Speed effects of automatic camera enforcement on main road 51

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ABSTRACT

This paper presents a study that looked at changes in vehicle speeds after the installation of automatic speed enforcement on main road 51 (Räsänen, Beilinson & Kallberg 2004). The length of the road section under surveillance was 42.5 km between the cities of Kirkkonummi and Karjaa in Southern Finland. The before-and-after study consisted of spot speed measurements using inductive loops and travel speed measurements using the license plate method.

Spot speed measurements were conducted during summer (100 kph) and winter (80 kph) speed limits. Travel speeds were measured only in summer. The study did not consider how effectively the enforcement was conducted. The mean spot speeds decreased at all six measurement points by 1.5–4.4 kph (speed limit 100 kph) immediately after automatic enforcement was introduced. The effect was almost the same a year after the beginning of enforcement (the speeds decreased by 1.1–3.5 kph). All six measurement points showed a similar result also during winter speed limits (the speeds decreased by 1.5–4.9 kph). As a control, speed data from five other measurement points outside the surveillance road section were collected. They did not show the decrease in mean spot speeds.

Speed limit excesses of more than 20 kph halved at all surveillance-area measurement spots immediately after automatic enforcement. Again, the effect was almost the same a year after the beginning of enforcement. Correspondingly, speed limit excesses of 11–20 kph decreased at least by a fourth at every measurement point. Speed limit excesses of more than 20 kph during wintertime halved at three measurement points, and at three others decreased by at least by a third. Also during wintertime the proportion of speed limit excesses of 11–20 kph decreased at least by a fourth at every measurement point. However, the proportion of these remained at 10–20% after enforcement during wintertime.

The mean travel speed decreased by 2.1 kph in the direction of Kirkkonummi but not in the direction of Karjaa. However, the standard deviation of speed was also reduced in the direction of Karjaa. The number of overtakings halved in both directions.

Background information

As in most countries, in Finland the driving speeds are monitored by the police. Fining procedures are categorical. Exceeding the driving limit by a maximum of 20 kph imposes a fixed fine, called the traffic fine. The amount can be as much as 115 € (Lappi-Seppälä, 2002). Exceeding the limit by more than 20 kph results in a fine based on the driver's daily income and is invariably greater than the traffic fine. Severe excesses of speed limits lead to a driving ban whereby the driver's licence is confiscated by the police for a specified time.

Driving speed is almost always a main factor in the most severe accidents (Ranta & Kallberg 1996). Speed enforcement is considered one of the most efficient — and most cost effective — actions in traffic safety (Elvik 2000).

In recent years speed enforcement has become considerably more versatile with the spread of camera enforcement. The Finnish Road Administration co-operates with the police by building and maintaining camera equipment on the roads. Camera-controlled roads covered 800 km in Finland at the end of year 2004.

However, there has been no exact data on how speed cameras affect driving speeds in Finland. Previous studies have merely focused on the effect on accidents. This paper describes a study showing how speed cameras affect driving speeds during the first years of implementation (Räsänen, Beilinson & Kallberg 2004). The effect on traffic safety was then discussed from a viewpoint of changes in driving speeds.

Material and methods

The stretch of Road 51 studied is a typical Finnish single-carriageway two-lane rural main road leading West from Helsinki. The enforced stretch is 42 km long and is situated less than 100 km from Helsinki, between the urban communities of Kirkkonummi and Karjaa. The speed limit was 100 kph in summer and 80 kph in winter.

The Finnish Road Administration built 13 camera housings along the study stretch of road and the police started camera enforcement in May 2003. The drivers on the enforced stretch were well informed by traffic signs (Figure 1) and in local newspapers.

The before-and-after study consisted of spot speed measurements using inductive loops and travel speed measurements using the license plate method. The “before” measurements were carried out during winter in early 2002 and 2003 and in the summer of 2002. The “after” measurements respectively were carried out in early 2004 and during the summers of 2003 and 2004.

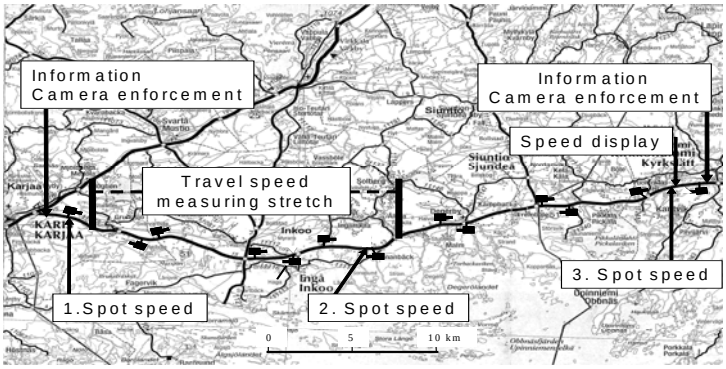

Figure 1. Enforced road stretch, measurement points, and camera housings.

There were three spot speed-measuring points along the enforced road stretch. As a control, five more measuring points were placed on the roads near the study stretch. For each measuring point and direction more than 20 000 speeds were analysed in the study. During summer even travel speeds were measured and overtakings were calculated on a 19 km long stretch.

Results

In the analysis of the results several aspects of the effects on speed distribution were discussed. Summertime and wintertime were analysed separately. Especially the effects of camera enforcement on following variables were studied:

Mean speeds

In the summer of 2003, immediately after starting the camera enforcement the mean speeds of all traffic fell by 1.5–4.4 kph. A year later in the summer of 2004 the effect remained almost as strong, with a reduction of 1.1–3.5 kph in mean speeds. The reduction of mean speeds of so-called “free” vehicles (no vehicle in front) was somewhat greater, namely 1.4–3.9 kph.

During the first winter (early 2004) after implementation of camera enforcement, the mean speeds of all traffic dropped by 1.5.–4.9 kmph.

Comparison with speed measurements elsewhere on the road confirmed a clear reduction in mean driving speeds along the enforced stretch of road.

Percentage of speeding

During the summer (speed limit 100 kmph) before camera enforcement, the percentage of speeding drivers varied between 15.9% and 42.1%, whereas a year later the range had fallen to 8.9 –34.5%.

Less than 10% of drivers were speeding by more than 10 kph (some 300–350 vehicles daily) before enforcement. As regards traffic safety this was the most important group of drivers. The speed-reducing effect of camera enforcement proved to be strongest among those who were speeding the most. Figure 2 shows that the proportion of speeding by more than 10 kph halved at most measuring points and decreased clearly at all points.

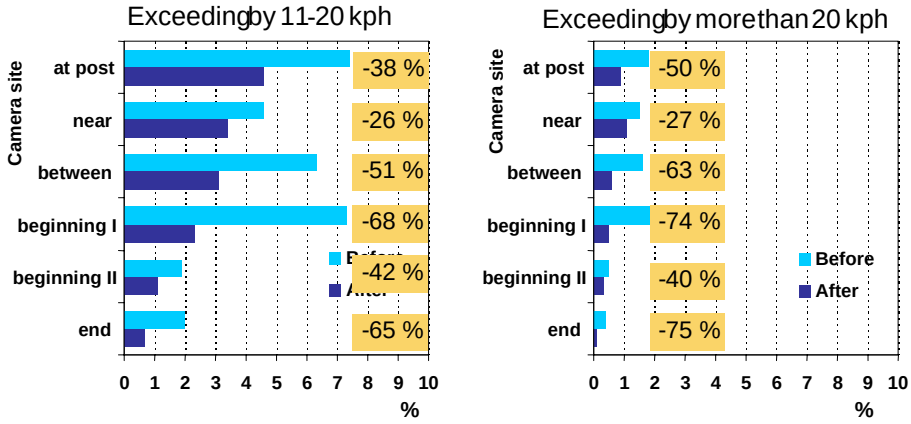

Figure 2. Percentage of vehicles speeding by 11–20 kph and by more than 20 kph in summer before and 1 year after starting camera enforcement.

In winter (speed limit 80 kph), speeding was much more common and varied before enforcement between 81.8% and 89.4% of drivers. After enforcement the percentage of speeding drivers had fallen to 70.0–82.2%.

Most of the speeding was mild, from 1–10 kph, but some 20–30% of drivers (800–1000 vehicles daily) were speeding by more than 10 kph before enforcement. The most excessive speeding was reduced the most during the winter. Speeding by more than 10 kph was reduced by 30–70% at various measuring points.

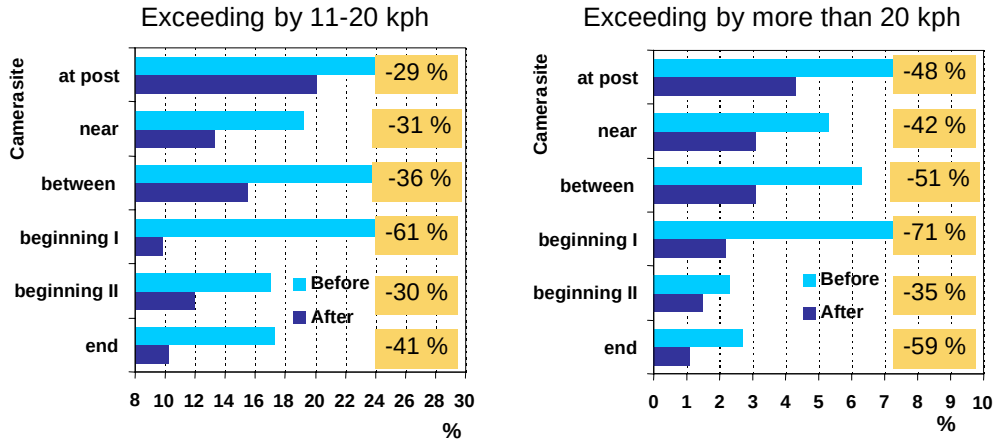

Figure 3. Percentage of vehicles speeding by 11–20 kph and by more than 20 kph in wintertime before and after starting camera enforcement.

In wintertime there was no change in the before or after measurements in the share of those speeding by 1–10 kph, and still more than half of the drivers exceeded the wintertime speed limit of 80 kph despite the camera enforcement. Speeding drivers did slow down but not enough to stay under the wintertime speed limit.

Though the camera enforcement effectively reduced speeds that exceeded the speed limit in both summer and winter, there are still many speeding drivers in traffic.

Time of day and traffic volume

In the summer the mean speeds in daytime were 0.1–1.3 kph lower than at night. In the winter the mean daytime speeds were very close to the mean speeds at night. The change in the mean speed before and after starting the camera enforcement was roughly the same for both day and night.

Speeds were reduced somewhat more when the traffic volume was low compared with heavy traffic. This may be because in low volumes of traffic there are more “free” vehicles on the road.

Weather conditions

In the summer, speeds seemed to slow down more in wet road conditions than when the road was dry.

Changes in travelling speeds and number of overtakings

Using video recordings travelling speeds were measured and numbers of overtakings calculated in summertime before the enforcement in 2002, immediately after the start of the camera enforcement in 2003, and one year later in 2004. The mean travel speeds are listed in Table 1.

Table 1. Mean travel speeds on main road 51 before and after camera enforcement .

Direction		Before -02	Immediately -03	After -04	Differ. 02/04	95% Confidence Interval
Helsinki	mean speed	95,4	92,2	93,3	–2,1	–1,5…–2,6
	st. deviation	7,4	6,3	6,5		
	n	1262	1385	1812		
Karjaa	mean speed	92,6	90,4	92,2	–0,4 ns	0,4…–0,8
	st. deviation	7,4	6,7	6,2		
	n	1672	1762	1739		

Immediately after starting the enforcement the mean travel speeds dropped clearly (3.2 kph and 2.2 kph) in both driving directions. One year after 2004 the mean travel speed in one direction had remained at a lower level (2.1 kph), but the speed in the other direction was only 0.4 kph lower than before camera enforcement. The standard deviation of the speed distribution remained lower in all cases.

The share of drivers who had overtaken during the 19 km long stretch of the road decreased immediately and still one year after starting camera enforcement. In the direction towards Helsinki the share of drivers who overtook was 55% before, 39% immediately after, and 29% one year after starting the enforcement. The figures towards Karjaa were 50% before, 35% immediately after, and 25% one year after. The existence of camera enforcement clearly decreased number of overtakings.

Driving speed and distance to camera pole

The distance of speed measuring points to camera poles varied. The results showed no connection between the distance to the camera housing and decrease in driving speeds. There was no observation of the so-called “kangaroo effect”, where drivers only slow down at the camera pole and speed up between poles. It is possible, however, that some drivers slowed down only at the camera poles.

Discussion

Naturally the change in objective and subjective risk of getting caught for speeding has an influence on driving speeds. In this study the policy of camera enforcement on main road 51 was not controlled. It was not known how many hours the enforcement camera was actually working, what was the tolerance to the speed limit and how many fines were sent.

On main road 51 the distance between camera poles varied from 4 to 9 km. From a traffic safety point of view we recommend not to use greater distances between camera poles as traffic may speed up between them.

In general the study proved that camera enforcement reduces speeding and most effectively excessive speeding. It also reduces the standard deviation of speed distribution and cuts overtakings.

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