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Memorandum

TO:	Cheryl Jarvis-Smith (ODOT), Barry Beyeler (City of Boardman)		
FROM:	Kevin Stankiewicz, Carl Springer, Pam O'Brien – DKS Associates		
DATE:	March 14, 2007		
SUBJECT:	Task 4a – Future Conditions Technical Memo - Boardman IAMP and TSP Update	P/A No.	06097-005-004

Introduction

This technical memorandum provides an evaluation of how the City of Boardman may grow as vacant lands are develops, and assesses how transportation facilities will perform as that growth occurs. Future year traffic conditions were evaluated to determine where access, capacity and multi-modal improvements would be needed to best serve existing and future residents and businesses in the city. In some cases, a range of solutions is possible for a given problem, and alternative projects are presented that will be screened and reviewed by the community before selected to preferred plan elements.

Land Inventory and Analysis

Land use forecasting and the associated travel activity that occurs with growth is a key factor in developing a functional transportation system. The amount of land that is planned to be developed, the type of land uses and how the land uses are mixed together has a direct relationship to the expected demands on the transportation system. Understanding the amount and type of land use is critical to taking actions to maintain or enhance the operation of the transportation system. Projected land uses were developed within the City's Urban Growth Boundary for the future year (2027). The following sections summarize the forecasted growth that will influence travel within Boardman. A detailed description of the land use forecasting is included in the Appendix.

Population and Employment Forecasts

Based on the Morrow County Transportation System Plan[1], the population in the City of Boardman is projected to grow at a rate of 2.5% per year. The Office of Economic Analysis

[1] Morrow County 2005 Transportation System Plan, July 23, 2005

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(OEA) determined the historical growth rate for the 2000-2025 period. The current population of the City of Boardman is 3,175. Based on the projected growth, the City of Boardman can expect a population of 5,031 in the year 2027.

Table 1: Boardman Population Projections

Year	City of Boardman Population
2007	3,175
2027	5,031

The 1997 Land Needs and Supply report[2] states that Boardman had ample land within the Urban Growth Boundary to meet the commercial and housing needs for the next 20 years and beyond, given the population projections for the study. Most of the future employment growth is expected to occur at the Port of Morrow, which is in the northeast corner of the city and extends beyond into unincorporated portions of the county. Additional employment growth will occur along the South Main corridor due to available lands for commercial and office development. Most of the future residential growth is expected to occur south of I-84.

The following section summarizes the forecasted growth that will influence future travel within the two IAMP study areas in Boardman. Future development was based on the current land use zoning, expected growth by the forecast year and input from the City of Boardman staff to include local expertise and knowledge of known developments.

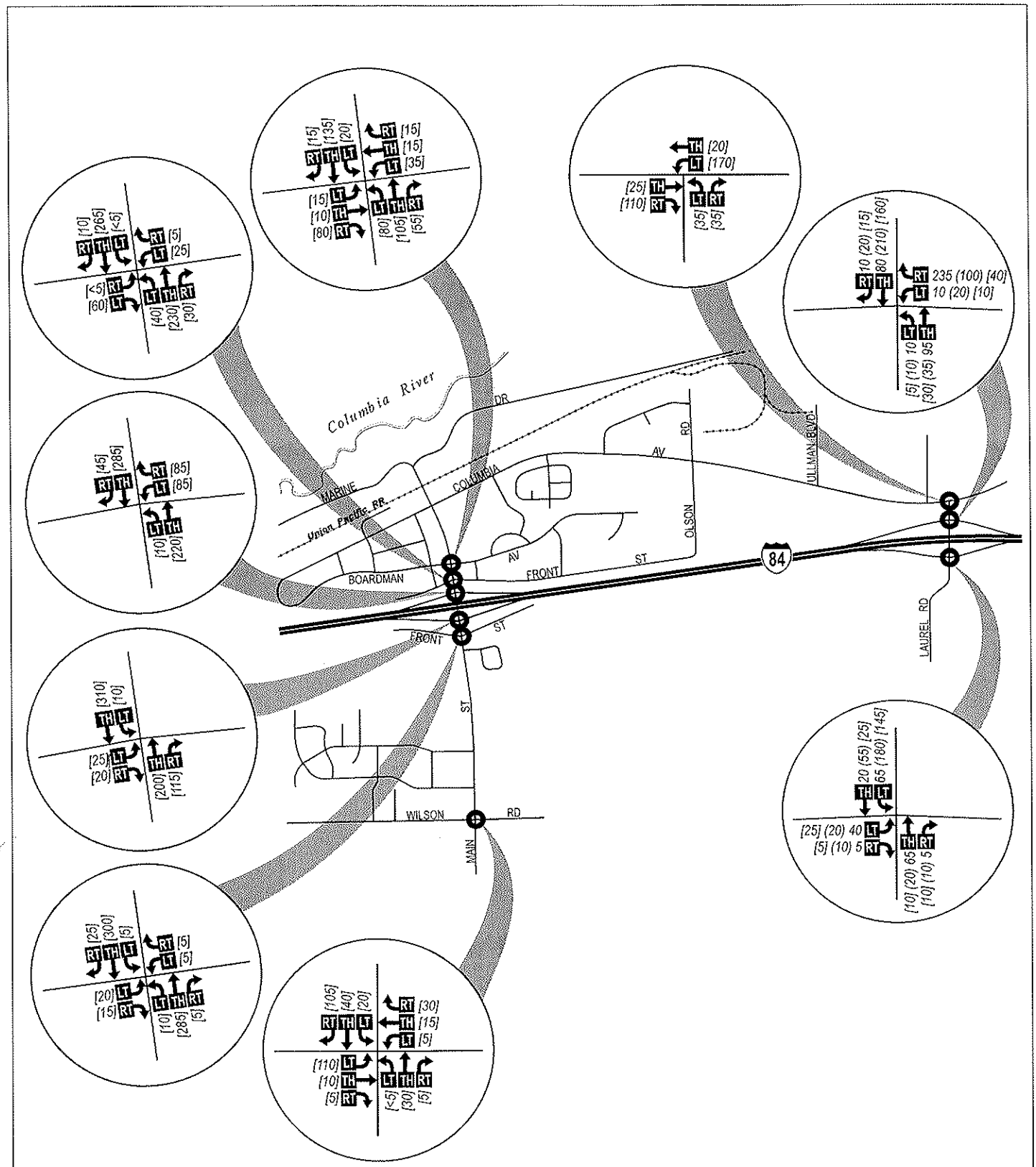
Travel Demand

As part of the City of Boardman Interchange Access Management Plan (IAMP) and Transportation System Plan (TSP) Update, an analysis was performed of 2027 future travel demand, deficiencies and needs for the Boardman transportation system. The analysis is based upon the transportation system inventory, analysis of existing conditions (Task 2a Memo) and forecasts of future demand based on land use projections for 2027. The project scope specifies that a Level 2 Cumulative Analysis be used for traffic volume forecasting. The cumulative analysis was used to forecast the future volumes in the two IAMP study area interchanges. The cumulative traffic volumes were calculated by adding the trips generated by the assumed development to the existing traffic counts, which were collected in September, 2006 (and factored for seasonal fluctuation). The existing traffic counts can be seen in Figure 1.

The following section summarizes the forecasted growth that will influence future travel within each of the IAMP study areas in Boardman. Figures 2 and 3 show the parcels that are expected to develop by the year 2027 in the Main Street IAMP study area and the Laurel Lane IAMP study area, respectively.

A travel demand method was developed and used to determine future traffic volumes in Boardman for the forecast year 2027. This method translates projected land use growth into motor vehicle trips and assigns them to the roadway network. The resulting traffic volume projections form the basis for identifying potential roadway deficiencies and for evaluating alternative circulation improvements.

[2] Land Needs and Supply – Boardman Urban Growth Boundary, Draft Report, July 17, 1997



LEGEND

- Study Intersection
- *AM (Midday) [PM]* - Peak Hour Traffic Volumes
  - *AM Peak* - 6:30-7:30 am
  - *(Midday) Peak* - 2:45-3:45 pm
  - *[PM] Peak* - 4:05-5:05 pm
- Volume Turn Movement (Left-Thru-Right)

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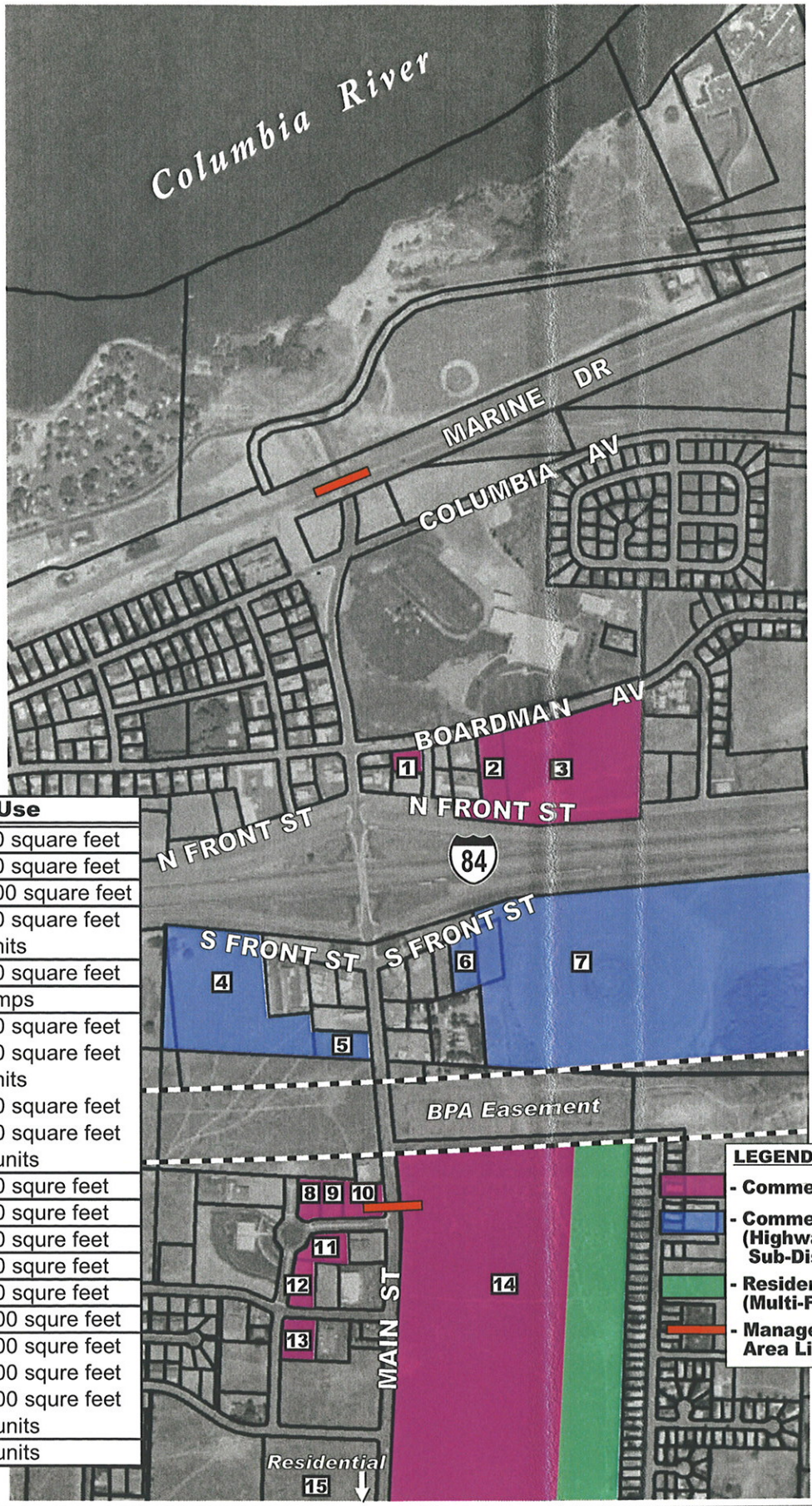
Figure 1

2006 EXISTING WEEKDAY PEAK HOURS TRAFFIC VOLUMES



Main Street

Parcel#	Assumed Land Use	
1	Convenience Store	2,000 square feet
2	Fast Food Restaurant	3,000 square feet
3	Specialty Retail	20,000 square feet
4	Restaurant	6,000 square feet
	Motel	65 units
5	Fast Food Restaurant	4,000 square feet
6	Gas Station with Mart	8 pumps
7	Fast Food Restaurant	4,000 square feet
	Restaurant	6,000 square feet
	Motel	65 units
	Car Wash	1,000 square feet
	Car Service Shop	2,000 square feet
	Housing	120 units
8	Office	5,000 squre feet
9	Office	5,000 squre feet
10	Bank	4,000 squre feet
11	Office	5,000 squre feet
12	Office	5,000 squre feet
13	Medical/Dental	10,000 squre feet
14	Specialty Retail	10,000 squre feet
	Drug Store	20,000 squre feet
	Hardware/Paint Store	10,000 squre feet
	Housing	120 units
15	Housing	100 units

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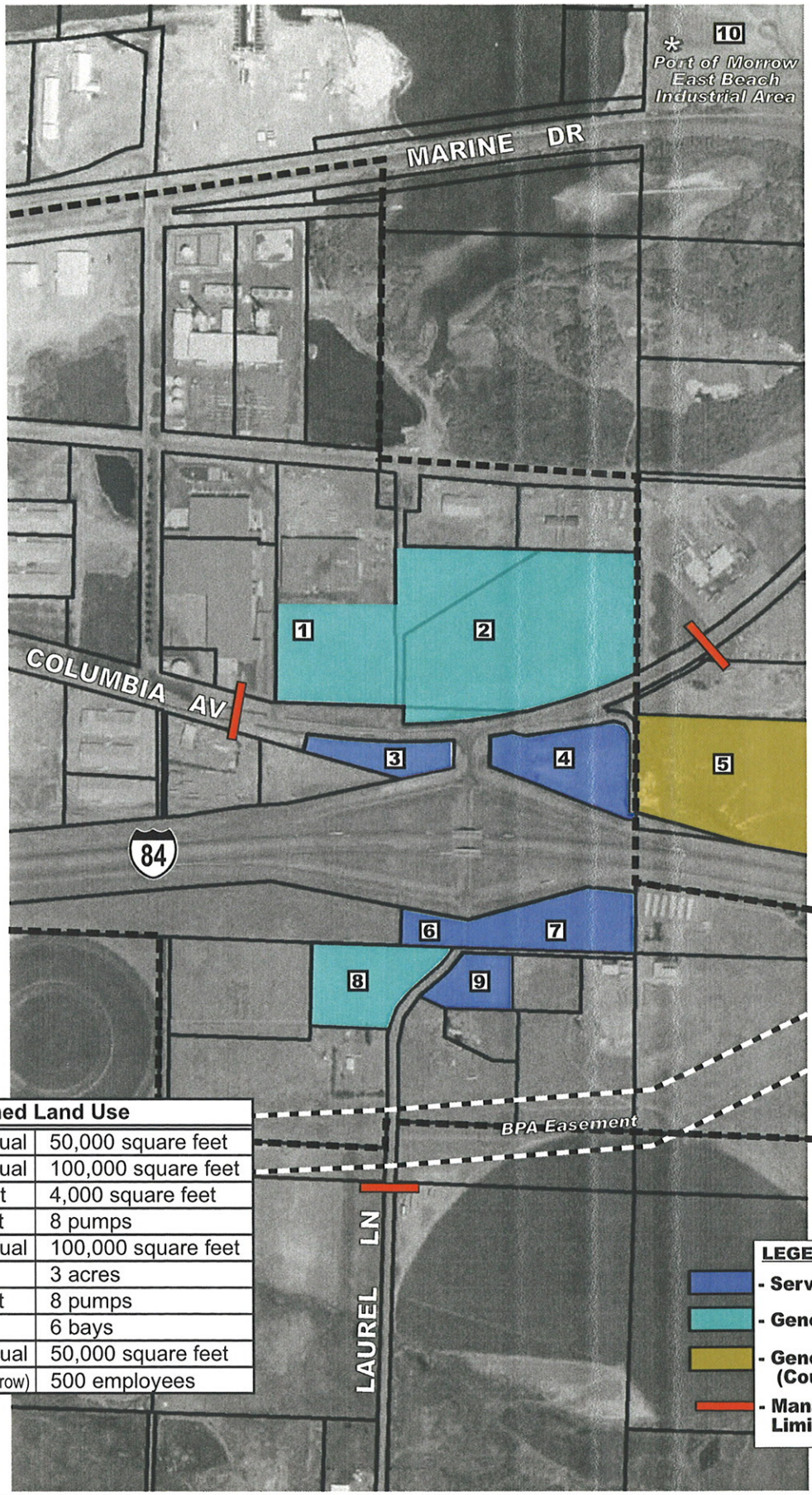
Figure 2

MAIN STREET 2027
BUILD-OUT SCENARIO



Laurel Lane

Parcel#	Assumed Land Use	
1	General Light Industrial	50,000 square feet
2	General Light Industrial	100,000 square feet
3	Fast Food Restaurant	4,000 square feet
4	Gas Station with Mart	8 pumps
5	General Light Industrial	100,000 square feet
6	RV Park	3 acres
7	Gas Station with Mart	8 pumps
8	Truck Stop	6 bays
9	General Light Industrial	50,000 square feet
10	East Beach (Port of Morrow)	500 employees

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Figure 3

LAUREL LANE 2027 BUILD-OUT SCENARIO

Main Street IAMP Study Area

Trip Generation

The trip generation process translates land use quantities (number of households, building square footage or employees) into vehicle trip ends (number of vehicles entering or leaving a particular development area) using established trip generation rates based on the Institute of Transportation Engineers (ITE) Trip Generation Manual[3]. Table 2 provides a listing of the weekday PM peak hour trip rates used in this analysis.

Table 2: PM Peak Hour Trip Generation Rates

Land Use Description	ITE Code	Land Use Unit	Vehicle Trips Per Land Use Unit
Single Family Detached Housing	210	Dwelling Unit	1.01
Housing - Condos	230	Dwelling Unit	0.52
Motel	320	Room	0.58
Single Tenant Office	715	1,000 s.f. building area	1.73
Medical/Dental Office	720	1,000 s.f. building area	5.18
Specialty Retail	812	1,000 s.f. building area	4.49
Free Standing Discount Store	815	1,000 s.f. building area	5.06
Hardware/Paint Store	816	1,000 s.f. building area	4.84
Convenience Mart	851	1,000 s.f. building area	52.41
Drug Store	881	1,000 s.f. building area	8.62
Bank Drive In	912	1,000 s.f. building area	45.74
Sit-Down High Turn Over Restaurant	932	1,000 s.f. building area	10.92
Fast Food with Drive In	934	1,000 s.f. building area	34.64
Auto Care Center	942	1,000 s.f. building area	3.38
Gas Station with Mart	945	Fuel Service Position	13.38
Self Service Car Wash	947	Fuel Service Position	5.54

Based on the assumed land uses for the build out development scenario, it is estimated that there will be an additional 11,700 new trips per day added to the system. During the PM peak hour, it is estimated that there will be an additional 1,100 trips generated by the future development, while an additional 1,000 new trips will be generated in the AM Peak hour. Tables A1 and A1a in the Appendix list each of the land uses and the estimated trips generated by them.

Many of the new trips generated by the future development will be shared by different land uses, so a reduction factor was applied to take this into account. Based on data in the ITE Trip Generation Manual, 5th Edition, a reduction rate of: 60% was applied to the Convenience Store land use, 43% was applied to the Fast Food land use, 35% was applied to the Retail land use and 27% was applied to the Gas Station land use.

[3] *Trip Generation Manual*, 7th Edition, Institute of Transportation Engineers, 2003.

One future land use that was not included in the trip generation was the Boardman Speedway, since as of this writing, a decision has not been made regarding this development. The main access for the speedway is planned to be off of Powers Road, which is about five miles to the west of the Main Street interchange in Boardman. The speedway will have an impact on the way the City develops and the rate at which it does. If the speedway development were to be built, further studies would need to be prepared by others to quantify all the potential impacts (transportation, environmental, economic, etc.).

Traffic Assignment

In this process, trips from the projected development are assigned to specific travel routes in the network, and resulting trip volumes are accumulated on links of the network until all trips are assigned. The trips related to the commercial and industrial development near the interchanges were distributed toward the freeway ramps, using similar turning movement percentages as the current counts. The residential, office, and commercial development on south Main Street has more of the trips distributed locally.

A detailed description of the land use forecasting, including key distribution assumptions is included in the Appendix.

The projected PM peak hour traffic volumes due to the build out scenario are shown in Figure 4. The cumulative PM Peak hour volume data for the Main Street IAMP study area is shown in Figure 5.

Volume Comparisons

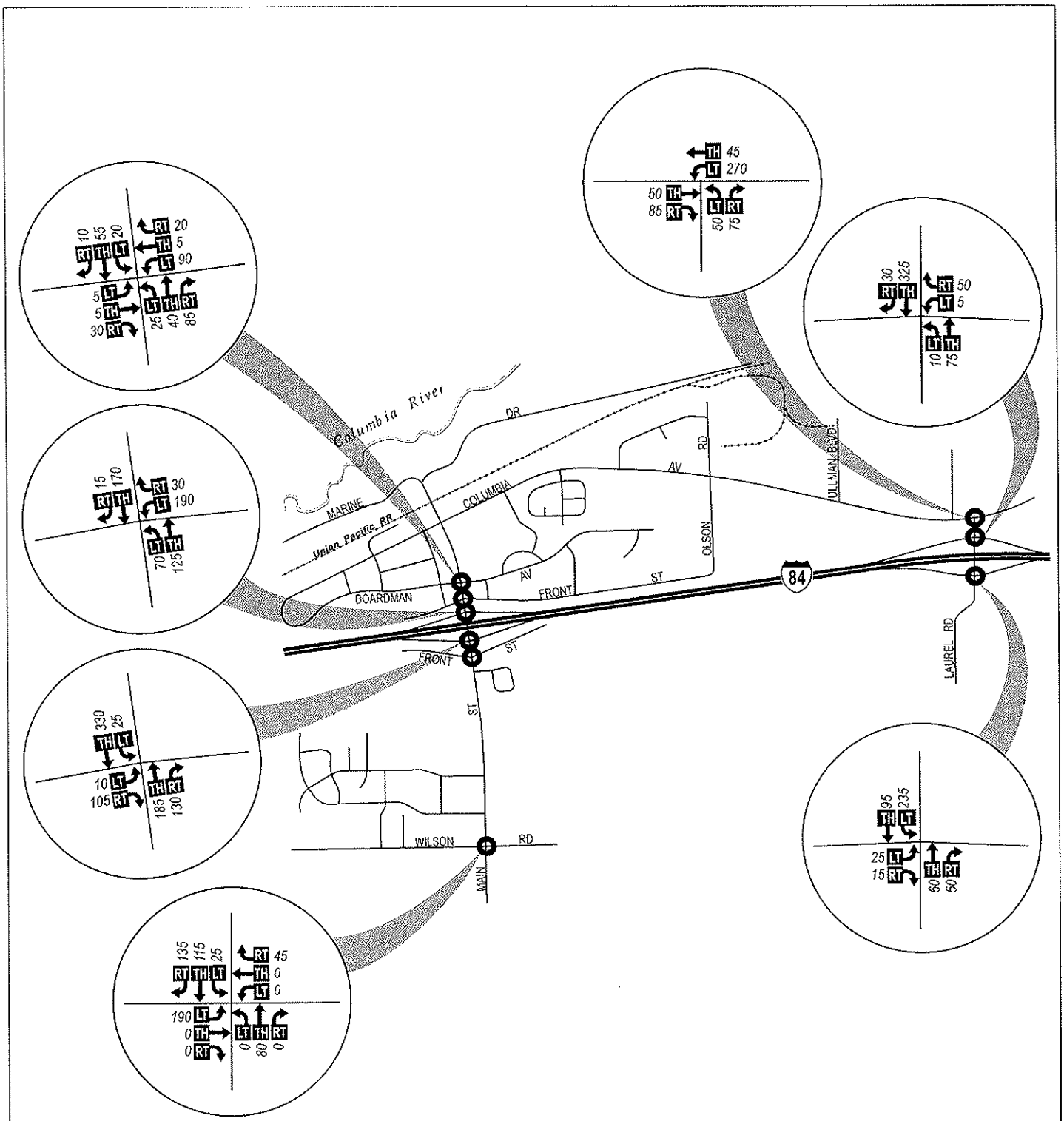
The Transportation System Plan[4] documents the 20 year forecasted traffic volumes in Boardman. The volumes were forecasted for the year 2020 and were developed by applying a 2.9 percent annual growth rate to existing volumes. The IAMP forecasts are based on trip generation and distribution from actual land use zoning. Table 3 shows the comparison between the volumes forecasted by the TSP[3] and this IAMP.

Table 3: PM Peak Hour Volume Comparison between TSP and IAMP

Location	Two-way PM Peak Hour Volume		Volume Difference
	TSP	IAMP	
Main Street North of I-84	875	975	100
Main Street on I-84 Overpass	900	1100	200
Main Street South of I-84	960	1400	440

The biggest difference is on Main Street south of I-84. This is understandable, since most of the development is assumed to take place on the Main Street corridor between I-84 and Wilson Road. The TSP assumed a growth rate that is applied to all movements equally, whereas the IAMP used the actual land use type and location in the analysis.

[4] Transportation System Plan, City of Boardman, Oregon 1999



LEGEND

- Study Intersection
- *00* - PM Peak Hour Traffic Volume
- LT TH RT - Volume Turn Movement (Left • Thru • Right)

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Figure 4

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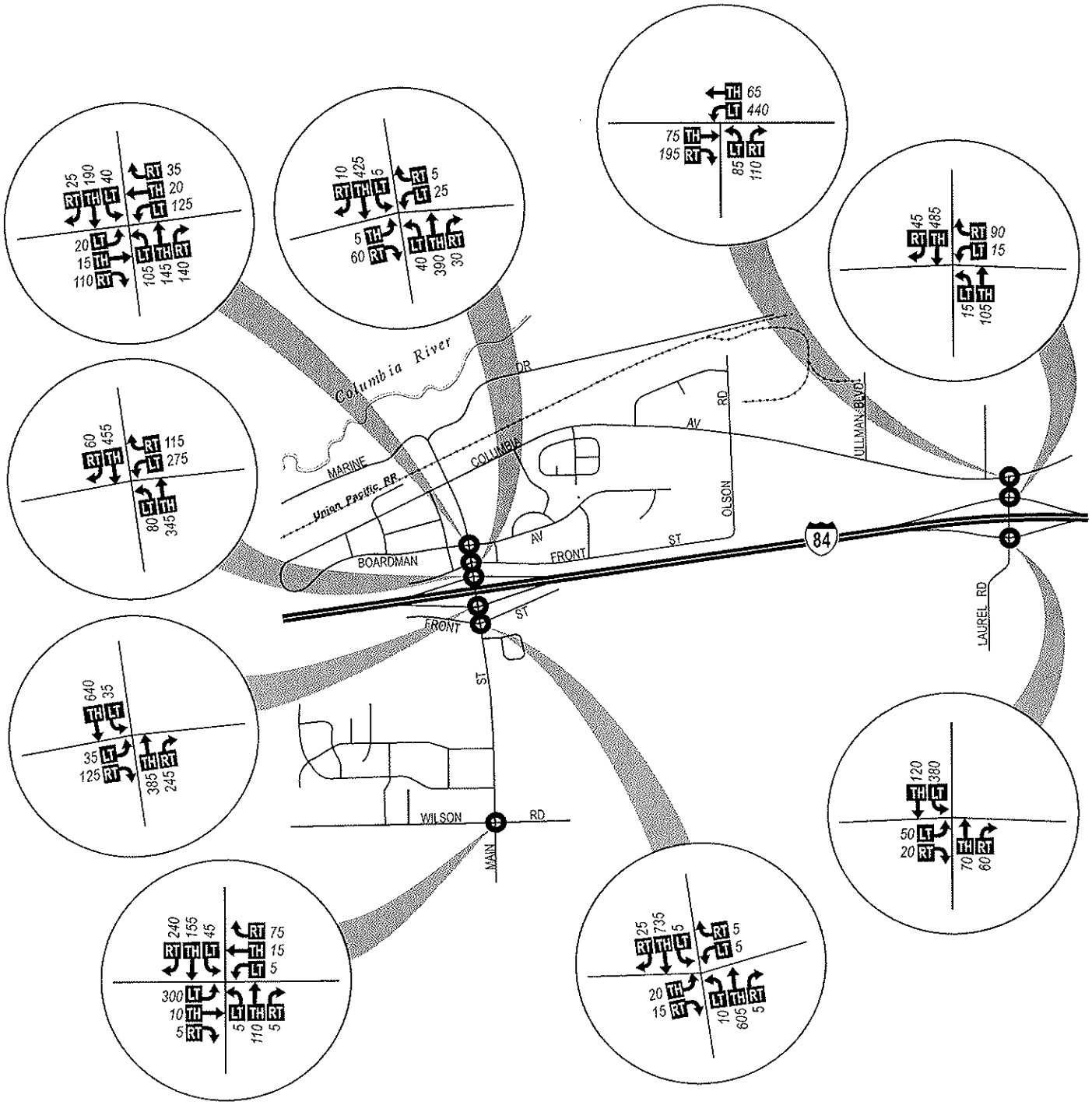
PM PEAK TRIPS GENERATED BY BUILD OUT DEVELOPMENT TRAFFIC VOLUMES



LEGEND

- Study Intersection
- 00 - PM Peak Hour Traffic Volume
- LT TH RT Left-Thru-Right - Volume Turn Movement

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Figure 5

2027 PM PEAK HOUR TRAFFIC VOLUMES

The forecasted volumes at the intersection of Main Street and Wilson Road are within 1% of each other.

The Main Street Development Plan[5] documents the year 2020 forecasted traffic volumes in the City of Boardman under two scenarios. The first scenario uses a 1.0 percent growth rate per year and also adds in volumes that are expected to be generated by three residential developments. The second scenario uses a 1.0 percent growth rate and adds in the residential development from Scenario 1 plus the new traffic that would be expected from the New Downtown Plan, which includes retail, office and more residential development. Table 4 shows the comparison between the volumes forecasted by the Downtown Plan[4] and this IAMP.

Table 4: PM Peak Hour Volume Comparison between Downtown Plan and IAMP

Location	Two-way PM Peak Hour Volume		Volume Difference
	Downtown Plan	IAMP	
Main Street North of I-84	1080	975	-105
Main Street on I-84 Overpass	1420	1100	-320
Main Street South of I-84	1830	1400	-430

The forecasted volumes for the Downtown Plan were about 30% higher than the IAMP forecasted volumes. The Downtown Plan assumed a growth rate in addition to actual development when forecasting the volumes, whereas the IAMP used only the land use type and location in the analysis and assumed that the growth rate would be included in the trip generation rates.

Study Area Roadway Capacity & Level of Service

Study intersections were analyzed using *Highway Capacity Manual*[6] methodologies for unsignalized intersections for comparison with the applicable jurisdiction's adopted performance standards identified in Technical Memorandum #1.

Analysis of traffic volumes is useful in understanding the general nature of traffic in an area, but by itself indicates neither the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of *level of service* (LOS) has been developed to subjectively describe traffic performance. Level of service can be measured at intersections and along key roadway segments.

Level of service categories are similar to report card ratings for traffic performance. Intersections are typically the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is generally diminished in their vicinities. Levels of Service A, B and C indicate conditions where traffic moves without significant delays over periods of peak travel demand. Levels of service D and E are progressively worse peak hour operating conditions and F conditions represent where demand exceeds the capacity of an intersection. Most urban communities set level of service D as the minimum acceptable level of service for peak hour

[5] City of Boardman Main Street "Downtown" Development Plan, 2000-2001
[6] *Highway Capacity Manual*, Transportation Research Board, Washington, D.C., 2000.

operation and plan for level of service C or better for all other times of the day. The *Highway Capacity Manual* provides level of service calculation methodology for both intersections and arterials[7]. The appendix includes a more detailed description of Level of Service analysis.

The traffic volume data shown in Figure 5 was used in the analysis. The percentage of heavy vehicles at each intersection was calculated and used in the analysis. From this analysis, intersection levels of service were obtained.

All non-state roadways within the study area are under the jurisdiction of the City of Boardman. The City has adopted standards for performance of City streets requiring operation of level of service "C" or better during the peak hour of the average weekday.

Table 4 shows the cumulative operational analysis for the unsignalized intersections within the Main Street IAMP study area (with substandard in bold). The results shown represent the critical movement at each intersection (usually a stop-controlled movement, such as a side-street left turn or crossing movement).

Table 5: Cumulative Weekday AM and PM Peak Hour Intersection Level of Service

Intersection	Average Delay (Sec)	Major Street LOS	Critical Movement	Critical Movement LOS
AM Peak Hour				
I-84 WB Ramp/Main Street	3.5	A	Westbound	C
I-84 EB Ramp/Main Street	1.2	A	Eastbound	C
PM Peak Hour				
Main Street/Boardman Ave	15.6	C	**Westbound**	**F**
Main Street/Front Street (North)	2.4	B	**Westbound**	**D**
I-84 WB Ramp/Main Street	**50.8**	**F**	**Westbound**	**F**
I-84 EB Ramp/Main Street	3.3	A	**Eastbound**	**D**
Main Street/Front Street (South)	1.9	A	**Eastbound**	**E**
Main Street/Wilson Road	17.3	C	Southbound	C

The intersection of Main Street & I-84 Westbound Ramp is expected to exceed the City standard Level of Service in the PM peak hour. There are five intersections where the worst-movement Level of Service exceeds the city standards in the PM peak hour, including Main Street & Boardman Avenue, Main Street & Front Street (North), Main Street & I-84 Westbound Ramp, Main Street & I-84 Eastbound Ramps and Main Street & Front Street (South).

The intersection of Main Street & I-84 WB ramp is expected to operate within the current City Level of Service standards until approximately half of the future development is complete.

[7] *Highway Capacity Manual 2000*, Transportation Research Board, Washington D.C., 2000, Chapters 16 and 17.

Deficiencies and Safety Issues

Based on the Existing Conditions Analysis and stakeholder interviews, current system deficiencies and/or safety issues are listed below:

- Access to businesses south of Front Street (South) is difficult due to the lack of access control and conflicting turning movements.
- The access spacing along North and South Main Street does not meet the Interchange Access Management standard spacing.
- The westbound approach at the I-84 Westbound ramp has poor sight distance due to the guard rail and fencing on the overpass bridge.
- Pedestrian access across the I-84 bridge and on/across South Main Street is limited.
- The main street interchange is one of two in Boardman that provide access to I-84. The combination of vehicles and pedestrians along this narrow section of roadway create conflicts between pedestrians and autos. The Main Street bridge across I-84 has very narrow sidewalks and no bike lanes.
- Bicycle system facilities are not continuous between neighborhoods south of I-84 and major destinations, such as schools. The existing multi-purpose path that runs along Wilson Road ends at Faler Road. Between Faler Road and Paul Smith Road, pedestrians and bicyclists must share the roadway with autos.
- There are no left-turn lanes on South Main Street.
- There are limited parallel routes to South Main Street for local trips to use away from the arterial.
- The roundabout at City Center Drive & Tatone Street is too tight for emergency vehicles to maneuver.

Additional system deficiencies and/or safety issues that were identified from the Future Conditions Analysis are listed below:

- The following intersection is expected to exceed the City standard Level of Service in the PM Peak Hour of the forecast year:
    - Main Street & I-84 Westbound Ramp
- The existing intersections of Main Street & Front Street (North), Main Street & I-84 Westbound Ramp, Main Street & I-84 Eastbound Ramp and Main Street & Front Street (South) are too closely spaced and will not function efficiently as traffic volumes grow.

System Alternatives

Following is a list of improvement alternatives that could be implemented to mitigate existing and anticipated transportation system deficiencies. The system alternatives are shown in Figures 6 and 7. Most of the system alternatives will be required based on a 20-year build-out scenario and the timing of the improvements are dependant on the pace of future development. Incremental improvements can be made as land is developed with the long term goal of improved street connectivity, improved bicycle/pedestrian network and limited direct access to Main Street.

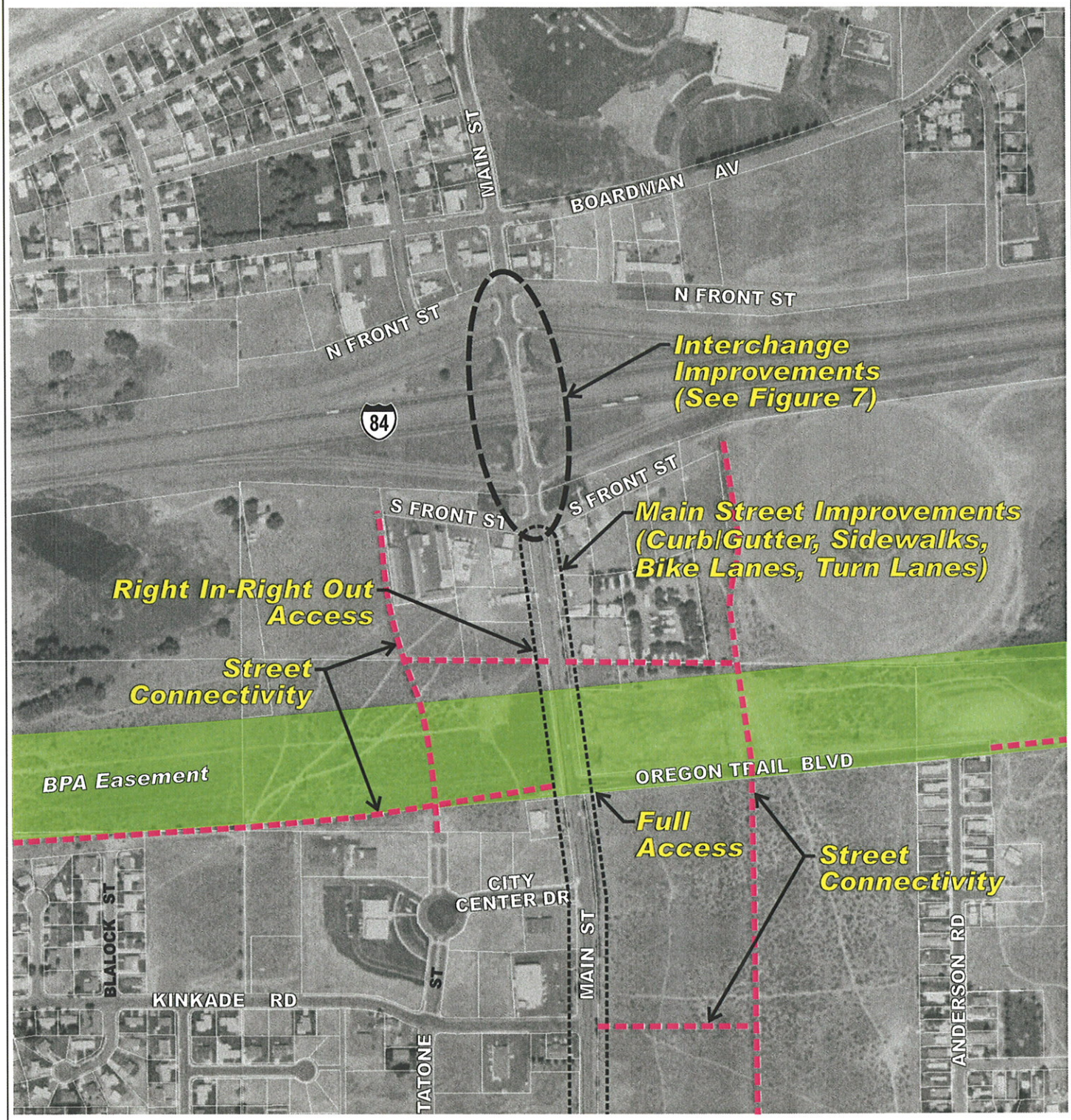

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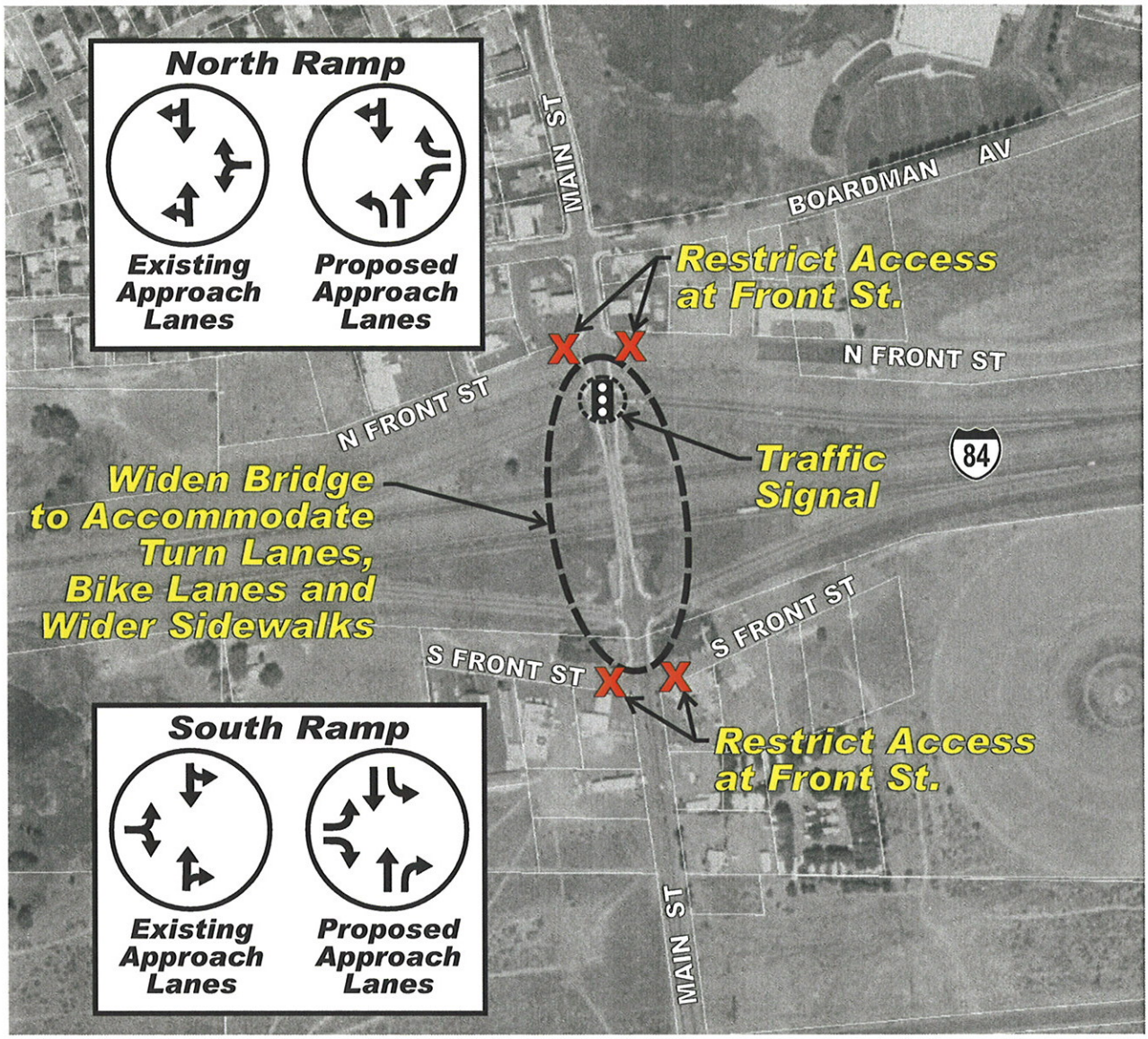
Figure 6

MAIN STREET IAMP SYSTEM ALTERNATIVES 20-Year Build Out Scenario



Triggers for Access Changes to Front Street:

1. *Side Street Level of Service Drops Below LOS E*
2. *Traffic Signal Installed at I-84 Ramps*
3. *Bridge Improvement Project Constructed*

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Figure 7

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MAIN STREET INTERCHANGE IMPROVEMENTS
20-Year Build Out Scenario

Interchange Area

The intersection of Main Street & I-84 Westbound Ramp will meet the traffic signal peak hour volume warrant in the PM peak hour in the forecast year. It is likely to therefore warrant a traffic signal under cumulative conditions. For good signal operations, a northbound left turn lane and storage space on the southbound approach would be recommended. The intersection of Front Street (North) is too close to the intersection for efficient signal operations. Front Street would most likely need to be terminated at 1st Street NE and 1st Street NW. As development occurs, the City should monitor the traffic volumes at the I-84 Ramp intersections to determine if the volumes would warrant a traffic signal. Depending on the rate of development, this most likely will be a long term (15 - 20 year) system improvement. The Main Street bridge across I-84 does not currently have room for turn lanes at the ramp intersections, which would be desirable if the intersections were signalized.

The intersection of Main Street & I-84 Eastbound Ramps does not currently meet the traffic signal peak hour warrant in the PM peak hour, but a small amount of development beyond what was forecast would likely increase the volume sufficiently to warrant a signal. In the forecast year, the minor street volumes at the intersection of Main Street & I-84 EB Ramp are expected to be approximately 90% of the volumes needed to meet the Peak Hour traffic signal warrant. A signal at this location would need a southbound left turn lane and northbound storage space. It would therefore be recommended that access to Front Street (South) be relocated.

The overpass bridge is currently too narrow to incorporate northbound and southbound left turn lanes at the ramp intersections, the sidewalks are very narrow and there are no bike lanes on the bridge. The bridge should be widened to accommodate the turn lanes, bike lanes and wider sidewalks, which would in turn improve the sight distance for drivers on the exit ramp approaches. The eastbound and westbound I-84 exit ramps should also be widened to accommodate separate left- and right turning vehicles.

The traffic volumes at the intersections of Main Street & Front Avenue North and Main Street & Front Avenue South should also be monitored as development occurs to determine if certain turning movements should be prohibited. Boardman Avenue can be used as alternate access to the properties along Front Street North. There is currently no alternate access for the properties along Front Street South, therefore additional access should be in place before restricting access to Front Street South from Main Street.

Triggers for access changes at Front Street North and Front Street South include:

- Side street level of service drops below LOSE
- Traffic signal installed at I-84 ramp(s)
- Bridge improvement project constructed

South Main Street

There are several potential opportunities to improve the north-south and east-west connectivity within the City, which will make drivers less dependent on Main Street for every trip around town. Currently, the north-south connectivity is limited to Main Street and Laurel Lane due mainly to the constraints of I-84, the Union Pacific

Railroad right of way and the Bonneville Power Administration's right of way. The east-west connectivity is limited to Wilson Lane, I-84 and Columbia Avenue.

North-south connectivity can be strengthened by creating a network of streets that parallel Main Street which provide access to future development. These new roadways provide access for local trips and can be constructed as development occurs. Some examples of street extensions that would strengthen north-south connectivity are:

- Extend Tatone Street from City Center Boulevard to Front Street, which would provide alternate access for the businesses along West Front Street. Tatone Street could also be extended south to intersect with Wilson Lane. The roundabout at the intersection of Tatone Street and City Center Boulevard will need to be evaluated to determine if the existing geometrics will accommodate a larger emergency vehicle.
- Extend Tatone Street from Willow Fork Drive to Wilson Road.
- Construct a new north-south roadway at a minimum of 600 feet east of Main Street, intersecting Oregon Trail Boulevard. This roadway will provide access to new development along the south side of I-84 and the commercial property south of Oregon Trail Boulevard.

East-west connectivity can be strengthened by creating a network of streets that parallel I-84 and Wilson Lane that provide access to future development. These new roadways provide access for local trips and can be constructed as development occurs. Some examples of street extensions that would strengthen east-west connectivity are:

- Extend Kinkade Road east from Main Street when land east of Main Street develops.
- Extend Oregon Trail to the east to connect to Olson Road and west to connect to Smith Road, with intersections at Faler Road, Willow Fork Drive, Blalock Street and City Center Drive.

The system improvements that enhance the north-south and east-west street connectivity can be constructed as vacant land is developed. The city can also choose to construct the transportation facilities prior to development as a way to encourage development in certain areas of the City. As the street connectivity is improved, drivers will be less dependant on using Main Street for local trips south of I-84. Once again, depending on the rate of development, the street connectivity will be a long term (and ongoing) system improvement.

Access

The long term goal is to reduce or minimize the number of access points along South Main Street. As vacant land is developed and street connectivity is completed, the access points should be evaluated. Reasonable alternate access must be in place before any access is removed.

The interchange access management standards adopted by ODOT should be addressed when land is redeveloped within the Main Street interchange area.

The number of access points should be reduced and/or combined on South Main Street. By reducing and combining access points, the number of conflict points is reduced, which improves the safety and operation of the roadway. This should be done as property develops and will be based on mutually agreed upon access changes and/or the addition of alternate access.

Left turn lanes should be provided on Main Street at the major access points to provide safe left turning access.

Pedestrian/Bicycle Network

The pedestrian network should be addressed in parallel to the street network improvements. In general, curb and sidewalk similar to North Main Street will improve the safety of pedestrians along South Main Street. Pedestrian access across Main Street is also important. Pedestrian crossings should be accommodated at the major access points (I-84 ramps, Oregon Trail Boulevard, City Center Boulevard, Kinkade Road and Wilson Road). This would include sidewalk with ADA pedestrian ramps on the corners and possibly supplemental signing and/or painted crosswalks. A "mid-block" pedestrian crossing could be accommodated on the north side of the BPA easement. The mid-block crossing could incorporate a center pedestrian refuge island, once South Main Street is reconstructed to the arterial standard.

A wider sidewalk and separate bike lanes on the Main Street bridge across I-84 will provide a safer facility for the pedestrians.

Gaps in the bicycle network should be addressed with any new roadway connectivity and new development. Bicycle facilities should be considered where the speed of the road is over 25 mph or the Average Daily Traffic is over 3,000 vehicles per day.

Sensitivity Analysis

The future distribution patterns have an impact on the forecasted turning movement volumes at study area intersections. If more traffic than forecasted uses the I-84 interchange ramps to go east or west on I-84 (instead of local trips), the intersection operations at the ramp intersections will degrade before the forecast year. If ten percent more of the forecasted traffic were to go through the I-84 ramp intersections, the intersection of Main Street & I-84 EB ramp would not meet the City LOS standards.

In the forecast year, the minor street volumes at the intersection of Main Street & I-84 EB Ramp are expected to be approximately 90% of the volumes needed to meet the Peak Hour traffic signal warrant. If more traffic than forecasted uses this intersection or if more traffic turns left from the EB ramp onto Main Street, the Peak Hour warrant will be met at this intersection.

Major Constraints

The following section identifies transportation, environmental, socio-economic, multi-modal and right of way constraints and/or issues associated with the transportation deficiencies for the Main Street area.

- The Bonneville Power Administration (BPA) has a major electrical transmission line that cuts across the city. The BPA easement is 395 feet wide and is about one quarter mile south and parallel to I-84. Any new roadways within the BPA easement would need to comply with regulations set forth by BPA.
- Interstate 84 runs east and west through the City and divides the town into roughly one third to the north and two-thirds to the south. The two roadways that cross I-84 and connect the north and south parts of town are Main Street and Laurel Avenue. Additional roadways that would connect the north and south parts of town would need to cross (over or under) I-84.
- There are identified wetland areas within the City of Boardman. Most of the wetland areas are located where new roadways are not anticipated in the future. However, there are two areas in the vicinity of future roadways and will need to be mitigated if new roadway construction impacts them. One area is approximately 30 acres and located south of I-84 and about a quarter mile west of Main Street. A second area is approximately 10 acres and is south of I-84 and about a third mile east of Main Street.
- A mobile home park is currently located on the west side of South Main Street between Front Street and the BPA easement. A new roadway that would provide east-west connectivity and access to businesses along Front Street would have an impact on the south part of this property. The impact may result in the relocation of some of the mobile homes or a redesign of the layout of the mobile home park.
- New roadways that strengthen north-south and east-west connectivity would provide access to businesses and homes, thus having a positive socio-economic impact.
- New roadway connections or road widening projects will require the purchase of right of way.
- There are no identified sources of funding for any of the transportation improvements.

Laurel Lane IAMP Study Area

Trip Generation

The trip generation process translates land use quantities (number of households, square footage or employees) into vehicle trip ends (number of vehicles entering or leaving a particular zone) using established trip generation rates based on the Institute of Transportation Engineers (ITE) Trip Generation Manual[8]. Table 6 provides a listing of the weekday PM peak hour trip rates used in this analysis.

Table 6: ITE PM Peak Hour Trip Rates for Laurel Lane IAMP Study Area

Land Use Description	ITE Code	Land Use Unit	Vehicle Trips Per Land Use Unit
General Light Industrial	110	1,000 sq. ft. building area	0.98
Warehouse	150	1,000 sq. ft. building area	0.59
Fast Food with Drive In	934	1,000 sq. ft. building area	34.64
Gas Station with Mart	945	Fueling Position	13.38
Truck Stop	[9]	Fueling Position	135

Based on the assumed land uses for the build out development scenario, it is estimated that there will be an additional 7,500 new trips per day added to the system. During the PM peak hour, it is estimated that there will be an additional 900 trips generated by the future development, while an additional 850 new trips will be generated in the AM Peak hour. Tables A1 and A1a in the Appendix list each of the land uses and the estimated trips generated by them. Many of the new trips generated by the future development will be shared by different land uses, so a reduction factor was applied to take this into account.

Traffic Assignment

In this process, trips from the projected development are assigned to specific travel routes in the network, and resulting trip volumes are accumulated on links of the network until all trips are assigned. The trips were distributed toward the freeway ramps using similar turning movement percentages as the current counts, with most of the trips oriented to/from the east on I-84. The trip assignment assumes that a connection between the Port of Morrow East Beach area and Highway 730 is in place, based on the Morrow County TSP.

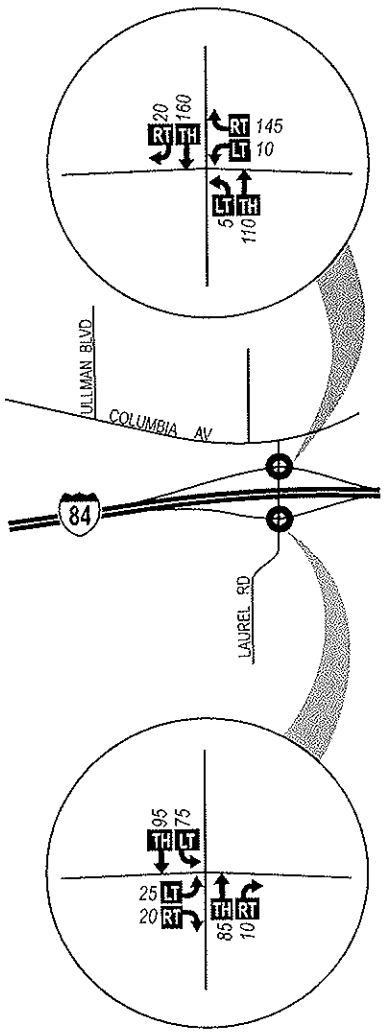
A detailed description of the land use forecasting, including key distribution assumptions is included in the Appendix.

The projected PM Peak hour traffic volumes due to the build out scenario are shown in Figure 4. The cumulative PM Peak hour volume data for the Laurel Lane IAMP study area is shown in Figure 5. The projected AM Peak hour traffic volumes due to the build out scenario and the cumulative AM Peak hour traffic volumes are shown in Figure 8.

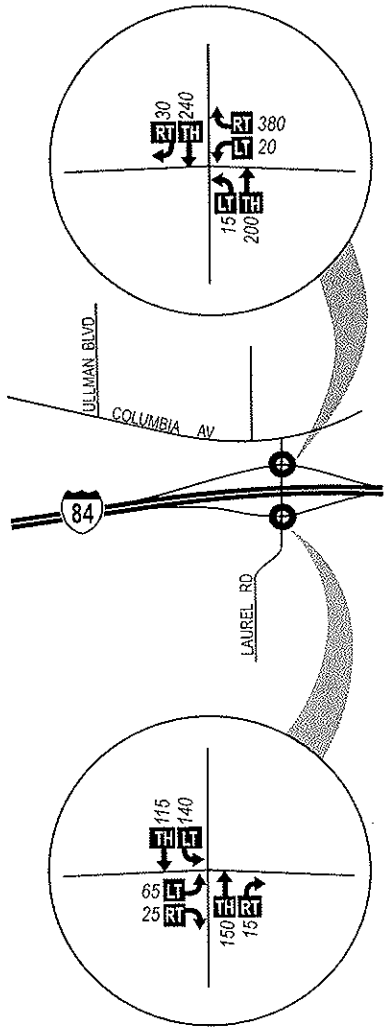
[8] *Trip Generation Manual*, 7th Edition, Institute of Transportation Engineers, 2003.

[9] *Trip rate based on field data used for the Westland Road Petro Travel Center in Umatilla County, OR – study completed by Kittelson and Associates (December 2003).*

AM TRIPS GENERATED BY BUILD OUT DEVELOPMENT



2027 AM PEAK HOUR TRAFFIC VOLUMES



LEGEND

- Study Intersection
- 00 - AM Peak Hour Traffic Volume
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

City of Boardman IAMP
February 2007

NO SCALE

DKS Associates
TRANSPORTATION SOLUTIONS

Figure 8

AM PEAK HOUR TRAFFIC VOLUMES

Volume Comparisons

The Transportation System Plan[10] documents the 20 year forecasted traffic volumes in Boardman. The volumes were forecasted for the year 2020 and were developed by applying a 2.9 percent annual growth rate to existing volumes. The IAMP forecasts are based on trip generation and distribution from actual land use zoning. Table 7 shows the comparison between the volumes forecasted by the TSP[3] and this IAMP.

Table 7: PM Peak Hour Volume Comparison between TSP and IAMP

Location	Traffic Entering Intersection		Volume Difference
	TSP	IAMP	
Laurel Lane & Columbia Avenue	410	970	560

The TSP assumed a growth rate that is applied to all movements equally, whereas the IAMP used the actual land use type and location in the analysis. The main development near the Laurel Lane interchange is expected to happen on the Port of Morrow property north and east of Boardman and most of the traffic will use the I-84 interchange at Laurel Lane.

Study Area Roadway Capacity & Level of Service

Study intersections within the IAMP areas were analyzed using *Highway Capacity Manual*[11] methodologies for unsignalized intersections for comparison with the applicable jurisdiction's adopted performance standards identified in Technical Memorandum #1.

The traffic volume data shown in Figure 6 was used in the analysis. The percentage of heavy vehicles at each intersection was calculated and used in the analysis. From this analysis, intersection levels of service were obtained.

All non-state roadways within the study area are under the jurisdiction of the City of Boardman. The City has adopted standards for performance of City streets requiring operation of level of service "C" or better during the peak hour of the average weekday.

Table 8 shows the cumulative operational analysis for the unsignalized intersections within the Laurel Lane IAMP study area (with substandard in bold). The results shown represent the critical movement at each intersection (usually a stop-controlled movement, such as a side-street left turn or crossing movement).

[10] Transportation System Plan, City of Boardman, Oregon 1999
[11] *Highway Capacity Manual*, Transportation Research Board, Washington, D.C., 2000.

Table 8: Cumulative Weekday PM Peak Hour Intersection Level of Service

Intersection	Average Delay (Sec)	Major Street LOS	Critical Movement	Critical Movement LOS
AM Peak Hour				
I-84 WB Ramp/Laurel Road	6.6	A	Westbound	B
I-84 EB Ramp/Laurel Road	4.8	A	Eastbound	B
PM Peak Hour				
Laurel Lane / Columbia Avenue	**32.3**	**D**	**Westbound**	**F**
I-84 WB Ramp/Laurel Lane	1.7	A	Westbound	B
I-84 EB Ramp/Laurel Lane	8.3	A	**Eastbound**	**D**

The intersection of Laurel Lane & Columbia Avenue is expected to exceed the City standard Level of Service in the PM peak hour. There are two intersections where the worst-movement Level of Service exceeds the city standards in the PM peak hour; Laurel Lane & Columbia Avenue and Laurel Lane & the I-84 Eastbound ramps.

Deficiencies and Safety Issues

Based on the Existing Conditions Analysis and stakeholder interviews, current system deficiencies or safety issues are listed below:

- The traffic control between the intersections of Laurel Lane & I-84 Eastbound Ramps and Laurel Lane & Columbia Avenue is confusing to drivers not familiar with the area. Since the Port of Morrow generates a lot of truck traffic, there are many non-local drivers using this intersection.
- Intersections are not large enough to accommodate the turning radii of trucks.
- There are no pedestrian or bicycle facilities in the Laurel Lane interchange area, which happens to have a larger that average percentage of heavy vehicles due to the industrial land uses in the area. Pedestrians and bicyclists must use the roadway shoulders along Laurel Lane and Columbia Avenue, which is not desirable due to the large percentage of truck in the area.

Additional system deficiencies and/or safety issues that were identified from the Future Conditions Analysis are listed below:

- The following intersection is expected to exceed the City standard Level of Service in the PM Peak Hour of the forecast year:
    - Laurel Lane & Columbia Avenue
- The future Port of Morrow development is expected to occur east of Laurel Lane, which would increase the truck traffic going to and coming from the east on Columbia Boulevard. This will increase the number of conflicting vehicles at the intersection of Laurel Lane & Columbia Boulevard.

System Alternatives

Following is a list of improvement alternatives that could be implemented to mitigate existing and anticipated transportation system deficiencies. The system alternatives are shown in Figure 9.

- Modify the traffic control at the intersection of Laurel Lane & Columbia Avenue so that the current eastbound "free" right turning traffic would have a stop sign or alter the traffic control so that all movements must stop. This will increase the average delay for the intersection and require more trucks to have to start from a stop condition.
- Reconfigure the intersection of Laurel Lane & Columbia Avenue to be a truck sized roundabout. This would likely require shifting the intersection further away from I-84, and providing a roundabout area that is approximately 250 feet in diameter. This concept would reduce truck stops and queues on all approaches.
- Install traffic signals at the intersections of Laurel Lane & Columbia Avenue and Laurel Lane & I-84 EB Ramp. Both intersections would need to be signalized and interconnected together in order to provide flow between the two intersections. This would allow smooth flow for the traffic with the green light, but will increase the delay for the vehicles waiting at the red light.
- Provide better signing and striping (e.g., more durable material striping) for the interchange area to accommodate non-local drivers.
- The interchange access management standards adopted by ODOT should be addressed when land is redeveloped within the Laurel Lane interchange area.
- A dedicated bike lane and sidewalks along Laurel Lane and Columbia Avenue would provide pedestrian connectivity and a safer facility for the pedestrian and cyclists.

Sensitivity Analysis

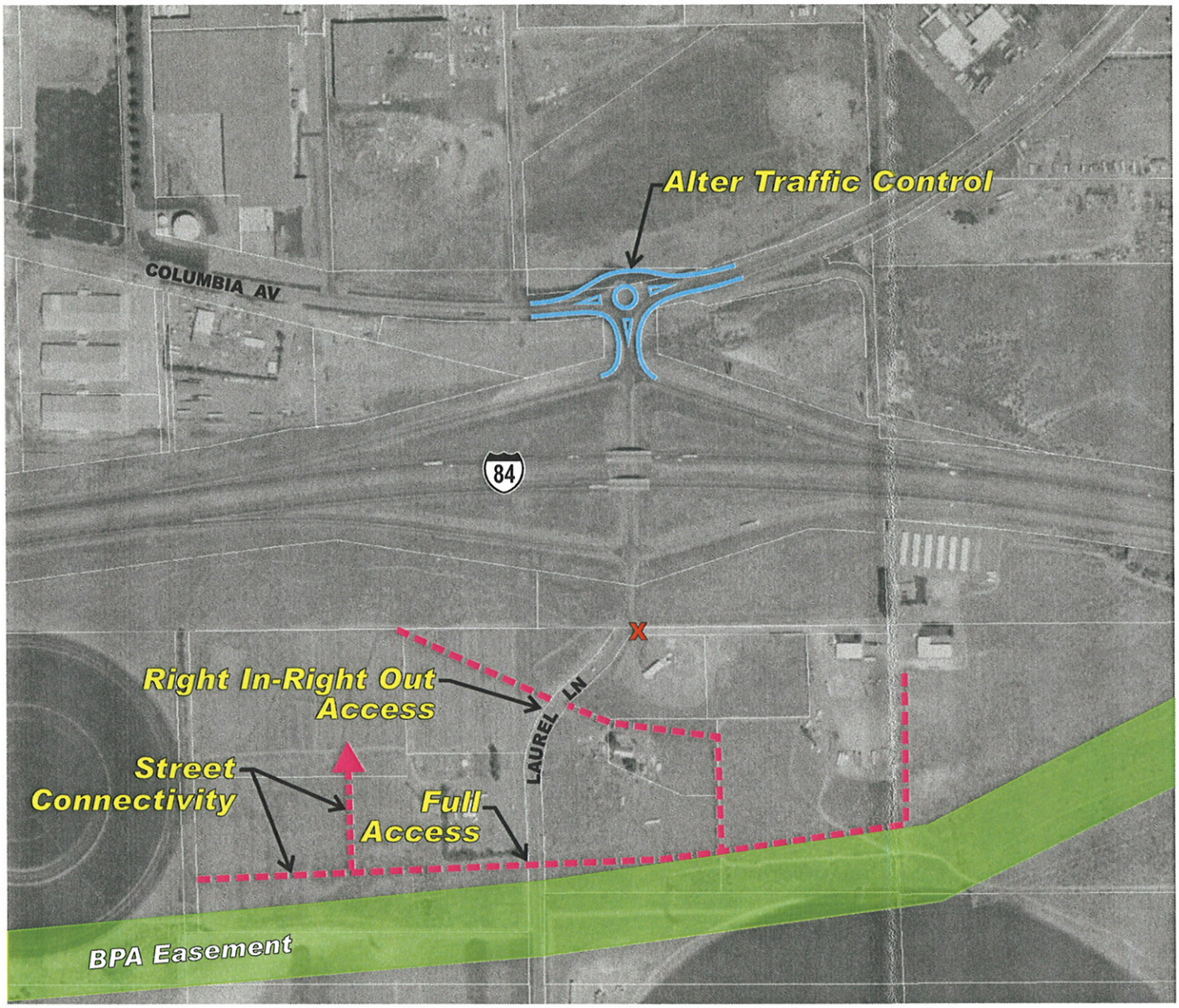
The future distribution patterns have an impact on the forecasted turning movement volumes at study area intersections. If the connection between the Port of Morrow and Highway 730 is not constructed, more traffic will use the Laurel Lane interchange. If 100 percent of the future Port of Morrow East Beach traffic were to use the I-84 & Laurel Lane interchange, the resulting LOS at the three intersections will be slightly worse than if the assumed 30 percent of new trips were to use a Highway 730 connection. The additional traffic would not require any additional system alternatives to what are listed above.

Major Constraints

The following section identifies transportation, environmental, socio-economic, multi-modal and right of way constraints and/or issues associated with the Laurel Lane transportation deficiencies.

- The Bonneville Power Administration (BPA) has a major electrical transmission line that cuts across the city. The BPA easement is 395 feet wide and is about one quarter mile south and parallel to I-84. Any new roadways within the BPA easement would need to comply with regulations set forth by BPA.

- Interstate 84 runs east and west through the City and divides the town into roughly one third to the north and two-thirds to the south. The two roadways that cross I-84 and connect the north and south parts of town are Main Street and Laurel Avenue. Additional roadways that would connect the north and south parts of town would need to cross (over or under) I-84.
- There are identified wetland areas within the City of Boardman. Most of the wetland areas are located where new roadways are not anticipated in the future. There are no identified wetland areas within the Laurel Lane IAMP area.
- New roadway connections or road widening projects will require the purchase of right of way.
- There are no identified sources of funding for any of the transportation improvements.



Alternate Traffic Control Options for Laurel Ln. & Columbia Ave.

1. *Roundabout*
2. *Traffic Signals at Laurel Ln. & I-84 WB Ramp and Laurel Ln. & Columbia Ave.*
3. *All-way Stop Control*

All Other Intersections will have Minor Street Stop Control

City of Boardman IAMP
March 2007

NO SCALE

DKS Associates
TRANSPORTATION SOLUTIONS

Figure 9

LAUREL LANE IAMP
SYSTEM ALTERNATIVES
Full Build Out Scenario

Appendix: Future Land Use/Trip Generation Assumptions:

- Land use assumptions were developed by Winterbrook Planning and reviewed by the City of Boardman and ODOT.
- Trips generation was based on the ITE Trip Generation Manual, 7th Edition.
- Trip reduction (pass by and shared trips) was based on ITE Trip Generation Manual, 7th Edition and was applied to Retail, Fast Food Restaurants, Convenience Mart and Gas Station.
- There were no background through trips added to the network, since the only development in the area would be in Boardman. There is minimal historical growth of traffic volumes on roadways in the area, so there was no additional growth rate applied to existing volumes.
- The Port of Morrow will expand by 225 employees in the near term (5 years). The traffic forecasts assume that the Port has 500 new employees in the next 20 years. It was assumed that one-third of the new trips will use the Hwy 730 interchange to access Each Beach, since the new connection is in the County TSP.

Main Street Trip Distribution:

East N Front "TAZ"
- 70% towards I-84 Ramps (south)
- 25% north
- 5% west

East S Front "TAZ"
- 60% towards I-84 Ramps (north)
- 35% south
- 5% west

West S Front "TAZ"
- 70% towards I-84 Ramps (north)
- 30% south

South Main "TAZ"
- 45% towards I-84 Ramps (north)
- 45% south
- 10% west

South Oregon Trail "TAZ"
- 45% towards I-84 Ramps (north)
- 45% south
- 10% west

South "TAZ"
- 100% towards I-84 Ramps (north)

Traffic was distributed at the ramps so that 45% was directed to the east, 25% was directed to the west and 30% was directed north.

Laurel Lane Trip Distribution:

All traffic was oriented to the I-84 Ramps and used current turning movement percentages at the intersections.

Trip Generation

Main Street IAMP

Table A1: Cumulative Development Raw Trip Generation – Main Street IAMP Area

Land Use	ITE Code	Units (square ft)	Trip Generation				
			Daily	AM In	AM out	PM In	PM Out
Convenience Mart	851	2,000	1,476	67	67	53	51
Fast Food w Drive-Thru	934	3,000	1,488	81	78	54	50
Free Standing Discount Store	815	20,000	1,120	11	5	51	51
East N Front - Subtotal			**4,085**	**160**	**150**	**158**	**152**
Gas Station w/Mart	945	8 pumps	1,302	40	40	54	54
Motel	320	65 rooms	592	15	27	20	18
Sit-Down High Turn Restaurant	932	6,000	763	36	33	40	26
SF Housing	210	120 units	1,148	23	68	76	45
Fast Food w Drive-Thru	934	4	1,984	108	104	72	67
Self Service Car Wash	947	3 stalls		0	0	8	8
Auto Care Center	942	2		4	2	3	3
East S Front - Subtotal			**5,790**	**226**	**274**	**274**	**220**
Motel	320	65 rooms	592	15	27	20	18
Sit-Down High Turn Restaurant	932	6	763	36	33	40	26
East S Front - Subtotal			**1,355**	**51**	**60**	**60**	**43**
Fast Food with Drive-Thru	934	4,000	1,984	108	104	72	67
Bank Drive-In	912	4,000	986	28	22	91	91
Single Tenant Office	715	5,000	58	8	1	1	7
Single Tenant Office	715	5,000	58	8	1	1	7
Medical Clinic	630	10,000	315	18	18	26	26
Single Tenant Office	715	5,000	58	8	1	1	7
Single Tenant Office	715	5,000	58	8	1	1	7
South Main - Subtotal			**3,216**	**186**	**148**	**195**	**213**
Drug Store with Drive Thru	881	20,000	1,763	30	23	84	88
Hardware/Paint Store	816	10,000	513	6	5	29	32
Specialty Retail	812	10,000	452	17	9	21	24
Housing – condos	230	120 units	703	9	44	42	21
South Main - Subtotal			**3,431**	**62**	**80**	**176**	**164**
Housing	210	100 units	957	19	56	64	37
South – Subtotal			**957**	**19**	**56**	**64**	**37**
Subtotal (Main Street IAMP Area)			**18,834**	**1,329**		**1,415**	

Table A1a: Cumulative Development Trip Generation – Main Street IAMP Area

Including Trip Reductions

		Trip Generation			
Land Use	**Daily**	**AM In**	**AM out**	**PM In**	**PM Out**
Convenience Mart*	590	27	27	21	21
Fast Food w Drive-Thru**	848	46	45	31	28
Free Standing Discount Store***	728	7	3	33	33
East N Front - Subtotal	**2,167**	**81**	**75**	**85**	**82**
Gas Station w/Mart****	951	29	29	39	39
Motel	592	15	27	20	18
Sit-Down High Turn Restaurant	763	36	33	40	26
SF Housing	1,148	23	68	76	45
Fast Food w Drive-Thru**	1,131	62	59	41	38
Self Service Car Wash****		0	0	6	6
Auto Care Center****		3	2	2	2
East S Front - Subtotal	**4,585**	**167**	**218**	**225**	**174**
Motel	592	15	27	20	18
Sit-Down High Turn Restaurant	763	36	33	40	26
East S Front - Subtotal	**1,355**	**51**	**60**	**60**	**43**
Fast Food with Drive-Thru**	1,131	62	59	41	38
Bank Drive-In	986	28	22	91	91
Single Tenant Office	58	8	1	1	7
Single Tenant Office	58	8	1	1	7
Medical Clinic	315	18	18	26	26
Single Tenant Office	58	8	1	1	7
Single Tenant Office	58	8	1	1	7
South Main - Subtotal	**2,663**	**140**	**103**	**164**	**185**
Drug Store with Drive Thru***	1,146	20	15	55	57
Hardware/Paint Store***	333	4	3	19	21
Specialty Retail***	294	11	6	14	15
Housing – condos	703	9	44	42	21
South Main - Subtotal	**2,761**	**44**	**68**	**129**	**114**
Housing	957	19	56	64	37
South – Subtotal	**957**	**19**	**56**	**64**	**37**
Subtotal – Main Street IAMP	**11,727**	**969**		**1,118**	

* Trip Reduction of 60% (Convenience Store)
** Trip Reduction of 43% (Fast Food)
***Trip Reduction of 35% (Retail)
****Trip Reduction of 27% (gas station)

Laurel Lane IAMP

Table A2: Cumulative Development Raw Trip Generation – Laurel Lane IAMP Area

Land Use	ITE Code	Units (square ft)	Trip Generation Daily	AM In	AM out	PM In	PM Out
General Light Industrial	110	50,000	349	40	6	6	43
Fast Food with Drive-Thru	934	4,000	1,984	108	104	72	67
West Columbia – Subtotal			**2,333**	**149**	**110**	**78**	**110**
General Light Industrial	110	100,000	697	81	11	12	86
General Light Industrial	110	100,000	697	81	11	12	86
Gas Station w/Mart	945	8 pumps	1,302	40	40	54	54
East Columbia - Subtotal			**2,696**	**202**	**62**	**77**	**226**
General Light Industrial	110	50,000	349	40	6	6	43
Gas Station w/Mart	945	8,000	1,302	40	40	54	54
Truck Stop	none	6 slots	810	39	42	42	39
Laurel Lane - Subtotal			**2,461**	**120**	**88**	**102**	**136**
Warehouse	150	500 emp	1,945	184	71	103	192
Laurel Lane - Subtotal			**1,945**	**184**	**71**	**103**	**192**
Subtotal for Laurel Lane IAMP Area			**9,435**	**1,021**		**1,075**	

Table A2a: Cumulative Development Trip Generation – Laurel Lane IAMP Area

Including Trip Reductions

Land Use	Trip Generation Daily	AM In	AM out	PM In	PM Out
General Light Industrial	349	40	6	6	43
Fast Food with Drive-Thru**	1,131	62	59	41	38
West Columbia – Subtotal	**1,480**	**102**	**65**	**47**	**81**
General Light Industrial	697	81	11	12	86
General Light Industrial	697	81	11	12	86
Gas Station w/Mart****	716	22	22	29	29
East Columbia - Subtotal	**2,110**	**184**	**44**	**53**	**202**
General Light Industrial	349	40	6	6	43
Gas Station w/Mart****	716	22	22	29	29
Truck Stop****	591	28	31	31	28
Laurel Lane - Subtotal	**1,656**	**91**	**58**	**66**	**101**
Warehouse	1,945	184	71	103	192
Laurel Lane - Subtotal	**1,945**	**184**	**71**	**103**	**192**
Subtotal (Laurel Lane IAMP)	**7,505**	**836**		**897**	

** Trip Reduction of 43% (Fast Food)
****Trip Reduction of 27% (gas station)

TRAFFIC LEVELS OF SERVICE

Analysis of traffic volumes is useful in understanding the general nature of traffic in an area, but by itself indicates neither the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of *level of service* (LOS) has been developed to subjectively describe traffic performance. Level of service can be measured at intersections and along key roadway segments.

Level of service categories are similar to report card ratings for traffic performance. Intersections are typically the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is generally diminished in their vicinities. Levels of Service A, B and C indicate conditions where traffic moves without significant delays over periods of peak travel demand. Level of service D and E are progressively worse peak hour operating conditions and F conditions represent where demand exceeds the capacity of an intersection. Most urban communities set level of service D as the minimum acceptable level of service for peak hour operation and plan for level of service C or better for all other times of the day. The *Highway Capacity Manual* provides level of service calculation methodology for both intersections and arterials[12]. The following sections provide interpretations of the analysis approaches.

Unsignalized Intersections (All-Way Stop Controlled)

Unsignalized intersections and all-way stop controlled intersections are each subject to a separate capacity analysis methodology. All-way stop controlled intersection operations are reported by leg of the intersection.

This method calculates a delay value for each approach to the intersection. The *2000 Highway Capacity Manual 2000* describes the detailed methodology. The following table describes the amount of delay associated with each level of service.

Level of Service	Delay (seconds)
A	0 – 10
B	> 10 – 15
C	> 15 – 25
D	> 25 – 35
E	> 35 – 50
F	> 50

Source: *Highway Capacity Manual 2000*, Exhibit 17-22

[12] *Highway Capacity Manual 2000*, Transportation Research Board, Washington D.C., 2000, Chapters 16 and 17.

Unsignalized Intersections (Two-Way Stop Controlled)

Unsignalized intersection level of service is reported for the major street and minor street (generally, left turn movements). The method assesses available and critical gaps in the traffic stream which make it possible for side street traffic to enter the main street flow. The *Highway Capacity Manual 2000* describes the detailed methodology. It is not unusual for an intersection to experience level of service E or F conditions for the minor street left turn movement. It should be understood that, often, a poor level of service is experienced by only a few vehicles and the intersection as a whole operates acceptably.

Unsignalized intersection levels of service are described in the following table.

Level of Service	Delay (sec/veh)	Expected Delay
A	0 – 10	Little or no delay
B	> 10 – 15	Short traffic delays
C	> 15 – 25	Average traffic delays
D	> 25 – 35	Long traffic delays
E	> 35 – 50	Very long traffic delays
F	> 50	Extreme delays potentially affecting other traffic movements in the intersection

Source: *Highway Capacity Manual 2000*, Exhibit 17-2

Signalized Intersections

For signalized intersections, level of service is evaluated based upon average vehicle delay experienced by vehicles entering an intersection. Control delay (or signal delay) includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. In previous versions of this chapter of the *HCM* (1994 and earlier), delay included only stopped delay. As delay increases, the level of service decreases. Calculations for signalized and unsignalized intersections are different due to the variation in traffic control. The *Highway Capacity Manual 2000* provides the basis for these calculations.

Level of Service	Delay (sec/veh)	Description
A	0 – 10	**Free Flow/Insignificant Delays:** No approach phase is fully utilized by traffic and no vehicle waits longer than one red indication. Most vehicles do not stop at all. Progression is extremely favorable and most vehicles arrive during the green phase.
B	> 10 – 20	**Stable Operation/Minimal Delays:** An occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles. This level generally occurs with good progression, short cycle lengths, or both.
C	> 20 – 35	**Stable Operation/Acceptable Delays:** Major approach phases fully utilized. Most drivers feel somewhat restricted. Higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, and the number of vehicles stopping is significant.
D	> 35 – 55	**Approaching Unstable/Tolerable Delays:** The influence of congestion becomes more noticeable. Drivers may have to wait through more than one red signal indication. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. The proportion of vehicles not stopping declines, and individual cycle failures are noticeable.
E	> 55 – 80	**Unstable Operation/Significant Delays:** Volumes at or near capacity. Vehicles may wait though several signal cycles. Long queues form upstream from intersection. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are a frequent occurrence.
F	> 80	**Forced Flow/Excessive Delays:** Represents jammed conditions. Queues may block upstream intersections. This level occurs when arrival flow rates exceed intersection capacity, and is considered to be unacceptable to most drivers. Poor progression, long cycle lengths, and v/c ratios approaching 1.0 may contribute to these high delay levels.

Source: *Highway Capacity Manual 2000*, Exhibit 16-2