

Revised Chapter for Highway Capacity Manual Published

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No longer should Transportation Research Board *Special Report 209* be referred to as the 1985 *Highway Capacity Manual* (HCM). A revised chapter on multilane highways (Chapter 7), approved by the TRB Committee on Highway Capacity and Quality of Service (A3A10), was published in July 1992. The manual was designed in a loose-leaf format to facilitate inclusion of periodical revisions. Chapter 7 is the first of the HCM material to be revised.

Recent Research on Multilane Highways

The National Cooperative Highway Research Program (NCHRP) initiated a project (Project 3-33) in June 1985 to respond to the need to base analyses on data from multilane highways. Objectives of the project included the following:

- Develop improved procedures,
- Collect and analyze field data,
- Prepare a revised chapter, and
- Develop revised software for the chapter.

The research team of JHK & Associates and Midwest Research Institute collected data on speed, volume, and turning movement at 49 sites in nine U.S. states. Data were collected from four- and six-lane divided and four-lane undivided highways.

In addition to field data collection, heavy vehicle equivalencies were developed using a Midwest Research Institute simulation model previously employed for the original freeway and multilane highway chapters.

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The revised procedure is a departure from that in previous versions of the chapter. The primary measure of effectiveness for defining level of service (LOS) is still density. However, the facility's speed-flow relationship is defined by its free-flow speed. Adjustment for conditions that are less than ideal are to be made to the free-flow speed and not to capacity.

The procedure furnishes a new set of equivalencies and factors for heavy vehicles. Adjustments are provided for both the frequency of access points and the median type. Adjustments for type of area and driver, which were employed in the 1985 edition of the HCM, are not included in the new procedures.

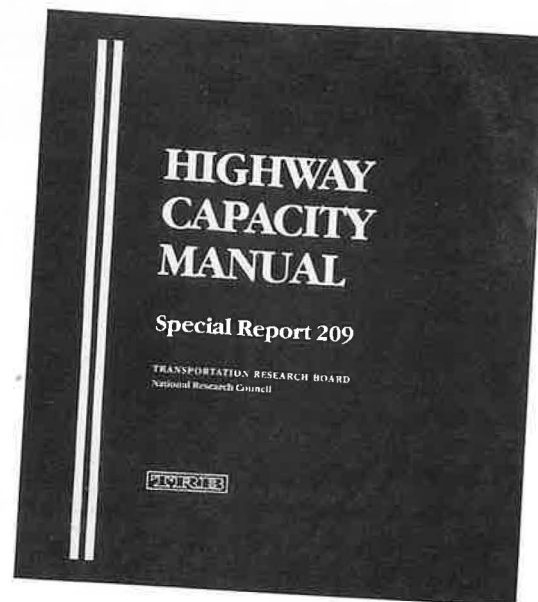
Key Features of New Chapter

Prediction of LOS and capacity for a multilane highway generally involves three steps: determination of free-flow speed, adjustment of volume, and determination of LOS and capacity.

Free-flow speed may be determined by direct measurement or an estimate. Associated with free-flow speed is a speed-volume relationship that may be used to determine LOS and capacity.

The established curves exhibit several distinctive features:

- The curves are parallel,
- Capacity varies with free-flow speed from 1,900 to 2,200 passenger cars per hour (pcph),
- Speed remains constant over a range of volumes up to 1,400 pcph,
- Speed reduction between 1,400 pcph and capacity ranges from 5 mph to 2 mph, and



Special Report 209: Highway Capacity Manual is available for \$60.00 from the Transportation Research Board, Box 289, Washington, D.C. 20055. Copies of the revised Contents, Index, Chapter 3 (Basic Freeway Segments), and Chapter 7 (Multilane Rural and Suburban Highways) are available for \$15.00.

- LOS is defined by rays emanating from the origin that represent different values of density.

Guidelines are provided for direct and indirect estimation of free-flow speed under ideal conditions. There is little basis for indirect estimation. Rules of thumb are furnished for predicting an ideal free-flow speed based on speed limit.

Adjustments to the ideal free-flow speed are provided in miles per hour. They are subtracted from the ideal free-flow speed, resulting in an estimate of the free-flow speed for the given conditions. Adjustments are provided for median type, lane width, lateral clearance, and access points.

Adjustments are also made to the volume for the peak-hour factor and heavy

vehicles. This results in an equivalent passenger-car flow rate. Guidelines are provided to account for variation in lane usage, where desired.

LOS is determined graphically by intersecting the projections of the flow rate (from the abscissa) with the speed-volume curve associated with the calculated or measured free-flow speed.

A separate planning procedure is provided, similar in format to the one in the 1985 manual. Tables are included for free-flow speeds of 50 and 60 mph. It is possible, however, to derive a similar planning table for any free-flow speed. Work sheets are provided for both the operational and planning procedures.

Relationship to Chapters on Freeways and Arterials

The adoption of capacities exceeding 2,000 passenger cars per hour per lane (pcphpl) for the speed-volume relationships for the multilane highway presented the committee with a coordination problem. The chapter on basic freeway segments currently establishes freeway capacity at 2,000 pcphpl under ideal conditions, unless local measurement suggests otherwise. With the inclusion of the new chapter on multilane highways, it would have been possible for an analyst to arrive at values for the capacity of a freeway lower than the capacity of a similar multilane facility.

The capacity committee determined that coordination should be established between the two chapters until the completion of research and development for the new freeway chapter. The coordination would not be limited to values for capacity under ideal conditions.

The coordination issue was resolved by the subcommittee on freeways, which developed an addendum to the freeway chapter (Chapter 3). This addendum establishes, for the interim, the following:

- Use of free-flow speed as the parameter to define the operational character of the facility,
- Acceptance of the 60 mph free-flow speed curve in Chapter 7 for Chapter 3

until further freeway research is conducted (freeway speeds may be higher),

- Use of LOS thresholds from Chapter 7 for the 60 mph free-flow speed curve, and
- Use of the revised heavy vehicle equivalents for freeway applications.

The chapter on urban and suburban arterials (Chapter 11) deals with facilities quite unlike multilane highways. The relationships developed for the new Chapter 7 are therefore not applicable to arterial analyses. However, use of free-flow speed more closely relates to the means by which arterials are analyzed. The adoption of free-flow speed as a common parameter across the range of freeway, multilane, and arterial facilities facilitates cross comparisons. This will be especially useful as suburban multilane highways are developed into arterials or freeways in response to adjacent development and growing traffic volumes.

Conclusion

The Committee on Capacity and Quality of Service has several activities under way for modification of the HCM in addition to publication of the new Chapter 7. As work progresses on other materials, the materials will be issued by the committee in several ways. Materials distributed for trial and comment by the user community, before being adopted by the committee, will be published as Transportation Research Circulars. In some cases, subcommittees may use less formal means for circulating trial materials for comment when procedures are in the early formative stages. However, when the capacity committee adopts a revision or replacement it will be distributed in loose-leaf format for inclusion in the manual, either as a replacement for or supplement to existing material.

TRB To Use Metric Units in Publications

Beginning with its 1993 publications, the Transportation Research Board will be using the International System of Units (SI), a modern version of the metric system of measurement, as the primary units of measurement. The shift is being made to be responsive to TRB's sponsors and to accommodate federal rules and procedures.

Each agency of the federal government must use SI in its procurements, grants, and other business-related activities, as required by the Omnibus Trade and Competitiveness Act of 1988 (Public Law 100-418) (see *TR News*, July-August 1991, p. 10). Federal agencies are required to convert to the metric system, or to develop plans for metric conversion, by the end of 1992. The Federal Highway Administration, for example, has developed a metric conversion plan whereby standards and engineering documents will be converted between 1992 and 1995, with full conversion implemented by 1996.

TRB will require that papers submitted for publication in the Transportation Research Record series and National Cooperative Highway Research Program reports include SI units as the primary units of measurement. The Board will follow *Standard Practice for Use of the International System of Units (SI)*, published by ASTM as E380-91. Authors and contractors may use SI units only or both SI and U.S. customary units; the latter (with U.S. customary units given in parentheses following the SI units) is the preferred style for the initial transition phase. This style will also be followed in TRB Special Reports and other published materials.