

Summary:

## Extended road shoulders on rural roads: A measure for cyclists and pedestrians?

**2-minus-1-roads with extended road shoulders and removed centre line aim at improving cycling and walking conditions along low traffic rural roads. They provide more space to vulnerable road users. The number of driving lanes is reduced from 2 to 1. The measure is currently not used in Norway. Experience from other countries has shown that 2-minus-1-roads do not lead to the expected speed reductions, and that overtaking vehicles keep less distance to cyclists because cyclists cycle further away from the edge of the road than on roads without extended shoulder. There is also confusion among road users as to what rules apply on 2-minus-1-roads. Problems may also arise from sand, gravel or parking cars in the road shoulder. If extended shoulders are to be used in Norway, it is recommended that additional measures are implemented, or alternative measures that are less easy to misunderstand.**

The present study summarizes results from evaluation studies of extended road shoulder and similar measures and it is estimated what effects may be expected in Norway on rural roads with a speed limit of 60 km/h or lower. A 2-minus-1-road is shown in figure S.1.



*Figur S.1: 2-minus-1-road (Helsingør Kommune 2006).*

## **Observed effects of extended road shoulders**

In Denmark, Sweden and the Netherlands trials have been made with 2-minus-1-roads. The results of evaluation studies are summarized in the following.

### ***Speed is not reduced on the long term, if no supplementary measures are implemented***

Speed reductions have not always been found on 2-minus-1-roads. When speed was reduced, the effects were either small or only short-lived. When speed reducing measures were implemented at the same time, e.g. reduced speed limits, road narrowings, or road humps, speed was in some, but not all, cases reduced.

### ***Effects on lateral placement are contrary to the intended effects, cyclists cycle closer to the middle of the road, but not cars***

It was expected that motor vehicles would drive closer to the centre of the road, and that cyclists would remain on the right side of the road. The findings were contrary, cyclists cycle closer to the middle of the road, while the lateral placement of cars was mostly unchanged. The space between cars and cyclists in passing situations was consequently reduced. Undesired effects of 2-minus-1-roads were not found in projects where there was enough space for both cyclists and motor vehicles and neither normally were required to cross the edge line.

### ***Traffic volumes may be reduced***

In Denmark and on one of four roads in Sweden reduced traffic volumes after the installation of 2-minus-1-roads have been found. A part of the through traffic had probably been transferred to a main road with frequent congestion problems. This result indicates that 2-minus-1-roads make driving less attractive, which is one of the intended effects. Effects on cycle or pedestrian volumes have not been evaluated.

### ***No increased feelings of security have been found***

Effects on feelings of security among cyclists have been evaluated in Denmark and Sweden. The results are ambiguous and large proportions of cyclists were not feeling safe neither before nor after the roads were converted to 2-minus-1-roads.

### ***Driving rules on 2-minus-1-roads are unclear and may be misunderstood***

In Denmark only about 30% of all road users thought that 2-minus-1-roads had the intended effects and that other roads also should be converted to 2-minus-1-roads. Most drivers stated that they knew how to drive on a 2-minus-1-road. All the same almost none gave the right answer to the question about the meaning of a sign that had been set up in order to explain what drivers shall do in case of oncoming traffic. Conflicts were observed in narrowed road sections where drivers did not know who was expected to yield (right of way was not formally defined).

## **Why do 2-minus-1-roads not work as intended?**

An undesired effect of 2-minus-1-roads is reduced space between motor vehicles and cyclists. The effects on speed are not as intended either. Possible explanations are two misunderstandings and worse driving conditions on the road shoulder.

### ***Misunderstanding no. 1 “The other has to give way”***

2-minus-1-roads are a new type of roads and road users have therefore no experience with it. Both car drivers and cyclists may perceive the extended shoulder as something it is not meant to be.

- Cyclists may believe that the extended shoulder on a 2-minus-1-road is a cycle lane because the edge line is similar to cycle lane markings. This may lead to the expectation that motor vehicles have nothing to do in the road shoulder.
- Drivers of motor vehicles may think that the extended shoulders are a part of the driving lane because the driving lane in the middle of the road is too narrow when there is oncoming traffic. This may lead to the expectation that cyclists have to use the rightmost part of the shoulder and give way to motor vehicles.

If both drivers and cyclists misunderstand the road markings on 2-minus-1-roads in the described manner, it is not difficult to imagine what may happen.

In Denmark a sign has been installed and brochures were distributed which explained the intended driving patterns. The sign was not understood. It seems questionable if a road design should be so complicated that user instructions are needed. Roads should rather be self-explanatory and “make” road users behave as intended.

### ***Misunderstanding no. 2 “Great to have a wide driving lane”***

The failure to find speed reductions may be due to the fact that both the driving lane and the road shoulders became wider when roads were converted to 2-minus-1-roads. Both wider lanes and wider shoulders have often been found to increase speed. On 2-minus-1-roads traffic volumes are usually small, and the probability of oncoming traffic may be underestimated by drivers.

### ***Maintenance problem***

If 2-minus-1-roads were leading to a changed lateral placement of motor vehicles towards the centre of the road, more sand, gravel etc. may accumulate in the road shoulder. This would make cycling on the right side of the road quite unattractive, and thereby neutralize the potential positive effect on the distance between motor vehicles and cyclists. However, no large effects on the lateral placement of cars were found and no information about the cycling conditions on the road shoulders on the trial roads is available. Parking cars on the shoulder were however reported as a problem in Sweden.

## **Possible use of extended road shoulders in Norway**

The intended effects of 2-minus-1-roads are more likely to occur if this road type is supplemented by other measures. 2-minus-1-roads may also be replaced by alternative measures.

### **Supplementary measures**

Speed reducing measures, such as reduced speed limits or speed enforcement, may improve the effects of 2-minus-1-roads on speed. Physical speed reducing measures, e.g. chicanes or rumble strips, may have negative effects on cyclists. Road narrowings may cause conflicts when there is oncoming traffic or in passing situations. Road humps that are designed in a cycle friendly way are a possible supplementary measure. Road lighting may also supplement 2-minus-1-roads. It has been found to improve safety and to make walking and cycling in the dark more pleasant. Warning signs may be used in critical situations such as sharp bends.

### **Alternative measures**

An alternative measure which has the same aim as 2-minus-1-roads, but a different design are “bike and chevron” road markings. An example is shown in Figure S.2. Bike and chevron symbols are marked on the right side of the road, indicating that cyclists are supposed to use the road, without suggesting that the right part of the driving lane might be reserved for cyclists. In Belgium and San Francisco it was found that this type of road marking has positive effects on driver and cyclist behaviour and reduces conflicts.



*Figur S.2: "Bike and Chevron" in San Francisco (fcgov.com Transportation Planning).*