Banks Transportation System Plan Update:
Transportation Needs, Opportunities and Constraints Report

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This memorandum provides an overview of the Future No-Build (Year 2029) traffic conditions within the Banks Transportation System Plan Update study area, as well as transportation needs, opportunities and constraints. Transportation needs are based on assessment of existing and future transportation conditions. Opportunities are options to address needs identified for the Banks future transportation system. Constraints are limitations or barriers to transportation system development.

Background - Existing Transportation Conditions Summary (Year 2009)

The following summarizes the findings from the existing transportation conditions report, which forms the basis for the development of future transportation conditions.

Congestion (Year 2009)

All six identified study intersections perform well from a volume/capacity measurement in 2009, meeting Oregon Department of Transportation and Washington County mobility standards as appropriate.

Study intersections include:

- OR 47 (Main Street) & NW Oak Way
- OR 47 (Main Street) & OR 47 Exit
- OR 47 (Main Street) & NW Trellis Way
- OR 47 (Main Street) & NW Banks Road
- NW Banks Road & NW Aerts Road
- OR 6 & NW Aerts Road

Westbound vehicle queuing at OR 47 (Main Street) and NW Banks Road blocks the nearby intersection causing delay and inhibiting vehicle mobility. This location is identified for

realignment and at-grade rail crossing consolidation in 2010 (Rural State Transportation Improvement Program funds) which will help alleviate queuing and safety problems, but will not reduce delay for vehicles stopped and waiting to turn onto or cross OR 47 from the stop-controlled approaches. Vehicle queuing (in which the queue exceeds available lane storage length) also occurs at the OR 47 (Main Street)/Oak Way signalized intersection at the eastbound right and left turn lanes, northbound right turn lane, and southbound right turn lane.

Community members have identified queuing on Main Street at the end of the school day as an issue. The school district is working on a circulation plan to manage the traffic.

Safety

Safety analysis shows that the study area is performing better (lower accident rates) than statewide averages for segment crash rates. Intersection crash rates do not suggest there are any safety issues at study intersections; however, relative to each other, the Aerts Road/OR 6 intersection area has experienced several crashes and has been noted by the community as dangerous for turning approach road traffic. There are no areas within the study area that are on the top 10% ODOT Safety Priority Index System (SPIS) list.

Pedestrian, Bicycle and Transit Travel

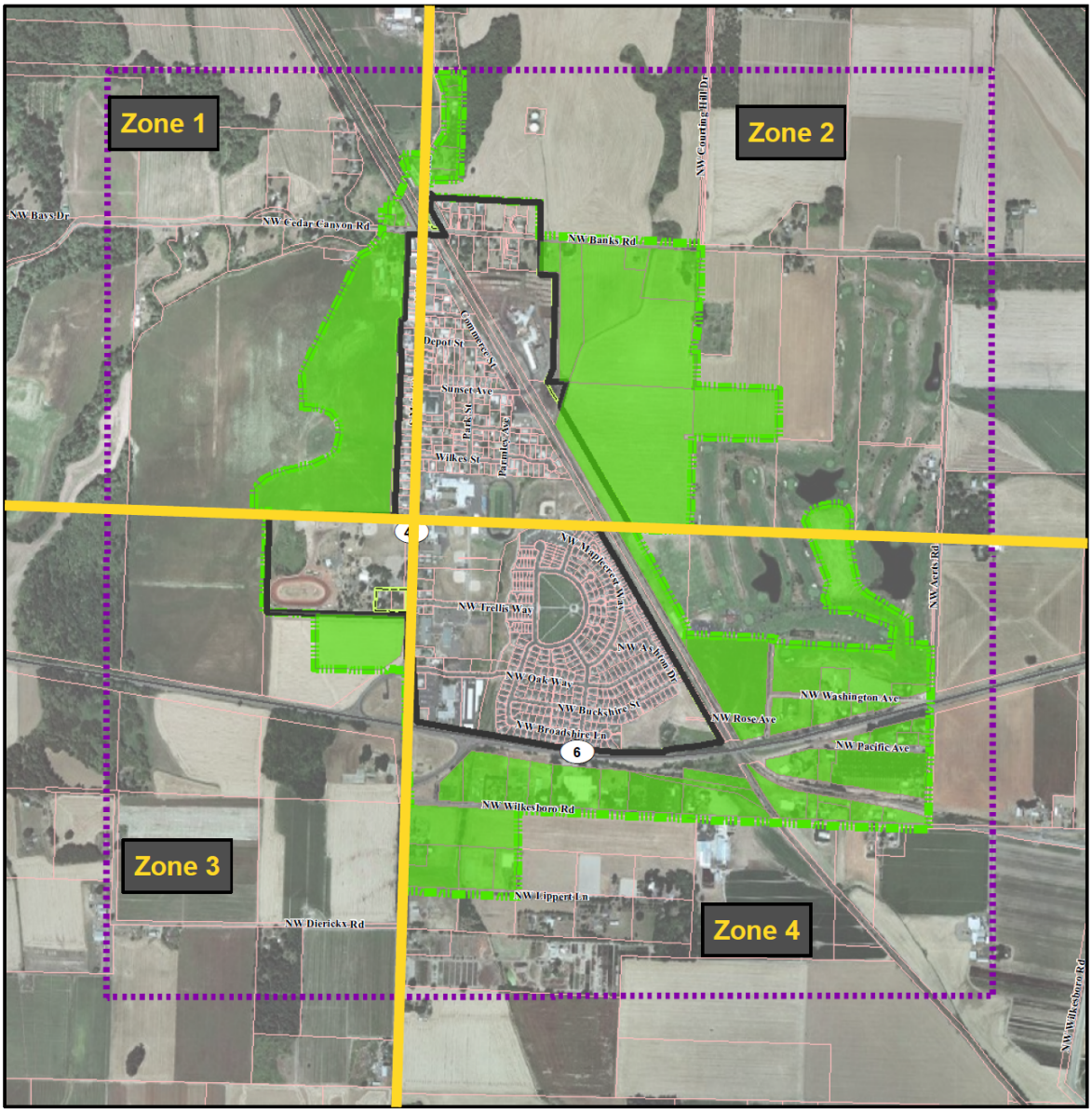
There are limited bicycle facilities and transit facilities in Banks. Though some of Banks is well-served with pedestrian facilities (including access to the Banks-Vernonia trail), there is a lack of north-south pedestrian/bicycle connectivity in the eastern portion of the city.

Future Transportation Conditions Summary (2029)

The following is a summary of the future transportation conditions analyzed for Banks. The future transportation conditions examined traffic levels that would be expected in 2029 based on the recommended Urban Growth Boundary strategy (see Figure 1). The recommended Urban Growth Boundary (UGB) expansion will result in increases in traffic – the future transportation plan will account for this growth. These results are discussed in greater detail in the remainder of this memorandum.

Congestion (Year 2029)

- In 2029, three study intersections are expected to be highly congested and not meet the Oregon Highway Plan mobility standards.
- Congestion from OR 47 (Main Street) and NW Banks Road causes vehicle backups along NW Banks Road to the NW Sellers Road intersection.
- All legs on the OR 47 (Main Street) and NW Oak Way intersection have at least one movement where the queue is longer than the available storage length. Additionally, the southbound through queues on OR 47 will extend upstream to the adjacent intersection, resulting in longer queues at NW Trellis Way.
- OR 6 at NW Aerts Road will experience queues in excess of 600 feet, demonstrating the intersection will not have sufficient capacity to handle forecasted volumes.



LEGEND

- Existing (2009) Urban Growth Boundary
- Potential Urban Growth Boundary Expansion
- Banks Transportation System Plan Study Boundary
- City of Banks Boundary
- Study Area Taxlots

N

0 0.25 0.5

Miles

VICINITY MAP

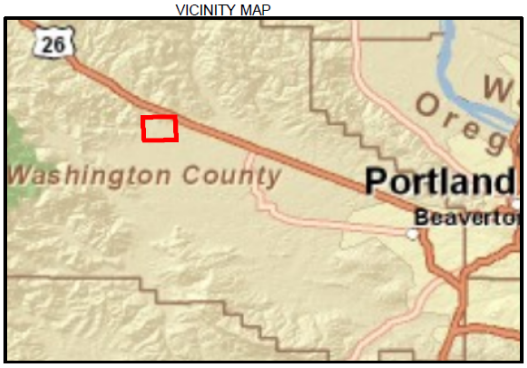


Figure 1
Trip Generation Zones

Banks Transportation System Plan

Pedestrian, Bicycle and Transit Travel

- Pedestrian and bicycle connections are needed to link the expanded urban growth boundary areas with the remainder of the city. This is particularly important for expansion east or south of the existing UGB.
- Banks is working with the Tillamook County Transportation District (TCTD) to negotiate a shuttle stop in Banks and North Plains which would provide Banks with easier transit access to North Plains, Portland and Tillamook. UGB expansion will result in greater need for transit services, including demand-response service.

2029 No-Build Traffic Analysis

Context

The 2029 no-build traffic analysis looks at what congestion and intersection queuing results would look like in 2029 if (a) the urban growth boundary were to be expanded as reflected in Figure 1, and (b) no additional roadway projects are built, aside from the funded realignment of Sellers Road near the Banks Road/OR 47 (Main Street) intersection. This analysis helps to show where future deficiencies would be so that potential solutions can be developed. Although this memorandum discusses opportunities and constraints, recommended solutions to transportation problems will be included in a future memorandum.

Project Study Area

The project study area for the 2029 Future No-Build traffic analysis is based on the existing traffic analysis study area outlined *Technical Memorandum 2.4 Banks Transportation System Plan Update: Existing Conditions*. The analysis study area includes six existing intersections in and near the City of Banks. With the realignment of Sellers Road approximately 200 feet east at NW Banks Road to accommodate a Banks-Vernonia Trail trailhead, the intersection of Sellers Road and NW Banks Road will be reported as a separate intersection, increasing the number of study intersections to seven.

Analysis conducted in 2009 indicates that Banks needs to expand its urban growth boundary (UGB) by approximately 248 acres (approximately 154 acres of buildable residential land and 94 acres of commercial and industrial land) by 2029 for consistency with the 20-year population and employment forecasts consistent with the Banks Comprehensive Plan and the City's Economic Opportunities Analysis. The recommended UGB expansion area is illustrated in **Figure 1**.

Analysis Year and Time Period

The year 2029 is the horizon analysis year for the Future No-Build traffic analysis. This year provides a 20-year forecast horizon from existing conditions. The 30th highest hour was selected as the future No-Build analysis time period because it is consistent with the existing conditions traffic analysis and ODOT methods.

Future No-Build Forecasting

There is no available travel demand model for the study area; consequently, the development of future no-build turning movement volumes was a two-step process. The first step was to estimate future background turning movements based on historical trends. Additionally, trip generation, trip distribution, and traffic assignment was completed for land included in the UGB expansion based on assumed land use type (e.g. residential, commercial or industrial). Analysis for traffic generated by the UGB expansion was completed using the cumulative analysis method in the ODOT *Analysis Procedures Manual* (Section 4.6.2, Updated May 2009). It should be noted that this cumulative analysis is somewhat conservative due to the nature of the traffic assumptions – traffic impacts may be somewhat overstated.

Future Background Traffic Volumes

Historical trends provided by ODOT are used to forecast future volumes and evaluate future deficiencies within the traffic system. **Table 1** shows the forecasted growth rates calculated for the project area for state highways OR 47 and OR 6.

TABLE 1
State Highway Annual Growth Rates

Milepost	2006 ADT	2027 ADT	Source	Overall Factor	1-year growth
OR 47 – Nehalem Highway No. 102					
82.90	6,800	8,900	MODEL	1.31	1.47%
83.11	6,800	9,000	MODEL	1.32	1.54%
83.13	7,200	9,500	MODEL	1.32	1.52%
83.53	8,000	10,500	MODEL	1.31	1.49%
				OR 47 Annual Rate	1.51%
				OR 47, 21-Year Factor	1.32
OR 6 Wilson River Highway No. 37					
49.24	8,700	12,500	MODEL	1.44	2.08%
				OR 6 Average Annual Rate	2.08%
				OR 6, 21-Year Factor	1.44

Notes:
Source: ODOT 2027 Highway Future Volume Table
http://www.oregon.gov/ODOT/TD/TP/docs/TADR/2027FVT.pdf
The available growth rates are only projected to year 2027; this study assumed the AAGR to continue at the same rate through year 2029.

Volumes used to calculate the annual growth rate are chosen based on either an R-squared value from historic volume trends or a travel demand model. As shown in the table, MODEL is written as the source instead of an R-squared value. This indicates that ODOT's Transportation Planning Analysis Unit (TPAU) used a travel demand model to populate the data in the table. The annual rate for OR 47 was calculated using an average of the growth rates within the study area. The annual rate for OR 6 was calculated using the growth rate at the only location along OR 6 that occurred within the study area.

The annual growth rate on OR 47 suggests a growth of 1.51 percent per year or about a 32 percent increase in traffic over the 20-year planning period life (2009 to 2029). This 32 percent factor was applied to each of the existing 2009 30th highest hour intersection turn

movements on OR 47 (except those accessing only a local street) to obtain 2029 background 30th highest hour intersection volumes.

The annual growth rate on OR 6 suggests a growth of 2.08% percent per year or about a 44 percent increase in traffic over the 20-year planning period (2009 to 2029). This 44 percent factor was applied to each of the existing 2009 30th highest hour intersection turn movements on OR 6 (except those accessing only a local street) to obtain 2029 background 30th highest hour intersection volumes.

This future traffic growth represents the growth due to trips passing through the study area (external-external trips) or trips that have one trip end outside the study area (external-internal and internal-external trips). Therefore, the forecast factors were only applied to turning movements that access streets that extend beyond the study boundary.

UGB Expansion Volumes

For the land included in the UGB expansion, a manual trip generation and traffic assignment process was completed.

Trip Generation

The Banks area was divided into four zones with the land use growth estimated in each zone (see Figure 1). . The ITE *Trip Generation Manual (8th Edition)* was used to estimate the number of trips for each zone. In total, the assumed development resulted in 3,150 new trip ends for the study area. This information is summarized in **Tables 2 through 5**.

TABLE 2

Zone 1: Trips Generated for Projected Development in Northwest Development Zone, by Land Use Category

Zoning	Land Use Category/ITE Code*	Developable Acres	PM Peak-Hour Trips Generated
Low Density Single Family	Single-Family Detached Housing (210)	9.8 (59)**	65
Single Family	Single-Family Detached Housing (210)	8.6 (69)**	75
Multifamily	Residential Condominium/Townhouse (230)	4.6 (78)**	49
High Density Multifamily	Apartment (220)	1.8 (43)**	41
Mixed Use	Apartment (220) Specialty Retail Center (814)	4.6 (46)** 4.6 (39.9)**	43 117
Industrial	General Light Industrial (110), Industrial Park (130), Manufacturing (140)	1.7	14
		Total =	404 trip ends Entering = 232 Exiting = 172

Used peak hour of adjacent street traffic, one hour between 4:00 p.m. and 6:00 p.m.
*Multiple codes listed assume a blend of uses to develop

** Number in parenthesis represent dwelling units for residential developments or 1,000 building square feet for commercial developments.

TABLE 3

Zone 2: Trips Generated for Projected Development in Northeast Development Zone, by Land Use Category

Zoning	Land Use Category/ITE Code*	Developable Acres	PM Peak-Hour Trips Generated
Low Density Single Family	Single-Family Detached Housing (210)	33.0 (198)**	194
Single Family	Single-Family Detached Housing (210)	24.0 (192)**	189
Industrial	General Light Industrial (110), Industrial Park (130), Manufacturing (140)	10.2	83
		Total =	466 trip ends Entering = 268 Exiting = 198

Used peak hour of adjacent street traffic, one hour between 4:00 p.m. and 6:00 p.m.
*Multiple codes listed assume a blend of uses to develop

** Number in parenthesis represent dwelling units for residential developments or 1,000 building square feet for commercial developments.

TABLE 4

Zone 3: Trips Generated for Projected Development in Southwest Development Zone, by Land Use Category

Zoning	Land Use Category/ITE Code*	Developable Acres	PM Peak-Hour Trips Generated
Commercial	General Office (710), Medical/Dental Office Building (720), Specialty Retail Center (814), Shopping Center (820), Apparel Store (876), Hair Salon (918), High Turnover (sit-down) Restaurant (932), Fast Food Restaurant without Drive-Through Window (933), Auto Parts & Service Center (943)	6.5 (99.3)	843
		Total =	843 trip ends Entering = 383 Exiting = 460

Used peak hour of adjacent street traffic, one hour between 4:00 p.m. and 6:00 p.m.
*Multiple codes listed assume a blend of uses to develop

** Number in parenthesis represent dwelling units for residential developments or 1,000 building square feet for commercial developments.

TABLE 5

Zone 4: Trips Generated for Projected Development in Southeast Development Zone, by Land Use Category

Zoning	Land Use Category/ITE Code*	Developable Acres	PM Peak-Hour Trips Generated
Single Family	Single-Family Detached Housing (210)	10.1 (81)**	87
High Density Single Family	Single-Family Detached Housing (210)	19.4 (194)**	191
Industrial	General Light Industrial (110), Industrial Park (130), Manufacturing (140)	63.9	515
Commercial	General Office (710), Medical/Dental Office Building (720), Specialty Retail Center (814), Shopping Center (820), Apparel Store (876), Hair Salon (918), High Turnover (sit-down) Restaurant (932), Fast Food Restaurant without Drive-Through Window (933), Auto Parts & Service Center (943)	4.7 (70.9)	644
		Total =	1,437 trip ends Entering = 628 Exiting = 809

Used peak hour of adjacent street traffic, one hour between 4:00 p.m. and 6:00 p.m.
*Multiple codes listed assume a blend of uses to develop

** Number in parenthesis represent dwelling units for residential developments or 1,000 building square feet for commercial developments.

Traffic Assignment

The assignment of the trips related to the UGB expansion (**Tables 2 through 5**) assumed no intrazonal trips. Furthermore, of the land use codes used in the analysis, only Shopping Center (820) and High Turnover (sit-down) Restaurant (932) have pass-by trip information in ITE's *Trip Generation Handbook* (2nd Edition). For these two land uses, pass-by trips were taken from external-external trips.

These two assumptions will result in a conservative analysis (higher forecasted volumes) as it estimates a simplified forecast that assumes all trips are only to a single destination and do not include multiple purposes.

The traffic assignment of the trips began with the following network loading assumptions.

Zone 1:
- 70% of trips access through the Sunset Avenue connection to OR 47.
- 30% of trips to/from NW Cedar Canyon Road.

Zone 2:
- 40% of trips to/from NW Banks Road.
- 40% of trips access NW Aerts Road through the new north-south connection to Zone 4.
- 20% of trips are to Zone 4 through the new north-south connection.

Zone 3:
- 100% of trips access through new connection with OR 47.

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Zone 4: Industrial Trips South of OR 6
- 60% access OR 47 via Wilkesboro Road.
- 40% access OR 6 via NW Aerts Road

Zone 4: Residential and Commercial Trips North of OR 6
- 40% of trips access through new connection with NW Aerts Road.
- 40% of trips access NW Banks Road through the new north-south connection to Zone 2
- 20% of trips are to Zone 2 through the new north-south connection.

Using these access percentages and the assumed future street network, the assignment of trips was completed using logical route choices (i.e., turning volumes were based on existing turning movement percentages) to assign trips to logical destinations or to external stations. The future turning movement volumes, including existing volumes plus the growth from historical trends, and the traffic assignment of the UGB expansion trips are summarized in **Figure A.1** in **Appendix A**.

Future Planned Infrastructure Projects

The traffic analysis assumes that no additional roadway infrastructure projects will be built by 2029 except for those projects that are funded. In other words, the analysis assumes that all future traffic uses the existing roadway network.

Sellers Road at NW Banks Road is the only funded project in the study area within the planning horizon. Sellers Road is planned to be realigned so that the intersection occurs approximately 200 feet east of the existing intersection with NW Banks Road. Each approach is assumed to be one-lane with no turn lanes, similar to the existing intersection. The traffic control assumed was a STOP approach for Sellers Road while NW Banks Road is uncontrolled.

At the signalized intersection of OR 47 (Main Street) and NW Oak Way, the signal cycle length and phase splits were updated to account for the expected growth. Since updating signal timings requires no new infrastructure or signal equipment, this is a typical change that can be expected to be completed by ODOT staff. Additionally, with a 20-year study horizon, it is reasonable to assume that signal timings will be updated within that timeframe.

It is assumed for sake of analysis that traffic from Zone 1 of the UGB expansion would link with some kind of roadway connection to both Cedar Canyon Road and to OR 47 (Main Street) and that Zone 2 and 4 would be linked with a north-south connection near the rail line.

Methodology

Performance and Mobility Standards

For the 2029 Future No-Build conditions, the mobility standards for intersections within ODOT's jurisdiction vary based on roadway classification. **Table 6** shows the mobility standards for the intersection operational analysis.

Traffic Analysis Software Tools

A Synchro 7 computer traffic operations model was constructed for the 2029 Future No-Build analysis. The future model uses existing truck percentages as that is the most accurate available data and future geometrics and post-processed turning movement volumes. Peak hour factors were updated to be consistent with the guidance in the APM (Section 5.3.3), which is 0.95 for major arterials, 0.90 for minor arterials, and 0.85 for minor streets.

SimTraffic, a traffic microsimulation software program, was used to collect vehicle queuing information for all intersections. Queue results are reported as a 95th percentile expected queue length, which means that 95 percent of the time during the peak hour analyzed, the queue length should be less than or equal to the value reported. An average of five runs of SimTraffic was used.

Future Intersection Operations

The volume to capacity ratios and 95th percentile queue lengths were collected from the future no-build Synchro and SimTraffic simulation models for the seven study area intersections. The post processed 2029 balanced volumes for each intersection were utilized in the analysis.

Operational Analysis Results

Results from the operational analysis results show that three of the seven study intersections do not meet the applicable ODOT or Washington County mobility standards for the 2029 Future No-Build condition. These results indicate that the future traffic growth assumed will lead to operational problems at several locations in Banks, Oregon.

In the existing conditions analysis, all of the intersections meet mobility standards, but in future No-Build conditions, three intersections (OR 47 & NW Banks Road, OR 47 & NW Trellis Way, and OR 6 & NW Aerts Road) were identified as not meeting the mobility standards. At these stop controlled intersections along Oregon State Highways, the V/C ratio on the minor street approaches are above the mobility standard. With the growth of through traffic on the uncontrolled approaches and the minor street traffic growth, the side street traffic that is crossing or turning left will be expected to have a difficult time finding a sufficient gap in traffic to allow them to safely complete their maneuver.

Table 6 shows the results of the 2029 Future No-Build intersection operational analysis. **Figure A.1** of **Appendix A** shows the volumes, channelization, and analysis results for all of the study area intersections. **Appendix B** shows the Synchro HCM reports for each study intersection.

Queuing Analysis Results

The vehicle queue analysis identifies deficient vehicle storage locations and provides key information as this project advances into the alternative development stage. **Table 7** shows the forecast 2029, 95th percentile vehicle queue lengths for each movement at the study intersections. The movements that are expected to have inadequate storage are shown in the table with black highlight. Two intersections (a total of nine movements) have queue lengths that exceed available storage capacity. Six of these movements are either exclusive left or right turn pockets. Of the remaining three movements, one is a through lane at OR 47 (Main Street) and NW Oak Way and the other two are a combined left/through/right lane and a

combined left/through lane at OR 47 (Main Street) and NW Banks Road.. **Appendix C** shows the full results from the SimTraffic Queuing Report.

TABLE 6
Banks Traffic Analysis – 2029 Future No-Build Operational Results

ID	Intersection	Control Type	Future No-Build Mobility Standard	Intersection Performance					
				V/C Ratio		Average Vehicle Delay (sec)		Level of Service	
1	OR 47 (Main Street) & NW Oak Way	Signalized	0.75	0.71		14.1		B	
2	OR 47 (Main Street) & OR 47 Exit	OWSC	0.75	0.44[1]	0.53[2]	9.5[1]	37.6[2]	A[1]	E[2]
3	OR 47 (Main Street) & NW Trellis Way	OWSC	0.85	0.58[1]	**1.02[2]**	0[1]	>100[2]	A[1]	F[2]
4	OR 47 (Main Street) & NW Banks Road	TWSC	0.90	0.12[1]	**> 2.0[2]**	3.2[1]	>100[2]	A[1]	F[2]
5	NW Banks Road & NW Aerts Road	TWSC	0.90*	0.03[1]	0.27[2]	1.4[1]	14.0[2]	A[1]	B[2]
6	OR 6 & NW Aerts Road	TWSC	0.70	0.28[1]	**> 2.0[2]**	7.8[1]	>100[2]	A[1]	F[2]
7	NW Banks Road & Sellers Road	OWSC	0.90*	0.24[1]	0.39[2]	0[1]	17.4[2]	A[1]	C[2]

Notes:
* ODOT mobility standards do not apply to the intersection since it is not located on the state highway system. Instead, the target mobility standard for the "first hour" of "Other Urban Areas" was used.
[1] Indicates OHP Mobility Standard V/C ratio or Level of Service for uncontrolled roadway approach
[2] Indicates OHP Mobility Standard V/C ratio or Level of Service for stop controlled roadway approach
Black highlighting indicates intersection does not meet mobility standards
OWSC: One-way stop-controlled
TWSC: Two-way stop-controlled
Mobility standards are established from 1999 Oregon Highway Plan, Policy Element, Table 6

As shown in **Table 7**, some of the estimated vehicle queue lengths extend a considerable distance from the intersection. For example, one intersection demonstrating a queuing problem is OR 47 (Main Street) and NW Oak Way. This is the ramp intersection between OR 47 and OR 6 and the main access to and from the City of Banks when accessing Banks from the south. Every leg of this intersection is expected to experience queues that exceed their storage. At this location, all but one exclusive turning pocket is predicted to have queues that exceed the storage which results in turning vehicles blocking through movements. This compounding vehicle queuing condition causes a reduction in intersection capacity as well as potentially increases the risk of crashes. Additionally, the queue for the southbound through lane extends from the signal beyond the upstream intersection, resulting in several long queue lengths at Trellis Way.

Another intersection with queues exceeding storage is OR 47 (Main Street) and NW Banks Road where queues on the westbound approach extends further than the storage. With the relocation of Sellers road to the east, the storage area increased from 20 feet to approximately 200 feet (removing a safe area for the train crossing), but the queue length exceeds the storage. As a result, the westbound and southbound queues at the Sellers Road intersection and in several simulation runs even the queues at NW Banks Road and NW Aerts Road were impacted, worsening the traffic operations at those intersections as well.

At the intersection of OR 6 and NW Aerts Road; the queues do not exceed the storage area, however the larger issue is the vehicle queue that develops on the north approach (> 1,000 feet) and south approach (600 feet) as well as queues over 400 feet on OR 6 (the uncontrolled approaches) which are result of left-turning vehicles not being able to find a gap in approaching traffic.

TABLE 7

2029 Future No-Build 95th Percentile Queues at Banks Study Area Intersections

ID	Intersection	Approach	Lane Group	Storage (feet)	2029 Queue Length (feet)
1	OR 47 (Main Street) & NW Oak Way	Eastbound	**Left**	**70**	**260**
			Thru	750	300
			Right	**30**	**100**
		Westbound	**Left**	**250**	**720**
			Thru/Right	950	710
		Northbound	Left	95	70
			Thru	950	470
			Right	**70**	**130**
		Southbound	**Left**	**125**	**340**
			Thru	**530**	**590**
			Right	**25**	**70**
2	OR 47 (Main Street) & OR 47 Exit	Westbound	Left/Right	750	130
		Northbound	Thru	-	20
			Right	70	40
		Southbound	Left	115	90
			Thru	-	0
3	OR 47 (Main Street) & NW Trellis Way	Westbound	Left/Right	-	450
		Northbound	Thru/Right	-	90
		Southbound	Left	125	70
			Thru	-	380
4	OR 47 (Main Street) & NW Banks Road	Eastbound	Left/Thru/Right	-	280
		Westbound	**Left/Thru/Right**	**200**	**330**
		Northbound	**Left/Thru**	**100**	**110**
		Southbound	Left/Thru/Right	-	370
5	NW Banks Road & NW Aerts Road	Eastbound	Left/Thru/Right	-	0
		Westbound	Left/Thru/Right	-	90
		Northbound	Left/Thru/Right	-	130
		Southbound	Left/Thru/Right	Driveway	30
6	OR 6 & NW Aerts Road	Eastbound	Left/Thru/Right	-	410
		Westbound	Left/Thru/Right	-	660
		Northbound	Left/Thru/Right	-	610
		Southbound	Left/Thru	-	> 1000
			Right	50	0
7	NW Banks Road & Sellers Road	Eastbound	Left/Thru	200	150
		Westbound	Thru/Right	-	> 1000
		Southbound	Left//Right	-	420

Notes:

95th Percentile queues calculated using an average of five, one hour SimTraffic runs

Queue lengths not reported for free-flowing and uncontrolled movements

Queue lengths rounded up to the nearest ten feet

Numbers in black highlight indicate a vehicle queue length that exceeds the available storage length

Although the entrances to Banks Elementary School and High School are not study intersections, the school district has noted concern over the queuing in present day along Main Street at these entrances. As volumes along Main Street continue to increase, the 2029

queues at the school entrances are assumed to increase as well. This issue will be noted during the process of alternatives analysis.

Needs and Constraints

Based on the examination of existing and future transportation conditions, the following needs have been identified:

- Safety at OR 6/Aerts Road.
- Safety, especially for pedestrians and bicyclists, along Main Street.
- Pedestrian and bicycle linkages both north-south within the existing Banks UGB and connecting expansion areas with each other and the remainder of the city – particularly the downtown commercial area, schools and Sunset Park.
- Solutions to congestion issues at OR 6 at NW Aerts Road and OR 47 (Main Street) at both NW Trellis Way and NW Banks Road.
- Solutions to queuing issues at OR 47 (Main Street) at both NW Oak Way and NW Banks Road, and OR 6 at NW Aerts Road.
- Enhanced local connections to reduce the Banks residents use of the state highway system for local trips.

The following constraints will guide the types of solutions that will address the needs identified:

- Topography along Banks Road – Banks Road is hilly, with poor sight distance in many locations. Improvement of this rural roadway to urban standards may be cost-prohibitive.
- Railroad lines – The stop controlled intersections of NW Banks Road & NW Aerts Road, OR 47 & NW Banks Road and OR 6 & NW Aerts Road would need to support a lot of traffic under the no-build scenario. Any examination of alleviating that load through an east-west connection(s) would need to cross two sets of railroad tracks (Port of Tillamook Bay and P&W). ODOT Rail Division discourages at-grade crossings and grade-separated crossings generally cost between $20-30 million.
- Main Street, adjacent land uses – Many residences and commercial buildings in Banks are located close to the street; also, Main Street functions as the heart of the city. Expansion of Main Street would be constrained, as public right-of-way is not available. Expansion of Main Street may also not be desired by the community due to safety concerns in relation to pedestrians, school children, etc.
- Schools and parks along Main Street – The location of schools and parks along Main Street require special attention, particularly relating to safety concerns for children.
- Flooding on NW Cedar Canyon Road – Several community members have discussed how NW Cedar Canyon Road has flooded in past years west of the OR 47 and NW Banks Road intersection.

- Neighborhood streets – Many residents have expressed concerns about increased traffic along local streets. Some connectivity options would increase traffic along local roadways that have historically been neighborhood streets in character.
- Access management – ODOT has access control along OR 6 in the study area. No new accesses are allowed on OR 6. ODOT also has access spacing standards along OR 47.
- Signal warrants – Any new signal would need to meet ODOT signal warrants.
- Cost – In general, many of the transportation connections or upgrades required to accommodate population and employment associated with UGB expansion will be expensive. Railroad crossings (grade-separated crossings can exceed $20 million), upgrades of rural county roadways (e.g. Banks Road, Aerts Road), realignment of roadways (e.g. a potential realignment of Wilkesboro to the south), widening to add turn lanes, and any upgrades to Main Street would be expensive and potentially cost prohibitive. Traffic signal installation is also expensive (approximately $250,000 per signal).

Further analysis of solutions will also take into account the decision criteria included in Appendix D.

Potential Opportunities and Range of Solutions

The following opportunities for transportation system improvement will be further discussed during the alternatives analysis portion of the transportation analysis.

Opportunities to Reduce Congestion and Queuing Issues

The intersection of OR 47 (Main Street) and NW Banks Road actually operates as three separate intersections, and exhibits a v/c ratio over ODOT's mobility standards for the westbound movement in the future condition. Complicating the three separate intersections is the railroad crossing NW Banks Road. The project that will alter NW Sellers Road so that it intersects NW Banks Road further to the east, will provide more storage space, but does not help vehicles on the stop-controlled approaches that will experience long delays while waiting to finding gaps in order to perform their maneuver. As the intersection is currently stop-controlled, installing a traffic signal may better control traffic to help reduce the delay and queues on the side approaches, but would impact the performance of the non-controlled approaches. Prior to signal installation, the location would need to be evaluated to determine if the location meets ODOT signal warrants and spacing guidelines.

The operations at the two-way stop controlled intersection at OR 6 and NW Aerts Road may justify turn lanes to better accommodate turning vehicles (e.g., store vehicles out of path of through traffic). Additionally, installing a traffic signal should better control traffic to help reduce the delay and queues on the side approaches, but would likely impact the performance of the non-controlled approaches. Prior to signal installation, the location would need to be evaluated to determine if the location meets ODOT signal warrants and spacing guidelines. Alternatives may also include constructing a partial or full interchange to serve the area's traffic, but also needs further study to understand the trade-off between traffic operations and the interchange footprint.

The OR 47 one-way stop controlled intersections at Trellis Way does not meet the mobility thresholds. Adding additional turn lanes (or lengthening the existing turn lanes, if possible) may provide acceptable operations. Otherwise, installation of a traffic signal may need to be considered if evaluation finds the locations meets ODOT signal warrants and spacing guidelines.

Additionally, the signalized intersection of OR 47 (Main Street) and NW Oak Way will have vehicle queues that exceed available storage in the future conditions. Every leg of the intersection has queues that extend past the existing turn pockets, and in some cases extend into the next intersection. Below are potential suggestions to reduce congestion on each approach:

- Most southbound and northbound movements show queues exceeding the available storage. A low-cost, short-term and easy to implement improvement to reduce vehicle queuing for the southbound left movement is to extend the left turn pocket from 125 feet to 350 feet. The area is already paved; it would simply require restriping and would not require any right of way acquisition. However, additional storage may still be needed to serve the traffic growth expected in the area.
- For the eastbound left movement, a similar turn pocket extension would decrease the queuing. Currently the left turn pocket is 70 ft. Extending the turn pocket to 150 feet would provide turning vehicles with a refuge, removing them from the traffic stream of vehicles continuing through the intersection. This improvement would require more paved area, though the land on either side of Oak Way is vacant.
- The westbound left queue substantially exceeds the available storage. Many of the vehicles are heading eastbound onto OR 6 towards Hillsboro and Portland. Increasing the turn pocket would be difficult as the road is constrained on either side by development, and there is little available right of way to expand the width of the road.

These potential solutions will be evaluated during alternatives analysis.

Opportunities to Improve Safety

Currently OR 6 is designated as a safety corridor. There are no identified safety issues from the crash data, and crash rates are below the state average. However, the Banks City Council identified one area of concern, OR 6 near NW Aerts Road. One fatality was reported in this area, this one mile stretch of road has a high incidence of turn-related crashes, and there are a high proportion of fixed object crashes. Some safety improvements could include increased lighting, a roadside inventory to identify fixed objects in the clear zone, and increased enforcement of speed limits and safe driving in the vicinity. These will be examined during the alternatives analysis.

Opportunities for Enhanced Local Circulation

Individual developments in UGB expansion land would be required to provide internal circulation for vehicles, pedestrians and bicyclists, which should be codified per City of Banks Development Code. Local circulation options should look at the feasibility of new or enhanced east-west connections (e.g. upgrades to Wilkesboro Road, Banks Road, or potential rail crossings) as well as north-south connections (e.g. upgrade of NW Aerts Road, connections between areas of UGB expansion). Circulation of local trips (e.g. home to store;

home to school) should also include bicycle and pedestrian connections – to assist residents moving around Banks without using vehicles.

Opportunities for Bicycle and Pedestrian Connections

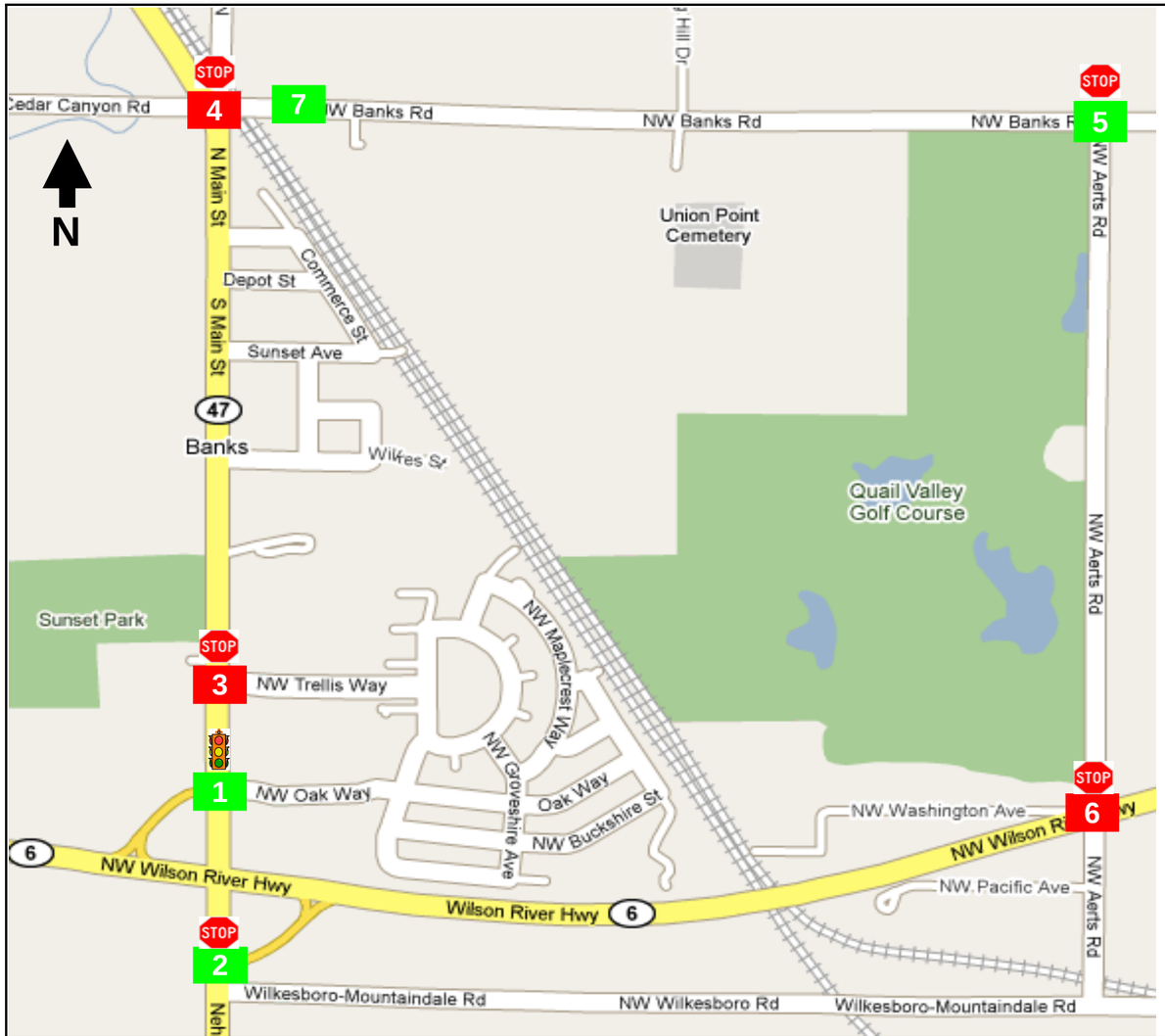
Currently bicycle lanes and pedestrian sidewalks are not connected. Improvements should focus on connecting the existing system of bike lanes and sidewalks to improve non-motorized mobility.

Other improvements could include connections to Banks destinations, including the residential areas to schools, the library, and town hall. There is a need to connect expansion areas east of the railroad tracks with the schools through a nonmotorized crossing. The potential new and upgraded roadways should include bicycle and pedestrian accommodations.

Consider Future Transit Connections

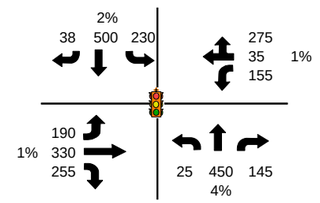
The City of Banks is working with the Tillamook County Transportation District (TCTD) to negotiate a shuttle stop in Banks and North Plains on its way to Portland. This would allow Banks citizens easier transit access to North Plains, Portland and Tillamook.

Appendix A: Future No-Build Traffic Operations



1	OR 47 & NW Oak Way

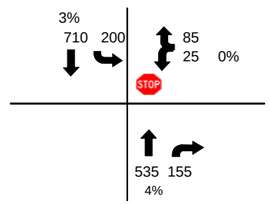
V/C Ratio Std: 0.75 OR 47 30th HV Factor: 1.16
V/C Ratio: 0.71 Oak Way 30th HV Factor: 1.16
OR 6 30th HV Factor: 1.62



Count Date: January 6, 2009
Peak Hour: 4:30-5:30 PM

2	OR 47 & OR 47 Exit

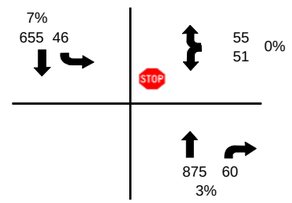
V/C Ratio Std: 0.75 OR 47 30th HV Factor: 1.16
V/C Ratio: 0.53 OR 6 30th HV Factor: 1.62



Count Date: January 6, 2009
Peak Hour: 4:30-5:30 PM

3	OR 47 & NW Trellis Way

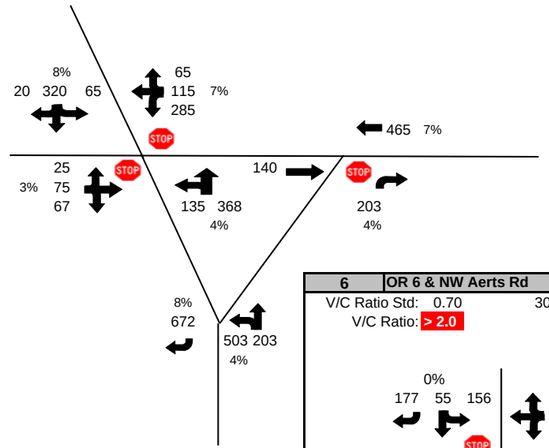
V/C Ratio Std: 0.85 30th HV Factor: 1.21
V/C Ratio: 1.02



Count Date: December 4, 2008
Peak Hour: 4:30-5:30 PM

4	OR 47 & NW Banks Rd

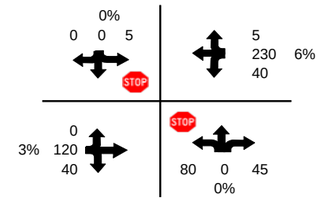
V/C Ratio Std: 0.90 30th HV Factor: 1.21
V/C Ratio: > 2.0



Count Date: December 4, 2008
Peak Hour: 4:30-5:30 PM

5	NW Banks Rd & NW Aerts Rd

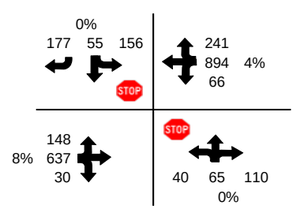
V/C Ratio Std: 0.90 30th HV Factor: 1.21
V/C Ratio: 0.27



Count Date: December 4, 2008
Peak Hour: 4:30-5:30 PM

6	OR 6 & NW Aerts Rd

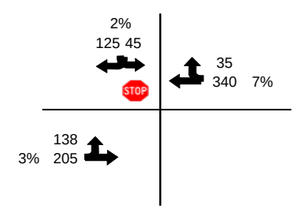
V/C Ratio Std: 0.70 30th HV Factor: 1.21
V/C Ratio: > 2.0



Count Date: December 4, 2008
Peak Hour: 4:30-5:30 PM

7	NW Banks Road & Sellers Road

V/C Ratio Std: 0.90 30th HV Factor: 1.21
V/C Ratio: 0.39



Count Date: December 4, 2008
Peak Hour: 4:30-5:30 PM

CH2MHILL

FIGURE A.1 Tillamook: Banks UGB/TSP Update

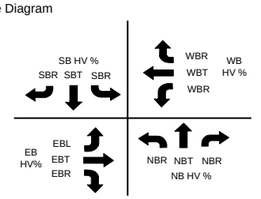
2029 Future No-Build: Volumes, Channelization, & V/C Ratios

Notes:

1. "V/C Ratio Std" corresponds to the intersection's mobility standard
2. Mobility Standards are based on Oregon Highway Plan
3. A green box on the map represents an acceptable measured mobility
4. A red box on the map represents a failing measured mobility
5. The reported Peak Hour Factor (PHF) is for the overall intersection
6. Truck Percentages calculated from raw counts
7. All 30th Highest Hour volumes were seasonally adjusted
8. Intersection map source: Google Earth Maps

Legend:

Volume Diagram



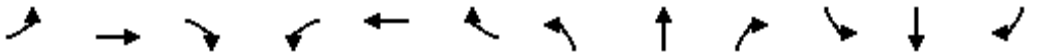
555 Turning Movement Volume
HV% Percent Heavy Vehicles

Channelization

Stop Controlled Intersection

Signalized Intersection

Appendix B: HCM Synchro Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	330	255	155	35	275	25	450	145	230	500	38
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	10	10	12	13	16	16	14	14	14
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		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		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.87		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1646	1733	1473	1536	1402		1652	1907	1621	1739	1830	1556
Flt Permitted	0.44	1.00	1.00	0.41	1.00		0.34	1.00	1.00	0.39	1.00	1.00
Satd. Flow (perm)	761	1733	1473	668	1402		598	1907	1621	710	1830	1556
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	204	355	274	167	38	296	26	474	153	242	526	40
RTOR Reduction (vph)	0	0	94	0	191	0	0	0	61	0	0	7
Lane Group Flow (vph)	204	355	180	167	143	0	26	474	92	242	526	33
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	2%	2%	2%
Turn Type	Perm		Perm	Perm			Perm		Perm	Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	20.0	20.0	20.0	20.0	20.0		27.4	27.4	27.4	27.4	27.4	27.4
Effective Green, g (s)	20.0	20.0	20.0	20.0	20.0		28.4	28.4	28.4	28.4	28.4	28.4
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.35		0.50	0.50	0.50	0.50	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	2.3	2.3	2.3	2.3	2.3		4.8	4.8	4.8	5.0	5.0	5.0
Lane Grp Cap (vph)	270	615	522	237	497		301	960	816	358	921	784
v/s Ratio Prot		0.20			0.10			0.25			0.29	
v/s Ratio Perm	c0.27		0.12	0.25			0.04		0.06	c0.34		0.02
v/c Ratio	0.76	0.58	0.34	0.70	0.29		0.09	0.49	0.11	0.68	0.57	0.04
Uniform Delay, d1	16.0	14.8	13.4	15.7	13.1		7.3	9.3	7.4	10.5	9.8	7.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	1.0	0.2	8.1	0.2		0.2	0.8	0.1	6.5	1.4	0.0
Delay (s)	26.6	15.7	13.6	23.8	13.3		7.5	10.0	7.5	17.0	11.1	7.1
Level of Service	C	B	B	C	B		A	B	A	B	B	A
Approach Delay (s)		17.7			16.8			9.3			12.7	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	56.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	25	85	535	155	200	710
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.91	0.91	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	93	563	163	211	747
Pedestrians			1			
Lane Width (ft)			15.0			
Walking Speed (ft/s)			4.0			
Percent Blockage			0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						1028
pX, platoon unblocked						
vC, conflicting volume	1733	563			563	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1733	563			563	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	64	82			79	
cM capacity (veh/h)	77	529			1003	

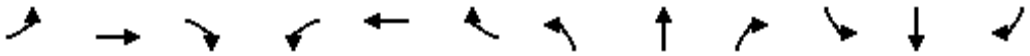
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	121	563	163	211	747
Volume Left	27	0	0	211	0
Volume Right	93	0	163	0	0
cSH	227	1700	1700	1003	1700
Volume to Capacity	0.53	0.33	0.10	0.21	0.44
Queue Length 95th (ft)	70	0	0	20	0
Control Delay (s)	37.6	0.0	0.0	9.5	0.0
Lane LOS	E			A	
Approach Delay (s)	37.6	0.0		2.1	
Approach LOS	E				

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	51	55	875	60	46	655
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.91	0.91	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	56	60	921	63	48	689
Pedestrians	7		7			7
Lane Width (ft)	15.0		12.0			13.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			588			
pX, platoon unblocked	0.85	0.85			0.85	
vC, conflicting volume	1753	967			991	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1799	869			898	
tC, single (s)	6.4	6.2			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.3	
p0 queue free %	18	80			92	
cM capacity (veh/h)	68	295			617	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	116	984	48	689
Volume Left	56	0	48	0
Volume Right	60	63	0	0
cSH	114	1700	617	1700
Volume to Capacity	1.02	0.58	0.08	0.41
Queue Length 95th (ft)	170	0	6	0
Control Delay (s)	162.8	0.0	11.3	0.0
Lane LOS	F		B	
Approach Delay (s)	162.8	0.0	0.7	
Approach LOS	F			

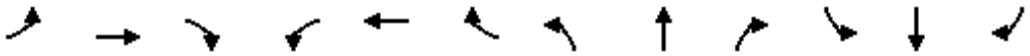
Intersection Summary			
Average Delay	10.6		
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	75	67	285	115	65	135	368	0	65	320	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	82	73	310	125	71	142	387	0	68	337	21
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	1289	1156	347	1269	1166	387	358			387		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1289	1156	347	1269	1166	387	358			387		
tC, single (s)	7.1	6.5	6.2	7.2	6.6	6.3	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.6	4.1	3.4	2.2			2.3		
p0 queue free %	28	50	89	0	20	89	88			94		
cM capacity (veh/h)	38	162	693	67	157	650	1190			1139		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	182	505	529	426
Volume Left	27	310	142	68
Volume Right	73	71	0	21
cSH	137	92	1190	1139
Volume to Capacity	1.33	5.50	0.12	0.06
Queue Length 95th (ft)	288	Err	10	5
Control Delay (s)	250.6	Err	3.2	1.9
Lane LOS	F	F	A	A
Approach Delay (s)	250.6	Err	3.2	1.9
Approach LOS	F	F		

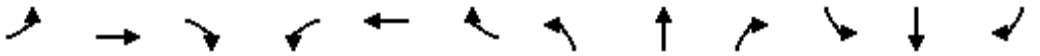
Intersection Summary				
Average Delay	3105.7			
Intersection Capacity Utilization	96.3%	ICU Level of Service	F	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	120	40	40	230	5	80	0	45	5	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	0	141	47	47	271	6	94	0	53	6	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	276			188			532	535	165	585	556	274
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	276			188			532	535	165	585	556	274
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			79	100	94	98	100	100
cM capacity (veh/h)	1281			1362			449	439	885	389	427	770

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	188	324	147	6
Volume Left	0	47	94	6
Volume Right	47	6	53	0
cSH	1281	1362	546	389
Volume to Capacity	0.00	0.03	0.27	0.02
Queue Length 95th (ft)	0	3	27	1
Control Delay (s)	0.0	1.4	14.0	14.4
Lane LOS		A	B	B
Approach Delay (s)	0.0	1.4	14.0	14.4
Approach LOS			B	B

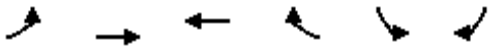
Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	148	637	30	66	894	241	40	65	110	156	55	177
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	156	671	32	69	941	254	42	68	116	164	58	186
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												2
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1195			702			2327	2332	686	2355	2221	1068
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1195			702			2327	2332	686	2355	2221	1068
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	72			92			0	0	74	0	0	31
cM capacity (veh/h)	564			886			0	25	451	0	29	272

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	858	1264	226	408
Volume Left	156	69	42	164
Volume Right	32	254	116	186
cSH	564	886	0	0
Volume to Capacity	0.28	0.08	Err	8967.95
Queue Length 95th (ft)	28	6	Err	Err
Control Delay (s)	7.8	2.9	Err	Err
Lane LOS	A	A	F	F
Approach Delay (s)	7.8	2.9	Err	Err
Approach LOS			F	F

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	132.4%	ICU Level of Service	H
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	138	205	340	35	45	125
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	150	223	370	38	49	136
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	408				911	389
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	408				911	389
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	87				82	79
cM capacity (veh/h)	1146				264	660

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	373	408	185
Volume Left	150	0	49
Volume Right	0	38	136
cSH	1146	1700	473
Volume to Capacity	0.13	0.24	0.39
Queue Length 95th (ft)	11	0	46
Control Delay (s)	4.2	0.0	17.4
Lane LOS	A		C
Approach Delay (s)	4.2	0.0	17.4
Approach LOS			C

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

Appendix C: SimTraffic Queue Report

Intersection: 1: NW Oak Way & OR 47 (Main Street)

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	TR	L	T	R	L	T	R
Maximum Queue (ft)	220	249	82	555	495	120	563	100	275	542	58
Average Queue (ft)	153	209	71	403	316	20	261	66	210	314	32
95th Queue (ft)	257	299	97	712	710	61	465	126	331	585	62
Link Distance (ft)		224		594	594		947			527	
Upstream Blk Time (%)	2	13		22	16					8	
Queuing Penalty (veh)	0	0		0	0					61	
Storage Bay Dist (ft)	70		30			95		70	125		25
Storage Blk Time (%)	38	45	22			0	33	2	58	40	2
Queuing Penalty (veh)	225	202	117			0	56	11	311	107	15

Intersection: 2: OR 47 Exit & OR 47 (Main Street)

Movement	WB	NB	NB	SB
Directions Served	LR	T	R	L
Maximum Queue (ft)	180	39	70	108
Average Queue (ft)	58	2	4	49
95th Queue (ft)	122	20	34	89
Link Distance (ft)	310	386		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			70	115
Storage Blk Time (%)		0	0	0
Queuing Penalty (veh)		0	0	1

Intersection: 3: NW Trellis Way & OR 47 (Main Street)

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	426	154	100	610
Average Queue (ft)	198	16	23	78
95th Queue (ft)	446	88	66	380
Link Distance (ft)	435	527		3164
Upstream Blk Time (%)	16			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)			125	
Storage Blk Time (%)				7
Queuing Penalty (veh)				3

Intersection: 4: NW Banks Road & OR 47 (Main Street)

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LT	LTR
Maximum Queue (ft)	283	131	84	184
Average Queue (ft)	136	91	47	38
95th Queue (ft)	276	113	92	109
Link Distance (ft)	262	27	68	361
Upstream Blk Time (%)	8	97	3	
Queuing Penalty (veh)	0	452	15	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: NW Banks Road & NW Aerts Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LR	LR
Maximum Queue (ft)	5	172	155	34
Average Queue (ft)	0	13	47	6
95th Queue (ft)	0	81	121	26
Link Distance (ft)	4429	460	3905	216
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: OR 6 & Aerts Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LT
Maximum Queue (ft)	410	529	586	3707
Average Queue (ft)	380	273	586	2860
95th Queue (ft)	402	654	601	3764
Link Distance (ft)	363	497	586	3905
Upstream Blk Time (%)	77	11	100	1
Queuing Penalty (veh)	0	0	0	1
Storage Bay Dist (ft)				
Storage Blk Time (%)				100
Queuing Penalty (veh)				177

Intersection: 7: NW Banks Road & Sellers Road

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	164	3987	378
Average Queue (ft)	52	2915	328
95th Queue (ft)	146	4373	417
Link Distance (ft)	154	4429	333
Upstream Blk Time (%)	3	4	88
Queuing Penalty (veh)	11	12	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 41: NW Banks Road & Hwy 47

Movement	EB	WB	NB
Directions Served	T	T	R
Maximum Queue (ft)	30	232	88
Average Queue (ft)	6	177	57
95th Queue (ft)	26	216	80
Link Distance (ft)	27	154	63
Upstream Blk Time (%)	2	73	5
Queuing Penalty (veh)	2	340	10
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 42: Hwy 47 &

Movement	NB
Directions Served	LT
Maximum Queue (ft)	337
Average Queue (ft)	86
95th Queue (ft)	252
Link Distance (ft)	3164
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 2130

Appendix D: Decision Criteria

The following criteria could be used to evaluate potential transportation alternatives and select recommended transportation solutions for the TSP. The proposed evaluation criteria include:

- **Traffic Operations.** *Does the alternative mitigate existing and anticipated (2029) traffic congestion?* This criterion measures the extent to which alternatives alleviate existing and anticipated future traffic congestion.
- **Safety.** *Does the alternative mitigate existing or anticipated safety issues?* This criterion measures the extent to which alternatives ensure safety for all users (drivers, transit, pedestrians, and bicyclists).
- **Mobility.** *Does the alternative enhance mobility for all users?* This criterion measures the extent to which alternatives enhance mobility for transportation users (freight, nonmotorized, transit, transportation disadvantaged, etc.).
- **Land Use.** *Does the alternative minimize land use impacts? Is the alternative consistent with state and local land use planning goals?* This criterion measures the extent to which alternatives minimize property impacts and impacts on existing residential and business access. This criterion relates to economic development because it also evaluates the extent to which alternatives impact future business development through property takes. It also relates to consistency with local, regional and statewide land use plans.
- **Environmental & Social Impacts.** *Does the alternative minimize environmental and social impacts, including impacts on existing and future development and low-income/minority populations?* Most alternatives will have some built and natural environmental impacts. This criterion measures the extent to which alternatives minimize impacts on the social and environmental considerations for the interchange management area. This criterion includes environmental justice considerations.
- **Support for Implementation.** *Can the alternative be supported by both the state and local community?* This criterion measures the extent to which alternatives can be agreed upon that meet the needs and interests of stakeholders within acceptable timelines.
- **Cost-Effectiveness.** *Is the scale of the alternative consistent with the benefits it provides? Is it a practical, affordable solution?* All alternatives will have costs associated with development and implementation. This criterion evaluates how effective the alternative is at relieving congestion compared to the cost.