## PARSONS BRINCKERHOFF

### Memorandum

- To: Harold Jones, John A. Giometti Virginia Department of Transportation
- From: Michael Fendrick, Parsons Brinckerhoff
- Date: November 30, 2012
- Subject: DRAFT Preliminary Traffic Review for US 29 Charlotteville Bypass Interchange Comparison

The following is a draft assessment of multiple traffic issues at the US 29 Bypass interchange at the southern termini of the proposed US 29 Charlotteville Bypass. In particular this analysis focuses on a single movement from the western (southern terminus of the project on eastbounf US 29/250 to the proposed US 250 Bypass in a northbound direction.

The analysis is preliminary and subject to changes based on design setails and other assumption that have yet to be defined. This review also focuses only on traffic issues, and any selection of an interchange will need to consider multiple other factors including costs, impacts, constructability, etc.. The analysis was conducted using Synchro files provided with JMT with adjustments for grades and truck percentages. The traffic volume utilized matched the 2040 forecast used in the NEPA analysis, but are still subject to modification based on existing counts and analysis by JMT.

Key issues noted in this review fallinto four categories including:

- Description of the Promary Movement
- Travel Times for the Primary Movement
- Signal Operations through each Interchange for the Primary Movement
- Grade Issues as they Affect Traffic Flow in the Interchange
- Other Items

### **Primary Movement**

- The total through volume utilizing this movement is estimated as 774/835 vph in AM/PM respectively based on the forecast. This would roughly reflect 8,000 vpd.
- As would be expected, the flyover is the best from a traffic and operations perspective (all green).

### **Travel Time Comparison**

- The travel time (first line) is the most pure comparison of the effect on the freeway to freeway movement.
  - It is measured from the Old Ivy Road Bridge to Sta. 29+00 as noted above.
    The actual distance varies based on the ramp alignments followed for each alternative.



- The 3 lane diamond with steep grades is substantially slower than the other alternatives. The 5 lane diamond is slower than the partial cloverleaf, albeit a graduated difference.
- The average travel speed between these points was computed based on the length as well as including signal delays. Therefore, it truly is an average speed and does not reflect a constant speed.

# Table 1. Comparison of Traffic Operations for Critical EB US 29/250 movement toUS 250 Bypass Northbound movement (approx. 8,000 vpd)

Measure of Effectiveness	3 lane diamond with steep grade	5 lane diamond with adjusted grade	Partial cloverleaf with adjusted grade	Flyover with adjusted grade
Travel Time for Critical Movement				
Total Travel Time (sec)	154.8	105.0	92.5	57.7
Percent Time Compared with Flyover	270%	180%	160%	100%
Stop time (sec)	33.1	19.9	9.7	0.0
Total Distance (ft)	4840	4840	5175	4170
Avg Speed	21.3	31.4	38.1	49.3
Traffic Signal Operations for Critical Movement				
No. of Signals	2	2	1	0
Total Stops	1131	864	706	0
Stops per Thru	1.35	1.03	0.85	0.00
Percent of Thru Vehicles Required to Stop at South Signal (near UVA)	91%	80%	0%	0%
Percent of Thru Vehicles Required to Stop at North Signal (near Canterbury Hills)	34%	23%	85%	0%
Percent of Thru Vehicle Required to Stop at two signals	31%	19%	0%	0%
Percent of Thru Vehicles Required to Stop at one signal only	94%	85%	85%	0%
Percent of Thru Vehicles Required to Stop at no signals	6%	15%	15%	100%
Other Issues				
Structure width	3 In bridge	5 In bridge	4 In bridge?	3 In bridge
Old Ivy to new ichange	LOS E weave	LOS E weave	CD	split CD

Legend:

Good Fair Fair/Poor Poor



### **Signal Operations**

Table 1 also examines signal operations in terms of the key through movement from US 29/US 250 eastbound to the new US 29 Bypass Northbound. Key findings include:

- The analysis focused on the specific movements within the traffic signal (instead of the overall signal operations). For both diamonds, the highest delays and highest percentage of stops were at the signal south of US 250 (nearer UVA) and lower at the northern intersection (nearer Canterbury Hills.)
- Signal operations for the North signal (near Canterbury Hills) for the diamond and loop alternatives have similar volumes. As shown in the table, however, the North signal had a much higher percentage of stops with the Partial Clover & Loop than either diamond scenario. The primary causes are:
  - Upon running a SimTraffic run, it was apparent that the diamonds caused higher delays at the first signal, but by releasing the ramp traffic with a double left as part of a platoon, it was processed more efficiently at the second signal.
  - In contrast, with the loop scenario, traffic arrives randomly at the northern signal (nearer Canterbury Hills). In addition, it is processed in a single lane. There is more wait time for the randomly arriving vehicles despite some higher green times. Nevertheless, the Partial Clover with a Loop interchange processes the key movement faster, but not at a substantially lower travel time (12.5 seconds faster for the average vehicle).

### Grade Issues

- In comparison, the RFP proposed interchange (3 lane diamond with steep grades) has issues with both traffic signals (2), but more critically truck acceleration from a stop condition. For the analysis, I used the RFP proposed grades on Leonard Sandridge.
- For the adjusted grade scenarios, I had no grades available so I assumed minimal issues with acceleration. This may need adjusted, but in any case it is reasonable to assume that the grades would be lower than 8%-11% as now are proposed on/near the Leonard Sandridge Road bridge.
- In general, I estimated (using the AASHTO Green Book truck acceleration charts on the proposed grade), that trucks would not reach 45 mph for over 1400 feet (approx. Sta. 29+00). It is likely necessary to define the section of Leonard Sandridge through the interchange as higher than a local street.

### Other Items

• It is noted that the number of lanes for the Sandridge Road Bridge varies between alternatives. The partial clover can likely be served with a 4 lane (instead of 5 lane bridge). Similarly the flyover would likely require a 3 lane bridge.



- The diamond alternatives have a traditional weave on US 29/250 eastbound between Old Ivy Road and the new interchange. Utilizing HCS, this weave area is forecast to operate at LOS E. This is the section that barely met the RFP requirements using the 2036 RFP volumes and the VISSIM analysis (which can yield different results than HCS). In addition to the higher 2040 projections used in the NEPA study, JMT is also looking at whether the Old Ivy ramp projections are too low. It is possible that the final alternative will need to utilize a CD or ramp system similar to what is shown in the Partial Clover and/or flyover alternative.
- For the southbound approach of the proposed Bypass to the interchange, the current design shows a single lane to US 29/250 with the 2-lane freeway being split with 1 lane to US 29/250 and 1 lane to Leonard Sandridge. This will require signing, etc, to get approximately 85% of the traffic (1,201 vph in the PM peak) into the right lane and directing 190 vph to the Leonard Sandridge bridge and interchange. From a capacity standpoint, this will likely work, but it violates driver expectancy in terms of a major freeway dropping off at s ingle lane. Ideally there would be room for a left exit to Sandridge and then reducing the two lanes to one lane after the split.
- There is an operational issue on the US 29/250 freeway between Ivy Road and the proposed interchange. In the EB direction, this affects the weave (see 2<sup>nd</sup> bullet) under Other Items). The issue is actually worse in the westbound direction where the ramp merges back into US 29/250. The 2040 PM merge is at LOS F using HCS, primarily due to inadequate through capacity on US 29/250 under the bridges. Due to restrictions at the Old Ivy Road bridge, railroad bridge, and Ivy Road bridge the merge lane cannot be lengthened. We have all acknowledged that this is a needed future project, and we will need to make sure that FHWA is understanding as part of the IJR review process.