KITTELSON & ASSOCIATES, INC.
TRANSPORTATION PLANNING/TRAFFIC ENGINEERING
610 SW ALDER, SUITE 700 • PORTLAND, OR 97205 • (503) 228-5230 • FAX (503) 273-8169

October 10, 2006 Project #: 7976

Chuck McGraw
City of Madras
Community Development Department
71 SE "D" Street
Madras, Oregon 97741

RE: City of Madras TSP Refinement Plans and Amendments

Dear Chuck:

This report provides additional information to update the City of Madras's Transportation System Plan (TSP). The information provided in this report has been divided into three areas: Refinement Plans, Updated Project List, and Additional Amendments. The following sections provide the background and details of these areas.

Background

Per Oregon Administrative Rule (OAR) Division 12, "Transportation Planning" 660-012-000, the City of Madras initiated the process to prepare its long-range transportation plan in 1994 with the help of a grant from the Oregon Department of Transportation (ODOT). A consultant team prepared the Transportation System Plan (TSP), which was published in 1995. After the City and ODOT staff's extensive review, the document was modified and republished in 1998. The City adopted the modified TSP in August 1998.

The impact of the, then newly proposed, Department of Correction's facility located to the east of the City was not included in the original TSP. In order to incorporate the impact of the proposed facility, the City decided to update its Comprehensive Plan and TSP through the Transportation Growth Management (TGM) grant from ODOT and Department of Land Conservation and Development (DLCD) in 2000. The plan was completed and adopted by the City in 2001.

In 2005, Jefferson County began preparing their TSP with the help of a grant from ODOT. The county TSP project included the preparation of refinement plans for the Madras Truck Route and J Street improvements. This report summarizes the results of those refinement plans. In addition, this report updates the list of City projects to reflect the impact of the County TSP project list in an effort to coordinate the City's TSP project list with the new County's TSP project list. Furthermore, during the County TSP process, City staff recognized the need to include additional amendments to address the growing development trends in the City. These amendments are also included in this report.

Madras Truck Route Refinement Plan

Determination of Need

Technical Memoranda "A" and "B" of the Jefferson County TSP project provide detailed information needed to determine the needs of the proposed Madras Truck Route. The information provided in this section is a summary of the memoranda.

US 97 and US 26, in Central Oregon, are critical elements of Oregon's Statewide Highway Freight System. The *1999 Oregon Highway Plan* classifies these roadways as Statewide Highways and designated Freight Routes. According to the 2004 Automatic Traffic Recorder (ATR) data obtained from ODOT, US 97 carries around 6,300 average daily traffic (ADT) and US 26 carries around 11,900 ADT, just north of City of Madras downtown. Through downtown Madras US 97/US 26 carries around 19,700 ADT, while south of downtown Madras, US 97/US 26 carries around 13,100 ADT. The ATR data also show that 14%–18% of the traffic on the highway is truck traffic. These high traffic volumes and truck percentages indicate the importance of the truck mobility through downtown Madras.

Technical Memoranda "A" provided the near-term operational and safety analysis of US 97/US 26 through downtown Madras. The US97/US26 North intersection was recently realigned and upgraded as part of ODOT's 2004–2007 Statewide Transportation Improvement Program (STIP) project. With the upgrade, the intersection is anticipated to operate at level-of-service (LOS) "C" and at a volume-to-capacity (v/c) ratio of 0.73 during the 30th highest hour. This level of operation meets the ODOT mobility standard of 0.75 for the intersection.

While the operation of the US 97/US 26 North intersection will meet the operational standards in the near term, the proposed intersection modification will not eliminate operational concerns related to truck traffic traveling through downtown Madras. Downtown Madras will continue to have numerous traffic signals and low travel speeds that do not facilitate the mobility of freight traffic on US 97/US 26. As such, in spite of the recent upgrade to the US 97/US 26 North intersection, a truck route bypassing downtown Madras is anticipated to reduce the volume of downtown truck traffic, improve the operation of the intersections in downtown, and facilitate truck mobility around Madras.

A safety analysis was also conducted on US 97/US 26 around Madras as part of the needs analysis. The crash data (for a three year period) obtained from the ODOT Crash Unit revealed that US 97/US 26 through the Madras City Limit experienced annual crash rates of 1.34, 1.86, and 1.46 crashes per million vehicle miles traveled, respectively. These crash rates are higher than the statewide average for similar facilities, which were reported at 1.16, 1.28 and 0.99 for the same three year period, respectively.

Long-Term Transportation Need

Technical Memorandum "B" analyzed various traffic volume forecast scenarios to determine the most realistic estimate of future traffic volume in the area. The analysis reviewed three traffic volume forecasting methodologies, namely, historic traffic growth, ODOT future volume forecast and updated population forecast. Based on extensive discussions with City, ODOT and County

staff, the updated population forecast methodology that included the impact of the Department of Correction facilities that is currently under construction on the east side of the city, was determined to most closely approximate the future traffic volume forecast in and around the city. As such, the traffic volume on US 97/US 26 through downtown Madras and south of downtown were forecasted to grow annually at 3.37% and 2.37%, respectively.

Based on the forecasted traffic volume, US 97/US 26 North and South intersection are anticipated to operate at LOS "F" in year 2025 if no improvements are made to the facilities through downtown Madras.

The existing and future operational and safety analysis indicates that, at the current pace of traffic growth, US 97/US 26 is anticipated to carry a high volume of traffic through downtown Madras by 2025. The increase in traffic volume in downtown Madras will deteriorate the operation and safety of the roadway. As US 97 and US 26 are classified as highways of statewide significance, the mobility of vehicles on the highway is important to the economic viability of the state.

Alternative Analysis

Concerns with Approved Alternative

Figure 1 shows the approved alignment of the Madras Truck Route as recommended in the 2001 City of Madras TSP Update. Several new developments have occurred in Madras since the adoption of the TSP. Some of the new commercial developments that were approved have impacted the feasibility of the approved truck route alignment. One of the major developments is a new hotel and mixed-use retail development planned and approved for construction to the west of the existing US 97/US 26 North intersection in downtown. The location of this development eliminates the ability to create the northern connection of the truck route as previously planned in the TSP update.

A second concern relates to access management along Culver Highway 361. The route is anticipated to have a high volume of truck traffic and relatively high travel speed. Access from adjacent properties will likely be limited to facilitate the mobility of truck traffic and enhance safety. However, the section of existing Culver Highway 361 that the planned truck route is to follow is lined with single- and multi-family homes that have direct access to the highway. Access management to facilitate the truck route along this section of highway would be challenging.

Given these concerns and the high cost of the planned alignment, this refinement plan evaluates the feasibility of an alternative alignment taking right-of-way impact, in-process developments, and current and future transportation operation and safety concerns into account.

Refinement Plan Alternatives

The Madras Truck Route will provide alternate access for regional traffic passing through Madras, thus reducing traffic volume and the percentage of truck traffic traveling through downtown Madras. The alternate access can be provided on existing roadways or on a new roadway that bypasses the downtown area. After considering the existing roadway network, impact on existing businesses, and physical constraints, past studies recommended that a feasible alternative is to provide a truck bypass that generally follows the existing Culver Highway 361 alignment. Taking those recommendations into account, this refinement plan developed additional alternative based on the information received from two sources: 1) comments received from the public and input from

County, ODOT, and City staff; and 2) the technical analysis of traffic operations and safety on the roadway. Three new alignment options were proposed for the northern connection of the bypass and four new alignment options were proposed for the southern connection. Figure 2 shows the alternative alignments and provides the advantages and disadvantages of each.

The Madras Truck Route is anticipated to be a limited-access expressway with a median barrier to improve the mobility of vehicles. It is planned to have four 12-foot travel lanes and a 12-foot raised median, with four-foot shy distance, two eight-foot bike lanes, an eight-foot planer strip and a six-foot sidewalk on both sides for a total of 114-foot right-of-way (See Figure 2 for detail cross-section). Access to the expressway will be provided via right-in/right-out driveways and full-access traffic signals at the intersections with Fairground Road, Belmont Street, and C Street.

The Madras Truck Route has various advantages and disadvantages, highlighted below.

Advantages

- Reduces regular and truck traffic through downtown Madras, thus improving safety and mobility for local traffic and pedestrians in downtown Madras.

- Increases the mobility of regional truck traffic by providing an access-controlled facility.

- Utilizes existing right-of-way of Culver Highway 361 for majority of the alignment.

- Minimal impact on land outside the urban growth boundary, which will require a goal exception from Department of Land Conservation and Development (DLCD).

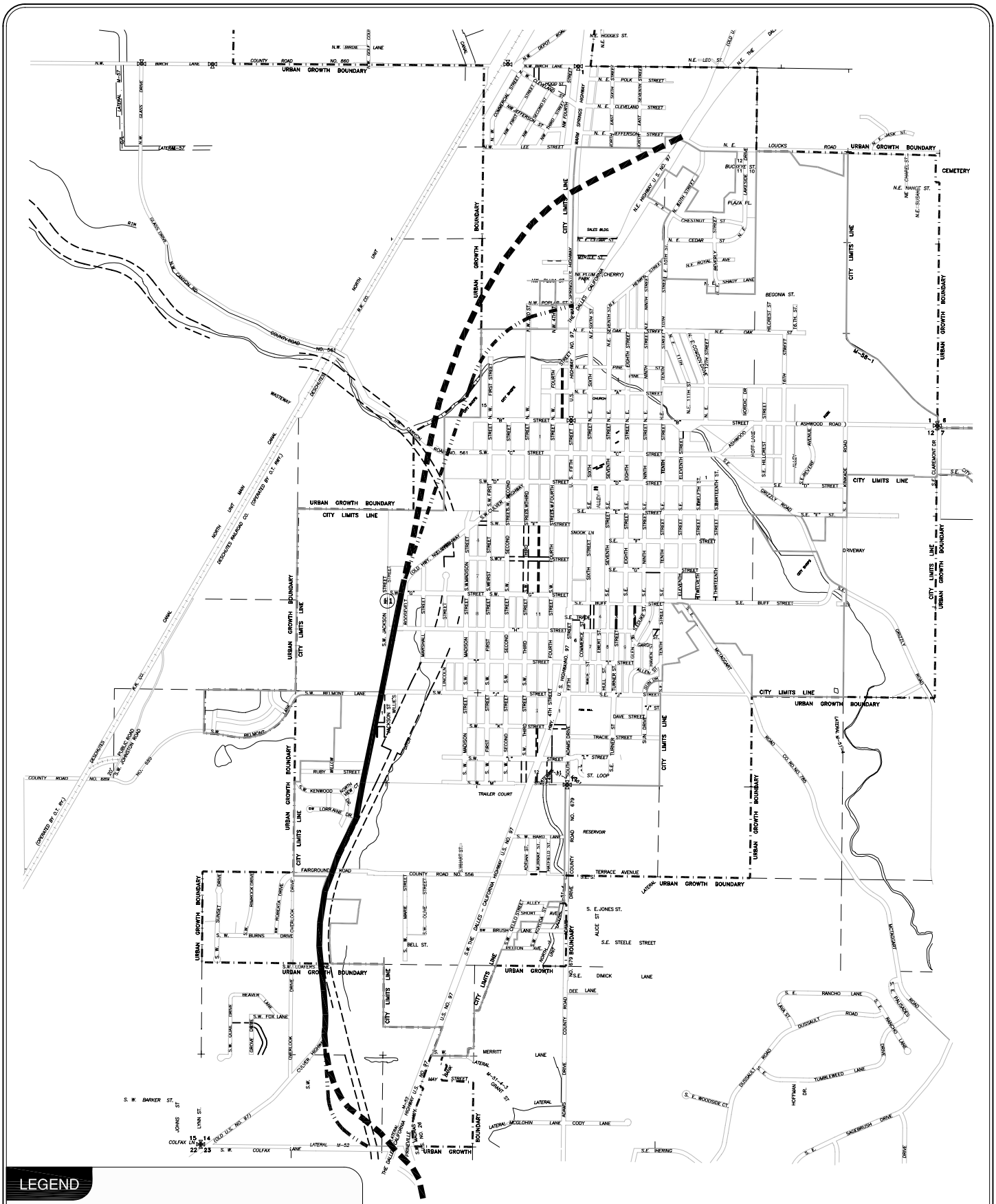
Disadvantage

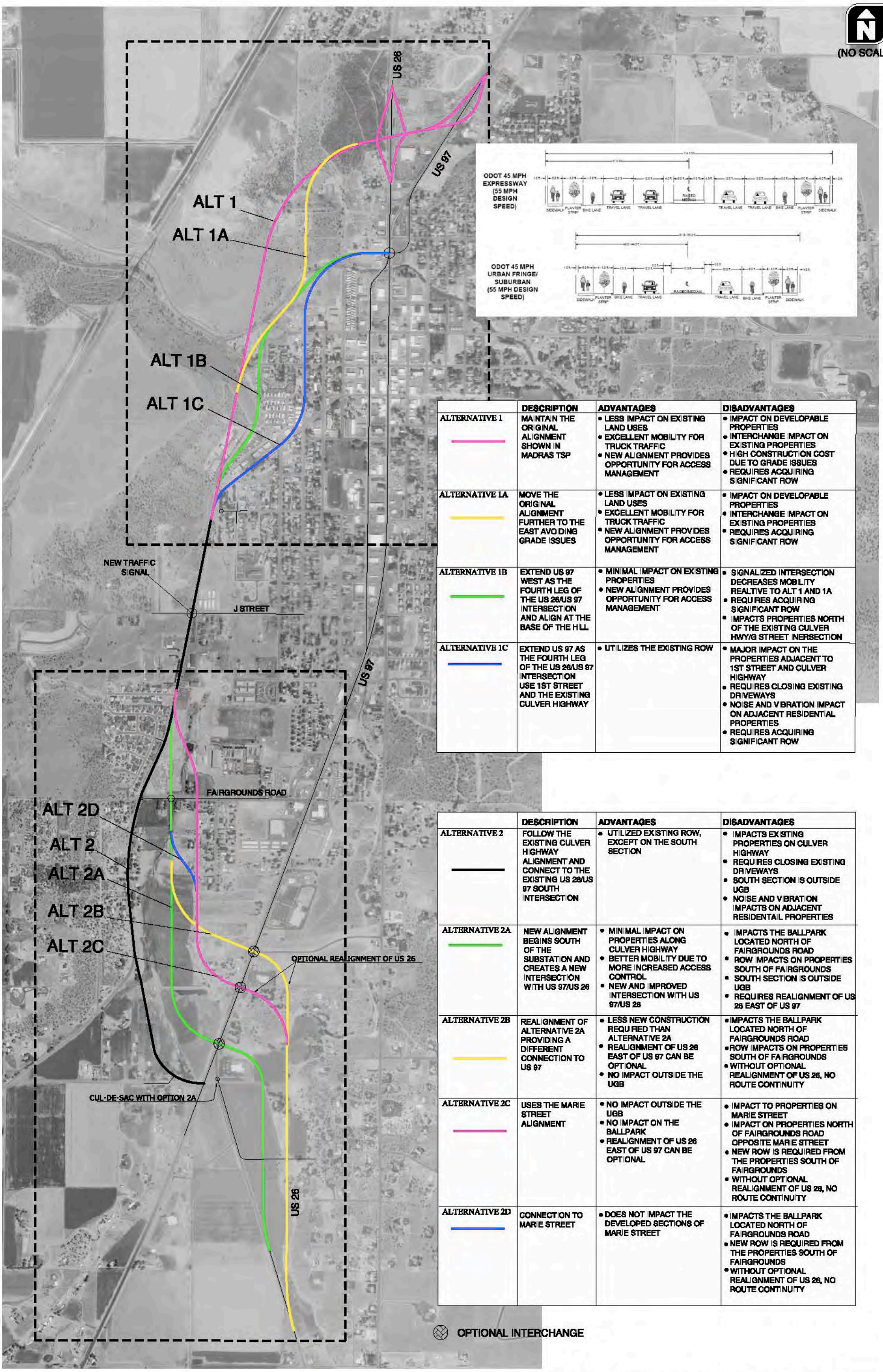
- Impacts access to and from existing properties along Culver Highway. Alternate access, such as a frontage road, should be provided to the affected properties.

- Changes the characteristic of portions of Culver Highway from a rural/semi-urban highway to a higher speed, limited-access expressway.

- Requires acquisition of significant right-of-way along Culver Highway.

According to the City staff, the Alternative 1C and Alternative 2 concepts appear to have the most advantages. Alternative 1C begin at the US 97/US 26 North intersection as a west approach of the intersection. It then follows 1st Street and the existing Culver Highway alignment. The alignment does not impact the proposed hotel development and preserves the area for further development. In addition, the alignment stays to the east of the railroad track and the bluff on the west side of the city, which will reduce the cost of the project considerably. However, the alignment will have a right-of-way and access impact on the properties on 1st Street and portions of the Culver Highway alignment.


URBAN GROWTH BOUNDARY
CITY LIMITS LINE
COUNTY ROAD NO. 560
LOUCKS ROAD
CEMETERY
N.E. HIGHWAY U.S. NO. 97
N.E. 6TH STREET
PLAZA PL.
CHESTNUT ST.
N.E. CEDAR ST.
N.E. ROYAL AVE.
N.E. SHADY LANE
BEGONIA ST.
N.E. OAK
N.E. PINE
N.E. 11TH ST.
NORDIC DR.
ASHWOOD ROAD
S.E. HILLCREST
S.E. CLAREMONT DR.
GRIZZLY ROAD
S.E. "F" STREET
S.E. "D" STREET
S.E. "C" STREET
S.E. "A" STREET
S.E. BUFF STREET
S.E. TRAIL
S.W. OLIVER STREET
S.W. HIGHWAY 97
S.W. JACKSON
S.W. BELMONT LANE
S.W. KENWOOD
S.W. LORRAINE
FAIRGROUND ROAD
COUNTY ROAD NO. 556
TERRACE AVENUE
S.W. THE DALLES - CALIFORNIA HIGHWAY U.S. NO. 97
S.W. BRUSH LANE
S.E. STEELE STREET
S.E. DIMICK LANE
DEE LANE
S.E. RANCHO LANE
DUSSAULT ROAD
TUMBLEWEED LANE
HOFMAN DR.
SAGEBRUSH DRIVE
S.E. WOODSIDE CT.
S.W. COLFAX LANE
S.W. BARKER ST.
S.W. FOX LANE
MERRITT LANE
MAY STREET
MCGLOHIN LANE
CODY LANE
TRAILER COURT
RESERVOIR
DRIVEWAY
SNOOK LN
DAVE STREET
TRACIE STREET
ST. LOOP
S.E. JONES ST.
ALICE ST.
BELL ST.
RUBY STREET
S.W. BURNS DRIVE
S.W. FOX LANE
BEAVER LANE
S.E. HERING
S.E. PAUSKEY
S.E. MONTGOMERY
S.E. GRIZZLY ROAD
S.E. "F" ST.
S.E. "D" STREET
S.E. "C" STREET
S.E. "A" STREET
S.E. BUFF STREET
S.E. TRAIL
S.E. STEELE STREET
S.E. DIMICK LANE
S.E. RANCHO LANE
S.E. PAUSKEY
S.E. WOODSIDE CT.
S.E. HERING
S.E. SAGEBRUSH DRIVE
S.E. HOFMAN DR.
S.E. TUMBLEWEED LANE
S.E. DUSSAULT ROAD
S.E. RANCHO LANE



	DESCRIPTION	ADVANTAGES	DISADVANTAGES
ALTERNATIVE 1	MAINTAIN THE ORIGINAL ALIGNMENT SHOWN IN MADRAS TSP	• LESS IMPACT ON EXISTING LAND USES • EXCELLENT MOBILITY FOR TRUCK TRAFFIC • NEW ALIGNMENT PROVIDES OPPORTUNITY FOR ACCESS MANAGEMENT	• IMPACT ON DEVELOPABLE PROPERTIES • INTERCHANGE IMPACT ON EXISTING PROPERTIES • HIGH CONSTRUCTION COST DUE TO GRADE ISSUES • REQUIRES ACQUIRING SIGNIFICANT ROW
ALTERNATIVE 1A	MOVE THE ORIGINAL ALIGNMENT FURTHER TO THE EAST AVOIDING GRADE ISSUES	• LESS IMPACT ON EXISTING LAND USES • EXCELLENT MOBILITY FOR TRUCK TRAFFIC • NEW ALIGNMENT PROVIDES OPPORTUNITY FOR ACCESS MANAGEMENT	• IMPACT ON DEVELOPABLE PROPERTIES • INTERCHANGE IMPACT ON EXISTING PROPERTIES • REQUIRES ACQUIRING SIGNIFICANT ROW
ALTERNATIVE 1B	EXTEND US 97 WEST AS THE FOURTH LEG OF THE US 26/US 97 INTERSECTION AND ALIGN AT THE BASE OF THE HILL	• MINIMAL IMPACT ON EXISTING PROPERTIES • NEW ALIGNMENT PROVIDES OPPORTUNITY FOR ACCESS MANAGEMENT	• SIGNALIZED INTERSECTION DECREASES MOBILITY REALTIVE TO ALT 1 AND 1A • REQUIRES ACQUIRING SIGNIFICANT ROW • IMPACTS PROPERTIES NORTH OF THE EXISTING CULVER HWY/G STREET INERSECTION
ALTERNATIVE 1C	EXTEND US 97 AS THE FOURTH LEG OF THE US 26/US 97 INTERSECTION USE 1ST STREET AND THE EXISTING CULVER HIGHWAY	• UTILIZES THE EXISTING ROW	• MAJOR IMPACT ON THE PROPERTIES ADJACENT TO 1ST STREET AND CULVER HIGHWAY • REQUIRES CLOSING EXISTING DRIVEWAYS • NOISE AND VIBRATION IMPACT ON ADJACENT RESIDENTIAL PROPERTIES • REQUIRES ACQUIRING SIGNIFICANT ROW

	DESCRIPTION	ADVANTAGES	DISADVANTAGES
ALTERNATIVE 2	FOLLOW THE EXISTING CULVER HIGHWAY ALIGNMENT AND CONNECT TO THE EXISTING US 26/US 97 SOUTH INTERSECTION	• UTILIZED EXISTING ROW, EXCEPT ON THE SOUTH SECTION	• IMPACTS EXISTING PROPERTIES ON CULVER HIGHWAY • REQUIRES CLOSING EXISTING DRIVEWAYS • SOUTH SECTION IS OUTSIDE UGB • NOISE AND VIBRATION IMPACTS ON ADJACENT RESIDENTAIL PROPERTIES
ALTERNATIVE 2A	NEW ALIGNMENT BEGINS SOUTH OF THE SUBSTATION AND CREATES A NEW INTERSECTION WITH US 97/US 26	• MINIMAL IMPACT ON PROPERTIES ALONG CULVER HIGHWAY • BETTER MOBILITY DUE TO MORE INCREASED ACCESS CONTROL • NEW AND IMPROVED INTERSECTION WITH US 97/US 26	• IMPACTS THE BALLPARK LOCATED NORTH OF FAIRGROUNDS ROAD • ROW IMPACTS ON PROPERTIES SOUTH OF FAIRGROUNDS • SOUTH SECTION IS OUTSIDE UGB • REQUIRES REALIGNMENT OF US 26 EAST OF US 97
ALTERNATIVE 2B	REALIGNMENT OF ALTERNATIVE 2A PROVIDING A DIFFERENT CONNECTION TO US 97	• LESS NEW CONSTRUCTION REQUIRED THAN ALTERNATIVE 2A • REALIGNMENT OF US 26 EAST OF US 97 CAN BE OPTIONAL • NO IMPACT OUTSIDE THE UGB	• IMPACTS THE BALLPARK LOCATED NORTH OF FAIRGROUNDS ROAD • ROW IMPACTS ON PROPERTIES SOUTH OF FAIRGROUNDS • WITHOUT OPTIONAL REALIGNMENT OF US 26, NO ROUTE CONTINUITY
ALTERNATIVE 2C	USES THE MARIE STREET ALIGNMENT	• NO IMPACT OUTSIDE THE UGB • NO IMPACT ON THE BALLPARK • REALIGNMENT OF US 26 EAST OF US 97 CAN BE OPTIONAL	• IMPACT TO PROPERTIES ON MARIE STREET • IMPACT ON PROPERTIES NORTH OF FAIRGROUNDS ROAD OPPOSITE MARIE STREET • NEW ROW IS REQUIRED FROM THE PROPERTIES SOUTH OF FAIRGROUNDS • WITHOUT OPTIONAL REALIGNMENT OF US 26, NO ROUTE CONTINUITY
ALTERNATIVE 2D	CONNECTION TO MARIE STREET	• DOES NOT IMPACT THE DEVELOPED SECTIONS OF MARIE STREET	• IMPACTS THE BALLPARK LOCATED NORTH OF FAIRGROUNDS ROAD • NEW ROW IS REQUIRED FROM THE PROPERTIES SOUTH OF FAIRGROUNDS • WITHOUT OPTIONAL REALIGNMENT OF US 26, NO ROUTE CONTINUITY

MADRAS TRUCK ROUTE REFINEMENT PLAN ALTERNATIVES
PROJECT 18
MADRAS, OREGON

FIGURE 2

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K:\H_Portland\proj\file\7978 - Madras TSP Amendment\dwg\fig\Fig 2 Madras Truck Route Refinement Alts.dwg Oct 10, 2006 - 11:27am - sonia Layout Tab: FIG 2

Alternative 2 follows the existing alignment of Culver Highway to SW Loafers Lane, where it diverts to intersect with US 97 near the existing US 97/US 26 South intersection. This new intersection with US 97 will most likely be a grade-separated interchange in the long run. As shown in Figure 2, various other alignments were analyzed for advantages and disadvantages. However, based on discussion with City staff, it was determined that Alternative 2, which follows the approved alignment of the Madras Truck Route, is the most feasible.

The planning-level cost estimate for Alternative 1C, improvement to the existing alignment of Culver Highway 361, and Alternative 2, is approximately $7.5 million, $8.75 million, and $3 million, respectively. The total estimated cost is $19.25 million, without consideration for right of way acquisition, impacts to adjacent properties, or the cost of interchanges.

Evaluation of the Madras Truck Route/US 97/US 26 North Intersection

Alternative 1C connects to the existing US 97/US 26 North intersection as the fourth leg of the intersection, which currently serves a small retail development. The impact of the truck route on the turning movements at the intersection was determined after reviewing the existing turning movement patterns. In order to estimate traffic volume on the Madras Truck Route, approximately 55 percent of the existing westbound left-turning traffic and 30 percent of the southbound through traffic was assigned to the new truck route. Similarly, 55 percent of the northbound right-turning traffic and 30 percent of the northbound through traffic is estimated to use the new truck route. With these turning movement estimates, the intersection is anticipated to operate at volume to capacity ratio of 0.70 in 2025 traffic condition with the lane configuration listed below.

- Northbound: left-turn, through, and through-right lanes
- Southbound: left-turn, dual through, and right-turn lanes
- Eastbound: dual left-turn, through, and through right-turn lanes
- Westbound: dual left-turn, through, and through right-turn lanes

Even with the lanes recommended above, the total delay incurred at a traffic signal will increase as traffic volume increases. Therefore, it is recommended to preserve the option to provide an interchange at the Madras Truck Route/US 97/US 26 North intersection in the future. An interchange will provide the highest degree of mobility and route continuity for US 97 and US 26. By reducing delay in transporting goods and services, the interchange is anticipated to enhance the economic benefit to the region

Evaluation of the Madras Truck Route/US 97/US 26 South Intersection

The growth in traffic on US 97 and US 26 south of Madras is anticipated to deteriorate the operation of the existing US 97/US 26 South intersection. Without the Madras Truck Route, the intersection will require a traffic signal to meet the ODOT mobility standard in 2025. The intersection is anticipated to operate at a volume-to-capacity ratio of 0.67 under 2025 traffic conditions with a traffic signal installed. With the Madras Truck Route, which is anticipated to connect to US 97 in the vicinity of the intersection, the intersection area would need to be redesigned to an interchange to provide adequate mobility for truck traffic.

Recommendation

The next steps required to formalize the Madras Truck Route include conducting a further detail analysis and a feasibility study to determine the full impact of the proposed truck by-pass on adjacent properties and finalizing the preferred alternative. The analysis should consider other potential solutions to mitigate the operation and safety of US 97/US 26 through downtown. Options include optimizing the operation of US 97/US 26 through downtown Madras and/or adding capacity to the existing roadway. The study would likely need to include a National Environmental Policy Act (NEPA) analysis and appropriate environmental assessments of the alternative alignments of the future US 97 Truck Bypass before a final preferred alternative alignment is chosen.

J Street Improvement Refinement Plan

Background and Determination of Need

J Street is the main east-west connection in the south end of downtown Madras and provides access to the Palisades State Park to the west and new residential developments to the east. On the westside of Madras, J Street is known as Belmont Street and is mostly a two-lane rural roadway with minimal shoulder widths and shallow drainage ditches on both sides of the roadway. To the east of US 97, J Street is a two-lane roadway with urban features, (e.g. bike lanes and sidewalks), and provides access to new residential developments on the east end of the roadway, near McTaggart Road.

Past studies have identified the need to improve the operation of the intersections of J Street and US 97/US 26 Northbound and Southbound. In order to determine that the J Street improvements are still needed, analyses were conducted at three study intersections, namely J Street/US 97/US 26 Northbound, J Street/US 97/ US 26 Southbound, J Street/Adams Drive, to evaluate the existing operation of the intersections. The following section is a summary to technical analysis provided in Technical Memoranda “A”, “B” and “C” of the Jefferson County TSP.

The operation analysis was based on the 30th highest traffic volume and latest analysis guidelines provided by ODOT. Figure 3 shows the results of the operational analysis at the intersections. As shown in the figure, all the intersections meet the OHP standard, except the J Street/US 97/US 26 Southbound intersection. The westbound left-turn movement at the J Street/US 97/US 26 Southbound intersection operates at volume-to-capacity ratio greater than 1.0 during the 30th highest hour.

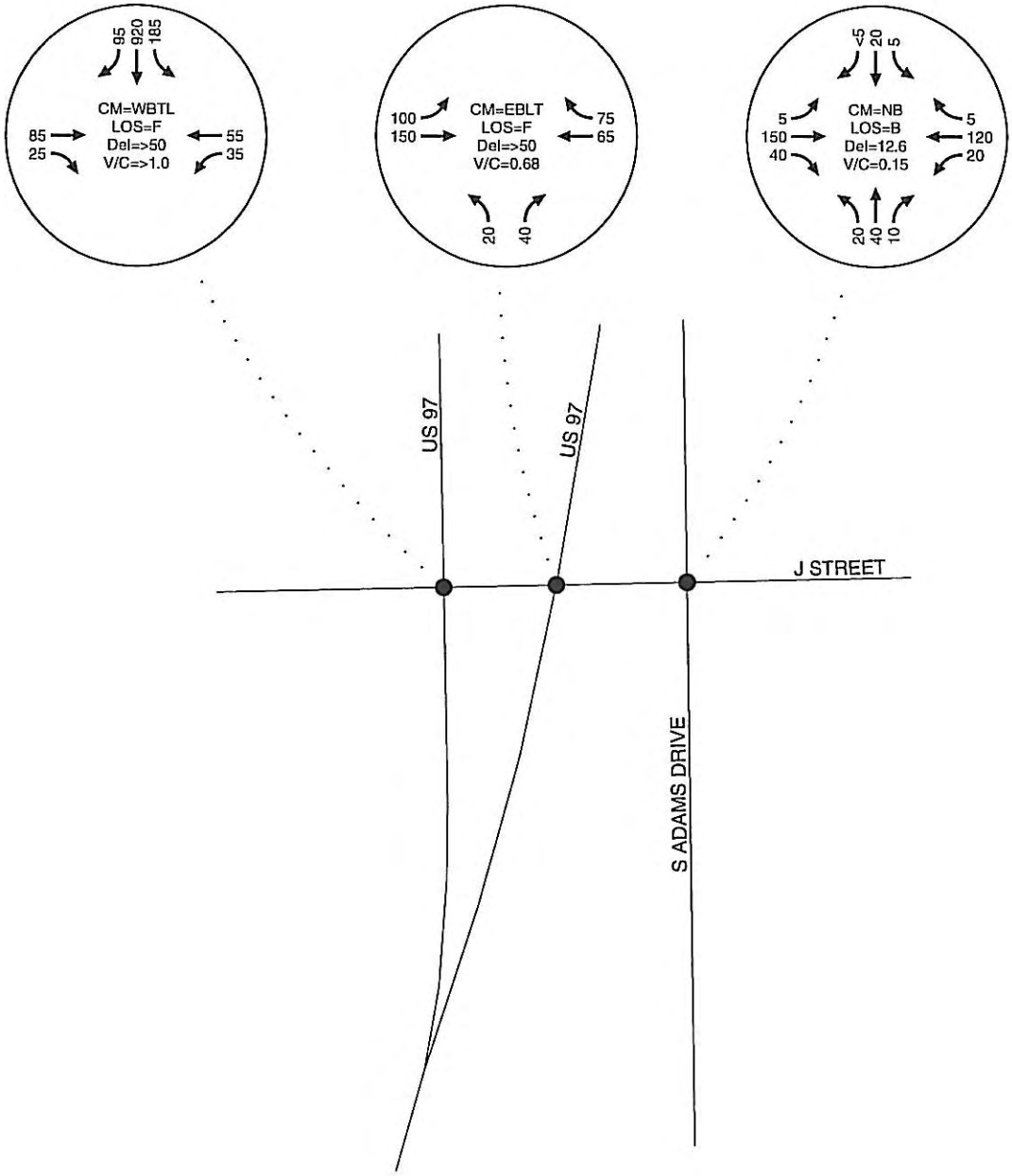
As mentioned in the Madras Truck Route Refinement Plan section, the traffic volume in downtown Madras is anticipated to grow at the rate of 3.37% annually. Using this growth rate, a 20-year analysis was conducted to the study intersection. Based on the analysis, the J Street/US 97/US 26 Northbound and Southbound intersections are anticipated to operation over capacity in year 2025 if no improvements are made at the intersections.

Similarly, a review of the five year crash history (from 2000–2004) revealed that there were six and seven crashes reported at the J Street/US 97/US 26 Southbound and J Street/US 97/US 26 Northbound intersections, respectively. The majority of the crashes were angle-type collisions. One of the potential causes of the high number of crashes is the close proximity of the two intersections which makes it an unsafe environment for motorists in the area. With the anticipated 70-percent increase in traffic volume over the next 20 years, the number and severity of crashes at the intersections are likely to increase in the future if no improvements are made at the intersection.

In addition, field observation revealed several other factors impacting the capacity and safety of the intersection:

- When looking north, the sight distance for the westbound movement at the J Street/US 97/US 26 Southbound intersection is not adequate for safe turning movements. The existing on-street parking on US 97/US 26 southbound blocks the view of oncoming southbound traffic.

(NO SCALE)



2005 EXISTING TRAFFIC CONDITIONS
30th HIGHEST HOUR
MADRAS, OREGON

FIGURE 3

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- The westbound through movement at the J Street/US 97/US 26 Southbound intersection is not aligned with the corresponding receiving lane.
- US 97/US 26 Southbound traffic merges from two lanes to one lane through the J Street intersection.
- US 97/ US 26 Northbound traffic diverges from one lane to two lanes through the J Street intersection.

In summary, J Street forms two closely spaced (60 feet apart) intersections with the US 97/US 26 couplet. The close proximity of these intersections presents traffic operation problems on J Street including high vehicle delay for east-west traffic, queuing problems, and safety concerns. In addition, the US 97/US 26 couplet is two lanes in each direction to the north of J Street and one lane in each direction to the south. The lane transition occurs through J Street exacerbating the operation and safety concerns at the intersection. As a result, it was determined that the intersections of J Street and US 97/US 26 Northbound and Southbound continue to need improvements to provide a safe operational environment in both the short and long term.

Alternative Analysis

The 1998 City of Madras TSP proposed two design alternatives at the J Street/US 97/US 26 intersections. The design alternatives provided more distance between the US 97/US 26 southbound and northbound intersections with J Street. The first alternative realigned US 97/US 26 northbound (or 5th Street) to 7th Street, while the second alternative realigned it to 10th Street. The TSP recommends realigning US 97/US 26 northbound to 10th Street as 7th Street is found to have "inadequate geometry to function as a good north-south route."

Subsequently, the 2001 City of Madras TSP Update reviewed the alternatives presented in the 1998 TSP and recommended two additional design alternatives. These alternatives are show in Figure 4 and discussed below.

Design Option 1

Design Option 1 shortens the existing one-way couplet by shifting the couplet transition north of J Street and signalizing the J Street/US 97/US 26 intersection. With this option, there will be only one intersection between J Street and US 97/US 26, which eliminates the operational hazards of having two closely spaced intersections. However, this design option will impact existing businesses located between the US 97/US 26 couplet, north of J Street.

Design Option 2

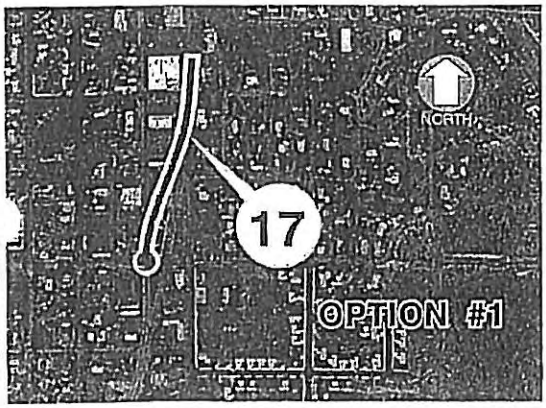
Design Option 2 extends the existing one-way US 97/US 26 couplet through downtown by shifting the couplet transition south of J Street and signalizing both the southbound and northbound J Street intersections. With this option, the current alignment of Adams Drive will be used for the realigned section of US 97/26. While this option will increase the distance between the existing closely spaced intersections, the new signalized intersections will still be within 200 feet of one another and will require signal coordination to reduce queues.

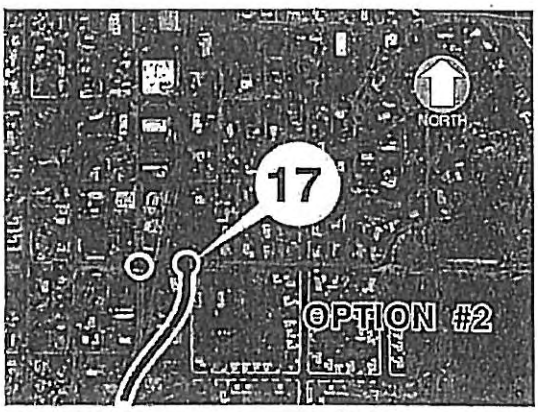
#17 "J" Street/US 97 Intersection Realignment

PURPOSE:
Provides a safe "J" Street crossing of the US 26/US 97 couplet and improves the east-west connectivity within Madras.

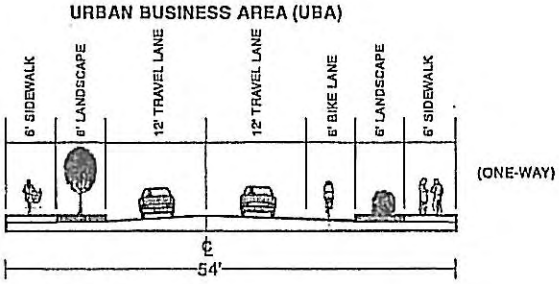
PROJECT DESCRIPTION:
This project has two design options that both require significant right-of-way and will likely impact existing businesses. Design Option #1 shortens the existing one-way couplet by shifting the couplet transition north of "J" Street and signalizing the "J" Street/US 26/US 97 intersection. Design Option #2 lengthens the existing one-way couplet by shifting the couplet transition south of "J" street and signalizing both the 4th Street and 5th Street intersections. Both of these design options will require Adams Drive to be reconfigured.

TIME FRAME: 10-20 years





TYPICAL CROSS-SECTION:



Based on qualitative review of the design options, the 2001 TSP update recommended Design Option 2 as a preferred alternative. The main advantage of Design Option 2 over Design Option 1 is that it "allows for future 5-lane section" of the highway.

Refinement Plan Alternatives

Alternative Solution A: Install Traffic Signal at the Current Intersection Location

One of the options to improve the operation of the J Street/US 97/US 26 intersections is to install traffic signals at the current location of the northbound and southbound intersections. Due to the proximity of these intersections (there is approximately 60 feet of storage between the intersections), a Synchro analysis was conducted at the intersections to take the progression of traffic between the intersections into consideration. The northbound and southbound intersections are anticipated to operate at volume to capacity ratio of 0.48 and 0.41, respectively, during the weekday p.m. peak hour periods with the traffic signals in place under 2005 traffic conditions.

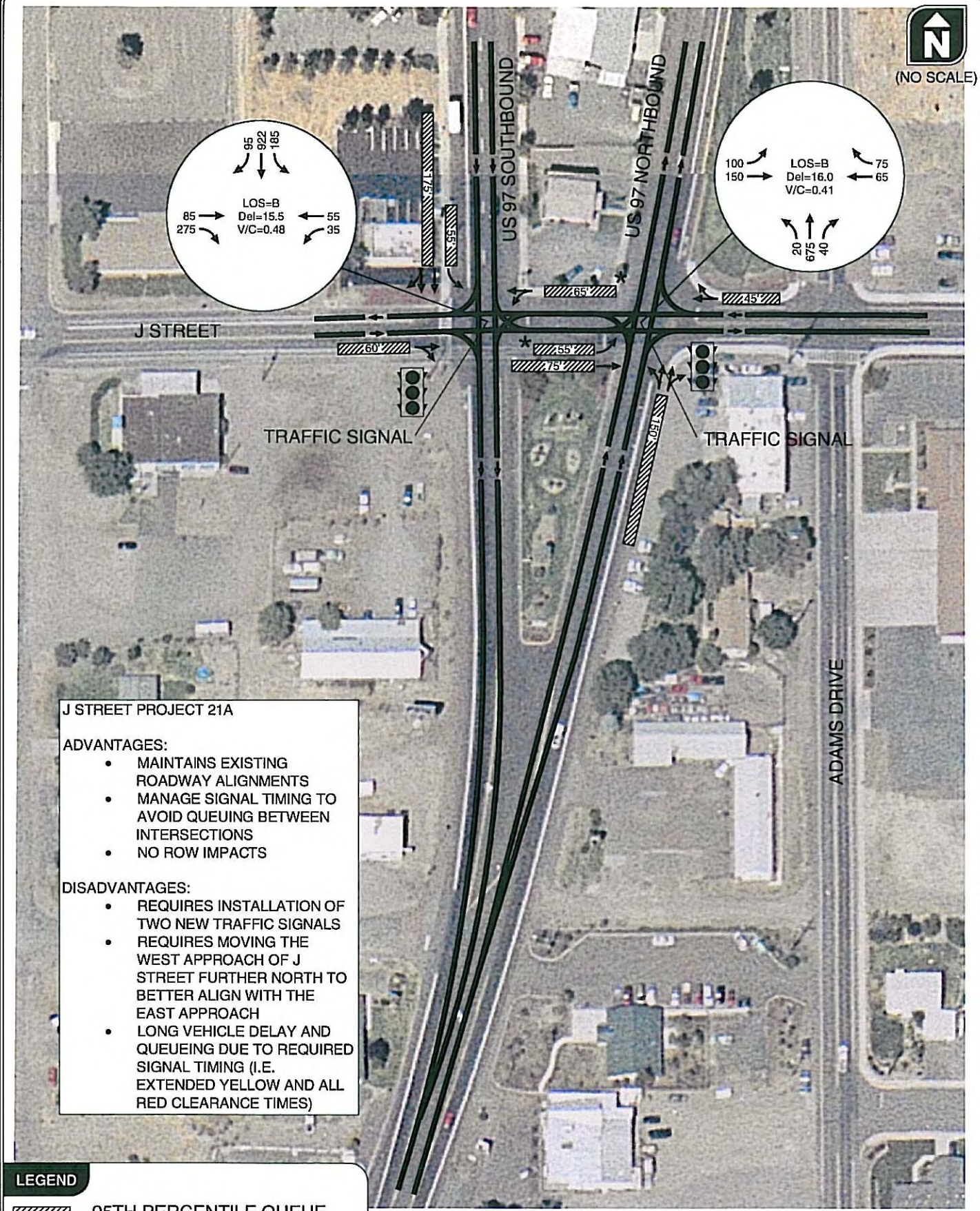
A review of the 95th percentile queues between the intersections showed that the eastbound and westbound queues at the intersections will exceed the 60 feet of available storage between the intersections. Subsequently, the queues are anticipated to spill back through the upstream signals. Even with east-west coordination between the intersections, the queues between the intersections are anticipated to exceed available storage. Furthermore, with anticipated growth in traffic on US 97/26, the coordination of the signals in the east-west direction will adversely impact the operation and queue for the north-south traffic at both the intersections. Consequently, it was determined that installing traffic signals at the current intersection location is not a viable solution. Figure 5 shows the general layout of this solution.

Alternative Solution B: Single Point Urban Intersection

One option to eliminate the issue of queues between the intersections is to redesign the two intersections into a one signal-point urban intersection. The intersection is anticipated to operate at a volume-to-capacity ratio of 0.59 as a single intersection under 2005 traffic condition. The intersection needs to be improved to the lane configuration listed below to meet the ODOT mobility standard of volume to capacity ratio 0.70 under 2025 traffic condition.

- Northbound: left-turn, dual through, and right-turn lanes
- Southbound: dual left-turn, dual through, and right-turn lanes
- Eastbound and Westbound: dual left-turn, through, and through-right turn lanes

This lane configuration will widen the intersection considerably and have adverse impact on the properties adjacent to the intersection. In addition, pedestrian and bicycle mobility through the intersection will be challenging, especially for children and the elderly. Hence, this solution was not determined to address all the operational and safety needs of the area. Figure 6 shows the single-line drawing of alternative solution B.



POTENTIAL J STREET ALTERNATIVE SOLUTION A
INSTALL TRAFFIC SIGNAL AT CURRENT LOCATION
2005 30TH HIGHEST HOUR TRAFFIC CONDITIONS

FIGURE 5

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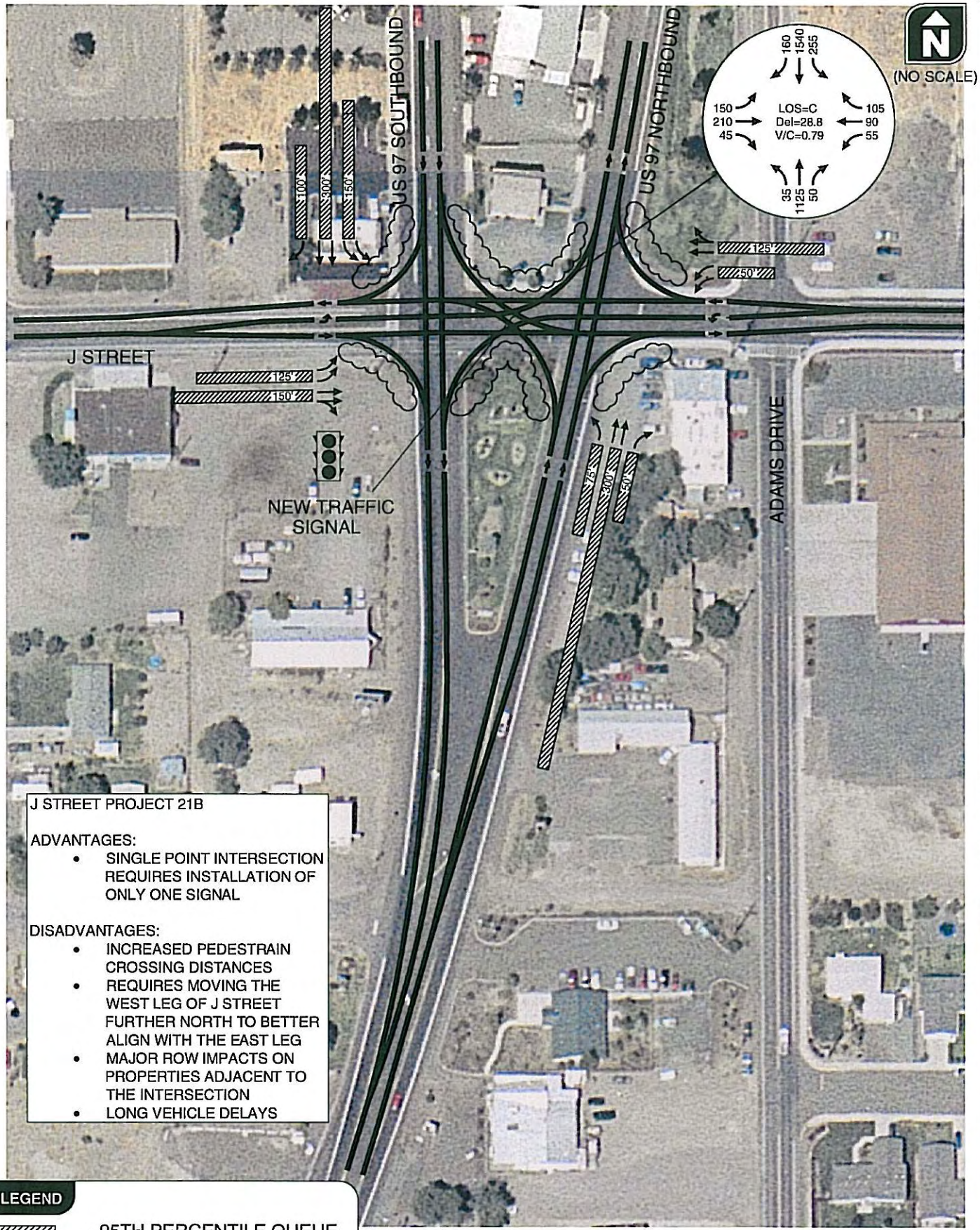

LEGEND

- 95TH PERCENTILE QUEUE
- RIGHT-OF-WAY IMPACT

POTENTIAL J STREET ALTERNATIVE SOLUTION B
SINGLE POINT URBAN INTERSECTION
2025 30TH HIGHEST HOUR TRAFFIC CONDITIONS

FIGURE 6

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Alternative Solution C: US 97/US 26 Realignment

As discussed previously, the 2001 Madras TSP Update evaluated realigning the highway north and south of J Street. The report recommended realigning the highway to the south of J Street based on the impact to current businesses and other concerns.

The current refinement plan evaluated two options for realigning the US 97/US 26 northbound approach south of J Street. The southern of the two alignments was determined to have lesser impact of the properties, based on discussions with City and County staff. A Synchro analysis was conducted to ensure that the traffic signal at the new realigned intersection would operate acceptably. The analysis showed that the J Street/US 97/US 26 Southbound intersection would operate at a volume-to-capacity ratio of 0.73 and the J Street/US 97/US 26 Northbound intersection would operate at a volume-to-capacity ratio of 0.67 during the 2025 30th highest hour conditions. Figure 7 shows the single-line drawing of alternative alignment C. Figure 8 shows the double-line drawing of the southern alignment option.

The US 97/US 26 realignment project has several advantages and disadvantages, which are highlighted below.

Advantages

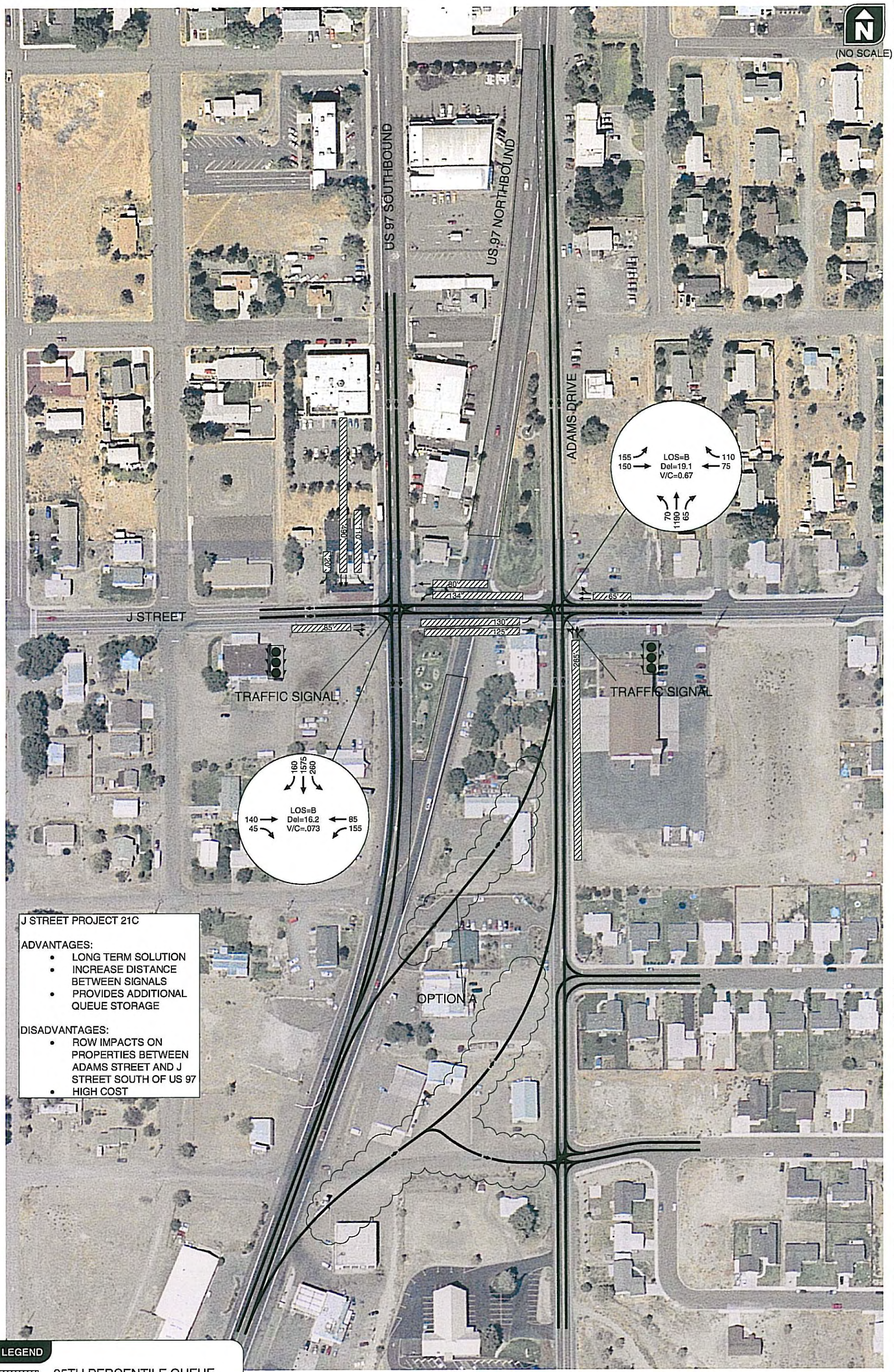
- Provides enough queuing distance between the northbound and southbound approaches of the highway, to store the vehicles on J Street.
- Reduces the speed for the northbound approach by using a low-speed design for the realignment.
- Extends the couplet south and provides access to additional properties for development.

Disadvantages

- Adversely impacts properties south of J Street between Adams Street and US 97/US 26.
- Substantial construction and right-of-way cost. ODOT cost estimate for the project is approximately $9 million.

Recommendation

The transportation alternatives presented above were discussed in detail in the technical advisory committee meetings and presented to the public in an open house. Based on the discussion and review comments received, Alternative C, the realignment of the US 97/US 26 northbound approach to Adams Street, was found to be most feasible and provides a long-term solution.



POTENTIAL J STREET ALTERNATIVE C
US 97/US 26 NORTHBOUND APPROACH REALIGNMENT
MADRAS, OREGON

FIGURE 7

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Transportation Engineering / Planning

J STREET ALTERNATIVE SOLUTION C - DOUBLE-LINE DRAWING OF
US 97/US 26 NORTHBOUND APPROACH REALIGNMENT
MADRAS, OREGON

FIGURE 8

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Kittelson & Associates, Inc.
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City of Madras TSP Project List Update

Several projects were identified in and around the City of Madras city limits during the course of preparing Jefferson County TSP. These projects addressed the long-term transportation needs of the County and City. The projects were reviewed by the technical advisory committee for the Jefferson County TSP, which included staff from City of Madras planning division, engineering division, school district as well as the police department. Some of these projects impacted the list of projects approved in the 2001 City of Madras TSP Update. In addition, the updated project list takes into consideration the recent residential developments in the east side of town.

In an effort to coordinate the two project lists (County and City), this section updates the City of Madras TSP project list to match the ones recommended in the County TSP. The following section identifies the projects that are impacted. The project number listed below refers to the City's TSP project list. Figure 9 provides the updated Figure B6 of the 2001 City of Madras TSP Update.

#6 Fairgrounds Road Extension (US 26/US 97 to ~~Adams Drive~~ Grizzly Road)

Extend Fairground Road future east to Grizzly Road. This extension represents anticipated future growth in the area.

#7 ~~Oak Street~~ Maple Street Extension (~~3rd~~-1st Street to US 26/US 97)

In order to coordinate with the newly constructed US 26/US 97 North intersection, and preserving the option of extending the fourth leg of the intersection as the Madras Truck Route, change Oak Street extension to Maple Street extension.

#8 ~~3rd~~ 1st Street Extension (~~Oak Street~~ Maple Street to B Street)

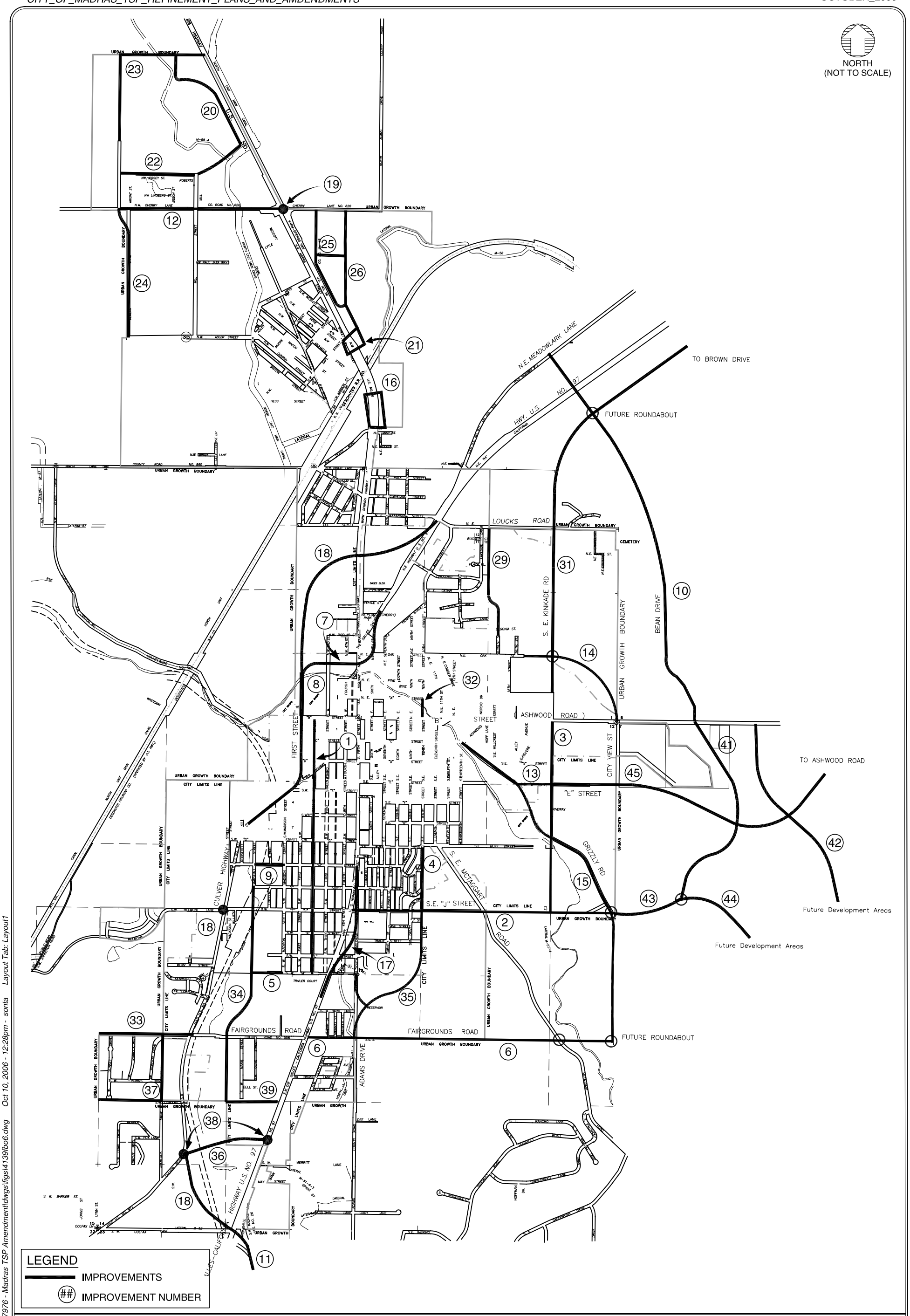
In order to coordinate with the Madras Truck Route option, change the project to 1st Street extension from Maple Street to B Street.

#10 ~~Claremont Street~~ Bean Drive Extension (~~US 97~~ Meadow Lark to ~~Grizzly Road~~ B Street)

Change project #10 Claremont Street extension from US 97 to Grizzly Road to Bean Drive extension from Meadow Lark to B Street to coordinate with Jefferson County TSP. The future intersection of Bean Drive/Kinkade Road is planned to be a modern roundabout.

#14 Oak Street Extension (16th Street to ~~Claremont~~ City View Street)

The alignment of the Oak Street extension is altered to form a curvilinear roadway and intersection opposite the City View Street/B Street intersection. A modern roundabout is planned at the intersection of Kinkade Avenue and Oak Street.



UPDATED SUMMARY OF PROPOSED TRANSPORTATION SYSTEM IMPROVEMENTS

K — W	CITY OF MADRAS COMPREHENSIVE PLAN AND TRANSPORTATION SYSTEM PLAN UPDATE OCTOBER 2006	S:\LOGOS\madras.tif	FIGURE B6

4139\DWGS\TECHMEMO#2B\4139F0B6

FIGURE 9

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#17 J Street/US 97 Intersection Realignment

Based on the refinement plan presented in previous section of this report, update the J Street/US 97 intersection realignment design to the double-line design shown in Figure 8. The project is estimated to cost approximately $9 million dollars including right-of-way acquisition, engineering and construction cost, according to the ODOT cost estimate.

#18A – D Madras Truck By-Pass Alignments

The Madras Truck Route refinement plan analyzed various alternative alignments, as described in the previous section. Based on the discussion on those alignments, the alignment that extends the truck route as the fourth leg of the US 97/US 26 North intersection and follows 1st Street to the current alignment of Culver Highway was identified as the most feasible alignment. The alignment is named as Alternative 1C and Alternative 2 in Figure 2. Even though the alignment addresses some of the concerns, such as the impact on the hotel development and cost of construction, it is anticipated to continue to have major right-of-way and access impacts on the properties adjacent to Culver Highway. As such, it is recommended that a detailed quantitative impact analysis be conducted in accordance with NEPA process before a final preferred alternative is selected.

#27 ~~Alder Street Improvements (Glass Drive to Mill Street)~~

This project is recommended to be removed from the list as it has already been built and is not identified in Jefferson County TSP.

#28 ~~Lakeside Drive Extension (Loucks Road to Kinkade Avenue)~~

This project is replaced by the Kinkade Avenue extension and is not included in the Jefferson County TSP.

#30 ~~Cedar Street Extension (Lakeside Drive to Claremont Extension)~~

This project is recommended to be removed from the list as Marigold Street, which runs parallel to Cedar Street, is proposed to extended to Bean Drive.

#31 Kinkade Avenue Extension (~~US 97~~ Brown Drive to ~~"A"~~ B Street)

The alignment of this project is modified to be extended north from B Street to the future extension of Bean Drive and continue to the northeast to Brown Drive. This project is anticipated to provide residential developments around Brown Drive with alternative access to downtown Madras without relying on US 97. The intersections of Kinkade Avenue/Bean Drive and Kinkade Avenue/Oak Street are planned to be modern roundabouts.

#35 Adams Drive/10th Street Connection

The alignment of this project is modified to illustrate a road connection on 10th Street from J Street to Fairgrounds Road and on Fairgrounds Road from 10th Street to Adams Drive (rearrange alignment to an "L" shape).

#41 Bean Drive Extension (Ashwood Road to J Street Extension)

The alignment of Bean Drive extension has been modified to accommodate current development pattern in the area. The final alignment of this project will need to accommodate topographical constraints and final developmental activity in the area.

#42 North-South UGB Road #1 (~~"E"~~ B Street to J Street)

The final alignment of this project will need to accommodate topographical constraints and development activity in the area.

#43 J Street Extenstion (Grizzly Road to Bean Drive Extension)

The alignment of the extension has been modified to accommodate current development pattern in the area. The final alignment of this project will need to accommodate topographical constraints and developmental activity in the area.

#44 East-West UGB Road #1 (~~Kinkade Avenue to Claremont~~ City View Street to Future Growth Area)

The final alignment of this project will need to accommodate topographical constraints and development activity in the area.

#45 ~~East-West UGB Road #1~~ E Street Extension (Kinkade Avenue to ~~"J" Street Extension~~ Ashwood Road)

Extend E Street east to Ashwood Road to accommodate future development in the area. The final alignment of this project will need to accommodate topographical constraints and development plan.

Additional Amendments

In recent years, City of Madras has witnessed a high pace of growth. The rate of growth is primarily attributed to the construction of the Department of Correction facility on the east side of the city and to the general population growth in Central Oregon, especially around the cities of Bend and Redmond. As such, large areas that were previously uninhabited are now being developed into residential sub-divisions, especially on the east side of the city. The updated list of projects provided in the previous section addressed some of the long-term transportation needs of these areas to accommodate the growth.

Furthermore, City of Madras is recommending to amend the City's TSP to include additional engineering standards and guidelines. These standards and guidelines will assist city officials in requiring new construction to follow standard engineering practices. It will also ensure that basic operational and safety features are provided in the design of the transportation system in and around the city.

Modern Roundabout Design and Operation Consideration

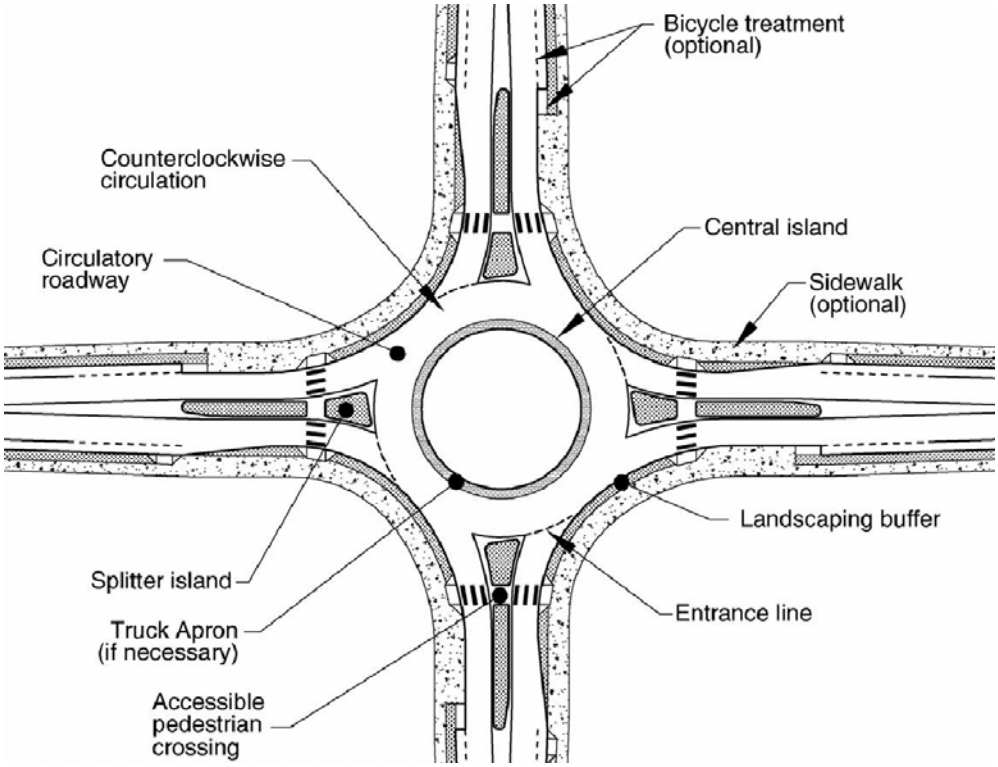
Modern roundabouts are a form of intersection design that provide safe and efficient flow of traffic within a certain range of traffic volume. Numerous research studies in the U.S. and abroad have shown that the operation of roundabouts is highly dependent on its geometric design and the characteristic of the traffic volume it serves. The detailed information on the safety, operations, and design of roundabout is provided in *Roundabouts: An Informational Guide*, published by the Federal Highway Administration (FHWA). The document stipulates that before the details of the geometry are defined, three fundamental elements must be determined in the preliminary design stage:

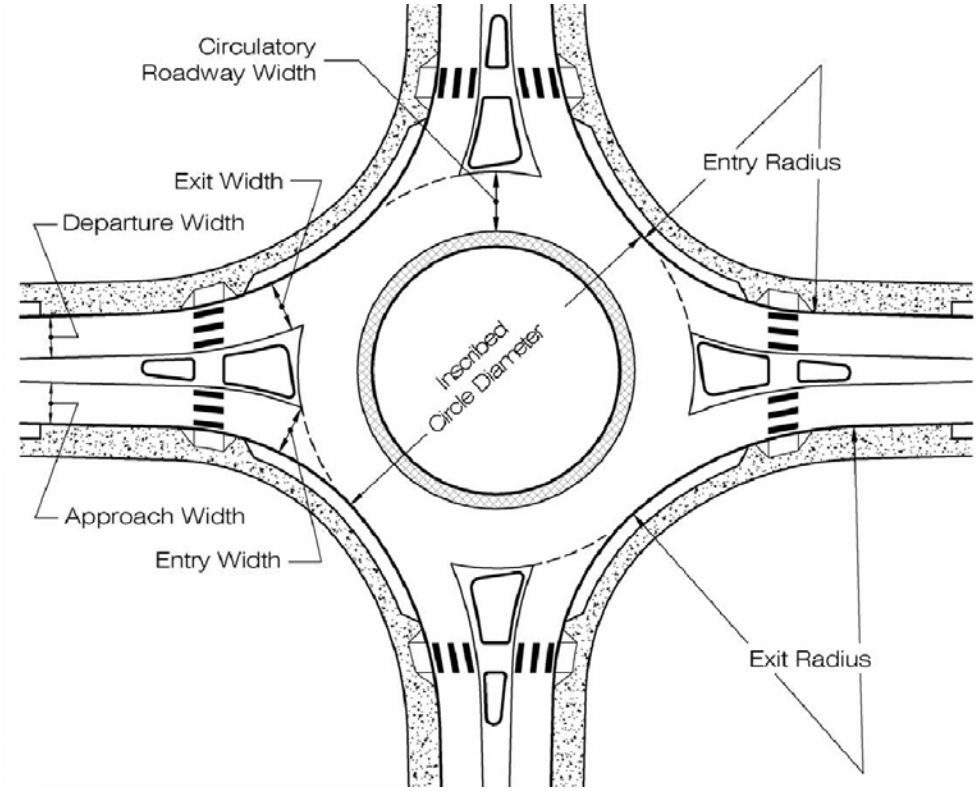
1. The optimal roundabout size;
2. The optimal position; and
3. The optimal alignment and arrangement of approach legs.

The document also highlights following critical design principals for roundabouts:

- Speed Profiles
- Design Speed
- Vehicle Paths
- Speed-Curve Relationship
- Speed Consistency

Other design considerations like design vehicle and non-motorized design users, among others, are also discussed in detail in the document. A volume-to-capacity (v/c) ratio of 0.85 is recommended as the operational standard of a roundabout. Exception to the v/c ratio standard is recommended when long-term analysis is conducted. Figure 10 shows key features and dimensions of modern roundabout.





KEY ROUNDABOUT FEATURES AND DIMENSIONS
MADRAS, OREGON

FIGURE **10**

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City of Madras Roundabout Standard

City of Madras and Jefferson County are planning to build several modern roundabouts around the city. In an effort to ensure that proper engineering standards are used when constructing roundabouts in and around the city, following design guidelines are recommended to be followed:

1. *Roundabouts: An Informational Guide* published by FHWA
2. *A Policy on Geometric Design of Highways and Streets* (Green Book), published by AASHTO
3. *Manual of Uniform Traffic Control Devices,* published by FHWA

Table 1 shows the recommended inscribed circle diameter ranges that is provided in Exhibit 6-19 of the roundabout guide.

Table 1 Recommended Inscribed Circle Diameter Ranges from Exhibit 6-19 of the *Roundabouts: An Informational Guide*

Site Category	Typical Design Vehicle	Inscribed Circle Diameter Range *
Mini-Roundabout	Single-Unit Truck	45 – 80 feet
Urban Compact	Single-Unit Truck/Bus	80 – 100 feet
Urban Single Lane	WB-50	100 – 130 feet
Urban Double Lane	WB-50	150 – 180 feet
Rural Single Lane	WB-67	115 – 130 feet
Rural Double Lane	WB-67	180 – 200 feet

* Assumes 90 degree angles between entries and no more then four legs.

Intersections of roadway facility types should consider all forms on intersection to ensure safe operating environment. Subject to a discretionary analysis by the Public Works Department, a modern roundabout is the initially preferred form of intersection between two major collectors or higher facilities. Based on City of Madras staff review of roundabouts in the region, a modern roundabout with an inscribed circle diameter of 190 feet and right-of-way of 252 feet diameter shall be dedicated as default, if no safety and operational analysis is presented to justify a smaller inscribed circle diameter. A roundabout with smaller inscribed diameter might be approved at certain location if a 20-year traffic safety and operation analysis determines that a smaller roundabout will operate adequately in the long-term. It is recommended that such a safety and operational analysis be conducted at all proposed/planned roundabouts before a final design is approved.

Planned Roundabouts

City of Madras and Jefferson County are planning to construct modern roundabouts at the following intersections:

- Kinkade Avenue/Oak Street/City View Street

- Kinkade Avenue extension/Bean Drive extension
- J Street extension/Bean Drive extension
- J Street extension/Grizzly Road
- Fairground Road extension/Grizzly Road
- Fairground Road extension/McTaggart Road

US 97/US 26 Highway Upgrade: K Street to Colfax Road

City of Madras and ODOT are planning to upgrade US 97/US 26 south of downtown Madras, from K Street to Colfax Road. The highway upgrade is anticipated to improve the operation and safety of motorist on the highway by reducing speed and adding urban features on the highway. Within a 100-foot right-of-way, the cross-section of the highway will include:

- Two 12-foot travel lanes
- One 16-foot center two-way left-turn lane
- Two 8-foot bike lanes
- 15-foot planter strip/drainage ditch on each side
- 6-foot sidewalk on each side

Figure 11 shows the cross-section of the US 97/US 26 highway upgrade. It should be noted that the above cross-section was included at the request of City staff. No specific reviews of the cross-section were conducted as part of the TSP amendment process.

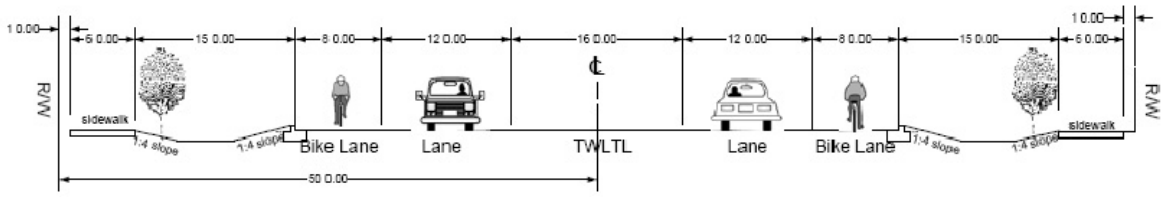
Culver Highway Upgrade: 1st Street to Colfax Road

Culver Highway is planned to be upgraded from 1st Street to Colfax Road as part of the Madras Truck Route. The design will include urban features and a posted speed of 45 mph.

- Two 12-foot travel lanes
- One 13-foot raised median with 3-foot shy distance on each side
- Two 8-foot bike lanes
- 4-8-foot planter strip on each side
- 6-foot sidewalk on each side

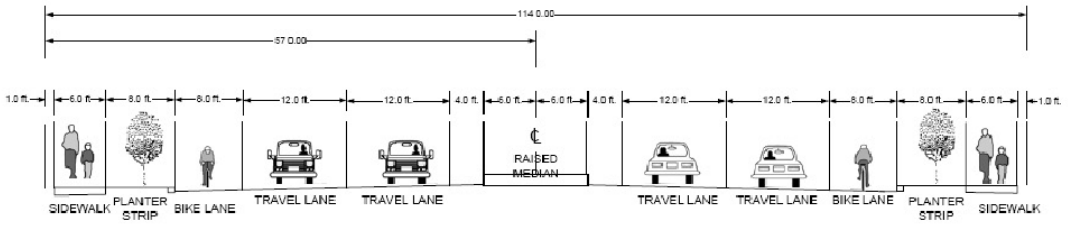
Figure 11 also shows the planned cross-section of Culver Highway/Madras Truck Route upgrade. Similar to US 97/US 26 cross-section, it should be noted that the cross-section for Culver Highway was included at the request of City staff. No specific reviews or impact analysis of the cross-section were conducted as part of the TSP amendment process.

TYPICAL SECTION US 97 – "K" STREET TO COLFAX RD.

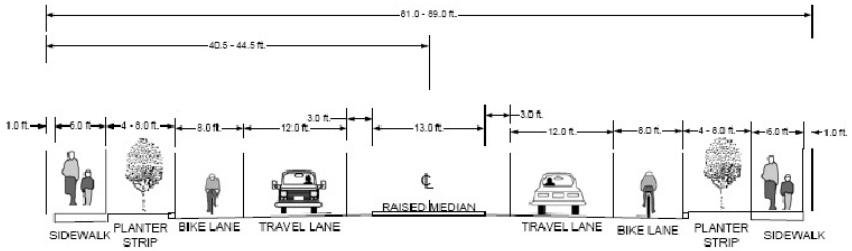


TYPICAL SECTION CULVER HIGHWAY - 1ST STREET TO COLFAX RD.

ODOT 45 MPH EXPRESSWAY (55 MPH DESIGN SPEED)



ODOT 45 MPH URBAN FRINGE/ SUBURBAN (55 MPH DESIGN SPEED)



US 97/US 26 AND CULVER HIGHWAY PLANNED CROSS-SECTION
MADRAS, OREGON

FIGURE 11