2 MOTORIST INFORMATION SYSTEMS: AN INTRODUCTION

2.1 INTRODUCTION
Motorist information systems enhance drivers' knowledge of the situation in road networks, and thus improve driver's decision-making (Ben-Akiva et al., 1991; Bonsall et al., 1991; van Berkum and van der Mede, 1993). However, it is far less well understood whether and to what extent the interaction between the drivers themselves and the information and the drivers may reduce potential beneficial effects of these new technologies. A few models have been developed in order to assess the potential of motorist information systems. Whether these are able to capture the main characteristics of these systems is unclear (Watling, 1994). Using simulation experiments, Mahmassani and Chen (1991) and Mahmassani and Jayakrishnan (1991) found that if more than 20 per cent of the drivers are equipped with the motorist information system, the negative effects due to concentration and overreaction (Ben-Akiva et al., 1991), may begin to outweigh the beneficial effects. Concentration takes place if the information reduces the variations among drivers, increases uniformity of perceptions of network conditions and thus increases congestion. Overreaction occurs if drivers do not fully take into account the responses of other drivers provided with the same information, thereby shifting the congestion from one road to another. In these circumstances Mahmassani and Jayakrishnan (1991) argued that provision of coordinated information is necessary. Other studies, for example Watling and van Vuren (1993), supported these findings, but stated that the level of market penetration beyond which the system wide performance starts to deteriorate is dependent on the kind of information provided and the behavioural responses of the drivers.

The term motorist information system refers to an implemented information system that provides travellers with historical, current or predictive information on travel times of alternative routes, allowing travellers to choose their least costly alternative. Whether and to what extent this also leads to an increased efficiency of the transport network is the subject of the present book. Thus far, research has shown that the impacts of motorist information systems are rather uncertain, as the behavioural responses of the users towards these systems are difficult to trace. Some

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1This chapter is based on Emmerink, Nijkamp, Rietveld and Axhausen (1994) and Emmerink, Axhausen, Nijkamp and Rietveld (1995c) published in Transport Reviews and International Journal of Transport Economics, respectively.

2The phenomena of overreaction and concentration are discussed in Section 2.3.

3The level of market penetration is the percentage of drivers equipped with a motorist information system.
studies addressing this issue have been conducted; see for instance Allen (1993), Bonsall (1992b), Caplice and Mahmassani (1992), Conquest et al. (1993) and Spyridakis et al. (1991). Although these studies give more insight into the behavioural issues involved, they do not indicate a clear pattern regarding users’ responses. A large variance in the results is observed and strong conclusions can generally not be drawn.

A motorist information system affects both the equipped and the non-equipped drivers. In fact, one can argue that the following three performance measures are influenced:

1. the average road network travel time;
2. the average road network travel time of the equipped drivers;
3. the average road network travel time of the non-equipped drivers.

The interactions between a motorist information system and the drivers - resulting in changes of the above listed travel times - affect the market potential and economic viability of these systems. With most scarce commodities, the benefits obtained from buying the commodity are independent of the level of market penetration. As mentioned above, this is not necessarily true for motorist information systems. The aim of this chapter is to discuss some of the economic implications of this dependency and to raise economic issues that are relevant when implementing motorist information systems. In particular, the focus is on the externalities (both positive and negative) caused by motorist information systems, and the implications of these externalities on the economic viability. In addition, the traffic generating potential of these new technologies is discussed.

In discussing these issues, other potential purposes of motorist information systems such as a decrease in stress or anxiety, an increase in safety, a decrease in pollution etc. will be ignored. In particular the potential of these technologies to reduce stress or anxiety may be heavily underestimated.

The discussion in this chapter initially focuses on the case of recurrent congestion, that is, congestion due to under-capacity of the road network. Later on, the more relevant case of non-recurrent congestion, congestion caused by incidents such as bad weather or traffic accidents, will be addressed. This is an important extension, since expectations of motorist information systems are particularly high for non-recurrent network conditions.

The chapter is organised as follows. First, Section 2.2 reviews the literature on potential benefits of motorist information systems, while Section 2.3 turns to potential adverse effects. Next, Section 2.4 and 2.5 discuss the use of the well-known Wardrop’s principles in relation to motorist information systems; concepts that will prove to be useful throughout this book. Section 2.6 discusses the externalities involved in implementing a motorist information system, while Section 2.7 focuses on the traffic generating effects. Then, Section 2.8 touches the issue of market penetration of these systems, Section 2.9 extends the scope to the case of non-recurrent congestion, and Section 2.10 raises some issues of the government’s role in dealing

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4 In a two player game in which the players represent the road users, de Palma (1992) showed that this is not necessarily true, even with the provision of perfect information. A similar result has been obtained by Arnott et al. (1991) under imperfect information.