HCM – Sixth Edition

What’s New in the HCM Sixth Edition

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Presentation Overview

- Need for an Updated HCM
- HCM Structure
- Presentation of Information Changes
- New Capabilities
After HCM 2010 was published, four emerging topics chapters (35–38) were released online:

- Active Traffic and Demand Management (ATDM) update (Ch. 35)
- Travel time reliability (Ch. 36, 37)
- Managed lanes (Ch. 38)
Need for a Major Update to the HCM 2010

- The interim chapters, plus other soon-to-be-completed research, needed to be integrated into the HCM
  - Allows the use of all methods in combination
  - Facilitates software development
  - Software facilitates use and implementation
- The new material would also impact the length of the HCM
- Thus, a major update was needed
Over the years, HCM content has expanded considerably beyond simply “highway capacity”

- Multiple performance measures
- Many facility types
- Multimodal analysis

Transportation professionals and decision-makers have not always been aware of these additional features
Previous HCM editions have had a year attached

Looking forward, it is likely that chapters will continue to be released or updated as new research is completed, rather than waiting for a critical mass to accumulate

- Two-lane highway update
- Advances in ATDM
- Connected and autonomous vehicles

Each chapter will have its own version number, allowing chapters to be updated independently
HCM Structure

Printed HCM

Volume 1: Concepts
Volume 2: Uninterrupted Flow
Volume 3: Interrupted Flow
Volume 4: Applications Guide

Online

HCM - Sixth Edition
HCM Presentation Changes

- Additional changes have been made for the HCM Sixth Edition
  - Standardized chapter outlines
  - Presentation of the core chapter methodology, followed by extensions
  - Summary tables listing data requirements, potential data sources, suggested default values, and sensitivity of results to inputs
  - Example results in many chapters
  - Example problems moved to Volume 4
Example Summary Data Table

<table>
<thead>
<tr>
<th>Required Data and Units</th>
<th>Potential Data Source(s)</th>
<th>Suggested Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highway class (I, II, III)</strong></td>
<td>Determine from functional class, land use, motorist expectation</td>
<td>Must be provided</td>
</tr>
<tr>
<td><strong>Lane width (ft)</strong></td>
<td>Road inventory, aerial photo</td>
<td>12 ft</td>
</tr>
<tr>
<td><strong>Shoulder width (ft)</strong></td>
<td>Road inventory, aerial photo</td>
<td>6 ft</td>
</tr>
<tr>
<td><strong>Access-point density (both sides)</strong> (access points/mi)</td>
<td>Field data, aerial photo</td>
<td>Class I and II: 8/mi Class III: 16/mi</td>
</tr>
<tr>
<td><strong>Terrain type (level, rolling, specific grade)</strong></td>
<td>Design plans, analyst judgment</td>
<td>Must be provided</td>
</tr>
<tr>
<td><strong>Percent no-passing zone</strong> (%)</td>
<td>Road inventory, aerial photo</td>
<td>Level: 20% Rolling: 40% More extreme: 80%</td>
</tr>
<tr>
<td><strong>Free-flow speed</strong> (mi/h)</td>
<td>Direct speed measurements, estimate from design speed or speed limit</td>
<td>Base free-flow speed: Speed limit + 10 mi/h (see discussion in text)</td>
</tr>
<tr>
<td><strong>Passing lane length</strong> (mi)</td>
<td>Field data, road inventory, aerial photo</td>
<td>Must be provided</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Demand Data</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hourly demand volume (veh/h)</strong></td>
</tr>
<tr>
<td><strong>Directional volume split (%)</strong></td>
</tr>
<tr>
<td><strong>Analysis period length (min)</strong></td>
</tr>
<tr>
<td><strong>Peak hour factor</strong></td>
</tr>
<tr>
<td><strong>Heavy vehicle percentage (%)</strong></td>
</tr>
</tbody>
</table>
Freeway Facilities

- Core method described in Chapter 10
  - New freeway work zone method
  - New managed lanes method
  - New research on truck effects on freeway operations
  - Guidance on evaluating ATDM strategies on typical-day freeway operations
  - Improved guidance on segmenting freeways and matching section data from external databases to HCM segments
Freeway Reliability Analysis

- **New Chapter 11**
- Integrates reliability analysis methodology
  - Applies Chapter 10 method repeatedly with adjusted demands, capacities, lanes, and free-flow speeds to develop a travel time distribution
  - Incorporates demand variation, weather, incident, work zone, and special event effects
  - Produces a variety of useful reliability-related performance measures
Chapter 11 also describes how to evaluate the effects of ATDM strategies on freeway reliability.

The process for developing reliability “scenarios” and for accounting for weather and incident effects has been improved and is described in Chapter 25.

Chapter 25 also describes a calibration process that can be applied.
Chapter 12 merges the previous individual chapters on basic freeway segments and multilane highways.

- Uses one unified speed–flow equation applicable to both freeway and multilane highway segments, but the forms of the curves are different.
Other changes include:

- Revised truck PCE tables
- Increased emphasis on calibration through capacity and speed adjustment factors (CAFs and SAFs)
- Driver population effects now handled by CAFs and SAFs
- For multilane highways:
  - Density at capacity = 45 pc/mi/ln
  - Revised LOS E–F range to reflect revised density
  - New speed–flow curves for 65 and 70 mi/h highways
Chapter 13 integrates material on managed lane weaving sections and cross-weave effects in the general-purpose lanes.

- Emphasis on the use of CAFs and SAFs for calibration
- Chapter 27 provides new example problems demonstrating the new capabilities
Freeway Merges and Diverges

- Chapter 14 integrates material on managed lane merges and diverges
- New guidance on aggregating densities in segments with 3+ lanes
- Emphasis on the use of CAFs and SAFs for calibration
- Chapter 28 provides new example problems demonstrating the new capabilities
Two-Lane Highways

- No significant changes to the method
- New guidance on applying the method and interpreting its results
- Clarified that certain calculation steps need not be skipped if the performance measure being calculated is of interest to the analysis
- Chapter anticipated to be updated in a few years as a result of ongoing research
- Example problems moved to Chapter 26
Urban Street Facilities

- Service measure changed to **average travel speed** from average travel speed as percent of free-flow speed

<table>
<thead>
<tr>
<th>LOS</th>
<th>Travel Speed Threshold by Base Free-Flow Speed (mi/h)</th>
<th>Volume-to-Capacity Ratio^a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55  50  45  40  35  30  25</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>&gt;44 &gt;40 &gt;36 &gt;32 &gt;28 &gt;24 &gt;20</td>
<td>≤ 1.0</td>
</tr>
<tr>
<td>B</td>
<td>&gt;37 &gt;34 &gt;30 &gt;27 &gt;23 &gt;20 &gt;17</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>&gt;28 &gt;25 &gt;23 &gt;20 &gt;18 &gt;15 &gt;13</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>&gt;22 &gt;20 &gt;18 &gt;16 &gt;14 &gt;12 &gt;10</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>&gt;17 &gt;15 &gt;14 &gt;12 &gt;11 &gt;9  &gt;8</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>≤17 ≤15 ≤14 ≤12 ≤11 ≤9  ≤8</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Any</td>
<td>&gt; 1.0</td>
</tr>
</tbody>
</table>

- LOS A/B threshold lowered to the equivalent of 80% of free-flow speed
- New method for evaluating spillback
- Pedestrian and bicycle LOS now weighted by travel time instead of length
- Example problems moved to Chapter 29
Urban Street Reliability and ATDM

- New Chapter 17
  - Integrates material previously appearing in Chapter 35 and interim Chapters 36 and 37
- Reliability calculation process similar to that used for freeway reliability analysis
  - Repetitive application of Chapter 16 core method with varying inputs
- New guidance on analyzing ATDM strategies
Urban Street Segments

- Same service measure changes as described for urban street facilities
- New method for evaluating segments with midsegment lane blockage
- Improved procedure for predicting segment queue spillback time
- New adjustment factor for parking activity that affects free-flow speed estimation

![Diagram showing work zone and segment numbering]
- Procedure can now evaluate segments with roundabouts at one or both ends
- Right-turn-on-red vehicles incorporated into volume-balancing method for flows into and out of a segment
- Pedestrian and bicycle LOS scores now use time-based weighting
- Changes to bicycle and bus default values
Signalized Intersections

- Delay of unsignalized movements can now be considered (user-supplied input)
- Combined saturation flow adjustment factor for heavy vehicles and grade
- New saturation flow adjustment factors for intersection work zone presence, midsegment lane blockage, and downstream spillback
Signalized Intersections

- Chapter 31 provides an improved planning method with reduced input data requirements and simplified calculations.
- Example problems moved to Chapter 31.
Stop-Controlled Intersections

- No significant changes in the two-way and all-way stop methods
- Clarified how the peak hour factor is applied
- Example problems moved to Chapter 32
Roundabouts

- Capacity models have been updated as a result of new research
- New calibration procedure provided
- Clarified how the peak hour factor is applied
- Example problems moved to Chapter 33
The former Interchange Ramp Terminals chapter has been expanded to include a greater variety of distributed intersections.

- Two or more intersections with close spacing and displaced or distributed traffic movements that are operationally interdependent and are best analyzed as a single unit.
Intersection Forms Addressed

- **DLT**
- **MUT**
- **RCUT**
Ramp Terminals and Alternative Intersections

- New service measure: experienced travel time
  - Sum of control delays at each node and extra distance travel time experienced by rerouted movements

- New and updated example problems are located in supplemental Chapter 34
Questions?

- Questions on the HCM Update?

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