June 10, 2011

USKH
SHARED VISION, UNIFIED APPROACH.

Mr. John Pilcher
10223 S. Hangman Valley Road
Spokane, WA 99224

Subject: Latah Creek Development Traffic Impacts

Dear Mr. Pilcher:

We are sending this letter to convey the results of our traffic impact analysis conducted for your proposed Latah Creek housing development in Spokane, Washington.

Jeff Logan of our office has consulted with Washington State Department of Transportation (WSDOT) to determine the scope of analysis they will need in order to approve access for your project. Based on these discussions, we have only analyzed the traffic projected for the 2030 PM peak hour at the two proposed interchange ramp terminals, and at site access road/ramp intersection.

Project Background

This project consists of development of 97 single family residential lots on existing agricultural land between Latah Creek, High Drive, and the BNSF/UP Railroad in the southern portion of Spokane. There is a single road access to the site that crosses Latah Creek and intersects with US 195 at the Cheney-Spokane Road. USKH conducted a Trip Generation and Distribution memorandum for the project on February 17, 2010 that was subsequently updated for a larger number of dwelling units on April 27, 2011. This memorandum will provide the basis of our current analysis.

The US 195/Spokane-Cheney Road intersection has a documented crash problem. To address this crash problem, WSDOT is developing plans to construct a diamond interchange at this intersection. The ramp terminals would be composed of two-way stop controlled intersections, with stop control on the ramp approaches. WSDOT's planned improvements will change your site access from the US 195 intersection to a T intersection into the northbound interchange on-ramp. Since traffic from your development will impact the proposed interchange, WSDOT has requested this analysis.

A schematic figure showing the proposed US 195/Cheney-Spokane Road interchange is attached. This configuration provides your site with right-in, right-out access. I understand that there has been discussion of providing a left-out access to your site as well, so this analysis covers both potential configurations.

Methodologies

Traffic conditions were evaluated for this analysis using the Level of Service (LOS) methodologies of the *Highway Capacity Manual* (Transportation Research Board, 2000). The *Highway Capacity Manual* (HCM) provides a nationally recognized and locally accepted method of measuring traffic flow and congestion at intersections. Criteria range from LOS A, indicating free-flow conditions with minimal vehicle delays; to LOS F, indicating congestion with significant vehicle delays.

LOS for a two-way or four-way stop controlled intersection is the function of the average vehicle delay experienced by a particular approach or approach movement during a peak hour. Typically, the

approach or movement experiencing the worst LOS is reported for the entire intersection. Table 1 outlines the LOS criteria for unsignalized intersections.

Table 1 - Intersection LOS Criteria

LOS	Unsignalized Average Delay (sec/veh)	General Description
A	≤10	Free Flow
B	>10 - 15	Stable Flow (slight delays)
C	>15 - 25	Stable flow (acceptable delays)
D	>25 - 35	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>35 - 50	Unstable flow (intolerable delay)
F	>50	Forced flow (jammed)

Source: Highway Capacity Manual (TRB, 2000)

Conversations with WSDOT staff confirm they identify this area of Spokane as urban, which means that LOS D is the minimum acceptable condition, according to the Development Services Manual. Transportation improvements will be recommended for areas projected to operate below this LOS threshold.

We have used Synchro traffic analysis software, version 7, to conduct the traffic analysis. This tool does not correctly analyze the situation present on the northbound ramp (the free-left turn), so we calculated capacity and delay manually using the HCM methods.

Without-Project Traffic Conditions

In preparing the design documentation for the proposed interchange, WSDOT forecast traffic to 2030 and calculated expected LOS at the interchange ramp terminals. The northbound ramp intersection is expected to operate at LOS C, with a delay of 22.9 seconds per vehicle in the PM peak hour. The southbound ramp intersection is expected to operate at LOS C, with a delay of 20.5 seconds per vehicle in the PM peak hour.

With-Project Traffic Conditions

As described in our previous memorandum, the 97 proposed homes in your development are projected to generate 1,019 vehicle trips per day. For the PM peak hour, that equates to 65 entering vehicles and 39 exiting vehicles. Based on existing traffic volumes, we expect exiting traffic to be split 68 percent to the north, 18 percent to the south, and 14 percent out Cheney-Spokane Road. For entering traffic, the distribution is expected to be 77 percent from the north, 10 percent from the south, and 13 percent from the Cheney-Spokane Road.

How the development traffic uses the proposed interchange varies significantly depending on whether there is left turn access out of your development. We have developed turning movement volumes for both scenarios, and they are attached.

For the right-in, right-out scenario, the LOS for the various intersections is shown below.

Table 2 - 2030 PM – Right-In/Right Out			
Intersection	**LOS**	**Delay (seconds/vehicle)**	**Worst Approach**
SB Ramp Intersection	C	22.9	Southbound
NB Ramp Intersection	D	27.8	Northbound
Site Access Road	B	12.3	Site Access

For the scenario that includes left turns out of the development, the intersection LOS is below.

Table 3 - 2030 PM – Right-In/Right+Left Out			
Intersection	**LOS**	**Delay (seconds/vehicle)**	**Worst Approach**
SB Ramp Intersection	C	23.0	Southbound
NB Ramp Intersection	HCM: F Sidra: D	HCM: 54.9 Sidra: 25.2	Northbound (See Discussion)
Site Access Road	B	12.5	Site Access

Adding left turns out of the site would significantly reduce out of direction travel for motorists leaving the development and traveling to the south or west on Cheney-Spokane Road. However, adding the southbound right movement to the northbound ramp intersection has a significant negative impact on delays at that intersection due to the additional conflicting traffic flow.

Since the initial results show that the additional traffic at the intersection will cause delay to exceed WSDOT standards, we looked into the data to figure out what was driving the excessive delay. Delay at this intersection is caused by northbound (off-ramp) traffic waiting for gaps in the westbound (onto US 195) left traffic. For calculating delay, the HCM does not specifically address the situation in this case, where there is a left turn that has no stop sign and no opposing traffic. We contacted WSDOT to discuss potential modifications to the HCM analysis to better reflect the situation at hand, and they ran the volumes in their software model, Sidra, which also is based on the HCM. Sidra's calculated delay was 25.2 seconds, LOS D, which meets the WSDOT requirements.

Mitigation

Regardless of the access scenario, all of the intersections meet WSDOT mobility standards. However, WSDOT staff commented that the volumes at the site driveway would likely require a right turn lane on the ramp approach to the intersection. Upon review of section 1310.07(4) of WSDOT's Design Manual, right turn lanes are required on two lane-roadways when recommended by Exhibit 1310-19 of the Design Manual. Since the ramp is a one way, one-lane roadway, it operates the same as a two-lane, two way roadway. Given the volumes expected at the site, Exhibit 1310-19 does recommend a right turn lane on the ramp approach. The right turn lane should be designed to meet the requirements of Exhibit 1310-21.

Thank you for this opportunity to serve you. Please contact us if you have any questions or concerns about the information in this letter.

Sincerely,
USKH Inc.

Will Webb, P.E.
Civil Engineer

Jeff Logan, P.E.
Principal Civil Engineer

Attachment: Turning Movement Volumes, Analysis Outputs

Work Order: 1226800

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Technical Memorandum

Date:	1 July 2011	**W.O.#:**	1226800
To:	Greg Figg, WSDOT Planner	**cc:**	Jeff Logan, P.E.
From:	Will Webb, P.E.		Marla French, COS
Project:	Deep Pine Overlook Subdivision/PUD		
Subject:	Unit Threshold for Right Turn Lane		

Our traffic analysis letter for this project dated 10 June 2011 identified that a right turn lane into this development will eventually be required. The right turn lane guidelines are given in the WSDOT Design Manual and are based on the right turn and through traffic volumes projected at the site access point.

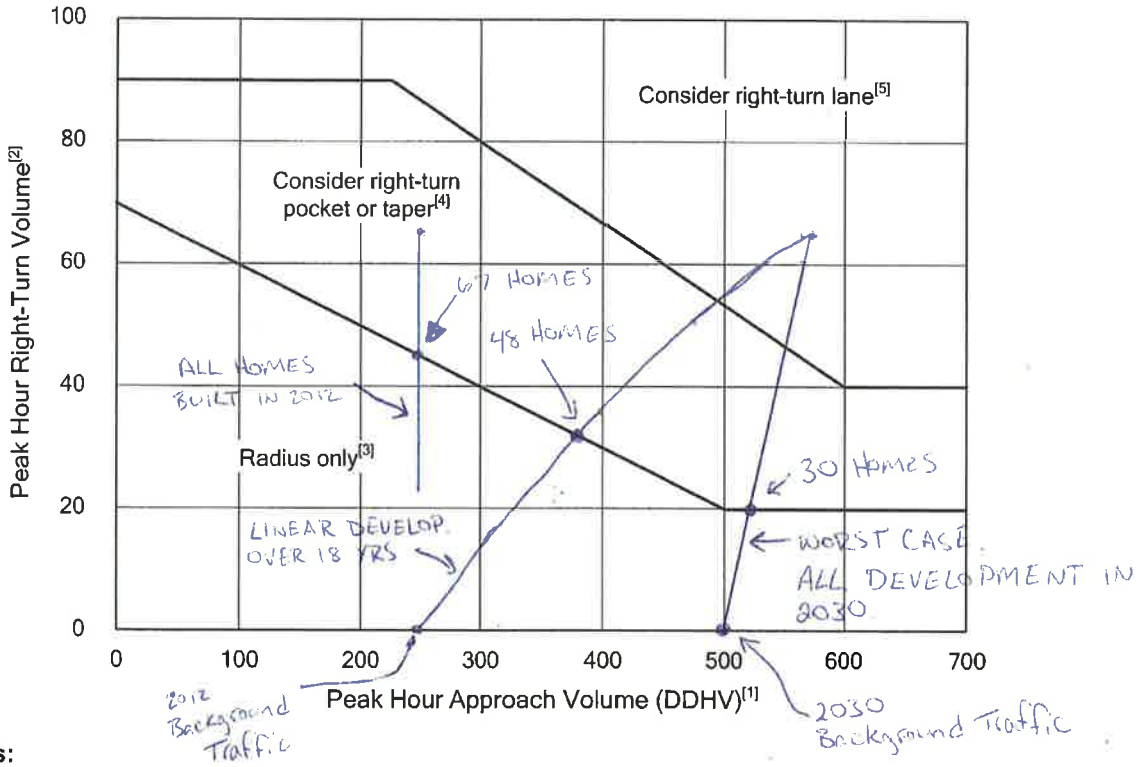
The City of Spokane, while reviewing the development application, has requested that we identify the number of units that can be built before the right turn lane is necessary. Since this threshold is based on the number of trips into the site, which is based on units constructed, and the number of trips passing by the site, which is based on the passage of time, it is not possible to pin down an exact number without knowing exactly when each house will be built. Construction is based on unpredictable market forces, so we will have to make some assumptions.

Attached is a copy of Exhibit 1310-19 from the 2010 WSDOT Design Manual. On this figure we have sketched out three development scenarios to determine how many units could be built before a right turn lane is necessary. These are based on a linear build out as well as a growth percentage of background traffic. The results are tabulated below:

Right Turn Lane Threshold	
Scenario	Unit Threshold Before Turn Lane is Necessary
All units constructed by 2012	67
Units constructed linearly between 2012 and 2030	48
All units constructed in 2030 or later	30

Even under the worst case, 30 units could be constructed before a turn lane needs to be constructed under WSDOT's standards based on the provided traffic model.

As discussed, actual traffic data from the ramp should be compared against the traffic model for the ramp data to determine the actual unit threshold before the turn lane is necessary.



Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).
For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20:
- The posted speed is 45 mph or below
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

[3] For right-turn corner design, see Exhibit 1310-14.

[4] For right-turn pocket or taper design, see Exhibit 1310-20.

[5] For right-turn lane design, see Exhibit 1310-21.

General:

For additional guidance, see 1310.07(3).

Right-Turn Lane Guidelines[6]
Exhibit 1310-19

(4) Speed Change Lanes

A speed change lane is an auxiliary lane primarily for the acceleration or deceleration of vehicles entering or leaving the through traveled way. Speed change lanes are normally provided for at-grade intersections on multilane divided highways with access control. Where roadside conditions and right of way allow, speed change lanes may be provided on other through roadways. Justification for a speed change lane depends on many factors, including speed; traffic volumes; capacity; type of highway; design and frequency of intersections; and accident history.