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# Recent developments and history of the Dutch HCM

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## Abstract

Around 1995 the need for a Dutch Highway Capacity Manual (HCM) was felt within Rijkswaterstaat (Rijkswaterstaat is the executive body of the Dutch Ministry of Infrastructure and the Environment). Previously the American HCM was used, but specific circumstances in the Netherlands made it necessary to develop a Dutch HCM. This led to the introduction of the Dutch HCM, *Handboek Capaciteitswaarden Infrastructuur Autosnelwegen* in 1999, followed by the 2nd edition in 2002. Then, after a long period a completely new 3rd edition was published in 2011 and a fourth edition was completed in 2015.

More than 15 years of research on highway capacities and the experience in using the manual has resulted in a practical handbook with an obligation to use it in planning studies for new and renewed highways in the Netherlands. The manual is one of the guidelines implemented in a working process system for planning studies.

Although different indicators have been used over the years in transportation policy, the volume-to-capacity ratio is still the main indicator for the traffic flow quality in the Dutch HCM. Before the introduction of the Dutch HCM (< 1999) this indicator had been used most frequently.

The most recent fourth version of Dutch HCM includes the research of capacities of tapers, cloverleaves, rush hour lanes and 4 lanes freeways. Weaving sections received special attention, as they are still simulated with the microsimulation model FOSIM. The new information was mostly added after requests of users. Because of a bigger role of consultants and less involvements of experts of Rijkswaterstaat in the highway designing process, guidelines become much more obligatory and nowadays contain specific minimum values and other specifications of the highway elements.

Analysis has also been performed of capacity measurements at more than 200 locations. The influence of, among others, lane width, speed limit, absence of emergency lanes, tunnels and bridges have been analyzed. Also different road work configurations have been analyzed. The results from these analyses have been used in the fourth version of the Dutch HCM to state the influence of different infrastructure elements on the capacity and to validate and update previously stated values.

*Keywords:* Dutch HCM, road design, managed lanes, traffic management, FOSIM, highway capacity

## 1 History of the Dutch HCM

At least since 1968 Rijkswaterstaat has researched the level of service (LOS) on the main roads in the Netherlands. The LOS according to the HCM was calculated every 2 years. This research was

done yearly after 1973 and continued until at least 1989. In 1986 Rijkswaterstaat conducted a first research on the capacity on Dutch freeways (Toorenburg, 1986), made possible by the installation on several freeways of the Motorway Traffic Management system (MTM). Among other functionalities, MTM counts traffic flows and measures speed on a large scale on the designated freeways (see paragraph 3.1 for further details on MTM). This has led to more knowledge about capacity values specifically for the Dutch situation.

In the 1990s Rijkswaterstaat had started the *CIA-1 project* for researching capacity. This culminated in the first Dutch HCM in 1999 (Rijkswaterstaat Adviesdienst Verkeer en Vervoer, 1999) with specific capacities for freeways (only freeways are covered in the Dutch HCM), volume-capacity-ratio and the congestion probability. Hereby the values for the capacity and the Dutch methods for determining the Level of Service achieved an official status. Other reasons for introducing a Dutch HCM and not using the American HCM anymore included: the specific situation on Dutch freeways with higher speeds and smaller inter-vehicular gaps, new traffic management systems (like ramp metering and MTM), peak hour lanes with narrow widths, and the need to update the manual more frequently. The software FOSIM (Freeway Operation SIMulation; see [www.fosim.nl](http://www.fosim.nl)) was used for estimating capacity for weaving sections because of the lack of means for measuring the capacity.

Soon after, a new, second, version of the document was introduced in 2002 (Schuurman, 2002). Then, after a long period a new third version was published in 2011 (Witteveen + Bos and TU Delft, 2011). The main reason for this long hiatus of 9 years was the necessity for research. Other causes included changes in the organization and a lack of priority. The third version was updated with new insights of the capacity of 2 and 3 lane freeways (per direction) and a more user-friendly approach for calculating the estimated capacity for weaving sections. Also the passenger car equivalent (PCE) of trucks was set on 2.0 instead of the previously used 1.5.

Since 2011 measurements of capacity and simulations with FOSIM were executed annually to prevent a longer waiting time for a new version. In 2015 the fourth version was introduced (Grontmij, 2015), which includes more capacity values based on real-life capacity measurements. Also the text has been adapted to facilitate a change in users for the Dutch HCM: from freeway design primarily done by employees of Rijkswaterstaat, to a situation where contractors and consultants do most of the design and Rijkswaterstaat acts as supervisor. This asks for more obligatory guidelines which nowadays contain specific minimum values for several design elements and other specifications of the highway elements.

The fourth version of the Dutch HCM also covers the capacities of tapers, cloverleaves, rush hour lanes and 4 lane freeways. In particular, weaving sections are given special attention as they are still simulated with FOSIM. Additional information has been added after requests from some users.

## 2 Indicators for freeway capacity

### 2.1 Early years: level of service

Rijkswaterstaat has a long history of observing the quality of the traffic flows on national roads (both freeways and highways) by measuring flow and speed. The first measurements were done manually, to identify possible traffic jams. The first traffic jam in the Netherlands occurred on the 29<sup>th</sup> of May 1955 (during Whit Sunday).

As far as is known, Rijkswaterstaat has monitored and published the level of service yearly since 1968. During these years the level of service is presented with the letters A to F, following the definition from the U.S. Highway Capacity Manual. As an example the *Nota nr. 73-11* (Rijkswaterstaat Dienst Verkeerskunde, 1973) states the level of service in 1972, indicating that “170 km of freeways and nearly 650 km of other national roads have a low level of service”. Here levels D, E and F were considered low levels of service. It was also stated that “the biggest concentration of problems with capacity were located in the Randstad” (the Midwest of the Netherlands).

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