Revisions to the TxDOT Guide for Determining Time Requirements for Traffic Signal Preemption at Highway-Rail Grade Crossings

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Presentation Outline

• History of TxDOT Worksheet
• Need for Revisions
• Describe Sections in Worksheet
• Items shown in RED indicate new items
TxDOT Worksheet – Prior to 2004

TIME FOR PARALLEL ROAD BEFORE SERVICING THE TRACK PHASE

THE GREATER OF:
MIN GREEN BEFORE PREEMPT 0 - 4 SECONDS ______ SECONDS
OR
PEDESTRIAN CLEARANCE TIME AS REQUIRED ______ SECONDS
PLUS:
CLEARANCE TIME = YELLOW + ALL RED (4 - 8 SECONDS)
(NORMAL INTERSECTION CLEARANCE TIME) ______ SECONDS

TOTAL TIME BEFORE SERVICING THE TRACK PHASE ______ SECONDS

TRACK CLEARANCE GREEN FOR DISTANCE L

<table>
<thead>
<tr>
<th>L</th>
<th>Minimum</th>
<th>Desirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>6 SECONDS</td>
<td>10 SECONDS</td>
</tr>
<tr>
<td>50</td>
<td>7 SECONDS</td>
<td>10 SECONDS</td>
</tr>
<tr>
<td>75</td>
<td>9 SECONDS</td>
<td>10 SECONDS</td>
</tr>
<tr>
<td>100</td>
<td>10 SECONDS</td>
<td>12 SECONDS</td>
</tr>
<tr>
<td>125</td>
<td>11 SECONDS</td>
<td>14 SECONDS</td>
</tr>
<tr>
<td>150</td>
<td>12 SECONDS</td>
<td>17 SECONDS</td>
</tr>
<tr>
<td>175</td>
<td>14 SECONDS</td>
<td>19 SECONDS</td>
</tr>
<tr>
<td>200</td>
<td>15 SECONDS</td>
<td>21 SECONDS</td>
</tr>
<tr>
<td>&gt;200</td>
<td>AS DETERMINED</td>
<td>AS DETERMINED</td>
</tr>
</tbody>
</table>

TOTAL TRACK CLEARANCE GREEN TIME ______ SECONDS

TOTAL TIME REQUIRED FOR TRACK CLEARANCE ______ SECONDS

NOTE: IF TOTAL TIME REQUIRED FOR TRACK CLEARANCE IS LESS THAN TOTAL RR WARNING TIME, SIMULTANEOUS PREEMPTION IS ALL THAT IS REQUIRED.

TOTAL TIME REQUIRED FOR TRACK CLEARANCE

= 20 SECONDS

MINIMUM RR WARNING
* TIME

= TIME TO BE ADDED TO RR WARNING TIME

* Does not include RR instrument lag time.
TxDOT Preemption Worksheet –2004 Update

• Updated the worksheet as result of research project conducted by TTI
  – Studied advance preemption at grade crossings
  – Specifically addressed preemption trap
  – Gate/vehicle interaction
  – Fillable and non-fillable format
Need for Revision

• Accommodate longer trucks
• New design case – left turning vehicle across grade crossing
• Guidance on pedestrian truncation
• Document preemption traffic signal parameters
• Fully automated Adobe form
Sections of Revised Worksheet

• Geometric Data & Defaults
• Right-of-way Transfer Time Calculation
• Queue Clearance Time Calculation
• Maximum Preemption Time Calculation
• Sufficient Warning Time Check
• Track Clearance Green Time Calculation
• Summary of Controller Preemption Settings
Section 1: Geometric Data and Defaults

User-Selected Design Vehicle (NEW)

- S-Bus 40
- WB-50
- WB-67 (Default)

- **CSD** = Clear storage distance
- **MTCD** = Minimum track clearance distance
- **SBD** = Stop bar setback distance
- **DVL** = Design vehicle length
  - \(L\) = Queue start-up distance, also stop-line distance
- **DVCD** = Design vehicle clearance distance
- **OSB** = Offset distance to Left-turn stop bar
  - \(A\) = Distance from curb line to center of farthest left turn lane
  - \(B\) = Distance from curb line to center of nearest lane receiving left turns
- **\(\theta\)** = Angle of turn (degrees)
Section 2. Right of Way Transfer Time

• Compute time required to transfer to track clearance time
• Includes preemption verification and response time delays
• Determines worse-case timing constraints
  – Vehicle phase
  – Pedestrian phase
• Compute the ROW transfer time
Section 3: Queue Clearance Time

Base Case (Mandatory)

Base + Left Turn (Optional)
Section 4: Maximum Preemption Time

• Compute maximum preemption time to clear queue
  – ROW Transfer Time
  – Queue Clearance Time
  – Desired Minimum Separation
Section 5: Sufficient Warning Time

Check

• Is time provided by RR ≥ maximum preemption time?
  – No ➜ required advance preemption time (APT) needed from RR

• Allows agencies document APT currently provided by RR to show it is sufficient

• Suggestion possibly ways to reduce maximum preemption time (where permitted by MUTCD)
Guidance for Truncating Pedestrian Intervals during Preemption

- Risk Management Approach (based on engineering study)

<table>
<thead>
<tr>
<th>Frequency of Pedestrian Usage</th>
<th>Frequency of Preemption Events</th>
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<tr>
<td>Very Light</td>
<td>Full</td>
</tr>
<tr>
<td>Light</td>
<td>Full</td>
</tr>
<tr>
<td>Moderate</td>
<td>Full Ped Clear</td>
</tr>
<tr>
<td>High</td>
<td>Full Ped Clear</td>
</tr>
<tr>
<td>Special circumstances</td>
<td>Full Ped Clear</td>
</tr>
</tbody>
</table>

- Frequency of Pedestrian Usage:
  - Very Light
  - Light
  - Moderate
  - High

- Frequency of Preemption Events:
  - Full
  - Partial
  - Intermediate
  - Full Ped Clear
Section 6: Track Clearance Green Time Calculation

- Preempt Trap Condition
  - Track clearance terminates before gates come down

- Track clearance green too long
Section 7: Summary of Controller Settings

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<thead>
<tr>
<th>Section</th>
<th>Setting</th>
<th>Remarks</th>
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</thead>
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<tr>
<td>Duration Time</td>
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<tr>
<td>Preempt Delay Time</td>
<td>(seconds)</td>
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<tr>
<td>Right of Way Transfer Phase</td>
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<td></td>
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<tr>
<td>Minimum Green Interval</td>
<td>(seconds)</td>
<td>5</td>
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<tr>
<td>Pedestrian Walk Interval</td>
<td>(seconds)</td>
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</tr>
<tr>
<td>Pedestrian Clearance Interval</td>
<td>(Flashing &quot;DON'T WALK&quot;); (seconds)</td>
<td>0</td>
</tr>
<tr>
<td>Yellow Change Interval</td>
<td>(seconds)</td>
<td>0.0</td>
</tr>
<tr>
<td>All Red Vehicle Clearance</td>
<td>(seconds)</td>
<td>0.0</td>
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<tr>
<td>Track Clearance Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Interval in the absence of</td>
<td>(seconds)</td>
<td>20</td>
</tr>
<tr>
<td>gate down circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Interval with gate down</td>
<td>(seconds)</td>
<td>15</td>
</tr>
<tr>
<td>circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow Change Interval</td>
<td>(seconds)</td>
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<tr>
<td>All Red Vehicle Clearance</td>
<td>(seconds)</td>
<td>0.0</td>
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<tr>
<td>Exit Phase</td>
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<tr>
<td>Dwell/Cycle Minimum Green Time</td>
<td>(seconds)</td>
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</tr>
<tr>
<td>Yellow Change Interval</td>
<td>(seconds)</td>
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</tr>
<tr>
<td>All Red Vehicle Clearance</td>
<td>(seconds)</td>
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</tbody>
</table>
Final Comments

• Status of Implementation
  – TxDOT adopted in Fall of 2017

• Acknowledgements
  – Texas A&M Transportation Institute
    • Kevin Balke
    • Steve Venglar
  – Texas Department of Transportation
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    • David Valdez
  – CTC, Inc.
    • Nicole Jackson
Questions