January 7, 2014

MEMORANDUM

TO: Andrew Stratton, PE
FROM: Holly Buck
Lyle DeVries
Steven Marfitano

SUBJECT: Breakpoint Analysis Results
FHU Reference No. 11-166-04

The goal for the breakpoint analysis is to determine an approximate year when the projects included in the “Year 2015 Phasing Plan with 88th Avenue Bridge Replacement” Package will lose efficacy. The Package and No Action alternative were evaluated in the Year 2015, 2025, and 2035 time horizons to determine the breakpoint year. The network was evaluated in the southbound direction in the morning peak period and the northbound direction in the evening peak period utilizing the performance measures, peak travel time and congestion duration. The peak travel time represents the longest travel trip time through the corridor between SH 7 and US 36 and the congestion duration represents the span of time during which trip duration exceeds free flow travel time as a result of congestion throughout the corridor.

The “2015 Phasing Plan with 88th Avenue Bridge Replacement” Package includes the following components:
1. SB general purpose lanes segment 84th Ave to Thornton Pkwy
2. Continuous acceleration/deceleration lane SB 84th Ave to US 36
3. Continuous acceleration/deceleration lane SB Thornton Pkwy to 84th
4. NB general purpose lanes segment 84th Ave to Thornton Pkwy
5. Continuous acceleration/deceleration lane NB I-270 to 84th Ave
6. Continuous acceleration/deceleration lane NB 84th Ave to Thornton Pkwy
7. Ramp meters SB at 120th Ave, 136th Ave, 144th Ave, and NB at Thornton Pkwy, 104th Ave, and 120th Ave
8. Continuous acceleration/deceleration lane SB 104th Ave to Thornton Pkwy
9. Continuous acceleration/deceleration lane SB 120th Ave to 104th Ave
10. Continuous acceleration/deceleration lane NB Thornton Pkwy to 120th Ave
11. Continuous acceleration/deceleration lane NB 104th to 120th Ave
12. 70th Ave & Washington St intersection improvements
AND Replacement of 88th Avenue bridge
AND Extended I-25 managed lane from 120th Ave to SH 7 (RAMP funding)
The results of the No Action alternative have been compiled in Table 1. As expected, the Year 2025 No Action results lie between Year 2015 and Year 2035 conditions, with the exception of the 2025 southbound AM peak travel time, which exceeds both Year 2015 and Year 2035 travel times. This result is highlighted in the table below.

Table 1. No Action Peak Travel Time and Congestion Duration

<table>
<thead>
<tr>
<th></th>
<th>AM Southbound Peak Travel Time</th>
<th>AM Southbound Congestion Duration</th>
<th>PM Northbound Peak Travel Time</th>
<th>PM Northbound Congestion Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>23 min</td>
<td>222 min</td>
<td>20 min</td>
<td>270 min</td>
</tr>
<tr>
<td>2015 No Action</td>
<td>21 min</td>
<td>196 min</td>
<td>21 min</td>
<td>207 min</td>
</tr>
<tr>
<td>2025 No Action</td>
<td>58* min</td>
<td>231 min</td>
<td>22 min</td>
<td>251 min</td>
</tr>
<tr>
<td>2035 No Action</td>
<td>43 min</td>
<td>240 min</td>
<td>24 min</td>
<td>272 min</td>
</tr>
</tbody>
</table>

*Value is higher than anticipated due to modeling anomaly.

Thorough review of the model indicates that the unexpected southbound AM peak travel time results have not occurred due to model development issues, and instead, reflect the model’s anticipation of future trip routing and bottleneck locations along the I-25 corridor which create a worse peak travel time during the 2025 period than will occur in 2035. While we do not expect that the network performance will actually produce travel times in 2025 that are significantly worse than 2035, the congestion duration results from the same run reveal that the majority of increase in duration between 2015 and 2035 should be expected by 2025.

The results of the improvement model runs have been included in Table 2. These results reflect each time period with the projects listed in the “Year 2015 Phasing Plan with 88th Avenue Bridge Replacement” Package.

Table 2. “Year 2015 Phasing Plan with 88th Avenue Bridge Replacement” Package Peak Travel Time and Congestion Duration

<table>
<thead>
<tr>
<th></th>
<th>AM Southbound Peak Travel Time</th>
<th>AM Southbound Congestion Duration</th>
<th>PM Northbound Peak Travel Time</th>
<th>PM Northbound Congestion Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>23 min</td>
<td>222 min</td>
<td>20 min</td>
<td>270 min</td>
</tr>
<tr>
<td>2015 with Package</td>
<td>14 min</td>
<td>64 min</td>
<td>15 min</td>
<td>208 min</td>
</tr>
<tr>
<td>2025 with Package</td>
<td>38 min</td>
<td>202 min</td>
<td>19 min</td>
<td>232 min</td>
</tr>
<tr>
<td>2035 with Package</td>
<td>42 min</td>
<td>229 min</td>
<td>20 min</td>
<td>281 min</td>
</tr>
</tbody>
</table>

In order to determine the breakpoint for the Package, a failure threshold must be defined along the corridor. It is difficult to define failure, since users have different expectations for the corridor. In an attempt to provide various viewpoints, breakpoints have been defined for three general conditions: an average speed of 45 mph from SH 7 to US 36, an average speed of 30 mph from SH 7 to US 36, and a return to existing conditions from SH 7 to US 36 (which represents a speed of 30 mph in the morning southbound and 34 mph in the afternoon northbound). Figure 1 and Figure 2 provide a visual representation of the breakpoint analysis results for the AM Southbound and PM Northbound, respectively.
Figure 1
AM Southbound Breakpoint

Figure 2
PM Northbound Breakpoint

LEGEND
- **No Build**
- **Existing**
- **Short Term Improvements**
- **30 mph through Corridor**
- **45 mph through Corridor**
Based on these results, the breakpoint year for each criterion has been identified. Table 3 demonstrates the breakpoint period for each of these conditions.

Table 3. Improvement Benefit Breakpoints

<table>
<thead>
<tr>
<th>Breakpoint Condition</th>
<th>AM Southbound Breakpoint</th>
<th>PM Northbound Breakpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 mph (SH 7 to US 36)</td>
<td>2015-2020</td>
<td>2015-2020</td>
</tr>
<tr>
<td>30 mph (SH 7 to US 36)</td>
<td>2020</td>
<td>Past 2035</td>
</tr>
<tr>
<td>Existing Conditions*</td>
<td>2020</td>
<td>2030</td>
</tr>
</tbody>
</table>

*Existing AM Southbound and PM Northbound average speeds are 30 mph and 34 mph, respectively.

The generalized summary of these results is that in the morning southbound direction, failure will occur quickly (between 2015 and 2020) despite the improvements included in the Package and the interim managed lanes improvement. As a result, additional improvements along the corridor will continue to be needed to accomplish acceptable levels of service along the corridor. The afternoon northbound direction will not experience as significant decline in level of service between 2015 and 2035 with the Package improvements and the interim managed lanes improvement. Depending on the failure criteria, additional improvement may be needed by 2020 extending to after 2035.