Example Problem 6D-1_2: Intersection with a Two-lane Highway

Determine if the bridge barrier rail restricts intersection sight distance for a left turn maneuver.

Given:
- Local Road intersecting a 2-lane state highway
- Design speed of the 2-lane highway = 60 mph
- Bridge barrier height = 34 inches
- Design vehicle – passenger car

Solution:
1. Using a time gap acceptance value from Table 3 and Equation 6D-1_4, determine the required intersection sight distance:
   \[ L = 1.47 \times 60 \times 8.0 = 705.6 \text{ ft} \approx 710 \text{ ft} \]

2. Construct departure sight triangle:

   \[ L = 710' \]

   Figure 2: Intersection sight triangle.
   The barrier rail falls within the sight triangle.

3. Calculate the elevations of the drivers and obstruction:
   Elevation of the driver on the local road (minor road):
Elev\textsubscript{h1} = 899.28 + 3.5 = 902.78 ft

Elevation of the driver on the two-lane highway (major road):

\[ \text{Elev}_{h2} = 919.83 + 3.5 = 923.33 \text{ ft} \]

Elevation of the top of barrier varies from 910.85 to 908.55 feet.

\begin{figure}
\centering
\includegraphics[width=0.8\textwidth]{vertical_sight_line.png}
\caption{Vertical sight line.}
\label{fig:vertical_sight_line}
\end{figure}

\textbf{Note:} Pavement surface elevations can be determined from survey .tin files, design files, or construction plans.

The height of the barrier is a sight obstruction.

4. Calculate the available intersection sight distance:

Since the barrier is the sight obstruction, the available intersection sight distance can be determined from similar triangles.

\begin{figure}
\centering
\includegraphics[width=0.8\textwidth]{modified_intersection_sight_triangle.png}
\caption{Modified intersection sight triangle.}
\label{fig:modified_intersection_sight_triangle}
\end{figure}
\[
\beta = \tan^{-1} \frac{6.5}{200} = 1.861^\circ \\
X = \frac{20.5}{\tan 1.861^\circ} = 631 \text{ ft} \\
V_{\text{major}} = \frac{631}{(1.47 \times 7.5)} = 57.2 \text{ mph or } 55 \text{ mph}
\]

Discussion:
When determining available intersection sight distance, the designer should use minimum values from Table 3 and assume the stopped driver is 14.5 feet from the edge of the through roadway.

Possible solutions are:
- Reduce the design speed of the state highway to 55 mph.
- Widen the bridge.
- Relocated the local road away from the bridge.