of the new interchange will have adequate capacity to serve the forecasted future demand. In focusing on the operational deficiencies, three locations are identified:

- The intersection on US 97 at O'Neil Highway;
- The intersection on Maple Avenue at 9th Street; and
- The intersection on US 97 at Kingwood Avenue.

US 97 at O'Neil Highway

This intersection was shown to be failing to meet performance standards under existing conditions with the stop-controlled approaches operating at level of service F and v/c ratios greater than 1.00. While the volumes of traffic attempting to leave the stop-controlled approaches are fairly low, the high volumes of traffic on US 97 do not provide enough gaps in traffic to serve them. With traffic volumes projected to increase by 2025, this condition worsens.

While the installation of a traffic signal would mitigate operations to be well within the adopted standards, the volumes of traffic on the stop-controlled approaches appear to be too low to meet the required warrants for such an installation. In addition, given the isolated, rural nature of the surrounding area and the high travel speeds on US 97, the installation of a traffic signal at this intersection may conflict with driver expectations and could create a safety hazard.

With a majority of the traffic on the stop-controlled approaches being associated with right turn movements, a potential improvement may be to restrict turns (e.g. right-in and right-out movements only). However, a complete engineering investigation considering the impacts of such an improvement and the availability of alternate routes for the restricted movements should be conducted first.

Another option may to offset the east and west approaches. This type of improvement does not mitigate the left turn movements, but would convert the through movements to right turns, which typically require fewer gaps on the highway and can often operate more safely. To convert through movements to right turns, the west approach must be located to the north of the east approach. In this case, Cinder Butte may

make moving Pershall Way to the north infeasible and the proximity to the proposed interchange may make moving O'Neil Highway to the south undesirable.

Maple Avenue at 9th Street

The intersection on Maple Avenue at 9th Street operated well under existing conditions, but degraded significantly by 2025, operating at a level of service F and failing to meet the City's performance standard. The failing future operations are largely due to the increased volumes on Maple Avenue resulting from the street extension from Negus Way to 19th Street.

The City of Redmond CIP includes a project at this intersection for "capacity improvements" with estimated funding at approximately $35,000. Further analysis revealed that the installation of a traffic signal would be required to restore operating conditions to meet performance standards. New traffic signal installations typically cost around $175,000. The installation of a roundabout may be another option for improving this intersection, but was not investigated due to the limited right-of-way available in this area.

US 97 at Kingwood Avenue

This intersection operated very poorly under existing conditions, but has been shown to improve in 2025 due to decreased traffic volumes on US 97 and the addition of separate left turn lanes on the east and west approaches. However, it will not meet the City's preferred performance standard requiring operation of level of service "E" or better, but may meet the lesser standard allowing low volume minor street approaches to operate at v/c ratios less than 0.90 with 95th percentile vehicle queues less than four vehicles during the peak hour.

A traffic signal, which has been identified in the City CIP as a future improvement at this intersection, could restore operations such that City performance standards are be met, but the traffic volumes on the east and west approaches may be too low to meet signal warrants. Therefore, finding a suitable solution will require further study. As future development patterns surrounding this intersection may differ from those assumed in the City-wide demand model used, creating localized impacts to side-street volumes, this intersection should be monitored to note if side-street volumes increase enough to warrant signalization.

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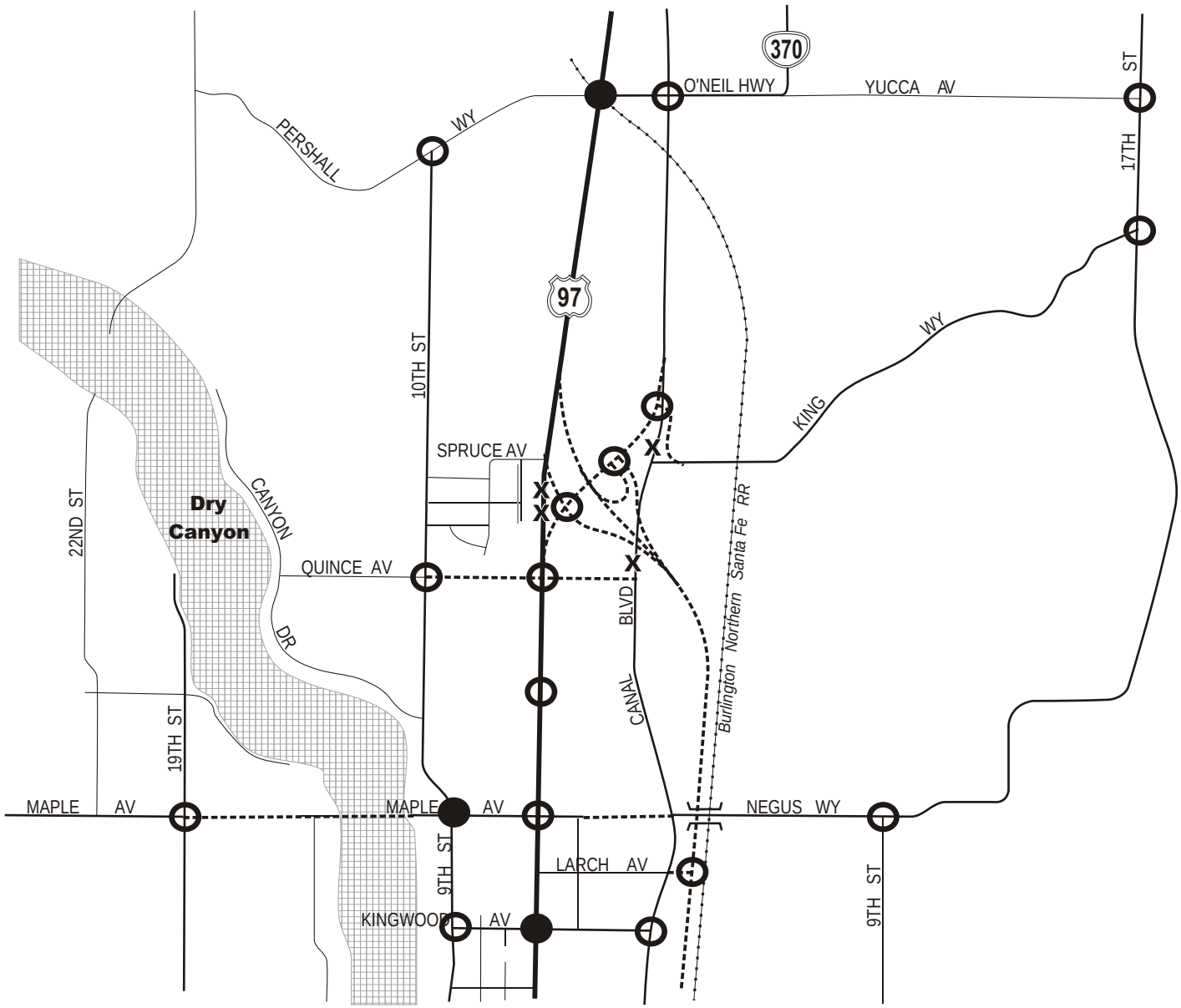
NO SCALE



LEGEND

- ● - Failing to Meet Adopted Performance Measures
- ○ - Meeting Adopted Performance Measures
- ----- - Planned Roadways
- X - Remove Roadway

Figure 4.10
IAMP AREA INTERSECTIONS FAILING TO MEET ADOPTED PERFORMANCE MEASURES - 2025 DHV

Access / Intersection Spacing

In Chapter 3, the existing access spacing on the area street network was compared to adopted access management spacing standards. It was found that on US 97, the number of approaches to the highway is far greater than would be allowed under ODOT's spacing standards, with access density increasing to the south. Access spacing on City streets generally met standards with some deficiencies noted to be related to public street intersection spacing on arterials. County roads were not assessed, as the County does not maintain access management spacing standards.

The changes to the state highway system resulting from the construction of the US 97 Reroute and interchange will require additional access management spacing standards to be applied to this area that specifically address interchange areas. Figure 4.11 displays US 97, the US 97 Reroute, and the new interchange (the primary routes of interests regarding access management), over an aerial photograph showing existing5 land development and associated access points and identifies different zones where access management spacing standards change. These zones are described below.

Zone 1: This zone includes the segment of US 97/US 97 Reroute bounded by the interchange, the interchange ramps, and the crossroad between the ramp terminals. According to OAR 734-051-0070(4)(a), "The Department shall not accept an application for an approach to a freeway, a freeway ramp, or an expressway ramp, or where an approach would be aligned opposite a freeway or expressway ramp terminal."

Recommendation: Within Zone 1, all access rights should be purchased and no access to the highway system should be allowed.

Zone 2: Zone 2 includes the interchange crossroads of US 97 and Canal Boulevard to the north and south of the interchange ramp terminals for a minimum distance of 1,320 feet. The southern section of this zone along US 97 (Zone 2A) covers an urban, multi-lane highway, with applicable access management spacing standards coming from Table 8 and Figure 4, as referenced in OAR 734-051-0125(2).

Recommendation: Within Zone 2A, a distance of at least 1,320 feet should be maintained between the interchange ramp terminal and the first right-in/right-out approach or first intersection allowing left turns and the last right-in/right-out approach and the start of the taper for the on-ramp.
The northern section along Canal Boulevard (Zone 2B) covers an urban, two-lane facility owned by the City of Redmond. While ODOT does maintain interchange area spacing standards for interchange crossroads, they are not directly applicable to facilities under the jurisdiction of other agencies. To maintain consistency with the treatment of access on the south side of the interchange, it is recommended that the City adopt ODOT's access management spacing standards for an area extending 1,320 feet from the US 97 northbound interchange ramp terminal. ODOT's access management spacing standards for two-lane crossroads in interchange areas are slightly different than those for multi-lane crossroads. As shown in Table 7 and Figure 3 of OAR 734-051, a distance of at least 1,320 feet should be maintained between the interchange ramp terminal and the first right-in/right-out approach or first intersection allowing left turns, but a shorter distance of 990 feet is allowed between the last right-in/right-out approach and the start of the taper for the on-ramp.

Recommendation: Within Zone 2B, a distance of at least 1,320 feet should be maintained between the interchange ramp terminal and the first right-in/right-out approach or first intersection allowing left turns.

[5] Photo taken in 2004.

A minimum distance of 990 feet should be maintained between the last right-in/right-out approach and the start of the taper for the on-ramp.

Zone 3: Zone 3 includes the remainder of US 97 south of the new interchange that is outside of Zone 2A. It is anticipated that the jurisdiction of this segment of US 97 will be transferred to the City of Redmond following the construction of the Reroute. This area maintains a lesser access spacing requirement than Zone 2A, but, as a major arterial[6], still demands a significant degree of protection. Assuming the current 45 mph speed zone is extended to cover this entire area, the City's adopted access management spacing guidelines from Table 15-2 in the City of Redmond Transportation System Plan (January 2000) require a separation of at least 800 feet between adjacent driveways and/or streets on the same side of the roadway and ½ mile between adjacent intersections.

Recommendation: Within Zone 3, a distance of at least 800 feet should be maintained between adjacent driveways and/or streets on the same side of the roadway. A minimum distance of ½ mile should be maintained between adjacent intersections.

Zone 4: Zone 4 includes the remainder of Canal Boulevard north of the new interchange that is outside of Zone 2B. With the exception of a small 200-foot segment at the southern end, which is City-owned, this section of Canal Boulevard is under the jurisdiction of Deschutes County, who does not maintain any access management spacing standards. However, since the land surrounding this roadway is included within the urban reserve area, it is recommended that the County adopt the current City of Redmond access management guidelines for major collector streets, requiring a minimum of 165 feet between driveways and/or streets and 330 feet between intersections. Implementing these guidelines will provide further protection for the interchange area and will ensure access spacing has been planned in accordance with City requirements prior to the roadway's future incorporation into the City.

Recommendation: Within Zone 4, it is recommended that the City continue to implement their adopted access management guidelines for major collector streets, requiring a minimum of 165 feet between driveways and/or streets and 330 feet between intersections. It is further recommended that the County adopt the same access management spacing guidelines for implementation on Canal Boulevard within this zone.

Zone 5: This zone includes US 97 to the north of the new interchange. While this section will continue to maintain the current alignment, the inclusion of the interchange will have a significant impact on access management needs. As a rural, Statewide Freight Route on the National Highway System and expressway with a posted speed of 55 mph, Table 2 from OAR 734-051 requires a separation of at least 5,280 feet (1-mile) between adjacent approaches on the same side of the highway. However, the construction of the new interchange will result in the application of spacing standards for interchange areas, which are more restrictive. According to Table 8 in OAR 734-051, these new spacing standards would require a minimum distance of 2 miles between the start of the ramp tapers and the nearest at-grade intersection (extending well beyond the IAMP area to nearly Davidson Way).

Recommendation: Within Zone 5, no direct access to the highway should be permitted. From Spruce Avenue north to O'Neil Highway, the City of Redmond and Deschutes County TSPs should be amended to show a frontage/backage road on both sides of US 97. At the time of development of redevelopment of properties adjacent to the highway, the City of Redmond and Deschutes County should require that a frontage/backage road be incorporated into the design of the development and should not allow any direct access to US 97. Where property adjacent to US 97 has access to a local street, through the application of

[6] As shown in the City of Redmond Urban Area Transportation Plan map (January 13, 2005).

local development regulations and OAR 734-051, the City, County, and State should require all new development to take access to the local street and not permit direct access to the highway.

Zone 6: Zone 6 includes the US 97 Reroute south of the new interchange. This zone is similar to Zone 5 in that the spacing standards for interchange areas from Table 8 in OAR 734-051 will apply, with the difference being that this area is entirely within the urban growth boundary. Therefore, the spacing standard from this table will require a minimum distance of 1 mile between the start of the ramp tapers and the nearest at-grade intersection (nearly reaching Hemlock Avenue). However, in the design of the US 97 Reroute, a right-in/right-out approach at Larch Avenue for southbound traffic has been included within this 1-mile envelope. To accommodate this element into the design, ODOT needs to approve a deviation to the access management spacing standards in Table 8 of OAR 734-051 prior to construction.

Recommendation: Within Zone 6, ODOT needs to approve a deviation to the access management spacing standards in Table 8 of OAR 734-051 for the US 97 right-in/right-out at Larch Avenue prior to construction.

Beyond the area bounded by the IAMP, it should also be acknowledged that ODOT maintains spacing standards for the separation of interchanges as well. For rural areas, these standards require 3 miles of separation between adjacent interchanges. For urban areas, a shorter distance of 1.9 miles is required. Therefore, with the proposed interchange in place, the construction of adjacent interchanges on US 97 would be restricted within an envelope ranging from approximately 11th Street in Terrebonne to the north and Highland Avenue to the south.

By looking at the number of access points per zone, the deficiency analysis (Chapter 3) an be refined to account for the future roadway system. Figure 4.12 displays the locations of existing access points along US 97 and the future crossroads over the new interchange and Table 4.F compares the number of existing access points in each access management zone to the number of access points that would be allowed to remain under the spacing standards applied in the description of each zone.

From Table 4.F, it can be seen that there are a significant number of access points that will require closure if compliance with spacing standards is to be attained. Options to explore for moving in the direction of the applicable access management spacing standards that should be considered during the development of preliminary improvement alternatives should include:

- The construction of new local roads to provide alternate access;
- The establishment of shared access points by creating easements; and
- The purchase of access rights for long-range protection.

Table 4.F: Access Deficiencies by Zone*

Access Management Zone	Existing Number of Access Points	Allowed Number of Access Points
1	7	0
2A	10	0
2B	10	1
3	41	10
4	15	30
5	22	0
6	N/A	0

* Includes existing access points only.

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NO SCALE

LEGEND

0 - Access Management Zone

- Future Study Area Arterial & Collector Roadways

Figure 4.11
ACCESS MANAGEMENT ZONES

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NO SCALE

LEGEND

- Access Point
- Planned Roadways
- US 97 Interchange Mainline and Crossroad
- Future Right-In/Right-Out Approach
- 6 - Access Management Zone

Figure 4.12
EXISTING ACCESS POINTS

Signal Spacing

ODOT's desired traffic signal spacing is ½-mile. While there are no traffic signals in the study area under existing conditions, there are several signals on US 97 planned for in the City of Redmond CIP that could be constructed in the future. These include signals at the intersections with Quince Avenue, a new public street to be constructed with the Wal-Mart development, Maple Avenue, and Kingwood Avenue. In addition, while it is currently unknown whether signals will be constructed at the interchange ramp terminals, it should be assumed that at some point in the future they will be needed there so as not to preclude their ability to function properly by locating another signal in close proximity.

On the City street system, another traffic signal is planned for in the City CIP at the intersection on Maple Avenue with 19th Street. In addition, while not currently planned for, the operations analysis of future conditions found that a traffic signal may be needed at the intersection on Maple Avenue at 9th Street as well.

It should be noted that signals spaced at least ½-mile (2,640 feet) apart generally do not impact each other and can operate without need for coordination. When closer than ½-mile, coordination of adjacent signals is typically recommended, especially on the state system, but the ability of the signals to operate well together is usually very good if spacing of at least ¼-mile (1,320 feet) is maintained. Under ¼-mile, coordination of adjacent signals is strongly recommended, with the ability of these signals to function without impacting each other degrading as spacing decreases.

Figure 4.13 illustrates the study area and identifies the locations of these potential future signals. As shown, with the exception of the signals at the interchange ramp terminals, the signals on US 97 would maintain spacing of at least 1,000 feet, with most signals being close to ¼-mile apart. On Maple Avenue, the signal at 9th Street would be approximately 1,000 feet from the signal on US 97. Therefore, the future signals on US 97 will all require coordination and the signal on Maple Avenue at 9th Street should be coordinated with the signal on Maple Avenue at US 97. Given the resulting signal spacing on US 97 from these planned signals, it is recommended that no additional signals be constructed south of the interchange on US 97 in the IAMP area.

Recommendation: Within the study area, with the exception of US 97 at the interchange ramp terminals, Quince Avenue, the proposed street to be constructed by Wal-Mart, Maple Avenue, and Kingwood Avenue, no additional signals should be approved on US 97 south of the interchange.

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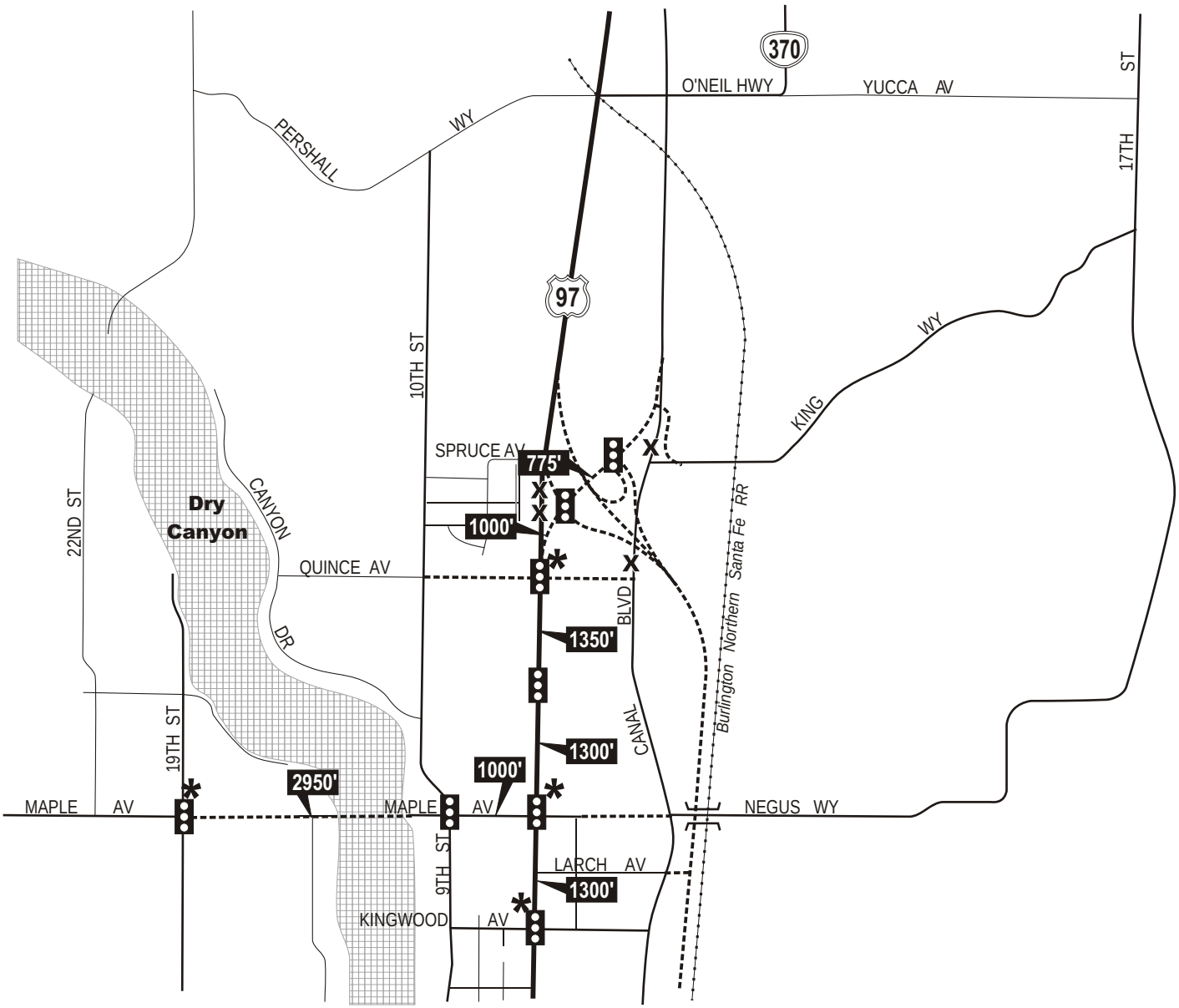
NO SCALE



LEGEND

- Potential Location of Future Traffic Signal
- 0000' - Distance Between Potential Location of Traffic Signal
- * - Planned in City CIP
- ----- - Planned Roadways
- X - Remove Roadway

Figure 4.13
POTENTIAL LOCATIONS OF FUTURE TRAFFIC SIGNALS IN THE IAMP AREA

Local Connectivity

When planning for future streets to enhance local connectivity in the IAMP area, consideration should be given to the following deficiencies.

- **Improving East-West Connectivity**: Within the IAMP study area, there are several north-south routes of significant length, but very few east-west routes due to a limited number of crossings at US 97, the canal, the railroad, and Dry Canyon (see Figure 3.3). This could result in increased demand at the available crossings, putting pressure on areas like Maple Avenue, O'Neil Highway/Pershall Way, and specifically at the intersections on US 97 at Maple Avenue, Quince Avenue, the northbound and southbound interchange ramp terminals, and O'Neil Highway/Pershall Way.
- **Providing Access to Lands Surrounding the US 97 Interchange**: The land surrounding the proposed interchange is predominantly vacant or underdeveloped (see Figure 3.1 and Figure 4.11). It should be anticipated that these lands would develop at urban densities with types of developments consistent with the commercial zoning. To ensure adequate access can be provided to these developments while maintaining the desired access management spacing standards on US 97 and the interchange crossroad, a local street plan should be adopted that will provide access to lands surrounding the interchange with connections to the interchange crossroad (US 97 and Canal Boulevard) located 1,320 feet from the interchange ramp terminals. This would result in all access provided through a future signal at Quince Avenue to the south and a new public street intersection on Canal Boulevard near the current urban growth boundary to the north. This plan should also include a new alignment of King Way to the north to improve the substandard spacing currently planned.
- **Reducing Access Points to US 97 to the North of the Interchange**: Much of the land to the north of the proposed interchange is currently outside of the urban growth boundary, with no public street intersections on US 97 prior to the intersection at O'Neil Highway/Pershall Way (see Figure 4.11). While some properties abutting US 97 can be accessed via 10th Street, Pershall Way, O'Neil Highway, or Canal Boulevard, there are several that can be accessed only from US 97. In recognition of the access management spacing standards and proximity to the new interchange that would prohibit direct access to US 97 in this area, a system of frontage roads or other local streets should be planned for to serve this area without creating access points to US 97 between the interchange and the intersection at Pershall Way/O'Neil Highway.

Freight Mobility

As noted in Chapter 3, the current land use zoning in the IAMP area includes commercial zoning down the middle surrounding US 97 and Canal Boulevard, with residential zoning of various densities to the east and west. While only a small amount of industrial land is located within the IAMP area, there is a significant amount to the southeast, including much of the lands within the City to the east of the railroad tracks.

There is a significant amount of truck traffic on US 97 moving freight through and within the City. While the US 97 Reroute should remove the through truck trips from the local system, other trips associated with origins or destinations within the City will remain. Considering the zoning surrounding this area, most local truck trips are anticipated to be traveling to and from the commercial and industrial developments along the highway and to the east of the US 97 Reroute. Therefore, the routes most heavily relied upon for freight movement in the IAMP area would include US 97, Canal Boulevard, Negus Way, NE 9th Street, and Quince Avenue within the commercially zoned area.

Of these routes, US 97 and NE 9th Street are currently constructed to accommodate truck traffic. The future projects to construct the US 97/US 97 Reroute interchange, the extensions of Quince Avenue and Negus Way, and the reconstruction of Canal Boulevard will need to consider freight movement requirements during the design process and should comply with the Highway Design Manual[7] for State facilities and the City of Redmond Standards and Specifications[8] for City streets. In addition, the design of future local streets planned to serve lands surrounding US 97 and the new interchange for the purpose of consolidating access (see "Local Connectivity" discussion above) should accommodate freight needs and should also be designed in accordance with the City's standards and specifications.

Bicycle and Pedestrian Facilities

While some bicycle and pedestrian facilities exist on the IAMP area streets, most of the arterial and collector routes studied maintain only partial improvements with many gaps needing to be filled (see Figure 4.14). The City of Redmond Transportation CIP contains several projects including bike lane construction, sidewalk construction, and complete street modernization/reconstruction that when completed will provide continuous bicycle and pedestrian facilities throughout most of the area's arterials and collectors, with some small gaps remaining to be filled by land development. The approximate locations of these planned projects are illustrated in Figure 4.14.

Multi-modal Constraints

The major modes of transportation existing within the IAMP area include motor vehicles (passenger cars and trucks), freight trains, bicycles, and pedestrians. With the construction of planned improvements listed in the City's Transportation CIP, the area street network will provide for adequate facilities for motor vehicle, bicycle, and pedestrian travel. As noted previously, the ability to facilitate these modes in the east-west direction is somewhat limited by the presence of Dry Canyon, US 97, the canal, and the Burlington Northern Santa Fe (BNSF) railway. These features may also have a significant impact on the development of future local street networks and frontage roads.

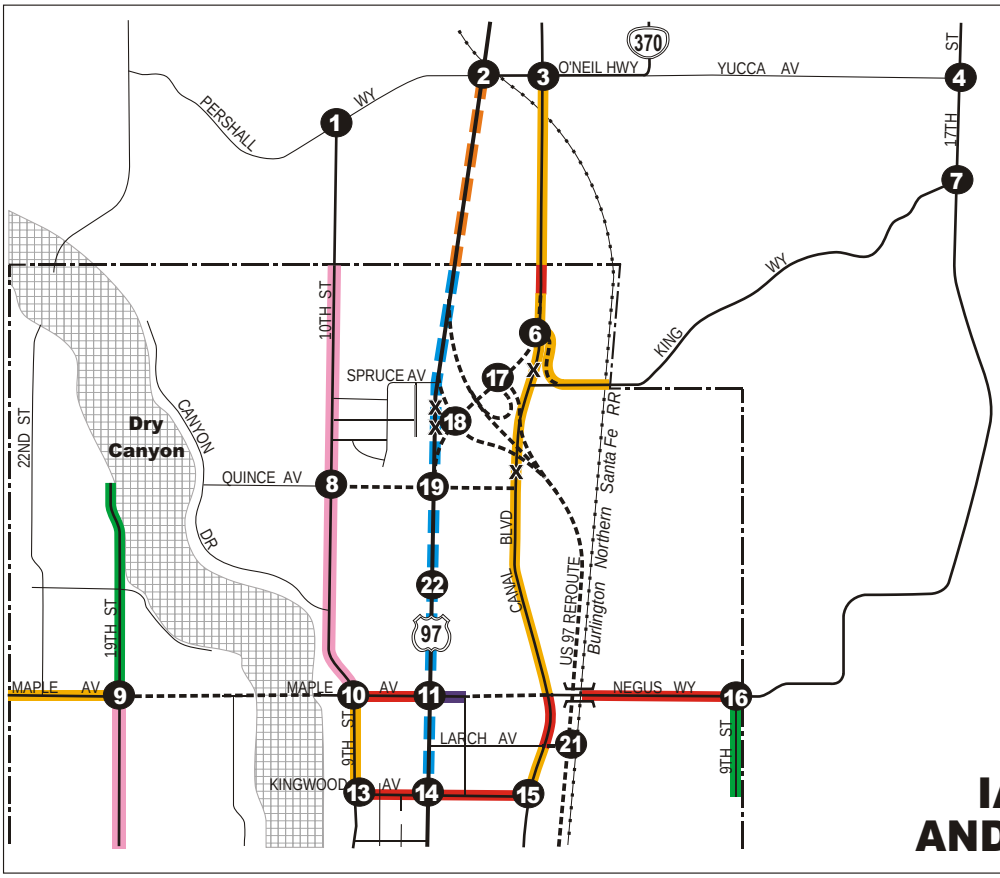
Potential Mode Conflicts

With the completion of the planned improvement projects in the City's Transportation CIP, most of the arterial and collector streets within the IAMP area will maintain separate bicycle lanes and sidewalks to minimize motor vehicle, bicycle, and pedestrian conflicts.
No new conflicts are anticipated to occur between rail movement along the BNSF railway and other transportation modes following the US 97 Reroute and interchange construction, as no new at-grade crossings are proposed and one existing at-grade crossing will be replaced by a grade-separated crossing. As future local streets are planned to enhance connectivity, the creation of additional at-grade crossings should be avoided.

Potential Right of Way Constraints

While much vacant or underdeveloped land remains in the IAMP area, there are a number of potential constraints to the purchase of additional right of way for future roadway alignments. In addition to existing developments, other features impacting potential roadway alignments include Dry Creek, the BNSF railway, the canal, lands zoned for park use, and lands zoned for exclusive farm use outside of the urban growth boundary.

[7] *Highway Design Manual*, Oregon Department of Transportation, 2003
[8] *Standards and Specifications*, City of Redmond Public Works Department, April 2003.



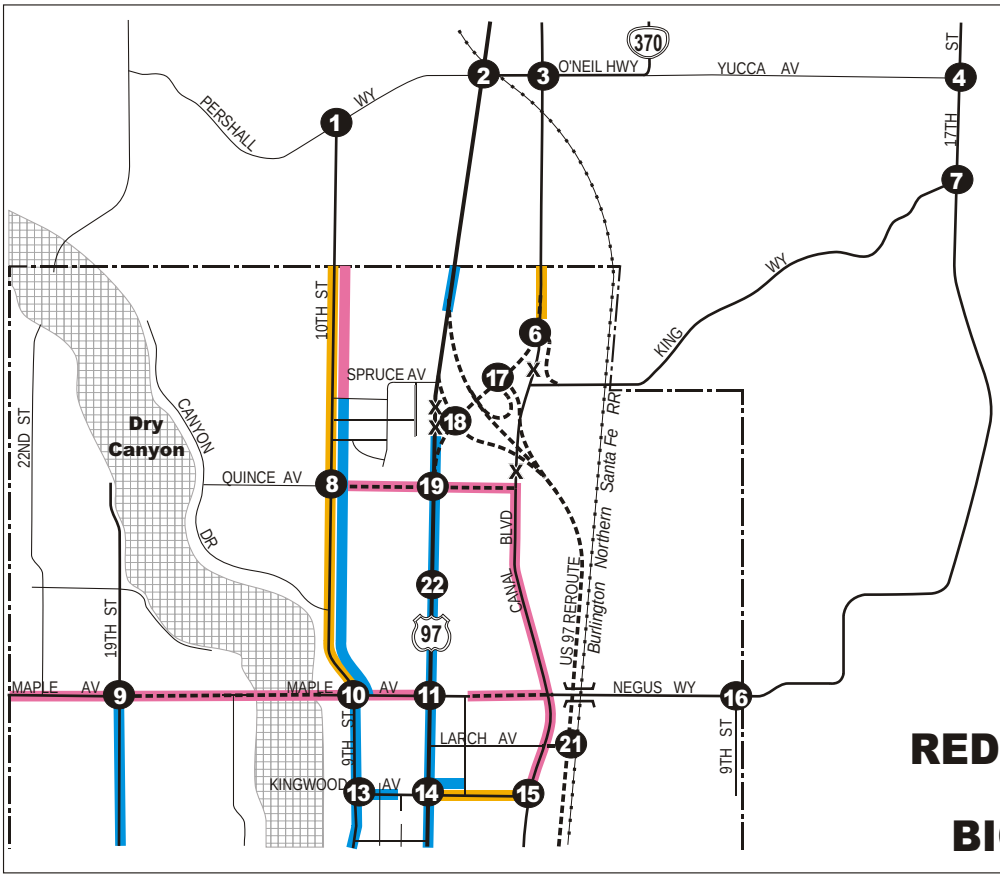
NO SCALE

LEGEND

- Sidewalk & Bike Lane
- Sidewalk, No Bike Lane
- Partial Sidewalk, Full Bike Lane
- Partial Sidewalk & Partial Bike Lane
- Partial Sidewalk, No Bike Lane
- No Sidewalk, Full Bike Lane
- No Sidewalk, No Bike Lane

0 - Study Intersection Number
X - Remove Roadway
- Planned Roadways
- Urban Growth Boundary

EXISTING IAMP AREA SIDEWALK AND BICYCLE FACILITIES



NO SCALE

LEGEND

- Modernization Project
- Bicycle Project
- Sidewalk Project

0 - Study Intersection Number
X - Remove Roadway
- Planned Roadways
- Urban Growth Boundary

REDMOND CIP PROJECTS WITH SIDEWALK OR BICYCLE COMPONENTS

Figure 4.14

CHAPTER 5: INTERCHANGE AREA MANAGEMENT PLAN

A range of facility improvements for providing adequate operation of the proposed interchange and surrounding transportation system were developed and evaluated. This chapter summarizes the facility improvements considered, including cost estimates, and provides prioritization for the implementation of these improvements through recommended short, medium, and long-range actions.

Transportation Facility Improvements

Transportation facility improvements are aimed at improving capacity and safety through measures such as traffic controls, turn lanes, enhanced street connectivity, and system management techniques. The transportation facility improvements considered are described below.

Traffic Controls & Geometric Improvements

In Chapter 4 a future deficiencies analysis identified three study area intersections that were projected to not meet adopted mobility standards. These locations included the intersections on US 97 @ O'Neil Highway, US 97 @ Kingwood Avenue, and Maple Avenue @ 9th Street. Improvements needed to restore operations in accordance with mobility standards at each location are described below.

US 97 @ O'Neil Highway

This intersection was shown to be not meeting performance standards under existing and future conditions with the stop-controlled approaches, operating at level of service F and volume-to-capacity ratios greater than 1.00. While the volumes of traffic attempting to leave the stop-controlled approaches are fairly low, the high volumes of traffic on US 97 do not provide sufficient gaps in traffic to serve them.

The installation of a traffic signal would mitigate operations to be well within the adopted standards, but the volumes of traffic on the stop-controlled approaches appear to be too low to meet the required warrants for such an installation. In addition, given the isolated, rural nature of the surrounding area and the high travel speeds on US 97, the installation of a traffic signal at this intersection may conflict with driver expectations and could create a safety hazard.

Apart from constructing a traffic signal, three other improvement options evaluated included:

- Implementing turn restrictions (Right-in/Right-out);
- Offsetting the intersection approaches; and
- Construction of an overpass.

With a majority of the traffic on the stop-controlled approaches being associated with right turn movements, a potential improvement may be to restrict turns (e.g. right-in and right-out movements only). Converting this intersection to right-in/right-out only would mitigate the failing operations and improve highway safety by eliminating the minor street through and left turn movements, which will experience very high delays in 2025. The existence of the right-in/right-out approaches would still fail to meet the access management spacing standard given the proximity to the new interchange, but would have a lesser degree of conflict with the interchange ramp movements than the existing configuration. However, such an improvement would result in a diversion of approximately 130 vehicles during the peak hour to other routes because several movements would no longer be available at this intersection. It would

also further degrade the east-west connectivity in the Redmond area, which is already limited. Another constraint to the implementation of this improvement option is the existence of developed properties whose only means of access is the highway. To restrict movement at US 97 and O'Neil Way to would make it extremely difficult to reasonably access the property with out the development of a local system of streets that could provide an alternate means of access to the properties.

Another alternative would be to offset the east and west approaches. This type of improvement does not mitigate the left turn movements, but would convert the through movements to right turns, which typically require fewer gaps on the highway and can often operate more safely. To convert through movements to right turns, the west approach must be located to the north of the east approach. In this case, Cinder Butte may make moving Pershall Way to the north infeasible and the proximity to the proposed interchange may make moving O'Neil Highway to the south undesirable. As this alternative would require the construction of new roadways, it would be more expensive to implement than the first alternative that restricts turn movements. It should also be noted that even with this improvement in place, the westbound approach is still expected to operate at a volume-to-capacity ratio of 0.67, which is greater than the maximum volume-to-capacity ratio of 0.60 allowed by the Highway Design Manual.1 Therefore, a design exception would be required before this alternative could be implemented.

Constructing an overpass would enhance east-west connectivity and would move in the direction of meeting ODOT's adopted access management spacing standards. However, this would be the most expensive alternative of the three considered and would only serve some of the smaller movements at this intersection, while cutting off the higher-volume ones. Like the first alternative that restricted turns, this alternative would also result in a diversion of traffic, but to a greater degree, with approximately 325 vehicles during the peak hour seeking new routes.

Considering these three improvement options, and the limitations associated with each, a phased approach to improvements at US 97 and O'Neil Highway was selected. The initial improvement is to restrict turning movements to right-in and right-out as warranted as an interim improvement after local connectivity has been enhanced to provide parallel routes to US 97 (see the Local Connectivity Plan), with the long-range improvement being the construction of an overpass. At the time the US 97 at O'Neil Highway intersection is restricted to right-in and right-out movements only, Canal Boulevard from O'Neil Highway to the new North Redmond interchange is to be evaluated for rerouting the O'Neil Highway to provide better access between US 97 and O'Neil Highway.

As previously noted, approximately 325 vehicles would be required to divert to other routes during the peak hour when the overpass is constructed, as no highway access would be allowed. Under the conservative assumption that all diverting traffic would reroute through the new North Redmond interchange via Canal Boulevard on the east side and 10th Street and Quince Avenue on the west side, the capacity analysis for study area intersections was revisited for the year 2025. It was found that all study intersections would continue to operate within adopted performance standards even with the turning movements removed from the US 97 at O'Neil Highway intersection.

As a note, while the analysis of the O'Neil Highway at Canal Boulevard intersection indicated operations would continue to be adequate in 2025 with traffic diverted in response to the construction of an overpass at US 97, the existing lane configurations and traffic controls may not be ideal to serve the new demand. With no direct access to US 97 from the existing intersection with O'Neil Highway, the dominant traffic movements are anticipated to be associated with the westbound left turns and northbound right turns, as vehicles divert to the new North Redmond interchange. Using typical applications of stop-sign traffic controls, where opposing approaches are required to stop, one of the two high-volume movements would

[1] *Highway Design Manual*, Oregon Department of Transportation, Table 10-1, 2003.

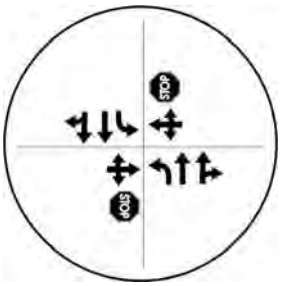
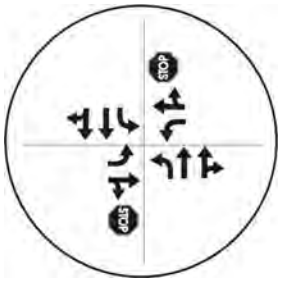
be required to stop with right of way being given to movements maintaining very low volumes. This configuration would not only be an inefficient way to serve traffic, but may conflict with expectations when O'Neil Highway is rerouted over Canal Boulevard to the south.

To improve intersection efficiency, stop-control could be shifted to the north and west approaches only. However, because that configuration is atypical and may be confusing to some motorists, other options for consideration should include roadway realignments to provide continuous, uncontrolled movements along the new O'Neil Highway approaches or the construction of a roundabout.

US 97 @ Kingwood Avenue

Despite decreased traffic volumes on US 97 (6th Street) resulting from the construction of the Reroute and the addition of separate left turn lanes on the east and west approaches, this intersection will not meet the City's preferred performance standard requiring operation of level of service "E" or better. A traffic signal, which has been identified in the City CIP as a future improvement at this intersection, will mitigate the failing minor street left turn movements and restore operations such that City performance standards are met. Because projected minor street volumes are low, the timing of the need for this signal is uncertain and may depend on the actual pattern of development in the area of the intersection. Therefore, the construction of the separate left turn lanes on the Kingwood Avenue approaches is to be implemented in the near term, with signalization being considered as a long-range improvement that would be implemented when warranted. Figure 5.1 provides a comparison of the 2025 no-build and mitigated scenarios.

Figure 5.1: US 97 at Kingwood Ave. Operational Improvements (2025)

No Build	Construction of Turn Lanes	Turn Lanes & Signalization
		
v/c = >1.0	v/c = 0.72	v/c = 0.53
LOS = F	LOS = F	LOS = B

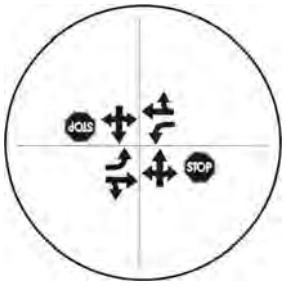
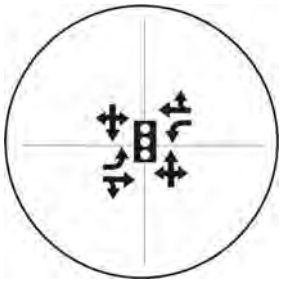
Maple Avenue @ 9th Street

The intersection on Maple Avenue at 9th Street was found to be operating at a level of service F and not meeting the City's performance standard by 2025. The failing future operations are largely due to the increased volumes on Maple Avenue resulting from the street extension from Negus Way to 19th Street.

Because Maple Avenue is classified as a minor arterial, it was assumed that future capacity improvements at this intersection would include the construction of separate left turn lanes on Maple Avenue, which would be consistent with the 3-lane standard cross-section shown in the City of Redmond Standards and

Specifications.2 However, even with this improvement in place, it was found that signalization would still be required to achieve acceptable operation. Because of the horizontal curve to the north on 9th/10th Street, sight distance for the northbound left turn traffic may be limited, requiring protected phasing. Figure 5.2 below, which compares the operations at this intersection in 2025 under the no-build (with CIP improvements in place) and mitigated conditions, shows the above described mitigation will provide operation consistent with the City's adopted performance standard requiring operation at a level of service E or better.

Figure 5.2: Maple Avenue at 9th Street Operational Improvements (2025)

No Build (w/CIP Improvements)		Proposed Mitigation	
			
v/c =	>1.0	v/c =	0.84
LOS =	F	LOS =	C

The City of Redmond CIP includes a project at this intersection for "capacity improvements" with estimated funding at approximately $35,000. New traffic signal installations typically cost around $175,000 (not including interconnect with adjacent signals, if needed), making the currently programmed project under-funded to construct all needed improvements. Therefore, an additional project must be added to the City CIP to construct a traffic signal at this intersection when warranted. The installation of a roundabout was not investigated due to the limited right-of-way available in this area.

Because the future deficiencies analysis found all other study area intersections to operate within adopted mobility standards in the year 2025, assuming planned projects in the City CIP and State STIP were in place, no other capacity improvements were considered.

Traffic Signal Plan

A future traffic signal plan was created to guide the orderly installation of traffic signals in the IAMP area, especially along US 97 (6th Street) and Canal Boulevard north of the proposed interchange, where poor progression of traffic due to inadequate signal spacing could impact long-term safety and operations at the proposed interchange ramp terminals.

Figure 5.3 displays a map of future traffic signal locations within the IAMP area to be used in evaluating potential conflicts with future proposals for traffic signals on the study area streets. This map identifies the locations of all currently planned traffic signals (there are currently no existing traffic signals) in the IAMP area, along with a future signal on US 97 (6th Street) between Maple Avenue and Quince Avenue

[2] *Standards and Specifications*, City of Redmond Public Works Department, April 2003.

that is anticipated to be constructed soon by an adjacent development and the recommended signal at the intersection of Maple Avenue and 9th Street described above.

A new signal on Canal Boulevard near the City of Redmond urban growth boundary has also been identified, as this would be the approximate location of the nearest traffic signal that could be constructed north of the interchange according to the recommended access spacing for this area. This signal would provide needed access to the lands surrounding the east side of the new interchange through future public streets (a future King Way alignment), as shown in the Local Connectivity Plan.

In evaluating future signal proposals, a traffic engineering investigation will need to be conducted to ensure that the proposed signal does not negatively impact the signals illustrated in Figure 5.3. A distance of at least 1,320 feet between new signals is to be required wherever feasible. Furthermore, no additional traffic signals will be constructed along the US 97 (6th Street)/Canal Boulevard corridor between Kingwood Avenue and the proposed King Way extension. In establishing the timing plans for all future signals, priority shall be given to the efficient operation of the interchange ramp terminals and the ability of the interchange crossroads to carry traffic away from the interchange.

Local Connectivity Plan

The future deficiencies analysis in Chapter 4 highlighted three areas where local connectivity was in need of improvement, including:

- Improving east-west connectivity;
- Providing access to lands surrounding the US 97 interchange; and
- Reducing access points to US 97 to the north of the interchange.

In response to these needs, a local connectivity plan was developed that builds on existing and planned streets in the IAMP area. This plan not only improves overall connectivity throughout the northern end of the City, but provides the ability eliminate direct approaches to US 97 and consolidate approaches to Canal Boulevard, while maintaining accessibility to individual properties in the corridor. Figure 5.4 displays the local connectivity plan, with key elements described below.

East-west connectivity will be enhanced through the proposed construction of:

- An overpass at the existing US 97 intersection with O'Neil Highway,
- A new street (Oak Avenue) from the intersection of Canyon Drive at 10th Street to Canal Boulevard. This new street would include a signalized intersection on US 97 (6th Street) between the intersections at Quince Avenue and Maple Avenue.
- A realigned of King Way, to include an overcrossing of the BNSF railroad, approximately ¼ mile north of the interchange
- Additional east-west streets are shown north of the proposed interchange, but no additional crossings of US 97 have been proposed as they would require costly grade separation.

To prevent access directly to the interchange crossroads within the access management spacing standards for interchange areas, new streets have been included to provide alternate access to properties in the immediate vicinity of the interchange. To the south of the interchange, these new streets would enable the first access point to US 97 (6th Street) to be limited to Quince Avenue, which is approximately 1,000 feet from the nearest interchange ramp terminal. To the north, the first access point would be limited to a new public street intersection near the current urban growth boundary (approximately 1,500 feet from the

nearest interchange ramp terminal), with an optional right-in/right-out approach on the west side of Canal Boulevard approximately 800 feet from the nearest interchange ramp terminal.

In recognition of the access management spacing standards for interchanges that would prohibit direct access to US 97 north of the proposed interchange within the IAMP area, a system of new public streets will be provided so that properties adjacent to US 97 can be accessed through City and County roads. While some of these roads may be constructed by land developers over time, it is recommended that the construction of select routes (identified in Figure 5.4 as "high-priority" streets) be prioritized so that they are in place within the next 5 to 10 years, which may require them to be incorporated into a capital improvement program.

All proposed streets shown in Figure 5.4 that are located within the urban growth boundary would be constructed to City of Redmond standards, with streets outside of the urban growth boundary being constructed to Deschutes County standards. Because of the relatively short segment lengths, it is assumed that all proposed streets would either be classified as collectors or local streets. According to the City of Redmond's Typical Minimum Street Cross Section Dimensions3, 5-foot wide sidewalks would be constructed as part of all collectors or local streets, with separate bike lanes only being constructed for major collectors and industrial collectors. Deschutes County's design standards4 do not include sidewalks for any road classifications, but allow for optional 4-foot wide bikeways on rural collectors.

Access Management Plan

A key element of the IAMP related to the long-range preservation of operational efficiency and safety of the proposed interchange is the management of access to the interchange crossroads (US 97/6th Street and Canal Boulevard), as well as to the mainline (US 97 and the Reroute). Because access points introduce a number of potential vehicular conflicts on a roadway and are frequently the causes of slowing or stopping vehicles, they can significantly degrade the flow of traffic and reduce the efficiency of the transportation system. By reducing the overall number of access points and providing greater separation between them, the impacts of these conflicts can be minimized.

Further Public Coordination Recommended
The access management actions in the IAMP are based on current property configurations and ownerships. Should property boundaries change in the future through consolidation or other land use action, the access management plan will be modified through agreement by the City of Redmond, Deschutes County, and ODOT, where such modifications will move in the direction of the adopted access management spacing standards contained in this plan. Additional access points will not be allowed where they would result from future land partitions or subdivisions. The actions listed in this plan shall not prevent the reconstruction of approaches as necessary to meet City, County, or ODOT standard design.

Implementation of the access management plan will occur incrementally over a long period of time because:

- Some affected properties maintain infrastructure (e.g. buildings and internal roadways) that was established based on prior approvals of access locations to the subject roadways, and
- Some elements of the plan depend on the presence of new local public streets that can not be constructed until funds are made available.

[3] *Standards and Specifications*, City of Redmond Public Works Department, April 2003.
[4] *Deschutes County Transportation System Plan*, 1998.

- The access management recommendations in this plan have been prioritized and categorized into short-range, medium-range, and long-range actions based on the constraints associated with their implementation. Short-range actions are to be executed during the construction of the interchange and the medium and long-range actions are to be executed as needed funds become available or as opportunities arise during property development/redevelopment.

To provide a basis for decision-making during the development of the access management plan, an access management strategy was established. The objectives of this plan are listed below.

1. Restrict all access from abutting properties to the interchange and interchange ramps.

2. Meet, or move in the direction of meeting, ODOT's adopted access management spacing standards for access to interchange crossroads.
    a. For US 97 (6th Street) from the southbound interchange ramp terminal to a distance of 1,320 feet to the south, the spacing standards from OAR 734-051-0125(2), Table 8 and Figure 4 apply, which would restrict all access for the full distance of 1,320 feet.
    b. For Canal Boulevard from the northbound interchange ramp terminal to a distance of 1,320 feet to the north, the spacing standards from OAR 734-051-0125(2), Table 7 and Figure 3 apply, which would restrict all access for the full distance of 1,320 feet, with a right-in/right-out access allowed on the southbound side of Canal Boulevard no closer than 990 feet from the interchange ramp terminal.

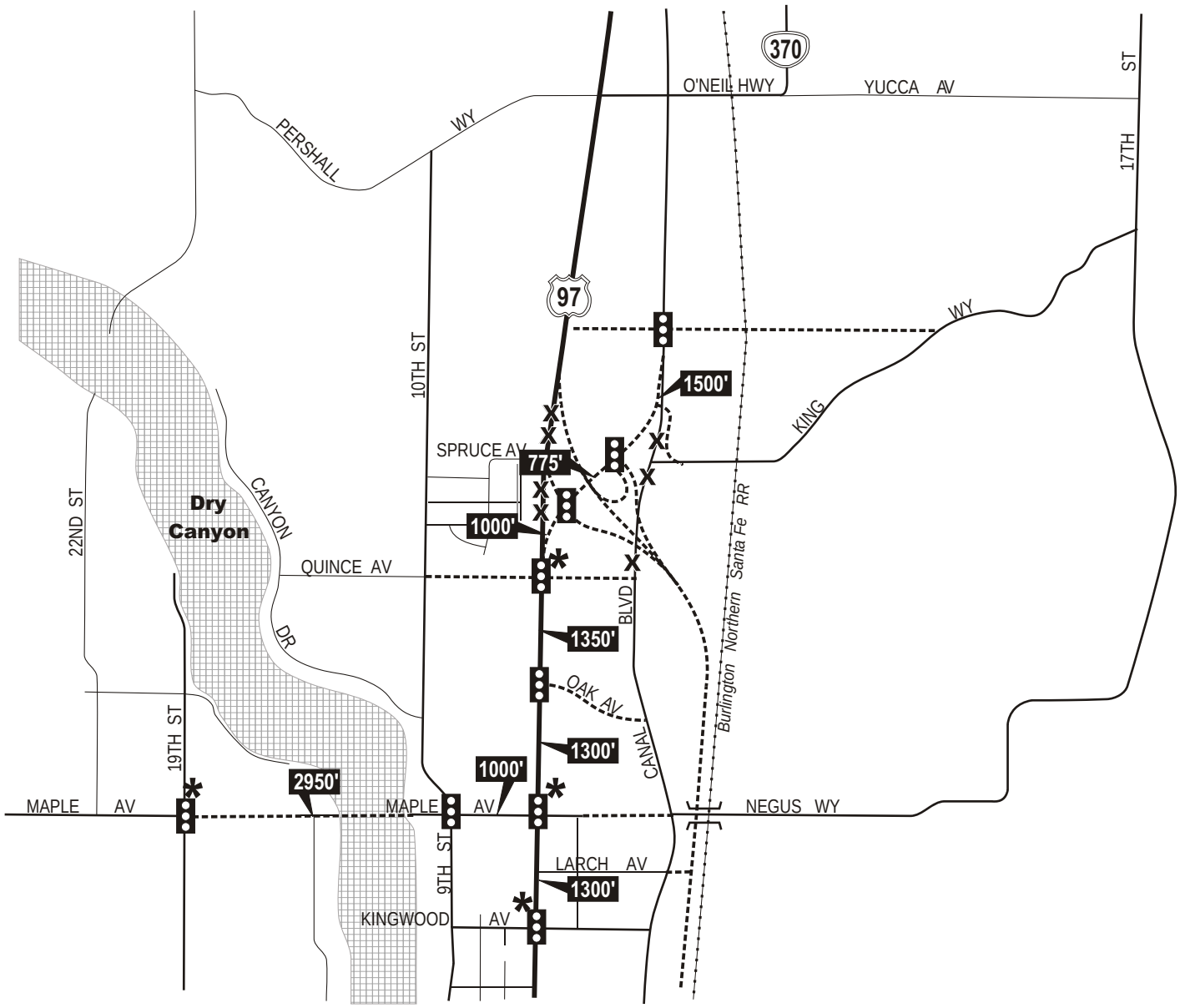
3. Meet, or move in the direction of meeting, the City of Redmond's adopted access management guidelines on US 97 (6th Street) from a point 1,320 feet from the southbound interchange ramp terminal to Kingwood Avenue (southern boundary of IAMP area). This would require access spacing of at least 800 feet between adjacent driveways and/or streets on the same side of the roadway and ½-mile between adjacent intersections.

4. In line with considering routing the O'Neil Highway down Canal Boulevard to the new North Redmond interchange, meet, or move in the direction of meeting ODOT's adopted access management spacing standards for access to District Highways.
    a. For the segment of roadway from a point 1,320 feet north of the northbound interchange ramp terminal to the urban growth boundary, the spacing standards for urban areas from OAR 734-051-0125(2), Table 4 would apply, which would require a minimum separation of 500 feet (assuming a posted speed of 40 or 45 mph) between approaches on the same side of the highway.
    b. For the segment of roadway outside the urban growth boundary, the spacing standards for rural areas from OAR 734-051-0125(2), Table 4 would apply, which would require a minimum separation of 500 feet (assuming a posted speed of 40 or 45 mph) between approaches on the same side of the highway.

5. Meet ODOT's adopted access management spacing standards for interchange mainlines.
    a. For US 97 between the interchange and O'Neil Highway (northern boundary of IAMP area), the spacing standards from OAR 734-051-0125(2), Table 8 and Figure 4 apply, which would restrict all access to US 97.
    b. For the US 97 Reroute between the interchange and Kingwood Avenue (southern boundary of IAMP area), the spacing standards from OAR 734-051-0125(2), Table 8 and Figure 4 apply, which would restrict all access to US 97. An exception to these standards may be allowed for a right-in/right-out approach at Larch Avenue, pending approval of a deviation by ODOT.

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE



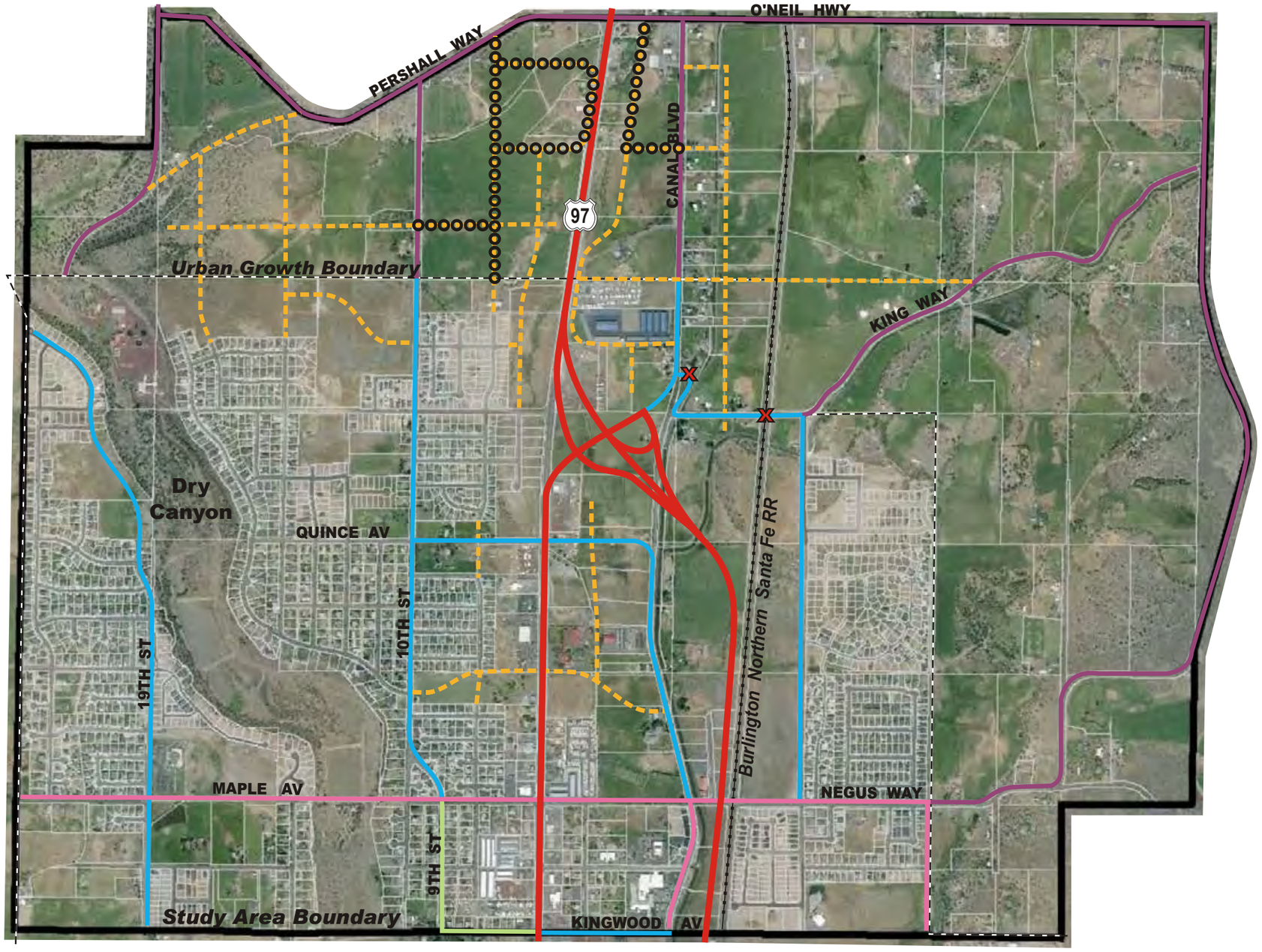
LEGEND

- Potential Location of Future Traffic Signal
- 0000' - Distance Between Traffic Signals
- * - Planned in City CIP
- ----- - Future Roadways
- X - Remove Roadway

Figure 5.3
TRAFFIC SIGNAL PLAN
North Redmond IAMP

DKS *Associates*
TRANSPORTATION SOLUTIONS

NO SCALE



LEGEND

- Major Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Rural Collector
- Proposed Street
- Proposed Street - ***High Priority***
- Close Street

Figure 5.4
LOCAL CONNECTIVITY PLAN
North Redmond IAMP

6. Purchase all abutting property access rights to US 97 (6th Street) and Canal Boulevard within 1,320 feet of the proposed interchange ramp terminals. Where accesses are allowed to remain within this area under the short-range action plan, access rights should be acquired with a temporary allowance to retain access until such time as reasonable alternate access becomes available.

7. In attempting to meet access management spacing standards, exceptions may be allowed to take advantage of existing property boundaries and existing or planned public streets, and to accommodate environmental constraints.

8. Replace private approaches with public streets, where feasible, to provide consolidated access to multiple properties.

9. Ensure all properties impacted by the project are provided reasonable access to the transportation system.

10. Align approaches on opposite sides of roadways where feasible to reduce turning conflicts.

11. Short-range actions shall accommodate existing development needs, unless property is to be purchased by ODOT.

Using this strategy, an action plan for each approach to the interchange mainline and crossroad was developed, as shown below in Table 5.A. The short-range actions will be implemented during the construction of the interchange. The medium-range actions are to be completed within 5 to 10 years, while the long-range actions are to be implemented over the 20-year planning period as funding becomes available or as opportunities arise through property development. The action plan has also been illustrated in Figure 5.5 to aid in the interpretation of the actions in Table 5.A.
Detailed information regarding approach and property characteristics, as well as existing access rights, has been compiled into inventory lists. These databases will provide needed information to ODOT staff in determining the appropriate procedure for executing the recommended actions in Table 5.1. The inventory lists, included in the appendix, have been separated into an existing approach physical inventory (Appendix 3) and an existing property access rights list (Appendix 4).

Table 5.A: North Redmond Access Actions

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
1	(Kingwood Ave.) No action.	Same as Short Range.	Same as Short Range.
2	No action.	Same as Short Range.	Same as Short Range.
3	No action.	Same as Short Range.	Same as Short Range.
4	No action.	Same as Short Range. Approach to remain in current location, aligned opposite Larch Ave.	Same as Short Range. Approach to remain in current location, aligned opposite Larch Ave.
5	No action.	Same as Short Range.	Same as Short Range.
6	Close approach upon property redevelopment. Future access to be taken from new shared	Same as Short Range.	Same as Short Range.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
	approach between tax lots 101 and 200 (see approach 7).		
7	Upon property redevelopment, approach to be relocated on or near property line between tax lots 101 and 200 to create a shared access between these properties. Easements shall be recorded to accommodate shared access. New approach shall align opposite the new combined approach between tax lots 1100 and 1000 (see approaches 72 and 73).	Same as Short Range.	Same as Short Range.
8	Close approach upon property redevelopment. Future access to be taken from Maple Ave. and/or shared approach with tax lot 200.	Same as Short Range.	Same as Short Range.
9	(Maple Ave.) No action.	Same as Short Range.	Same as Short Range.
10	No action.	Same as Short Range.	Same as Short Range.
11	Upon property redevelopment, approach to be relocated to abut northern property line of tax lot 500.	Same as Short Range.	Same as Short Range.
12	Close approach upon property redevelopment. Future access to be taken from approach 13.	Same as Short Range.	Same as Short Range.
13	No action.	Same as Short Range.	Same as Short Range.
14	Close approach upon property redevelopment. Future access to be taken from approach 15.	Same as Short Range.	Same as Short Range.
15	No action.	Same as Short Range.	Same as Short Range.
16	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
17	No action.	Acquire all access rights to US 97, with provision for temporary access to	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
		remain until such time as reasonable alternate access is made available.	easements).
18	No action.	Construct new public street.	Construct new public street.
19	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
20	No action.	Same as Short Range.	Approach to be relocated to abut northern property line of tax lot 600. Joint access to tax lots 600 and 500 shall be provided through easements. Access rights shall be modified to provide for joint access as described.
21	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
22	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
23	No action.	Close access. Alternate access available to Quince Ave.	Close access. Alternate access available to Quince Ave.
24	(Quince Ave.) No action.	Same as Short Range.	Same as Short Range.
25	(Spruce Ave.) Close access.	Same as Short Range.	Same as Short Range.
26	Close access. Alternate access available to Spruce & Teak.	Same as Short Range.	Same as Short Range.
27	Remain as right-in/right-out	Acquire all access	Close approach at such time as

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
	only, following construction of median barrier.	rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
28	Remain as right-in/right-out only, following construction of median barrier.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
29	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
30	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
31	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
32	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
33	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
34	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
35	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
36	(Pershall Way) No action.	Restrict turning movements to allow only right-ins and right-outs.	Close access and construct overpass of US 97.
37	(O'Neil Highway) No action.	Restrict turning movements to allow only right-ins and right-outs.	Close access and construct overpass of US 97.
38	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
39	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
40	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
41	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
42	No action.	Acquire all access rights to US 97, with provision for	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
		temporary access to remain until such time as reasonable alternate access is made available.	public roads or establishment of easements).
43	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
44	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
45	Close access. Alternate access available to Canal Blvd.	Same as Short Range.	Same as Short Range.
46	Close access. Alternate access available to Canal Blvd.	Same as Short Range.	Same as Short Range.
47	Close access. Alternate access available to Canal Blvd.	Same as Short Range.	Same as Short Range.
48	Close access. Alternate access available to Canal Blvd.	Same as Short Range.	Same as Short Range.
49	Close access. Retain all access rights to remainder property.	Same as Short Range.	Same as Short Range.
50	Close access. Retain all access rights to remainder property.	Same as Short Range.	Same as Short Range.
51	Close access. Retain all access rights to remainder property.	Same as Short Range.	Same as Short Range.
52	Close access. Retain all access rights to remainder property.	Same as Short Range.	Same as Short Range.
53	Close access. Retain all access rights to remainder property.	Same as Short Range.	Same as Short Range.
54	Close access. Alternate access available via other approaches.	Same as Short Range.	Same as Short Range.
55	Close access. Alternate access available via other approaches.	Same as Short Range.	Same as Short Range.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
56	Close access. Alternate access available via other approaches.	Same as Short Range.	Same as Short Range.
57	Close access and relocate near southern property line.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
58	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
59	No action.	Construct new public street (Quince Ave. extension).	Construct new public street (Quince Ave. extension).
60	No action.	Close access upon construction of new public street (approach 59).	Close access upon construction of new public street (approach 59).
61	No action.	Close access. Alternate access available via other approaches.	Close access. Alternate access available via other approaches.
62	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
63	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
64	No action.	Approach to be relocated approximately 75 feet to the south to align with an opposing	Approach to be relocated approximately 75 feet to the south to align with an opposing approach on the west side of US 97 (6th Street), constructed on tax lot 600 and abutting

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
		approach on the west side of US 97 (6th Street), constructed on tax lot 600 and abutting the northern property line (see approach #19). Approach shall provide joint access to tax lots 600 & 1000, with easements provided accordingly.	the northern property line (see approach #19). Approach shall provide joint access to tax lots 600 & 1000, with easements provided accordingly.
65	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
66	No action.	Acquire all access rights to US 97, with provision for temporary access to remain until such time as reasonable alternate access is made available.	Close approach at such time as reasonable alternate access becomes available (e.g. through construction of public roads or establishment of easements).
67	No action.	Construct new public street.	Construct new public street.
68	No action.	Close access upon construction of new public street (approach 67).	Close access upon construction of new public street (approach 67).
69	Access to be restricted to right-in/right-out when property redevelops.	Same as Short Range.	Same as Short Range.
70	No action.	Same as Short Range.	Access to be closed when approach 66 is converted to right-in/right-out.
71	Close approach upon property redevelopment. Access to be taken from internal streets to the east.	Same as Short Range.	Same as Short Range.
72	Close approach upon property redevelopment. Access to be taken from internal streets to the east.		Same as Short Range.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
73	(Maple Ave.) No action.	Same as Short Range.	Same as Short Range.
74	Close approach upon property redevelopment. Future access to be taken from Maple Ave.	Same as Short Range.	Same as Short Range.
75	Upon property redevelopment, approach to be relocated on or near property line between tax lots 1100 and 1000 and combined with approach 73 to create a shared access between these properties. Easements shall be recorded to accommodate shared access. New approach shall align opposite the new combined approach between tax lots 101 and 200 (see approach 7). Future access to be taken from Maple Ave. and the shared access between tax lots 1100 and 1000.	Same as Short Range.	Same as Short Range.
76	Upon property redevelopment, approach to be relocated on or near property line between tax lots 1100 and 1000 and combined with approach 72 to create a shared access between these properties. Easements shall be recorded to accommodate shared access. New approach shall align opposite the new combined approach between tax lots 101 and 200 (see approach 7).	Same as Short Range.	Same as Short Range.
77	Close approach upon property redevelopment. Future access to be taken from new shared approach between tax lots 1100 and 1000 (see approaches 72 and 73).	Same as Short Range.	Same as Short Range.
78	Close approach upon property redevelopment. Future access to be taken from Larch Ave.	Same as Short Range.	Same as Short Range.
79	(Larch Ave.) No action.	Same as Short Range.	Same as Short Range.
80	Upon redevelopment, reconstruct approach to align	Same as Short Range.	Same as Short Range.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
	opposite approach 3 to tax lot 400.		
81	Close approach upon redevelopment. Future access to be taken from approach 77.	Same as Short Range.	Same as Short Range.
82	Close approach upon property redevelopment. Future access to be taken from Kingwood Ave.	Same as Short Range.	Same as Short Range.
83	(Kingwood Ave.) No action.	Same as Short Range.	Same as Short Range.
84	Close access and restrict all access rights along Canal Blvd./US 97.	Prohibit direct access to tax lot 700 from Canal Blvd./US 97. Future access to be provided by new local streets.	Prohibit direct access to tax lot 700 from Canal Blvd./US 97. Future access to be provided by new local streets.
85	Close approach. Access to be provided from approach 86.	Future access to be provided by new public streets providing reasonable alternate access.	Future access to be provided by new public streets providing reasonable alternate access.
86	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
87	No action.	No action.	Close approach upon construction of new public streets providing reasonable alternate access.
88	No action.	Construct new public street.	Construct new public street.
89	Approach may remain upon property redevelopment. New approach may be relocated along property frontage, with minimum approach spacing of 500 feet provided between adjacent approaches.	Same as Short Range.	Same as Short Range.
90	No action.	Construct new public street.	Construct new public street.
91	Approach may remain upon property redevelopment. New approach shall be relocated along property frontage, aligned opposite the future public street approach (see approach 96).	Same as Short Range.	Same as Short Range.
92	Close approach upon property	Same as Short Range.	Same as Short Range.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
	redevelopment.		
93	(O'Neil Highway) No action.	Same as Short Range.	Same as Short Range.
94	(O'Neil Highway) No action.	Same as Short Range.	Same as Short Range.
95	Close approach upon property redevelopment. Future access to be provided by new public streets providing reasonable alternate access(see approach 96).	Same as Short Range.	Same as Short Range.
96	No action.	Construct new public street.	Construct new public street.
97	Approach may remain upon property redevelopment. New approach may be relocated along property frontage, with minimum approach spacing of 500 feet provided between adjacent approaches.	Same as Short Range.	Same as Short Range.
98	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
99	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
100	No action.	Construct new public street.	Construct new public street.
101	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
102	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
103	Approach may remain upon property redevelopment. New approach may be relocated along property frontage, with minimum approach spacing of 500 feet provided between adjacent approaches.	Same as Short Range.	Same as Short Range.
104	Approach may remain upon property redevelopment. New approach may be relocated along property frontage, with minimum approach spacing of 500 feet provided between adjacent approaches.	Same as Short Range.	Same as Short Range.

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
105	Close approach upon property redevelopment. Future access to be taken from approach 106 or new public streets providing reasonable alternate access.	Same as Short Range.	Same as Short Range.
106	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
107	Close approach upon property redevelopment. Future access to be taken from approach 109 or new public streets providing reasonable alternate access.	Same as Short Range.	Same as Short Range.
108	No action.	Construct new public street (King Way realignment).	Construct new public street (King Way realignment).
109	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
110	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
111	No action.	Same as Short Range.	Close approach upon construction of new public streets providing reasonable alternate access.
112	No action.	Close approach. Access to be provided from approach 111 or new public streets providing reasonable alternate access.	Close approach. Access to be provided from approach 111 or new public streets providing reasonable alternate access.
113	No action.	Close approach upon construction of new public streets providing reasonable alternate access.	Close approach upon construction of new public streets providing reasonable alternate access.
114	No action.	Close approach upon construction of new public streets providing reasonable alternate access.	Close approach upon construction of new public streets providing reasonable alternate access.
115	Close approach. Access to be provided from approach 114.	Same as Short Range.	Same as Short Range.
116	(King Way realignment)	Close approach. King	Close approach. King Way to be

Approach #	Short-Range Action	Medium-Range Action	Long-Range Action
	Construct new public street.	Way to be realigned to a location approximately 950 feet to the north (approach 108).	realigned to a location approximately 950 feet to the north (approach 108).

Notes: Refer to Figure 5.5a through 5.5c for location of state highway approaches cited in the above table.

Land Use Alternatives

Land use alternatives focus on controlling potential traffic demand for transportation facilities through the implementation of management techniques such as modification of zoning ordinances or requiring transportation demand management plans. Alternatives considered are described below.

Potential Development Density & Trip Generation

The analysis of future traffic conditions in the IAMP area was based on forecasts provided by the Redmond Area travel demand model developed by the Oregon Department of Transportation. In recognition of the buildable lands inventory that was included in the recently completed City of Redmond Urbanization Study5, the intensity of development assumed for the IAMP area in the Redmond Area travel demand model was compared to the projected development capacity from the buildable lands inventory to determine the reasonable maximum amount of trip generation resulting from future development. The buildable lands inventory concluded that sufficient land was available to support an additional 1,133 employees over what was assumed in the travel demand model in the area roughly bounded by Maple Avenue, NW 10th Street, Spruce Avenue, and NE 9th Street. Using a regression analysis on the travel demand model, inbound and outbound trip rates per employee were calculated, with the results shown below in Table 5.B.

Table 5.B: Estimated Trip Rates per Employee from the Redmond Area Travel Demand Model

Employment Type	Inbound Trip Rate	Outbound Trip Rate
Retail	0.98	1.66
Other	0.11	0.24

Assuming that all lands between NW 10th Street and the Burlington Northern Santa Fe railroad would produce predominantly retail employees and that all lands east of the railroad would produce predominantly other types of employees, the additional trips that would be generated would be approximately 2,060. These trips were added to the transportation system in the IAMP area according to the locations of the associated transportation analysis zones affected and the projected distribution of traffic in the future.

[5] *City of Redmond Urbanization Study*, ECONorthwest and Angelo Eaton & Associates, Inc., June 2005.

LEGEND

00 - Approach Number

X - Close Approach

▲ - Construct Approach

Ⓡ - Restricted Turn Movements

▮▮▮ - New Public Street (See Figure 5.4 Local Connectivity Plan)

Note: For detailed information regarding individual approach treatment, see Table 5.1.

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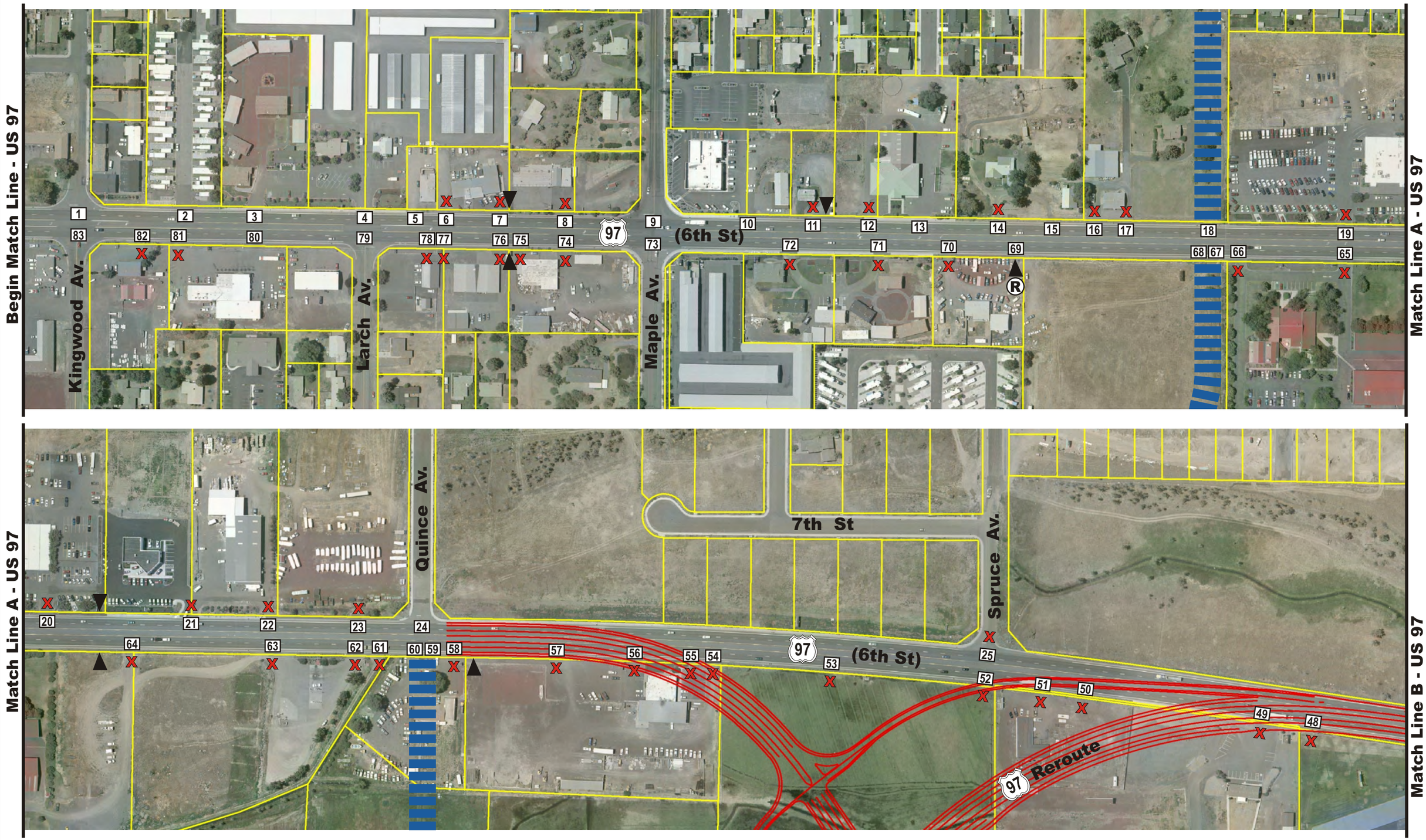
SCALE 0 50 100 200 FEET

Figure 5.5b
LONG-RANGE ACTION PLAN
North Redmond IAMP Access Management Plan



LEGEND

00 - Approach Number

X - Close Approach

▲ - Construct Approach

Ⓡ - Restricted Turn Movements

- New Public Street (See Figure 5.4 Local Connectivity Plan)

Note: For detailed information regarding individual approach treatment, see Table 5.1.

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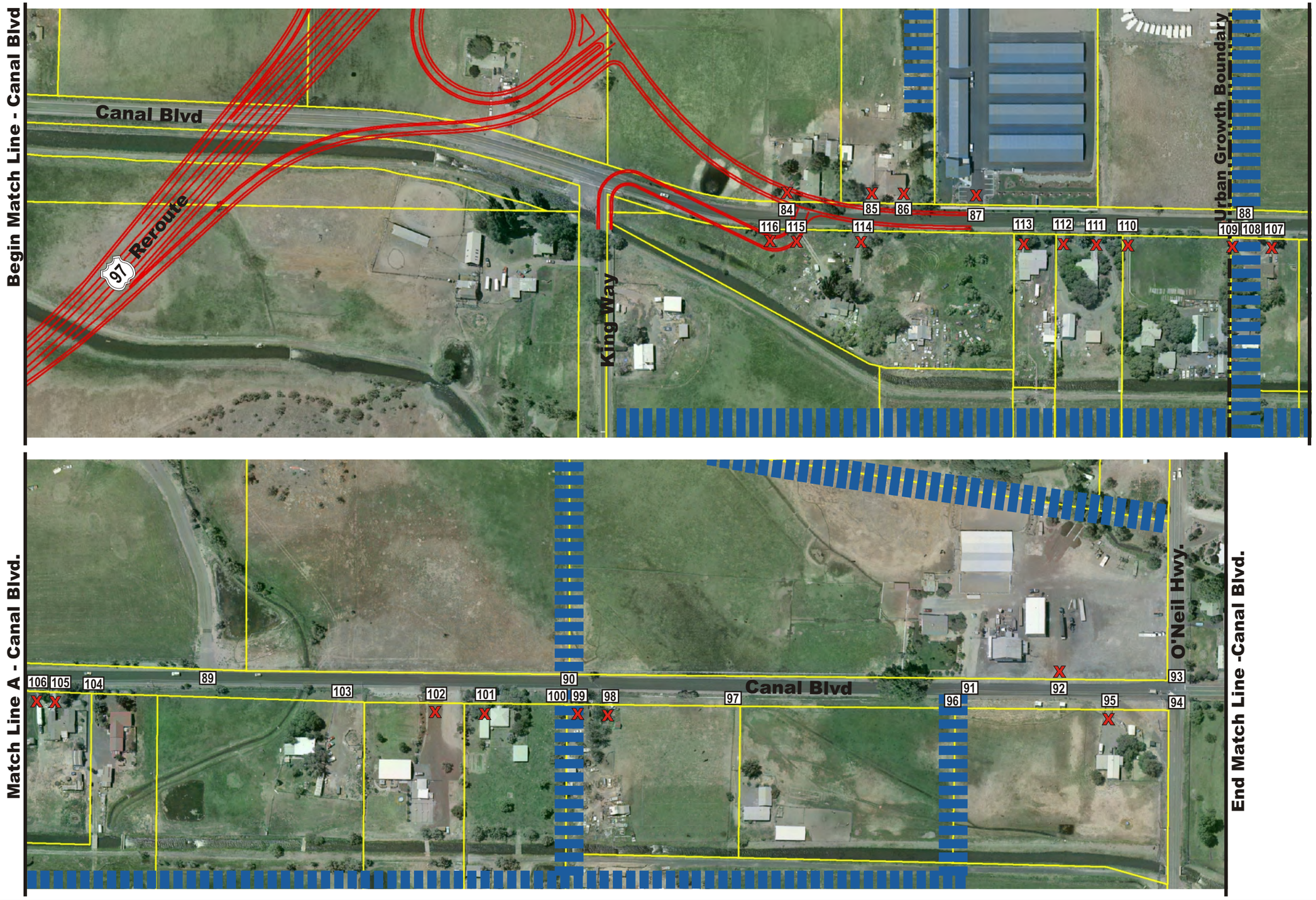
Figure 5.5a
LONG-RANGE ACTION PLAN
North Redmond IAMP Access Management Plan



LEGEND

00 - Approach Number

X - Close Approach

▲ - Construct Approach

Ⓡ - Restricted Turn Movements

- New Public Street (See Figure 5.4 Local Connectivity Plan)

Note: For detailed information regarding individual approach treatment, see Table 5.1.

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Figure 5.5c
LONG-RANGE ACTION PLAN
North Redmond IAMP Access Management Plan

The capacity analysis of study area intersections was repeated under these new conditions to assess the impact of the higher trip generation potential, with the results shown in Table 5.3. It should be noted that the mitigation previously described for the intersections on US 97 at O'Neil Highway, US 97 at Kingwood Avenue, and Maple Ave at 9th Street that was needed under the original trip generation assumptions, was assumed to be in place under this scenario as well. At the intersection on US 97 at O'Neil Highway, the mitigation assumed included the long-range improvement to construct an overpass. In addition, the planned signal at the US 97/Quince Avenue intersection was found to be required under this scenario.

As shown in Table 5.C, all study intersections are able to accommodate the increased trip potential while operating within adopted performance standards, with the exception of the intersection on the US 97 Reroute at Larch Avenue (projected to fail by the year 2020). As this intersection is already planned to be limited to right-in/right-out movements only, there is little that can be done to mitigate operations. The recommended improvement would be to construct an acceleration lane in the southbound direction on the US 97 Reroute to allow a free right turn from Larch Avenue that would merge into mainline traffic. This movement was analyzed using the Highway Capacity Software6 for freeway merges and was found to operate well with a volume-to-capacity ratio of 0.42 and a level of service B. ODOT has developed criteria for the installation of acceleration lanes. A key component is access spacing. The installation of an acceleration lane will need to meet the spacing standards in ODOT's technical bulletin. However, it should be recognized that constructing an acceleration lane at this location could impact the ability to construct an interchange on the US 97 Reroute in the area of Evergreen Avenue and Highland Avenue, should it be desired in the future (approximately 6,000 feet of separation between Larch Avenue and Evergreen Avenue). Because of this, this improvement is not recommended. The City and ODOT close Larch if safety and operational problems develop as part of the annual review process outlined in the adopted MOU for the US 97 Redmond Reroute.

Another alternative would be to allow the intersection to operate as projected, under the assumption that the high delays for traffic waiting to enter the reroute from Larch Avenue would result in diversion of traffic to other routes experiencing less delay. To meet ODOT's adopted mobility standard, approximately 200 eastbound right turns would need to divert away from this intersection. By performing a sensitivity test of study intersections on potential diversion routes, it appears adequate capacity would be available to accommodate this traffic. However, even if traffic demand does self-regulate through a partial diversion to other routes, the drivers that continue to access the US 97 Reroute from Larch Avenue may be encouraged to accept smaller gaps in traffic than preferred when experiencing long delays. Because of this, this alternative is not recommended.

[6] *Highway Capacity Software*, McTrans Center, University of Florida, Gainesville, FL, 2003.

Table 5.C: 2025 Design Hour Intersection Operations with Worst Case Trip Generation

	Intersection	Volume-to-Capacity Ratio		Level of Service		Performance Standard Met?
		measured	required	measured	required	
ODOT Facilities – Volume-to-Capacity Ratio Determines Performance Standard						
S	US 97 / NB US 97 Reroute	0.46	0.85	B	E	Yes
S	US 97 / SB US 97 Reroute	0.44	0.85	A	E	Yes
U	US 97 Reroute / Larch Ave	>1.0 (EB)	0.80	F (EB)	E	No
U	O'Neil Hwy / Canal Blvd	0.51 (NB)	0.80	B (NB)	E	Yes
City of Redmond Facilities – Level of Service Determines Performance Standard						
S	US 97 / Quince Ave	0.79	-	D	E	Yes
S	US 97 / Wal-Mart Access	0.71	-	E	E	Yes
S	US 97 / Maple Ave	0.84	-	C	E	Yes
S	US 97 / Kingwood Ave	0.53	-	B	E	Yes
U	Canal Blvd / Kingwood Ave	0.43 (EB)	-	D (EB)	E	Yes
U	Canal Blvd / King Way	0.27 (NB)	-	B (WB)	E	Yes
U	Quince Ave / 10th St	0.56 (WB)	-	C (EB)	E	Yes
S	Maple Ave / 9th St	0.84	-	C	E	Yes
S	Maple Ave / 19th St	0.95	-	E	E	Yes
U	Kingwood Ave / 9th St	0.11 (NB)	-	B (WB)	E	Yes
U	Negus Way / 9th St	0.42 (NB)	-	C (NB)	E	Yes
Deschutes County Facilities – Level of Service Determines Performance Standard						
U	Yucca Ave / 17th St	0.08 (EB)	-	A (EB)	D	Yes
U	17th St / King Way	0.07 (EB)	-	A (EB)	D	Yes
U	Pershall Way /10th St	0.17 (NB)	-	A (NB)	D	Yes

Note: (XX) = critical movement
S = signalized intersection
U = unsignalized intersection

Expansion of the Redmond Urban Growth Boundary – Urban Reserve

The City of Redmond recently extended their Urban Growth Boundary (UGB) to include all properties north of its existing city boundary, west of US 97, to Pershall Way. Redmond also adopted an Urban Reserve Area (URA) that includes all land east of US 97 to O'Neil Way. In expanding its UGB, rather than annex and rezone the area being brought into the UGB for urban use, and having to do the TPR analysis for adequacy of the transportation system, Redmond opted to not annex the area and with the concurrence of Deschutes County had the UGB rezoned to a new Urban Holding Zone – 10 Acre Minimum (UH-10). This action first put a temporary hold on future development within the UGB until it was annexed and rezoned, and it also deferred the TPR analysis to a subsequent date. Redmond also adopted amendments to its development regulations requiring master plans be prepared for properties requesting annexation and rezoning to the City.

Consequently, by the City expanding its UGB without designating the urban zoning for the area and doing the required TPR analysis, a significant amount of land was added to the UGB that could, in the future, be annexed to the city and developed with urban intensity uses. And without a land use plan for

the area, it is impossible to determine the magnitude of this action on the proposed US 97 Redmond Reroute Interchange.

To address this unknown within the context of the IAMP, the City of Redmond is required to amend its development regulations to require master plans prepared for properties adjacent to US 97 show as an element of their plan no direct access to US97 (Appendix 7). In addition, for an area defined as the "Highway Area Plan", or HAP (Appendix 8), adjacent to US97, the City is to prepare an area plan (aka master plan) that will establish a land use plan along US 97 that based on traffic analysis of the plan will not result in the planned land use exceeding the capacity of the interchange during the plan period.

Policies, Rules, & Ordinances

As land develops to urban densities within the interchange area, compliance will be required with the access management and circulation plans developed through the IAMP process. As part of the adoption of the IAMP, a number of amendments will be made to the City of Redmond Comprehensive Plan, Transportation System Plan (TSP) and development codes to reflect the amendments contained in Appendix 7 and actions outlined in the Memorandum of Understanding (MOU) in Appendix 8. In brief, they are as follows:

Comprehensive Plan Chapter 14 (Urbanization) –

- *Master plans to be consistent with the Local Street Connectivity Plan (Figure 5.4),*
- *Property annexed to relinquish all direct access rights to the highway, and*
- *Incorporate access management strategy for US 97 (6th Street) and North Canal Boulevard.*

Transportation System Plan –

- *Identify phased improvement at US 97 and O'Neil Highway to include right-in/right-out and a grade separated overcrossing,*
- *Identify need for signals at US 97 (6th Street) and Kingwood Avenue, and NW Maple and 9th Street,*
- *Access spacing requirements for US 97 (6th Street) and North Canal Boulevard,*
- *Local Street connectivity (Figure 5.6) and access closures (Table 5.A and Figures 5.5a-5.5c), and*
- *Signal Plan for US 97 Business (6th Street) and North Canal Boulevard (Figure 5.3).*

Development Codes –

- *Master plans shall show direct access to local street, not the State highway, be consistent with the Local Street Connectivity Plan, and relinquish all direct access to the highway, and*
- *Adopt access management spacing standards for US 97 (6th Street) and North Canal Boulevard consistent with the Oregon Highway Plan for highways classified as "Statewide" and "District" within an urban area.*

Memorandum of Understanding

In moving the US 97 Reroute into the construction phase, it was determined that the original agreement between ODOT and the City needed to be revised to incorporate changes to the project, and consummate in an MOU their agreement on long-term transportation and land use issues as they relate to the US 97

Reroute. This agreement, No. 23704, has been incorporated into the IAMP by reference and is included as Appendix 8. In general the MOU between ODOT and the City of Redmond:

- *Identifies the US 97 Reroute, Phase 1, as the first phase of a long-term solution for US 97 through Redmond;*
- *Sets forth that US 97 through Redmond will be managed as an Expressway facility from the O'Neil Junction through the Reroute Phase 1, and future phases consistent with the recommendations of the US 97 Redmond Refinement Plan;*
- *Requires the City to adopt the Access Management Plan for the US 97 Reroute and all the recommendations contained in the IAMP including amendments to Redmond's comprehensive Plan, TSP, and development codes as enumerated above.*
- *For an area defined as the "Highway Area Plan", or HAP (Appendix 8), adjacent to US97, the City is to prepare an area plan (A.K.A master plan) that will establish a land use plan along US 97 that based on traffic analysis of the plan will not result in planned land use exceeding the capacity of the interchange during the plan period.*

Cost Estimates

Planning-level cost estimates for all recommended improvement alternatives were calculated to aid in the identification of needed funding. Cost estimates included the fundamental elements of roadway construction projects, such as the roadway structure, bridge structures, curb and sidewalk, earthwork, retaining walls, right of way, pavement removal, and traffic signals. The estimated costs are shown below in Table 5.D, with work sheets showing assumed unit costs for construction elements provided in the appendix. For the purposes of providing these estimates, it was assumed that 40% of the road-miles within the County and City would be classified as collectors, with the remaining 60% classified as local streets. All costs are in 2006 dollars and do not reflect the added cost of inflation. Note that the recommended installation of a traffic signal at the US 97/Kingwood Avenue intersection has not been included as it is already listed in the City's CIP to be constructed when warranted, with an estimated cost of $375,650. When considering needed funding to construct the identified improvements below, it should be recognized that local streets are typically constructed by land owners as development occurs.

Table 5.D: Planning-level cost estimates for recommended improvement alternatives

Alternative	Estimated Cost
US 97/O'Neil Highway	
Restrict turn movements to r-in/r-out	$225,000
Offset intersection approaches	$1.4 million
Construct overpass	$3.2 million
Maple Ave/9th St signalization*	$220,000
Expanded Public Street Network	
City collectors	$9.9 million
City local streets	$13.4 million
County collectors**	$13.4 million
County local streets***	$21.2 million

* Assumes intersection geometry will be improved through projects already planned in the City CIP.
** Includes $5.9 million in "High-Priority" Streets.
*** Includes $3.8 million in "High-Priority" Streets.

Alternative Evaluation and Prioritization

With improvement alternatives identified, an evaluation of their ability to achieve the project goals will be provided, followed by a prioritization of successful alternatives into short, medium, and long-range plans to guide implementation.

Alternative Evaluation

Using the objectives for the North Redmond IAMP outlined in Chapter 2, the alternatives proposed were evaluated to ensure the goals established at the outset of the project would be met. The objectives used included criteria related to public involvement, addressing local issues, provision of transportation improvement alternatives, conformity with statewide plans and policies, and inclusion of policies and implementing measures to preserve the functionality of the interchange. The results of this evaluation have been provided in the Appendix 6.

Prioritization of Improvements

The improvement alternatives recommended as part of the IAMP have been prioritized into short, medium, and long-range actions, as shown in Table 5.E, to provide guidance for future implementation and funding. Short-range actions represent immediate needs and are proposed to be implemented at the time of interchange construction. Medium-range actions represent improvements that are not required immediately, but should be given priority over improvements identified as long-range actions. Assuming all improvements are planned for construction within a 20-year period, medium-range actions should be considered for implementation within 5 to 10 years. Long-range actions typically represent improvements of lower priority or requiring higher levels of funding. These improvements should be planned for construction within 10 to 20 years. The improvements listed in Table 5.E have also been illustrated in a Transportation Improvements Map (Figure 5.6) for the IAMP area.

It should be recognized that this prioritization of projects is not intended to imply that projects of higher priority must be implemented before projects of lower priority. Should opportunities arise, through private land development or other means, to construct specific projects earlier than the estimated time frame provided by this list, those resources should be utilized.

Table 5.E: Transportation Improvement Prioritization

Short-Range Improvements
· Short-range actions from access management plan.
Medium-Range Improvements
· Construct "High-Priority" public streets according to adopted Local Connectivity Plan.
· US 97/O'Neil Highway intersection improvements (right-in/right-out restrictions).
· US 97 (6th St.)/Kingwood Ave.: Construct separate left turn lanes on Kingwood Ave. and install traffic signal.
· Maple Ave./9th St.: Construct separate left turn lanes on Maple Ave. and install traffic signal.
· Medium-range actions from access management plan.
Long-Range Improvements
· Construct remainder of new public streets according to adopted Local Connectivity Plan.
· Long-range actions from access management plan.
· US 97 (6th St.)/Quince Ave.: Construct separate left turn lanes on Quince Ave. and install traffic signal.
· US 97/O'Neil Highway intersection improvements (grade-separated crossing over US 97).
· King Way Realignment (grade-separated crossing over BNSF).

Note: Medium and long-range improvements could be constructed sooner than anticipated as opportunities arise through private property development or other means.

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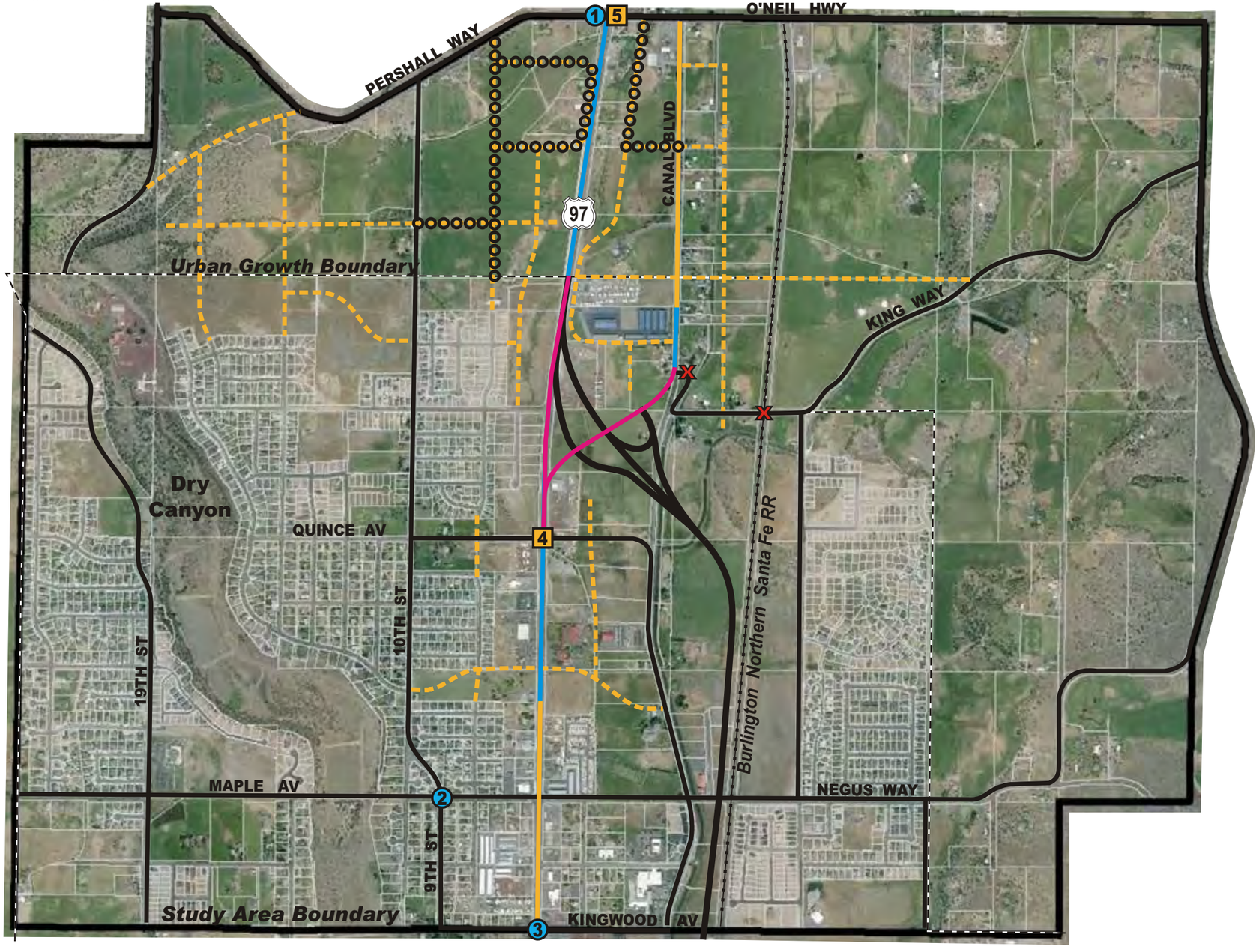
NO SCALE



Improvement Prioritization

Short-Range

- Access Management Short-Range Actions

Medium-Range

- Construct *"High Priority"* Public Streets
- Access Management Medium-Range Actions
- (1) US 97/O'Neil Hwy Improvements (Right-in/Right-out)
- (2) Maple Ave./9th St. Improvements
- (3) US 97 (6th St.)/Kingwood Ave. Improvements

Long-Range

- Construct Public Streets
- Access Management Long-Range Actions
- [4] US 97 (6th St.)/Quince Ave. Improvements
- [5] US 97/O'Neil Hwy Improvements (Overpass)

- Significant Existing & Planned Study Area Streets
- X Close Street

Figure 5.6
TRANSPORTATION IMPROVEMENTS MAP
North Redmond IAMP

DKS Associates
TRANSPORTATION SOLUTIONS

Project Participants

Project Advisory Committee

Mark Usselman	Interim ODOT Region 4 Manager
Alan Unger	City of Redmond Mayor
Dennis Luke	Deschutes County Board

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Dan Serpico	ODOT Region 4 Traffic (Alternate)
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Ron Oliver	Redmond Fire and Rescue
Karen Green	ODOT Freight Mobility Unit

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