



A before–after study of the effects on safety of environmental speed limits in the city of Oslo, Norway

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ABSTRACT

Starting in the winter of 2004–2005, a temporary speed limit of 60 km/h (ordinary speed limit: 80 km/h) was introduced on one of the major arterial roads in the city of Oslo, Norway as a measure to reduce air pollution, in particular the spread of micro-particles torn from the road surface by studded tyres. The speed limit, referred to as an environmental speed limit, was in force from November 1 to March 31. Similar speed limits were later introduced on other arterial roads in Oslo. This paper presents a before-and-after study of the effects of these speed limits on accidents. Four study designs were employed: (1) A simple before–after study; (2) A before–after study using the rest of Oslo as comparison group; (3) A before–after study based on accident rates; (4) An empirical Bayes before–after study. The latter design is widely regarded as the best, but its implementation in the current study was not straightforward. The number of injury accidents was reduced by about 25–35% according to all study designs. The estimate of effect did not differ much between the different study designs. It is reasonable to rule out confounding by chance variation, long-term trends, changes in traffic volume and regression-to-the-mean. It cannot be claimed, however, that the entire accident reduction was attributable to the environmental speed limits exclusively.

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1. Introduction

Air pollution in winter has attracted considerable attention as a health hazard in the city of Oslo, Norway. There are many sources of pollution, but two of the most important are cars and the heating of houses. An important component of the pollution attributable to cars is the spread of micro-particles torn off the road surface by cars using studded tyres. These particles can be inhaled and may worsen respiratory problems in susceptible individuals. The amount of particles spread in the air depends on many factors. One of them is the speed of traffic. More particles are spread at a high speed than at a low speed.

Starting in the winter season from November 1, 2004 to March 31, 2005 a so called “environmental speed limit” was introduced on one of the arterial roads in the city of Oslo, national road number 4. This road passes through several suburbs in the northeast of Oslo. The speed limit was lowered from 80 to 60 km/h for a length of about 7.4 km. Annual average daily traffic volume (AADT) on the road varies from 42,000 vehicles at the start of the road (closest to the city centre) to about 28,000 vehicles at the end of the section

subject to the environmental speed limit. An evaluation study published in 2005 (Hagen et al., 2005) concluded that the spread of particles had been reduced. The mean speed of traffic was reduced from 76.8 to 67.2 km/h (more recent data on speed are used subsequently in this paper). The pilot project was regarded as a success and environmental speed limits in the period from November 1 to March 31 have now been introduced on two more arterial roads in the city of Oslo: (1) The ring 3 road, going around the city mainly through suburban residential areas, with a length of about 15.6 km and a daily traffic volume varying from about 50,000 vehicles (Western end) to about 70,000 vehicles (Eastern end); (2) European road 18, the main arterial in the West of the City, carrying a daily traffic volume of 70,000–80,000 vehicles and extending for about 4.7 km. Thus, three main roads in Oslo now have a speed limit of 60 km/h between November 1 and March 31 and a speed limit of 80 km/h the rest of the year. All these roads are multilane divided highways with no access points to adjacent properties and no at-grade junctions. The map in Fig. 1 shows the roads that have the environmental speed limit.

The objective of this paper is to evaluate the effects of the environmental speed limits on road safety. Although improving safety was not the chief reason for introducing the speed limits, lowered speed limits tend to be associated with a lower mean speed of traffic, which in turn very often leads to fewer accidents (Elvik, 2009;

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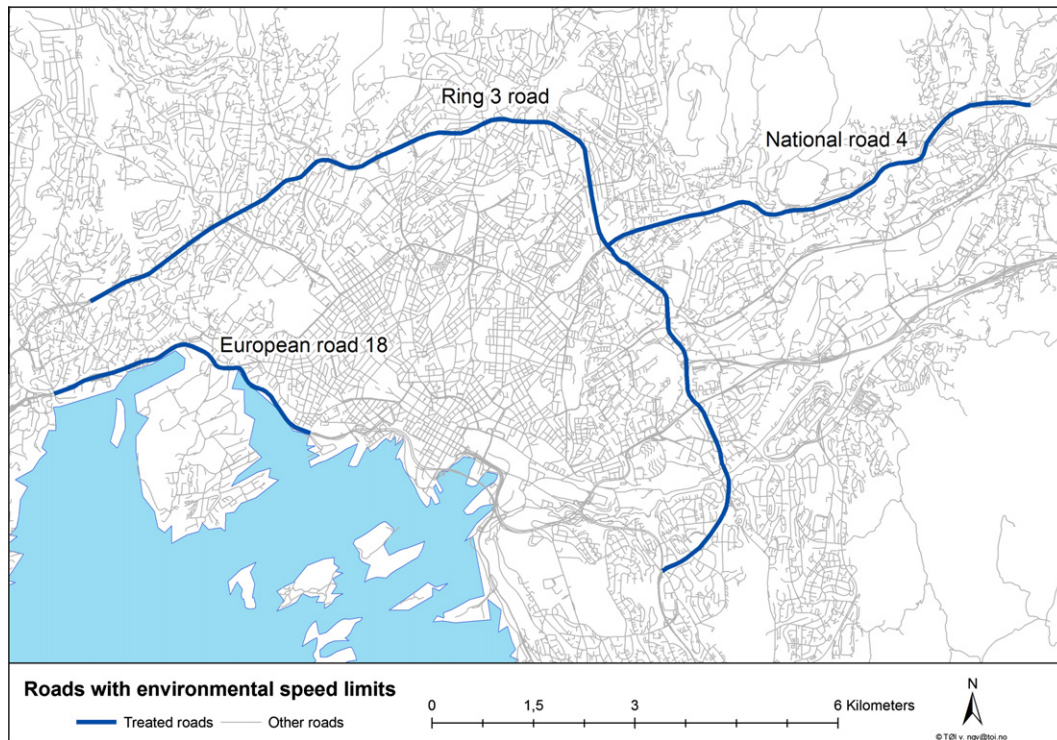


Fig. 1. Map of roads in Oslo with environmental speed limits in winter.

Cameron and Elvik, 2010). The study is based on data on accidents, speed and traffic volume provided by the Public Roads Administration, Region East.

2. Data and method

2.1. Sources of data

For national road 4, the before-period was from 1998–1999 to 2003–2004 (6 years). The after-period was from 2004–2005 to 2009–2010 (6 years). The before-period for the ring 3 road was from 2002–2003 to 2005–2006 (4 years) and the after-period from 2006–2007 to 2009–2010 (4 years). For European road 18, the before-period was from 2004–2005 to 2006–2007 (3 years) and the after-period from 2007–2008 to 2009–2010 (3 years). Data were provided for these periods by the Public Roads Administration, although for the ring 3 road and European road 18 data for longer before-periods are likely to be available. Table 1 shows the number of accidents recorded in the before- and after-periods for each of

the three arterial roads. The number of accidents refers to the period from November 1 to March 31.

For national road 4, the annual number of accidents varied between 5 and 21. All these accidents were police-reported injury accidents. Property-damage-only accidents are not reported in official accident statistics in Norway. For the ring 3 road, the annual count of accidents varied between 9 and 31. For European road 18, the annual count of accidents varied between 1 and 11. A declining trend over time was discernible on all three roads, although there were large fluctuations around the trend. Table 1 also shows traffic volume in million vehicle kilometres of driving before and after the environmental speed limits were introduced and the number of accidents in the rest of Oslo in the before- and after-periods.

2.2. Assessing the possible presence of selection bias

Although the environmental speed limits were not introduced for safety reasons, it is appropriate to check for the possible

Table 1

Accidents on treated roads, traffic volume and accidents in rest of Oslo before and after introduction of environmental speed limits.

Site	Length (km)	Before-period	After-period	Count of accidents before	Count of accidents after	Million vehicle km before	Million vehicle km after	Accidents in rest of Oslo before	Accidents in rest of Oslo after
National road 4	7.39	1998/1999–2003/2004	2004/2005–2009/2010	78	49	229.84	223.32	2222	1968
Ring 3 around Oslo	15.59	2002/2003–2005/2006	2006/2007–2009/2010	83	62	533.30	554.93	1292	1267
European road 18	4.73	2004/2005–2006/2007	2007/2008–2009/2010	22	16	174.39	166.44	1048	931
Total	27.51			183	127	937.53	944.69		

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