

8. VARYING SPEED LIMITS BASED ON WEATHER CONDITIONS

Kirsi PAJUNEN,
&
Juhani MÄNTTÄRI

Technical Research Centre of Finland,
Road, Traffic and Geotechnical Laboratory
Finnish National Road Administration

When developing speed limits there has been discussion about the inflexibility of the conventional speed limits when the conditions (weather, traffic amount) on the road are changing. The Finnish National Road Administration started 1989 to test varying the speed limits based on the weather conditions especially during the winter time.

The testing place is situated in the south-eastern part of Finland on the motor traffic way that partly runs near the coast. The comparison place is situated on the same road. Because the testing place is situated so near the coast the weather conditions differ from time to time very much from the weather conditions near it. The speed limit is normally 100 km/h. It is decreased to 80 km/h if (one or more) of the following reasons are valid:

1. There is snow, ice or slush on the surface of the road (road is slippery).
2. It is snowing heavily (sight is poor).
3. It is raining hard (danger of aqua planing and poor sight).
4. The damp road surface is unsalted and the surface temperature decreases under 0 degrees Celsius (road is slippery).
5. The damp road surface has been salted and the temperature reaches the estimated freezing point (road is slippery).
6. There is thick fog (sight is poor).
7. The wind speed is over 15 m/s (it is difficult to handle the vehicle).

Varying the speed limit very often has been avoided. The speed limit should stay the same for at least an hour.

The equipment at the testing place is a weather and road surface detector system, a micro computer situated in the maintenance area office and two varying speed limit signs. The signs are based on fibre optics.

The testing of the varying speed limit was started on January the 29th of 1990. During that winter (it was very warm and the connections between the weather detector system and the micro computer were not working properly) there was only one morning when the speeds were measured. It was snowing and the average speed was 84 km/h, which is more than 10 km/h

slower than the normal average speed of the road (96 km/h). The fastest speeds decreased most.

The speeds of the comparison place were however about the same as in the testing place although the speed limit was 100 km/h in the comparison place.

During the second winter before decreasing the speed limit the head of the maintenance area office usually checked personally the weather and road surface conditions of the testing place. When snowing the speeds decreased almost the same way in the testing place as in the comparison place. In figure 1 there are the average speeds per hour of the testing place (the upper line) and comparison place 1 (the lower line) for Saturday, February the 23rd 1991. It was snowing heavily. The speeds started to decrease already before the speed limit was decreased to 80 km/h. The speeds also started to increase when the weather became better (before the speed limit was increased to 100 km/h). The average speeds of the comparison place 1 (speed limit 80 km/h) acted the same way as the average speeds of the testing place.

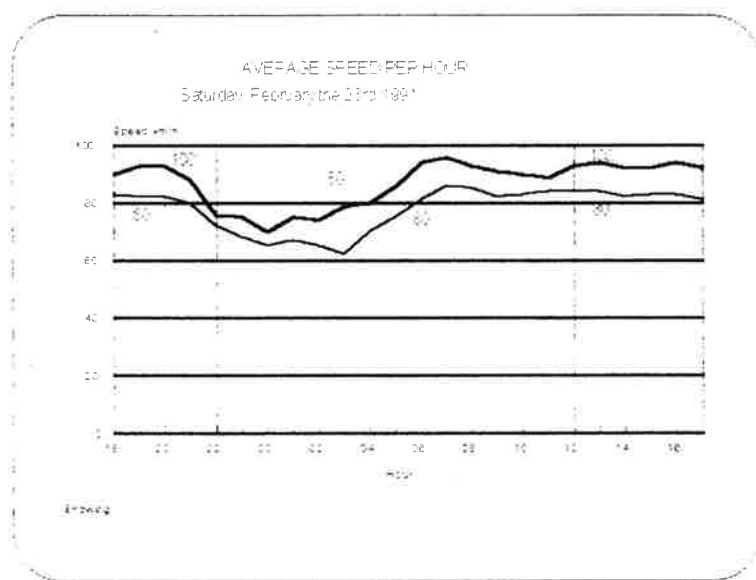


Figure 1. The average speeds per hour of the testing place and the comparison place 1 on Saturday, February the 23rd 1991 when it was snowing.

In figure 2 there are the average speeds per hour of the testing place (thick line) and the comparison place 2 (thin line) on Thursday, January the 3rd. Also then it was snowing. The speed limit of the comparison place 2 was 100 km/h. Again the speeds started to decrease before the speed limit was decreased and the speeds increased again before the increasing of the speed limit. The speeds of the testing place and the comparison place acted the same way. It seems that drivers adjust their speed according to weather conditions not according to speed limit.

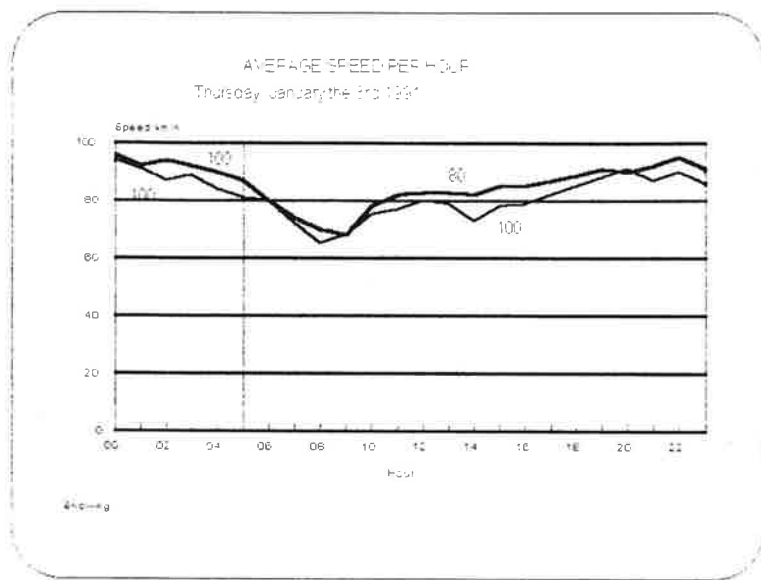


Figure 2. The average speeds per hour of the testing place and the comparison place 2 on Thursday, January the 3rd 1991 when it was snowing.

Because of the weather conditions the average speed could also decrease clearly under the decreased speed limit, for example in fog near 60 km/h. In figure 3 there are the average speeds per hour of testing place (thick line) and comparison place 1 (thin line) for Monday, March the 4th 1991 when it was very foggy. The fog began late in the evening. The average speeds of the testing place decreased clearly before the speed limit was decreased. For one hour the average speed of the testing place was under 60 km/h. Then the speeds increased again long before the speed limit was increased. The average speed of the comparison place 1 acted about the same although the changes were not so big.

When the weather was getting better the effect of the speed limit on the speeds was quite small. The average speed increased already during the 80 km/h speed limit to over 90 km/h. Normally when the speed limit is 100 km/h the average speed is 96 km/h. The effect of the speed limit sign is therefore estimated to about 5 km/h.

During the first summer the varying speed limit signs were damaged by a thunder storm. After that surge protection was added to both signs.

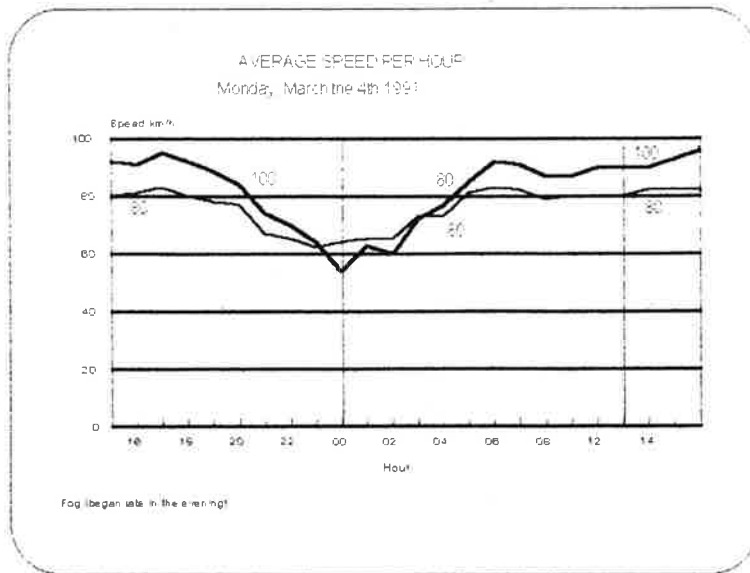


Figure 3. The average speeds per hour of the testing place and the comparison place 1 on Monday, March the 4th 1991 when it was foggy.

The use of varying speed limits during the first two testing winters was less than was planned. The reasons for that were for example warm winters, time that was needed to polish the programs and the faults in the connections. It also takes time to get acquainted with the use of the computer and the programs.

The effect of decreased speed limits was quite small. Because the sign that was used didn't look like the conventional speed limit sign it probably wasn't always understood as a limit. Therefore more information about varying speed limit signs should be available. When the weather was very bad the speeds decreased naturally significantly under the decreased speed limit.

The use of an automatic system can be considered. Then the weather and road surface detector system would give the decrease command directly to the signs. For full automation fog detectors must be added to the system.

The building of a varying speed limit system is expensive compared with the gained benefits. The expansion of the system that is directed only by the weather doesn't seem to be advisable. Later when traffic volume and speed data from the automatic traffic stations can also be used in the adjustment of the speed limit, the varying speed limits can be a sensible solution on the main roads where there are traffic jams.

The weather data could be informed directly to the road users by very simple means. That solution would be cheaper and could easily be expanded for all weather and road surface detector systems.