

August 29, 2007

Project No. OR07.031.T01
The Point At Wheeler Landing



Doug W. Hooper
City Manager
PO Box 177
Wheeler OR 97147

SUBJECT: Traffic Analysis for the proposed The Point At Wheeler Landing along Hemlock Street and west side of Hwy 101 in Wheeler, OR.

Dear Mr. Hooper:

As requested, a traffic impact analysis has been prepared for the buildout of the proposed The Point at Wheeler Landing residential and retail development on the west side of Hwy 101 /Hemlock Street on a site of approximately 8.9 acres zoned water related commercial / general commercial. This development will consist of 44 two-story townhomes, 14 three-story live-work townhomes which will have approximately 570 GSF of retail space and a garage on the first floor and the upper two levels as a residence and 3 two-story buildings that will have a total of approximately 19,077 GSF retail space. **Figure 1** contains a vicinity map of the proposed site and surrounding roadway system. Access to the site will be provided via a proposed west leg to the existing intersection of Highway 101 /Hemlock Street (see attached Figures). **Figure 1A** presents a site plan of the proposed development.

This traffic analysis includes a detailed assessment of the traffic impacts of the proposed The Point at Wheeler Landing and the growth in background traffic due to other sources. Based on the results of this analysis, it is concluded that the proposed development can be constructed without adversely affecting the traffic operational or safety characteristics of the adjacent roadway system. Specific findings of this study are as follows:

- When the entire site is developed, it is estimated that The Point At Wheeler Landing will generate approximately 652 **net new** vehicle trips during a typical weekday, including 38 vehicle trips during the AM peak hour and 62 vehicle trips during the PM peak hour.
- Analysis of future 2010 background traffic volumes that will exist regardless of buildout for the proposed development found that the study area intersection will operate at acceptable Levels of Service (LOS) C or better during the peak hour /30th HV with V/C ratio of 0.01 or better.
- Analysis of future 2010 traffic conditions with the buildout of The Point at Wheeler Landing found that the traffic generated by this development will not adversely impact future Levels of Service. These results indicate that the study area intersection will continue to operate at LOS C or better during the peak hour /30th HV with V/C ratio of 0.01 or better.

The following sections document the study's methodology, results, and major findings.

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PROPOSED DEVELOPMENT

The proposed The Point at Wheeler Landing residential and retail development on the west side of Hwy 101 /Hemlock Street on a site of approximately 8.9 acres zoned water related commercial /general commercial. This development will consist of 44 two-story townhomes, 14 three-story live-work townhomes which will have approximately 570 GSF of retail space and a garage on the first floor and the upper two levels as a residence and 3 two-story buildings that will have a total of approximately 19,077 GSF retail space. **Figure 1** contains a vicinity map of the proposed site and surrounding roadway system. Access to the site will be provided via a proposed west leg to the existing intersection of Highway 101 /Hemlock Street (see attached Figures). **Figure 1A** presents a site plan of the proposed development.

STUDY AREA

Based on preliminary discussion with ODOT staff and previous traffic impact analyses conducted by CTS Engineers in the City, one intersection was selected for the analysis during AM Peak, PM peak hour and 30th DHV (design hour volume) conditions at the minor street stop-controlled intersection of Hwy 101 /Hemlock Street.

EXISTING CONDITIONS

Transportation Facilities

Figure 2 shows the approximate location of The Point at Wheeler Landing development and the surrounding roadway network including the lane configurations in the study area.

Area Roadway System

The main roadways in the study area include Hwy 101 and Hemlock Street. **Table 1** presents the characteristics of these roadways. Area roadway and sight distance photos are in the Appendix to the report. Both existing and future traffic analyses in this study were conducted assuming existing roadway conditions.

Table 1: Summary of Study Area Roadway Characteristics

Street Name	Road Class	Width (Feet)	Speed Limit	Sidewalks	Bike Lane	On-Street Parking
Hwy 101 (At Hemlock Street)	State Route	28	North-45 South-25	East-Yes West-No	No	No
Hemlock Street	Local	18	-	No	No	No

Land Uses

Land use in the immediate vicinity to the south along Hwy 101 is mostly retail and a public boat launch and dock along Marine Drive. Land to the east of the site across Hwy 101 consists of single family homes.

Pedestrian and Bicycling Considerations

Sidewalks currently exist along the east side of Hwy 101. To the north of the Hemlock Street, neither sidewalks nor bike lanes are present along Hwy 101. However, Hwy 101 has shoulder bikeways. The applicant will provide sidewalks/walking paths, curbs and gutters throughout the internal roadway system.

Transit Considerations

"The Wave" operates bus routes to/from Portland's Union Station. The Wave traverses Tillamook County, providing service to Manzanita, Nehalem, Wheeler, Rockaway Beach, Garibaldi, Bay City, Tillamook, Hebo and Cloverdale and from these locations to Portland. The nearest stop to the site is about a quarter mile from the site's southern edge.

Existing Traffic Volumes

A reconnaissance of the site and its vicinity was conducted. To assess the impact of buildout of the proposed The Point at Wheeler Landing, traffic operations were analyzed during both AM and PM weekday peak hours because these periods represent reasonable "worst case" for traffic scenarios in the study area. Furthermore, traffic operations were also analyzed during 30th DH.

Traffic Volumes

Figure 3 shows recent weekday AM and PM peak hour traffic volumes obtained at the key intersection in the vicinity of the site. Traffic volumes during PM peak hour within the study area were obtained from actual weekday peak hour manual traffic counts conducted during August of 2007 and the AM counts were obtained from tube counts conducted during the same time in August of 2007. These data revealed that the weekday PM peak hour occurs between 3:00 - 4:00 PM, and the typical AM peak hour between 7:00 - 9:00 AM is significantly lower. This inconsistency is typical of the nature of the proposed site location. Traffic volumes greater than 25 were rounded upward to the nearest five vehicles. For the purpose of this traffic study, only PM peak hour between 3:00 - 4:00 PM will be analyzed.

To evaluate intersections for existing and future operational deficiencies, ODOT requires analysis of 30th highest design hour volumes (30th DHV), which is the hourly volume of traffic that is exceeded only 29 hours over the entire year. To estimate 30th DHV, typical PM peak hour volumes are adjusted using a seasonal factor. The ODOT methodology contained in the TPAU Manual - *Developing Design Hour Volumes* calls for averaging the most recent five years of seasonal factors after first tossing out the highest and lowest factors for each month. The 30th DHV is determined by adjusting typical PM peak hour volumes with a seasonal factor determined using data from an appropriate Automatic Traffic Recorders (ATR) or, if there is no ATR nearby, from the most current seasonal trend table. Approximately 8 miles south of Hemlock Street along Hwy 101 /Washington Street intersection in Rockaway Beach, ODOT maintains an Automatic Traffic Recorder (ATR) (29-001). Based on the data from this ATR it is revealed that the seasonal adjustment for the month of July (ATR's peak month) and August (traffic count month) is approximately the same (i.e. July/August = 143% / 143% = **1.00**). Therefore, the counts obtained in August **will not require adjustment**. Again, as mentioned earlier, for the purpose of this traffic study only PM peak hour will be analyzed.

Table 3: Seasonal Adjustment Factors For OR 18-B (Based on ATR #29-001 on OR 9)

	2006	2005	2004	2003	2002	Average
July (Peak Month of the year)	143%	128%	143%	148%	144%	143%
August (Traffic Count Month)	142%	124%	141%	148%	146%	143%

Peak Hour Traffic Operations

Traffic conditions at the key intersection in the study area were analyzed only during PM peak hour because the 30th DH along Hwy 101 is approximately the same as PM peak hour. Intersection operational analyses were conducted using the procedures in the **2000 Highway Capacity Manual (HCM)** for evaluating signalized and unsignalized intersections, which describe the traffic operations of an intersection in terms of its Volume to Capacity Ratio (V/C), Delay, Queue Length, and Level of Service (LOS). For unsignalized intersections, the intersection's LOS is stated relative to the most critical intersection approach or maneuver, typically the left turns from the minor street approach. For signalized intersections, the LOS is a function of the average vehicle delays that drivers on all approaches experience. For the section of Highway 101 in the vicinity of the site, ODOT standards require that all intersections operate at a V/C ratio of 0.75 or better (Aug 2005 Amendment to Table 6 in Policy 1F - Mobility Standards, 1999 Oregon Highway Plan). The V/C ratio is the ratio of hourly traffic volume to the theoretical maximum hourly volume of vehicles that a roadway section or approach can accommodate. The LOS worksheets for the results presented in this study are attached in the appendix to this report.

Table 2 presents the calculated results (V/C ratios) for our existing conditions analyses at all study area intersections based on the peak hour traffic volumes shown in **Figure 3**. These results indicate that the study area intersection will operate at LOS C or better during weekday peak hour /30th HV with V/C of 0.01 or better during. These findings were confirmed during our general observations of traffic operations. Furthermore, queuing along Hemlock Street is minimal (1 vehicle during the peak hour) which was confirmed during our intersection volume counts.

Table 2: Existing 2007 Weekday PM Peak Hour /30th DH Levels of Service

Intersection	AM Peak Hour			PM Peak Hour /30 th HV		
	Minor Street Stop Control					
	Avg Vehicle Delay (Sec/Veh)	V/C Ratio	LOS	Avg Vehicle Delay (Sec/Veh)	V/C Ratio	LOS
Hwy 101 /Hemlock Street (Critical Approach: WB)	-	-	-	EB-16.0 WB-13.1	0.01 0.01	C B

Traffic Safety

Collision records requested. Data pending.

Intersection Sight Distance

A general assessment of intersection sight distance was performed along the study area intersection. Photos in the Appendix illustrate sight distance at the study area intersections. Hwy 101 in the vicinity of Hemlock Street (site's proposed access) is relatively straight and flat. To the east, Hemlock Street terminates as a "dead end". ODOT standards require that intersection sight distances conform to **AASHTO – A Policy on Geometric Design of Highways and Streets 2001**, which requires that measurements be based on an eye height of three and one-half (3.5) feet above the controlled road at least fifteen (15) feet from the edge of the vehicle travel lane of the uncontrolled public road to an object height of three and one-half (3.5) feet on the uncontrolled public road. For Hwy 101, a state highway with a posted speed limit of 45 mph to the north of Hemlock Street and 25 mph to the south, AASHTO requires 500 feet of available clear sight distance for 45 mph and 280 feet for 25 mph. Our measurements from Hemlock Street found that sight distance exceeds 550 feet to the north, but is obstructed to the south due to vegetation. After the removal/trimming of vegetation, the sight distance to the south will be at least 400 feet, which exceeds the minimum criteria of 280 feet.

Based on the above and the field observations, it does not appear that the applicant needs to address any sight distance traffic safety problems in the immediate vicinity of the site.

TRAFFIC IMPACT ANALYSIS

The impact of traffic generated by the full buildout of The Point at Wheeler Landing on the surrounding street system during the critical weekday peak hours was analyzed as follows:

- A three-year buildout was assumed, to the year 2010. Therefore, the existing traffic volumes were adjusted to estimate future 2010 background traffic conditions including other nearby developments expected to be completed before 2010.
- Total AM and PM peak hour trips both into and out of The Point at Wheeler Landing site were estimated for complete buildout conditions.
- Existing traffic volumes on the roadways surrounding the site and the site's proximity to major roadways were evaluated to estimate the trip distribution patterns in the study area for vehicle trips generated by the site.
- Estimated site-generated traffic volumes for the AM and PM peak hours were assigned to the roadway network and added to the estimated 2010 background traffic volumes to represent future traffic conditions with full buildout of the site.
- Future LOS and volume-to-capacity ratios (v/c ratios) at key intersections in the study area were examined under both background and full buildout traffic conditions.

Future 2008 Background Traffic Volumes

The future year analysis, as required by ODOT (OAR 734-051-0180) for any single phase development with an anticipated ADT between 0 and 999, is the year of its opening. Full buildout of the proposed The Point at Wheeler Landing residential development is expected to occur by the end of 2010. To assess the likely future traffic conditions regardless of the proposed development, increases in traffic due to general growth as well as other proposed developments in the vicinity of the site were estimated. Discussion was held with City /ODOT staff to review the area. There are no other approved developments in the immediate area.

To assess the likely future traffic conditions regardless of the proposed development, increases in traffic due to general growth as well as other proposed developments in the vicinity of the site were estimated. Discussions/meetings were held with ODOT planning staff to review traffic growth trends along Hwy 101. This research found there were no other major developments in the near future that have been proposed or approved in the vicinity. To determine an appropriate background growth factor for developing design hour volumes (30th DHV) for this project, ODOT's TPAU (Transportation Planning and Analysis Unit) Future Volume Tables (FVTs) were used. These tables are based on historical volume trends from past years to project future volumes. Notably, data from mileposts north (MP 47.08) and south (MP 47.38) of the site were used to interpolate a more accurate result. As shown in **Table 3** and from the FVT at MP 47.08 along Highway 9 (US 101), the 2003 volume is shown as 5,400, the 2025 traffic volume is 7,100, and the r-squared value is 0.765. At MP 47.38 the 2003 volume was found to be 5,400, the 2025 traffic volume ,6800, and the r-squared value 0.93. Both of these r-squared values are acceptable and indicate a strong relationship between historical data points. Using this data, we first computed the 22 year growth factor for each milepost. At milepost 47.08 the 22 year growth factor is 1.31 (7,100/5,400), and at milepost 47.38 the 22 year growth rate is 1.25. Next, assuming a linear relationship, the average of these two 22 year growth factors was used to compute the annual growth factor: $\frac{((1.31+1.25)/2)-1}{22} = 0.0127$, or 1.3% straight-line growth per year. Thus, to calculate the 2010 future background PM or 30th DHV's that correspond with this annual growth rate and full buildout year, existing peak hour volumes (30th HV) in **Figure 3** were increased by 3.9 percent (3 years x 1.3% per year = 3.9%) to account for other increases in traffic due to sources outside the study area during the next three years to 2010. The resulting weekday future 2010 background PM peak hour /30th DHVs are shown in **Figure 5** and the intersection capacity analysis results are shown in **Table 4**.

Table 3: Development of Future Growth Factor

Location	From ODOT/TPAU Future Volume Tables			22 Year Growth Factor
	2003 Volume	2024 Volume	R ² Value	
US 101, Milepost 47.08	5,400	7,100	0.765	1.31
US 101, Milepost 47.38	5,400	6,800	0.939	1.25

These results indicate that under future background 2010 traffic conditions, traffic operations at study area intersections are expected to degrade only slightly when compared to the existing conditions analysis results. Intersection Levels of Service are similar to existing conditions. The critical mobility measure of V/C ratio is estimated to remain within acceptable criteria as results indicate in **Table 4**.

Table 4: Future Background 2010 Weekday PM Peak Hour /30th DH Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	Minor Street Stop Control					
	Avg Vehicle Delay (Sec/Veh)	V/C Ratio	LOS	Avg Vehicle Delay (Sec/Veh)	V/C Ratio	LOS
Hwy 101 /Hemlock Street (Critical Approach: WB)	-	-	-	EB-16.5 WB-13.4	0.01 0.01	C B

Site-Generated Traffic Volumes

Figure 1A shows the proposed site plan for The Point at Wheeler Landing. The applicant is proposing to construct about 44 two-story townhomes, 14 three-story live-work townhomes which will have approximately 570 GSF of retail space and a garage on the first floor and the upper two levels as a residence. This development also has three 2-story buildings that will have a total of approximately 19,077 GSF retail space. The site is located along the west side of Hwy 101 /Hemlock Street intersection on a site of approximately 8.9 acres zoned water related commercial /general commercial. Access to the site will be provided via a new public street connection along the west side of Hwy 101 and aligned with existing Hemlock Street. The number of vehicle trips into and out of The Point at Wheeler Landing were estimated using standard trip generation rates for Townhomes (Land Use Code 230) and Shopping Center (Land Use Code 820) as presented in the ITE Trip Generation Report (7th Edition). Also, for the work portions of the live/work units, the trip rates from ITE Land Use Code 710 General Office are applied to the work portion (GSF) of these dwellings. This is a very conservative approach because the trip generation for the residential use includes people leaving the home to go to work, and the office rates include people driving to work. The primary concept of these live/work dwellings is that people do not have to leave their home to travel to a traditional office/work place. **Thus, to remove double counts, trips generated by live portion from live/work units will not be included.** Trip rates in this ITE publication are based on empirical observations performed at many similar sized developments located throughout the United States.

Due to the nature of retail land uses in the proposed site, a full understanding of the trip types that will be traveling to/from the site is necessary. In evaluating the traffic impact of retail uses, it is important to realize that the majority of vehicle trips to/from a retail use, such as the proposed The Point at Wheeler Landing will result from vehicles already on the road making trips for other purposes, such as getting to/from work or shopping at adjacent uses. This is particularly true for retail uses along major commuter routes. The first trip type, *pass-by trips*, comes from drivers who are already traveling along an adjacent street. As they pass by the site as part of their regular travel route, they turn into the site to make a purchase and then continue on their original route. The second trip type is *diverted trips* from other drivers already on the road, but who divert their route a few streets to enter the site. After they make their purchase they then return to their original route. The third trip type is totally new trips on the roadway system. These include nearby residents who leave their home or office and drive to make a purchase and then return home without making any other stops. To be

conservative, we considered diverted as a new trip, so, for this study diverted trips are included in new trips.

Furthermore, it should also be noted that the proposed site includes both residential and retail. Based on **ITE Trip Generation Report (7th Edition)**, a mixed-use development such as the proposed will likely have trips that remain internal to the site (for example, trips from an on-site residential to an on-site retail destination). Analysis of potential internal travel demand was performed by using the **Multi-Use Development Trip Generation and Internal Capture Worksheet** from the **ITE Trip Generation Handbook**. This worksheet is set up to estimate the amount of internal travel based on the size/type of land uses for a typical mixed-use development. For instance, a retail and residential use in the same mixed-use development would be expected to produce internal trips between the two. The generated trips from each of these land uses were put into the internal capture spreadsheet (shown in the *Appendix*). It was found that approximately 17 percent of the traffic was internal trips. These internal trips were removed from the total site generated trips before applying the pass-by reduction. Based on these trip rates, and as shown below in **Table 5**, we estimate that The Point at Wheeler Landing will potentially generate approximately 652 new vehicle trips throughout a typical weekday, including 38 vehicle trips during the AM peak hour and 62 vehicle trips during the PM peak hour.

Table 5: Trip Generation Estimate for Buildout of The Point at Wheeler Landing

Land Use/ Site Location	Daily Trips	AM Peak Hour			PM Peak Hour		
		Total	In	Out	Total	In	Out
Attached Townhomes (44 Units) (ITE Code 230)	258	19	3	16	23	15	8
Live Work Townhomes (14 Units) (ITE Code 230)	82	6	1	5	7	5	2
Gen. Office in Live/Work Townhomes (14 @ 572 GSF ea. = 8,008) (ITE Code 710)	88	12	11	1	12	2	10
Shopping Center (19,077 GSF) - ITE Code 820A	819	20	12	8	72	35	37
Internal Trips 17%	139	3	2	1	12	6	6
Total External Trips	680	17	10	7	60	29	31
Pass-by Trips 55%	374	9	5	4	33	16	17
Total New /Diverted Trips 45%	306	7	4	3	27	13	14
Total Site Generated Trips	1,165	51	26	25	107	52	55
Total Internal Site Generated Trips	139	3	2	1	12	6	6
Total External Site Generated Trips	1,026	48	24	24	95	46	49
Total Pass-by Trips	374	9	5	4	33	16	17
Net New /Diverted Site Generated Trips	652	38	18	20	62	30	32

Distribution and Assignment of Site Generated Traffic

Traffic generated by the proposed The Point at Wheeler Landing residential and retail development was assigned to the roadway network by considering existing travel patterns obtained from AM and PM peak hour counts at the intersections of Hwy 101 /Hemlock Street. **Figure 6** displays the trip distribution that was assumed from these vehicle trips generated by this development. It was found that approximately 60 percent of the traffic travels south along Hwy 101 and 40 percent travels north. **Figure 7** shows these trip distributions and assignments of traffic associated with the proposed The Point at Wheeler Landing during the peak hours /30th HV.

Total Future 2008 Traffic Volumes and Levels of Service

Total future 2010 peak hour /30th HV traffic volumes at the study area intersections were estimated by adding the background future traffic volumes displayed in **Figure 5**, to the volumes that would be generated by buildout of The Point at Wheeler Landing shown in **Figure 6**. Total future 2010 peak hour /30th HV traffic volumes with buildout of The Point at Wheeler Landing are shown in **Figure 7**. The results of the intersection LOS analyses for total future 2010 traffic volumes are shown in **Table 6**. These results indicate that with The Point at Wheeler Landing fully built out, delays will degrade slightly from future background conditions. However, the study area intersections will continue to operate at LOS C with V/C ratio of 0.01 or better during weekday peak hour /30th HV peak hours, which meets ODOT standards for intersection performance.

Table 4: Future Background 2010 Weekday PM Peak Hour /30th DH Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	Minor Street Stop Control					
	Avg Vehicle Delay (Sec/Veh)	V/C Ratio	LOS	Avg Vehicle Delay (Sec/Veh)	V/C Ratio	LOS
Hwy 101 /Hemlock Street (Critical Approach: WB)	-	-	-	EB-15.1 WB-14.5	0.01 0.01	C B

SITE ACCESS AND CIRCULATION PLAN

Figure 1 and **Figure 1A** show the vicinity and proposed site plan. The applicant is proposing to construct 44 two-story townhomes, 14 three-story live-work townhomes which will have approximately 570 GSF of retail space and a garage on the first floor and the upper two levels as a residence and 3 two-story buildings that will have a total of approximately 19,077 GSF retail space. Access to the site will be provided via a proposed west leg to the existing intersection of Highway 101 /Hemlock Street (see attached Figures).

CONCLUSIONS

Based on the results of the analysis described in this report, it is concluded that the proposed The Point at Wheeler Landing development can be constructed without adversely affecting traffic operations or safety in the vicinity of the site. Furthermore, key intersection and roadways in the study area can operate at acceptable Levels of Service when this development is built out. No specific off-site roadway improvements are recommended to accommodate this development or mitigate its impact.

If you have any questions relating to the data or analyses discussed in this report, please contact me directly.

Sincerely,

Robert Morast
Robert Morast, P.E.
Transportation Engineer

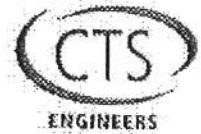
Attachments



EXPIRES 12-31-08

April 1, 2008

Project No. OR07.031.T01
The Point At Wheeler Landing



Doug W. Hooper
City Manager
PO Box 177
Wheeler OR 97147

RE: Addendum to the Traffic Impact Study Dated August 29, 2007 for The Point At Wheeler Landing on the west side of Hwy 101 /SW Hemlock Street intersection in Wheeler, OR.

Dear Mr. Hooper:

This letter is an addendum to the original traffic study dated August 29th 2007. It includes analysis of recent five years of crash history, and right and left turn lane criteria for the proposed The Point at Wheeler Landing development. The development is located on the west side of Hwy 101 /Hemlock Street on a site of approximately 8.9 acres zoned water related commercial / general commercial. As mentioned in the original report, this development will consist of 44 two-story townhomes, 14 three-story live-work townhomes which will have approximately 570 GSF of retail space and a garage on the first floor and the upper two levels as a residence and 3 two-story buildings that will have a total of approximately 19,077 GSF retail space. **Figure 1** contains a vicinity map of the proposed site and surrounding roadway system. Access to the site will be provided via a proposed west leg to the existing intersection of Highway 101 /Hemlock Street (see attached Figures). **Figure 1A** presents a site plan of the proposed development.

Traffic Safety

Collision records for the most recent five years of available data (Jan. 2002 to Dec. 2006) were obtained from Oregon Department of Transportation (ODOT) for the intersection of Highway 101 /Hemlock Street in the vicinity of the project site. This was analyzed to determine if traffic safety problems exist at the study area intersection in the vicinity of the site. **Figure 4** shows the location and type of reported incidents. A total of 4 crashes were reported, which equates to an average annual crash rate of 0.39 crashes per million entering vehicles. This number and rate of reported collisions are typical of the crashes experienced on similar roadways throughout the State.

Left Turn Lane Warrants

An analysis was conducted to determine if northbound vehicles turning left into the proposed site from Hwy 101 would meet warrants for requiring separate left turn lanes under total future 2010 traffic conditions. These warrants are based on the number of vehicles turning left, the posted speed limit or design speed, advancing volumes, and the opposing conflicting volumes during the critical PM peak hour. As shown in **Table 1** and based on Criterion 1 (vehicular volume) in the **ODOT Left Turn Lane Warrant Criteria**, these projected future 2010 traffic volumes at the proposed site access intersections (Hwy 101 /Hemlock Street) **meets** warrant criterion for requiring a separate northbound left turn lane under both 45mph and 25mph speed zone.

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Table 1: Results of Left Turn Warrant Analyses under Total Future 2010 Volume Conditions (Buildout of the The Point at Wheeler Landing)

Intersection	Total Future 2010 PM Peak Hour			ODOT Criteria	
	Design Speed (mph)	Left Turns (vph)	Opposing Plus Advancing Volume (vph/Lane)	Minimum Criteria (Lt Turns-vph)	Warrant Met?
Northbound Hwy 101 at Hemlock Street (Site Access)	45	26	728	10	Yes
Northbound Hwy 101 at Hemlock Street (Site Access)	25	26	728	12	Yes

In-bound Vehicle Queue Length Analysis

Queuing analysis was conducted at the site's access intersections of Hwy 101 /Hemlock Street. As mentioned earlier, the proposed development meets warrants for a northbound left turn lane. Intersection operations reported in the original traffic study were evaluated using the methodology outlined in the 2000 Highway Capacity Manual (HCM). However, for the purpose of queue length, AASHTO 2-minute Rule or SimTraffic analysis software cannot be used at this intersection due to the railroad crossing running parallel to the Hwy 101. In discussions with the Port of Tillamook Bay staff, trains passing through this area are approximately 1,000 to 1,500 feet (20-30 cargo cars) in length and travel at about 10 mph within the City limit. It was also found that a train with 30 cargo cars in length crosses the railroad crossing in about 2-3 minutes. Approximately 30 seconds before arriving at the crossing, the system which closes the gates at a crossing works by sensing the presence of a train on the tracks at a fixed distance from the crossing. That distance is set such that a train moving at the maximum permissible speed (10 mph) for that section of track will not reach the crossing until enough time has passed to allow the gates to fully close (approximately 500 feet at Hemlock Street). After several seconds of flashing lights and ringing bells, the crossing gates begin to lower, which usually takes about 5-10 seconds. This phenomenon can also be verified as follows:

$$C_t = \left[\frac{L_t + D_d + W_i}{S_t} \right]$$

Where:

- C_t = Clearance time in seconds
- L_t = Length of the Train in feet (1,500 feet)
- D_d = Distance of the detection loop from the road crossing in feet (about 500 feet)
- W_i = Width of an intersection (approximately 50 feet)
- S_t = Speed of the Train is 10mph. (10 mph x 5280) /3600 = 14.67 ft/sec

$$C_t = \left[\frac{1,500 + 500 + 50}{14.67} \right]$$

$$C_t = 140 \text{ sec} \approx 2.33 \text{ min} \approx 3 \text{ minutes}$$

(4 minutes under "worst case" scenario)

As shown in **Figure 7**, total future 2010 traffic volume with full buildout of The Point at Wheeler Landing will generate 26 northbound left turns entering into the site (Hemlock Street) from Hwy 101 during the PM peak hour. This equates to approximately 1 vehicle for every 2-minutes. However, due to railroad crossing at the site access a 4-minute "worst case" scenario is assumed which equates to a queue of 2 vehicles (50 feet). Furthermore, assuming there is a passenger car and a delivery truck in the queue, a storage length of 50-75 feet long should be sufficient.

Right Turn Lane Warrants

An additional analysis was also conducted to determine whether or not increased traffic along Hwy 101 at the proposed site access (Hwy 101 /Hemlock Street) intersections would meet warrants for requiring a separate right turn lane under total future 2010 traffic conditions with full buildout of the proposed development plan. As shown in **Table 2**, and based on Criterion 1 (vehicular volume) in the **ODOT Right Turn Lane Warrant Criteria**, the projected future 2010 southbound right turning vehicles in to the site from Hwy 101 **do not meet** the warrant criteria for requiring a separate right turn lane.

Similar to the analysis for left turn lane storage length, a right turning vehicle may also experience a waiting time of 3-4 minutes. Also, shown in **Figure 7**, total future 2010 traffic volume with full buildout of The Point at Wheeler Landing will generate 23 northbound right turns entering into the site (Hemlock Street) from Hwy 101 during the PM peak hour. This equates to approximately 1 vehicle for every 2-minutes and 2 vehicles (50 feet) queue for the entire waiting period. Thus, it is desirable to provide a right-turn pocket to avoid blocking of thru-vehicles along Hwy 101 at Hemlock Street. Finally, it should be noted that the section of Hwy 101 just north of Hemlock Street is marked with a dashed yellow centerline for northbound vehicles only indicating that passing is permitted. Furthermore, with the buildout of the proposed development, the segment of Hwy 101 will adopt a more urban character. Thus, it is recommended that ODOT should consider re-striping this section of Hwy 101 to a double solid yellow line and investigate moving the existing posted speed limit of 45 mph further to the north (approximately 500-1,000 feet).

Table 2: Results of Right Turn Warrant Analyses under Total Future 2010 Volume Conditions (Buildout of the The Point at Wheeler Landing)

Intersection	Total Future 2010 PM Peak Hour			ODOT Criteria	
	Design Speed (mph)	Right Turns (vph)	Design Hour Volume (vph/Lane)	Minimum Criteria (Rt Turns-vph)	Warrant Met?
Southbound Hwy 101 at Hemlock Street (Site Access)	45	23	393	29	No
Southbound Hwy 101 at Hemlock Street (Site Access)	25	23	393	61	No

Outbound Vehicle Queuing Analysis

Based on the request from ODOT staff, CTS Engineers conducted queuing analysis along the site's proposed access (Hemlock Street) location. A review of the site plan for the proposed development shows there is approximately 30 feet (~ 1 Passenger car or small delivery truck) of storage between the highway intersection and the train dynamic envelope. As discussed in the original report, full buildout of the proposed The Point at Wheeler Landing generates about 48 external vehicle trips during the AM peak hour of which 24 are entering vehicles and 24 are exiting vehicles, and 95 vehicle trips during the PM peak hour of which 46 are entering vehicles and 49 are exiting vehicles as shown in the trip generation **Table 5** of the original report. Based on intersection capacity analysis (HCM 2000) results, queuing along the unsignalized intersections will be minimal (0-1 vehicles). Intersection capacity analysis worksheet is attached as an **Appendix** to this report which shows 95th percentile queues. In brief, the potential for queue spillback to the railroad track is limited.

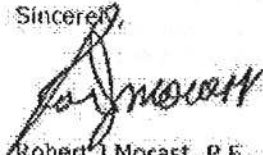
However, it is recommended that the applicant install a warning sign (R8-8 in MUTCD) "DO NOT STOP ON TRACKS" and standard railroad (RR) pavement markings to keep cars from stacking on the tracks. It is also recommended that a storage space (W10-11 in MUTCD) sign supplemented by a word message storage distance (W10-11a) "30 FEET BETWEEN TRACKS & HIGHWAY" should be used. These signs should be mounted in advance of the railroad crossing to advise drivers of the space available for vehicle storage between the highway intersection and the highway-rail grade crossing. Furthermore, a storage space (W10-11b) "30 FEET BETWEEN HIGHWAY & TRACKS BEHIND YOU" may be mounted at the highway intersection under the STOP sign intersection to remind drivers of the storage space between the tracks and the highway intersection.

CONCLUSIONS

Based on the results of the analyses described in this memo, it is concluded that the proposed The Point at Wheeler Landing can be constructed without adversely affecting traffic operations or safety in the vicinity of the site. A possible mitigation to improve traffic operations at the intersection of Hemlock Street /Hwy 101 would be to install a separate northbound left turn lane and a southbound right turn lane. Furthermore, it is also recommended that ODOT should consider re-striping this section of Hwy 101 to a double solid yellow line and investigate moving the existing posted speed limit of 45 mph further to the north. With full buildout of the proposed development key intersections and roadways in the study area operate at acceptable LOS and capacity as reported in the original report. No other specific off-site roadway improvements are recommended to accommodate this development or mitigate its impact.

If there are any questions related to the data or analyses contained in this memo, please contact Arshad Syed.

Sincerely,



Robert J. Morast, P.E., P.T.O.E.,
Transportation Engineer



Expires: 12/31/2008