



# How much benefit does Intelligent Speed Adaptation deliver: An analysis of its potential contribution to safety and environment

Frank Lai<sup>a,\*</sup>, Oliver Carsten<sup>a</sup>, Fergus Tate<sup>b</sup>

<sup>a</sup> Institute for Transport Studies, University of Leeds, Leeds LS2 9JT, UK

<sup>b</sup> MWH New Zealand Ltd., 123 Taranaki Street, PO Box 9624, Wellington, New Zealand

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## ABSTRACT

The UK Intelligent Speed Adaptation (ISA) project produced a rich database with high-resolution data on driver behaviour covering a comprehensive range of road environment. The field trials provided vital information on driver behaviour in the presence of ISA. The purpose of this paper is to exploit the information gathered in the field trials to predict the impacts of various forms of ISA and to assess whether ISA is viable in terms of benefit-to-cost ratio. ISA is predicted to save up to 33% of accidents on urban roads, and to reduce CO<sub>2</sub> emissions by up to 5.8% on 70 mph roads. In order to investigate the long-term impacts of ISA, two hypothetical deployment scenarios were envisaged covering a 60-year appraisal period. The results indicate that ISA could deliver a very healthy benefit-to-cost ratio, ranging from 3.4 to 7.4, depending on the deployment scenarios. Under both deployment scenarios, ISA has recovered its implementation costs in less than 15 years. It can be concluded that implementation of ISA is clearly justified from a social cost and benefit perspective. Of the two deployment scenarios, the Market Driven one is substantially outperformed by the Authority Driven one. The benefits of ISA on fuel saving and emission reduction are real but not substantial, in comparison with the benefits on accident reduction; up to 98% of benefits are attributable to accident savings. Indeed, ISA is predicted to lead to a savings of 30% in fatal crashes and 25% in serious crashes over the 60-year period modelled.

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## 1. Introduction

The literature on the relationship between both individual vehicle speed and traffic speed on the one hand and crash risk on the other is very extensive. A useful review of the literature on the subject was performed by Aarts and van Schagen (2006), while Finch et al. (1994) examined the relationship between changes in speed and speed limits and the consequent changes in accident numbers. They concluded that there was substantial support for a relationship in which a 1 km/h change in traffic speed on a road led to a 3% change in the number of accidents on that road.

Intelligent Speed Adaptation (ISA) is a system that brings feedback about speeding behaviour into the vehicle. It may merely warn the driver about speeding or it may intervene to prevent speeding. A number of studies of driver behaviour with various kinds of ISA systems have been reported (e.g. Duynstee et al., 2001; Lahrmann et al., 2001; Hjalmdahl and Várhelyi, 2004; Ehrlich et al., 2006).

However, there has been relatively little analysis of the overall impacts that deployment of ISA would bring to the quality of the traffic as a whole. Carsten and Tate (2005) predicted the accident

reduction from a wholesale deployment of ISA, but the predictions were based not on speeds observed from real-world experience with ISA speed but rather on a literature review that mainly used studies of compliance with speed limit advice from the roadside. The high-resolution data collected from the ISA-UK project provides a rich database for establishing a comprehensive picture of the potential impact of ISA on speed reduction (Lai et al., 2008). The purpose of this paper is to explore the information gathered in the field trials in order to predict the impacts of various forms of Intelligent Speed Adaptation; i.e. what does such a change in speed distribution imply in terms of system effects? Accident reduction is the most widely accepted measures for road safety, and it is well established that there is a positive association between speed and accident occurrence as well as severity (Nilsson, 1982; Elvik et al., 2004). Hence, how many accidents could ISA potentially save? In addition, ISA curtails excessive speeds towards the high end of the speed distribution, and hence the implications for fuel consumption and carbon dioxide emissions are also examined.

Three variants of ISA have been considered within the context of this paper:

- *Advisory ISA* which informs the driver of the speed limit and warns the driver when the limit is being exceeded.

\* Corresponding author. Tel.: +44 113 3436606; fax: +44 113 3435334.  
E-mail address: [f.c.h.lai@its.leeds.ac.uk](mailto:f.c.h.lai@its.leeds.ac.uk) (F. Lai).