THE EFFECTS OF 30KM SPEED LIMITS IN URBAN AREAS

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ABSTRACT

As a result of the Swedish "Vision Zero" the interest for speed management has increased. 30 km/h zones is considered an important "tool" to achieve the goal. The aim of our project is to assess some new 30 km/h zones and to develop planning methods to support traffic planners. Within the project we have developed two new methods, "Area wide speed measurements" and "Automated video based studies of pedestrian crossing behaviour". Our results show that speeds in residential areas often already are low and that the counter-measures used do not fulfil the "Vision Zero" goal, since the 85 percentile often is above 30 km/h. We have encountered behavioural modifications both on pedestrians and drivers. The behavioural modifications could be interpreted both positively and negatively from a safety point of view. Car drivers seem to be more willing to yield for pedestrians at pedestrian crossings when the speed is reduced. Often are safety project evaluated in terms of intentions or action taken rather than the effect on traffic behaviour. One of the conclusions from the project is that operational and concrete evaluation is needed if the "Vision Zero" shall be fulfilled with reasonable resources.

BACKGROUND

The Vison Zero

The overwhelming trend regarding traffic safety in Sweden is by far the introduction of the "Vision Zero" (Vägverket, 1996). The Vision Zero is a series of policies that is aiming at totally eliminate all fatal and serious traffic-related crashes. One interesting thing with the vision is that despite that the end goal is of utopia nature, still many elements are remarkably pragmatic. There will be a shift towards more responsibility on the authorities in traffic crashes. The Vision Zero is a joint product of the "Swedish National Road Administration", "The Swedish Police" and "The Swedish Association of Local Authorities" (Vägverket, 1997).

Reducing vehicle speeds are a key issue in fulfilling the Vision Zero. In urban areas where vulnerable road users are mixed with vehicle traffic the speed could not exceed 30 km/h if the Vision Zero should be met. The choice of 30 km/h is done based on the "Crash-violence curve" for pedestrians hit by a car. Then it is obvious that the

likelihood of a pedestrian to survive a crash with a car is dramatically reduced if the speed exceeds 30 km/h.

Before 1998 it was not legal to have 30 km/h –zones in Sweden

Even though The Swedish National Road Administration worked a lot with policy document that recommended max 30 km/h on streets where there is a mix of vehicle traffic and vulnerable road users it was illegal to have 30 km/h speed limits other than on specific streets with special needs, such as outside schools. In 1998 the regulations changed and it is now up to each local town or community to decide on speed limits even on an area wide scale.

Over the last years many towns have shown a great interest in area-wide speed reduction. This project is supposed to support this work both with results on effects of introduction of area-wide speed reduction and also tools and methods for planning and evaluation .

The method “Area-Wide Speed-measuring” is described in Jonsson and Ekman, 2000 and Jonsson, 1998.

RESULTS FROM LUND

In the city of Lund an area-wide reduction to 30 km/h was introduced in 1998. The area covers the very central parts of Lund. The debate before the introduction was very loud and some anticipated a very big impact on the travel times in Lund. The results however, as illustrated bellow show a very small effect. The effect was less than one km/h witch is less than we could measure.

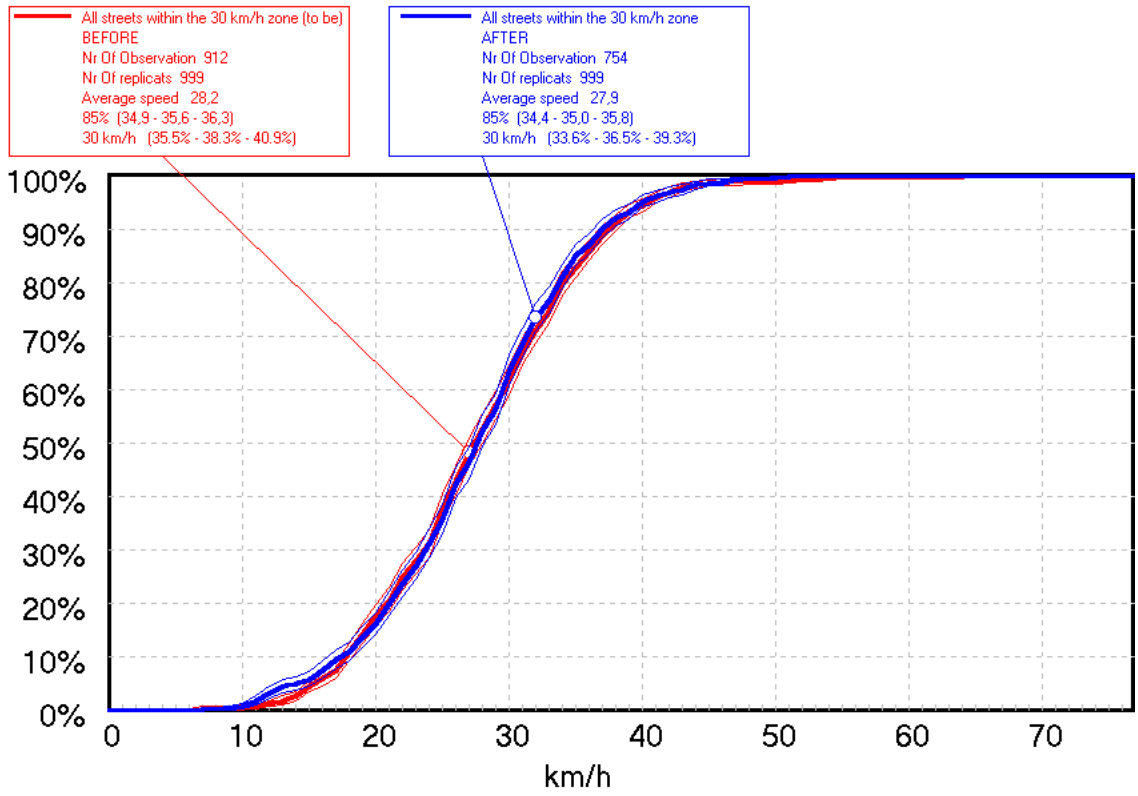

Figure 1 The results of several short speed measurements on the streets in the 30 km/h -zone in Lund

85 percentile of free vehicle speed.

Before

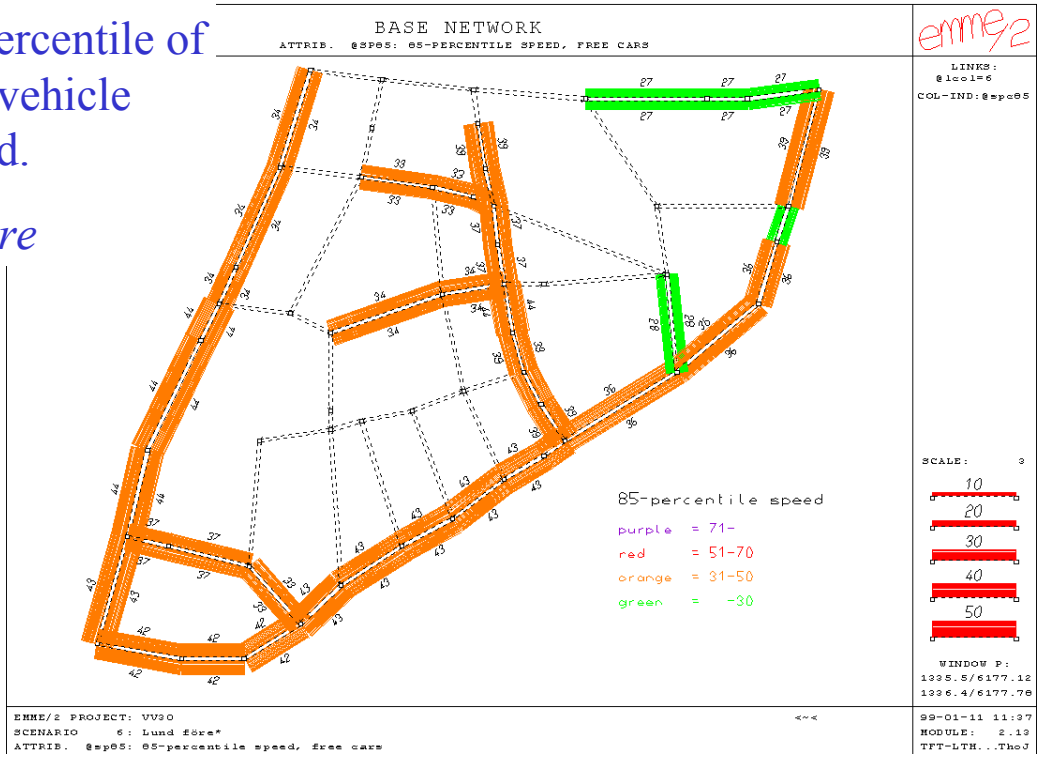

Figure 2 Area- Wide-Speed illustration of 85 percentile of free vehicle speeds in Lund, before situation

85 percentile of free vehicle speed.

After

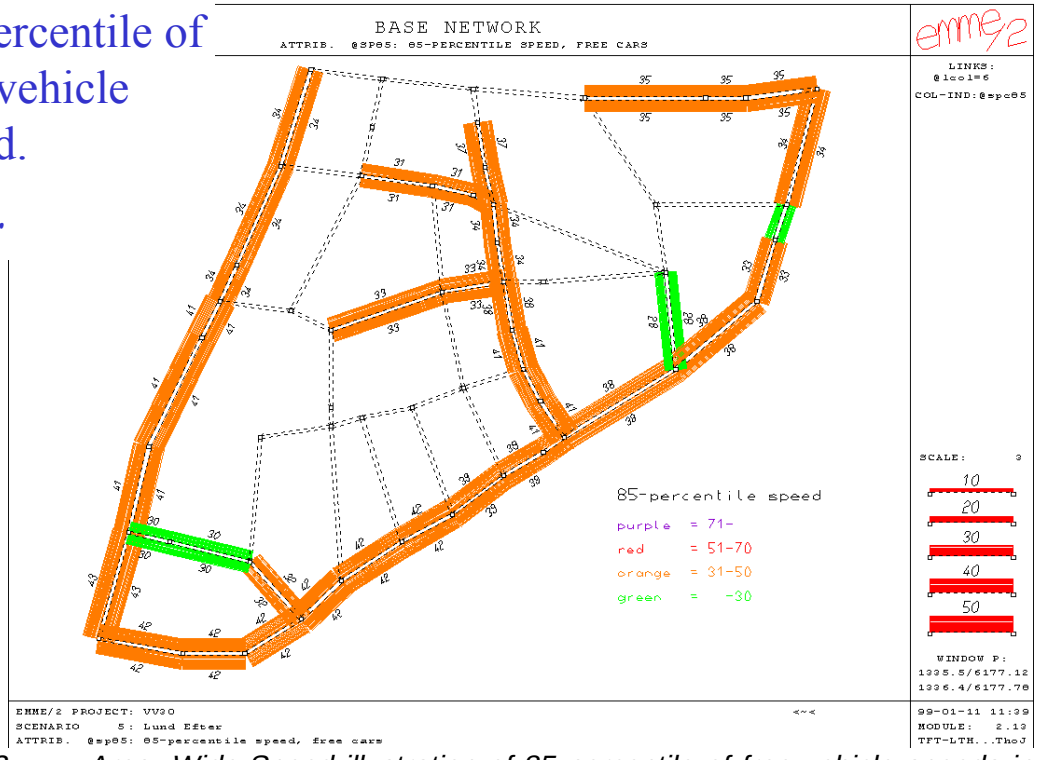

Figure 3 Area- Wide-Speed illustration of 85 percentile of free vehicle speeds in Lund, after situation

Two interesting conclusions could be drawn from this. Fist that the speeds already before the reduction of the speed limit were rather low. Only about 38% were driving faster than 30 km/h and very few faster than 40 km/h. The other, linked conclusion is

that the discussions and the debate before the introduction of the new limit could have been rather different if the speeds in the before situation had been measured and illustrated well.

One result that we found remarkable was that in our interviews many pedestrians stated that there had been a significant reduction in speeds. This is a topic that we want to continue with. Maybe drivers have a difference in driving behaviour if they drive in 37 km/h if they know that the speed limit is 50 compared with driving at the same speed if the limit is 30. The feeling of responsibility, and whether you have fulfilled your responsibilities or not, might differ if you are above or below the legal limit with the same actual speed.

RESULTS FROM STOCKHOLM

In Stockholm four different strategies was tested. In one, that already was signposted with 30 km/h and the countermeasures had more of a "refreshing character". Some speed reducing countermeasures was however installed.

In another area new speed limits with new signs was the only countermeasure.

In the third area, called "Kronoberg" The speed limit was changed, the signing was complemented by "gates". What here is called gates is a physical rebuilding of the entrance to the area. The pavement was extended over the small street. This means that a car entering the area has to drive over the extended pavement.

Figure 4 Gate in Kronoberg, Stockholm (Illustration by Sten Sedin, Stockholm konsult)

This resulted in a significant speed reduction locally around the gate but it seems to have had no major effect on the total area (Fellers, 1999).

In the forth area called "Sibirien" a more complete speed reduction scheme was implemented in this area. Not really surprising, the most significant result was obtained in the area called Sibirien where both signs and some physical countermeasures were used. The plans involved an even more substantial change in the physical environment. More humps were planned and zebra crossings were planned to be removed. These plans were revised after some strong local political pressure.

The results show clearly two things. First it is clear that there has been a significant reduction in speed. The 85 percentile was reduced with 3.0 km/h. Secondly we can once again see that the initial speeds where not as high as stated in the "before debate"

Figure 5 Countermeasures in Sibirien, Stockholm

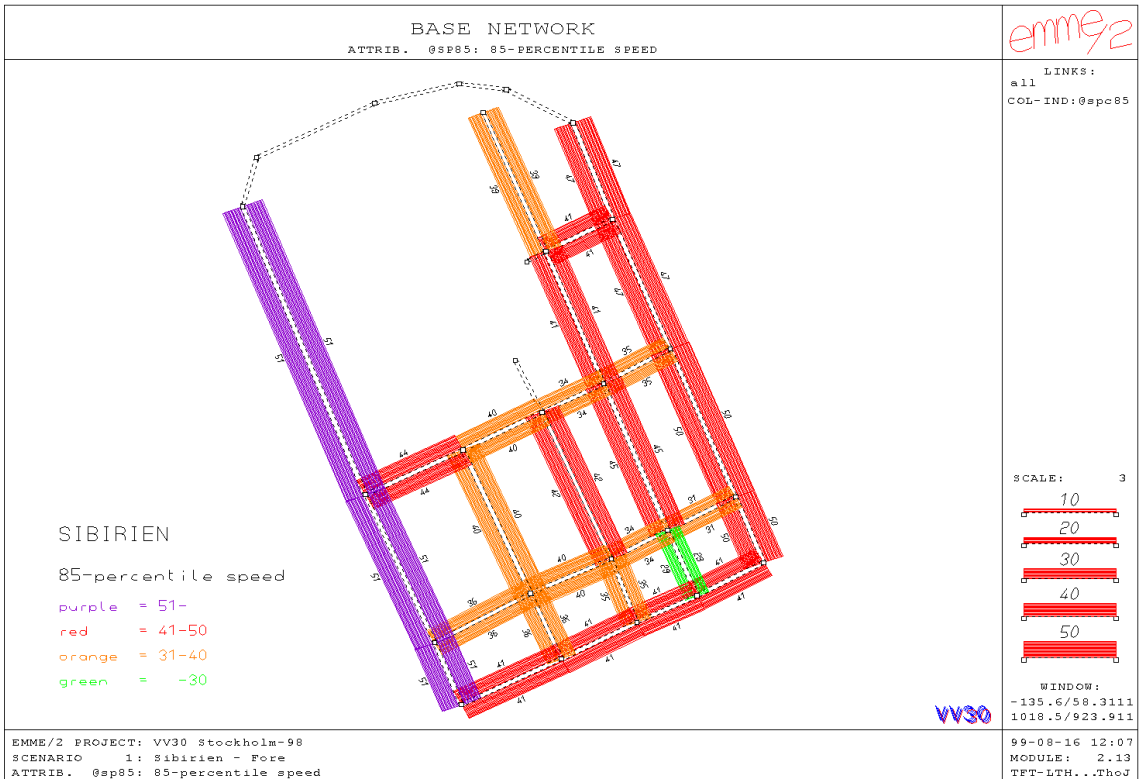

Figure 6 Area- Wide-Speed illustration of 85 percentile of free vehicle speeds, Sibirien Before

Figure 7 Area- Wide-Speed illustration of 85 percentile of free vehicle speeds, Sibirien, AFTER

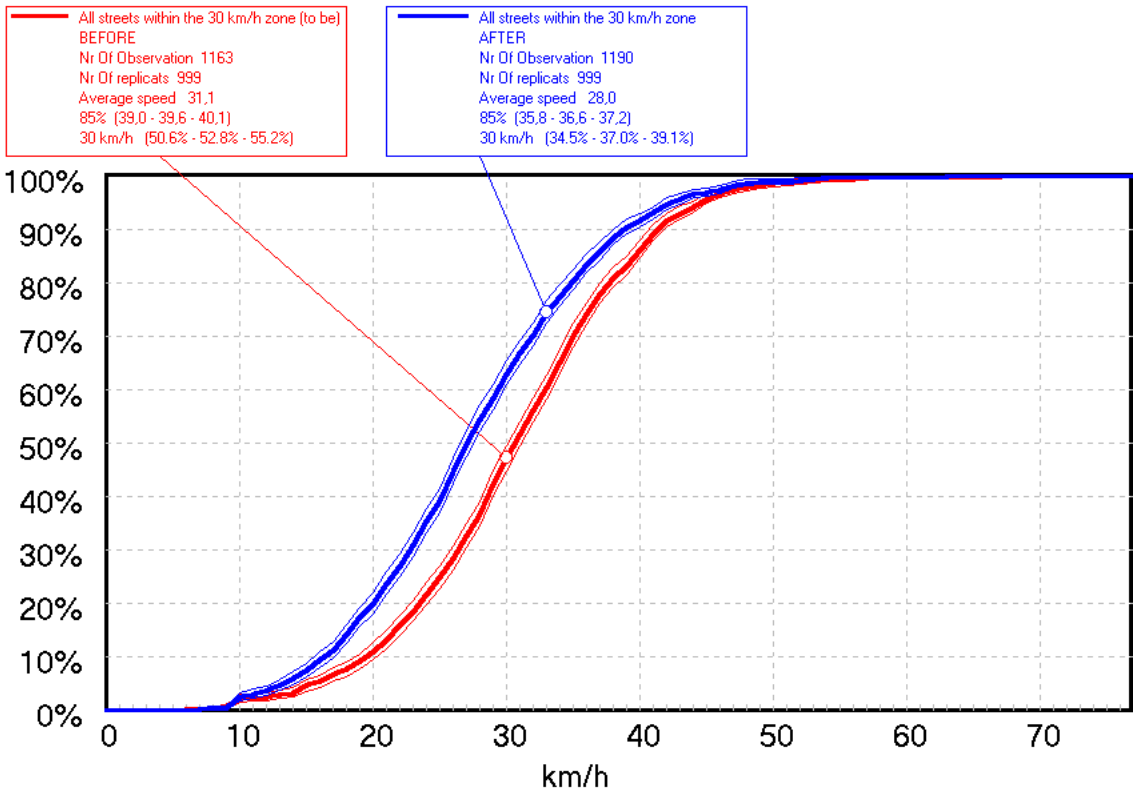

Figure 8 Result of all the speed measuring in the area "Sibirien" in Stockholm. Results before and after the rebuilding.

In Figure 8 we can see that the speed reduction is about 3 km/h. This reduction might not seem very big but the general experience of speed changes is that small changes result in relatively high outcome on safety. Another finding is that the speed reduction seems to be the same over the speed distribution. Sped reducing countermeasures like humps often give higher effect on the faster driver. The effect from Sibirien might indicate that the speed reducing effect could be explained as a result of information. The physical countermeasures used sparsely, could be seen as a information tool rather that actually forcing the drivers to drive slow at all streets.

THE EFFECT FROM ALL FOUR SITES

The result from the four different areas in Stockholm is illustrated in Table 1. We can here see that the speeds where not remarkably high in the before situation and that the reductions are small.

Table 1 The total effect of the four different speed reduction strategies tested in Stockholm. 85 percentile of free vehicle speeds

Stockholm	Before	After 1	After 2
Refreshed 30 zone	36		35
Signs	36	34	34
Signs + gates	39	37	38
Signs + gates + some humps	40		37

BEHAVIOUR ADAPTATION EFFECTS

Since behaviour adaptation effects seems to be at hand in almost any traffic safety countermeasure introduced. Even though speed normally is the regulator in the adaptation process, reducing vehicle speed might trig other adaptation processes, both on drivers and pedestrians.

The behaviour adaptation effects where studied with three different methods. The first was interviews of road users. The second was video based detailed crossing behaviour analyses. And the third was field observation in areas with different level of speed.

Interviews

In the pilot studies we found that many of the pedestrians said that they had encountered a change in drivers behaviour, in terms of driving slower and more polite.

In the more sophisticated interview we asked for situations that the pedestrians felt uncomfortable with in the interaction between pedestrians and drivers. We asked the subjects to rate the severity and the frequency of these situations. Some of the results are concluded in Table 2.

Table 2 Index for the subjective safety (the index is based on the product of severity and the frequency) (Risser and Jonsson, 2000)

Estimation of severity	Total	30[1] km/h	50[2] km/h	In my living area is it so that:
3,7	11,8	***9,7***[3]	***12,6***	drivers do not reduce speed in good time
3,8	11,4	11,5	11,9	drivers are driving too close
3,8	12,5	12,2	12,7	drivers passes at to high speed
4,4	14,5	15,0	14,8	drivers are passing to close and with too high speed
4,2	14,7	***12,1***	***15,2***	cars do not stop at zebra crossings
4,0	13,6	***12,1***	***14,0***	drivers try to pass first
3,7	11,5	10,9	11,9	turning vehicles frightens me
3,7	13,0	12,0	13,4	drivers do nor respect the speed limit
4,4	14,1	***12,1***	***14,7***	drivers are reckless
4,0	13,0	***12,0***	***13,5***	average frequency of dangerous events
Number		17	61	

The conclusion from this study is that the speed is an important factor but not the only one. The so-called other factors like “drivers do not stop at zebras” tend, however, to be more common or more serious for those living in areas where the speed limit is 50 km/h.

Detailed video analyses

The detailed video analyses we did are presented in a report by Andersson (2000). In short the findings are that we now have a very sensitive tool for making analyses of

[1] Persons living in areas with speed limit 30 km/h
[2] Persons living in areas with speed limit 50 km/h
[3] Numbers in **bold** indicate a significant difference according Man-Whitney U-test. A significant result is achieved when the difference between living in a 50 or 30 area is bigger than the difference between the total and the average.

pedestrian behaviour. The technique is yet not fully automated but it gives very detailed a rich data about pedestrian crossing behaviour. One Hypothesis tested was, whether, pedestrians should cross the street more skew if the speeds were reduced. The askewnes of crossing behaviour could be an indicator of a more “free crossing behaviour”.

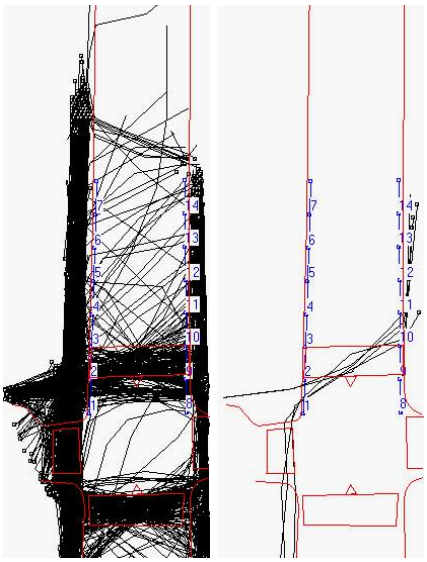

Figure 9 Example of crossing-trajectories of pedestrians with a selection of skew crossing behaviour.

The finding from two crossings that were studied was that the crossing angle on average increased from 14 to 16 degrees and 11 to 13 respectively, when speeds where reduced. If this is a big change or what influence on safety and comfort this has is yet to be found in future studies.

The third method, comparison of different locations with different levels of speed is presented in another paper. (Draskoczy, 2000). In short the findings where that the speed is an important factor for determining pedestrian right of way on zebra crossings. More remarkable is, however, that the relation between car flow and pedestrian flow is equally important. In order to provide pedestrians the legal right of way on zebras you need both low speeds on vehicles and a substantial flow of pedestrians.

The overall result indicate some major findings regarding the area wide speed reduction:

- Speeds are often rather low already
- Tools for effective planning are available.
- Only signing has little effect
- “Gating” and other physical changes might have an effect, but small
- Behavioural changes could be found, but we do not know how important they are
- The inhabitants are sensitive for the change

This study does not give the final result on whether 30 km/h zones are good or not but indicates quite clearly that the effect are rather “un-dramatic” and thus it seems to be no harm in using 30 km/h zones. The cost effectiveness of large-scale physical speed-reducing countermeasures is an interesting topic for large-scale evaluation.

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Control

Some of the studies described later in this document will be carried out in Helsingborg as well as in Lund. Helsingborg is a city 60 kilometres north-west of Lund and has about 115 000 inhabitants, compared with 100 000 for Lund. Helsingborg will be used as a control city to be able to detect eventual general changes in traffic behaviour. National data from the SNRA will also be used as a control.