Chapter 13
Multi-Modal Assessment of Highway Performance

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ABSTRACT

This chapter presents a multi-modal method for the assessment of highway performance. It is derived by extending a traditional assessment concept step by step taking into account the capacity and quality of different modes on the road as well as in the corridor. It defines an appropriate performance target and explains why a multi-modal concept has to consider transport demand in persons and goods rather than traffic volumes in vehicle units. It is shown that the concept allows for different options and measures to improve traffic quality and so supports the efficient use of existing infrastructure and the effective allocation of limited funds.

INTRODUCTION

This paper discusses methods for the assessment of road design. Its starting point is the traditional approach which is essentially based on the method established in the Highway Capacity Manual (HCM), the first guideline for the assessment of road design and operation, published in the United States of America in 1950. This method and its updates formed the basis of many guidelines for the assessment of road design in different countries; one of them is the Austrian Standard. This example is used to discuss the method and show how a method to assess whether an existing or planned road can fulfil its function can be extended by a multi-modal approach taking into account the capacity and quality of different means of transport on the road as well as in a corridor. Finally, it shows that a multi-modal concept allows a more efficient, cost-effective design and use of traffic infrastructure and supports an efficient allocation of limited funds by considering different options to meet road traffic quality targets. In addition to changing road design parameters, the potentials of all modes of transport as well as measures of mobility and traffic management can be considered in the assessment and planning process.

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BACKGROUND

The basis of the multi-modal concept described in the following chapter was laid when the Austrian Standard for the Assessment of Road Design RVS 3.7 (FSV, 1994) had to be revised in 2001. Austria, like many other countries, had to deal with growing road traffic volumes, the increasing financial problems of rail, and limited budgets. Moreover, there was evidence that the traditional approach of road standards assessing highway performance might not be useful to solve these problems but that tools which basically adjust road capacity to traffic demand might even be part of the problem.

In 1994, Knoflacher published considerations based on feedback loops that the level-of-service concept introduced by the HCM has repercussions on traffic growth (Knoflacher, 1994). The short-term satisfaction of transport demand, in conjunction with the assessment procedures and criteria used, forms a reinforcing feedback loop that generates ever greater demand for transport in the long term (see Figure 1).

The left side of the figure shows the logic of the HCM and of similar standards focused on road sections. When traffic volumes grow, service quality decreases. This inverse interaction is marked with a minus in the figure. Based on the standards, measures to increase road capacity have to been taken when service quality falls below a benchmark in order to raise it above the desired level again. The relation between travel quality and capacity seems to form a negative and therefore self-stabilizing feedback loop. But, in the long term, service quality, especially if it is directly related to travel speed, affects land use. This relationship is shown on the right side of the figure. Increasing travel speeds resulting in longer travel distances have caused developments such as urban sprawl and economic concentration in the last few decades. Longer travel distances led to more mileage hence to more road traffic in the road network which finally results in a higher traffic volume on the road section being the starting point of the loop. These proportional relations are marked with a plus. The inverse interaction between traffic volume and service quality again forms a negative, self-stabilizing feedback loop at the top. In combination, the two loops, however, form a positive and therefore reinforcing feedback circle. So, responding to traffic growth by increasing road capacity is generating even more traffic in the long term. Since there is a substantial time lag in the relations between increased travel speeds resulting from infrastructure improvement, land use changes, and traffic growth, this vicious circle is difficult to realize. However,

Figure 1. Reinforcing feedback loop between the level-of-service approach and traffic volume