TØI report 446/1999
Author: Rune Elvik
Oslo 1999, 116 pages Norwegian language

Summary:

Improving road safety in Norway

This report is a contribution to the National transport plan for the term 2002-2011, currently being drafted by the Norwegian government. The subject of the report is the potential for improving road safety in Norway. The report deals with road traffic only. Road traffic has the greatest number of fatalities and injuries of all modes of transport.

The potential for improving safety, the cost-effectiveness of measures and conflicts with other policy objectives

Three main issues form the subject of this report:

1 What is the maximum, theoretical potential for reducing the number of people who are killed or injured in road accidents in Norway, if all road safety measures are applied to the maximum conceivable extent?

2 What are the most cost-effective road safety measures, that is measures that give the greatest reduction in fatalities and injuries in relation to their costs of implementation?

3 What are the road safety measures that give benefits that are greater than costs, provided benefits are valued in monetary terms and include safety, mobility, transport costs and environmental factors?

These three issues refer to the maximum potential for improving safety, the most cost-effective way of doing so and the prospects for improving safety without getting into conflict with other policy objectives, relating to mobility, transport costs, and the environment.

Road safety targets for the 2002-2011 planning term

Official policy targets have been set for the 2002-2011 planning term. With respect to transport safety, a target has been set for a maximum of 200 people killed in accidents in the year 2012. This target applies to all modes of transport combined. As far as road traffic is concerned, this implies a target of no more 180 people killed in accidents in the year 2012.

A long-term vision stating that transport should not lead to deaths or permanent health impairments has been proposed for the year 2030. This long-term vision is partly based on the Swedish “Vision Zero” concept for road accidents.

Accident forecasts, prepared by the Institute of Transport Economics, are available for all years until 2030. For the year 2012, the predicted number of road accident

fatalities ranges from 282 to 372, depending on the assumptions made with respect to traffic growth and the long-term trend in the fatality rate per kilometre of travel. In this report, the highest of these forecasts has been applied (372 killed in 2012). This choice was made because this forecast is based on the assumption that the current fatality rate per kilometre of travel remains the same. This forecast implicitly assumes that only measures that maintain the current accident rate are carried out in the years before 2012. It is thus assumed that any reduction in the fatality rate must come from additional road safety measures that are carried out in the years before 2012.

132 road safety measures have been considered – 59 were included in the analysis

In order to estimate the potential for improving road safety in Norway, the cost-effectiveness of road safety measures and the benefit-cost ratio of these measures, a list of 132 measures was prepared. The list included 124 measures taken from the Traffic Safety Handbook and 8 new measures. Measures were screened for inclusion in a formal assessment of costs and benefits according to the following criteria:

1 Measures with unknown safety effects were not included. A total of 13 measures were left out for this reason.

2 Measures that, according to what is known, do not improve safety or perhaps even reduces it, were not included. This applied to 24 measures.

3 Measures that have been fully implemented in Norway, and hence no longer have any potential for further improving safety, were not included. A total of 15 measures belonged to this category.

4 Measures that overlap another measure were not included. A total of 13 measures were judged to overlap another measure, already included in the analysis.

5 Measures that are analytically non-tractable, meaning that it is impossible to define the measures in a way that permits meaningful estimates of costs and benefits to be made, were not included. A total of 8 measures were classified as analytically non-tractable.

This left 59 measures for inclusion in a formal assessment of safety potentials, costs and benefits. These measures include both well known measures, that have been used for years in Norway, and new measures, as yet not tested in Norway. The analysis included all measures, even those that probably cannot be introduced by the Norwegian government acting unilaterally. Moreover, current budget limits were disregarded throughout the analysis, as one of its purposes was to assess whether increased spending for road safety would be justified in terms of a cost-benefit evaluation.

Five alternative strategies for the use of road safety measures were developed

The 59 measures included in the analysis were combined to form five alternative road safety strategies, each consisting of a set of measures carried out during the 2002-2011 planning term. The five alternative strategies were:

1 To continue the present use of the measures (Business as usual strategy).

2 To apply measures if benefits (in monetary terms, and including all relevant policy objectives) are greater than costs, but not otherwise (Benefit-cost strategy).

3 To apply measures if the savings in accidents costs exclusively were greater than the costs (The cost-effectiveness strategy).

4 To apply measures based on the principles of Vision Zero. These principles imply reduced speed limits, tougher safety standards for motor vehicles, and more police enforcement to bring down the number of violations (Vision Zero strategy).

5 To apply all measures to their maximum conceivable extent (The maximum potential strategy).

For all strategies, effects on the number of fatalities and injuries, as well as effects for mobility, transport costs and the environment were estimated.

Road safety in Norway can be dramatically improved

Although Norway has one of the best road safety records of any highly motorised country, great reductions in the number of road accident fatalities and injuries remain possible. Table S.1 shows the estimated reductions in fatalities and injuries, as well as the 95% confidence limits for these reductions.

Table S.1: Estimated reductions in the number of road accident fatalities per year in Norway, and in the number of traffic injuries. 95% confidence limits

	Estimated reduction in the number of road accident fatalities			Estimated reduction in the number of road accident injuries		
Strategy	**Expected**	**Lower 95%**	**Upper 95%**	**Expected**	**Lower 95%**	**Upper 95%**
Business as usual	34	-1	65	910	565	1183
Benefit-cost	183	59	260	4355	1263	6895
Cost-effectiveness	203	74	274	5157	2030	7632
Vision Zero	218	131	273	5217	3519	6863
Maximum potential	248	139	285	7569	4273	9792

The estimates indicate that it is theoretically possible to reduce the number of road accident fatalities in Norway by 80%, compared to the annual average for the years 1990-1998, which was 306. A reduction of 248 would bring the annual number of

fatalities down to 58. The number of people injured in police reported road accidents can be brought down by 7,600, from about 12,000 per year to about 5,400 per year. This is a reduction of more than 60%.

The estimates indicate that continuing with business as usual will not reduce the number of road users killed in accidents. There might even be an increase, if traffic continues to grow. Figure S.1 shows the estimated number of road users killed in the year 2012, based on the accident forecast of 372 killed in that year if no measures are taken to reduce risk.

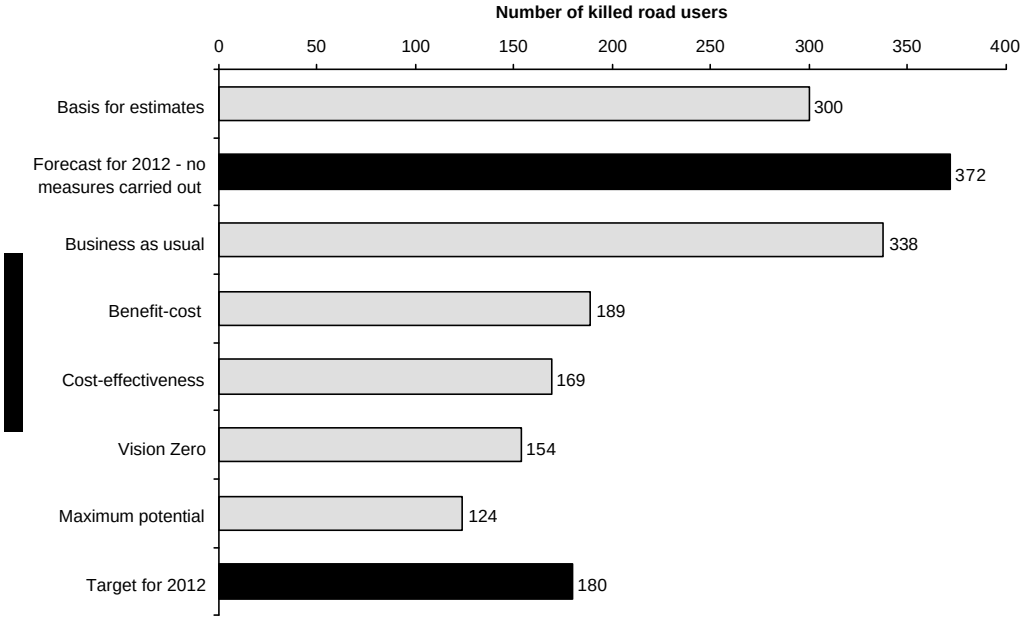

Figure S.1: Expected number of road accident fatalities in 2012 if alternative road safety strategies are implemented. Forecast for 2012 based on the assumption that no road safety measures are carried out, except those that maintain the current accident rate.

Figure S.1 shows that, in principle it is possible to realise the policy target set for the year 2012, even if the rather pessimistic accident forecast turns out to be correct. To realise the target in these adverse circumstances is, however, only possible if the most cost-effective road safety measures are given much higher priority than the case is today.

Improving road safety need not cost more than it does today

Table S.2 shows the economic consequences of the various road safety strategies. The amounts are present values in million NOK (1 NOK = 0.13 USD). A 7% discount rate was used. The row labelled “taxation costs” refers to the opportunity cost of scarce public funds raised by ordinary taxation.

Benefits are greater than costs in the benefit-cost strategy and in the cost-effectiveness strategy. In the other strategies, benefits are smaller than costs. The costs of the road safety measures are lower in the benefit-cost strategy than in the business as usual strategy. It is, in other words, possible to improve road safety substantially without increasing current public spending on road safety measures.

Table S.2:Economic consequences of alternative road safety strategies. Amounts in million NOK. 1 NOK = 0.13 US Dollars

	Alternative road safety strategies. Amounts in million NOK. Present values				
Costs and benefits	**Business as usual**	**Cost-benefit**	**Cost-effectiveness**	**Vision Zero**	**Maximum potential**
Accidents	16,130	50,308	60,005	65,747	91,450
Travel time	7,548	-6,093	-29,906	-18,964	-20,653
Vehicle costs	-3,247	7,519	5,967	1,939	-705
Environment	-377	1,327	1,832	1,167	256
Induced traffic	334	-106	-223	765	993
Total benefits	*20,389*	*52,955*	*37,674*	*50,655*	*71,340*
Investments	25,966	23,019	25,871	81,569	202,806
Annual costs	1,581	4,320	5,514	11,954	21,113
Taxation costs	4,308	2,242	2,721	14,054	28,471
Total costs	*31,856*	*29,581*	*34,108*	*107,577*	*252,390*

Table S.2 shows that the marginal returns of increasing spending on road safety measures decline very rapidly. The maximum potential strategy costs 8.5 times as much as the benefit-cost strategy, but gives only 1.8 times as large savings in accident costs. The costs of the maximum potential strategy amount to about 27% of the Norwegian gross national product in 1995. These costs are for the entire 2002-2011 planning term, however. Costs include both public expenditures and private outlays.

What ought to be done to improve road safety?

A question which is often asked, is what ought to be done to improve road safety? This question is best put to politicians or other government representatives. It is beyond the remit of research to advocate certain road safety policies. The findings of this report are, however, obviously relevant to any discussion about road safety priorities. It is therefore perhaps useful to point out the fact that some frequently made assertions in public discussions about road safety are not entirely correct. More specifically, the following points can be made:

- Road safety in Norway can be improved substantially. It is not true that all cheap and effective measures have already been taken.
- Improving road safety need not cost more than society is already spending for road safety. In particular, it is not necessary to increase public expenditures.
- ITS-systems cannot improve road safety in Norway very much in the short term. In the longer term (15-20 years), these systems could contribute towards safer roads.

- Motorways are the safest type of road, but building them is a very expensive way of reducing accidents in a country like Norway, which is sparsely populated and has lots of expensive terrain.
- The benefits of increasing speed enforcement greatly exceed the costs. This is equally true of reducing the speed limit in rural areas from 80 to 70 km/h.
- The greatest potential for improving road safety is attributable to traffic control (particularly speed limits), motor vehicle safety standards and police enforcement. Driver training and public education and information campaigns has a much smaller potential for improving road safety.