Recommended Instructions for Determining Warning Time and Calculating Minimum Approach Distance for Highway-Rail Grade Crossing Warning Systems
Revised 2000 (2 Pages) (SM3-3-10)

This Manual Part recommends instructions to determine the warning time and calculate the minimum approach distance for railroad activated warning devices at highway-rail grade crossings.

A. Minimum Warning Time (Through Train Movements): The least amount of time active warning devices shall operate prior to the arrival of a train at a railroad-highway grade crossing.

B. Clearance Time (CT): For two-quadrant railroad warning devices, the minimum track clearance distance is the length along a highway at one or more railroad tracks, measured from the railroad warning device, to 6 feet beyond the track(s) measured perpendicular to the far rail, along the centerline or edge line of the highway, as appropriate, to obtain the longer distance.

If the minimum track clearance distance exceeds 35 ft., Clearance Time is one second for each additional 10 ft., or portion thereof, over 35 ft.

Clearance Time may also be added by the public agency or railroad to account for site specific needs. Examples of additional Clearance Time include additional time for simultaneous preemption and/or additional gate delay time.

C. When gates are used, each gate arm shall start its downward motion not less than three seconds after flashing lights begin to operate and shall assume the horizontal position at least five seconds before the arrival of a normal train movement at the crossing. The timing requirements of this section apply to entrance gates only.

D. Buffer Time (BT): Buffer time is discretionary and may be provided in addition to MT and CT to accommodate for minor variations in train handling.
E. Equipment Response Time (ERT): Adjustments shall be made to provide for control circuit Equipment Response Time.

F. Advance Preemption Time (APT): The time as specified by the Highway Authority to provide advance notification of an approaching train prior to activation of the highway crossing warning devices for preemption. Buffer Time (BT) should be considered to be zero when calculating APT.

G. The Total Warning Time may be determined as follows:

Minimum Time  20 seconds
Plus CT
Minimum Warning Time
Plus BT
Total Warning Time

H. The total Approach Time may be determined as follows:

Total Warning Time
plus ERT
plus APT
Total Approach Time

I. Approach distance in feet = total approach time x 1.47 x maximum authorized speed in mph.
Note: 1.47 = distance traveled in 1 second at 1 mph.

J. Distance for each track involved to be calculated separately.
### TOTAL APPROACH TIME

<table>
<thead>
<tr>
<th>Equipment Response</th>
<th>Advanced Preemption</th>
<th>Total Warning Time</th>
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<tbody>
<tr>
<td>ERT</td>
<td>APT</td>
<td>20 SEC. Minimum</td>
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</table>

- **Gate Delay**: 3 Sec.
- **Minimum Before Gates Start To Descend**: 3 Sec.
- **Gate Descent**: 5 Sec.
- **Gate Horizontal**: 5 Sec.
- **Minimum Before Train Enters Crossing**: 5 Sec.

- **CT**: Lights Flash
- **BT**: Gate Delay

Start Crossing Approach  →  Crossing