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# Costs and benefits to Sweden of Swedish road safety research

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ABSTRACT

This paper summarises a study designed to answer the following question: what are the benefits to Swedish society of road safety research in Sweden funded by the Swedish Transport Research Council and the programme for vehicle safety research during the period 1971–2004? The paper starts by discussing whether research can answer this question at all and explains why a well-controlled study was not feasible. A case study approach was selected, and five major research projects were examined in detail for the purpose of trying to estimate their effects on road safety. Estimates of safety effects were developed for four of the projects, indicating that road safety measures that were at least to some extent based on the findings of the research projects have made major contributions to reducing the number of road accident fatalities in Sweden. The estimates are not analytically rigorous and should be treated as qualified guesses only. Causal inferences are not possible. Nevertheless, if taken at face value, they show that the benefits to society of road safety research are large and outweigh by a wide margin the costs of the research, and of the road safety measures developed as a result of research. Thus, even if the estimated safety benefits exaggerate the true effects, the benefits of applied road safety research are likely to be greater than the costs of conducting this research and implementing road safety measures developed by research.


## 1. Introduction

The task given to the study presented in this paper was stated by its sponsor as follows: what are the benefits to society of road safety research in Sweden funded by the Swedish Transport Research Council and the programme for vehicle safety research during the period 1971–2004?

Researching the study question was challenging. Although road safety research is an applied field of knowledge, because the transport system constantly changes and accidents are influenced by literally hundreds of factors, it is difficult to isolate the effects of specific road safety measures. Furthermore, the causal chain starting with the production of knowledge and ending by the successful application of that knowledge is often more complex than in those few cases when inventions with easily detectable benefits are made. Road safety research is not characterised by the sudden invention of miracle vaccines that make the problem go away. It is more aptly described as a field in which "knowledge tends to come in small doses" (Hauer, 1983). Besides, road safety policy and long-term trends in road safety are influenced by many factors, not just research.

Several approaches that can be taken to a study aiming to estimate the costs and benefits of road safety research were considered, but judged not to be feasible. A before-and-after study was ruled out, since no clearly designated before- or after-periods exist. Besides, controlling adequately for potentially confounding factors was regarded as impossible. Time-series analysis was also ruled out. There were no clearly discernible changes from year-to-year in research funding that could be linked to corresponding changes in road safety. Besides, implementing road safety measures based on research is likely to involve considerable, often unknown, lags in time. Comparing Sweden to other highly motorised countries in terms of road safety performance was rejected, as all countries to which it is reasonable to compare Sweden have also carried out extensive road safety research that Sweden may have benefited from, irrespective of its own research effort. Finally, an econometric analysis of variables influencing road safety was rejected as there are only 35 years of data, which makes it impossible to fit anything but a very simple model containing a few variables.

A case study approach was adopted. The cases selected for detailed study were, with one exception, cases for which extensive previous evaluation studies existed and for which the causal chain going from the production of knowledge to the improvement

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of road safety was judged to be sufficiently well known to support quantitative estimates of the benefits of research. The outcome measures used in the study were changes in the number of fatalities and injuries and monetary valuation of these changes.

## 2. The case study approach

Cases were selected from a database of research projects. All research projects in this database were funded by the Swedish Transport Research Council, which existed under different names from 1971 to 2000, or by VINNOVA, taking over the functions of the Transport Research Council in 2001. Care was taken to select cases whose history could be reconstructed in some detail by means of evaluation studies or interviews of researchers or representatives of the funding body. The criteria for selecting cases were: (1) cases represent research whose quality is recognised by the academic community, i.e. the main findings have been published in scientific journals following peer review. (2) Cases lead to the development or increased use of road safety measures whose effects have been evaluated according to accepted scientific standards. (3) Cases were selected to include all four major institutions performing road safety research in Sweden (identified below). The following cases were selected:

1. Research on urban safety management at the Lund Institute of Technology, in particular a project in Växjö, designed to reduce speed in inner cities (Hydén and Várhelyi, 2000).
2. Research on child restraints at the Swedish Road and Transport Research Institute (VTI) and Chalmers Technical University (Aldman, 1962; Carlsson et al., 1987; Tingvall, 1987; Turbell et al., 1993; Isaksson-Hellman et al., 1997).
3. Research at Chalmers on neck injury protection and side impact protection (Håland, 1994; Viano and Olsén, 2001; Braver and Kyrychenko, 2003; Eriksen et al., 2004).
4. Research on police enforcement at VTI and the Department of Psychology, Uppsala University (Nilsson and Åberg, 1986; Nilsson and Engdahl, 1986).
5. Research conducted by means of the driving simulator at VTI (Törnros, 1998).

For all these cases except case number 5, estimates were developed of their effects on road safety in Sweden. No specific road safety measure developed as a result of studies conducted by means of the VTI driving simulator was identified; quantifying the effects of research by means of the simulator in terms of fatalities and injuries prevented was therefore not possible.

## 3. Evaluating the effects of selected factors that have influenced long-term trends in road safety in Sweden

Fig. 1 shows the annual number of road accident fatalities in Sweden from 1970 to 2005. In 1970, 1307 people died in road accidents. In 2005 the number was 440, a reduction of about 66%.

A trend line has been included which shows an annual decrease in the number of fatalities of 2.9%. A 95% confidence interval around this trend line is also shown. The trend line shows the systematic improvements in road safety from a fitted value of 1258 fatalities in 1970 to 454 in 2005.

In order to identify the contributions of the selected cases of road safety research to reducing the number of road accident fatalities and injuries in Sweden, an attempt was made to estimate the effects on long-term trends of as many factors as possible. The estimates relied to a major extent on previous estimates developed by VTI (Nilsson et al., 2002). Given the fact that the number of road

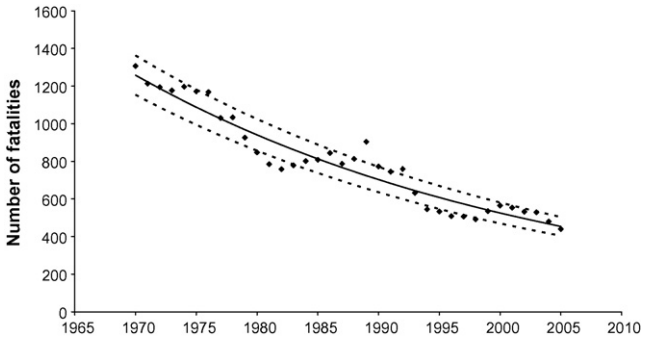


**Fig. 1.** Road accident fatalities in Sweden from 1970 to 2005.

accident fatalities in Sweden has declined from 1307 in 1970 to 440 in 2005, analysis focused only on factors that might explain this decline, not on factors that might lead to an increasing number of fatalities, although such factors have been present throughout the period.

The following sections briefly explain how the effects of various factors were estimated. Complete details are found in the main report from the study (Kolbenstvedt et al., 2007). The following factors were included:

1. Reduction of travel performed by pedestrians, cyclists and moped riders.
2. Reduction of travel performed by young drivers.
3. Construction of motorways (freeways).
4. Construction of 2 + 1 roads with median guardrail.
5. Urban speed management; speed-reducing measures in towns.
6. Increased seat belt wearing by car drivers.
7. Increased seat belt wearing by car passengers.
8. Increased use of child restraints.
9. Increase in share of cars that have airbags.
10. Enhanced neck injury and side impact protection in cars.
11. Increased and more effective police enforcement.

### 3.1. Reduction of travel pedestrian, cyclist and moped travel

National travel behaviour surveys made in Sweden during 1984–1985 (Thulin, 1987), 1992–1995 (Thulin and Kronberg, 1998) and 1997–1999 (Nilsson, 2004) show that pedestrian, cycle and moped travel has been reduced. The effects of these reductions were estimated by assuming that the injury and fatality rates remained unchanged, i.e. it was assumed that the number of injuries and fatalities would decline in proportion to the reduction in the amount of travel.

### 3.2. Reduction of travel performed by young drivers

Between 1989 and 1996, travel performed by drivers aged 18–24 years was reduced from 7758 to 4689 million km (Brüde, 2005). It has remained stable since 1996. The number of killed car occupants aged 18–24 years declined from 141 in 1989 to 77 in 2001, having reached a low of 47 in 1996 and 1997. If the 1989-fatality rate had remained unchanged, 84 fatalities would have been expected to occur in 1996 and each of the years thereafter.

### 3.3. Construction of motorways (freeways)

According to Nilsson et al. (2002) the proportion of vehicle kilometres driven on motorways increased from 18.9% to 22.5% of the total vehicle kilometres on national roads in the period from 1994 to 2000. It was estimated that the increase in the proportion of