Traffic Signal Preemption Using TXDOT’s New Preemption Procedures

By Nicole L. Jackson, PE, PTOE

August 22, 2018
Agenda

- How we got here
- What’s new?
- Why it won’t always work
  - Complex Designs
  - Railroad limitations
- Ask for help
How we got here
Railroad Preemption

The purpose of railroad preemption is to provide an opportunity for vehicles to clear the track area before the train arrives at the crossing.
Railroad Preemption

Comprised of 3 parameters:

1. Right-of-Way Transfer Time
Railroad Preemption

Comprised of 3 parameters:

1. Right-of-Way Transfer Time
2. Queue Clearance Time
Railroad Preemption

Comprised of 3 parameters:

1. Right-of-Way Transfer Time
2. Queue Clearance Time
3. Separation Time
Preemption Form

- First developed under Texas A&M Transportation Institute (TTI) Research Report (September 2005)
- Used nationally by many agencies
- Simple, but required to manually “look up” values and some interpretation
Preemption Form

• 2011 – As part of a Florida project, HDR completed comparison study:
  • Texas A&M Transportation Institute Methodology
  • University of Florida Methodology
  • Northwestern Traffic Institute Methodology
• TTI and Northwestern yielded very similar results
• University of Florida was much higher
Preemption Form

- TXDOT identified the need to improve the form
- Worked once more with TTI Research and CTC, Inc to make modifications
- New form released around October 2017
What’s new?
Preemption Form

New form upgrades included:

1. Automate previous “look up” values
2. Guidance on pedestrian timing / truncation
3. Account for left turning vehicles
Automation

Old form:

- Required look up of clearance values using graphs and tables
- Often lead to errors
- Frequently, grades at the crossing were neglected
- Failure to read the fine print
Automation

New form:

- Requires more measurements to be made
- No more reading clearance value on graphs
- Accounting for grade is automatic
Pedestrian Timing / Truncation

- Pedestrian time has significant effect on amount of preemption time (1:1)
- Pedestrian timing guidance non-existent for preemption
- Road authorities hesitant to truncate
Pedestrian Timing / Truncation

New preemption form instructions includes 5 additional pages for pedestrian timing guidance
Pedestrian Timing / Truncation

Takes into consideration:
- Pedestrian Volumes
- Frequency of Preemption Events
- Intersection Geometry
- Signal Timing
- School Crossings / Mobility or Visually Impaired Pedestrians

Table 4. Suggested Pedestrian Clearance Strategies to be used under Different Levels of Preemption Event Frequencies and Pedestrian Conditions where the Largest Pedestrian Crossing Width is 40 feet or more.

<table>
<thead>
<tr>
<th>Preemption Events</th>
<th>Very Light (0-5 preemption events per day)</th>
<th>Light (6-10 preemption events per day)</th>
<th>Moderate (10-20 preemption events per day)</th>
<th>Frequent (&gt;20 preemption events per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian Conditions</td>
<td>Full Truncation</td>
<td>Full Truncation</td>
<td>Full Truncation</td>
<td>Intermediate Truncation</td>
</tr>
<tr>
<td>Very Light</td>
<td>(1 cycle out of every 20 cycles or more is used to cross pedestrians)</td>
<td>(1 cycle out of every 10 to 20 cycles is used to cross pedestrians)</td>
<td>(1 cycle out of every 4 to 10 cycles is used to cross pedestrians)</td>
<td>(1 cycle out of every 1 to 3 cycles is used to cross pedestrians)</td>
</tr>
<tr>
<td>Light</td>
<td>Full Truncation</td>
<td>Intermediate Truncation</td>
<td>Partial Truncation</td>
<td>Full Pedestrian Clearance</td>
</tr>
<tr>
<td>Moderate</td>
<td>Intermediate Truncation</td>
<td>Partial Truncation</td>
<td>Full Pedestrian Clearance</td>
<td></td>
</tr>
<tr>
<td>Frequent</td>
<td>Partial Truncation</td>
<td>Partial Truncation</td>
<td>Full Pedestrian Clearance</td>
<td></td>
</tr>
<tr>
<td>Frequented by Less Mobile (Elderly) or Mobility and/or Visually Impaired Pedestrians</td>
<td></td>
<td></td>
<td></td>
<td>Full Pedestrian Clearance</td>
</tr>
</tbody>
</table>
Pedestrian Timing / Truncation

Gives options for:

- Full Truncation
- Intermediate Truncation
- Partial Truncation

OR

- Full Pedestrian Clearance
Left Turning Vehicles

Biggest risk when…

1. Short clear storage distance (less than a design vehicle length)
2. Large percentage of tractor trailers making the movement
3. Low advance preemption time or using simultaneous preemption
Left Turning Vehicles
Why it won’t always work
Why it won’t always work

Complex Designs:

1. Multiple leg crossings
Why it won’t always work

Complex Designs:

1. Multiple leg crossings
2. Crossing through intersection
Why it won’t always work

Complex Designs:

1. Multiple leg crossings
2. Crossing through intersection
3. Queue cutter traffic signals
Why it won’t always work

Railroad Limitations:

• New AREMA 50-second rule

For grade crossing warning systems interconnected with highway traffic signals, System Design Time minus Equipment Response Time shall not exceed 50 seconds (MWT + CT + BT + APT)

By necessity, must consider other options.
Ask for help
Closing Thoughts

- Remember – It’s more detailed than you will ever imagine
- Communication is essential
- It will take longer than you ever thought due to the complexity of the solutions
- You will uncover problems and challenges in almost every location
- Seek expert advice if you have not had specific in-depth training on preemption operation and design
Closing Thoughts
Questions

Nicole L. Jackson, PE, PTOE
682-730-8147
njackson@ctcinc.com