

Hunter, Kathy (UTC)

From: John Deskins <John.Deskins@ci.kennewick.wa.us>
Sent: Thursday, May 18, 2017 11:19 AM
To: Hunter, Kathy (UTC)
Cc: 'Rogalsky, Pete'; Jeff Peters (jpeters@CI.RICHLAND.WA.US); Cary Roe
Subject: TR-070818 Order Granting Petition to Reconstruct Highway Rail-Grade Crossing at Leslie Road - Compliance Requirement
Attachments: Final Leslie & Clearwater Tech Memo.pdf

Kathy,

Per the subject order I am submitting the attached technical memo addressing operations and potential queuing at the intersection of Clearwater Avenue and Leslie Road. I do apologize for the tardiness of the report, but on the positive side, timing of new traffic counts and some key supplementary traffic studies allowed me to have much better data to work with than was available at the time of the original due date.

I believe the report lays out the analysis reasonably clearly and I find that in the first 5 years, and even the first 10 years, that the outside lane (of the two approach lanes) on Leslie Road is always sufficiently clear as to allow any potential queuing in the inside lane to have an escape route off of the tracks. During this time period we don't expect that any significant changes or mitigation will be necessary. Beyond 10 years it is possible that delay issues may necessitate some approach lane assignment changes which would also then probably require some escape areas be created concurrently with those changes. Even these mitigation would be relatively minor in scope. Please feel free to contact me with any questions you may have.

Sincerely,

John Deskins, PE, PTOE
City of Kennewick
Traffic Engineer
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This e-mail and your response are considered a public record and will be subject to disclosure under Washington's Public Records Disclosure Act.

*posted
5-23-17
K/H*



TECHNICAL MEMORANDUM

Traffic Engineering Division

To: Cary Roe, Public Works Director/City of Kennewick
Pete Rogalsky, Public Works Director/City of Richland

From: John Deskins, Traffic Engineer

Date: April 21, 2017

Re: Report on the 20-Year Projections of 95th Percentile Queuing Analysis for the Intersection of Clearwater Avenue/Ridgeline Drive/Leslie Road/Badger Road

Executive Summary

This memo evaluates the 95th percentile queuing predicted to occur on the Leslie Road approach to the Clearwater & Leslie roundabout to understand the potential for queues to block the railroad tracks. Several scenarios for 2036 were analyzed including AM and PM peak hours and scenarios that include the Rachel Road connector between Steptoe Street and Leslie Road (anticipated to reduce traffic and queues on Leslie Road approach) and/or reconfiguration of the turn movements for each of the two lanes of the Leslie Road approach lanes. In some 2036 scenarios, including the AM Peak hour, even with the Rachel Road connector completed, the queues on the inside lane (left-turns, thru, and right-turns allowed) of the Leslie Road approach exceed the reasonable queuing capacity in front of the tracks of six vehicles. Without the Rachel Road connector the inside lane 95th percentile queue could start to exceed storage as early as 2021-2022. Despite the queuing that exceeds storage, the outside lane was designed as right-turn only which was anticipated to have very low queuing such that it could be used as an escape slip lane for vehicles that might be trapped on the tracks in the inside lane. In all such scenarios the anticipated outside lane queue is only one vehicle leaving approximately 120-140 feet of queue storage in that lane available for effective use as an escape lane. Depending on overall growth, it is possible that the inside lane on the Leslie Road approach starts to exceed vehicle delay thresholds (an average wait of 50 seconds per vehicle) around 2027 or 2028 in the AM peak hour. This could prompt a lane configuration change on the approach that would not only reduce average vehicle delay, but would also better balance the queues on the approach, bringing the 95th percentile queues down to three vehicles or less in all 2036 build scenarios. If the cities of Kennewick and Richland decide to change the lane configuration of the approach on Leslie Road to reduce delay and/or Level of Service (LOS) concerns, then at the time of the change, addition of new escape slip lanes should be considered on each side of the roadway, particularly if the Rachel Road connection has not been made. Within the 20 year time horizon, the described mitigations appear to be more than sufficient, leaving

potentially more complex and costly signalization of approaches and/or interconnecting track circuits for the roundabout much farther off in the future.

Scope of Study

Per the Joint Agreement between the Cities of Richland and Kennewick and Benton County, every five years the cities of Kennewick and Richland are to prepare updated 20-year traffic volumes and analysis of 95th percentile queues on the Leslie Road approach for the intersection of Clearwater Avenue and Leslie Road, I am providing this report for submission to the WUTC and BNSF. The traffic volumes were to be developed using the Benton-Franklin Council of Governments Regional Transportation Planning Model. The original report was to be prepared by the City of Kennewick in 2015. Though the report is past due, the analysis should be much more realistic as the existing baseline counts were from 2012 and the current BFCG model does not provide the granularity of data needed for a proper analysis. The model only provides some select link volumes, and then only for the PM peak hour, which in this case does not turn out to be the controlling peak hour. Note that the updated BFCG model available later this year should be much more useful when it comes to providing the next analysis in five years. Though not from the BFCG model, much better data is now available with turning movement counts that were collected in 2016 and a Traffic Impact Study that covers most of the buildout of commercial and industrial area along Clearwater Avenue as well as the in-process traffic estimates from the new Desert Hills Middle School located at Ridgeline Drive (formerly Leslie Road in City of Kennewick) and Clodfelter Road. The subject traffic study for the Clearwater Commercial Binding Site Plan provides a coinciding final design year projection for 2036 and covers 85 acres of primarily commercial and some industrial land along Clearwater Avenue. This technical memorandum will perform analysis of 95th percentile queuing in 2016 and 2036 for both AM and PM peak hours based on the best available data for 2036 projections, detail any instances, where the anticipated 95th percentile queue may cross the tracks and estimate what year that may occur.

Background

The intersection commonly known as Clearwater Avenue and Leslie Road sits on the outside edges of both Kennewick and Richland, one half within Kennewick and the other within the Urban Growth Area of Richland. As growth started to pick up in Badger Canyon, the intersection became busier and started experiencing more crashes. The City of Kennewick installed turn lanes on Clearwater and Badger Roads and moved the stop bars closer to the road for better judgement of gaps. As issues continued to occur, the City of Kennewick installed a 4-way stop in February of 2007. Knowing this was only an interim solution and that higher level traffic control was needed, the Cities of Kennewick and Richland applied and received funding for an intersection improvement at the location. Ultimately in April 2011, the current roundabout was opened to traffic. The roundabout has performed very well as expected and no significant changes have been made or considered since the original opening date. The roundabout design was a result of a Value Engineering study performed by WSDOT. There were concerns however that this was not a common practice to place to install a roundabout so near a railroad track. It was noted that the arrangement is not significantly different from having the same approach controlled by a stop sign other than that roundabouts are generally much more efficient, and thus the potential for queuing across the tracks is much reduced. To address the concerns of the BNSF, the cities agreed to provide specific periodic analysis of current and future traffic volumes and queuing of the Leslie Road approach. The following sections will document the analysis

process as well as the conclusions and any recommendations necessary as a result of the analysis.

Existing Conditions

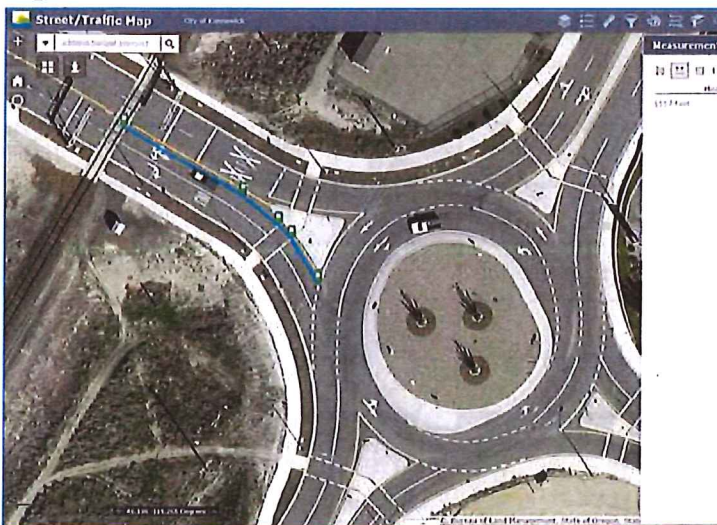
In 2016, the City of Kennewick performed a citywide traffic counting program. At that time the intersection of Clearwater Avenue and Leslie Road had AM and PM peak hour counts taken (See Appendix A). These counts were utilized for the 2016 95th percentile queuing analysis.

It is important to note the available queue storage for the intersection. The lane configuration on the Leslie approach allows for two travel lanes. The inside lane allows all movements, left, through, and right-turns and has 155 feet of storage from the yield line to the track (see Figure 1 on next page) which is enough for 6 vehicles with average length of 25 feet (vehicle plus gap between vehicles). The outside lane allows Right-turns only and has a storage length that is slightly longer at 166 feet. Note that the existing lane configuration for Leslie was chosen for two specific reasons. First, the queue in the outside right-turn only lane was anticipated to always be short enough so that any vehicles potentially queued on the tracks in the inside lane would have an escape route (Similar to the slip road concept described in the third page of Appendix D). Second, the right-turn from the inside lane is the preferred mode if traffic is light and drivers want to utilize the westbound I-82 on-ramp. This reduces the need to merge over two lanes in a short distance to get to the left-turn lane.

Traffic Projections

Traffic projections for 2036 from the regional model were not practical at this time due to the limited nature of the current model and the fact that a new model is not yet complete. The model should provide the needed estimates for the next queuing analysis report in 5 years. The city however had a recent traffic impact study performed for a Binding Site Plan proposal on Clearwater Avenue. This study provided reasonably good estimates for the intersection of Clearwater & Leslie in the 2036 design year. Their estimates were used directly for the basic PM analysis. However, the BSP analysis did not account for the construction of the Rachel Road

Figure 1 – Aerial of Clearwater & Leslie Roundabout w/ Railroad Tracks



connector, a planned collector street in the City of Richland that would offload a large number of Leslie Road approach left-turns as well as a large number of Clearwater Avenue approach right-turns. The Rachel Road collector, for which the final alignment has not yet been set, is intended to run parallel to Clearwater Avenue, but intended to provide a shorter route to Steptoe Street that does not involve the risk of being delayed by an at-grade train crossing. Utilizing work performed in 2008 for the Steptoe Street Extension (See Appendix B) that included analysis of PM traffic with and without the Rachel Road connector (referred to as "Center" in the figures), estimates of left-turn and right-turn reductions were proportionally estimated and the analysis was again performed with these anticipated reductions. For AM projections there was no data from the BFCG Regional Model, or from the BSP or for the Steptoe Street Study. However, AM trip generation data was provided and so utilizing this data an estimate of 2036 AM traffic counts was made using a 1% background growth from the 2016 traffic counts and layering on the Clearwater Binding Site Plan trips as well as the new Desert Hills Middle School. Using similar proportionate reductions as the PM data for the Rachel Road connector, 2036 AM estimates were made that included estimated reductions. As it turns out, the AM scenarios are those that control due to the higher AM commute volumes from Leslie Road to Clearwater Avenue. The traffic volumes for each scenario are clearly shown in graphical map views in Appendix C. Each map is followed by corresponding analysis report pages.

Results of Queuing Analysis & Recommendations

As described earlier, the queuing analysis was performed for both AM and PM peak hours and for multiple scenarios utilizing the *Highway Capacity Manual*, 6th Edition methods provided in Synchro software. The results of the 95th percentile queuing analysis are shown in number of vehicles queued and highlighted in the analysis sheets that follow the maps for each scenario in Appendix C. The table below shows the results of the queuing analysis for multiple scenarios including No Build (meaning no Rachel Road connector), with the Rachel Road connector, and versions of the latter two where there is a reconfiguration of the two approach lanes on the Leslie Road approach. A summary of the analysis is presented below in Table 1.

Table 1 – 95th Percentile Peak Hour Traffic Queues in Vehicles

Peak Hour Period	AM		PM	
	Inside	Outside	Inside	Outside
<i>Lane (Inside = Left Lane, Outside = Right Lane)</i>				
2016 – No Build	2	1	1	1
2036 – No Build	17	1	9	1
2036 – No Build, but Reconfiguration of Leslie Approach	6	4	4	3
2036 – Build w/ Rachel Road Connector	9	1	5	1
2036 – Build w/ Rachel & Reconfiguration of Leslie	3	3	2	3

It has been determined by measurement that there is queue storage for six vehicles in queue. The summary in Table 1 shows three scenarios where this queue distance is exceeded in the inside lane. Note in all three of these scenarios the predicted queue length for the outside (right-

turn only) lane is just one vehicle, meaning there will likely be approximately 120-140 feet available in the outside lane for any vehicle potentially on the tracks in the inside lane to move into. This again is per the original design that allows the inside lane to be used as a slip road escape route as shown in Appendix D.

Of the three scenarios that exceed the available queuing space, the first two are both the AM and PM 2036 No Build scenarios if no Rachel Road connector is built. Basic linear interpolation of the queue analysis suggests that the 95th percentile queue will start exceeding the available queue storage in the Inside lane in about 2021-2022 in the AM peak hour (2027 in the PM peak hour) if no Rachel Road connector is constructed. If the Rachel Road connector is constructed, the queuing is expected to exceed available queue storage in the Inside lane, again in the AM peak hour only, in approximately 2027 or 2028, while the PM peak has five vehicles in 2036. Again it is noted that as long as the existing lane configuration stays in place there should be no actual need for further mitigations since there is over 100 feet of available storage anticipated in the Outside (right) lane for vehicles needing to escape the Inside lane.

In reviewing the analysis results it was noted that the inside lane of the Leslie Road approach has exceeded the LOS threshold for delay per vehicle in the 2036 design year in the AM peak hour if the Rachel Road connector is not constructed. While the overall intersection Level of Service is an LOS D with an average of 32 seconds delay, which meets the overall intersection threshold for delay, the volume to capacity ratio for that individual lane is 1.03 and the delay is an average of 68 seconds per vehicle which exceeds the threshold of 50 seconds of delay for LOS F. If it is determined necessary to resolve the LOS issue, then the likely remedy is to change the lane configuration on the Leslie Road. The change would be making the Inside lane a left-turn only and the Outside lane a lane where all movements are allowed. To make this work, minor modifications would be necessary on the Leslie Road and Badger Road approach splitter islands, and removal of a portion of the south side truck apron, and then appropriate striping changes. In making these changes the queuing in each lane is more balanced and in all cases is contained within the available storage as is noted in Table 1 on the previous page. However, without the Rachel Road connector the lanes are approaching available storage, so it would be appropriate to creating escape route slip lanes for both lanes at the time of any such lane configuration change. This is easily done for the Outside lane by taking the planter strip and for the Inside lane by taking the outbound queue storage lane (there are two lanes when only one is necessary). The report referenced in Appendix D suggests a minimum of 66 feet clear of the track for the escape slip lanes and it is noted there is about 80-90 feet available for this purpose. Finally, the lane configuration change, if made, has impacts on the intersection for the westbound I-82 ramps. With right-turns only from the right lane, those drivers wanting to head westbound on I-82 will need to make two lane changes in a short distance to get onto the freeway as currently configured (two-way stop control) or if converted to a traffic signal. A roundabout for those ramps would be much more efficient and would require only one lane change for the drivers making the movement from Leslie to westbound I-82