Purpose

To define the process for warranting left-turn phasing at existing signalized intersections.

UDOT Recommended Guidelines

Guidelines for Left-Turn Phasing

The following flow-chart has been established as criteria for recommending left-turn phasing at signalized intersections. A left-turn phase may be installed after less restrictive measures to reduce delay, congestion, and crashes have been considered. The overall signalized corridor/network operations should be considered when evaluating the impacts of left-turn phasing. Even if the criteria in the flowchart are met for left-turn phasing, engineering judgment should be used to determine whether left-turn phasing is implemented.

Before completing the flowchart for left-turn phasing, the intersection should be evaluated by the TOC to determine if signal timing adjustments can mitigate the problem. The intersection should also be evaluated for sight distance and geometric issues that may determine whether a protected-only left-turn phase is required. A field review is recommended for all sites before changes to left-turn phasing are implemented. Criteria for left-turn phasing are found on the attached flowchart.

Guidelines for Dual Left-Turn Lanes

UDOT recommends the following guidelines in helping to make decisions when to install dual left-turn lanes.

I. A capacity sensitivity analysis should be performed. When performing the capacity sensitivity analysis, the default analysis values in Synchro should be:
   a. Cycle length: 120 seconds
   b. Ideal saturation flow rate: 1900 vphpl
   c. Percent heavy vehicles: 2%
   d. Lane widths: 12 feet
   e. Analyze with no parking and non CBD
   f. Optimize splits

   Table 1 below shows the recommended left turn volumes and the opposing through volume to capacity (v/c) ratio to use in assisting to make the decision for dual left-turns. The v/c ratio is calculated using HCM 2010 methodologies.
Table 1: Capacity Analysis Guidelines

<table>
<thead>
<tr>
<th>Left-Turn Volume</th>
<th>Opposing Through V/C ≥</th>
<th>Recommend</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 - 269</td>
<td>0.95</td>
<td>Dual Left-Turn Lanes</td>
</tr>
<tr>
<td>270 - 279</td>
<td>0.75</td>
<td>Dual Left-Turn Lanes</td>
</tr>
<tr>
<td>280 - 319</td>
<td>0.65</td>
<td>Dual Left-Turn Lanes</td>
</tr>
<tr>
<td>320 - 359</td>
<td>0.6</td>
<td>Dual Left-Turn Lanes</td>
</tr>
<tr>
<td>360 - 389</td>
<td>0.55</td>
<td>Dual Left-Turn Lanes</td>
</tr>
<tr>
<td>390 - 420</td>
<td>0.5</td>
<td>Dual Left-Turn Lanes</td>
</tr>
<tr>
<td>≥ 420</td>
<td></td>
<td>Dual Left-Turn Lanes</td>
</tr>
</tbody>
</table>

II. The number of hours where left-turn volume meets the guidelines in the capacity analysis in Table 1 should be considered where the dual left-turn lanes provide a benefit. A comparison with the vehicle delays should be made during the other non-peak hours in the day.

III. The location of the intersection where the dual left is being considered should also consider the lane distribution that will be obtained. For example, if the intersection is close to a freeway on-ramp, there may not be good lane utilization since vehicles will favor the lane providing the best access to the ramp.

IV. Consideration should be given for the need to minimize the green time given to left turns on one approach so that added green time is available for the other phases.

V. Compatibility of the dual left exclusive phasing operations with the signal coordination should be evaluated.

VI. The Designer and Project Manager shall consult with the Region Traffic Operations Engineer and the Division of Traffic & Safety before adding dual left-turn lanes when the left-turn volume is less than 420 vph.

VII. If there is no opposing through movement, such as at a three-way “T” intersection, then no additional signal phase is needed. Instead of using the above volume and v/c criteria, consideration should be given to opposing pedestrian phases, available right-of-way needed for the additional lane, and existing left-turn queue lengths at the intersection. If cycle failure (queue doesn't clear during each signal cycle) is occurring often, dual left-turn lanes should be considered.
(1) - The number of opposing lanes and the posted speed limit should be considered together. If there is a high speed limit with a large number of opposing thru lanes, protected phasing could be considered. However, if there is a high speed limit with only one or two opposing thru lanes, permitted phasing could be appropriate.

(2) - If there is a history of severe left-turn crashes at the study location during the last three years, further study is recommended. A safety study, similar to an operational safety report (OSR) should be completed to determine whether protected left-turn phasing would reduce crashes at the study location. Even if a safety study is needed, the rest of the flow chart should still be evaluated.

(3) - See Dual Left-Turn Lane Guidelines

(4) - Volume cross product (opposing thru hourly volume multiplied by left-turn hourly volume) exceeds the appropriate following value:
   a) Random arrivals (no other traffic signals within 0.5 mile)
      One opposing lane: 50,000
      Two or three opposing lanes: 100,000
   b) Platoon arrivals (other traffic signals within 0.5 mile)
      One opposing lane: 60,000
      Two or three opposing lanes: 120,000

(5) - Cycle failure (queues do not completely discharge during each signal cycle) or excessive queuing that blocks thru traffic or adjacent major intersections may indicate that permissive / protected left-turn phasing is needed.