MEMORANDUM

To: Gary Horton SE, Summit County

From: Charles Allen PE, PTOE, Parametrix
      Tim Peterson, Parametrix

Date: April 28, 2017

Subject: Jeremy Ranch Roundabout Trip Generation Effect Analysis

Introduction
The purpose of this memo is to document an analysis examining the effects of potential development on a roundabout design for the Jeremy Ranch interchange. In response to concerns about the traffic impact a proposed development and park-and-ride lot could have on the interchange, Summit County requested Parametrix to evaluate 2040 traffic conditions. This memo summarizes the results and findings.

Background
In 2015, the Utah Department of Transportation (UDOT) and Summit County conducted a joint study to identify a preferred re-design for the I-80/Jeremy Ranch interchange and adjacent frontage road intersections (Kilby Road/Homestead Road, Rasmussen Road/Homestead Road). The outcome of the study was a design that consolidates the interchange ramp termini and frontage road intersections into two large roundabouts (see Figure 1). The design met two major goals of the study: avoid the need for intersection signalization and avoid any structural changes to the I-80 bridges over Homestead Road. The study concluded the interchange could serve forecasted 2040 AM and PM peak hour traffic demand at acceptable levels of service.

Since the 2015 study, a development proposal located northeast of the interchange and a park-and-ride lot concept positioned southeast of the interchange has elicited concerns about whether the interchange design will be able to accommodate the resulting traffic volumes. Representatives of the development on the northeast have conducted a trip generation and trip distribution analysis of their site traffic. The study evaluated a number of land use type and density options and bracketed the range of generated trips referred to as the Low Parking scenario and the High Parking scenario. Summit County desires to test the impact of these development trip scenarios utilizing their own modified trip distribution scheme. Additionally, Summit County would like to include the expected trips from the potential park-and-ride lot southeast of the interchange.
Figure 1 – 2015 Jeremy Ranch Interchange Study Preferred Design Concept
Analysis
To provide context for the development trips, Parametrix compared the development and park-and-ride lot trip generation against the growth assumptions in the 2015 study. Using state and regional travel demand models, as well as Summit County planning documents, the 2015 study assumed an approximate 70 percent traffic volume increase for the north side of I-80 and an approximate 40 percent traffic volume increase on the south side of I-80. Parametrix determined that most of the trips predicted for the development and the park-and-ride lot are encapsulated within these growth assumptions, although a few exceptions occur, as discussed below.

The proposed development and park-and-ride lot primarily load trips into the interchange area via Rasmussen Road and Kilby Road at the east legs of each roundabout. Parametrix determined that during the PM peak hour, predicted development trips on eastbound Rasmussen Road (development outbound trips) and westbound Kilby Road (park-and-ride inbound trips) exceed 2040 growth assumptions. In contrast, westbound trips on Rasmussen Road and eastbound trips on Kilby Road are within 2040 growth assumptions (see Table 1).

Table 1 – PM Peak Hour Development and Park-and-Ride Trips vs 2040 Background Growth

<table>
<thead>
<tr>
<th>Road</th>
<th>Direction</th>
<th>2040 Background Growth</th>
<th>Development + Park-and-Ride Trips</th>
<th>Low Parking Scenario</th>
<th>High Parking Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Volume</td>
<td>Difference</td>
<td>Volume</td>
</tr>
<tr>
<td>Rasmussen</td>
<td>Eastbound (away from N roundabout)</td>
<td>142</td>
<td>218</td>
<td>+76</td>
<td>405</td>
</tr>
<tr>
<td>Road</td>
<td>Westbound (towards N roundabout)</td>
<td>186</td>
<td>93</td>
<td>-93</td>
<td>176</td>
</tr>
<tr>
<td>Kilby Road</td>
<td>Eastbound (away from S roundabout)</td>
<td>104</td>
<td>77</td>
<td>-27</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Westbound (towards S roundabout)</td>
<td>102</td>
<td>145</td>
<td>+43</td>
<td>207</td>
</tr>
</tbody>
</table>

Low Parking Scenario Analysis
Parametrix shared the results of the trip generation comparison to Summit County. Summit County staff then directed Parametrix to add only the Low Parking scenario trips in excess of the 2040 background growth to the VISSIM microsimulation traffic model and analyze interchange performance.

Results show the excess Low Parking scenario trips result in a Level of Service (LOS) E for the I-80 westbound off-ramp approach at the north roundabout. Because failure on any one leg of a roundabout results in failure for the entire roundabout, Parametrix determined the trips from the Low Parking scenario in excess of 2040 background traffic cause the north roundabout fail.
Examining the results of the Low Parking scenario, Parametrix identified a minor design change to improve performance of the north roundabout. The design change is to spiral out the outer circulating lane at the west Rasmussen Road exit and also develop a new inside circulating lane at the same location. This treatment is similar to what is already in the design for the east Kilby Road exit at the south roundabout. Parametrix determined that including the spiral-out configuration influences the lane utilization on several of the other north roundabout approaches such that the LOS at the I-80 westbound off-ramp approach improves to LOS B. Figure 2 compares the approach LOS for the original and spiral-out designs under the Low Parking scenario.

**Figure 2 – Low Parking Scenario Analysis Design Comparison**

Low Parking Scenario – Original Design

Low Parking Scenario – Spiral Out Design

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**High Parking Scenario Analysis**

Parametrix conducted analysis for the High Parking scenario to test the ability of the spiral-out design to accommodate the increase traffic load. As shown in Figure 3, with the excess High Parking development traffic volumes, the I-80 westbound off-ramp approach again experiences failing conditions.
Parametrix interpolated the point at which development trips are anticipated to cause failure at the I-80 off-ramp approach, and thus, failure for the north roundabout with the spiral-out configuration. Results were expressed in terms of the number of trips the development incurs on eastbound Rasmussen Road in excess of the 2040 growth assumptions.

Due to the intricacies of roundabout operations as well as the variation among microsimulation outputs, Parametrix applied a 95th percentile confidence band to the results. Figure 4 summarizes the results showing that the I-80 westbound approach is anticipated to fail when development trips on eastbound Rasmussen Road exceed the 2040 growth assumptions by approximately 160 to 300 PM peak hour trips.
Conclusions

The roundabout design from the 2015 study is anticipated to be unable to accommodate the development Low Parking scenario and park-and-ride trips in excess of 2040 background growth. The I-80 westbound off-ramp approach at the north roundabout exhibits a failing LOS under these conditions. However, a slight change to the design to add a spiral-out configuration at the west leg (Rasmussen Road) of the north roundabout is sufficient to mitigate the failing LOS. This spiral-out configuration largely represents only a change to lane striping and is similar to what the 2015 design features for the south roundabout at the east Kilby Road leg.

Though the spiral-out configuration mitigates conditions with the Low Parking scenario excess traffic, it does not prevent the interchange from experiencing failing LOS under volumes from the High Parking scenario. Interpolation of results between the two scenarios suggests the north roundabout will fail when development PM peak hour traffic on eastbound Rasmussen Road is 160 to 300 trips in excess of 2040 background conditions.

The results of this analysis provide context for the potential impact of development and park-and-ride traffic to the interchange roundabout design. As development plans continue to evolve and the roundabout interchange concept moves forward to final design and construction, Parametrix recommends careful review of the traffic performance. Roundabout operation is particularly sensitive to the complex interaction of the various approach legs. Changes to volumes and geometry at one approach leg can greatly influence the performance on other roundabout legs. On the other hand, small tweaks to design can offer significant benefits to operation. Final geometric design details and a clearer picture of development land use will help ensure a roundabout configuration that meets anticipated traffic demand.