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Responsible Senior Program Officer: B. Ray Derr

Highway Capacity Manual Applications Guidebook

This digest announces the results of NCHRP Project 3-64, "Highway Capacity Manual Applications Guide." In this project, a research team composed of key authors of the Highway Capacity Manual (HCM) led by Mr. Wayne Kittelson of Kittelson & Associates identified areas of confusion faced by HCM users and developed material to address those concerns.

INTRODUCTION

The *Highway Capacity Manual Applications Guidebook* (available at <http://hcmguide.com/>) uses real-world case studies to illustrate how the *Highway Capacity Manual* (HCM) and other analysis tools can be used. Any user of the HCM will benefit from reviewing one or more of the case studies. This digest summarizes the contents of the guide.

For more than 50 years, the HCM has been viewed as the authoritative reference document for use in conducting engineering analyses aimed at determining the operational adequacy of a transportation facility. Whereas the first (1950) edition of this manual contained 147 pages and was used mostly by civil engineers for sizing and designing highway facilities, the fourth (2000) edition of the manual contains approximately 1,100 pages; is used by a full range of people who contribute to the transportation system; and is a multidimensional document that addresses basic travel characteristics (speed, volume, and passengers carried, etc.), fundamental principles of traffic flow theory (speed, flow, density), mode of travel (private vehicle, walking, bicycling, and transit), level of analysis (planning, design, and operations), influence area (point, segment, facility, corridor, and system), type of analysis ("look-up" table, analytical, or computer simulation), and condition (undersaturated or oversaturated).

The HCM has obviously become a much more complex and challenging document for practitioners to effectively apply than was the case in 1950. To their credit, the authors of HCM2000

have undertaken substantial efforts to facilitate user applications, including carefully organizing the way in which the material is presented with a small set of example problems at the end of each chapter and providing a companion multimedia CD-ROM that uses audio, visual, and hypertext elements to expand upon critical points and to further illustrate problem solutions. Even so, the sheer size of the document and the complexity and inter-related nature of the included material result in several fundamental problems:

1. Many practitioners have difficulty understanding some of the parameters and how/when to apply them.
2. Sample problems take practitioners to the point of completing the calculations, but do not give guidance in interpretation or resolution.
3. The issues practitioners often face (e.g., what form of intersection control would be most effective?) are not easy to answer under the current format of HCM2000.
4. No explicit guidance is given on which input parameters are most important to "get right" and which are less important.
5. Many practitioners are not explicitly aware of the limitations of the various HCM procedures, and they do not recognize situations where other methods (such as microscopic simulation) would be more appropriate to apply.

Recently, the National Cooperative Highway Research Program (NCHRP) completed a project aimed at addressing some of these issues. The *Highway Capacity Manual Applications Guide-*

book (HCMAG) is the product of this effort. It is a web-accessible compilation of five real-world case studies that collectively demonstrate how to (a) develop suitable input data sets, (b) identify an appropriate analysis methodology, and then (c) reasonably apply and interpret the results of the selected analysis for a variety of transportation facility types. The HCMAG was designed and written primarily for new and infrequent users of highway capacity and quality of service analysis procedures, but it contains insights that will be of use to all practitioners.

Attending to the complete range of highway capacity analysis issues that can arise in real-world problems was well outside the time and budget constraints available to the NCHRP project that produced the HCMAG. Therefore, this initial edition of the guide focuses on the facility types most commonly encountered by current users of the HCM. Through user surveys, these facility types were determined to include signalized intersections, unsignalized intersections, urban streets, two-lane highways, and freeways. Even while these are the focus of individual problems contained in the HCMAG, the real-world nature of the five case studies means that each problem also addresses the inevitable interactions among multiple facility types as well as multimodal considerations.

The five case studies were selected to reflect a wide range of real-world situations from around the United States. They are as follows:

1. *US 95/Styner-Lauder intersection (Moscow, Idaho)*—This is an unsignalized intersection on an urban arterial that transitions into a two-lane highway. Issues related to intersection control type, signal timing considerations, arterial coordination, type of analysis (operational vs. planning), and two-lane highways are discussed within this case study.
2. *State Route 146 (Clifton Park, New York)*—This is an arterial segment containing both signalized and unsignalized intersections that connects to a freeway. Issues related to data collection techniques, arrival type, phasing, cycle length, lane utilization, lost time, and uncertainty are addressed, as well as issues associated with arterial/freeway interface points.
3. *Krome Avenue (Miami-Dade County, Florida)*—This is a two-lane highway that transitions into a suburban arterial and contains both signalized and unsignalized intersections. Issues related to the transition from an uninterrupted flow facility to an interrupted flow facility, application of both planning-level and operations-level analysis procedures, and evaluation of various intersection forms and control options are all discussed within this case study.
4. *Alternate Route 7 (Albany, New York)*—This is a freeway system characterized by significant freeway-to-

freeway movements and variously spaced interchanges. Issues related to basic freeway segments, weaving sections, ramp junctions, and use of microscopic simulation are discussed within this case study.

5. *Museum Road (Gainesville, Florida)*—This is an on-campus arterial at the University of Florida that also serves substantial pedestrian, bicycle, and transit volumes. Issues related to pedestrian, bicycle, and transit impacts on intersection operational and performance considerations are discussed within this case study.

Altogether, 25 problems and 73 separate analyses are contained within these five case studies. The case studies are presented within a format that allows readers to easily access the information that happens to be of particular interest to them at the time. Each case study is presented as a separate chapter, so practitioners can also follow a case study through from beginning to end in order to more fully understand the system considerations that must accompany any analysis relating to capacity and quality of service characteristics associated with a particular facility. Each case study chapter is organized to include an overview of the case study, an introduction to the issues that will be addressed, a “getting started” section that sets the stage for the problems that follow, a set of two to six problems that require one or more separate analyses, and a summary analysis of the key points made within the case study. Each case study also includes a navigable index, downloadable datasets (in XML format) that can be imported into the Highway Capacity Software and other analytical tools, and key word search capabilities.

The HCMAG is designed for use with any standard web browser, and, in this mode, it takes advantage of hyperlinks, navigation bars, and pop-up windows to make information readily available to the reader. The reader can print a hard-copy version of each chapter for use in off-line environments. Similarly, a CD-ROM version of the HCMAG is also available for use on computers where there is no on-line access to the internet.

Instruction templates that incorporate the HCMAG into discussions of highway capacity analysis will be available on or about the end of the first quarter in 2004. These materials will be presented in both PowerPoint and outline formats and are designed to facilitate the integration of the HCMAG into college-level classes and training seminars on highway capacity analysis. They will be freely available on the HCM web site.

The HCMAG is an important companion document to the HCM. It should aid in the understanding and performance levels of students, entry-level analysts, and infrequent HCM users. Through use of real-world case studies, the HCMAG also demonstrates and encourages systemwide thinking across multiple types of facilities and modes.

WHERE TO FIND IT

The *Highway Capacity Manual Applications Guidebook* can be accessed on the internet at:

<http://hcmguide.com>

A CD-ROM version is available for downloading at:

<http://trb.org/hcmag>

Later this year, the CD-ROM will be available for purchase from the Transportation Research Board's bookstore (202-334-3213).

These digests are issued in order to increase awareness of research results emanating from projects in the Cooperative Research Programs (CRP). Persons wanting to pursue the project subject matter in greater depth should contact the CRP Staff, Transportation Research Board of the National Academies, 500 Fifth Street, NW, Washington, DC 20001.

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