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MEMORANDUM

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Project #: 13278

To: Rob Hayes-St. Clair
JH Ranch

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Project: French Creek Road

Subject: DRAFT Micro-Simulation Analysis & Findings

Kittson & Associates, Inc. (KAI) has completed the VISSIM micro-simulation analysis of the French Creek Road Section 4. The purpose of the capacity threshold analysis was to determine the number of vehicles that can be added without exceeding the County's Level of Service (LOS) threshold. Findings indicate that a bidirectional volume of 865 additional JH Ranch trips can be accommodated without backing up traffic outside the Section 4 of French Creek Road and exceeding delays corresponding to LOS D.

VISSIM ANALYSIS

The VISSIM simulation analysis was prepared according to the technical parameters and assumptions provided in the memorandum developed by KAI and agreed to by Omni-Means dated April 16, 2013. However, based on visual inspection of the simulation runs, the coding for the northern priority rule was modified to ensure a conservative approach as follows:

The directional stop rule will be coded within 30 feet of the southern power pole. The priority (stop) rules in this case will be applied in the event of northbound and southbound traffic arriving within the predetermined 30 feet vicinity of the southern power pole. In this event the following rules apply:

- *Pick-up trucks or heavy vehicles would stop and provide right-of-way to the opposing passenger car*
- *Heavy vehicles would stop and provide right-of-way to the opposing vehicle of another classification.*
- *When two heavy vehicles or two pick-up trucks encounter each other from the opposite directions, whichever vehicle is the second to arrive to this section of roadway (100 feet) will yield right of way to the opposing vehicle.*

KAI determined that the priority rule would result in essentially the same travel conditions for a range of traffic volumes, which may not be the case on the ground. In other words, the prevailing roadway

constraints as depicted through the priority rules would not greatly affect travel patterns of vehicles. In order to make the model match the anticipated ground conditions, a "conflict area" was coded at this single location in lieu of the "priority rule". For all other locations, priority rules were maintained consistent with the April 16, 2013 memorandum. The conflict area performs similar functions as the priority rule which is managing right of way between vehicles on two different links. While a "conflict area" is an alternative to a "priority rule", it offers greater and more intelligent control.

The priority rules at the northern pole location were modified using conflict areas with the following features:

- Conflict areas measure about 30 feet (consistent with the priority rule assumption)
- Northbound direction provides clear sight distance to view on-coming traffic, while southbound direction does have some sight distance restrictions. Therefore, northbound traffic is supposed to and is assumed to give right of way to the southbound traffic.
- Gap time is assumed to be 0.5 second for cars and 1 second for pick-up trucks and heavy vehicle.
- Safety factor is assumed as 1.5.
- Visibility was assumed to be low (100 feet) given prevailing roadway constraints, i.e. sight obstructions and horizontal curve.

VISSIM CALIBRATION

The calibration was based on the peak hour traffic volumes. Table 1 compares simulation outputs with the traffic volume inputs. VISSIM simulation runs were based on a minimum 10 minute seeding time, 60 minute analysis time (divided into four 15 minute intervals), and reflect an average of 10 multiple runs. As shown, the baseline simulation model replicated actual traffic volumes for each direction of travel within prescribed error limits (Guidelines for Applying Traffic Micro-simulation Modeling Software, Publication NO. FHWA-HRT-04-040, Dowling Associates, June 2004).

Table 1: VISSIM Model Calibration Results (Section 4)

Direction	Simulated Traffic Volumes [1] (veh/hour)	Traffic Counts [1] (veh/hour)	Difference
Northbound	62	64	4%
Southbound	41	40	-1%

1 Shows average of ten runs

2 Data collected by SHN Consulting Engineers

The measure of effectiveness i.e. travels time, delay and LOS under the baseline conditions are illustrated in Table 2. As such, the segment currently operates at LOS B.

Table 2: Baseline Conditions Measure of Effectiveness (Section 4)

Simulated Travel Time [1] (sec)	Free Flow Speed [2] (mph)	Distance (ft)	Free Flow Travel Time (sec)	Delay (sec)	LOS [3]
21.6	40	578	9.9	11.7	B

1 Average of simulation ten runs and two directions

2 Assumed as posted speed limit

3 Based on Highway Capacity Manual 2010 Signalized Intersection criteria

CAPACITY THRESHOLD ANALYSIS - ADDITIONAL JH RANCH TRAFFIC

Once the model was calibrated to traffic counts, traffic volumes originating from and destined to JH Ranch were iteratively increased until the delay corresponding to LOS D was reported (in which case system gridlock is also observed). The performance measures and visualization were tracked for all iterations. The maximum throughput before vehicles start experiencing average delays corresponding to LOS D for signal controls was computed as 969 for both directions combined. In other words, an estimated additional 865 JH Ranch vehicles in both directions can be accommodated by the narrow section of French Creek Road without exceeding the County's LOS threshold criteria.

Table 3 provides measures of effectiveness for the baseline-plus-additional-JH-Ranch traffic scenario. It shows that an additional 865 bidirectional peak hour trips would result in an average delay of 31.7 seconds per vehicle which is denoted as LOS C. Although transition from LOS C to LOS D is marked at 35 seconds of delay per vehicle, the increase in traffic volumes to 870 resulted in roadway gridlock according to the simulation (visual check). Hence, a maximum of 865 additional vehicles could be accommodated without causing gridlock.

Table 3: Measures of Effectiveness for Additional JH Ranch Traffic

Added Traffic (Both Directions)	Simulated Travel Time [1] (sec)	Free Flow Speed [2] (mph)	Distance (ft)	Free Flow Travel Time (sec)	Delay (sec)	LOS [3]
865	41.5	40	578	9.9	31.7	C

1 Average of ten runs and two directions

2 Assumed as posted speed limit

3 Based on Highway Capacity Manual 2010 Signalized Intersection criteria

FINDINGS AND CONCLUSION

The VISSIM model represents 10 a.m. traffic conditions on a weekday, which is reported as the peak hour on an average weekday. The VISSIM model was calibrated to the existing ground counts. The baseline simulation model estimates the French Creek Road's Section 4 to be operating at LOS B. The simulated travel time was compared with the free flow travel time for the 578 feet of Section 4 to estimate delay and LOS.

The VISSIM simulation analysis estimated that a bidirectional 865 additional JH Ranch trips can be accommodated without backing up traffic outside the Section 4 of French Creek Road and exceeding delays corresponding to LOS D.