Lesson 5: Design Consistency Module (DCM)

Overview

The Design Consistency Module evaluates operating speed consistency through a speed-profile model that estimates expected 85th percentile, free-flow, passenger vehicle speeds along a highway.

For more details, see the Design Consistency Module Engineer’s Manual.

In the work problem, you will use the Design Consistency Module to evaluate the operating speed consistency of IHSDM Pike.

Work Problem

Exercise:
- 5.1: Evaluate the Design Consistency of IHSDM Pike
Exercise 5.1: Evaluate the Design Consistency of Existing IHSDM Pike

I. Create a Design Consistency Evaluation

1. If necessary, start IHSDM by double clicking the shortcut icon on your desktop screen, or on ihsdm.exe in the IHSDM software home directory.

2. To view the highways under the “IHSDM Pike” Project, click on the + sign to the left of the “IHSDM Pike” node to expand the tree. You should see highway nodes for ‘ihsdm pike’ and ‘route1’ and an intersection node for ‘route1/ihsdm pike.’

3. To create an Evaluation for IHSDM Pike:
   a. Select the highway node corresponding to “ihsdm pike” by clicking it once.
   b. Click the “New Evaluation” button on the Button Panel to bring up the “Select an evaluation type” window in the desktop area.
   c. Fill in or select:
      - Title: Design Consistency 1
      - Comment: Design Consistency Evaluation
      - Description: Design Consistency evaluation of existing IHSDM Pike.
      - Evaluation type: Design Consistency
   d. Click on “Next”.

![Image of IHSDM Pike Evaluation Wizard](image-url)
II. Set the Evaluation Attributes

1. “Set design consistency attributes”:
   a. Evaluation bounds: the defaults are the start and end stations of IHSDM Pike. Keep these default values.
   b. Analysis Vehicle: Passenger Car – Type 1
   c. Design Checks: check the boxes for both “Design vs. Operating Speed” and “Predicted Speed Differential of Adjacent Elements”
   d. Click “Next”
2. “Set speed attributes”: Verify that 62 mph is entered for the desired speed and for vehicle speeds at the start and end stations of the highway. Accept these default values, and click “Next.”
3. IHSDM checked the highway data provided vs. the data that could be used for the design consistency evaluation. The “Data issues” screen lists data elements that may need further review. There are no highway elements listed for review, so click “Next” to proceed.

4. On the “Evaluation settings summary” screen, check the summary to ensure that the previous steps were completed properly. Make sure the box is checked for “Show Report on Run Completion.” Click “Run” to run the Evaluation.
III. Run DCM Evaluation

The status screen shows the progress of the evaluation. Once it is completed, the Show Report, Graph-Increasing (for travel in the direction of increasing stations), and Graph-Decreasing (for travel in the direction of decreasing stations) buttons become active. The Evaluation Report should open in an html browser automatically. Minimize the report for later access.

IV. View/Interpret DCM Output

1. Generate a DCM graph outside of the evaluation report:
   a. Click the “Graph - Increasing” button on the status screen, to open a graph showing the design consistency results for travel in the direction of increasing stations. Click on the “maximize” icon in the upper right corner of the window for a better view.
b. Select “View>Toggle Legend” from the pull-down menu to display the legend below the graph

- **Q 5.1.1**: What are the approximate locations of any red “flags” on the speed profile (indicating speed differentials between adjacent design elements of >12 mph)?

- **Q 5.1.2**: What are the approximate locations of any yellow “flags” on the speed profile (indicating speed differentials between adjacent design elements of >6 mph, <12 mph)?

<table>
<thead>
<tr>
<th>Locations of Red Flags (Station)</th>
<th>Locations of Yellow Flags (Station)</th>
</tr>
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</table>

<p>| | |</p>
<table>
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</table>


c. Close the graph by selecting “File” and “Close” from the pull-down menu on the “DCM Data Graph” window

2. View/Interpret the DCM evaluation report:
a. Maximize the Evaluation Report. Or, if it has been closed, click the “Show Report” button on the status window.

Graphs are also in the Evaluation Report with a default format.

b. Scroll through the Evaluation Report (or click on the link in the Table of Contents) to find the Graph of Design Consistency Results in the directions of increasing and decreasing stations

- **Q 5.1.3**: How do the speed profiles differ by direction of travel?

<table>
<thead>
<tr>
<th>How do the speed profiles differ by direction of travel?</th>
</tr>
</thead>
</table>

| ![Graph of Design Consistency Results](image) |

How do the speed profiles differ by direction of travel?

c. Scroll down to the “Design Speed Assumption Check (in the direction of decreasing stations)” table
- **Q 5.1.4** Which two sections have the greatest differential between the estimated operating speed \((V_{85})\) and the design speed \((V_{\text{design}})\)? Where does this occur?

<table>
<thead>
<tr>
<th>Greatest Differential Between (V_{85}) and (V_{\text{design}}) (mph)</th>
<th>Station (From)</th>
<th>Station (To)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

- d. Scroll down to the “Speed Differential of Adjacent Design Elements Check (in the direction of increasing stations)” table

- **Q 5.1.5**: What is the greatest speed differential?
- **Q 5.1.6**: What is the start station of the curve with the greatest speed differential?

<table>
<thead>
<tr>
<th>Greatest Differential Between Speed ((V_{85})) on Curve and Preceding Element (mph)</th>
<th>Start Station of Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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- e. Close the Evaluation Report
- f. Close the “Status” screen by clicking the Close button.
Lesson 5 Work Problem – Answer Key

Exercise 5.1

- **Q 5.1.1**: What are the approximate locations of any red “flags” on the speed profile (indicating speed differentials between adjacent design elements of >12 mph)?

- **Q 5.1.2**: What are the approximate locations of any yellow “flags” on the speed profile (indicating speed differentials between adjacent design elements of >6 mph, <12 mph)?

<table>
<thead>
<tr>
<th>Locations of Red Flags (Station)</th>
<th>4+507</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations of Yellow Flags (Station)</td>
<td>9+982; 10+533</td>
</tr>
</tbody>
</table>

- **Q 5.1.3**: How do the speed profiles differ by direction of travel?

  **Possible answers include:**
  - For compound curve beginning at sta. 4+507.470: red flag for increasing stations, green flag for decreasing stations
  - For curve beginning near sta. 10+533.717: yellow flag for increasing stations, red flag for decreasing stations

- **Q 5.1.4** Which two sections have the greatest differential between the estimated operating speed ($V_{85}$) and the design speed ($V_{design}$)? Where does this occur?

<table>
<thead>
<tr>
<th>Greatest Differential Between $V_{85}$ and $V_{design}$ (mph)</th>
<th>Station (From)</th>
<th>Station (To)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>14+281.693</td>
<td>11+157.303</td>
</tr>
<tr>
<td>12</td>
<td>3+703.461</td>
<td>0+349.458</td>
</tr>
</tbody>
</table>
- **Q 5.1.5**: What is the greatest speed differential?
- **Q 5.1.6**: What is the start station of the curve with the greatest speed differential?

| Greatest Differential Between Speed \(V_{85}\) on Curve and Preceding Element (mph) | 17.5 |
| Start Station of Curve |
| 4+507.470 |

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