PREPARED FOR

ODOT Region 2
City of Tillamook
Tillamook County

PREPARED BY

CH2MHILL

Jeanne Lawson Associates, Inc.

REVISED DRAFT

Tillamook Transportation Refinement Plan

January 2006

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Report

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Introduction

The Tillamook Transportation Refinement Plan was undertaken to develop solutions to three interrelated transportation issues in downtown Tillamook, Oregon (Figure 1):

- Transportation safety, with an emphasis on pedestrians
- Adverse impacts of truck traffic (volume, speed, noise, safety)
- Parking utilization and supply

To address these issues, the plan recommends changes to the Tillamook transportation system in the following areas:

- Improvements to truck routes outside of downtown, in particular minor improvements to county roads to support existing levels of truck traffic on those facilities
- Tillamook Lumber Mill circulation, in particular how trucks enter and exit the mill and the related effect on truck traffic in downtown Tillamook
- Design of Main and Pacific Avenues downtown (US 101 Couplet), in particular issues of pedestrian safety, circulation, and aesthetics
- Downtown traffic circulation, in particular congestion and safety at the intersection of US 101 and OR 6
- Downtown parking, in particular improving the management and use of existing spaces and identifying options for creating additional spaces

Background

The City of Tillamook and Tillamook County Transportation System Plans (TSPs) prepared in recent years identified several issues related to the adverse impacts of traffic, in particular truck traffic, on the state highways (US 101 and OR 6) that pass through the commercial core of downtown Tillamook. These issues are summarized as follows:

- **Truck Transportation Issues:** As part of the TSP process in 2002 and 2003, Tillamook County and City of Tillamook staff members identified the need and desire to minimize the impacts of local and through freight truck traffic in the City of Tillamook downtown commercial area and in residential neighborhoods in the city. These issues were studied at an introductory level in the Large Vehicle Alternative Route Study included in the city and county TSPs. Because of the complex nature of this problem, specific solutions were not recommended in the TSPs and additional study was recommended.
- **Downtown Safety and Parking Issues:** The 2003 City of Tillamook TSP identified a number of improvements to improve pedestrian, bicycle, and vehicle safety in the downtown area, including changes to intersections on US 101 and a recommendation for consideration as a Special Transportation Area (STA), which the Oregon Department of Transportation (ODOT) has subsequently conferred. The TSP also recommended a downtown parking study be conducted as a first step to identifying specific parking issues and solutions.

The city and county asked ODOT for assistance in resolving these issues, in the form of a refinement plan to the TSP. A "refinement plan" is defined in the state Transportation Planning Rule as:

> ...[A]n amendment to the transportation system plan, which resolves, at a systems level, determinations on function, mode or general location which were deferred during transportation system planning because detailed information needed to make those determinations could not reasonably be obtained during that process.

Study Area

This refinement plan includes three overlapping study areas centered on downtown Tillamook (Figure 1[1]):

- Safety: Main and Pacific Avenues from Front Street to 10th Street (for downtown safety)
- Parking: The city's designated Town Center area and designated Parking District (for parking)
- Truck Travel: US 101 from South Prairie Road on the south to Juno Hill on the north and from the Whiskey Creek Road intersection of OR 131 on the west to the Fairview Road intersection on OR 6 on the east

Technical Documentation

The discussion in this plan is supported by a number of detailed technical memorandums, which are included in the Appendix:

- Memo #1: Plan and Policy Review
- Memo #2: Goals and Evaluation Criteria
- Memo #3: Existing and Future Traffic Operations and Safety
- Memo #4: Downtown Speed Study Results
- Memo #5: Parking Study – Existing Conditions
- Memo #6: Truck Travel Data Collection and Analysis
- Memo #7A: Downtown Traffic Alternatives Analysis
- Memo #7B: Preliminary List of Downtown Parking and Safety Alternatives
- Memo #8: Preliminary List of Truck Route Alternatives
- Memo #9: Sidewalk Structural Review
- Memo #10: Downtown Parking Recommendations
- Memo #11: ODOT Pedestrian Safety Study
- Memo #12: Alternatives Development and Evaluation
- Memo #13: Illumination and Signage Recommendations
- Memo #14: Public Involvement Summary
- Memo #15: Cost Estimates
- Memo #16: Funding Options
- Memo #17: Adoption Recommendations

[1] All figures appear at the end of this document.

Planning Process

Project Management

A project management team (PMT) consisting of the consultant team and staff members from ODOT, the City of Tillamook, Tillamook County, the Tillamook Downtown Association, and the Department of Land Conservation and Development provided guidance and policy direction for this plan. The PMT met monthly by telephone throughout the refinement plan process.

Public Involvement

A multi-faceted public involvement approach was taken on this project to ensure the effective involvement of members of the Tillamook community and other interested stakeholders. The approach included the following:

- Refinement Plan Advisory Committee (RPAC)—The RPAC was a 22-member committee of Tillamook-area residents, elected officials, business people, and public agency staff members. It was designed to represent a range of interests in Tillamook transportation issues, including downtown business people and truck-based businesses outside of downtown. The RPAC met six times between September 2004 and November 2005.
- Public Workshops—Two hands-on public workshops were conducted, in January and February 2005, to solicit involvement of the broader community in the identification of problems and brainstorming of solutions.
- Public Open Houses—Two public open houses were conducted during the project, one to present preliminary alternatives (July 2005 at the Tillamook farmers' market) and one to present the draft plan (November 2005 at the Tillamook Forestry Center). Open house materials also were displayed at City Hall after the July 2005 event.
- Mailings, Media, and Advertisements—Public events were publicized through the use of mailings to interested parties, as well as to downtown businesses and those with a potential interest in truck transportation issues. This refinement plan and public events were described in notices, articles, and advertisements in the Tillamook *Headlight Herald* and announced on the local radio station.

Further documentation of the public involvement process is included in the Appendix (Memo #14).

Plan and Policy Review

At the beginning of the planning process, the consultant team reviewed city, county, and state plans and policies for the jurisdictions that own, regulate, or provide public services on the public roadways and adjacent lands in the study area. The purpose of this review was to help ensure that proposed changes were consistent with these documents, and to aid in the development of implementing ordinances for the plan. Results of the plan and policy review are included in the Appendix (Memo #1).

Goals and Evaluation Criteria

Starting from the statement of work for the project and a discussion at the first RPAC meeting, the consultant team developed draft goals and evaluation criteria for the project that the RPAC reviewed and approved at its second meeting. The goals and evaluation criteria (see Table 1) create a framework to ensure that the plan responds to the goals and desires of the community. The draft alternatives were evaluated using these criteria.

TABLE 1
Goals and Evaluation Criteria

Goals	Evaluation Criteria
1 Improve US 101 Downtown Safety and Comfort	Pedestrian safety Vehicle safety Bicycle safety Pedestrian crossings within the Town Center area Vehicle speeds Traffic congestion Aesthetics and streetscape amenities
2 Address Downtown Parking Deficiencies	Parking safety and comfort on US 101 Parking supply on US 101 Public parking supply downtown Employee parking supply downtown Recreational vehicle (RV) parking supply downtown Parking regulations (time limits) Directional signage to public parking
3 Address Adverse Impacts of Trucks on US 101 Downtown	Reduces number of through truck trips Slows truck speeds Improves truck turning Provides a buffer between trucks and on-street parking Supports downtown businesses and economy
4 Develop Alternate Truck Routes	Minimizes impacts on residential land uses Truck trip efficiency (likelihood route will be used) Provides linkage to industrially zoned land, including underdeveloped industrial parcels Supports local and regional businesses and economy Minimizes impacts on natural resources and resource lands Minimizes impact on flood hazard/rating Amount of new road outside the Urban Growth Boundary Efficient use of existing highway capacity Compatibility with future interchange in the vicinity of OR 6 and Wilson River Loop
5 Address Other Identified Issues	Cost-effectiveness of transportation investments Consistency with applicable standards (city, county, ODOT) Consensus among affected jurisdictions on implementing the alternative Implementable within a 20-year timeframe Provides a year-round solution

Existing and Future Conditions Review

After the first RPAC meeting, the consultant team reviewed and documented existing and anticipated future transportation conditions in the project area. The review was based on existing documents, traffic operations and impacts analysis, field reviews, and traffic and safety data collection.

Results of the existing conditions review are provided in the Appendix in the corresponding memos identified below. The key types of data collected and analyzed were:

- Traffic operations (volumes, congestion, etc.) (Memo #3)
- Crash and safety conditions and data for all modes (Memo #3)
- Vehicle speeds (Memo #4)
- Parking supply and utilization (Memo #5)
- Truck counts and travel routes around and through downtown (Memo #6)
- Pedestrian crossing behavior (Memo #11)
- Signage and illumination (Memo #13)

Development and Evaluation of Alternatives

Following the review of plans and policies, development of goals and evaluation criteria, and review of existing and future conditions, the consultant team developed alternatives to respond to the project purpose and goals. The following were key steps in the alternatives development process:

1. Using a public workshop format, brainstorm with the RPAC and interested stakeholders the nature of the problems and identify a wide range of potential solutions (January-February 2005).

2. From the list of brainstorm ideas, develop a range of alternatives that seek to meet project goals and evaluation criteria (March-April 2005).

3. Present draft alternatives to the PMT and ODOT for preliminary review and comparison against applicable policies and standards (April 2005).

4. Revise initial draft alternatives as necessary in response to PMT and ODOT comments and present to RPAC (May-June 2005).

5. Present alternatives to the general public and solicit comments in an open house format (July 2005).

6. Through an iterative process with the PMT, RPAC, and affected stakeholders, modify and further develop the alternatives (August-September 2005).

7. Evaluate the alternatives using the evaluation criteria, present results to the RPAC, and select preferred alternatives (September-October 2005).

8. Prepare Draft Refinement Plan and present results to ODOT for review, to the general public at an open house, and to the RPAC at final meeting (November 2005).

9. Based on input from ODOT, the general public, and the RPAC, prepare Revised Draft Refinement Plan, including any final modifications to preferred alternatives and draft plan.

Further documentation of the alternatives development and evaluation process is included in the Appendix (Memo #12).

Recommendations

As data were collected and potential solutions developed, it became apparent that no single solution would be adequate to address the interrelated issues of safety, parking, and truck traffic. This was due in part to the fact that the potential for a partial or full truck bypass of downtown Tillamook was not feasible. This, to address the issues identified in the plan, five groups of alternatives were developed:

- Alternate Truck Route Options (Outside of Downtown)
- Tillamook Lumber Mill Options
  Main and Pacific Avenue Design Alternatives (US 101 Couplet)
- Downtown Traffic Alternatives (Intersection of US 101 and OR 6)
  Downtown Parking Options

As illustrated in Figure 2, the preferred alternatives from the five groups combine to form the total solution to the identified transportation issues. The recommendation options are discussed below according to each of the five groups. For cross reference to detailed information on the various options, the original option or alternative number codes are included in the descriptions.

Alternate Truck Route Options (Outside of Downtown)

Figure 3 illustrates recommendations for making changes to truck routes outside of downtown Tillamook. As documented in Memo #12, of all the possible alternate route options studied, the vast majority were determined to be infeasible because of cost, physical constraints, policy constraints, or a combination of these factors. As a result, the recommendations described in this section are typically smaller scale projects, with generally incremental benefits but relatively fewer costs or impacts.

Recommendations

Implement improvements on selected county roads that will support the continued use of these facilities for a moderate amount of truck traffic:

- US 101 and Latimer Road—install signal and related improvements (project currently under design) (Option C1)
- Wilson River Highway (OR 6) and Wilson River Loop—construct new interchange (project currently under design) (Option C2)
- US 101 and Front Street—improve signage to encourage trucks to use this existing alternate route (Option C9)

- US 101 and Long Prairie Road—construct intersection improvements, including left-turn lane (project currently under design) (Option D1)
- Trask River Road and Johnson Creek Bridge—replace bridge to remove weight restrictions (project under design) (Option D8)

Tillamook Lumber Mill Options

Figure 4 illustrates recommendations for making changes to the Tillamook Lumber Mill site. As shown in the evaluation results in Memo #12 (see Appendix), a number of options were considered for routing traffic to and from the mill. The evaluation results suggested that the existing accesses and routes to and from the mill were in the best locations but that changes on the mill site itself had a significant potential to reduce truck trips in downtown Tillamook.

Recommendations

Work with the Tillamook Lumber Mill on the following changes that are intended to reduce the number of truck trips in downtown Tillamook (Option B1):

- In cooperation with ODOT, develop a new 3rd Street access that can be used for all trucks, both entering and exiting (requires relocation of ODOT maintenance building/ site).
- Make site and circulation changes (for example, improve roads, rearrange log stacks) to allow the existing 10th Street access and proposed 3rd Street access to be used as either entrance or exit for all trucks.
- Redesign rail spur onsite and/or work with Port of Tillamook Bay (POTB) rail to minimize traffic stoppage on 3rd Street due to rail switching.
- Once the above improvements are complete, encourage drivers to use the mill entrance/exit that minimizes truck travel through downtown Tillamook.
- In cooperation with Averill Trucking, develop a satellite location for Averill Trucking operations on or near the Tillamook Lumber Mill site to reduce the number of trips through downtown (Option C8).

Phasing

Relocating the ODOT site is critical to the feasibility of creating a new 3rd Street access. This option should be pursued first. The primary constraints appear to be funding and the availability of a suitable site for relocation. However, because the intent of this option is to improve conditions on the state highway, potential financial and logistical support from ODOT should be explored further.

Main and Pacific Avenue Design Alternatives

Figure 5 illustrates recommendations for making changes to the design of Main and Pacific Avenues. As documented in Memo #12 (see Appendix), the alternatives development process included a variety of options intended to improve the function of Main and Pacific Avenues for all travel modes. The options that would have removed existing features (for example, on-street parking) to allow space to widen travel lanes generally did not fare well against the goals and evaluation criteria. In short, because of the constrained space and the large number of functions provided (that is, business storefronts, pedestrian circulation, motor vehicle circulation, and parking), the functions are in a delicate balance with each other and a change to one affects the others. Thus, the recommendations that fared the best against the evaluation criteria would result in only minor to moderate changes, albeit positive ones, to the existing system.

Recommendations

Short-term (0-5 years). From 1st Street to 5th Street, implement streetscape and related improvements to slow traffic and better delineate pedestrian space and movements (Options D and E):

- Add continental-style crosswalks at all intersections.
- Add advance stop bars and signage before pedestrian crossings.
- Restrict parking on upstream side of key corners (for example, 2nd and Main) to improve driver-pedestrian visibility.
- Improve lighting at intersections where it is potentially deficient (for example, 5th and Main).
- Add new landscaping where space allows (combination of street trees, sidewalk planter boxes, etc.).
- Add pedestrian-scale lighting to improve pedestrian safety and downtown aesthetics. Include options for hanging banners, planters, etc.
- Reconstruct/repair existing sidewalks to make them compatible with the Americans with Disabilities Act (curb ramps), improve aesthetics, and allow for new landscaping opportunities.
- Reduce sign clutter by consolidating existing public signs (highway signs, local street signs, information signs).
- Work with property owners to improve storefronts and business signage to enhance aesthetics, create a coordinated image, and reduce the tunnel effect of existing signage. Improve visual appeal to drivers and encourage them to slow down (improve safety) and stop (support businesses) in Tillamook.

Medium-term (5-10 years)

- Implement Options D and E (described above) from 6th to 12th Streets.

Long-term (if short- and medium-term measures are not adequate)

- Add combination of traditional and off-set curb extensions to slow traffic (Figure 6), improve pedestrian visibility, and provide opportunities for aesthetic enhancements (such as landscaping).
- Implement Option B: Narrow the sidewalks on Main and Pacific Avenues by 2 feet on each side, widen travel lanes to 12 feet each, maintain 8-foot parking lanes on both sides,

and add combination of traditional and off-set curb extensions. Option B would be implemented only in combination with Options D and E, described above.

Downtown Traffic Alternatives

ODOT intends to begin a highway design project at the intersection of US 101 and OR 6 in early 2006 (Oregon Statewide Transportation Improvement Program [STIP] project #14313). This project will include additional study of solutions at this location before a preferred alterative is selected and engineered for future construction when funding is identified. For this reason, this refinement plan does not recommend a single preferred alternative for this location. Instead, the following alternatives are recommended for further study as part of the upcoming design project. The alternatives are illustrated in Figure 7 and documented in detail in Memo #7A (see Appendix).

Recommendations for Further Study

- Implement two-way traffic on 1st and 3rd Streets to reduce congestion and reduce truck trips downtown (Alternative 1). This would require a new traffic signal or other form of intersection control at OR 6 and Miller Street.
- Add an additional northbound travel lane over Hoquarten Slough (Alternative 4).
- Implement a combination of Alternatives 1 and 4.
- Consider other traffic solutions at 1st Street and Main/Pacific Avenues, either alone or in combination with one of the above options.

Downtown Parking Options

Following the study of existing parking conditions (documented in Memo #5 in the Appendix), a menu of options to increase both parking supply and utilization was developed. These recommendations are summarized in Table 2 and illustrated in Figure 8. An illustration of diagonal parking on 2nd Avenue is provided in Figures 9 and 10. A detailed discussion of parking recommendations is provided in Memo #10 in the Appendix.

If additional RV parking is desired in addition to the specific recommendations below, the City could consider dedicating any of the other on- or off-street parking areas for RV-priority or RV-only parking.

TABLE 2
Parking Recommendations

No.	Concept Name	Concept Description	Timeframe
1	Recreational Vehicle (RV) Parking	Set aside more on-street parking area reserved for RVs	Short-term
2	Potential RV Overnight Parking	Possibly allow RVs to park overnight in the (new) Safeway parking lot	Medium-term
3	Employee Parking (Surface)	Allow employees to park in city parking lots on east and west sides of Ivy, just south of 2nd Street	Short-term
4	Future Employee or Public Parking	Possible acquisition of property immediately east of Stillwell Avenue to expand employee and visitor parking	Long-term

TABLE 2
Parking Recommendations

No.	Concept Name	Concept Description	Timeframe
5	Future Parking Structure	Options include building a deck or larger parking structure on current city parking lots, and building a structured parking area on south side of 1st street west of Ivy Avenue, looking for opportunities to team with others as property is redeveloped.	Long-term
6	Angle Parking	Change parallel parking to angle parking along 2nd Street, Ivy Avenue, and Laurel Avenue. There are several ways this concept could be designed, depending on the roadway width. Two of these are described below:	Short-term
		Angle parking on one side, parallel parking on the other side, two-way traffic	
		Angle parking on one side, parallel parking on the other side, one-way traffic	
7	Resident Permit Parking	Allow residents to park overnight and/or for longer periods during the day along Laurel Avenue between 3rd Street and 5th Street	Short-term
8	Shared Parking for Employee Use	Explore opportunities to share parking with businesses that (a) use their parking areas more in the evening or on weekends, or (b) have surplus parking areas	Short-term
9	New lots for visitor and/or employee use	Construction of one or more surface parking areas on parcels currently vacant, for use by visitors and/or employees	Long-term
10	Main and Pacific	Option 1 removes parking from one side of the highway, using width to construct a bicycle lane or landscaping and slightly increasing travel lane width	Medium-term
		Option 2 keeps parking on both sides of the highway but reduces sidewalk width to construct bicycle lane and slightly increase roadway width	
11	On-street Parking Regulation	Option 1 simplifies parking regulations to mainly a 2-hour time limit throughout town	Short-term
		Option 2 reintroduces parking meters	Long-term
12	Signage	Adds signage to guide visitors to parking areas off the state highway	Short-term

Adoption and Implementation

This section of the plan describes roles and responsibilities for project implementation, cost estimates and potential funding sources, and information on plan adoption.

Jurisdictional Roles

Responsibility for implementing this refinement plan falls to three primary jurisdictions: the City of Tillamook, Tillamook County, and ODOT. Their respective roles and the roles of other entities are suggested in Table 3.

TABLE 3
Suggested Implementation Roles: City of Tillamook, Tillamook County, and ODOT

Alternatives	Lead Implementation Responsibility	Secondary Implementation Responsibility
Alternate Truck Route Options (Outside of Downtown)	Tillamook County	City of Tillamook ODOT
Tillamook Lumber Mill Concepts	City of Tillamook (working with Tillamook Lumber Mill)	Port of Tillamook Bay (Rail) ODOT Tillamook County
Main and Pacific Avenue Design Alternatives (US 101 Couplet)	ODOT	City of Tillamook
Downtown Traffic Alternatives (Intersection of US 101 and OR 6)	ODOT	City of Tillamook Tillamook County
Downtown Parking Recommendations	City of Tillamook	ODOT (for Main and Pacific)

Cost Estimates

Costs to design and construct the recommended alternatives on the state highways (US 101 and OR 6) were estimated at a planning level. Based on the conceptual design of each element, a 30 percent contingency was included in the construction cost estimate to account for potential unknowns typically identified during preliminary and final design. The estimates include engineering design fees and right-of-way costs but do not include potential environmental permitting or utility relocation costs. These cost estimates are documented in the Appendix (Memo #15).

Funding

A variety of federal, state, and local funding sources could be used to improve the transportation system in Tillamook. A detailed discussion of potential funding options is provided in the Appendix (Memo #16).

Federal and State Sources

Most federal and state funding programs are competitive and involve clear documentation of the project need, costs, and benefits. The STIP is the primary programming document that identifies transportation priorities for federal and state funding in Oregon. The STIP provides a schedule and identifies funding for projects throughout the state. It also lists projects that are planned for construction during a 4-year period. Projects that are included in the STIP are regionally significant and have been given a high priority through planning efforts. The STIP has five categories—modernization, safety, bridge, pavement preservation, and operations. All federally funded transportation projects, as well as all state and locally funded projects that are deemed "regionally significant," must be included in the STIP.

Local Sources

Local funding for the projects in this transportation plan typically would come from the City or County and potential future bond or other local revenues. Other local funding sources might include grants and private funds.

Table 4 is a qualitative assessment (low, medium, and high) of the revenue potential, implementation feasibility, and voter approval requirements for a number of potential local revenue and funding sources.

TABLE 4
Local Funding Options: Potential Revenue Potential and Implementation Feasibility

Potential Funding/ Revenue Source	Revenue Potential[a]	Feasibility of Implementing[b]	Voter Approval Required?
Urban Renewal District	Medium to High	High	Yes
Local Improvement District	Low to Medium	High	No
Revenue and General Obligation Bonds	Medium to High	Medium	Yes
System Development Charges	Low to High	Medium	No
Transportation Utility/ Impact Fees	Low to Medium	Medium	No
General Fund	N/A[c]	Medium	No
County Vehicle Registration Fee	Low to Medium	Medium	Yes
Road User Fee/ Toll	Low to High	Low	No
Traffic Impact Fee	Low to Medium	Medium	No
Parking Tax	Low to Medium	Low	Yes
Gas Tax	Low to High	Medium	Yes
Parking Meters and Fines	Low	Medium	No
Hotel Tax	Low to Medium	Medium	Yes
Sales Tax	Medium to High	Low	Yes
ODOT Bicycle and Pedestrian Program	Low to Medium	High	No

[a] Revenue potential for many of the funding sources would vary and depend on the extent of implementation (for example, tax rate, fee, toll) and extent of new development (for system development charges and traffic impact fees).

[b] Considers legal feasibility, potential public perception/approval, and administrative costs.

[c] This is not a new revenue source; money is redistributed from the general fund to transportation.

Plan Adoption

It is recommended that the City of Tillamook adopt this refinement plan as an amendment to the City TSP and that Tillamook County acknowledge it as an appendix to their TSP. Detailed recommendations for the city and county regarding plan adoption are provided in the Appendix (Memo #17).

Figures

Tillamook Transportation Refinement Plan

Study Area

Tillamook, OR

Figure 1

Legend

- Highways
- Local Roads
- Railroads
- City Limits

STUDY AREAS

- Truck Route
- Downtown Safety
- Downtown Parking

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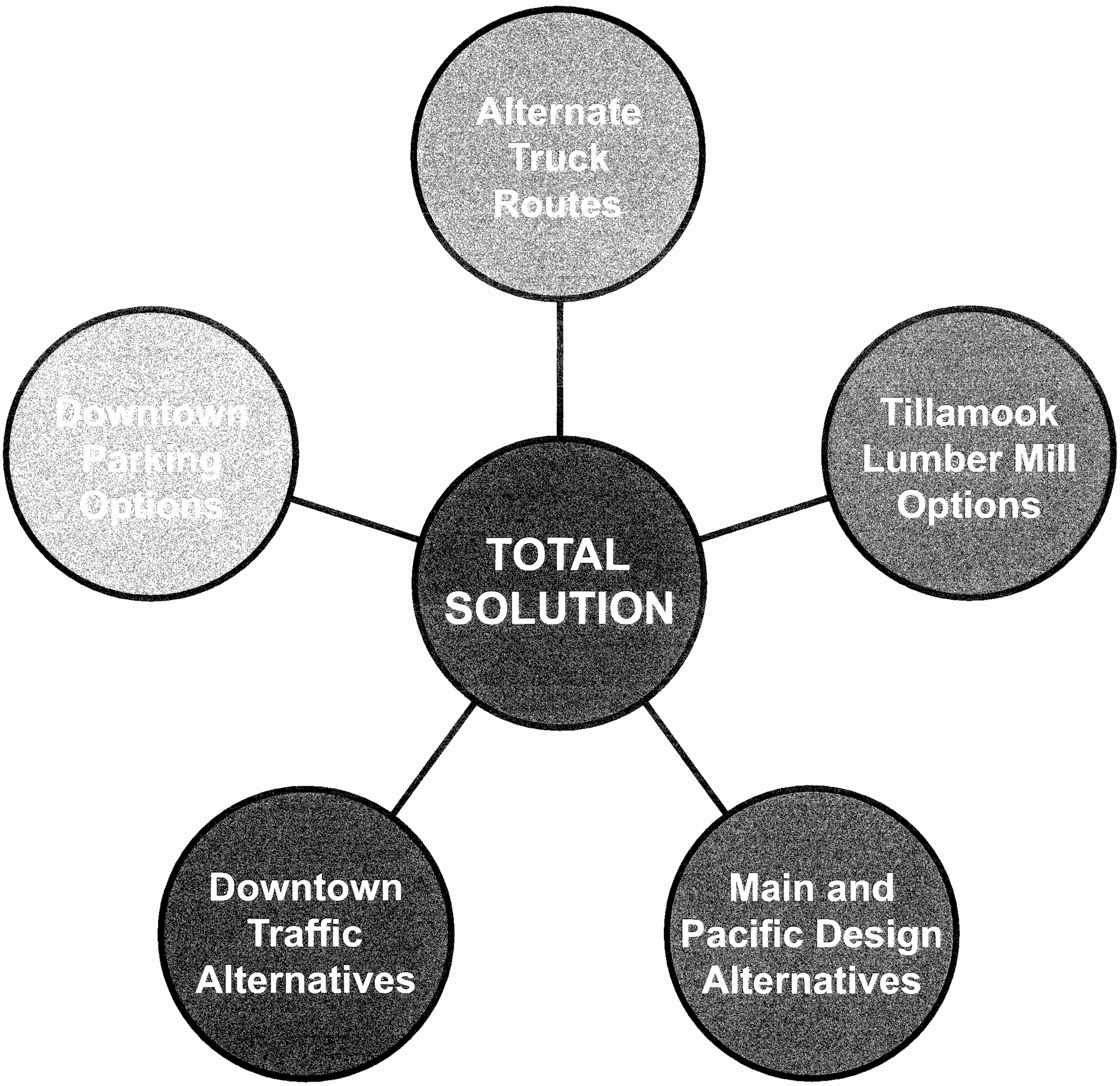


FIGURE 2
Total Transportation Solution for Downtown Tillamook
TILLAMOOK TRANSPORTATION REFINEMENT PLAN

RECOMMENDATIONS
Alternate Truck Routes

Implement improvements on selected County roads that will support the continued use of these facilities for a moderate amount of truck traffic:

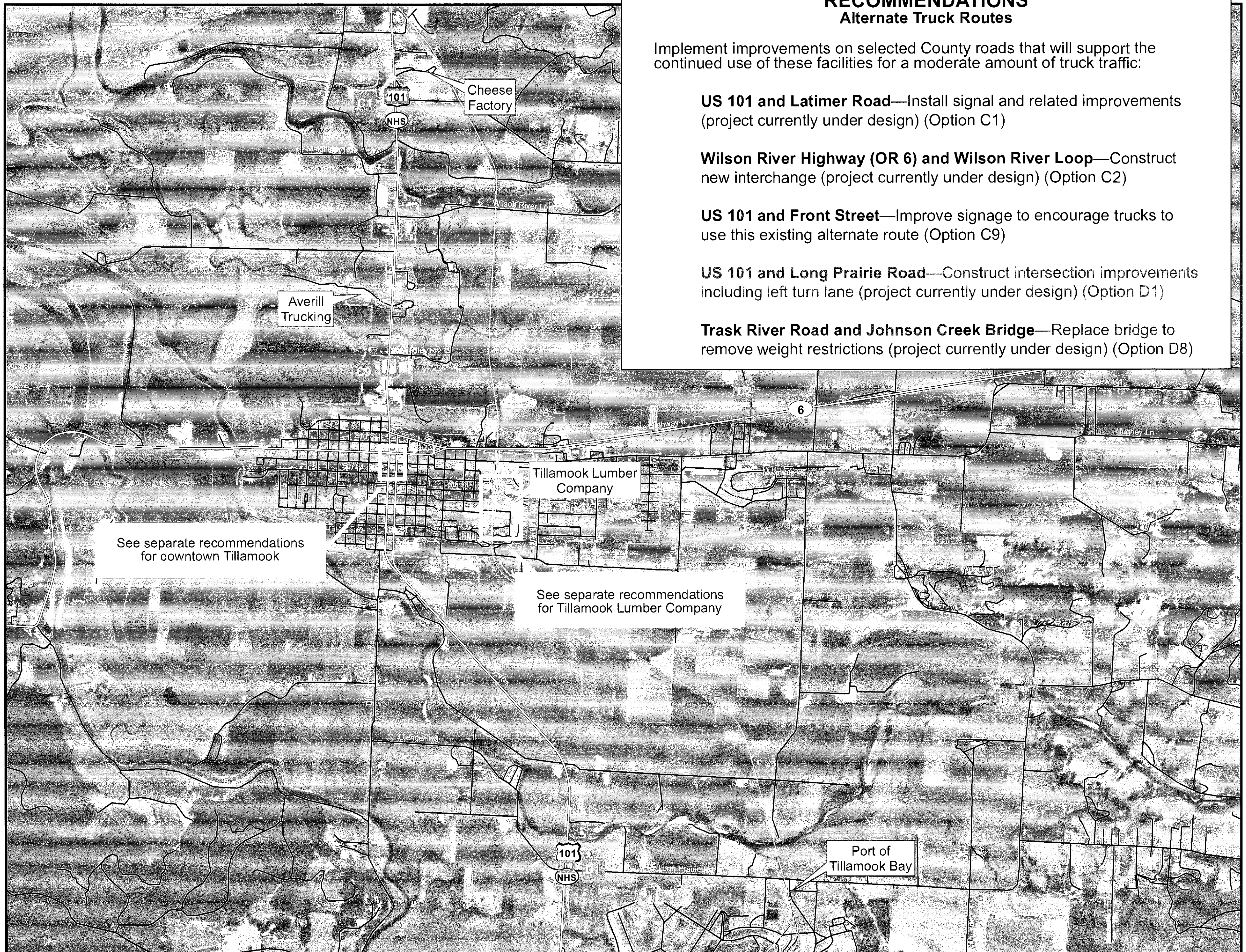
US 101 and Latimer Road—Install signal and related improvements (project currently under design) (Option C1)

Wilson River Highway (OR 6) and Wilson River Loop—Construct new interchange (project currently under design) (Option C2)

US 101 and Front Street—Improve signage to encourage trucks to use this existing alternate route (Option C9)

US 101 and Long Prairie Road—Construct intersection improvements including left turn lane (project currently under design) (Option D1)

Trask River Road and Johnson Creek Bridge—Replace bridge to remove weight restrictions (project currently under design) (Option D8)



Tillamook Transportation Refinement Plan

Truck Route Recommendations

Tillamook, OR

Figure 3

Legend

- Highways
- Local Roads
- Railroads
- City Limits

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0 1,250 2,500 3,750 5,000
Feet

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RECOMMENDATIONS
Tillamook Lumber Mill

Work with the Tillamook Lumber Mill on the following changes that are intended to reduce the number of truck trips in downtown Tillamook (Option B1):

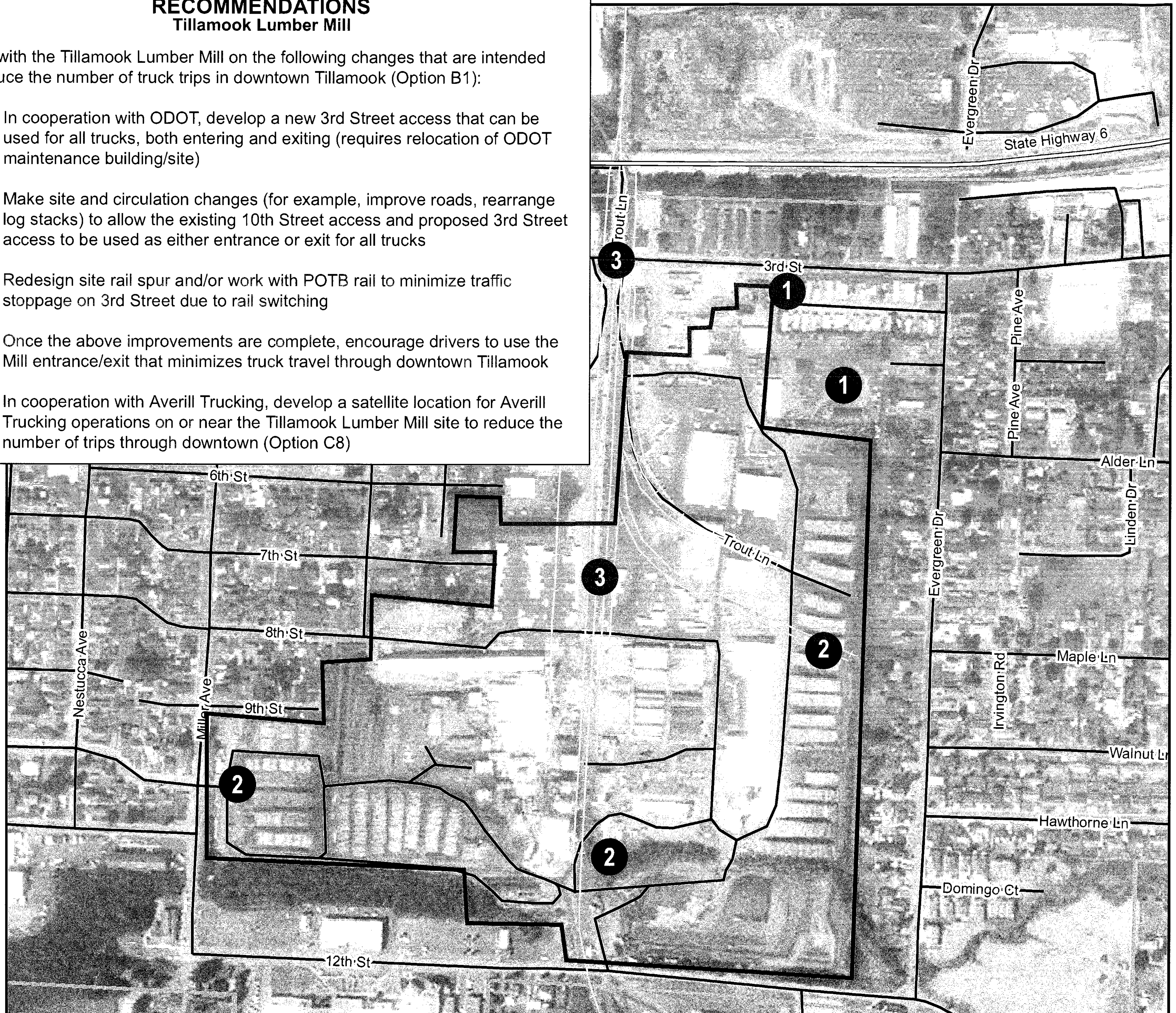
1. In cooperation with ODOT, develop a new 3rd Street access that can be used for all trucks, both entering and exiting (requires relocation of ODOT maintenance building/site)

2. Make site and circulation changes (for example, improve roads, rearrange log stacks) to allow the existing 10th Street access and proposed 3rd Street access to be used as either entrance or exit for all trucks

3. Redesign site rail spur and/or work with POTB rail to minimize traffic stoppage on 3rd Street due to rail switching

Once the above improvements are complete, encourage drivers to use the Mill entrance/exit that minimizes truck travel through downtown Tillamook

In cooperation with Averill Trucking, develop a satellite location for Averill Trucking operations on or near the Tillamook Lumber Mill site to reduce the number of trips through downtown (Option C8)



Tillamook Transportation Refinement Plan

Tillamook Lumber Mill: Recommended Site Circulation Changes

Tillamook, OR

Figure 4

Legend

- Highways
- Local Roads
- Railroads
- City Limits
- Approximate Property Boundary

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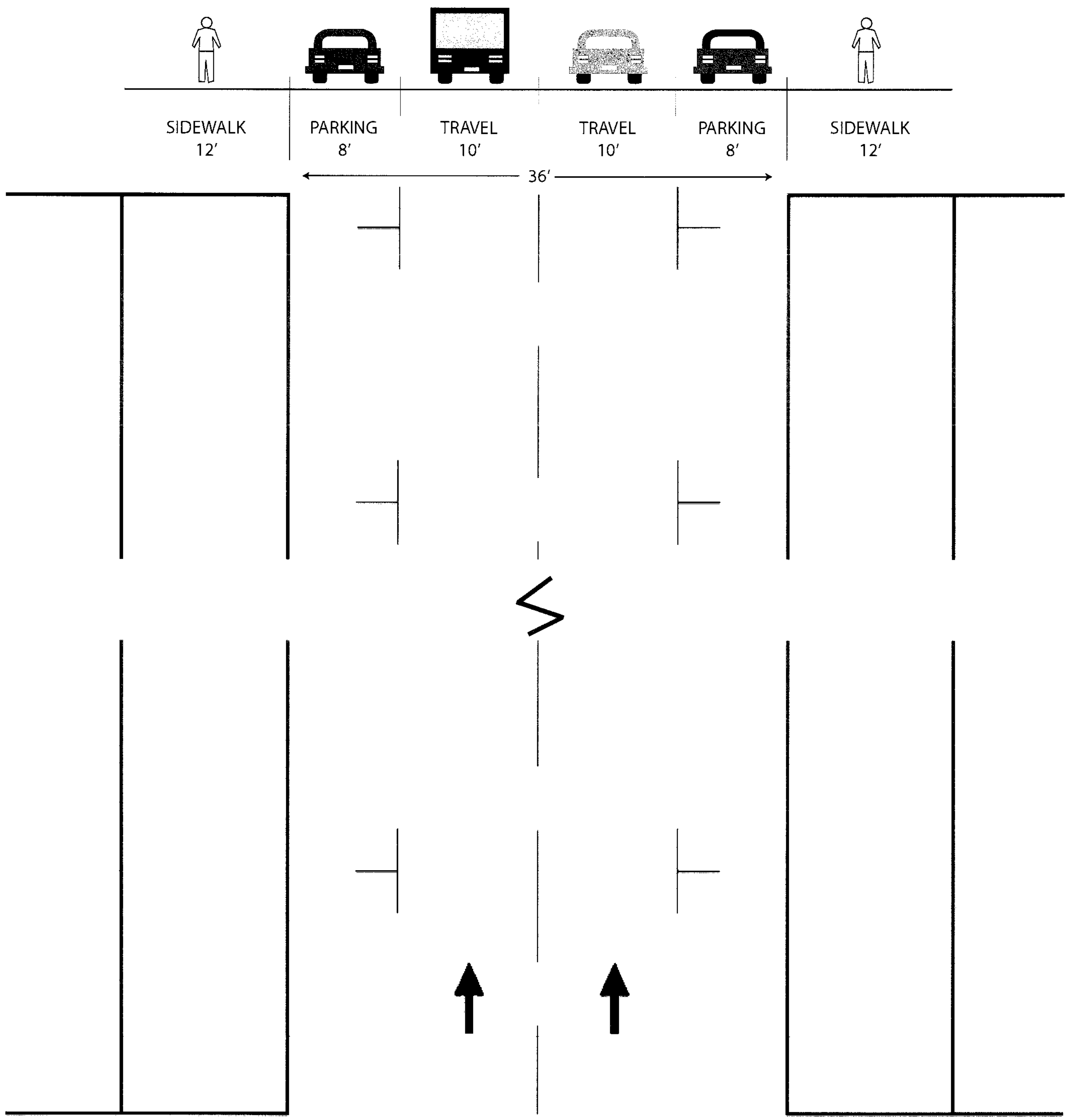


RECOMMENDATIONS

Main and Pacific Design

Short-term (0-5 years)

From 1st Street to 5th Street, implement streetscape and related improvements to slow traffic and better delineate pedestrian space and movements (Options D and E):

- Add continental-style crosswalks at all intersections
- Add advance stop bars and signage before pedestrian crossings
- Restrict parking on upstream side of key corners (for example, 2nd and Main) to improve driver-pedestrian visibility
- Improve lighting at intersections where it is potentially deficient (for example, 5th and Main)
- Add new landscaping where space allows (combination of street trees, sidewalk planter boxes, etc.)
- Add pedestrian-scale lighting to improve pedestrian safety and downtown aesthetics. Include options for hanging banners, planters, etc.
- Reconstruct/repair existing sidewalks to make them ADA compatible (curb ramps), improve aesthetics, and allow for new landscaping opportunities
- Reduce sign clutter by consolidating existing public signs (highway signs, local street signs, information signs)
- Work with property owners to improve storefronts and business signage to improve aesthetics, create coordinated image, and reduce tunnel effect of existing signage. Improve visual appeal to drivers and encourage them to slow down (improve safety) and stop (support businesses) in Tillamook.

Medium-term (5-10 years)

- Implement Options D and E (described above) from 6th to 12th Streets

Long-term (if short- and medium-term measures are not adequate)

- Add a combination of traditional and off-set curb extensions to slow traffic, improve pedestrian visibility, and provide opportunities for aesthetic enhancements (for example, landscaping)
- Implement Option B: Narrow the sidewalks on Main and Pacific Avenues by 2 feet on each side, widen travel lanes to 12 feet each, maintain 8-foot parking lanes on both sides, and add a combination of traditional and off-set curb extensions. Option B would only be implemented if in combination with Options D and E described above.

FIGURE 5
Main and Pacific Design Recommendations
TILLAMOOK TRANSPORTATION REFINEMENT PLAN

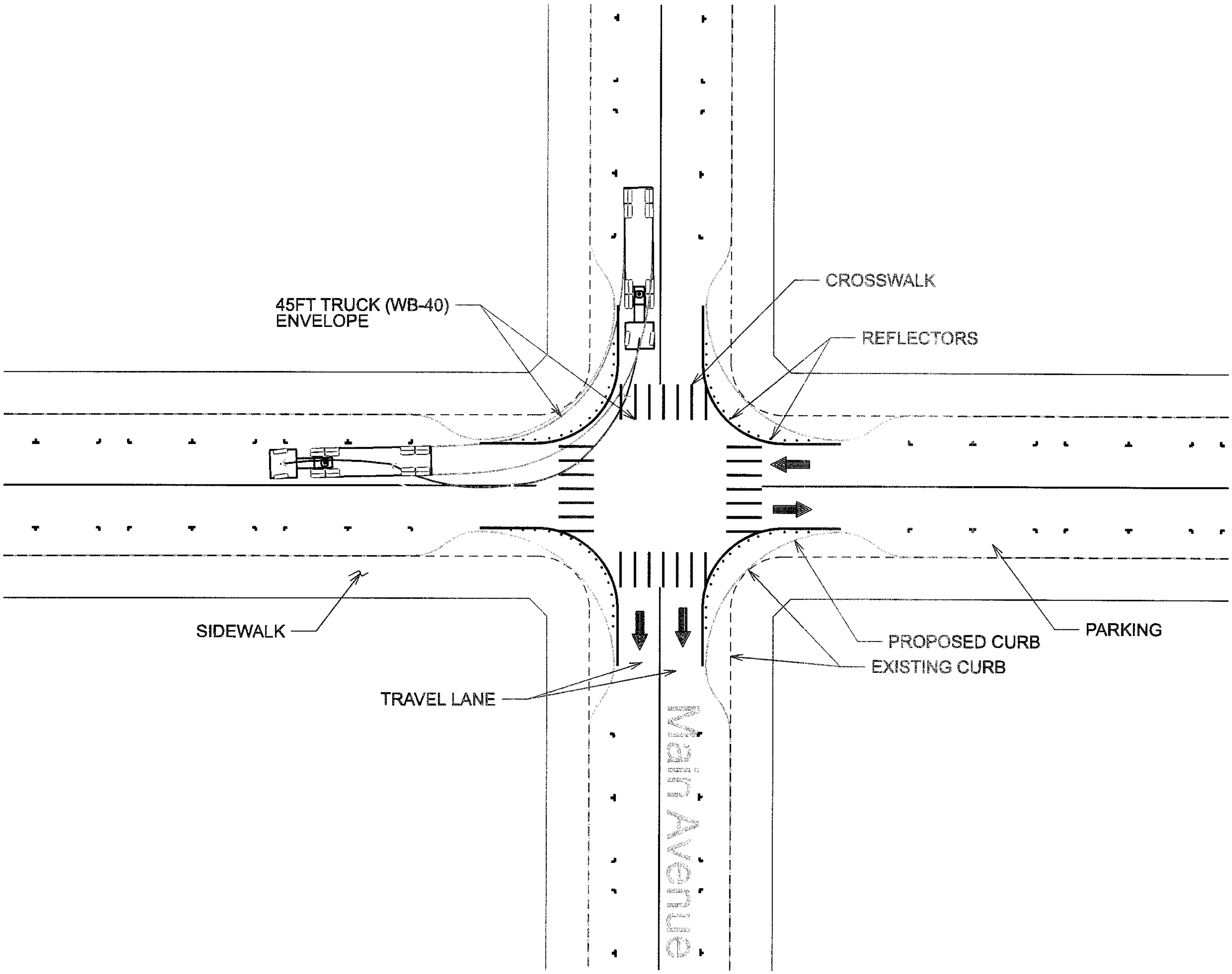
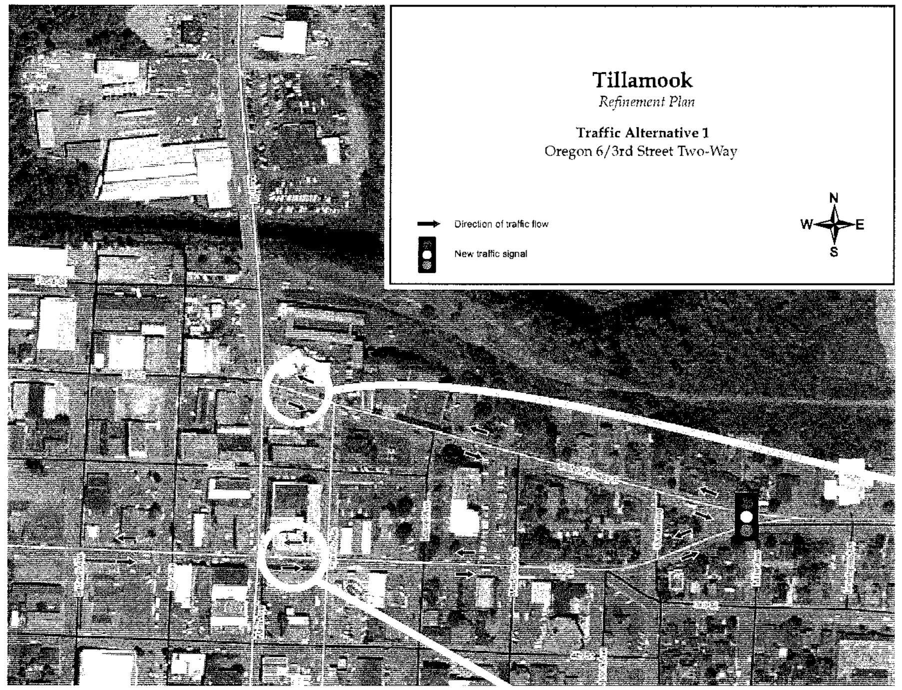
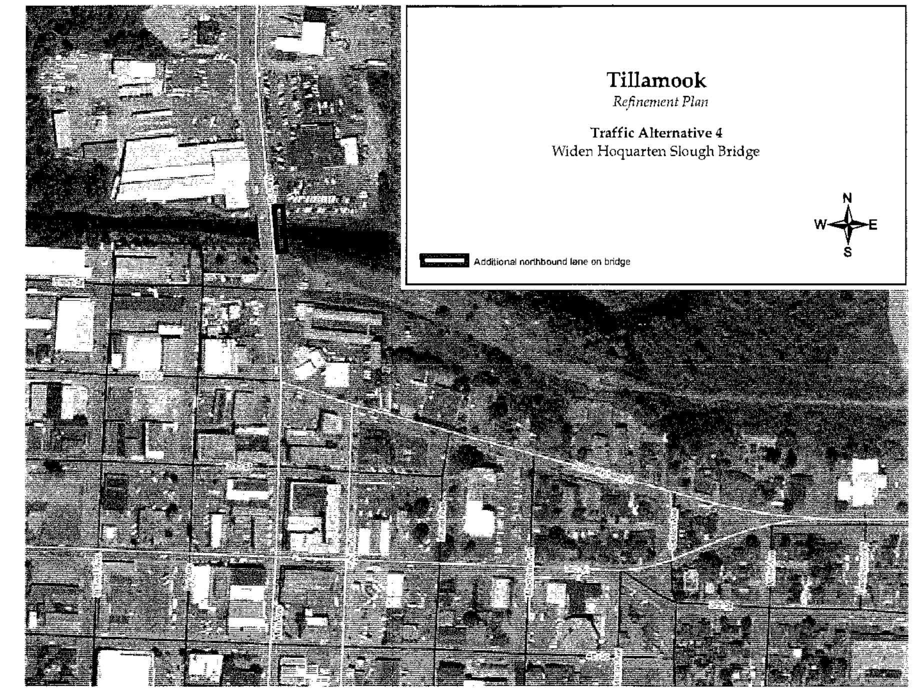
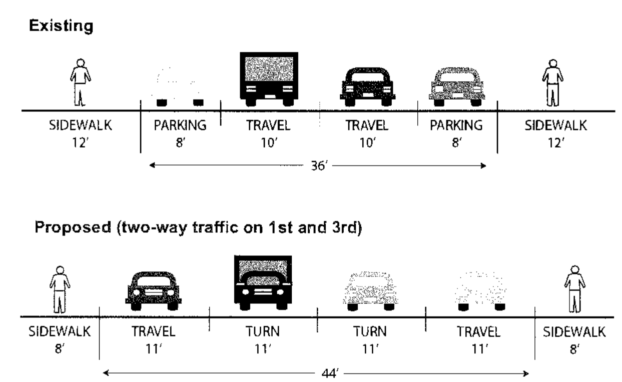


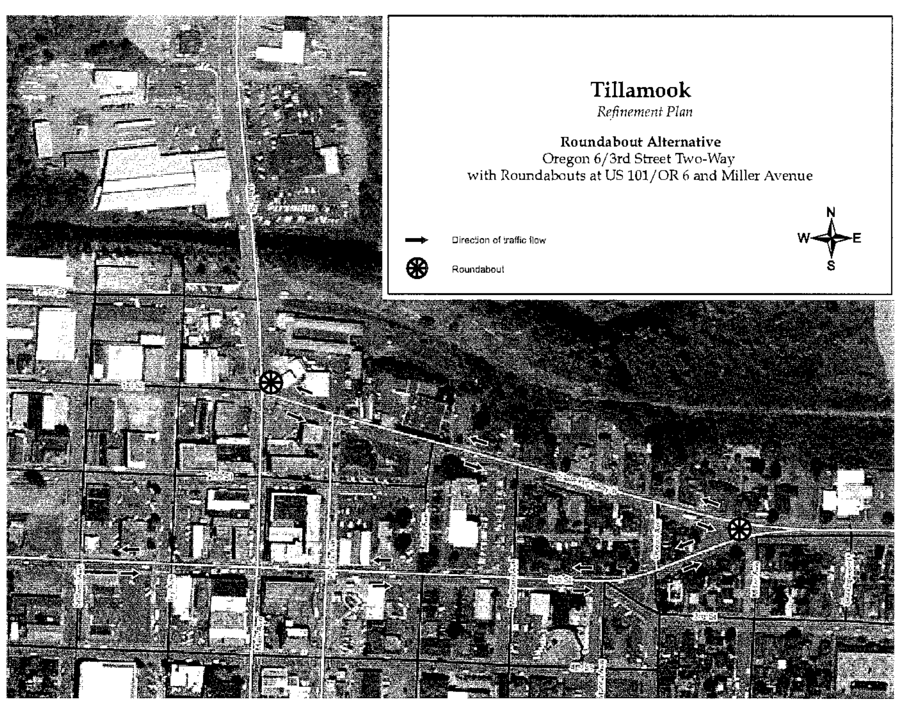
FIGURE 6
Off-set Curb Extensions
TILLAMOOK TRANSPORTATION REFINEMENT PLAN







Third Street between Main and Pacific



RECOMMENDATIONS FOR FURTHER STUDY
Downtown Traffic

- Implement two-way traffic on 1st and 3rd Streets to reduce congestion and reduce truck trips downtown (Alternative 1). This would require a new traffic signal or roundabout at OR 6 and Miller Street.
- Add an additional northbound travel lane over Hoquarten Slough (Alternative 4)
- Implement a combination of Alternative 1 and Alternative 4
- Construct a roundabout in the vicinity of 1st Street and Main/Pacific Avenues either alone or in combination with one of the options above

FIGURE 7
Downtown Traffic Recommendations for Further Study
TILLAMOOK TRANSPORTATION REFINEMENT PLAN

CH2MHILL

RECOMMENDATIONS
Downtown Parking

1 RV Parking
In addition to the current RV parking spaces on 2nd Avenue, add new RV parking spaces on 5th Avenue just east of Ivy (south side of the new Safeway lot). Add signage so these areas are easy for visitors to find.

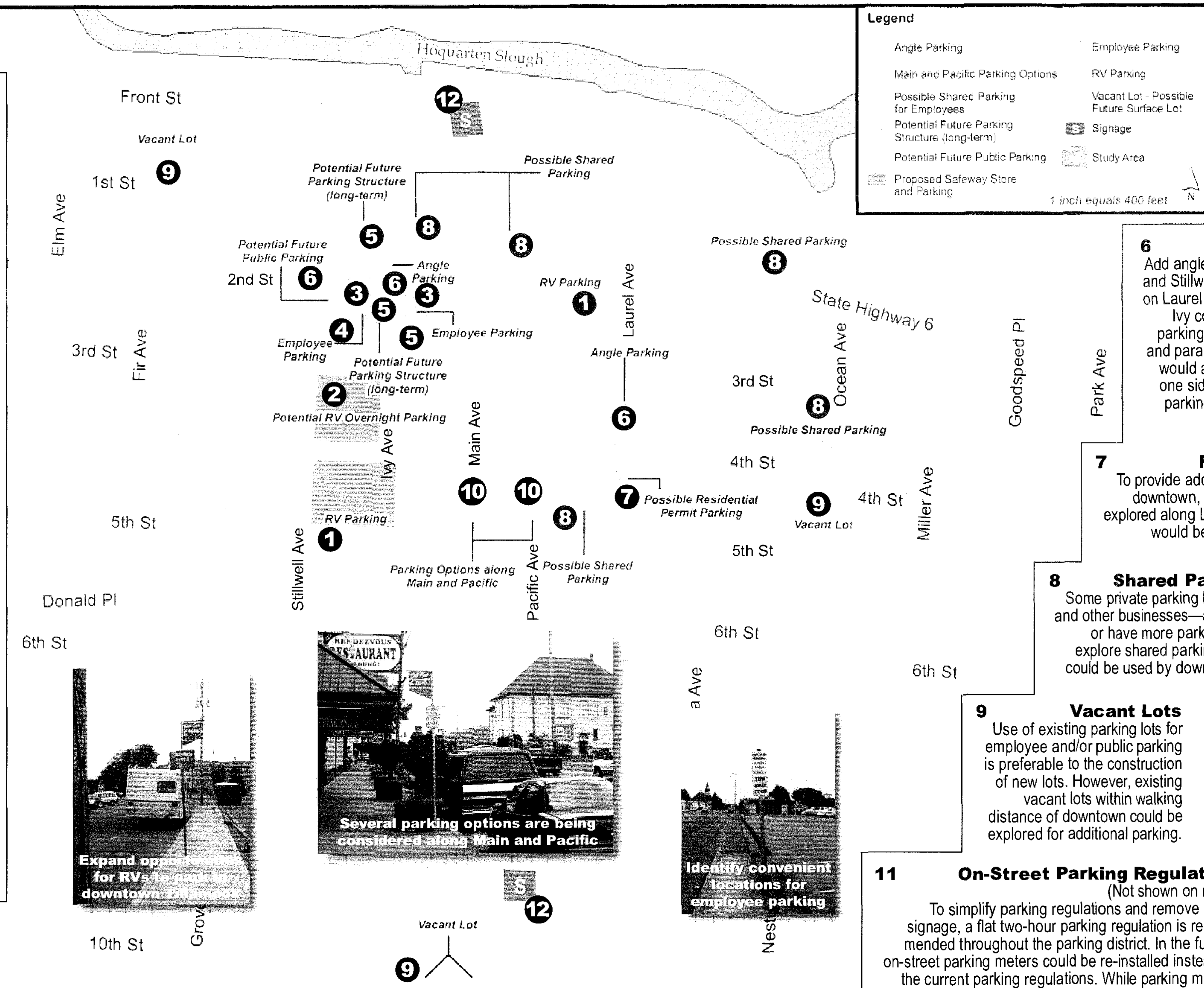
2 Potential RV Overnight Parking
Explore the willingness of Safeway to allow RVs to park overnight in their parking lot. This may require adjustments to City regulation.

3 Employee Parking
Parking for downtown employees is needed. The City currently has a monthly parking permit program for the lot facing 2nd Street just west of Ivy. The City could expand this program to the lot just east of Ivy, where parking could be used by employees with a permit or visitors by meter.

4 Future Employee and/or Public Parking
The City could acquire one or both of these properties and expand the permit parking area for employee parking, and/or make it available for visitors.

5 Future Parking Structure
Two locations have been identified for potential long-term future parking structures.

- Building a deck or a structure on the existing City-owned lots (south side of 2nd, between Main and Stillwell). If a structure were built, the potential for first-floor retail should be explored.
- The parcel on the south side of 1st Avenue just west of Ivy is likely to be redeveloped at some point in the future. When this occurs the City should explore the possibility of public parking on the site.



6 Angle Parking
Add angle parking on 2nd Street between Ivy and Stillwell, on Ivy between 1st and 3rd, and on Laurel between 3rd and 5th. Both 2nd and Ivy could accommodate 45 degree angle parking on one side, a one-way traffic lane, and parallel parking on the other side. Laurel would accommodate 60 degree parking on one side, either with two-way traffic and no parking on the other side, or one-way with parallel parking on the other side.

7 Resident Permit Parking
To provide additional parking options for residents downtown, residential permit parking should be explored along Laurel between 3rd and 5th. Permits would be managed by the City of Tillamook.

8 Shared Parking for Employee Use
Some private parking lots—such as churches, restaurants and other businesses—are underused during the weekdays or have more parking than they need. The City should explore shared parking agreements so that extra spaces could be used by downtown employees on a permit basis.

9 Vacant Lots
Use of existing parking lots for employee and/or public parking is preferable to the construction of new lots. However, existing vacant lots within walking distance of downtown could be explored for additional parking.

10 Main and Pacific Parking Options
Several options for Main and Pacific are proposed to make parking more safe comfortable for users. These are shown on a separate figure.

11 On-Street Parking Regulation
(Not shown on map)
To simplify parking regulations and remove extra signage, a flat two-hour parking regulation is recommended throughout the parking district. In the future, on-street parking meters could be re-installed instead of the current parking regulations. While parking meters would bring revenue to the city, it would require up-front expense and the support of the business community.

12 Signage
Signage is recommended for the north and south ends of the downtown area to safely and clearly direct out-of-town visitors to parking areas off the state highway.

FIGURE 8
Downtown Parking Recommendations
TILLAMOOK TRANSPORTATION REFINEMENT PLAN

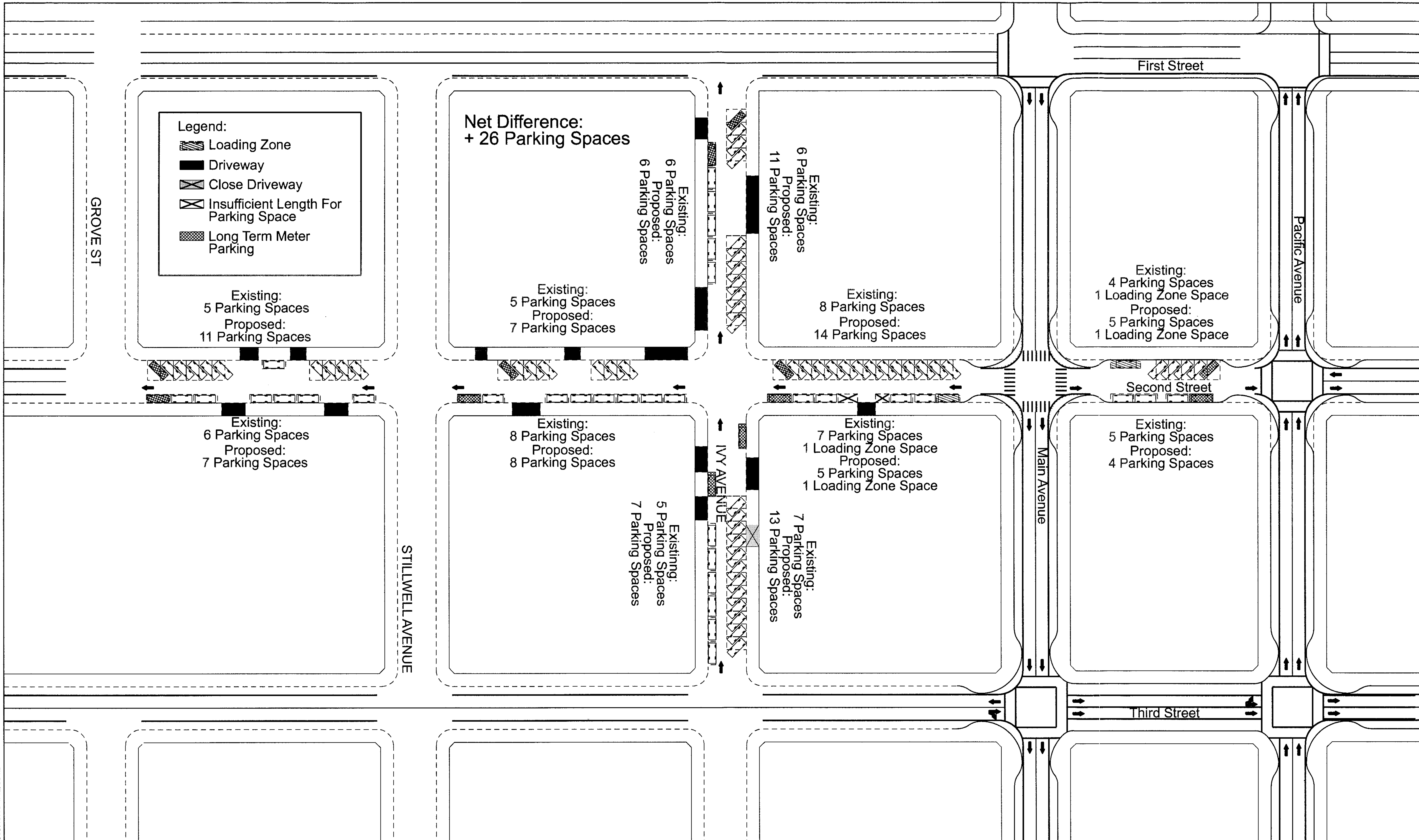


FIGURE 9
2nd and Ivy Diagonal Parking (Option 1: With Curb Extensions)
TILLAMOOK TRANSPORTATION REFINEMENT PLAN

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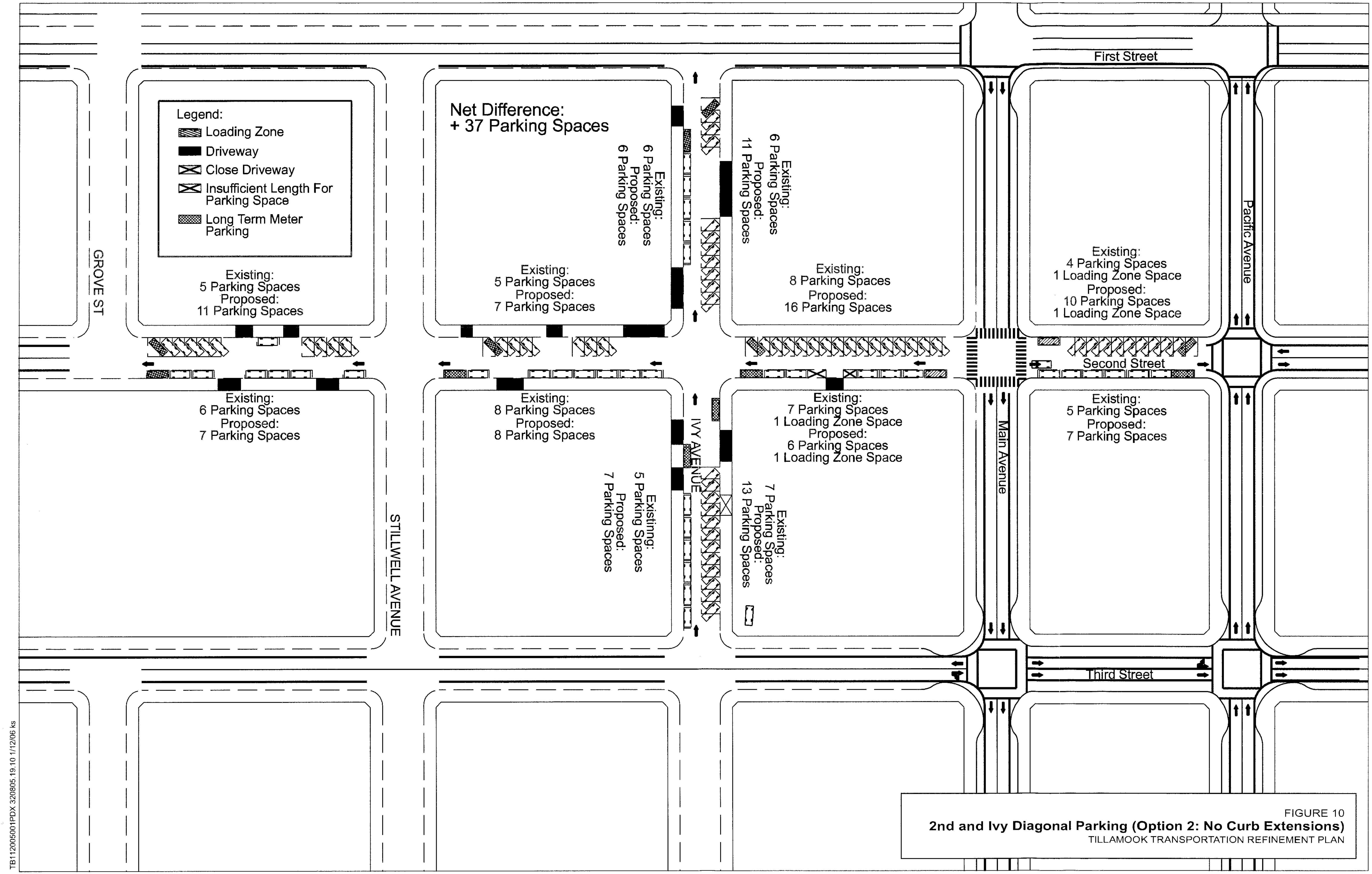


FIGURE 10
2nd and Ivy Diagonal Parking (Option 2: No Curb Extensions)
TILLAMOOK TRANSPORTATION REFINEMENT PLAN

MEMO #1

Plan and Policy Review

Tillamook Transportation Refinement Plan: Plan and Policy Review (Memo #1)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Michael Hoffman, CH2M HILL
Tim Burkhardt, CH2M HILL

DATE: November 16, 2004

Introduction

This memo reviews documents and policies that are relevant to or may present constraints to potential alternatives to be developed as part of the Tillamook Transportation Refinement Plan. Although each document contains many plans or policies, only those most directly relevant to this project are discussed.

Documents Reviewed

Federal

State of Oregon/ODOT

- Transportation Planning Rule (OAR 660-12)
- Oregon Transportation Plan (1992)
- Oregon Highway Plan (1999)
- Oregon Highway Design Manual (2003)
- Access Management Rules (OAR 734-051)
- Oregon Bicycle and Pedestrian Plan (1995)
- Oregon Transportation Safety Action Plan (1995)
- Proposed Oregon Coast Highway Corridor Master Plan (1995)
- TGM *Main Street Handbook for Oregon Communities* (1999)
- TGM *Parking Made Easy: Taming the Downtown Parking Beast* (2001)

Tillamook County

- Tillamook County Comprehensive Plan [DRAFT](2004)

City of Tillamook

- City of Tillamook Comprehensive Plan (1981, amended 1982)
- City of Tillamook Transportation System Plan (2003)
- City of Tillamook Zoning Code
- Tillamook Town Center Plan (OTAK and Pacific Rim Resources, 1999)

- Oregon Tillamook Alternate Log Truck Route Section Conceptual Design Report (OTAK, 2001)
- Oregon Oregon Downtown Development Association's Resource Team Report for Tillamook, Oregon (2002)

Federal Plans and Policies

Federal transportation planning requirements, such as those specified in the Transportation Equity Act for the 21st Century (TEA-21) and its implementing regulations, are addressed through state and local plans.

State of Oregon/ODOT Plans and Policies

Transportation Planning Rule

The Transportation Planning Rule (TPR) implements Oregon Statewide Planning Goal 12, which encourages construction of transportation facilities that are safe and efficient and designed to reduce automobile reliance. The objective of the TPR is to reduce air pollution, congestion, and other livability problems found in urban areas.

The TPR requires the preparation of regional transportation systems plans (TSPs) by metropolitan planning orgainizations or counties and local TSPs by counties and cities. Through TSPs, the TPR provides a means for regional and local jurisdictions to identify long-range (20-year) strategies for the development of local transportation facilities and services for all modes, to integrate transportation and land use, to provide a basis for land use and transportation decision-making, and to identify projects for the State Transportation Improvement Program. TSPs need to be consistent with the State Transportation Plan and its modal and multimodal elements.

Project Relevance: The City of Tillamook and Tillamook County TSPs were developed to address the requirements of the TPR.

Oregon Transportation Plan (1992)

The Oregon Transportation Plan (OTP) is a long-range policy document that addresses federal and state mandates for systematic statewide transportation system planning. It is developed by the Oregon Department of Transportation. The goal of the OTP is to promote a safe, efficient, and convenient transportation system over the next 40 years that improves livability and facilitates economic development for residents of the state. The OTP's goals, policies and actions integrate all modes of transportation with the intention of encouraging the most appropriate mode for each type of travel. The Plan's System Element identifies a coordinated multimodal transportation system, to be developed over the next 20 years, which is intended to implement the goals and policies of the Plan. The goals and policies of the OTP cover a broad range of issues. Goals and policies most directly applicable to the Tillamook Refinement Plan are discussed below.

Goal 1: Characteristics of the System

Policy 1E – Connectivity Among Places

- *Action 1E.1* - calls for the identification of a multimodal network of facilities to meet requirements for the movement of people, goods, and services throughout Oregon and the development of a plan to implement that system.

Policy 1G – Safety

- *Action 1G.4* – resources should be targeted to dangerous routes and locations in cooperation with local and state agencies.
- *Action 1G.9* – calls for the transportation system to be built, operated, and regulated so that users feel safe and secure as they travel.

Goal 2: Livability

Policy 2C – Relationship of Interurban and Urban Mobility

- *Action 2C.3* – encourages local and regional transportation system plans and land use plans to avoid dependence on the state highway system for direct access to commercial, residential or industrial development adjacent to a state highway.

Policy 2D – Facilities for Pedestrians and Bicyclists

- *Action 2D.1* – encourages communities to make walkways, pedestrian shelters and bikeways an integral part of the circulation pattern within and between communities to foster safe interactions between motor vehicles, bicyclists and pedestrians.

Goal 3: Economic Development

Policy 3B – Linkages to Markets

- *Action 3B.1* – calls for the provision of a direct, convenient and physically suitable system for goods movement to transportation facilities and commercial and industrial areas to ensure the timely delivery of goods.
- *Action 3B.3* - *t*he highway system should be maintained, preserved, and improved in order to provide infrastructure for the efficient movement of goods by truck and bus.

Goal 4: Implementation

Policy 4G – Management Practices

- *Action 4G.1* – calls for preserving, maintaining, and improving transportation infrastructure and services that are of statewide significance.
- *Action 4G.2* – encourages communities to manage such factors as the number, spacing, type, and location of accesses, intersections and signals in order to operate the transportation system at reasonable levels of service and in a cost-effective manner.
- *Action 4G.4* – calls for controlled accesses to statewide transportation corridors and facilities.

Oregon Highway Plan (1999)

The 1999 Oregon Highway Plan (OHP)is a modal element of the 1992 OTP and defines policies and investment strategies for Oregon's state highway system over the next 20 years. The plan contains three elements—a vision element that describes the broad goal for how the highway system should look in 20 years; a policy element that contains goals, policies, and actions to be followed by state, regional, and local jurisdictions; and a system element that includes an analysis of needs, revenues, and performance measures.

The policy element contains several policies and actions, described below, that are relevant to the Tillamook Refinement Plan.

Policy 1A: State Highway Classification System

Policy 1A develops a state highway classification system to guide ODOT priorities for system investment and management.

Action 1A.1 defines five categories of state highway facilities - interstate highways, statewide highways, regional highways, district highways, and local interest roads. Two of these (interstate and statewide highways) are part of the national highway system.

Interstate highways provide connections to major cities and regions within the state and facilitate movement to and from other states. The management objective for interstate highways is to provide safe and efficient high-speed travel in urban and rural areas.

Statewide highways provide inter-urban and inter-regional mobility and connections to larger urban areas, ports, and major recreation areas not directly served by Interstate Highways. Statewide highways also provide connections for intra-urban and intra-regional trips. The management objective for statewide highways is to provide safe and efficient, high-speed, continuous-flow operation along the corridor, with minimal interruptions to flow in constrained or urban areas.

Action 1A.2 defines and classifies expressways as a subset of statewide, regional, and district highways. The function of expressways is to provide safe and efficient high speed and high volume traffic movements with minimal interruptions, for interurban travel and connections to ports and major recreation areas. Along expressways, private access is discouraged, connections to public roads are highly controlled, traffic signals (rural areas only) are discouraged, and nontraversable medians are encouraged.

Project Relevance: The state highway classification system includes five classifications: Interstate, Statewide, Regional, District, and Local Interest Roads. Additionally, there are four special purpose categories that overlay the basic classifications: special land use areas, statewide freight route, scenic byways, and lifeline routes. In Tillamook, US 101 is a Statewide Highway on the State Highway Classification System, and is also on the National Highway System (NHS); OR 6 is a Regional Highway on the State Highway Classification System from US 26 to US 101. West of US 101, the road is designated at Highway 131 and classified as a District Highway.

The "Scenic Byway" designation is applied to roads with exceptional scenic value. US 101 is designated as a scenic byway.

Policy 1B: Land Use and Transportation

Policy 1B directs the state to work with regional agencies and local jurisdictions to consider land use when planning transportation systems and projects. Action 1B.7 gives special designations for certain land use patterns off the freeway to foster compact development patterns in communities. The three designations provided are special transportation area, commercial center, and urban business area. Special Transportation Areas are described as follows:

> *"The primary objective of managing highway facilities in an existing or future Special Transportation Area is to provide access to community activities, businesses, and residences and to accommodate pedestrian movement along and across the highway in a downtown, business district and/or community center including those in unincorporated communities as defined by OAR 660-22. An STA is a highway segment designation that may be applied to a highway segment, when a downtown, business district or community center straddles the state highway within an urban growth boundary or in an unincorporated community in accordance with Action 1B.9. Direct street connections and shared on-street parking are encouraged in urban areas and may be encouraged in unincorporated communities. Direct property access is limited in an STA. Local auto, pedestrian, bicycle and transit movements to the business district or community center are generally as important as the through movement of traffic. Traffic speeds are slow, generally 25 miles per hour (40 kilometers per hour) or less."*

Project Relevance: In support of recommendations in the 2003 City of Tillamook TSP, the Oregon Transportation Commission (OTC) designated the segment of US 101 that passes through downtown Tillamook (1st Street to 10th Street) as an STA.

Policy 1D: Scenic Byways

This policy recognizes the need to preserve and enhance designated Scenic Byways and the need to consider aesthetic and design elements along with safety and performance on these designated scenic byways.

Project Relevance: US 101 is a designated National Scenic Byway and therefore Policy 1D must be considered when project alternatives that affect the highway are being considered.

Policy 1F: Highway Mobility Standards

Policy 1.F addresses state highway performance expectations for planning and plan implementation or amendment, as well as providing guidance for managing access and traffic control systems.

Project Relevance: The City of Tillamook TSP notes that under existing 30th-highest hour operating conditions (2002), 3 of the 13 intersections in the area studied in Tillamook do not meet OHP mobility standards beacuase they exceed v/c ratios. In the future (No Buld scenario), this number increases to 5.

Policy 1G: Major Investments

Action 1G.1 directs agencies to make the fewest number of structural changes to a roadway system to address its identified needs and deficiencies, and to protect the existing highway system before adding new facilities to it. The action ranks four priorities of projects, as follows:

- 1. Preserving the functionality of the existing system
- 2. Making minor improvements to improve the efficiency and capacity of the existing system
- 3. Adding capacity to the existing system
- 4. Building new transportation systems

Project Relevance: The Tillamook Refinement Plan will be analyzing existing and future traffic conditions in the Tillamook study area, in particular with respect to truck traffic. Alternative sloutions will be developed in concert with the stated objective of this policy.

Policy 2F: Traffic Safety

Policy 2F emphasizes the state's efforts to improve safety of all users of the highway system. It includes several Actions that are directly pertinent to the objectives of the Tillamook Refinement Plan.

- Action 2F.1 calls for the establishment of a process to develop and implement the most cost-effective solutions to high priority safety problems.
- Action 2F.2 requires the establishment of a process to evaluate and the project selection and solution process for any project in which safety improvement is the stated objective.
- Action 2F.3 states that, when identifying solutions to traffic safety problems, solutions should include, but not be limited to, the following:
  - Increasing traffic enforcement;
  - Involving business and community groups and the media in educational efforts;
  - Making appropriate engineering improvements;
  - Constructing safe and convenient crossings for bicyclists and pedestrians; and
  - Managing access to the highway.
- Action 2F.4 addresses the development and implementation of the Safety Management System to target resources to sites with the most significant safety issues.
- Action 2F.6 calls for the state to work with citizens and local jurisdictions to address safety concerns on the state highway system.

Project Relevance: A major component of the Tillamook Refinement Plan's scope is to address and provide alternative solutions for addressing safety concerns in the City of Tillamook. The above Actions of Policy 2F of the OHP provide a guide for this effort.

Policy 3A: Classification and Spacing Standards

- Action 3A.1 calls for state highway access to be managed based on the highway's respective access management classifications.
- Action 3A.2 calls for the establishment of spacing standards on state highways based on highway classification, type of area and speed.
- Action 3A.3 calls for the location and spacing of traffic signals on state highways to be managed so as to ensure the safe and efficient movement of people and goods.

Project Relevance: The Tillamook Refinement Plan will be utilizing access management as a tool to help craft solutions for Tillamook's safety concerns and will be following applicable access standards set forth in the OHP.

Policy 4A: Efficiency of Freight Movement

Policy 4A and its Actions emphasize the need to maintain and improve the efficiency of freight movement on the state highway system.

Project Relevance: Given that both US 101 and OR State Route 6 are on the state highway system, the Tillamook Refinement Plan will be responsive to the objectives of Policy 4A.

ODOT Highway Design Manual (2003)

The ODOT Highway Design Manual (HDM) provides uniform standards and procedures for ODOT. It is intended to provide guidance for the location and design of new construction, major reconstruction, and resurfacing, restoration or rehabilitation projects on the state highways. The manual is used by ODOT staff for planning studies and during project development. State and local planners use the manual in determining design requirements as they relate to state highways in TSPs, Corridor Plans, and Refinement Plans. The OHDM is to be used for all projects that are located on state highways.

Project Relevance: Although the OHDM is not typically considered a planning document, ODOT staff often review projects at the planning stage to see that they can satisfy the standards in the OHDM at the time they are constructed. The OHDM prescribes design standards for roadways in the state system based on the functional classifications of the particular roadway. In regard to the state highways involved in the Tillamook Refinement Plan, there are two applicable sections that provide dimensional and operational standards applicable to OR 228. The first is Section 7 (Rural Non-Freeway Highway Design) which applies to the "rural minor arterial" functional classification of State Route 6; the second is Section 8 (Urban Non-Freeway Highway Design) which applies to the "urban principal arterial" functional classification of US 101 inside the city limits of Tillamook. The standards vary with speed and traffic volume.

ODOT Access Management Rules - OAR 734-051

The intention of ODOT's Access Management Rules is to balance the safety and mobility needs of travelers along state highways with the access needs of property and business owners. ODOT's rules manage access to the state's highway facilities to the degree necessary to maintain functional use, highway safety, and the preservation of public investment consistent with the 1999 OHP and local comprehensive plans.

Project Relevance: OAR 734-51 is pertinent to the Tillamook Refinement Plan in two ways. First, future applications for access and private approach-related permits onto either US 101 or OR State Route 6 within the City of Tillamook are subject to the procedures and criteria outlined in OAR 734-51. Second, any scheme to reconfigure accesses in the city should be done in accordance with OAR 734-051-0155, applicable sections of which are excerpted below.

734-051-0155, Access Management Plans, Access Management Plans for Interchanges, and Interchange Area Management Plans

(1) The Department encourages the development of Access Management Plans, Access Management Plans for Interchanges, and Interchange Area Management Plans to maintain highway performance and improve safety by improving system efficiency and management before adding capacity consistent with the 1999 Oregon Highway Plan.

2) Access Management Plans and Access Management Plans for Interchanges are developed for a designated section of highway with priority placed on facilities with high volumes or providing important statewide or regional connectivity where:
(a) Existing developments do not meet spacing standards;
(b) Existing development patterns, land ownership patterns, and land use plans are likely to result in a need for deviations; or
(c) An access management plan would preserve or enhance the safe and efficient operation of a state highway.
(3) Access Management Plans and Access Management Plans for Interchanges may be developed:
(a) By the Department;
(b) By local jurisdictions; or
(c) By consultants.

(4) Access Management Plans and Access Management Plans for Interchanges comply with all of the following:
(a) Are prepared for a logical segment of the state highway and include sufficient area to address highway operation and safety issues and development of adjoining properties including local access and circulation.
(b) Describe the roadway network, right-of-way, access control, and land parcels in the analysis area.
(c) Are developed in coordination with local governments and property owners in the affected area.
(d) Are consistent with any applicable adopted Transportation System Plan, Local Comprehensive Plan, Corridor Plan, or Special Transportation Area or Urban Business Area designation, or amendments to the Transportation System Plan unless the jurisdiction is exempt from transportation system planning requirements under OAR 660-012-0055.
(e) Are consistent with the 1999 Oregon Highway Plan.
(f) Contain short, medium, and long-range actions to improve operations and safety and preserve the functional integrity of the highway system.
(g) Consider whether improvements to local street networks are feasible.
(h) Promote safe and efficient operation of the state highway consistent with the highway classification and the highway segment designation.
(i) Consider the use of the adjoining property consistent with the comprehensive plan designation and zoning of the area.
(j) Provide a comprehensive, area-wide solution for local access and circulation that minimizes use of the state highway for local access and circulation.

(k) Are approved by the Department through an intergovernmental agreement and adopted by the local government, and adopted into a Transportation System Plan unless the jurisdiction is exempt from transportation system planning requirements under OAR 660-012-0055.
(l) Are used for evaluation of development proposals.
(m) May be used in conjunction with mitigation measures.

Oregon Bicycle and Pedestrian Plan (1995)

The Oregon Bicycle and Pedestrian Plan provides guidance to regional and local jurisdictions for the development of safe, connected bicycle and pedestrian systems. The plan is a modal element of the Oregon Transportation Plan. The plan includes two major sections: policies and implementation strategies; and design, maintenance and safety information. The stated bicycle and pedestrian transportation vision is as follows: "Oregon envisions a transportation system where walking and bicycling are safe and convenient transportation modes for urban trips."

Project Relevance: This plan affects bicycle and pedestrian facilities on state-owned facilities. US 101 is a designated State Bike Route (Oregon Coast Bikeway). As such, provision and treatment of bicycle and pedestrian facilities on US 101 must be consistent with ODOT policies.

Oregon Transportation Safety Action Plan (1995)

The Oregon Transportation Safety Action Plan forms the safety element of the Oregon Transportation Plan (OTP). The intent of the plan is to improve the safety on Oregon's highways for all users. The policy for safety in the OTP (Policy 1G) is as follows: "It is the policy of the State of Oregon to improve continually the safety of all facets of statewide transportation for system users including operators, passengers, pedestrian, recipients of goods and services, and property owners."

The Safety Action Plan contains 70 actions as Oregon's "transportation safety agenda" for a 20-year planning horizon. The Safety Action Plan helped shape the direction of the safety elements of the City of Tillamook TSP and contains several Actions that are pertinent to the scope of the Tillamook Refinement Plan. Applicable actions are as follows:

- Action 19: Consider the roadway, human, and vehicle elements of safety in modal, corridor and local system plan development and implementation. These plans should include the following:
    - Involvement in the planning process of engineering, enforcement, and emergency service personnel as well as local transportation safety groups.
    - Safety objectives.
    - Resolution of goal conflicts between safety and other issues.
    - Application of access management standards to corridor and system planning.

- Action 20: In planning and project development, consider access management techniques which show significant improvements in safety for the roadway user. Access management techniques which may be used individually or in various combinations include the following:

- Appropriate access and public street spacing and design.
- Proper spacing and coordination of traffic signals.
- Installation of non-traversable medians.
- Proper spacing and design of median openings.
- Provision of lanes for turning traffic.
- Interparcel circulation.
- Use of city and county road infrastructure as an alternative to increased access.
- Protection of the functional area of an intersection.
- Proper spacing of interchanges.

- Action 21: Consider safety—including the special needs of motorcyclists, bicyclists, and pedestrians—in all road maintenance functions.

- Action 66: Increase emphasis on programs that will encourage pedestrian travel and improve pedestrian safety. The following action (applicable to the Tillamook Refinement Plan) should be undertaken:
  - Require walkways and safe pedestrian crossings on all appropriate road projects. The lack of walkways and safe crossing opportunities contribute to pedestrian crashes.

Project Relevance: A major component of the Tillamook Refinement Plan scope is to address and provide alternative solutions for addressing safety concerns in the City of Tillamook. The above actions provide a guide for this effort.

Oregon Coast Highway Corridor Master Plan (1995)

The Oregon Coast Highway Corridor Master Plan focuses on the need to coordinate land use patterns and transportation systems and recognize the multimodal nature of the transportation system. According to the Master Plan, the impetus for the plan developed from several policy directives at the state and federal levels, including the LCDC Transportation Planning Rule (TPR), the ODOT State Agency Coordination Program, the Oregon Transportation Plan (OTP), the Oregon Highway Plan (OHP), and the federal Intermodal Surface Transportation Efficiency Act (ISTEA).

The Master Plan includes a vision statement and several goals and objective. The goals for the entire coastal corridor include the following:

1) **Process Goal.** Develop a transportation plan that builds an ongoing planning and implementation partnership among ODOT and each of the communities and jurisdictions that have a stake in the future of transportation along the Oregon Coast Highway Corridor.
2) **Transportation Goal.** Develop a 20-year plan to manage future transportation needs in the Coast Highway Corridor and prolong the useful life of the existing transportation system.
3) **Resources Goal.** Develop a plan for a transportation system to harmonize with the inherent beauty of the coastal region, protect environmental resources, and enhance the enjoyment of the Corridor's beauty and resources by corridor users.

4) **Community Goal.** Develop a plan for a transportation system that supports the individual character and plans of the communities along the corridor.
5) **Economic Goal.** Develop a plan for a transportation system that supports sustainable economic diversity and vitality and provides responsible stewardship of public funds.

Project Relevance: The Oregon Coast Highway (US 101) is the main street in downtown Tillamook. The Tillamook Refinement Plan must be be consistent with the objectives set forth in the Oregon Coast Highway Corridor Master Plan.

TGM's Main Street Handbook for Oregon Communities (1999)

Main Street…when a highway runs through it: A Handbook was produced by the Transportation and Growth Management Program (TGM), a joint program of ODOT and the Oregon Department of Land Conservation and Development (DLCD) for communities in Oregon that have a main street that also serves as a highway. The handbook is intended to help these communities (such as Tillamook) to strike a balance between the needs of pedestrians, shoppers, employees, business owners, and residents with the needs of auto and freight movement.

Project Relevance: The *Main Street Handbook* speaks to the issue of truck movement and pedestrian safety at the heart of this Refinement Plan. The handbook provides tools and ideas for reclaiming main street qualities to improve quality of life while also providing for adequate mobility and accessibility. The techniques included the handbook are intended to:

- Encourage drivers to drive at the desired speed.
- Improve the aesthetic appearance of the street.
- Enhance the street environment, particularly for pedestrians.
- Minimize conflicts between highway users: pedestrians, bicyclists, transit, freight carriers, and motorists.
- Encourage through traffic to stay on the highway.
- Provide other routes for local traffic.
- Increase the economic vitality of a community.

TGM 's Parking Management Made Easy (2001)

Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast was produced by the Transportation and Growth Management Program (TGM), a joint program of ODOT and the DLCD. This guide provides cities with a rudimentary, step-by-step approach for assessing parking problems in their community. The guide aims to help users achieve:

- An understanding of people's concerns about downtown parking.
- A mapped and listed inventory of existing on-street and off-street parking, both public and private.
- Parking inventory by block and block face at specific times of day.

- An inventory of how long cars stay in parking spaces.

Project Relevance: The procedures in this guide are being utilized to assess existing parking conditions in the City of Tillamook as part of the Tillamook Refinement Plan.

Tillamook County Plans and Policies

Tillamook County Comprehensive Plan [DRAFT]

The Tillamook County Comprehensive Plan draft document was written under the guidance of Oregon's Statewide Planning Goals and Guidelines. Reviewed by the state to meet strict statewide land use requirements, the Comprehensive Plan establishes the guiding goals and principles for land use in Tillamook County. The element of the Comprehensive Plan that was reviewed for this document is the Transportation Element (Goal 12).

The Transportation Element is divided into the following sections:

- Overview
- Highway Transportation
- Public Transportation
- Air Transportation
- Water Transportation
- Rail Transportation

Project Relevance: The policies for each section applicable to the Tillamook Refinement Plan are as follows:

Section 2.3 Road Design Standards and Planning Criteria

a. Tillamook County shall officially establish road improvement standards so that roads are constructed that are safe, durable, convenient, provide adequate drainage, allow flexibility in design and minimize costs.

a. The County will invite the participation of fire districts, sewer and water district, the PUD and local developers in establishing these standards.

b. The standards shall be administered by the County Public Works Department.

This section also contains the County's current standards for street and road type.

Section 2.4 Access Management

The following policies apply to the developed sections of Highway 101:

- Driveways along the arterial should be removed to the maximum extent possible.
- Adjacent side by side driveways serving two commercial businesses should be reconstructed to a combined joint use access driveway. This combined access driveway should benefit the business through additional off street parking spaces. An agreement

between the businesses relative to a joint circulation easement between properties may be necessary.

- As a condition of any permit, if a land use changes, or a business is "substantially changed" driveway access and internal parking should be reevaluated and/or modified to be consistent with the access management policy.
- The City and County shall continue with plan and site reviews including the requirement for an impact analysis indicating the impact of the new development of Highway 101 roadway.
- Developers of undeveloped land parcels shall pay their fare share of traffic-orientated improvements as required.

The following policies apply to the undeveloped sections of Highway 101:

- Access to new commercial areas shall be primarily from major cross streets intersecting with Highway 101.
- Minimum desirable distance between major access cross streets shall be 2,000 feet. The 2,000 feet minimum spacing distance is based upon the potential need of signalization and coordinating vehicle speeds for signal progression.
- Minimum desirable spacing between access driveways along the arterial shall be 200 feet.
- Develop standard four way intersections along Highway 101 instead of "T" intersections close together. Minimum desirable distance between offset "T" intersections along Highway 101 shall be 400 feet. The 400 feet minimum desirable distance is based upon two off set intersections requiring left turn vehicle storage between intersections.
- The appropriate City/County staff shall continue with plan and site review, including the requirement for an impact analysis indicating the impact of the new development on Highway 101.

Section 2.5 Bicycle Facilities

- The County shall encourage the formation of a County Advisory Committee having responsibility for developing a County bikeway plan.
- The County shall continue to disapprove the establishment of the State's Coast Highway bike route along county roads until State funds are providing to improve those roads to meet safe bike route standards.

Tillamook County Transportation System Plan (TSP) [DRAFT - 2004]

The Draft Tillamook County TSP is the blueprint for future improvements to all aspects of the county's transportation systems. The pending County TSP will:

- Identify transportation projects for future funding.

- Coordinate planned transportation improvements with planned land uses.
- Reduce cost and increases efficiency of providing transportation facilities and services.
- Identify current and future issues with the county's transportation systems.
- Coordinate and plan for all modes of transportation.

Changes to several ordinances are necessary to carry out the policies of the T SP and state law. The following is a summary of proposed changes to ordinances administered by the Community Development Department, including the Comprehensive Plan, Land Use Ordinance, and Land Division Ordinance. The following changes to ordinances administered by the Public Works Department have also been proposed:

- Update several Comprehensive Plan Policies to reflect modern standards and conditions.
- Add several definitions to the Land Use and Land Division Ordinances.
- Amend Land Use Ordinance to allow certain transportation facilities outright or
- conditionally in many zones.
- Add new notification requirements for certain land use actions near ODOT facilities.
- Require connecting streets to be planned in new subdivisions.
- Review future plan and ordinance amendments for impact on transportation facilities.
- Require bicycle parking at certain new developments. Provide enhanced pedestrian and bicycle circulation in some areas.
- Reduce required size of blocks in new subdivisions in most cases.
- New streets will be required to conform with modern standards.

Project Relevance: Alternative proposals made for the Tillamook Refinment will be responsive to the goals and objectives of the pending Tillamook County TSP.

City of Tillamook

City of Tillamook Comprehensive Plan (1981, amended 1982)

Several sections of the City's Comprehensive Plan contains polices on transportation needs and programs. Transportation-related policies that are relevant to the Tillamook refinement plan are reviewed below.

Community Objectives

In order to help insure economic viability, the Comprehensive Plan provided elements for the expansion for the Central Business District and the Highway Commercial zone. The Comprehensive Plan describes that a prime concern of the community is the transportation of people through the City and to businesses and that efforts should be made to ease the flow of congested traffic patterns; develop adequate parking and provide for pedestrian safety. In addition, access and circulation plans must be developed to facilitate these problems with emphasis added to highway commercial areas.

Population, Land Requirements and Urbanization

At the time the Comprehensive Plan was drafted (1981), the City had 263 acres of land within the Urban Growth Boundary dedicated to streets and rights-of-way(s).

This section of the City's Comprehensive Plan includes an analysis of the City's interest in a potential expansion of the City's Urban Growth Boundary to include additional Highway Commercial land. Areas for expansion were identified as: land surrounding the (current) Central Business District; land along Highway 6, east of existing City limits; land along US 101 north of the City to the Wilson River.

This section of the Comprehensive Plan also describes an increased need for land devoted to off-street parking, both within the Downtown and Highway Commercial areas.

As part of the annexation process which was completed during the drafting of the Comprehensive Plan, a Development Ordinance was developed and contained standards for access management for Highway Commercial development.

Economic Development

The Economic Development section of the Comprehensive Plan described the following transportation-related policies included concerns regarding traffic and parking in the City's downtown.

- Policy 25: The City will continue to acquire and develop land for off-street parking in the downtown area
- Policy 26: New development and conversions in the central commercial district are encouraged and may be required to provide off-street parking. Generally, elimination of off-street parking requirements shall not take place unless adequate uncommitted parking spaces exist within one block walking distance, or when established off hour shared arrangements allow double use of available space.
- Policy 27: The City shall continue to monitor new commercial development to assure that available parking spaces equal customer demand. The City shall encourage private investors to fund needed parking (by LID, revenue bonds, etc).
- Policy 28: Where rights-of-way have low traffic volumes and rerouting is convenient, streets shall be closed for traffic movement and used for parking. Application of this policy to Ivy between Third and Fourth shall be explored. Opportunities for improving parking on other downtown streets shall be considered. The City shall consider using the present City Hall site for future downtown parking.

Policies related to the proposed annexation of highway commercial property within the City reflects the City's interest in maintaining adequate parking and access along these properties.

- Policy 31: The City shall encourage the development of a tourist wayside-rest area along Highway 101 north. The site would also accommodate a Chamber of Commerce building.

Circulation and Parking

- Policy 36:A vehicular/pedestrian access circulation Traffic Safety Plan was adopted by the City in February 1981. The plan addresses conditions and needs in the downtown, neighborhood and highway commercial areas. As part of the Traffic Safety Plan, a joint City and County access management plan for the Highway 101 north area has been approved. The plan shall be used as a guideline during the site review process for transportation-related matters.

- Policy 41: The site development of neighborhood commercial areas shall be designed to provide adequate off street parking and to insure traffic safety on surrounding streets.

Transportation System

Goal: To provide and encourage a safe, convenient and economical transportation system.
Objectives

- To increase the safety of the Tillamook transportation system
- To provide a convenient and economical road system

Vehicular Circulation
This section of the Comprehensive Plan describes the State's road classification system and the roads in Tillamook according to this designation:

- Principal Arterials: US 101
- Minor Arterials: Wilson River Highway from east to Main Street
- Major Collectors: Third Street from Main Street going west
- Minor Collectors: Most other streets, unpaved streets and unimproved rights of way

Tillamook shall take full advantage of its present investment in street improvements and also take actions to insure future developments are in the best interest of the local residents, which includes facilitating the flow of goods and services for the local economy.

- Policy 52: The City should pursue funds from the State for implementing transportation programs. Emphasis shall be placed on programs which minimize adverse social, economic and environmental impacts and costs.

City of Tillamook Transportation System Plan (2003)

The City of Tillamook Transportation System Plan (TSP), adopted in 2003, attempts to provide a framework of goals, objectives, and policies to achieve and maintain acceptable mobility standards and meet anticipated travel demands. The TSP serves as a guide for the city to develop appropriate transportation facilities in the city.

Project Relevance: A significant portion of the TSP's goals and objectives, as well as recommended projects that were evaluated in the TSP, apply to the Tillamook Refinement Plan, as described below.

Relevant Goals and Objectives

Goal 1: Coordination - Maintain a transportation system plan that is consistent with the goals and objectives of the City of Tillamook, Tillamook County and the state.

- Objective 1: Provide a transportation system that is consistent with other elements and objectives of the *City of Tillamook City Comprehensive Plan* and other policy documents.

- Objective 2: Ensure consistency with state policies including the OTP and the OHP regarding transportation issues relating to Oregon 6 and U.S. 101.
- Objective 3: Coordinate with the Port of Tillamook Bay regarding the Tillamook Airport, the Port of Tillamook Bay Industrial Park and the Port of Tillamook Bay shortline railroad.
- Objective 4: Coordinate land use and transportation decisions to efficiently use public infrastructure investments to:

  a. Maintain the mobility and safety of the roadway system
  a. Foster compact development patterns
  a. Encourage the availability and use of transportation alternatives
  a. Enhance livability and economic competitiveness

Goal 2: Safety - Provide a transportation system that maintains adequate levels of safety for all users.

- Objective 1: Enhance safety at the intersection of Oregon 6 and U.S. 101, and west toward the Hoquarten Slough Bridge.
- Objective 2: Improve the safety of rail crossings, particularly at 12th Street and 3rd Street.
- Objective 3: Identify safe connections for vehicles, bicycles and pedestrians across U.S. 101, Oregon 6 and Wilson River Loop.
- Objective 6: Undertake, as needed, special traffic studies in problem areas, especially around schools, to determine appropriate traffic controls to effectively and safely manage vehicle and pedestrian traffic.

Goal 3: Livability and Economic Viability - Provide a transportation system that balances transportation system needs with the community desire to maintain a pleasant, economically viable city.

- Objective 1: Minimize adverse social, economic and environmental impacts created by the transportation system, including balancing the need for street connectivity and the need to minimize neighborhood cut-through traffic.
- Objective 3: Improve transportation facilities without major disruption of existing neighborhoods or downtown.
- Objective 4: Promote pedestrian-oriented design and the provision of pedestrian amenities in the downtown area, such as pedestrian-scale lighting.
- Objective 5: Ensure adequate vehicle and bicycle parking and parking signage in the downtown commercial area, using techniques such as shared parking areas where appropriate.
- Objective 6: Minimize traffic congestion in the downtown commercial area.
- Objective 8: Discourage through-traffic and high speeds in residential areas.

Goal 4: Circulation and Mobility - Develop an interconnected, multimodal transportation system that serves the travel needs of Tillamook.

- Objective 1: Promote alternatives to ease adverse impacts (congestion, noise, safety) of commercial truck traffic in town.
- Objective 2: Provide a network of arterials, collectors and local streets that are interconnected, appropriately spaced and reasonably direct.
- Objective 3: Balance the simultaneous needs to accommodate local traffic and through-travel while incorporating traffic calming provisions.
- Objective 5: Safely, efficiently and economically move motor vehicles, pedestrians, bicyclists, transit, trucks, and trains to and through Tillamook.
- Objective 7: Recognize and balance freight needs with needs for local circulation, safety and access.

Goal 5: Capacity - Provide a transportation system that has sufficient capacity to serve the needs of all users.

- Objective 1: Enhance capacity at the intersection of Oregon 6 and U.S. 101, and west toward the Hoquarten Slough Bridge.
- Objective 2: Protect capacity on existing and improved roads to provide acceptable service levels to accommodate anticipated demand.
- Objective 3: Limit access points on highways and major arterials, and use techniques such as alternative access points when possible to protect existing capacity.
- Objective 4: Minimize direct access points on to arterial rights-of-way.
- Objective 5: Update and maintain required access management standards for new development and work toward modifications of existing development to preserve the safe and efficient operation of roadways, consistent with functional classification.

Goal 6: System Preservation – Work to ensure that development does not preclude the construction of identified future transportation improvements, and that development mitigates the transportation impacts it generates when appropriate.

- Objective 1: Identify and preserve locations for potential future street connections.
- Objective 3: Consider transportation impacts when making land use decisions, and consider land use impacts (in terms of land use patterns, densities, and designated uses) when making transportation-related decisions.

Goal 7: Accessibility - Provide a transportation system that serves the needs of all members of the community for all routes and all available modes of transportation.

- Objective 1: Consider the transportation disadvantaged when developing alternatives to meet growing transportation needs.
- Objective 3: Develop and maintain travel routes for pedestrians, bicyclists and the physically handicapped.

Goal 9: Pedestrian and Bicycle Facilities - Provide for an interconnected system of pedestrian and bicycle facilities in Tillamook.

- Objective 1: Ensure and strengthen the presence of safe, attractive and convenient pedestrian and bicycle access to and circulation in the downtown area.
- Objective 2: Place priority on sidewalk pavement improvements for the downtown area.
- Objective 3: Preserve and enhance the U.S. 101 coast bicycle route.
- Objective 4: Work to develop safe, connected pedestrian and bicycle facilities near schools, residential districts and commercial districts.
- Objective 5: Develop bicycle lanes or shoulder bikeways on all arterial streets, major collectors and minor collectors.
- Objective 6: Ensure adequate pedestrian access on all streets in commercial zones.
- Objective 7: Use unused rights-of-way for greenbelts, walking trails or bike paths where appropriate.
- Objective 8: Promote multimodal connections where appropriate.
- Objective 9: Develop safe and convenient pedestrian and bicycle systems that link all land uses, provide connections to transit facilities and provide access to publicly owned land intended for general public use.
- Objective 10: Support and encourage increased levels of bicycling and walking.

Relevant Recommended Projects

Freight Projects

Roadway Alternatives - Existing Infrastructure

- NB-1 (No-Build): Maintain existing roadway system and truck routing.
- NB-2 (Modified No-Build): Construct improvements along existing segments of US 101 and OR 6 to accommodate large vehicles on state highways in Tillamook.

Roadway Alternatives - North of OR 6

- N-1: Latimer Road/Wilson River Loop
- N-2: Latimer Road/New Section of Roadway Connecting Latimer Road and OR 6 (e.g., located somewhere between POTB railroad and existing Wilson River Loop)
- N-3: Latimer Road/Sollie Smith Road/Schild Road
- N-4: Latimer Road/Sollie Smith Road/Olsen Road

Roadway Alternatives - South of OR 6

- S-1: McCormick Loop/Schild Road
- S-2: Long Prairie Road/Trask River Road/Olsen Road

- S-3: Long Prairie Road/Connection between Long Prairie Road and McCormick Loop /McCormick Loop/Schild Road
- S-4: Connection between 12th Street and US 101/12th Street/Marolf Loop/3rd Street/Wilson River Loop*
- S-5: Connection between 12th Street and US 101/12th Street/Connection between 12th Street and McCormick Loop/McCormick Loop/Schild Road*
- S-6: Connection between 12th Street and US 101/12th Street/Connection between 12th Street and Trask River Road/ Trask River Road/Olsen Road*
- S-7: Connection between 12th Street and US 101/12th Street/Marolf Loop/Marolf Loop Extension*
- S-8: McCormick Loop/Connection between McCormick Loop and Trask River Road/Trask River Road/Olsen Road
- S-9: Long Prairie Road/Connection between McCormick Loop and Long Prairie Road/McCormick Loop/Connection between McCormick Loop and Trask River Road/Trask River Road/Olsen Road
- S-10: McCormick Loop/Connection between McCormick Loop and Marolf Loop/Marolf Loop/Connection between 3rd Street and OR 6. This alternative could also connect with Long Prairie Road to the south.

Roadway Alternatives - Tillamook Lumber Company Mill Access

- No-Build (existing condition). Trucks access the mill from U.S. 101 via 10th Street and exit the mill using 3rd Street and Delmonte. Although it is discouraged, other local streets also are sometimes used to reach the 10th Street entrance to the mill.
- M1-A (North/East Access via Existing Local Streets). Relocate the mill access to 3rd Street and construct improvements from new entrance to the large vehicle alternate route to the east. This alternative would likely require internal reconfiguration of the mill. (Evergreen Drive, a residential street, was not considered a feasible route and is therefore not considered here.)
- M1-B (South Access via Existing Local Streets). Relocate the mill access to 12th Street and construct improvements from new entrance to the large vehicle alternate route to the east. This alternative would likely require internal reconfiguration of the mill.
- M1-C (North Access to OR 6 via 3rd Street). As described in the Truck Route Section Conceptual Design Report (OTAK, 2001), the access point could be relocated to 3rd Street. Access from OR 6 could be provided by extending Evergreen Drive from OR 6 to 3rd Street. This access could be provided via a ramp from OR 6 or as an at-grade connection.
- M2 (North Access via Dedicated Route). Construct a new section of road from the mill to North US 101 along the Port of Tillamook Bay Railroad tracks.
- M3 (South Access via Local Streets or Dedicated Route). Construct a new section of road from the mill to South US 101. This alternative could be constructed as an extension of

12th Street west to US 101, as a new section of roadway directly south of mill to US 101, or as a new section of roadway along the Port of Tillamook Bay Railroad tracks.

Non-Roadway Alternatives - Land Use

- Relocate TLC mill to the POTB industrial area

Non-Roadway Alternatives – Inter-Modal

- Work to shift a portion of local and regional truck traffic to other modes (e.g., rail and barge).

Mobility Projects

- Extend Meadow Avenue to 12th Street
- Extend Beech Street to Marolf Loop
- Designate Spruce Avenue as a public road and remove the barriers at Apple and Beech Streets. Connect Spruce to Cypress to complete roadway grid system.
- 9th Street, cul-de-sac one side of the park and add parking on the other side
- Extend Filbert Street to Marolf Loop
- Extend Hawthorne Lane between Meadow and Williams Avenues
- Extend Williams Avenue south to 12th Street
- Extend 12th Street to McCormick Loop (after development occurs in area)

Operational-Modernization Projects

Outside Downtown

- Provide an eastbound right-turn lane at U.S. 101 and Wilson River Loop intersection (to U.S. 101 southbound) while providing for safe pedestrian and bicycle movements.
- Provide grade-separated interchange at Oregon 6 and Wilson River Loop intersection.
- Widen Wilson River Bridge at U.S. 101. Part of current STIP.

Downtown

- Install traffic signal at Netarts Highway (131) (3rd Street) and Stillwell Avenue. Provide a northbound and southbound left-turn lane.
- Construct a pedestrian island that provides a channelized westbound right-turn at the U.S. 101 and Oregon 6 intersection, reconstruct northeast corner, provide downstream lane and widen Hoquarten Bridge. Provide signing that yields vehicles to pedestrians crossing this lane.
- Create a couplet system along 1st Street (westbound) and Netarts Highway (131) (3rd Street) (eastbound) between Stillwell Avenue and U.S. 101 (Main Avenue). Improves operations at U.S. 101 and Oregon 6 and at U.S. 101 (Main Avenue) and 3rd Street.

Project includes signing, channelization/restriping and intersection signal equipment and timing modifications.

Parking Projects

- Conduct parking study to understand parking use at various times during the year
- Provide signing along U.S. 101 to off-street lots off U.S. 101
- Construct off-street parking at city-owned lot along Ivy Avenue. Provide signing along U.S. 101 to this lot.

Pedestrian/Bicycle/Trail Projects

- Construct bike lanes and sidewalk on 3rd Street, east of Evergreen Drive to Trask River Road, repave roadway from Nestucca Avenue to city UGB. Provide marked crosswalks near Tillamook County Fairgrounds with pedestrian area warning signs. Restripe crosswalks near Wilson Elementary School/Goodspeed Park area on 3rd Street. Retrofit ramps along 3rd Street to ADA compliance near Goodspeed Park and Wilson Elementary School.
- Provide bike route between Evergreen Drive to Trask River bridge. Eastbound: Route on 3rd Street, south onto Ash Avenue, east on 4th Street, north on Ocean Place, east on 3rd Street. Would require bike lanes on 3rd Street to Ash Avenue to shared roadway on Ash Avenue, 4th Street and Ocean Place. Westbound: 3rd Street from Evergreen Drive, north on Ocean Place, west on Oregon 6, cross U.S. 101 on First Street, south on Birch Avenue, west on 2nd Street, south on Ash Avenue, west on 3rd Street. Provide bike lanes on 3rd Street and Oregon 6, all other roads are shared roadway designation. Bike lanes on Oregon 6 can be provided with striping modifications. Requires advanced signing on U.S. 101 and 3rd Street.
- Create a bicycle bypass in downtown area along Stillwell Avenue. Create bike lane connections with U.S. 101 along Front Street and 11th Street. Provide advanced signing. Remove parking on one side of road to provide bike lanes. Coordinate with Hoquarten Slough Trail. Might require undercrossing with U.S. 101 at Front Street. Additional study required. Complete sidewalk system on Stillwell Avenue, Front to 1st Streets and 11th to 12th Streets. Construct ADA ramps along Stillwell Avenue near Liberty Elementary School (7th and 8th Street crossings). Restripe crosswalks along Stillwell Avenue.
- Downtown sidewalk construction/replacement from Hoquarten Slough to 4th Street. Includes bulb-outs at 2nd, 3rd and 4th Streets. This is phase 1 of the TE project
- Downtown sidewalk construction/ replacement from 4th to 12th Streets. Includes bulb-outs at 9th and 11th Streets. This is phase 2 for the TE project.
- Construct sidewalk and bike lanes on Evergreen Drive. Repave road with asphalt.
- Construct sidewalk on 12th Street, east of the high school to Marolf Loop, repave from Miller Avenue to Marolf Loop. Provide adequate width along 12th Street from high school to Marolf Loop for shared roadway designation.

- Complete sidewalk and provide bike lanes on 3rd Street, west of Ash Avenue. Removal of parking on one side.
- Provide adequate bike lane width and sidewalk and repave Alder Lane between Evergreen Drive and Cypress/Dogwood intersection.
- Provide adequate shoulder on Brookfield Avenue. Road would need to be acquired by city.
- Provide adequate shoulder on McCormick Loop for shared roadway designation, repave road at south end.
- Provide adequate shoulder on Marolf Loop for shared roadway designation, repave road, add sidewalk.
- Construct sidewalk along 4th Street from Nestucca to Miller Avenues. Contingent on development.
- Provide ADA-compliant ramps along Miller Avenue. Provide painted crosswalks along Miller Avenue.
- Construct ADA-compliant ramps along 10th Street. (Currently ramps exist only at Stillwell Avenue and U.S. 101 intersections.)
- Provide sidewalk on north side of 11th Street between Stillwell Avenue and U.S. 101, retrofit south side sidewalk, overlay roadway between Stillwell and Miller Avenues.
- Provide bicycle parking in downtown Tillamook. Benches, drinking fountains, trash receptacles, and informational signage or historical kiosks are recommended.

Safety Projects

- Consolidate driveways near intersection of U.S. 101 and Hadley Road (high accident rate). Provide a median barrier to restrict the driveways near the intersection to a right-in, right-out.
- Improve driver awareness (bulb-outs, removal of parking, consolidation of driveways) at U.S. 101 (Pacific Avenue) at 3rd Street (top 10 percent SPIS site). Improve signing and striping on the eastbound approach.
- Improve the pedestrian visibility (possible remedies include improved bulb-outs with parking removal, pedestrian activated crossing blinking lights, etc.) at U.S. 101 (Pacific Avenue) at 2nd Street (top 10 percent SPIS site) and at U.S. 101 and Main Avenue.
- Realign intersection at 12th Street and U.S. 101 (Pacific Avenue) to provide adequate SSD.
- Create gateway at southern end of U.S. 101 couplet.
- Provide a raised island at Ocean Place at 4th and 3rd Streets (skewed intersections) for a safe pedestrian refuge with marked crosswalks on every approach.

- Construct a roundabout and realign approaches at Ocean Place at 4th and 3rd Streets (skewed intersections). Provide advanced signing and striping to provide safe operating conditions.
- Redesign intersection of Alder Lane at Dogwood and Cypress Streets (offset intersection near school) to remove parking area (or revise to not interfere with intersection operations). Provide all-way, stop-controlled intersection. Provide shoulder along eastside of intersection for pedestrians and revise crosswalk locations.
- Relocate stop bar at 12th Street and Tillamook River Road to provide better sight distance
- Upgrade 12th Street railroad crossing with safety measures, such as gate and flashing lights. First step would be study by ODOT rail.

City of Tillamook Zoning Code

Project Relevance: Section 4 of the City of Tillamook Zoning Ordinance includes transportation-related definitions, background information and requirements. These are summarized below.

Section 4 - Definitions

The Definitions section of the City of Tillamook Planning and Zoning Ordinance lists several definitions that pertain to the transportation/public facilities policies. These include the following: Access or Access Way; Alley; parking Area, Public; Parking Space; Roadway; Sidewalk; Street (includes the terms, road, highway, lane, avenue and Arterial; Cul-de-sac; Half Street; Local Street; Major Collector; Marginal Access Street; Minor Collector).

Section 11 – Open Space Land Use District (O District)

This section includes development standards for permitted and conditional uses located in the O District. Transportation facilities are not addressed.

Section 12 – Single Family Residential (R-7.5 District)

This section includes development standards for permitted and conditional uses located in the R-7.5 District. Public facilities include public utilities and are allowed as a conditional use in this zone.

Section 13 – Single Family Residential (R-5.0 District)

This section includes development standards for permitted and conditional uses located in the R-5.0 District. Public facilities include public utilities and are allowed as a conditional use in this zone. Off street parking and loading standards in Section 25 must be met.

Section 14 – Multiple Use Residential (R-O District)

This section includes development standards for permitted and conditional uses located in the R-O District. Public facilities include public utilities and are allowed as a conditional use in this zone. Site Plan approval is required for all uses except single family and duplex dwellings in this zone. Off street parking and loading standards in Section 25 must be met.

Section 15 – Neighborhood Commercial District (C-N District)

This section includes development standards for permitted and conditional uses located in the C-N District. Public facilities include public utilities and are allowed as a conditional use in this zone. Site Plan approval is required for all uses in this zone. Off street parking and loading standards in Section 25 must be met.

Section 16 – Highway Commercial District (C-H District)

This section includes development standards for permitted and conditional uses located in the C-H District. Rest stops or Waysides are permitted outright in this zone. Site Plan approval is required for all uses in this zone. Off street parking and loading standards in Section 25 must be met. Access requirements are determined on the basis of the Traffic Capacity Analysis as per Section 22, 6 (f) and the City of Tillamook City Overall Traffic Plan.

Section 17 – Central Commercial District (C-C District)

This section includes development standards for permitted and conditional uses located in the C-C District. Public facilities are allowed as a conditional use. Site Plan approval is required for all uses in this zone. Off street parking and loading standards in Section 25 or an equivalent standard shall be met. Certain areas designated by Ordinance 979 are exempt from off street parking requirements.

Section 17.1 – Town Center District (TC District)

The City has developed an area within a 15 block area of downtown Tillamook as the City's Town Center (TC). This section includes development standards for permitted and conditional uses located in the TC District. Public facilities are allowed as a conditional use. Site Plan approval is required for all uses in this zone. For commercial uses off-street parking is not required; residential uses require one space per unit and civic uses shall use the parking standards in Section 25. Parking lots shall be placed to the rear of buildings in accordance with the Building Orientation standards. Loading and service areas are encouraged to be located along sides or to the rear of buildings and are required to be screened. Parking areas shall be separated from building by either a raided concrete walkway or landscaped strip with a minimum of five feet. Rear parking lots shall be designed so vehicles can travel across them; shared parking is encouraged.

Section 18 – Light Industrial District (I-L District)

This section includes development standards for permitted and conditional uses located in the I-L District. Public facilities are allowed as a conditional use. Site Plan approval is required for all uses in this zone. Off street parking and loading standards in Section 25 shall be met.

Access points from a public road to properties in an I-L District shall be so located as to minimize traffic congestion and to avoid directing traffic on to local access streets of a primarily residential character. Site Plan approval is required for all uses.

Section 19 – General Industrial District (I-G District)

This section includes development standards for permitted and conditional uses located in the I-G District. Public facilities are allowed as a conditional use. Site Plan approval is

required for all uses in this zone. Off street parking and loading standards in Section 25 shall be met.
Access points from a public road to properties in an I-L District shall be so located as to minimize traffic congestion and to avoid directing traffic on to local access streets of a primarily residential character. Site Plan approval is required for all uses.

Section 19.1 – Public and Semi Public District

This section includes development standards for permitted and conditional uses located in the I-G District. Public facilities are allowed as a conditional use. Site Plan approval is required for all new construction or substantial remodeling. Surface parking areas shall not be required for short term uses that generate large parking requirements. Off street parking and loading shall be provided as required in Section 25 to meet the normal operational requirements of specific uses. Access requirements are determined on the basis of the Traffic Capacity Analysis as per Section 22, 6 (f) and the City of Tillamook City Overall Traffic Plan.

Section 19.2 - Limited Use Overlay (LU)

The Limited Use Overlay was established in response to the Averill Mediation Agreement (1995). The standards within this overlay zone are primarily designed to mitigate for any effects of the uses on the properties containing the overlay. Transportation-related standards include limited access along Highway 101 and limitations on truck traffic along Werner Road.

Section 20 – Flood Hazard Overlay (FHO)

The Flood Hazard Overlay Zone was established to provide standards for development within flood-prone areas of the City. The standards apply primarily to the development of structures within the Overlay. Standards for transportation-related facilities are not included in the FHO Zone.

Section 20.1 – Airport Overlay (AO)

The Airport Overlay describes permitted and conditional uses within the Airport Overlay Zone. The Zone was established to provide standards for development within areas identified as "Airport Imaginary Surfaces" as applicable to the Tillamook County Airport. The areas are identified on the Airport Approach and Clear Zone Maps as adopted by the Port of Tillamook Bay. Uses are limited to those that would not interfere with airplane operation. Standards for transportation-related facilities are not included in the AO Zone.

Section 20.2 – Hazards Overlay Zone (HO)

Section 20.2 describes permitted and conditional uses within the Hazards Overlay Zone. The Zone was established to provide standards for development within areas identified as inundation zones for tsunami activity. The areas are identified on the Tsunami Hazard Map of Tillamook Quadrangle. Sites within the Overlay Zone are required to complete a Site Investigation prior to development. Standards for transportation-related facilities are not included in the HO Zone.

Section 21 – Estuary Standards and Requirements

Section 21 provides standards for development according to the following Tillamook County zones:

- Section 1.030 Definitions for Estuary Zones, Shorelands Overlay Zone and Water-Dependent Development Zone
- Section 3.100 Estuary Zones
- Section 3.106 Estuary Conservation 1 Zone (EC1)
- Section 3.120 Review of Regulated Activities
- Section 3.140 Estuary Development Standards
- Section 3.090 Shoreland Overlay Zone (SH)

Section 22 – Site Development Standards

Site Development standards are required for development within the following City zones (R-O, P, S-P, C-C, C-N, C-H, I-L, and I-G) to encourage the development of structures with a level of design and an overall analysis of the site. Transportation-related standards required during the Site Development process include provision of a Traffic Capacity Plan. A Traffic Capacity Plan shall include the points of egress and ingress, on-site traffic movement; off-street parking; vision clearance areas and a carrying capacity plan for the site. Off-street parking areas are required to be developed with landscaping for screening and buffering. If required, the elements of a Traffic Capacity Analysis follow those required by the Oregon Department of Transportation, Highway Division, "Minimum Requirements for Traffic Report." These elements include the following:

- Alternative site access
- Existing and projected AM and PM traffic
- Determination of the existing levels of service and projected levels of service at each intersection and access points—made in conformance with nationally accepted capacity manuals.
- Traffic signal needs based on a minimum level of service
- Trip generation based on the ITE Trip Generation Manual (1976)
- Consideration for bicycle and pedestrian usage of the development

Section 23 – Land Division and Planned Unit Development

Section 23 describes the standards and criteria for development of a Planned Unit Development and Major/Minor Partitions and Subdivisions within the City of Tillamook. Transportation-related standards for the Planned Unit Development include the development of an off street parking plan; a circulation diagram and street design based on the City's Public Works Construction Standards. Land Division standards include minor land partitioning (a partition without development of a street) and major land partitioning (development of a street as part of a land division). Design standards for streets reference Tillamook City Public Works Construction Standards.

Section 24 – Sign Standards and Requirements

This section contains standards for construction of signs within the City of Tillamook.

Section 25 – Off Street Parking and Loading

This section contains provisions for off-street parking when erecting new structures and increasing capacity for existing structures. If a structure is changing size, the following ratio is used: if the expansion does not increase the building size by more than 50% of the capacity or market value, additional parking is required only in proportion to the expansion; if the expansion increases the building size greater than 50% of the capacity or market value, parking and loading spaces must be provided for the entire used according to Section 25.

According to this section, in the event several uses occupy a single structure or land parcel, the total requirements for off-street parking and loading shall be the sum of the requirements of the several uses computed separately except if the uses occur at separate times. Shared parking provisions are also permitted. On-street parking credit is also available in the Multiple Use Residential; Central Commercial; Town Center and outside of the C-4 Parking District. This section also includes standards for the number of required spaces per use. This section contains a provision for maximum parking, that the minimum number of parking spaces cannot be exceeded by more than 10%.

Section 26 – Fence, Hedge and Shrub Standards

This section contains the Vision Clearance Area standards for the City. The minimum distance is 30 feet for Residential Zones; 15 feet in all other zones and plantings cannot exceed 3 feet within this area.

Section 28 – Provisions Applying to Special Uses

This section contains special standards for utilities that permits traffic signals in any zoning district.

Tillamook Town Center Plan (OTAK and Pacific Rim Resources, 1999)

The Tillamook Town Center Plan includes opportunities for a downtown area that has a mixed-use environment, pedestrian-friendly design, and more attractive visual character. The plan defines a town center boundary and illustrates opportunities for new public open space, potential land uses including civic and government buildings, and architectural restoration of key buildings. The plan supports those opportunities with conceptual site plans, design guidelines, and an outline for a new code district.

Plan opportunities and proposed changes expressed by the Tillamook Town Center Plan that are relevant to the Tillamook Refinement Plan include:

- New public open space in the form of a greenway park and trail to include a pedestrian/bike link between the park and town square.
- A streetscape enhancement plan which encourages the use of "green walls" (vegetation three to four foot high) to screen parking lots that form the edge of streets.
- A code change recommendation to: eliminate or reduce the off-street parking requirement for commercial uses; set parking maximums; and locate parking to the side or rear of buildings.
- A "Town Square Spatial and Circulation Diagram"

Project Relevance: Alternative proposals made for the Tillamook Refinment will be responsive to the objectives of the Town Center Plan.

Tillamook Alternate Log Truck Route Section Conceptual Design Report (OTAK, 2001)

The purpose of this alternative route report was to provide the preliminary engineering to evaluate viable alternate log truck routes. This report was meant to address the negative impacts to safety and revitalization efforts associated with the existing truck route through downtown Tillamook.

Project Relevance: The Tillamook Refinement Plan's truck transportation study will be analyzing and identifying alternative solutions to relieve the continuing negative impacts to dosntown Tillamook associated with heavy log truck traffic.

Oregon Downtown Development Association's Resource Team Report for Tillamook, Oregon (2002)

The Oregon Downtown Development Association Plan completed a conceptual document for Tillamook for strengthening the Downtown.

*Project Relevance:*Highlights of the report that addressed transportation related improvements relevant to the Tillamook Refinement Plan include:

- Repairing and maintaining sidewalks in the City's downtown.
- Recommendations on a Truck Bypass Route along Latimer Road, Wilson River Loop, Marolf Loop and ending on 12th Street.
- Providing streetscape enhancements.
- Reclaiming alleyways as pedestrian ways.

MEMO #2

Goals and Evaluation Criteria

Tillamook Transportation Refinement Plan: Goals and Evaluation Criteria (Memo #2)

PREPARED FOR:	Valerie Grigg Devis, ODOT
PREPARED BY:	Tim Burkhardt, CH2M HILL
COPIES:	Project Management Team
DATE:	Revised: May 5, 2005
PROJECT NUMBER:	320805.19

The following goals and evaluation criteria have been prepared for the Tillamook Refinement Plan based on the plan objectives and work to date. This information will be used to evaluate the solutions developed by the project team and stakeholders and to guide the selection of a preferred alternative. The goals and evaluation criteria will be reviewed and endorsed by the Project Management Team and the Refinement Plan Advisory Committee prior to being finalized. (This version of the memo reflects discussion at the May 3, 2005, Advisory Committee meeting.)

Goal 1: Improve US 101 Downtown Safety and Comfort

Evaluation Criteria

- Pedestrian safety
- Vehicle safety
- Bicycle safety
- Pedestrian crossings within the Town Center area
- Vehicle speeds
- Traffic congestion
- Aesthetics and streetscape amenities

Goal 2: Address Downtown Parking Deficiencies

Evaluation Criteria

- Parking safety and comfort on US 101
- Parking supply on US 101
- Public parking supply downtown
- Employee parking supply downtown

- RV parking supply downtown
- Parking regulations (time limits)
- Directional signage to public parking

Goal 3: Address Adverse Impacts of Trucks on US 101 Downtown

Evaluation Criteria

- Reduces number of through truck trips
- Slows truck speeds
- Provides a buffer between trucks and on-street parking
- Supports downtown businesses and economy

Goal 4: Develop Alternate Truck Routes

Evaluation Criteria

- Minimizes impacts on residential land uses
- Truck trip efficiency (likelihood route will be used)
- Provides linkage to industrially zoned land, including under -developed industrial parcels
- Supports local and regional businesses and economy
- Impacts on natural resources and resource lands
- Impact on flood hazard/rating
- Amount of new road outside the Urban Growth Boundary
- Efficient use of existing highway capacity
- Compatibility with future interchange in the vicinity of Highway 6 and Wilson River Loop

Goal 5: Address Other Identified Issues

Evaluation Criteria

- Cost-effectiveness of transportation investments
- Consistency with applicable standards (City, County, ODOT)
- Consensus among affected jurisdictions on implementing the alternative
- Implementable within a 20-year time frame
- Provides a year-round solution

MEMO #3

Existing and Future Traffic Operations and Safety

Tillamook Transportation Refinement Plan: Existing and Future Traffic Operations and Safety (Memo # 3)

PREPARED FOR:	Valerie Grigg Devis/ODOT
PREPARED BY:	Tim Burkhardt/CH2M HILL Andra Henriques/CH2M HILL Craig Grandstrom/CH2M HILL
COPIES:	Project Management Team Dorothy Upton/ODOT
DATE:	Revised: November 30, 2005

This memorandum documents existing and future roadway operating conditions within the City of Tillamook and identifies transportation safety concerns. Deficiencies identified in this memo will be considered during the development of alternatives in the subsequent tasks of this project. The memorandum includes a description of the project area, a brief inventory of current transportation facilities, and a traffic operations and safety analysis. The memorandum identifies transportation deficiencies along the existing road network and discusses next steps.

Referenced figures and appendixes are attached to the end of this memo.

Crash Analysis

Intersection Crash Analysis - Existing Conditions

A crash analysis was conducted using data obtained from ODOT for US 101 within the project study limits of US 101 between First Street and Twelfth Street. Crash data from January 1, 1999, to December 31, 2003, was obtained from ODOT for each intersection. Table 1 summarizes the number of crashes resulting in property damage only, injuries, and fatalities, with the calculated accident rate at each of the 24 intersections from years 1999 to 2003. The crash analysis is based upon reported accidents only.

TABLE 1
Crash Analysis for Study Intersections (Year 1999 to 2003)

Intersection/Segment	Total Number of Accidents	Property Damage Only	Injury	Fatality	Crash Rate (in MVM)[1]
US 101 (Main Avenue) & First Street	22	17	5	0	0.49
US 101 (Pacific Avenue) & First Street	0	0	0	0	0.00
US 101 (Main Avenue) & Second Street	20	16	3	1	0.88
US 101 (Pacific Avenue) & Second Street	2	2	0	0	0.14
US 101 (Main Avenue) & Third Street	16	12	4	0	0.55
US 101 (Pacific Avenue) & Third Street	7	6	1	0	0.29
US 101 (Main Avenue) & Fourth Street	18	15	3	0	0.85

TABLE 1
Crash Analysis for Study Intersections (Year 1999 to 2003)

Intersection/Segment	Total Number of Accidents	Property Damage Only	Injury	Fatality	Crash Rate (in MVM)[1]
US 101 (Pacific Avenue) & Fourth Street	1	0	1	0	0.05
US 101 (Main Avenue) & Fifth Street	5	5	0	0	0.29
US 101 (Pacific Avenue) & Fifth Street	3	1	2	0	0.21
US 101 (Main Avenue) & Sixth Street	2	2	0	0	0.12
US 101 (Pacific Avenue) & Sixth Street	1	1	0	0	0.07
US 101 (Main Avenue) & Seventh Street	1	1	0	0	0.06
US 101 (Pacific Avenue) & Seventh Street	0	0	0	0	0.00
US 101 (Main Avenue) & Eight Street	2	2	0	0	0.12
US 101 (Pacific Avenue) & Eight Street	2	2	0	0	0.14
US 101 (Main Avenue) & Ninth Street	2	2	0	0	0.12
US 101 (Pacific Avenue) & Ninth Street	0	0	0	0	0.00
US 101 (Main Avenue) & Tenth Street	6	4	2	0	0.35
US 101 (Pacific Avenue) & Tenth Street	1	1	0	0	0.07
US 101 (Main Avenue) & Eleventh Street	12	11	1	0	0.70
US 101 (Pacific Avenue) & Eleventh Street	1	1	0	0	0.07
US 101 (Main Avenue) & Twelfth Street	11	10	1	0	0.64
US 101 (Pacific Avenue) & Twelfth Street	1	1	0	0	0.07
Total	**158**	**127**	**30**	**1**	**N/A**

Source: ODOT Crash Data, Years 1999 to 2003.

1 - Crash Rate in units of million entering vehicles.

Of the total 158 crashes that occurred over the five-year period at intersections in the study area, 127 involved property damage only, 30 resulted in injury and one resulted in a fatality.

The highest number of crashes at any one intersection in the study area occurred at First Street/Main Avenue. Over the five year study period, there were a total of 22 crashes at this intersection. Seventeen of the crashes were property damage only and five resulted injury. The one fatality occurred at Main Avenue and Second Street. It involved a bicyclist and a heavy vehicle. This is discussed further in the bicycle facilities section.

All intersection crash rates along US 101 in the study area are below 1.0. The highest crash rate of 0.88 occurs at Second Street/Main Avenue. Crash rates below 1.0 typically do not indicate a safety deficiency.

Table 2 and 3 further evaluate the intersections by examining the type of collision that occurred for all the accidents within the study area and the cause of each accident. Table 2 shows that rear-end and entering at angle/turning were the most prevalent accidents; with 74 percent of the total accidents being one of these two types. These accidents are typical along a corridor with closely spaced intersections/driveways. Although evidence is not available, the parallel parking along US 101, which requires vehicles to stop, reverse and maneuver, could contribute to the number of rear-end and sideswipe accidents (third highest).

TABLE 2
Collision Summary for the 5 year period from 1999 – 2003

Collision Type	Total	Percentage
Rear-end	43	27%
Entering at Angle/Turning	75	47%
Sideswipe	28	18%
Park	3	2%
Backing	3	2%
Pedestrian	3	2%
Fixed/Other Object	3	2%
Total	**158**	**100%**

Table 3 identifies the reported factor that caused the collision. For 34 percent of the conditions, a driver was driving too fast. This factor may indicate that higher than posted speeds occur frequently along US 101, especially south of the downtown area, although recent speed data did not suggest a clear pattern (see Memo #4: Downtown Speed Study Results).

Another condition that frequently occurred was a driver failing to yield. This caused 30 percent of the accidents and could be an indication that divers are confused or unclear or there is poor signing of the conditions through the corridor. The failure to yield could also be an indication of poor sight distance at intersections/driveways.

TABLE 3
Causality Summary for the 5 year period from 1999 – 2003

Cause	Total	Percentage
Driving Too Fast	54	34%
Failed to Yield	47	30%
Disregarded Traffic Signal	17	11%
Improper Passing	14	9%
Improper Turn	12	8%
Other (Improper Driving)	8	5%
Other (Not Improper Driving)	2	1%
Drove on Wrong Side of Road	2	1%
Followed Too Close	1	1%
Passed Stop Sign	1	1%
Total	**158**	**100%**

Safety Priority Index System Sites

The Safety Priority Index System (SPIS) method is used by ODOT to identity locations with safety problems due to the crash frequency, rate, and severity at the site. The top 10 percent ranked SPIS sites are evaluated each year by ODOT to identify improvements that may reduce the number and severity of accidents. SPIS data was provided by ODOT for the period from 1999 and 2003. In Tillamook, several intersections were ranked as top 10 percent SPIS sites the past five years. Table 4 shows the breakdown of SPIS sites for each of these years.

TABLE 4
SPIS Site Summary for Study Area (Year 1999 to 2003)

Year	Main Ave & First St	Main Ave & Second St	Main Ave & Third St	Pacific Ave & Second St	Pacific Ave & Third St	Pacific Ave & Fourth St
2003	X	X	X			
2001				X	X	X
2000	X	X		X	X	X
1999	X	X		X	X	X

Note: The US 101 Couplet in Tillamook was not investigated in 2002.

There are currently three SPIS sites in Tillamook along the US 101 couplet. Each 2003 site occurs along Main Avenue at First Street, Second Street and Third Street. These 2003 SPIS sites will be further assessed in the alternatives development phase of the project for safety improvements along the US 101 couplet.

Segment Crash Rates - Existing Conditions

As described in the 2003 State Highway Crash Rate Tables published by the ODOT Crash Analysis and Reporting Unit, US 101 is considered a non-freeway principal arterial. Table 5 summarizes the year 2003 crash rate and the 5-year average crash rate (1999 to 2003) for the segment of US 101 within the study limits of Tillamook.

TABLE 5
Crash Rates along US 101 in the Study Area

Roadway	Year 2003 Crash Rate[1]	Year 2003 Statewide Average Crash Rate[1]	5-year Average Crash Rate[1]	5-year Statewide Average Crash Rate[1]
US 101 (SB) MP 65.74 – 66.26	15.88	2.74	11.50	1.51
US 101 (NB) MP 65.64 – 65.68	5.27	2.74	N/A[2]	1.51
US 101 (NB) MP 65.68 – 65.77	3.52	2.74	N/A[2]	1.51
US 101 (NB) MP 65.77 – 65.87	28.46	2.74	22.19	1.51
US 101 (NB) MP 65.87 – 66.26	6.52	2.74	6.36	1.51

Source: 2003 State Highway Crash Rate Table, Crash Analysis and Reporting Unit, ODOT.

1 – Crash Rate in units of million vehicles miles.

2 – Crash Rates for all five years not available in ODOT document.

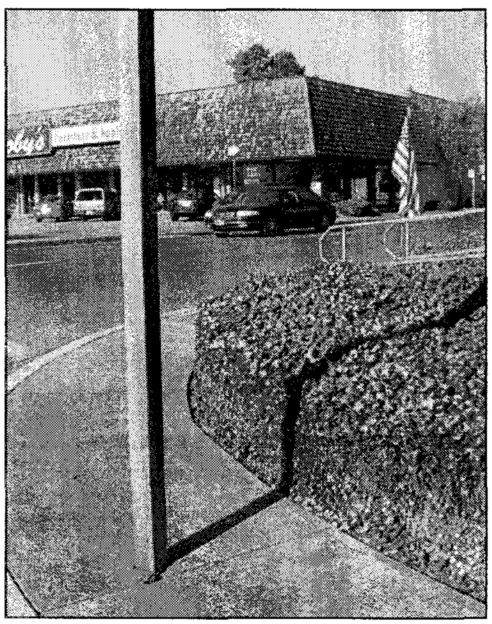
On urban, non-freeway, principal arterials throughout the state, the 5-year statewide average crash rate was 1.51 crashes per million vehicle miles (MVM) and the 2003 statewide average rate was 3.15 per MVM. As shown in Table 5, for each segment of roadway compared, both the year 2003 and 5-year average crash rates along US 101 exceed the statewide averages on similar types of roadway. This may indicate that while the intersection accident rates are low (refer to Table 1) there is a high percentage of mid-block accidents. This could be attributed to the parallel parking on both sides of US 101 and the commercial and residential driveway accesses along US 101.

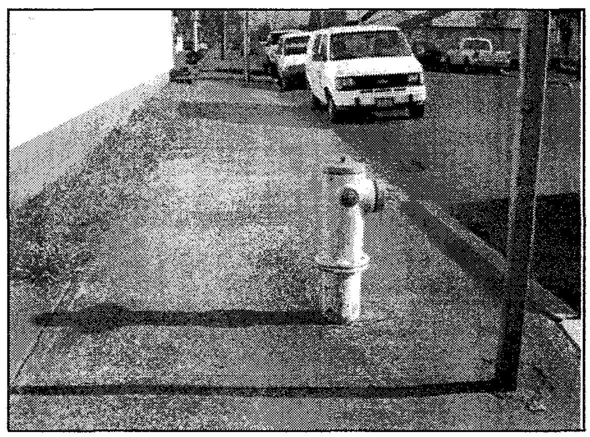
Downtown Safety

Pedestrian Facilities

The pedestrian facilities throughout Tillamook vary in content and quality. The sidewalk width in the US 101 couplet is as wide as 12 feet at times, and is much narrower at other times. The couplet has nearly continuous sidewalks extending north and south within the study area of First Street down to Twelfth Street on Main and Pacific Avenue. The only exception is between Eleventh and Twelfth Street on the east side of Main Avenue where there is a section of the block that does not have any sidewalk. Some of the sidewalk is in excellent condition, but there are other areas where the sidewalk is cracked and in a condition that could be considered unsafe to some users. Throughout the couplet there are several locations where a fire hydrant or sign is mounted directly in the walking path of the sidewalk. Providing consistent standard facilities is paramount to pedestrian walkability and safety.

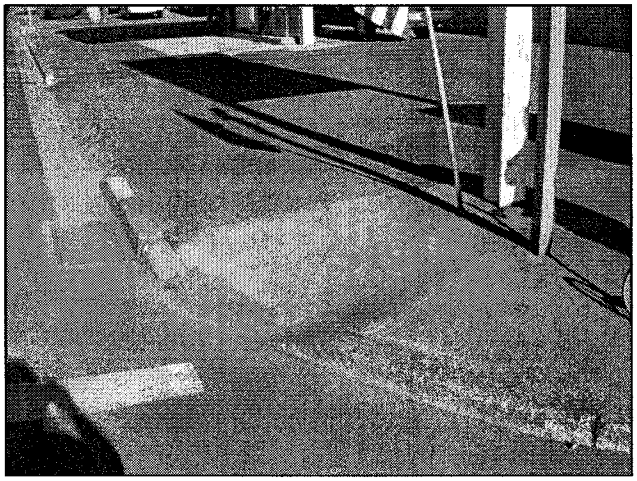
Every intersection within the study area has a striped crossing on each leg, although in some cases the paint has faded. Nearly every intersection also has at least one luminaire to light the area at night. Most corners have curb ramps, but most of the existing ramps are not built to ADA standards. Main Avenue at Second Street has two curb bulb outs extending into Main on the north side of the intersection. Some examples of the sidewalk conditions are shown in the photographs below.



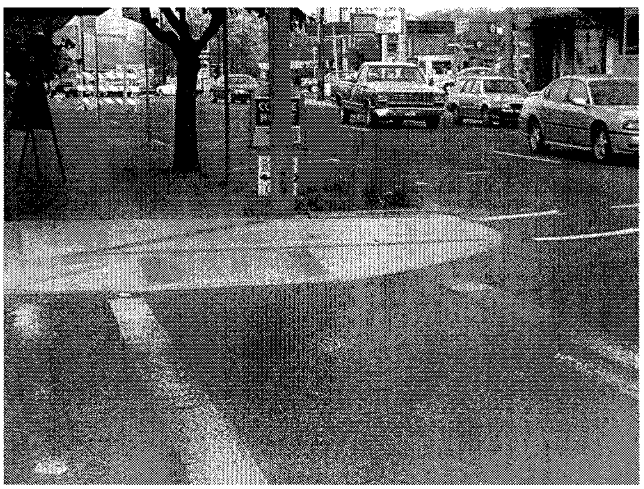


Sidewalk along US 101 couplet

US 101 (Main Avenue) and 12th Street



Sub-standard curb ramp on US 101 (Pacific Avenue) and 11th Street



Curb extension at 2nd and Main

Bicycle Facilities

US 101 throughout Tillamook is part of the Oregon Coast Bike Route. This section of US 101 falls under the bikeway classification of shared roadway. As a shared roadway, US 101 is signed as a bike route, but not striped as one. The bicycles and vehicles along the downtown segment of US 101 share two 10 foot travel lanes in the northbound and southbound directions.

In August of 2003, there was a fatal accident involving a bicyclist and a heavy vehicle at Main Avenue and Second Street. Indications are that the bicyclist was traveling in the parking lane and swerved into or in front of the truck driving in the travel lane. While it is possible the cyclist in this case may not have been riding safely, this accident nevertheless points out the conflict between vehicles and bicycle traffic in this segment of US 101.

Parking Conditions

Parallel parking is available on both sides of the Main and Pacific Avenues throughout the couplet. Generally, the northern end of the couplet has a much higher percent usage of the parking spaces than the southern end of the couplet, as the downtown retail core is located between First and Fifth Streets. A number of local stakeholders have expressed a concern for parking along this segment of US 101 during periods of high traffic volumes, and trucks in particular. The citizens also feel unsafe while making the parallel parking maneuvers with highway traffic approaching behind their vehicles. See Memo #5: Parking Existing Conditions and Utilization Study for further description and evaluation of existing parking conditions within the downtown area.

Truck Traffic

Truck traffic has a large impact on US 101 within the Tillamook couplet. The size and volume of the trucks traveling though downtown create a feeling of unease for pedestrians and bicyclists. The trucks traveling though Tillamook are often large and have limited space to maneuver. Alternate routes for trucks are being studied as part of this project. See Memo #6: Truck Data Collection and Analysis for further discussion of truck existing conditions and travel patterns.

Motor Vehicle Operations – Existing Condition

The study area has been analyzed for motor vehicle operations for the existing (2004) and future (2025) conditions based on the existing roadway geometry and lane configuration. Traffic counts have been taken at the study area intersections to use in this analysis. This data is used to determine roadway operating conditions within the study area.

Study Intersections and Raw Traffic Counts

Traffic volume data was collected and operational analysis was performed at the following study intersections:

Signalized

- First Street and Main Avenue
- First Street and Pacific Avenue
- Third Street and Main Avenue
- Third Street and Pacific Avenue
- Fourth Street and Main Avenue
- Fourth Street and Pacific Avenue

Unsignalized

- Second Street and Main Avenue
- Second Street and Pacific Avenue
- Tenth Street and Main Avenue
- Tenth Street and Pacific Avenue

Traffic counts were collected on September 8, 2001, November 4, 2004, and November 16, 2004. See Appendix A for the raw traffic counts[1].

[1] ODOT agreed to the 2001 counts, since travel patterns have remained fairly consistent and more recent 2004 counts were taken next to the 2001 counts to ensure consistent volume balancing.

Analysis of Automated Traffic Recorder Sites

ODOT traffic analysis procedures require the 30th highest hour traffic volumes be used to calculate volume to capacity (V/C) ratios for intersections and street segments. As required by ODOT's Transportation Planning Analysis Unit (TPAU), the seasonal factor tables on the ODOT website were used to calculate 30th highest hour traffic volumes.[2] As stipulated in TPAU's review of the methodology, included in Appendix B, the analysis of a comparable automated traffic recorder (ATR) site was performed since no ATR site exists on US 101 in Tillamook. Rockaway ATR 29-001 was used to match the roadway and traffic characteristics of US 101 within downtown Tillamook. US 101 in the study area has an average daily traffic (ADT) volume between approximately 6,000 and 13,000 vehicles. Data from the ATR site, available on the ODOT website,[3] was used to determine a seasonal factor of approximately 1.68 to calculate 30th highest hour traffic volumes for the November 4 intersection count and 1.80 for the November 16 intersection counts.

Two intersections were not counted in 2004; these two intersections are Third Street at Main and Pacific Avenues. Both of these intersections had 4-hour (full classification) counts taken in September 2001. To utilize these counts, 2004 counts were collected at First Street/Main Avenue and First Street/Pacific Avenue which already had traffic counts collected in September 2001. At the two First Street intersections a growth factor of 1.18 was calculated based on the two different counts (2001 and 2004). This growth factor was applied to the 2001 counts taken at Third Street to represent 2004 traffic volumes. Appendix B includes a detailed discussion of this seasonal factor process in the traffic assumptions and methodology memo reviewed and accepted by ODOT.

In addition to the growth factor process, the 30th highest hour traffic volumes along US 101 within the study area were not completely balanced since the traffic counts were collected in different months and in some cases different years. To adjust for this imbalance, the differences were minimized by adjusting the entering/exiting volumes along US 101 throughout the Main and Pacific Avenues couplet. Since the block lengths are very short there are few opportunities to turn except at intersections, so the intersection volumes should be balanced to reflect accurate conditions. Figure 1 shows the balanced existing (2004) 30th highest hour traffic volumes in Tillamook.

State Highway Mobility Standards

All of the study intersections included in the existing operational analysis in Tillamook are on US 101, which is part of the National Highway System. The 1999 Oregon Highway Plan (OHP) designates US 101 as Statewide Highway (NHS). In downtown Tillamook, the speed limit on US 101 is less than 45 mph and this section of highway (from 1st Street to 10th Street) is designated as a Special Transportation Area (STA). The mobility standard designated by the OHP for this section of US 101 is a volume-to-capacity (V/C) ratio of less than 0.90.

According to the OHP, OR 6 is a Regional Highway and Netarts Highway 131 is a District Highway. Both are in a non-MPO area with speed limits of less than 45 mph. Therefore, the mobility standard for OR 6 is a V/C ratio of less than 0.80 and the mobility standard for Netarts Highway 131 is a V/C ratio of less than 0.85.

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2 http://www.odot.state.or.us/tddtpau/papers/2000_Seasonal%20_Factors.pdf

3 http://www.odot.state.or.us/tdb/traffic_monitoring/01tvt/atr01_29.htm

For the local road approaches, the OHP stipulates a V/C ratio of 0.85. For signalized intersections, the OHP designates the V/C by intersection, not approach, and requires the state standard be the V/C threshold. For unsignalized intersections, the OHP designates the V/C by approach, and requires the state standard be the V/C threshold for the state road approaches, and the local road standard for the local cross streets.

Operational Analysis of Existing Conditions (30th Highest Hour)

Using the existing (2004) 30th highest hour traffic volumes, an operational analysis of existing conditions was conducted with Synchro, version 6, for the ten study intersections. Synchro is based on the Highway Capacity Manual, TRB Special Report 209. Results from the Synchro HCM Signalized and Unsignalized Reports are reported for each of the ten intersections. For a listing of all the analysis inputs and assumptions, refer to the assumptions and methodology memo in Appendix B.

Table 6 presents the OHP mobility standard and V/C ratio for each intersection analyzed under existing 30th highest hour conditions. Table 6 reports the existing intersection results for the ten study intersections. Appendix C contains detailed reports for each individual intersection.

TABLE 6
Intersection Operational Analysis – Existing (2004) 30th Highest Hour

Intersection	OHP Mobility Standard		Observed Maximum V/C Ratio	
Signalized				
First Street and Main Avenue	0.90		**1.05**	
First Street and Pacific Avenue	0.90		0.77	
Third Street and Main Avenue	0.90		**1.06**	
Third Street and Pacific Avenue	0.90		0.70	
Fourth Street and Main Avenue	0.90		0.78	
Fourth Street and Pacific Avenue	0.90		**1.14**	
Unsignalized	**Major**	**Minor**	**Major**	**Minor**
Second Street and Main Avenue	0.90	0.90	0.51	0.80
Second Street and Pacific Avenue	0.90	0.90	0.32	0.25
Tenth Street and Main Avenue	0.90	0.90	0.38	0.78
Tenth Street and Pacific Avenue	0.90	0.90	0.31	0.79

Source: Synchro HCM Unsignalized and Signalized Reports
Note: For unsignalized intersections, the V/C ratio is presented for the worst movement for each street.
V/C ratios in **BOLD** indicate higher than acceptable mobility levels.

As shown in Table 6, seven of the ten study intersections meet mobility standards designated in the OHP under existing 30th highest hour conditions. The three intersections that do not meet the mobility standards are First Street/Main Avenue, Third Street/Main Avenue and Fourth Street/Pacific Avenue. At both Main Avenue intersections, coupling a significant southbound volume are high amounts of conflicting cross street traffic creating poor operating conditions.

At Fourth Street and Pacific Avenue intersection, the east and westbound approaches are on the same signal phase thereby create poor operating conditions for the eastbound left-turning vehicles, which only has permitted (not protected) signal operations. In addition, the east and westbound approaches have less green time relative to the northbound/US 101 approach (Pacific Avenue).

Existing Vehicle Queuing Analysis (30th Highest Hour)

The V/C ratio provides only one measure-of-effectiveness of the intersection operation. Vehicle queuing overflow in the turn lane indicates locations with deficient vehicle storage. Deficient vehicle storage can also occur in through lanes as vehicle queues can extend past the upstream intersection. Table 7 shows the movements that have a queue length which exceeds the storage. Six intersections (a total of 15 movements) are identified where the 95th percentile queue length exceeds the available storage capacity. Six of the deficient storage lengths are associated with exclusive left or right turn lanes. The other nine deficient storage lengths are either through, combined left/through or combined through/right lanes. Existing conditions queue lengths for all locations are provided in Appendix D.

TABLE 7
2004 30th Highest Hour Queue Lengths (that exceed storage)

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
First Street and Main Avenue						
	Eastbound	Lt	1.05	SimTraffic	35	50
		Rt	1.05	SimTraffic	220	500
	Westbound	Rt	1.05	SimTraffic	60	80
	Southbound	Th, Th/Rt	1.05	SimTraffic	220	460
First Street and Pacific Avenue						
	Westbound	Th, Th/Rt	0.77	SimTraffic	220	550
	Northbound	Lt	0.77	SimTraffic	140	200
		Lt/Th	0.77	SimTraffic	140	160
	Southbound[6]	Rt	0.77	SimTraffic	<50	370
Third Street and Main Avenue						
	Eastbound	Th/Rt	1.06	SimTraffic	215	500
Third Street and Pacific Avenue						
	Northbound	Th, Th/Rt	0.70	Synchro	215	240
Fourth Street and Main Avenue						
	Eastbound	Th/Rt	0.78	SimTraffic	215	510
Fourth Street and Pacific Avenue						
	Eastbound	Lt	1.14	SimTraffic	35	60
		Th	1.14	SimTraffic	145	180
	Westbound	Th/Rt	1.14	SimTraffic	215	530
	Northbound	Lt/Th, Th/Rt	1.14	SimTraffic	210	940

[1] Lane Group abbreviations are as follows: Lt = left lane, Rt = right lane and Th = through lane.

[2] For signalized intersections, overall intersection V/C ratio reported. For unsignalized intersections, highest V/C ratio per lane group reported.

[3] Queue lengths not reported for free-flowing, uncontrolled movements.

[4] Existing storage for through-lanes displayed only when queue expected to surpass the distance to the upstream

TABLE 7
2004 30th Highest Hour Queue Lengths (that exceed storage)

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)

intersection.

[5] Queue lengths were rounded up to the nearest ten feet. Highest queue length reported per lane group.

[6] Southbound leg of First Street and Pacific Avenue is a driveway access for several businesses.

NOTE: Depending on the intersection V/C ratio, either Synchro or SimTraffic output is utilized; refer to Appendix B for when each method is appropriate.

Queue lengths can impact overall intersection corridor operations by delaying/blocking the through movement, and/or restricting upstream vehicle movements. For signalized intersections with turning pockets, long vehicle queues can spillback into the through lanes, thereby blocking side-streets, private driveways and hindering through traffic from proceeding. Through lanes with a higher queue length than existing storage indicates vehicles are spilling back into the adjacent upstream intersection, thereby blocking the traffic movements at that intersection.

Three of the intersections identified as having queue length deficiencies also reported V/C ratios higher than ODOT mobility standards. These intersections are First Street/Main Avenue, Third Street/Main Avenue and Fourth Street/Pacific Avenue.

Motor Vehicle Facilities – Future No-Build Condition

Forecasted Year 2025 Traffic Volumes

Because a transportation model for the study area is unavailable, the use of historical trend forecasts to evaluate future deficiencies and to analyze system alternatives is used for this analysis. This forecasting process was approved by ODOT as part of the methods and assumptions memorandum in Appendix B. Table 8 shows the forecasted Average Annual Growth Rate (AAGR) calculated for OR 101 in Tillamook.

TABLE 8
State Highway Annual Growth Rates

Highway	Annual Growth Rate (2001-2022)
US 101 (#9), MP 65.65	1.20 percent

Source: ODOT Transportation Volume Tables
http://www.odot.state.or.us/tddtpau/DataRes.html#Future%20Traffic%20Volumes

Note: The available growth rates are only projected to year 2023; this study assumed the AAGR to continue at the same rate through year 2025.

The volumes used to calculate the annual growth rate are chosen based on the R-squared value. The R-squared value measures the correlation between the historical data points and the generated trend. The annual rate was calculated using the overall factor at mile point 65.65 because of this mile point's R-squared value (0.75) held the highest confidence level within the study area.

The annual growth rate from this location suggests a growth of 1.20 percent per year or about a 25 percent increase in traffic over the 21-year roadway design life (2004 to 2025). This 25 percent factor was applied uniformly to each of the existing 2004 30th highest hour intersection turn movements to obtain future 2025 No-Build 30th highest hour intersection volumes. Figure 2 shows a schematic of the study area that provides 2025 No-Build 30th highest hour intersection turn movements.

Operational Analysis - Future (2025) No-Build Conditions

An operational analysis was conducted for the forecasted year 2025 No-Build conditions with Synchro, version 6. This software package is based on the Highway Capacity Manual, TRB Special Report 209. Results from the Synchro HCM Signalized and Unsignalized Reports are reported in this memorandum.

For No-Build conditions, the OHP Mobility standards apply. Because there are no known programmed improvements at the study intersections, the No-Build condition assumes the current traffic control and lane channelization at the intersection.

Similar to the existing conditions analysis, for the signalized intersections, the OHP designates the V/C by intersection, not approach, and requires the state standard be the V/C threshold. For the unsignalized intersections, the OHP designates the V/C by approach, and requires the state standard be the V/C threshold for the state road approaches.

Table 9 presents the OHP mobility standard and V/C ratio for each intersection analyzed under existing future 2025 30th highest hour conditions. Table 9 reports the 2025 No-Build intersection results for the ten study intersections. Appendix E contains detailed reports for each individual intersection.

TABLE 9
Intersection Operational Analysis – No-Build (2025) 30th Highest Hour

Intersection	OHP Mobility Standard[1]		Observed Maximum V/C Ratio	
Signalized				
First Street and Main Avenue	0.90		**1.14**	
First Street and Pacific Avenue	0.90		**0.95**	
Third Street and Main Avenue	0.90		**1.30**	
Third Street and Pacific Avenue	0.90		0.88	
Fourth Street and Main Avenue	0.90		**0.99**	
Fourth Street and Pacific Avenue	0.90		**0.97**	
Unsignalized	**Major**	**Minor**	**Major**	**Minor**
Second Street and Main Avenue	0.90	0.90	0.63	**>2.0**
Second Street and Pacific Avenue	0.90	0.90	0.38	0.42
Tenth Street and Main Avenue	0.90	0.90	0.48	**>2.0**
Tenth Street and Pacific Avenue	0.90	0.90	0.35	**1.13**

TABLE 9
Intersection Operational Analysis – No-Build (2025) 30th Highest Hour

Intersection	OHP Mobility Standard[1]	Observed Maximum V/C Ratio

Source: Synchro HCM Unsignalized and Signalized Reports
Note: For unsignalized intersections, the V/C ratio is presented for the worst movement for each road.
Numbers in **BOLD** indicate higher than acceptable mobility levels.
[1]Existing and No-Build V/C ratios are the same per ODOT Highway Plan. See the previous section of this memo titled *State Highway Mobility Standards* under *Motor Vehicle Operations – Existing Condition* for discussion on the appropriate V/C ratio for each intersection.

Under future 30th highest hour operating conditions (2025), eight of the ten study intersections along US 101 are not expected to meet OHP mobility standards. The analysis shows that the high volumes along Main Street create significant failing conditions as some of the V/C ratios are well over 1.0. It is expected the current channelization and operations of the couplet will not be able to accommodate the anticipated future traffic growth without operational improvements.

The next phase of the project will develop and evaluate alternatives to improve these and other deficiencies along US 101. Alternatives will be developed based upon the project's goals and objectives, including preservation of the state highway system.

Vehicle Queuing Analysis - Future (2025) No-Build Conditions

As discussed in the Existing Conditions section, an analysis of vehicle queues identifies deficient vehicle storage locations and provides key information as this project advances into the alternative development stage. Below, Table 10 shows each movement in the study area that has a 95th percentile vehicle queue length that exceeds the available storage length. Six intersections (a total of 17 movements) are identified where the queue length exceeds the available storage capacity. Seven of the movements are either exclusive left or right turn lanes. The other ten movements are either through, combined left/through or combined through/right lanes. Queue lengths for all locations are provided in Appendix F.

TABLE 10
2025 30th Highest Hour Queue Lengths (that exceed storage)

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
First Street and Main Avenue						
	Eastbound	Lt	1.14	SimTraffic	35	70
	Eastbound	Rt	1.14	SimTraffic	220	510
	Westbound	Rt	1.14	SimTraffic	60	70
	Southbound	Th, Th/Rt	1.14	SimTraffic	220	440
First Street and Pacific Avenue						
	Westbound	Th, Th/Rt	0.95	SimTraffic	220	550
	Northbound	Lt	0.95	SimTraffic	140	180
		Lt/Th	0.95	SimTraffic	140	200
	Southbound[6]	Rt	0.95	SimTraffic	<50	180
Third Street and Main Avenue						
	Eastbound	Th/Rt	1.30	SimTraffic	215	640

TABLE 10
2025 30th Highest Hour Queue Lengths (that exceed storage)

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
Third Street and Pacific Avenue						
	Eastbound	Lt/Th, Th	0.88	SimTraffic	150	190
	Northbound	Th, Th/Rt	0.88	SimTraffic	215	310
Fourth Street and Main Avenue						
	Eastbound	Th/Rt	0.99	SimTraffic	215	670
	Westbound	Lt	0.99	SimTraffic	40	70
Fourth Street and Pacific Avenue						
	Eastbound	Lt	0.97	SimTraffic	35	70
		Th	0.97	SimTraffic	145	210
	Westbound	Th/Rt	0.97	SimTraffic	215	600
	Northbound	Lt/Th, Th/Rt	0.97	SimTraffic	210	1030

[1] Lane Group abbreviations are as follows: Lt = left lane, Rt = right lane and Th = through lane.

[2] For signalized intersections, overall intersection V/C ratio reported. For unsignalized intersections, highest V/C ratio per lane group reported.

[3] Queue lengths not reported for free-flowing, uncontrolled movements.

[4] Existing storage for through-lanes displayed only when queue expected to surpass the distance to the upstream intersection.

[5] Queue lengths were rounded up to the nearest ten feet. Highest queue length reported per lane group.

[6] Southbound leg of First Street and Pacific Avenue is a driveway access for several businesses.

NOTE: Depending on the intersection V/C ratio, either Synchro or SimTraffic output is utilized; refer to Appendix B for when each method is appropriate.

As shown in the table, some of the estimated vehicle queue lengths extend a considerable distance from the intersection and could create very undesirable conditions as they may block numerous upstream intersections/driveways, thereby creating gridlock throughout the corridor.

The majority of the long vehicle queues are expected to occur on the side streets as the traffic signals are coordinated along Main and Pacific Avenues to provide efficient north-south through movement through Tillamook along US 101. The east-west (side-street) locations noted below are expected to have significantly longer vehicles queues than the provided storage:

- Eastbound approach at First Street and Main Avenue
- Westbound approach at First Street and Pacific Avenue
- Eastbound approach at Third Street and Main Avenue
- Eastbound approach at Fourth Street and Main Avenue
- Westbound approach at Fourth Street and Pacific Avenue

It is expected that the short cross-streets roadways between Main and Pacific Avenues will have relatively short queue lengths as the signals are timed to minimize vehicles queues between the US 101 couplet.

The only north and southbound through movements that are expected to have vehicle queues longer than 500 feet are the north (First Street) and south (Fourth Street) limits of the traffic signal system. As vehicles along US 101 progress within the downtown core, northbound and southbound vehicles queues are expected to be relatively shorter.

All six of the intersections identified above as having queue length deficiencies also reported V/C ratios higher than ODOT mobility standards.

Next Steps

Potential roadway and other changes to address the deficiencies identified in this memo will be developed and evaluated in the next part of this project. The results will be documented and illustrated in a subsequent memorandum.

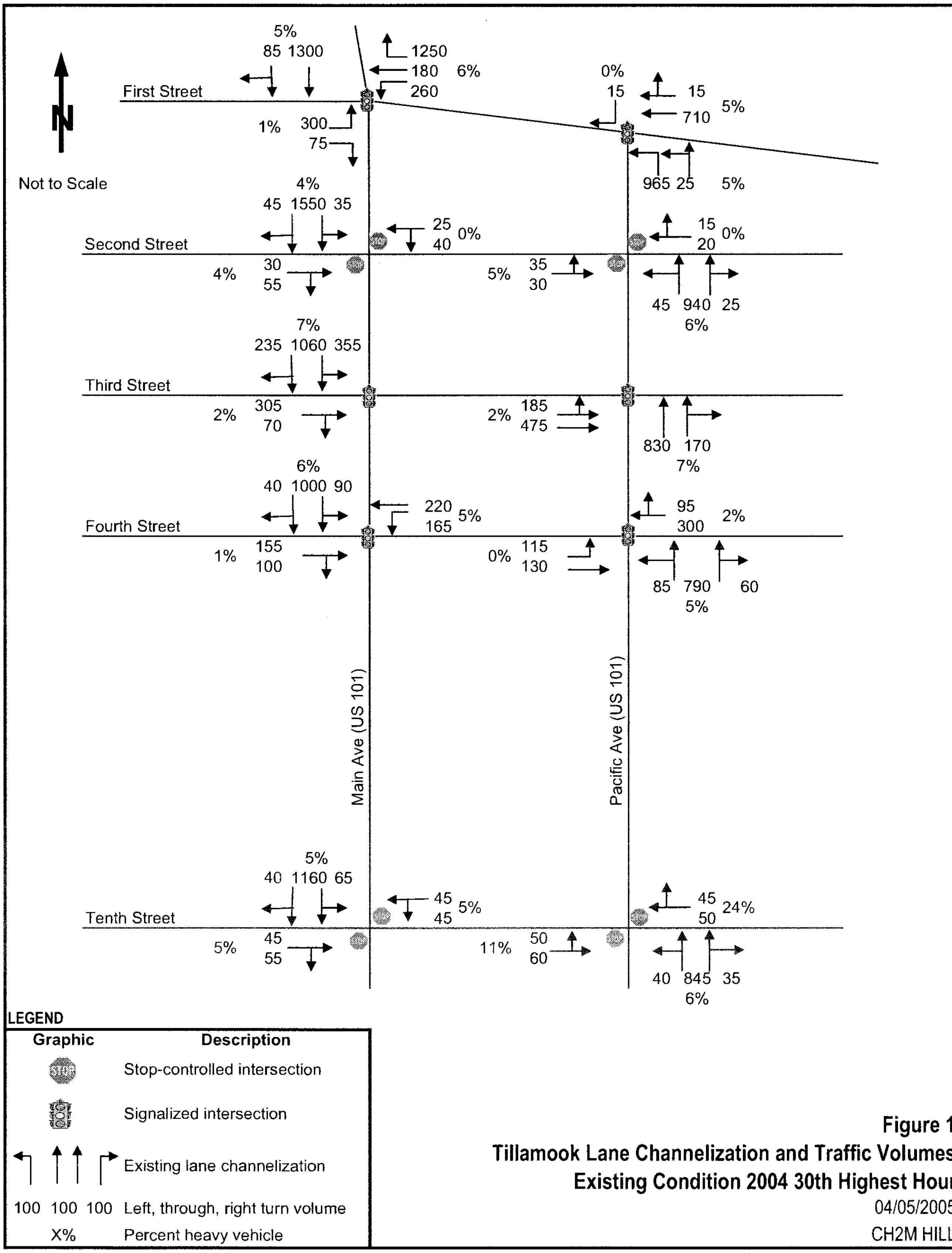

Figure 1
Tillamook Lane Channelization and Traffic Volumes
Existing Condition 2004 30th Highest Hour
04/05/2005
CH2M HILL

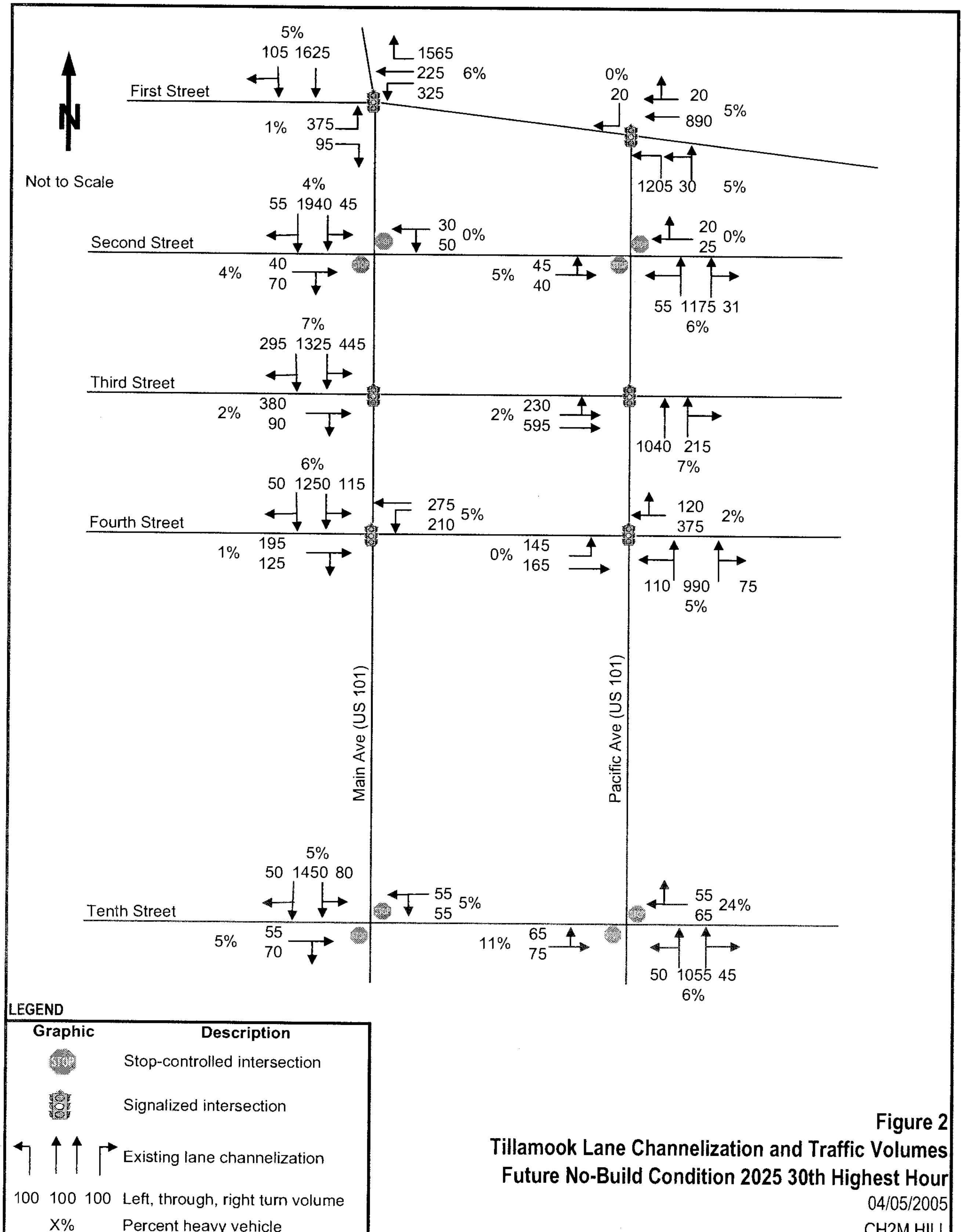

Figure 2
Tillamook Lane Channelization and Traffic Volumes
Future No-Build Condition 2025 30th Highest Hour
04/05/2005
CH2M HILL

Appendix A: Raw Traffic Counts

Vehicular Turning Movement

Original 16-hr Count

11/4/04

Main Ave (US 101) & First St

SOUTHBOUND

Total: 8620

% Truck: 5%

Right	Thru	Left
568	**8052**	**0**

EASTBOUND

Total: 2177

% Truck: 1%

Left	**1805**
Thru	**0**
Right	**372**

WESTBOUND

Total: 10189

% Truck: 6%

7517	Right
1093	Thru
1579	Left

NORTHBOUND

Left	Thru	Right
0	**0**	**0**

Total: 0

% Truck: N/A

Vehicular Turning Movement

Original 16-hr Count

11/4/04

Pacific Ave (US 101) & First St

SOUTHBOUND

Total: 73

% Truck: 0%

Right	Thru	Left
73	**0**	**0**

EASTBOUND

Total: 0

% Truck: N/A

Left	**0**
Thru	**0**
Right	**0**

WESTBOUND

47	Right
5061	Thru
0	Left

Total: 5108

% Truck: 5%

NORTHBOUND

Left	Thru	Right
5492	**70**	**0**

Total: 5562

% Truck: 5%

Vehicular Turning Movement

Original 16-hr Count

11/4/04

Main Ave (US 101) & Second St

SOUTHBOUND

Total: 10457

% Truck: 4%

Right	Thru	Left
321	**9918**	**218**

EASTBOUND

Total: 411

% Truck: 4%

Left	**0**
Thru	**142**
Right	**269**

WESTBOUND

0	Right
218	Thru
239	Left

Total: 457

% Truck: 0%

NORTHBOUND

Left	Thru	Right
0	**0**	**0**

Total: 0

% Truck: N/A

Vehicular Turning Movement

Original 16-hr Count

11/4/04

Pacific Ave (US 101) & Second St

SOUTHBOUND

Total: 0

% Truck: N/A

Right	Thru	Left
0	**0**	**0**

EASTBOUND

Total: 356

% Truck: 5%

Left	**176**
Thru	**180**
Right	**0**

WESTBOUND

Total: 208

% Truck: 0%

68	Right
140	Thru
0	Left

NORTHBOUND

Left	Thru	Right
310	**5551**	**122**

Total: 5983

% Truck: 6%

Vehicular Turning Movement

Original 14-hr Count

Collected on 9/8/01 -- grown to 2004

Main Avenue (US 101) & 3rd Street (OR 6)

SOUTHBOUND

Total: 12588

% Truck: 7%

Right	Thru	Left
1588	**7277**	**3723**

WESTBOUND

Total:

% Truck:

0	Right
0	Thru
0	Left

EASTBOUND

Total: 3647

% Truck: 2%

Left	**5**
Thru	**2978**
Right	**664**

NORTHBOUND

Left	Thru	Right
0	**0**	**0**

Total:

% Truck:

Vehicular Turning Movement

Original 14-hr Count

Collected on 9/8/01 -- grown to 2004

Pacific Avenue (US 101) & 3rd Street (OR 6)

SOUTHBOUND

Total:

% Truck:

Right	Thru	Left
0	**0**	**0**

WESTBOUND

Total: 6614

% Truck: 2

Left **1477**

Thru **5127**

Right **9.44**

0 Right

0 Thru

12.98 Left

Total:

% Truck:

EASTBOUND

0	**5834**	**1213**
Left	Thru	Right

Total: 7047

% Truck: 7

NORTHBOUND

Vehicular Turning Movement

Original 16-hr Count

11/16/04

Main Ave (US 101) & Fourth St

SOUTHBOUND

Total: 6517

% Truck: 6%

Right	Thru	Left
293	**5800**	**424**

EASTBOUND

Total: 1276

% Truck: 1%

Left	**0**
Thru	**766**
Right	**510**

WESTBOUND

Total: 2257

% Truck: 5%

0	Right
1281	Thru
976	Left

NORTHBOUND

Left	Thru	Right
0	**0**	**0**

Total: 0

% Truck: N/A

Vehicular Turning Movement

Original 16-hr Count

November 16, 2004

Pacific Ave (US 101) & Fourth St

SOUTHBOUND

Total: 0

% Truck: N/A

Right	Thru	Left
0	**0**	**0**

Total: 1298

% Truck: 0%

Left **623**

Thru **675**

Right **0**

EASTBOUND

520 Right

1655 Thru

0 Left

Total: 2175

% Truck: 2%

WESTBOUND

509	**5400**	**329**
Left	Thru	Right

Total: 6238

% Truck: 5%

NORTHBOUND

Vehicular Turning Movement

Original 16-hr Count

11/4/04

Main Ave (US 101) & Tenth St

SOUTHBOUND

Total: 73

% Truck: 0%

Right	Thru	Left
73	**0**	**0**

EASTBOUND

Total: 0

% Truck: N/A

Left	**0**
Thru	**0**
Right	**0**

WESTBOUND

Total: 5108

% Truck: 5%

47	Right
5061	Thru
0	Left

NORTHBOUND

Left	Thru	Right
5492	**70**	**0**

Total: 5562

% Truck: 5%

Vehicular Turning Movement

Original 16-hr Count

11/4/04

Pacific Ave (US 101) & Tenth St

SOUTHBOUND

Total: 0

% Truck: N/A

Right	Thru	Left
0	**0**	**0**

EASTBOUND

Total: 571

% Truck: 11%

Left	**224**
Thru	**347**
Right	**0**

WESTBOUND

Total: 513

% Truck: 24%

289	Right
224	Thru
0	Left

NORTHBOUND

Left	Thru	Right
164	**5283**	**140**

Total: 5587

% Truck: 6%

Appendix B: Traffic Methodology

Appendix B – Operational Analysis Methodology

30th Highest Traffic Volume Methodology

There are six signalized intersections and four unsignalized intersections that will be included in the study. These locations are listed below.

Signalized

- 1st Street (US 101)/Main Avenue (US 101)
- 1st Street (US101/OR 6)/Pacific Avenue (US 101)
- 3rd Street (OR 131/OR 6)/Main Avenue (US 101)
- 3rd Street (OR 6)/Pacific Avenue (US 101)
- 4th Street/Main Avenue (US 101)
- 4th Street/Pacific Avenue (US 101)

Unsignalized

- 2nd Street/Main Avenue (US 101)
- 2nd Street/Pacific Avenue (US 101)
- 10th Street/Main Avenue (US 101)
- 10th Street/Pacific Avenue (US 101)

Most of the counts are 16-hour (full classification) and were recently collected in November 2004, except for the 3rd Street/Main Avenue and 3rd Street/Pacific Avenue intersections which are 14-hour (full classification) and were taken in September 2001. In addition to the counts recently collected in 2004, 1st Street/Main Avenue and 1st Street/Pacific Avenue also had traffic counts collected in September 2001. A growth factor will be calculated based on the two different counts (2001 and 2004) taken at the two intersections along 1st Street and this growth factor will be applied to the 2001 counts taken at 3rd Street so they represent 2004 volumes. This approach has been previously approved by TPAU.

An automated traffic recorder (ATR) site is not stationed within the City of Tillamook's limits. In order to factor the traffic counts to the 30th highest hour volumes, seasonal factors from the Rockaway ATR site (29-001) will be used. The Rockaway ATR site will be used because it is the closest recorder to Tillamook at 10 miles to the north along US 101.

The procedure used to create 30th highest hour volumes (30 HHV) will utilize the same steps outlined in the pdf file located on the weblink below; which is to divide the count period seasonal factor by the peak period seasonal factor to get the 30 HHV seasonal factor. Once the peak hour volumes (from the traffic counts) are determined, the 30 HHV seasonal factor will be applied to get 30th highest hour volumes.

(http://www.odot.state.or.us/tddtpau/SysAnalysis.html#DataRes)

Traffic Forecast Methodology

The forecasted traffic volumes will use the 2023 future volume table located on the weblink below. To arrive at the 20-year design year, the volumes will be extrapolated an additional two years to create 2025 conditions. Rates will be taken from US 101 (Oregon Coast

Highway #9) within the study area. Only forecasts with R-squared values greater than 0.75 will be used for the growth rates.

(http://www.odot.state.or.us/tddtpau/SysAnalysis.html#DataRes)

Traffic Analysis Software and Input Assumptions

Synchro software will be used for the intersection analysis. The reported results will be the V/C ratios from the HCM report. A list of assumptions is shown in Table 1.

TABLE 1

Synchro Operations Parameters/Assumptions

	Condition	
Arterial Intersection Parameters	**Existing (2004)**	**Design Year (2025) No-Build and Build Alternatives**
Peak Hour Factor	From traffic count. If not provided then 0.85 for local and collector street 0.90 for minor arterials 0.95 for major arterials	0.85 for local and collector street 0.90 for minor arterials 0.95 for major arterials
Conflicting Bikes and Pedestrian per Hour	From traffic count, if not provided, assume 10 peds/bikes per approach	Ditto
Area Type	"Other" Area	Ditto
Ideal Saturation Flow Rate (for all movements)	1800	Ditto
Lane Width	From As-builts, field visit or ODOT website, otherwise 12 feet	Ditto
Percent Heavy Vehicles	From traffic count, otherwise 5%	Ditto
Percent Grade	From As-builts, otherwise 0%	Ditto
Parking Maneuvers per Hour	From field visit, otherwise assume 0	Ditto
Bus Blockages	From field visit, otherwise assume 0.	Ditto
Intersection signal phasing and coordination	Current timing plan	Optimize phase and cycle length, phase sequence and offset (if signals are coordinated)
Intersection signal timing optimization limits	Current timing plan	60 to 120 seconds depending on the number of phases
Minimum Green time	Current timing plan, otherwise 10 sec. if no pedestrian time required.	Ditto
Yellow and all-red time	From timing plan, otherwise (Y) = 4 seconds and (R) = 1 second	Ditto
Right Turn on Red	Allow except were signed to not	Ditto
95 Percentile vehicle queues calculated based on an average of 25 feet per vehicle and: For V/C < 0.70, use Synchro reports and/or	Yes	Ditto

[1] The simulation will be for one hour with the peak 15-minutes in the first 15 minutes. The results from this simulation will be applied to signalized and unsignalized intersections.

TABLE 1

Synchro Operations Parameters/Assumptions

	Condition	
Arterial Intersection Parameters	**Existing (2004)**	**Design Year (2025) No-Build and Build Alternatives**
the 95th Percentile for the 2-minute rule For V/C > 0.70, use SimTraffic report (the average of at least 5 runs of 1 hour length with 15-min peak divided out)[1]		
Level of service goals	Highway V/C threshold from the Oregon Highway Plan (OHP). Non-Highway results combination of delay (LOS) and V/C ratio	Highway No-Build V/C threshold from the Oregon Highway Plan (OHP) and Build V/C thresholds from the Highway Design Manual. Non-Highway results combination of delay (LOS) and V/C ratio
US 101 – Statewide Non-Freight Route within the STA	0.90	0.90 (NB) / 0.90 (Build)
US 101 – Statewide Non-Freight Route outside the STA	0.80	0.80 (NB) / 0.75 (Build)
Wilson River Highway (First Street) – Regional Highway	0.80	0.80 (NB) / 0.75 (Build)
Second Street – Local Road	0.85	0.85 (NB) / 0.80 (Build)
Netarts Highway (3rd Street) – District Highway	0.85	0.85 (NB) / 0.80 (Build)
4th Street – Local Road	0.85	0.85 (NB) / 0.80 (Build)
10th Street – Local Road	0.85	0.85 (NB) / 0.80 (Build)

Note: Ditto is used when the Design Year 2025 assumption is similar to the Existing assumption.

Assumptions consistent with White Paper on Application of Oregon Highway Plan Mobility Standards.

Appendix C: Existing Synchro Reports

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰		↱	↰	↑	↱					↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0					4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00					0.95	
Frpb, ped/bikes	1.00		0.98	1.00	1.00	1.00					1.00	
Flpb, ped/bikes	1.00		1.00	0.99	1.00	1.00					1.00	
Frt	1.00		0.85	1.00	1.00	0.85					0.99	
Flt Protected	0.95		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (prot)	1580		1585	1816	1642	1443					3221	
Flt Permitted	0.63		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (perm)	1046		1585	1816	1642	1443					3221	
Volume (vph)	300	0	75	260	180	1250	0	0	0	0	1300	85
Peak-hour factor, PHF	0.83	0.83	0.83	0.92	0.92	0.92	0.25	0.25	0.25	0.87	0.87	0.87
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	361	0	90	283	196	1359	0	0	0	0	1494	98
RTOR Reduction (vph)	0	0	3	3	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	361	0	87	280	196	1359	0	0	0	0	1585	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type	D.Pm		custom	Perm		custom						
Protected Phases					4	4 6					6	
Permitted Phases	4		4	4								
Actuated Green, G (s)	30.0		30.0	30.0	30.0	65.0					27.0	
Effective Green, g (s)	30.0		30.0	30.0	30.0	65.0					27.0	
Actuated g/C Ratio	0.46		0.46	0.46	0.46	1.00					0.42	
Clearance Time (s)	4.0		4.0	4.0	4.0						4.0	
Vehicle Extension (s)	0.2		0.2	0.2	0.2						0.2	
Lane Grp Cap (vph)	483		732	838	758	1443					1338	
v/s Ratio Prot					0.12	c0.94					c0.49	
v/s Ratio Perm	0.35		0.05	0.15								
v/c Ratio	0.75		0.12	0.33	0.26	0.94					1.18	
Uniform Delay, d1	14.4		10.0	11.1	10.7	0.0					19.0	
Progression Factor	1.00		1.00	1.21	1.20	1.00					1.00	
Incremental Delay, d2	5.5		0.0	0.1	0.0	9.0					91.0	
Delay (s)	19.9		10.0	13.6	12.9	9.0					110.0	
Level of Service	B		A	B	B	A					F	
Approach Delay (s)		17.9			10.1			0.0			110.0	
Approach LOS		B			B			A			F	

Intersection Summary			
HCM Average Control Delay	52.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	105.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↱		↰	↰↑				↱
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0				4.0
Lane Util. Factor					0.95		0.95	0.95				1.00
Frt					1.00		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.95				1.00
Satd. Flow (prot)					3003		1227	1233				1557
Flt Permitted					1.00		0.95	0.95				1.00
Satd. Flow (perm)					3003		1227	1233				1557
Volume (vph)	0	0	0	0	710	15	965	25	0	0	0	15
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.90	0.90	0.90	0.50	0.50	0.50
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	0	0	0	747	16	1072	28	0	0	0	30
RTOR Reduction (vph)	0	0	0	0	3	0	42	42	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	760	0	495	521	0	0	0	30
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type							Split					custom
Protected Phases					4		2	2				
Permitted Phases												4 2
Actuated Green, G (s)					23.1		33.9	33.9				65.0
Effective Green, g (s)					23.1		33.9	33.9				65.0
Actuated g/C Ratio					0.36		0.52	0.52				1.00
Clearance Time (s)					4.0		4.0	4.0				
Vehicle Extension (s)					5.2		5.2	5.2				
Lane Grp Cap (vph)					1067		640	643				1557
v/s Ratio Prot					c0.25		0.40	c0.42				
v/s Ratio Perm												0.02
v/c Ratio					0.71		0.77	0.81				0.02
Uniform Delay, d1					18.1		12.5	12.9				0.0
Progression Factor					1.00		0.58	0.58				1.00
Incremental Delay, d2					2.9		7.4	8.9				0.0
Delay (s)					21.0		14.7	16.5				0.0
Level of Service					C		B	B				A
Approach Delay (s)		0.0			21.0			15.6			0.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		1.00									0.95	
Frpb, ped/bikes		1.00									1.00	
Flpb, ped/bikes		1.00									1.00	
Frt		0.97									0.98	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		1359									2658	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		1359									2658	
Volume (vph)	0	305	70	0	0	0	0	0	0	355	1060	235
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	339	78	0	0	0	0	0	0	374	1116	247
RTOR Reduction (vph)	0	14	0	0	0	0	0	0	0	0	50	0
Lane Group Flow (vph)	0	403	0	0	0	0	0	0	0	0	1687	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type										Perm		
Protected Phases		4									6	
Permitted Phases		4								6	6	
Actuated Green, G (s)		20.8									36.2	
Effective Green, g (s)		20.8									36.2	
Actuated g/C Ratio		0.32									0.56	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		435									1480	
v/s Ratio Prot		c0.30										
v/s Ratio Perm											0.63	
v/c Ratio		0.93									1.14	
Uniform Delay, d1		21.4									14.4	
Progression Factor		1.00									0.72	
Incremental Delay, d2		25.2									66.4	
Delay (s)		46.5									76.7	
Level of Service		D									E	
Approach Delay (s)		46.5			0.0			0.0			76.7	
Approach LOS		D			A			A			E	

Intersection Summary			
HCM Average Control Delay	70.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑						↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.97				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		2849						2680				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		2849						2680				
Volume (vph)	185	475	0	0	0	0	0	830	170	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	195	500	0	0	0	0	0	874	179	0	0	0
RTOR Reduction (vph)	0	42	0	0	0	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	653	0	0	0	0	0	1035	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4	4						2				
Actuated Green, G (s)		18.8						38.2				
Effective Green, g (s)		18.8						38.2				
Actuated g/C Ratio		0.29						0.59				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		824						1575				
v/s Ratio Prot								c0.39				
v/s Ratio Perm		0.23										
v/c Ratio		0.79						0.66				
Uniform Delay, d1		21.3						9.0				
Progression Factor		0.99						1.02				
Incremental Delay, d2		1.6						0.9				
Delay (s)		22.7						10.0				
Level of Service		C						B				
Approach Delay (s)		22.7			0.0			10.0			0.0	
Approach LOS		C			A			B			A	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.41	1.00						1.00	
Satd. Flow (perm)		1435		709	1943						2957	
Volume (vph)	0	155	100	165	220	0	0	0	0	90	1000	40
Peak-hour factor, PHF	0.87	0.87	0.87	0.93	0.93	0.93	0.92	0.92	0.92	0.88	0.88	0.88
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	178	115	177	237	0	0	0	0	102	1136	45
RTOR Reduction (vph)	0	32	0	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	261	0	177	237	0	0	0	0	0	1280	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		17.9		17.9	17.9						39.1	
Effective Green, g (s)		17.9		17.9	17.9						39.1	
Actuated g/C Ratio		0.28		0.28	0.28						0.60	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		395		195	535						1779	
v/s Ratio Prot		0.18			0.12							
v/s Ratio Perm				c0.25							0.43	
v/c Ratio		0.66		0.91	0.44						0.72	
Uniform Delay, d1		20.9		22.8	19.4						9.1	
Progression Factor		1.00		0.62	0.68						0.45	
Incremental Delay, d2		3.2		5.9	0.0						0.2	
Delay (s)		24.1		20.1	13.3						4.3	
Level of Service		C		C	B						A	
Approach Delay (s)		24.1			16.2			0.0			4.3	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			↰↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1451			2970				
Flt Permitted	0.15	1.00			1.00			1.00				
Satd. Flow (perm)	277	1800			1451			2970				
Volume (vph)	115	130	0	0	300	95	85	790	60	0	0	0
Peak-hour factor, PHF	0.63	0.63	0.63	0.59	0.59	0.59	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	183	206	0	0	508	161	92	859	65	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	8	0	0	0	0
Lane Group Flow (vph)	183	206	0	0	652	0	0	1008	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	26.0	26.0			26.0			31.0				
Effective Green, g (s)	26.0	26.0			26.0			31.0				
Actuated g/C Ratio	0.40	0.40			0.40			0.48				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	111	720			580			1416				
v/s Ratio Prot		0.11			0.45							
v/s Ratio Perm	c0.66							0.34				
v/c Ratio	1.65	0.29			1.12			0.71				
Uniform Delay, d1	19.5	13.2			19.5			13.5				
Progression Factor	0.73	0.72			1.00			1.00				
Incremental Delay, d2	326.1	0.1			76.2			3.1				
Delay (s)	340.3	9.5			95.7			16.5				
Level of Service	F	A			F			B				
Approach Delay (s)		165.2			95.7			16.5			0.0	
Approach LOS		F			F			B			A	

Intersection Summary			
HCM Average Control Delay	69.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			↰						↰↱	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	30	55	40	25	0	0	0	0	35	1550	45
Peak Hour Factor	0.83	0.83	0.83	0.75	0.75	0.75	0.92	0.92	0.92	0.95	0.95	0.95
Hourly flow rate (vph)	0	36	66	53	33	0	0	0	0	37	1632	47
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.60	0.60	0.60	0.60	0.60		0.60					
vC, conflicting volume	1746	1729	839	974	1753	0	1679			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1577	1550	72	295	1589	0	1467			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	44	89	72	48	100	100			98		
cM capacity (veh/h)	25	65	583	188	64	1091	281			1607		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	102	87	853	863
Volume Left	0	53	37	0
Volume Right	66	0	0	47
cSH	153	108	1607	1700
Volume to Capacity	0.67	0.80	0.02	0.51
Queue Length 95th (ft)	95	113	2	0
Control Delay (s)	66.4	112.9	0.6	0.0
Lane LOS	F	F	A	
Approach Delay (s)	66.4	112.9	0.3	
Approach LOS	F	F		

Intersection Summary			
Average Delay	9.0		
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	35	30	0	0	20	15	45	940	25	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	33	0	0	22	16	49	1022	27	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked	0.82	0.82		0.82	0.82	0.82				0.82		
vC, conflicting volume	636	1147	0	1149	1133	524	0			1049		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	327	954	0	957	937	191	0			834		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	91	84	100	100	90	98	97			100		
cM capacity (veh/h)	426	199	1075	150	211	673	1593			659		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	71	38	560	538
Volume Left	38	0	49	0
Volume Right	0	16	0	27
cSH	279	299	1593	1700
Volume to Capacity	0.25	0.13	0.03	0.32
Queue Length 95th (ft)	24	11	2	0
Control Delay (s)	22.2	18.8	0.9	0.0
Lane LOS	C	C	A	
Approach Delay (s)	22.2	18.8	0.5	
Approach LOS	C	C		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	45	55	45	45	0	0	0	0	65	1160	40
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.92	0.92	0.92	0.95	0.95	0.95
Hourly flow rate (vph)	0	53	65	53	53	0	0	0	0	68	1221	42
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1405	1379	632	839	1400	0	1263			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1405	1379	632	839	1400	0	1263			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	60	84	63	59	100	100			96		
cM capacity (veh/h)	64	134	416	144	130	1075	530			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	118	106	679	653
Volume Left	0	53	68	0
Volume Right	65	0	0	42
cSH	213	136	1600	1700
Volume to Capacity	0.55	0.78	0.04	0.38
Queue Length 95th (ft)	74	117	3	0
Control Delay (s)	40.8	89.5	1.2	0.0
Lane LOS	E	F	A	
Approach Delay (s)	40.8	89.5	0.6	
Approach LOS	E	F		

Intersection Summary			
Average Delay	9.7		
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	50	60	0	0	50	45	40	845	35	0	0	0
Peak Hour Factor	0.68	0.68	0.68	0.87	0.87	0.87	0.88	0.88	0.88	0.92	0.92	0.92
Hourly flow rate (vph)	74	88	0	0	57	52	45	960	40	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	651	1091	0	1115	1071	500	0			1000		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	651	1091	0	1115	1071	500	0			1000		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	67	55	100	100	68	89	97			100		
cM capacity (veh/h)	221	194	1056	87	182	462	1593			700		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	162	109	526	520
Volume Left	74	0	45	0
Volume Right	0	52	0	40
cSH	205	255	1593	1700
Volume to Capacity	0.79	0.43	0.03	0.31
Queue Length 95th (ft)	138	50	2	0
Control Delay (s)	66.9	29.2	0.9	0.0
Lane LOS	F	D	A	
Approach Delay (s)	66.9	29.2	0.5	
Approach LOS	F	D		

Intersection Summary			
Average Delay	11.0		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix D: Existing Queue Table

Appendix D – Existing Queue Analysis Table

QUEUE ANALYSIS
2004 30th Highest Hour

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
First Street and Main Avenue						
	Eastbound	Lt	1.05	SimTraffic	35	50
		Rt	1.05	SimTraffic	220	500
	Westbound	Lt	1.05	SimTraffic		160
		Th	1.05	SimTraffic		90
		Rt	1.05	SimTraffic	60	80
	Southbound	Th, Th/Rt	1.05	SimTraffic	220	460
First Street and Pacific Avenue						
	Westbound	Th, Th/Rt	0.77	SimTraffic	220	550
	Northbound	Lt	0.77	SimTraffic	140	200
		Lt/Th	0.77	SimTraffic	140	160
	Southbound[6]	Rt	0.77	SimTraffic	<50	370
Third Street and Main Avenue						
	Eastbound	Th/Rt	1.06	SimTraffic	215	500
	Southbound	Lt/Th, Th/Rt	1.06	SimTraffic		160
Third Street and Pacific Avenue						
	Eastbound	Lt/Th, Th	0.70	Synchro		120
	Northbound	Th, Th/Rt	0.70	Synchro	215	240
Fourth Street and Main Avenue						
	Eastbound	Th/Rt	0.78	SimTraffic	215	510
	Westbound	Lt	0.78	SimTraffic	40	30
		Th	0.78	SimTraffic		50
	Southbound[6]	Lt/Th, Th/Rt	0.78	SimTraffic	<50	150
Fourth Street and Pacific Avenue						
	Eastbound	Lt	1.14	SimTraffic	35	60
		Th	1.14	SimTraffic	145	180
	Westbound	Th/Rt	1.14	SimTraffic	215	530
	Northbound	Lt/Th, Th/Rt	1.14	SimTraffic	210	940
Second Street and Main Avenue						
	Eastbound	Th/Rt	0.67	Synchro		100
	Westbound	Lt/Th	0.80	2 Min Rule		60
Second Street and Pacific Avenue						
	Eastbound	Lt/Th	0.25	Synchro		30
	Westbound	Th/Rt	0.13	Synchro		20
Tenth Street and Main Avenue						
	Eastbound	Th/Rt	0.55	Synchro		80
	Westbound	Lt/Th	0.78	2 Min Rule		80
Tenth Street and Pacific Avenue						
	Eastbound	Lt/Th	0.79	2 Min Rule		100

QUEUE ANALYSIS
2004 30th Highest Hour

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
	Westbound	Th/Rt	0.43	Synchro		50

[1] Lane Group abbreviations are as follows: Lt = left lane, Rt = right lane and Th = through lane.
[2] For signalized intersections, overall intersection V/C ratio reported. For unsignalized intersections, highest V/C ratio per lane group reported.
[3] Queue lengths not reported for free-flowing, uncontrolled movements.
[4] Existing storage for through-lanes displayed only when queue expected to surpass the distance to the next intersection.
[5] Queue lengths were rounded up to the nearest ten feet. Highest queue length reported per lane group.
[6] Southbound leg of First Street and Pacific Avenue is a driveway access for several businesses.

Appendix E: Future Synchro Reports

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰		↱	↰	↑	↱					↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0					4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00					0.95	
Frpb, ped/bikes	1.00		0.98	1.00	1.00	1.00					1.00	
Flpb, ped/bikes	1.00		1.00	0.99	1.00	1.00					1.00	
Frt	1.00		0.85	1.00	1.00	0.85					0.99	
Flt Protected	0.95		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (prot)	1580		1585	1815	1642	1443					3221	
Flt Permitted	0.56		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (perm)	939		1585	1815	1642	1443					3221	
Volume (vph)	300	0	75	260	180	1250	0	0	0	0	1300	85
Peak-hour factor, PHF	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%
Adj. Flow (vph)	441	0	110	342	237	1645	0	0	0	0	1711	112
RTOR Reduction (vph)	0	0	4	4	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	441	0	106	338	237	1645	0	0	0	0	1816	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type	D.Pm		custom	Perm		custom						
Protected Phases					4	4 6					6	
Permitted Phases	4		4	4								
Actuated Green, G (s)	29.0		29.0	29.0	29.0	70.0					33.0	
Effective Green, g (s)	29.0		29.0	29.0	29.0	70.0					33.0	
Actuated g/C Ratio	0.41		0.41	0.41	0.41	1.00					0.47	
Clearance Time (s)	4.0		4.0	4.0	4.0						4.0	
Vehicle Extension (s)	0.2		0.2	0.2	0.2						0.2	
Lane Grp Cap (vph)	389		657	752	680	1443					1518	
v/s Ratio Prot					0.14	c1.14					0.56	
v/s Ratio Perm	0.47		0.07	0.19								
v/c Ratio	1.13		0.16	0.45	0.35	1.14					1.20	
Uniform Delay, d1	20.5		12.9	14.8	14.0	35.0					18.5	
Progression Factor	1.00		1.00	0.91	0.90	1.00					1.00	
Incremental Delay, d2	87.2		0.0	0.1	0.0	66.6					95.1	
Delay (s)	107.7		12.9	13.4	12.7	101.6					113.6	
Level of Service	F		B	B	B	F					F	
Approach Delay (s)		88.8			78.6			0.0			113.6	
Approach LOS		F			E			A			F	

Intersection Summary			
HCM Average Control Delay	93.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	130.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↱		↰	↰↑				↱
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0				4.0
Lane Util. Factor					0.95		0.95	0.95				1.00
Frt					1.00		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.95				1.00
Satd. Flow (prot)					3003		1227	1233				1557
Flt Permitted					1.00		0.95	0.95				1.00
Satd. Flow (perm)					3003		1227	1233				1557
Volume (vph)	0	0	0	0	710	15	965	25	0	0	0	15
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%
Adj. Flow (vph)	0	0	0	0	934	20	1270	33	0	0	0	20
RTOR Reduction (vph)	0	0	0	0	2	0	17	17	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	952	0	618	651	0	0	0	20
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type							Split					custom
Protected Phases					4		2	2				
Permitted Phases												4 2
Actuated Green, G (s)					25.4		36.6	36.6				70.0
Effective Green, g (s)					25.4		36.6	36.6				70.0
Actuated g/C Ratio					0.36		0.52	0.52				1.00
Clearance Time (s)					4.0		4.0	4.0				
Vehicle Extension (s)					5.2		5.2	5.2				
Lane Grp Cap (vph)					1090		642	645				1557
v/s Ratio Prot					c0.32		0.50	c0.53				
v/s Ratio Perm												0.01
v/c Ratio					0.87		0.96	1.01				0.01
Uniform Delay, d1					20.8		16.0	16.7				0.0
Progression Factor					1.00		0.82	0.81				1.00
Incremental Delay, d2					8.6		17.7	27.4				0.0
Delay (s)					29.4		30.8	41.0				0.0
Level of Service					C		C	D				A
Approach Delay (s)		0.0			29.4			36.0			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱									↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		1.00									0.95	
Frpb, ped/bikes		1.00									1.00	
Flpb, ped/bikes		1.00									1.00	
Frt		0.97									0.98	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		1359									2657	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		1359									2657	
Volume (vph)	0	305	70	0	0	0	0	0	0	355	1060	235
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%
Adj. Flow (vph)	0	401	92	0	0	0	0	0	0	467	1395	309
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	54	0
Lane Group Flow (vph)	0	481	0	0	0	0	0	0	0	0	2117	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type										Perm		
Protected Phases		4									6	
Permitted Phases		4								6	6	
Actuated Green, G (s)		23.0									39.0	
Effective Green, g (s)		23.0									39.0	
Actuated g/C Ratio		0.33									0.56	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		447									1480	
v/s Ratio Prot		c0.35										
v/s Ratio Perm											0.80	
v/c Ratio		1.08									1.43	
Uniform Delay, d1		23.5									15.5	
Progression Factor		1.00									0.86	
Incremental Delay, d2		64.4									194.8	
Delay (s)		87.9									208.0	
Level of Service		F									F	
Approach Delay (s)		87.9			0.0			0.0			208.0	
Approach LOS		F			A			A			F	

Intersection Summary			
HCM Average Control Delay	185.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑						↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.97				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		2849						2680				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		2849						2680				
Volume (vph)	185	475	0	0	0	0	0	830	170	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%
Adj. Flow (vph)	243	625	0	0	0	0	0	1092	224	0	0	0
RTOR Reduction (vph)	0	24	0	0	0	0	0	21	0	0	0	0
Lane Group Flow (vph)	0	844	0	0	0	0	0	1295	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4	4						2				
Actuated Green, G (s)		26.1						35.9				
Effective Green, g (s)		26.1						35.9				
Actuated g/C Ratio		0.37						0.51				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		1062						1374				
v/s Ratio Prot								c0.48				
v/s Ratio Perm		0.30										
v/c Ratio		0.79						0.94				
Uniform Delay, d1		19.6						16.1				
Progression Factor		0.76						0.46				
Incremental Delay, d2		0.4						7.4				
Delay (s)		15.1						14.8				
Level of Service		B						B				
Approach Delay (s)		15.1			0.0			14.8			0.0	
Approach LOS		B			A			B			A	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.38	1.00						1.00	
Satd. Flow (perm)		1435		654	1943						2957	
Volume (vph)	0	155	100	165	220	0	0	0	0	90	1000	40
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%
Adj. Flow (vph)	0	228	147	243	324	0	0	0	0	118	1316	53
RTOR Reduction (vph)	0	21	0	0	0	0	0	0	0	0	4	0
Lane Group Flow (vph)	0	354	0	243	324	0	0	0	0	0	1483	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		26.0		26.0	26.0						36.0	
Effective Green, g (s)		26.0		26.0	26.0						36.0	
Actuated g/C Ratio		0.37		0.37	0.37						0.51	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		533		243	722						1521	
v/s Ratio Prot		0.25			0.17							
v/s Ratio Perm				c0.37							0.50	
v/c Ratio		0.66		1.00	0.45						0.98	
Uniform Delay, d1		18.4		22.0	16.6						16.6	
Progression Factor		1.00		0.57	0.55						0.38	
Incremental Delay, d2		2.4		40.0	0.1						3.2	
Delay (s)		20.8		52.5	9.3						9.5	
Level of Service		C		D	A						A	
Approach Delay (s)		20.8			27.8			0.0			9.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1451			2970				
Flt Permitted	0.21	1.00			1.00			1.00				
Satd. Flow (perm)	380	1800			1451			2970				
Volume (vph)	115	130	0	0	300	95	85	790	60	0	0	0
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%
Adj. Flow (vph)	169	191	0	0	441	140	112	1039	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	7	0	0	0	0
Lane Group Flow (vph)	169	191	0	0	564	0	0	1223	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	29.3	29.3			29.3			32.7				
Effective Green, g (s)	29.3	29.3			29.3			32.7				
Actuated g/C Ratio	0.42	0.42			0.42			0.47				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	159	753			607			1387				
v/s Ratio Prot		0.11			0.39							
v/s Ratio Perm	c0.44							0.41				
v/c Ratio	1.06	0.25			0.93			0.88				
Uniform Delay, d1	20.3	13.2			19.4			16.9				
Progression Factor	0.61	0.66			1.00			1.00				
Incremental Delay, d2	74.8	0.0			20.4			8.4				
Delay (s)	87.3	8.8			39.7			25.3				
Level of Service	F	A			D			C				
Approach Delay (s)		45.6			39.7			25.3			0.0	
Approach LOS		D			D			C			A	

Intersection Summary			
HCM Average Control Delay	32.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**
Lane Configurations		↑↱			↰↑						↰↑↑↱	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	30	55	40	25	0	0	0	0	35	1550	45
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	44	81	59	37	0	0	0	0	46	2039	59
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.54	0.54	0.54	0.54	0.54		0.54					
vC, conflicting volume	2180	2161	1049	1215	2191	0	2099			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2330	2296	255	559	2350	0	2181			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	80	0	0	100	100			97		
cM capacity (veh/h)	0	20	402	0	19	1091	135			1607		

Direction, Lane #	**EB 1**	**WB 1**	**SB 1**	**SB 2**
Volume Total	125	96	1066	1079
Volume Left	0	59	46	0
Volume Right	81	0	0	59
cSH	51	0	1607	1700
Volume to Capacity	2.43	Err	0.03	0.63
Queue Length 95th (ft)	321	Err	2	0
Control Delay (s)	821.3	Err	0.8	0.0
Lane LOS	F	F	A	
Approach Delay (s)	821.3	Err	0.4	
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	35	30	0	0	20	15	45	940	25	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	51	44	0	0	29	22	59	1237	33	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked	0.61	0.61		0.61	0.61	0.61				0.61		
vC, conflicting volume	774	1388	0	1394	1372	635	0			1270		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	992	0	1001	965	0	0			797		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	90	68	100	100	80	97	96			100		
cM capacity (veh/h)	491	140	1075	89	150	662	1593			506		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	96	51	678	651
Volume Left	51	0	59	0
Volume Right	0	22	0	33
cSH	228	225	1593	1700
Volume to Capacity	0.42	0.23	0.04	0.38
Queue Length 95th (ft)	49	21	3	0
Control Delay (s)	31.8	25.7	1.0	0.0
Lane LOS	D	D	A	
Approach Delay (s)	31.8	25.7	0.5	
Approach LOS	D	D		

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	55.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	45	55	45	45	0	0	0	0	65	1160	40
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	66	81	66	66	0	0	0	0	86	1526	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1757	1724	789	1048	1750	0	1579			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1757	1724	789	1048	1750	0	1579			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	18	75	0	15	100	100			95		
cM capacity (veh/h)	14	81	327	41	78	1075	399			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	147	132	849	816
Volume Left	0	66	86	0
Volume Right	81	0	0	53
cSH	138	54	1600	1700
Volume to Capacity	1.07	2.46	0.05	0.48
Queue Length 95th (ft)	200	338	4	0
Control Delay (s)	158.8	829.3	1.4	0.0
Lane LOS	F	F	A	
Approach Delay (s)	158.8	829.3	0.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	69.1		
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↱			↰↱				
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	50	60	0	0	50	45	40	845	35	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	74	88	0	0	74	66	53	1112	46	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	764	1263	0	1284	1240	579	0			1158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	764	1263	0	1284	1240	579	0			1158		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	45	42	100	100	48	84	97			100		
cM capacity (veh/h)	134	151	1056	53	141	407	1593			611		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	162	140	609	602
Volume Left	74	0	53	0
Volume Right	0	66	0	46
cSH	143	204	1593	1700
Volume to Capacity	1.13	0.68	0.03	0.35
Queue Length 95th (ft)	227	106	3	0
Control Delay (s)	177.5	53.9	1.0	0.0
Lane LOS	F	F	A	
Approach Delay (s)	177.5	53.9	0.5	
Approach LOS	F	F		

Intersection Summary			
Average Delay	24.4		
Intersection Capacity Utilization	55.0%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix F: Future Queue Tables

Appendix F – Future Queue Analysis Table

QUEUE ANALYSIS
2025 30th Highest Hour

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
First Street and Main Avenue						
	Eastbound	Lt	1.14	SimTraffic	35	70
		Rt	1.14	SimTraffic	220	510
	Westbound	Lt	1.14	SimTraffic		160
		Th	1.14	SimTraffic		110
		Rt	1.14	SimTraffic	60	70
	Southbound	Th, Th/Rt	1.14	SimTraffic	220	440
First Street and Pacific Avenue						
	Westbound	Th, Th/Rt	0.95	SimTraffic	220	550
	Northbound	Lt	0.95	SimTraffic	140	180
		Lt/Th	0.95	SimTraffic	140	200
	Southbound[6]	Rt	0.95	SimTraffic	<50	180
Third Street and Main Avenue						
	Eastbound	Th/Rt	1.30	SimTraffic	215	640
	Southbound	Lt/Th, Th/Rt	1.30	SimTraffic		210
Third Street and Pacific Avenue						
	Eastbound	Lt/Th, Th	0.88	SimTraffic	150	190
	Northbound	Th, Th/Rt	0.88	SimTraffic	215	310
Fourth Street and Main Avenue						
	Eastbound	Th/Rt	0.99	SimTraffic	215	670
	Westbound	Lt	0.99	SimTraffic	40	70
		Th	0.99	SimTraffic		180
	Southbound	Lt/Th, Th/Rt	0.99	SimTraffic		130
Fourth Street and Pacific Avenue						
	Eastbound	Lt	0.97	SimTraffic	35	70
		Th	0.97	SimTraffic	145	210
	Westbound	Th/Rt	0.97	SimTraffic	215	600
	Northbound	Lt/Th, Th/Rt	0.97	SimTraffic	210	1030
Second Street and Main Avenue						
	Eastbound	Th/Rt	>2.0	2 Min Rule		90
	Westbound	Lt/Th	>2.0	2 Min Rule		70
Second Street and Pacific Avenue						
	Eastbound	Lt/Th	0.42	Synchro		50
	Westbound	Th/Rt	0.23	Synchro		30
Tenth Street and Main Avenue						
	Eastbound	Th/Rt	1.07	2 Min Rule		110
	Westbound	Lt/Th	>2.0	2 Min Rule		100
Tenth Street and Pacific Avenue						
	Eastbound	Lt/Th	1.13	2 Min Rule		120

QUEUE ANALYSIS
2025 30th Highest Hour

Intersection	Approach	Lane Group[1]	V/C Ratio[2]	Analysis Method[3]	Existing Storage[4] (feet)	Queue Length[5] (feet)
	Westbound	Th/Rt	0.68	Synchro		110

[1] Lane Group abbreviations are as follows: Lt = left lane, Rt = right lane and Th = through lane.
[2] For signalized intersections, overall intersection V/C ratio reported. For unsignalized intersections, highest V/C ratio per lane group reported.
[3] Queue lengths not reported for free-flowing, uncontrolled movements.
[4] Existing storage for through-lanes displayed only when queue expected to surpass the distance to the next intersection.
[5] Queue lengths were rounded up to the nearest ten feet. Highest queue length reported per lane group.
[6] Southbound leg of First Street and Pacific Avenue is a driveway access for several businesses.

MEMO #4

Downtown Speed Study Results

Tillamook Transportation Refinement Plan: Downtown Speed Study Results (Memo #4)

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COPIES: Project Management Team, Tillamook Transportation Refinement Plan

DATE: May 10, 2005

PROJECT NUMBER: 320805.19

Introduction

This memorandum summarizes the speed study along US 101 in downtown Tillamook. This study was conducted by ODOT staff on Thursday September 16th, 2004, and Monday September 20th, 2004, to determine if vehicle speeds are above the posted speed limit along US 101 through downtown Tillamook. As discussed in this memo, the data do not suggest the need for improvements to reduce vehicle speeds along US 101 at this time.

Methods and Results

The standard threshold to determine if vehicles are speeding is based on the 85th percentile speed, defined as the speed at which 85 percent of the traffic is traveling at or below. This speed is typically used to decide if a road is experiencing high vehicle speeds and treatments are need to lower vehicles speeds.

Speed data was collected at six locations along US 101, three in each direction (northbound and southbound). The locations were between Hoquarten Slough and the Hadley Road intersection, 3rd Street, and 10th Street. The posted speed limit at these locations is 35, 20 and 30 miles per hour (mph), respectively. Table 1 shows that for most locations the vehicle speeds are close to the posted speeds.

The one location were speeds are noticeably higher than the posted speed is southbound US 101 (Main Avenue) at 10th Street. At this location the 85th percentile speed for both cars and trucks is slightly greater than the posted speed limit. In addition, the maximum vehicle speed measured is significantly over the posted speed and the percentage of vehicles exceeding the posted speeds are the highest compared to any other locations. Refer to Attachment A for graphic presentation of Table 1.

TABLE 1

Speed Study Results

		Cars Only				Trucks Only		
Location	**Posted Speed**	**85th % Speed**	**Max Speed**	**% Exceeding Posted Speed**	**85th % Speed**	**Max Speed**	**% Exceeding Posted Speed**
US 101 NB (Pacific Avenue), north of 3rd Street Intersection	20	20	29	12	18	19	0
US 101 SB (Main Avenue), north of 3rd Street Intersection	20	20	32	14	16	22	7
US 101 NB (Pacific Avenue), north of 10th Street Intersection	30	30	33	13	30	31	11
US 101 SB (Main Avenue), south of 10th Street Intersection	30	33	38	26	32	33	55
US 101 NB, between Hoquarten Slough and Hadley Intersection	35	36	44	18	36	40	25
US 101 SB, between Hoquarten Slough and Hadley Intersection	35	35	39	9	33	33	0

ODOT staff collected one hour of data between 10 am to 1 pm. Data was only collected for vehicles not influenced by red lights, turning, or vehicles slowing to turn in front of them.

As part of the data collection, ODOT separated the vehicle information by vehicle type "car" and "truck." The truck 85th percentile speeds are similar to or lower than the posted speed at all of the locations. The maximum speeds for trucks are generally significantly lower than for cars. In some situations, the truck's maximum speed is even less than the posted speed. The one location where trucks are over the posted speed limit is southbound US 101 (Main Avenue) at 10th Street. Even though the 85th percentile truck speed at this location is 32 mph (posted speed limit is 30 mph) and the percentage of trucks exceeding the posted speed is 55 percent, the maximum speed is 33 mph. This indicates that while a majority of trucks are traveling above 30 mph, none are over 33 mph. Overall, the truck speed data suggests that trucks speeds along US 101 are generally not above the posted speed.

Conclusions and Next Steps

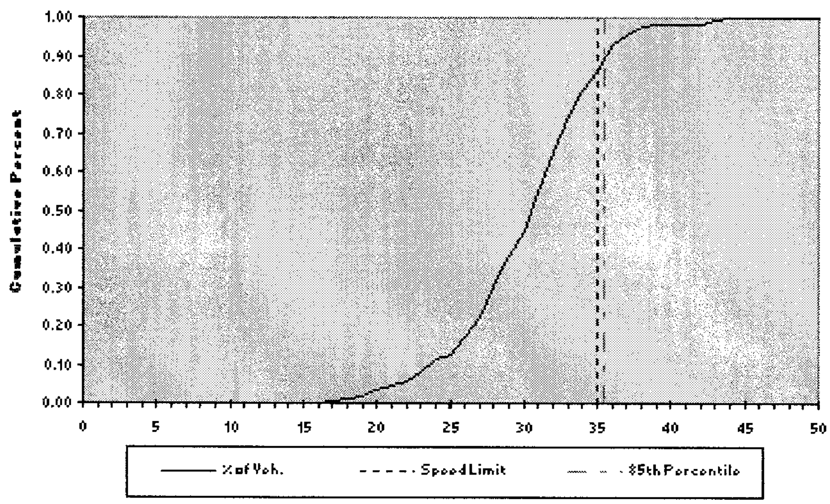
Discussions with Terry Wright, City of Tillamook Police Chief, suggest the need to collect additional speed data in the southbound direction of US 101 near 12th Street. Vehicle speeds at this location have been observed to be high as vehicles are accelerating as they leave Tillamook. The data already collected at 10th Street is consistent with this observation, and may indicate vehicles are starting to accelerate at this point. ODOT staff are planning to collect data at this location in early 2005.

Based on the data to be collected at 12th Street, improvements may be suggested to reduce vehicle speeds along US 101 southbound as vehicles exit Tillamook. Otherwise, no other locations analyzed are experiencing speeds that suggest the need for improvements.

Attachments A – Speed Location Charts

US 101 NB and SB between Hoquarten Slough and Hadley Road – Cars Only

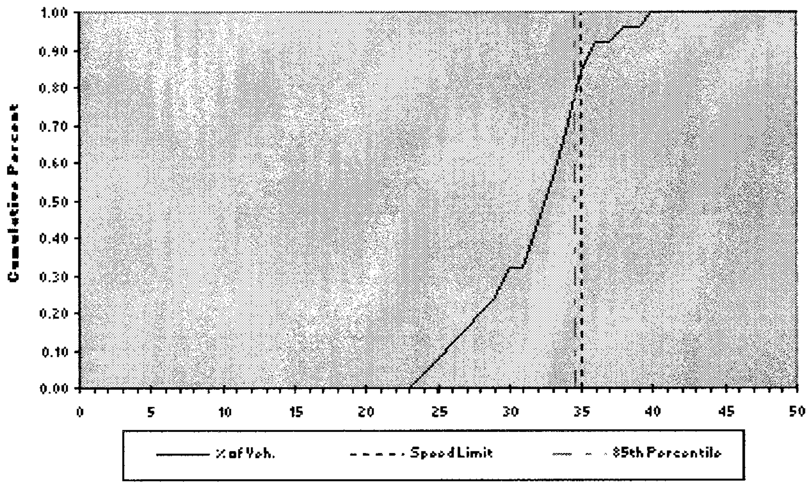
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Thursday 9/16/2004
City:	Tillamook	Time:	11:55 AM-12:50 PM
County:	Tillamook		
Location:	North of Hoquarten Sl N End Power Motor Near MP 65.5	Weather:	Showers to Rain
	Cars Only	Direction of Travel:	N-S/S-N



	MPH NB	Averaged	MPH SB
# of Vehicles	91	170	79
85th % Speed	36	36	35
Pace Limits	27 - 36	27 - 36	26 - 35
% In Pace	78%	77%	76%
Mean Speed	31.37	30.52	29.66
Median Speed	32	31	30
Std. Dev.	4.63	4.72	4.68
Max Speed	44	44	39
Posted Speed	35	35	35

US 101 NB and SB between Hoquarten Slough and Hadley Road – Trucks Only

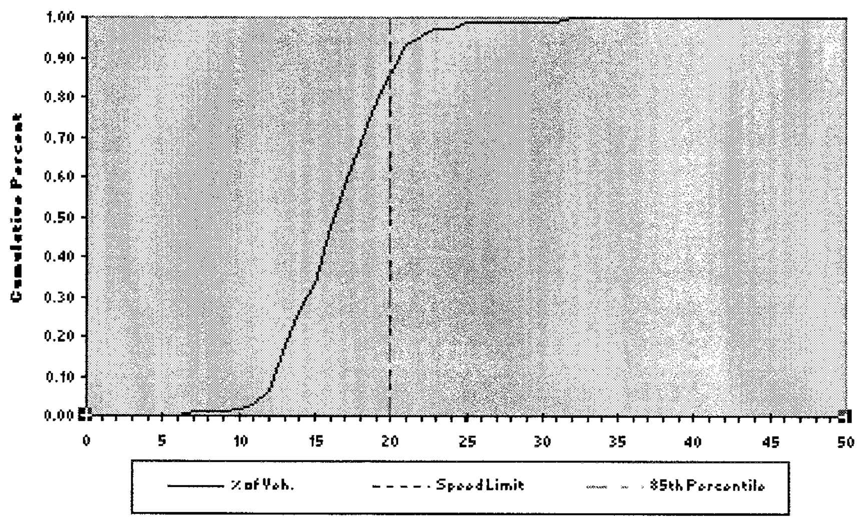
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Thursday 9/16/2004
City:	Tillamook	Time:	11:55 AM-12:50 PM
County:	Tillamook		
Location:	North of Hoquarten Sl N End Power Motor Near MP 65.5	Weather:	Showers to Rain
	Trucks Only	Direction of Travel:	N-S/S-N



	MPH NB	Averaged	MPH SB
# of Vehicles	16	25	9
85th % Speed	36	35	33
Pace Limits	27 - 36	26 - 35	24 - 33
% In Pace	88%	94%	100%
Mean Speed	34.00	31.56	29.11
Median Speed	34	33	32
Std. Dev.	3.12	4.02	3.62
Max Speed	40	40	33
Posted Speed	35	35	35

Main Avenue (US 101) north of 3rd Street – Cars Only

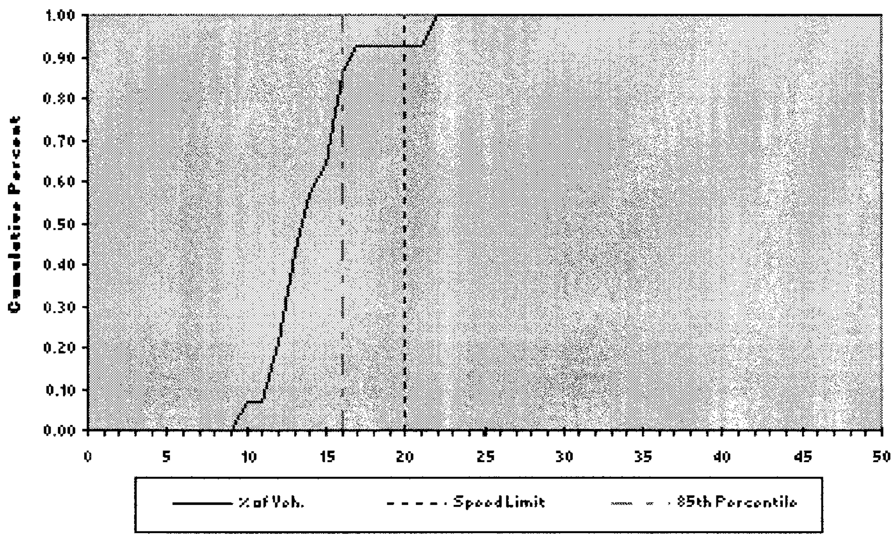
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Monday 9/20/2004
City:	Tillamook	Time:	11:10 AM-11:50 AM
County:	Tillamook		
Location:	At 3rd Street Southbound Just north of intersection w/Main Southbound only, Cars only	Weather:	Clear
		Direction of Travel:	N-S



	MPH		MPH
	SB	Averaged	0
# of Vehicles	114	114	0
85th % Speed	20	20	0
Pace Limits	12 - 21	#DIV/0!	#DIV/0!
% In Pace	90%	#DIV/0!	#DIV/0!
Mean Speed	16.94	#DIV/0!	#DIV/0!
Median Speed	17	17	0
Std. Dev.	3.51	3.51	#DIV/0!
Max Speed	32	32	0
Posted Speed	20	20	0

Main Avenue (US 101) north of 3rd Street – Trucks Only

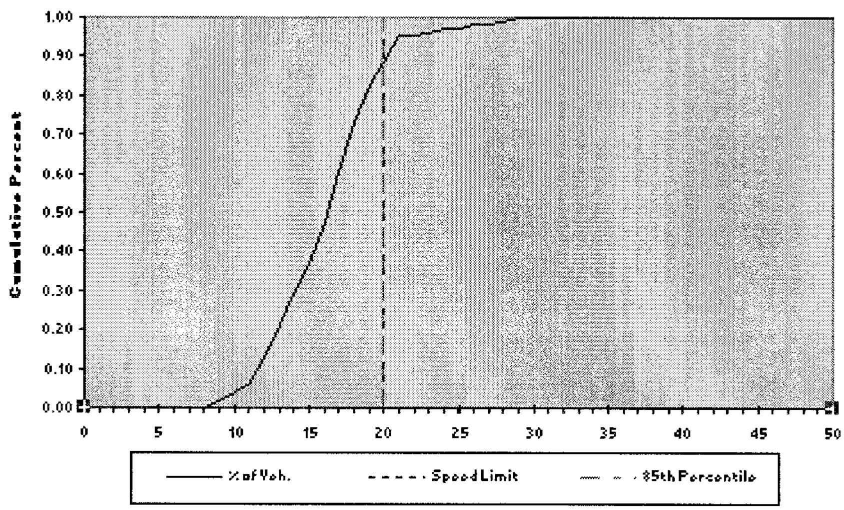
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Monday 9/20/2004
City:	Tillamook	Time:	11:10 AM-11:50 AM
County:	Tillamook		
Location:	At 3rd Street Southbound Just north of intersection w/Main	Weather:	Clear
	Southbound only, Trucks only	Direction of Travel:	N-S



	MPH		MPH
	SB	Averaged	0
# of Vehicles	14	14	0
85th % Speed	16	16	0
Pace Limits	8 - 17	#DIV/0!	#DIV/0!
% In Pace	93%	#DIV/0!	#DIV/0!
Mean Speed	14.50	#DIV/0!	#DIV/0!
Median Speed	14	14	0
Std. Dev.	2.90	2.90	#DIV/0!
Max Speed	22	22	0
Posted Speed	20	20	0

Pacific Avenue (US 101) north of 3rd Street – Cars Only

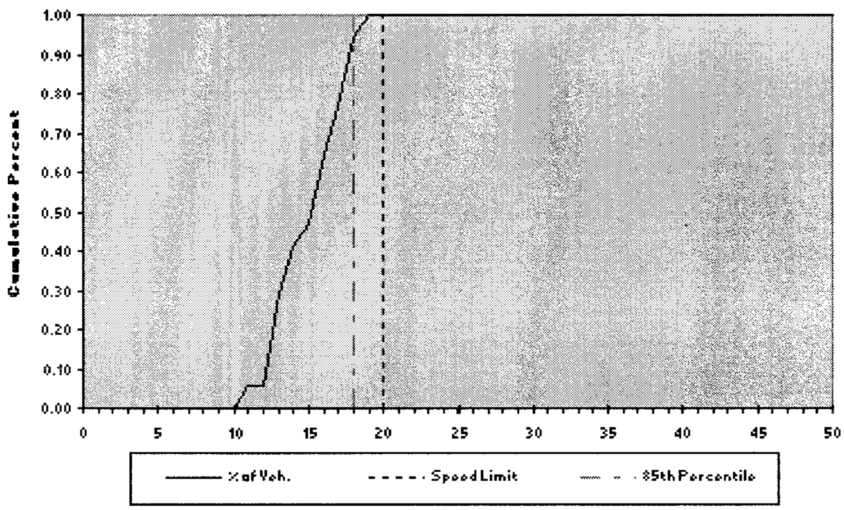
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Monday 9/20/2004
City:	Tillamook	Time:	10:20 AM-11:05 AM
County:	Tillamook		
Location:	At 3rd Street Northbound Just north of intersection w/Pacific	Weather:	Clear
	Northbound only, Cars only	Direction of Travel:	S-N



	MPH		MPH
	NB	Averaged	0
# of Vehicles	103	103	0
85th % Speed	20	20	0
Pace Limits	12 - 21	#DIV/0!	#DIV/0!
% In Pace	89%	#DIV/0!	#DIV/0!
Mean Speed	16.61	#DIV/0!	#DIV/0!
Median Speed	17	17	0
Std. Dev.	3.66	3.66	#DIV/0!
Max Speed	29	29	0
Posted Speed	20	20	0

Pacific Avenue (US 101) north of 3rd Street – Trucks Only

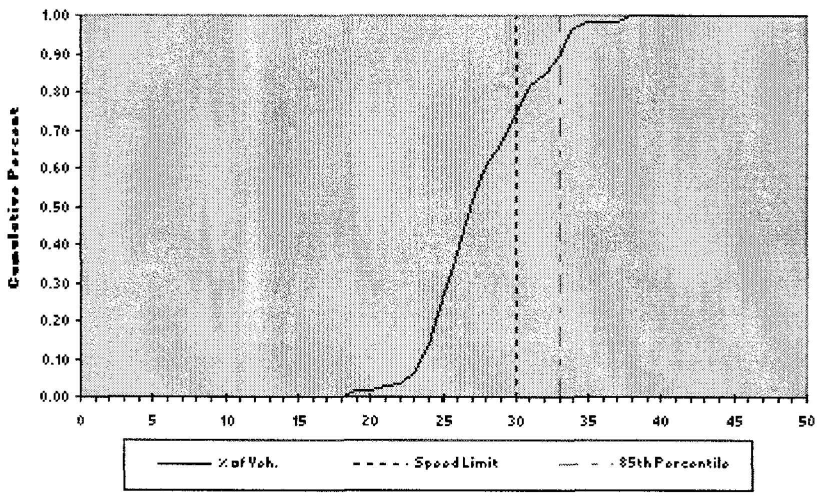
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Monday 9/20/2004
City:	Tillamook	Time:	10:20 AM-11:05 AM
County:	Tillamook		
Location:	At 3rd Street Northbound Just north of intersection w/Pacific Northbound only, Trucks only	Weather: Direction of Travel:	Clear S-N



	MPH		MPH
	NB	Averaged	0
# of Vehicles	17	17	0
85th % Speed	18	18	0
Pace Limits	10 - 19	#DIV/0!	#DIV/0!
% In Pace	100%	#DIV/0!	#DIV/0!
Mean Speed	15.35	#DIV/0!	#DIV/0!
Median Speed	16	16	0
Std. Dev.	2.32	2.32	#DIV/0!
Max Speed	19	19	0
Posted Speed	20	20	0

Main Avenue (US 101) south of 10th Street – Cars Only

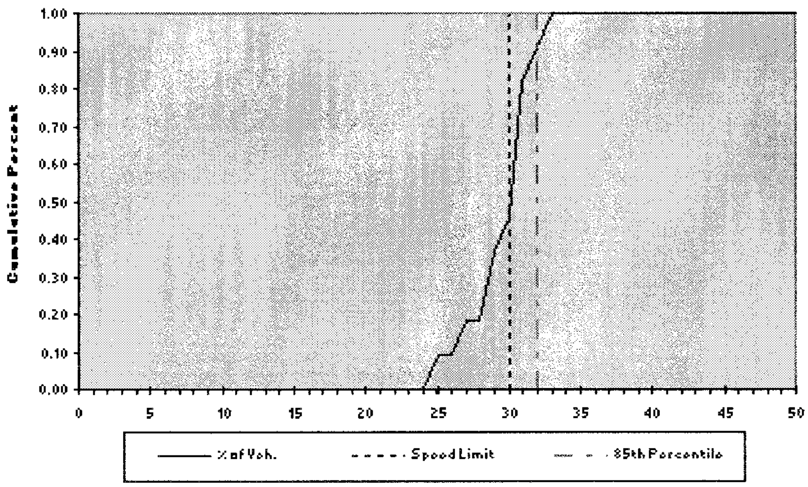
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Thursday 9/16/2004
City:	Tillamook	Time:	11:10 AM-11:35 AM
County:	Tillamook		
Location:	At 10th Street Southbound Just south of intersection w/Main Cars only	Weather:	Showers
		Direction of Travel:	N-S



	MPH SB	Averaged	MPH 0
# of Vehicles	109	109	0
85th % Speed	33	33	0
Pace Limits	24 - 33	#DIV/0!	#DIV/0!
% In Pace	83%	#DIV/0!	#DIV/0!
Mean Speed	28.06	#DIV/0!	#DIV/0!
Median Speed	27	27	0
Std. Dev.	3.73	3.73	#DIV/0!
Max Speed	38	38	0
Posted Speed	30	30	0

Main Avenue (US 101) south of 10th Street – Trucks Only

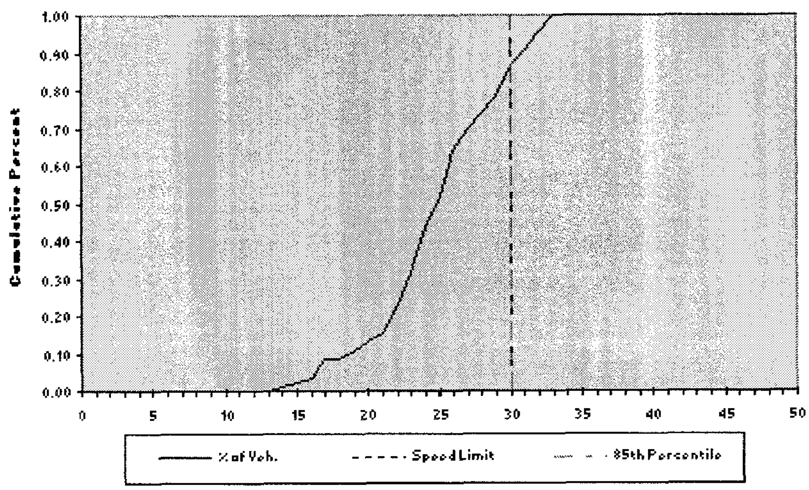
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Thursday 9/16/2004
City:	Tillamook	Time:	11:10 AM-11:35 AM
County:	Tillamook		
Location:	At 10th Street Southbound Just south of intersection w/Main	Weather:	Showers
	Southbound only, Trucks only	Direction of Travel:	N-S



	MPH		MPH
	SB	Averaged	0
# of Vehicles	11	11	0
85th % Speed	32	32	0
Pace Limits	24 - 33	#DIV/0!	#DIV/0!
% In Pace	100%	#DIV/0!	#DIV/0!
Mean Speed	29.91	#DIV/0!	#DIV/0!
Median Speed	31	31	0
Std. Dev.	2.30	2.30	#DIV/0!
Max Speed	33	33	0
Posted Speed	30	30	0

Pacific Avenue (US 101) north of 10th Street – Cars Only

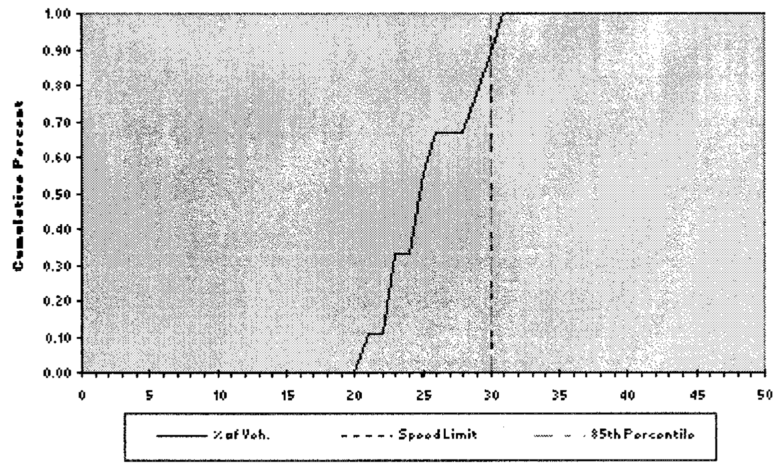
Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Thursday 9/16/2004
City:	Tillamook	Time:	10:40 AM-11:05 AM
County:	Tillamook		
Location:	At 10th Street Northbound Just north of intersection w/Pacific Northbound only, Cars only	Weather:	Showers
		Direction of Travel:	S-N



	MPH		MPH
	NB	Averaged	0
# of Vehicles	83	83	0
85th % Speed	30	30	0
Pace Limits	22 - 31	#DIV/0!	#DIV/0!
% In Pace	75%	#DIV/0!	#DIV/0!
Mean Speed	25.29	#DIV/0!	#DIV/0!
Median Speed	25	25	0
Std. Dev.	4.49	4.49	#DIV/0!
Max Speed	33	33	0
Posted Speed	30	30	0

Pacific Avenue (US 101) north of 10th Street – Trucks Only

Roadway:	Oragon Coast Highway US 101 (OR 9)	Date:	Thursday 9/16/2004
City:	Tillamook	Time:	10:40 AM-11:05 AM
County:	Tillamook		
Location:	At 10th Street Northbound Just north of intersection w/Pacific Northbound only, Trucks only	Weather:	Showers
		Direction of Travel:	S-N



	MPH NB	Averaged	MPH 0
# of Vehicles	9	9	0
85th % Speed	30	30	0
Pace Limits	21 - 30	#DIV/0!	#DIV/0!
% In Pace	89%	#DIV/0!	#DIV/0!
Mean Speed	25.89	#DIV/0!	#DIV/0!
Median Speed	26	26	0
Std. Dev.	3.44	3.44	#DIV/0!
Max Speed	31	31	0
Posted Speed	30	30	0

MEMO #5

Parking Study—Existing Conditions

Tillamook Transportation Refinement Plan: Parking Study - Existing Conditions (Memo #5)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Theresa Carr, CH2M HILL
Tim Burkhardt, CH2M HILL
Craig Grandstrom, CH2M HILL

COPIES: Project Management Team

DATE: May 10, 2005

This memorandum describes parking conditions in downtown Tillamook, including utilization conditions. The parking study has been prepared as part of the Tillamook Refinement Plan and consists of two main elements – stakeholder interviews and a parking utilization study. This memorandum summarizes the comments heard from area stakeholders, outlines the methodology used for the utilization study, and presents findings from this study.

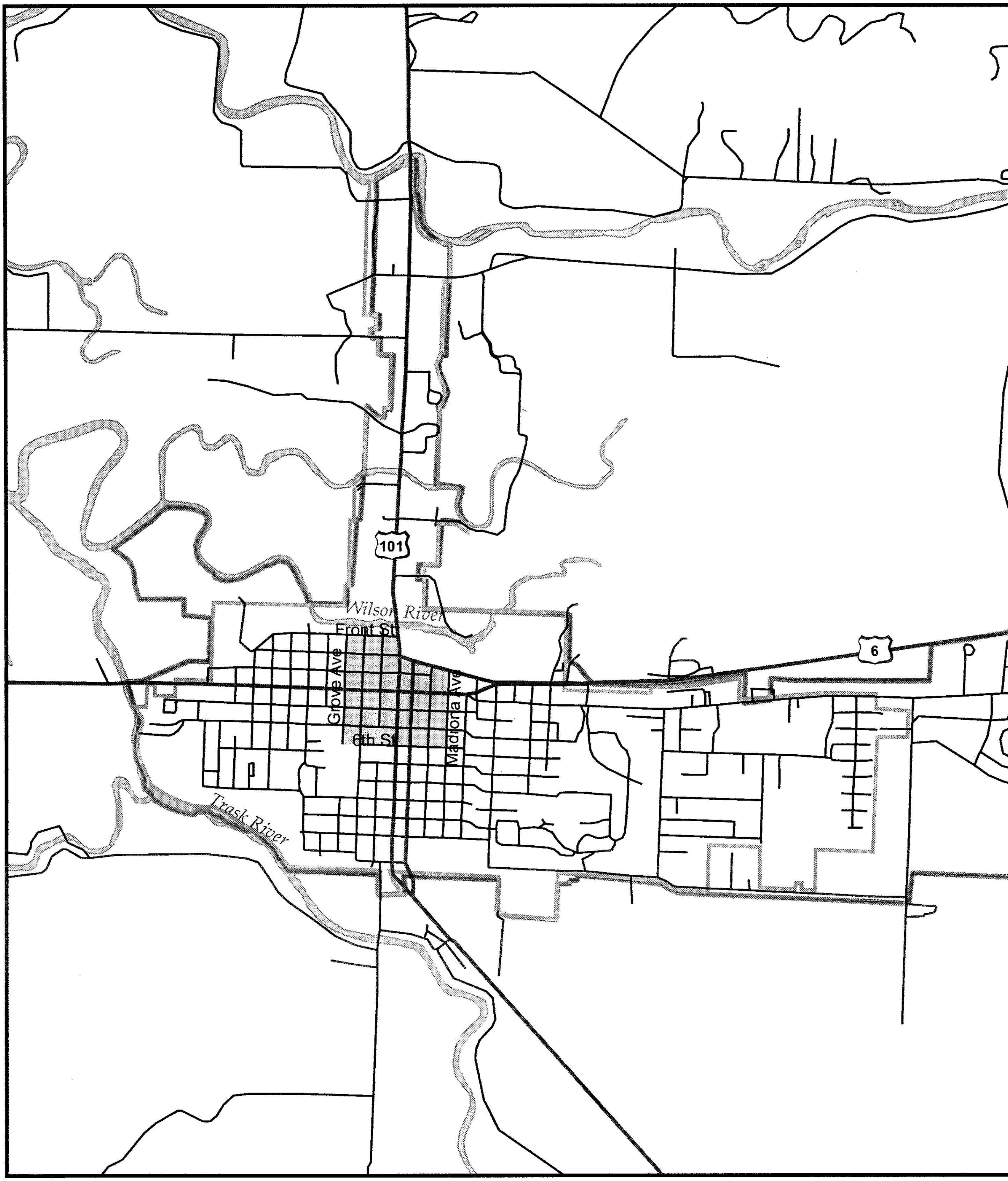
The study area used for the parking study follows the boundaries of the downtown parking district with extensions one block to the north and the west as recommended by City of Tillamook and the Oregon Department of Transportation (ODOT) (Figure 1). The study area is bounded on the north by Front Street, on the east by Madrona Avenue, on the south by Sixth Street, and on the west by Grove Avenue. Parking in much of the district is time regulated. Parking regulations range from 15 minutes to 3 hours, depending on the location. Some interior parking lots are metered.

Stakeholder Interviews

Telephone interviews were conducted with six representative stakeholders in downtown Tillamook. Stakeholders were asked to describe current parking conditions within the district. Names of stakeholders were provided by City of Tillamook staff, and are listed below.

TABLE 1
Stakeholders Interviewed for Parking Study

Name	Affiliation
Ken Bell	Parking Committee Member
Brenda Bower	Tillamook Parking Enforcement Officer
Sally Clay	Tillamook Downtown Association
Doug Henson	City Councilor, Business Owner
George Langlois	Business Owner
Terry Wright	Tillamook Chief of Police



Legend

- Highways
- Local Roads
- Study Area for Parking Study
- Tillamook City Limits
- Urban Growth Boundary
- Rivers

N

1 inch equals 2,000 feet

1,000 0 1,000 2,000 Feet

Figure 1
Study Area

Tillamook Parking Study

Tillamook, Oregon

CH2MHILL

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Findings from the interviews are summarized by topic below.

Parking Capacity

Several stakeholders stated that parking capacity was more an issue of perception than reality. The perception problem focused on the limited capacity of stalls in front of particular businesses, and customer lack of willingness to walk from available parking to shopping destinations. One stakeholder stated that the downtown area experienced peaks in demand – generally before work and during the lunchtime hour – where parking was difficult to find downtown. Another stakeholder found that parking downtown was available, but individuals did not perceive it to be available parking because of safety concerns along Pacific and Main Avenues (see safety section).

Two stakeholders cited the potential for future capacity issues. The first issue involved use of the old Ray's parking lot by employees working in the downtown area. When this site is redeveloped to house the new Safeway supermarket, the parking lot will no longer be available to employees. Parking stalls for all-day use may need to be identified. The second issue related to economic development of the downtown core. Currently downtown is characterized by several vacant commercial buildings. If the City is successful in their economic development efforts to attract new businesses to downtown, parking capacity could become a concern.

Parking Safety

All interviewed stakeholders listed safety as a concern for individuals parking along Pacific and Main Avenues. The concern is related to the large volumes of larger-sized vehicles (including log trucks and recreational vehicles) traveling the narrow lanes of the highway through downtown, becoming a hazard both for parked vehicles (sideswipes were cited, as were missing side mirrors) and for drivers opening their doors onto the highway side of the road. The result of this problem has been unwillingness by drivers to park along Pacific and Main Avenue, leading to a perception of lost sales for businesses in downtown. One business owner interviewed cited a loss of 40 percent of business when the business was relocated downtown.

Parking Regulations

Stakeholders had mixed feelings about the City's parking regulations. Some felt that the regulations were working better than in the past now that a City police officer is responsible for enforcing parking regulations. Other stakeholders cited business owners and employees as the biggest violators of the parking ordinance, and stated that employees were known to move their vehicle from one spot on a given block face to another to comply with the letter of the parking regulation, while disregarding the regulation's intent, which is to free parking stalls downtown for customers. Another stakeholder voiced a concern that parking regulations are too complicated (for example, three regulations on one block face).

Signage/Education

Multiple stakeholders interviewed voiced a concern that drivers – especially those unfamiliar with downtown Tillamook – do not know where to park. Narrow streets and heavy traffic volumes can be intimidating for people looking to stop. The downtown area is relatively short and drivers are outside of the downtown core before they have a chance to look for parking. Signage located at both ends of the downtown core indicating clear, designated parking areas is needed, according to these stakeholders.

Other (Non-Parking Related)

Stakeholders interviewed in relation to parking concerns also provided feedback in other areas related to transportation in downtown Tillamook, but not specific to parking. These comments are briefly listed below.

- Much of traffic along Pacific and Main Avenues in downtown Tillamook is through traffic (does not stop in downtown Tillamook).
- Johnson Bridge is closed to trucks (weight limit) which reroutes trucks through downtown Tillamook.
- Truck drivers dislike driving along Pacific and Main Avenues in Tillamook, due to fear of collisions with parked and moving vehicles, pedestrians, and bicyclists.
- The travel lanes are not wide enough.

Parking Utilization Study

A parking utilization study was conducted October 2-14, 2004, following the general guidelines of *Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast* (2001), a publication of the Oregon Transportation and Growth Management (TGM) Program.

Parking Inventory

An inventory of on-street and off-street parking stalls and regulations was conducted on October 2, 2004. For each block face within the study area, the project team identified the number of on-street parking stalls, the presence and type of parking restrictions, the type of parking (e.g., parallel, diagonal), and the presence of any special parking areas (e.g., handicapped stalls, compact stalls, loading areas). Within the interior of each block, the project team identified all internal parking lots, including parking lots associated with a particular business. Underutilized private lots can often provide sharing opportunities for cities with parking overutilization issues. Figure 2 displays the parking inventory in downtown Tillamook.

There are a total of 1,413 parking stalls in the study area. Roughly half of these stalls (705 stalls) are on-street parking. Approximately 20 percent (491 stalls) of the total stalls are under some form of parking regulation, as shown in Table 2.

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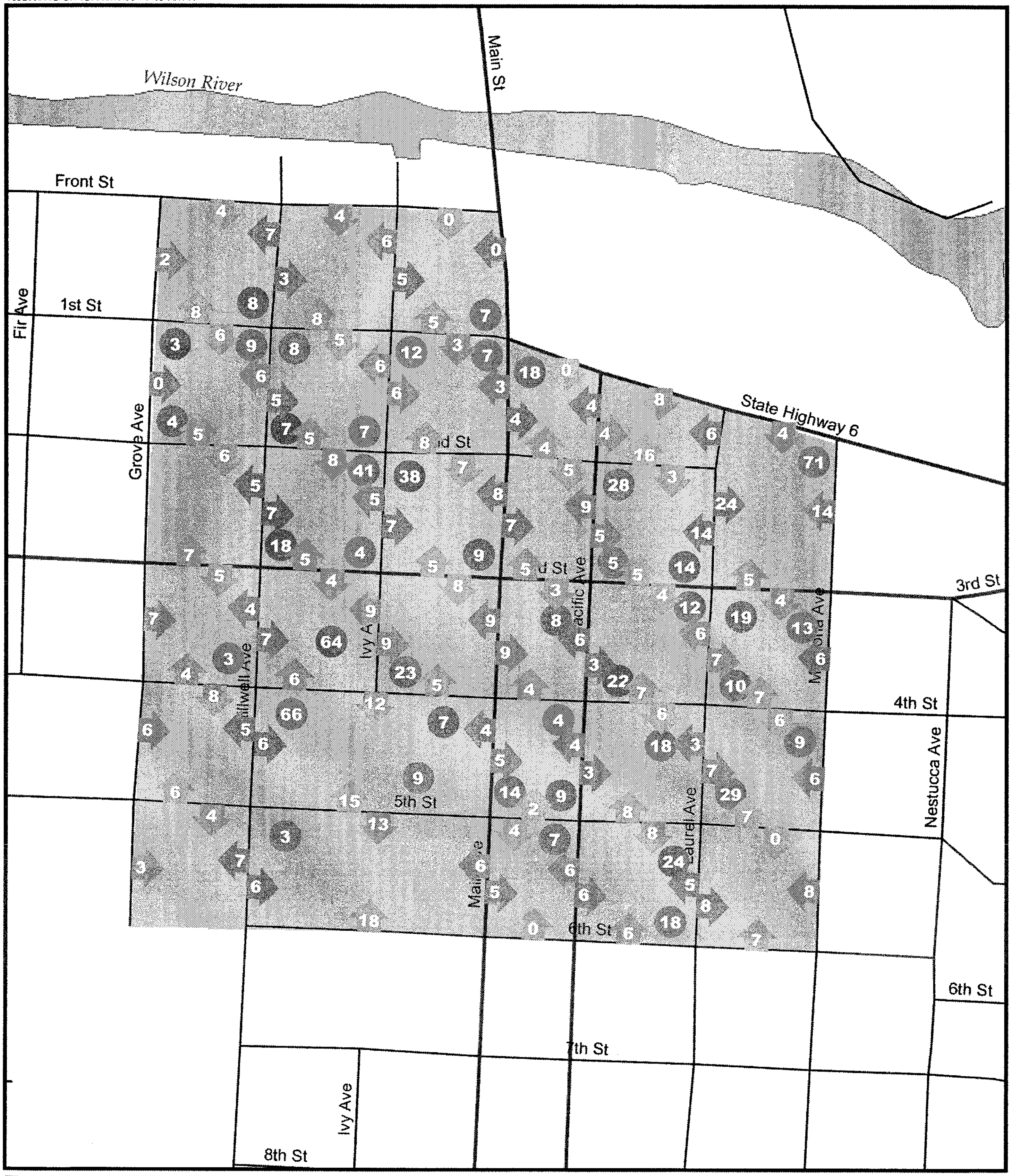

Legend

- Highways
- Local Roads
- Study Area
- Rivers
- On-Street Parking, north & south
- On-Street Parking, east & west
- Off-Street Parking

Note: Numbers indicate number of parking spaces at each location or block face.

N

1 inch equals 300 feet

200 0 200 400 Feet

Figure 2
Parking Inventory
(October 2004)
Tillamook Parking Study
Tillamook, Oregon

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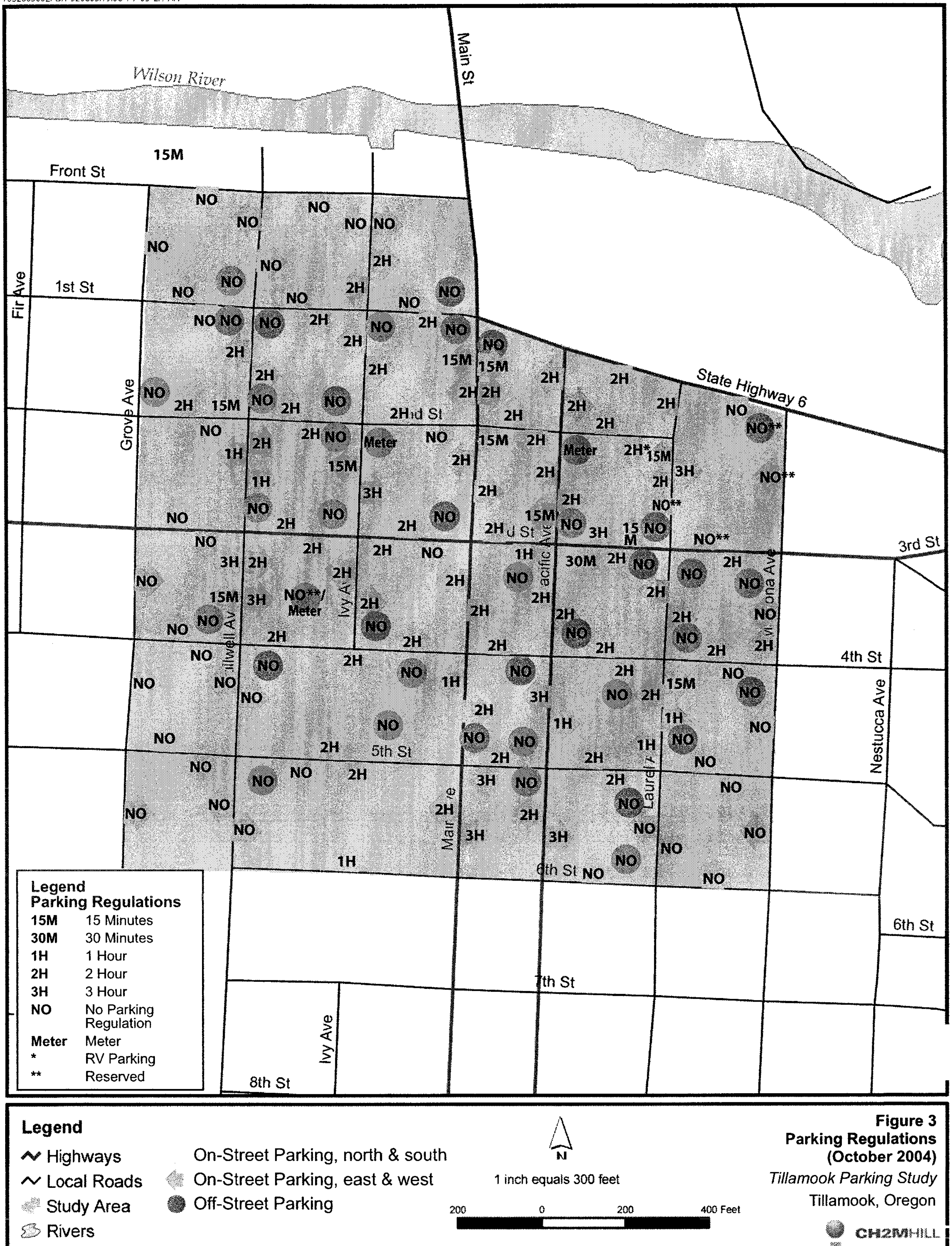

Figure 3
Parking Regulations
(October 2004)
Tillamook Parking Study
Tillamook, Oregon

TABLE 2
Parking Inventory Within Study Area, by Parking Regulation

Type of Regulation	Number of Stalls
15 minutes	27
30 minutes	2
1 hour	42
2 hours	364
3 hours	56
No Regulation	922
Total	**1,413**

Total includes stalls 705 on-street and 708 interior parking lots.

Figure 3 displays the current (October 2004) parking regulations in the study area. Most regulated stalls are on-street. Approximately 70 percent of on-street parking stalls in the study area are under some form of parking regulation.

Roughly 2.5 percent (36 stalls) of all stalls in the study area are reserved for use by persons with disabilities. All of these stalls are located off-street, within internal parking lots. Another 54 off-street stalls are metered parking. There is currently no on-street metered parking in the area. Metered parking was used in the past but removed by the City at the request of downtown business owners and replaced by parking time regulations.

A portion of one block face (3 stalls) is reserved for RV use, and two interior parking lots within the study area (103 stalls) are reserved for employees or other use.

Parking Utilization – Methodology

The project team collected parking utilization data at five intervals over two days - one weekday (Thursday, October 14) and one weekend day (Saturday, October 9). Using the parking inventory data, the team counted occupied parking stalls during the following five time intervals on both days:

- Morning (8:00 a.m. - 9:30 a.m.)
- Mid-Morning (10:00 a.m. - 11:30 a.m.)
- Lunch (11:30 a.m. - 1:00 p.m.)
- Mid-Afternoon (1:30 p.m. - 3:00 p.m.)
- Afternoon (3:00 p.m. - 4:30 p.m.)

The number of occupied parking stalls for each block face and grouping was recorded for each time interval. An area's parking utilization is defined as the percent of available parking that is occupied by vehicles, for any given time interval or over a series of time intervals. Utilization was determined for parking on each block face and each internal lot.

Stalls with different parking regulations on the same block face were analyzed separately. Areas that are more than 90 percent utilized are considered at capacity. According to the *Parking Management Made Easy* guide, the 90 percent threshold is significant because at this utilization rate drivers find parking difficult to find and either circle around looking for unoccupied stalls, or give up and drive away.

Seasonality

Based on data collected by the ODOT Automated Traffic Recorder 29-001 located on US 101 just north of Tillamook, the traffic volumes along US 101 in the study area are typical (100 percent of Average Annual Daily Traffic) during the months of October and May. Because the majority of businesses in downtown Tillamook serve local and regional patrons year-round, parking in downtown Tillamook is less susceptible to the summer tourist peak than other cities along the Oregon Coast whose businesses depend more on tourism. Thus, the parking data collected in October 2004 represents a time of "average" through traffic on US 101 in Tillamook - not the summer peak, not the winter low - and is most appropriate for identifying general parking issues and potential solutions.

Ideally, parking data would be collected at multiple points during the year to identify seasonal impacts. However, this level of data collection is typically applied only for projects with acute seasonality needs or demands, such as at a state park or a ski resort. Because the Tillamook refinement plan draws on general trends and recommends solutions for the downtown as a whole, the typical parking condition was considered most desirable and appropriate for the data collection effort. However, it is understood that there may be some increased demand during the summer and that parking solutions developed will need to take this into account.

Because this parking utilization study represents only a snapshot in time, the public workshops, stakeholder interviews and other public input are being used to validate and refine the utilization data and will continue to play an important role in developing recommendations.

Parking Utilization – Findings

General Findings

Overall, the study area did not show a parking utilization problem. On average over the two-day study period, 29 percent of available stalls were occupied. This average changes when the weekday is differentiated from the weekend - the average weekday utilization was 38 percent while the weekend utilization was 20 percent - but still far from the 90 percent capacity threshold described in the previous section.

Looking at the five separate time intervals, the lunchtime and early afternoon intervals were the busiest, for both weekday and Saturday. The weekday count showed 44 percent of available parking stalls occupied during both the 11:30am and 1:30 pm intervals. The Saturday count showed 23 percent occupied for the same two intervals. See Table 3 below.

TABLE 3
Average Parking Utilization Rate by Time Interval – Weekday and Weekend

Time Interval	Percent Occupied
Thursday Average	**38%**

Thursday 8:00 am	24%
Thursday 10:00 am	42%
Thursday 11:30 am	44%
Thursday 1:30 pm	44%
Thursday 3:00 pm	37%
Saturday Average	**20%**
Saturday 8:00 am	11%
Saturday 10:00 am	20%
Saturday 11:30 am	23%
Saturday 1:30 pm	23%
Saturday 3:00 pm	21%
Average - Both Days	**29%**

The locations of higher parking utilization were markedly different on weekdays as compared to weekends. Parking areas that were highly utilized on weekdays – such as interior lots used by employees – were not highly utilized on weekends. Other parking areas – such as on-street parking near apartment buildings – were highly utilized on weekends but not on weekdays. Different lots are used at different times and at different utilization rates.

Pacific and Main

Parking utilization along Pacific and Main Avenues was less than 50 percent for all time periods for both weekday and weekend counts. This indicates that parking capacity along these two streets downtown is adequate. For both corridors together, the utilization rate ranged between 14 percent on weekday and Saturday mornings to 35 percent at the weekday lunchtime. On average, both Pacific and Main were equally utilized, although the capacity on Main is higher than on Pacific. Tables 4 and 5 provide a breakdown of utilization rates on Pacific and Main for weekday and weekend, respectively.

TABLE 4

Parking Utilization along Pacific and Main - Weekday

Description	Capacity	Thurs 8:00 am	Thurs 10:00 am	Thurs 11:30 am	Thurs 1:30 pm	Thurs 3:00 pm
Entire Corridor (Main and Pacific)	111	14%	35%	34%	35%	28%
Main Only						
Both East and West Side	61	11%	34%	33%	34%	31%
East Side Only	30	13%	30%	40%	33%	37%
West Side Only	31	10%	39%	26%	35%	26%

TABLE 4

Parking Utilization along Pacific and Main - Weekday

Description	Capacity	Thurs 8:00 am	Thurs 10:00 am	Thurs 11:30 am	Thurs 1:30 pm	Thurs 3:00 pm
Entire Corridor (Main and Pacific)	111	14%	35%	34%	35%	28%
Main Only						
Pacific Only						
Both East and West Side	50	16%	36%	36%	36%	24%
East Side Only	17	0%	12%	29%	41%	12%
West Side Only	33	24%	48%	39%	33%	30%

Table 4 shows that parking on the Pacific/Main couplet remained under 50 percent on weekdays, and ranged between 0 and 48 percent depending on location and time of day. There does not appear to be a clear preference for drivers as to the particular side of street – the east and west sides for both Pacific and Main Avenues are both variedly used.

Table 5 below shows parking utilization for the Pacific/Main couplet on weekends.

TABLE 5

Parking Utilization along Pacific and Main - Weekend

Description	Capacity	Sat 8:00 am	Sat 10:00 am	Sat 11:30 am	Sat 1:30 pm	Sat 3:00 pm
Entire Corridor (Main and Pacific)	111	14%	23%	24%	25%	20%
Main Only						
Both East and West Side	61	18%	34%	36%	26%	26%
East Side Only	30	13%	33%	30%	20%	27%
West Side Only	31	23%	35%	42%	32%	26%
Pacific Only						
Both East and West Side	50	10%	8%	10%	24%	12%
East Side Only	17	12%	0%	6%	12%	0%
West Side Only	33	9%	12%	12%	30%	18%

Parking utilization along the couplet was generally lower on weekends than on weekdays, with a utilization rate ranging from 0 to 42 percent, depending on particular location and time interval. Lunchtime and early afternoon are the most popular weekend time intervals. Unlike the weekday observations, Saturday drivers appeared to clearly prefer parking along the west side of both Pacific and Main. This is not likely due to level of comfort parking on one side of the road or the other, as the west side is to the driver's right on Main but to the driver's left on Pacific. Instead, higher utilization on the west side is probably due to proximity to restaurants and retailers on the west sides of Pacific and Main.

Low parking utilization rates along Pacific and Main may be due to perceptions of safety described earlier, as well as parking regulations. On-street parking along the highway is time constrained. As described below, drivers preferred locations that were not time-regulated.

Parking Regulations

Lots without parking regulations (generally located along the periphery of the study area) were the most highly utilized. As shown in Table 6 below, parking areas without time regulations were consistently higher utilized – with rates up to 17 percent higher for the weekday early afternoon period.

TABLE 6
Utilization Rates for Parking Areas with and without Parking Regulations

Time Interval	Percent Utilized - Stalls with Parking Regulation	Percent Utilized - Stalls with no Parking Regulation
Thursday Average	**29%**	**43%**
Thursday 8:00 am	16%	29%
Thursday 10:00 am	35%	45%
Thursday 11:30 am	36%	48%
Thursday 1:30 pm	33%	49%
Thursday 3:00 pm	25%	43%
Saturday Average	**16%**	**22%**
Saturday 8:00 am	8%	13%
Saturday 10:00 am	16%	22%
Saturday 11:30 am	20%	25%
Saturday 1:30 pm	21%	25%
Saturday 3:00 pm	17%	24%
Average - Both Days	**23%**	**32%**

Although Table 6 combines both on-street and interior lots, the on-street, unregulated parking areas were the most highly valued and generally had utilization rates at or near 90 percent. Employees parking in unregulated stalls likely comprise much of this demand. See the employee parking and location-specific utilization rates sections for further discussion.

Employee Parking

One obvious segment of demand for unregulated parking areas in the downtown is for downtown employees. There is very little employee parking available inside the study area, and for instances where parking is made available (for example, City Offices) it is insufficient to meet total employee demand. Employees are asked to park outside the parking district and walk in to jobs. For those working on the Main/Pacific Couplet, this could be a walk of several blocks.

In addition to on-street unregulated parking areas such as 1st Street between Madrona and Laurel, 3rd Street between Laurel and Pacific, and 2nd Street between Main and Ivy, the Ray's parking lot (located south of 3rd Street, between Ivy and Stillwell) was heavily used throughout the weekday. This area is the location of the old Ray's supermarket, now vacant. It has 64 stalls, and was 47 percent utilized during the Thursday time period. Witholding the early (8am) Thursday time interval, average utilization increased to 56 percent. This was not replicated on Saturday observations. See Table 7.

TABLE 7
Parking Utilization at Old Ray's Lot

Time Interval	No. of Vehicles Observed in Old Ray's Lot	Percent of Lot Utilized
Thursday Average	**30**	**47%**
Thursday 8:00 am	9	14%
Thursday 10:00 am	33	52%
Thursday 11:30 am	38	59%
Thursday 1:30 pm	34	53%
Thursday 3:00 pm	35	55%
Saturday Average	**7**	**11%**
Saturday 8:00 am	3	5%
Saturday 10:00 am	7	11%
Saturday 11:30 am	9	14%
Saturday 1:30 pm	8	13%
Saturday 3:00 pm	7	11%
Average - Both Days	**18.3**	**29%**

Although the utilization in this lot is not close to the 90 percent capacity threshold, the finding is important in that Safeway is expected to be moving to this location in the near term. They will be building their supermarket structure on the old Ray's site, with parking one block to the north. The approximately 40 employees using the old Ray's lot will be forced to park elsewhere, either on street outside the parking district or competing for the minimal on-street lots in the district without regulation.

Location-Specific Utilization Rates

Tables 8 and 9 provide an overview of individual parking areas where utilization rates higher than 90 percent were observed for one or more periods during the weekday and weekend intervals. Table 8 provides information for the weekday count; Table 9 provides information for the weekend count. The same lots are displayed for both weekday and weekend, even though some parking areas had a high utilization rate only for one date.

Overall, 198 on-street parking areas or parking lots were inventoried in the study area. Of these, 39 blocks or lots were for one of the time periods at capacity. On average, parking was more highly utilized on the weekday, with 14 locations at or over capacity for one of the time periods during the Thursday field inventory while only 4 locations were at or over capacity on the weekend.

TABLE 8A
Identification of Parking Areas at Capacity – Weekday (On-Street)

Street	From*	To	No. Stalls	Parking Regulation	Thurs 8:00 am	Thurs 10:00 am	Thurs 11:30 am	Thurs 1:30 pm	Thurs 3:00 pm	Total	Comment
On-Street Parking											
1st	Ivy	Main	3	2 Hour			■	■		2	Close to downtown, off Main Street
1st	Laurel	Madrona	4	None	■	■	■	■	■	5	Near City Hall, no parking regulation
2nd	Grove	Stillwell	6	None		■				1	No regulation, near residential
2nd	Stillwell	Grove	3	None				■	■	2	Near services
2nd	Pacific	Main	4	2 Hour			■		■	2	Close to downtown, off Main Street
2nd	Main	Pacific	1	15 Minute			■	■	■	3	Close to downtown, off Main Street
2nd	Main	Pacific	4	2 Hour		■		■		3	Close to downtown, off Main Street
3rd	Ivy	Main	2	None		■				1	Off Main Street, no regulation
3rd	Main	Pacific	3	1 Hour						0	Close to downtown, off Main Street
3rd	Pacific	Laurel	2	2 Hour					■	1	Near police station and commercial
3rd	Laurel	Pacific	2	15 Minute		■			■	2	Close to downtown, off Main Street
3rd	Madrona	Laurel	5	None	■	■	■	■	■	5	Used by visitors to City Hall
4th	Stillwell	Grove	4	None		■	■			2	No parking regulation, near residential.
5th	Main	Pacific	4	3 Hour					■	1	Close to downtown, off Main Street
5th	Pacific	Main	2	2 Hour		■				1	Close to downtown, off Main Street
Grove	1st	Front	2	None						0	Used by nearby residents.
Stillwell	1st	Front	3	None			■	■	■	3	Near hardware and feed store
Stillwell	3rd	4th	3	3 Hour		■	■			2	Near Senior Center and services
Ivy	1st	Front	3	2 Hour			■	■		2	Near hardware and feed store
Ivy	Front	1st	3	2 hour	■	■				2	Near hardware and feed store
Main	1st	2nd	1	1 Hour						0	One, 1-hour stall
Main	1st	2nd	2	2 Hour				■		1	Small number of stalls, centrally located
Laurel	3rd	1st	3	Commissioner	■					1	Reserved for use by Commissioners.
Laurel	3rd	1st	21	3 Hour		■				1	Used by visitors to City Hall
Laurel	2nd	3rd	2	Police	■	■	■	■	■	5	Reserved for use by police vehicles
Laurel	2nd	3rd	10	2 Hour		■				1	Close to City Hall
Laurel	2nd	3rd	2	15 Minute				■		1	Was used by police vehicles
Madrona	1st	3rd	14	Reserved				■		1	Reserved for use by City employees
Madrona	3rd	4th	5	None		■	■		■	3	Near City Hall, no parking regulation

* The "from" and "two" streets indicate direction. For example, one area is on 2nd between Grove and Stillwell, indicating an easterly direction; parking is on the south side of the street. A number of parking areas have identical "street" "from" and "to" fields. These areas are differentiated by varied parking regulations, which have been determined to affect demand.

TABLE 8B
Identification of Parking Areas at Capacity – Weekday (Off-Street)

Street	From*	To	No. Stalls	Parking Regulation	Thurs 8:00 am	Thurs 10:00 am	Thurs 11:30 am	Thurs 1:30 pm	Thurs 3:00 pm	Total	Comment
Off-Street Parking Lots											
1st	Stillwell	Grove	3	Private	■			■	■	3	Used by nearby business
2nd	Ivy	Stillwell	7	Business						0	NAPA Auto Parts Lot
3rd	Ivy	Stillwell	4	2 Hour Parking		■	■	■		3	2 Hour Parking within larger lot
4th	Laurel	Pacific	22	Business		■	■			2	Commercial business lot
5th	Main	Ivy	8	Business			■			1	Commercial business lot
6th	Laurel	Pacific	15	Business		■	■			2	Commercial business lot
Stillwell	3rd	4th	3	Service				■		1	Sr. Center Lot
Stillwell	2nd	1st	8	Service		■	■			2	Counseling Center lot
Main	4th	5th	6	Business						0	Commercial business lot
Pacific	5th	6th	6	Business					■	1	Ford Repair Building Lot

NOTE: Tables 8A-B display only those parking areas that were identified as at or over capacity at one or more study intervals during the weekday or weekend study periods. Parking areas not included in these tables were not observed to be at or over capacity at any time during the study period.

Blacked cells are locations observed to be at or over 90 percent utilized during the given time interval.

TABLE 9A
Identification of Parking Areas at Capacity – Weekend (On-Street)

Street	From	To	No. Stalls	Parking Regulation	Sat 8:00 am	Sat 10:00 am	Sat 11:30 am	Sat 1:30 pm	Sat 3:00 pm	Total	Comment
On-Street Parking											
1st	Ivy	Main	3	2 Hour				■		1	Close to downtown, off Main Street
1st	Laurel	Madrona	4	None						0	Near City Hall, no parking regulation
2nd	Grove	Stillwell	6	None						0	No regulation, near residential
2nd	Stillwell	Grove	3	None						0	Near services
2nd	Main	Pacific	1	15 Minute						0	Close to downtown, off Main Street
2nd	Main	Pacific	4	2 Hour		■				1	Close to downtown, off Main Street
2nd	Pacific	Main	4	2 Hour						0	Close to downtown, off Main Street
3rd	Ivy	Main	2	None					■	1	Off Main Street, no regulation
3rd	Main	Pacific	3	1 Hour			■			1	Close to downtown, off Main Street
3rd	Pacific	Laurel	2	2 Hour					■	1	Near police station and commercial
3rd	Laurel	Pacific	2	15 Minute						0	Close to downtown, off Main Street
3rd	Madrona	Laurel	5	None						0	Used by visitors to City Hall
4th	Stillwell	Grove	4	None						0	No parking regulation, near residential.
5th	Main	Pacific	4	3 Hour						0	Close to downtown, off Main Street
5th	Pacific	Main	2	2 Hour						0	Close to downtown, off Main Street
Grove	1st	Front	2	None	■	■	■			3	Used by nearby residents.
Stillwell	1st	Front	3	None						0	Near hardware and feed store
Stillwell	3rd	4th	3	3 Hour						0	Near Senior Center and services
Ivy	Front	1st	3	2 hour						0	Near hardware and feed store
Ivy	1st	Front	3	2 Hour						0	Near hardware and feed store
Main	1st	2nd	1	1 Hour			■			1	Only one, 1-hour stall
Main	1st	2nd	2	2 Hour		■				1	Small number of stalls, centrally located
Laurel	3rd	1st	3	Commissioner						0	Reserved for use by Commissioners.
Laurel	3rd	1st	21	3 Hour						0	Used by visitors to City Hall
Laurel	2nd	3rd	2	Police	■	■	■	■	■	5	Reserved for use by police vehicles
Laurel	2nd	3rd	10	2 Hour						0	Close to City Hall
Laurel	2nd	3rd	2	15 Minute						0	Was used by police vehicles
Madrona	1st	3rd	14	Reserved						0	Reserved for use by City employees
Madrona	3rd	4th	5	None						0	Near City Hall, no parking regulation

• The "from" and "two" streets indicate direction. For example, one area is on 2nd between Grove and Stillwell, indicating an easterly direction; parking is on the south side of the street. A number of parking areas have identical "street" "from" and "to" fields. These areas are differentiated by varied parking regulations, which have been determined to affect demand.

TABLE 9B
Identification of Parking Areas at Capacity – Weekend (Off-Street)

Street	From	To	No. Stalls	Parking Regulation	Sat 8:00 am	Sat 10:00 am	Sat 11:30 am	Sat 1:30 pm	Sat 3:00 pm	Total	Comment
Off-Street Parking Lots											
1st	Stillwell	Grove	3	Private		■	■			2	Used by nearby business
2nd	Ivy	Stillwell	7	Business		■				1	NAPA Auto Parts Lot
3rd	Ivy	Stillwell	4	2 Hour Parking						0	2 Hour Parking within larger lot
4th	Laurel	Pacific	22	Business						0	Commercial business lot
5th	Main	Ivy	8	Business			■			1	Commercial business lot
6th	Laurel	Pacific	15	Business						0	Commercial business lot
Stillwell	2nd	1st	8	Service						0	Counseling Center lot
Stillwell	3rd	4th	3	Service						0	Sr. Center Lot
Main	4th	5th	6	Business				■		1	Commercial business lot
Pacific	5th	6th	6	Business				■	■	2	Ford Repair Building Lot

NOTE: Tables 9A-B display only those parking areas that were identified as at or over capacity at one or more study intervals during the weekday or weekend study periods. Parking areas not included in these tables were not observed to be at or over capacity at any time during the study period.

Blacked cells are locations observed to be at or over 90 percent utilized during the given time interval.

On Thursday, the first time interval (8:00 am) was the least utilized time, which is understandable for a district consisting of a mixture of retail shops and eateries in addition to office buildings. The highest utilization is during the mid-day. This is consistent with findings from the stakeholder interviews, that restaurants and retail in the downtown core is a draw for people during the lunch hour. During the mid-day, some parking areas remained at capacity for more than one time interval. This could indicate that people are parking long-term in the downtown area.

For weekday counts, on-street unregulated parking areas on the northeast section of the downtown core (along Laurel and Madrona Avenues, 1st, 2nd and 3rd Streets) were highly utilized. This is likely an indication of demand for the public entities in this section of town. Tillamook City Hall is located in this area, as is the Tillamook County Justice Court, the Bay City Police Department and the Tillamook County Pioneer Museum. Together these entities draw a large number of employees and visitors.

The streets just off Pacific and Main in the downtown core are also highly utilized on weekdays. This is true especially for 2nd and 3rd Avenues. With the stakeholder comments that drivers are uncomfortable parallel parking on US 101, it is understandable that these streets, still in the downtown area but on sometimes-wider streets carrying lower traffic volumes, are more attractive. This is also seen with the streets parallel to the highway, such as Ivy and Stillwell. Some drivers may be parking on these streets to access offices and retail off the highway, but others are likely parking on these parallel streets and walking to destinations along Pacific and Main.

Highly used interior lots are generally limited to those smaller parking areas used by businesses for employee or customer parking. Larger lots, such as the Tillamook County Library, the public meter lot on the east side of Ivy between 2nd and 3rd Streets, lots reserved for monthly pass holders (such as the one on the southeast corner of the Pacific/2nd intersection), and the old Ray's lot, were consistently used but not at capacity.

Far fewer parking areas reached 90 percent utilization on Saturday observation. The location of highly utilized areas is closer to the downtown core, such as 2nd Street and 3rd Streets between Main and Pacific, 1st and 3rd Streets between Ivy and Main, and 3rd Street between Pacific and Laurel. This could be an indication of drivers visiting the downtown area for shopping, dining, or errands. Again, drivers prefer to park on the side streets near but not directly on the highway.

Some parking areas, while at or over capacity, have very few stalls and with one or two parked cars meet the capacity threshold. The comment column in Tables 8A-8B provides a description of each parking area observed to be at or over capacity during the study period.

Next Steps

Feedback on current parking conditions and potential parking improvements was received at a January 2005 public workshop. This information will be used along with the findings from this study to develop a set of improvement options that will maximize the attractiveness and effectiveness of parking in the downtown study area. This work will be done in conjunction with the downtown safety plan and the truck study.

MEMO #6

Truck Travel Data Collection and Analysis

Tillamook Transportation Refinement Plan: Truck Travel Data Collection and Analysis (Memo #6)

PREPARED FOR: Valerie Grigg Devis, ODOT
Dorothy Upton, ODOT

PREPARED BY: Craig Grandstrom, CH2M HILL
Tim Burkhardt, CH2M HILL

DATE: May 21, 2005

This memorandum presents the results of the truck origin-destination study that was conducted for the Tillamook Refinement Plan in November 2004. This two-day study was conducted to understand truck patterns into, from, and through the City of Tillamook. This data is being used to create and evaluate alternatives to provide a safe traveling environment and reduce the levels of truck traffic within the City of Tillamook.

Data Collection Summary

The license plate data collection efforts were conducted over a two-day period, November 16th and 17th, 2004. Over these two days, license plate information was collected for approximately 10 hours each day (only during daylight), beginning at 7 am and ending near 4 pm. To ensure all major truck patterns were captured, data was collected at 14 locations around Tillamook. Refer to Attachment A for details on the truck count locations, the information each location provided and a map of the area with the locations identified.

On November 16th, 2004, over 2,800 license plate recordings were collected and on November 17th, 2004, over 2,400 license plate recordings were collected. These recordings were then sorted and combined to create truck "paths." For example, a truck that comes from Portland and heads south through Tillamook to the City of Newport, will be recorded first at location #3 then will travel through Tillamook and turn south on US 101 where it is recorded at location #8 and finally at location #10. Based on the camera locations, well over 100 different "paths" were analyzed. This data was then summarized to create Figures 1 through 6, which present where trucks are coming from and going to (in percentages) as a total, of through-only trips and Tillamook business-related trips.

Analysis of Results

Total Truck Traffic

After reviewing and compiling the license plate data, there were, on average, over 800 trucks that came from the north or south on US 101 and from Wilson River Highway (OR 6) that entered Tillamook during each 10 hour period. Similarly, there were also, on average, just over 800 trucks that exited Tillamook during each 10 hour period. Approximately 15 percent of the overall truck traffic uses OR 6. The percentage of truck traffic to the north and to the south of Tillamook on US 101 is almost equally distributed. Slightly more trips use US 101, south of Tillamook, which accounts for approximately 45 percent of the total truck trips, while truck traffic, north of Tillamook on US 101 accounts for approximately 40 percent of the total trips entering and exiting Tillamook.

Along the other minor truck routes - Wilson River Loop, Trask River Road and Netarts Highway - about 20 to 35 truck trips occur during each 10 hour period. For each of these minor truck routes, this equates to less than 5 percent of the overall truck traffic around Tillamook. Wilson River Loop had the highest truck traffic between these three roads as slightly more than 30 trucks in each direction were recorded during each 10 hour period. This is partially due to the Tillamook Cheese Factory use of Wilson River Loop.

Refer to Figure 2 for a schematic of the total truck patterns.

Through-Only Truck Traffic

Through-only truck traffic refers to trucks that are not stopping in or coming from Tillamook. These trucks are merely traveling through Tillamook.

Between the two major truck routes (US 101 and OR 6) a majority (66 percent) of the trucks proceeding through Tillamook are along US 101, when both directions of travel are combined. Trucks traveling on OR 6 and US 101 (either from or to OR 6) are evenly distributed between those heading to or coming from the north or the south on US 101. Each of these directions on US 101 comprised slightly over 10 percent of the total through truck traffic in Tillamook. Slightly more than 5 percent of the trucks going through Tillamook use the Latimer Road/Wilson River Loop connection between US 101 and OR 6.

Refer to Figure 1 for a schematic of the through-only truck trips.

Tillamook Business-Related Truck Traffic

Key to the truck origin-destination survey was the trucks that either come from or are going to four identified major truck generators within or surrounding Tillamook. These four businesses are the Tillamook Cheese Factory, Tillamook Lumber Company, Port of Tillamook Bay, and Averill Trucking. Refer to the map in Attachment A for each business location.

Tillamook Cheese Factory

For each 10 hour time period, there were about 120 total trucks entering or exiting the Cheese Factory. The license plate survey suggests that the distribution of trucks in and out of the factory is even: 50 percent in and 50 percent out for each 10 hour period.

Thirty-five percent of the Cheese Factory trucks are coming from or going to OR 6, with two-thirds of this traffic using the Latimer Road/Wilson River Loop connection. Slightly more Cheese Factory trucks are coming from or going to the south on US 101 then to the north on US 101 (32 percent versus 27 percent).

Refer to Figure 3 for a schematic of the Tillamook Cheese Factory truck traffic.

Tillamook Lumber Company

The Tillamook Lumber Company provides truck access on both 3rd Street and 10th Street. During each 10 hour period, the lumber company generated about 260 truck trips, with over two-thirds of the trucks using the access on 10th Street.

At 3rd Street, the majority (75 percent) of the trucks either came from or went to the north on US 101 or to/from the east on OR 6, with slightly more than 40 percent from/to the north on US 101. Similarly, at 10th Street, the majority of trucks were coming from or going to the north on US 101 or from/to the east via OR 6. Similarly, at the 10th Street access, truck traffic to/from the north on US 101 was the highest percentage with about 50 percent of the trucks from 10th Street coming from or going to those directions.

Refer to Figure 5 for a schematic of the Tillamook Lumber Company truck traffic.

Port of Tillamook Bay

The Port of Tillamook Bay generates the largest amount of truck traffic, with approximately 360 trucks during each 10 hour period. A majority of these trucks are assumed to be smaller delivery-type vehicles. Thirty percent of the total Port truck traffic was coming from or heading to the north on US 101, while 27 percent were going to/coming from the south on US 101. A little over 20 percent were coming from/heading to the east on OR 6. The truck distribution is evenly distributed between US 101 and Trask River Road to connect OR 6 and the Port of Tillamook Bay.

Refer to Figure 6 for a schematic of the Port of Tillamook Bay truck traffic.

Averill Trucking

Relative to the pervious three businesses, Averill generates the smallest amount of truck traffic in Tillamook. Approximately 65 trucks enter and exit Averill Trucking during each 10 hour period. Slightly less than half of the Averill trucks are heading to or coming from the south on US 101. Truck traffic to/from the north on US 101 and to/from the east on OR 6 is evenly distributed with about 25 percent on each highway.

Refer to Figure 4 for a schematic of the Averill Trucking truck traffic.

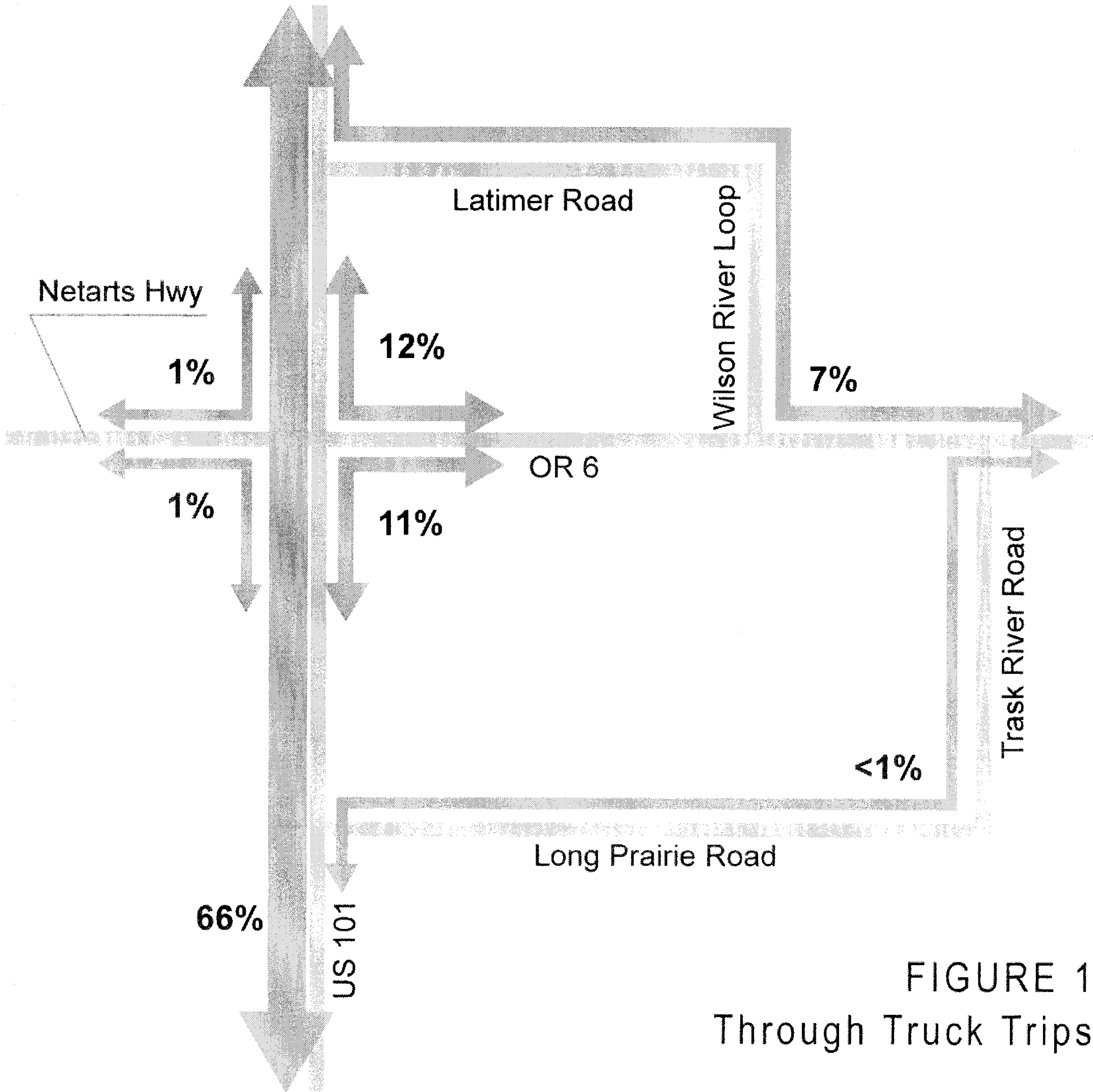

FIGURE 1
Through Truck Trips

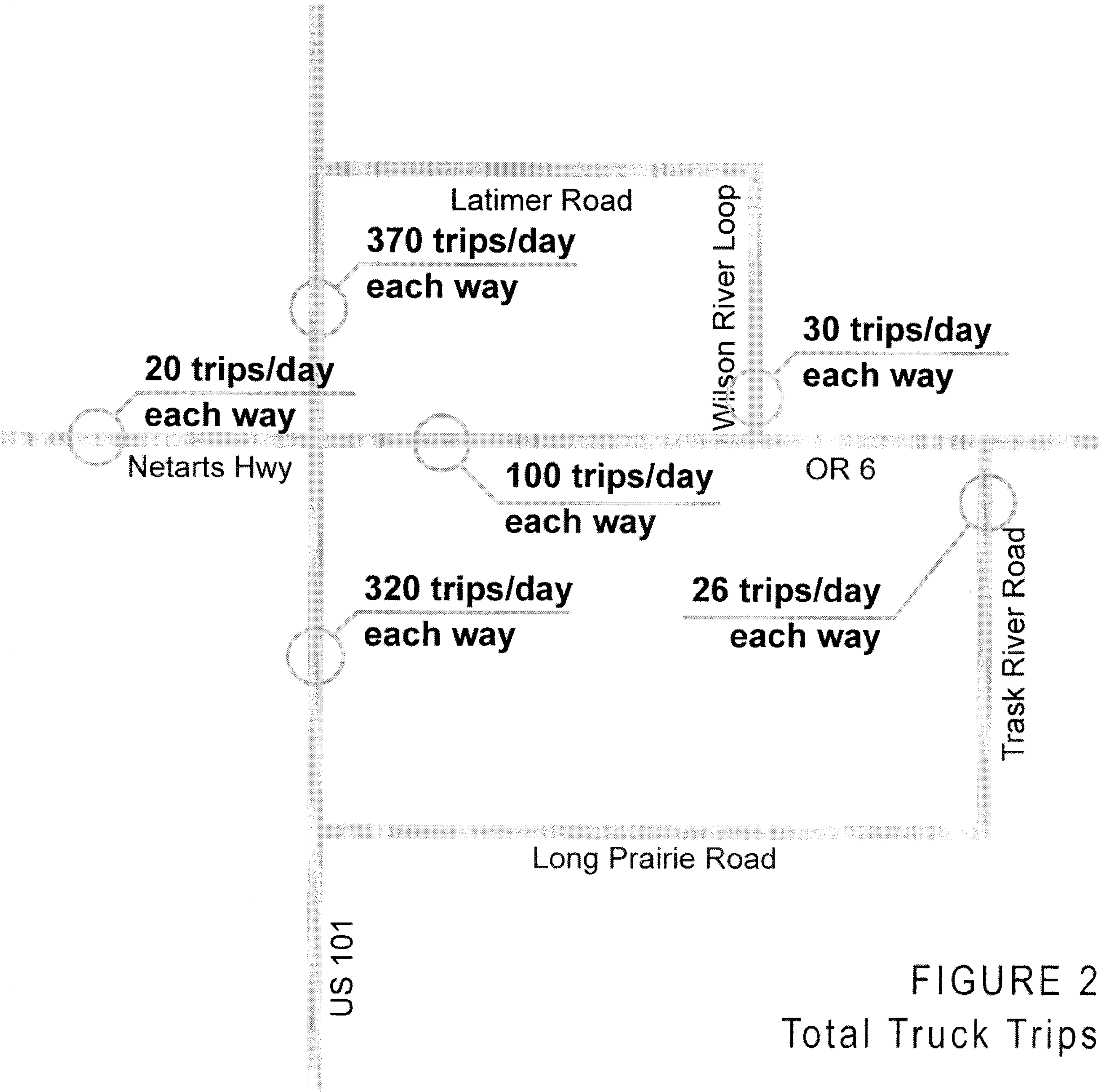

FIGURE 2
Total Truck Trips

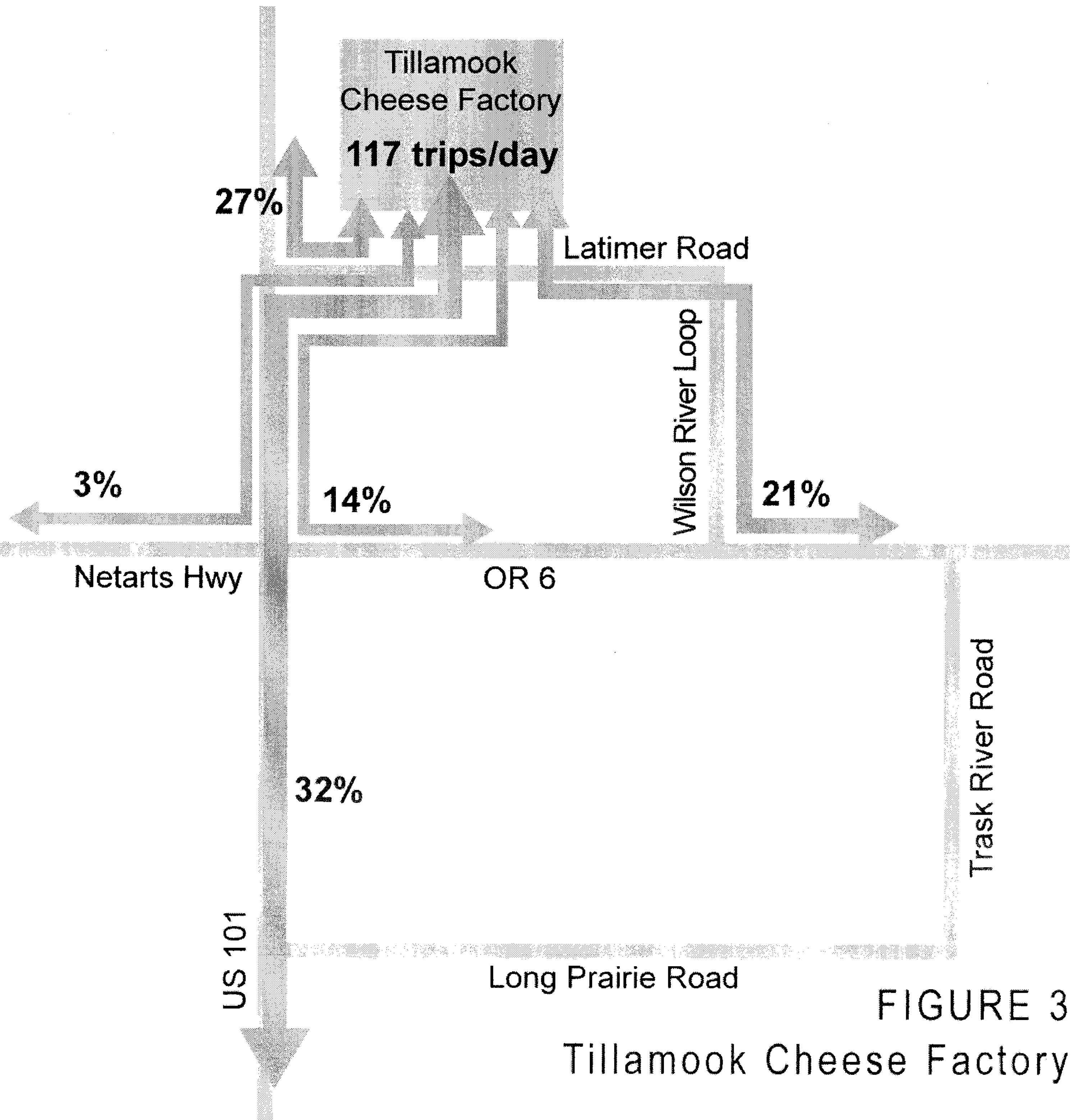

FIGURE 3
Tillamook Cheese Factory

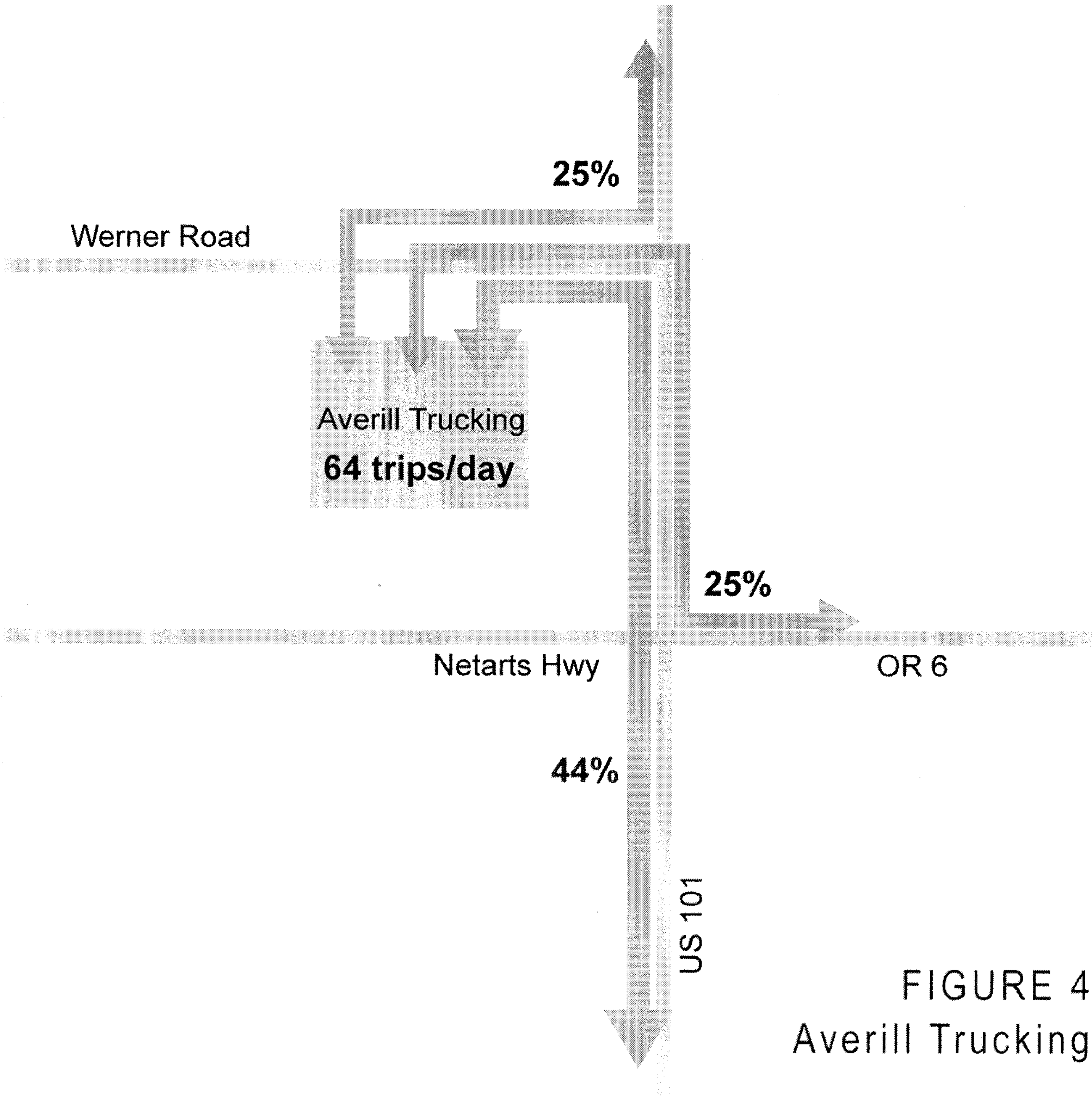

FIGURE 4
Averill Trucking

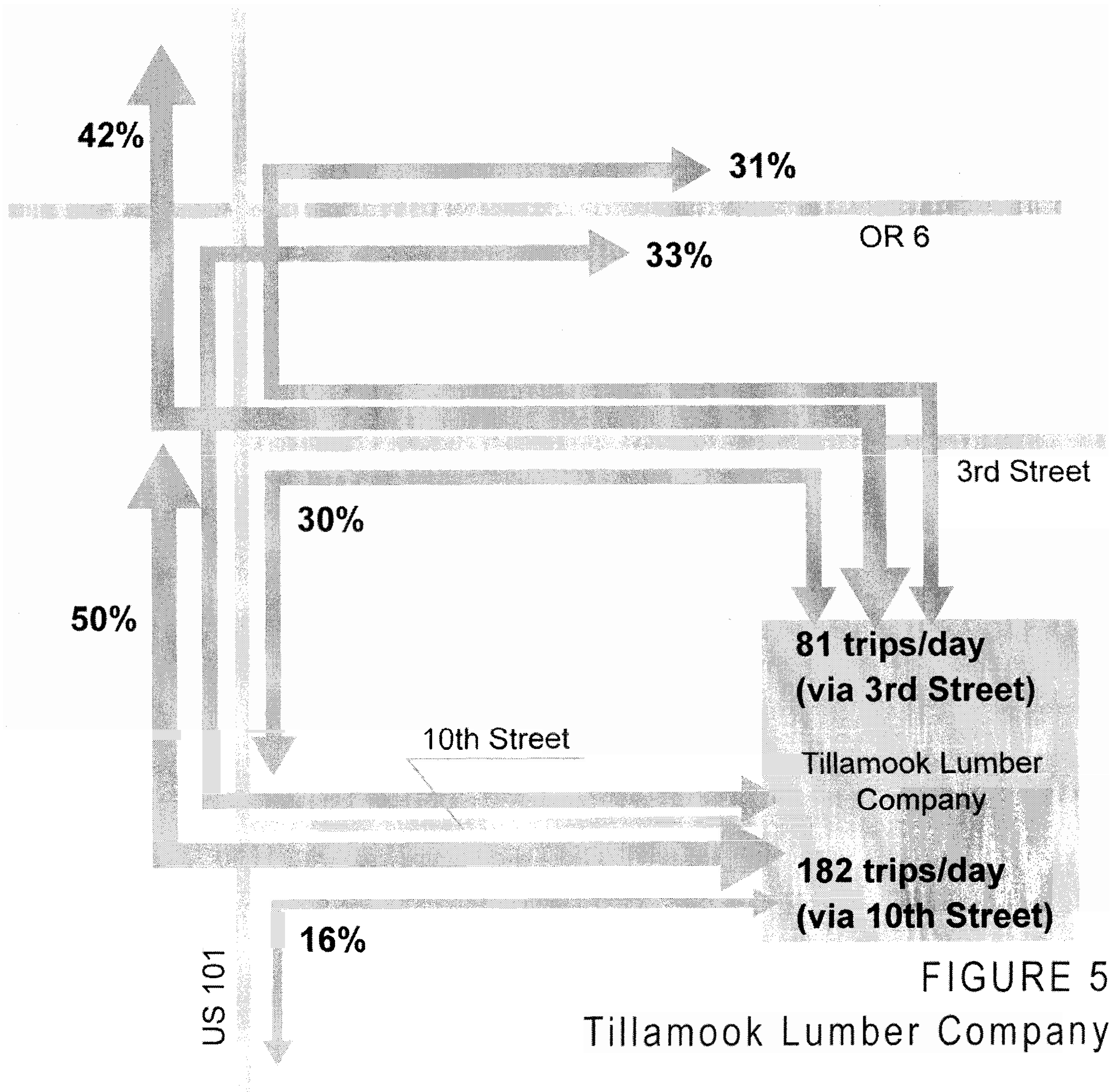

FIGURE 5
Tillamook Lumber Company

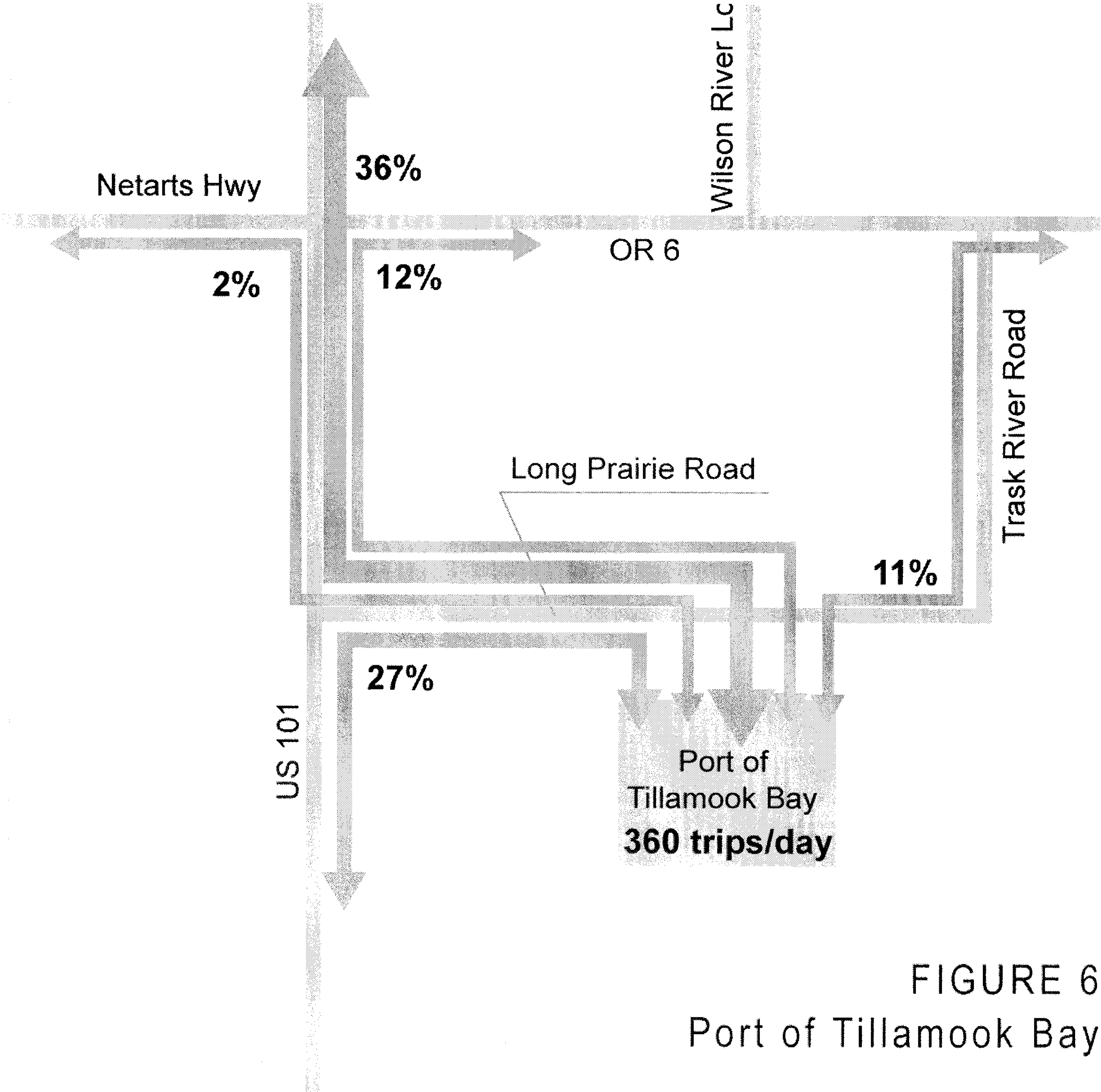

FIGURE 6
Port of Tillamook Bay

Attachment A

TECHNICAL MEMORANDUM CH2MHILL

Tillamook Refinement Plan - Data Collection - Intersection Counts and Truck Camera Locations

PREPARED FOR: Jerry Womack/Traffic Smithy
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PREPARED BY: Craig Grandstrom/CH2M HILL

DATE: October 5, 2004

This memorandum explains the detailed understanding and identification of the study's camera locations for the truck origin-destination information. We request that Traffic Smithy review this memorandum to finalize the locations, data collection and costs before proceeding into the field.

Truck Data Collection – Camera Locations

Based on recent discussions with Jerry Womack at Traffic Smithy, we are requesting cameras at 14 locations for 12 hours for two days. These two days would be consecutive days between Tuesday and Thursday of a typical week (i.e. either Tuesday and Wednesday or Wednesday and Thursday). In addition a classification of the type of truck would be recorded to understand if the vehicle is a light, medium or heavy truck (for instance we need to be able to differentiate between a creamery and log truck). We understand the data will be collected during the first week of November. At this time, we anticipate that day light (when license plates can be accurately read) will be no greater than 12 hours.

As part of the data gathered, the time the truck was recorded at each camera location would also be collected so a trip is easily decipherable as an origin or a destination since many trips will come into the city and leave the city within the 14-hours.

Based on this understanding and the conference call with Traffic Smithy last week, a map (Figure 1) is included as part of this memo to display the approaches that are critical to understanding the truck movements in the area. Below describes where each camera would be located and what information would be gathered. Table 1 provides a summary of these locations and the key data that is needed at each location.

1) Westbound Hwy 6 (Wilson River Hwy) at Olsen Road - This location needs to capture the eastbound trucks turning left onto Olsen Road to head south.

2) Westbound Hwy 6 (Wilson River Hwy) at Wilson River Loop Road - This location needs to capture the eastbound trucks turning right onto Wilson River Loop Road to head north and bypass the City.

3) Westbound Hwy 6 (Wilson River Hwy) at RR bridge - This location will be able to show the trucks heading into Tillamook from the east.

4) Eastbound Hwy 6 (Wilson River Hwy) at RR bridge - This location will be able to show the trucks heading out of Tillamook to the east.

5) Southbound US 101, south of Werner Road, camera looking north – This location will show the trucks heading southbound, from the north, along US 101 into Tillamook and any trucks turning right into Averill Trucking.

6) US 101 NB, north of Werner Road, camera looking south – This location will record the trucks heading northbound on US 101 out of Tillamook and any trucks turning left into Averill Trucking.

7) Tillamook Cheese Factory Delivery Driveway along Latimer Road, east of US 101 – This location will show the trucks heading into and out of the Tillamook Cheese Factory. Movements that need to be recorded are the left and right into and out of the factory.

8) Southbound US 101 (Main Avenue) at 3rd Street (Netarts Highway), camera looking north. Camera should be placed south of 3rd Street to record how the southbound vehicles proceed. This location needs to record the trucks that are going left, through or right at this intersection. Trucks turning left presumably are heading east on Wilson River Highway. Trucks going through this location are heading into the Mill, Port of Tillamook Bay or proceeding through the City to another location to the south. Trucks turning right are heading along Netarts Highway to the west.

9) Southbound US 101 (Main Avenue) at 3rd Street (Netarts Highway), camera looking west along 3rd Street between Main and Pacific Avenues. This location will give us information on trucks from Netarts Highway. Movements that need to be recorded are the eastbound through and eastbound right turn. If the eastbound trucks proceed through Main Avenue, they either are continuing east along Wilson River Highway and will be captured at camera location #3 or are heading north along Pacific Avenue (US 101 NB) and will also be collected at camera #5. Trucks turning right are heading either to the Mill, Port of Tillamook Bay or an unknown location south of the City using US 101 and will be captured also by cameras at those locations.

10) Southbound US 101 (Main Avenue), south of 12th Street – This camera location will capture all southbound truck movements heading out of Tillamook to either the Port or an unknown location south of the City.

11) Northbound US 101 (Pacific Avenue), south of 12th Street - This camera location will capture all northbound truck movements heading into Tillamook.

12) Tillamook Lumber Mill Driveway, east end of 10th Street - This location will give us the truck traffic entering and exiting the Mill from the west access. All trucks should proceed into and out of the Mill from 10th Street. Based on how the truck enters into the

study area either via camera location #1, 4 or 6 and how it leaves the study area either via camera location #3,5 or 7 the trip path should be definable.

13) Tillamook Lumber Mill Driveway, along 3rd Street, at railroad tracks - This location will give us the truck traffic entering and exiting the Mill from the north access. Movements that need to be recorded are the lefts and right-turns in and out of the Mill.

14) Port of Tillamook Bay Driveway, along Long Prairie Road - This location will record the truck traffic entering and exiting the Port. Movements that need to be recorded are the lefts and rights in and out of the Port.

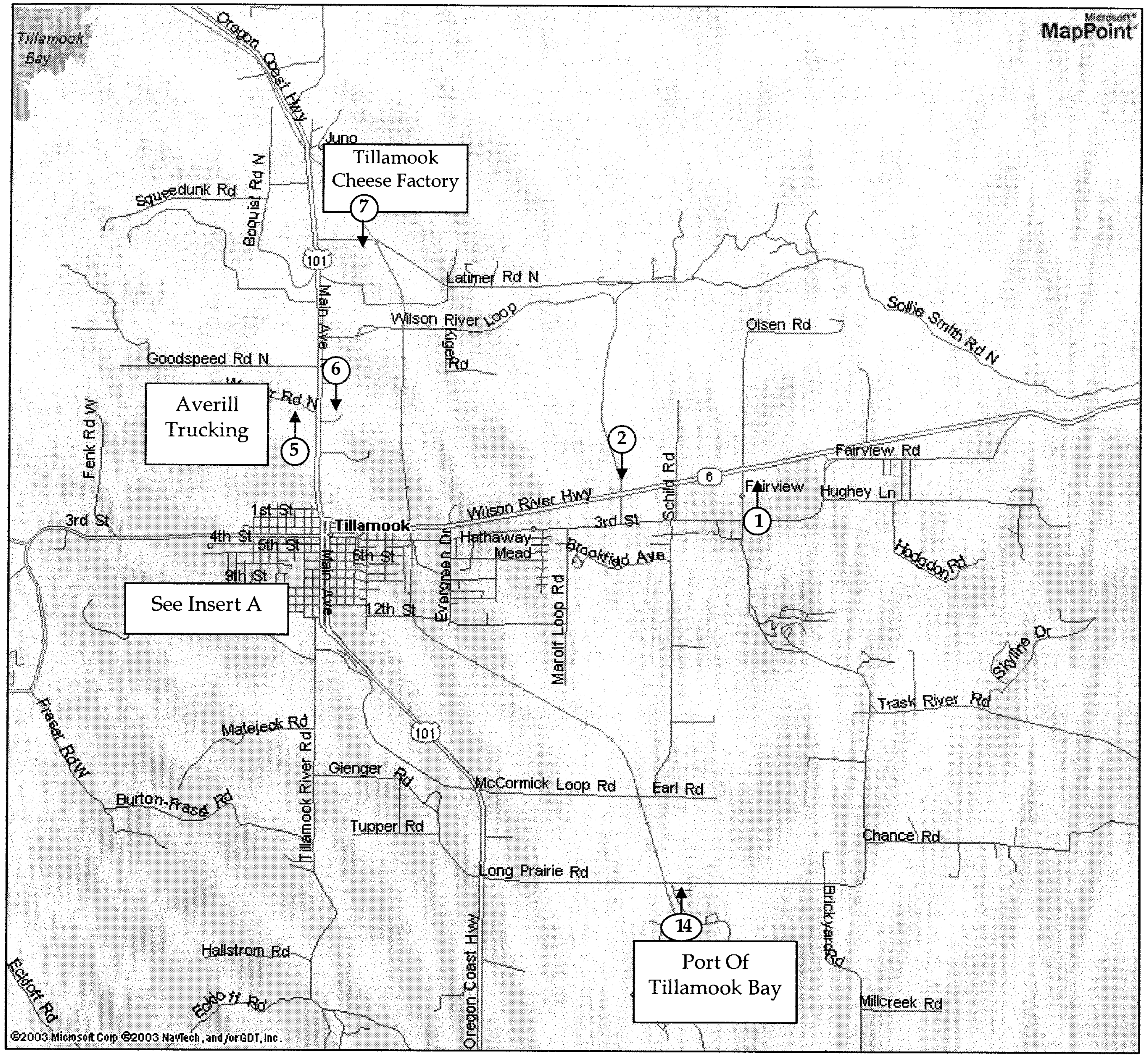
TABLE 1
Truck Camera Descriptions

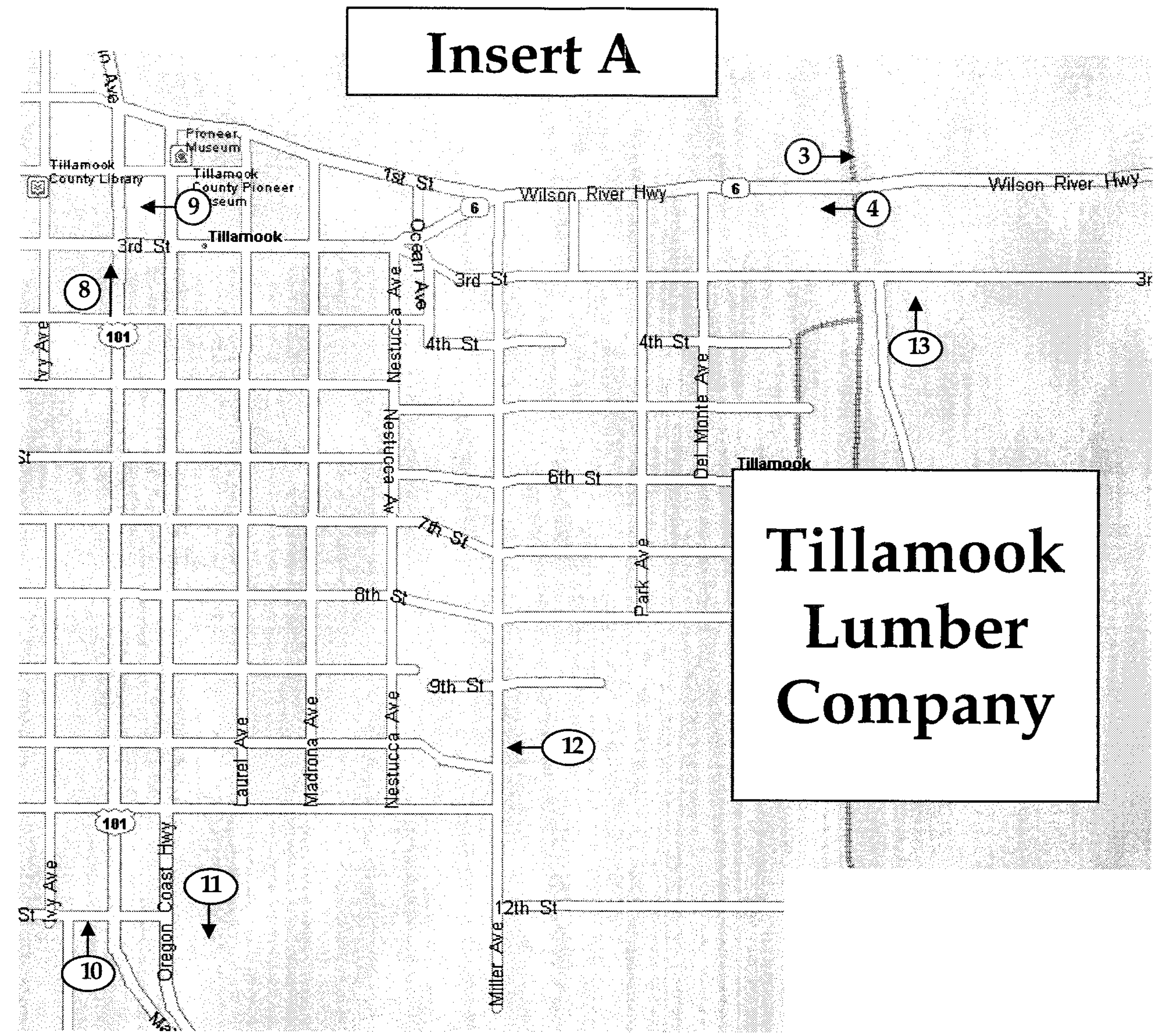
Camera Location	Observed Movements	Notes/Comments
#1 – Hwy 6 (Wilson River Hwy) at Olsen Road, camera looking north along Olsen Road	WB LT, NB RT (from Olsen Road)	Assume WB TH speeds are too fast to pick up. Will get this movement at camera #3
#2 – Hwy 6 (Wilson River Hwy) at Wilson River Loop Road, camera looking south along Wilson River Loop	WB RT, SB LT (from Wilson River Loop)	Assume WB TH speeds are too fast to pick up. Will get this movement at camera #3
#3 – Westbound Hwy 6 (Wilson River Hwy) at RR tracks	WB TH	Speeds should be slow enough (posted for 35 mph) to record license plates.
#4 – Eastbound Hwy 6 (Wilson River Hwy) at RR tracks	EB TH	Speeds should be slow enough (posted for 35 mph) to record license plates.
#5 – US 101 SB, south of Werner Road, looking north	SB TH and SB RT (Averill Trucking)	Speeds should be slow enough (posted for 35 mph) to record license plates. Need to get through trucks and trucks turning into Averill Trucking driveway.
#6 – US 101 NB, north of Werner Road, looking south	NB TH and NB LT (Averill Trucking)	Speeds should be slow enough (posted for 35 mph) to record license plates. Need to get through trucks and trucks turning into Averill Trucking driveway.
#7 – Tillamook Cheese Factory Delivery Driveway along Latimer Road, east of US 101	Entering and Exiting Trucks (SB LT, SB RT, EB LT, and WB RT)	Need to pick up all trucks entering and exiting the Cheese Factory.
#8 – US 101 at 3rd Street (Netarts Hwy.)	SB LT, SB TH and SB RT	
#9 – US 101 at 3rd Street (Netarts Hwy.)	EB TH and EB RT	
#10 – US 101 SB, south of 12th Street	SB TH	Speeds should be slow enough (posted for 35 mph) to record license plates.
#11 – US 101 NB, south of 12th Street	NB TH	Speeds should be slow enough (posted for 35 mph) to record license plates.
#12 – Tillamook Lumber Mill Driveway, east end of 10th Street	Entering and Exiting Trucks (WB TH, EB TH)	Need to record all trucks entering/exiting the Mill.
#13 – Tillamook Lumber Mill Driveway, along 3rd Street, at railroad tracks	Entering and Exiting Trucks (NB LT, NB RT, EB RT, and WB LT)	Need to record all trucks entering/exiting the Mill.
#14 – Port of Tillamook Bay Driveway, along Long Prairie Road	Entering and Exiting Trucks (NB LT, NB RT, EB RT, and WB LT)	Need to record all trucks entering and exiting the Port of Tillamook Bay

TABLE 1
Truck Camera Descriptions

Camera Location	Observed Movements	Notes/Comments

WB – Westbound, EB – Eastbound, SB – Southbound, NB – Northbound
TH – Through movement, LT – Left-turn movement, RT – Right-turn movement





NOTE: Arrows on map indicated direction camera is pointing (opposite of traffic flow).

MEMO #7A

Downtown Traffic Alternatives Analysis

TECHNICAL MEMORANDUM 7A **CH2MHILL**

Tillamook Transportation Refinement Plan: Downtown Traffic Alternatives Analysis (Memo #7A)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Craig Grandstrom, CH2M HILL
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Tim Burkhardt, CH2M HILL

COPIES: Project Management Team, Tillamook Transportation Refinement Plan

DATE: REVISED: August 19, 2005

PROJECT NUMBER: 320805.19

This memorandum defines and analyzes preliminary alternatives developed to improve traffic operations and mobility in downtown Tillamook, in particular on the state highways. These alternatives form one component of the packaged solutions to downtown safety, parking, and truck traffic concerns being developed for the Tillamook Refinement Plan.

The memo and the alternatives are divided into two parts - traditional alternatives and roundabout alternatives. The alternatives and traffic operations details are illustrated in the corresponding figures attached to this memo. Traffic operations for each alternative are summarized in the tables below.

Traditional Alternatives

Alternative 1 – Two-Way OR 6/1st Street and 3rd Street

This alternative would rechannelize the OR 6/1st Street and 3rd Street couplet, between Pacific and Miller Avenues, to provide two-way east-west travel along both streets. One through lane in each direction would be provided along both streets, which potentially could widen at intersections for turn lanes. To better balance traffic between 1st and 3rd Streets, the westbound through movement would not be allowed at Main Avenue and 1st Street. This alternative would also require modification of the Wilson River Highway and Miller Avenue intersection. This intersection could either become a signalized intersection or a roundabout.

The block of 3rd Street between Main and Pacific Avenues is 36 feet wide from curb to curb with 12-foot sidewalks. The block currently has two lanes of traffic and parking on both sides (approximate cross-section is 8-10-10-8 curb-to-curb). With Alternative 1, this block likely would be a 4-lane section that would extend a half-block in each direction for transition purposes. If a 4-lane section (that is, separate eastbound and westbound left turn lanes) is needed, which appears likely due to vehicle queuing, minimally adequate lane widths (11 feet) could be provided only by also removing 4 feet of sidewalk from each side of the street. This would provide four 11-foot lanes and 8-foot sidewalks.

This alternative could be combined with Alternative 2. The analysis of combining Alternatives 1 and 2 together is provided in Alternative 5.

Traffic Operations Comment

This alternative removes significant traffic volume along Main Avenue between 1st and 3rd Streets by routing southbound US 101 vehicles that wish to head east on Wilson River Highway onto 1st Street (instead of 3rd Street) and westbound vehicles from Wilson River Highway that wish to head south on US 101 along 3rd Street (instead of 1st Street). Because of this reduction in traffic volume, the Main Avenue intersections at 2nd and 3rd Street show noticeable V/C ratio improvements and there is a significant decrease in traffic volumes at Main Avenue and 1st Street.

This alternative will also eliminate a significant amount of truck traffic along Main Avenue between 1st and 3rd Streets. For example, trucks from US 101 SB to OR 6 EB currently travel through downtown along Main Street and turn onto 3rd Street. These trucks would now turn east on 1st Street instead. Similarly, trucks from OR 6 westbound to US 101 southbound currently travel along 1st Street and turn left to go southbound on US 101. These trips would now proceed on 3rd Street and then turn south, avoiding the downtown core. See Table 1 for traffic operational analysis results.

Alternative 2 –Pacific Avenue Northward Extension

This alternative would extend the US 101 couplet (Pacific Avenue) north of Hoquarten Bridge, connecting Pacific Avenue into US 101 just north of the slough. The predominant northbound US 101 traffic flows would occur on this new connection. Eastbound traffic from 1st Street would continue to use the existing northbound lane on US 101 at the Hoquarten Bridge. This would require a new two-lane bridge across the slough and likely would require an additional traffic signal (for northbound traffic only) where the two northbound roads come together north of the slough.

This alternative could be combined with Alternative 1. The analysis of combining Alternatives 1 and 2 together is provided in Alternative 5.

Traffic Operations Comment

The improvements with this alternative are focused on the northern portion of the downtown core. No operational benefits are expected south of 1st Street. This alternative would remove a significant portion of traffic volumes from the Main Avenue and 1st Street intersection and would rechannelize a significant portion of the westbound through movement at Pacific Avenue and 1st Street intersection to become a right turn movement which has fewer conflicts. See Table 1 for operational analysis results.

Alternative 3 – Extend the OR 6 Couplet (Main Avenue to the West)

This alternative would extend the OR 6 couplet west from Main Street to an undetermined cross-street. In other words, 3rd Street would be a one-way eastbound both east and west of the US 101 couplet. First Street would be one-way westbound both east and west of US 101.

Potential termination streets are Stillwell or Ivy Street. This alternative would result in circuitous travel along local streets to access US 101, in particular trips coming from Netarts Highway and heading north on US 101. This alternative was identified in the Tillamook TSP.

Traffic Operations Comment

While this alternative would resolve a few isolated intersection problems by creating fewer signal phases, it forces vehicles into circuitous routes through the downtown core, thereby increasing the V/C ratio at many intersections. This alternative would also shift a high amount of traffic volume onto City streets that would need to be reconstructed to accommodate the shift in travel patterns. See Table 1 for traffic operational analysis results.

Alternative 4 - Widen Hoquarten Slough Bridge

This alternative would widen the Hoquarten Slough Bridge by one lane to provide an additional northbound travel lane, resulting in two travel lanes in each direction. At the intersection of 1st Street and Main Avenue (US 101), the westbound right turn lane would be channelized to operate as a free-flowing movement. These improvements potentially require additional right-of-way to the north and east of 1st Street and Main Avenue (US 101) intersection.

Traffic Operations Comment

This alternative would rectify a current deficiency of an unbalanced number of travel lanes on US 101. This alternative would allow the eastbound left turn and westbound right turn at 1st Street and Main Avenue to have separate northbound receiving lanes on US 101, thereby improving traffic flow by minimizing vehicle conflicts. This would also allow two receiving lanes for the westbound right turn, improving the flow of traffic on northbound US 101. See Table 1 for traffic operational analysis results.

Alternative 5 – Two-Way OR 6/1st Street and 3rd Street AND Pacific Avenue Northward Extension (combination of Alts. 1 and 2)

This alternative combines the features described in Alternatives 1 and 2 to test their compatibility.

Traffic Operations Comment

This alternative would provide the greatest improvement of the traditional alternatives compared to the No-Build condition since significant traffic is routed more efficiently through the downtown core. Operations at several intersections would be expected to improve with this alternative. See Table 1 for traffic operational analysis results.

TABLE 1
Intersection Operational Analysis Comparison– No Build and Build Alternatives (2025) 30th Highest Hour

Intersection	Design Mobility Standard		No Build		Alt. 1 Two-Way OR 6/1st Street and 3rd Street		Alt. 2 Pacific Avenue Northward Extension		Alt. 3 Extend the OR 6 Couplet (Main Avenue to the West)		Alt. 4 Widen Hoquarten Slough Bridge		Alt. 5 Two-Way OR 6/1st Street and 3rd Street AND Pacific Avenue Northward Extension (combo of Alts. 1 and 2)	
Signalized	**V/C Ratio**		**V/C Ratio**		**V/C Ratio**	Delta	**V/C Ratio**	Delta	**V/C Ratio**	Delta	**V/C Ratio**	Delta	**V/C Ratio**	Delta
1st Street and Main Avenue	0.90		1.14		1.14	0	1.17	+0.03	1.42	+0.28	1.14	0	0.94	-0.20
1st Street and Pacific Avenue	0.90		0.95		0.95	0	0.92	-0.03	1.11	+0.16	0.95	0	0.94	-0.01
3rd Street and Main Avenue	0.90		1.30		1.08	-0.22	1.30	0	1.08	-0.22	1.30	0	1.08	-0.22
3rd Street and Pacific Avenue	0.90		0.88		0.92	+0.04	0.88	0	1.02	+0.14	0.88	0	0.92	+0.04
Fourth Street and Main Avenue	0.90		0.99		0.98	-0.01	0.98	-0.01	0.97	-0.02	0.98	-0.01	0.98	-0.01
Fourth Street and Pacific Avenue	0.90		0.97		0.97	0	0.98	+0.01	0.98	+0.01	0.98	+0.01	0.97	0
US 101 and Pacific Avenue	0.75		**N/A**		**N/A**	N/A	0.84	N/A	**N/A**	N/A	**N/A**	N/A	0.82	N/A
Unsignalized	**Major**	**Minor**	**Major**	**Minor**	**Major**	**Minor**	**Major**	**Minor**	**Major**	**Minor**	**Major**	**Minor**	**Major**	**Minor**
Second Street and Main Avenue	0.90	0.90	0.63	>2.0	0.41	0.46	0.63	>2.0	0.52	1.13	0.63	**>2.0**	0.41	0.46
Second Street and Pacific Avenue	0.90	0.90	0.38	0.42	0.33	0.45	0.38	0.44	0.50	1.04	0.38	0.44	0.33	0.45

Source: Synchro HCM Unsignalized and Signalized Reports. For unsignalized intersections, the V/C ratio is presented for the worst movement for each road.

US 101 from 1st Street to 10th Street is designated as a Special Transportation Area (STA). This table uses the corresponding V/C ratios where appropriate.

Underlined V/C Ratios indicate better than No-Build operations.

Numbers in shaded **BOLD** indicate higher than acceptable mobility levels.

Delta = Change compared to No Build

Roundabout Alternatives

Several alternatives were developed that could replace the existing traffic signals at 1st Street and Main Avenue and/or 1st Street and Pacific Avenue with a modern roundabout. In addition, a roundabout was tested at OR 6 and Miller Avenue, where a traffic signal is proposed as part of the Two-Way OR 6/1st and 3rd Street alternatives.

There are a number of advantages of roundabouts over traffic signals. Roundabouts provide the desired traffic control without requiring traffic to stop; thereby increase the vehicular capacity of the intersection. They can also provide excellent pedestrian safety and circulation and an aesthetically pleasing and visible "gateway" to a community. Roundabouts at either location could have adverse impacts on properties immediately adjacent to the roundabout. Although a preliminary operational assessment is conducted in this study, further analysis would be required to determine the benefits and drawbacks of a roundabout at either of these two locations.

The roundabout alternatives, which assume a roundabout in combination with selected modifications identified in the Traditional Alternatives Section, are as follows:

- Alternative R1 - Two-Way OR 6/1st Street and 3rd Street (Alternative 1 in the Traditional Alternatives Section)
- Alternative R2 - Two-Way OR 6/1st Street and 3rd Street with 2nd Northbound Lane on Hoquarten Slough Bridge (Alternative 2 in the Traditional Alternatives Section)
- Alternative R3 - 2nd Northbound Lane on Hoquarten Slough Bridge (Alternative 4 in the Traditional Alternatives Section)
- Alternative R4 - Two-Way OR 6/1st Street and 3rd Street with Pacific Avenue Extension (Alternative 5 in the Traditional Alternatives Section)

Traffic Operations Comments

Traffic operations analysis was conducted to determine how separate roundabouts or a combined roundabout would affect traffic operations at the intersections of US 101 (Main and Pacific Avenues) and OR 6 and at the intersection of OR 6 and Miller Avenue. The V/C ratio threshold for each of the intersections analyzed below is 0.90, as shown in Table 1 of the previous section. The results are described below.

Separate Roundabouts at Main and Pacific Avenues

Two separate roundabouts working in tandem at the adjacent intersections of Main Avenue and 1st Street and Pacific Avenue and 1st Street were tested for each of the alternatives outlined above as well as the future No-Build condition.

Roundabouts in these locations would need two circulating lanes due to the volume of traffic on US 101 and OR 6. The roundabouts tested have an outer diameter of 150 feet. If the roundabouts were centered on the existing intersections of Main Avenue and 1st Street and Pacific Avenue and 1st Street to reduce right of way impact, the distance of straight roadway between the roundabouts would be approximately 70 feet. This would provide a very short distance between them, indicating that the roundabouts would function as one system.

Although the Pacific Avenue and 1st Street roundabout would operate without capacity or queuing issues, the westbound queuing at Main Avenue and 1st Street would cause the tandem roundabouts to fail in all alternatives except for Alternative R4. The Main Avenue and 1st Street westbound queuing in Alternatives R1, R2, and R3 would extend into the roundabout at Pacific Avenue and 1st Street, disrupting the flow of traffic and creating an unsafe condition. Although Alternative R4 does not have the same queuing problem, vehicle queues would extend into nearby unsignalized intersections. Both roundabouts in Alternative R4 would also exceed the V/C ratio standard (0.90) with a measured V/C ratio of 0.95 at Main Avenue and 1st Street and 0.92 at Pacific Avenue and 1st Street.

Table 2 shows the operational analysis results for the roundabout at Main Avenue and 1st Street and Table 3 shows the operational analysis results for the roundabout at Pacific Avenue and 1st Street.

Combined Roundabout at Main and Pacific Avenues

The combined single roundabout analyzed refers to one large roundabout that would join together the intersections of Main Avenue and 1st Street and Pacific Avenue and 1st Street. The roundabout would be constructed between Main and Pacific Avenue along 1st Street. Various roundabout geometrics and channelization should be considered to minimize the amount of right-of-way needed. Among the alternatives would be a "peanut shaped" circulating track. This roundabout would have two circulating lanes due to the high volume of traffic on US 101 and OR 6.

The combined roundabout was tested for Alternatives R2 and R3. (Alternative R4 was not analyzed for the combined roundabout scenario because the configuration is operationally very similar to Alternative R2 and the same results are expected.) In Alternative R2, the combined roundabout functions well. None of the entering roundabout approaches are expected to create vehicle queues that extend into nearby intersections, and the measured V/C ratio (0.76) does not exceed the V/C ratio standard (0.90). In Alternative R3, vehicle queues from three approaches are expected to extend into nearby unsignalized intersections. In addition, the expected V/C ratios for Alternative R3 (0.97) exceeds the V/C ratio thresholds (0.90).

Table 4 shows the operational analysis results for a combined roundabout on 1st Street (OR 6) between Main and Pacific Avenues.

Roundabout at OR 6/Miller Street

A roundabout at OR 6 and Miller Street was tested for all of the alternatives that would require OR 6 to be a two-way roadway, which includes Alternatives R1, R2, and R4. The roundabout tested at this intersection has one circulating lane and an outer diameter of 130 feet. The results are the same for each alternative, because the variations in the three alternatives do not affect the traffic volumes or channelization at OR 6 and Miller Street. For each of the Alternatives R1, R2, and R4, none of the vehicle queues are expected to extend into nearby intersections, and the measured V/C ratio (0.59) is less than the V/C ratio threshold of 0.90.

TABLE 2
Main Ave and 1st St Roundabout Channelization and Queues

	Future No-Build			Alt R1 – Two-Way OR 6/1st Street and 3rd Street			Alt R2 – Two-Way OR 6/1st Street and 3rd Street with 2nd Northbound Lane on Hoquarten Slough Bridge			Alt R3 – 2nd Northbound Lane on Hoquarten Slough Bridge			Alt R4 – Two-Way OR 6/1st Street and 3rd Street with Pacific Avenue Extension		
Approach	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**
Eastbound Entering	2	**725**	**1.11**	1	170	0.73	1	180	0.74	2	**720**	**1.10**	1	**390**	**0.95**
Westbound Exiting	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A
Northbound Entering	0	N/A	N/A	0	N/A	N/A	0	N/A	N/A	0	N/A	N/A	0	N/A	N/A
Southbound Exiting	2	N/A	N/A	2	N/A	N/A	2	N/A	N/A	2	N/A	N/A	2	N/A	N/A
Westbound Entering	2	**4170**	**1.36**	2	**4362**	**1.39**	2	**260**	0.77	2	**930**	**1.01**	2	10	0.05
Eastbound Exiting	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A
Southbound Entering	2	**545**	**0.93**	2	100	0.56	2	120	0.57	2	**690**	**0.97**	2	170	0.58
Northbound Exiting	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A
Overall Circulating Lanes and V/C	2	N/A	**1.36**	2	N/A	**1.39**	2	N/A	0.77	2	N/A	**1.10**	2	N/A	**0.95**

Numbers in shaded **BOLD** indicate higher than acceptable mobility levels or a vehicle queue that will extend into an upstream intersection.

See Appendix B for the aaSIDRA 2.1 roundabout analysis output.

TABLE 3
Pacific Ave and 1st St Roundabout Channelization and Queues

	Future No-Build			Alt R1 – Two-Way OR 6/1st Street and 3rd Street			Alt R2 – Two-Way OR 6/1st Street and 3rd Street with 2nd Northbound Lane on Hoquarten Slough Bridge			Alt R3 – 2nd Northbound Lane on Hoquarten Slough Bridge			Alt R4 – Two-Way OR 6/1st Street and 3rd Street with Pacific Avenue Extension		
Approach	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**
Eastbound Entering	0	N/A	N/A	1	60	0.27	1	60	0.27	0	N/A	N/A	1	0	0.26
Westbound Exiting	2	N/A	N/A	1	N/A	N/A	1	N/A	N/A	2	N/A	N/A	1	N/A	N/A
Northbound Entering	2	0	0.39	2	120	0.52	2	120	0.52	2	0	0.39	2	110	0.52
Southbound Exiting	0	N/A	N/A	0	N/A	N/A	0	N/A	N/A	0	N/A	N/A	0	N/A	N/A
Westbound Entering	2	120	0.57	1	200	0.79	1	200	0.79	2	120	0.57	1	**340**	**0.92**
Eastbound Exiting	0	N/A	N/A	1	N/A	N/A	1	N/A	N/A	0	N/A	N/A	1	N/A	N/A
Southbound Entering	1	10	0.05	1	10	0.06	1	10	0.06	1	10	0.05	0	N/A	N/A
Northbound Exiting	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	1	N/A	N/A	2	N/A	N/A
Overall Circulating Lanes and V/C	2	N/A	0.57	2	N/A	0.79	2	N/A	0.79	2	N/A	0.57	2	N/A	**0.92**

Numbers in shaded **BOLD** indicate higher than acceptable mobility levels or a vehicle queue that will extend into an upstream intersection.

See Appendix C for the aaSIDRA 2.1 roundabout analysis output.

TABLE 4
Pacific Ave/Main Ave and 1st St Combined Roundabout Channelization and Queues

	Future No-Build			Alt R1 – Two-Way OR 6/1st Street and 3rd Street			Alt R2 – Two-Way OR 6/1st Street and 3rd Street with 2nd Northbound Lane on Hoquarten Slough Bridge			Alt R3 – 2nd Northbound Lane on Hoquarten Slough Bridge			Alt R4 – Two-Way OR 6/1st Street and 3rd Street with Pacific Avenue Extension		
Approach	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**
Eastbound Entering	Roundabout not analyzed for this alternative			Roundabout not analyzed for this alternative			2	100	0.50	2	**290**	0.86	Roundabout not analyzed for this alternative; operational results would be similar to Alternative R2.		
Westbound Exiting							1	N/A	N/A	1	N/A	N/A			
Northbound Entering							0	N/A	N/A	0	N/A	N/A			
Southbound Exiting							2	N/A	N/A	2	N/A	N/A			
Northwest bound Entering							2	300	0.76	2	170	0.63			
Southeast bound Existing							0	N/A	N/A	0	N/A	N/A			
Westbound Entering							2	165	0.61	2	**420**	**0.94**			
Eastbound Exiting							1	N/A	N/A	0	N/A	N/A			
Southbound Entering							2	170	0.57	2	**660**	**0.97**			
Northbound Exiting							2	N/A	N/A	2	N/A	N/A			
Overall Circulating Lanes and V/C							2	N/A	0.76	2	N/A	**0.97**			

Numbers in shaded **BOLD** indicate higher than acceptable mobility levels or a vehicle queue that will extend into an upstream intersection.

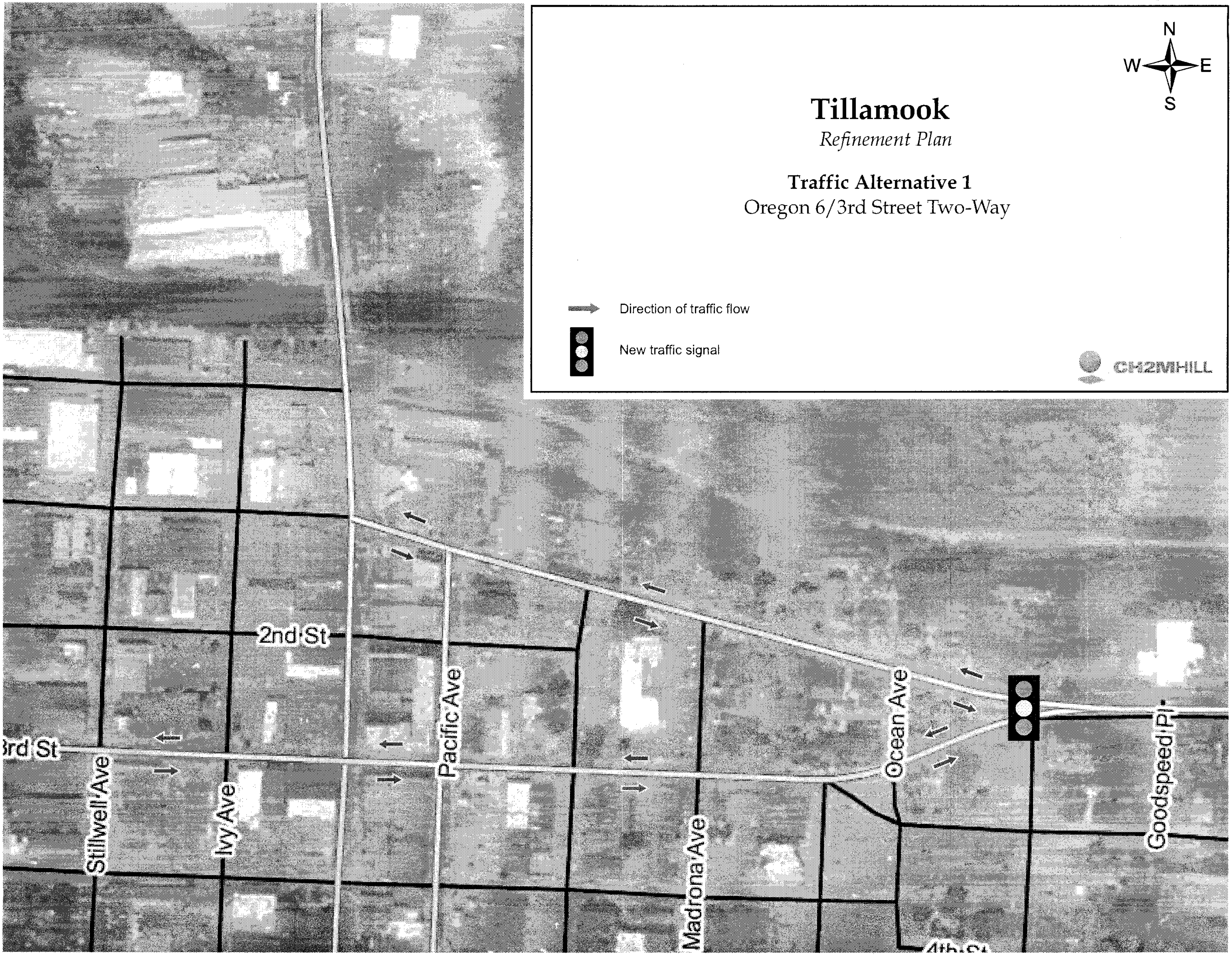
See Appendix D for the aaSIDRA 2.1 roundabout analysis output.

TABLE 5
OR 6 and Miller Ave Roundabout Channelization and Queues

	Future No-Build			**Alt R1 – Two-Way OR 6/1st Street and 3rd Street**			**Alt R2 – Two-Way OR 6/1st Street and 3rd Street with 2nd Northbound Lane on Hoquarten Slough Bridge**			**Alt R3 – 2nd Northbound Lane on Hoquarten Slough Bridge**			**Alt R4 – Two-Way OR 6/1st Street and 3rd Street with Pacific Avenue Extension**		
Approach	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**	**Lanes**	**95th Queue**	**V/C**
Eastbound Entering				1	100	0.45									
Westbound Exiting				1	N/A	N/A									
Northeast bound Entering				1	105	0.44									
Southwest bound Exiting				1	N/A	N/A									
Northbound Entering		Roundabout not needed for this alternative		1	10	0.03		Same as Alt R1			Roundabout not needed for this alternative			Same as Alt R1	
Southbound Exiting				1	N/A	N/A									
Westbound Entering				1	200	0.59									
Eastbound Exiting				1	N/A	N/A									
Overall Circulating Lanes and V/C				1	N/A	0.59									

Numbers in shaded BOLD indicate higher than acceptable mobility levels or a vehicle queue that will extend into an upstream intersection.

See Appendix E for the aaSIDRA 2.1 roundabout analysis output.



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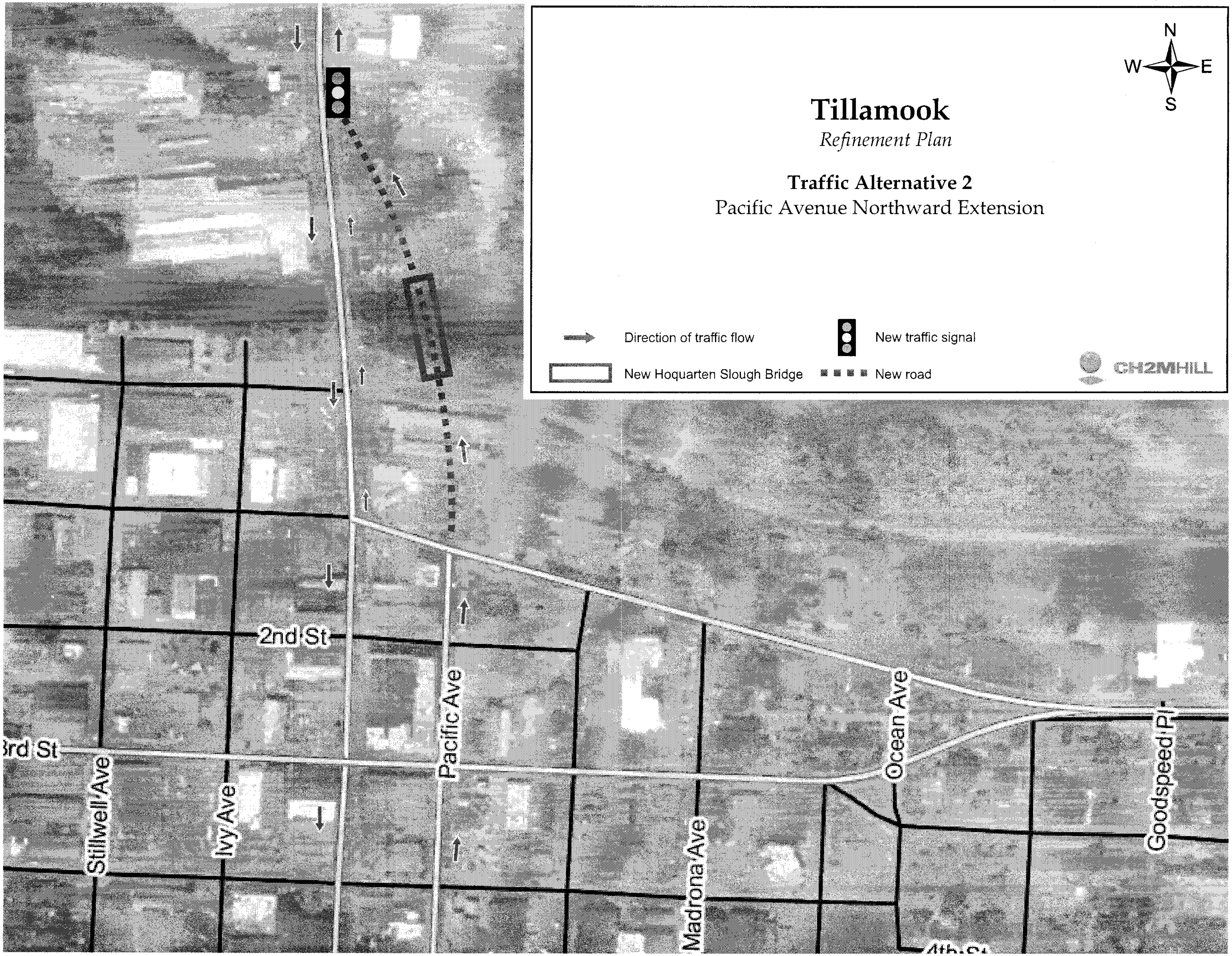

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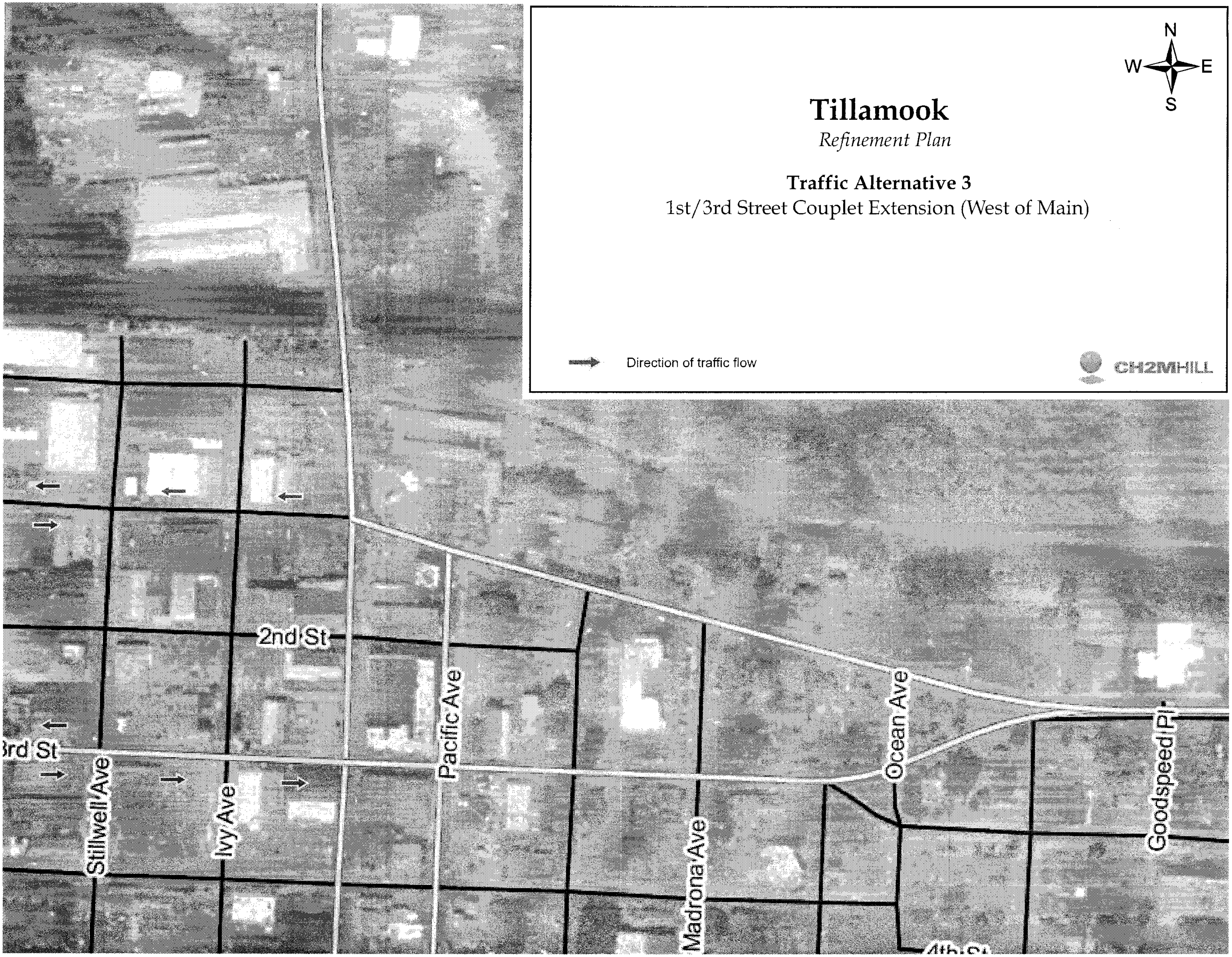
Tillamook

Refinement Plan

Traffic Alternative 3

1st/3rd Street Couplet Extension (West of Main)



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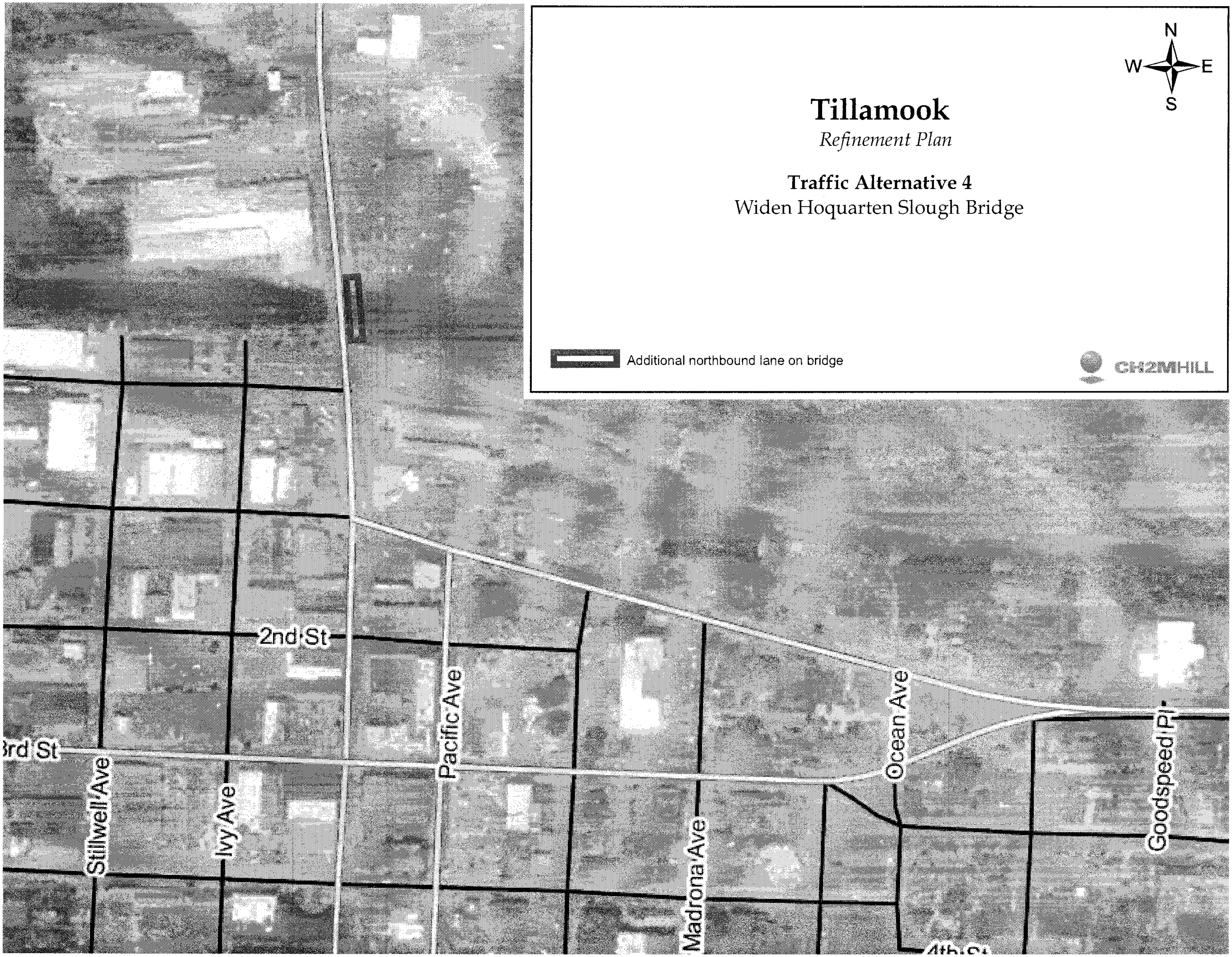
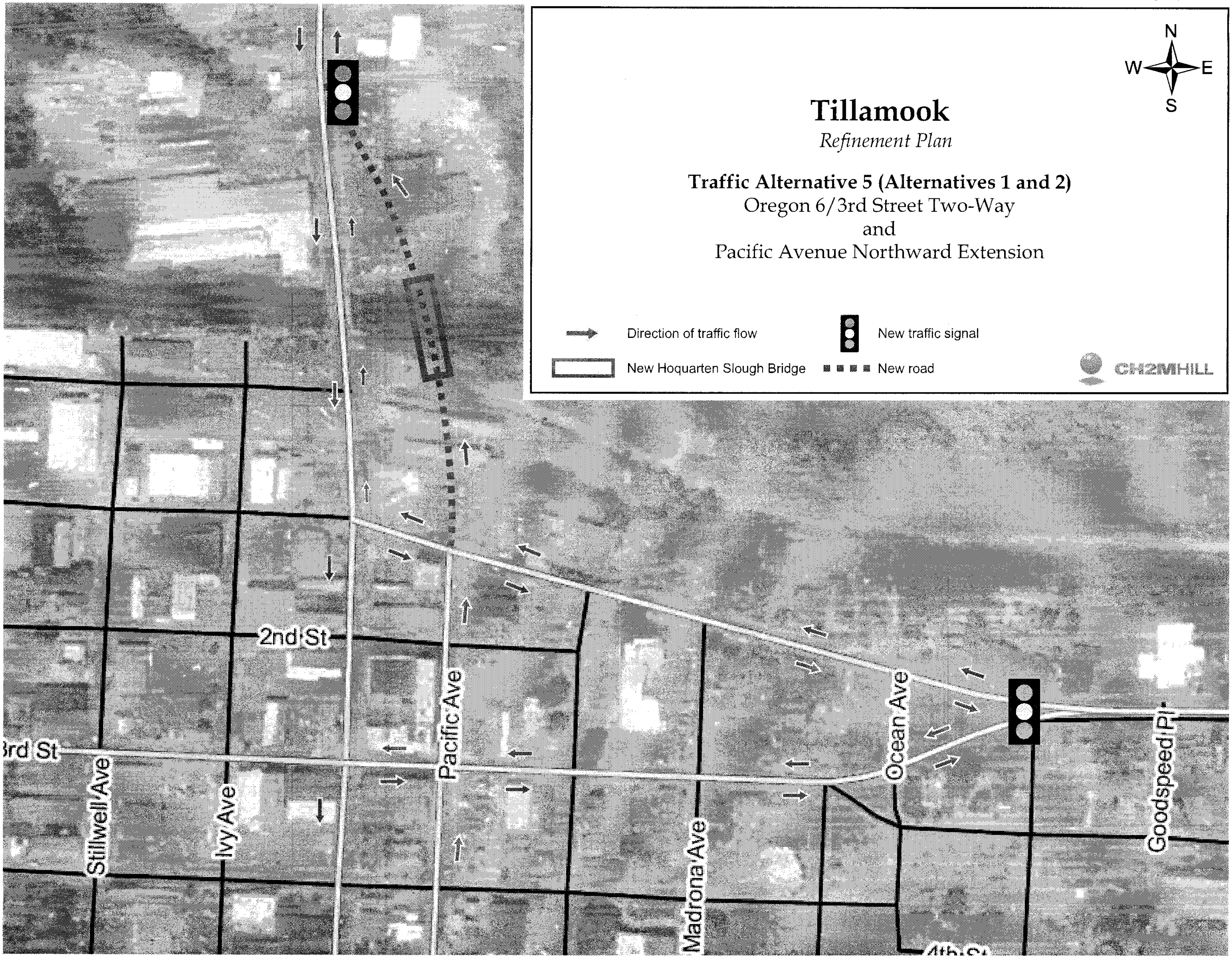


Tillamook

Refinement Plan

Traffic Alternative 4

Widen Hoquarten Slough Bridge


Tillamook
Refinement Plan
Traffic Alternative 5 (Alternatives 1 and 2)
Oregon 6/3rd Street Two-Way
and
Pacific Avenue Northward Extension
N
W
E
S
Direction of traffic flow
New traffic signal
New Hoquarten Slough Bridge
New road
CH2MHILL
2nd St
3rd St
Stillwell Ave
Ivy Ave
Pacific Ave
Madrona Ave
Ocean Ave
Goodspeed Pl
4th St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰		↱					↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0		4.0					4.0	
Lane Util. Factor	1.00	1.00		1.00		1.00					0.95	
Frpb, ped/bikes	1.00	0.98		1.00		1.00					1.00	
Flpb, ped/bikes	1.00	1.00		0.99		1.00					1.00	
Frt	1.00	0.89		1.00		0.85					0.99	
Flt Protected	0.95	1.00		0.95		1.00					0.99	
Satd. Flow (prot)	1580	1561		1815		1443					3184	
Flt Permitted	0.95	1.00		0.69		1.00					0.99	
Satd. Flow (perm)	1580	1561		1309		1443					3184	
Volume (vph)	375	25	70	10	0	1560	0	0	0	395	1230	105
Peak-hour factor, PHF	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	441	29	82	11	0	1642	0	0	0	416	1295	111
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	6	0
Lane Group Flow (vph)	441	92	0	11	0	1642	0	0	0	0	1816	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type	Perm			D.Pm		custom				Split		
Protected Phases		4				4 6				6	6	
Permitted Phases	4			4								
Actuated Green, G (s)	32.0	32.0		32.0		80.0					40.0	
Effective Green, g (s)	32.0	32.0		32.0		80.0					40.0	
Actuated g/C Ratio	0.40	0.40		0.40		1.00					0.50	
Clearance Time (s)	4.0	4.0		4.0							4.0	
Vehicle Extension (s)	0.2	0.2		0.2							0.2	
Lane Grp Cap (vph)	632	624		524		1443					1592	
v/s Ratio Prot		0.06				c1.14					0.57	
v/s Ratio Perm	0.28			0.01								
v/c Ratio	0.70	0.15		0.02		1.14					1.14	
Uniform Delay, d1	20.0	15.3		14.5		40.0					20.0	
Progression Factor	1.00	1.00		0.82		1.00					1.00	
Incremental Delay, d2	2.7	0.0		0.0		65.5					71.4	
Delay (s)	22.7	15.3		11.9		105.5					91.4	
Level of Service	C	B		B		F					F	
Approach Delay (s)		21.2			104.8			0.0			91.4	
Approach LOS		C			F			A			F	

Intersection Summary			
HCM Average Control Delay	87.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	130.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑			↑↱		↰	↰↑↱		↰		↱
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lane Util. Factor		1.00			1.00		0.95	0.95		1.00		1.00
Frt		1.00			1.00		1.00	1.00		1.00		0.85
Flt Protected		1.00			1.00		0.95	0.96		0.95		1.00
Satd. Flow (prot)		1799			1450		1227	1231		1710		1530
Flt Permitted		0.99			1.00		0.95	0.96		0.26		1.00
Satd. Flow (perm)		1791			1450		1227	1231		462		1530
Volume (vph)	5	415	0	0	530	20	1025	30	10	5	0	15
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	5	437	0	0	558	21	1079	32	11	5	0	16
RTOR Reduction (vph)	0	0	0	0	2	0	0	1	0	0	0	8
Lane Group Flow (vph)	0	442	0	0	577	0	557	564	0	5	0	8
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type	Perm						Split			D.Pm		custom
Protected Phases		4			4		2	2				
Permitted Phases	4									2		2
Actuated Green, G (s)		33.0			33.0		39.0	39.0		39.0		39.0
Effective Green, g (s)		33.0			33.0		39.0	39.0		39.0		39.0
Actuated g/C Ratio		0.41			0.41		0.49	0.49		0.49		0.49
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Vehicle Extension (s)		5.2			5.2		5.2	5.2		5.2		5.2
Lane Grp Cap (vph)		739			598		598	600		225		746
v/s Ratio Prot					c0.40		0.45	c0.46				
v/s Ratio Perm		0.25								0.01		0.01
v/c Ratio		0.60			0.97		0.93	0.94		0.02		0.01
Uniform Delay, d1		18.3			22.9		19.2	19.4		10.6		10.6
Progression Factor		0.64			1.00		0.50	0.50		1.00		1.00
Incremental Delay, d2		0.2			28.5		12.7	13.7		0.2		0.0
Delay (s)		11.9			51.5		22.4	23.4		10.8		10.6
Level of Service		B			D		C	C		B		B
Approach Delay (s)		11.9			51.5			22.9			10.6	
Approach LOS		B			D			C			B	

Intersection Summary			
HCM Average Control Delay	28.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1358		1710	1800						2669	
Flt Permitted		1.00		0.17	1.00						1.00	
Satd. Flow (perm)		1358		302	1800						2669	
Volume (vph)	0	380	90	260	285	0	0	0	0	15	1065	235
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	400	95	274	300	0	0	0	0	16	1121	247
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	23	0
Lane Group Flow (vph)	0	484	0	274	300	0	0	0	0	0	1361	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type				pm+pt						Perm		
Protected Phases		4		3	8						6	
Permitted Phases		4		8						6	6	
Actuated Green, G (s)		23.0		36.0	36.0						36.0	
Effective Green, g (s)		23.0		36.0	36.0						36.0	
Actuated g/C Ratio		0.29		0.45	0.45						0.45	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		3.0	3.0						0.2	
Lane Grp Cap (vph)		390		294	810						1201	
v/s Ratio Prot		c0.36		c0.10	0.17							
v/s Ratio Perm				0.31							0.51	
v/c Ratio		1.24		0.93	0.37						1.13	
Uniform Delay, d1		28.5		29.4	14.5						22.0	
Progression Factor		1.00		0.49	0.93						0.67	
Incremental Delay, d2		128.8		13.4	0.1						63.2	
Delay (s)		157.3		27.7	13.5						78.0	
Level of Service		F		C	B						E	
Approach Delay (s)		157.3			20.3			0.0			78.0	
Approach LOS		F			C			A			E	

Intersection Summary			
HCM Average Control Delay	80.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	131.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.99			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1424	1400			1787			2651				
Flt Permitted	0.20	1.00			1.00			0.99				
Satd. Flow (perm)	297	1400			1787			2651				
Volume (vph)	230	165	0	0	360	20	185	830	215	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	242	174	0	0	379	21	195	874	226	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	23	0	0	0	0
Lane Group Flow (vph)	242	174	0	0	398	0	0	1273	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	pm+pt						Perm					
Protected Phases	7	4			8			2				
Permitted Phases	4	4					2	2				
Actuated Green, G (s)	32.0	32.0			18.0			40.0				
Effective Green, g (s)	32.0	32.0			18.0			40.0				
Actuated g/C Ratio	0.40	0.40			0.22			0.50				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	3.0	0.2			3.0			0.2				
Lane Grp Cap (vph)	260	560			402			1326				
v/s Ratio Prot	c0.12	0.12			0.22							
v/s Ratio Perm	c0.26							0.48				
v/c Ratio	0.93	0.31			0.99			0.96				
Uniform Delay, d1	29.4	16.4			30.9			19.2				
Progression Factor	0.38	0.08			1.00			0.52				
Incremental Delay, d2	6.2	0.0			41.6			10.2				
Delay (s)	17.4	1.4			72.5			20.3				
Level of Service	B	A			E			C				
Approach Delay (s)		10.7			72.5			20.3			0.0	
Approach LOS		B			E			C			A	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	131.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑>		↰	↑						<↑↑>	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.37	1.00						1.00	
Satd. Flow (perm)		1435		636	1943						2957	
Volume (vph)	0	195	125	205	275	0	0	0	0	115	1250	50
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	229	147	241	324	0	0	0	0	121	1316	53
RTOR Reduction (vph)	0	21	0	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	355	0	241	324	0	0	0	0	0	1487	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		29.8		29.8	29.8						42.2	
Effective Green, g (s)		29.8		29.8	29.8						42.2	
Actuated g/C Ratio		0.37		0.37	0.37						0.53	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		535		237	724						1560	
v/s Ratio Prot		0.25			0.17							
v/s Ratio Perm				c0.38							0.50	
v/c Ratio		0.66		1.02	0.45						0.95	
Uniform Delay, d1		20.9		25.1	18.9						18.0	
Progression Factor		1.00		0.55	0.56						0.34	
Incremental Delay, d2		2.4		42.8	0.1						1.9	
Delay (s)		23.3		56.6	10.7						8.0	
Level of Service		C		E	B						A	
Approach Delay (s)		23.3			30.2			0.0			8.0	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	128.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1457			2970				
Flt Permitted	0.21	1.00			1.00			1.00				
Satd. Flow (perm)	375	1800			1457			2970				
Volume (vph)	145	165	0	0	375	100	105	990	75	0	0	0
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	171	194	0	0	441	118	111	1042	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	6	0	0	0	0
Lane Group Flow (vph)	171	194	0	0	546	0	0	1226	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	32.3	32.3			32.3			39.7				
Effective Green, g (s)	32.3	32.3			32.3			39.7				
Actuated g/C Ratio	0.40	0.40			0.40			0.50				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	151	727			588			1474				
v/s Ratio Prot		0.11			0.37							
v/s Ratio Perm	c0.46							0.41				
v/c Ratio	1.13	0.27			0.93			0.83				
Uniform Delay, d1	23.8	15.9			22.7			17.3				
Progression Factor	0.63	0.61			1.00			1.00				
Incremental Delay, d2	99.5	0.0			20.7			5.6				
Delay (s)	114.6	9.8			43.4			22.9				
Level of Service	F	A			D			C				
Approach Delay (s)		58.9			43.4			22.9			0.0	
Approach LOS		E			D			C			A	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	128.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	40	70	40	30	0	0	0	0	45	1205	65
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	47	82	47	35	0	0	0	0	47	1268	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.54	0.54	0.54	0.54	0.54		0.54					
vC, conflicting volume	1415	1397	668	835	1432	0	1337			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	908	875	0	0	939	0	762			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	68	86	86	74	100	100			97		
cM capacity (veh/h)	96	147	577	348	138	1091	460			1607		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	82	682	703
Volume Left	0	47	47	0
Volume Right	82	0	0	68
cSH	280	211	1607	1700
Volume to Capacity	0.46	0.39	0.03	0.41
Queue Length 95th (ft)	58	43	2	0
Control Delay (s)	28.5	32.6	0.8	0.0
Lane LOS	D	D	A	
Approach Delay (s)	28.5	32.6	0.4	
Approach LOS	D	D		

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↱			↰↱				
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	40	0	0	20	20	50	990	30	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	47	0	0	24	24	53	1042	32	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked												
vC, conflicting volume	662	1179	0	1187	1163	537	0			1074		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	662	1179	0	1187	1163	537	0			1074		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	82	74	100	100	88	95	97			100		
cM capacity (veh/h)	287	179	1075	114	190	494	1593			657		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	100	47	574	553
Volume Left	53	0	53	0
Volume Right	0	24	0	32
cSH	223	274	1593	1700
Volume to Capacity	0.45	0.17	0.03	0.33
Queue Length 95th (ft)	53	15	3	0
Control Delay (s)	33.6	20.8	1.0	0.0
Lane LOS	D	C	A	
Approach Delay (s)	33.6	20.8	0.5	
Approach LOS	D	C		

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	55	70	55	55	0	0	0	0	80	1450	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	65	82	65	65	0	0	0	0	84	1526	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1753	1721	789	1046	1747	0	1579			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1753	1721	789	1046	1747	0	1579			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	20	75	0	17	100	100			95		
cM capacity (veh/h)	16	81	327	44	78	1075	399			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	147	129	847	816
Volume Left	0	65	84	0
Volume Right	82	0	0	53
cSH	140	56	1600	1700
Volume to Capacity	1.05	2.30	0.05	0.48
Queue Length 95th (ft)	197	323	4	0
Control Delay (s)	152.2	752.9	1.4	0.0
Lane LOS	F	F	A	
Approach Delay (s)	152.2	752.9	0.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	62.4		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	65	75	0	0	65	55	50	1055	45	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	76	88	0	0	76	65	53	1111	47	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	763	1263	0	1284	1239	579	0			1158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	763	1263	0	1284	1239	579	0			1158		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	41	42	100	100	46	84	97			100		
cM capacity (veh/h)	130	151	1056	53	141	407	1593			611		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	165	141	608	603
Volume Left	76	0	53	0
Volume Right	0	65	0	47
cSH	141	201	1593	1700
Volume to Capacity	1.17	0.70	0.03	0.35
Queue Length 95th (ft)	237	111	3	0
Control Delay (s)	190.6	56.4	1.0	0.0
Lane LOS	F	F	A	
Approach Delay (s)	190.6	56.4	0.5	
Approach LOS	F	F		

Intersection Summary			
Average Delay	26.3		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0		4.0	4.0	4.0						4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00						0.95	
Frpb, ped/bikes	1.00		0.98	1.00	1.00						1.00	
Flpb, ped/bikes	1.00		1.00	0.99	1.00						1.00	
Frt	1.00		0.85	1.00	1.00						0.99	
Flt Protected	0.95		1.00	0.95	1.00						1.00	
Satd. Flow (prot)	1580		1585	1815	1636						3221	
Flt Permitted	0.56		1.00	0.95	1.00						1.00	
Satd. Flow (perm)	929		1585	1815	1636						3221	
Volume (vph)	375	0	95	325	225	5	0	0	0	0	1625	105
Peak-hour factor, PHF	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	441	0	112	342	237	5	0	0	0	0	1711	111
RTOR Reduction (vph)	0	0	4	4	1	0	0	0	0	0	7	0
Lane Group Flow (vph)	441	0	108	338	241	0	0	0	0	0	1815	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type	D.Pm		custom	Perm								
Protected Phases					4						6	
Permitted Phases	4		4	4								
Actuated Green, G (s)	29.0		29.0	29.0	29.0						33.0	
Effective Green, g (s)	29.0		29.0	29.0	29.0						33.0	
Actuated g/C Ratio	0.41		0.41	0.41	0.41						0.47	
Clearance Time (s)	4.0		4.0	4.0	4.0						4.0	
Vehicle Extension (s)	0.2		0.2	0.2	0.2						0.2	
Lane Grp Cap (vph)	385		657	752	678						1518	
v/s Ratio Prot					0.15						c0.56	
v/s Ratio Perm	c0.47		0.07	0.19								
v/c Ratio	1.15		0.16	0.45	0.36						1.20	
Uniform Delay, d1	20.5		12.9	14.8	14.1						18.5	
Progression Factor	1.00		1.00	0.78	0.80						1.00	
Incremental Delay, d2	91.7		0.0	0.1	0.1						93.8	
Delay (s)	112.2		12.9	11.5	11.3						112.3	
Level of Service	F		B	B	B						F	
Approach Delay (s)		92.1			11.4			0.0			112.3	
Approach LOS		F			B			A			F	

Intersection Summary			
HCM Average Control Delay	88.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑	↱		↰↑↑				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)					4.0	4.0		4.0				
Lane Util. Factor					0.95	0.95		0.95				
Frt					0.96	0.85		1.00				
Flt Protected					1.00	1.00		0.99				
Satd. Flow (prot)					1333	1177		2791				
Flt Permitted					1.00	1.00		0.99				
Satd. Flow (perm)					1333	1177		2791				
Volume (vph)	0	0	0	0	350	525	185	1050	0	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	0	0	0	368	553	195	1105	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	35	0	20	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	471	398	0	1280	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type						Perm	Split					
Protected Phases					4		2	2				
Permitted Phases						4						
Actuated Green, G (s)					26.6	26.6		35.4				
Effective Green, g (s)					26.6	26.6		35.4				
Actuated g/C Ratio					0.38	0.38		0.51				
Clearance Time (s)					4.0	4.0		4.0				
Vehicle Extension (s)					5.2	5.2		5.2				
Lane Grp Cap (vph)					507	447		1411				
v/s Ratio Prot					c0.35			c0.46				
v/s Ratio Perm						0.34						
v/c Ratio					0.93	0.89		0.91				
Uniform Delay, d1					20.8	20.3		15.8				
Progression Factor					1.00	1.00		0.97				
Incremental Delay, d2					24.5	20.4		5.2				
Delay (s)					45.3	40.7		20.5				
Level of Service					D	D		C				
Approach Delay (s)		0.0			43.1			20.5			0.0	
Approach LOS		A			D			C			A	

Intersection Summary			
HCM Average Control Delay	29.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		1.00									0.95	
Frpb, ped/bikes		1.00									1.00	
Flpb, ped/bikes		1.00									1.00	
Frt		0.97									0.98	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		1358									2657	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		1358									2657	
Volume (vph)	0	380	90	0	0	0	0	0	0	445	1325	295
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	400	95	0	0	0	0	0	0	468	1395	311
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	54	0
Lane Group Flow (vph)	0	483	0	0	0	0	0	0	0	0	2120	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type										Perm		
Protected Phases		4									6	
Permitted Phases		4								6	6	
Actuated Green, G (s)		23.0									39.0	
Effective Green, g (s)		23.0									39.0	
Actuated g/C Ratio		0.33									0.56	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		446									1480	
v/s Ratio Prot		c0.36										
v/s Ratio Perm											0.80	
v/c Ratio		1.08									1.43	
Uniform Delay, d1		23.5									15.5	
Progression Factor		1.00									0.46	
Incremental Delay, d2		66.7									195.7	
Delay (s)		90.2									202.8	
Level of Service		F									F	
Approach Delay (s)		90.2			0.0			0.0			202.8	
Approach LOS		F			A			A			F	

Intersection Summary			
HCM Average Control Delay	181.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑						↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.97				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		2849						2680				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		2849						2680				
Volume (vph)	230	595	0	0	0	0	0	1040	215	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	242	626	0	0	0	0	0	1095	226	0	0	0
RTOR Reduction (vph)	0	24	0	0	0	0	0	21	0	0	0	0
Lane Group Flow (vph)	0	844	0	0	0	0	0	1300	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4	4						2				
Actuated Green, G (s)		26.2						35.8				
Effective Green, g (s)		26.2						35.8				
Actuated g/C Ratio		0.37						0.51				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		1066						1371				
v/s Ratio Prot								c0.48				
v/s Ratio Perm		0.30										
v/c Ratio		0.79						0.95				
Uniform Delay, d1		19.5						16.2				
Progression Factor		0.76						0.47				
Incremental Delay, d2		0.4						7.6				
Delay (s)		15.2						15.1				
Level of Service		B						B				
Approach Delay (s)		15.2			0.0			15.1			0.0	
Approach LOS		B			A			B			A	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.38	1.00						1.00	
Satd. Flow (perm)		1435		652	1943						2957	
Volume (vph)	0	195	125	205	275	0	0	0	0	115	1250	50
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	229	147	241	324	0	0	0	0	121	1316	53
RTOR Reduction (vph)	0	21	0	0	0	0	0	0	0	0	4	0
Lane Group Flow (vph)	0	355	0	241	324	0	0	0	0	0	1486	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		26.0		26.0	26.0						36.0	
Effective Green, g (s)		26.0		26.0	26.0						36.0	
Actuated g/C Ratio		0.37		0.37	0.37						0.51	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		533		242	722						1521	
v/s Ratio Prot		0.25			0.17							
v/s Ratio Perm				c0.37							0.50	
v/c Ratio		0.67		1.00	0.45						0.98	
Uniform Delay, d1		18.4		21.9	16.6						16.6	
Progression Factor		1.00		0.57	0.55						0.41	
Incremental Delay, d2		2.4		35.7	0.1						3.4	
Delay (s)		20.8		48.1	9.2						10.3	
Level of Service		C		D	A						B	
Approach Delay (s)		20.8			25.8			0.0			10.3	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1451			2970				
Flt Permitted	0.21	1.00			1.00			1.00				
Satd. Flow (perm)	376	1800			1451			2970				
Volume (vph)	145	165	0	0	375	120	105	990	75	0	0	0
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	171	194	0	0	441	141	111	1042	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	7	0	0	0	0
Lane Group Flow (vph)	171	194	0	0	565	0	0	1225	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	29.2	29.2			29.2			32.8				
Effective Green, g (s)	29.2	29.2			29.2			32.8				
Actuated g/C Ratio	0.42	0.42			0.42			0.47				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	157	751			605			1392				
v/s Ratio Prot		0.11			0.39							
v/s Ratio Perm	c0.45							0.41				
v/c Ratio	1.09	0.26			0.93			0.88				
Uniform Delay, d1	20.4	13.3			19.5			16.8				
Progression Factor	0.62	0.67			1.00			1.00				
Incremental Delay, d2	83.4	0.0			21.3			8.2				
Delay (s)	96.0	9.0			40.7			25.1				
Level of Service	F	A			D			C				
Approach Delay (s)		49.7			40.7			25.1			0.0	
Approach LOS		D			D			C			A	

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations	↑↑			↑↑		↱↱
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		0.88
Frt	1.00			1.00		0.85
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3353			3353		2640
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3353			3353		2640
Volume (vph)	380	0	0	1730	0	1555
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	413	0	0	1880	0	1690
RTOR Reduction (vph)	0	0	0	0	0	115
Lane Group Flow (vph)	413	0	0	1880	0	1575
Turn Type						custom
Protected Phases	2			2 4		4
Permitted Phases						
Actuated Green, G (s)	20.0			70.0		42.0
Effective Green, g (s)	20.0			70.0		42.0
Actuated g/C Ratio	0.29			1.00		0.60
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	958			3353		1584
v/s Ratio Prot	0.12			c0.56		c0.60
v/s Ratio Perm						
v/c Ratio	0.43			0.56		0.99
Uniform Delay, d1	20.4			0.0		13.9
Progression Factor	0.30			1.00		0.59
Incremental Delay, d2	0.1			0.2		13.5
Delay (s)	6.2			0.2		21.7
Level of Service	A			A		C
Approach Delay (s)	6.2			0.2	21.7	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↳			↰						↰↑↳	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	40	70	50	30	0	0	0	0	45	1940	55
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	47	82	59	35	0	0	0	0	47	2042	58
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.55	0.55	0.55	0.55	0.55		0.55					
vC, conflicting volume	2183	2166	1050	1222	2195	0	2100			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2335	2303	263	577	2356	0	2183			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	79	0	0	100	100			97		
cM capacity (veh/h)	0	20	399	0	19	1091	135			1607		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	94	1068	1079
Volume Left	0	59	47	0
Volume Right	82	0	0	58
cSH	50	0	1607	1700
Volume to Capacity	2.60	Err	0.03	0.63
Queue Length 95th (ft)	339	Err	2	0
Control Delay (s)	901.6	Err	0.8	0.0
Lane LOS	F	F	A	
Approach Delay (s)	901.6	Err	0.4	
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	40	0	0	25	20	55	1175	30	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	47	0	0	29	24	58	1237	32	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked	0.60	0.60		0.60	0.60	0.60				0.60		
vC, conflicting volume	772	1384	0	1392	1368	634	0			1268		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	980	0	993	954	0	0			788		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	89	67	100	100	81	96	96			100		
cM capacity (veh/h)	489	142	1075	88	152	658	1593			507		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	100	53	676	650
Volume Left	53	0	58	0
Volume Right	0	24	0	32
cSH	227	231	1593	1700
Volume to Capacity	0.44	0.23	0.04	0.38
Queue Length 95th (ft)	52	22	3	0
Control Delay (s)	32.8	25.2	1.0	0.0
Lane LOS	D	D	A	
Approach Delay (s)	32.8	25.2	0.5	
Approach LOS	D	D		

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	55	70	55	55	0	0	0	0	80	1450	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	65	82	65	65	0	0	0	0	84	1526	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1753	1721	789	1046	1747	0	1579			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1753	1721	789	1046	1747	0	1579			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	20	75	0	17	100	100			95		
cM capacity (veh/h)	16	81	327	44	78	1075	399			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	147	129	847	816
Volume Left	0	65	84	0
Volume Right	82	0	0	53
cSH	140	56	1600	1700
Volume to Capacity	1.05	2.30	0.05	0.48
Queue Length 95th (ft)	197	323	4	0
Control Delay (s)	152.2	752.9	1.4	0.0
Lane LOS	F	F	A	
Approach Delay (s)	152.2	752.9	0.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	62.4		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	65	75	0	0	65	55	50	1055	44	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	76	88	0	0	76	65	53	1111	46	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	763	1262	0	1283	1239	578	0			1157		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	763	1262	0	1283	1239	578	0			1157		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	41	42	100	100	46	84	97			100		
cM capacity (veh/h)	131	152	1056	53	141	407	1593			611		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	165	141	608	602
Volume Left	76	0	53	0
Volume Right	0	65	0	46
cSH	141	202	1593	1700
Volume to Capacity	1.17	0.70	0.03	0.35
Queue Length 95th (ft)	237	110	3	0
Control Delay (s)	190.1	56.3	1.0	0.0
Lane LOS	F	F	A	
Approach Delay (s)	190.1	56.3	0.5	
Approach LOS	F	F		

Intersection Summary			
Average Delay	26.3		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰↑	↱					↓↳	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)					4.0	4.0					4.0	
Lane Util. Factor					0.95	1.00					0.95	
Frpb, ped/bikes					1.00	1.00					1.00	
Flpb, ped/bikes					1.00	1.00					1.00	
Frt					1.00	0.85					0.97	
Flt Protected					0.98	1.00					1.00	
Satd. Flow (prot)					3031	1443					3146	
Flt Permitted					0.98	1.00					1.00	
Satd. Flow (perm)					3031	1443					3146	
Volume (vph)	0	0	0	270	290	1940	0	0	0	0	1340	335
Peak-hour factor, PHF	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	0	0	284	305	2042	0	0	0	0	1411	353
RTOR Reduction (vph)	0	0	0	0	6	0	0	0	0	0	25	0
Lane Group Flow (vph)	0	0	0	0	583	2042	0	0	0	0	1739	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type				Perm		custom						
Protected Phases					4	4 6					6	
Permitted Phases				4								
Actuated Green, G (s)					44.0	90.0					38.0	
Effective Green, g (s)					44.0	90.0					38.0	
Actuated g/C Ratio					0.49	1.00					0.42	
Clearance Time (s)					4.0						4.0	
Vehicle Extension (s)					0.2						0.2	
Lane Grp Cap (vph)					1482	1443					1328	
v/s Ratio Prot						c1.41					0.55	
v/s Ratio Perm					0.19							
v/c Ratio					0.39	1.42					1.31	
Uniform Delay, d1					14.6	45.0					26.0	
Progression Factor					1.05	1.00					1.00	
Incremental Delay, d2					0.0	187.2					144.8	
Delay (s)					15.3	232.2					170.8	
Level of Service					B	F					F	
Approach Delay (s)		0.0			183.6			0.0			170.8	
Approach LOS		A			F			A			F	

Intersection Summary			
HCM Average Control Delay	178.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	130.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0				4.0
Lane Util. Factor					0.95		0.95	0.95				1.00
Frt					1.00		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.95				1.00
Satd. Flow (prot)					3003		1227	1233				1557
Flt Permitted					1.00		0.95	0.95				1.00
Satd. Flow (perm)					3003		1227	1233				1557
Volume (vph)	0	0	0	0	890	20	1580	30	0	0	0	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	0	0	0	937	21	1663	32	0	0	0	21
RTOR Reduction (vph)	0	0	0	0	1	0	5	5	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	957	0	827	858	0	0	0	21
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type							Split					custom
Protected Phases					4		2	2				
Permitted Phases												4 2
Actuated Green, G (s)					26.0		56.0	56.0				90.0
Effective Green, g (s)					26.0		56.0	56.0				90.0
Actuated g/C Ratio					0.29		0.62	0.62				1.00
Clearance Time (s)					4.0		4.0	4.0				
Vehicle Extension (s)					5.2		5.2	5.2				
Lane Grp Cap (vph)					868		763	767				1557
v/s Ratio Prot					c0.32		0.67	c0.70				
v/s Ratio Perm												0.01
v/c Ratio					1.10		1.08	1.12				0.01
Uniform Delay, d1					32.0		17.0	17.0				0.0
Progression Factor					1.00		0.64	0.64				1.00
Incremental Delay, d2					62.4		45.3	59.3				0.0
Delay (s)					94.4		56.1	70.2				0.0
Level of Service					F		E	E				A
Approach Delay (s)		0.0			94.4			63.3			0.0	
Approach LOS		A			F			E			A	

Intersection Summary			
HCM Average Control Delay	73.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱									↰↑	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.95									0.95	
Frpb, ped/bikes		1.00									1.00	
Flpb, ped/bikes		1.00									1.00	
Frt		0.97									1.00	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		2798									2718	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		2798									2718	
Volume (vph)	0	755	180	0	0	0	0	0	0	445	1230	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	795	189	0	0	0	0	0	0	468	1295	0
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	14	0
Lane Group Flow (vph)	0	961	0	0	0	0	0	0	0	0	1749	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type										Perm		
Protected Phases		4									6	
Permitted Phases		4								6	6	
Actuated Green, G (s)		28.0									54.0	
Effective Green, g (s)		28.0									54.0	
Actuated g/C Ratio		0.31									0.60	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		870									1631	
v/s Ratio Prot		c0.34										
v/s Ratio Perm											0.64	
v/c Ratio		1.10									1.07	
Uniform Delay, d1		31.0									18.0	
Progression Factor		1.00									0.95	
Incremental Delay, d2		63.4									34.0	
Delay (s)		94.4									51.1	
Level of Service		F									D	
Approach Delay (s)		94.4			0.0			0.0			51.1	
Approach LOS		F			A			A			D	

Intersection Summary			
HCM Average Control Delay	66.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑						↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.97				
Flt Protected		0.98						1.00				
Satd. Flow (prot)		2810						2679				
Flt Permitted		0.98						1.00				
Satd. Flow (perm)		2810						2679				
Volume (vph)	605	595	0	0	0	0	0	1040	215	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	637	626	0	0	0	0	0	1095	226	0	0	0
RTOR Reduction (vph)	0	28	0	0	0	0	0	19	0	0	0	0
Lane Group Flow (vph)	0	1235	0	0	0	0	0	1302	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4	4						2				
Actuated Green, G (s)		39.0						43.0				
Effective Green, g (s)		39.0						43.0				
Actuated g/C Ratio		0.43						0.48				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		1218						1280				
v/s Ratio Prot								c0.49				
v/s Ratio Perm		0.44										
v/c Ratio		1.06dl						1.02				
Uniform Delay, d1		25.5						23.5				
Progression Factor		0.46						0.56				
Incremental Delay, d2		11.5						21.7				
Delay (s)		23.1						34.9				
Level of Service		C						C				
Approach Delay (s)		23.1			0.0			34.9			0.0	
Approach LOS		C			A			C			A	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.37	1.00						1.00	
Satd. Flow (perm)		1435		632	1943						2957	
Volume (vph)	0	195	125	205	275	0	0	0	0	115	1250	50
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	229	147	241	324	0	0	0	0	121	1316	53
RTOR Reduction (vph)	0	22	0	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	354	0	241	324	0	0	0	0	0	1487	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		34.1		34.1	34.1						47.9	
Effective Green, g (s)		34.1		34.1	34.1						47.9	
Actuated g/C Ratio		0.38		0.38	0.38						0.53	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		544		239	736						1574	
v/s Ratio Prot		0.25			0.17							
v/s Ratio Perm				c0.38							0.50	
v/c Ratio		0.65		1.01	0.44						0.94	
Uniform Delay, d1		23.0		28.0	20.8						19.8	
Progression Factor		1.00		0.55	0.55						0.61	
Incremental Delay, d2		2.1		40.1	0.1						1.7	
Delay (s)		25.2		55.5	11.4						13.7	
Level of Service		C		E	B						B	
Approach Delay (s)		25.2			30.2			0.0			13.7	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1451			2970				
Flt Permitted	0.20	1.00			1.00			1.00				
Satd. Flow (perm)	359	1800			1451			2970				
Volume (vph)	145	165	0	0	375	120	105	990	75	0	0	0
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	171	194	0	0	441	141	111	1042	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	5	0	0	0	0
Lane Group Flow (vph)	171	194	0	0	568	0	0	1227	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	37.9	37.9			37.9			44.1				
Effective Green, g (s)	37.9	37.9			37.9			44.1				
Actuated g/C Ratio	0.42	0.42			0.42			0.49				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	151	758			611			1455				
v/s Ratio Prot		0.11			0.39							
v/s Ratio Perm	c0.48							0.41				
v/c Ratio	1.13	0.26			0.93			0.84				
Uniform Delay, d1	26.0	16.9			24.8			19.9				
Progression Factor	0.64	0.62			1.00			1.00				
Incremental Delay, d2	100.0	0.0			20.3			6.1				
Delay (s)	116.6	10.6			45.1			26.1				
Level of Service	F	B			D			C				
Approach Delay (s)		60.2			45.1			26.1			0.0	
Approach LOS		E			D			C			A	

Intersection Summary			
HCM Average Control Delay	36.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	40	70	45	30	0	0	0	0	45	1555	55
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	47	82	53	35	0	0	0	0	47	1637	58
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.59	0.59	0.59	0.59	0.59		0.59					
vC, conflicting volume	1778	1761	847	1019	1789	0	1695			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1625	1595	53	343	1644	0	1484			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	21	86	48	39	100	100			97		
cM capacity (veh/h)	20	60	590	102	58	1091	272			1607		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	88	866	876
Volume Left	0	53	47	0
Volume Right	82	0	0	58
cSH	139	78	1607	1700
Volume to Capacity	0.93	1.13	0.03	0.52
Queue Length 95th (ft)	160	160	2	0
Control Delay (s)	120.2	235.0	0.8	0.0
Lane LOS	F	F	A	
Approach Delay (s)	120.2	235.0	0.4	
Approach LOS	F	F		

Intersection Summary			
Average Delay	18.9		
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	40	0	0	25	20	50	1550	30	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	47	0	0	29	24	53	1632	32	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked	0.58	0.58		0.58	0.58	0.58				0.58		
vC, conflicting volume	959	1768	0	1776	1753	832	0			1663		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	201	1600	0	1613	1572	0	0			1418		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	79	18	100	100	53	96	97			100		
cM capacity (veh/h)	251	57	1075	12	62	631	1593			282		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	100	53	868	847
Volume Left	53	0	53	0
Volume Right	0	24	0	32
cSH	97	104	1593	1700
Volume to Capacity	1.04	0.51	0.03	0.50
Queue Length 95th (ft)	159	57	3	0
Control Delay (s)	182.4	71.1	0.9	0.0
Lane LOS	F	F	A	
Approach Delay (s)	182.4	71.1	0.4	
Approach LOS	F	F		

Intersection Summary			
Average Delay	12.2		
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	55	70	55	55	0	0	0	0	80	1450	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	65	82	65	65	0	0	0	0	84	1526	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1753	1721	789	1046	1747	0	1579			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1753	1721	789	1046	1747	0	1579			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	20	75	0	17	100	100			95		
cM capacity (veh/h)	16	81	327	44	78	1075	399			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	147	129	847	816
Volume Left	0	65	84	0
Volume Right	82	0	0	53
cSH	140	56	1600	1700
Volume to Capacity	1.05	2.30	0.05	0.48
Queue Length 95th (ft)	197	323	4	0
Control Delay (s)	152.2	752.9	1.4	0.0
Lane LOS	F	F	A	
Approach Delay (s)	152.2	752.9	0.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	62.4		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↱			↰↑↱				
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	65	75	0	0	65	55	50	1055	45	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	76	88	0	0	76	65	53	1111	47	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	763	1263	0	1284	1239	579	0			1158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	763	1263	0	1284	1239	579	0			1158		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	41	42	100	100	46	84	97			100		
cM capacity (veh/h)	130	151	1056	53	141	407	1593			611		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	165	141	608	603
Volume Left	76	0	53	0
Volume Right	0	65	0	47
cSH	141	201	1593	1700
Volume to Capacity	1.17	0.70	0.03	0.35
Queue Length 95th (ft)	237	111	3	0
Control Delay (s)	190.6	56.4	1.0	0.0
Lane LOS	F	F	A	
Approach Delay (s)	190.6	56.4	0.5	
Approach LOS	F	F		

Intersection Summary			
Average Delay	26.3		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰		↱	↰	↑	↱					↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0					4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00					0.95	
Frpb, ped/bikes	1.00		0.98	1.00	1.00	1.00					1.00	
Flpb, ped/bikes	1.00		1.00	0.99	1.00	1.00					1.00	
Frt	1.00		0.85	1.00	1.00	0.85					0.99	
Flt Protected	0.95		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (prot)	1580		1585	1815	1642	1443					3221	
Flt Permitted	0.56		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (perm)	939		1585	1815	1642	1443					3221	
Volume (vph)	375	0	95	325	225	1565	0	0	0	0	1625	105
Peak-hour factor, PHF	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	441	0	112	342	237	1647	0	0	0	0	1711	111
RTOR Reduction (vph)	0	0	4	4	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	441	0	108	338	237	1647	0	0	0	0	1815	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type	D.Pm		custom	Perm		custom						
Protected Phases					4	6					6	
Permitted Phases	4		4	4		4						
Actuated Green, G (s)	29.0		29.0	29.0	29.0	62.0					33.0	
Effective Green, g (s)	29.0		29.0	29.0	29.0	62.0					33.0	
Actuated g/C Ratio	0.41		0.41	0.41	0.41	0.89					0.47	
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0					4.0	
Vehicle Extension (s)	0.2		0.2	0.2	0.2	0.2					0.2	
Lane Grp Cap (vph)	389		657	752	680	1443					1518	
v/s Ratio Prot					0.14	c0.54					0.56	
v/s Ratio Perm	0.47		0.07	0.19		0.60						
v/c Ratio	1.13		0.16	0.45	0.35	1.14					1.20	
Uniform Delay, d1	20.5		12.9	14.8	14.0	4.0					18.5	
Progression Factor	1.00		1.00	0.88	0.88	1.00					1.00	
Incremental Delay, d2	87.2		0.0	0.1	0.0	67.1					94.8	
Delay (s)	107.7		12.9	13.0	12.4	71.1					113.3	
Level of Service	F		B	B	B	E					F	
Approach Delay (s)		88.5			55.9			0.0			113.3	
Approach LOS		F			E			A			F	

Intersection Summary			
HCM Average Control Delay	82.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	130.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↱		↰	↰↑				↱
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0				4.0
Lane Util. Factor					0.95		0.95	0.95				1.00
Frt					1.00		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.95				1.00
Satd. Flow (prot)					3003		1227	1233				1557
Flt Permitted					1.00		0.95	0.95				1.00
Satd. Flow (perm)					3003		1227	1233				1557
Volume (vph)	0	0	0	0	890	20	1205	30	0	0	0	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	0	0	0	937	21	1268	32	0	0	0	21
RTOR Reduction (vph)	0	0	0	0	3	0	17	17	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	955	0	617	649	0	0	0	21
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type							Split					custom
Protected Phases					4		2	2				
Permitted Phases												4 2
Actuated Green, G (s)					25.4		36.6	36.6				70.0
Effective Green, g (s)					25.4		36.6	36.6				70.0
Actuated g/C Ratio					0.36		0.52	0.52				1.00
Clearance Time (s)					4.0		4.0	4.0				
Vehicle Extension (s)					5.2		5.2	5.2				
Lane Grp Cap (vph)					1090		642	645				1557
v/s Ratio Prot					c0.32		0.50	c0.53				
v/s Ratio Perm												0.01
v/c Ratio					0.88		0.96	1.01				0.01
Uniform Delay, d1					20.8		16.0	16.7				0.0
Progression Factor					1.00		1.17	1.16				1.00
Incremental Delay, d2					8.8		16.7	25.9				0.0
Delay (s)					29.7		35.6	45.3				0.0
Level of Service					C		D	D				A
Approach Delay (s)		0.0			29.7			40.6			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM Average Control Delay	35.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱									↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		1.00									0.95	
Frpb, ped/bikes		1.00									1.00	
Flpb, ped/bikes		1.00									1.00	
Frt		0.97									0.98	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		1358									2657	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		1358									2657	
Volume (vph)	0	380	90	0	0	0	0	0	0	445	1325	295
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	400	95	0	0	0	0	0	0	468	1395	311
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	54	0
Lane Group Flow (vph)	0	483	0	0	0	0	0	0	0	0	2120	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type										Perm		
Protected Phases		4									6	
Permitted Phases		4								6	6	
Actuated Green, G (s)		23.0									39.0	
Effective Green, g (s)		23.0									39.0	
Actuated g/C Ratio		0.33									0.56	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		446									1480	
v/s Ratio Prot		c0.36										
v/s Ratio Perm											0.80	
v/c Ratio		1.08									1.43	
Uniform Delay, d1		23.5									15.5	
Progression Factor		1.00									0.41	
Incremental Delay, d2		66.7									195.7	
Delay (s)		90.2									202.0	
Level of Service		F									F	
Approach Delay (s)		90.2			0.0			0.0			202.0	
Approach LOS		F			A			A			F	

Intersection Summary			
HCM Average Control Delay	181.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑						↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.97				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		2849						2680				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		2849						2680				
Volume (vph)	230	595	0	0	0	0	0	1040	215	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	242	626	0	0	0	0	0	1095	226	0	0	0
RTOR Reduction (vph)	0	24	0	0	0	0	0	21	0	0	0	0
Lane Group Flow (vph)	0	844	0	0	0	0	0	1300	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4	4						2				
Actuated Green, G (s)		26.2						35.8				
Effective Green, g (s)		26.2						35.8				
Actuated g/C Ratio		0.37						0.51				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		1066						1371				
v/s Ratio Prot								c0.48				
v/s Ratio Perm		0.30										
v/c Ratio		0.79						0.95				
Uniform Delay, d1		19.5						16.2				
Progression Factor		0.76						0.47				
Incremental Delay, d2		0.4						7.6				
Delay (s)		15.2						15.1				
Level of Service		B						B				
Approach Delay (s)		15.2			0.0			15.1			0.0	
Approach LOS		B			A			B			A	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.38	1.00						1.00	
Satd. Flow (perm)		1435		652	1943						2957	
Volume (vph)	0	195	125	205	275	0	0	0	0	115	1250	50
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	229	147	241	324	0	0	0	0	121	1316	53
RTOR Reduction (vph)	0	21	0	0	0	0	0	0	0	0	4	0
Lane Group Flow (vph)	0	355	0	241	324	0	0	0	0	0	1486	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		26.0		26.0	26.0						36.0	
Effective Green, g (s)		26.0		26.0	26.0						36.0	
Actuated g/C Ratio		0.37		0.37	0.37						0.51	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		533		242	722						1521	
v/s Ratio Prot		0.25			0.17							
v/s Ratio Perm				c0.37							0.50	
v/c Ratio		0.67		1.00	0.45						0.98	
Uniform Delay, d1		18.4		21.9	16.6						16.6	
Progression Factor		1.00		0.57	0.55						0.38	
Incremental Delay, d2		2.4		35.7	0.1						3.4	
Delay (s)		20.8		48.1	9.2						9.8	
Level of Service		C		D	A						A	
Approach Delay (s)		20.8			25.8			0.0			9.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1451			2970				
Flt Permitted	0.21	1.00			1.00			1.00				
Satd. Flow (perm)	376	1800			1451			2970				
Volume (vph)	145	165	0	0	375	120	105	990	75	0	0	0
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	171	194	0	0	441	141	111	1042	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	7	0	0	0	0
Lane Group Flow (vph)	171	194	0	0	565	0	0	1225	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	29.2	29.2			29.2			32.8				
Effective Green, g (s)	29.2	29.2			29.2			32.8				
Actuated g/C Ratio	0.42	0.42			0.42			0.47				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	157	751			605			1392				
v/s Ratio Prot		0.11			0.39							
v/s Ratio Perm	c0.45							0.41				
v/c Ratio	1.09	0.26			0.93			0.88				
Uniform Delay, d1	20.4	13.3			19.5			16.8				
Progression Factor	0.62	0.67			1.00			1.00				
Incremental Delay, d2	83.4	0.0			21.3			8.2				
Delay (s)	96.0	9.0			40.7			25.1				
Level of Service	F	A			D			C				
Approach Delay (s)		49.7			40.7			25.1			0.0	
Approach LOS		D			D			C			A	

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			↰						↰↑↱	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	40	70	50	30	0	0	0	0	45	1940	55
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	47	82	59	35	0	0	0	0	47	2042	58
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.54	0.54	0.54	0.54	0.54		0.54					
vC, conflicting volume	2183	2166	1050	1222	2195	0	2100			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2337	2304	256	571	2357	0	2184			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	79	0	0	100	100			97		
cM capacity (veh/h)	0	20	401	0	19	1091	134			1607		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	94	1068	1079
Volume Left	0	59	47	0
Volume Right	82	0	0	58
cSH	49	0	1607	1700
Volume to Capacity	2.62	Err	0.03	0.63
Queue Length 95th (ft)	339	Err	2	0
Control Delay (s)	907.7	Err	0.8	0.0
Lane LOS	F	F	A	
Approach Delay (s)	907.7	Err	0.4	
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑			↑↱			↰↑↑↱				
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	40	0	0	25	20	55	1175	30	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	47	0	0	29	24	58	1237	32	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked	0.60	0.60		0.60	0.60	0.60				0.60		
vC, conflicting volume	772	1384	0	1392	1368	634	0			1268		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	980	0	993	954	0	0			788		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	89	67	100	100	81	96	96			100		
cM capacity (veh/h)	489	142	1075	88	152	658	1593			507		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	100	53	676	650
Volume Left	53	0	58	0
Volume Right	0	24	0	32
cSH	227	231	1593	1700
Volume to Capacity	0.44	0.23	0.04	0.38
Queue Length 95th (ft)	52	22	3	0
Control Delay (s)	32.8	25.2	1.0	0.0
Lane LOS	D	D	A	
Approach Delay (s)	32.8	25.2	0.5	
Approach LOS	D	D		

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	55	70	55	55	0	0	0	0	80	1450	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	65	82	65	65	0	0	0	0	84	1526	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1753	1721	789	1046	1747	0	1579			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1753	1721	789	1046	1747	0	1579			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	20	75	0	17	100	100			95		
cM capacity (veh/h)	16	81	327	44	78	1075	399			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	147	129	847	816
Volume Left	0	65	84	0
Volume Right	82	0	0	53
cSH	140	56	1600	1700
Volume to Capacity	1.05	2.30	0.05	0.48
Queue Length 95th (ft)	197	323	4	0
Control Delay (s)	152.2	752.9	1.4	0.0
Lane LOS	F	F	A	
Approach Delay (s)	152.2	752.9	0.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	62.4		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↱			↰↑↱				
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	65	75	0	0	65	55	50	1055	45	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	76	88	0	0	76	65	53	1111	47	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	763	1263	0	1284	1239	579	0			1158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	763	1263	0	1284	1239	579	0			1158		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	41	42	100	100	46	84	97			100		
cM capacity (veh/h)	130	151	1056	53	141	407	1593			611		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	165	141	608	603
Volume Left	76	0	53	0
Volume Right	0	65	0	47
cSH	141	201	1593	1700
Volume to Capacity	1.17	0.70	0.03	0.35
Queue Length 95th (ft)	237	111	3	0
Control Delay (s)	190.6	56.4	1.0	0.0
Lane LOS	F	F	A	
Approach Delay (s)	190.6	56.4	0.5	
Approach LOS	F	F		

Intersection Summary			
Average Delay	26.3		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰		↱					↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	10	12	14	16	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0		4.0					4.0	
Lane Util. Factor	1.00	1.00		1.00		1.00					0.95	
Frpb, ped/bikes	1.00	0.98		1.00		1.00					1.00	
Flpb, ped/bikes	1.00	1.00		0.99		1.00					1.00	
Frt	1.00	0.89		1.00		0.85					0.99	
Flt Protected	0.95	1.00		0.95		1.00					0.99	
Satd. Flow (prot)	1580	1561		1815		1443					3184	
Flt Permitted	0.95	1.00		0.69		1.00					0.99	
Satd. Flow (perm)	1580	1561		1309		1443					3184	
Volume (vph)	375	25	70	25	0	5	0	0	0	395	1230	105
Peak-hour factor, PHF	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	441	29	82	26	0	5	0	0	0	416	1295	111
RTOR Reduction (vph)	0	31	0	0	0	0	0	0	0	0	5	0
Lane Group Flow (vph)	441	80	0	26	0	5	0	0	0	0	1817	0
Confl. Peds. (#/hr)			10	10								10
Heavy Vehicles (%)	1%	1%	1%	6%	6%	6%	0%	0%	0%	5%	5%	5%
Turn Type	Perm			D.Pm		custom				Split		
Protected Phases		4				4 6				6	6	
Permitted Phases	4			4								
Actuated Green, G (s)	23.9	23.9		23.9		80.0					48.1	
Effective Green, g (s)	23.9	23.9		23.9		80.0					48.1	
Actuated g/C Ratio	0.30	0.30		0.30		1.00					0.60	
Clearance Time (s)	4.0	4.0		4.0							4.0	
Vehicle Extension (s)	0.2	0.2		0.2							0.2	
Lane Grp Cap (vph)	472	466		391		1443					1914	
v/s Ratio Prot		0.05				0.00					c0.57	
v/s Ratio Perm	c0.28			0.02								
v/c Ratio	0.93	0.17		0.07		0.00					0.95	
Uniform Delay, d1	27.3	20.7		20.1		0.0					14.8	
Progression Factor	1.00	1.00		1.04		1.00					1.00	
Incremental Delay, d2	25.5	0.1		0.0		0.0					10.2	
Delay (s)	52.8	20.8		21.0		0.0					25.0	
Level of Service	D	C		C		A					C	
Approach Delay (s)		46.3			17.6			0.0			25.0	
Approach LOS		D			B			A			C	

Intersection Summary			
HCM Average Control Delay	29.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frt		1.00			0.87			1.00				
Flt Protected		1.00			1.00			1.00				
Satd. Flow (prot)		1799			1264			2807				
Flt Permitted		1.00			1.00			1.00				
Satd. Flow (perm)		1791			1264			2807				
Volume (vph)	5	415	0	0	10	540	5	1050	10	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	5	437	0	0	11	568	5	1105	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	442	0	0	561	0	0	1120	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	5%	5%	5%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type	Perm						Split					
Protected Phases		4			4		2	2				
Permitted Phases	4											
Actuated Green, G (s)		37.3			37.3			34.7				
Effective Green, g (s)		37.3			37.3			34.7				
Actuated g/C Ratio		0.47			0.47			0.43				
Clearance Time (s)		4.0			4.0			4.0				
Vehicle Extension (s)		5.2			5.2			5.2				
Lane Grp Cap (vph)		835			589			1218				
v/s Ratio Prot					c0.44			c0.40				
v/s Ratio Perm		0.25										
v/c Ratio		0.53			0.95			0.92				
Uniform Delay, d1		15.1			20.5			21.3				
Progression Factor		0.78			1.00			0.78				
Incremental Delay, d2		0.5			26.4			6.1				
Delay (s)		12.4			46.9			22.8				
Level of Service		B			D			C				
Approach Delay (s)		12.4			46.9			22.8			0.0	
Approach LOS		B			D			C			A	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1358		1710	1800						2669	
Flt Permitted		1.00		0.17	1.00						1.00	
Satd. Flow (perm)		1358		302	1800						2669	
Volume (vph)	0	380	90	260	285	0	0	0	0	15	1065	235
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	400	95	274	300	0	0	0	0	16	1121	247
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	23	0
Lane Group Flow (vph)	0	484	0	274	300	0	0	0	0	0	1361	0
Confl. Peds. (#/hr)			10							10		10
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)		10	10							10	10	10
Turn Type				pm+pt						Perm		
Protected Phases		4		3	8						6	
Permitted Phases		4		8						6	6	
Actuated Green, G (s)		23.0		36.0	36.0						36.0	
Effective Green, g (s)		23.0		36.0	36.0						36.0	
Actuated g/C Ratio		0.29		0.45	0.45						0.45	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		3.0	3.0						0.2	
Lane Grp Cap (vph)		390		294	810						1201	
v/s Ratio Prot		c0.36		c0.10	0.17							
v/s Ratio Perm				0.31							0.51	
v/c Ratio		1.24		0.93	0.37						1.13	
Uniform Delay, d1		28.5		29.4	14.5						22.0	
Progression Factor		1.00		0.47	0.92						0.52	
Incremental Delay, d2		128.8		20.1	0.1						66.4	
Delay (s)		157.3		33.8	13.5						77.8	
Level of Service		F		C	B						E	
Approach Delay (s)		157.3			23.2			0.0			77.8	
Approach LOS		F			C			A			E	

Intersection Summary			
HCM Average Control Delay	81.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	131.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.99			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1424	1400			1787			2651				
Flt Permitted	0.24	1.00			1.00			0.99				
Satd. Flow (perm)	360	1400			1787			2651				
Volume (vph)	230	165	0	0	360	20	185	830	215	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	242	174	0	0	379	21	195	874	226	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	22	0	0	0	0
Lane Group Flow (vph)	242	174	0	0	398	0	0	1273	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	7%	7%	7%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	pm+pt						Perm					
Protected Phases	7	4			8			2				
Permitted Phases	4	4					2	2				
Actuated Green, G (s)	33.7	33.7			20.1			38.3				
Effective Green, g (s)	33.7	33.7			20.1			38.3				
Actuated g/C Ratio	0.42	0.42			0.25			0.48				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	3.0	0.2			3.0			0.2				
Lane Grp Cap (vph)	279	590			449			1269				
v/s Ratio Prot	c0.10	0.12			0.22							
v/s Ratio Perm	c0.26							0.48				
v/c Ratio	0.87	0.29			0.89			1.00				
Uniform Delay, d1	27.7	15.3			28.8			20.8				
Progression Factor	0.36	0.08			1.00			0.55				
Incremental Delay, d2	2.8	0.0			18.5			18.5				
Delay (s)	12.7	1.3			47.3			30.0				
Level of Service	B	A			D			C				
Approach Delay (s)		7.9			47.3			30.0			0.0	
Approach LOS		A			D			C			A	

Intersection Summary			
HCM Average Control Delay	29.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	131.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱		↰	↑						↰↑↱	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frt		0.95		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1435		1629	1943						2957	
Flt Permitted		1.00		0.37	1.00						1.00	
Satd. Flow (perm)		1435		636	1943						2957	
Volume (vph)	0	195	125	205	275	0	0	0	0	115	1250	50
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	229	147	241	324	0	0	0	0	121	1316	53
RTOR Reduction (vph)	0	21	0	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	355	0	241	324	0	0	0	0	0	1487	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	0%	0%	0%	6%	6%	6%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		4			4						6	
Permitted Phases		4		4						6		
Actuated Green, G (s)		29.8		29.8	29.8						42.2	
Effective Green, g (s)		29.8		29.8	29.8						42.2	
Actuated g/C Ratio		0.37		0.37	0.37						0.53	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		535		237	724						1560	
v/s Ratio Prot		0.25			0.17							
v/s Ratio Perm				c0.38							0.50	
v/c Ratio		0.66		1.02	0.45						0.95	
Uniform Delay, d1		20.9		25.1	18.9						18.0	
Progression Factor		1.00		0.53	0.53						0.34	
Incremental Delay, d2		2.4		42.8	0.1						1.9	
Delay (s)		23.3		56.2	10.2						8.1	
Level of Service		C		E	B						A	
Approach Delay (s)		23.3			29.8			0.0			8.1	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	128.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑↱			↰↑↱				
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frt	1.00	1.00			0.97			0.99				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1710	1800			1457			2970				
Flt Permitted	0.21	1.00			1.00			1.00				
Satd. Flow (perm)	375	1800			1457			2970				
Volume (vph)	145	165	0	0	375	100	105	990	75	0	0	0
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	171	194	0	0	441	118	111	1042	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	6	0	0	0	0
Lane Group Flow (vph)	171	194	0	0	546	0	0	1226	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	5%	5%	5%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	32.3	32.3			32.3			39.7				
Effective Green, g (s)	32.3	32.3			32.3			39.7				
Actuated g/C Ratio	0.40	0.40			0.40			0.50				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	151	727			588			1474				
v/s Ratio Prot		0.11			0.37							
v/s Ratio Perm	c0.46							0.41				
v/c Ratio	1.13	0.27			0.93			0.83				
Uniform Delay, d1	23.8	15.9			22.7			17.3				
Progression Factor	0.62	0.61			1.00			1.00				
Incremental Delay, d2	99.5	0.0			20.7			5.6				
Delay (s)	114.2	9.8			43.4			22.9				
Level of Service	F	A			D			C				
Approach Delay (s)		58.7			43.4			22.9			0.0	
Approach LOS		E			D			C			A	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	128.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations	↑↑			↑↑		↱↱
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		0.88
Frt	1.00			1.00		0.85
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3353			3353		2640
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3353			3353		2640
Volume (vph)	380	0	0	1730	0	1560
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	413	0	0	1880	0	1696
RTOR Reduction (vph)	0	0	0	0	0	107
Lane Group Flow (vph)	413	0	0	1880	0	1589
Turn Type						custom
Protected Phases	2			2 4		
Permitted Phases						4
Actuated Green, G (s)	21.5			80.0		50.5
Effective Green, g (s)	21.5			80.0		50.5
Actuated g/C Ratio	0.27			1.00		0.63
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	901			3353		1667
v/s Ratio Prot	0.12			c0.56		
v/s Ratio Perm						c0.60
v/c Ratio	0.46			0.56		0.95
Uniform Delay, d1	24.4			0.0		13.7
Progression Factor	1.20			1.00		0.43
Incremental Delay, d2	0.6			0.2		6.0
Delay (s)	29.8			0.2		11.8
Level of Service	C			A		B
Approach Delay (s)	29.8			0.2	11.8	
Approach LOS	C			A	B	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	40	70	40	30	0	0	0	0	45	1205	65
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	47	82	47	35	0	0	0	0	47	1268	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								272			283	
pX, platoon unblocked	0.52	0.52	0.52	0.52	0.52		0.52					
vC, conflicting volume	1415	1397	668	835	1432	0	1337			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	884	851	0	0	916	0	735			0		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	68	85	86	75	100	100			97		
cM capacity (veh/h)	98	149	565	340	140	1091	461			1607		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	82	682	703
Volume Left	0	47	47	0
Volume Right	82	0	0	68
cSH	280	211	1607	1700
Volume to Capacity	0.46	0.39	0.03	0.41
Queue Length 95th (ft)	57	43	2	0
Control Delay (s)	28.5	32.7	0.8	0.0
Lane LOS	D	D	A	
Approach Delay (s)	28.5	32.7	0.4	
Approach LOS	D	D		

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↱			↰↑↱				
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	40	0	0	20	20	50	990	30	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	47	0	0	24	24	53	1042	32	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								274			206	
pX, platoon unblocked												
vC, conflicting volume	662	1179	0	1187	1163	537	0			1074		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	662	1179	0	1187	1163	537	0			1074		
tC, single (s)	7.6	6.6	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	82	74	100	100	88	95	97			100		
cM capacity (veh/h)	287	179	1075	114	190	494	1593			657		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	100	47	574	553
Volume Left	53	0	53	0
Volume Right	0	24	0	32
cSH	223	274	1593	1700
Volume to Capacity	0.45	0.17	0.03	0.33
Queue Length 95th (ft)	53	15	3	0
Control Delay (s)	33.6	20.8	1.0	0.0
Lane LOS	D	C	A	
Approach Delay (s)	33.6	20.8	0.5	
Approach LOS	D	C		

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱			↰↑						↰↑↱	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	55	70	55	55	0	0	0	0	80	1450	50
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	65	82	65	65	0	0	0	0	84	1526	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1753	1721	789	1046	1747	0	1579			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1753	1721	789	1046	1747	0	1579			0		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.4	3.6	4.0	3.4	2.2			2.2		
p0 queue free %	100	20	75	0	17	100	100			95		
cM capacity (veh/h)	16	81	327	44	78	1075	399			1600		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	147	129	847	816
Volume Left	0	65	84	0
Volume Right	82	0	0	53
cSH	140	56	1600	1700
Volume to Capacity	1.05	2.30	0.05	0.48
Queue Length 95th (ft)	197	323	4	0
Control Delay (s)	152.2	752.9	1.4	0.0
Lane LOS	F	F	A	
Approach Delay (s)	152.2	752.9	0.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	62.4		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	65	75	0	0	65	55	50	1055	45	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	76	88	0	0	76	65	53	1111	47	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	763	1263	0	1284	1239	579	0			1158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	763	1263	0	1284	1239	579	0			1158		
tC, single (s)	7.7	6.7	7.1	8.0	7.0	7.4	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.7	4.2	3.5	2.3			2.2		
p0 queue free %	41	42	100	100	46	84	97			100		
cM capacity (veh/h)	130	151	1056	53	141	407	1593			611		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	165	141	608	603
Volume Left	76	0	53	0
Volume Right	0	65	0	47
cSH	141	201	1593	1700
Volume to Capacity	1.17	0.70	0.03	0.35
Queue Length 95th (ft)	237	111	3	0
Control Delay (s)	190.6	56.4	1.0	0.0
Lane LOS	F	F	A	
Approach Delay (s)	190.6	56.4	0.5	
Approach LOS	F	F		

Intersection Summary			
Average Delay	26.3		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

Tillamook Roundabout Analysis
Main Ave & 1st St
No-Build

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  - Intersection Type: Roundabout
  - Driving on the right-hand side of the road
  - Input data specified in US units
  - Default Values File No. 11
  - Peak flow period (for performance): 15 minutes
  - Unit time (for volumes): 60 minutes (Total Flow Period)
  - Delay definition: Control delay
    Geometric delay included
  - HCM Delay and Queue Models option selected
  - Level of Service based on: Delay (HCM method)
  - Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: West Leg								
12	437	4	0	0	109	1	1.00	0.85
East: East Leg								
22	322	21	223	14	1547	99	1.00	0.95
North: North Leg								
42	0	0	1625	86	106	6	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	2	19.68	2053	5.2	2062	0	N	0.570
East: East Leg											
90	30	150	2	2	19.68	399	1.0	399	0	Y	0.903
North: North Leg											

90	30	150	2	2	19.68	579	6.0	586	0	N	0.878

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	2062	19.2	49.3	1.17	0.817	2.00*	56.4	1.65
Right	2	Subdominant	2062	19.2	49.3	1.17	0.817	2.25	63.5	2.04
East: East Leg										
Left	1	Subdominant	399	14.5	191.7	2.00	0.385	3.30	70.0	3.00
Thru	1	Subdominant	399	14.5	191.7	2.00	0.385	3.29	69.9	2.99
Right	2	Dominant	399	14.5	191.7	2.00	0.385	2.43	51.7	2.21
North: North Leg										
Thru	1	Subdominant	586	18.7	169.0	2.00	0.515	2.69	74.0	2.45
	2	Dominant	586	18.7	169.0	2.00	0.515	2.42	66.4	2.20
Right	2	Dominant	586	18.7	169.0	2.00	0.515	2.42	66.5	2.20

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

* Critical gap or follow-up headway set to MINIMUM value

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.		Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: West Leg														
12	LR	551	498	1.106	77.3	E	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg														
22	LTR	2226	1634	1.362	127.4	F	- - - - NA - - - -				- - - - NA - - - -			
North: North Leg														
42	TR	1823	1964	0.928	14.8	B	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LR	551	498	1.106	382	-23.3	436	-12.4	260	-47.8
East: East Leg									
22 LTR	2226	1634	1.362	1857	13.6	806	-50.7	1423	-12.9
North: North Leg									
42 TR	1823	1964	0.928	2188	11.4	1083	-44.9	1556	-20.8

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LR	551	0.9	2053	5.2	2062	498	0.85	-23	32	1.106
East: East Leg										
22 LTR	2226	6.0	399	1.0	399	1634	0.85	-38	50	1.362*
North: North Leg										
42 TR	1823	5.0	579	6.0	586	1964	0.85	-8	100	0.928

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	E
Worst movement Level of Service	=	F
Average intersection delay (s)	=	76.8
Largest average movement delay (s)	=	127.4
Largest back of queue, 95% (ft)	=	4168
Performance Index	=	337.17
Degree of saturation (highest)	=	1.362
Practical Spare Capacity (lowest)	=	-38 %
Effective intersection capacity, (veh/h)	=	3377
Total vehicle flow (veh/h)	=	4600
Total person flow (pers/h)	=	5520
Total vehicle delay (veh-h/h)	=	98.08
Total person delay (pers-h/h)	=	117.70
Total effective vehicle stops (veh/h)	=	14093
Total effective person stops (pers/h)	=	16911
Total vehicle travel (veh-mi/h)	=	1720.7
Total cost ($/h)	=	1985.33
Total fuel (ga/h)	=	131.0
Total CO2 (kg/h)	=	1242.57

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 LR	11.83	14.20	77.3	0.98	2.21	28.8	725	38.71	10.5

East: East Leg									
22 LTR	78.78	94.54	127.4	0.93	4.58	159.1	4168	234.63	7.4
North: North Leg									
42 TR	7.47	8.97	14.8	1.00	1.47	20.9	545	63.82	19.4

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
551	1.106	11.83	14.20	77.3	0.98	2.21	725	38.71	10.5
East: East Leg									
2226	1.362	78.78	94.54	127.4	0.93	4.58	4168	234.63	7.4
North: North Leg									
1823	0.928	7.47	8.97	14.8	1.00	1.47	545	63.82	19.4
ALL VEHICLES:									
4600	1.362	98.08	117.70	76.8	0.96	3.06	4168	337.17	10.3
INTERSECTION (persons):									
5520	1.362		117.70	76.8	0.96	3.06		337.17	10.3

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg									
1 L	12	441	398	1.107	93.8	2.53	28.8	725	
2 R	12	110	312	0.353	11.3	0.96	2.4	61	160
East: East Leg									
1 LT	22	580	853	0.680	6.3	0.78	6.8	177	
2 R	22	1646	1208	1.363	170.1	5.91	159.1	4168	
North: North Leg									
1 T	42	854	920	0.928	15.2	1.49	19.7	511	
2 TR	42	969	1044	0.928	14.3	1.46	20.9	545	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 L	12	441	0	0	441	150	398	1.107	100
2 R	12	0	0	110	110	110	312	0.353	32P
East: East Leg									
1 LT	22	343	237	0	580	150	853	0.680	50P
2 R	22	0	0	1646	1646	150	1208	1.363	100

North: North Leg									
1 T	42	0	854	0	854	150	920	0.928	100
2 TR	42	0	857	112	969	150	1044	0.928	100

P Lane under-utilisation found by the "Program"

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LR	13.5	229.44	0.240	6.87	0.197	127.9
	13.5	229.44	0.240	6.87	0.197	127.9
East: East Leg						
22 LTR	85.5	1331.04	1.540	57.23	1.533	810.9
	85.5	1331.04	1.540	57.23	1.533	810.9
North: North Leg						
42 TR	32.0	424.84	0.496	18.48	0.533	303.8
	32.0	424.84	0.496	18.48	0.533	303.8
INTERSECTION:	131.0	1985.33	2.275	82.58	2.263	1242.6

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 L	441			441	1				1.107	93.8	725	
2 R			110	110	1				0.353	11.3	61	160
	441	0	110	551	1				1.107	77.3	725	

East: East Leg

1 LT	343	237		580	6		0.680	6.3	177
2 R			1646	1646	6		1.363	170.1	4168
	343	237	1646	2226	6		1.363	127.4	4168
North: North Leg									
1 T		854		854	5		0.928	15.2	511
2 TR		857	112	969	5		0.928	14.3	545
	0	1711	112	1823	5		0.928	14.8	545
ALL VEHICLES				Total Flow	% HV		Max X	Aver. Delay	Max Queue
				4600	5		1.362	76.8	4168

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LR	551	498	1.106	77.3	E	28.8	725
		551		1.106	77.3	E	28.8	725
East: East Leg								
22	LTR	2226	1634	1.362*	127.4	F	159.1	4168
		2226		1.362	127.4	F	159.1	4168
North: North Leg								
42	TR	1823	1964	0.928	14.8	B	20.9	545
		1823		0.928	14.8	B	20.9	545
ALL VEHICLES:		4600		1.362	76.8	E	159.1	4168

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.
* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	West	50.2	14.7	276.0	1800	299
	South	89.8	18.4	58.4	1800	104
	North	47.9	14.5	188.2	1800	299
East: East Leg						

	West	171.8	23.5	141.4	1800	171
	South	57.0	15.5	223.8	1800	271
	North	89.8	18.4	58.4	1800	171
North: North Leg						
	West	89.8	18.4	58.4	1800	170
	South	171.8	20.0	141.4	1800	143

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

Lane No.	Mov No.	Deg. Satn x	Stop-line Delay 1st d1	Stop-line Delay 2nd d2	Stop-line Delay Total dSL	Acc. Dec. dn	Queuing Total dq	Queuing MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
			Delay (seconds/veh)								
West: West Leg											
1 L	12	1.107	8.9	78.6	87.5	4.6	82.9	17.2	65.8	6.3	93.8
2 R	12	0.353	8.5	1.2	9.7	4.9	4.8	0.4	4.4	1.6	11.3
East: East Leg											
1 LT	22	0.680	2.4	1.2	3.6	4.0	0.1	0.0	0.1	2.7	6.3
2 R	22	1.363	3.2	164.6	167.8	5.4	162.3	44.7	117.6	2.3	170.1
North: North Leg											
1 T	42	0.928	4.2	10.0	14.2	5.8	8.4	5.1	3.3	1.1	15.2
2 TR	42	0.928	3.8	9.3	13.1	5.7	7.4	5.0	2.4	1.2	14.3

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	Effective Stop Rate he1	Effective Stop Rate he2	Effective Stop Rate Geom. hig	Effective Stop Rate Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 L	1.107	1.00	1.53	0.00	2.53	1.000	3.20
2 R	0.353	0.90	0.04	0.02	0.96	0.900	0.09
East: East Leg							
1 LT	0.680	0.63	0.07	0.08	0.78	0.726	0.12
2 R	1.363	0.89	5.03	0.00	5.91	1.000	7.19
North: North Leg							
1 T	0.928	0.98	0.51	0.00	1.49	1.000	0.85
2 TR	0.928	0.94	0.51	0.00	1.46	1.000	0.82

hig is the average value for all movements in a shared lane hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 L	1.107	7.8	3.1	7.7	10.7	14.8	19.1	22.4	28.8	34.2	0.40
2 R	0.353	0.0	0.8	0.0	0.8	1.4	1.7	2.0	2.4	2.8	0.38
East: East Leg											
1 LT	0.680	0.2	1.9	0.4	2.2	3.9	4.7	5.4	6.8	7.9	0.10
2 R	1.363	55.3	7.7	55.9	63.6	76.4	101.8	120.9	159.1	190.9	2.32
North: North Leg											
1 T	0.928	2.4	3.6	3.5	7.0	10.5	13.3	15.4	19.7	23.2	0.28
2 TR	0.928	2.5	3.8	3.8	7.6	11.1	14.1	16.4	20.9	24.7	0.30

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 L	1.107	197	77	193	270	374	482	563	725	860	0.40
2 R	0.353	1	19	1	20	36	44	49	61	71	0.38
East: East Leg											
1 LT	0.680	6	49	10	58	101	124	142	177	206	0.10
2 R	1.363	1448	202	1465	1667	2001	2668	3168	4168	5002	2.32
North: North Leg											
1 T	0.928	62	92	91	183	273	346	401	511	603	0.28
2 TR	0.928	65	98	98	197	289	368	427	545	643	0.30

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	Negn	Exit Speeds Negn	Cruise	Queue Move-up 1st Grn	2nd Grn	Av. Section Spd Running	Overall
West: West Leg								
12	25.0	15.3	15.3	24.0	10.2		17.5	10.5
East: East Leg								
22	25.0	18.5	18.5	24.2	15.7		14.3	7.4
North: North Leg								
42	25.0	19.9	19.9	20.3	13.9		20.2	19.4

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Main Ave & 1st ST
Alternative R1

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: West Leg								
12	437	4	29	1	82	1	1.00	0.85
East: East Leg								
22	10	1	0	0	0	0	1.00	0.95
21	0	0	5	1	0	0	1.00	0.95
23	0	0	0	0	1544	99	1.00	0.95
North: North Leg								
42	395	21	0	0	0	0	1.00	0.95
41	0	0	1230	65	0	0	1.00	0.95
43	0	0	0	0	105	6	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	1	19.68	1721	5.0	1727	0	N	0.964

East: East Leg											
90	30	150	2	2	19.68	441	1.0	441	0	N	0.904
North: North Leg											
90	30	150	2	2	19.68	16	6.0	16	0	N	0.998

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap Hdwy (s)	Critical Gap Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	1727	21.3	65.0	1.01	0.676	2.36	73.6	2.15
Thru	1	Dominant	0	21.3		0.00	0.000	0.00U	0.0	0.00U
Right	1	Dominant	1727	21.3	65.0	1.01	0.676	2.36	73.6	2.15
East: East Leg										
Left	1	Subdominant	441	14.5	173.2	2.00	0.417	3.77	80.0	3.43
Thru	1	Subdominant	441	14.5	173.2	2.00	0.417	4.04	85.8	3.67
Right	2	Dominant	441	14.5	173.2	2.00	0.417	2.43	51.6	2.21
North: North Leg										
Left	1	Subdominant	16	18.1	5997.5	2.00	0.019	2.61	69.4	2.37
Thru	1	Subdominant	16	18.1	5997.5	2.00	0.019	2.61	69.4	2.37
	2	Dominant	16	18.1	5997.5	2.00	0.019	2.27	60.4	2.07
Right	2	Dominant	16	18.1	5997.5	2.00	0.019	2.28	60.6	2.07

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

U User specified critical gap or follow-up headway for an entry stream modified for HV effects if any

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.		Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Lower Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Upper Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS
West: West Leg														
12	LTR	554	756	0.733	14.9	B	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg														
22	L	11	442	0.025	7.7	A	- - - - NA - - - -				- - - - NA - - - -			
21	T	6	241	0.025	2.2	A	- - - - NA - - - -				- - - - NA - - - -			
23	R	1643	1180	1.392	183.9	F	- - - - NA - - - -				- - - - NA - - - -			
North: North Leg														
42	L	416	738	0.564	6.4	A	- - - - NA - - - -				- - - - NA - - - -			
41	T	1295	2299	0.563	0.6	A	- - - - NA - - - -				- - - - NA - - - -			
43	R	111	197	0.563	2.3	A	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LTR	554	756	0.733	428	-43.4	583	-22.9	244	-67.7
East: East Leg									
22 L	11	442	0.025	803	81.7	351	-20.6	646	46.2
21 T	6	241	0.025	438	81.7	192	-20.3	353	46.5
23 R	1643	1180	1.392	1333	13.0	573	-51.4	1064	-9.8
North: North Leg									
42 L	416	738	0.564	808	9.5	312	-57.7	562	-23.8
41 T	1295	2299	0.563	2515	9.4	971	-57.8	1749	-23.9
43 R	111	197	0.563	216	9.6	83	-57.9	150	-23.9

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LTR	554	1.1	1721	5.0	1727	756	0.85	16	100	0.733
East: East Leg										
22 L	11	9.1	441	1.0	441	442	0.85	3315	100	0.025
21 T	6	16.7	441	1.0	441	241	0.85	3314	100	0.025
23 R	1643	6.0	441	1.0	441	1180	0.85	-39	100	1.392*
North: North Leg										
42 L	416	5.0	16	6.0	16	738	0.85	51	100	0.564
41 T	1295	5.0	16	6.0	16	2299	0.85	51	100	0.563
43 R	111	5.4	16	6.0	16	197	0.85	51	100	0.563

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	E
Worst movement Level of Service	=	F
Average intersection delay (s)	=	77.8
Largest average movement delay (s)	=	183.9
Largest back of queue, 95% (ft)	=	4352
Performance Index	=	282.41
Degree of saturation (highest)	=	1.392
Practical Spare Capacity (lowest)	=	-39 %
Effective intersection capacity, (veh/h)	=	2899

Total vehicle flow (veh/h)	=	4036
Total person flow (pers/h)	=	4843
Total vehicle delay (veh-h/h)	=	87.26
Total person delay (pers-h/h)	=	104.71
Total effective vehicle stops (veh/h)	=	11393
Total effective person stops (pers/h)	=	13671
Total vehicle travel (veh-mi/h)	=	1523.6
Total cost ($/h)	=	1757.50
Total fuel (ga/h)	=	115.3
Total CO2 (kg/h)	=	1093.29

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 LTR	2.30	2.75	14.9	0.87	1.13	6.7	168	16.67	19.8
East: East Leg									
22 L	0.02	0.03	7.7	0.44	0.62	0.1	3	0.26	21.9
21 T	0.00	0.00	2.2	0.44	0.31	0.1	3	0.12	23.5
23 R	83.93	100.72	183.9	1.00	6.33	166.1	4352	232.57	5.6
North: North Leg									
42 L	0.73	0.88	6.4	0.08	0.55	3.5	91	9.16	22.4
41 T	0.20	0.24	0.6	0.08	0.08	3.5	91	21.60	24.5
43 R	0.07	0.09	2.3	0.07	0.29	3.5	91	2.03	23.8

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
554	0.733	2.30	2.75	14.9	0.87	1.13	168	16.67	19.8
East: East Leg									
1660	1.392	83.96	100.75	182.1	0.99	6.27	4352	232.95	5.7
North: North Leg									
1822	0.564	1.00	1.20	2.0	0.08	0.20	91	32.79	24.0
ALL VEHICLES:									
4036	1.392	87.26	104.71	77.8	0.56	2.82	4352	282.41	10.3
INTERSECTION (persons):									
4843	1.392		104.71	77.8	0.56	2.82		282.41	10.3

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg									
1 LTR	12	554	756	0.733	14.9	1.13	6.7	168	

East: East Leg								
1 LT	22, 21	17	683	0.025	5.7	0.51	0.1	3
2 R	23	1643	1180	1.392	183.9	6.33	166.1	4352
North: North Leg								
1 LT	42, 41	848	1504	0.563	3.4	0.31	3.5	91
2 TR	41, 43	974	1729	0.563	0.8	0.10	3.5	91

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 LTR	12	441	30	83	554	158	756	0.733	100
East: East Leg									
1 LT	22, 21	11	6	0	17	17	683	0.025	100
2 R	23	0	0	1643	1643	150	1180	1.392	100
North: North Leg									
1 LT	42, 41	416	432	0	848	150	1504	0.563	100
2 TR	41, 43	0	863	111	974	150	1729	0.563	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LTR	9.6	131.51	0.152	5.49	0.159	90.7
	9.6	131.51	0.152	5.49	0.159	90.7
East: East Leg						
22 L	0.2	2.50	0.003	0.11	0.003	1.9
21 T	0.1	1.17	0.001	0.05	0.001	0.9
23 R	78.7	1272.31	1.462	53.53	1.415	746.6
	79.0	1275.98	1.466	53.68	1.420	749.3
North: North Leg						
42 L	7.1	90.65	0.102	3.72	0.114	67.1
41 T	18.0	238.01	0.245	7.19	0.245	170.3
43 R	1.7	21.34	0.023	0.81	0.026	15.8
	26.7	350.00	0.370	11.72	0.384	253.2
INTERSECTION:	115.3	1757.50	1.989	70.89	1.963	1093.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 LTR	441	30	83	554	1				0.733	14.9	168	
	441	30	83	554	1				0.733	14.9	168	
East: East Leg												
1 LT	11	6		17	12				0.025	5.7	3	
2 R			1643	1643	6				1.392	183.9	4352	
	11	6	1643	1660	6				1.392	182.1	4352	
North: North Leg												
1 LT	416	432		848	5				0.563	3.4	91	
2 TR		863	111	974	5				0.563	0.8	91	
	416	1295	111	1822	5				0.563	2.0	91	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	4036	5	1.392	77.8	4352

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LTR	554	756	0.733	14.9	B	6.7	168
		554		0.733	14.9	B	6.7	168
East: East Leg								

22 L	11	442	0.025	7.7	A	0.1	3
21 T	6	241	0.025	2.2	A	0.1	3
23 R	1643	1180	1.392*	183.9	F	166.1	4352
	1660		1.392	182.1	F	166.1	4352
North: North Leg							
42 L	416	738	0.564	6.4	A	3.5	91
41 T	1295	2299	0.563	0.6	A	3.5	91
43 R	111	197	0.563	2.3	A	3.5	91
	1822		0.564	2.0	A	3.5	91
ALL VEHICLES:	4036		1.392	77.8	E	166.1	4352

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.
* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	South	109.4	19.8	58.1	1800	165
	East	133.3	21.3	106.0	1800	165
	North	47.9	14.5	188.2	1800	299
East: East Leg						
	West	171.8	23.5	141.4	1800	171
	South	57.0	15.5	223.8	1800	331
	North	89.8	18.4	58.4	1800	171
North: North Leg						
	West	89.8	18.4	58.4	1800	170
	South	171.8	23.5	141.4	1800	170
	East	47.9	14.5	188.2	1800	302

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

Lane No.	Mov No.	Deg. Satn x	Stop-line Delay 1st d1	Stop-line Delay 2nd d2	Stop-line Delay Total dSL	Acc. Dec. dn	Queuing Total dq	Queuing MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
			Delay (seconds/veh)								
West: West Leg											
1 LTR	12	0.733	6.1	3.5	9.6	4.2	5.4	2.8	2.6	5.3	14.9
East: East Leg											
1 LT	22, 21	0.025	1.7	0.0	1.7	2.3	0.0	0.0	0.0	6.0 0.5	5.7
2 R	23	1.392	3.5	178.1	181.6	5.4	176.2	49.4	126.7	2.3	183.9

North: North Leg											
1 LT	42, 41	0.563	0.0	0.0	0.0	0.4	0.0	0.0	0.0	6.3 0.5	3.4
2 TR	41, 43	0.563	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5 2.3	0.8

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 LTR	0.733	0.82	0.24	0.07	1.13	0.870	0.57
East: East Leg							
1 LT	0.025	0.30	0.00	0.22	0.51	0.436	0.00
2 R	1.392	0.91	5.42	0.00	6.33	1.000	7.98
North: North Leg							
1 LT	0.563	0.02	0.00	0.29	0.31	0.081	0.00
2 TR	0.563	0.01	0.00	0.09	0.10	0.075	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

---

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LTR	0.733	0.6	1.5	0.7	2.2	3.8	4.7	5.4	6.7	7.8	0.09
East: East Leg											
1 LT	0.025	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.00
2 R	1.392	58.4	7.4	59.1	66.4	79.7	106.3	126.2	166.1	199.3	2.42
North: North Leg											
1 LT	0.563	0.0	1.1	0.0	1.1	2.0	2.5	2.8	3.5	4.0	0.05
2 TR	0.563	0.0	1.1	0.0	1.1	2.0	2.5	2.8	3.5	4.1	0.05

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio

West: West Leg											
1	LTR	0.733	16	38	17	56	96	118	135	168	196	0.09
East: East Leg											
1	LT	0.025	0	1	0	1	2	2	3	3	4	0.00
2	R	1.392	1531	193	1548	1741	2089	2785	3308	4352	5222	2.42
North: North Leg											
1	LT	0.563	0	29	0	29	53	64	73	91	105	0.05
2	TR	0.563	0	29	0	29	53	65	74	91	106	0.05

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	App. Speeds Negn	Exit Speeds Negn	Exit Speeds Cruise	Queue Move-up 1st Grn	Queue Move-up 2nd Grn	Av. Section Spd Running	Av. Section Spd Overall
West: West Leg								
12	25.0	15.6	15.6	25.0	9.0		20.5	19.8
East: East Leg								
22	25.0	15.5	15.5	25.0			21.9	21.9
21	25.0	23.5	23.5	25.0			23.5	23.5
23	25.0	18.4	18.4	25.0	15.7		12.1	5.6
North: North Leg								
42	25.0	14.5	14.5	25.0			22.4	22.4
41	25.0	23.5	23.5	25.0			24.5	24.5
43	25.0	18.4	18.4	25.0			23.8	23.8

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Main Ave & 1st St
Alternative R2

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: West Leg								
12	437	4	29	1	82	1	1.00	0.85
East: East Leg								
22	10	1	5	1	0	0	1.00	0.95
23	0	0	0	0	1544	99	1.00	0.95
North: North Leg								
42	395	21	0	0	0	0	1.00	0.95
41	0	0	1230	65	0	0	1.00	0.95
43	0	0	0	0	105	6	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	1	19.68	1721	5.0	1727	0	N	0.956
East: East Leg											
90	30	150	2	2	19.68	441	1.0	441	0	N	0.903

North: North Leg											
90	30	150	2	2	19.68	16	6.0	16	0	N	0.996

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	1727	21.3	65.0	1.01	0.676	2.36	73.6	2.15
Thru	1	Dominant	0	21.3		0.00	0.000	0.00U	0.0	0.00U
Right	1	Dominant	1727	21.3	65.0	1.01	0.676	2.36	73.6	2.15
East: East Leg										
Left	1	Subdominant	441	14.5	173.2	2.00	0.417	2.81	59.7	2.56
Thru	1	Subdominant	441	14.5	173.2	2.00	0.417	3.02	64.0	2.74
Right	1	Subdominant	441	14.5	173.2	2.00	0.417	2.73	58.0	2.48
	2	Dominant	441	14.5	173.2	2.00	0.417	2.47	52.5	2.25
North: North Leg										
Left	1	Subdominant	16	18.1	5997.5	2.00	0.019	2.61	69.4	2.37
Thru	1	Subdominant	16	18.1	5997.5	2.00	0.019	2.61	69.4	2.37
	2	Dominant	16	18.1	5997.5	2.00	0.019	2.27	60.4	2.07
Right	2	Dominant	16	18.1	5997.5	2.00	0.019	2.28	60.6	2.07

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

U User specified critical gap or follow-up headway for an entry stream modified for HV effects if any

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: West Leg													
12 LTR	554	750	0.739	15.0	B	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg													
22 LT	17	22	0.773	8.4	A	- - - - NA - - - -				- - - - NA - - - -			
23 R	1643	2163	0.760	6.3	A	- - - - NA - - - -				- - - - NA - - - -			
North: North Leg													
42 L	416	737	0.564	6.4	A	- - - - NA - - - -				- - - - NA - - - -			
41 T	1295	2294	0.565	0.6	A	- - - - NA - - - -				- - - - NA - - - -			
43 R	111	197	0.563	2.3	A	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LTR	554	750	0.739	428	-42.9	584	-22.1	244	-67.5
East: East Leg									
22 LT	17	22	0.773	27	22.7	12	-45.5	22	0.0
23 R	1643	2163	0.760	2636	21.9	1134	-47.6	2104	-2.7
North: North Leg									
42 L	416	737	0.564	808	9.6	313	-57.5	562	-23.7
41 T	1295	2294	0.565	2515	9.6	973	-57.6	1749	-23.8
43 R	111	197	0.563	216	9.6	83	-57.9	150	-23.9

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LTR	554	1.1	1721	5.0	1727	750	0.85	15	100	0.739
East: East Leg										
22 LT	17	11.8	441	1.0	441	22	0.85	10	100	0.773*
23 R	1643	6.0	441	1.0	441	2163	0.85	12	100	0.760
North: North Leg										
42 L	416	5.0	16	6.0	16	737	0.85	51	100	0.564
41 T	1295	5.0	16	6.0	16	2294	0.85	51	100	0.565
43 R	111	5.4	16	6.0	16	197	0.85	51	100	0.563

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	B
Average intersection delay (s)	=	5.6
Largest average movement delay (s)	=	15.0
Largest back of queue, 95% (ft)	=	260
Performance Index	=	92.32
Degree of saturation (highest)	=	0.773
Practical Spare Capacity (lowest)	=	10 %
Effective intersection capacity, (veh/h)	=	5223
Total vehicle flow (veh/h)	=	4036
Total person flow (pers/h)	=	4843
Total vehicle delay (veh-h/h)	=	6.22
Total person delay (pers-h/h)	=	7.47

Total effective vehicle stops (veh/h)	=	2446
Total effective person stops (pers/h)	=	2935
Total vehicle travel (veh-mi/h)	=	1523.6
Total cost ($/h)	=	831.61
Total fuel (ga/h)	=	64.8
Total CO2 (kg/h)	=	614.80

Table S.5 - MOVEMENT PERFORMANCE

Mov No.		Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg										
12	LTR	2.31	2.78	15.0	0.88	1.14	6.8	171	16.75	19.7
East: East Leg										
22	LT	0.04	0.05	8.4	0.81	0.90	9.5	250	0.46	21.7
23	R	2.87	3.44	6.3	0.81	0.88	9.9	260	41.83	22.2
North: North Leg										
42	L	0.73	0.88	6.4	0.10	0.54	4.2	109	9.27	22.4
41	T	0.20	0.24	0.6	0.09	0.08	4.3	112	21.96	24.5
43	R	0.07	0.09	2.3	0.09	0.29	4.3	112	2.06	23.8

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
554	0.739	2.31	2.78	15.0	0.88	1.14	171	16.75	19.7
East: East Leg									
1660	0.773	2.91	3.49	6.3	0.81	0.88	260	42.29	22.2
North: North Leg									
1822	0.565	1.00	1.20	2.0	0.10	0.20	112	33.29	23.9
ALL VEHICLES:									
4036	0.773	6.22	7.47	5.6	0.49	0.61	260	92.32	22.5
INTERSECTION (persons):									
4843	0.773		7.47	5.6	0.49	0.61		92.32	22.5

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.		Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg										
1	LTR	12	554	750	0.739	15.0	1.14	6.8	171	
East: East Leg										
1	LTR	22, 23	782	1030	0.760	6.6	0.90	9.5	250	
2	R	23	878	1156	0.760	6.1	0.86	9.9	260	

North: North Leg								
1 LT	42, 41	848	1502	0.564	3.4	0.31	4.2	109
2 TR	41, 43	974	1726	0.564	0.8	0.10	4.3	112

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 LTR	12	441	30	83	554	158	750	0.739	100
East: East Leg									
1 LTR	22, 23	11	6	765	782	150	1030	0.760	100
2 R	23	0	0	878	878	150	1156	0.760	100
North: North Leg									
1 LT	42, 41	416	432	0	848	150	1502	0.564	100
2 TR	41, 43	0	863	111	974	150	1726	0.564	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LTR	9.6	131.73	0.153	5.50	0.159	90.9
	9.6	131.73	0.153	5.50	0.159	90.9
East: East Leg						
22 LT	0.3	3.84	0.005	0.18	0.005	2.9
23 R	28.1	345.20	0.409	16.20	0.484	266.9
	28.4	349.04	0.414	16.38	0.489	269.8
North: North Leg						
42 L	7.1	90.78	0.102	3.73	0.114	67.2
41 T	18.0	238.68	0.247	7.31	0.248	171.0
43 R	1.7	21.38	0.024	0.81	0.026	15.9
	26.8	350.84	0.372	11.86	0.388	254.2
INTERSECTION:	64.8	831.61	0.939	33.74	1.036	614.8

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal) = 1.800

Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 LTR	441	30	83	554	1				0.739	15.0	171	
	441	30	83	554	1				0.739	15.0	171	
East: East Leg												
1 LTR	11	6	765	782	6				0.760	6.6	250	
2 R			878	878	6				0.760	6.1	260	
	11	6	1643	1660	6				0.760	6.3	260	
North: North Leg												
1 LT	416	432		848	5				0.564	3.4	109	
2 TR		863	111	974	5				0.564	0.8	112	
	416	1295	111	1822	5				0.564	2.0	112	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	4036	5	0.773	5.6	260

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LTR	554	750	0.739	15.0	B	6.8	171
		554		0.739	15.0	B	6.8	171
East: East Leg								
22	LT	17	22	0.773*	8.4	A	9.5	250
23	R	1643	2163	0.760	6.3	A	9.9	260
		1660		0.773	6.3	A	9.9	260

North: North Leg							
42 L	416	737	0.564	6.4	A	4.2	109
41 T	1295	2294	0.565	0.6	A	4.3	112
43 R	111	197	0.563	2.3	A	4.3	112
	1822		0.565	2.0	A	4.3	112
ALL VEHICLES:	4036		0.773	5.6	A	9.9	260

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.
* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	South	109.4	19.8	58.1	1800	165
	East	133.3	21.3	106.0	1800	165
	North	47.9	14.5	188.2	1800	299
East: East Leg						
	West	171.8	23.5	141.4	1800	171
	South	57.0	15.5	223.8	1800	331
	North	89.8	18.4	58.4	1800	171
North: North Leg						
	West	89.8	18.4	58.4	1800	170
	South	171.8	23.5	141.4	1800	170
	East	47.9	14.5	188.2	1800	302

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
Lane No.	Mov No.	Deg. Satn x	Stop-line Delay 1st d1	2nd d2	Total dSL	Acc. Dec. dn	Queuing Total dq	MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
West: West Leg											
1 LTR	12	0.739	6.1	3.6	9.7	4.2	5.5	2.8	2.7	5.3	15.0
East: East Leg											
1 LTR	22, 23	0.760	2.4	1.8	4.2	4.4	0.0	0.0	0.0	4.2 2.3	6.6
2 R	23	0.760	2.1	1.6	3.8	4.4	0.0	0.0	0.0	2.3	6.1
North: North Leg											
1 LT	42, 41	0.564	0.0	0.0	0.0	0.5	0.0	0.0	0.0	6.3 0.5	3.4
2 TR	41, 43	0.564	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.5 2.3	0.8

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 LTR	0.739	0.83	0.24	0.06	1.14	0.876	0.58
East: East Leg							
1 LTR	0.760	0.73	0.12	0.06	0.90	0.810	0.18
2 R	0.760	0.70	0.11	0.06	0.86	0.804	0.16
North: North Leg							
1 LT	0.564	0.02	0.00	0.29	0.31	0.098	0.00
2 TR	0.564	0.01	0.00	0.09	0.10	0.092	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LTR	0.739	0.7	1.5	0.7	2.2	3.9	4.8	5.5	6.8	7.9	0.10
East: East Leg											
1 LTR	0.760	0.5	2.5	0.7	3.2	5.4	6.6	7.6	9.5	11.1	0.14
2 R	0.760	0.4	2.6	0.8	3.4	5.6	6.9	7.9	9.9	11.6	0.14
North: North Leg											
1 LT	0.564	0.0	1.4	0.0	1.4	2.4	3.0	3.4	4.2	4.9	0.06
2 TR	0.564	0.0	1.4	0.0	1.4	2.5	3.1	3.5	4.3	5.0	0.06

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LTR	0.739	17	39	18	57	98	120	137	171	200	0.10
East: East Leg											
1 LTR	0.760	12	65	20	84	141	174	200	250	292	0.14

2 R	0.760	12	68	20	88	146	181	207	260	304	0.14
North: North Leg											
1 LT	0.564	0	35	0	35	63	77	88	109	127	0.06
2 TR	0.564	0	36	0	36	65	80	90	112	130	0.06

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	App. Speeds Negn	Exit Speeds Negn	Exit Speeds Cruise	Queue Move-up 1st Grn	Queue Move-up 2nd Grn	Av. Section Spd Running	Av. Section Spd Overall
West: West Leg								
12	25.0	15.6	15.6	25.0	9.0		20.5	19.7
East: East Leg								
22	25.0	18.1	18.1	25.0	14.5		21.7	21.7
23	25.0	18.4	18.4	25.0	15.2		22.2	22.2
North: North Leg								
42	25.0	14.5	14.5	25.0			22.4	22.4
41	25.0	23.5	23.5	25.0			24.5	24.5
43	25.0	18.4	18.4	25.0			23.8	23.8

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Main Ave & 1st St
Alternative R3

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES Demand flows in veh/hour as used by the program								
West: West Leg								
12	437	4	0	0	109	1	1.00	0.85
East: East Leg								
22	322	21	223	14	0	0	1.00	0.95
23	0	0	0	0	1597	102	1.00	0.92
North: North Leg								
42	0	0	1625	86	106	6	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	2	19.68	2049	5.2	2058	0	Y	0.570
East: East Leg											
90	30	150	2	2	19.68	401	1.0	401	0	Y	0.902

North: North Leg

90	30	150	2	2	19.68	572	6.0	579	0	Y	0.835

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap Hdwy (s)	Critical Gap Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	2058	19.3	49.4	1.17	0.815	2.00*	56.5	1.65
Right	2	Subdominant	2058	19.3	49.4	1.17	0.815	2.25	63.6	2.05
East: East Leg										
Left	1	Subdominant	401	14.5	190.7	2.00	0.387	2.72	57.8	2.48
Thru	1	Subdominant	401	14.5	190.7	2.00	0.387	2.72	57.7	2.47
Right	1	Subdominant	401	14.5	190.7	2.00	0.387	2.72	57.8	2.47
	2	Dominant	401	14.5	190.7	2.00	0.387	2.46	52.1	2.23
North: North Leg										
Thru	1	Subdominant	579	18.7	171.0	2.00	0.510	2.69	74.0	2.45
	2	Dominant	579	18.7	171.0	2.00	0.510	2.42	66.4	2.20
Right	2	Dominant	579	18.7	171.0	2.00	0.510	2.42	66.6	2.20

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

* Critical gap or follow-up headway set to MINIMUM value

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Lower Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Upper Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS
West: West Leg													
12 LR	551	500	1.102	75.5	E	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg													
22 LT	580	574	1.010	25.2	C	- - - - NA - - - -				- - - - NA - - - -			
23 R	1699	1682	1.010	27.5	C	- - - - NA - - - -				- - - - NA - - - -			
North: North Leg													
42 TR	1823	1876	0.972	20.4	C	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model

Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LR	551	500	1.102	382	-23.6	446	-10.8	250	-50.0
East: East Leg									
22 LT	580	574	1.010	699	21.8	302	-47.4	540	-5.9
23 R	1699	1682	1.010	2048	21.8	886	-47.3	1581	-6.0
North: North Leg									
42 TR	1823	1876	0.972	2188	16.6	1223	-34.8	1612	-14.1

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LR	551	0.9	2049	5.2	2058	500	0.85	-23	32	1.102*
East: East Leg										
22 LT	580	6.0	401	1.0	401	574	0.85	-16	100	1.010
23 R	1699	6.0	401	1.0	401	1682	0.85	-16	100	1.010
North: North Leg										
42 TR	1823	5.0	572	6.0	579	1876	0.85	-13	100	0.972

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	C
Worst movement Level of Service	=	E
Average intersection delay (s)	=	30.1
Largest average movement delay (s)	=	75.5
Largest back of queue, 95% (ft)	=	928
Performance Index	=	197.95
Degree of saturation (highest)	=	1.102
Practical Spare Capacity (lowest)	=	-23 %
Effective intersection capacity, (veh/h)	=	4222
Total vehicle flow (veh/h)	=	4653
Total person flow (pers/h)	=	5584
Total vehicle delay (veh-h/h)	=	38.90
Total person delay (pers-h/h)	=	46.68
Total effective vehicle stops (veh/h)	=	7723
Total effective person stops (pers/h)	=	9267
Total vehicle travel (veh-mi/h)	=	1740.4
Total cost ($/h)	=	1228.21
Total fuel (ga/h)	=	92.6
Total CO2 (kg/h)	=	878.17

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 LR	11.56	13.87	75.5	0.98	2.19	28.3	712	38.14	10.7
East: East Leg									
22 LT	4.05	4.86	25.2	1.00	1.73	33.2	870	25.33	17.0
23 R	12.96	15.55	27.5	1.00	1.45	35.4	928	61.66	21.9
North: North Leg									
42 TR	10.33	12.40	20.4	1.00	1.67	26.3	685	72.82	17.9

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
551	1.102	11.56	13.87	75.5	0.98	2.19	712	38.14	10.7
East: East Leg									
2279	1.010	17.01	20.42	26.9	1.00	1.52	928	86.98	20.4
North: North Leg									
1823	0.972	10.33	12.40	20.4	1.00	1.67	685	72.82	17.9
ALL VEHICLES:									
4653	1.102	38.90	46.68	30.1	1.00	1.66	928	197.95	17.5
INTERSECTION (persons):									
5584	1.102		46.68	30.1	1.00	1.66		197.95	17.5

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg									
1 L	12	441	400	1.101	91.5	2.50	28.3	712	
2 R	12	110	313	0.351	11.2	0.96	2.4	61	160
East: East Leg									
1 LTR	22, 23	1073	1062	1.010	26.7	1.61	33.2	870	
2 R	23	1206	1194	1.010	27.1	1.44	35.4	928	
North: North Leg									
1 T	42	854	879	0.972	21.0	1.69	24.5	637	
2 TR	42	969	997	0.972	19.9	1.66	26.3	685	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h)	Min Cap (veh	Tot Cap (veh	Deg. Satn	Lane Util

		Lef	Thru	Rig	Tot	/h)	/h)	x	%
West: West Leg									
1 L	12	441	0	0	441	150	400	1.101	100
2 R	12	0	0	110	110	110	313	0.351	32P
East: East Leg									
1 LTR	22, 23	343	237	493	1073	150	1062	1.010	100
2 R	23	0	0	1206	1206	150	1194	1.010	100
North: North Leg									
1 T	42	0	854	0	854	150	879	0.972	100
2 TR	42	0	857	112	969	150	997	0.972	100

P Lane under-utilisation found by the "Program"

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LR	13.4	226.60	0.237	6.83	0.196	126.8
	13.4	226.60	0.237	6.83	0.196	126.8
East: East Leg						
22 LT	12.1	161.53	0.191	7.40	0.211	115.1
23 R	33.3	382.55	0.513	20.86	0.682	315.8
	45.4	544.08	0.704	28.26	0.893	431.0
North: North Leg						
42 TR	33.8	457.53	0.532	19.75	0.565	320.4
	33.8	457.53	0.532	19.75	0.565	320.4
INTERSECTION:	92.6	1228.21	1.473	54.83	1.653	878.2

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane	Demand Flow (veh/h)	Adj.	Eff Grn	Deg	Aver.	Longest	Shrt

No.	L	T	R	Tot	%HV	Basic Satf.	(secs) 1st	2nd	Sat x	Delay (sec)	Queue (ft)	Lane (ft)
West: West Leg												
1 L	441			441	1				1.101	91.5	712	
2 R			110	110	1				0.351	11.2	61	160
	441	0	110	551	1				1.101	75.5	712	
East: East Leg												
1 LTR	343	237	493	1073	6				1.010	26.7	870	
2 R			1206	1206	6				1.010	27.1	928	
	343	237	1699	2279	6				1.010	26.9	928	
North: North Leg												
1 T		854		854	5				0.972	21.0	637	
2 TR		857	112	969	5				0.972	19.9	685	
	0	1711	112	1823	5				0.972	20.4	685	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	4653	5	1.102	30.1	928

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LR	551	500	1.102*	75.5	E	28.3	712
		551		1.102	75.5	E	28.3	712
East: East Leg								
22	LT	580	574	1.010	25.2	C	33.2	870
23	R	1699	1682	1.010	27.5	C	35.4	928
		2279		1.010	26.9	C	35.4	928
North: North Leg								
42	TR	1823	1876	0.972	20.4	C	26.3	685
		1823		0.972	20.4	C	26.3	685
ALL VEHICLES:		4653		1.102	30.1	C	35.4	928

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.
* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	West	50.2	14.7	276.0	1800	299
	South	89.8	18.4	58.4	1800	104
	North	47.9	14.5	188.2	1800	299
East: East Leg						
	West	171.8	23.5	141.4	1800	171
	South	57.0	15.5	223.8	1800	271
	North	89.8	18.4	58.4	1800	171
North: North Leg						
	West	89.8	18.4	58.4	1800	170
	South	171.8	20.0	141.4	1800	143

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
		Deg.	Stop-line Delay			Acc.	Queuing		Stopd		
Lane No.	Mov No.	Satn x	1st d1	2nd d2	Total dSL	Dec. dn	Total dq	MvUp dqm	(Idle) di	Geom dig	Control dic
West: West Leg											
1 L	12	1.101	8.8	76.4	85.3	4.6	80.7	16.8	63.9	6.3	91.5
2 R	12	0.351	8.4	1.2	9.6	4.9	4.7	0.4	4.3	1.6	11.2
East: East Leg											
1 LTR	22, 23	1.010	3.5	18.9	22.4	5.5	17.0	8.5	8.5	2.7 6.0	26.7
2 R	23	1.010	3.2	17.9	21.1	5.4	15.6	9.3	6.3	6.0	27.1
North: North Leg											
1 T	42	0.972	4.1	15.8	19.9	5.8	14.1	7.0	7.1	1.1	21.0
2 TR	42	0.972	3.7	15.0	18.7	5.7	13.0	6.9	6.0	1.2	19.9

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							

1 L	1.101	1.00	1.50	0.00	2.50	1.000	3.14
2 R	0.351	0.90	0.04	0.02	0.96	0.899	0.08
East: East Leg							
1 LTR	1.010	0.90	0.71	0.00	1.61	1.000	1.25
2 R	1.010	0.86	0.57	0.00	1.44	1.000	1.20
North: North Leg							
1 T	0.972	0.98	0.70	0.00	1.69	1.000	1.17
2 TR	0.972	0.95	0.72	0.00	1.66	1.000	1.14

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 L	1.101	7.6	3.1	7.5	10.5	14.6	18.8	21.9	28.3	33.5	0.40
2 R	0.351	0.0	0.7	0.0	0.8	1.4	1.7	2.0	2.4	2.8	0.38
East: East Leg											
1 LTR	1.010	5.5	5.3	7.3	12.6	16.9	21.9	25.7	33.2	39.5	0.48
2 R	1.010	5.8	5.7	7.8	13.5	17.9	23.3	27.3	35.4	42.2	0.52
North: North Leg											
1 T	0.972	3.6	4.0	5.0	9.0	12.8	16.4	19.1	24.5	29.0	0.35
2 TR	0.972	3.9	4.3	5.4	9.7	13.7	17.6	20.5	26.3	31.2	0.38

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 L	1.101	192	77	188	265	367	473	553	712	844	0.40
2 R	0.351	1	19	1	19	36	43	49	61	71	0.38
East: East Leg											
1 LTR	1.010	144	138	191	329	443	574	673	870	1035	0.48
2 R	1.010	152	148	205	353	469	610	716	928	1104	0.52
North: North Leg											
1 T	0.972	95	105	129	234	334	427	497	637	754	0.35
2 TR	0.972	101	112	141	253	356	457	533	685	811	0.38

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	Negn	Exit Speeds Negn	Cruise	Queue Move-up 1st Grn	2nd Grn	Av. Section Spd Running	Overall

West: West Leg								
12	25.0	15.3	15.3	24.0	10.2		17.6	10.7
East: East Leg								
22	25.0	18.7	18.7	22.0	15.4		19.2	17.0
23	40.0	18.4	18.4	25.0	15.9		24.6	21.9
North: North Leg								
42	25.0	19.9	19.9	20.3	14.0		19.6	17.9

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Main Ave & 1st St
Alternative R4

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION
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* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES Demand flows in veh/hour as used by the program								
West: West Leg								
12	437	4	29	1	82	1	1.00	0.85
East: East Leg								
22	25	2	5	1	5	1	1.00	0.95
North: North Leg								
42	395	21	1230	65	105	6	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	1	13.00	1737	5.0	1743	0	N	0.902
East: East Leg											
90	30	150	2	1	13.00	441	1.0	441	0	N	0.892
North: North Leg											
90	30	150	2	2	13.00	32	6.0	32	0	N	0.995

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	1743	21.2	64.2	1.02	0.682	2.85	88.8	2.14
Thru	1	Dominant	1743	21.2	64.2	1.02	0.682	2.86	88.8	2.14
Right	1	Dominant	1743	21.2	64.2	1.02	0.682	2.85	88.8	2.14
East: East Leg										
Left	1	Dominant	441	14.5	173.2	2.00	0.417	4.16	88.3	2.69
Thru	1	Dominant	441	14.5	173.2	2.00	0.417	4.53	96.2	2.93
Right	1	Dominant	441	14.5	173.2	2.00	0.417	4.53	96.2	2.93
North: North Leg										
Left	1	Subdominant	32	16.8	2777.3	2.00	0.038	4.03	99.3	2.40
Thru	1	Subdominant	32	16.8	2777.3	2.00	0.038	4.03	99.3	2.40
	2	Dominant	32	16.8	2777.3	2.00	0.038	3.54	87.3	2.11
Right	2	Dominant	32	16.8	2777.3	2.00	0.038	3.55	87.5	2.11

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.		Dem Flow (veh/h)	aaSIDRA Cap. (veh/h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh/h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh/h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: West Leg														
12	LTR	554	583	0.950	35.2	D	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg														
22	LTR	39	799	0.049	6.6	A	- - - - NA - - - -				- - - - NA - - - -			
North: North Leg														
42	LTR	1822	3118	0.584	2.1	A	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LTR	554	583	0.950	405	-30.5	557	-4.5	228	-60.9
East: East Leg									
22 LTR	39	799	0.049	1285	60.8	965	20.8	1026	28.4
North: North Leg									
42 LTR	1822	3118	0.584	3492	12.0	1359	-56.4	2432	-22.0

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LTR	554	1.1	1737	5.0	1743	583	0.85	-11	100	0.950*
East: East Leg										
22 LTR	39	10.3	441	1.0	441	799	0.85	1641	100	0.049
North: North Leg										
42 LTR	1822	5.0	32	6.0	32	3118	0.85	45	100	0.584

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	D
Average intersection delay (s)	=	9.8
Largest average movement delay (s)	=	35.2
Largest back of queue, 95% (ft)	=	388
Performance Index	=	61.09
Degree of saturation (highest)	=	0.950
Practical Spare Capacity (lowest)	=	-11 %
Effective intersection capacity, (veh/h)	=	2541
Total vehicle flow (veh/h)	=	2415
Total person flow (pers/h)	=	2898
Total vehicle delay (veh-h/h)	=	6.56
Total person delay (pers-h/h)	=	7.87
Total effective vehicle stops (veh/h)	=	1439
Total effective person stops (pers/h)	=	1727
Total vehicle travel (veh-mi/h)	=	921.0
Total cost ($/h)	=	530.16
Total fuel (ga/h)	=	39.3
Total CO2 (kg/h)	=	372.28

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									

12	LTR	5.42	6.50	35.2	0.97	1.88	15.4	388	25.28	15.4
East: East Leg										
22	LTR	0.07	0.09	6.6	0.55	0.57	0.3	9	0.91	22.1
North: North Leg										
42	LTR	1.07	1.28	2.1	0.21	0.21	6.4	166	34.89	23.6

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
554	0.950	5.42	6.50	35.2	0.97	1.88	388	25.28	15.4
East: East Leg									
39	0.049	0.07	0.09	6.6	0.55	0.57	9	0.91	22.1
North: North Leg									
1822	0.584	1.07	1.28	2.1	0.21	0.21	166	34.89	23.6
ALL VEHICLES:									
2415	0.950	6.56	7.87	9.8	0.39	0.60	388	61.09	21.0
INTERSECTION (persons):									
2898	0.950		7.87	9.8	0.39	0.60		61.09	21.0

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg									
1 LTR	12	554	583	0.951	35.2	1.88	15.4	388	
East: East Leg									
1 LTR	22	39	799	0.049	6.6	0.57	0.3	9	
North: North Leg									
1 LT	42	851	1457	0.584	3.6	0.31	6.4	166	
2 TR	42	971	1661	0.584	0.8	0.12	6.4	166	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 LTR	12	441	30	83	554	150	583	0.951	100
East: East Leg									
1 LTR	22	27	6	6	39	39	799	0.049	100
North: North Leg									

1 LT	42	416	435	0	851	150	1457	0.584	100
2 TR	42	0	860	111	971	150	1661	0.584	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LTR	11.1	165.20	0.186	6.36	0.181	105.5
	11.1	165.20	0.186	6.36	0.181	105.5
East: East Leg						
22 LTR	0.7	8.63	0.010	0.37	0.011	6.5
	0.7	8.63	0.010	0.37	0.011	6.5
North: North Leg						
42 LTR	27.4	356.32	0.386	12.78	0.409	260.3
	27.4	356.32	0.386	12.78	0.409	260.3
INTERSECTION:	39.3	530.16	0.582	19.52	0.601	372.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 LTR	441	30	83	554	1				0.951	35.2	388	
	441	30	83	554	1				0.951	35.2	388	
East: East Leg												
1 LTR	27	6	6	39	10				0.049	6.6	9	
	27	6	6	39	10				0.049	6.6	9	

North: North Leg								
1 LT	416	435		851	5	0.584	3.6	166
2 TR		860	111	971	5	0.584	0.8	166
	416	1295	111	1822	5	0.584	2.1	166

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	2415	4	0.950	9.8	388

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)
West: West Leg								
12	LTR	554	583	0.950*	35.2	D	15.4	388
		554		0.950	35.2	D	15.4	388
East: East Leg								
22	LTR	39	799	0.049	6.6	A	0.3	9
		39		0.049	6.6	A	0.3	9
North: North Leg								
42	LTR	1822	3118	0.584	2.1	A	6.4	166
		1822		0.584	2.1	A	6.4	166
ALL VEHICLES:		2415		0.950	9.8	A	15.4	388

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	South	116.1	20.3	58.0	1800	165
	East	133.3	21.3	106.0	1800	165
	North	47.9	14.5	188.2	1800	299
East: East Leg						
	West	171.8	23.5	141.4	1800	171
	South	57.0	15.5	223.8	1800	331
	North	116.1	20.3	58.0	1800	171

North: North Leg

West	103.1	19.4	58.2	1800	170
South	171.8	23.5	141.4	1800	170
East	47.9	14.5	188.2	1800	302

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
		Deg.	Stop-line Delay			Acc.	Queuing		Stopd		
Lane	Mov	Satn	1st	2nd	Total	Dec.	Total	MvUp	(Idle)	Geom	Control
No.	No.	x	d1	d2	dSL	dn	dq	dqm	di	dig	dic
West: West Leg											
1 LTR	12	0.951	8.0	21.9	29.9	4.7	25.2	10.3	14.9	5.3	35.2
East: East Leg											
1 LTR	22	0.049	2.0	0.0	2.0	2.9	0.0	0.0	0.0	4.6	6.6
North: North Leg											
1 LT	42	0.584	0.2	0.0	0.2	1.2	0.0	0.0	0.0	3.3	3.6
2 TR	42	0.584	0.2	0.0	0.2	1.3	0.0	0.0	0.0	0.7	0.8

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

							Queue
	Deg.	-- Effective Stop Rate --				Prop.	Move-up
Lane	Satn			Geom.	Overall	Queued	Rate
No.	x	he1	he2	hig	h	pq	hqm
West: West Leg							
1 LTR	0.951	0.97	0.89	0.01	1.88	0.974	2.01
East: East Leg							
1 LTR	0.049	0.38	0.00	0.19	0.57	0.555	0.00
North: North Leg							
1 LT	0.584	0.06	0.00	0.25	0.31	0.221	0.00
2 TR	0.584	0.04	0.00	0.07	0.12	0.204	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

---

Table D.3A - LANE QUEUES (veh)

	Deg.	Ovrfl.	Average (veh)	Percentile (veh)	Queue

Lane No.	Satn x	Queue No	Nb1	Nb2	Nb	70%	85%	90%	95%	98%	Stor. Ratio
West: West Leg											
1 LTR	0.951	3.1	2.1	3.3	5.4	8.4	10.5	12.2	15.4	18.1	0.22
East: East Leg											
1 LTR	0.049	0.0	0.1	0.0	0.1	0.2	0.2	0.3	0.3	0.4	0.00
North: North Leg											
1 LT	0.584	0.0	2.1	0.0	2.1	3.7	4.5	5.1	6.4	7.4	0.09
2 TR	0.584	0.0	2.1	0.0	2.1	3.7	4.5	5.1	6.4	7.4	0.09

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane	Deg. Satn	Ovrfl. Queue	Average (feet)			Percentile (feet)					Queue Stor.
No.	x	No	Nb1	Nb2	Nb	70%	85%	90%	95%	98%	Ratio
West: West Leg											
1 LTR	0.951	79	54	82	136	212	266	307	388	456	0.22
East: East Leg											
1 LTR	0.049	0	3	0	3	5	6	7	9	10	0.00
North: North Leg											
1 LT	0.584	0	55	0	55	95	117	133	166	193	0.09
2 TR	0.584	0	55	0	55	95	117	134	166	194	0.09

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov	App. Speeds		Exit Speeds		Queue Move-up		Av. Section Spd	
No.	Cruise	Negn	Negn	Cruise	1st Grn	2nd Grn	Running	Overall
West: West Leg								
12	25.0	15.7	15.7	25.0	9.5		18.4	15.4
East: East Leg								
22	25.0	17.3	17.3	25.0			22.1	22.1
North: North Leg								
42	25.0	21.2	21.2	25.0			23.6	23.6

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Pacific Ave & 1st St
No-Build

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES Demand flows in veh/hour as used by the program								
South: South Leg								
32	1206	63	0	0	0	0	1.00	0.95
31	0	0	31	2	0	0	1.00	0.95
East: East Leg								
21	0	0	888	47	0	0	1.00	0.95
23	0	0	0	0	19	1	1.00	0.95
North: North Leg								
42	0	0	0	0	20	0	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
South: South Leg											
90	30	150	2	2	13.00	0	0.0	0	0	N	1.000
East: East Leg											
90	30	150	2	2	13.00	1302	5.0	1307	0	N	1.000

North: North Leg											
90	30	150	2	1	13.00	2204	5.0	2212	0	N	0.838

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
South: South Leg										
Left	1	Subdominant	0	0.0		2.00	0.000	3.96	0.0	2.34
	2	Dominant	0	0.0		2.00	0.000	3.41	0.0	2.01
Thru	2	Dominant	0	0.0		2.00	0.000	3.44	0.0	2.03
East: East Leg										
Thru	1	Subdominant	1307	15.7	63.3	1.06	0.578	3.16	72.6	2.31
	2	Dominant	1307	15.7	63.3	1.06	0.578	2.65	60.9	1.94
Right	2	Dominant	1307	15.7	63.3	1.06	0.578	2.65	60.9	1.94
North: North Leg										
Right	1	Dominant	2212	18.9	45.0	1.06	0.804	2.63	72.9	1.96

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
South: South Leg													
32 L	1269	3242	0.391	9.1	A	2256	0.562	9.1	A	2689	0.472	9.1	A
31 T	33	84	0.393	0.5	A	59	0.559	0.5	A	70	0.471	0.5	A
East: East Leg													
21 T	935	1652	0.566	8.4	A	- - - - NA - - - -				- - - - NA - - - -			
23 R	20	35	0.571	7.4	A	- - - - NA - - - -				- - - - NA - - - -			
North: North Leg													
42 R	20	417	0.048	11.7	B	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
South: South Leg									
32 L	1269	3242	0.391	3496	7.8	1340	-58.7	2428	-25.1
31 T	33	84	0.393	91	8.3	35	-58.3	63	-25.0
East: East Leg									
21 T	935	1652	0.566	1152	-30.3	709	-57.1	754	-54.4
23 R	20	35	0.571	25	-28.6	15	-57.1	16	-54.3
North: North Leg									
42 R	20	417	0.048	268	-35.7	198	-52.5	150	-64.0

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
South: South Leg										
32 L	1269	5.0	0			3242	0.85	117	100	0.391
31 T	33	6.1	0			84	0.85	116	100	0.393
East: East Leg										
21 T	935	5.0	1302	5.0	1307	1652	0.85	50	100	0.566
23 R	20	5.0	1302	5.0	1307	35	0.85	49	100	0.571*
North: North Leg										
42 R	20	0.0	2204	5.0	2212	417	0.85	1672	100	0.048

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	B
Average intersection delay (s)	=	8.7
Largest average movement delay (s)	=	11.7
Largest back of queue, 95% (ft)	=	115
Performance Index	=	57.38
Degree of saturation (highest)	=	0.571
Practical Spare Capacity (lowest)	=	49 %
Effective intersection capacity, (veh/h)	=	3985
Total vehicle flow (veh/h)	=	2277
Total person flow (pers/h)	=	2732
Total vehicle delay (veh-h/h)	=	5.51
Total person delay (pers-h/h)	=	6.61
Total effective vehicle stops (veh/h)	=	1739
Total effective person stops (pers/h)	=	2086
Total vehicle travel (veh-mi/h)	=	983.9
Total cost ($/h)	=	578.72
Total fuel (ga/h)	=	55.6
Total CO2 (kg/h)	=	527.29

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
South: South Leg									
32 L	3.22	3.87	9.1	0.00	0.65	0.0	0	30.39	23.4
31 T	0.00	0.01	0.5	0.00	0.07	0.0	0	0.51	24.8
East: East Leg									
21 T	2.17	2.61	8.4	0.73	0.94	4.4	115	25.41	23.1
23 R	0.04	0.05	7.4	0.73	0.93	4.4	115	0.50	22.0
North: North Leg									
42 R	0.07	0.08	11.7	0.80	0.84	0.3	7	0.58	21.8

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
South: South Leg									
1302	0.393	3.23	3.87	8.9	0.00	0.64	0	30.89	23.4
East: East Leg									
955	0.571	2.21	2.66	8.3	0.73	0.94	115	25.91	23.0
North: North Leg									
20	0.048	0.07	0.08	11.7	0.80	0.84	7	0.58	21.8
ALL VEHICLES:									
2277	0.571	5.51	6.61	8.7	0.31	0.76	115	57.38	23.2
INTERSECTION (persons):									
2732	0.571		6.61	8.7	0.31	0.76		57.38	23.2

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
South: South Leg									
1 L	32	602	1539	0.391	9.1	0.65	0.0	0	
2 LT	32, 31	700	1787	0.391	8.7	0.62	0.0	0	
East: East Leg									
1 T	21	414	732	0.566	9.3	0.95	4.1	107	
2 TR	21, 23	541	955	0.566	7.6	0.93	4.4	115	
North: North Leg									
1 R	42	20	417	0.048	11.7	0.84	0.3	7	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane	Mov	Dem Flow (veh/h)	Min Cap	Tot Cap	Deg.	Lane

No.	No.	Lef	Thru	Rig	Tot	(veh /h)	(veh /h)	Satn x	Util %
South: South Leg									
1 L	32	602	0	0	602	150	1539	0.391	100
2 LT	32, 31	667	33	0	700	150	1787	0.391	100
East: East Leg									
1 T	21	0	414	0	414	150	732	0.566	100
2 TR	21, 23	0	521	20	541	150	955	0.566	100
North: North Leg									
1 R	42	0	0	20	20	20	417	0.048	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
South: South Leg						
32 L	31.6	329.12	0.485	24.49	0.670	299.5
31 T	0.4	5.99	0.006	0.17	0.006	4.3
	32.0	335.11	0.491	24.66	0.676	303.7
East: East Leg						
21 T	22.8	234.45	0.346	17.77	0.498	216.2
23 R	0.3	4.22	0.005	0.19	0.006	3.2
	23.1	238.67	0.351	17.96	0.503	219.4
North: North Leg						
42 R	0.4	4.94	0.007	0.34	0.009	4.1
	0.4	4.94	0.007	0.34	0.009	4.1
INTERSECTION:	55.6	578.72	0.850	42.96	1.188	527.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
South: South Leg												
1 L	602			602	5				0.391	9.1	0	
2 LT	667	33		700	5				0.391	8.7	0	
	1269	33	0	1302	5				0.391	8.9		
East: East Leg												
1 T		414		414	5				0.566	9.3	107	
2 TR		521	20	541	5				0.566	7.6	115	
	0	935	20	955	5				0.566	8.3	115	
North: North Leg												
1 R			20	20	0				0.048	11.7	7	
	0	0	20	20	0				0.048	11.7	7	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	2277	5	0.571	8.7	115

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
South: South Leg								
32	L	1269	3242	0.391	9.1	A	0.0	0
31	T	33	84	0.393	0.5	A	0.0	0
		1302		0.393	8.9	A	0.0	0
East: East Leg								
21	T	935	1652	0.566	8.4	A	4.4	115
23	R	20	35	0.571*	7.4	A	4.4	115
		955		0.571	8.3	A	4.4	115
North: North Leg								
42	R	20	417	0.048	11.7	B	0.3	7
		20		0.048	11.7	B	0.3	7
ALL VEHICLES:		2277		0.571	8.7	A	4.4	115

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
South: South Leg						
	West	57.0	15.5	223.8	1800	562
	North	171.8	23.5	141.4	1800	170
East: East Leg						
	West	171.8	23.5	141.4	1800	427
	North	103.1	19.4	58.2	1800	170
North: North Leg						
	West	116.1	20.3	58.0	1800	398

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
Lane No.	Mov No.	Deg. Satn x	Stop-line 1st d1	2nd d2	Delay Total dSL	Acc. Dec. dn	Queuing Total dq	MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
South: South Leg											
1 L	32	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	9.1
2 LT	32, 31	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1 0.5	8.7
East: East Leg											
1 T	21	0.566	5.3	1.8	7.1	4.8	2.3	1.6	0.7	2.2	9.3
2 TR	21, 23	0.566	4.1	1.4	5.5	4.7	0.8	0.8	0.0	2.2 1.9	7.6
North: North Leg											
1 R	42	0.048	8.6	0.0	8.6	4.7	4.0	0.0	4.0	3.1	11.7

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
South: South Leg							

1 L	0.391	0.00	0.00	0.65	0.65	0.000	0.00
2 LT	0.391	0.00	0.00	0.62	0.62	0.000	0.00
East: East Leg							
1 T	0.566	0.74	0.14	0.06	0.95	0.739	0.30
2 TR	0.566	0.73	0.13	0.07	0.93	0.726	0.27
North: North Leg							
1 R	0.048	0.77	0.00	0.07	0.84	0.799	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
South: South Leg											
1 L	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
2 LT	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
East: East Leg											
1 T	0.566	0.3	1.1	0.3	1.3	2.4	2.9	3.3	4.1	4.8	0.06
2 TR	0.566	0.3	1.1	0.3	1.4	2.6	3.1	3.6	4.4	5.1	0.06
North: North Leg											
1 R	0.048	0.0	0.1	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.00

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
South: South Leg											
1 L	0.391	0	0	0	0	0	0	0	0	0	0.00
2 LT	0.391	0	0	0	0	0	0	0	0	0	0.00
East: East Leg											
1 T	0.566	7	27	7	35	62	76	86	107	124	0.06
2 TR	0.566	7	29	8	37	67	81	93	115	134	0.06
North: North Leg											
1 R	0.048	0	2	0	2	4	5	6	7	8	0.00

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	Negn	Exit Speeds Negn	Cruise	Queue Move-up 1st Grn	2nd Grn	Av. Section Spd Running	Overall
South: South Leg								
32	25.0	15.5	15.5	40.0			23.4	23.4
31	25.0	23.5	23.5	25.0			24.8	24.8

East: East Leg								
21	25.0	23.5	23.5	40.0	10.6		23.2	23.1
23	25.0	19.4	19.4	25.0	10.9		22.0	22.0
North: North Leg								
42	25.0	20.3	20.3	40.0			23.2	21.8

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Pacific Ave & 1st St
Alternative R1

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: West Leg								
12	5	1	415	22	0	0	1.00	0.95
South: South Leg								
32	1025	54	0	0	0	0	1.00	0.95
31	0	0	30	2	10	1	1.00	0.95
East: East Leg								
22	0	0	530	28	20	1	1.00	0.95
North: North Leg								
42	5	1	0	0	16	1	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	1	13.00	5	1.0	5	0	N	0.999

South: South Leg											
90	30	150	2	2	13.00	447	5.0	449	0	N	0.994
East: East Leg											
90	30	150	2	1	19.68	1116	5.0	1120	0	N	0.810
North: North Leg											
90	30	150	2	1	13.00	1637	5.0	1643	0	N	0.802

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	5	15.5	15508.3	2.00	0.006	4.13	93.7	2.44
Thru	1	Dominant	5	15.5	15508.3	2.00	0.006	3.71	84.2	2.20
South: South Leg										
Left	1	Dominant	449	23.3	274.1	2.00	0.422	3.48	118.9	2.26
	2	Subdominant	449	23.3	274.1	2.00	0.422	3.82	130.5	2.48
Thru	2	Subdominant	449	23.3	274.1	2.00	0.422	3.86	131.9	2.50
Right	2	Subdominant	449	23.3	274.1	2.00	0.422	3.96	135.5	2.57
East: East Leg										
Thru	1	Dominant	1120	15.7	74.0	1.06	0.519	2.62	60.3	2.38
Right	1	Dominant	1120	15.7	74.0	1.06	0.519	2.62	60.2	2.38
North: North Leg										
Left	1	Dominant	1643	18.2	58.5	1.39	0.793	3.25	86.9	2.43
Right	1	Dominant	1643	18.2	58.5	1.39	0.793	2.94	78.6	2.20

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: West Leg													
12 LT	443	1629	0.272	0.6	A	- - - - NA - - - -				- - - - NA - - - -			
South: South Leg													
32 L	1079	2080	0.519	9.0	A	- - - - NA - - - -				- - - - NA - - - -			
31 TR	43	83	0.518	4.1	A	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg													
22 TR	579	734	0.789	7.4	A	- - - - NA - - - -				- - - - NA - - - -			

North: North Leg

42 LR	23	394	0.058	11.6	B	- - - - NA - - - -	- - - - NA - - - -

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LT	443	1629	0.272	1783	9.5	1241	-23.8	1239	-23.9
South: South Leg									
32 L	1079	2080	0.519	2362	13.6	1107	-46.8	1680	-19.2
31 TR	43	83	0.518	94	13.3	44	-47.0	67	-19.3
East: East Leg									
22 TR	579	734	0.789	692	-5.7	654	-10.9	470	-36.0
North: North Leg									
42 LR	23	394	0.058	401	1.8	365	-7.4	273	-30.7

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LT	443	5.2	5	1.0	5	1629	0.85	213	100	0.272
South: South Leg										
32 L	1079	5.0	447	5.0	449	2080	0.85	64	100	0.519
31 TR	43	7.0	447	5.0	449	83	0.85	64	100	0.518
East: East Leg										
22 TR	579	5.0	1116	5.0	1120	734	0.85	8	100	0.789*
North: North Leg										
42 LR	23	8.7	1637	5.0	1643	394	0.85	1356	100	0.058

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	B
Average intersection delay (s)	=	6.8
Largest average movement delay (s)	=	11.6
Largest back of queue, 95% (ft)	=	192
Performance Index	=	52.24

Degree of saturation (highest)	=	0.789
Practical Spare Capacity (lowest)	=	8 %
Effective intersection capacity, (veh/h)	=	2747
Total vehicle flow (veh/h)	=	2167
Total person flow (pers/h)	=	2600
Total vehicle delay (veh-h/h)	=	4.09
Total person delay (pers-h/h)	=	4.90
Total effective vehicle stops (veh/h)	=	1523
Total effective person stops (pers/h)	=	1828
Total vehicle travel (veh-mi/h)	=	839.8
Total cost ($/h)	=	465.50
Total fuel (ga/h)	=	36.5
Total CO2 (kg/h)	=	345.87

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 LT	0.07	0.09	0.6	0.05	0.08	2.2	56	7.56	24.6
South: South Leg									
32 L	2.69	3.23	9.0	0.63	0.76	4.4	114	27.39	21.6
31 TR	0.05	0.06	4.1	0.64	0.60	4.4	114	0.95	22.9
East: East Leg									
22 TR	1.20	1.44	7.4	0.85	1.07	7.4	192	15.70	22.0
North: North Leg									
42 LR	0.07	0.09	11.6	0.82	0.82	0.4	10	0.65	20.6

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
443	0.272	0.07	0.09	0.6	0.05	0.08	56	7.56	24.6
South: South Leg									
1122	0.519	2.74	3.29	8.8	0.63	0.76	114	28.34	21.7
East: East Leg									
579	0.789	1.20	1.44	7.4	0.85	1.07	192	15.70	22.0
North: North Leg									
23	0.058	0.07	0.09	11.6	0.82	0.82	10	0.65	20.6
ALL VEHICLES:									
2167	0.789	4.09	4.90	6.8	0.57	0.70	192	52.24	22.2
INTERSECTION (persons):									
2600	0.789		4.90	6.8	0.57	0.70		52.24	22.2

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Dem Flow	Cap	Deg.	Aver.	Eff.	Q u e u e 95% Back	Short

Lane No.	Mov No.	(veh /h)	(veh /h)	Satn x	Delay (sec)	Stop Rate	----------- (vehs)	(ft)	Lane (ft)
West: West Leg									
1 LT	12	443	1629	0.272	0.6	0.08	2.2	56	
South: South Leg									
1 L	32	594	1145	0.519	8.8	0.75	4.4	114	
2 LTR	32, 31	528	1017	0.519	8.8	0.77	4.4	114	
East: East Leg									
1 TR	22	579	734	0.789	7.4	1.07	7.4	192	
North: North Leg									
1 LR	42	23	394	0.058	11.6	0.82	0.4	10	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 LT	12	6	437	0	443	150	1629	0.272	100
South: South Leg									
1 L	32	594	0	0	594	150	1145	0.519	100
2 LTR	32, 31	485	32	11	528	150	1017	0.519	100
East: East Leg									
1 TR	22	0	558	21	579	150	734	0.789	100
North: North Leg									
1 LR	42	6	0	17	23	23	394	0.058	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LT	6.1	81.27	0.083	2.42	0.083	58.0
	6.1	81.27	0.083	2.42	0.083	58.0
South: South Leg						
32 L	19.4	247.74	0.286	10.78	0.323	184.2
31 TR	0.7	8.66	0.010	0.37	0.011	6.5
	20.1	256.40	0.296	11.15	0.334	190.7
East: East Leg						
22 TR	9.9	122.77	0.148	5.81	0.170	93.6
	9.9	122.77	0.148	5.81	0.170	93.6

North: North Leg						
42 LR	0.4	5.06	0.006	0.21	0.006	3.5
	0.4	5.06	0.006	0.21	0.006	3.5
INTERSECTION:	36.5	465.50	0.532	19.59	0.593	345.9

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 LT	6	437		443	5				0.272	0.6	56	
	6	437	0	443	5				0.272	0.6	56	
South: South Leg												
1 L	594			594	5				0.519	8.8	114	
2 LTR	485	32	11	528	5				0.519	8.8	114	
	1079	32	11	1122	5				0.519	8.8	114	
East: East Leg												
1 TR		558	21	579	5				0.789	7.4	192	
	0	558	21	579	5				0.789	7.4	192	
North: North Leg												
1 LR	6		17	23	9				0.058	11.6	10	
	6	0	17	23	9				0.058	11.6	10	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	2167	5	0.789	6.8	192

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LT	443	1629	0.272	0.6	A	2.2	56
		443		0.272	0.6	A	2.2	56
South: South Leg								
32	L	1079	2080	0.519	9.0	A	4.4	114
31	TR	43	83	0.518	4.1	A	4.4	114
		1122		0.519	8.8	A	4.4	114
East: East Leg								
22	TR	579	734	0.789*	7.4	A	7.4	192
		579		0.789	7.4	A	7.4	192
North: North Leg								
42	LR	23	394	0.058	11.6	B	0.4	10
		23		0.058	11.6	B	0.4	10
ALL VEHICLES:		2167		0.789	6.8	A	7.4	192

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.
* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	East	171.8	23.5	141.4	1800	170
	North	57.0	15.5	223.8	1800	330
South: South Leg						
	West	57.0	15.5	223.8	1800	330
	East	103.1	19.4	58.2	1800	170
	North	171.8	23.5	141.4	1800	170
East: East Leg						
	West	171.8	23.5	141.4	1800	170
	North	109.4	19.8	58.1	1800	170
North: North Leg						
	West	116.1	20.3	58.0	1800	165
	East	57.0	15.5	223.8	1800	327

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

Lane No.	Mov No.	Deg. Satn x	Delay (seconds/veh) Stop-line 1st d1	Delay 2nd d2	Delay Total dSL	Acc. Dec. dn	Queuing Total dq	Queuing MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
West: West Leg											
1 LT	12	0.272	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.6	0.6
South: South Leg											
1 L	32	0.519	2.5	0.2	2.7	3.0	0.0	0.0	0.0	6.0	8.8
2 LTR	32, 31	0.519	2.8	0.4	3.2	3.1	0.2	0.2	0.0	6.0 0.9	8.8
East: East Leg											
1 TR	22	0.789	3.6	3.3	6.9	5.5	1.4	1.4	0.0	0.6	7.4
North: North Leg											
1 LR	42	0.058	8.9	0.0	8.9	4.5	4.4	0.0	4.4	2.7	11.6

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	Effective Stop Rate he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 LT	0.272	0.01	0.00	0.07	0.08	0.052	0.00
South: South Leg							
1 L	0.519	0.52	0.02	0.21	0.75	0.622	0.03
2 LTR	0.519	0.55	0.03	0.19	0.77	0.635	0.05
East: East Leg							
1 TR	0.789	0.85	0.21	0.01	1.07	0.851	0.43
North: North Leg							
1 LR	0.058	0.77	0.00	0.06	0.82	0.816	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

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Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											

1 LT	0.272	0.0	0.7	0.0	0.7	1.3	1.5	1.8	2.2	2.5	0.03
South: South Leg											
1 L	0.519	0.1	1.3	0.1	1.4	2.5	3.1	3.5	4.4	5.1	0.06
2 LTR	0.519	0.1	1.3	0.1	1.4	2.5	3.1	3.5	4.4	5.1	0.06
East: East Leg											
1 TR	0.789	0.6	1.8	0.7	2.4	4.2	5.2	5.9	7.4	8.6	0.11
North: North Leg											
1 LR	0.058	0.0	0.1	0.0	0.1	0.2	0.3	0.3	0.4	0.4	0.01

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LT	0.272	0	18	0	18	33	40	46	56	65	0.03
South: South Leg											
1 L	0.519	1	35	2	37	66	81	92	114	133	0.06
2 LTR	0.519	2	34	3	37	66	81	92	114	132	0.06
East: East Leg											
1 TR	0.789	15	46	18	64	109	135	154	192	224	0.11
North: North Leg											
1 LR	0.058	0	3	0	3	6	7	8	10	12	0.01

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	Negn	Exit Speeds Negn	Cruise	Queue Move-up 1st Grn	2nd Grn	Av. Section Spd Running	Overall
West: West Leg								
12	25.0	23.4	23.4	25.0			24.6	24.6
South: South Leg								
32	25.0	15.5	15.5	25.0	15.1		21.6	21.6
31	25.0	22.5	22.5	25.0	14.6		22.9	22.9
East: East Leg								
22	25.0	23.4	23.4	25.0	10.5		22.0	22.0
North: North Leg								
42	25.0	19.1	19.1	25.0			22.1	20.6

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Pacific Ave & 1st St
Alternative R2

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION
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* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: West Leg								
12	5	1	415	22	0	0	1.00	0.95
South: South Leg								
32	1025	54	0	0	0	0	1.00	0.95
31	0	0	30	2	10	1	1.00	0.95
East: East Leg								
22	0	0	530	28	20	1	1.00	0.95
North: North Leg								
42	5	1	0	0	16	1	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	1	13.00	5	1.0	5	0	N	0.999

South: South Leg										
90	30	150	2	2	13.00	447	5.0	449	0	N* 0.994
East: East Leg										
90	30	150	2	1	19.68	1116	5.0	1120	0	N 0.810
North: North Leg										
90	30	150	2	1	13.00	1637	5.0	1643	0	N 0.802

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	5	15.5	15508.3	2.00	0.006	4.13	93.7	2.44
Thru	1	Dominant	5	15.5	15508.3	2.00	0.006	3.71	84.2	2.20
South: South Leg										
Left	1	Dominant	449	23.3	274.1	2.00	0.422	3.48	118.9	2.26
	2	Subdominant	449	23.3	274.1	2.00	0.422	3.82	130.5	2.48
Thru	2	Subdominant	449	23.3	274.1	2.00	0.422	3.86	131.9	2.50
Right	2	Subdominant	449	23.3	274.1	2.00	0.422	3.96	135.5	2.57
East: East Leg										
Thru	1	Dominant	1120	15.7	74.0	1.06	0.519	2.62	60.3	2.38
Right	1	Dominant	1120	15.7	74.0	1.06	0.519	2.62	60.2	2.38
North: North Leg										
Left	1	Dominant	1643	18.2	58.5	1.39	0.793	3.25	86.9	2.43
Right	1	Dominant	1643	18.2	58.5	1.39	0.793	2.94	78.6	2.20

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: West Leg													
12 LT	443	1629	0.272	0.6	A	- - - - NA - - - -				- - - - NA - - - -			
South: South Leg													
32 L	1079	2080	0.519	9.0	A	- - - - NA - - - -				- - - - NA - - - -			
31 TR	43	83	0.518	4.1	A	- - - - NA - - - -				- - - - NA - - - -			

East: East Leg

22 TR	579	734	0.789	7.4	A	---- NA ----	---- NA ----
North: North Leg							
42 LR	23	394	0.058	11.6	B	---- NA ----	---- NA ----

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LT	443	1629	0.272	1783	9.5	1241	-23.8	1239	-23.9
South: South Leg									
32 L	1079	2080	0.519	2362	13.6	1107	-46.8	1680	-19.2
31 TR	43	83	0.518	94	13.3	44	-47.0	67	-19.3
East: East Leg									
22 TR	579	734	0.789	692	-5.7	654	-10.9	470	-36.0
North: North Leg									
42 LR	23	394	0.058	401	1.8	365	-7.4	273	-30.7

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LT	443	5.2	5	1.0	5	1629	0.85	213	100	0.272
South: South Leg										
32 L	1079	5.0	447	5.0	449	2080	0.85	64	100	0.519
31 TR	43	7.0	447	5.0	449	83	0.85	64	100	0.518
East: East Leg										
22 TR	579	5.0	1116	5.0	1120	734	0.85	8	100	0.789*
North: North Leg										
42 LR	23	8.7	1637	5.0	1643	394	0.85	1356	100	0.058

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	B
Average intersection delay (s)	=	6.8
Largest average movement delay (s)	=	11.6
Largest back of queue, 95% (ft)	=	192

Performance Index	=	52.24
Degree of saturation (highest)	=	0.789
Practical Spare Capacity (lowest)	=	8 %
Effective intersection capacity, (veh/h)	=	2747
Total vehicle flow (veh/h)	=	2167
Total person flow (pers/h)	=	2600
Total vehicle delay (veh-h/h)	=	4.09
Total person delay (pers-h/h)	=	4.90
Total effective vehicle stops (veh/h)	=	1523
Total effective person stops (pers/h)	=	1828
Total vehicle travel (veh-mi/h)	=	839.8
Total cost ($/h)	=	465.50
Total fuel (ga/h)	=	36.5
Total CO2 (kg/h)	=	345.87

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 LT	0.07	0.09	0.6	0.05	0.08	2.2	56	7.56	24.6
South: South Leg									
32 L	2.69	3.23	9.0	0.63	0.76	4.4	114	27.39	21.6
31 TR	0.05	0.06	4.1	0.64	0.60	4.4	114	0.95	22.9
East: East Leg									
22 TR	1.20	1.44	7.4	0.85	1.07	7.4	192	15.70	22.0
North: North Leg									
42 LR	0.07	0.09	11.6	0.82	0.82	0.4	10	0.65	20.6

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
443	0.272	0.07	0.09	0.6	0.05	0.08	56	7.56	24.6
South: South Leg									
1122	0.519	2.74	3.29	8.8	0.63	0.76	114	28.34	21.7
East: East Leg									
579	0.789	1.20	1.44	7.4	0.85	1.07	192	15.70	22.0
North: North Leg									
23	0.058	0.07	0.09	11.6	0.82	0.82	10	0.65	20.6
ALL VEHICLES:									
2167	0.789	4.09	4.90	6.8	0.57	0.70	192	52.24	22.2
INTERSECTION (persons):									
2600	0.789		4.90	6.8	0.57	0.70		52.24	22.2

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Dem Q u e u e

Lane No.	Mov No.	Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	95% Back (vehs)	95% Back (ft)	Short Lane (ft)
West: West Leg									
1 LT	12	443	1629	0.272	0.6	0.08	2.2	56	
South: South Leg									
1 L	32	594	1145	0.519	8.8	0.75	4.4	114	
2 LTR	32, 31	528	1017	0.519	8.8	0.77	4.4	114	
East: East Leg									
1 TR	22	579	734	0.789	7.4	1.07	7.4	192	
North: North Leg									
1 LR	42	23	394	0.058	11.6	0.82	0.4	10	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 LT	12	6	437	0	443	150	1629	0.272	100
South: South Leg									
1 L	32	594	0	0	594	150	1145	0.519	100
2 LTR	32, 31	485	32	11	528	150	1017	0.519	100
East: East Leg									
1 TR	22	0	558	21	579	150	734	0.789	100
North: North Leg									
1 LR	42	6	0	17	23	23	394	0.058	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LT	6.1	81.27	0.083	2.42	0.083	58.0
	6.1	81.27	0.083	2.42	0.083	58.0
South: South Leg						
32 L	19.4	247.74	0.286	10.78	0.323	184.2
31 TR	0.7	8.66	0.010	0.37	0.011	6.5
	20.1	256.40	0.296	11.15	0.334	190.7
East: East Leg						
22 TR	9.9	122.77	0.148	5.81	0.170	93.6

	9.9	122.77	0.148	5.81	0.170	93.6
North: North Leg						
42 LR	0.4	5.06	0.006	0.21	0.006	3.5
	0.4	5.06	0.006	0.21	0.006	3.5
INTERSECTION:	36.5	465.50	0.532	19.59	0.593	345.9

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 LT	6	437		443	5				0.272	0.6	56	
	6	437	0	443	5				0.272	0.6	56	
South: South Leg												
1 L	594			594	5				0.519	8.8	114	
2 LTR	485	32	11	528	5				0.519	8.8	114	
	1079	32	11	1122	5				0.519	8.8	114	
East: East Leg												
1 TR		558	21	579	5				0.789	7.4	192	
	0	558	21	579	5				0.789	7.4	192	
North: North Leg												
1 LR	6		17	23	9				0.058	11.6	10	
	6	0	17	23	9				0.058	11.6	10	
ALL VEHICLES				Total Flow	% HV				Max X	Aver. Delay	Max Queue	
				2167	5				0.789	6.8	192	

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LT	443	1629	0.272	0.6	A	2.2	56
		443		0.272	0.6	A	2.2	56
South: South Leg								
32	L	1079	2080	0.519	9.0	A	4.4	114
31	TR	43	83	0.518	4.1	A	4.4	114
		1122		0.519	8.8	A	4.4	114
East: East Leg								
22	TR	579	734	0.789*	7.4	A	7.4	192
		579		0.789	7.4	A	7.4	192
North: North Leg								
42	LR	23	394	0.058	11.6	B	0.4	10
		23		0.058	11.6	B	0.4	10
ALL VEHICLES:		2167		0.789	6.8	A	7.4	192

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	East	171.8	23.5	141.4	1800	170
	North	57.0	15.5	223.8	1800	330
South: South Leg						
	West	57.0	15.5	223.8	1800	330
	East	103.1	19.4	58.2	1800	170
	North	171.8	23.5	141.4	1800	170
East: East Leg						
	West	171.8	23.5	141.4	1800	170
	North	109.4	19.8	58.1	1800	170
North: North Leg						
	West	116.1	20.3	58.0	1800	165
	East	57.0	15.5	223.8	1800	327

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

Lane No.	Mov No.	Deg. Satn x	Stop-line Delay 1st d1	2nd d2	Total dSL	Acc. Dec. dn	Queuing Total dq	MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
West: West Leg											
1 LT	12	0.272	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.6	0.6
South: South Leg											
1 L	32	0.519	2.5	0.2	2.7	3.0	0.0	0.0	0.0	6.0	8.8
2 LTR	32, 31	0.519	2.8	0.4	3.2	3.1	0.2	0.2	0.0	6.0 0.9	8.8
East: East Leg											
1 TR	22	0.789	3.6	3.3	6.9	5.5	1.4	1.4	0.0	0.6	7.4
North: North Leg											
1 LR	42	0.058	8.9	0.0	8.9	4.5	4.4	0.0	4.4	2.7	11.6

Delay (seconds/veh)

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 LT	0.272	0.01	0.00	0.07	0.08	0.052	0.00
South: South Leg							
1 L	0.519	0.52	0.02	0.21	0.75	0.622	0.03
2 LTR	0.519	0.55	0.03	0.19	0.77	0.635	0.05
East: East Leg							
1 TR	0.789	0.85	0.21	0.01	1.07	0.851	0.43
North: North Leg							
1 LR	0.058	0.77	0.00	0.06	0.82	0.816	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio

West: West Leg										
1 LT	0.272	0.0	0.7	0.0	0.7	1.3	1.5	1.8	2.2	2.5	0.03
South: South Leg										
1 L	0.519	0.1	1.3	0.1	1.4	2.5	3.1	3.5	4.4	5.1	0.06
2 LTR	0.519	0.1	1.3	0.1	1.4	2.5	3.1	3.5	4.4	5.1	0.06
East: East Leg										
1 TR	0.789	0.6	1.8	0.7	2.4	4.2	5.2	5.9	7.4	8.6	0.11
North: North Leg										
1 LR	0.058	0.0	0.1	0.0	0.1	0.2	0.3	0.3	0.4	0.4	0.01

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LT	0.272	0	18	0	18	33	40	46	56	65	0.03
South: South Leg											
1 L	0.519	1	35	2	37	66	81	92	114	133	0.06
2 LTR	0.519	2	34	3	37	66	81	92	114	132	0.06
East: East Leg											
1 TR	0.789	15	46	18	64	109	135	154	192	224	0.11
North: North Leg											
1 LR	0.058	0	3	0	3	6	7	8	10	12	0.01

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	Negn	Exit Speeds Negn	Cruise	Queue Move-up 1st Grn	2nd Grn	Av. Section Spd Running	Overall
West: West Leg								
12	25.0	23.4	23.4	25.0			24.6	24.6
South: South Leg								
32	25.0	15.5	15.5	25.0	15.1		21.6	21.6
31	25.0	22.5	22.5	25.0	14.6		22.9	22.9
East: East Leg								
22	25.0	23.4	23.4	25.0	10.5		22.0	22.0
North: North Leg								
42	25.0	19.1	19.1	25.0			22.1	20.6

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Pacific Ave & 1st St
Alternative R3

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
South: South Leg								
32	1206	63	0	0	0	0	1.00	0.95
31	0	0	31	2	0	0	1.00	0.95
East: East Leg								
21	0	0	888	47	0	0	1.00	0.95
23	0	0	0	0	19	1	1.00	0.95
North: North Leg								
42	0	0	0	0	20	0	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
South: South Leg											
90	30	150	2	2	13.00	0	0.0	0	0	N	1.000
East: East Leg											

90	30	150	2	2	13.00	1302	5.0	1307	0	N	1.000
North: North Leg											
90	30	150	2	1	13.00	2204	5.0	2212	0	N	0.838

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	---- Circulating/Exiting Stream --- Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap Hdwy (s)	Critical Gap Dist (ft)	Foll-up Headway (s)
South: South Leg										
Left	1	Subdominant	0	0.0		2.00	0.000	3.96	0.0	2.34
	2	Dominant	0	0.0		2.00	0.000	3.41	0.0	2.01
Thru	2	Dominant	0	0.0		2.00	0.000	3.44	0.0	2.03
East: East Leg										
Thru	1	Subdominant	1307	15.7	63.3	1.06	0.578	3.16	72.6	2.31
	2	Dominant	1307	15.7	63.3	1.06	0.578	2.65	60.9	1.94
Right	2	Dominant	1307	15.7	63.3	1.06	0.578	2.65	60.9	1.94
North: North Leg										
Right	1	Dominant	2212	18.9	45.0	1.06	0.804	2.63	72.9	1.96

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

		aaSIDRA				HCM 2000 Lower				HCM 2000 Upper			
Mov No.	Dem Flow (veh /h)	Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS
South: South Leg													
32 L	1269	3242	0.391	9.1	A	2256	0.562	9.1	A	2689	0.472	9.1	A
31 T	33	84	0.393	0.5	A	59	0.559	0.5	A	70	0.471	0.5	A
East: East Leg													
21 T	935	1652	0.566	8.4	A	- - - -	NA	- - - -		- - - -	NA	- - - -	
23 R	20	35	0.571	7.4	A	- - - -	NA	- - - -		- - - -	NA	- - - -	
North: North Leg													
42 R	20	417	0.048	11.7	B	- - - -	NA	- - - -		- - - -	NA	- - - -	

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model

Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
South: South Leg									
32 L	1269	3242	0.391	3496	7.8	1340	-58.7	2428	-25.1
31 T	33	84	0.393	91	8.3	35	-58.3	63	-25.0
East: East Leg									
21 T	935	1652	0.566	1152	-30.3	709	-57.1	754	-54.4
23 R	20	35	0.571	25	-28.6	15	-57.1	16	-54.3
North: North Leg									
42 R	20	417	0.048	268	-35.7	198	-52.5	150	-64.0

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
South: South Leg										
32 L	1269	5.0	0			3242	0.85	117	100	0.391
31 T	33	6.1	0			84	0.85	116	100	0.393
East: East Leg										
21 T	935	5.0	1302	5.0	1307	1652	0.85	50	100	0.566
23 R	20	5.0	1302	5.0	1307	35	0.85	49	100	0.571*
North: North Leg										
42 R	20	0.0	2204	5.0	2212	417	0.85	1672	100	0.048

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	B
Average intersection delay (s)	=	8.7
Largest average movement delay (s)	=	11.7
Largest back of queue, 95% (ft)	=	115
Performance Index	=	57.38
Degree of saturation (highest)	=	0.571
Practical Spare Capacity (lowest)	=	49 %
Effective intersection capacity, (veh/h)	=	3985
Total vehicle flow (veh/h)	=	2277
Total person flow (pers/h)	=	2732
Total vehicle delay (veh-h/h)	=	5.51
Total person delay (pers-h/h)	=	6.61
Total effective vehicle stops (veh/h)	=	1739
Total effective person stops (pers/h)	=	2086
Total vehicle travel (veh-mi/h)	=	983.9
Total cost ($/h)	=	578.72
Total fuel (ga/h)	=	55.6
Total CO2 (kg/h)	=	527.29

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
South: South Leg									
32 L	3.22	3.87	9.1	0.00	0.65	0.0	0	30.39	23.4
31 T	0.00	0.01	0.5	0.00	0.07	0.0	0	0.51	24.8
East: East Leg									
21 T	2.17	2.61	8.4	0.73	0.94	4.4	115	25.41	23.1
23 R	0.04	0.05	7.4	0.73	0.93	4.4	115	0.50	22.0
North: North Leg									
42 R	0.07	0.08	11.7	0.80	0.84	0.3	7	0.58	21.8

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
South: South Leg									
1302	0.393	3.23	3.87	8.9	0.00	0.64	0	30.89	23.4
East: East Leg									
955	0.571	2.21	2.66	8.3	0.73	0.94	115	25.91	23.0
North: North Leg									
20	0.048	0.07	0.08	11.7	0.80	0.84	7	0.58	21.8
ALL VEHICLES:									
2277	0.571	5.51	6.61	8.7	0.31	0.76	115	57.38	23.2
INTERSECTION (persons):									
2732	0.571		6.61	8.7	0.31	0.76		57.38	23.2

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
South: South Leg									
1 L	32	602	1539	0.391	9.1	0.65	0.0	0	
2 LT	32, 31	700	1787	0.391	8.7	0.62	0.0	0	
East: East Leg									
1 T	21	414	732	0.566	9.3	0.95	4.1	107	
2 TR	21, 23	541	955	0.566	7.6	0.93	4.4	115	
North: North Leg									
1 R	42	20	417	0.048	11.7	0.84	0.3	7	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
South: South Leg									
1 L	32	602	0	0	602	150	1539	0.391	100
2 LT	32, 31	667	33	0	700	150	1787	0.391	100
East: East Leg									
1 T	21	0	414	0	414	150	732	0.566	100
2 TR	21, 23	0	521	20	541	150	955	0.566	100
North: North Leg									
1 R	42	0	0	20	20	20	417	0.048	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
South: South Leg						
32 L	31.6	329.12	0.485	24.49	0.670	299.5
31 T	0.4	5.99	0.006	0.17	0.006	4.3
	32.0	335.11	0.491	24.66	0.676	303.7
East: East Leg						
21 T	22.8	234.45	0.346	17.77	0.498	216.2
23 R	0.3	4.22	0.005	0.19	0.006	3.2
	23.1	238.67	0.351	17.96	0.503	219.4
North: North Leg						
42 R	0.4	4.94	0.007	0.34	0.009	4.1
	0.4	4.94	0.007	0.34	0.009	4.1
INTERSECTION:	55.6	578.72	0.850	42.96	1.188	527.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
South: South Leg												
1 L	602			602	5				0.391	9.1	0	
2 LT	667	33		700	5				0.391	8.7	0	
	1269	33	0	1302	5				0.391	8.9		
East: East Leg												
1 T		414		414	5				0.566	9.3	107	
2 TR		521	20	541	5				0.566	7.6	115	
	0	935	20	955	5				0.566	8.3	115	
North: North Leg												
1 R			20	20	0				0.048	11.7	7	
	0	0	20	20	0				0.048	11.7	7	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	2277	5	0.571	8.7	115

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
South: South Leg								
32	L	1269	3242	0.391	9.1	A	0.0	0
31	T	33	84	0.393	0.5	A	0.0	0
		1302		0.393	8.9	A	0.0	0
East: East Leg								
21	T	935	1652	0.566	8.4	A	4.4	115
23	R	20	35	0.571*	7.4	A	4.4	115
		955		0.571	8.3	A	4.4	115
North: North Leg								
42	R	20	417	0.048	11.7	B	0.3	7
		20		0.048	11.7	B	0.3	7
ALL VEHICLES:		2277		0.571	8.7	A	4.4	115

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
South: South Leg						
	West	57.0	15.5	223.8	1800	562
	North	171.8	23.5	141.4	1800	170
East: East Leg						
	West	171.8	23.5	141.4	1800	427
	North	103.1	19.4	58.2	1800	170
North: North Leg						
	West	116.1	20.3	58.0	1800	398

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

Lane No.	Mov No.	Deg. Satn x	Stop-line 1st d1	Stop-line 2nd d2	Delay Total dSL	Acc. Dec. dn	Queuing Total dq	Queuing MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
South: South Leg											
1 L	32	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	9.1
2 LT	32,	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	8.7
	31									0.5	
East: East Leg											
1 T	21	0.566	5.3	1.8	7.1	4.8	2.3	1.6	0.7	2.2	9.3
2 TR	21,	0.566	4.1	1.4	5.5	4.7	0.8	0.8	0.0	2.2	7.6
	23									1.9	
North: North Leg											
1 R	42	0.048	8.6	0.0	8.6	4.7	4.0	0.0	4.0	3.1	11.7

Delay (seconds/veh) applies to columns d1 through dic.

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
South: South Leg							

1 L	0.391	0.00	0.00	0.65	0.65	0.000	0.00
2 LT	0.391	0.00	0.00	0.62	0.62	0.000	0.00
East: East Leg							
1 T	0.566	0.74	0.14	0.06	0.95	0.739	0.30
2 TR	0.566	0.73	0.13	0.07	0.93	0.726	0.27
North: North Leg							
1 R	0.048	0.77	0.00	0.07	0.84	0.799	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
South: South Leg											
1 L	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
2 LT	0.391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
East: East Leg											
1 T	0.566	0.3	1.1	0.3	1.3	2.4	2.9	3.3	4.1	4.8	0.06
2 TR	0.566	0.3	1.1	0.3	1.4	2.6	3.1	3.6	4.4	5.1	0.06
North: North Leg											
1 R	0.048	0.0	0.1	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.00

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
South: South Leg											
1 L	0.391	0	0	0	0	0	0	0	0	0	0.00
2 LT	0.391	0	0	0	0	0	0	0	0	0	0.00
East: East Leg											
1 T	0.566	7	27	7	35	62	76	86	107	124	0.06
2 TR	0.566	7	29	8	37	67	81	93	115	134	0.06
North: North Leg											
1 R	0.048	0	2	0	2	4	5	6	7	8	0.00

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	Negn	Exit Speeds Negn	Cruise	Queue Move-up 1st Grn	2nd Grn	Av. Section Spd Running	Overall
South: South Leg								
32	25.0	15.5	15.5	40.0			23.4	23.4
31	25.0	23.5	23.5	25.0			24.8	24.8

East: East Leg								
21	25.0	23.5	23.5	40.0	10.6		23.2	23.1
23	25.0	19.4	19.4	25.0	10.9		22.0	22.0
North: North Leg								
42	25.0	20.3	20.3	40.0			23.2	21.8

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Pacific Ave & 1st St
Alternative R4

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: West Leg								
12	5	0	437	0	0	0	1.00	0.95
South: South Leg								
32	5	1	0	0	0	0	1.00	0.95
31	0	0	1050	55	0	0	1.00	0.95
33	0	0	0	0	10	1	1.00	0.95
East: East Leg								
22	0	0	10	1	0	0	1.00	0.95
23	0	0	0	0	540	28	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
90	30	150	2	1	13.00	0	0.0	0	0	N	1.000
South: South Leg											

90	30	150	2	2	13.00	442	0.0	442	0	N	1.000
East: East Leg											
90	30	150	2	1	13.00	1116	5.0	1120	0	N	0.814

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap Hdwy (s)	Critical Gap Dist (ft)	Foll-up Headway (s)
West: West Leg										
Left	1	Dominant	0	0.0		2.00	0.000	3.61	0.0	2.13
Thru	1	Dominant	0	0.0		2.00	0.000	3.61	0.0	2.13
South: South Leg										
Left	1	Subdominant	442	23.4	279.4	2.00	0.417	4.26	146.0	2.76
Thru	1	Subdominant	442	23.4	279.4	2.00	0.417	3.82	131.2	2.48
	2	Dominant	442	23.4	279.4	2.00	0.417	3.49	119.6	2.26
Right	2	Dominant	442	23.4	279.4	2.00	0.417	3.62	124.1	2.34
East: East Leg										
Thru	1	Dominant	1120	23.4	110.4	1.04	0.514	3.44	118.1	2.47
Right	1	Dominant	1120	23.4	110.4	1.04	0.514	3.31	113.8	2.38

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.		Dem Flow (veh/h)	aaSIDRA Cap. (veh/h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Lower Cap. (veh/h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Upper Cap. (veh/h)	Deg. Satn x	Av. Delay (sec)	LOS
West: West Leg														
12	LT	442	1690	0.262	0.6	A	1161	0.381	0.6	A	1385	0.319	0.6	A
South: South Leg														
32	L	6	12	0.500	9.4	A	- - - - NA - - - -				- - - - NA - - - -			
31	T	1105	2152	0.513	3.4	A	- - - - NA - - - -				- - - - NA - - - -			
33	R	11	21	0.524	4.6	A	- - - - NA - - - -				- - - - NA - - - -			
East: East Leg														
22	T	11	12	0.917	18.6	B	- - - - NA - - - -				- - - - NA - - - -			
23	R	568	621	0.915	19.0	B	- - - - NA - - - -				- - - - NA - - - -			

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h.

Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 LT	442	1690	0.262	1800	6.5	1250	-26.0	1250	-26.0
South: South Leg									
32 L	6	12	0.500	13	8.3	6	-50.0	9	-25.0
31 T	1105	2152	0.513	2432	13.0	1136	-47.2	1729	-19.7
33 R	11	21	0.524	24	14.3	11	-47.6	17	-19.0
East: East Leg									
22 T	11	12	0.917	13	8.3	12	0.0	9	-25.0
23 R	568	621	0.915	678	9.2	642	3.4	461	-25.8

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 LT	442	0.0	0			1690	0.85	225	100	0.262
South: South Leg										
32 L	6	16.7	442	0.0	442	12	0.85	70	100	0.500
31 T	1105	5.0	442	0.0	442	2152	0.85	66	100	0.513
33 R	11	9.1	442	0.0	442	21	0.85	62	100	0.524
East: East Leg										
22 T	11	9.1	1116	5.0	1120	12	0.85	-7	100	0.917*
23 R	568	4.9	1116	5.0	1120	621	0.85	-7	100	0.915

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	B
Average intersection delay (s)	=	7.0
Largest average movement delay (s)	=	19.0
Largest back of queue, 95% (ft)	=	335
Performance Index	=	51.47
Degree of saturation (highest)	=	0.917
Practical Spare Capacity (lowest)	=	-7 %
Effective intersection capacity, (veh/h)	=	2338
Total vehicle flow (veh/h)	=	2143
Total person flow (pers/h)	=	2572
Total vehicle delay (veh-h/h)	=	4.19
Total person delay (pers-h/h)	=	5.02
Total effective vehicle stops (veh/h)	=	1476
Total effective person stops (pers/h)	=	1771
Total vehicle travel (veh-mi/h)	=	797.6
Total cost ($/h)	=	446.61

Total fuel (ga/h) = 34.3
Total CO2 (kg/h) = 325.34

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 LT	0.07	0.08	0.6	0.00	0.08	0.0	0	6.84	24.7
South: South Leg									
32 L	0.02	0.02	9.4	0.62	0.80	4.2	110	0.15	21.5
31 T	1.03	1.24	3.4	0.61	0.50	4.2	110	23.26	23.1
33 R	0.01	0.02	4.6	0.61	0.61	4.2	110	0.24	22.7
East: East Leg									
22 T	0.06	0.07	18.6	0.96	1.50	12.9	335	0.40	18.6
23 R	3.00	3.60	19.0	0.96	1.51	12.9	335	20.57	18.5

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
442	0.262	0.07	0.08	0.6	0.00	0.08	0	6.84	24.7
South: South Leg									
1122	0.524	1.06	1.28	3.4	0.61	0.51	110	23.66	23.1
East: East Leg									
579	0.917	3.05	3.66	19.0	0.96	1.51	335	20.97	18.5
ALL VEHICLES:									
2143	0.917	4.19	5.02	7.0	0.58	0.69	335	51.47	21.9
INTERSECTION (persons):									
2572	0.917		5.02	7.0	0.58	0.69		51.47	21.9

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg									
1 LT	12	442	1690	0.262	0.6	0.08	0.0	0	
South: South Leg									
1 LT	32, 31	529	1029	0.514	3.7	0.55	4.2	110	
2 TR	31, 33	593	1156	0.514	3.2	0.47	4.2	110	
East: East Leg									
1 TR	22, 23	579	633	0.914	19.0	1.51	12.9	335	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 LT	12	5	437	0	442	150	1690	0.262	100
South: South Leg									
1 LT	32, 31	6	523	0	529	150	1029	0.514	100
2 TR	31, 33	0	582	11	593	150	1156	0.514	100
East: East Leg									
1 TR	22, 23	0	11	568	579	150	633	0.914	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 LT	5.5	78.18	0.080	2.16	0.075	51.8
	5.5	78.18	0.080	2.16	0.075	51.8
South: South Leg						
32 L	0.1	1.37	0.002	0.06	0.002	1.0
31 T	17.5	220.89	0.254	9.36	0.283	166.2
33 R	0.2	2.24	0.003	0.10	0.003	1.7
	17.8	224.49	0.259	9.51	0.288	168.9
East: East Leg						
22 T	0.2	2.72	0.003	0.13	0.004	2.0
23 R	10.8	141.21	0.168	6.53	0.189	102.7
	11.0	143.93	0.171	6.66	0.192	104.6
INTERSECTION:	34.3	446.61	0.510	18.34	0.555	325.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360

Heavy vehicle idle fuel rate (US gal/h) = 0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 LT	5	437		442	0				0.262	0.6	0	
	5	437	0	442	0				0.262	0.6		
South: South Leg												
1 LT	6	523		529	5				0.514	3.7	110	
2 TR		582	11	593	5				0.514	3.2	110	
	6	1105	11	1122	5				0.514	3.4	110	
East: East Leg												
1 TR		11	568	579	5				0.914	19.0	335	
	0	11	568	579	5				0.914	19.0	335	
ALL VEHICLES				Total Flow 2143	% HV 4				Max X 0.917	Aver. Delay 7.0	Max Queue 335	

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	LT	442	1690	0.262	0.6	A	0.0	0
		442		0.262	0.6	A	0.0	0
South: South Leg								
32	L	6	12	0.500	9.4	A	4.2	110
31	T	1105	2152	0.513	3.4	A	4.2	110
33	R	11	21	0.524	4.6	A	4.2	110
		1122		0.524	3.4	A	4.2	110
East: East Leg								
22	T	11	12	0.917*	18.6	B	12.9	335
23	R	568	621	0.915	19.0	B	12.9	335
		579		0.917	19.0	B	12.9	335
ALL VEHICLES:		2143		0.917	7.0	A	12.9	335

Level of Service calculations are based on
average control delay including geometric delay (HCM criteria),
independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the
aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	East	171.8	23.5	141.4	1800	164
	North	57.0	15.5	223.8	1800	327
South: South Leg						
	West	47.9	14.5	188.2	1800	301
	East	103.1	19.4	58.2	1800	170
	North	171.8	23.5	141.4	1800	170
East: East Leg						
	West	133.3	21.3	106.0	1800	169
	North	116.1	20.3	58.0	1800	170

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
Lane No.	Mov No.	Deg. Satn x	Stop-line Delay 1st d1	2nd d2	Total dSL	Acc. Dec. dn	Queuing Total dq	MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
West: West Leg											
1 LT	12	0.262	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6
South: South Leg											
1 LT	32, 31	0.514	2.8	0.3	3.1	4.0	0.0	0.0	0.0	6.3 0.5	3.7
2 TR	31, 33	0.514	2.4	0.2	2.6	3.9	0.0	0.0	0.0	0.5 1.9	3.2
East: East Leg											
1 TR	22, 23	0.914	5.3	12.0	17.4	5.6	11.8	6.1	5.7	1.3 1.6	19.0

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 LT	0.262	0.00	0.00	0.08	0.08	0.000	0.00
South: South Leg							
1 LT	0.514	0.49	0.03	0.03	0.55	0.621	0.04
2 TR	0.514	0.42	0.02	0.03	0.47	0.607	0.02
East: East Leg							
1 TR	0.914	0.96	0.54	0.01	1.51	0.960	1.12

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LT	0.262	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
South: South Leg											
1 LT	0.514	0.1	1.3	0.1	1.4	2.5	3.0	3.4	4.2	4.9	0.06
2 TR	0.514	0.0	1.3	0.1	1.4	2.5	3.0	3.4	4.2	4.9	0.06
East: East Leg											
1 TR	0.914	1.9	2.3	2.1	4.4	7.1	8.9	10.2	12.9	15.1	0.19

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 LT	0.262	0	0	0	0	0	0	0	0	0	0.00
South: South Leg											
1 LT	0.514	2	33	3	36	64	78	89	110	128	0.06
2 TR	0.514	1	34	2	36	64	78	89	110	128	0.06
East: East Leg											
1 TR	0.914	49	60	56	115	185	231	266	335	393	0.19

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov	App. Speeds	Exit Speeds	Queue Move-up 1st	2nd	Av. Section Spd

No.	Cruise	Negn	Negn	Cruise	Grn	Grn	Running	Overall
West: West Leg								
12	25.0	23.4	23.4	25.0			24.7	24.7
South: South Leg								
32	25.0	14.5	14.5	25.0	14.1		21.5	21.5
31	25.0	23.5	23.5	25.0	15.1		23.1	23.1
33	25.0	19.4	19.4	25.0	15.2		22.7	22.7
East: East Leg								
22	25.0	21.3	21.3	25.0	10.3		20.1	18.6
23	25.0	20.3	20.3	25.0	10.5		20.0	18.5

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Main Ave/Pacific Ave & 1st St
Alternative R2

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

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* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES	Demand flows in veh/hour as used by the program							
West: 1st Street								
12	437	4	29	1	82	1	1.00	0.85
SouthEast: Pacific Avenue								
72	5	0	0	0	0	0	1.00	0.92
71	0	0	1058	56	0	0	1.00	0.92
73	0	0	0	0	41	2	1.00	0.92
East: OR 6								
22	10	1	5	1	539	34	1.00	0.95
North: US 101								
42	395	21	1230	65	105	6	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: 1st Street											

120	30	180	2	2	13.00	1726	5.0	1733	0	N	0.920
SouthEast: Pacific Avenue											
105	30	165	2	2	13.00	886	2.9	887	0	N	0.887
East: OR 6											
120	30	180	2	2	13.00	1561	3.9	1562	0	N	0.682
North: US 101											
90	30	150	2	2	13.00	21	4.5	21	0	N	0.996

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Dist (ft)	Foll-up Headway (s)
West: 1st Street										
Left	1	Dominant	1733	22.5	68.6	1.02	0.678	2.23	73.4	1.67
Thru	2	Subdominant	1733	22.5	68.6	1.02	0.678	2.78	91.7	2.08
Right	2	Subdominant	1733	22.5	68.6	1.02	0.678	2.78	91.7	2.08
SouthEast: Pacific Avenue										
Left	1	Subdominant	887	15.8	94.1	1.82	0.641	3.38	78.4	2.36
Thru	1	Subdominant	887	15.8	94.1	1.82	0.641	3.40	78.7	2.37
	2	Dominant	887	15.8	94.1	1.82	0.641	2.93	67.9	2.04
Right	2	Dominant	887	15.8	94.1	1.82	0.641	2.93	67.8	2.04
East: OR 6										
Left	1	Subdominant	1562	22.3	75.5	1.32	0.746	3.04	99.5	2.26
Thru	1	Subdominant	1562	22.3	75.5	1.32	0.746	3.26	106.8	2.42
Right	1	Subdominant	1562	22.3	75.5	1.32	0.746	2.95	96.6	2.19
	2	Dominant	1562	22.3	75.5	1.32	0.746	2.35	77.0	1.75
North: US 101										
Left	1	Subdominant	21	18.5	4598.6	2.00	0.026	4.01	109.0	2.38
Thru	1	Subdominant	21	18.5	4598.6	2.00	0.026	4.01	109.0	2.38
	2	Dominant	21	18.5	4598.6	2.00	0.026	3.51	95.2	2.08
Right	2	Dominant	21	18.5	4598.6	2.00	0.026	3.51	95.5	2.09

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Lower Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS	HCM 2000 Upper Cap. (veh /h)	Deg. Satn x	Av. Delay (sec)	LOS
West: 1st Street													
12 LTR	554	1107	0.500	10.6	B	- - - - NA - - - -				- - - - NA - - - -			

SouthEast: Pacific Avenue							
72 L	5	7	0.714	20.2	C	- - - - NA - - - -	- - - - NA - - - -
71 T	1114	1466	0.760	12.8	B	- - - - NA - - - -	- - - - NA - - - -
73 R	43	57	0.754	14.4	B	- - - - NA - - - -	- - - - NA - - - -
East: OR 6							
22 LTR	590	965	0.611	13.1	B	- - - - NA - - - -	- - - - NA - - - -
North: US 101							
42 LTR	1822	3176	0.574	1.7	A	- - - - NA - - - -	- - - - NA - - - -

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: 1st Street									
12 LTR	554	1107	0.500	514	-53.6	458	-58.6	291	-73.7
SouthEast: Pacific Avenue									
72 L	5	7	0.714	7	0.0	4	-42.9	6	-14.3
71 T	1114	1466	0.760	1667	13.7	981	-33.1	1377	-6.1
73 R	43	57	0.754	64	12.3	38	-33.3	53	-7.0
East: OR 6									
22 LTR	590	965	0.611	948	-1.8	695	-28.0	719	-25.5
North: US 101									
42 LTR	1822	3176	0.574	3523	10.9	1364	-57.1	2451	-22.8

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: 1st Street										
12 LTR	554	1.1	1726	5.0	1733	1107	0.85	70	36	0.500
SouthEast: Pacific Avenue										
72 L	5	0.0	886	2.9	887	7	0.85	19	100	0.714
71 T	1114	5.0	886	2.9	887	1466	0.85	12	100	0.760*
73 R	43	4.7	886	2.9	887	57	0.85	13	100	0.754
East: OR 6										
22 LTR	590	6.1	1561	3.9	1562	965	0.85	39	100	0.611
North: US 101										
42 LTR	1822	5.0	21	4.5	21	3176	0.85	48	100	0.574

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	C
Average intersection delay (s)	=	7.7
Largest average movement delay (s)	=	20.2
Largest back of queue, 95% (ft)	=	300
Performance Index	=	104.92
Degree of saturation (highest)	=	0.760
Practical Spare Capacity (lowest)	=	12 %
Effective intersection capacity, (veh/h)	=	5432
Total vehicle flow (veh/h)	=	4128
Total person flow (pers/h)	=	4954
Total vehicle delay (veh-h/h)	=	8.78
Total person delay (pers-h/h)	=	10.53
Total effective vehicle stops (veh/h)	=	2992
Total effective person stops (pers/h)	=	3591
Total vehicle travel (veh-mi/h)	=	1559.7
Total cost ($/h)	=	881.20
Total fuel (ga/h)	=	68.3
Total CO2 (kg/h)	=	647.31

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: 1st Street									
12 LTR	1.63	1.95	10.6	0.77	0.96	3.9	98	14.96	21.1
SouthEast: Pacific Avenue									
72 L	0.03	0.03	20.2	0.96	1.32	10.5	272	0.18	18.7
71 T	3.96	4.76	12.8	0.97	1.30	11.5	300	35.73	20.2
73 R	0.17	0.21	14.4	0.97	1.32	11.5	300	1.39	19.7
East: OR 6									
22 LTR	2.15	2.58	13.1	0.96	1.14	6.3	164	18.48	20.1
North: US 101									
42 LTR	0.84	1.01	1.7	0.17	0.15	6.5	170	34.18	23.9

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: 1st Street									
554	0.500	1.63	1.95	10.6	0.77	0.96	98	14.96	21.1
SouthEast: Pacific Avenue									
1162	0.760	4.16	5.00	12.9	0.97	1.30	300	37.30	20.1
East: OR 6									
590	0.611	2.15	2.58	13.1	0.96	1.14	164	18.48	20.1
North: US 101									
1822	0.574	0.84	1.01	1.7	0.17	0.15	170	34.18	23.9
ALL VEHICLES:									
4128	0.760	8.78	10.53	7.7	0.59	0.72	300	104.92	21.8

INTERSECTION (persons):

4954	0.760	10.53	7.7	0.59	0.72	104.92	21.8

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: 1st Street									
1 L	12	441	881	0.500	11.7	1.02	3.9	98	
2 TR	12	113	627	0.180	6.1	0.74	1.0	25	
SouthEast: Pacific Avenue									
1 LT	72, 71	523	688	0.760	13.8	1.30	10.5	272	
2 TR	71, 73	639	841	0.760	12.2	1.31	11.5	300	
East: OR 6									
1 LTR	22	245	401	0.612	14.9	1.12	5.3	140	
2 R	22	345	564	0.612	11.9	1.16	6.3	164	200
North: US 101									
1 LT	42	849	1480	0.574	3.1	0.26	6.5	169	
2 TR	42	973	1697	0.574	0.4	0.05	6.5	170	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: 1st Street									
1 L	12	441	0	0	441	150	881	0.500	100
2 TR	12	0	30	83	113	113	627	0.180	36P
SouthEast: Pacific Avenue									
1 LT	72, 71	5	518	0	523	150	688	0.760	100
2 TR	71, 73	0	596	43	639	150	841	0.760	100
East: OR 6									
1 LTR	22	11	6	228	245	150	401	0.612	100
2 R	22	0	0	345	345	150	564	0.612	100
North: US 101									
1 LT	42	416	433	0	849	150	1480	0.574	100
2 TR	42	0	862	111	973	150	1697	0.574	100

P Lane under-utilisation found by the "Program"

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: 1st Street						
12 LTR	9.3	125.41	0.145	5.20	0.152	87.7
	9.3	125.41	0.145	5.20	0.152	87.7
SouthEast: Pacific Avenue						
72 L	0.1	1.32	0.002	0.05	0.002	0.9
71 T	20.5	256.43	0.316	12.82	0.363	194.0
73 R	0.8	10.09	0.012	0.48	0.014	7.5
	21.3	267.84	0.330	13.36	0.378	202.4
East: OR 6						
22 LTR	10.8	136.38	0.163	6.46	0.189	102.9
	10.8	136.38	0.163	6.46	0.189	102.9
North: US 101						
42 LTR	26.8	351.57	0.374	11.86	0.385	254.3
	26.8	351.57	0.374	11.86	0.385	254.3
INTERSECTION:	68.3	881.20	1.012	36.88	1.105	647.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: 1st Street												
1 L	441			441	1				0.500	11.7	98	
2 TR		30	83	113	2				0.180	6.1	25	
	441	30	83	554	1				0.500	10.6	98	
SouthEast: Pacific Avenue												
1 LT	5	518		523	5				0.760	13.8	272	
2 TR		596	43	639	5				0.760	12.2	300	
	5	1114	43	1162	5				0.760	12.9	300	
East: OR 6												

1 LTR	11	6	228	245	6	0.612	14.9	140	
2 R			345	345	6	0.612	11.9	164	200
	11	6	573	590	6	0.612	13.1	164	
North: US 101									
1 LT	416	433		849	5	0.574	3.1	169	
2 TR		862	111	973	5	0.574	0.4	170	
	416	1295	111	1822	5	0.574	1.7	170	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	4128	5	0.760	7.7	300

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)
West: 1st Street								
12	LTR	554	1107	0.500	10.6	B	3.9	98
		554		0.500	10.6	B	3.9	98
SouthEast: Pacific Avenue								
72	L	5	7	0.714	20.2	C	10.5	272
71	T	1114	1466	0.760*	12.8	B	11.5	300
73	R	43	57	0.754	14.4	B	11.5	300
		1162		0.760	12.9	B	11.5	300
East: OR 6								
22	LTR	590	965	0.611	13.1	B	6.3	164
		590		0.611	13.1	B	6.3	164
North: US 101								
42	LTR	1822	3176	0.574	1.7	A	6.5	170
		1822		0.574	1.7	A	6.5	170
ALL VEHICLES:		4128		0.760	7.7	A	11.5	300

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.
* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)

West: 1st Street						
	South	139.3	21.7	69.6	1800	164
	East	174.9	23.6	132.9	1800	161
	North	59.6	15.7	234.0	1800	336
SouthEast: Pacific Avenue						
	West	64.5	16.2	202.6	1800	161
	South	66.4	16.4	312.8	1800	409
	East	86.7	18.1	32.8	1800	170
	North	214.5	25.0	123.0	1800	161
East: OR 6						
	West	200.0	24.9	156.5	1800	165
	South	67.0	16.4	263.1	1800	363
	North	139.3	21.7	69.6	1800	170
North: US 101						
	West	103.1	19.4	58.2	1800	170
	South	200.0	24.9	156.5	1800	164
	East	55.8	15.3	219.2	1800	327

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
		Deg.	Stop-line Delay			Acc.	Queuing		Stopd		
Lane No.	Mov No.	Satn x	1st d1	2nd d2	Total dSL	Dec. dn	Total dq	MvUp dqm	(Idle) di	Geom dig	Control dic
West: 1st Street											
1 L	12	0.500	4.5	1.3	5.8	3.8	2.0	1.3	0.7	5.9	11.7
2 TR	12	0.180	5.1	0.0	5.1	4.4	0.8	0.0	0.8	0.9	6.1
SouthEast: Pacific Avenue											
1 LT	72,	0.760	6.7	7.0	13.7	6.4	7.3	3.5	3.7	6.5	13.8
	71									0.0	
2 TR	71,	0.760	5.8	6.2	12.0	6.5	5.5	3.5	2.1	0.0	12.2
	73									2.4	
East: OR 6											
1 LTR	22	0.612	8.1	5.5	13.6	5.7	7.9	2.0	5.9	1.3	14.9
2 R	22	0.612	6.3	4.4	10.7	6.0	4.8	2.0	2.8	1.1	11.9
North: US 101											
1 LT	42	0.574	0.1	0.0	0.1	1.0	0.0	0.0	0.0	3.0	3.1
2 TR	42	0.574	0.1	0.0	0.1	1.1	0.0	0.0	0.0	0.3	0.4

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	Effective Stop Rate he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: 1st Street							
1 L	0.500	0.79	0.11	0.12	1.02	0.789	0.24
2 TR	0.180	0.71	0.00	0.04	0.74	0.705	0.00
SouthEast: Pacific Avenue							
1 LT	0.760	0.96	0.34	0.00	1.30	0.960	0.62
2 TR	0.760	0.97	0.34	0.00	1.31	0.972	0.59
East: OR 6							
1 LTR	0.612	0.93	0.17	0.01	1.12	0.934	0.37
2 R	0.612	0.97	0.18	0.00	1.16	0.975	0.35
North: US 101							
1 LT	0.574	0.04	0.00	0.23	0.26	0.180	0.00
2 TR	0.574	0.02	0.00	0.03	0.05	0.166	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

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Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: 1st Street											
1 L	0.500	0.2	1.1	0.2	1.3	2.3	2.8	3.1	3.9	4.5	0.05
2 TR	0.180	0.0	0.3	0.0	0.3	0.6	0.7	0.8	1.0	1.1	0.01
SouthEast: Pacific Avenue											
1 LT	0.760	1.1	2.3	1.3	3.6	5.9	7.3	8.3	10.5	12.2	0.15
2 TR	0.760	1.1	2.5	1.5	3.9	6.4	8.0	9.2	11.5	13.5	0.17
East: OR 6											
1 LTR	0.612	0.4	1.4	0.3	1.7	3.1	3.8	4.3	5.3	6.2	0.08
2 R	0.612	0.4	1.7	0.4	2.1	3.6	4.4	5.0	6.3	7.3	0.82
North: US 101											
1 LT	0.574	0.0	2.1	0.0	2.1	3.7	4.6	5.2	6.5	7.6	0.09
2 TR	0.574	0.0	2.1	0.0	2.1	3.7	4.6	5.2	6.5	7.6	0.09

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: 1st Street											
1 L	0.500	5	27	5	32	57	69	79	98	114	0.05
2 TR	0.180	0	8	0	8	14	18	20	25	28	0.01
SouthEast: Pacific Avenue											
1 LT	0.760	28	59	34	92	152	189	217	272	318	0.15
2 TR	0.760	30	64	38	103	167	208	239	300	351	0.17

East: OR 6											
1 LTR	0.612	10	38	8	46	80	99	112	140	163	0.08
2 R	0.612	11	44	10	54	94	115	132	164	191	0.82
North: US 101											
1 LT	0.574	0	56	0	56	96	119	135	169	196	0.09
2 TR	0.574	0	56	0	56	97	119	136	170	197	0.09

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds		Exit Speeds		Queue Move-up		Av. Section Spd	
	Cruise	Negn	Negn	Cruise	1st Grn	2nd Grn	Running	Overall
West: 1st Street								
12	25.0	17.0	17.0	25.0	10.3		21.3	21.1
SouthEast: Pacific Avenue								
72	25.0	16.4	16.4	25.0	12.0		20.1	18.7
71	25.0	25.0	25.0	25.0	12.4		21.0	20.2
73	25.0	18.1	18.1	25.0	12.8		20.7	19.7
East: OR 6								
22	25.0	21.6	21.6	25.0	10.8		21.4	20.1
North: US 101								
42	25.0	22.4	22.4	25.0			23.9	23.9

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
Main Ave/Pacific Ave & 1st St
Alternative R3

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
                    Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left LV	Left HV	Through LV	Through HV	Right LV	Right HV	Flow Scale	Peak Flow Factor
VEHICLES Demand flows in veh/hour as used by the program								
West: 1st Street								
12	437	4	0	0	111	1	1.00	0.85
SouthEast: Pacific Avenue								
72	21	1	0	0	0	0	1.00	0.92
71	0	0	1224	64	0	0	1.00	0.92
East: OR 6								
22	302	19	89	6	510	33	1.00	0.95
North: US 101								
42	0	0	1678	88	108	6	1.00	0.92

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream: Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: 1st Street											
120	30	180	2	2	13.00	2109	5.2	2118	0	N	0.565

SouthEast: Pacific Avenue											
105	30	165	2	2	13.00	441	1.0	441	0	N	0.895
East: OR 6											
120	30	180	2	2	13.00	1751	4.0	1753	0	N	0.738
North: US 101											
90	30	150	2	2	13.00	584	5.7	589	0	N	0.909

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream: Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap: Hdwy (s)	Critical Gap: Dist (ft)	Foll-up Headway (s)
West: 1st Street										
Left	1	Subdominant	2118	23.5	58.6	1.17	0.830	2.69	92.6	2.01
	2	Dominant	2118	23.5	58.6	1.17	0.830	2.04	70.2	1.52
Right	2	Dominant	2118	23.5	58.6	1.17	0.830	2.04	70.2	1.52
SouthEast: Pacific Avenue										
Left	1	Subdominant	441	15.7	188.1	1.01	0.236	3.78	87.1	2.45
Thru	1	Subdominant	441	15.7	188.1	1.01	0.236	3.78	87.2	2.45
	2	Dominant	441	15.7	188.1	1.01	0.236	3.39	78.2	2.19
East: OR 6										
Left	1	Subdominant	1753	21.8	65.7	1.04	0.694	2.84	90.9	2.13
Thru	2	Dominant	1753	21.8	65.7	1.04	0.694	2.25	71.9	1.68
Right	2	Dominant	1753	21.8	65.7	1.04	0.694	2.24	71.7	1.68
North: US 101										
Thru	1	Subdominant	589	17.7	159.0	1.29	0.371	3.68	95.9	2.45
	2	Dominant	589	17.7	159.0	1.29	0.371	3.30	85.8	2.19
Right	2	Dominant	589	17.7	159.0	1.29	0.371	3.30	85.9	2.20

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.		Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: 1st Street														
12	LR	553	645	0.857	42.7	D	-	- - - NA - - -		-	-	- - - NA - - -		-
SouthEast: Pacific Avenue														
72	L	22	35	0.629	9.6	A	-	- - - NA - - -		-	-	- - - NA - - -		-
71	T	1288	2049	0.629	3.1	A	-	- - - NA - - -		-	-	- - - NA - - -		-

East: OR 6							
22 LTR	959	1022	0.938	22.8	C	- - - - NA - - - -	- - - - NA - - - -
North: US 101							
42 TR	1880	1930	0.974	23.3	C	- - - - NA - - - -	- - - - NA - - - -

NA Values for this roundabout capacity model have not been calculated because the model was not applicable for the given roundabout conditions. Note that the HCM models are only applicable to single-lane roundabouts with circulating flows less than 1200 veh/h. Also note that results are not calculated for any of the models for slip lane or continuous movements. See the aaSIDRA Traffic Model Reference Guide for roundabout limits.

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh/h)	aaSIDRA Cap. (veh/h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh/h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh/h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh/h)	Ger. GapAcc % Diff from aaSIDRA
West: 1st Street									
12 LR	553	645	0.857	582	-9.8	690	7.0	364	-43.6
SouthEast: Pacific Avenue									
72 L	22	35	0.629	42	20.0	19	-45.7	33	-5.7
71 T	1288	2049	0.629	2433	18.7	1136	-44.6	1949	-4.9
East: OR 6									
22 LTR	959	1022	0.938	585	-42.8	431	-57.8	398	-61.1
North: US 101									
42 TR	1880	1930	0.974	2252	16.7	1134	-41.2	1702	-11.8

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Adjust. Flow (pcu/h)	Total Cap. (veh/h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: 1st Street										
12 LR	553	0.9	2109	5.2	2118	645	0.85	-1	100	0.857
SouthEast: Pacific Avenue										
72 L	22	4.5	441	1.0	441	35	0.85	35	100	0.629
71 T	1288	5.0	441	1.0	441	2049	0.85	35	100	0.629
East: OR 6										
22 LTR	959	6.0	1751	4.0	1753	1022	0.85	-9	72	0.938
North: US 101										
42 TR	1880	5.0	584	5.7	589	1930	0.85	-13	100	0.974*

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	B
Worst movement Level of Service	=	D
Average intersection delay (s)	=	19.9

Largest average movement delay (s)	=	42.7
Largest back of queue, 95% (ft)	=	656
Performance Index	=	155.56
Degree of saturation (highest)	=	0.974
Practical Spare Capacity (lowest)	=	-13 %
Effective intersection capacity, (veh/h)	=	4827
Total vehicle flow (veh/h)	=	4702
Total person flow (pers/h)	=	5642
Total vehicle delay (veh-h/h)	=	25.95
Total person delay (pers-h/h)	=	31.14
Total effective vehicle stops (veh/h)	=	5863
Total effective person stops (pers/h)	=	7036
Total vehicle travel (veh-mi/h)	=	1773.0
Total cost ($/h)	=	1093.66
Total fuel (ga/h)	=	87.0
Total CO2 (kg/h)	=	824.57

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: 1st Street									
12 LR	6.57	7.88	42.7	1.00	1.49	11.5	290	26.87	14.3
SouthEast: Pacific Avenue									
72 L	0.06	0.07	9.6	0.75	0.89	6.3	163	0.61	21.4
71 T	1.11	1.33	3.1	0.74	0.51	6.4	167	27.95	22.8
East: OR 6									
22 LTR	6.07	7.29	22.8	0.96	1.58	16.0	419	36.66	17.7
North: US 101									
42 TR	12.14	14.57	23.3	1.00	1.52	25.2	656	63.46	23.5

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: 1st Street									
553	0.857	6.57	7.88	42.7	1.00	1.49	290	26.87	14.3
SouthEast: Pacific Avenue									
1310	0.629	1.17	1.40	3.2	0.74	0.51	167	28.56	22.8
East: OR 6									
959	0.938	6.07	7.29	22.8	0.96	1.58	419	36.66	17.7
North: US 101									
1880	0.974	12.14	14.57	23.3	1.00	1.52	656	63.46	23.5
ALL VEHICLES:									
4702	0.974	25.95	31.14	19.9	0.92	1.25	656	155.56	20.3
INTERSECTION (persons):									
5642	0.974		31.14	19.9	0.92	1.25		155.56	20.3

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: 1st Street									
1 L	12	219	255	0.857	47.7	1.43	9.0	226	
2 LR	12	334	390	0.857	39.5	1.52	11.5	290	
SouthEast: Pacific Avenue									
1 LT	72, 71	609	969	0.629	3.6	0.57	6.3	163	
2 T	71	701	1115	0.629	2.8	0.46	6.4	167	
East: OR 6									
1 L	22	321	472	0.680	17.7	1.16	5.6	148	150
2 TR	22	638	680	0.939	25.3	1.79	16.0	419	
North: US 101									
1 T	42	871	894	0.974	24.4	1.53	23.9	620	
2 TR	42	1009	1036	0.974	22.3	1.51	25.2	656	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: 1st Street									
1 L	12	219	0	0	219	150	255	0.857	100
2 LR	12	222	0	112	334	150	390	0.857	100
SouthEast: Pacific Avenue									
1 LT	72, 71	22	587	0	609	150	969	0.629	100
2 T	71	0	701	0	701	150	1115	0.629	100
East: OR 6									
1 L	22	321	0	0	321	150	472	0.680	72P
2 TR	22	0	95	543	638	150	680	0.939	100
North: US 101									
1 T	42	0	871	0	871	150	894	0.974	100
2 TR	42	0	895	114	1009	150	1036	0.974	100

P Lane under-utilisation found by the "Program"

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: 1st Street						
12 LR	11.5	176.78	0.193	6.14	0.177	108.4
	11.5	176.78	0.193	6.14	0.177	108.4

SouthEast: Pacific Avenue						
72 L	0.4	5.29	0.006	0.23	0.007	3.9
71 T	21.0	261.38	0.309	11.77	0.349	198.8
	21.4	266.67	0.315	12.00	0.356	202.7
East: OR 6						
22 LTR	19.6	256.49	0.303	11.77	0.340	185.8
	19.6	256.49	0.303	11.77	0.340	185.8
North: US 101						
42 TR	34.5	393.72	0.539	21.58	0.704	327.6
	34.5	393.72	0.539	21.58	0.704	327.6
INTERSECTION:	87.0	1093.66	1.349	51.49	1.578	824.6

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: 1st Street												
1 L	219			219	1				0.857	47.7	226	
2 LR	222		112	334	1				0.857	39.5	290	
	441	0	112	553	1				0.857	42.7	290	
SouthEast: Pacific Avenue												
1 LT	22	587		609	5				0.629	3.6	163	
2 T		701		701	5				0.629	2.8	167	
	22	1288	0	1310	5				0.629	3.2	167	
East: OR 6												
1 L	321			321	6				0.680	17.7	148	150
2 TR		95	543	638	6				0.939	25.3	419	
	321	95	543	959	6				0.939	22.8	419	
North: US 101												
1 T		871		871	5				0.974	24.4	620	
2 TR		895	114	1009	5				0.974	22.3	656	
	0	1766	114	1880	5				0.974	23.3	656	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	4702	5	0.974	19.9	656

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: 1st Street								
12	LR	553	645	0.857	42.7	D	11.5	290
		553		0.857	42.7	D	11.5	290
SouthEast: Pacific Avenue								
72	L	22	35	0.629	9.6	A	6.3	163
71	T	1288	2049	0.629	3.1	A	6.4	167
		1310		0.629	3.2	A	6.4	167
East: OR 6								
22	LTR	959	1022	0.938	22.8	C	16.0	419
		959		0.938	22.8	C	16.0	419
North: US 101								
42	TR	1880	1930	0.974*	23.3	C	25.2	656
		1880		0.974	23.3	C	25.2	656
ALL VEHICLES:		4702		0.974	19.9	B	25.2	656

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: 1st Street						
	South	139.3	21.7	69.6	1800	164
	North	59.6	15.7	234.0	1800	336
SouthEast: Pacific Avenue						
	West	64.5	16.2	202.6	1800	164
	South	66.4	16.4	312.8	1800	413
	North	214.5	25.0	123.0	1800	164
East: OR 6						

	West	200.0	24.9	156.5	1800	165
	South	67.0	16.4	263.1	1800	363
	North	139.3	21.7	69.6	1800	170
North: US 101						
	West	103.1	19.4	58.2	1800	170
	South	200.0	24.9	156.5	1800	164

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
		Deg.	Stop-line Delay			Acc.	Queuing		Stopd		
Lane	Mov	Satn	1st	2nd	Total	Dec.	Total	MvUp	(Idle)	Geom	Control
No.	No.	x	d1	d2	dSL	dn	dq	dqm	di	dig	dic
West: 1st Street											
1 L	12	0.857	12.5	29.3	41.8	4.8	37.0	5.0	32.0	5.9	47.7
2 LR	12	0.857	9.5	25.7	35.2	5.3	29.9	5.8	24.1	4.3	39.5
SouthEast: Pacific Avenue											
1 LT	72, 71	0.629	2.2	0.9	3.1	4.9	0.0	0.0	0.0	6.5 0.3	3.6
2 T	71	0.629	1.8	0.7	2.5	4.8	0.0	0.0	0.0	0.3	2.8
East: OR 6											
1 L	22	0.680	6.8	5.2	12.0	4.5	7.5	2.4	5.2	5.7	17.7
2 TR	22	0.939	5.6	18.7	24.4	6.2	18.2	8.8	9.4	1.0	25.3
North: US 101											
1 T	42	0.974	4.6	15.9	20.5	6.7	13.8	9.2	4.6	3.9	24.4
2 TR	42	0.974	4.0	14.3	18.2	6.6	11.6	9.0	2.7	4.1	22.3

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

	Deg.	-- Effective Stop Rate --				Prop.	Queue Move-up
Lane	Satn			Geom.	Overall	Queued	Rate
No.	x	he1	he2	hig	h	pq	hqm
West: 1st Street							
1 L	0.857	0.99	0.43	0.01	1.43	0.990	0.97
2 LR	0.857	1.00	0.52	0.00	1.52	1.000	1.07
SouthEast: Pacific Avenue							
1 LT	0.629	0.49	0.06	0.02	0.57	0.749	0.10
2 T	0.629	0.40	0.05	0.01	0.46	0.736	0.08

East: OR 6							
1 L	0.680	0.89	0.21	0.06	1.16	0.891	0.46
2 TR	0.939	0.99	0.79	0.00	1.79	0.995	1.61
North: US 101							
1 T	0.974	1.00	0.53	0.00	1.53	1.000	1.34
2 TR	0.974	0.99	0.52	0.00	1.51	1.000	1.27

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: 1st Street											
1 L	0.857	1.3	2.0	1.0	3.0	5.1	6.3	7.2	9.0	10.5	0.13
2 LR	0.857	1.8	2.5	1.5	3.9	6.4	8.0	9.2	11.5	13.5	0.16
SouthEast: Pacific Avenue											
1 LT	0.629	0.2	1.8	0.3	2.1	3.6	4.4	5.0	6.3	7.3	0.09
2 T	0.629	0.2	1.9	0.3	2.1	3.7	4.5	5.2	6.4	7.5	0.09
East: OR 6											
1 L	0.680	0.5	1.4	0.4	1.8	3.2	4.0	4.5	5.6	6.6*	0.98
2 TR	0.939	2.9	2.5	3.1	5.6	8.7	10.9	12.6	16.0	18.8	0.23
North: US 101											
1 T	0.974	3.8	3.6	5.1	8.7	12.5	16.0	18.6	23.9	28.2	0.34
2 TR	0.974	3.9	3.9	5.4	9.3	13.2	16.9	19.7	25.2	29.9	0.36

Values printed in this table are back of queue (vehicles).
* Queue length exceeds short lane length due to specification of a percentile queue in the aaSIDRA Configuration File. For calculation of this statistic, you may specify the lane with full length.

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: 1st Street											
1 L	0.857	33	51	25	76	127	158	180	226	264	0.13
2 LR	0.857	45	62	37	99	161	201	231	290	340	0.16
SouthEast: Pacific Avenue											
1 LT	0.629	5	46	7	54	93	115	131	163	190	0.09
2 T	0.629	4	48	7	55	96	118	134	167	194	0.09
East: OR 6											
1 L	0.680	12	38	10	48	85	104	119	148	172*	0.98
2 TR	0.939	77	66	81	147	228	287	331	419	493	0.23
North: US 101											
1 T	0.974	99	94	132	227	325	416	484	620	734	0.34
2 TR	0.974	102	100	141	241	343	439	512	656	777	0.36

Values printed in this table are back of queue (feet).
* Queue length exceeds short lane length due to specification of a

percentile queue in the aaSIDRA Configuration File. For calculation of this statistic, you may specify the lane with full length.

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	App. Speeds Negn	Exit Speeds Negn	Exit Speeds Cruise	Queue Move-up 1st Grn	Queue Move-up 2nd Grn	Av. Section Spd Running	Av. Section Spd Overall
West: 1st Street								
12	25.0	16.9	16.9	25.0	10.2		19.7	14.3
SouthEast: Pacific Avenue								
72	25.0	16.4	16.4	25.0	14.1		21.4	21.4
71	25.0	24.0	24.0	25.0	14.5		22.8	22.8
East: OR 6								
22	25.0	20.2	20.2	25.0	10.4		19.7	17.7
North: US 101								
42	40.0	24.5	24.5	25.0	13.3		25.1	23.5

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

Tillamook Roundabout Analysis
OR 6 & Miller
Alternative R1

aaTraffic SIDRA US Highway Capacity Manual (2000) Version

RUN INFORMATION

* Basic Parameters:
  Intersection Type: Roundabout
  Driving on the right-hand side of the road
  Input data specified in US units
  Default Values File No. 11
  Peak flow period (for performance): 15 minutes
  Unit time (for volumes): 60 minutes (Total Flow Period)
  Delay definition: Control delay
  Geometric delay included
  HCM Delay and Queue Models option selected
  Level of Service based on: Delay (HCM method)
  Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table S.0 - TRAFFIC FLOW DATA

Mov No.	Left		Through		Right		Flow Scale	Peak Flow Factor
	LV	HV	LV	HV	LV	HV		
VEHICLES Demand flows in veh/hour as used by the program								
West: West Leg								
12	0	0	425	22	10	1	1.00	0.95
SouthWest: Southwest Leg								
52	5	1	380	20	5	1	1.00	0.95
South: South Leg								
32	10	1	0	0	5	1	1.00	0.95
East: East Leg								
22	5	1	930	49	0	0	1.00	0.95

Based on unit time = 60 minutes.
Flow Scale and Peak Hour Factor effects included in flow values.

Table R.0 - ROUNDABOUT BASIC PARAMETERS

Cent Island Diam (ft)	Circ Width (ft)	Insc Diam. (ft)	No.of Circ. Lanes	No.of Entry Lanes	Av.Ent Lane Width (ft)	Circulating/Exiting Stream Flow (veh/h)	%HV	Adjust. Flow (pcu/h)	%Exit Incl.	Cap. Constr. Effect	O-D Factor
West: West Leg											
98	16	130	1	1	13.00	411	5.0	412	0	N	0.984
SouthWest: Southwest Leg											
98	16	130	1	1	13.00	458	5.0	460	0	N	0.925

South: South Leg											
98	16	130	1	1	13.00	853	5.0	856	0	N	0.893
East: East Leg											
98	16	130	1	1	13.00	16	5.0	16	0	N	0.998

Table R.1 - ROUNDABOUT GAP ACCEPTANCE PARAMETERS

Turn	Lane No.	Lane Type	Circulating/Exiting Stream Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Critical Gap Hdwy (s)	Critical Gap Dist (ft)	Foll-up Headway (s)
West: West Leg										
Thru	1	Dominant	412	15.3	196.0	2.00	0.395	4.35	97.6	2.37
Right	1	Dominant	412	15.3	196.0	2.00	0.395	4.52	101.3	2.46
SouthWest: Southwest Leg										
Left	1	Dominant	460	19.9	229.2	2.00	0.430	4.77	139.6	2.62
Thru	1	Dominant	460	19.9	229.2	2.00	0.430	4.29	125.4	2.36
Right	1	Dominant	460	19.9	229.2	2.00	0.430	4.77	139.6	2.62
South: South Leg										
Left	1	Dominant	856	20.0	123.2	2.00	0.666	3.94	115.5	2.29
Right	1	Dominant	856	20.0	123.2	2.00	0.666	4.23	123.8	2.46
East: East Leg										
Left	1	Dominant	16	15.3	5096.6	2.00	0.019	4.61	103.3	2.34
Thru	1	Dominant	16	15.3	5096.6	2.00	0.019	4.14	92.8	2.10

Environment Factor: 1.00
Entry/Circulating Flow Adjustment: Medium

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table R.5 - ROUNDABOUT CAPACITY & LEVEL OF SERVICE - aaSIDRA & HCM MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	aaSIDRA Av. Delay (sec)	aaSIDRA LOS	HCM 2000 Lower Cap. (veh /h)	HCM 2000 Lower Deg. Satn x	HCM 2000 Lower Av. Delay (sec)	HCM 2000 Lower LOS	HCM 2000 Upper Cap. (veh /h)	HCM 2000 Upper Deg. Satn x	HCM 2000 Upper Av. Delay (sec)	HCM 2000 Upper LOS
West: West Leg													
12 TR	458	1030	0.445	2.8	A	810	0.565	4.6	A	996	0.460	2.7	A
SouthWest: Southwest Leg													
52 LTR	412	934	0.441	3.1	A	774	0.532	4.9	A	955	0.431	3.0	A
South: South Leg													
32 LR	17	620	0.027	7.9	A	488	0.035	9.8	A	625	0.027	8.6	A
East: East Leg													
22 LT	985	1682	0.586	1.0	A	1141	0.863	1.3	A	1362	0.723	1.1	A

Table R.6 - ROUNDABOUT ALTERNATIVE CAPACITY MODELS

Mov No.	Dem Flow (veh /h)	aaSIDRA Cap. (veh /h)	aaSIDRA Deg. Satn x	NAASRA 1986 Cap. (veh /h)	NAASRA 1986 % Diff from aaSIDRA	Ger. Linear Cap. (veh /h)	Ger. Linear % Diff from aaSIDRA	Ger. GapAcc Cap. (veh /h)	Ger. GapAcc % Diff from aaSIDRA
West: West Leg									
12 TR	458	1030	0.445	1228	19.2	909	-11.7	884	-14.2
SouthWest: Southwest Leg									
52 LTR	412	934	0.441	1165	24.7	872	-6.6	842	-9.9
South: South Leg									
32 LR	17	620	0.027	656	5.8	547	-11.8	488	-21.3
East: East Leg									
22 LT	985	1682	0.586	1769	5.2	1201	-28.6	1230	-26.9

Table S.2 - MOVEMENT CAPACITY PARAMETERS

Mov No.	Demand Flow (veh/h)	HV (%)	Opposing Movement Flow (veh/h)	Opposing Movement HV (%)	Opposing Movement Adjust. Flow (pcu/h)	Total Cap. (veh /h)	Prac. Deg. Satn xp	Prac. Spare Cap. (%)	Lane Util (%)	Deg. Satn x
West: West Leg										
12 TR	458	5.0	411	5.0	412	1030	0.85	91	100	0.445
SouthWest: Southwest Leg										
52 LTR	412	5.3	458	5.0	460	934	0.85	93	100	0.441
South: South Leg										
32 LR	17	11.8	853	5.0	856	620	0.85	3000	100	0.027
East: East Leg										
22 LT	985	5.1	16	5.0	16	1682	0.85	45	100	0.586*

Table S.3 - INTERSECTION PARAMETERS

Intersection Level of Service	=	A
Worst movement Level of Service	=	A
Average intersection delay (s)	=	2.0
Largest average movement delay (s)	=	7.9
Largest back of queue, 95% (ft)	=	196
Performance Index	=	43.92
Degree of saturation (highest)	=	0.586
Practical Spare Capacity (lowest)	=	45 %
Effective intersection capacity, (veh/h)	=	3197
Total vehicle flow (veh/h)	=	1872
Total person flow (pers/h)	=	2246
Total vehicle delay (veh-h/h)	=	1.02
Total person delay (pers-h/h)	=	1.23
Total effective vehicle stops (veh/h)	=	605
Total effective person stops (pers/h)	=	726
Total vehicle travel (veh-mi/h)	=	689.1
Total cost ($/h)	=	422.22
Total fuel (ga/h)	=	29.4
Total CO2 (kg/h)	=	278.79

Table S.5 - MOVEMENT PERFORMANCE

Mov No.	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue 95% Back (vehs)	Longest Queue 95% Back (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
12 TR	0.36	0.43	2.8	0.65	0.48	3.8	98	11.15	18.9
SouthWest: Southwest Leg									
52 LTR	0.35	0.43	3.1	0.74	0.53	4.0	105	10.29	18.8
South: South Leg									
32 LR	0.04	0.04	7.9	0.76	0.63	0.2	6	0.49	17.9
East: East Leg									
22 LT	0.28	0.33	1.0	0.16	0.16	7.5	196	21.99	19.5

Table S.6 - INTERSECTION PERFORMANCE

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: West Leg									
458	0.445	0.36	0.43	2.8	0.65	0.48	98	11.15	18.9
SouthWest: Southwest Leg									
412	0.441	0.35	0.43	3.1	0.74	0.53	105	10.29	18.8
South: South Leg									
17	0.027	0.04	0.04	7.9	0.76	0.63	6	0.49	17.9
East: East Leg									
985	0.586	0.28	0.33	1.0	0.16	0.16	196	21.99	19.5
ALL VEHICLES:									
1872	0.586	1.02	1.23	2.0	0.41	0.32	196	43.92	19.2
INTERSECTION (persons):									
2246	0.586		1.23	2.0	0.41	0.32		43.92	19.2

Queue values in this table are 95% back of queue (feet).

Table S.7 - LANE PERFORMANCE

Lane No.	Mov No.	Dem Flow (veh /h)	Cap (veh /h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue 95% Back (ft)	Short Lane (ft)
West: West Leg									
1 TR	12	458	1030	0.445	2.8	0.48	3.8	98	
SouthWest: Southwest Leg									
1 LTR	52	412	934	0.441	3.1	0.53	4.0	105	
South: South Leg									
1 LR	32	17	620	0.027	7.9	0.63	0.2	6	
East: East Leg									
1 LT	22	985	1682	0.586	1.0	0.16	7.5	196	

Table S.8A - LANE FLOW AND CAPACITY INFORMATION

Lane No.	Mov No.	Dem Flow (veh/h) Lef	Thru	Rig	Tot	Min Cap (veh /h)	Tot Cap (veh /h)	Deg. Satn x	Lane Util %
West: West Leg									
1 TR	12	0	447	11	458	150	1030	0.445	100
SouthWest: Southwest Leg									
1 LTR	52	6	400	6	412	150	934	0.441	100
South: South Leg									
1 LR	32	11	0	6	17	17	620	0.027	100
East: East Leg									
1 LT	22	6	979	0	985	150	1682	0.586	100

For roundabouts, the capacity value for continuous movements is obtained as the basic saturation flow without any adjustments. Saturation flow scale applies if specified.

Table S.12A - FUEL CONSUMPTION, EMISSIONS AND COST - TOTAL

Mov No.	Fuel Total gal/h	Cost Total $/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
West: West Leg						
12 TR	7.3	104.26	0.109	3.59	0.105	69.7
	7.3	104.26	0.109	3.59	0.105	69.7
SouthWest: Southwest Leg						
52 LTR	6.7	93.75	0.099	3.34	0.097	63.1
	6.7	93.75	0.099	3.34	0.097	63.1
South: South Leg						
32 LR	0.3	4.27	0.004	0.15	0.004	2.8
	0.3	4.27	0.004	0.15	0.004	2.8
East: East Leg						
22 LT	15.1	219.94	0.218	6.41	0.198	143.2
	15.1	219.94	0.218	6.41	0.198	143.2
INTERSECTION:	29.4	422.22	0.431	13.49	0.404	278.8

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel ($/US gal)	=	1.800
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income ($/h)	=	18.00
Time value factor	=	0.40
Average occupancy (persons/veh)	=	1.2
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0

Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

The idle fuel and vehicle mass parameters given above are the default values (data given in RIDES may override some of these parameters).

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
West: West Leg												
1 TR		447	11	458	5				0.445	2.8	98	
	0	447	11	458	5				0.445	2.8	98	
SouthWest: Southwest Leg												
1 LTR	6	400	6	412	5				0.441	3.1	105	
	6	400	6	412	5				0.441	3.1	105	
South: South Leg												
1 LR	11		6	17	12				0.027	7.9	6	
	11	0	6	17	12				0.027	7.9	6	
East: East Leg												
1 LT	6	979		985	5				0.586	1.0	196	
	6	979	0	985	5				0.586	1.0	196	
ALL VEHICLES				Total Flow	% HV				Max X	Aver. Delay	Max Queue	
				1872	5				0.586	2.0	196	

Total flow period = 60 minutes. Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	(ft)
West: West Leg								
12	TR	458	1030	0.445	2.8	A	3.8	98
		458		0.445	2.8	A	3.8	98
SouthWest: Southwest Leg								
52	LTR	412	934	0.441	3.1	A	4.0	105
		412		0.441	3.1	A	4.0	105
South: South Leg								
32	LR	17	620	0.027	7.9	A	0.2	6
		17		0.027	7.9	A	0.2	6

East: East Leg							
22 LT	985	1682	0.586*	1.0	A	7.5	196
	985		0.586	1.0	A	7.5	196
ALL VEHICLES:	1872		0.586	2.0	A	7.5	196

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.
For the criteria, refer to the "Level of Service" topic in the aaSIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

Table D.0 - GEOMETRIC DELAY DATA

From Approach	To Approach	Negn Radius (ft)	Negn Speed (mph)	Negn Dist. (ft)	Appr. Dist. (ft)	Downstream Distance (ft)
West: West Leg						
	SouthWest	82.3	17.8	32.8	1800	106
	South	116.2	20.0	50.1	1800	106
	East	196.7	20.0	125.6	1800	128
SouthWest: Southwest Leg						
	West	55.4	15.3	261.1	1800	310
	South	82.3	17.8	32.8	1800	107
	East	196.7	20.0	94.2	1800	103
South: South Leg						
	West	55.4	15.3	217.6	1800	288
	SouthWest	55.4	15.3	261.1	1800	288
	East	116.2	20.0	50.1	1800	103
East: East Leg						
	West	196.7	20.0	125.6	1800	168
	SouthWest	55.4	15.3	174.0	1800	168
	South	55.4	15.3	217.6	1800	266

Maximum Negotiation (Design) Speed = 30.0 mph
Downstream Distance calculated by aaSIDRA

Downstream distance is distance travelled from the stopline until exit cruise speed is reached (includes negotiation distance). Acceleration distance is weighted for light and heavy vehicles. The same distance applies for both stopped and unstopped vehicles.

Table D.1 - LANE DELAYS

			Delay (seconds/veh)								
Lane No.	Mov No.	Deg. Satn x	Stop-line Delay 1st d1	2nd d2	Total dSL	Acc. Dec. dn	Queuing Total dq	MvUp dqm	Stopd (Idle) di	Geom dig	Control dic
West: West Leg											
1 TR	12	0.445	2.8	0.0	2.8	3.8	0.0	0.0	0.0	0.0	2.8
SouthWest: Southwest Leg											
1 LTR	52	0.441	3.0	0.0	3.0	4.3	0.0	0.0	0.0	0.1	3.1
South: South Leg											
1 LR	32	0.027	5.6	0.0	5.6	3.9	1.7	0.0	1.7	2.4	7.9
East: East Leg											

1 LT	22	0.586	0.1	0.0	0.1	0.9	0.0	0.0	0.0	0.9	1.0

dn is average stop-start delay for all vehicles queued and unqueued

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds (RIDES Approach Data screen), and negotiation radius or negotiation speed data (RIDES Extra Data - Geometric Delay data screen).

Table D.2 - LANE STOPS

Lane No.	Deg. Satn x	-- Effective Stop Rate -- he1	he2	Geom. hig	Overall h	Prop. Queued pq	Queue Move-up Rate hqm
West: West Leg							
1 TR	0.445	0.48	0.00	0.00	0.48	0.653	0.00
SouthWest: Southwest Leg							
1 LTR	0.441	0.53	0.00	0.00	0.53	0.738	0.00
South: South Leg							
1 LR	0.027	0.56	0.00	0.07	0.63	0.757	0.00
East: East Leg							
1 LT	0.586	0.04	0.00	0.12	0.16	0.160	0.00

hig is the average value for all movements in a shared lane
hqm is average queue move-up rate for all vehicles queued and unqueued

Table D.3A - LANE QUEUES (veh)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (veh) Nb1	Nb2	Nb	Percentile (veh) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 TR	0.445	0.0	1.2	0.0	1.2	2.2	2.7	3.0	3.8	4.4	0.05
SouthWest: Southwest Leg											
1 LTR	0.441	0.0	1.3	0.0	1.3	2.3	2.9	3.2	4.0	4.7	0.06
South: South Leg											
1 LR	0.027	0.0	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.00
East: East Leg											
1 LT	0.586	0.0	2.5	0.0	2.5	4.3	5.3	6.0	7.5	8.8	0.11

Values printed in this table are back of queue (vehicles).

Table D.3B - LANE QUEUES (feet)

Lane No.	Deg. Satn x	Ovrfl. Queue No	Average (feet) Nb1	Nb2	Nb	Percentile (feet) 70%	85%	90%	95%	98%	Queue Stor. Ratio
West: West Leg											
1 TR	0.445	0	32	0	32	57	69	79	98	114	0.05

SouthWest: Southwest Leg										
1 LTR	0.441	0	34	0	34	61	74	85	105	122	0.06
South: South Leg										
1 LR	0.027	0	2	0	2	3	4	5	6	7	0.00
East: East Leg										
1 LT	0.586	0	65	0	65	111	138	157	196	229	0.11

Values printed in this table are back of queue (feet).

Table D.4 - MOVEMENT SPEEDS (mph)

Mov No.	App. Speeds Cruise	App. Speeds Negn	Exit Speeds Negn	Exit Speeds Cruise	Queue Move-up 1st Grn	Queue Move-up 2nd Grn	Av. Section Spd Running	Av. Section Spd Overall
West: West Leg								
12	20.0	20.0	20.0	20.0			18.9	18.9
SouthWest: Southwest Leg								
52	20.0	19.9	19.9	20.0			18.8	18.8
South: South Leg								
32	20.0	16.9	16.9	20.0			18.4	17.9
East: East Leg								
22	20.0	18.1	18.1	20.0			19.5	19.5

"Running Speed" is the average speed excluding stopped periods.

--- End of aaSIDRA Output ---

MEMO #7B

Preliminary List of Downtown Parking and Safety Alternatives

Tillamook Refinement Plan: Preliminary List of Downtown Parking & Safety Alternatives (Memo #7B)

PREPARED FOR:	Valerie Grigg Devis, ODOT
PREPARED BY:	Tim Burkhardt, CH2M HILL
COPIES:	Project Management Team
DATE:	REVISED: May 3, 2005
PROJECT NUMBER:	320805.19

This is a preliminary list for presentation and discussion at the May 3 advisory committee meeting.

(d = downtown parking and safety alternative)

A. MAIN AND PACIFIC (GENERAL)

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
dA1. Pedestrian Safety and Streetscape improvements (generally)	Pedestrian scale lighting	Yes
	New street trees and other landscaping	
	Pedestrian scale lighting	
	Continental style crosswalks at all US 101 intersections	
	Curb extensions where feasible, including elongated curb extensions at some locations	
	Colored pavement on key cross-street intersections	
	Re-build 2nd Street between Main and Pacific as a "slow street"- resurface with pavers, add enhanced crosswalks	
dA2. Pedestrian Safety Improvements at 2nd and Main	Remove parking for 1-2 stalls on NW and NW corners	Yes
	Add additional curb extensions where feasible – especially, enlarge curb extension at NE corner	
	Add advance signage and stop bar as recommended by City and ODOT	
	Review/adjust signal timing to increase gap between 1st and 3rd, as recommended by ODOT and City	
	See also Parking and Safety alternative B1 and Traffic Operations alternative C1	

A. MAIN AND PACIFIC (GENERAL)

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
dA1. Pedestrian Safety and Streetscape improvements (generally)	Pedestrian scale lighting New street trees and other landscaping Pedestrian scale lighting Continental style crosswalks at all US 101 intersections Curb extensions where feasible, including elongated curb extensions at some locations Colored pavement on key cross-street intersections Re-build 2nd Street between Main and Pacific as a "slow street"- resurface with pavers, add enhanced crosswalks	Yes
dA3. Reduce sign clutter and improve signage	To improve safety and reduce driver confusion To encourage drivers to stop Combine with way-finding program for key local destinations	Yes
dA4. Review driveways on Main and Pacific and identify potential closures to improve safety	Look for opportunities to combine driveways, close unneeded driveways, redevelopment opportunities	Yes

B. MAIN AND PACIFIC – PARKING AND SAFETY

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
dB1. Widen travel lanes, add bike lanes, remove parking on right hand side (see illustration and cross section)	Travel lanes are wider Opens visual field for driver (good for safety, may increase speeds) Bike lane improves bike safety and provides buffer On-street parking remains on one side of street – drivers exit on curb site of street Maintains existing sidewalk width Parking on left side may be unfamiliar to drivers Less parking in front of businesses – may need to provide more elsewhere (see parking alternatives)	Yes

dB1A. Widen travel lanes, narrow sidewalks, retain parking on both sides, add curb extensions (see illustration and cross section)	Travel lanes are wider – provides more space for through vehicles, more buffer for parking with only minor opening of visual field Reduces sidewalk width by two feet on each side (expensive due to basements) Maintains on-street parking on both sides of street; new curb extensions would remove some parking spaces Bikes potentially accommodated in shared lane	Yes
dB2. Remove parking on left hand side and add bike lane to right hand side next to parking lane	No buffer for left-hand sidewalk Car doors open to bike lane Blocks between Main and Pacific become island with no on-street parking	No
dB3. Remove on-street parking from alternate sides of street	Potentially more "fair" to businesses Confusing for drivers Cannot safely provide bike lane	No
D-B4. Remove parking on one side, widen sidewalk and travel lanes, do not add bike lane	No buffer for right-hand sidewalk No bicycle facilities	No
dB5. Narrow sidewalk, widen travel and parking lanes, do not add bike lane	Conflicts with pedestrian/streetscape goals No bicycle facilitities No traffic calming benefits	No
dB6. Make Main and Pacific both two way streets	Reduces vehicle capacity (increase congestion) Creates difficult intersections/congestion at north and south end (cross-overs)	No
dB7. Make one street for trucks and the other for cars	Adverse impact on downtown businesses on truck road Creates difficult intersections/congestion at north and south end (cross-overs) Could not enforce (truck route voluntary)	No
dB8. Keep road as is but just improve streetscape	Does not go far enough, not enough improvement	No

C. MAIN AND PACIFIC – TRAFFIC OPERATIONS AND MOBILITY

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?

dC1. Two-way OR 6/1st Street and 3rd Street	See Memo 7A for traffic analysis Would require removal of parking and narrower sidewalks on 3rd St. between Main and Pacific (see cross-section illustrations)	Yes
dC2. Pacific Avenue Northward Extension	See Memo 7A for traffic analysis Would have property impacts on motel and auto dealer Would require new bridge over slough	Yes
dC3. Extend the OR 6/3rd Street Couplet (from Main Avenue to the West)	See Memo 7A for traffic analysis	No
dC4. Widen Hoquarten Slough Bridge	See Memo 7A for traffic analysis Would require new bridge over slough	Yes
dC5. Two-way OR 6/1st Street and 3rd Street AND Pacific Avenue Northward Extension (combination of Alts. 1 and 2)	See Memo 7A for traffic analysis	Yes
dC6. Two-Way OR 6/1st Street and 3rd Street with Roundavouts	See Memo 7A for traffic analysis	Yes

D. PARKING – DOWNTOWN TILLAMOOK

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
dD1a. Safety/Comfort	Remove parking from right hand side of Main and Pacific, widen travel lanes, add bike lane	Yes
dD1b. Safety/Comfort	Keep parking on both sides of Main and Pacific, narrow sidewalks, widen travel lanes	Yes
dD2. Supply	**Employee Parking** Provide all-day off-street employee parking Replace lost employee parking at old Ray's site Consider shared parking options (for example, churches) **Public Parking** Develop public parking lot with future structured parking opportunity Consider adding diagonal parking on selected side streets (Ivy, 2nd); consider back-in diagonal parking More designated RV parking – consider 5th Street west of Main and Main and Pacific south of 4th or 5th \	Yes
dD3. Regulation	Simplify parking regulations – for example, make 2-hour parking the standard with a few exception areas (for example, 15-minute) Consider requiring parking passes (free or very low cost) for employee parking lot	Yes
dD4. Signage	Provide signage from US 101 to public parking lots and for RV parking areas Develop citywide signage and wayfinding plan – reduce sign clutter and improve aesthetics Consider Cannon Beach parking sign examples	Yes

MEMO #8

Preliminary List of Truck Route Alternatives

Tillamook Refinement Plan: Preliminary List of Truck Route Alternatives (Memo #8)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Tim Burkhardt, CH2M HILL

COPIES: Project Management Team

DATE: REVISED: May 3, 2005

PROJECT NUMBER: 320805.19

This is a preliminary list for discussion and presentation at the May 3 advisory committee meeting. The location of each alternative is shown on the map that follows this memo.

(t = truck alternative)

A. DOWNTOWN TILLAMOOK

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tA1a. Widen travel lanes, add bike lanes, remove parking on right hand side downtown alternative #dB1)	See Downtown Parking and Safety Alternatives (Memo 7B)	Yes
tA1b. Widen travel lanes, narrow sidewalks, retain parking on both sides, add curb extensions (downtown alternative #dB1A)	See Downtown Parking and Safety Alternatives (Memo 7B)	Yes
tA2. OR 6/3rd Street Two-Way (downtown alternative #dC1 or dC6)	Reduces significant number of truck trips on US 101 between 1st Street and 3rd Street Improves intersection operations	Yes
tA3. Pacific Avenue Northward Extension (downtown alternative #dC2)	Reduces congestion (including for trucks) in downtown Tillamook	Yes
tA4. Use abandoned railroad (old Front Street) north of OR 6	Connection to OR 6 problematic/infeasible in particular due to grade separation Benefit appears limited Conflicts with Slough trail plans	No

B. TILLAMOOK LUMBER MILL

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tB1. Internal layout and circulation changes to reduce trips through Tillamook	Make 3rd Street most efficient and desirable access for all trucks traveling to/from the north or east Make 10th Street most efficient and desirable access for all trucks traveling to/from south	Yes
tB2. Use DelMonte Ave as primary north access to Mill from OR 6	This is the existing condition – recently rebuilt. Grade is reasonable. Disadvantages include adjacent park and nearby school. Would minor improvements to DelMonte to make it work even better and/or minimize adverse impacts of trucks?	Yes
tB3. Trout Ave northward extension as primary access to Mill from OR 6	>10% grade presents fatal flaw	No
tB4. Evergreen Dr northward extension as primary access to Mill from OR 6	10% grade presents fatal flaw	No
tB5. OR 6 Buttonhook/ramp to 3rd at Evergreen	Would require significant structure but would not accommodate all movements Would conflict with existing land uses between 3rd Street and OR 6	No
tB6. Marolf Loop northward extension as primary access to Mill from OR 6	Grade is less than at Evergreen Would increase truck traffic on east end of 3rd Street (residential)	?No
tB7. Wilson River Loop as primary access to Mill from OR 6	Would increase truck traffic on east end of 3rd Street (residential) Depends on future OR 6/WR Loop intersection solution	?No
tB8. Schild Road/3rd Street as primary access to Mill from OR 6	Would increase truck traffic on east end of 3rd Street (residential) Depends on future OR 6/WR Loop intersection solution	?No
tB9. Use existing 11th Street instead of 10th for Mill access	Street includes multi-family residential building and some commercial uses – somewhat more compatible land uses than on 10th Appears to be detrimental to 11th in proportion with benefits to 10th – not worth the switch	No
tB10. Use new/extended 12th Street instead of 10th for Mill	On paper, would provide new direct street with few or not conflicting uses between US 101 and	No

B. TILLAMOOK LUMBER MILL

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tB1. Internal layout and circulation changes to reduce trips through Tillamook	Make 3rd Street most efficient and desirable access for all trucks traveling to/from the north or east Make 10th Street most efficient and desirable access for all trucks traveling to/from south	Yes
tB2. Use DelMonte Ave as primary north access to Mill from OR 6	This is the existing condition – recently rebuilt. Grade is reasonable. Disadvantages include adjacent park and nearby school. Would minor improvements to DelMonte to make it work even better and/or minimize adverse impacts of trucks?	Yes
access	Miller But 12th east of Miller includes High School and Head Start– new connection would increase traffic and trucks Extension would have some impact on existing structures and water/wetland areas	

C. NORTH OF OR 6

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tC1. Signal at US 101 and Latimer Rd.	Safety/operations improvement To be installed in _____ (year)	Yes
tC2. Wilson River Loop/OR 6 intersection improvement	Presumably will be an interchange How will it connect to south?	Yes
tC3. N-S Bypass on railroad R/W, adjacent to railroad tracks (north of OR6)	Efficient bypass Could provide direct connection to Mill Assume RR already raised out of floodplain Assume some impacts on resource lands Would require interchange-type facility and overpass at OR 6 High cost, low feasibility	?No
tC4. NW/SE diagonal bypass	Efficient bypass	No

C. NORTH OF OR 6

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tC1. Signal at US 101 and Latimer Rd.	Safety/operations improvement To be installed in _____ (year)	Yes
across resource lands	Resource land/UGB impacts and costs assumed to be fatal flaw	
tC5. Latimer Road/Wilson River Loop intersection improvements to improve truck turning efficiency	Would require new bridge structure	Yes
tC6. Latimer Road pavement improvements	Improve pavement to handle existing and future truck traffic Increased truck traffic conflicts with residential uses adjacent to road (although consistent with functional classification) Depends on future OR 6/WR Loop intersection solution	Yes
tC7. Latimer Road frontage/backage road	To reduce impacts of truck traffic on some residential properties Does not appear feasible and would create many new impacts	No
tC8. Relocate Averill Trucking south of downtown Tillamook (e.g., Port of Tillamook Bay?)	Assumption is would reduce truck trips through downtown, based on truck data collection but still be viable for business operations (need to verify with Averill)	Yes
tC9. Impoved signage for Front Street alt. truck route	Encourage trucks heading WB on Netarts Highway from US 101 north to use Front Street Would remove some trips on Main between 1st and 3rd	Yes
tC10. Signage to encourage use of Latimer/Wilson River Loop bypass route	Not recommended because roads are not improved to truck route standards, assumed ODOT would not approve	No

D. SOUTH OF OR 6

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tD1. Signal at US 101 and Long Prairie Rd	Would make truck turns to/from Long Prairie Rd easier/safer especially in peak periods Is not likely to meet warrants – would present safety hazard because outside of urban area; flashing yellow light already in place	No
tD2. N-S Bypass on railroad R/W, adjacent to railroad tracks (south of OR6)	Efficient bypass Could provide direct connection to Mill Assume RR already raised out of floodplain Assume some impacts on resource lands Would require interchange-type facility and overpass at OR 6 High cost, low feasibility	?No
tD3. SW-NE diagonal bypass across resource lands	Efficient bypass Resource land/UGB impacts and costs assumed to be fatal flaw	No
tD4. Olson/Trask/3rd Street – change stop control to Olson/Trask is free and 3rd is stop controlled	Appears feasible although grade may be an issue Depends on future OR 6/WR Loop intersection solution	Yes
tD5. Improvements to Trask River Road/Long Prairie Loop to promote use as bypass (in general)	Infeasible to reconstruct much of both roads to truck route standards (e.g., lane widths, shoulder, grades) – in particular Trask River Road Instead, maintain to existing functional classification standards (major collector) to continue use as unofficial bypass for minority of vehicles	Yes
tD6. McCormick Loop extension at south across river to Long Prairie Road (in general)	McCormick Loop existing conditions and functional class (minor collector) inconsistent with use as truck bypass – narrow, rural residential	No
tD7. Better connection and alignment between Schild Road and McCormick Loop	Only one adjacent building on Schild Rd Still expect stop control because of grade differences Depends on future OR 6/WR Loop intersection solution	Yes
tD8. Johnson Creek Bridge – remove weight restrictions	Eliminate weight restrictions from Trask River Road bypass Bridge repair/replacement to be completed	Yes

D. SOUTH OF OR 6

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
tD1. Signal at US 101 and Long Prairie Rd	Would make truck tums to/from Long Prairie Rd easier/safer especially in peak periods Is not likely to meet warrants – would present safety hazard because outside of urban area; flashing yellow light already in place _____ (year).	No
tD9. Signage to encourage use of Trask River Road/Long Prairie Road bypass route	Not recommended because roads are not improved to truck route standards, assumed ODOT would not approve	No

MEMO #9

Sidewalk Structural Review

Tillamook Transportation Refinement Plan: Sidewalk Structural Review (Memo #9)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Tim Burkhardt, CH2M HILL
Lwin Hwee, P.E., CH2M HILL

COPIES: Project Management Team

DATE: August 15, 2005

Introduction

Implementation of some of the alternatives being considered as part of the Tillamook Transportation Refinement Plan would result in narrowing existing sidewalks to accommodate wider travel lanes in downtown Tillamook for vehicles. Areas under consideration include Main and Pacific Avenues, and the block of 3rd Street between Main and Pacific.

City of Tillamook staff familiar with the businesses have pointed out that some of the basements in these locations extend beneath the sidewalks and that relocating sidewalks here could be difficult or cost-prohibitive. This memo documents the observations made from a field investigation to further understand this issue.

Field Review

A field review of the potentially affected area was conducted on July 12, 2005, with staff from CH2M HILL, the City of Tillamook and ODOT including:

- Tim Burkhardt and Lwin Hwee (CH2M HILL)
- Tim Lyda and Arley Sullivan (City of Tillamook)
- Mark Lusby (ODOT)

The field review consisted of a walking inspection on a number of the potentially affected basements. The area of primary focus was Main Avenue between 1st and 4th Streets and 3rd Street between Main and Pacific. Based on their familiarity with the existing conditions, City staff were able to rule out most of the properties beyond this area as not having the potential for basement foundation concerns.

Findings

Figure 1 shows the location of areas reviewed during the field visit and the location of the basement with respect to the sidewalk. Results are reported in the following categories:

- **No basement/no basement under sidewalk** – At these locations, either there was no basement at all or the basement did not extend laterally beneath the sidewalk. *These locations would not present any issues with respect to moving the sidewalks as conceptually proposed.*
- **Basement access door(s) only under sidewalk** – These locations have basement access panels in the sidewalk. However, the basement itself does not otherwise extend outside the building footprint into the sidewalk. Narrowing the sidewalk at these locations would require filling in or relocating the access panels but would not require a major modification to the basement. While some of the access panels are currently used and would need to be maintained, many are welded shut and indications are that property owners would support having them eliminated. *These locations would require some additional effort with respect to moving the sidewalks but the level of effort and cost are expected to be moderate – see cost estimates.*
- **Basement under sidewalk** – This condition occurred at only one location – the Tillamook Hotel Building at the northeast corner of Main Avenue and 3rd Street. As indicated in Figure 1, the basement extends beneath the sidewalk on both the Main Avenue and 3rd Street sides of the building. The basement wall extends to the sidewalk curb. The sidewalk measure 12 ft wide from the front wall of the existing building to the sidewalk curb. *This location would require substantial effort with respect to narrowing the sidewalks, relocating the basement wall and re-decking the sidewalk surface above the basement. Enclosing sections of basement below the sidewalk may be considered as an alternative to maintaining the basement below the sidewalk, and is expected to cost less than moving the existing basement wall to the new sidewalk curb line. This cost estimate is not provided in this memo – see cost estimates.*

Basement Wall Reconstruction

At 3rd and Main, the basement wall is located approximately at the outside edge of the 12-foot sidewalk on both the Main Avenue and 3rd Street sides. A row of columns running parallel to the basement walls on both Main and 3rd Street is approximately 12 feet from the base wall. The existing 20 inch x 20 inch columns are spaced approximately 11 feet on centers with the exception of the two columns at the corner of Main and 3rd. On the Main Avenue side, the sidewalk was replaced when the building was remodeled in the 1990's and a new row of columns about 12 inches in diameter, 6 feet from the basement wall, has been added to support the new sidewalk. The basement is approximately 12 feet deep and extends 67 feet on Main Avenue and 82 feet on 3rd Street along the basement wall. See Figure 2 for plan view of basement and sidewalks. The concrete floor beams spanning the sidewalk between the basement wall and the existing square columns have exposed rebars and the cross-section of these beams has been reduced due to spalling of concrete. See Figure 3 for pictures of the columns and floor beams.

Narrowing the sidewalk from 12 feet to 8 feet and 10 feet would require reconstruction of the basement wall. The existing concrete building would need to be temporary shored during reconstruction of the sidewalk. Deterioration of the concrete ceiling, beams and columns in the basement have been observed. Some repairs associated with the basement underneath the existing building are likely. An assessment of the repairs associated with the building was not part of the site investigation.

The following are two alternatives considered in evaluating the cost of narrowing the sidewalks:

1. Move basement wall approximately 2 feet and 4 feet, respectively, on Main Ave and 3rd Street toward the building to the new edge of sidewalk. The floor beams and sidewalk will be replaced. New floor beams supporting the sidewalk will be spliced into the existing floor beams supporting the building below. As an alternate to reconstructing the floor beams, a deck slab may be constructed without the floor beams by thickening the concrete slab section between the building and the edge of sidewalk.

2. Move basement wall to existing columns supporting the building. The new basement wall will be built by in-filling between 20 inch x 20 inch concrete columns. The basement below the sidewalk will be removed and backfilled. This alternate would reduce the area of the basement by approximately 1,600 SF.

Basement Access Panels

Based on our field observation, most if not all of the access panels have been welded shut at the sidewalk level. There is no evidence that these access panels are being used by the businesses today. Each panel occupies approximately 60 SF underneath the sidewalk. The basement walls are located on the inside edge of the sidewalk supporting the adjoining building. The opening created in the basement wall for the access panel may be in-filled and the area below the sidewalk backfilled for construction of the new sidewalk. There are four access panels on the east side of Main between 2nd and 3rd Street, two on the west side of Main between 1st and 3rd Street, one on the west side of Pacific between 2nd and 3rd Street and finally, one on the south side of 3rd Street between Main and Pacific.

Construction Cost Estimates

Narrowing Sidewalk (3rd and Main)

	Extg Sidewalk		New Sidewalk		New Area (SF)	Cost/SF	Subtotal
	Width	Length	Width	Length			
Main Ave	12	82	10	78	780	$160	**$124,800
Pacific Ave	12	67	8	55	440	$160	**$70,400
*Total					1302		$195,200

Access Panel Closure

	Access Panels		Total Area(SF)	Cost/SF	Subtotal
	Each	Area/Panel			

Access Panel Closure

	Access Panels		Total Area(SF)	Cost/SF	Subtotal
Main Ave	6	60	360	$60	$21,600
Pacific Ave	1	60	60	$60	$3,600
3rd Street	1	60	60	$60	$3,600
*Total			480		$28,800

*Construction costs only. Engineering (design and construction) not included in the estimates. These estimates do not include any contingency for unknowns. Typically, a contingency of 40% is added to a planning level cost estimate such as this.

**Potential repair costs associated with the Tillamook Hotel Building at the corner of 3rd and Main are not included in the estimate.

Conclusions

Narrowing the identified sidewalks in downtown Tillamook appears to be technically feasible. The estimated costs to relocate basement walls at 3rd and Main and closures of the basement access panels are reported above. Considerations for implementation would include the availability of funds for these costs, the need to work with property owners and address any of their concerns, and any additional issues or costs associated with other structural repairs that might be needed on the affected building.

Legend
Basement Under Sidewalk
Basement Access Doors Only Under Sidewalk

N W E S

0 25 50 75
Feet

Figure 1

Sidewalk Structural Review

Tillamook Refinement Plan

CH2MHILL

File Path: \\rosa\proj\ODOT\320805\GIS\MXDs\figure1_sidewalk-structural-review.mxd, Date: July 27, 2005 6:13:33 AM

Note:
Details of basement plan are shown to demonstrate placement of 20"x20" and 12" dia. concrete columns in relation to the basement walls and sidewalks. Other details of the basement plan are not available and not shown for the planning level study.

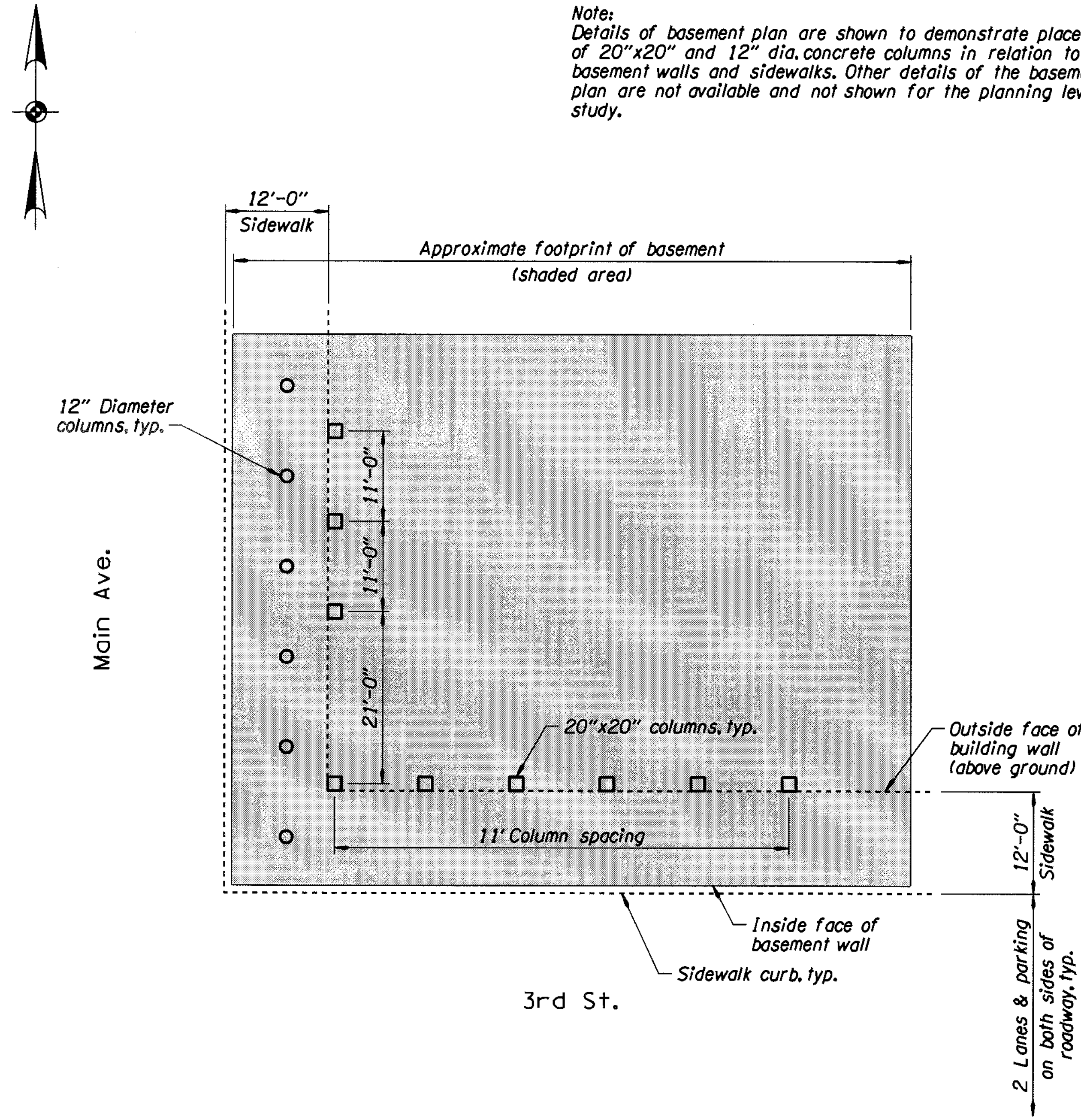


FIGURE 2
BASEMENT PLAN
TILLAMOOK HOTEL BUILDING
(3RD & MAIN)
Tillamook, Oregon

NOT FOR CONSTRUCTION
INFORMATION ONLY

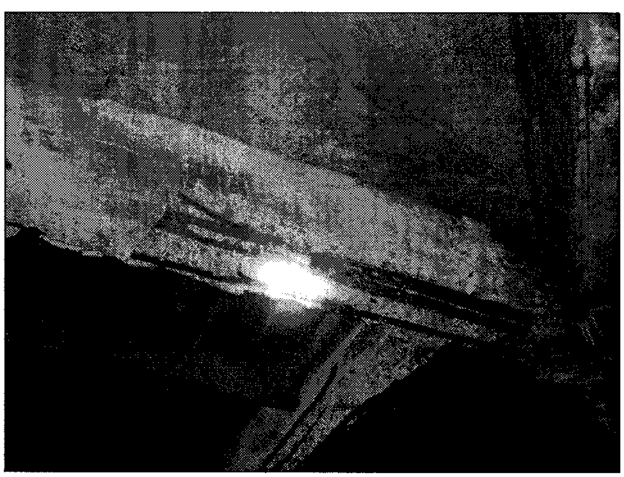
CH2MHILL

LOOKING WEST @ SQUARE COLUMNS

LOOKING NORTH @ ROUND COLUMNS

LOOKING NORTH @ ROUND & SQUARE COLUMNS

LOOKING EAST @ SQUARE COLUMNS



ceiling of basement

LOOKING WEST ON 3RD STREET

FIGURE 3
SITE PHOTOS
TILLAMOOK HOTEL BUILDING
(3RD & MAIN)
Tillamook, Oregon

NOT FOR CONSTRUCTION
INFORMATION ONLY

CH2MHILL

MEMO #10

Downtown Parking Recommendations

Tillamook Transportation Refinement Plan: Downtown Parking Recommendations (Memo #10)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Theresa Carr, CH2M HILL
Tim Burkhardt, CH2M HILL

COPIES: Project Management Team

DATE: January 9, 2006

Introduction

This memorandum provides recommended solutions to address identified parking issues in downtown Tillamook. These recommendations are part of the larger Tillamook Transportation Refinement Plan and are based on the results of technical work documented as Memo # 5 (Parking Utilization Study and Existing Conditions) and input from key project stakeholders.

The parking study focused on downtown Tillamook. The parking study area is bounded on the west by Grove Avenue, on the east by Madrona Avenue, on the north by Front Street (1st Street east of Main Avenue), and on the south by 6th Street. The study analyzed both on-street and off-street parking areas, including public stalls and lots as well as parking areas used by private businesses.

Recommendations

The parking utilization study included stakeholder interviews and parking counts on a typical weekday and a typical weekend day. Findings from that study indicated that safety and accessibility were the largest parking-related concerns for visitors to the downtown Tillamook area, and the time limitations on the downtown parking supply was the largest concern for employees. According to project stakeholders, improvements were needed to make it clearer for visitors to the area where parking areas were located. Also, although recommendations were not made to remove parking on Main and Pacific, it was generally understood that these streets will be less friendly to visitors than parking off the highway. Another concern of residents and business owners was how to accommodate employees of downtown businesses. On-street parking in the downtown area is regulated to certain parking time limits, varying between 15 minutes and three hours. Employees have been making use of a vacated supermarket parking lot, though this area has been recently redeveloped and is no longer available to employees.

Recommendations to address these and other concerns over parking in the downtown area are illustrated in Figure 1 and described in brief below.

1. ***Dedicated RV Parking –*** In addition to the current RV parking spaces on 2nd Avenue just east of Pacific, additional RV spaces should be designated on 5th Avenue just east of Ivy, on the south side of the new Safeway lot. Both of these areas are located at one end or the other of the downtown couplet. With proper signage, they should be easy for visitors not familiar with the area to find. RVs also can park in non-designated locations on city streets and surface parking lots.

2. ***Possible RV Overnight Parking –*** This option would explore the willingness of Safeway to allow RVs to park overnight in their parking lot. This may require adjustments to City zoning code.

3. ***Employee Parking –*** With the construction of the new Safeway on the old Ray's Supermarket site, parking to accommodate employees of the downtown core will be needed. The city currently administers a monthly parking permit program for the lot facing 2nd just west of Ivy. It is recommended that the City expand this program for the City lot just east of Ivy, where parking could be used by employees with a permit (small fee to cover administrative costs) or by visitors by meter.

   The City currently recommends that employees park outside the parking district where no time limitations exist. A concern raised by stakeholders is that the pedestrian environment is not consistent outside the parking district, making the walk to the core unpleasant in certain locations. This plan recommends improvements to the pedestrian environment, including consistent sidewalks and landscaping where appropriate to make walking more pleasant for employees and visitors.

4. ***Possible Future Expansions of Employee and/or Public Parking, Including Structure –*** The Eagles building on the corner of 2nd and Stillwell may be for sale. The City could acquire this property and expand the permit parking area for employee parking, and/or make it available for visitors.

5. ***Future Parking Structure –*** Two locations were identified for potential long-term future parking structures. The first location is building a deck or a structure on the existing City-owned lots (south side of 2nd, between Main and Stillwell). If a structure is built, the potential for first-floor retail should be explored. The second parcel is located on the south side of 1st Avenue just west of Ivy is expected to be redeveloped at some point during the 20-year planning horizon. When this occurs, the City should explore the possibility of public parking on the site.

6. ***Angle Parking –*** At the request of the City of Tillamook, angle parking was explored along 2nd Avenue between Grove Street and Pacific Street, and along Ivy Street between 1st Avenue and 3rd Avenue. According to field surveys, the width of 2nd Avenue is approximately 36 feet and the width of Ivy Street is approximately 32 feet. According to *Parking* (Eno Foundation, 1990 rep. 2003), these widths are adequate to accommodate 45 degree angle parking with one-way traffic. In addition, there is sufficient room to accommodate parallel parking on the south side of 2nd Avenue and on the west side of Ivy Street. Few changes were assumed to driveway placement and location, or to

location of loading zones. One driveway was assumed to be closed on the east side of Ivy Street between 2nd Avenue and 3rd Avenue.

Two options were explored, as illustrated in Figures 2 and 3.

- *Option 1:* Option 1 adds 45 degree angle parking along the north side of 2nd Avenue between Grove Street and Pacific Street, and along the east side of Ivy Street between 1st Avenue and 3rd Avenue. The traffic channelization of 2nd Avenue would change to one way in the westbound direction between Grove Street and Main Street, and one way in the eastbound direction between Main Street and Pacific Street. This change in direction east and west of Main Street is recommended to simplify the movements at the 2nd and Main intersection, and improve safety - under this scenario no traffic enters Main Street from 2nd Avenue. Channelization along Ivy Street is modified to be one-way in the northbound direction. Option 1 accommodates parallel parking on the south side of 2nd Avenue, and along the west side of Ivy Street. Option 1 includes bulbouts along Main Street and Pacific Street at 2nd Avenue to reduce the crossing distance for pedestrians. This option provides a net increase of 26 parking stalls over the existing parking configuration.
- Option 2 is identical to Option 1 except that it does not include the bulbouts at the intersections of 2nd Avenue and Main Street or 2nd Avenue and Pacific Street. Option 2 provides a net increase of 37 stalls over the existing parking configuration.

Another location of possible angle parking in the downtown area is Laurel Street. Laurel Street is 40 feet wide between 3rd Avenue and 5th Avenue, which should accommodate 60 degree parking on one side, with either two-way traffic and no parking on the other side, or one-way with parallel parking on the other side.

7. ***Resident Permit Parking*** – City staff have noted that residents of the downtown area make up another segment of parking demand. Currently residents rent space from off-street parking lots inside the district, park outside the district and walk in, or park inside the district outside the hours of regulation and move their vehicle as needed. It is recommended that residential permit parking be explored along Laurel between 3rd and 5th Streets. This parking would be managed by the City of Tillamook as an element of the existing permit program.
8. ***Possible Shared Parking*** – Several interior lots throughout the district are underutilized during the weekday. These lots belong either to restaurants, churches, or businesses with more than adequate parking for their employees and customers. The City should explore shared parking at some of these locations, to be made available to employees of the downtown area on a permit basis.
9. ***Vacant Lots*** – Maximum use of existing surface lots for employee and/or public parking is preferable to the construction of a new lot. However, if this were needed, a number of existing vacant lots within walking distance of downtown were identified.
   - ***Main and Pacific Parking Options*** – Main Street and Pacific Street are the subject of several recommendations made in the refinement plan, which address mobility, safety, and truck travel. Please refer to the main Refinement Plan for a description of these recommendations.

10. ***On-Street Parking Regulation*** – Simplification of the parking regulations is desired. A flat two-hour parking regulation appears to be sufficient. The reinstitution of on-street parking meters also was suggested for the parking district to replace the current parking regulations. It is understood that the City has the parking meters that were used in the area in the past still in their possession, so costs to reintroduce parking meters are expected to be low. However, substantial outreach to business owners and residents is highly recommended, and further study would be desired before a final recommendation is made.

    As a first step toward reintroducing meters, and to accommodate employees working downtown, it is recommended that one space per block face be set aside for long-term (max 8 hours) parking meter.

11. ***Signage*** – Signage is recommended for the north and south ends of the downtown area to safely and clearly direct out-of-town visitors to parking areas off the state highway.

Implementation

The table below suggests implementation timing (short-term, medium-term, long-term) and qualitative cost estimate for each of the parking recommendations identified above and on the corresponding map.

PARKING RECOMMENDATIONS: IMPLEMENTATION TIMEFRAME AND COST CONSIDERATIONS

No.	Concept Name	Concept Description	Timeframe	Cost	Cost Items
1	RV Parking	Set aside more on-street parking area reserved for RVs	Short-Term	Low	Signage Coordination with businesses
2	Potential RV Overnight Parking	Possibly allow RVs to park overnight in the (new) Safeway parking lot	Medium-Term	Low	Signage Coordination with Safeway Possible amendments to City zoning code
3	Employee Parking (surface)	Allow employees to park in City parking lots on east and west sides of Ivy, just south of 2nd Street	Short-Term	Low	Signage Administrative costs to run employee monthly passes
4	Future Employee or Public Parking	Possible acquisition of property immediately east of Stillwell Avenue to expand employee and visitor parking	Long-Term	High	Property acquisition Grading and paving Striping and signage Minimal additional administrative costs to expand employee monthly pass program
5	Future Parking	Options include	Long-Term	High	Possible property

PARKING RECOMMENDATIONS: IMPLEMENTATION TIMEFRAME AND COST CONSIDERATIONS

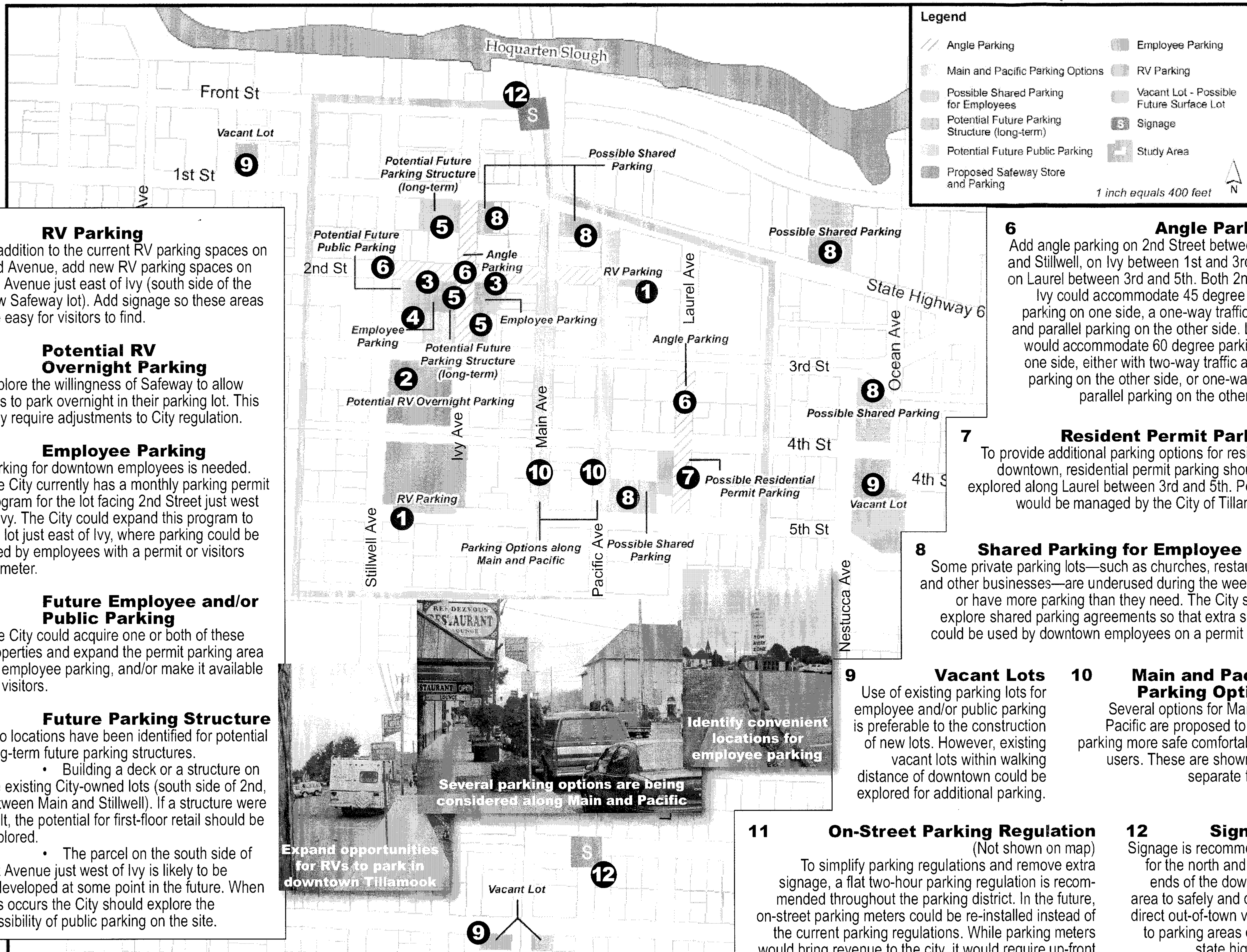
No.	Concept Name	Concept Description	Timeframe	Cost	Cost Items
	Structure	building a deck or larger parking structure on current city parking lots, and building a structured parking area on south side of 1st street west of Ivy Avenue, looking for opportunities to team with others as property is redeveloped.			acquisition, depending on current owner and likelihood of joint development venture Construction costs for a deck or parking structure (approx. $25,000/stall) If the City is a tenant, rent payments will be a cost. If the City owns the parcel and rents space to other businesses (e.g., first floor retail), rent payments from these other businesses are an expected revenue source
6	Angle Parking	Change parallel parking to angle parking along 2nd Avenue between Grove Street and Pacific Street, Ivy Street between 1st Avenue and 3rd Avenue, and Laurel Street between 3rd Avenue and 5th Avenue to include angle parking on the north side of 2nd Avenue and the east side of Ivy Street. Traffic would be one-way and parallel parking would be provided on the south side of 2nd Avenue and the west side of Ivy Street. Laurel Street would either remain two-directional or transitioned to one way with parallel parking on one side.	Short-Term	Medium	Signage and striping Public outreach on change in circulation patterns Design of one-way street network
7	Resident Permit Parking	Allow residents to park overnight and/or for longer periods during the day along Laurel Avenue between 3rd Street and 5th Street.	Short-Term	Low	Administrative costs to develop a residential permit parking program Signage on streets where residential permit parking would be relevant
8	Shared Parking for Employee Use	Explore opportunities to share parking with businesses that either use their parking areas	Short-Term	Low	Possible lease agreements with private businesses

PARKING RECOMMENDATIONS: IMPLEMENTATION TIMEFRAME AND COST CONSIDERATIONS

No.	Concept Name	Concept Description	Timeframe	Cost	Cost Items
		more in the evening or on weekends, or that have surplus parking areas.			Administrative costs to set up and operate system
9	New lots for visitor and/or employee use	Construction of one or more surface parking areas on parcels currently vacant, for use by visitors and/or employees	Long-Term	High	Property Acquisition Design and construction of new lot Signage Administrative costs to operate lot
10	Main and Pacific	*See Refinement Plan*			
11	On Street Parking Regulation	Option 1 simplifies parking regulations to mainly a 2-hour time limit throughout town.	Short-Term	Low	Change parking code New signage
		Option 2 reintroduces parking meters	Long-Term	Medium	Outreach to community Installation of meters Operation of meters
12	Signage	Adds signage to guide visitors to parking areas off the state highway	Short-Term	Low	Procurement and installation of signs

Short-Term = 0-5 years
Medium-Term = 5-10 years
Long-Term = 10-20 years

DOWNTOWN PARKING OPTIONS



1 RV Parking
In addition to the current RV parking spaces on 2nd Avenue, add new RV parking spaces on 5th Avenue just east of Ivy (south side of the new Safeway lot). Add signage so these areas are easy for visitors to find.

2 Potential RV Overnight Parking
Explore the willingness of Safeway to allow RVs to park overnight in their parking lot. This may require adjustments to City regulation.

3 Employee Parking
Parking for downtown employees is needed. The City currently has a monthly parking permit program for the lot facing 2nd Street just west of Ivy. The City could expand this program to the lot just east of Ivy, where parking could be used by employees with a permit or visitors by meter.

4 Future Employee and/or Public Parking
The City could acquire one or both of these properties and expand the permit parking area for employee parking, and/or make it available for visitors.

5 Future Parking Structure
Two locations have been identified for potential long-term future parking structures.

- Building a deck or a structure on the existing City-owned lots (south side of 2nd, between Main and Stillwell). If a structure were built, the potential for first-floor retail should be explored.
- The parcel on the south side of 1st Avenue just west of Ivy is likely to be redeveloped at some point in the future. When this occurs the City should explore the possibility of public parking on the site.

6 Angle Parking
Add angle parking on 2nd Street between Ivy and Stillwell, on Ivy between 1st and 3rd, and on Laurel between 3rd and 5th. Both 2nd and Ivy could accommodate 45 degree angle parking on one side, a one-way traffic lane, and parallel parking on the other side. Laurel would accommodate 60 degree parking on one side, either with two-way traffic and no parking on the other side, or one-way with parallel parking on the other side.

7 Resident Permit Parking
To provide additional parking options for residents downtown, residential permit parking should be explored along Laurel between 3rd and 5th. Permits would be managed by the City of Tillamook.

8 Shared Parking for Employee Use
Some private parking lots—such as churches, restaurants and other businesses—are underused during the weekdays or have more parking than they need. The City should explore shared parking agreements so that extra spaces could be used by downtown employees on a permit basis.

9 Vacant Lots
Use of existing parking lots for employee and/or public parking is preferable to the construction of new lots. However, existing vacant lots within walking distance of downtown could be explored for additional parking.

10 Main and Pacific Parking Options
Several options for Main and Pacific are proposed to make parking more safe comfortable for users. These are shown on a separate figure.

11 On-Street Parking Regulation
(Not shown on map)
To simplify parking regulations and remove extra signage, a flat two-hour parking regulation is recommended throughout the parking district. In the future, on-street parking meters could be re-installed instead of the current parking regulations. While parking meters would bring revenue to the city, it would require up-front expense and the support of the business community.

12 Signage
Signage is recommended for the north and south ends of the downtown area to safely and clearly direct out-of-town visitors to parking areas off the state highway.

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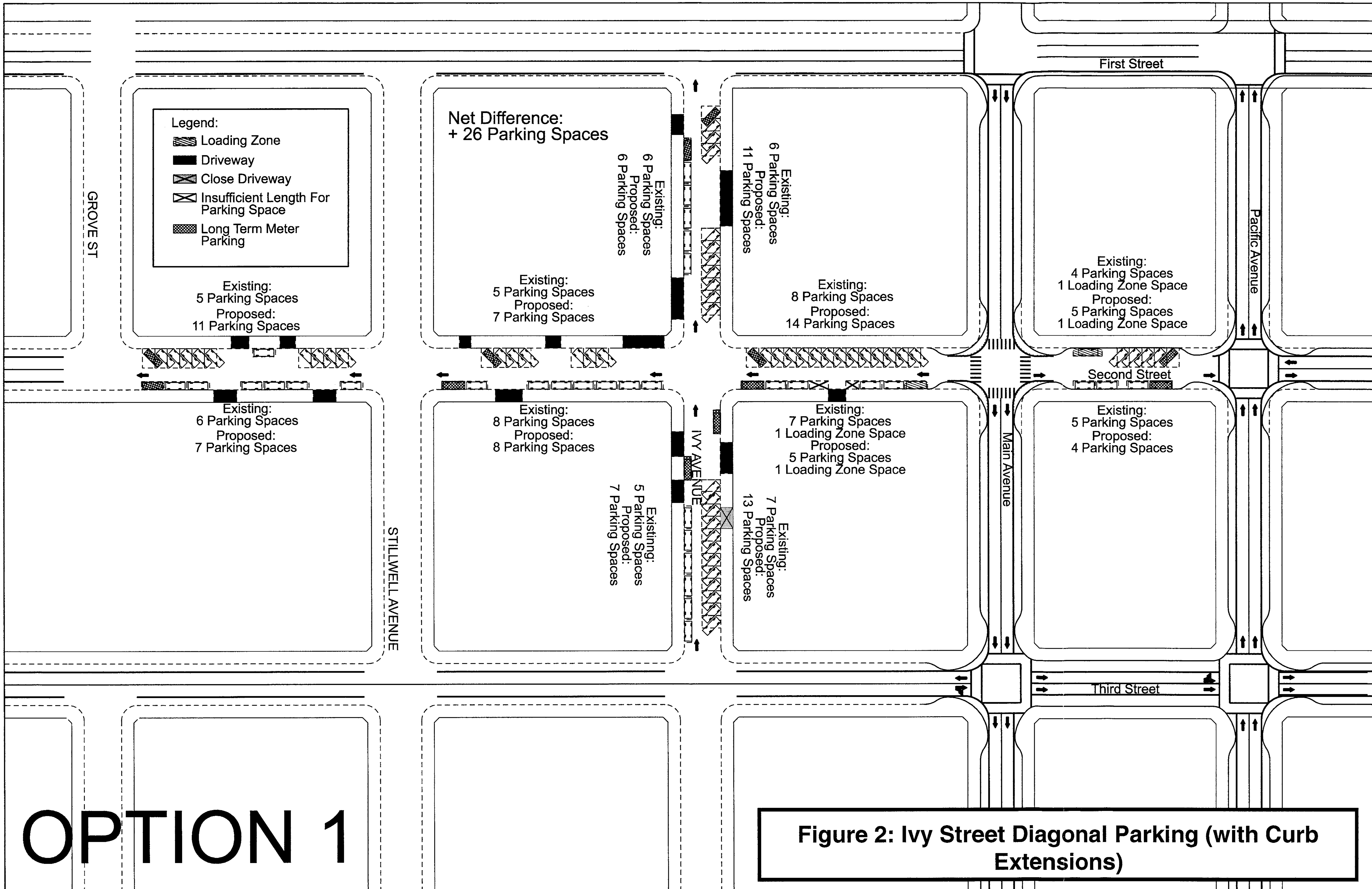

OPTION 1

Figure 2: Ivy Street Diagonal Parking (with Curb Extensions)

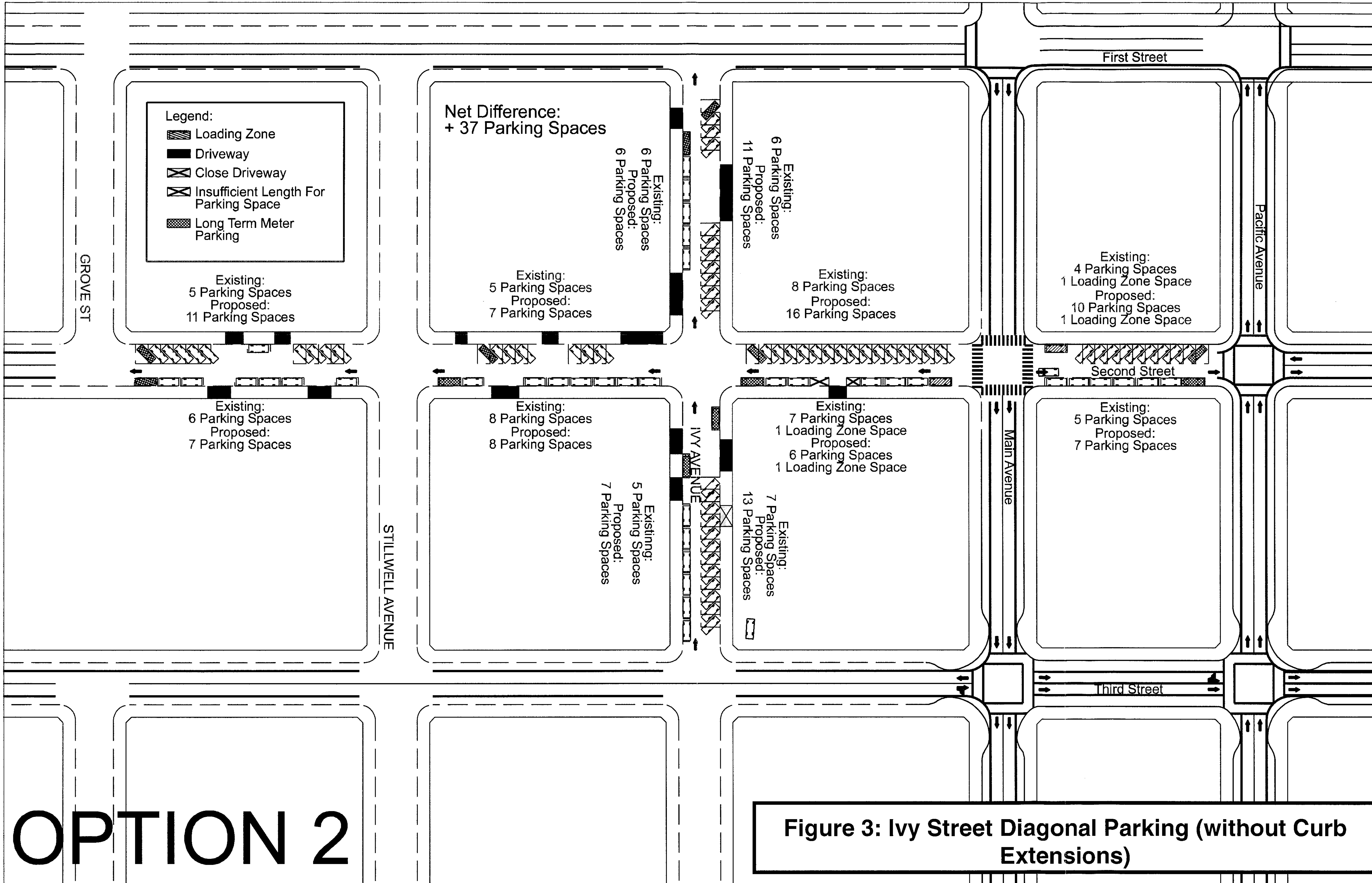

Figure 3: Ivy Street Diagonal Parking (without Curb Extensions)

MEMO #11

ODOT Pedestrian Safety Study

Tillamook Transportation Refinement Plan: ODOT Pedestrian Safety Study (Memo #11)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Tim Burkhardt, CH2M HILL

DATE: September 12, 2005

This memo transmits the results of ODOT's pedestrian safety study in downtown Tillamook, with data collected by video camera on May 15 and 16, 2005 (Report 1) and August 2 and 3, 2005 (Report 2). The two reports were prepared by Cindy L. Westbrook, ODOT Region 2 Transportation Safety Coordinator. The reports were reviewed in the preparation of recommendations for downtown Tillamook.

Tillamook City Pedestrian Safety Report
(Report #1)

Below are my observations by camera location. For my ease in taking notes the tapes were arbitrarily numbered and some specific times were noted if you would like to review specific incidents.

Tape 1 - Camera at Highway 101 looking south at 1st Street and Slough Bridge. There were very few pedestrians at this location. There appeared to be a sidewalk on the bridge but no sidewalk before or after the bridge on Highway 101 making the location not very inviting for pedestrians. In the morning hours I only counted 17 pedestrians and 6 bicyclists. We did have a couple of people dart across Highway 101 but there were no near misses. If we were to put sidewalk in at this location pedestrian traffic would no doubt increase. It quite honestly did not appear to me to be a very safe place to walk and the low number of pedestrian reflects that.

Tape 2 - Camera at Highway 101 looking North at 3rd Street near the Tillamook County Pioneer Museum. The oncoming traffic is south bound on Highway 101 and 3rd Street is also Highway 6 east bound. There was a great deal more pedestrians at this location. I counted 63 pedestrians during day light hours. There were several mid-block location crosses but these appeared to pose no problems. Driver behavior was good except for some cars stopping in the crosswalk on 3rd which may be a visibility issue. During the evening and nighttime hours Highway 101 appeared to be well lit however additional lighting on 3rd Street would improve safety at this location. There were no pedestrians from 9:00 PM until 7:00 AM. There were more bicycles at this location as I counted 17 during the daylight hours.

Tape 3 - Camera looking at Highway 101 North and 3rd or Highway 6 going East. The crosswalks were well delineated however, there were few pedestrians present. There was a fair amount of truck traffic and trucks turning onto Highway 6 take two lanes to make the turn. Trucks and motor homes on Highway 101 and Highway 6 appear to be over the center line most of the time. The lanes on both highways appear to be fairly narrow. This intersection might benefit from some additional lighting as it was too dark after 7:00 PM to see pedestrians on the tape. There was very little bicycle traffic.

Tape 4 – Camera looking south at 9th and 10th Street with oncoming traffic north bound on Highway 101. These crosswalks are in need of striping, they were very poorly delineated. While there was a fair amount of traffic on Highway 101 there was little traffic on 9th. There were pedestrians but certainly not a lot. There were several mid-block crosses at the motel and a lot of activity in the phone booth near the motel. There appeared to be some visibility issues with parked cars on Highway 101. I did note some lane changes on 101 in the intersection with 9th Street.

Tape 5 – Camera looking at 101 North and 2nd Street. These crosswalks were all in need of better delineation. I also thought that 2nd Street would benefit from better illumination. Driver behavior was pretty good although not everyone does stop for pedestrian on 2nd even if they are off the curb. Vehicular traffic picks up considerably at 5:00 PM however there is not an increase in pedestrian traffic at that time. There appears to be modified bulb outs on 2nd but they were hard to see. It was difficult to tell if they benefited safety. There was a little bit of bicycle traffic but no problems noted.

Tape 6 - Camera looking North on Highway 101 at 1st Street. This was a skewed and interesting intersection with only 2 crosswalks. There was very little pedestrian traffic and no noted problems. Delineation at this location was good and the lighting on Highway 101 was good after dark. 1st Street might benefit from added illumination however there was very little pedestrian traffic after dark. My personal impression was that this is a rather complicated intersection and people may avoid it for that reason.

Tape 7 - Camera looking south on Highway 101 at the 9th and 10th street intersections. The delineation was not good at these crosswalks. There were several mid-block crosses. This camera caught a school bus accident at about 12:23. The bus appears to clip a parked car that may be in a no parking zone. The accident was very minor and the police did come. There was not a lot of pedestrian traffic at this location and the street emptied out at 5:00 PM and stayed very quiet through out the night. After 9:00 PM there was very little visibility and no pedestrians.

Tape 8 - Camera looking North on Highway 101 and 2nd Street. This intersection has good delineation but narrow lanes. There is not an abundance of pedestrians at this location either. There are a few mid-block crosses but no close calls. Vehicles parked on the street do cut down on visibility and additional illumination may be beneficial.

Conclusions:
In my opinion several of the intersections would benefit from additional lighting and several are in need of delineation. Driver behavior was for the most part good, however it is obvious that not everyone is aware of the new pedestrian law and the requirement to stay stopped while the pedestrian clears the adjacent lane. I saw no close calls or near misses involving pedestrians. There is a fair amount of mid-block crossing going on which might be helped by better delineation at crosswalks which could encourage pedestrians to use them. It was obvious in some locations that people would park on the street, wait for clearing and cross at their car rather than going to the corner. A certain amount of this is to be expected and even with pedestrian education is hard to stop. Again, please note that even with the mid block crosses there were no near misses noted.

It is also interesting to note that I saw very few bicycles at any of the intersections. Of the bicycles I did see very few get off there bikes and walk them across the street as recommended but seem to wait for the signal and cross on their bike. I also noted that there were very few children and almost no school age children walking at these intersections or crossing any of the streets. I did see lots of school buses and one unfortunate minor school bus accident involving a parked car. I further observed that all streets appear very narrow without bike lanes. The addition of on-street parking really cuts down on lane width and visibility for everyone.

There is not an abundance of pedestrian traffic at any of these locations however school is still in session and the tourist season has not begun. It would be interesting to review a couple of the busier locations such as Highway 101 and 3rd Street in late July or early August. The best recommendation I can make is for additional delineation at a few specific locations and additional illumination as noted above.

Respectfully Submitted by:

Cindy L. Westbrook
Region 2 Transportation Safety Coordinator

Supplemental Report on Pedestrian Safety
In Tillamook- Tourist Season
(Report #2)

There were 4 additional videos to review of pedestrian activity in Tillamook during the month of August 2005. While I did not watch every hour of every tape I believe I watched enough to get a flavor for what issues there might be.

My first observation is as we had expected, there are many more pedestrians during the peak tourist season than we saw in the spring when school was still in session. Generally speaking I thought pedestrian behavior was good with most people using the crosswalks and I believe waiting for the WALK signal.

In general driver behavior was also good stopping in advance of crosswalks. The biggest problem I saw at any intersection was traffic stacking that caused cars to stop in crosswalks waiting for an intersection to clear. This is clearly a highway capacity issue that was only observed at peak commute times.

The intersection of Highway 101 and 2nd Street near Pioneer Museum is clearly in need of delineation and could benefit from additional illumination. However I have to say that there were not large volumes of pedestrians at this location.

Additional illumination would also be helpful at 2nd and Main. There was some traffic stacking at this location which occasionally blocked pedestrian access across Main. In spite of this problem driver behavior was good and pedestrians had little time to wait for motorists.

The other suggestion I would make for safety improvements is the addition of advance stop bars at all crosswalk locations. This would improve visibility for all pedestrians.

In conclusion I have to say that I did not observe any accidents or near misses. I believe that in general pedestrians and motorists in this area are careful and courteous.

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Cindy L. Westbrook
Region 2 Transportation Safety Coordinator

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Respectfully Submitted,
Cindy Westbrook, Region 2 Transportation Safety Coordinator

MEMO #12

Alternatives Development and Evaluation

Tillamook Transportation Refinement Plan: Alternatives Development and Evaluation (Memo #12)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Tim Burkhardt, CH2M HILL

COPIES: Project Management Team

DATE: October 11, 2005

Introduction

The options and alternatives developed for the Tillamook Refinement Plan were based on technical data, past plans, input from the Project Management Team, the consultant team, and the general public.

Evaluation Methods

The alternatives were evaluated qualitatively against the goals and evaluation criteria developed early in the process. As shown in the attached spreadsheets, the options or alternatives were rated on a five-point scale (from +2 to -2) for each criterion. A total of 100 points were distributed among the five goals (based on the technical team's assessment of their relative importance) to provide a weighting factor to the points for each criteria. The weighted points were totaled and then, based on the totals, grouped into three categories: "recommended" (green), "possibly recommended" (yellow), and "not recommended" (red). The determination of where one category ended and the other began was subjective but based on the relative distribution of the total scores for a given alternative group.

Alternatives Considered and Evaluation Results

Alternate Truck Routes

A large number of concepts were considered to improve existing roads or develop new roads for the purpose of reducing the volume of through truck traffic (and other through traffic) in downtown Tillamook. A number of these concepts came from ideas suggested by project stakeholders at public meetings and workshops. The concepts, which are described and illustrated in Memo #8, are divided into four groups:

- North of OR 6 ("C" options)
- South of OR 6 ("D" options)
- Downtown Tillamook ("A" options)
- Tillamook Lumber Mill ("B" options)

This section discusses the North of OR 6 and South of OR 6 solutions. Solutions in downtown Tillamook are addressed by the Downtown Traffic and Main and Pacific Avenue Street Design alternatives. Solutions related to the Tillamook Lumber Mill are discussed in the corresponding section.

Alternatives Considered

Alternate truck routes north and south of OR 6 were developed to improve existing opportunities or develop new opportunities for through traffic to bypass downtown Tillamook. The alternatives range from intersection improvements to entirely new roads.

Evaluation Results

The results show that four of the "C" options and two of the "D" options were *recommended* and three other options were *possibly recommended.* The remaining options were *not recommended* due to low scores against the evaluation criteria. The recommended options are focused improvements to existing facilities that are already under design or construction. The possibly recommended options are relatively easy to implement but have potentially limited value.

Tillamook Lumber Mill Options

The data collection portion of the Refinement Plan, which included a license plate survey of truck travel patterns (see Memo #6), identified opportunities to make changes to the local street system and the to Tillamook Lumber Mill site to reduce the volume of trucks entering and exiting the Mill via downtown Tillamook.

Alternatives Considered

The alternatives considered for the Tillamook Lumber Mill are described and illustrated in Memo #13. The alternatives seek to address a key conclusion of the data collection effort: that a significant number of trips that go through downtown Tillamook to get to and from the Mill could be re-routed outside of downtown if the internal circulation at the Mill were reconfigured. Specifically, if the two access points at the Mill (via 3rd Street and via 10th Street) could be used for both entering and exiting by both log trucks and product (lumber, chips) trucks. The result would be that all trucks heading to or from the north or east would use the 3rd Street access; all trips heading to or from the south would use the 10th Street access.

Evaluation Results

Options B1 and B2 were *recommended*; options B5, B6, and B7 were *possibly recommended*; and the remainder were *not recommended*. Option B1, to implement internal layout and circulation changes on the Mill site so as to create two full-service access points, scored the highest. Option B2, to use Del Monte Avenue as the primary access from OR 6, confirms that this existing route is the best of those options available. The possibly recommended options are other potential routes to access the Mill from OR 6. While these options had relatively few adverse impacts, it is not clear whether they would be justifiable by their benefits compared to the existing route (Del Monte).

Main and Pacific Design Alternatives

Alternatives Considered

The following alternatives that would change the design of Main and Pacific Avenues in the US 101 couplet were considered:

- No-Build (Existing Conditions): Two 10-foot travel lanes, two 8-foot parking lanes, 12-foot sidewalks on both sides.
- Option A (Remove Parking 1): Remove parking on right-hand side, widen travel lanes to 12 feet/11 feet, add 5-foot bike lane, maintain 8-foot parking on left hand side
- Option B (Narrow Sidewalks): Narrow sidewalks by 2 feet on each side, widen travel lanes to 12 feet each, maintain 8-foot parking on both sides
- Option C (Remove Parking 2): Remove parking on right-hand side, widen travel lanes to 12 feet each, add landscape strip in place of remaining space in right-hand parking lane, maintain 8-foot parking on left hand side
- Option D (Streetscape - can combine with any other option): Add corner and/or offset curb extensions, reconstruct/repair sidewalks and curb ramps, add new landscaping (combination of street trees, sidewalk planter boxes, etc.), add illumination at key intersections, add advance stop bars and signage before pedestrian crossings, paint/repaint crosswalks using continental style, reduce sign clutter by consolidating existing public signs (highway signs, local street and information signs). Phase I would extend from 1st to 5th Streets (to capture new Safeway location). Phase II would extend from 6th to 12th Streets.
- Option E (Storefront - can combine with any other option): Work with property owners to improve storefronts and business signage (private signs) to improve aesthetics, create coordinated image, and reduce tunnel effect. Improve visual appeal to drivers and encourage them to slow down (improve safety) and stop in Tillamook (support businesses).

Two other alternatives were suggested by project stakeholders but were not pursued because they did not adequately address the purpose of the project:

- Remove parking on one side, widen travel lanes, do not add bike lane or landscaping: This alternative was determined to be fatally flawed because it would place vehicle traffic directly adjacent to the sidewalk with no buffer for the length of the couplet. While this would address truck/traffic movement, the lack of buffer would have significant adverse impacts on the downtown pedestrian and business environment. The concept would be expected to increase traffic speeds downtown due to the wider cross-section with little opportunity for intervening design features such as curb extensions or on-street parking.
- Remove and redevelop buildings on one side of Main Street, replace with 5-lane highway section: This alternative was determined to be fatally flawed because it would remove a substantial portion of the existing downtown Main Street. While the change in highway cross-section would result in a highway built to current standards that would

address the identified transportation issues, it would remove much of the existing downtown, the primary resource that the Refinement Plan intends to preserve and enhance.

Evaluation Results

As shown in the spreadsheet, Option D (Streetscape) and Option E (Storefront) scored the highest and were the only *recommended* options. Option B (Narrow Sidewalks) was scored as *possibly recommended*. Option A (Remove Parking 1) and Option C (Remove Parking 2) were *not recommended*. Because of the constrained space in this location, the addition of any new feature generally means the removal of some other feature. As a result, the alternatives with the least adverse impact on existing functions scored the best. The Remove Parking options tended to score lower due to anticipated increase in vehicle speeds that would result and the associated adverse impacts on the pedestrian environment. The "possibly recommended" results for Option B (Narrow Sidewalks) suggest that this option may be worth its costs if the recommended options (which are less expensive) do not adequately address the problems.

Downtown Traffic Alternatives

While the Refinement Plan was not initially focused on improvements to the intersection of US 101 and OR 6, during the process it became clear that traffic congestion and other issues at this intersection (safety, pedestrian circulation, vehicle speed, and the intersection's function as a gateway entrance to Tillamook) made it integral to the Plan.

Alternatives Considered

The alternatives considered include the following changes, in various combinations:

TABLE 1.
Alternatives Considered for US 101 and OR 6 Intersection

Traditional Alternatives	Roundabout Alternatives *(add to the features of traditional alternatives)*
Add northbound through lane at intersection	Two separate roundabouts at Main and Pacific
Add additional lane over Hoquarten Slough	One combined roundabout at Main and Pacific
Convert 1st Street and 3rd Street to two-way streets to improve circulation and intersection operations	Roundabout at OR 6 and Miller

Memo #7A describes and illustrates the traffic alternatives considered and the results of the operational analysis conducted for each.

Evaluation Results

Most of the alternatives were recommended for further study as part of the upcoming STIP project at US 101 and OR 6. Only two (traditional alternatives 2 and 3) were not recommended for further study, primarily due to a lack of positive impact on traffic operations at the intersection. Given that the DSTIP project will require a detailed alternatives analysis, no attempt was made at this time to further narrow the identified alternatives.

Downtown Parking Recommendations

Recommendations to address downtown parking needs are based on the results of previous technical work (Memo # 5: Parking Utilization Study and Existing Conditions) and input from stakeholders.

The recommendations are described in detail and illustrated in Memo #10: Parking Recommendations. Unlike the other solutions developed in the Refinement Plan, the parking recommendations were not evaluated against each other but instead are intended to be a menu of choices that can be implemented by the City of Tillamook based on priorities, funding, etc. Memo #10 includes recommendations for when the concepts should be implemented (i.e., short-term, medium-term, long-term) and describes cost and other considerations.

Tillamook Transportation Refinement Plan

Alternatives Evaluation: Alternate Truck Routes

			Alternate Truck Routes																			
			North of Oregon 6											South of Oregon 6								
Criteria #	Evaluation Criteria	Assigned Weight	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	D1	D2	D3	D4	D5	D6	D7	D8	D9
1	*1. Improve US 101 Downtown Safety & Comfort*	25																				
	Pedestrian Safety		0	1	1	1	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0
	Vehicle Safety		0	1	1	1	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0
	Bicycle Safety		0	1	1	1	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0
	Pedestrian Crossings within the Town Center Area		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Vehicle Speeds		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Traffic Congestion		0	0	1	2	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0
	Aesthetics and Streetscape Amenities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SUB-TOTAL		**0**	**75**	**100**	**125**	**0**	**0**	**0**	**75**	**0**	**75**	**0**	**0**	**100**	**125**	**0**	**0**	**0**	**0**	**0**	**0**
2	*2. Address Downtown Parking Deficiencies*	15																				
	Parking Safety and Comfort on US 101		N/A	0	1	2	0	0	0	1	0	1	0	0	1	2	0	0	0	0	0	0
	Parking Supply on US 101		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Public Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Employee Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	RV Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Parking Regulations		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Directional Signage to Public Parking		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SUB-TOTAL		**0**	**0**	**15**	**30**	**0**	**0**	**0**	**15**	**0**	**15**	**0**	**0**	**15**	**30**	**0**	**0**	**0**	**0**	**0**	**0**
3	*3. Address Adverse Impacts of Trucks on US 101 Downtown*	20																				
	Reduces Truck Trips through Downtown		1	1	1	1	1	1	1	1	0	1	1	1	1	2	1	1	1	1	1	1
	Slows Truck Speeds		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Provides a Buffer between Trucks and On-Street Parking		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Supports Downtown Business and Economy		0	0	-1	-1	0	0	0	0	0	0	0	0	-1	-2	0	0	0	0	0	0
	SUB-TOTAL		**20**	**20**	**0**	**0**	**20**	**20**	**20**	**20**	**0**	**20**	**20**	**20**	**0**	**0**	**20**	**20**	**20**	**20**	**20**	**20**
4	*4. Develop Alternate Truck Routes*	25																				
	Minimizes impact on residential land uses		-1	-2	-1	1	-1	-1	-2	0	0	0	-1	-1	1	1	0	-1	-1	0	0	-1
	Truck trip efficiency (likelihood route will be used)		1	1	1	2	1	1	1	N/A	0	0	1	0	1	2	0	-1	0	0	0	0
	Provides linkage to industrially-zoned land, including under-developed industrial parcels		0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	2	0	0	0
	Supports local and regional business and economy		1	1	0	0	0	0	0	-1	0	0	0	1	0	0	0	0	0	0	1	0
	Impacts on natural resources and resource lands		0	0	-1	-2	-1	0	-1	0	0	-1	0	0	-1	-2	0	0	-1	0	0	0
	Impact on flood hazard/rating		0	0	0	-2	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Amount of new road outside the Urban Growth Boundary		0	0	-1	-2	0	0	-1	0	0	0	0	0	-1	-2	-1	0	0	0	0	0
	Efficient use of existing highway capacity		0	-1	-1	-2	-1	-1	-1	N/A	1	-1	-1	1	-1	-2	0	-1	-1	0	0	-1
	Compatibility with future interchange in the vicinity of Oregon Highway 6 and Wilson River Loop		1	2	0	0	1	1	1	N/A	0	0	2	0	0	0	0	0	0	0	0	0
	SUB-TOTAL		**50**	**25**	**-75**	**-125**	**-25**	**0**	**-100**	**-25**	**25**	**-50**	**25**	**25**	**-25**	**-75**	**-25**	**-75**	**-25**	**0**	**25**	**-50**
5	*5. Address Other Identified Issues*	15																				
	Cost-Effectiveness of Transportation Investments		1	-1	-2	-2	-1	0	-1	1	1	-1	1	1	-2	-2	1	-1	-1	-1	1	1
	Consistency with Applicable Standards (City, County, ODOT)		1	1	-1	-1	1	1	-1	0	1	-2	-2	1	-1	-1	1	0	0	0	0	-1
	Consensus among Affected Jurisdictions on Implementation of Alternative																					
	Implementable within a 20-Year Time Frame		1	1	-2	-2	1	1	-1	1	2	-1	-2	1	-2	-2	1	-1	-1	1	1	-1
	Provides a Year-Round Solution		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	SUB-TOTAL	100	**60**	**30**	**-60**	**-60**	**30**	**45**	**-30**	**45**	**75**	**-45**	**-30**	**60**	**-60**	**-60**	**60**	**-15**	**-15**	**15**	**45**	**0**
	TOTAL POINTS		**130**	**150**	**-20**	**-30**	**25**	**65**	**-110**	**130**	**100**	**15**	**15**	**105**	**30**	**20**	**55**	**-70**	**-20**	**35**	**90**	**-30**

Rating System

2	Very Positive
1	Positive
0	Neutral/No Effect
-1	Negative
-2	Very Negative

Recommended
Possibly recommended
Not recommended

Tillamook Transportation Refinement Plan

Alternatives Evaluation: Tillamook Lumber Mill Options

Tillamook Lumber Mill Options

Criteria #	Evaluation Criteria	Assigned Weight	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
1	***1. Improve US 101 Downtown Safety & Comfort***	25										
	Pedestrian Safety		1	0	0	0	0	0	0	0	0	0
	Vehicle Safety		1	0	0	0	0	0	0	0	0	0
	Bicycle Safety		1	0	0	0	0	0	0	0	0	0
	Pedestrian Crossings within the Town Center Area		0	0	0	0	0	0	0	0	0	0
	Vehicle Speeds		0	0	0	0	0	0	0	0	0	0
	Traffic Congestion		0	0	0	0	0	0	0	0	0	0
	Aesthetics and Streetscape Amenities		0	0	0	0	0	0	0	0	0	0
	SUB-TOTAL		75	0	0	0	0	0	0	0	0	0
2	***2. Address Downtown Parking Deficiencies***	15										
	Parking Safety and Comfort on US 101		2	1	1	1	1	1	1	1	0	0
	Parking Supply on US 101		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Public Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Employee Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	RV Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Parking Regulations		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Directional Signage to Public Parking		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SUB-TOTAL		30	15	15	15	15	15	15	15	0	0
3	***3. Address Adverse Impacts of Trucks on US 101 Downtown***	20										
	Reduces Truck Trips through Downtown		2	1	1	1	1	1	1	1	0	0
	Slows Truck Speeds		0	0	0	0	0	0	0	0	0	0
	Provides a Buffer between Trucks and On-Street Parking		0	0	0	0	0	0	0	0	0	0
	Supports Downtown Business and Economy		2	1	1	1	1	1	1	1	0	0
	SUB-TOTAL		80	40	40	40	40	40	40	40	0	0
4	***4. Develop Alternate Truck Routes***	25										
	Minimizes impact on residential land uses		-1	-1	1	1	-1	-2	-2	-2	0	-2
	Truck trip efficiency (likelihood route will be used)		1	1	-2	-2	1	0	0	0	1	1
	Provides linkage to industrially-zoned land, including under-developed industrial parcels		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Supports local and regional business and economy		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impacts on natural resources and resource lands		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-1
	Impact on flood hazard/rating		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Amount of new road outside the Urban Growth Boundary		N/A	N/A	N/A	N/A	-1	N/A	N/A	N/A	N/A	N/A
	Efficient use of existing highway capacity		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Compatibility with future interchange in the vicinity of Oregon Highway 6 and Wilson River Loop		0	0	0	0	0	0	2	-2	N/A	N/A
	SUB-TOTAL		0	0	-25	-25	-25	-50	0	-100	25	-50
5	***5. Address Other Identified Issues***	15										
	Cost-Effectiveness of Transportation Investments		2	1	-1	-1	-2	0	0	0	-2	0
	Consistency with Applicable Standards (City, County, ODOT)		1	1	-1	-1	-1	-1	-1	-1	0	0
	Consensus among Affected Jurisdictions on Implementation of Alternative											
	Implementable within a 20-Year Time Frame		1	1	-2	-2	1	1	1	1	1	1
	Provides a Year-Round Solution		1	1	1	1	1	1	1	1	1	1
	SUB-TOTAL	100	75	60	-45	-45	-15	15	15	15	0	30
	TOTAL POINTS		260	115	-15	-15	15	20	70	-30	25	-20

Rating System

2	Very Positive
1	Positive
0	Neutral/No Effect
-1	Negative
-2	Very Negative

Recommended

Possibly recommended

Not recommended

Tillamook Transportation Refinement Plan

Alternatives Evaluation: Main and Pacific Street Design Alternatives

Main and Pacific Street Design Alternatives

Criteria #	Evaluation Criteria	Assigned Weight	No-Build	Option A (Remove Parking 1)	Option B (Narrow Sidewalks)	Option C (Remove Parking 2)		Option D (Streetscape)	Option E (Storefront)
1	***1.Improve US 101 Downtown Safety & Comfort***	25							
	Pedestrian Safety		1	0	1	0		1	0
	Vehicle Safety		0	1	1	1		0	0
	Bicycle Safety		0	2	1	0		1	0
	Pedestrian Crossings within the Town Center Area		0		0	-1		1	0
	Vehicle Speeds			2	0	-1			0
	Traffic Congestion		N/A	N/A	N/A	N/A		N/A	N/A
	Aesthetics and Streetscape Amenities		0	0	0	1		2	1
	SUB-TOTAL		--	0	75	0		150	25
2	***2. Address Downtown Parking Deficiencies***	15							
	Parking Safety and Comfort on US 101		-1	1	1	1		1	0
	Parking Supply on US 101		0	2	0	2			0
	Public Parking Supply Downtown		N/A	N/A	N/A	N/A		N/A	N/A
	Employee Parking Supply Downtown		N/A	N/A	N/A	N/A		N/A	N/A
	RV Parking Supply Downtown		N/A	N/A	N/A	N/A		N/A	N/A
	Parking Regulations		N/A	N/A	N/A	N/A		N/A	N/A
	Directional Signage to Public Parking		N/A	N/A	N/A	N/A		N/A	N/A
	SUB-TOTAL		-15	-15	15	-15		0	0
3	***3. Address Adverse Impacts of Trucks on US 101 Downtown***	20							
	Reduces Truck Trips through Downtown		0		0	0		0	0
	Slows Truck Speeds		2	2	0	2			1
	Improves Truck Turning		0	2	1	1			0
	Provides a Buffer between Trucks and On-Street Parking			1		1			
	Supports Downtown Business and Economy		0	-2	-1	-2			1
	SUB-TOTAL		40	20	20	-40		40	40
4	***4. Develop Alternate Truck Routes***	25							
	Minimizes impact on residential land uses		N/A	N/A	N/A	N/A		N/A	N/A
	Truck trip efficiency (likelihood route will be used)		N/A	N/A	N/A	N/A		N/A	N/A
	Provides linkage to industrially-zoned land, including under-developed industrial parcels		N/A	N/A	N/A	N/A		N/A	N/A
	Supports local and regional business and economy		N/A	N/A	N/A	N/A		N/A	N/A
	Impacts on natural resources and resource lands		N/A	N/A	N/A	N/A		N/A	N/A
	Impact on flood hazard/rating		N/A	N/A	N/A	N/A		N/A	N/A
	Amount of new road outside the Urban Growth Boundary		N/A	N/A	N/A	N/A		N/A	N/A
	Efficient use of existing highway capacity		N/A	N/A	N/A	N/A		N/A	N/A
	Compatibility with future interchange in the vicinity of Oregon Highway 6 and Wilson River Loop		N/A	N/A	N/A	N/A		N/A	N/A
	SUB-TOTAL								
5	***5. Address Other Identified Issues***	15							
	Cost-Effectiveness of Transportation Investments		2	2	-2	1		0	0
	Consistency with Applicable Standards (City, County, ODOT)		0	1	1	1		1	1
	Consensus among Affected Jurisdictions on Implementation of Alternative								
	Implementable within a 20-Year Time Frame		1	1	1	1		1	1
	Provides a Year-Round Solution		0	0	0	0		0	0
	SUB-TOTAL	100	45	60	0	45		30	30
	TOTAL POINTS		**120**	**25**	**110**	**-10**		**220**	**95**

Rating System

2	Very Positive
1	Positive
0	Neutral/No Effect
-1	Negative
-2	Very Negative

Recommended
Possibly recommended
Not recommended

Tillamook Transportation Refinement Plan

Alternatives Evaluation: Downtown Traffic Alternatives			Downtown Traffic Alternatives													
			Traditional Alternatives					Roundabout Alternatives								
								Separate Roundabouts at Main & Pacific				Combined Roundabout at Main & Pacific				Roundabout at Miller Ave.
Criteria #	Evaluation Criteria	Assigned Weight	1	2	3	4	5	S-R1	S-R2	S-R3	S-R4	C-R1	C-R2	C-R3	C-R4	M-R1
1	*1. Improve US 101 Downtown Safety & Comfort*	25														
	Pedestrian Safety		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Vehicle Safety		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Bicycle Safety		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pedestrian Crossings within the Town Center Area		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Vehicle Speeds		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Traffic Congestion		0	-1	-1	0	1	1	2	1	1	N/A	2	0	2	1
	Aesthetics and Streetscape Amenities		0	0	0	0	0	1	1	1	1	1	1	1	1	1
	SUB-TOTAL		0	-25	-25	0	25	50	75	50	50	25	75	25	75	50
2	*2. Address Downtown Parking Deficiencies*	15														
	Parking Safety and Comfort on US 101		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Parking Supply on US 101		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Public Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Employee Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	RV Parking Supply Downtown		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Parking Regulations		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Directional Signage to Public Parking		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SUB-TOTAL															
3	*3. Address Adverse Impacts of Trucks on US 101 Downtown*	20														
	Reduces Truck Trips through Downtown		1	0	0	0	1	1	1	0	1	1	1	0	1	1
	Slows Truck Speeds		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Provides a Buffer between Trucks and On-Street Parking		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Supports Downtown Business and Economy		-1	-1	0	0	-1	-2	-1	-1	-2	-1	-2	-1	-2	0
	SUB-TOTAL		0	-20	0	0	0	-20	0	-20	-20	0	-20	-20	-20	20
4	*4. Develop Alternate Truck Routes*	25														
	Minimizes impact on residential land uses		1	1	1	1	1	1	1	1	1	1	1	1	1	-1
	Truck trip efficiency (likelihood route will be used)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Provides linkage to industrially-zoned land, including under-developed industrial parcels		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Supports local and regional business and economy		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Impacts on natural resources and resource lands		0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Impact on flood hazard/rating		0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Amount of new road outside the Urban Growth Boundary		0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Efficient use of existing highway capacity		1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Compatibility with future interchange in the vicinity of Oregon Highway 6 and Wilson River Loop		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SUB-TOTAL		50	50	50	50	50	50	50	50	50	50	50	50	50	0
5	*5. Address Other Identified Issues*	15														
	Cost-Effectiveness of Transportation Investments		1	-1	-1	1	0	0	0	0	0	0	0	0	0	1
	Consistency with Applicable Standards (City, County, ODOT)		1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Consensus among Affected Jurisdictions on Implementation of Alternative															
	Implementable within a 20-Year Time Frame		1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Provides a Year-Round Solution		1	1	1	1	1	1	1	1	1	1	1	1	1	1
	SUB-TOTAL	100	60	30	30	60	45	45	45	45	45	45	45	45	45	60
	TOTAL POINTS		110	35	55	110	120	125	170	125	125	120	150	100	150	130

Rating System

2	Very Positive
1	Positive
0	Neutral/No Effect
-1	Negative
-2	Very Negative

Recommended for further study
Not recommended

MEMO #13

Illumination and Signage Recommendations

Tillamook Transportation Refinement Plan: Illumination and Signage Recommendations (Memo # 13)

PREPARED FOR: Valerie Grigg Devis/ODOT

PREPARED BY: Tim Burkhardt/CH2M HILL
Andra Henriques/CH2M HILL
Eric Shimizu/CH2M HILL

COPIES: Project Management Team

DATE: November 18, 2005

This memorandum documents the existing conditions of the illumination and signage on U.S. 101 in the Tillamook downtown core and provides recommendations for addressing deficiencies. Two important issues under consideration in the Tillamook Refinement Plan are illumination and signage, which contribute to the safety and aesthetics of a roadway corridor. Information on these topics is provided at a conceptual level, as neither illumination nor signage were the subject of detailed technical investigations in the refinement plan scope of work.

Illumination

Existing Conditions

An illumination survey was conducted for the Tillamook downtown area, which included Main Avenue and Pacific Avenue from Front Street through Twelfth Street. Figure 1 shows a graphical representation of the existing luminaires in downtown Tillamook.

Nearly every intersection has at least one luminaire. The intersections of Main Avenue and Twelfth Street as well as Pacific Avenue and Fifth Street do not have any illumination. Three intersections along Main Avenue (2nd, 3rd and 4th Street) have two luminaires as well as Pacific Avenue and 3rd Street. There is one mid-block luminaire on both Main Avenue and Pacific Avenue on the block between Eighth Street and Ninth Street.

Illumination - Recommendations

Based on a qualitative review of existing conditions, the following recommendations for Main and Pacific Avenues appear prudent:

- Add illumination to those intersections that are currently unlit.
- Provide additional illumination on 5th Street at Main and Pacific, to bring these intersections to the same level (two luminaires per intersection) currently seen at the other downtown core intersections (2nd, 3rd, and 4th). This is recommended in light of the new Safeway store and an anticipated increase in pedestrian activity at this location.

In order to develop more specific improvements, an in depth technical analysis (e.g., quantitative measurement of current illumination levels) would be required. In the mean time, the following general recommendations can be made based on current conditions and Oregon Department of Transportation highway illumination standards.

- For areas along the corridor that have more business and retail, an average illuminance level of 1.2 foot candles is desired in the intersection and throughout the block based on IES national guidelines.
- If a section of roadway segment shows a history of night-time crashes then it would be desirable to light throughout the block; otherwise, lighting at the intersections is acceptable.
- For more residential areas of the study area, lower average illuminance levels of 0.8 foot candles are desired.
- Desired uniformity of 3:1 or better for all locations. The City may choose to provide uniformity of 4:1 or better along roadway segments between intersections.
- The number of luminaires required to meet the levels of luminance depends on the wattage and mounting height. The acceptable wattage varies between 250 and 400. When the wattage is higher, the number of luminaires required generally decreases. The mounting height will depend on any city height restrictions.
- If decorative sidewalk lighting is desired, then the city should choose an architectural theme and decide on a decorative street light that would fit within this theme. The decorative street lights generally do not light the roadway to the full level of light previously mentioned, but it improves aesthetics while lighting the sidewalk. Spacing will depend on desired illuminance levels. Wattage for the decorative street lights is generally 250 watts.
- In the more residential areas light pollution should be taken into consideration. If a luminaire is installed it should have street side or house side shields, or should use a Type III medium or full cutoff high pressure sodium lamp.
- In general, for the non decorative luminaires, the high pressure sodium lamps should be used.

Signage

Existing Conditions

A qualitative survey of existing signage was conducted for the Tillamook downtown area, which included Main Avenue and Pacific Avenue from Front Street through Twelfth Street.

There are a few notable locations within the study area that are mentioned below.

- 1st and Main: This is one of the intersections where US 101 and OR 6 converge. When traveling westbound on OR 6, the signs are mounted on an overhead structure. This is a good method to mount signs in this location due to the high traffic volumes, large percentage of trucks and restricted sight distance (especially for those coming north on US 101).

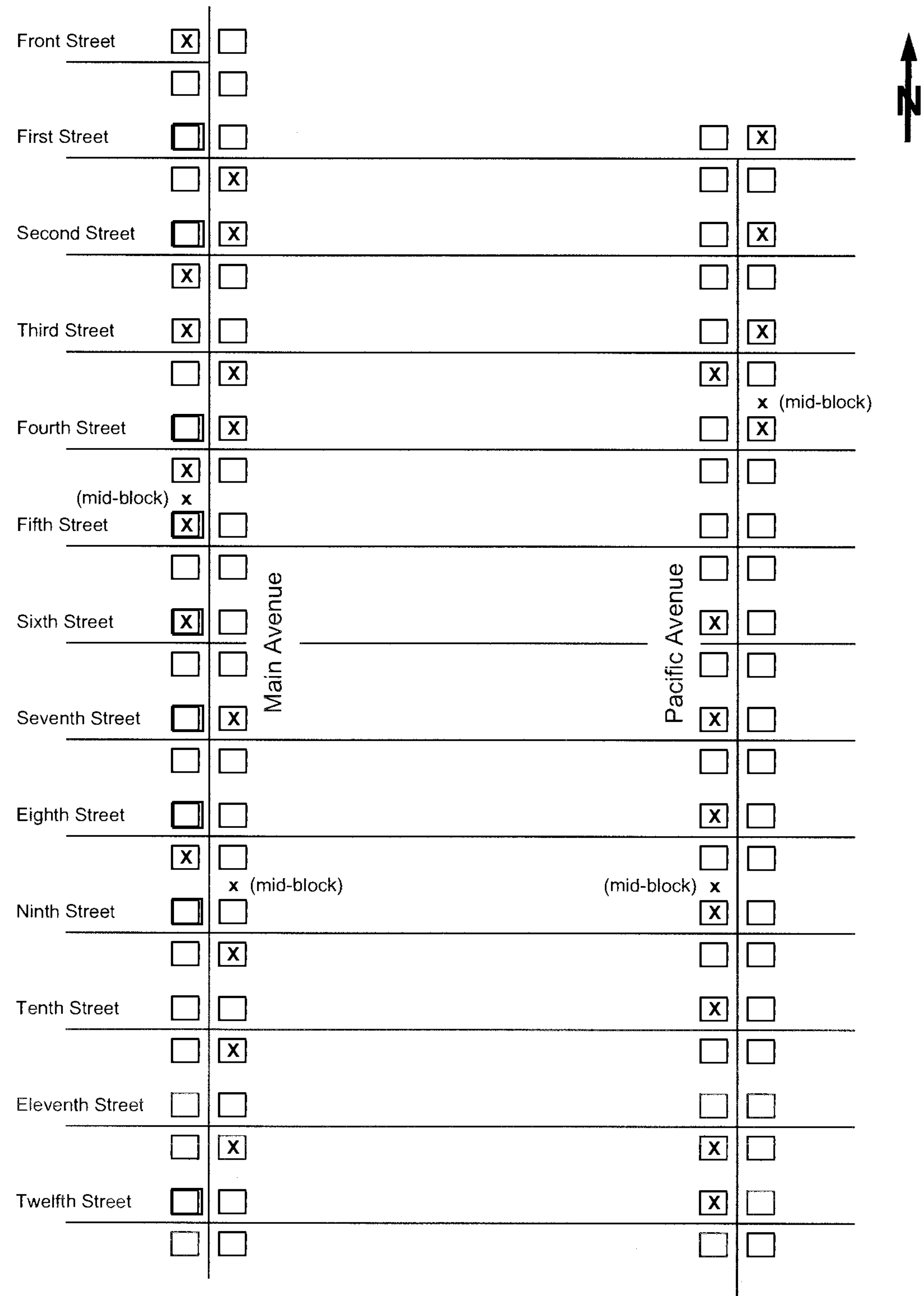
- 2nd and Main: Traveling southbound on Main, there are a large number of signs on the right hand side of the street near the intersection with 2nd Street that appear cluttered and may lead to driver confusion.
- Main Avenue and 3rd Street poses a challenge because of the conversion of 3rd Street from one-way to two-way at the intersection, which affects driver expectation. The northern section of Pacific Avenue has the challenge of clearly noting the best way of travel to OR 6 and US 101.
- The combination of local interest signs and all the highway directional signs creates sign clutter at key intersections (e.g., 3rd and Main).
- The use of single-side signs may be appropriate for vehicles on one-way streets but is of concern for pedestrians who are unable to easily read the signs.

Signage – Recommendations

A more in depth signage inventory and analysis would be an appropriate step in the future at a time when roadway design work was underway and roadway survey data was being collected. Such information could be used to develop specific sign-by-sign recommendations. In the mean time, the following are general recommendations to improve roadway signage on US 101 in downtown Tillamook:

- Signage should be simple and clear.
- Follow MUTCD guidance for priority of sign placement. Regulatory signs should be the highest priority.
- Generally, spacing should be evaluated based on the speed of the roadway to provide adequate space between groupings of signs.
- Unnecessary signs should be removed. Consider removing or relocating some of the local interest signs, especially where the two state highways are intersecting and there are directional signs that already require the special attention of drivers.
- Identify possible locations where overhead structures could be used for mounting signs. This may be useful on Pacific Avenue, between 1st Street and 3rd Street.
- To optimize visibility, mount street name signs on mast arms when the intersection is signalized. Mast arm signs should generally be double sided and have at least 12 inch capital letters and 9 inch lower case letters. Note that any time a sign is added to a signal pole or mast arm, it must be verified that the pole type, bolt connections, and foundation are sufficient for the added load that the sign creates.
- When intersections are not signalized, street name signs may be mounted on opposing corners, be double sided and have at least 6 inch capital letters and 4.5 inch lower case letters.

- Local signage should be unified by creating a theme and adapting all the local signs to match that theme.
- Local interest signs could be mounted together (depending upon the quantity of signs) at entrance points to the city, improving their visibility and drivers opportunity to react to them and reducing signage clutter at key roadway intersections.
- A wayfinding program could be developed to create a unified theme and system for signage to guide visitors (both vehicle and other modes) to attractions in Tillamook.
- Clear signage should be added directing visitors to an area where they can park (see parking recommendations documented separately).
- As noted in the parking study, simplifying parking regulations would provide the opportunity to remove a number of signs, thus reducing sign clutter downtown.



LEGEND

Graphic	Description
[X]	Corner with existing luminaire
[ ]	Corner with no luminaire
x	Mid-block luminaire

Figure 1
Tillamook Existing Illumination
11/18/2005
CH2M HILL

MEMO #14

Public Involvement Summary

Tillamook Transportation Refinement Plan: Public Involvement Summary (Memo #14)

PREPARED FOR: File

PREPARED BY: Tim Burkhardt, CH2M HILL

DATE: January 4, 2006

This memo provides documentation of the public involvement process conducted for the Tillamook Transportation Refinement Plan.

A multi-faceted public involvement approach was taken on this project to ensure the effective involvement of members of the Tillamook community and other interested stakeholders. The approach included the following:

- Refinement Plan Advisory Committee (RPAC) – The RPAC was a 22-member committee of Tillamook-area residents, elected officials, business people, and public agency staff members. It was designed to represent a range of interests in Tillamook transportation issues, including downtown business people and truck-based businesses outside of downtown. The RPAC met six times between September 2004 and November 2005.
- Public Workshops – Two hands-on public workshops were conducted, in January and February 2005, to solicit involvement of the broader community in the identification of problems and brainstorming of solutions.
- Public Open Houses – Two public open houses were conducted during the project, one to present preliminary alternatives (July 2005 at the Tillamook farmers' market) and one to present the draft plan (November 2005 at the Tillamook Forestry Center). Open house materials also were displayed at City Hall after the July 2005 event.
- Mailings, Media, and Advertisements – Public events were publicized through the use of mailings to interested parties, as well as to downtown businesses and those with a potential interest in truck transportation issues. This refinement plan and public events were described in notices, articles, and advertisements in the Tillamook *Headlight Herald* and announced on the local radio station.

Documentation of the public involvement process (meetings) follows this page.

Tillamook Refinement Plan
Truck Transportation Study and *Downtown Safety and Parking Plan*

Refinement Plan Advisory Committee (RPAC)
Meeting #1

Tuesday, September 28, 7:00 p.m. – 9:00 p.m.
Oregon Department of Forestry
5005 East 3rd Avenue, Tillamook

Agenda

7:00 Introduction

- Welcome
- Introductions
- Review agenda

7:15 Project Overview

- Purpose and goals
- Organization, involvement and decision making
- Review tasks and schedule

7:30 Advisory Committee Roles and Responsibilities

- Discuss roles and responsibilities handout
- Changes, additions?
- Group formation – who is missing

8:00 Break

8:10 Goals and Issues Discussion

- Project background and goals
- Problem statement and issues discussion

8:45 Next Steps

- Downtown walking tour (if interest)
- Existing conditions analysis, including truck and parking data collection
- Next Advisory Committee meeting

9:00 Adjourn

Tillamook Refinement Plan
Truck Transportation Study and Downtown Safety and Parking Plan
Refinement Plan Advisory Committee (RPAC)
Meeting #1 Tuesday, September 28, 7:00 p.m. – 9:00 p.m.

Draft Meeting Summary

Agenda

- Welcome, Introductions
- Review agenda
- Project Overview
- Advisory Committee Roles and Responsibilities
- Problem statement and issues discussion
- Existing conditions analysis, including truck and parking data collection

Participants

Sally Clay, TDA
Dana Clay, Green Diamond
Jack Colleknon, TP Freight Lines
Gary Hanenkrat, Tillamook Cheese
Mike Lipke, Hampton Lumber Mills
Terry Wright , Tillamook Police
Rick Adams, Tillamook Fire
Eric Swanson, 911
Norm Myers , Tillamook Traffic Safety
Bob Reed, Tillamook County Road Advisory Committee
Shell Sheldon, Sheldon Oil
Suzie Coughlan, City Council
Carolyn Decker, City Council
Joseph Martin, City Council
Doug Henson, City Council
Sandy Hemenway, Tillamook Chamber of Commerce
George Langlois, Tillamook Apartments
Dwight Guenther, School District #9
Ed Werner, Coast Wide Ready Mix
Wayne Auble, Oregon Department of Forestry
Brett Hesmark, Dentist

Staff
Valerie Grigg Devis, ODOT
Bill Campbell, Tillamook County
Aaron Suko, Tillamook County
Mark Gervasi, City of Tillamook
Tim Lyda, City of Tillamook
David Mattison, City of Tillamook

Consultants

Tim Burkhardt	CH2MHill
Heather Leigh Fuller	CH2MHill
Jamie Damon	JLA, Inc

Introductions

The group began the meeting by introducing themselves and answering the following question - "At the end of this process I hope that..."

- We'll consider public safety
- Find solutions to truck and safety issues
- Improve the parking in downtown
- Adoptable solutions
- Transportation options are safe and economical
- Efficient and safe movement of raw materials through the area
- Move trucks safely
- Safer more efficient way to get trucks in and out of facilities
- Enforce traffic – solve the problems
- A solution for all
- Get an answer to solve 2nd and Main!
- Get answers, wrap the process up and move on
- Something positive out of all of this
- Its not just trucks – emergency services movements are a problem too
- Solutions with broad support and creative funding
- Result is something of value
- Harmonious decisions regarding pedestrians, bikes and trucks
- Safe transportation around the city – a bypass?
- Long term solutions that are workable for everyone
- Consider school district, pedestrian and traffic around schools
- Solutions for safety issues not just truck traffic but tourists also
- Do something about too much traffic coming through the city
- Bring focus on the importance of solving the problems as part of the TSP
- Safe and efficient – resolve gridlock especially around the schools
- Resolve access for trucks through town – don't hinder the truck movement
- Solutions that are locally based and supported

Project Overview

Tim Burkhardt, the project manager from CH2MHill, presented an overview of the project purpose, schedule, organization and tasks. Tim distributed a graphic showing the schedule and task list. The purpose of the project is to develop a plan that documents the problems relating to truck movement and downtown parking and safety and outline potential solutions to resolve the problems for the City, County and State to implement. The project will be completed by the end of 2005. The group had the following comments/questions:

- Is there a law that protects trucks from limiting their ability to move efficiently?
- What is the process for implementation?
- How long will it take to get the funding?
- We need to think "out of the box" and consider some ideas that may seem crazy!

Advisory Committee Roles and Responsibilities
Jamie Damon, facilitator with JLA, Inc., led the group through a discussion of the advisory committee's role and responsibilities. Jamie distributed a handout with sample roles, meeting guidelines, and an organizational chart. The group discussed and amended the handout (see attached "Structure and Meeting Guidelines.)

The group also discussed the committee make-up and who should fill the seats. All interested parties will be notified of the committee's meetings. The discussion of the group composition was to develop a "core group" who could commit to participating in all 7 of the anticipated committee meetings as well as the workshops. The group decided on the following for the make-up of the committee.

Tillamook Transportation Refinement Plan Advisory Committee	
Seat	**Name, Organization**
Trucking interest logging & agriculture	Mike Lipke, Hampton Lumber Mills
Trucking interest other goods	Gary Hanenkrat, TCCA Tillamook County Creamery Association
Trucking interest outlying area	Don Averill, Avrill Trucking
Trucking interest outlying area	Dana Clay, Green Diamond
Trucking interest independent drivers	Barry Mamano
Port of Tillamook Bay	Ken Bell
Local merchant	Brett Hesmark, Dentist, downtown business
Local Merchant	Tom Larson, Larson Body & Glass
Downtown Resident	George Langlois, Tillamook Apartments
Tillamook Downtown Association & Parking District	Sally Clay
Parking Enforcement	Brenda Bellows
Emergency Services - Police	Chief Terry Wright (or designee), Tillamook Police Department
Emergency Services - Fire	Chief Rick Adams (or designee), Tillamook Fire
Emergency Services - 911	Eric Swanson, Tillamook 911
Transit Tillamook County Transportation District	Heather Ornelas, Tillamook County Transportation District
Chamber of Commerce &Visitors Bureau	Sandie Hemenway, Tillamook Chamber
County Road Advisory Committee	Bob Reed, Tillamook County Road Advisory Committee
Tillamook Traffic Safety Advisory Committee	Norm Meyers, Tillamook Traffic Safety Advisory Committee
School District Transportation Manager	Dwight Guenther, School District #9
Tillamook Economic Development Council (EDC)	
County - Elected official	Tim Josi
City – Elected official	Doug Henson

Problem Statement and Issues Discussion

Tim lead presented a draft "Project Objectives" and invited the groups input on the document. The group had the following input:

- Include Emergency Services
- Consider issues relating to flooding
- Consider more than "existing" truck based businesses
- Include more than simply "downtown enhancement"

Tim continued with an overview of the upcoming technical tasks which include traffic counts and invited the group to look at the maps at the end of the meeting and give input on locations for getting counts.

Next Meeting

The next meeting was tentatively scheduled for December 7 from 7 – 9pm at the Oregon Department of Forestry.

A meeting summary and meeting notice will be distributed by email at least one week prior to the next meeting.

Tillamook Transportation Refinement Plan

Refinement Plan Advisory Committee (RPAC)
Structure and Meeting Guidelines (updated 10-21-04)

Purpose of the Committee

- The Refinement Plan Advisory Committee (RPAC) will work to develop an agreed upon set of recommendations to the Project Management Team, City Council and County Commission for resolving the truck route issues and parking and safety issues in the downtown area.

Committee Responsibilities

- The Committee will meet up to 7 times over the next year and a half.
- Committee members are expected to participate in up to 3 workshops.
- Committee members are expected to participate in up to 2 public meetings.
- Committee members are expected to read the materials sent in advance of meetings and participate fully in the meetings.

Committee Structure

- The RPAC is comprised of up to 21 "seats" representing the range of stakeholders.
- The Committee will include the following "seats":

1. Trucking interest – logging/agriculture
2. Trucking interest – other goods
3. Trucking interest – outlying area
4. Trucking interest – outlying area
5. Trucking – independent drivers
6. Port of Tillamook Bay
7. Local merchant
8. Local merchant
9. Downtown Resident
10. Tillamook Downtown Association & Parking District
11. Parking Enforcement
12. Emergency Services – Police
13. Emergency Services – Fire/EMS
14. Transit – Tillamook County Transportation District
15. Visitors Bureau
16. Liaison from the County Road Advisory Committee
17. Liaison from the Tillamook Traffic Safety Advisory Committee
18. School District Transportation Manager
19. Tillamook Economic Development Council (EDC)
20. County - Elected official
21. City – Elected official

Meeting Guidelines

- Meetings will be held on the first Tuesday of each month, from 7pm -9pm in Tillamook at the Oregon Department of Forestry, 5005 East 3rd Avenue.
- Meeting materials will be <u>emailed</u> a <u>week</u> in advance of the meeting.
- Discussions will be facilitated.
- Meetings will be tape-recorded

- RPAC members will share the available speaking time, be respectful of a range of opinions, and focus on successfully completing the agreed upon agenda.
- Public comment will be allowed for 5 minutes at the beginning and 5 minutes at the end of each meeting.
- The public is encouraged to submit comments in writing. Comment cards will be available at each meeting.

Decision Making

- The RPAC is advisory and makes recommendations to the PMT.
- The group will strive for consensus decision-making using an agreed upon definition of consensus.
- If consensus cannot be reached, 2/3 of the group needs to be in agreement for a recommendation to be forwarded and all dissenting opinions will be forwarded.
- All opinions will be part of the meeting record.
- "Freeze" decision points – no revisiting of decisions unless significant new information is introduced.

Internal Communication

- RPAC members are encouraged to contact each other outside of meetings to discuss the project and resolve issues.
- All project information will be available electronically.

External Communication

- RPAC members are encouraged to share project information with other members of the community and act as a liaison to the constituent group that they represent.
- RPAC members can call the following project managers directly with any questins or concerns:
    - Bill Campell, Tillamook County, (503) 842-3408, bcampbell@co.tillamook.or.us
    - Mark Gervasi, City of Tillamook, (503) 842-2472, mgervasi@tillamookor.gov
    - Valerie Grigg Devis, Oregon Department of Transportation, (503) 986-5751, valerie.griggdevis@odot.state.or.us

- Requests for information by the Media or broader public should be directed to one of the above listed project managers.

Coordination with the Working Groups

Truck Route and Downtown Safety and Parking Working Group and Workshops

At key points in the process, Truck Route and Downtown Safety and Parking Working Groups will participate in several workshops. The workshops will have invited participation from people who can speak in detail to the issues for each topic. One or two workshops will be held with each group.

- The "Truck Route" Working Group will include trucking interests who are affected by, have an interest in, or have expertise to be able to discuss alternative truck routes.

- The "Downtown Parking/Safety" Working Group will include business owners and others who may be impacted by or have expertise to be able to discuss alternatives for downtown parking or safety.

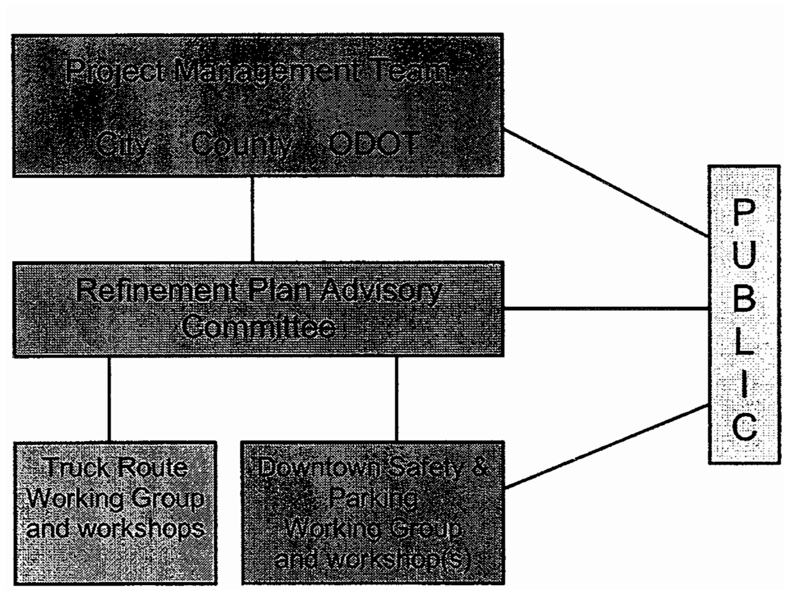
The outcomes of these workshops will be shared with the RPAC for consideration and merged into a coordinated recommendation to the Project Management Team.

Coordination with the Public

- The various interests of the Tillamook County and City of Tillamook public are represented by the RPAC.
- The Public is encouraged to attend RPAC meetings and will be given time at every meeting to participate.
- The Public is encouraged to participate in the workshops and public meetings that are of interest to them.
- The Public can contact the project managers listed on page two directly at any time.
- Notices of the RPAC meetings, workshops and public meetings will be placed in the local paper a week before meetings.
- Meeting materials will be available at the meetings.

Tillamook Transportation Refinement Plan

Public/Agency Organizational Chart



September 2004

Tillamook Transportation Refinement Plan

Advisory Committee

September 28, 2004

Set#

(6) Brett Estmack

	Name	Affiliation	Address (including city and zip code)	Phone Number	E-mail
3	~~Sally Clay~~	~~TDA~~	~~2023 2ND St~~	~~842-5421~~	~~tda@oregoncoast.com~~
	~~Heather Lamb Fuller~~	CH2MHill	Portland 97201	235-5000	hfuller@CH2M.com
5	Dane Clay	GDR	3470 Alderwood Tillamook	815-1114 (c) 842-3180 (o)	dclay@greendiamond.com
	Jack Colleknon	TP Freight Lines	2703 3rd ST Tillamook	842-2574	Jack.Colleknon@TPFreight.Com
3	Gary Hanenkrat	Tillamook Cheese	P.O. Box 313 Tillamook 97141	842-4481	GHanenkrat@TillamookCheese.Com
5	Mike Lipke	Hampton Lumber Mills	P.O. Box 8 Willamina, OR 97396	876-1309	mikelipke@hamptonaffiliates.com
	Carolyn Decker	Tillamook City Council	805 Manor Place, Tillamook OR	503 842 8227	CarolynK@oregoncoast.com
	Joseph Martin	Till. City Council	511 Birch Av Tillamook 97141	842-2484	
	Tim Lyda	City of Tillamook	210 Laurel Ave. Tillamook 97141	842-2343	
	David Mattison	City of Tillamook	210 Laurel Ave. Tillamook 97141	842-3443	dmattison@tillamookor.gov
11	Terry Wright	Tillamook P.D.	210 Laurel Ave Tillamook 97141	842-2522	TWRIGHT@TILLAMOOKOR.GOV
13	Rick Adams	Tillamook Fire	2310 Fourth St. Tillamook 97141	842-7587	tillamookfire@wcn.net
12	Eric Swanson	Tillamook 9-1-1	Po Box 911 Tillamook OR 97141	842-3446	[illegible]@wcn.net
	Aaron Suko	Tillamook County	503 Marolf Loop Rd, Tillamook OR 97141	842-3419	asuko@co.tillamook.or.us
10	Norm Myers	Tillamook Traffic Safety	312 Stillwell Av. Tillamook OR 97141	842-2882	pca@oregoncoast.com
15	Bob Reed	Till. County Road Advisory Comm	P.O. Box 282 Oceanside, OR 97134	842-5270	avalon@harborside.com
	Shell Sheldon	Sheldon Oil Co.	2801 3rd St. Tillamook OR. 97141	503-842-2172	Sheldoil@PacificEr.com
	Suzy Coughlan	City Council	804 Williams Ave Tillamook, Or 97141	842-5713	coughlans@tillamook.k12.or.us
14	Sandy [illegible]	Tillamook Chamber	3705 Hwy 101 N. Tillamook, Or 97141	842-7525	tillchamber@wcn.net
8	[illegible]	Till. Opts.	918 Pacific Ave Tillamook Or 97141	842-5453	
20	Doug Henson	City Council	1130 Meadow Ave. Tillamook Or.	842-5378	dough@oregoncoast.com
17	Dwight Guenther	School Dist #9	6825 Officers Row Tillamook	842-2601	
	Ed Werner	Coast Wide Ready Mix	5500 Sollie Smith Rd. Tillamook	Bus 842-4437 Home 842-7311	503/842-1595 fax (no email)
	Valerie Grigg Devis	ODOT	455 Airport Rd	986-5751	valerie.grigg.devis@odot.state...
	Bill Campbell	TCCD - Tillamook County	201 Laurel Ave, Tillamook OR 97141	842-3408	bcampbel@co.tillamook.or.us
	Wayne Auble	Oregon Dept. of Forestry	5005 Third ST Tillamook, OR 97141	842-2545	Wauble@ODF.STATE.OR.US

Tillamook Transportation Refinement Plan
Tillamook Safety and Parking Workshop
January 19, 2005

The downtown safety and parking workshop was held on January 19, 2005 from 7:00pm – 9:00pm at the Oregon Department of Forestry, 5005 E. 3rd Avenue, Tillamook. The purpose of the workshop was to give downtown businesses, residents, agencies and other interested parties an opportunity to identify downtown parking and safety issues in Tillamook. The outcome of the workshop will assist the Oregon Department of Transportation, the City of Tillamook and Tillamook County in developing solutions to address the problems. The workshop was attended by approximately 38 people. The meeting began with a brief presentation of the data collected-to-date regarding parking and safety issues in the downtown area. The participants were then asked to work in groups of 6 -8 people to discuss their experience with parking and safety problems and their ideas to address the problems. The meeting concluded with each small group reporting the highlights of their discussion to the full group.

The following is a compilation of the comments received from the small groups:

OVERALL ISSUES

- Concerned about lack of seasonal data-great fluctuations in speed, volumes, ability to park downtown in the summer.
- Concerned that decisions are made using the data-needs to be balanced with reality.
- Be sure to combine truck and parking issues at some point in the process.
- Need to take into account extra long vehicles (RV's pulling boats/cars etc.)

SAFETY

Lanes

- Narrow lanes
  - doors taken off cars
- Lost 8 mirrors
- Take 2' off sidewalks to get more road width

Signage

- Too many signs/spacing of signs
- Get sandwich boards off of the street
- Improved signage
- Improved signage-less confusion for drivers

Congestion

- Safeway will generate more traffic
- Congestion causes safety concerns
  - people get frustrated when crossing streets
  - tourists block intersections

- Slough bridge bottleneck- need 2 lanes NB at 1st

Visibility

- Visibility at 2nd and Main blocked by parked cars

Trucks

- Can you use old Front Street (east side) for trucks?
- Truck traffic is a safety issue
- Tunnel from 1st – 12th for trucks
- Tunnel from 9th and 10th for logging trucks
- Truck reroute
- Two trucks traveling side by side take whole road
- Trucks are supposed to be in right lane only, they don't do that
- Drive on sidewalk when trying to parallel park, big truck problem
- Big trucks turning on right at 3rd and Main (RV's mostly) clip the curb. The power pole comes down 2-3 times a summer.
- Signal timing between 1st/Main and 3rd/Main slow so 2nd truck speeds up clear the light.
- Remove truck traffic downtown
- Effect of Wilson River bypass?
  - Change 1st from 1-way to 2-way to allow trucks to turn down
- Can't mandate trucks to use Front street truck route

Pedestrians

- Pedestrian danger
- 5th Pacific/ Main pedestrian safety
- More pedestrian friendly crosswalks on Main/Pacific all through the corridor
- Curb extensions on Main and 1st gateway
- No way to cross on 101 and First from KFC to gas station
- More bump-outs to ensure safety of pedestrians
- Lights in pedestrian crossing to alert vehicles that a pedestrian is going to cross the street
- Pedestrian- cars not seeing pedestrians outside downtown core.
- Crossing Pacific and 2nd people are distracted crossing lanes and are not looking at pedestrians or people parking vehicles.
- South on Main can't see pedestrians at 2nd and Main
- Remove crosswalk on North side of 2nd to channel pedestrians to south side 2nd/Main- better visibility
- Curb extensions on Main/2nd, Pacific/2nd, 9th/Main/Pac11th/Pac/Main, 5th?
- Raised intersections-especially at 2nd/Main level of sidewalk
- Safety for special needs at intersections

Streetscape/Lighting

- Better lighting at night for pedestrians (south side)
- Need streetscape lighting (i.e. old fashioned) at night- need for pedestrian safety

Bicycles

- Bike unfriendly
- Bike lanes on Main and Pacific
- Narrow sidewalks- make part into bicycle lane
- Enforce skateboard/bikes on sidewalks
- Bicyclists don't ride on highway because of safety
- Stillwell bike route not signed

Seasonal Traffic

- Summer traffic- in summer time going up north 101/heavy traffic/emergency vehicles
- RV's reroute

Speed

- Enforcement of speed
- Lower speed limit for trucks/auto

Other

- 101 and 6- confusing
- Lebanon solved traffic right with alt. route
- Safety on 2nd and Main and Pacific
- 4th & Main driveways too close to intersections
- Need street lights
- Main street theatre
- Theme for Tillamook- Supernatural
- Plan for the city- don't do projects to put out fires
- Relocate Businesses on Hwy 101 and Relocate and make highway freeway
- Stoplight on 2nd and Main
- South Wilson River for road, bring into mall property-1-way South bound EB, avoids downtown.
- Turn Pacific into a 2-way through town helps with turn radius onto Route 6. Remove 1 side parking on Pacific to allow wider lanes.

PARKING

Business

- Designated employee parking lot
- Currently employee unfriendly
- Employee- need space in structure
- Adequate employee parking is the key to making downtown parking work
- Address the displacement of spaces by Safeway
- What will happen to 4th street when Safeway comes?
- Analysis of what is available for employees and where the parking is located

Seasonal/Special

- More designated RV and other parking adjacent to highway (e.g. in front of Safeway)
- Better RV parking on Second

- Need parking for fishing boats at slough
- Need parking for RV's and Special needs
- No real capacity issue in downtown-even in the summer
- So many cars you can't see the nice store displays flower beds, etc...

Parking Structure/Lot
- Parking structure to accommodate parking loss on Main and Pacific
- Parking structure needed to get parking off 101
- More identified and user friendly off street parking
- Parking lot lighting for safety
- A sign program for downtown is needed especially to identify location of parking lots, especially free parking
- Small town friendliness includes free parking (like cannon beach)
- No parking lot directional signs

Removing/Changing
- Main Street parking on one side only
- Pacific parking on west side only
- Removal of parking on one side of 101 (Main)
- No RV parking on HWY 101
- Remove all parking on 101
- Cut 2 feet off sidewalks on 101 to allow more space for parking
- Diagonal parking on side streets- will give more spaces
- Parking space at transportation site on 2nd and Laurel
- Need long-term parking
- 3rd/Ivy old library – remove it for parking

Regulation and Enforcement
- Tires on sidewalk for safety- got ticket
- City sidewalk regulations too restrictive?
- Re-designate the unused loading zones
- Some 15 minute spaces not needed
- Parking meters
- Parking regulations- inconsistent all over the city, they need to be consistent. Have one time limit so there is no confusion.
- Enforcement is sporadic
- City bends street parking regs to suit the businesses of each block

Parking and Safety
- Perception of parking problem (hazard)
- Unable to parallel park large vehicles, especially on Main and Pacific
- Worse on Main than Pacific
- People don't park on 101
- Parallel parking-blocks traffic
- Pacific parking on west side only
- Hard to parallel park on Main and Pacific

- Parking zones in parking district
- Frightening for elderly and moms with small children
- Parking on main streets to narrow
- It would alleviate the fear factor of parking on Main if the large trucks were off of Main.

Other

- Quality issue, not quantity
- Research done summer and winter
- Copy Cannon beach directional signs for Parking! (Clear, readable, inviting)
- 3rd/Stillwell: new library – What about ped crossing on 3rd

The following are tables and diagrams that were written on the charts from the small group discussions

Parking Solutions

-Meter

-Multi-level structure for county courthouse
- 1 level public
- 1 level employees

- Charge for parking county employees

- More RV parking. Well marked otherside of museum on SR 6.

- Time limits an issue at 3pm millworks visiting local establishments. 2nd street on street just East and West of Main. Daily heavier towards end of week.

- Peripheral lots, especially RV's

- Possible use of lot at Pacific and 4th

- Possible structure on old library site

- 1-way HWY 101 with angle parking between 2nd and 3rd

- Structure at same location

- 1st and 3rd to 1-way streets, angle parking, or 2nd to 1-way

- 3rd 1-way extend west also helps with RV's clipping the curb.

Problems

-near courthouse capacity issue

-county used all pkg near courthouse

- apt (2nd/3rd/pac) park along 3/d east pacific

- city employee outflow along Madrona S. of courthouse

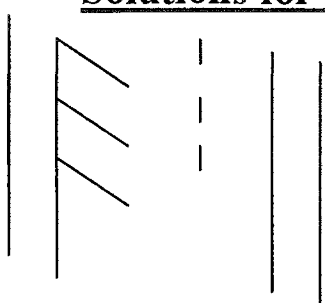
- RV parking insufficient

Safety → **“Main Street Options”**

- Would like parking removed from **Main** street
- Parking is **very important** to Main street business
- Parking **slows** traffic down
- Why not have parking on 1-side?
- Why not put bike lane on the right

east park | lane 1 | lane 2 | bike lane west
main
No alley access More alley access

Solutions for 2nd

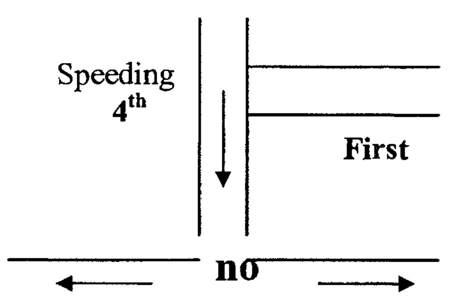


Diagonal parking on 2nd street

Can 2nd street be a 1-way? (both directions)

Traffic is entering downtown southbound from intersection **fast** (35mph)
Because of uphill and making signal

Possible **re-sync** of lights at 1st and 3rd and 4th to discourage those who are pushing the signals



Pedestrian Crossing

- More street lighting- to help pedestrians at night time especially for new safe wall
- Consider 2 embedded pedestrian lighting for crosswalks
- Strengthen pavers/other crosswalk identification
- RV's should be included as "trucks" (if they don't always drive very well)
  (for a bypass)

The following is a compilation of the comments received from the comment forms:

SAFETY AND "MAIN STREET"

1) **What are your concerns about safety on Main and Pacific downtown?**
   - Lack of attention and lack of planning in the downtown traffic area. Main and Pacific have reached their saturation point. Horrible bottleneck on state highways.
   - Provide for those with special needs, retired, physically limited, mentally challenged. Think about Tillamook as being super natural, supportive of ecological principles walking, bicycle riding, street vendors, and walking to shops.
   - Unsafe because we are trying to do too much in the limited width. The roadway is too narrow for 2 lanes (especially with trucks) and 2 rows of parking.
   - Put lights at all intersections to control foot traffic. Coordinate them with the traffic lights (2nd street to 5th street).
   - Existing lanes are too narrow for today's wider and larger vehicles.
   - Speed of trucks-rapid acceleration to make 3rd and Main light, crosswalk on 2nd and Main for pedestrian safety, bicycle pathway (non-existing), young people riding bikes on sidewalks.
   - People getting out of their cars with logging trucks going down the street. Pedestrians not being able to be seen by trucks and RV's. The pedestrian crossing is not adequate.
   - Emergency vehicles different plans at different times of the year. Pedestrian safety 5th and Main and Pacific. Speed enforcements, special needs. No RV on 101, better lighting.
   - "Trucks" big trucks. The same threat exists from motor homes, boat trailer haulers, testosterone pickups, etc...
   - Street corners are too sharp for long lengthy vehicles. Left hand turn viewing for Hwy 101, access blocked intersections from June through

Sept. Narrow parking width and traffic lanes. October 1st through 21st high volume towed fish boat season.

- Truck traffic, sign spacing, narrow lanes, emergency vehicles going north in the summer, pedestrian danger, reroute the RV's, bicycle unfriendly, more pedestrian signs at crosswalks, no corner cuts in the cone, driveways too close to intersections.
- Lanes are too narrow, pedestrian issues too many signs, spacing, emergency vehicles can't access north, too few signaled pedestrian crosswalks, 4th and Main driveway too close to intersection.

2) What should be done to improve safety?

- Remove trucks from downtown area. Light at 2nd and Main and 2nd and Pacific, reduce speed limit.
- Better sidewalks and lighting to improve pedestrian crossing areas
- One row of parking on the left, 2 of traffic wider than existing, one bike lane on the right side.
- Increase lane width
- Improved signage, enforcement and education, possibly a light system at 2nd and Main to protect the pedestrians.
- Possible removal of parking on Main on one side of the street. Bump outs, truck route, a parking safety plan, provide parking structure to accommodate parking eliminated on Main and Pacific, and traffic.
- Parking on side street or highway, bike lanes on Main street, lights signaling when pedestrians can cross.
- Lit crosswalks, bright paint, empty space for crosswalk.
- Please don't consider summer traffic and speed measurement to be only an element "in an ideal world". It is the real world and your group should know that without hard thinking. Don't be silly enough to plan a highway here in the off season.
- Reduce sidewalk width 10-12" each from 1st through 8th. Share gained width to parking and traffic lanes.
- Main street parking on East side only. Pacific street parking on West side only with parallel parking on opposite sides. Install pedestrian friendly crosswalk, has controls all the way through. Add a bike lane on west side.
- Eliminate one side of parking on both Main and Pacific. Install more pedestrian friendly controlled crosswalks, and add bike lanes on Main and Pacific.

3) What would make Main and Pacific a better "Main Street"?

- No trucks, less traffic, wider streets, narrower sidewalks.
- More business and parking on one side only, street vendors, 2 lanes of traffic, one bike route, think about a tunnel or overpass.
- Adequate cross walks at all intersections, limiting the driving on Main and Pacific, shift driveways to cross streets, store front upgrades, more standard treatment both blocks.

- Remove one side street parking and increase lane size, which also would improve visibility for pedestrian traffic and bicycle traffic. Make 2nd street one way from Main East to Laurel, west to Stillwell with angle parking spaces.
- Plantings, benches, kiosks with info on area.
- Have a plan that would incorporate parking, safety, streetscapes, and pedestrian bump outs.
- Gateway on 1st and Main, "slow down".
- Get rid of on street parking so the store fronts and attempts at beautification are given some kind of graceful space.
- Pedestrian only control lights (2nd Street) and large lengthy vehicular cornering
- Decorative street lights, eliminate sandwich board signs, street trees, consistent sidewalk and theme, curb extensions, gateway to Main and First, need crosswalk on Highway 101 and First Street.
- Add more illumination, lights, and door consistency, curb extensions, consistent intersections.

4) Do you have any other concerns or suggestions?

- No physical way for pedestrians to cross from West-East at First and Main.
- Calling industrial and commercial trucking the problem; it's also motor homes, travel trailers, and towed boats and trailers. I own a motor home with car towing and a 21 foot sport fishing boat that requires two lane clearances on 1st and 3rd.
- Signs at entrances to town and free parking on all side streets
- The proposed Safeway store that has a through street with a lot of traffic, at its front doors. Need to vacate 4th between Ivy and Stillwell.
- What is going to happen when Safeway gets going and the people that come from north want to get out of town? Are they going to need to go east on 3rd, 2nd, 4th then north on Pacific? 1st Street can't handle any more East bound traffic because it gets clogged up now under average traffic level because the west bound traffic has the right of way almost all of the time?
- You really need to get data in peak summer. Using winter data and trying to project it to summer is not possible or valid.
- Have what we do with parking and pedestrian use fit with a theme for the city (i.e.: supernatural the most ecological city in Oregon). This was a pedestrian safety meeting and it was held outside of town making it necessary to drive to attend.

DOWNTOWN PARKING

1) What are your concerns and suggestions for the following parking issues?

Parking capacity (number of spaces)

- There is no oversized vehicle parking more identified and user friendly off street parking.
- No RV parking no signs to tell drivers where to sign, parking garage, more identified and user friendly off street parking.
- RV's and oversized vehicles size, employee unfriendly
- Diagonal parking on side streets
- Number is ok but location may not always as convenient as people would like.
- Reduce the number of spots on Main and Pacific. Increase the number of spaces on side streets.
- Quality of parking is more of an issue than the quantity.

Safety when parking on Main and Pacific

- Lanes too narrow can't open doors. Lanes too narrow for parallel parking blocks both lanes.
- Main Street parking on East side only, Pacific Street parking on West side only with parallel parking on opposite sides. Install pedestrian friendly cross walk, has controls all the way through add bike lane on West side.
- Intimidating streets to narrow, site long term parking locations, narrow sidewalks.
- Take off some of parking on one side of the street (101)
- Terribly frightening for elderly and people with small children. Narrow streets intimidation by trucks and motor homes.
- Still too crowded generally parking delays traffic.
- Street is too narrow and truck traffic problems.
- Street is too narrow; people hate parking with trucks and huge RV's going by, lots of mirrors ripped off of parked vehicles.

Employee parking needs

- Employee unfriendly need more off street parking
- Employee unfriendly, ride the bus or use parking meters
- Need structure
- Stricter enforcement keeps people out of the care area. Consistency
- Employee parking needs to leave more room for customers, consider off street parking for employees.
- Think about library and Safeway will need spots, community should not have to absorb the extra load, multi-level parking.
- Not major issues at this point rental stalls at this point rental stalls and free parking outside of the district are available to employees.

Existing parking regulations (time limits)

- Somewhat confusing, explore new parking zones
- Parking zones
- Parking zones dynamic, allow changes with in land uses. Consistency would go up and confusion would go down.
- Make consistent all over the city, not make exceptions to put out fires or free parking.
- Will always need some short term parking to support the customers.

- Are not enforced… that applies to 5' limitation parking spots that are marked off for pedestrian safety.
- Necessary!! If they weren't in place people would abuse the parking situation.

Other

- Remove plug on side highway
- Consider a location for farmers market on weekend and parking during the week.
- I like the downtown business and want to see them succeed, but I don't like to park on Main.

2) Do you have any other parking concerns or suggestions?

- Eliminate all bump outs and critical intersections for emergency access.
- Parking structure. Diagonal or side street parking.
- Parking structure that goes over Ivy and has city parking on both sides of the street and above the street. Also, if old library site is sold for retail, site possible co-op with city to make it happen.
- We need to have parking for RV's. Research needs to be balanced (summer vs. fall or winter).
- I would rather not see any additional parking, but it is necessary. And would like to see a multi-level structure. Downtown Salem has good diagonal parking.
- Diagonal parking could be utilized in certain area

Tillamook Transportation Refinement Plan
Alternate Truck Route Workshop
March 8, 2005

The Truck Route workshop was held on March 8, 2005, from 7:00pm – 9:00pm at the Oregon Department of Forestry, 5005 E. 3rd Avenue, Tillamook. The purpose of the workshop was to give local area truck oriented businesses, residents, agencies and other interested parties an opportunity to identify truck route issues and preliminary solutions for the Tillamook area. The outcome of the workshop will assist the Oregon Department of Transportation, the City of Tillamook and Tillamook County in developing truck route alternatives. The workshop was attended by approximately 45 people. The meeting began with a brief presentation of the data collected-to-date regarding how trucks move through the Tillamook area. The participants were then asked to work in groups of 6 -8 people to discuss their experiences moving trucks through the area including any related safety and routing issues and ideas. The meeting concluded with each small group reporting the highlights of their discussion to the full group.

The following is a compilation of the comments received from the small groups:

OVERALL QUESTIONS/COMMENTS

- Need mileage for different routes for comparison
- What is the impact of possibly changing the status of Highway 101? (Pending Legislation)
- How are seasonal adjustments accounted for? (Fishing, RV's, etc.)
- Where is the Trask lumber traffic going?

TRUCK ISSUES

Downtown

- The shift from 2-way to 1-way caused conflict on 3rd
- Could parking on Main be reduced to one side?
- Downtown delivery vehicles can obstruct traffic-especially Ivy Street between 3rd and 4th. Need loading zones!
- Truck traffic downtown is deteriorating downtown buildings/structures
- Too much truck traffic on Main and Pacific
- Roads-downtown streets not designed for large trucks
- Pedestrian safety
- Turning radius on downtown streets Rv's-trucks
- Reduce truck traffic downtown
- Front street is ineffective, cannot go only @ SW or ES movements
- Median on front street and 101 impedes truck flow-this is supposed to be the city's truck route alternative

Speed

- Trucks travel too quickly on Latimer, not safe to walk on road, narrow road
- Perception of trucks going fast

- Hwy 6 traffic speeds

Lanes
- Safety/Roadway width on Main from 1st/3rd-Mirrors Clipped
- Widen ROW on each side of train track from Highway 6 to 101. Put a lane for trucks on each side.
- 2 trucks side by side in the corridor/Main/Pacific, you get perception of being intimidated, claustrophobia
- Damage to doors, mirrors

Congestion
- Congestion on 3rd/Main: Especially when long trucks turn need to turn east
- 3rd/Main-Stacking onto 101 North and stacking from Pacific signal west
- All roads lead to bottleneck 101,6,131 all converge at 1 point

Outside of Tillamook/Rural Area
- Side road access
- Turning on rural roads, radius concerns
- Narrow roads for the size of today's trucks
- Take Trask River Road to avoid the scales
- Johnson Creek Bridge has a load limit under design presently (OTIA)
- Is there a weight limit on Mill Creek Bridge?
- Numbers from Trask seem too low
- 4-5 min longer from Port to cheese factory on "back" roads
- Bridge over slough (101N) has only 1 lane in the north direction
- East to south (6-101) trucks take 3 lanes to turn

Other
- Roadway damage, house damage, land damage, on Latimer from constant truck traffic.
- Public education re: driving next to a truck
- Noise!
- Mix use of roads (Bikes, cars, trucks, RV's)
- Trucks pulling out onto highway
- School buses
- Long Prairie and 101- needs signal, long waits, farm traffic

TRUCK ROUTE SUGGESTIONS/OTHER SOLUTIONS
- Interchange at middle Wilson River Loop and Trask River possible Schild to be the interchange not WRL or Trask
- Highway 101 from north to south-cross Hoquarten Slough-make left on Hoquarten property, follow old rail line to turn into Mill.
- Need a stop light - Stillwell and Safeway
- Make parking on one side of Street and Main
- Decrease sidewalks to make streets wider on 101

- Fix Bridge at Johnson Bridge so trucks won't have to go through Till. (Eastbound trucks from Port have to go downtown due to weight restriction on bridge)
- Improved shoulders and turning radius anywhere i.e. turn off Sollie Smith to go to creamery. Road slanted wrong.
- Use existing truck route on Stillwell-improve southern turning radius to 10th
- Look @ Lebanon, OR for their improvements for truck routes
- 1% tax break for big trucking Co. i.e. Creamery, Lumber, if they use a preferred route
- Partner with the mill to build a new entrance into log yard from Evergreen
- Build road from old Wilson River Loop Road to follow rail road tracks
- Fixing Johnson Creek Bridge-Fall 2006, load limited now
- Signal at 101 and Latimer
- Signal at 101 and Long Prairie
- Wilson River Highway and Highway 6 Interchange
- Highway 6-2 way all the way to 101
- Remove parking from one side of 101
- Circulation change at the Mill-10th and Miller
- Extend 12th to Hamptons Mill-Eliminate truck traffic from residential area
- New road from Highway 6/ Wilson River Loop up to signal @ Fred Meyer.
- 1st and Stillwell = reverse stop signs to favor truck route, so trucks are encouraged to use the alternative to 101.
- Trask River Road (Johnson Creek Bridge) will be completed fall 2006. Johnson Creek Bridge is load limited currently this should facilitate Trask River Road as truck route to BOTB
- Internal circulation at Mill - could reduce significant trips on 101 throughout downtown. Could reduce 30% of traffic southbound 101 using 3rd Street if internally re-routed to 10th street.
- Could reduce 33% of north bound 101 going out 3rd street rather than using 10th
- Averill should locate at POTB to reduce trips through downtown by 69%
- Widen Hoquarten Bridge; clean up Highway 6/Highway 101 Intersection/Ground Zero make first priority/Highway 6 2 way-east and west.
- Ramp at PUD substation for Highway 6 traffic to Hampton
- Get log trucks off 10th to Mill
- Add new entrance to Hampton going northbound to Mill on 12th somewhere
- Use 11th to Mill for log trucks going north to Hampton
- Eliminate parking on one side of Main/Pacific for the whole way 1st to south couplet
- Get ODOT/City to support a downtown parking structure
- Remove "smart" light at 1st and main-gets out of sync
- Use existing RxR right of way for new road

The following is a compilation of the comments received from the comment forms:

1) What are your concerns about truck traffic:

A) In downtown Tillamook?

- Enforce existing traffic laws
- Streets are too narrow
- Streets to narrow-take parking off Main and Pacific collaborate stop signs, forget pedestrian crossing on 2nd and Main.
- It is frightening, parking should be stopped at least 5 blocks along Main Ave
- Remove parking one side of the street
- As long as they stay inside the speed limit there is no trouble
- Configuration- have width and radius turning does not allow trucks to operate safely
- Noise, congestion, speeding, trucks in tandem, overwhelming to people trying to get out of a car
- Safety- two people dead so far from trucks. Intimidation- they scare people, noise, volumes of trucks trying to get through town.
- Traffic lanes on Main Street too narrow. May have to fill in some basements to reduce sidewalk width.
- Too much traffic on Main and Pacific with narrow travel way. Congested traffic on Main and Tenth and Pacific and Tenth.
- Safety, passing, parking
- Safety, congestion
- Mix of traffic trucks, tankers, long freight trucks, delivery vehicles, SUV's, bicycles, or vehicles pulling trailers.

B) Outside of downtown Tillamook?

- Roads are too narrow, rough, and too crooked
- Roads are too narrow, too rough and in poor condition and to crooked
- Latimer Rd. is already a disaster, and increasing the trucks will make it impossible
- Too much and too fast on Latimer Rd. Road bed failing because of heavy trucks, there is no "load limit" on trucks- Do not heed speed limit.
- As long as they stay inside the speed limit there is no trouble
- Again lanes are too narrow for modern trucks, many roads have no shoulders
- Amount of trucks going through on 101
- Have to persuade truck drivers to use alternate routes- they want to go the shortest way
- Road/pavement quality with increased traffic and use
- Trucks on roads not built for the loads being carried- Road beds, pavement detonating, coordination of multiple trips from same site areas.

2) What should be done to reduce the amount of truck traffic downtown?

- Find a bypass for truck traffic by way of the railroad on each side of tracks going north and south.
- Start work now on finding a feasible inexpensive as possible bypass.
- Don't know
- Operate in certain hours and days
- I'm not sure that should be the goal. Would rather build the road to handle the traffic
- Voluntary re-route, Hwy 6 and Wilson River Loop overpass should help for a new route.
- Find alternate routes
- Inside study of traffic at Tillamook Rd to determine if their traffic patterns could be altered and reduce some downtown trips
- Truck route (require for Tillamook based firms) and encourage through truck traffic to use the route
- Coordinate major truck destinations for time best to avoid congestion on main roads.

3) **If money becomes available to build a new alternate truck route or improve an existing alternate route (such as Wilson River Loop) which route is the best, and why?**

- A new route so it won't jeopardize the existing home owners and their homes on Latimer Rd.
- Use parts of either/or- no matter how you go much of the current roads will not hold up to heavy truck traffic.
- Diagonal across farmland from Wilson Loop intersection to Fred Meyer intersection.
- Build a new truck route
- Wilson loop to long Prairie Rd keeps the people out of town that don't want to be here.
- Latimer, Wilson, River Loop, 101n to 6, Shield, Trask River Rd, Long Prairie Rd
- Drew map on back of sheet
- Trucks, River Rd for now- the Wilson River Loop not bad- look for a new connection between hwy 6 in to Tillamook around Evergreen.
- Push Evergreen through to Hwy 6, add additional lane to Northbound lane on Hoquarten Bridge (Hwy 101), Signage at Latimer and Long Prairie Rd. encouraging use of truck route (no trucks turning East onto 3rd from HWY 101).
- Right of way access vs. improvements, lots of resistance by Himby's resisting the added traffic especially trucks.

4) **Assuming there will always be trucks downtown, what could be done to reduce the negative effects of trucks?**

- Take parking off main street
- Take parking off the west side on Main and East side on Pacific to give more room for driving through town.

- Remove parking on Main and Pacific sign and point directional information for turning radius for big trucks
- Slow them down
- Operate in certain hours of the day
- Wider lanes and provide room for turning movements. This may require parking and pedestrian may need to limited.
- Take one side of parking on Main X2 lane 101- 2 lane all the way on 101- eliminate bottleneck @ Hoquarten Slough Bridge
- Change the speed limit, widen the street by narrowing the sidewalks on eliminate parking on Main and Pacific.
- Park on one side of the street
- Remove parking from one side of Main Street between 1st and 4th and wider lanes.
- Increase lane width by reduction of sidewalk widths by having parking only on one side- good luck!

5) Do you have any other concerns or suggestions?

- We can't eliminate the truck traffic because it is important to the economy of Tillamook. We just need to find a new route that is good and safe for everyone.
- Money- too many of county roads and state roads are in bad shape. They were not built to carry the size, length, and weight of current allowable trucks. Either no bicycles or build streets wide enough to accommodate them- 101, 131, 6 and all county roads.
- Lower speed limit on Latimer Rd. and enforce it.
- Lower speed limit on Latimer and enforce it, not safe!
- No
- Lack of funding for construction makes it almost impossible to do a major improvement.
- More? operation to the Port
- We need trucks, we need safety. Find ways to benefit freight movers by working with the adopted plan.
- Trucks parking too close to intersections make it difficult for vehicles trying to cross to assess oncoming cross traffic. Safeway relocation in blocks between 3rd and 5th and Stillwell and vacated Ivy Street. Will work out problems with trucks coming for supply on Stillwell and down 5th.

Tillamook Refinement Plan
Truck Transportation Study and *Downtown Safety and Parking Plan*

Refinement Plan Advisory Committee
Meeting #2

Tuesday, May 3, 2005, 7:00 p.m. – 9:00 p.m.
Tillamook County Courthouse, 2nd Floor (BOC Hearing Room)
201 Laurel Avenue, Tillamook

Agenda

7:00 Introduction

- Welcome
- Introductions
- Review agenda

7:10 Summary of Activities Since Last Meeting

- Speed study, traffic and safety analysis (September-November)
- Parking utilization study (October)
- Truck data collection (November)
- Downtown workshop (January)
- Truck workshop (March)
- Initial synthesis of ideas and ODOT review (April)

7:15 Review Project Evaluation Criteria

7:30 Presentation and Discussion of Draft Concepts

- Downtown traffic
- Downtown parking and safety
- Truck routes

8:50 Next Steps

- Revise and refine concepts
- Public open house to present concepts (mid-June)
- Evaluate concepts, select preferred
- Advisory Committee meeting to review evaluation results (July/Aug?)

9:00 Adjourn

Tillamook Transportation Refinement Plan

Advisory Committee

May 3, 2005

Name	Affiliation	Address (including city and zip code)	Phone Number	E-mail
Brenda Bower	Tillamook PD	210 Laurel	842-2522	bbower@oregoncoast.com
Doug Henson	Tillamook City Council	1130 Meadow Ave	815-2807	
Sandy Hemenway	Tillamook Chamber	3705 Hwy 101 N. Tillamook	842-7525	tillchamber@wcn.net
Britt Hestmark	Downtown Merchants Board	1115 Main Ave Tillamook	842-7188	
David Mattison	Tillamook City Planning	210 Laurel Tillamook	842-3443	dmattison@tillamookor.gov
Terry Wright	" " P.D.	" - " " Basement	842-2522	TWright@tillamookor.gov
Joseph Martin	Tillamook City Council	511 Birch Av Tillamook 97141	842-2484	
Mark Gervasi	City Manager Tillamook	210 Laurel Ave, Tillamook 97141	842-2472	MGervasi@tillamookor.gov
Mike Lipke	Hampton Lumber Mills	P.O. Box 8 Willamina, OR 97396	815-6309	mikelipke@hamptonaffiliates.com
Barry Mammano	Grunder Equipment	PO Box 171 Rockaway 97136	355-2570	
Don Averill	Averill TRK	1500 101 N Main Till. or 97141	842-5189	
Laren Woolley	Coastal program DLCD	Newport, OR 97365	541-563-3745	laren.woolley@state.or.us
Valerie Grigg Devis	ODOT - Reg. 2	455 SW 13th, Salem 97301	503-986-5751	valerie.grigg.devis@odot.state.or.us
Kathleen Newton	EDC & Headlight Herald	1908 2nd St. Tillamook 97141	503 842-7535	knewton@orcoastnews.com
Theresa Carr	CH2MHill		503-736-4381	theresa.carr@ch2m.com
Norm Meyers				
Bill Campbell	Tillamook County	201 Laurel Ave,	842-3408	bcampbel@co.tillamook.or.us

Tillamook Refinement Plan
Truck Transportation Study and *Downtown Safety and Parking Plan*

Refinement Plan Advisory Committee
Meeting #3

Tuesday, June 7, 2005, 6:00 p.m. – 8:00 p.m.
Tillamook County Courthouse, 2nd Floor (BOC Hearing Room)
201 Laurel Avenue, Tillamook

Agenda

6:00 Introduction

- Welcome
- Introductions
- Review agenda

6:10 Summary of Activities Since Last Meeting

- Additional parking analysis
- Additional traffic analysis (roundabouts)
- Revised evaluation criteria in response to May RPAC discussion
- ODOT traffic data collection (cameras)

6:15 Presentation and Discussion of Draft Concepts (Continued)

- Downtown traffic
- Truck routes
- Curb extensions
- Main and Pacific options
- Off-street parking

7:45 Next Steps

- Revise and refine concepts
- Public open house to present concepts (Saturday, June 25)
- Evaluate concepts, select preferred
- Advisory Committee meeting to review evaluation results

8:00 Adjourn

Tillamook Transportation Refinement Plan
Farmer's Market Booth and City Hall Display
July 2005

A booth was held at the Tillamook Farmer's Market on July 9, 2005 from 9:00 a.m. until 2:00 p.m. at the Tillamook Farmer's Market, on Laurel Ave., in downtown Tillamook. The same displays of information were also available in the lobby of Tillamook City Hall the week of July 11, 2005 through July 15, 2005.

The purpose of the booth and displays was to give downtown businesses, residents, agencies and other interested parties an opportunity to come and talk with project staff, learn more about the range of options and to offer additional ideas. The options had been developed as a result of two community workshops held earlier in the year. It is estimated that well over 50 people stopped by the booth and it is unknown how many people viewed the displays in City Hall. The displays of information included a map of the project vicinity and several displays outlining the range of options. Participants were asked to complete a questionnaire and share their preferences. We received nine completed questionnaires. Many people who stopped by the booth did not complete a questionnaire, but verbally offered positive feedback to the project team about the proposed improvements. The majority of people who commented were glad to see that some improvements to resolve the parking and truck route issues were being proposed and were glad that the City, County and ODOT were working together to solve the problems.

The following is a compilation of the comments received from the questionnaires:

TRUCK AND THROUGH TRAFFIC OPTIONS

Which options do you think are most feasible? Use the map inside to show other ideas.

- 6 of 9 people responded to this question
    - Re-route 101 east of Mill, and intersect at Hwy 6.
    - Improve Long Prairie Road intersection at 101. This entrance is dangerous, and needs a traffic signal. Difficult to pass through from East to West across 101.
    - Provide a second river crossing for Netarts Hwy to North as shown on map. Avoid congestion downtown and one-way streets.
    - Bypass on east side of town.
    - Provide wider travel lanes.

DOWNTOWN PARKING OPTIONS

Which parking improvements are most important to you? Use the map inside to show other ideas.

- 5 of 9 people responded to this question
    - Needs parking lot close to 101 with a nice bathroom. Children play structure, landscaping, and direct pedestrian connections to downtown.
    - No angled parking in areas with high traffic volumes.
    - Free parking throughout, a parking lot adjacent to the courthouse.

- Have no parking on one side of Main and Pacific with wider travel lanes.
- Support angled parking.
- Future parking structure

DOWNTOWN TRAFFIC OPTIONS
Please rank options A- D in order of your preference (first choice = "1", second choice = "2"...)

- 6 of 9 people responded to this question
- Additional comments: Change all one-way streets to two way streets.
    - Widen Hoquarten Bridge
    - Dislike the two-way on 3rd street
    - Make round-about 2 lanes
    - Favor a bypass option from Hwy 101 North and South
- 3 - "c" as first choice
- 1 - "a" as first choice
- 2 - "b" as first choice
- 1 – "c" as a second choice
- 1 - "d" as second choice
- 1 – "a" as a third choice
- 1 – "d" as a fourth choice

MAIN AND PACIFIC ROADWAY DESIGN OPTIONS
Please rank options A- C in order of your preference (first choice = "1", second choice = "2"...)

- 5 of 9 people responded to this question
- Additional Comments: Existing conditions preferred
    - No bike lanes on Hwy.
    - Too many other distractions that are dangerous (curb bump outs)
    - Bike routes to continue one block over.
    - Add bike lanes on 101 or around town - bike bypass
    - Like curb bump outs, low landscaping, "raised" cross walks, and bumpy surface slow drivers down.
    - parking on one side only
    - bike lanes
    - Bike path would be nice!
    - 12' sidewalks seem a bit much!
    - Narrow sidewalks! Get state's money and build it.
- 3 - "a" as their first choice
- 1 - "b" as their first choice
- 1 – "c" as their first choice
- 2 - "c" as their second choice
- 1 – "b" as their second choice
- 1 – "a" as their third choice
- 1 – "b" as their third choice

MAIN STREET AND PACIFIC STREETSCAPE OPTIONS

Which streetscape option(s) do you like best? Why?

- 3 of 9 people responded to this question
  - Existing, but with moving back parking - allowed spaces
  - Curb outs, like 2nd and Main
  - Colored ladder bar is a nicer visual than regular ladder bar

Which streetscape options do you dislike? Why?

- 2 of 9 people responded to this question
  - Street striping is slippery when walking
  - Curb bump outs
  - Curb extensions are visually nice but take up a lot of space

WHERE DOES YOUR OPINION FALL ON THE SCALE BELOW?

- 3 of 9 people responded to this question
  - Removing one or two buildings would be OK if it improves congestion and safety (1)
  - We should preserve what we've got- don't impact buildings on Main and Pacific to make space for improved roads (1)
  - We should redevelop much of Main and Pacific to make space for improved roads (1)

Tillamook Transportation Refinement Plan
Truck Transportation Study and
Downtown Safety and Parking Plan

OVERVIEW

The Oregon Department of Transportation in cooperation with the City of Tillamook and Tillamook County is preparing the Tillamook Transportation Refinement Plan to address:

- The possible development of alternative routes for through traffic and freight mobility in and surrounding the City of Tillamook
- Traffic hazards, congestion, pedestrian safety, and parking on and adjacent to Highway 101 in downtown Tillamook

The Refinement Plan began in summer 2004 and will be completed in Fall 2005.

WHAT ALTERNATIVES ARE BEING CONSIDERED?

A number of alternatives have been developed based on a review of existing conditions, collection of traffic and safety data, public workshops, and input from the advisory committee. Proposed options address the design of Highway 101 downtown and the intersection of Highway 101 and Wilson River Highway, on- and off-street parking, and possible improvements outside of downtown to improve truck and through traffic mobility.

HOW ARE BUSINESSES, PROPERTY OWNERS AND THE COMMUNITY INVOLVED?

A 21-member Refinement Plan Advisory Committee has been established to provide recommendations to the Project Management Team regarding issues, alternatives, and solutions. The committee, which has met three times since September 2004, includes local community representatives from trucking, agriculture, logging, downtown businesses, emergency services, schools, and elected officials. Two hands-on public workshops were held in early 2005 to understand stakeholder concerns and brainstorm potential solutions. The June 9, 2005, public open house is an option for the community to review and comment on the alternatives now being considered.

Property owners and others who have an interest in the study area can call or contact ODOT directly, attend the advisory committee meetings, participate in workshops, and attend community open houses, and public hearings. A mailing list has been developed which includes property owners, businesses, residents, interest groups and others who have an interest in the study area.

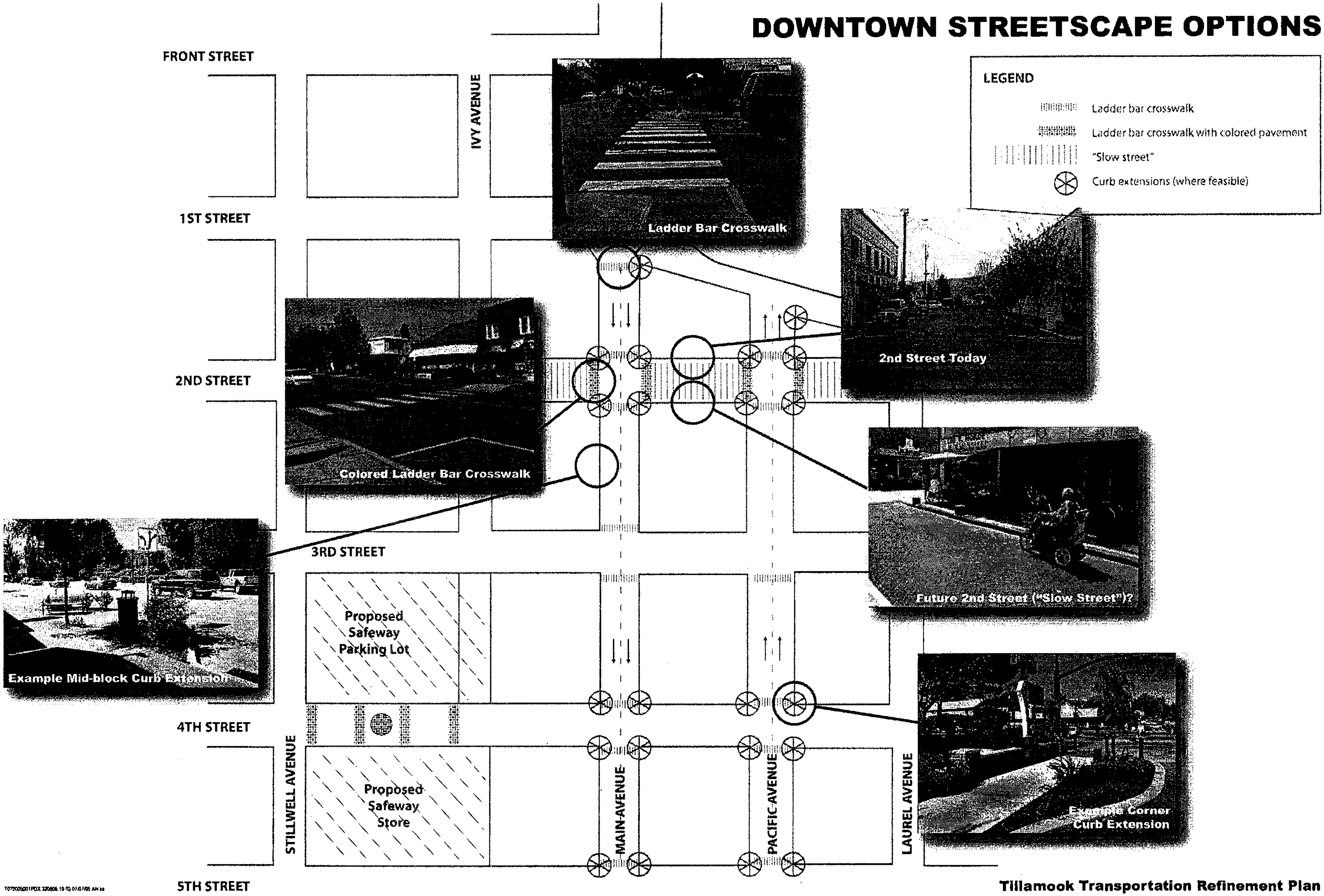
FOR MORE INFORMATION CONTACT

Valerie Grigg Devis
Northwest Senior Transportation Planner
Oregon Department of Transportation
(503) 986-5751
valerie.griggdevis@odot.state.or.us

Mark Gervasi
City Manager
City of Tillamook
(503) 842-2472
mgervasi@tillamookor.gov

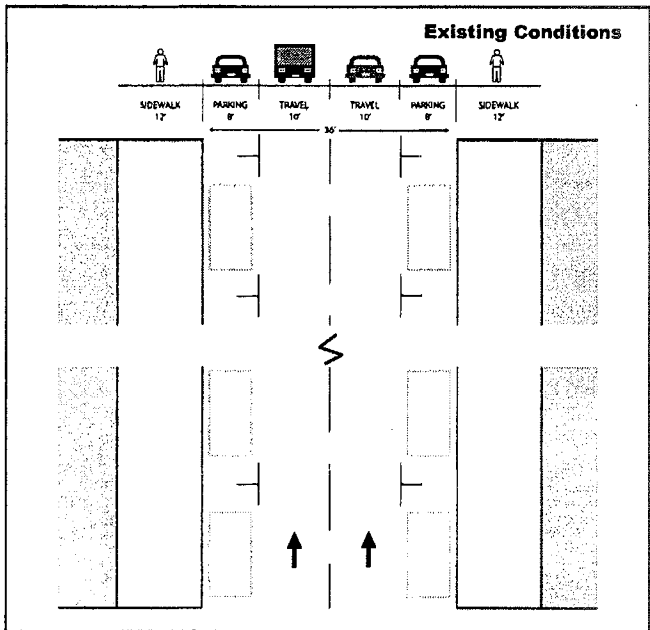
Bill Campbell
Community Development Director
Tillamook County
(503) 842-3408
bcampbel@co.tillamook.or.us

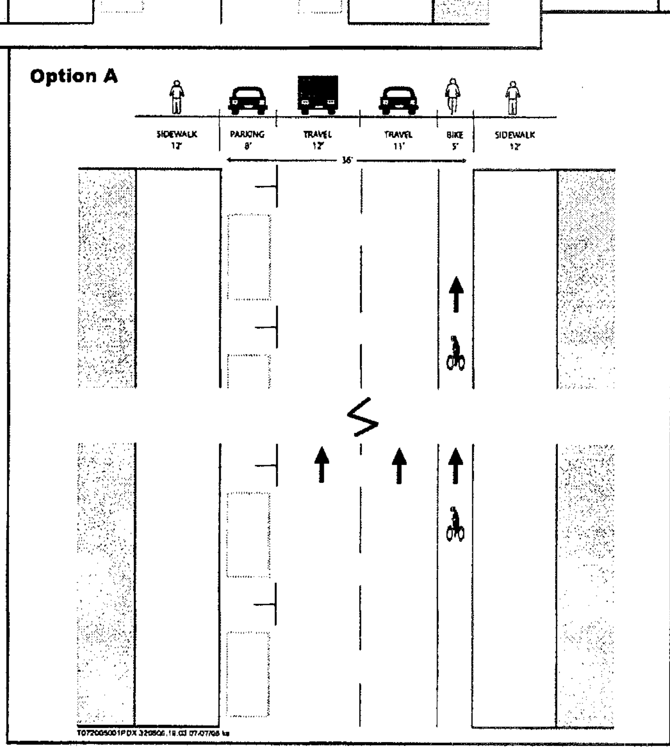
DOWNTOWN STREETSCAPE OPTIONS

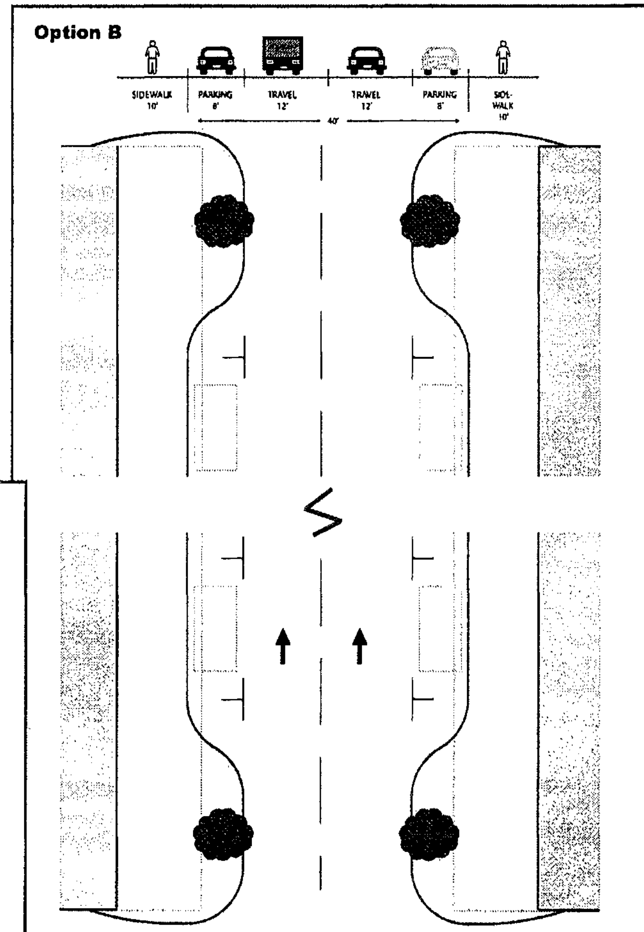


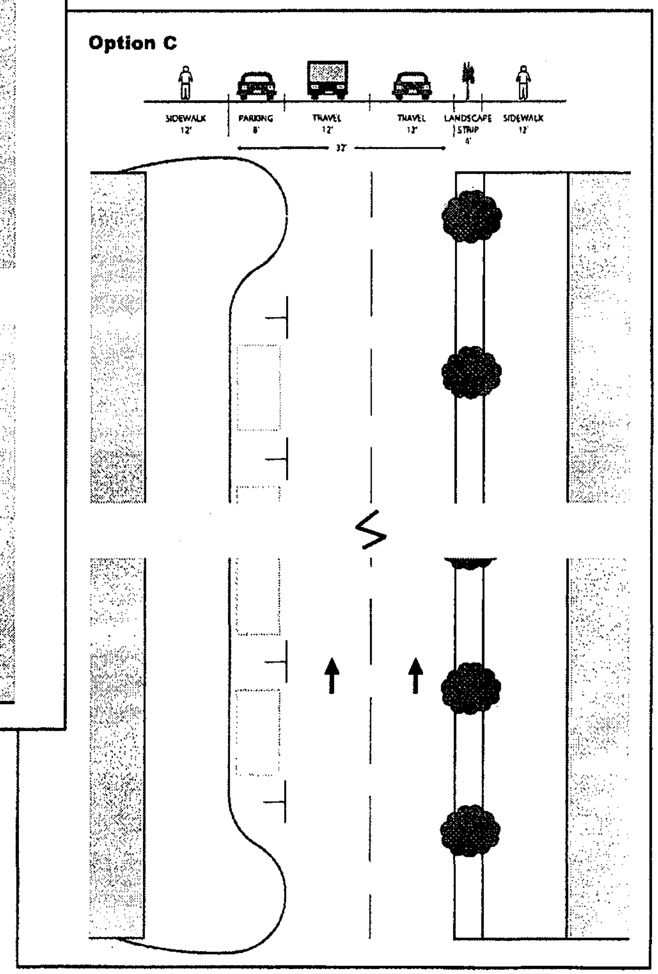
Tillamook Transportation Refinement Plan

MAIN STREET AND PACIFIC STREET DESIGN OPTIONS

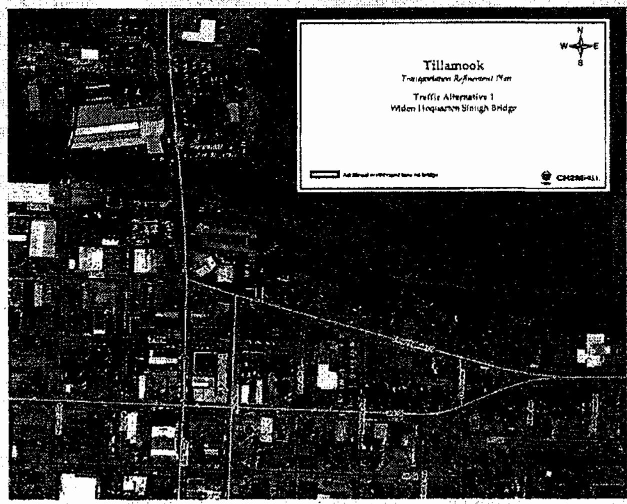


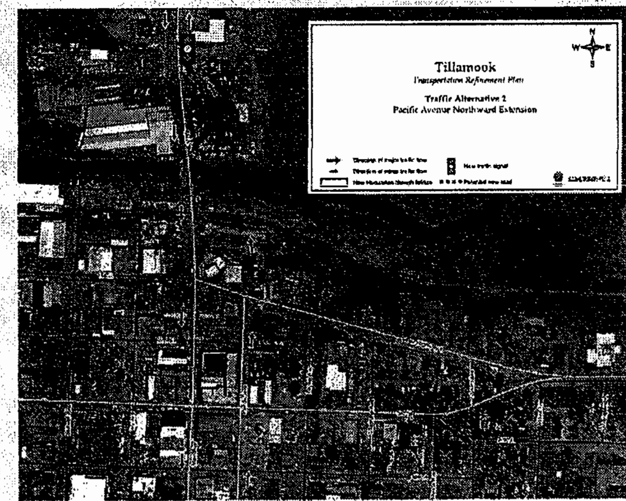


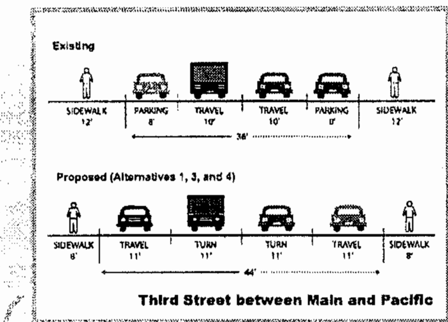


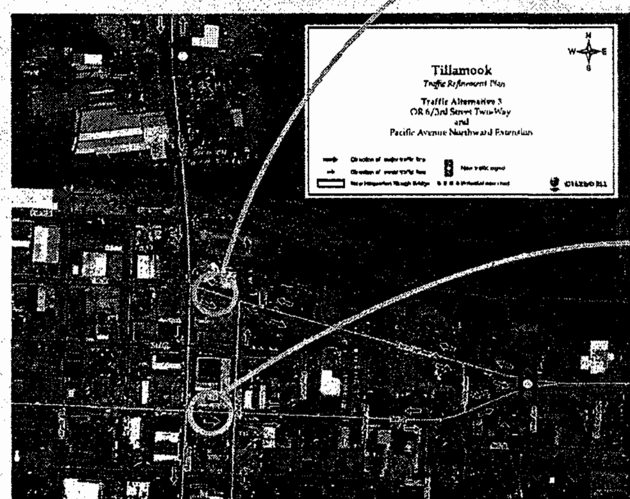


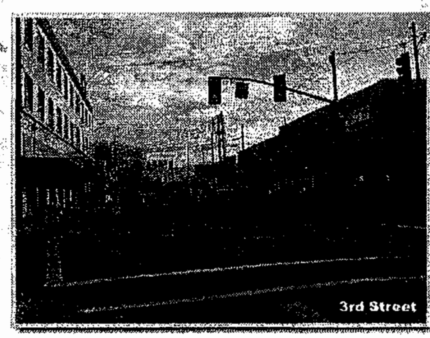
DOWNTOWN TRAFFIC OPTIONS

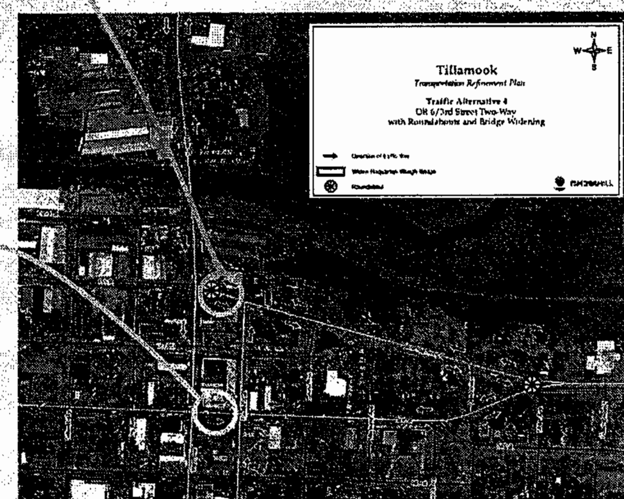




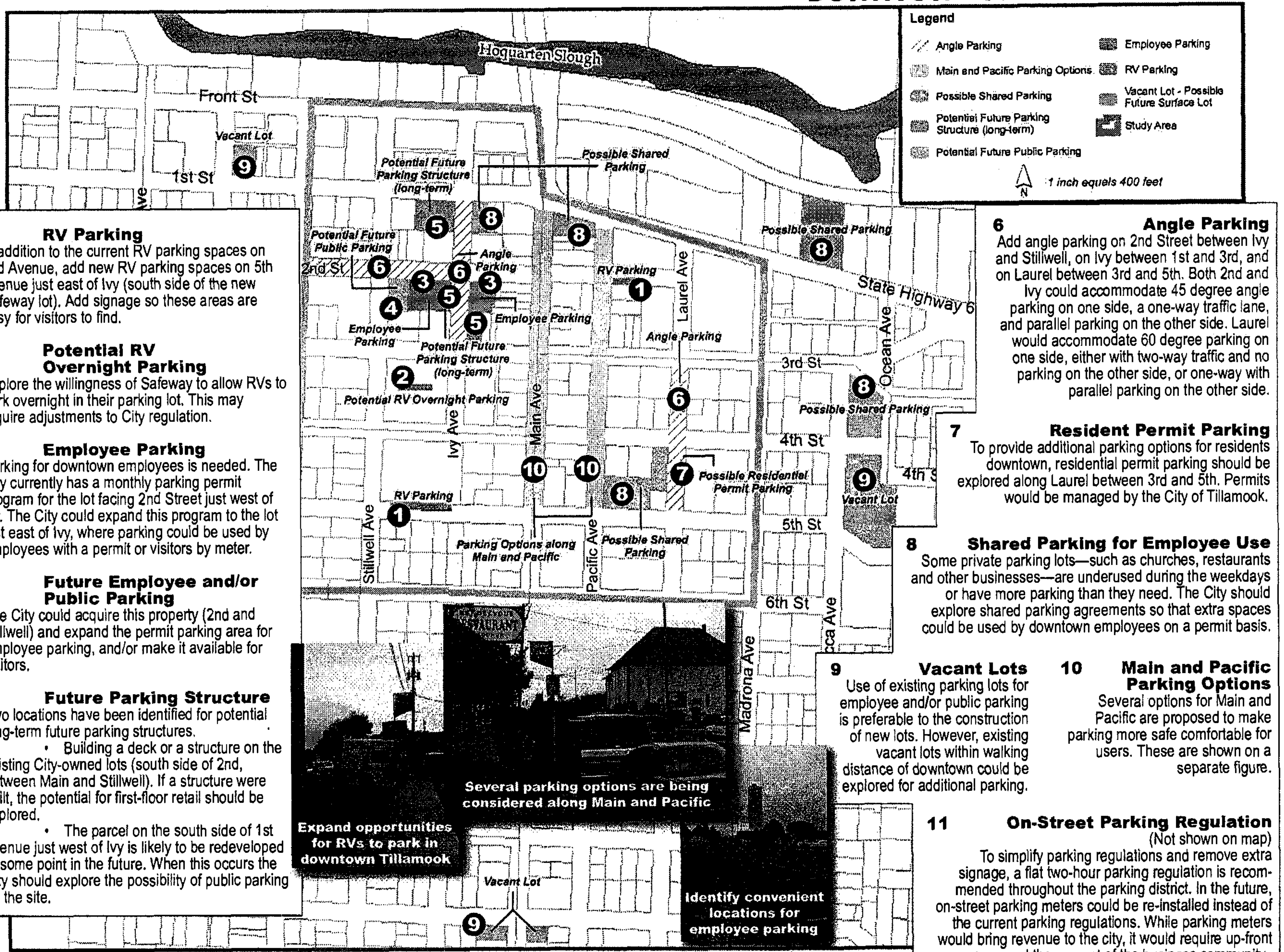








DOWNTOWN PARKING OPTIONS



1 RV Parking
In addition to the current RV parking spaces on 2nd Avenue, add new RV parking spaces on 5th Avenue just east of Ivy (south side of the new Safeway lot). Add signage so these areas are easy for visitors to find.

2 Potential RV Overnight Parking
Explore the willingness of Safeway to allow RVs to park overnight in their parking lot. This may require adjustments to City regulation.

3 Employee Parking
Parking for downtown employees is needed. The City currently has a monthly parking permit program for the lot facing 2nd Street just west of Ivy. The City could expand this program to the lot just east of Ivy, where parking could be used by employees with a permit or visitors by meter.

4 Future Employee and/or Public Parking
The City could acquire this property (2nd and Stillwell) and expand the permit parking area for employee parking, and/or make it available for visitors.

5 Future Parking Structure
Two locations have been identified for potential long-term future parking structures.

- Building a deck or a structure on the existing City-owned lots (south side of 2nd, between Main and Stillwell). If a structure were built, the potential for first-floor retail should be explored.
- The parcel on the south side of 1st Avenue just west of Ivy is likely to be redeveloped at some point in the future. When this occurs the City should explore the possibility of public parking on the site.

6 Angle Parking
Add angle parking on 2nd Street between Ivy and Stillwell, on Ivy between 1st and 3rd, and on Laurel between 3rd and 5th. Both 2nd and Ivy could accommodate 45 degree angle parking on one side, a one-way traffic lane, and parallel parking on the other side. Laurel would accommodate 60 degree parking on one side, either with two-way traffic and no parking on the other side, or one-way with parallel parking on the other side.

7 Resident Permit Parking
To provide additional parking options for residents downtown, residential permit parking should be explored along Laurel between 3rd and 5th. Permits would be managed by the City of Tillamook.

8 Shared Parking for Employee Use
Some private parking lots—such as churches, restaurants and other businesses—are underused during the weekdays or have more parking than they need. The City should explore shared parking agreements so that extra spaces could be used by downtown employees on a permit basis.

9 Vacant Lots
Use of existing parking lots for employee and/or public parking is preferable to the construction of new lots. However, existing vacant lots within walking distance of downtown could be explored for additional parking.

10 Main and Pacific Parking Options
Several options for Main and Pacific are proposed to make parking more safe comfortable for users. These are shown on a separate figure.

11 On-Street Parking Regulation
(Not shown on map)
To simplify parking regulations and remove extra signage, a flat two-hour parking regulation is recommended throughout the parking district. In the future, on-street parking meters could be re-installed instead of the current parking regulations. While parking meters would bring revenue to the city, it would require up-front expense and the support of the business community.

Tillamook Transportation Refinement Plan

Truck and Through-Traffic Options

Tillamook, OR

Location of Preliminary Alternatives

Legend

- Highways
- Local Roads
- Railroads
- City Limits
- **A1** Downtown Tillamook
- **B1** Tillamook Lumber Mill
- **C1** North of Oregon 6
- **D1** South of Oregon 6

N W E S

0 1,250 2,500 3,750 5,000

Feet

CH2MHILL

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Tillamook Truck and Through Traffic Options

- A number of options are under consideration to improve the safety and efficiency of truck traffic and other through traffic as it moves through Tillamook.
- The options have been divided up geographically as shown in the tables and the map. worth further study
- All of the options recommended for further consideration will be formally evaluated prior to making a recommendation.

A. DOWNTOWN TILLAMOOK

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
A1. Main/Pacific re-design options (wider lanes, narrower sidewalks, curb extensions, etc.)	Several options proposed Seeks to improve balance between all modes and downtown users See other graphics for illustrations	Yes
A2. OR 6/3rd Street Two-Way traffic	Reduces significant number of truck trips on US 101 between 1st Street and 3rd Street Reduces intersection congestion See other graphics for illustrations	Yes
A3. Pacific Avenue Northward Extension	Reduces congestion (including for trucks) in downtown Tillamook Conflicts with existing land uses See other graphics for illustration	Yes
A4. Redesign OR 6/US 101 intersection	Reduces congestion, improves safety Potential conflicts with existing land uses See other graphics for illustration	Yes
A5. Use abandoned railroad (old Front Street) north of OR 6	Connection to OR 6 problematic due to grade separation Benefit appears limited Conflicts with Slough trail plans	No

B. TILLAMOOK LUMBER MILL

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
B1. Internal layout and circulation changes to reduce trips through Tillamook	Make 3rd Street best access for all trucks traveling to/from the north or east Make 10th Street best access for all trucks traveling to/from south	Yes
B2. Use DelMonte Ave as primary north access to Mill from OR 6	This is the existing condition – recently rebuilt. Disadvantages include adjacent park, nearby school, and railroad crossing.	Yes
B3. Trout Ave northward extension as primary access to Mill from OR 6	>10% grade presents fatal flaw	No
B4. Evergreen Dr northward extension as primary access to Mill from OR 6	>10% grade presents fatal flaw	No
B5. OR 6 Buttonhook/ramp to 3rd at Evergreen	Would require significant structure and would not accommodate all movements Would conflict with land uses between 3rd St, OR 6	No
B6. Marolf Loop northward extension as primary access to Mill from OR 6	Grade is less than at Evergreen Would increase truck traffic on east end of 3rd Street (residential)	Yes
B7. Wilson River Loop as primary access to Mill from OR 6	Would increase truck traffic on east end of 3rd Street (residential) Depends on OR 6/WR Loop intersection solution	Yes
B8. Schild Road/3rd Street as primary access to Mill from OR 6	Would increase truck traffic on east end of 3rd Street (residential) Depends on OR 6/WR Loop intersection solution	Yes
B9. Use existing 11th Street instead of 10th for Mill access	Street includes multi-family residential building and some commercial uses Appears to be detrimental to 11th in proportion with benefits to 10th – not worth the switch	No
B10. Use new/extended 12th Street instead of 10th for Mill access	Could provide new direct street with few or no conflicting uses between US 101 and Miller But 12th includes High School and Head Start– new connection would increase traffic and trucks Extension would have some impact on existing structures and water/wetland areas	No

C. NORTH OF OR 6

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
C1. Signal at US 101 and Latimer Rd.	Safety/operations improvement – currently under design.	Yes
C2. Wilson River Loop/OR 6 intersection improvement	Interchange currently under design	Yes
C3. N-S Bypass on railroad R/W, adjacent to railroad tracks (north of OR6)	Efficient bypass – but high cost, low feasibility Could provide direct connection to Mill. Assumes RR already raised out of floodplain Impacts on resource lands, UGB issues. Would require interchange-type facility and overpass at OR 6	No
C4. NW/SE diagonal bypass across resource lands	Efficient bypass Resource land/UGB impacts and costs assumed to be fatal flaw	No
C5. Latimer Road/Wilson River Loop intersection improvements	Would require new bridge and related improvements to improve truck turning efficiency	Yes
C6. Latimer Road pavement improvements	Improve pavement for existing and future truck traffic – consistent with functional classification Truck traffic conflicts with residential uses adjacent to road	Yes
C7. Latimer Road frontage/backage road	Reduce impacts of truck traffic by creating separate access road(s) Would create many new impacts; low feasibility	No
C8. Relocate Averill Trucking south of downtown Tillamook (to Port of Tillamook Bay? co-locate at Lumber Mill?)	Could reduce truck trips through downtown Solution would need to work well for existing business	Yes
C9. Impoved signage for Front Street alt. truck route	Encourage trucks heading WB on Netarts Highway from US 101 north to use Front Street Would remove some trips on Main between 1st and 3rd	Yes
C10. Signage to encourage use of Latimer/Wilson River Loop bypass route	Not recommended because roads are not improved to truck route standards ODOT would by unlikely to approve	No

D. SOUTH OF OR 6

NAME/DESCRIPTION	SUMMARY	CONSIDER FURTHER?
D1. Intersection improvements (turn lanes, etc.) at US 101 and Long Prairie Rd	Would make truck turns to/from Long Prairie Rd easier/safer especially in peak periods These improvements are currently under design	Yes
D2. N-S Bypass on railroad R/W, adjacent to railroad tracks (south of OR6)	Efficient bypass – but high cost, low feasibility Could provide direct connection to Mill. Assume RR already raised out of floodplain Assume some impacts on resource lands, UGB issues. Would require interchange-type facility and overpass at OR 6	No
D3. SW-NE diagonal bypass across resource lands	Efficient bypass Resource land/UGB impacts and costs assumed to be fatal flaw	No
D4. Olson/Trask/3rd Street – change stop control to Olson/Trask is free and 3rd is stop controlled	Appears feasible although grade may be an issue for sight distance/safety.	Yes
D5. Improvements to Trask River Road/Long Prairie Loop to promote use as bypass (in general)	Infeasible to reconstruct roads to truck standards (e.g., lane widths, shoulder, grades) – in particular Trask River Road Instead, maintain to existing functional classification standards (major collector) to continue use as unofficial bypass for minority of vehicles	Yes
D6. McCormick Loop extension at south across river to Long Prairie Road (in general)	McCormick Loop existing conditions and functional class (minor collector) inconsistent with use as truck bypass – narrow, rural residential	No
D7. Better connection and alignment between Schild Road and McCormick Loop	Only one adjacent building on Schild Rd Still expect stop control because of grade differences	Yes
D8. Johnson Creek Bridge – remove weight restrictions	Eliminate weight restrictions from Trask River Road bypass Bridge replacement currently under design	Yes
D9. Signage to encourage use of Trask River Road/Long Prairie Road bypass route	Not recommended because roads are not improved to truck route standards ODOT would be unlikely to approve	No

Tillamook Refinement Plan
Truck Transportation Study and *Downtown Safety and Parking Plan*

Refinement Plan Advisory Committee
Meeting #4

Thursday, September 22, 2005, 6:00 p.m. – 8:00 p.m.
Oregon Department of Forestry
5005 East 3rd Avenue, Tillamook

Agenda

6:00 Introduction

- Welcome
- Introductions
- Review agenda

6:10 Activities Since Last Meeting

- Farmer's Market booth (July)
- Additional pedestrian data collection (May and August)
- Additional traffic analysis (roundabouts)
- 2nd Street parking options
- Funding of "D-STIP" project for US 101 and OR 6 intersection

6:30 Packaging and Evaluation of Refinement Plan Options (Part I)

- Alternate Truck Routes
- Tillamook Lumber Mill Options
- Downtown Traffic Alternatives
- Main and Pacific Street Design Alternatives
- Downtown Parking Recommendations

7:45 Next Steps

- October Advisory Committee meeting to continue review of evaluation results (date?)
- November Advisory Committee meeting and Public Open House to present Draft Refinement Plan (date?)
- Revised Draft Refinement Plan and Adoption Process
- Final Plan

8:00 Adjourn

Tillamook Refinement Plan - Advisory Committee

SIGN-IN

9/22/05

1) Alex Cousins	Jeanne Lawson Assoc.	503/235-5881
2) JAMIE LANE	ODOT	503-338-8817
3) Valerie Grigg Devis	ODOT Planning	503 986-5751
4) David Mattison	City of Tillamook	503 842-3443
5) Carolyn Decker	City of Tillamook Council	503-842-8271
6.) Mike Lipke	Hampton Lumber/Tillamook Lumber	(503) 780-2855
7) Mark Labhart	Tillamook County	503-842-3403
8 Norm Myers	Tillamook County Traffic Safety	503-842-2882
9. Dwight Guenther	Dist. 9 Transportation	503-842-2601
10 Dana Clay	Green Diamond Resource Co	503-842-3180
11 Sally Clay	TDpt dSClay@oregon[illegible]	503 [illegible]
Doug Henson	City Council	842-5378
Bill Campbell	Tillamook County TCD	842 3408
Aaron Buko	Tillamook County - P.W.	842-3419
Suzanne Weber	Till City Council	503 842.5612
Gary Hanenkrat	TCCA	503-842-4481
Shawn Reiersgaard	TCCA	503-815-1338
Barry Mammano	Gaunder Equip Mgmt	503-355-2526
Elaine Hungerford	Interested citizen	503-842-7411
TED HUNGERFORD	" "	" " 7411

Tillamook Refinement Plan
Truck Transportation Study and *Downtown Safety and Parking Plan*

Refinement Plan Advisory Committee
Meeting #5

Tuesday, October 11, 2005, 6:00 p.m. – 8:00 p.m.
Tillamook County Courthouse, 2nd Floor (BOC Hearing Room)
201 Laurel Avenue, Tillamook

Agenda

6:00 Introduction

- Welcome
- Introductions
- Review agenda

6:10 Evaluation and Discussion of Refinement Plan Options (Part II)

- Downtown Traffic Alternatives
- Main and Pacific Design Alternatives

7:45 Next Steps

- Wednesday, November 30 - Public Open House and final Advisory Committee meeting to present Draft Refinement Plan
- December – Prepare Revised Draft Refinement Plan
- Early 2006 - Adoption Process and Final Plan

8:00 Adjourn

Tillamook Refinement Plan
RPAC Meeting #5

10-12-05

Name	Affiliation	Phone	Sandwich
Alex Cousins	JLA	(503) 235-5881	Chicken salad
Valerie Grigg Devis	ODOT	503-986-5751	Veggie/wheat
Bill Campbell	TILCO/TCD	503 842 3408	TOO soon. Cored oldus turn. atu
MARK GERVASI	CITY/TILL.	503-842-2472	VEGGIE
Laren Woolley	DLCD Field rep.	541-563-3745	Roast Beef/swi
David Mattison	City of Tillamook	(503) 842-3443	Tuna salad CUT FOR SAF
T. WRIGHT	CITY OF TILLAMOOK	842-2522	CHICKEN ?
Brenda Bower	City of Tillamook	842-2522	Chicken or Turi
BARRY MANNING	GRUNDER EQUIPMENT	355-2526	" "
Alene Allen	citizen - 1102 5th St Till.	842 7188	" "

(would like more info & notice of meetings

MEETING SUMMARY

Tillamook Transportation Refinement Plan
Public Open House: Tillamook Forestry Center
November 30, 2005

A public open house was held on Wednesday, November 30, 2005 from 5:00 p.m. until 7:00 p.m. at the Tillamook Forestry Center, on Third Street in Tillamook. The purpose of the meeting was to give downtown businesses, residents, agencies and other interested parties an opportunity to come and talk with project staff and learn more about the draft Tillamook Transportation Refinement Plan being presented. The draft plan had been developed as a result of five previous Project Advisory Committee meetings and two community workshops held in 2005. Approximately 30 people attended the meeting. Participants were asked to complete a questionnaire and provide their input about the draft plan. Nine completed questionnaires were turned in.

The questionnaire consisted of the following:

Please tell us what you think about the proposed transportation solutions being presented tonight:

1. Alternate Truck Route Options (Outside of Downtown)
2. Tillamook Lumber Mill Options
3. Main and Pacific Design Alternatives (US 101 Couplet)
4. Downtown Traffic Alternatives (Intersection of US 101 and OR 6)
5. Downtown Parking Options
6. Other Comments

Overall, the comments were supportive of the ideas contained in the draft Refinement Plan. Many of the respondents included additional ideas for consideration.

The following is a compilation of the comments received from the questionnaires:

1. **Alternate Truck Route Options (Outside of Downtown)**
(Two of nine people responded to this question)

- *Anything is better than what we are dealing with now*
- *Some good options here – they need to be done well enough to attract truckers to use them.*

2. **Tillamook Lumber Mill Options**
(Four of nine people responded to this question)

- *I like the idea of two full access routes to the mill from Third and Tenth Streets – I am a property owner on Tenth Street.*
- *Great ideas here if you can persuade Hampton to play ball – making it possible to change truck access is critical to improving downtown traffic.*

- *This is the single most challenging obstacle to work with. Hope the options to take truck traffic off Tenth Street work out.*
- *Suggest the Mill and City consider moving Tenth Street truck access to Eleventh. There is a tight curve on Tenth that is a hazard to two-way traffic. The cost to move their entrance should not be prohibitive. Eleventh Street is wider than Tenth.*

3. **Main and Pacific Design Alternatives (US 101 Couplet)**
(Four of nine people responded to this question)

- *In spite of the loss of parking, I think restricting the parking at upstream corners (?) would greatly enhance safety.*
- *A bad idea for the amount of out of town travelers we get. A nightmare for recreational vehicles towing trailers or second vehicles. A nightmare for large vehicles.*
- *I am personally not a fan of curb extensions – primarily because there is often a big difference between the planned extension and the actual construction. These are often awkward to use for vehicles, while of great benefit to pedestrians.*
- *I like the roundabout and having Highway 6 a two-way street.*

4. **Downtown Traffic Alternatives (Intersection of US 101 and OR 6)**
(Five of nine people responded to this question)

- *I think two-way traffic on First and Third streets would only add to the confusion. Tourists already have enough trouble figuring it out. An additional lane over Hoquarten would certainly improve traffic flow.*
- *Definitely pursue Alternative 4. This would solve east-west gridlock on Highway 6. This would really solve US 101 north-south gridlock.*
- *Let's not create another Lincoln City with its traffic jams. Need to find a way to keep the traffic moving (the roundabout idea) and not stop it. Whatever is done in the short-term should not hinder a longer-term solution.*
- *Another lane on the Hoquarten Slough Bridge is badly needed. The suggested changes into two-way and one-way merit careful consideration.*
- *Seem to be covering all of the bases here. Looks like widening the bridge would be simplest. Roundabouts need to be doubly advantageous to overcome the confusion most drives have when encountering them.*

5. **Downtown Parking Options**
(Seven of nine people responded to this question)

- *I think overnight parking for RV's in the new Safeway parking lot is unrealistic. Safeway is going to experience a lot of non-customer use on a day-to-day basis. Putting too many expectations on them may force them to close their lot. I really like the ideas about additional parking around Second and Ivy, etc.*
- *Alternate 1 may work at Stillwell and Fifth. Not a real advantage at Second and Pacific. Competes with wide local transit buses.*
- *My favorite idea is multi-level off-street parking. I don't like parking along 101 on Main especially. Diagonal parking option would be an improvement.*
- *I've never experienced parking difficulty but the City certainly needs to plan for the future, particularly after the Safeway and library construction is completed.*

- *I know the option of taking parking away from one side of Main is not popular, but it would certainly encourage more people to stop because there would be more room in each lane for cars and trucks.*
- *Good, innovative thinking.*
- *Parking structures should be explored. One-way street changes should go all one direction on a street (Second Street should not have opposite directions on either side of Main). One-way's should be no more than one block apart in opposite directions.*

6. **Other Comments**
(Five of nine people responded to this question)

- *Definitely do Main and Pacific Street widening from First to Fifth Streets. Encourage PUD beautification grants – put electrical service lines underground (reference Joseph, OR, also Illinois Valley town). Encourage USDA rural development grants – ease of use for farm and forest trucks. Definite safety improvement project.*
- *Better bike route signing through town. Consider non-motorized human transport options like carts and bicycle trailers in Tillamook city core. Sidewalks and curb lane areas should be able to support a little wider uses than the average pedestrian.*
- *None of this is earth-shocking change; it all looks pretty reasonable to do.*
- *Looking forward to development. Would appreciate feedback on the Tenth Street truck access (John Coopersmith – 812-2052)*
- *Offset curbs – a real pedestrian safety and vehicular liability reduction project. Alternative – place pedestrian crossing lights – costly and somewhat of a traffic impediment.*

Tillamook Transportation Refinement Plan

Open House

November 30, 2005

Name	Affiliation	Address (including city and zip code)	Phone Number	E-mail
A. D. "Gus" Meyer	TEP, SWCD	1715 Skyline Dr., Tillamook, OR, 97141	503-815-8449	abmeyer@Pacifier.com
[illegible] Kalkhoven	NW ACT	Po Box 217 Nehalem OR 97131	368-6770	shirley[illegible]@nehalemtel.net
Alene Allen	Citizen	1102 5th St Tillamook OR 97141	503-842-7185	
[illegible]		175 [illegible] North	842-6436	
Chris Kell	TCTD/citizen	13485 Trask Rv Rd Tillamook	842-5800	kell@oregoncoast.com
GEORGINE BEVERIDGE	NONE	1009 Meadow Ave. Tillamook	842-3709	
DAVID WELLS	SELF	2390 NIELSEN RD TILLAMOOK	842-2545	
Sandy Hemenway	Tillamook Chamber	3705 Hwy 101 N. Tillamook	842-7525	tillchamber@oregoncoast.com
Larry Ksionzyk	DLCD	Salem	373-0050 x 278	Larry.Ksionzyk@state.or.us
Barry Mammano	[illegible] Equipment	PO Box 171 Rockaway 97136	355-2520	Biddie oregon coast.com
Aaron Sulco	Till Co P.W.		842-3419	
[illegible]		10035 FAIRVIEW RD 97141	842-5124	
Michael Morgan	Tillamook PUD	4205 [illegible] St.	842 815 8628	mmorgan@tpud.org
Carolyn H. Decker	Tillamook	805 Manor Place	842-8271	Carolyn H.@oregoncoast.com
David Mattison	City of Tillamook	210 Laurel Ave, Tillamook 97141	842-3443	dmattison@tillamookor.gov
GARY HONENKAMP	TCCA	PO Box 313 Tillamook, Or 97141	842-4481	
Dana H. Clay	Green Diamond Resource Co	PO Box 190 Tillamook, Or 97141	842-3180	dclay@greendiamond.com
SALLY CLAY	TDA	2003 2ND TILLAMOOK OR 97141	842-3145	dsclay@oregoncoast.com
MARK GERVASI	CITY OF TILLAMOOK	210 LAUREL AVE, TILL. OR 97141	842-2472	MGERVASI@TILLAMOOKOR.GOV
Joe Hopp	Headlight-Herald	1908 2nd St. Tillamook OR 97141	842-7535	jhopp@orcoastnews.com
Elaine Hungerford	citizen	980 [illegible] Hwy W Tillamook	842-7411	
Ted Hungerford	"	" " 97141	"	
[illegible]	Hampton Lumber Mills.			
BILL HOLMSTROM	TCTD	4213 MAROLF PL APT D. 97141	842-5748	williamh@gmail.com

Tillamook Transportation Refinement Plan

Open House

November 30, 2005

Name	Affiliation	Address (including city and zip code)	Phone Number	E-mail
Mark Labhart	Tillamook Co.	201 Laurel	842-3403	mlabhart@co.tillamook.or.us
Rick Adams	Tillamook Fire	2310 4th	842-7587	tillamookfire@ [illegible]-net
Norm Myers	Till. Co. Traffic Safety	312 Stillwell Av	842-2852	PCA@OregonCoast.Com
Bob Reed	Road Advisory Committee	5410 Grand Ave Till.	842-5270	AVALON@ [illegible] .COM
Heather Ornelas	TCTD, NWACT	510 Madison	815-8283	ornelas@tillamookbus.com
BOB MC PHEETERS	Tillamook City	901-STILLWELL - TILLAMOOK 97141	503-8426434	BobMcPheeters11@Earthlink.com
Kathleen Newton	EDCTC + Headlight Herald			

Tillamook Transportation Refinement Plan
Public Open House: Tillamook Forestry Center
November 30, 2005

Please tell us what you think about the proposed transportation solutions being presented tonight:

1. Alternate Truck Route Options (Outside of Downtown):

2. Tillamook Lumber Mill Options:

3. Main and Pacific Design Alternatives (US 101 Couplet):

PLEASE FILL OUT OTHER SIDE

4. Downtown Traffic Alternatives (Intersection of US 101 and OR 6):

5. Downtown Parking Options:

6. Other Comments:

Thank you for taking the time to tell us what you think. Please put this form in one of the comment boxes when you are done. If you prefer to mail this form in later, comments will be accepted through December 15, 2005.

Mail this form to:

Jeanne Lawson Associates
Attn: Alex Cousins
1110 SE Alder Street, Suite 301
Portland, OR 97214

Tillamook Refinement Plan
Truck Transportation Study and *Downtown Safety and Parking Plan*

Refinement Plan Advisory Committee
Meeting #6

Wednesday, November 30, 2005, 7:30 p.m. – 9:00 p.m.
Oregon Department of Forestry
5005 East 3rd Avenue, Tillamook

Agenda

7:30 Introduction

- Welcome
- Review agenda

7:40 Review and Discuss Draft Refinement Plan

- Comments heard from general public at Open House
- Comments from Advisory Committee
- Summarize any revisions to Draft Plan

8:50 Next Steps

- December – Prepare Revised Draft Refinement Plan
- Early 2006 - Adoption Process and Final Plan

9:00 Adjourn

Tillamook Transportation Refinement Plan: Advisory Committee Meeting #6 (November 30, 2005)

ATTENDEES:

Committee Members
Rick Adams
Dana Clay
Sally Clay
Gary Hanenkrat
Sandie Hemenway
Mark Labhart
Mike Lipke
Barry Mammano
Norm Myers
Kathleen Newton
Carolyn Decker
Heather Ornelas
Bob Reed

Staff/Consultants
Tim Burkhardt
Bill Campbell
Mark Gervasi
Valerie Grigg Devis
David Mattison
Brandy Steffen

FROM: Tim Burkhardt, CH2M HILL

DATE: December 19, 2005

Discussion Summary

Following the public open house, dinner was served at 7:15 pm and the committee began discussing the Draft Refinement Plan. Tim Burkhardt opened the discussion by saying that the purpose of this meeting was to review and discuss the Draft Tillamook Transportation Refinement Plan, presented just prior to the meeting at a public open house.

After a brief review of the project to date, the conversation shifted to the issue of parking. Valerie confirmed that ODOT had reviewed the addition of diagonal parking to Ivy & 2nd and approved it with respect to the state highway. Tim indicated that, under a separate contract, CH2M HILL was preparing a site plan for TCTD for a second parking concept on 2nd Street that would include a transit center and related facilities. The result will be a concept for discussion by the City and TCTD but this option will not be included in the Refinement Plan. The key issue will be the net impact of the concept on parking.

Main & Pacific alterations were discussed. The modified bump-out was a concern for ODOT for pedestrian safety issues and committee members raised the concern over truck turning radius and taking up multiple lanes. Other committee members were supportive. While the modified bump-out was a compromise compared to a full bump-out, it was not the preferred option of the plan. Some mentioned that this modified bump out was good because it did not impede the truck turning motion. Norm Myers mentioned that this would require an educational process for pedestrian safety. It was also mentioned that the wheelchair sloping to the street would help delineate the curb area/bump out from the street.

A question was raised regarding adding angled parking on 2nd and the safe distance from the crosswalk when cars were backing out of spaces. Someone recommended adding loading zones between the parking spaces and crosswalk to create a buffer zone. Metered parking was also discussed as an alternative for supplying employees with parking spaces near their job.

County Commissioner Mark Labhart then raised the question that when this plan was put to the County, whether this committee would support it. He reframed the question by asking, "Is there anyone who can't live with something in here?" One of the committee members asked to hear whether Hamptom Mill would support it. Mike Lipke responded that the recommendations for the Mill were within the realm of possibility thought they may not be the final solution. He said that he is willing to be involved in the real solution. When pressed about the plan as it stands, he said that it looks good.

This lead to a discussion of whether the lumber mill entrance on 10th Street could be moved to 11th Street. It was mentioned that this would move trucks away from this mostly residential street to a less residential street, but closer to the High School and a Head Start facility. It would also be a substantial, non-profitable investment for the lumber mill. However, Mike said that the mill was interested in being a good neighbor. He also said that for options on the Mill site in general, not all of the decision for this topic rested with the mill, but also with the Port of Tillamook Bay since the railroad runs through the mill.

Mark Labhart indicated that the weight of this committee meant a lot and asked his question again. Norm Myers said that the plan did not do enough and he would like a truck and automotive bypass route around the city. There was a lot of discussion on this topic. About three committee members felt strongly that the plan did not go far enough with respect to a bypass. Other members pointed out that this plan did not limit future development of a bypass. Based on the overall goals and objectives of the study and the feasibility of a bypass route, the plan focuses on the city itself and solutions for the problem using the existing state highways. Valerie also mentioned the issue and expense of a traffic model, which does not exist for Tillamook, as a prerequisite for a true bypass study. After discussion about the feasibility of a bypass route and the scope of this particular plan, the committee members who wanted a bypass agreed that the refinement plan was a good start in the right direction.

Heather Ornelas said that she was uncomfortable with the term "roundabout" being used in the alternatives section and that a more general "traffic alternatives" should be used since some people do no like roundabouts and no option has yet been selected. Her concern was about that roundabouts can be controversial and the potential delay that could be created by this word choice.

Several committee members felt that provision of RV parking was lacking in the plan. There was more discussion on this topic, including several proposals for solving the problem. It was concluded that the plan did not limit RV parking improvements but that further identification of specific solutions would be up to the City.

Mark Labhart asked again whether the committee supported the plan and, hearing no negative responses, he asked if there should be a vote. Dana Clay made a motion for the Advisory Committee to approve the plan and Barry Mammano seconded the motion. All committee members present voted in the affirmative. There were no dissenting or abstaining votes.

The committee meeting then concluded at around 8:30 pm.

Action Items

- Alert Committee members when the final plan is put to the City and County of Tillamook for adoption.
- Add the Port of Tillamook Bay to the secondary implementation role column for the Tillamook Lumber Mill in the implementation table
- Send out a copy of the final report to all committee members
- Respond to request by Heather Ornelas to change wording in alternatives section for downtown traffic alternatives from "roundabout" to "looking at multiple design alternatives".
- Make a recommendation in the report for a specific RV parking implementation plan within the central downtown area. A few options that were raised included additional parking spaces on Ivy, using the County library site for RVs, creating a shuttle between the old Safeway to downtown, and creating an RV designated parking area.

Next Steps

The revisions discussed during the meeting will be made to the plan prior to beginning the adoption process with the City of Tillamook and Tillamook County, expected to be completed in the first quarter of 2006. A copy of the Final Plan will be provided to the advisory committee members.

MEMO #15

Cost Estimates

Tillamook Transportation Refinement Plan: Cost Estimates (Memo #15)

PREPARED FOR: File

PREPARED BY: Andra Henriques, CH2M HILL
Tim Burkhardt, CH2M HILL

DATE: January 13, 2006

This memo transmits summaries of the planning-level cost estimates prepared for the recommended projects in the Tillamook Transportaiton Refinement Plan.

Costs to design and construct the various projects were estimated at a planning level. Based on the conceptual design of each project or element, a 40 percent contingency has been included in the construction cost estimate to account for potential unknowns typically identified during preliminary and final design.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Capacity Improvements (Table 5-1)

PROJECT:	(Tillamook Refinement Plan) Improve signage at US 101 and Front Street to encourage trucks to use this existing alternate route.

DESIGN LEVEL: Preliminary	REFERENCE NAME/PHONE		SHEET 1 of 1
KIND OF WORK: Roadway	LENGTH (MI.):	DATE 01/13/2006	NAME

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$36,000	$0
2	Roundabout	EA	0.00	$,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$39,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$5,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$67,000	$0
6	Intersection Widening	EA	0.00	$3,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$5,000	$0
8	Interconnect Signal	LS	0.00	$0,000	$0
9	New Signal	EA	0.00	$40,000	$0
10	Signal Modifications	EA	0.00	$0,000	$0
11	Transit Enhancements	EA	0.00	$5,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$34,000	$0
14	Landscaping	Mi.	0.00	$25,000	$0
15	Bridges	SF	0.00	$50	$0
16	Curb Extensions	EA	0.00	$,500	$0
17	Walls - Structural	LS	0.00	$50,000	$0
18	Signing	EA	1.00	$,000	$,000
19	Striping	SF	0.00	$	$0
20	Decorative Lighting	Mi.	0.00	$,28000	$0
	SUBTOTAL				***$5,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP&DT	3.0-8.0%	8.0%	$0
	Mobiliation	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$7,000***
	Design Engineering	13.0%	13.0%	$,000
	Construction Engineering	10.0%	10.0%	$,000
	TOTAL PROJECT COST			**$9,000**

NOTES:

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT:	(Tillamook Refinement Plan) On Main and Pacific Avenues, between 1st St and 5th St: Add continental style crosswalks at all intersections.				
DESIGN LEVEL: Preliminary		**REFERENCE NAME/PHONE**			**SHEET** 1 of 1
KIND OF WORK: Roadway		**LENGTH (MI.):**		**DATE** 01/13/2006	**NAME**
NO.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL**
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	2,800.00	$4	$11,200
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$11,200***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$1,000
	Mobilization	8.0-10.0%	8.0%	$1,000
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$4,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$17,200***
	Design Engineering	13.0%	13.0%	$2,000
	Construction Engineering	10.0%	10.0%	$2,000
	TOTAL PROJECT COST			**$21,200**

NOTES:

Line 19 - Crosswalks on US 101 only.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 1st St and 5th St: Add advance stop bars and signage before pedestrian crossings.

DESIGN LEVEL: Preliminary	REFERENCE NAME/PHONE		SHEET 1 of 1
KIND OF WORK: Roadway	LENGTH (MI.):	DATE 01/13/2006	NAME

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	720.00	$4	$2,880
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$7,880***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$1,000
	Mobilization	8.0-10.0%	8.0%	$1,000
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$3,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$12,880***
	Design Engineering	13.0%	13.0%	$2,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$15,880**

NOTES:

Line 19 - Stop bars on US 101 only.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 1st St and 5th St: Restrict parking on upstream side of key corners to improve driver-pedestrian visibility.

DESIGN LEVEL: Preliminary	REFERENCE NAME/PHONE		SHEET 1 of 1
KIND OF WORK: Roadway	LENGTH (MI.):	DATE 01/13/2006	NAME

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.04	$15,000	$600
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$5,600***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$2,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$7,600***
	Design Engineering	13.0%	13.0%	$1,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$9,600**

NOTES:

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 1st St and 5th St: Improve lighting at intersections where it is potentially deficient.

DESIGN LEVEL: Preliminary	REFERENCE NAME/PHONE		SHEET 1 of 1
KIND OF WORK: Roadway	LENGTH (MI.):	DATE 01/13/2006	NAME

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.39	$234,000	$91,260
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$91,260***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$2,000
	TP & DT	3.0-8.0%	8.0%	$7,000
	Mobilization	8.0-10.0%	8.0%	$7,000
	Erosion Control	0.5-2.0%	2.0%	$2,000
	Contingency	40.0%	40.0%	$37,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0	$0
	TOTAL CONSTRUCTION COST			***$146,260***
	Design Engineering	13.0%	13.0%	$19,000
	Construction Engineering	10.0%	10.0%	$15,000
	TOTAL PROJECT COST			**$180,260**

NOTES:

Line 13 - This assumes the installation of new illumination.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 6th St and 12th St: Add continental-style crosswalks at all intersections.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	3,920.00	$4	$15,680
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$15,680***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$1,000
	Mobilization	8.0-10.0%	8.0%	$1,000
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$6,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0	$0
	TOTAL CONSTRUCTION COST			***$23,680***
	Design Engineering	13.0%	13.0%	$3,000
	Construction Engineering	10.0%	10.0%	$2,000
	TOTAL PROJECT COST			**$28,680**

NOTES:

Line 19 - Crosswalks on US 101 only.

CH2M HILL
Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT:	(Tillamook Refinement Plan) On Main and Pacific Avenues, between 6th St and 12th St: Add advance stop bars and signage before ped crossings.				
DESIGN LEVEL: Preliminary		REFERENCE NAME/PHONE			SHEET 1 of 1
KIND OF WORK: Roadway		LENGTH (MI.):		DATE 01/13/2006	NAME
NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	1,008.00	$4	$4,032
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$9,032***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$1,000
	Mobilization	8.0-10.0%	8.0%	$1,000
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$4,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$15,032***
	Design Engineering	13.0%	13.0%	$2,000
	Construction Engineering	10.0%	10.0%	$2,000
	TOTAL PROJECT COST			**$19,032**

NOTES:

Line 19 - Stop bars on US 101 only.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 6th St and 12th St: Restrict parking on upstream side of key corners to improve driver-ped visibility.					
DESIGN LEVEL: Preliminary		**REFERENCE NAME/PHONE**			**SHEET** 1 of 1
KIND OF WORK: Roadway		**LENGTH (MI.):**		**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.05	$15,000	$750
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$5,750***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$2,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$7,750***
	Design Engineering	13.0%	13.0%	$1,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$9,750**

NOTES:

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Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 5th St and 12th St: Improve lighting at intersections where it is potentially deficient.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.72	$234,000	$168,480
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$168,480***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$4,000
	TP & DT	3.0-8.0%	8.0%	$13,000
	Mobilization	8.0-10.0%	8.0%	$13,000
	Erosion Control	0.5-2.0%	2.0%	$3,000
	Contingency	40.0%	40.0%	$67,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$268,480***
	Design Engineering	13.0%	13.0%	$35,000
	Construction Engineering	10.0%	10.0%	$27,000
	TOTAL PROJECT COST			**$330,480**

NOTES:
Line 13 - This assumes the installation of new illumination.

CH2M HILL
Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) Narrow the sidewalks on Main and Pacific Avenues between 1st and 5th Streets by 2 feet on each side; widen travel lanes to 12 feet each, maintain 8-foot parking on both sides , and add combination of traditional and off-set curb extensions.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.56	$736,000	$412,160
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.13	$239,000	$31,070
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	1.56	$15,000	$23,400
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	40.00	$1,500	$60,000
17	Walls - Structural	LS	1.00	$250,000	$250,000
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$776,630***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$19,000
	TP & DT	3.0-8.0%	8.0%	$62,000
	Mobilization	8.0-10.0%	8.0%	$62,000
	Erosion Control	0.5-2.0%	2.0%	$16,000
	Contingency	40.0%	40.0%	$311,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$1,246,630***
	Design Engineering	13.0%	13.0%	$162,000
	Construction Engineering	10.0%	10.0%	$125,000
	TOTAL PROJECT COST			**$1,533,630**

NOTES:

Line 1 - This is for the reconstructed sidewalk on Main and Pacific to cut back for the extra travel width.
Line 3 - This is for the reconstructed roadway to be build where the sidewalk is being removed.
Line 7 - Restripe corridor due to shift in lanes.
Line 16 - Assumes some type of curb extension on each corner.
Line 17 -To fix basements below 3rd and Main Street for sidewalk alteration.

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Tillamook Refinement Plan Cost Estimate - Safety Improvements (Table 5-2)

PROJECT: (Tillamook Refinement Plan) On Main and Pacific Avenues, between 1st St and 12th St: Add combination of traditional and off-set curb extensions.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	72.00	$3,000	$216,000
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$216,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$5,000
	TP & DT	3.0-8.0%	8.0%	$17,000
	Mobilization	8.0-10.0%	8.0%	$17,000
	Erosion Control	0.5-2.0%	2.0%	$4,000
	Contingency	40.0%	40.0%	$86,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$345,000***
	Design Engineering	13.0%	13.0%	$45,000
	Construction Engineering	10.0%	10.0%	$35,000
	TOTAL PROJECT COST			**$425,000**

NOTES:

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: Set aside more on-street parking area reserved for RVs.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.05	$15,000	$750
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.25	$5,000	$1,250
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$2,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$1,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$3,000***
	Design Engineering	13.0%	13.0%	$0
	Construction Engineering	10.0%	10.0%	$0
	TOTAL PROJECT COST			**$3,000**

NOTES:

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Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: (Tillamook Refinement Plan) Change parallel parking to angle parking in specified locations along 2nd Street, Ivy Avenue, and Laurel Avenue.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.25	$15,000	$3,750
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$3,750***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$2,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$5,750***
	Design Engineering	13.0%	13.0%	$1,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$7,750**

NOTES:

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Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: (Tillamook Refinement Plan) Simplify parking regulations by establishing a 2-hour time limit throughout town.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$5,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$2,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$7,000***
	Design Engineering	13.0%	13.0%	$1,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$9,000**

NOTES:

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Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: (Tillamook Refinement Plan) Acquire property immediately east of Stillwell Avenue to expand employee and visitor parking.

DESIGN LEVEL: Preliminary		**REFERENCE NAME/PHONE**			**SHEET** 1 of 1
KIND OF WORK: Roadway		**LENGTH (MI.):**		**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$0***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$0
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0	$0
	TOTAL CONSTRUCTION COST			***$0***
	Design Engineering	13.0%	13.0%	$0
	Construction Engineering	10.0%	10.0%	$0
	TOTAL PROJECT COST			**$0**

NOTES:

Cost Estimate To Be Decided

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Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: (Tillamook Refinement Plan) Construct parking structure.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$0***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$0
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0	$0
	TOTAL CONSTRUCTION COST			***$0***
	Design Engineering	13.0%	13.0%	$0
	Construction Engineering	10.0%	10.0%	$0
	TOTAL PROJECT COST			**$0**

NOTES:
Cost Estimate To Be Decided

CH2M HILL
Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: (Tillamook Refinement Plan) Construct one or more surface parking areas on parcels currently vacant, for use by visitors and/or employees.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.16	$239,000	$38,240
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	400.00	$4	$1,600
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$39,840***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$1,000
	TP & DT	3.0-8.0%	8.0%	$3,000
	Mobilization	8.0-10.0%	8.0%	$3,000
	Erosion Control	0.5-2.0%	2.0%	$1,000
	Contingency	40.0%	40.0%	$16,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$63,840***
	Design Engineering	13.0%	13.0%	$8,000
	Construction Engineering	10.0%	10.0%	$6,000
	TOTAL PROJECT COST			**$77,840**

NOTES:

This cost is calculated for 1000 square feet of parking lot.

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Tillamook Refinement Plan Cost Estimate - Parking Improvements (Table 5-8)

PROJECT: (Tillamook Refinement Plan) Reintroduce parking meters.					
DESIGN LEVEL: Preliminary		**REFERENCE NAME/PHONE**			**SHEET** 1 of 1
KIND OF WORK: Roadway		**LENGTH (MI.):**		**DATE** 01/13/2006	**NAME**
NO.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL**
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
21	Parking Meter	EA	455.00	$50	$22,750
	SUBTOTAL				***$22,750***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$1,000
	TP & DT	3.0-8.0%	8.0%	$2,000
	Mobilization	8.0-10.0%	8.0%	$2,000
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$9,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$36,750***
	Design Engineering	13.0%	13.0%	$5,000
	Construction Engineering	10.0%	10.0%	$4,000
	TOTAL PROJECT COST			**$45,750**

NOTES:

Line 21 - In the parking district there are approximately 700 parking stalls. This estimate assumes 70% of the stalls share a two-headed parking meter.

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Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 1st St. to 5th St: Add new landscaping where space allows.					
DESIGN LEVEL: Preliminary		REFERENCE NAME/PHONE			SHEET 1 of 1
KIND OF WORK: Roadway		LENGTH (MI.):		DATE 01/13/2006	NAME
NO.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL**
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.39	$225,000	$87,750
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$87,750***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$2,000
	TP & DT	3.0-8.0%	8.0%	$7,000
	Mobilization	8.0-10.0%	8.0%	$7,000
	Erosion Control	0.5-2.0%	2.0%	$2,000
	Contingency	40.0%	40.0%	$35,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$140,750***
	Design Engineering	13.0%	13.0%	$18,000
	Construction Engineering	10.0%	10.0%	$14,000
	TOTAL PROJECT COST			**$172,750**

NOTES:

Line 14 - This is for landscaping along US 101.

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Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 1st St to 5th St: Add ped scale lighting to improve ped safety and downtown aesthetics.					
DESIGN LEVEL: Preliminary		**REFERENCE NAME/PHONE**			**SHEET** 1 of 1
KIND OF WORK: Roadway		**LENGTH (MI.):**		**DATE** 01/13/2006	**NAME**
NO.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL**
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.39	$2,288,000	$892,320
	SUBTOTAL				***$892,320***

	ADDITIONAL COSTS	**RANGE**	**PERCENTAGE**	**TOTAL**
	Construction Surveying	1.0-2.5%	2.5%	$22,000
	TP & DT	3.0-8.0%	8.0%	$71,000
	Mobilization	8.0-10.0%	8.0%	$71,000
	Erosion Control	0.5-2.0%	2.0%	$18,000
	Contingency	40.0%	40.0%	$357,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$1,431,320***
	Design Engineering	13.0%	13.0%	$186,000
	Construction Engineering	10.0%	10.0%	$143,000
	TOTAL PROJECT COST			**$1,760,320**

NOTES:

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Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 1st St to 5th St: Reconstruct/repair existing sidewalks to make ADA-compatible (curb ramps), improve aesthetics, and allow for new landscaping opportunities.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.04	$736,000	$29,440
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$29,440***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$1,000
	TP & DT	3.0-8.0%	8.0%	$2,000
	Mobilization	8.0-10.0%	8.0%	$2,000
	Erosion Control	0.5-2.0%	2.0%	$1,000
	Contingency	40.0%	40.0%	$12,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$47,440***
	Design Engineering	13.0%	13.0%	$6,000
	Construction Engineering	10.0%	10.0%	$5,000
	TOTAL PROJECT COST			**$58,440**

NOTES:

Line 1 - This price is for both sides of one block.

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Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 1st St to 5th St: Reduce sign clutter by consolidating existing public signs.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$5,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$2,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0	$0
	TOTAL CONSTRUCTION COST			***$7,000***
	Design Engineering	13.0%	13.0%	$1,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$9,000**

NOTES:

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Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 1st St to 5th St: Work with property owners to improve storefronts and business signage to improve aesthetics, create coordinated image, and reduce tunnel effect of existing signage.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**	**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):** / **DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$0***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$0
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0	$0
	TOTAL CONSTRUCTION COST			***$0***
	Design Engineering	13.0%	13.0%	$0
	Construction Engineering	10.0%	10.0%	$0
	TOTAL PROJECT COST			**$0**

NOTES:
N/A - no calculable cost for this project.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 5th St to 12th St: Add new landscaping where space allows.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**		**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):**	**DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.72	$225,000	$162,000
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$162,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$4,000
	TP & DT	3.0-8.0%	8.0%	$13,000
	Mobilization	8.0-10.0%	8.0%	$13,000
	Erosion Control	0.5-2.0%	2.0%	$3,000
	Contingency	40.0%	40.0%	$65,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$260,000***
	Design Engineering	13.0%	13.0%	$34,000
	Construction Engineering	10.0%	10.0%	$26,000
	TOTAL PROJECT COST			**$320,000**

NOTES:

Line 14 - This is for landscaping along US 101 from 5th to 12th Street.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 6th St to 12th St: Add ped scale lighting to improve ped safety and downtown aesthetics.

DESIGN LEVEL: Preliminary	REFERENCE NAME/PHONE		SHEET 1 of 1
KIND OF WORK: Roadway	LENGTH (MI.):	DATE 01/13/2006	NAME

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.72	$2,288,000	$1,647,360
	SUBTOTAL				***$1,647,360***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$41,000
	TP & DT	3.0-8.0%	8.0%	$132,000
	Mobilization	8.0-10.0%	8.0%	$132,000
	Erosion Control	0.5-2.0%	2.0%	$33,000
	Contingency	40.0%	40.0%	$659,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$2,644,360***
	Design Engineering	13.0%	13.0%	$344,000
	Construction Engineering	10.0%	10.0%	$264,000
	TOTAL PROJECT COST			**$3,252,360**

NOTES:

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 6th St to 12th St: Reconstruct/repair existing sidewalks to make ADA-compatible (curb ramps), improve aesthetics, and allow for new landscaping opportunities.

DESIGN LEVEL: Preliminary	REFERENCE NAME/PHONE		SHEET 1 of 1
KIND OF WORK: Roadway	LENGTH (MI.):	DATE 01/13/2006	NAME

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.04	$736,000	$29,440
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$29,440***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$1,000
	TP & DT	3.0-8.0%	8.0%	$2,000
	Mobilization	8.0-10.0%	8.0%	$2,000
	Erosion Control	0.5-2.0%	2.0%	$1,000
	Contingency	40.0%	40.0%	$12,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$47,440***
	Design Engineering	13.0%	13.0%	$6,000
	Construction Engineering	10.0%	10.0%	$5,000
	TOTAL PROJECT COST			**$58,440**

NOTES:

Line 1 - This price is for both sides of one block.

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 6th St to 12th St: Reduce sign clutter by consolidating existing public signs.

DESIGN LEVEL: Preliminary	**REFERENCE NAME/PHONE**	**SHEET** 1 of 1
KIND OF WORK: Roadway	**LENGTH (MI.):** / **DATE** 01/13/2006	**NAME**

NO.	ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	1.00	$5,000	$5,000
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$5,000***

	ADDITIONAL COSTS	RANGE	PERCENTAGE	TOTAL
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$2,000
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$7,000***
	Design Engineering	13.0%	13.0%	$1,000
	Construction Engineering	10.0%	10.0%	$1,000
	TOTAL PROJECT COST			**$9,000**

NOTES:

CH2M HILL

Tillamook Refinement Plan Cost Estimate - Pedestrian and Bike Improvements (Table 5-9)

PROJECT: (Tillamook Refinement Plan) From 6th St to 12th St: Work with property owners to improve storefronts and business signage to improve aesthetics, create coordinated image, and reduce tunnel effect of existing signage.

DESIGN LEVEL: Preliminary		**REFERENCE NAME/PHONE**			**SHEET** 1 of 1
KIND OF WORK: Roadway		**LENGTH (MI.):**		**DATE** 01/13/2006	**NAME**
NO.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL**
1	Curb, Gutter, Sidewalks & Drainage	Mi.	0.00	$736,000	$0
2	Roundabout	EA	0.00	$1,500,000	$0
3	New Roadway	Lane-Mi.	0.00	$239,000	$0
4	Overlay Existing Roadway	Lane-Mi.	0.00	$55,000	$0
5	Reconstruct Existing Roadway	Lane-Mi.	0.00	$267,000	$0
6	Intersection Widening	EA	0.00	$43,000	$0
7	Restriping Existing Roadway	Lane-Mi.	0.00	$15,000	$0
8	Interconnect Signal	LS	0.00	$30,000	$0
9	New Signal	EA	0.00	$140,000	$0
10	Signal Modifications	EA	0.00	$60,000	$0
11	Transit Enhancements	EA	0.00	$25,000	$0
12	Traffic Calming	%	0.00	-	$0
13	Illumination	Mi.	0.00	$234,000	$0
14	Landscaping	Mi.	0.00	$225,000	$0
15	Bridges	SF	0.00	$150	$0
16	Curb Extensions	EA	0.00	$1,500	$0
17	Walls - Structural	LS	0.00	$250,000	$0
18	Signing	EA	0.00	$5,000	$0
19	Striping	SF	0.00	$4	$0
20	Decorative Lighting	Mi.	0.00	$2,288,000	$0
	SUBTOTAL				***$0***

	ADDITIONAL COSTS	**RANGE**	**PERCENTAGE**	**TOTAL**
	Construction Surveying	1.0-2.5%	2.5%	$0
	TP & DT	3.0-8.0%	8.0%	$0
	Mobilization	8.0-10.0%	8.0%	$0
	Erosion Control	0.5-2.0%	2.0%	$0
	Contingency	40.0%	40.0%	$0
	Escalation (per year)	0.5-2.0%	0.0%	
	-current year		0.0%	$0
	TOTAL CONSTRUCTION COST			***$0***
	Design Engineering	13.0%	13.0%	$0
	Construction Engineering	10.0%	10.0%	$0
	TOTAL PROJECT COST			**$0**

NOTES:

N/A - no calculable cost for this project.

MEMO #16

Funding Options

Tillamook Transportation Refinement Plan: Funding Options (Memo #16)

PREPARED FOR: Valerie Grigg Devis, ODOT

PREPARED BY: Tim Burkhardt, CH2M HILL
Darren Muldoon, CH2M HILL

COPIES: Project Management Team

DATE: November 20, 2005

This memorandum provides an overview of the Oregon Statewide Transportation Investment Program (STIP), and potential federal, state, and local funding sources for the Tillamook Transportation Refinement Plan. A brief qualitative implementation summary of the potential local funding sources is also provided at the end of this memorandum.

The Statewide Transportation Investment Program (STIP)

The STIP is the primary programming document that identifies transportation priorities for federal and state funding in Oregon. The STIP provides a schedule and identifies funding for projects throughout the state. The STIP lists projects that are planned for construction during a 4-year period. Projects that are included in the STIP are regionally significant and have been given a high priority through planning efforts. The STIP has five categories—modernization, safety, bridge, pavement preservation, and operations.

All federally funded transportation projects, as well as all state and locally funded projects that are deemed "regionally significant" must be included in the STIP. The current adopted (2004-2007) STIP[1] contains $1.35 billion of transportation projects. Approximately 80 percent of STIP projects are federally funded. The following is a summary of how a project gets into the STIP[2]:

- ODOT monitors the state's transportation system using technical and objective methods.
- Public involvement (ongoing throughout all stages of the STIP process)
  - Citizen input and ideas for new projects;
  - Transportation planning and local priority process (corridor plans, region plans, system plans);
  - Area Commissions on Transportation (ACTs) and Oregon Transportation Commission (OTC) review.
- ODOT ranks conditions and needs across the state;

[1] A Draft 2006-2009 STIP has been developed, but has not been adopted; federal approval is expected by the end of 2005.

[2] A more detailed explanation is available at http://www.oregon.gov/ODOT/HWY/STIP/generalstip.shtml.

- OTC considers needs expressed by citizens, cities, counties, councils of governments, and Area Commissions on Transportation (ACTs);
- OTC sets funding levels for different types of projects;
- OTC prioritizes projects and matches to available funding levels;
- Draft STIP is created;
- Public review of proposed projects;
- OTC and United States Department of Transportation (USDOT) approval Final STIP;
- Oregon STIP is published (every other year).

The Final 2006-2009 STIP is currently being reviewed by USDOT. USDOT approval of the Final 2006-2009 STIP is expected by December 2005.

Existing and Potential Funding Sources

Federal Funding Sources

Federal funding sources account for approximately 21 percent of transportation project funding within the state of Oregon. Because Tillamook County is outside the boundary of a Metropolitan Planning Organization (MPO), federal funding is predominately made available through state or county programs, though some funding is made available directly to cities within Tillamook County. The most significant federal sources are the Federal Highway Trust Fund and federal forest revenues.

Federal Highway Trust Fund

These revenues come from motor vehicle fuel taxes, sales taxes for heavy trucks and trailers, tire taxes, and annual heavy truck use taxes. Funds are appropriated to individual states on an annual basis. These revenues are used by the state, counties, and cities and must be matched with state and local funds.

Federal Forest Revenues

Some federal forest revenues are used for roads, and are distributed directly to counties and earmarked for specific projects. Of total federal forest revenues, approximately 65% of federal forest revenues are distributed to the county where the revenue was produced, and then this is redistributed among the local taxing districts, including to the county itself[3]. Of the amount redistributed to Tillamook County, 75% goes to the County's Road Fund. In 2004, this amounted to approximately $1.7 million[4].

State Funding Sources

The two most significant state funding sources are the State Highway Fund and the Oregon Transportation Investment Act (OTIA).

[3] Association of Oregon Counties. *Shared Revenue Agreements & State Stewardship*. 2004. www.aocweb.org/Philip/AOC_Shared_Revenue_Report.pdf

[4] Tillamook County Public Works, 2005. http://www.co.tillamook.or.us/gov/pw/funding/usfs-rev-tillco.htm

State Highway Fund

Revenues are received from a combination of state fuel taxes, vehicle registration and title fees, and the truck weight-mile tax. State Highway Trust Fund revenues may be used only for construction and maintenance of state and local highways, bridges, and roadside rest areas, but a reasonable amount of the fund must be spent on walkways and bikeways. State Highway Fund revenues are appropriated by the OTC on an annual basis. Appropriation is based on population for cities and registered vehicles for counties; net revenues are distributed in the following manner:

- State - 60 percent;
- Counties - 24 percent (by number of vehicles registered);
- Cities - 16 percent (by population).

Oregon Transportation Investment Act (OTIA) of 2001

OTIA revenues are derived from automobile and truck registration and title fees, as well as a net increase in the weight-mile tax, to finance construction bond sales. OTIA funds are not typically used for construction of new highway facilities. In the future, debt service on the OTIA program will be funded in part through a portion of Oregon's transportation modernization program, which is otherwise used to bring existing highway facilities to current safety and operational standards. The remaining modernization program budget for use on other projects is $23 million annually (state and federal funds combined) for the entire state.

A newer source of potential highway project funding is the Oregon Innovative Partnerships Program (OIPP), which allows the creation of public-private partnerships to fund highway projects. This program gives ODOT the freedom to ask for proposals, or accept unsolicited proposals for transportation projects from private firms and governmental organizations. Private companies can participate at the conceptual stage of project development, allowing innovative techniques and finance plans to be proposed early in the project. Though public-private partnerships can be funded a number of ways, tolling is a common consideration.

A potential future state funding source would be some form of fees collected on the miles driven by each vehicle or person in the state. Although efforts are underway to explore such a program, no proposals exist at this time.

Local Funding Sources

Oregon counties and cities have the power to devise their own non-property tax and other local revenue structures without specific state enabling legislation. Although these sources are typically implemented at the city level, some are also applicable at a regional or multi-jurisdictional level as well. The institution of some of these revenue sources could make available some of the transportation fund revenue that currently goes towards maintenance and preservation. Existing and potential local funding sources are listed and described below.

Urban Renewal Districts

Urban renewal districts are formed in selected areas of a city, creating a tax-increment financing (TIF) mechanism to generate urban renewal funds. TIF works by 'freezing' property values at the beginning of an urban renewal plan, and assessing a fee only on the incremental growth in property value observed since the beginning of the urban renewal district plan. The revenues generated within an urban renewal district are used to secure bonds to finance projects and programs within the district. Use of the funds is not limited to transportation projects. Funds generated within each district must be spent within that urban renewal district.

Before an urban renewal district can be established, the needs and required funding must be identified. This would typically take the form of an urban renewal plan. The urban renewal plan would specify the boundaries for the urban renewal district, the proposed improvements to be made, the costs associated with these improvements, and the amount and source of funding. A new urban renewal area would require approval by the jurisdiction's designated urban renewal agency, and cannot overlap with existing urban renewal plans.

Urban renewal has been suggested in the past as a tool to fund a variety of projects in Tillamook. In particular given the new Safeway development downtown and the potential for related new development, urban renewal should be explored further both for transportation and other infrastructure and development projects.

Local Improvement Districts

Local Improvement Districts (LIDs) are created by property owners within a district of a city to raise revenues for constructing street improvements within the same district. LIDs may be used to assess property owners for improvements that benefit properties. Property owners typically enter into LIDs because they see economic advantage to the improvements. Assessments are secured by property liens. LIDs could be implemented to fund new connector roads that will benefit one or more groups of property owners at a higher rate than a city as a whole.

The formation of LID districts is governed by state law and local jurisdictional development codes. LID revenues could be used solely for capital costs. Similar to TIF revenues, LID revenues could be combined with other revenue sources.

Revenue and General Obligation Bonds

General Obligation Bonds pay for construction of large capital improvements. This method is typically used to fund road improvements that will benefit an entire community. General Obligation Bonds add the cost of the improvement to property taxes over a period of time. Oregon State law requires a double majority voter approval is required for instituting General Obligation Bonds. Revenue is collected in property tax billings.

System Development Charges

System Development Charges (SDCs) are a one-time fee assessed on new development, to compensate for increased traffic associated with new development. SDCs are limited to those capital improvements that will be or were required to increase capacity because of increased demand due to current or expected development. This method is commonly acceptable to the public because new residents, rather than current residents, pay for the improvements. It is applied to capital improvement projects that increase transportation system capacity as necessary to serve new development. Revenues provided by this method are variable because they are linked to the amount of new development.

Transportation Utility/ Impact Fees

Similar to water, sewer, and other utility fees, these fees allocate costs to the system's users, based on their use of the system. Revenues are directed towards maintenance and preservation of the existing transportation network. These fees are typically attributed to each property based on the land use of the property and the number of trips generated. Fees are administered in a similar fashion to other utilities (for example, sewer, water, electricity). Several cities in Oregon have already implemented this system, including Grants Pass, Ashland, Medford, Wilsonville, and Philomath. Much of the revenue from these fees would be expected to go to preservation and maintenance of the existing roadway network, which could make some of the street revenue that currently goes to preservation and maintenance available for new projects.

General Fund

The general fund for a given jurisdiction is comprised of discretionary revenues. As a result, application toward transportation capital improvement projects is very limited in most jurisdictions. A substantial majority of general fund revenues are applied to operating expenses for public safety and other public services.

County Vehicle Registration Fee

Vehicle registration fees are generally, but not directly, related to actual transportation system use. With voter approval, counties may impose a vehicle registration fee that is no more than the state's vehicle registration fee. For a County registration fee, ODOT would collect revenue from the fees and pay the revenue back to the counties that establish registration fees. The Oregon Constitution requires all revenues to be used for the construction and maintenance of highways, roads, and streets. There are 34,208 registered vehicles in Tillamook County[5]. Each dollar of a county registration fee would therefore generate about $34,208, minus the administrative collection cost by ODOT. Thus, a $10 annual registration fee could generate a gross of approximately $340,000.

Road User Fee/ Toll

This method would implement a toll or fee on a portion of a roadway for use of that roadway. Since tourism can account for significant seasonal traffic volume changes on roadways in Tillamook County, in theory the County could employ a road user fee or toll to support transportation related improvements as a result of the seasonal traffic volume changes.

Traffic Impact Fees

This method is used to finance necessary road improvements associated with new development. The fee, which can vary for different land uses, is calculated based on the estimated number of vehicle trips generated by the proposed development. Revenues are

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[5] ODOT, 2005. *Oregon Department of Transportation Fund Apportionments: Registered Vehicles by County.* http://www.oregon.gov/odot/cs/fs/countyreg_fy06.pdf

generated in this manner and must be used for capital improvements and not maintenance activities.

Parking Tax

This method would impose a business tax based on the number of parking spaces at a business. Oregon State law does not preclude cities from developing a city or regional parking tax based on the number of parking spaces at a business. However, it has not been determined if a parking tax collected through business licenses fees could legally be used for transportation projects. In addition, there could be a high administrative cost since a database of the parking spaces for all properties would be needed.

Gas Tax

Gas tax revenues can be used to fund either operating or capital costs, but the Oregon Constitution restricts gas tax revenue to road or bridge projects, not transit. Gas taxes generally measure demand for use of transportation facilities, so the equity is fairly high. However, fuel revenues are expected to level off in the short-term and then drop permanently, as the purchasing power of fuel revenues decreases with inflation and more fuel-efficient vehicles are purchased.

Parking Meters and Fines

This method would implement parking meters, monitoring, and parking fines in selected areas of the city. Parking meters: (1) promote parking turnover; (2) distribute limited on-street parking time equitably; (3) provide space for short-term shoppers; (4) maximize the economic vitality by providing opportunities for more conveniently; (5) generate revenue[6]. In general, most people try to abide by the time limitations imposed by parking meters. Since parking meters are generally self-enforcing, they could be used to aid in the enforcement of time limit restrictions and to promote desired parking turnover at curb spaces while creating revenue. Generated revenue would also be used to offset the costs of installation, operation, and maintenance.

Hotel/ Lodging Tax

Many Oregon jurisdictions impose a local hotel tax (also known as a transient room tax). Presently, four jurisdictions (Lake Oswego, Lincoln City, Umatilla County, and Union County) have been identified as dedicating revenue from a hotel/ lodging tax to transportation projects.

Sales Tax

This method would impose a sales tax on goods sold within Tillamook or Tillamook County. Oregon counties and cities have the power to implement a sales tax, but no jurisdiction in Oregon currently imposes a sales tax[7].

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[6] National Trust for Historic Preservation and The Institute for Transportation Engineers. *The Parking Handbook for Small Communities*. 1994.

[7] Wood Village, Oregon is considering implementing a 1% sales tax.

ODOT Bicycle and Pedestrian Program

ODOT's Bicycle and Pedestrian Program awards grants on an annual basis to construct improvements to improve bicycle and pedestrian safety. Grants awarded for the FY 2006-2007 amounted to approximately $5 million. Projects receiving funding from this program are expected to receive a local match.

Implementation: Local Funding Options

The table below is a qualitative assessment (low, medium, and high) of the revenue potential and implementation feasibility, and if voter approval is required by law, for the local revenue and funding sources identified above.

LOCAL FUNDING OPTIONS: POTENTIAL FUNDING/ REVENUE AND IMPLEMENTATION FEASIBILITY

Potential Funding/ Revenue Source	Revenue Potential[1]	Feasibility of Implementing[2]	Voter Approval Required?
Urban Renewal District	Medium to High	High	Yes
Local Improvement District	Low to Medium	High	No
Revenue and General Obligation Bonds	Medium to High	Medium	Yes
System Development Charges	Low to High	Medium	No
Transportation Utility/ Impact Fees	Low to Medium	Medium	No
General Fund	N/A[3]	Medium	No
County Vehicle Registration Fee	Low to Medium	Medium	Yes
Road User Fee/ Toll	Low to High	Low	No
Traffic Impact Fee	Low to Medium	Medium	No
Parking Tax	Low to Medium	Low	Yes
Gas Tax	Low to High	Medium	Yes
Parking Meters and Fines	Low	Medium	No
Hotel Tax	Low to Medium	Medium	Yes
Sales Tax	Medium to High	Low	Yes
ODOT Bicycle and Pedestrian Program	Low to Medium	High	No

[1] Revenue potential for many of the funding sources would vary and depend on the extent of implementation (e.g. tax rate, fee, toll, etc) and extent of new development (for system development charges and traffic impact fees).

[2] Considers legal feasibility, potential public perception/approval, and administrative costs.

[3] This is not a new revenue source; money is redistributed from the general fund to transportation.

MEMO #17

Adoption Recommendations

Tillamook Transportation Refinement Plan: Adoption Recommendations (Memo #17)

PREPARED FOR: Mark Gervasi, City of Tillamook
Bill Campbell, Tillamook County
Valerie Grigg Devis, ODOT

PREPARED BY: Michael Hoffmann, CH2M HILL
Tim Burkhardt, CH2M HILL

DATE: January 4, 2006

Implementation Authority

Responsibilities for the development, adoption, and implementation of the Tillamook Refinement Plan are determined by regulatory authority. Local agency authority comes from and through state statutes, and city and county comprehensive plans and development codes. State of Oregon authority comes in the form of policy and administrative rules governing authority over federal and state systems, as granted through the following:

- State Agency Coordination Rule and Agreement (SAC 1990—OAR 731-015) - The purpose of this rule is to define which ODOT actions are land use actions and how ODOT will meet its responsibilities for coordinating these activities with the statewide land use planning program, other agencies, and local governments.
- Transportation Planning Rule (OAR 660-012) - This rule is one of several statewide planning rules that provides protection of the long-term livability of Oregon's communities for future generations. The rule requires multi-modal transportation plans to be coordinated with land use plans. In complying with the rule, state and local governments must satisfy requirements that lead to implementation of a transportation system that is consistent with the planned land uses.

Recommended Actions

City of Tillamook Actions:

- Adopt, through City ordinance, the Tillamook Refinement Plan and associated changes to the TSP. A draft of this ordinance ["City of Tillamook Refinement Plan Adoption Ordinance"] is attached to this memo.
- Modify TSP to include changes explicitly designated in Tillamook Refinement Plan Adoption Ordinance. Recommended modifications to the TSP ["Recommended TSP Modifications"] are attached to this memo.
- Collaborate with ODOT and Tillamook County to implement the recommendations of the Tillamook Refinement Plan.

Tillamook County Actions:

- Review and acknowledge Tillamook Refinement Plan
- Collaborate with ODOT and the City of Tillamook to implement the recommendations of the Tillamook Refinement Plan.

State/ODOT Actions:

- Review Tillamook Refinement Plan
- Collaborate with the City of Tillamook and Tillamook County to implement the recommendations of the Tillamook Refinement Plan.

Department of Land Conservation and Development Actions:

- Review the Tillamook Refinement Plan
- Acknowledge amendments to City of Tillamook TSP made as part of Tillamook Refinement Plan adoption

ORDINANCE NO. ____________

AN ORDINANCE AMENDING THE CITY OF TILLAMOOK TRANSPORTATION SYSTEM PLAN, AN ELEMENT OF THE TILLAMOOK COMPREHENSIVE PLAN, TO INCLUDE THE TILLAMOOK TRANSPORTATION REFINEMENT PLAN AND IMPLEMENT THE RECOMMENDED IMPROVEMENTS CONTAINED THEREIN

WHEREAS, The City of Tillamook is acting pursuant to the authority of OAR 660.012.0015(3); and

WHEREAS, a Refinement Plan, as defined by OAR 660.012.0005(21), means an amendment to the transportation system plan, which resolves, at a systems level, determinations on function, mode or general location which were deferred during transportation system planning because detailed information needed to make those determinations could not reasonably be obtained during that process.

WHEREAS, the City Transportation System Plan (TSP), completed in June 2003, recommended further refinement study to identify improvements to mitigate the impacts of local and through freight traffic on the City's downtown, improve pedestrian, bicycle, and vehicle safety downtown; and develop solutions to parking utilization and supply; and

WHEREAS, the Tillamook Transportation Refinement Plan contains study analysis and subsequent recommendations to address the issues noted above and fulfill the purpose of a refinement plan as defined by OAR 660.012.0005(21); and

WHEREAS, ODOT contracted with the firm CH2M HILL to manage a project consultant team to develop the Tillamook Transportation Refinement Plan; and

WHEREAS, City-appointed staff and elected officials worked closely with the Oregon Department of Transportation (ODOT), Tillamook County, the Tillamook Downtown Association, and the Department of Land Conservation and Development, and project consultant team in planning for future transportation improvements in the City of Tillamook, through participation on the Project Management Team (PMT) for this project and the development of the Tillamook Transportation Refinement Plan; and

WHEREAS, a multi-faceted public involvement program, involving the following components, was instrumental in guiding the development of the Tillamook Refinement Plan: a Refinement Plan Advisory Committee (RPAC) consisting of 22 Tillamook-area residents, elected officials, business people, and public agency staff, met six times over the course of the project; two hands-on public workshops; two public open houses; project-relevant public information dissemination in the form of mailings and media advertisements; and

WHEREAS, the Tillamook Transportation Refinement Plan documents the land use planning, transportation planning, and public involvement work that resulted in the recommended improvements; and

WHEREAS, the City has held public hearing on the Tillamook Transportation Refinement Plan on [insert date] and [insert date]; and

WHEREAS, this Ordinance amends the City of Tillamook TSP Section 5 to read as described in Exhibit A, hereto attached, with deletions shown with ~~strikethrough~~ and new text underlined; and

NOW, THEREFORE, THE CITY OF TILLAMOOK ORDAINS AS FOLLOWS:

SECTION 2. The City Council of the City of Tillamook does hereby amend the Tillamook TSP to incorporate, by reference, the Tillamook Transportation Refinement Plan, hereto attached as Exhibit B.

SECTION 4. The Tillamook Transportation Refinement Plan is adopted as a supporting document to the Tillamook Transportation System Plan, an element of the City's Comprehensive Plan.

SECTION 5. EFFECTIVE DATE. This ordinance shall take effect on the [insert] day after its enactment.

Passed by the City Council this [insert] day of [insert month], 2006, by the following vote:

First Reading Ayes: ____ Nays: _____
Second ReadingAyes: ____ Nays: _____

APPROVED BY THE MAYOR, this _______ day of ____________________, 2005.

____
Bob McPheeters, Mayor

ATTESTED BY:

____
Bernadette Sorensen, City Recorder

ATTACHMENTS (2): EXHIBIT A; EXHIBIT B

SECTION 5

Transportation System Plan

Introduction

This section of the TSP document comprises the actual TSP for adoption by the City of Tillamook and acknowledgment by the State of Oregon. The rest of the document provides background documentation for the contents of this section.

This section begins with the TSP goals and objectives and identifies how the TSP meets the goals and objectives. The remainder of this section identifies the transportation projects and policies recommended for implementation during the next 20 years in Tillamook, along with estimated costs and timing.

TSP Goals and Objectives

As described in Section 2, goals and objectives were developed at the beginning of the TSP process. They are intended to provide a framework for the planning process, to represent the values of the city, and be consistent with and supportive of the policies of relevant agencies. The goals and objectives are implemented through the specific projects and policies identified in the TSP. These projects and policies are summarized for each goal and described in this section.

Goal 1: Coordination

Maintain a transportation system plan that is consistent with the goals and objectives of the City of Tillamook, Tillamook County and the state.

Objectives

1. Provide a transportation system that is consistent with other elements and objectives of the *City of Tillamook City Comprehensive Plan* and other policy documents.

2. Ensure consistency with state policies including the OTP and the OHP regarding transportation issues relating to Oregon 6 and U.S. 101.

3. Coordinate with the Port of Tillamook Bay regarding the Tillamook Airport, the Port of Tillamook Bay Industrial Park and the Port of Tillamook Bay shortline railroad.

4. Coordinate land use and transportation decisions to efficiently use public infrastructure investments to:

   a. Maintain the mobility and safety of the roadway system
   b. Foster compact development patterns
   c. Encourage the availability and use of transportation alternatives
   d. Enhance livability and economic competitiveness

5. Establish a local street master plan for the City of Tillamook.

Implementation Strategies

The TSP process has been coordinated with the plans and policies of relevant agencies through the plan and policy review conducted at the beginning of the process and provided in the Background Document, and through meetings of the PAC. The Port of Tillamook Bay staff participated on the PAC and reviewed draft documents. Consistency with relevant sections of the OHP and the TPR are documented throughout the TSP.

Goal 2: Safety

Provide a transportation system that maintains adequate levels of safety for all users.

Objectives

1. Enhance safety at the intersection of Oregon 6 and U.S. 101, and west toward the Hoquarten Slough Bridge.
2. Improve the safety of rail crossings, particularly at 12th Street and 3rd Street.
3. Identify safe connections for vehicles, bicycles and pedestrians across U.S. 101, Oregon 6 and Wilson River Loop.
4. Encourage improvements that minimize the impacts associated with frequent flooding.
5. Develop lifeline and evacuation routes in coordination with local, regional, state and private entities.
6. Undertake, as needed, special traffic studies in problem areas, especially around schools, to determine appropriate traffic controls to effectively and safely manage vehicle and pedestrian traffic.

Implementation Strategies

Numerous safety projects are included in the TSP, based on the review of existing and future conditions and input from the PAC. There are projects in the relevant sections of the TSP that correspond to all of the objectives for this goal.

Goal 3: Livability and Economic Viability

Provide a transportation system that balances transportation system needs with the community desire to maintain a pleasant, economically viable city.

Objectives

1. Minimize adverse social, economic and environmental impacts created by the transportation system, including balancing the need for street connectivity and the need to minimize neighborhood cut-through traffic.
2. Preserve, protect and ensure access to the city's significant natural features and historic sites, including the Pioneer Museum.

3. Improve transportation facilities without major disruption of existing neighborhoods or downtown.

4. Promote pedestrian-oriented design and the provision of pedestrian amenities in the downtown area, such as pedestrian-scale lighting.

5. Ensure adequate vehicle and bicycle parking and parking signage in the downtown commercial area, using techniques such as shared parking areas where appropriate.

6. Minimize traffic congestion in the downtown commercial area.

7. Develop and implement a street tree program, with emphasis on the downtown area.

8. Discourage through-traffic and high speeds in residential areas.

Implementation Strategies

Many of the needs identified in Tillamook relate directly to the issue of balancing the needs of highway traffic with local traffic and other community needs. As a result, the TSP reflects this goal throughout. Changes to the transportation system are focused on improving the existing system rather than creating new routes (with the exception of the street extension projects). The evaluation criteria for individual projects reflect this goal as do the projects included in the TSP.

Goal 4: Circulation and Mobility

Develop an interconnected, multimodal transportation system that serves the travel needs of Tillamook.

Objectives

1. Promote alternatives to ease adverse impacts (congestion, noise, safety) of commercial truck traffic in town.

2. Provide a network of arterials, collectors and local streets that are interconnected, appropriately spaced and reasonably direct.

3. Balance the simultaneous needs to accommodate local traffic and through-travel while incorporating traffic calming provisions.

4. Minimize travel distances and vehicle-miles traveled.

5. Safely, efficiently and economically move motor vehicles, pedestrians, bicyclists, transit, trucks, and trains to and through Tillamook.

6. Encourage development patterns that offer connectivity and mobility options for members of the community.

7. Recognize and balance freight needs with needs for local circulation, safety and access.

Implementation Strategies

Circulation and mobility in Tillamook are addressed in several areas of the TSP. The freight system plan identifies several improvements related to truck traffic in the city, in balance with other modes and livability issues. Several street extensions, and pedestrian and bicycle improvements are identified to improve connectivity.

Goal 5: Capacity

Provide a transportation system that has sufficient capacity to serve the needs of all users.

Objectives

1. Enhance capacity at the intersection of Oregon 6 and U.S. 101, and west toward the Hoquarten Slough Bridge.
2. Protect capacity on existing and improved roads to provide acceptable service levels to accommodate anticipated demand.
3. Limit access points on highways and major arterials, and use techniques such as alternative access points when possible to protect existing capacity.
4. Minimize direct access points on to arterial rights-of-way.
5. Update and maintain required access management standards for new development and work toward modifications of existing development to preserve the safe and efficient operation of roadways, consistent with functional classification.

Implementation Strategies

Capacity needs in Tillamook were studied as part of the existing and future conditions analysis. Capacity improvements at the Oregon 6 and U.S. 101 intersection are included in the state roadway section of the TSP, as are access management improvements on U.S. 101 north of downtown. City code has been reviewed to identify potential changes to access management provisions.

Goal 6: System Preservation

Work to ensure that development does not preclude the construction of identified future transportation improvements, and that development mitigates the transportation impacts it generates when appropriate.

Objectives

1. Identify and preserve locations for potential future street connections.
2. Require developers to aid in the development of the transportation system by dedicating or reserving needed rights-of-way, by constructing half or full street improvements and by constructing off-street pedestrian, bicycle and transit facilities when appropriate and needed to serve new development.
3. Consider transportation impacts when making land use decisions, and consider land use impacts (in terms of land use patterns, densities, and designated uses) when making transportation-related decisions.
4. Ensure that development does not preclude the construction of identified future transportation improvements.

Implementation Strategies

Several changes to the Tillamook zoning code are recommended to coordinate future development with transportation system needs and to address the potential impacts of development on the transportation system.

Goal 7: Accessibility

Provide a transportation system that serves the needs of all members of the community for all routes and all available modes of transportation.

Objectives

1. Consider the transportation disadvantaged when developing alternatives to meet growing transportation needs.
2. Upgrade existing transportation facilities and work with public transportation providers to provide services that improve access for all users.
3. Develop and maintain travel routes for pedestrians, bicyclists and the physically handicapped.

Implementation Strategies

The TSP has been coordinated with TCTD and includes background information on the existing public transportation system and a description of TCTD's plans for improvements to the system. While no new public transportation facilities are included in the TSP because they are beyond the city's jurisdiction, the many pedestrian, bicycle and trail projects will aid pedestrians, bicyclists and those who use these modes in combination with transit.

Goal 8: Public Transportation

Work to improve cost-effective and safe public transportation through and within Tillamook.

Objectives

1. Work with the TCTD to develop transit systems and stations and related facilities in convenient and appropriate locations that adequately and efficiently serve Tillamook.
2. Work to improve the signage and amenities at transit stops and stations.
3. Work with TCTD to expand transit service as necessary during summer months of peak travel.
4. Provide for the transportation disadvantaged by complying with state and federal regulations and cooperating with the TCTD and other agencies to provide transportation services for the disadvantaged.

Implementation Strategies

The TSP has been coordinated with the TCTD and includes background information on the existing public transportation system and a description of TCTD's plans for improvements to the system. While no new public transportation facilities are included in the TSP because they are beyond the city's jurisdiction, the many pedestrian, bicycle and trail projects will aid pedestrians, bicyclists and those who use these modes in combination with transit.

Goal 9: Pedestrian and Bicycle Facilities

Provide for an interconnected system of pedestrian and bicycle facilities in Tillamook.

Objectives

1. Ensure and strengthen the presence of safe, attractive and convenient pedestrian and bicycle access to and circulation in the downtown area.
2. Place priority on sidewalk pavement improvements for the downtown area.
3. Preserve and enhance the U.S. 101 coast bicycle route.
4. Work to develop safe, connected pedestrian and bicycle facilities near schools, residential districts and commercial districts.
5. Develop bicycle lanes or shoulder bikeways on all arterial streets, major collectors and minor collectors.
6. Ensure adequate pedestrian access on all streets in commercial zones.
7. Use unused rights-of-way for greenbelts, walking trails or bike paths where appropriate.
8. Promote multimodal connections where appropriate.
9. Develop safe and convenient pedestrian and bicycle systems that link all land uses, provide connections to transit facilities and provide access to publicly owned land intended for general public use.
10. Support and encourage increased levels of bicycling and walking.

Implementation Strategies

Many improvements to the pedestrian and bicycle system are included in the TSP, particularly near pedestrian generators, such as downtown and schools. Trail improvements are included.

Goal 10: Environment

Provide a transportation system that balances transportation facilities and services with the need to protect the environment and significant natural features.

Objectives

1. Promote a transportation system that encourages energy conservation, in terms of efficiency of the roadway network and the standards developed for street improvements.
2. Encourage use of alternative modes of transportation and encourage development that minimizes reliance on the automobile.
3. Minimize transportation impacts on coastal and inland natural resources.

Implementation Strategies

Beneficial environmental impacts will result from the connectivity/mobility projects and from pedestrian, bicycle and trail projects that support the use of non-motorized transportation in the city. Potential adverse environmental impacts were considered and identified through the project evaluation process. Where substantial environmental impacts would result from a proposed project, these are noted. Some projects with substantial impacts were eliminated from further consideration in the evaluation process.

Goal 11: Transportation Funding

Provide reasonable and effective funding mechanisms for city transportation improvements identified in the TSP.

Objectives

1. Develop a financing program that establishes transportation priorities and identifies funding mechanisms for implementation.
2. Develop proposed improvements with sufficient detail to qualify for funding of engineering and construction phases.
3. Develop and implement a transportation impact fee program to collect funds from new developments to be used for off-site and on-site transportation improvements.
4. Identify funding opportunities for a range of projects, and coordinate with county, state and federal agencies.
5. Develop improvements that meet applicable local, county, state and federal plans, standards and criteria.

Implementation Strategies

Section 6 includes the transportation financing plan that addresses this goal.

Transportation System Plan

This subsection identifies the transportation improvements and policies that should be implemented in the next 20 years in Tillamook to improve motor vehicle operations, safety, and pedestrian and bicycle travel. The plan also includes public transportation, rail and water elements. The transportation improvements and policies in this section were included on the basis of the information presented in previous sections of this document, including the analysis of existing and future, forecasted, no-build conditions; the analysis of alternatives and projects; and the selection of a preferred alternative.

The transportation system plan is divided into the following plan elements:

- State Roadway System
- Local Roadway System
- Freight System
- Pedestrian System
- Bicycle System

- Public Transportation
- Rail System

Figure 5-1 shows the locations of the roadway capacity and safety projects included in the TSP.

Because not all of the projects are likely to be funded under existing revenue sources, each project is given a priority in terms of years. The priorities are based on the measures of effectiveness and input from stakeholders, including the PAC. An order-of-magnitude cost also is included for most projects. The list of projects does not represent a financially constrained plan.

State Roadway System

The state roadway network in Tillamook, which consists of U.S. 101, Oregon 6 and Netarts Highway (131), serves both local and tourist traffic. In this subsection, capacity and safety improvements on U.S. 101 are outlined. This subsection also discusses highway segment designations, planning studies, functional classifications and lifeline routes.

Capacity Improvements

Table 5-1 presents the capacity improvements that are recommended for U.S. 101, Oregon 6 or Netarts Highway (131) in Tillamook. The projects are numbered and shown in Figure 5-1.

Figure 5-1 Capacity and Safety Project Locations

11 x 17

front

Figure 5-1 Capacity and Safety Project Locations

11 x 17

back

TABLE 5-1
Recommended Capacity Improvements on State Facilities

Project Number	Location and Description	Estimated Cost	Priority (years)
1	Provide grade-separated interchange at Oregon 6 and Wilson River Loop intersection.[1] ~~(Part of Draft 2004–2007 STIP.)~~ (project currently under design; scheduled for construction in 2007)	~~$8,270,000~~ $12,270,000	0-5
2	Widen Wilson River Bridge at U.S. 101. Includes other capacity improvements outside the city's UGB. (Part of current STIP.)	$3,895,000	0-5
3	Provide an eastbound right-turn lane at U.S. 101 and Wilson River Loop intersection (to U.S. 101 southbound) while providing for safe pedestrian and bicycle movements.	$100,000	0-5
4	Install a traffic signal at Netarts Highway (131) (3rd Street) and Stillwell Avenue and provide northbound and southbound left-turn lanes.[1]	$250,000	5-10
5	Construct a pedestrian island that provides a channelized westbound right-turn at U.S. 101 and Oregon 6 intersection, reconstruct northeast corner, provide downstream lane and widen Hoquarten Slough Bridge. Provide signing that yields vehicles to pedestrians crossing the right-turn lane.[1]	$3,000,000	5-10
~~6~~	~~Create a one-way couplet system along 1st Street (westbound) and Netarts Highway (131) (3rd Street) (eastbound) between Stillwell Avenue and U.S. 101 (Main Avenue). Project includes signing, channelization/restriping and intersection signal equipment and timing modifications.~~[1]	~~$100,000~~	~~5-10~~
	Improve signage at US 101 and Front Street to encourage trucks to use this existing alternate route.	$10,000	0-5
	Install signal and related improvements at US 101 and Latimer Road. (Project currently under design).	$3,525,000	0-5
	Construct intersection improvements at US 101 and Long Prairie Road including left turn lane. (Project currently under design; scheduled for construction in 2007).	$902,000	10+

[1] Improvements included in other tables. The costs associated with this project should only be counted once.

It is noted that any modifications to the signing and traffic control on the state system would have to be approved by the State Traffic Engineer.

STIP = Statewide Transportation Improvement Program.

UGB = urban growth boundary.

Safety Improvements

Table 5-2 presents the safety improvements that are recommended for state facilities in Tillamook. The projects are numbered and shown on Figure 5-1.

TABLE 5-2
Recommended Safety Improvements on State Facilities

Project Number	Location and Description	Estimated Cost	Priority (years)
1	Construct Interchange at Wilson River Loop and Oregon 6.[1] (Part of Draft 2004–2007 STIP.)	$8,270,000	0-5
2	Consolidate driveways near intersection of U.S. 101 and Hadley Road and provide a median barrier to restrict the driveways near the intersection to right-in, right-out.	$50,000	0-5
3	Improve driver awareness (bulb-outs, removal of parking, consolidate of driveways) at U.S. 101 (Pacific Avenue) and 3rd Street. Improve signing and striping on the eastbound approach.	$50,000	0-5
4	Improve the pedestrian visibility (by treatments such as improved corner bulb-outs with parking removal) at U.S. 101 (Pacific Avenue and Main Avenue) and 2nd Street.	$100,000	0-5
	On Main and Pacific Avenues, between 1st Street and 5th Street: Add continental-style crosswalks at all intersections.	$20,000	0-5
	On Main and Pacific Avenues, between 1st Street and 5th Street: Add advance stop bars and signage before pedestrian crossings.	$15,000	0-5
	On Main and Pacific Avenues, between 1st Street and 5th Street: Restrict parking on upstream side of key corners (e.g., 2nd and Main) to improve driver-pedestrian visibility.	$10,000	0-5
	On Main and Pacific Avenues, between 1st Street and 5th Street: Improve lighting at intersections where it is potentially deficient (e.g., 5th and Main).	$180,000	0-5
5	Signalize Netarts Highway (131) at Stillwell Avenue.[1]	$250,000	5-10
6	Reconstruct westbound approach at U.S. 101 and Oregon 6 (skewed geometry, potential safety issues with confusing operations) and create one-way couplet to remove eastbound approach.[1]	$3,100,000	5-10
7	Provide a raised island at Ocean Place and 4th and 3rd Streets for a safe pedestrian refuge with marked crosswalks on every approach. Designate Ocean Place between the Oregon 6 couplet as northbound only.	$200,000	5-10
	On Main and Pacific Avenues, between 6th Street and 12th Street: Add continental-style crosswalks at all intersections.	$30,000	5-10
	On Main and Pacific Avenues, between 5th Street and 12th Street: Add advance stop bars and signage before pedestrian crossings.	$20,000	5-10
	On Main and Pacific Avenues, between 5th Street and 12th Street: Restrict parking on upstream side of key corners (e.g., 2nd and Main) to improve driver-pedestrian visibility.	$10,000	5-10

TABLE 5-2
Recommended Safety Improvements on State Facilities

Project Number	Location and Description	Estimated Cost	Priority (years)
	On Main and Pacific Avenues, between 5th Street and 12th Street: Improve lighting at intersections where it is potentially deficient (e.g., 5th and Main).	$330,000	5-10
8	Provide a gateway along Pacific Avenue at the south end of the city.	$150,000	10+
9	Realign 12th Street and U.S. 101 (Pacific Avenue).	$250,000	10+
10	Construct a roundabout at Ocean Place and 4th and 3rd Streets, and realign approaches. Provide advanced signing and striping to provide safe operating conditions.	$750,000	10+
	Narrow the sidewalks on Main and Pacific Avenues (between 1st and 5th Streets) by 2 feet on each side; widen travel lanes to 12 feet each, maintain 8-foot parking lanes on both sides, and add combination of traditional and off-set curb extensions.	$1,535,000	10+
	On Main and Pacific Avenues, between 1st Street and 12th Street: Add combination of traditional and off-set curb extensions to slow traffic, improve pedestrian visibility, and provide opportunities for aesthetic enhancements (e.g., landscaping).	$425,000	10+

[1] Improvements included in other tables. The costs associated with this project should be counted only once.

It is noted that any modifications to the signing and traffic control on the state system would have to be approved by the State Traffic Engineer.

Access Management

Access management improvements to consolidate driveways and provide a median barrier similar to U.S. 101 north of the Wilson River Loop intersection are recommended along U.S. 101, north of Hoquarten Bridge to Wilson River Loop intersection (see Goal 2). Consolidation of driveways should occur with redevelopment. Driveway consolidation and median access control is recommended near U.S. 101 and Hadley Road. Also, access management and the need for a local access road system near Suppress Road should be explored in a refinement study.

To protect transportation facilities and to provide for safe multimodal transportation in the City of Tillamook, several changes have been proposed to the city's ordinances. A new subsection has been added to the city's Zoning Ordinance, Section 22.1, Subsection 17, Access Management. This section provides for the closing or consolidation of access points and provides access spacing options to create walkable and safe pedestrian crossings. Optional language for shared driveways, vertical clearance and fire access has been included in Section 7. The city's existing Zoning Code, Section 22, Site Development Standards, includes a requirement for completion of a traffic impact study. This existing code and the proposed changes help the city to be in compliance with the TPR.

Highway Segment Designation

The OHP provides for special designation of certain highway segments to guide future planning and management decisions, and to balance the needs of through traffic with local traffic and development. The designations, which include STAs, commercial centers, and urban business areas, have specific objectives for access management, automobiles, pedestrian and bicycle accommodation, transit amenities and development. Neither the commercial center nor urban business area designations apply to the City of Tillamook. The STA designation does apply, as outlined below.

The city staff has expressed interest in pursuing an STA designation on a portion of U.S. 101 in Tillamook to better balance the needs of through traffic with local traffic and economic development. An STA designation, if appropriate, would help the city and ODOT address through traffic needs on U.S. 101 while supporting the city's desire to maintain and enhance the downtown area as an aesthetically appealing destination that functions well for pedestrians and bicyclists and is economically vibrant.

The STA designation is a tool developed and supported by the OTC designed to make a downtown district function well when the state highway is also the community's main street. For example, an STA may have special features that result in lower speeds, narrower lane widths and wider sidewalks on the state highway. The STA designation process is currently under review by ODOT. Some designations may require a detailed management plan (as described in OHP Policy 1B.11).

Potential STA Benefits

- Provides greater flexibility for state highway standards, such as highway mobility, street spacing, signal spacing and street treatments. For example, highway mobility standards may allow for more congestion than on other urban highways.
- Receives ODOT approval up front. Addresses exceptions early in the planning process and in writing.
- Provides certainty about how the highway will be managed.

Potential STA Drawbacks

- Criteria and the process are exacting – must be a good fit to the existing city conditions or the city must have future plans that would make it a good fit.
- It is a new program that has not yet been implemented on a statewide highway, such as U.S. 101
- There may be other, easier ways to make the desired changes, including the use of guidelines for downtown areas provided by the 2002 ODOT Highway Design Manual.

Review of STA Characteristics

Table 5-3 provides a preliminary review of STA characteristics as they relate to Tillamook and indicates that the downtown core area of the city on U.S. 101 already has many of the characteristics. The downtown core area is functioning as if an STA were in place: posted speeds are low, lane widths are relatively narrow, sidewalks are as wide as space allows. An

STA designation could help formalize these conditions by putting them in the form of an agreement between ODOT and the city.

Based on this and the city's interest in the STA, an STA designation is recommended for this segment of U.S. 101 between at least 1st Street and 9th Street, and possibly as far south as 12th Street (see Table 5-3). As of October 2003, the ODOT staff has recommended an STA designation in Tillamook on U.S. 101 (Main and Pacific Avenues) from 1st Street to 9th Street. The OTC will be asked to approve this designation in November 2003. If the OTC approves the designation at that time, a refinement study for the STA may not be needed.

TABLE 5-3
Preliminary Review of STA Characteristics as They Relate to Tillamook[1]

STA Characteristic	Is Characteristic Present Today or Likely in Future?	Notes
Location		
Must straddle a state highway; any new development to be built off of the highway or only on one side	Yes	Assuming STA was designated in downtown area.
Cannot be located on a freeway or expressway	Yes	U.S. 101 is a statewide highway and not a freeway or expressway.
Area has a majority, if not all, of STA attributes, either as existing or planned uses and infrastructure through an adopted plan	Maybe	Issues listed as "maybe" in this table would need to be resolved, such as through future development.
STA does not apply to entire city	Yes	Proposed STA area would be in downtown core area, such as 1st Street to 12th Street.
Traffic		
STA located in compact area with local street network to facilitate local auto and pedestrian circulation	Yes	Development in downtown core area is compact and there is a local street network.
Traffic speeds are slow, generally 25 mph or less	Yes	Current posted speed on U.S. 101 in the downtown core area is 20 mph.
Identify strategies for addressing freight and through traffic including speed, possible signalization, parallel or other routes, actions elsewhere in the corridor	Maybe	Would need to study options for parallel or alternative routes to assure adequate traffic capacity (see Freight Needs subsection of TSP).
Design		
In STA area, there are mixed uses; buildings are close together	Yes	The downtown commercial area has mixed uses with buildings close together.
Sidewalks have ample width and are adjacent to highway and buildings	Yes	Most sidewalks have ample width and are adjacent to the highway and buildings in the downtown commercial area.
Public road connections are preferred over private driveways	Maybe	Access management is a key component of an STA. Some driveway closures might be required in the downtown commercial area.
There is on-street parking or else there are shared parking lots located behind or to side of buildings	Yes	On-street parking is present throughout the downtown core area. The TSP includes plans for a parking study and possible additional off-street parking area.
Streets are designed for ease of crossing by	Yes	Improvements proposed in this plan would

TABLE 5-3
Preliminary Review of STA Characteristics as They Relate to Tillamook[1]

STA Characteristic	Is Characteristic Present Today or Likely in Future?	Notes
pedestrians		improve pedestrian crossing conditions.

[1] This table is based on the STA description in the Oregon Highway Plan. As of May 2003, the STA designation process is under review.

STA = special transportation areas.

TSP = transportation system plan.

Planning Studies

During the TSP process, a number of issues were raised for which resolution is beyond the scope of the TSP. Therefore, additional studies that focus solely on the issues/problems identified are recommended. Funding for these projects should be joint agreements between any related agencies. Table 5-4 presents the recommended planning studies for Tillamook.

TABLE 5-4
Recommended Planning Studies

Location and Description	Priority (years)
U.S. 101 Access Management Study	0-5
12th Street Railroad Crossing Safety	0-5
~~Detailed Large Vehicle Alternate Route Study~~	~~0-5~~
~~Downtown Parking Study~~	~~0-5~~
STA Management Plan (if needed, depends on ODOT requirements)	0-5
Lumber Mill Truck Circulation Option Study	0-5
Trail Development Study. Include Phase 2 of Hoquarten Slough Trail.	5-10

STA = special transportation area.

Maintenance/Preservation/Operations

The TSP for Tillamook does not recommend specific maintenance, preservation and operations projects. If a roadway is recommended for other roadway improvements, it may be beneficial to include improvements for maintenance needs at that time. However, some of the projects included in Appendix B include maintenance, preservation or operation components that address existing deficiencies.

Functional Classifications

State Facilities

As discussed in Section 2, ODOT has identified the functional classifications of roadways of statewide significance within the Tillamook city limits. No changes to the functional classifications of the state highways U.S. 101, Oregon 6 and Netarts Highway (131) are recommended:

- U.S. 101 - principal arterial
- Oregon 6 - minor arterial
- Netarts Highway (131) - urban/rural major collector

Lifeline Routes

In the vicinity of Tillamook, several roadways—U.S. 101, Netarts Highway (131), Oregon 6, Latimer Road and Wilson River Loop—are designated as lifeline routes. U.S. 101 (south of Oregon 6), Netarts Highway (131), Latimer Road, Wilson River Loop and Oregon 6 (between U.S. 101 and Wilson River Loop) are designated as Priority 1 lifeline routes, which means they are essential for emergency responses in the first 72 hours after an incident. U.S. 101 (north of Oregon 6) and Oregon 6 (east of Wilson River Loop) are designated as a Priority 2 lifeline routes, which means they are desirable for emergency responses in the first 72 hours after an incident or are routes essential for economic recovery. No changes are recommended to these designations.

Local Roadway System

This subsection summarizes the recommended functional classifications for local roads in Tillamook to meet transportation system needs in the 20-year planning horizon. The recommendations in this section were based on input from the PAC, City of Tillamook staff, Tillamook County staff, and the inventory of existing conditions. Coordination between ODOT, the City of Tillamook and Tillamook County will be necessary to implement the functional classification modifications listed in this section. Associated design standards are discussed in the next subsection. The recommended functional classifications for the City of Tillamook are shown in Figure 5-2.

In addition to the recommendations listed in this section, the City of Tillamook, Tillamook County and ODOT should continue to review roadway functional classifications throughout the 20-year horizon and make changes as necessary based on ADT volumes, changes in use or development, pedestrian/bicycle usage, the surrounding road network, speed and access control.

The proper classification of each roadway is important to help determine the appropriate traffic control, design standards, pedestrian and bicycle facilities, and access to adjacent properties for a roadway segment. The following are the functional classification definitions for Tillamook:

- **Arterial Roadways.** The primary function of an arterial roadway is to provide mobility. Therefore, arterials typically carry higher traffic volumes and allow higher travel speeds while providing limited access to adjacent properties.
- **Collector Roadways.** The function of a collector roadway is to collect traffic from local streets and provide connections to arterial roadways. Generally, collectors operate with moderate speeds and provide more access in comparison to arterials.
- **Local Roadways.** The primary function of a local roadway is to provide access to local traffic and route users to collector roadways. Generally, local roadways operate with low speeds, provide limited mobility, and carry low traffic volumes compared with other roadway classifications.

Figure 5-2 Functional Roadway Classification

8.5 x 11

Arterials

East of U.S. 101 to the city's UGB, the City of Tillamook and Tillamook County should consider classifying 3rd Street as an arterial. This recommendation is based on the relatively high ADT volumes, relatively high truck volumes, and multimodal use (that is, bicyclists, pedestrians and transit). An arterial functional classification is not recommended for any other roads under city or county jurisdiction. U.S. 101 (Main Street and Pacific Avenue) and Oregon 6 (1st Street and 3rd Street) will continue to function as the city's main streets. These streets are under ODOT jurisdiction and should continue to be classified as arterials as described above. The TSP aims to balance these dual functions through specific project and policies, including streetscape and pedestrian projects and potential STA designation.

Collectors

As shown in Table 5-5, the following roadway facilities should be classified as collectors:

TABLE 5-5
City of Tillamook Roadway Classification System

Road	Segment	Agency Jurisdiction
Olsen/Trask River Road	Oregon 6 to 3rd Street	Tillamook County
Tillamook River Road	City limits to 12th Street	Tillamook County
Wilson River Loop	U.S. 101 to city limits, Oregon 6 to 3rd Street	Tillamook County
12th Street	Stillwell Avenue to Marolf Loop	Tillamook County and City of Tillamook
Marolf Loop	Entire Length	Tillamook County
McCormick Loop	3rd Street to city limits	Tillamook County
Brookfield Avenue	Entire Length	Tillamook County, City of Tillamook, and Private
Evergreen Drive	North of Oregon 6	Tillamook County
Goodspeed Road	U.S. 101 to city Limits	Tillamook County
Makinster Road	U.S. 101 to city Limits	Tillamook County
Stillwell Avenue	Front Street to 12th Street	City of Tillamook
Alder Lane	Evergreen Drive to Dogwood/Cypress Street	City of Tillamook
Evergreen Drive	12th Street to 3rd Street	City of Tillamook
1st Street	Birch Avenue to U.S. 101	City of Tillamook
2nd Street	Ash Avenue and Birch Avenue	City of Tillamook
Ash Avenue	2nd Street to 4th Street	City of Tillamook
Front Street	Cedar Avenue to U.S. 101	City of Tillamook
Miller Avenue	3rd Street to 12th Street	City of Tillamook
4th Street	Ash Avenue to Miller Avenue	City of Tillamook
10th Street	U.S. 101 to Miller Avenue	City of Tillamook
11th Street	Stillwell Avenue to Miller Avenue	City of Tillamook
Ocean Place	4th Street to Oregon 6	City of Tillamook
Cedar Avenue	Front Street to 1st Street	City of Tillamook
Birch Avenue	1st Street to 3rd Street	City of Tillamook

ODOT currently classifies Williams Avenue as a collector. Based on a review of existing and future conditions, ODOT should consider re-classifying Williams Avenue as a local street. Williams Avenue is a very low volume road in a residential grid network and is misrepresented on ODOT mapping. On the ODOT mapping Williams Avenue is shown as extending from 3rd Street to 12th Street, when it actually only is between Alder Lane and Hawthorne Lane.

Any new roads or extensions that are constructed within the City of Tillamook, as listed in Table 5-6, should be classified based upon the ADT and usage by pedestrians, bicycles, and trucks. Many of the proposed extensions are expected to carry through traffic in addition to local traffic, which would likely lead to a collector functional classification.

Local

All city roadway facilities not listed above are recommended to be classified as local roads.

Roadway Design Standards

City and County Facilities

Roadway design standards were developed for each functional classification for city facilities. Each functional classification requires different design standards based on the operating conditions (volumes, access management, speeds) and users (bicyclists, pedestrians, motorists) of the roadway. The design standards are not intended to require the city to update and retrofit current roadways to new standards, but should be applied during future development. See Figures 5-3, 5-3A and 5-4 for proposed roadway standards on arterial, collector and local roadways.

Urban Growth Management Agreement

City standards generally apply to county roadways in the city limits and within the UGB. Tillamook County and the seven incorporated cities in the county (including Tillamook) have adopted Urban Growth Management Agreements (UGMAs) with each other. The purpose of the agreements is to provide for coordination of services in the city-county mutual interest area, defined as lands that are outside of the city limits, but within the city's UGB. By definition, these lands are determined to be necessary and suitable for future urban development. The UGMA requires that the city and county coordinate with each other regarding major transportation improvement projects, county road vacations, extensions of city services and annexations. The UGMA also recommends that the city and county consider the possibility of developing a common set of road, street and storm drainage standards to be used in the mutual interest area.

State Facilities

Roadway design standards were not developed for state facilities. Applicable standards on state roads are provided in the ODOT Design Manual.

Figure 5-3 Roadway Cross-Sections

8½ x 11

Figure 5-3A Roadway Cross-Sections

8 ½ x 11

Figure 5-4 Roadway Cross-Sections

8½ x 11

Capacity Improvements

Table 5-6 presents the capacity and widening improvements that are recommended for local facilities in Tillamook. The projects are numbered and shown in Figure 5-1. Many of the road extensions are dependent on development. If development occurs, then agreements with the developers should be required to construct these extensions.

TABLE 5-6
Capacity and Widening Improvements on Local Facilities

Project Number	Location and Description	Estimated Cost	Priority (years)
1	Extend 12th Street to McCormick Loop	$1,500,000	0-5
2	Extend Williams Avenue south to 12th Street	$275,000	0-5
3	Extend Meadow Avenue to 12th Street	$500,000	5-10
4	Extend Beech Street to Marolf Loop	$120,000	5-10
5	Extend Hawthorne Lane between Meadow and Williams Avenues	$1,100,000	5-10
6	Designate Spruce Avenue as a public road and remove the barriers at Apple and Beech Streets. Connect Spruce to Cypress to complete roadway grid system	$150,000	5-10
7	9th Street, cul-de-sac one side of the park and add parking on the other side	$100,000	5-10
8	Extend Filbert Street to Marolf Loop	$225,000	10+

Safety Improvements

Table 5-7 presents the safety improvements that are recommended for local facilities in Tillamook. The projects are numbered and shown in Figure 5-1.

TABLE 5-7
Recommended Safety Improvements on Local Facilities

Project Number	Location and Description	Estimated Cost	Priority (years)
1	Upgrade 12th Street railroad crossing with safety measures, such as gate and flashing lights. First step would be study by ODOT rail.	$250,000	0-5
2	On Ocean Place at 4th and 3rd Streets provide a raised island for a safe pedestrian refuge with marked crosswalks on every approach. Designate Ocean Place between the Oregon 6 couplet as northbound only.[1]	$200,000	0-5
3	12th Street and Tillamook River Road—relocate stop bar to provide better sight distance	$5,000	0-5
4	Redesign the intersection at Alder Lane and Dogwood and Cypress Streets to remove the parking area (or revise to not interfere with intersection operations), provide all-way, stop-controlled intersection. Provide shoulder along eastside of intersection for pedestrians and revise crosswalk locations.	$100,000	5-10

TABLE 5-7
Recommended Safety Improvements on Local Facilities

Project Number	Location and Description	Estimated Cost	Priority (years)
5	Construct a roundabout on Ocean Place at 4th and 3rd Streets, and realign the approaches. Provide advanced signing and striping to provide safe operating conditions.[1]	$750,000	10+

[1] Improvements are included in other tables. The costs associated with this project should be counted only once.

ODOT = Oregon Department of Transportation.

Parking Improvements

Table 5-8 presents the parking improvements that are recommended for Tillamook.

TABLE 5-8
Parking Improvements

Project Number	Location and Description	Estimated Cost	Priority (years)
1	Provide signing along U.S. 101 to off-street lots off U.S. 101	$5,000	0-5
	Set aside more on-street parking area reserved for RVs	$5,000	0-5
	Allow employees to park in City parking lots on east and west sides of Ivy, just south of 2nd Street.	N/A	0-5
	Change parallel parking to angle parking in specified locations along 2nd Street, Ivy Avenue, and Laurel Avenue.	$10,000	0-5
	Provide resident permit parking by allowing residents to park overnight and/or for longer periods during the day along Laurel Avenue between 3rd Street and 5th Street.	N/A	0-5
	Explore opportunities to share parking with businesses that either use their parking areas more in the evening or on weekends, or that have surplus parking areas.	N/A	0-5
	Simplify parking regulations by establishing a 2-hour time limit throughout town.	$10,000	0-5
	Consider allowing RVs to park overnight in the (new, as of November 2005) Safeway parking lot.	N/A	5-10
	Acquire property immediately east of Stillwell Avenue to expand employee and visitor parking.	To be determined	10+
	Construct parking structure. Options include building a deck or larger parking structure on current city parking lots, and building a structured parking area on south side of 1st street west of Ivy Avenue, looking for opportunities to team with others as property is redeveloped.	To be determined	10+
	Construction of one or more surface parking areas on parcels currently vacant, for use by visitors and/or employees.	$80,000 (per 1,000 square feet)	10+
	Reintroduce parking meters.	$45,000	10+
2	~~Conduct parking study to understand parking use at various times during the year.~~	~~$50,000~~	~~0-5~~

Freight System

As part of the TSP process, City of Tillamook and Tillamook County staffs identified the need and desire to minimize the impacts of local and through freight truck traffic and large recreational vehicles in the City of Tillamook downtown commercial area and in residential neighborhoods in the city. Subsequent to the TSP, a refinement plan was conducted that included a study of options to reduce the adverse impact of trucks downtown. Most of these recommendations have been included elsewhere in the TSP.

The following steps are recommended, in cooperation with the Tillamook Lumber Mill, to reduce the number of truck trips in downtown Tillamook.

- In cooperation with ODOT, develop a new 3rd Street access that can be used for all trucks, both entering and exiting (requires relocation of ODOT maintenance building).
- Make site and circulation changes (for example, improve roads, rearrange log stacks) to allow the existing 10th Street access and proposed 3rd Street access to be used as either entrance or exit for all trucks.
- Redesign rail spur onsite and/or work with Port of Tillamook Bay (POTB) rail to minimize traffic stoppage on 3rd Street due to rail switching.
- Once the above improvements are complete, encourage drivers to use the mill entrance/exit that minimizes truck travel through downtown Tillamook.
- In cooperation with Averill Trucking, develop a satellite location for Averill Trucking operations on or near the Tillamook Lumber Mill site to reduce the number of trips through downtown.

A further detailed evaluation of the above steps is recommended (as noted in Table 5-4 of this TSP).

~~Because of the complex nature of this problem, specific solutions are not recommended in the TSP. Several potential solutions are identified and discussed in the large vehicle alternate route study in Appendix C.~~

~~For the purposes of the TSP, the following additional study is recommended:~~

- ~~Detailed Large Vehicle Alternate Route Study: Several specific recommendations for this study are identified in Appendix C. In summary, the detailed study would take the preliminary work from the large vehicle alternate route study done for the TSP and develop further detail, with a focus on cost-effective solutions that are most likely to be used (for example, minimize out-of-direction travel or trip time). It would also include an internal circulation study at the Tillamook Lumber Company mill site. This study would identify opportunities and constraints for changing circulation patterns at the mill to improve overall truck routing.~~

~~After completion of this refinement study, the priorities of projects included in the City of Tillamook TSP may shift, as many of the potential solutions include improvements on state and county facilities.~~

Pedestrian and Bicycle Systems

Table 5-9 displays the recommended pedestrian facility improvements along existing streets and roads in Tillamook for the next 20 years. Each of these projects is shown in Figure 5-5. If the project is only a pedestrian or bicycle project, it is denoted with a "P" or "B", respectively. If the project is a pedestrian and a bicycle project, then it is denoted with a "PB".

TABLE 5-9
Pedestrian and Bicycle System Improvements

Project Number	Project Type	Location and Description	Estimated Cost	Priority (years)
1	P	Downtown sidewalk construction/replacement from Hoquarten Slough to 4th Street. Includes bulb-outs at 2nd, 3rd and 4th Streets. This is Phase 1 of the transportation enhancement project.	$450,000	0-5
2	PB	Construct sidewalk on 12th Street, east of the high school to Marolf Loop, repave from Miller Avenue to Marolf Loop. Provide adequate width along 12th Street from high school to Marolf Loop for shared roadway designation.[1]	$1,400,000	0-5
3	B	Provide adequate bike lane width and sidewalk and repave Alder Lane between Evergreen Drive and the Cypress/Dogwood intersection[1]	$740,000	0-5
4	PB	Develop Phase 1 of the Hoquarten Slough Trail along the south side of Hoquarten Slough for approximately 1,000 feet. Connect parks along the slough and proposed Stillwell Avenue bike route. This is a current project of the Tillamook County estuary organization.	$100,000	0-5
	P	From 1st Street to 5th Street: Add new landscaping where space allows (combination of street trees, sidewalk planter boxes, etc.).	$175,000	0-5
	P	From 1st Street to 5th Street: Add pedestrian scale lighting to improve pedestrian safety and downtown aesthetics. Include options for hanging banners, planters, etc.	$1,760,000	0-5
	P	From 1st Street to 5th Street: Reconstruct/repair existing sidewalks to make ADA-compatible (curb ramps), improve aesthetics, and allow for new landscaping opportunities.	$60,000 (per block, both sides)	0-5
	P	From 1st Street to 5th Street: Reduce sign clutter by consolidating existing public signs (highway signs, local street signs, and information signs).	$10,000	0-5
	P	From 1st Street to 5th Street: Work with property owners to improve storefronts and business signage to improve aesthetics, create coordinated image, and reduce tunnel effect of existing signage. Improve visual appeal to drivers and encourage them to slow down (improve safety) and stop (support businesses) in Tillamook.	N/A	0-5
5	PB	Create trail plan to assess roadway connectivity and off-street trails projects. Include the development of Hoquarten Slough Trail Phase 2.	$50,000	5-10
6	PB	Construct bike lanes and sidewalk on 3rd Street, east of Evergreen Drive to Trask River Road, repave roadway from Nestucca Avenue to the city UGB. Provide marked crosswalks near the Tillamook County Fairgrounds with pedestrian area warning signs. Restripe crosswalks near Wilson Elementary/ Goodspeed Park area on 3rd Street. Retrofit ramps along 3rd Street to ADA compliance near Goodspeed Park and Wilson School. [1]	$2,850,000	5-10

TABLE 5-9
Pedestrian and Bicycle System Improvements

Project Number	Project Type	Location and Description	Estimated Cost	Priority (years)
7	B	Provide bike route from Evergreen Drive to Trask River Bridge. **Eastbound:** Enter city on 3rd Street, south onto Ash Avenue, east on 4th Street, north on Ocean Place, east on 3rd Street. Would require bike lanes on 3rd Street to Ash Avenue, to shared roadway on Ash Avenue, 4th Street and Ocean Place. **Westbound**: On 3rd Street from Evergreen Drive, north on Ocean Place, west on Oregon 6 (1st Street), cross U.S. 101, south on Birch Avenue, west on 2nd Street, south on Ash Avenue, west on 3rd Street. Provide bike lanes on 3rd Street and Oregon 6. All other roads are shared roadway designation. Bike lanes on Oregon 6 can be provided with striping modifications. Bike lanes on 3rd Street west of Ash Avenue will require removal of parking on one side of road. Requires advanced signing on U.S. 101 and 3rd Street. Complete sidewalk on 3rd Street, west of Ash Avenue.[1]	$50,000	5-10
8	PB	Create a bicycle bypass in downtown area along Stillwell Avenue, create bike lane connections with U.S. 101 along Front Street and 11th Street. Provide advanced signing. Remove parking on one side of road to provide bike lanes. Coordinate with Hoquarten Slough Trail. Might require undercrossing with U.S. 101 at Front Street. Additional study required. Complete sidewalk system on Stillwell Avenue, Front to 1st Streets and 11th to 12th Streets. Construct ADA ramps along Stillwell Avenue near Liberty Elementary School (7th and 8th Street crossings). Restripe crosswalks along Stillwell Avenue.[1]	$1,800,000	5-10
9	P	Downtown sidewalk construction/replacement from 4th to 12th Street. Includes bulb-outs at 9th and 11th Streets. This is Phase 2 for the transportation enhancement project.	$900,000	5-10
10	PB	Construct sidewalk and bike lanes on Evergreen Drive. Repave road with asphalt.[1]	$790,000	5-10
11	P	Provide ADA-compliant ramps along Miller Avenue. Provide painted crosswalks along Miller Avenue	$30,000	5-10
12	P	Construct ADA-compliant ramps along 10th Street. (Currently ramps exist only at Stillwell Avenue and U.S. 101 intersections)	$25,000	5-10
13	PB	Provide bicycle parking in downtown Tillamook. Benches, drinking fountains, trash receptacles, and informational signage or historical kiosks are recommended	$50,000	5-10
14	B	Provide bicycle parking at sport fields on Alder Lane	$1,000	5-10
15	B	Provide bicycle parking at Tillamook County Fairgrounds	$1,000	5-10
16	B	Provide bicycle parking at TCTD, 2nd and Laurel Avenue, transit center	$1,000	5-10
17	B	Provide bicycle parking at hospital	$1,000	5-10
18	B	Provide bicycle parking at Goodspeed Park	$1,000	5-10

TABLE 5-9
Pedestrian and Bicycle System Improvements

Project Number	Project Type	Location and Description	Estimated Cost	Priority (years)
19	B	Provide bicycle parking at 9th Street Park	$1,000	5-10
20	B	Provide bicycle parking at Carnahan Park	$1,000	5-10
	P	From 5th Street to 12th Street: Add new landscaping where space allows (combination of street trees, sidewalk planter boxes, etc.).	$320,000	5-10
	P	From 5th Street to 12th Street: Add pedestrian scale lighting to improve pedestrian safety and downtown aesthetics. Include options for hanging banners, planters, etc.	$3,255,000	5-10
	P	From 5th Street to 12th Street: Reconstruct/repair existing sidewalks to make ADA-compatible (curb ramps), improve aesthetics, and allow for new landscaping opportunities.	$60,000 (per block, both sides)	5-10
	P	From 5th Street to 12th Street: Reduce sign clutter by consolidating existing public signs (highway signs, local street signs, and information signs).	$10,000	5-10
	P	From 5th Street to 12th Street: Work with property owners to improve storefronts and business signage to improve aesthetics, create coordinated image, and reduce tunnel effect of existing signage. Improve visual appeal to drivers and encourage them to slow down (improve safety) and stop (support businesses) in Tillamook.	N/A	5-10
21	PB	Provide adequate shoulder on Brookfield Avenue. Road may need to be acquired by city.[1]	$220,000	10+
22	PB	Provide adequate shoulder on McCormick Loop for shared roadway designation, repave road at south end. [1]	$250,000	10+
23	PB	Provide adequate shoulder on Marolf Loop for shared roadway designation, repave road, add sidewalk. [1]	$250,000	10+
24	P	Construct sidewalk along 4th Street from Nestucca to Miller Avenues. Contingent on development.	$60,000	10+
25	P	Provide sidewalk on north side of 11th Street between Stillwell Avenue and U.S. 101, retrofit south side sidewalk, overlay roadway between Stillwell and Miller Avenues	$130,000	10+

[1] Project is a joint pedestrian/bicycle improvement and appears on Table 5-11, as well. The cost should be accounted for in one table only.

ADA = Americans with Disabilities Act.

TCTD = Tillamook County Transportation District.

UGB = urban growth boundary.

The cost associated with the sidewalk improvements is for both sides of the road. It is expected that with limited funds, the sidewalk projects may be phased over time and begin with construction sidewalk on one side only. This would reduce costs dramatically because right-of-way impacts could be significantly or altogether avoided.

Pedestrian System Improvements

The Tillamook pedestrian system can be characterized as comprehensive in some areas of the city and lacking in some areas east of the downtown. Gaps in pedestrian connectivity exist in the residential areas. Also, the high number of private accesses and conflict opportunities are barriers to continuous, connected pedestrian facilities in certain areas of Tillamook. ADA compliance also is an important component of the Tillamook TSP.

Sidewalks

Existing sidewalk is generally located in all areas except in the east area of the city. Including Evergreen Drive, roads to the east either provide a narrow shoulder or have no pedestrian facilities. Sidewalk condition varies, with most areas exhibiting old, cracked sidewalk. In newer areas of the city, where development has occurred recently, the sidewalk is in good condition. This is noticeable in the commercial area along U.S. 101 to the north. In most areas, the sidewalk does not comply with ADA ramping and width requirements.

Figure 5-5 Pedestrian and Bicycle Improvements

11 x 17

front

Figure 5-5 Pedestrian and Bicycle Improvements

11 x 17

back

To provide a network of safe and connected facilities that will promote a balanced transportation system, sidewalk improvements have been identified. Particular focus is placed on increasing pedestrian safety by installing new sidewalks in areas frequently used by pedestrians. Where sidewalks do not exist and where it is not feasible to build them, shoulder widening is recommended.

Crosswalks

To assist pedestrians in crossing busy roadways and improve pedestrian safety, marked crosswalks and pedestrian warning signage should be installed at several locations: near Tillamook schools, the hospital, Tillamook County Fairgrounds, any parks and along U.S. 101.

Pedestrian Standards and Policies

To enhance pedestrian safety, circulation and connectivity, and to comply with the TPR, several changes have been proposed to the Zoning Ordinance in Tillamook. Much of the pending language for inclusion in the Zoning Ordinance that supports pedestrian safety and circulation (such as access management and access spacing) has been recommended for adoption. The proposed code changes also address pedestrian access, requiring construction of pathways when street connections are not feasible. The new street cross sections, recommended for adoption into the city's *Design Standards and Details* document, reflect new street design standards, which require sidewalks along all new arterials and collectors as well as providing for either a sidewalk or a 5-foot-wide shoulder along new local streets. Optional planting strips can serve to buffer pedestrians from automobile traffic. These new standards and policies encourage pedestrian trips because they facilitate safe, direct and convenient access to local destinations. See Section 7 for detailed information on recommended amendments to the city's ordinances.

Pedestrian System Plan

Pedestrian activity in Tillamook is concentrated in the downtown area, the residential areas east and west of downtown, and the commercial area north of downtown. The focus of the pedestrian system element of the TSP is to improve connections in the community and enhance pedestrian access to Tillamook's recreational features.

Providing a connected network of pedestrian facilities in Tillamook is important to:

- Serve shorter pedestrian trips from neighborhoods to area recreational and activity centers, such as schools
- Provide access to public transit
- Meet residents' and visitors' recreational needs
- Provide circulation in the downtown area

To meet specific goals and objectives identified in this TSP, the city will encourage walking as a means of transportation by addressing the following:

- **Connectivity.** The city will work to develop a connected network of pedestrian facilities. Connected networks are important to provide continuity between communities and to improve safety.
- **Safety.** The city will work to provide a secure walking environment. For residents to use the pedestrian system, it must be perceived as safe.
- **Design.** The city can ensure pedestrian-oriented design by adopting policies and development standards that integrate pedestrian scale, facilities, access and circulation into the design of residential, commercial and industrial projects.

The pedestrian system plan identifies system and facility improvements that will contribute to a safe and well-connected pedestrian environment. The system will promote walking as a viable transportation mode and address needs of the transportation disadvantaged. Figure 5-6 shows the pedestrian system on the city's arterial and collector system. (A pedestrian facility inventory on local streets was beyond the scope of the TSP.)

Bicycle System Improvements

The Oregon Coast Bike Route passes through Tillamook along U.S. 101 and uses marked bike lanes or shoulders that are 3 feet wide or wider and are marked with signage.

The remainder of the Tillamook bicycle system generally consists of either shared roadways (particularly on local roads) or shoulder bikeways and are characterized by good pavement condition. Aside from the Oregon Coast Bike Route, most bikeways are not marked with bicycle signage. The bicycle system lacks facilities in Tillamook. The current designated roads, such as Alder Lane, are characterized by low visibility pavement markings, small travel width and a multitude of various vehicles types that can cause barriers or hazards for bicyclists.

Bikeways and Trails

To promote safe and convenient bicycle links between commercial, recreational and other land uses, improvements to the bicycle system have been identified. Further, to better enhance the downtown area and connect bicycle traffic with parks and the designated bicycle routes, a bicycle trail along the south side of Hoquarten Slough has been identified as a high priority project. This project is being studied by the Tillamook County estuary organization. To further enhance the trail system, a study that examines opportunities to develop trails east and north of the city should be conducted.

Signage

To promote safety and awareness of bicyclists where they share facilities with pedestrian and vehicular traffic, designation signage is recommended along U.S. 101, Oregon 6 and Netarts Highway (131).

Bicycle Parking

To comply with the standards stated in the OBPP, bicycle parking will be installed at community activity centers, such as the transit center, various schools and parks in Tillamook, the Tillamook County Fairgrounds, downtown area and hospital. Refer to Table 5-10 for the list of bicycle parking locations.

Figure 5-6 Pedestrian System Plan

11 x 17

front

Figure 5-6 Pedestrian System Plan

11 x 17

back

Bicycle Standards and Policies

To enhance bicycle safety, circulation and connectivity, and to comply with the TPR, several changes have been proposed to the city's Zoning Ordinance. Recommendations have been made to include bicycle parking standards in the Zoning Ordinance and to adopt new street cross sections. The new street cross sections, recommended for adoption into the city's *Design Standards and Details* documents, reflect new design standards, which require bike-ways on arterials and provide options for their construction on collector streets constructed in the city. The proposed changes also address bicycle access and circulation, requiring construction of multi-use pathways when street connections are not feasible. These new standards and policies encourage bicycle trips because they facilitate direct, safe and convenient access to local destinations. See Section 7 for detailed information on recommended amendments to the city's ordinances.

Bicycle System Plan

Bicycle travel offers commuters, children and others an important option for transportation and is a transportation choice for people who do not own vehicles. Cycling is also an important recreational option, especially in scenic areas of Oregon such as Tillamook.

This bicycle system element of the TSP establishes a network of bicycle lanes and routes throughout Tillamook, to connect trip generators and provide a safe, interconnected bicycle system. While all roadways and streets can be used as bikeways, designated routes along bicycle streets and roads and/or separated bicycle lanes on busy streets can improve safety as well as increase bicycle use.

Figure 5-7 illustrates the bicycle plan for Tillamook. It includes shared roadways, shoulder bikeways, bicycle lanes, and designated bike routes. Table 5-10 describes Tillamook's designated bicycle routes and labels them as city or state facilities. Projects to improve the bicycle system are listed with the pedestrian system improvements in Table 5-9.

TABLE 5-10
Tillamook Designated Bicycle Routes

Bike Facility Name	Between		Management
U.S. 101	North city limits	Oregon 6	ODOT
U.S. 101	12th Street	South city limits	ODOT
Stillwell Avenue	Front Street	12th Street	City
Front Street	Stillwell Avenue	U.S. 101	City
Oregon 6	East city limits	U.S. 101	ODOT
First Street	U.S. 101	Birch Avenue	City
Birch Avenue	1st Street	2nd Street	City
2nd Street	Birch Avenue	Ash Avenue	City
Ash Avenue	2nd Street	4th Street	City
Netarts Highway (131) (3rd Street)	Ash Avenue	West city limits	ODOT
4th Street	Ash Avenue	Ocean Place	City
Ocean Place	4th Street	Oregon 6	City
3rd Street	Ocean Place	McCormick Loop	City/County

TABLE 5-10
Tillamook Designated Bicycle Routes

Bike Facility Name	Between		Management
12th Street	Miller Avenue	Marolf Loop	City/County
Miller Avenue	3rd Street	12th Street	City
Evergreen Drive	3rd Street	12th Street	City
Alder Lane	Evergreen Drive	Dogwood Street	City
11th Street	Stillwell Avenue	Miller Avenue	City
Marolf Loop	3rd Street	12th Street	City/County
McCormick Loop	3rd Street	South city limits	City/County

ODOT = Oregon Department of Transportation.

Public Transportation

The TCTD currently operates public transportation services both in Tillamook, and between Tillamook and surrounding communities. In Tillamook, the addition of transit amenities at transit stops should be considered, including covered benches, bus pullouts, signage and concrete landing pads. These amenities would make the system more visible to potential users and possibly attract new riders. Also, all transit stops should be accessible to all potential riders per ADA standards.

TCTD has outlined opportunities to improve public transportation services on a county level, including the following items:

- **Provide annual incremental route expansion**
- **Provide park-and-ride services at the TCTD's building headquarters.** This is a planned facility included in the Phase 2 construction of the TCTD's new headquarters building. It is expected that the park-and-ride will provide 25 stalls. Two STIP projects were awarded to TCTD for the new bus facilities (STIP #12484 and #12089).
- **Improve connections with other transit service providers.** Currently, connections between transit service providers, including Sunset Empire, Greyhound, Pacific Transit and Oregon Coachways are not available or not well coordinated.
- **Provide transit pull-outs on state and county facilities**
- **Enlarge transit shelters.** This is a current proposal to the Tillamook City Council. It includes expansion of the transit center on 2nd Street and Laurel Avenue, and adds additional shelters at stops where there are none.
- **Provide additional services at the 2nd Street and Laurel Avenue transit center stop.** Includes providing restrooms, customer service station and bike racks.
- **Advertise and promote TCTD services**
- **Coordinate TCTD, ODOT and Tillamook County efforts** to explore the need for implementing TDM measures, such as carpooling and vanpooling in the county.

Figure 5-7 Bicycle System Plan

11 x 17

front

Figure 5-7 Bicycle System Plan

11 x 17

back

- **Expand services** to these communities: Manzanita, Bayside Gardens, Nehalem, Wheeler, Oceanside, and Pacific City.
- **Form a citizen advisory committee to develop a public transportation program.**

Rail System

The existing rail line owned and operated by the Port of Tillamook Bay serves the Tillamook Lumber Company and the port. There are two existing at-grade crossings along this line, which are located at 3rd Street (flashing lights and automatic gate) and 12th Street (signage only). The existing rail line currently is being upgraded to a Class II rail facility. When the rail facility is upgraded and train speeds increase in Tillamook, safety improvements at the 12th Street crossing should become a high priority.

The existing rail line in Tillamook is part of a countywide rail system. On a county level, the following rail issues have been identified and should be addressed:

- Identify and prioritize improvements on railroad bridges throughout the county to ensure the system is able to function throughout the 20-year design horizon.
- Explore opportunities to expand tourist rail services throughout the county and in the City of Tillamook.
- Consider improvements at the Latimer Road railroad crossing as necessary to accommodate increased truck traffic.
- Upgrade the existing railroad tracks from Tillamook to Blimp Boulevard. This improvement is currently underway.
- Expand the ability of the system to transport rock from local quarries and wood chips. To transport these products along the existing rail lines, the Port of Tillamook Bay would need to acquire new cars to carry rock and chips.
- Improve marketing of the Port of Tillamook Bay, including improving the appearance (road improvements) and infrastructure (storm drainage, rail line) of the port.