# Willamette Street Traffic Analysis

24th Avenue – 29th Avenue
Eugene, Oregon

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Prepared for:

**City of Eugene**
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# EXECUTIVE SUMMARY

McKenney Engineering conducted traffic analysis to evaluate improvement alternatives for the section of Willamette Street between 24th and 29th Avenues. The purpose of this analysis was to determine how pedestrian-crossing access might be improved while maintaining adequate street capacity and operational safety. The analysis evaluated two street design options, and two traffic-signal improvement alternatives:

Center-Turn Lane With Median. Re-stripe Willamette Street to a three-lane section with center turn lane, bicycle lanes and pedestrian refuges (raised median islands) at strategic points.

Hybrid Center-Turn Lane with Median. Re-stripe Willamette Street to a variable three/four-lane section and provide pedestrian refuges (raised median islands) at strategic points.

Full Traffic Signal. Install full intersection traffic signal control at Willamette Street /25th Avenue.

Mid-Block Pedestrian Signal. Install a mid-block pedestrian signal in the vicinity of Willamette Street /25th Avenue.

The study identified a number of factors beyond safe crossing opportunities, which impede pedestrian mobility within the study area. They included conflicts with bicyclists on the sidewalk, and noise, wind, and exhaust from vehicular traffic. Delays to through traffic and frequent lane changes were also identified as roadway safety issues.

The Center-Turn Lane with Median design is recommended to address these conditions. By providing a center turn lane and on-street bicycle lanes this design would reduce pedestrian-bicycle conflicts, move motor vehicle lanes away from sidewalks, enhance bicycle mobility, and facilitate vehicular turns at driveways.

# INTRODUCTION

This report summarizes traffic operations analysis prepared by McKenney Engineering to evaluated design alternatives for the section of Willamette Street between 24th and 29th Avenues. The analysis compared the performance of four design options, which could potentially improve pedestrian mobility within the study area. Enhancing opportunities for pedestrians to cross Willamette Street safely and efficiently was as a key objective to this effort.

Two street-design options and two traffic-signal improvement options were evaluated:

1) Center-turn lane with median. Re-stripe Willamette Street to a three-lane section with center turn lane, bicycle lanes and pedestrian refuges (raised median islands) at strategic points.

2) Hybrid center-turn lane with median. Re-stripe Willamette Street to a variable three/four-lane section and provide pedestrian refuges (raised median islands) at strategic points.

3) Full traffic signal. Install full intersection traffic signal control at Willamette Street /25th Avenue.

4) Mid-block pedestrian signal. Install a mid-block pedestrian signal in the vicinity of Willamette Street /25th Avenue.

The full traffic signal and mid-block pedestrian signal options were each evaluated in the context of the existing four-lane street design and the center-turn lane with median design.

# STUDY SCOPE AND METHODOLOGY

## *Analysis Area*

The analysis area extended along Willamette Street between 24th Avenue and 29th Avenue, including signalized intersections at 24th, 27th and 29th Avenues, and unsignalized intersections at 24th Place, 25th, 26th, and 28th Avenues.

## *Traffic Analysis*

There were three major components to the analysis:

1) Traffic operations were observed directly and using videotapes to evaluate existing conditions and identify operational issues.

2) A recent three-year history of traffic collision diagrams was reviewed and plotted on an aerial photograph to identify high-crash locations and crash patterns.

3) The *Synchro* analysis package and Highway Capacity Software (*HCS*) were used to evaluate existing arterial and intersection levels of service, and compare the performance of improvement options.

# EXISTING CONDITIONS

### *Abutting Land Use*

The abutting land along Willamette Street is fully developed with commercial and residential uses. This development includes a wide range of both retail and service businesses. The commercial district is anchored on the south by Willamette Plaza Shopping Center. Several medical offices extend along the west side of Willamette between 24th and 25th Avenues. Other major traffic generators are a small commercial mall (west side) and Oasis Market (east side), which are located between 25th Avenue and 26th Avenue.

### *Street Design*

Between 24th and 29th Avenues the existing Willamette Street design is nominally 42-feet wide and provides two travel lanes in each direction with 11-foot curbside and 10-foot inside lanes. The street widens to 54 feet approaching 29th Avenue to accommodate dedicated left-turn lanes. At 24th Avenue the curbside northbound lane is striped for right-turn only. The posted speed on Willamette Street is 25 MPH and free flow traffic speeds are in the 25-30 MPH range.

The traffic signal at 29th Avenue is fully actuated and runs in free (uncoordinated) mode at all times. The traffic signals at 27th and 24th Avenues operate with vehicle and pedestrian detection on the side street approaches only. These two signals are coordinated on a 70-sec cycle during weekday hours of 7:15 AM and 7:00 PM.

### *Transit Service*

LTD Bus Routes #24 and #25 operate on Willamette Street. Each of these routes runs two buses per hour during the AM Mid-day and PM peak periods. Bus stops served by these routes are shown on the aerial photograph that accompanies this report. Daily boarding/deboarding data for these stops was obtained from LTD and is summarized in the following table.

| | Boarding | Deboarding |
|---|---|---|
| West -side of Willamette, south of 24th | 7 | 34 |
| East-side of Willamette, north of 25th | 54 | 9 |
| West -side of Willamette, south of 25th | 13 | 43 |
| East-side of Willamette, north of 27th | 35 | 7 |
| West -side of Willamette, south of 27th | 3 | 44 |
| East-side of Willamette, north of 29th | 123 | 18 |
| West-side of Willamette, north of 29th | 29 | 100 |

This data indicates the highest volume of boarding/deboarding occurs at stops near the

intersections of 29th, 27th and 25th Avenues.

### *Traffic Volumes*

Traffic volume assumptions for the AM, Mid-day and PM peak hours were developed from traffic count data provided by City of Eugene Transportation Division. These counts show that volume on Willamette Street reaches 1,100 vehicles per hour (in one direction) during peak periods. AM, Mid-day and PM peak intersection turning volumes are summarized in Figures 1, 2 and 3.

# IMPROVEMENT ALTERNATIVES

Two roadway design alternatives and two signalization alternatives were evaluated in this analysis. The following sections describe the design assumptions and features of these alternatives.

## *Roadway Options*

### Option A – Center-Turn Lane with Median

This option would re-stripe Willamette Street to a three-lane section with center turn lane, bicycle lanes and pedestrian refuges (raised median islands) at strategic points. The street cross section for this option would be as shown below.

```
                          < --- 42' Total --- >
| 5" |     10.5'    |      11'        |     10.5'    | 5' |
  Bike      Thru        Center Turn         Thru       Bike
                          or Median
```

### Option B – Hybrid Center-Turn Lane With Median

This option would re-stripe Willamette Street to a variable three/four-lane section and provide pedestrian refuges (raised median islands) at strategic points. Transition sections or lane drops at intersections would be required to blend the two different cross-sections design. At median locations the street cross section for this option would be as shown below.

```
                    < --- 42' Total --- >
|     13'     |      16'       |     13'     |
    Thru           Median          Thru
```

### Roadway Design Assumptions

To create a transition from the existing four-lane Willamette Street to a three-lane design would require a lane drop at an intersection and/or a lane-reduction taper. Using a 10.5-foot lane width and vehicle speed of 25-30 MPH the taper criteria for lane-reductions in the Manual on Uniform Traffic control Devices (3B-13 of MUTCD Rev. 9/84) call for taper lengths of 110-160 feet.

For purposes of this analysis a taper length of 150 feet was assumed. Lane reduction designs for roadway Options A and B based on this assumption are shown in Figures 4 and 5.

### *Signalization Options*

#### Option 1 – Full Traffic Signal

This option would install full intersection traffic signal control at Willamette Street /25$^{th}$ Avenue. The signal is assumed to be semi-actuated, coordinated and operating on a 70-second cycle in the same manner as the existing signals at 24$^{th}$ and 27$^{th}$ Avenues.

#### Option 2 – Mid-Block Pedestrian Signal

This option would install a mid-block pedestrian signal in the vicinity of Willamette Street /25$^{th}$ Avenue. The signal is assumed to be pedestrian-actuated only and operating in "free" mode so that Willamette Street traffic would be interrupted only when a pedestrian actuated the push button to cross.

# TRAFFIC OPERATIONS ANALYSIS

### *Field/Video Observations*

Approximately 15 hours of street operations were video taped by Eugene Transportation Division. The recording camera was positioned on the west side of Willamette Street looking north from a point approximately 180 feet north of 27th Avenue. Video taping was done during the following periods:

| Day | Date | Time Period |
|---|---|---|
| Thursday | 5/24/01 | 0930-1200 |
| Tuesday | 5/22/01 | 1200-1500 |
| Thursday | 5/24/01 | 1200-1500 |
| Tuesday | 5/22/01 | 1445-1645 |
| Tuesday | 5/22/01 | 1700-1800 |
| Thursday | 5/24/01 | 1500-1800 |

These videotapes show pedestrian, bicycle, transit and automobile traffic activity within an approximately one-half block area. The videotapes were reviewed and six one-hour segments covering peak travel periods were analyzed in detail to identify operational issues of interest. The following key observations were noted during the detailed review:

1) A significant source of traffic delays along Willamette is vehicles making turns at driveways and intersections. During heavy traffic periods vehicles waiting to turn left into driveways block the inside travel lanes. Curb radii are generally short (6-10 feet) at intersections on Willamette Street and most driveways have little or no flare (length of transition from full-height curb to gutter level). These conditions often force turning vehicles to slow to a near stop to avoid running over the curb. The resulting delays to through traffic provoke frequent lane changes.

2) The signal coordination between 24th and 27th Avenues creates noticeable platoons of traffic with regular gaps. These gaps facilitate driveway/intersection turning movements and aid pedestrians crossing Willamette.

3) LTD buses do not always stop to load or unload passengers at every bus stop. No major traffic delays due to stopped buses were noted.

4) The number of pedestrians walking along Willamette Street (101) was slightly lower than the number of cyclists (112).

5) Of 112 bicyclists passing through the study section, 77 percent traveled on the west sidewalk, 17 percent on the east sidewalk, and only six percent (seven trips during the six-hour period) traveled in the roadway. The result is frequent bicycle-pedestrian conflicts.

6) The relatively narrow travel lanes and curbside sidewalks along Willamette expose pedestrians to substantial noise, air blasts and exhaust from motor vehicles. In addition, a significant amount of standing water was observed in the west gutter south of the camera site (even on hot dry days). On several occasions this water was splashed across the sidewalk by buses and trucks traveling southbound in the curbside lane – a problem that would be worse in the rainy season. These conditions make pedestrian travel along Willamette uninviting.

### *Traffic Collision Analysis*

The Transportation Division provided traffic collision diagrams for the study section covering the years 1997, 1998 and 1999. Mid-block collision data was plotted on an aerial photograph and analyzed to identify locations where collisions might be related to driveway operations or other street design characteristics. The data analysis is summarized in the following table.

**Three-year Traffic Collision Summary**

| Street Section | Drive-way | Rear-end | Other | Bike | Ped | Total |
|---|---|---|---|---|---|---|
| 24th Ave – 24th Pl | 1 | 2 | | 1 | | 4 |
| | | | | | | |
| 24th Pl – 25th Ave | | 3 | | | | 3 |
| | | | | | | |
| 25th Ave – 26th Ave | | 2 | 1 | 1 | | 4 |
| | | | | | | |
| 26th Ave – 27th Ave | 3 | 3 | | 1 | | 7 |
| | | | | | | |
| 27th Ave – 28th Ave | 2 | 3 | | | | 5 |
| | | | | | | |
| 28th Ave – 29th Ave | 4 | 3 | | 1 | | 8 |
| | | | | | | |
| **Total** | 10 | 16 | 1 | 4 | | 31 |

The tabulated data indicates the most frequent mid-block crash types are rear-end (16) and driveway-related turning collisions (10). These types of collisions are likely related to the driveway delay operations previously described.

Although a high number of crashes occurred in the section between 26th Avenue and 28th Avenue (six rear-end and five driveway-related crashes) there was no particular location with an exceptionally high crash frequency or pattern.

Bicycles were involved in 13 percent of crashes but no mid-block pedestrian collisions were noted during the study period.

## *Improvement Alternatives – General Evaluation*

### Roadway Option A

Implementation of Roadway Option A was determined to be most feasible starting approximately 120 feet south of 24th Avenue and extending to the point where Willamette Street begins to widen north of 29th Avenue (near the south driveway to Willamette Plaza). Within this section the street is on a straight alignment and maintains a consistent width. Two locations for raised-median pedestrian refuges were tentatively identified:

1) Between 24th Place and 25th Avenue, near the LTD bus stop in front of Oasis Market, and

2) Just south of 26th Avenue opposite the Glenwood Café.

Advantages of this option are:

1) On-street bicycle lanes would encourage cyclists to use the street instead of the sidewalk. This would improve service to pedestrians by reducing bicycle-pedestrian conflicts and placing motor vehicle traffic farther from the sidewalk.

2) On-street bicycle lanes would encourage cyclists to ride with the flow of street traffic thus reducing unexpected auto/bike conflicts.

3) Motor-vehicle travel lanes would be offset five feet from the curb, which would effectively increase the turning radius for vehicles turning at driveways and intersections. This would reduce through-traffic delays due to turning movements.

Disadvantages of this option are:

1) There appear to be few locations suitable for raised-median pedestrian refuges that would not conflict to some degree with adjacent driveways.

2) Left-turn conflicts in the center turn lane may occur where driveways are closely spaced or located near intersections.

## Roadway Option B

As shown in Figure 5 implementation of Roadway Option B would require modification of approximately 300 feet of the roadway at each location where a raised median was installed. The only significant benefit of this option would be the creation of pedestrian refuges, which would allow a two-stage crossing of Willamette Street at those points.

Disadvantages of this option are:

1) As with Option A, there are few locations where the pedestrian refuges and associated lane reductions would not conflict with a number adjacent driveways.

2) This Option would not improve sidewalk operations or service to bicycle traffic, much of which now operates on the sidewalks.

3) If installed at multiple locations, pedestrian refuge islands would increase vehicular conflicts at the required lane reduction points.

## Signalization Option 1

Although it would provide a protected crossing for pedestrians at this location, existing traffic conditions do not warrant signalization at 25th Avenue. Side street traffic volumes are below 60 vehicles-per-hour during peak periods and there is no significant accident history. Due to the near equal spacing of 25th Avenue from existing signals at 24th and 27th Avenues the adverse effects of a new signal on arterial level of service could be minimized by operating in coordinated mode. Level-of-service analysis assuming coordination was performed for both the existing lane configuration and Roadway Option A (see analysis section).

## Signalization Option 2

Field and videotape observations indicate a low volume of pedestrians crossing Willamette Street. To model the operation of a mid-block pedestrian signal in Synchro a standard intersection was defined but no side-street vehicular volume was assigned. The location selected is approximately 180 feet north of 25th Avenue. The signal was assumed to operate non-coordinated and the number of “pedestrian calls per hour” was assumed to be 25. Level-of-service analysis was performed for both the existing lane configuration and Roadway Option A.

## Level-of-Service Analysis

For purposes of comparing design options, arterial level-of-service analysis was performed using the *Synchro* package by *Trafficware*. This analysis was supplemented with Highway Capacity Manual analysis using the McTrans Highway Capacity Software (*HCS 2000*) to confirm results at critical intersections. Due to its higher traffic volumes, the PM peak hour was selected as the analysis period for this comparison.

The following scenarios were analyzed:

- Existing Four-lane Design
- Existing Four-lane Design with Signal Option 1
- Existing Four-lane Design with Signal Option 2

- Three-lane Option A with Existing Signals
- Three-lane Option A with Signal Option 1
- Three-lane Option A with Signal Option 2

Key arterial level-of-service parameters as calculated by *Synchro* for these scenarios are summarized in the following table.

**Arterial Level of Service Comparison**
(Northbound/Southbound)

| | **Existing 4-Lane** | | | **Roadway Option A, 3-lane** | | |
|---|---|---|---|---|---|---|
| | **Existing Signals** | **Signal Option 1** | **Signal Option 2** | **Existing Signals** | **Signal Option 1** | **Signal Option 2** |
| | | | | | | |
| **Signal Delay** | 33.4 / 42.1 | 37.9 / 43.2 | 37.4 / 49.5 | 33.6 / 70.3 | 43.7 / 80.0 | 38.6 / 76.8 |
| **Travel Time** | 114 / 129 | 124 / 136 | 125 / 144 | 115 / 157 | 130 / 173 | 127 / 171 |
| **Arterial Speed** | 18.1 / 16.9 | 16.6 / 16.1 | 16.5 / 15.2 | 18.0 / 13.9 | 15.9 / 12.7 | 16.3 / 12.8 |
| **Arterial LOS** | C / C | C / C | C / C | C / C | C / C | C / C |
| | | | | | | |

The assumed improvement options would not affect operations at 24th Avenue and 29th Avenue. The following table shows signalized intersection levels of service as calculated by *Synchro*. Results are shown for existing conditions and for cases where LOS would be significantly changed by the roadway/signal modifications.

**Intersection Level of Service Comparison**
(LOS – Control Delay sec/veh)

| | Existing 4-Lane | | | Roadway Option A, 3-lane | | |
|---|---|---|---|---|---|---|
| | **Existing Signals** | **Signal Option 1** | **Signal Option 2** | **Existing Signals** | **Signal Option 1** | **Signal Option 2** |
| | | | | | | |
| **24th Avenue** | B – 14.4 | | | | | |
| **25th Avenue** | | A – 2.8 | | | A – 8.9***** | |
| **27th Avenue** | A – 7.5 | A – 7.5 | A – 8.9 | B – 16.2***** | B – 13.8***** | B – 18.6***** |
| **29th Avenue** | D – 38.4 | | | | | |
| | | | | | | |

*******These results reflect semi-actuated operation with current side-street demand. With a three-lane design the southbound Willamette Street movement calculates as near capacity in some cases (see Synchro analysis output). Balancing this factor are the overall arterial level of service (LOS C) and the benefits of moving left-turning vehicles out of the through lanes.*

# CONCLUSIONS/RECOMMENDATIONS

## *Recommended Alternative*

Of the alternatives evaluated in this study, Roadway Option A (Center-turn lane with median) is recommended for improving pedestrian access and mobility in the study area. This recommendation is based on the conclusions outlined below.

1) The study identified a number of factors beyond safe crossing opportunities, which impede pedestrian mobility within the study area. They include conflicts with bicyclists on the sidewalk, noise, wind and exhaust from vehicular traffic, and vehicle turns and lane change maneuvers. Option A addresses these issues by providing a center turn lane and on-street bicycle lanes. This design would reduce pedestrian-bicycle conflicts, move motor vehicle lanes away from sidewalks, enhance bicycle mobility, and facilitate vehicular turns at driveways.

2) The level-of-service analysis indicates that a three-lane design is generally viable from an arterial capacity standpoint under existing traffic conditions. The surrounding neighborhood development is mature and widening of Willamette Street to add through capacity is considered unlikely. The street's function of providing primary access to abutting properties is expected to continue and dominate in the future.

3) It appears feasible to implement the three-lane design in phases, starting at the north end of study area, and thus evaluate its effectiveness before revising the entire $24^{th}$ – $29^{th}$ segment.

## *Other Recommendations*

### Bus Stop Turnouts

With a three-lane design stopped buses would have a greater impact on through traffic flow along Willamette. Developing bus turnouts where feasible would be a valuable improvement to offset this impact. However, the right-of-way width for Willamette Street is generally only 60 feet, which restricts opportunities for developing turnouts without substantial costs. One exception is the 480-foot section, on the west side, south of $25^{th}$ Avenue, which has an addition 10 feet of right-of-way.

## Driveway Consolidation

The large number of driveways along Willamette Street adversely impacts all modes of travel through the study area. Elimination and/or consolidation of driveways where possible would be a valuable component of the three-lane design. In some cases it appears that these types of improvements might be combined with parking lot redesigns to increase the number of parking spaces for the businesses. During the course of this study the following locations were identified where these types of improvements may be feasible:

1) The former service station site on the southeast corner at 25th Avenue. This building appears to be unoccupied at this time. It currently has two driveways onto Willamette Street and two onto 25th Avenue.

2) The Eugene hardware site on the southeast corner at 28th Avenue. The parking lot bordering Willamette Street currently has two driveways onto Willamette Street and one onto 25th Avenue. It appears the depth of this lot could provide a greater number of parking spaces by closing the northernmost driveway onto Willamette and restriping the lot with two rows of diagonal parking spaces.