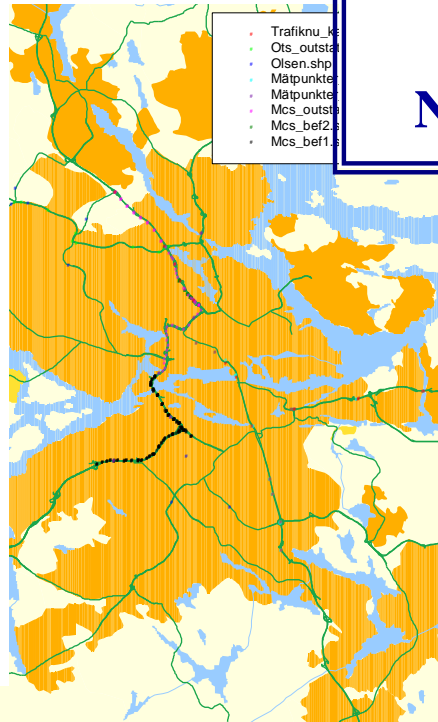


Low cost safety measures in Sweden

Anders Wengelin

Swedish Transport Administration



State roads:

Almost 100 000 km

Rural and major town through road

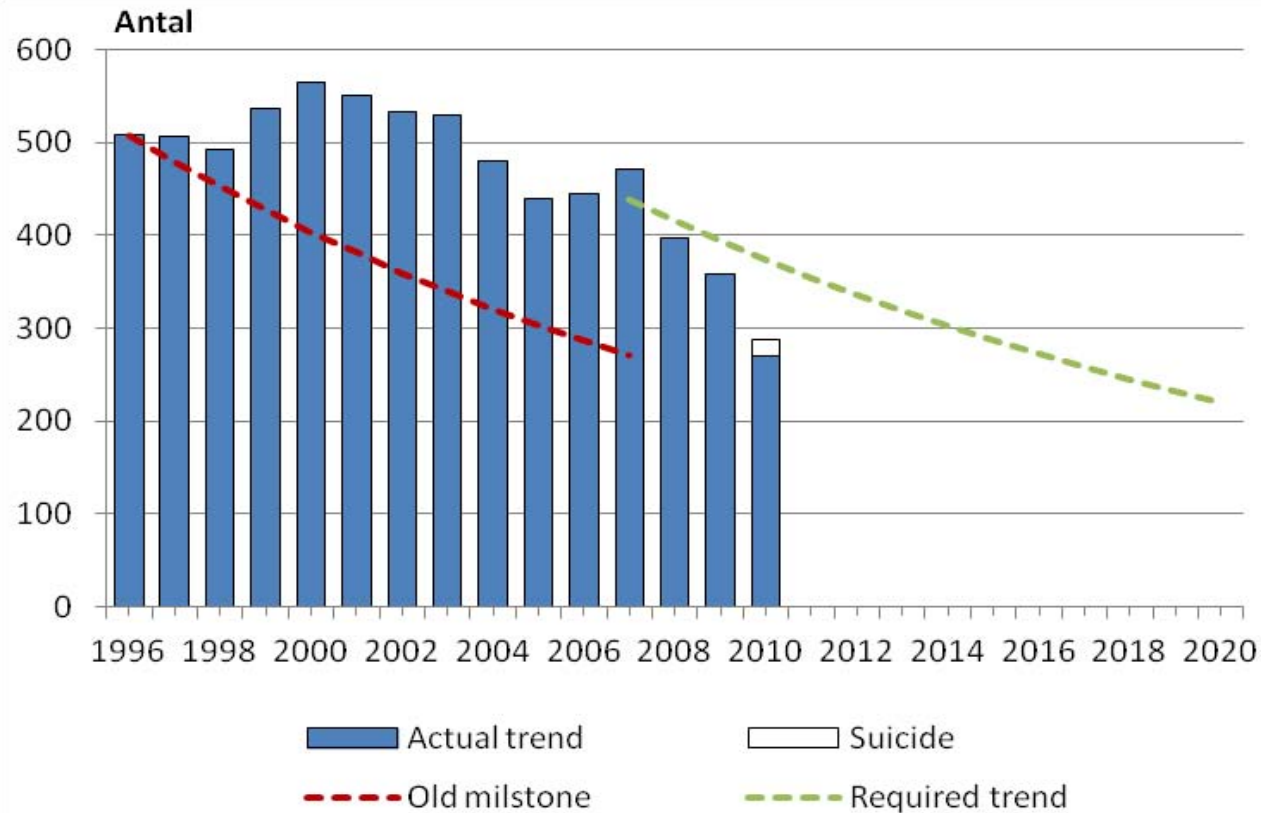
National roads 8000 km

Municipality roads

40 000 km

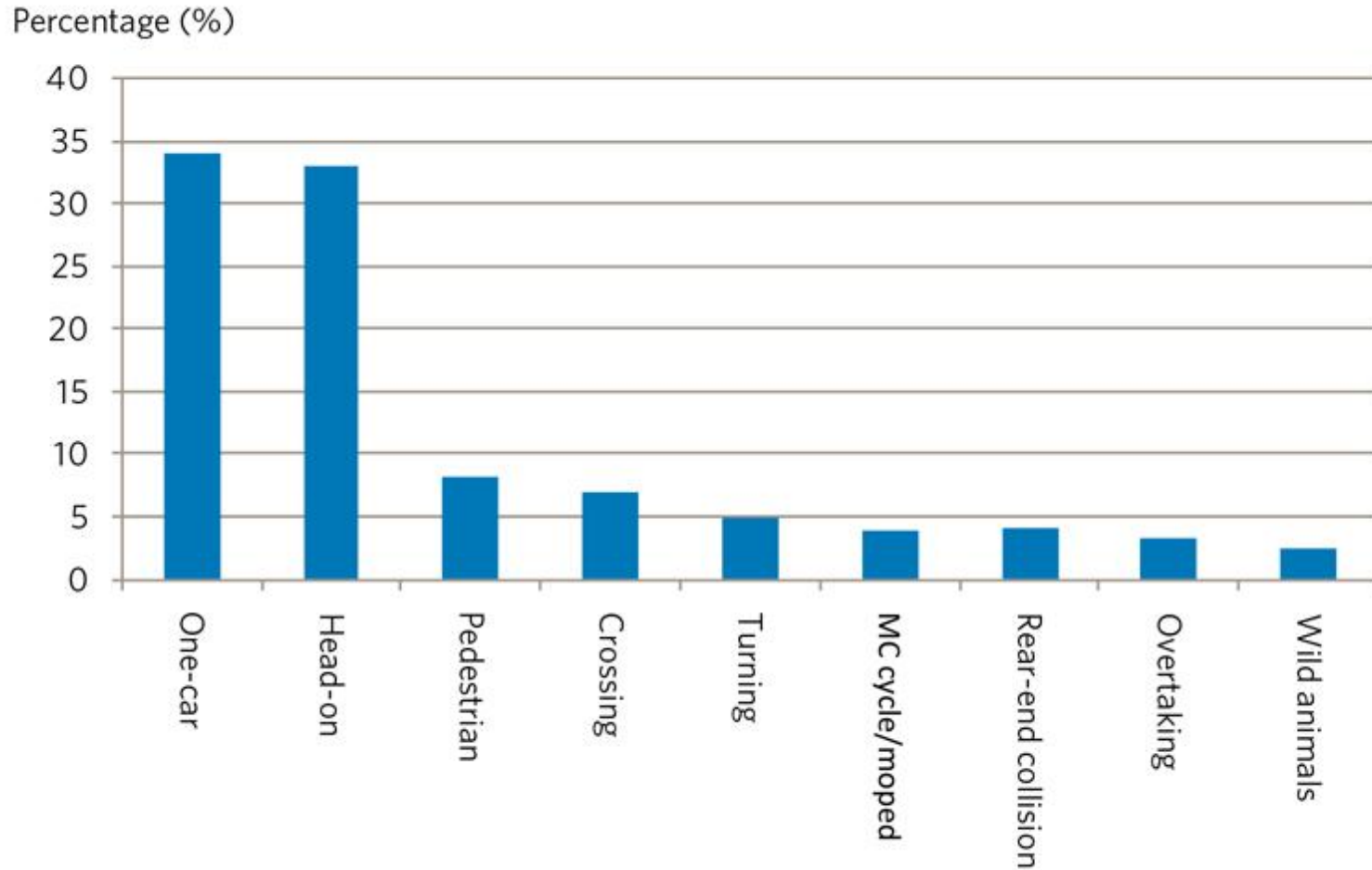
Private roads

Traffic fatalities:



- **State roads 200**
- **Municipality roads 60**
- **Private roads 10**

Fatalities 2006-2010 by accident type:



Motorway cross-sections

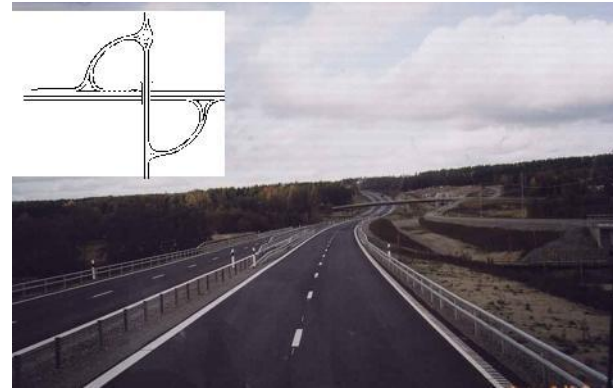


Traditional 26.5 m

- 3.75 m traffic lanes
- 2.75/1.0 m outer/inner hard shoulder
- 4 m median

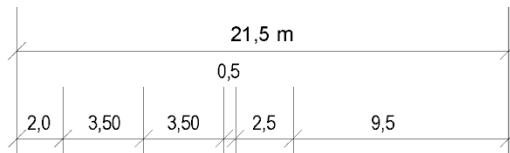
Low cost/low intrusion 18.5 m

- 3.25 m traffic lanes
- 2.0 m outer hard shoulder
- 1.5 m median



Today's compromise 21.5 m

- 3.5 m traffic lanes
- 2.0/0.5 m outer/inner hard shoulder
- 2.5 m median



Vägbana Mittrensa Vägbana

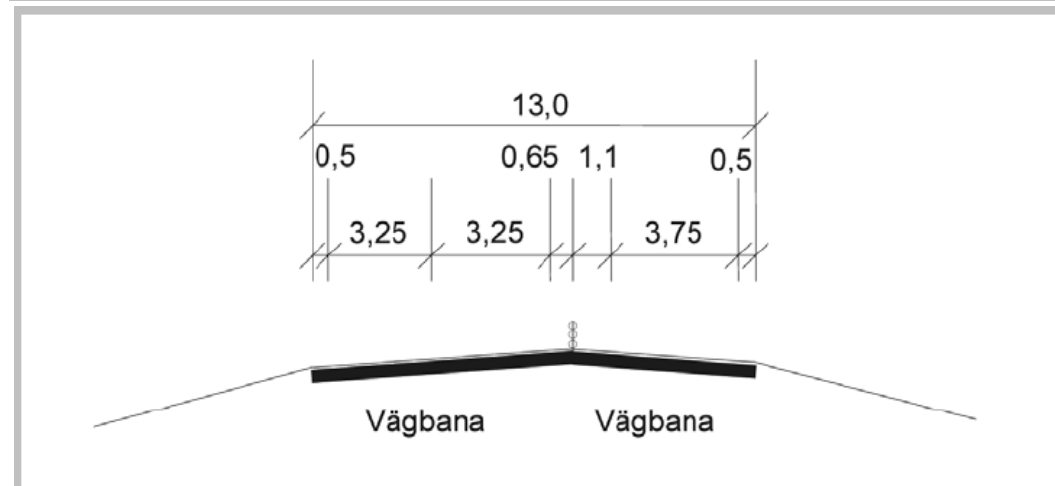
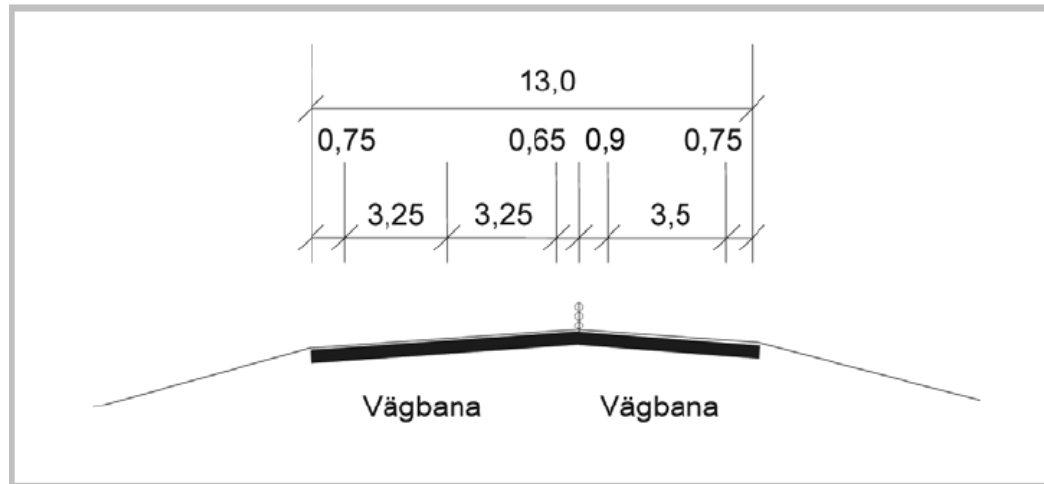
Low cost safety improvements step 1

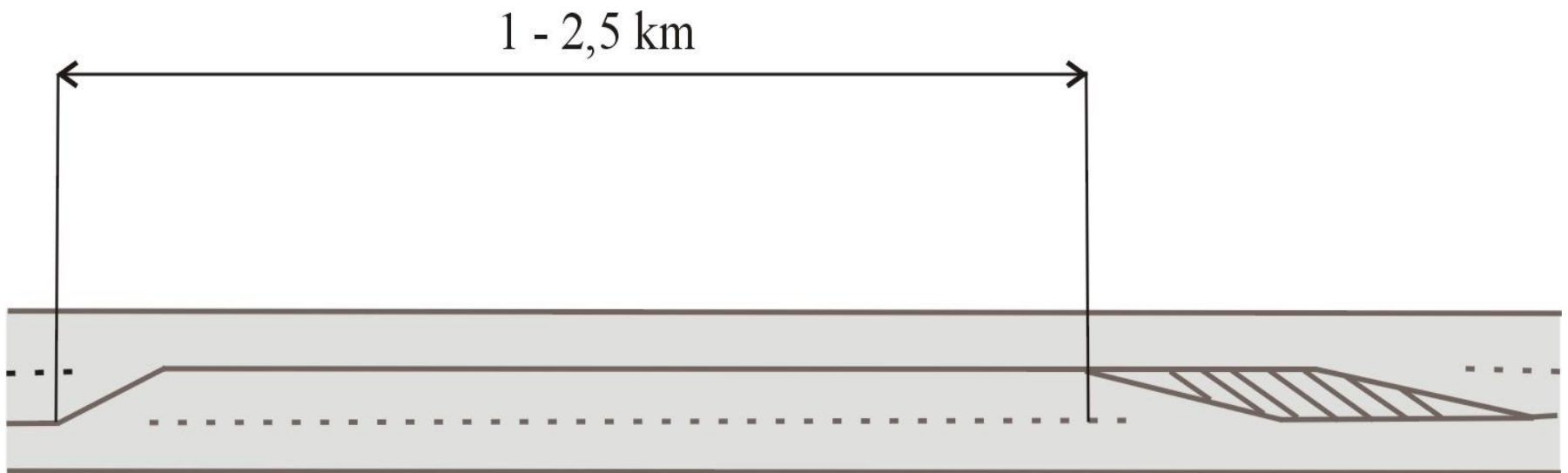
- 2+1 with median barrier -



- **Over 2 000 km wide two-lanes converted to 2+1 cable barrier since 1998**
- **Investment cost 200-300 E/m**
- **70-80 % decrease in fatalities**
- **Improved level-of-service**
- **Barrier crash rate 0.3/Million veh km**
- **Maintenance and rutting disadvantages**

Standard cross section on existing 13 m wide road





- **cable barrier**
- **intersections in transitions**
- **access control and separation, if possible**
- **sometimes 1+1 or 2+2**

Low cost safety improvements step 1

- 2+1 with median barrier -

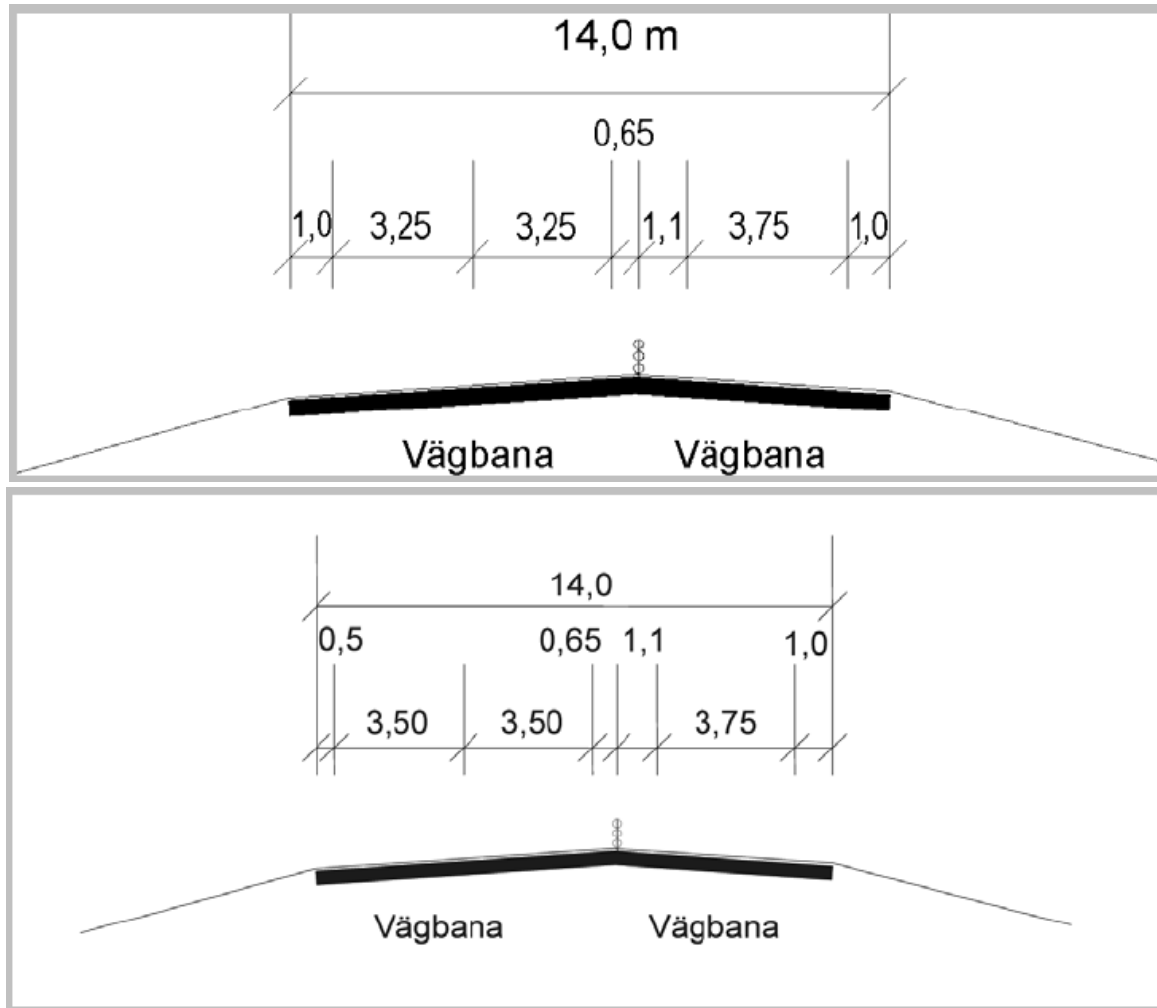


- **Over 2 000 km wide two-lanes converted to 2+1 cable barrier since 1998**
- **Investment cost 200-300 E/m**
- **70-80 % decrease in fatalities**
- **Improved level-of-service**
- **Barrier crash rate 0.3/Million veh km**
- **Maintenance and rutting disadvantages**

One-lane width > 5.1 m
Else problem for wide transports and emergency vehicle



Standard cross section on new road 14 m

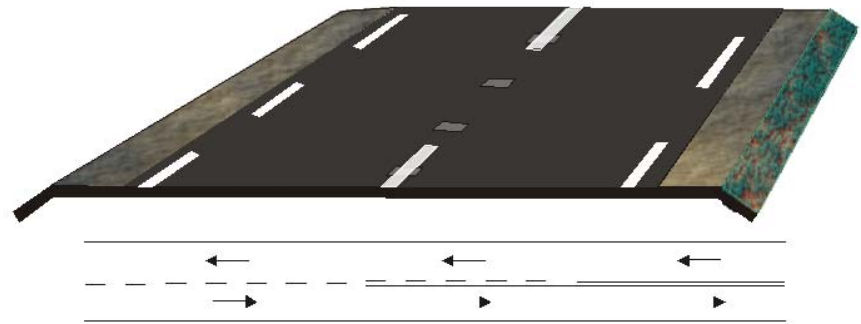


Low cost safety improvements step 2

- Milled rumble centre lines -



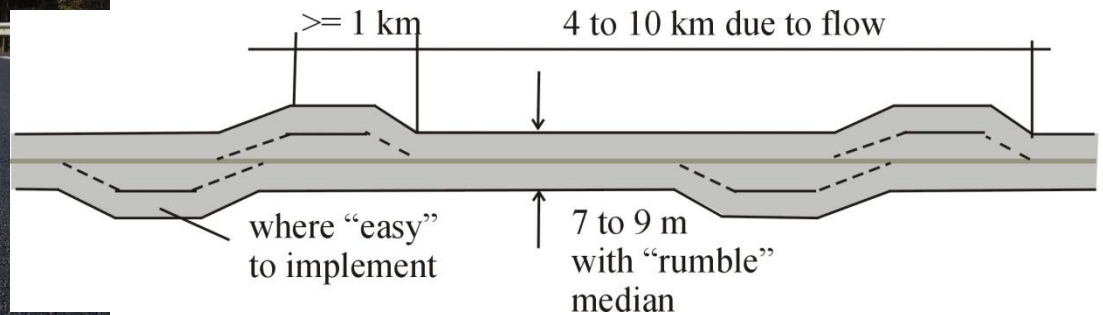
- since 2005 some 4000 km
- safety effects ?
- some noise problems
- motor cyclists



Low cost safety improvements step 3 - rumbled medians and overtaking lanes -



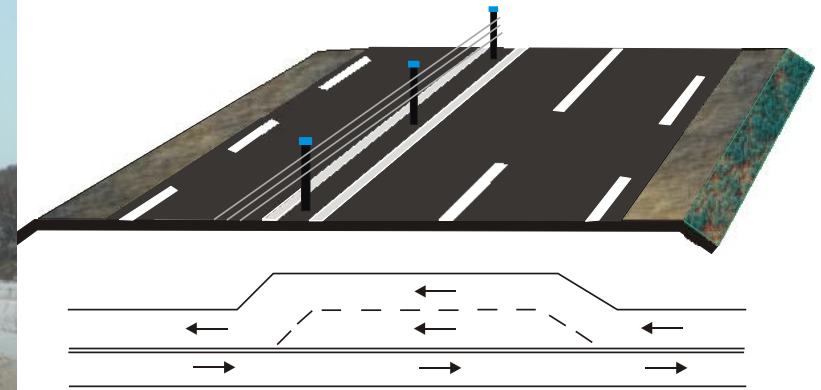
- some 50 km
- to be applied on <9 m two-lane roads



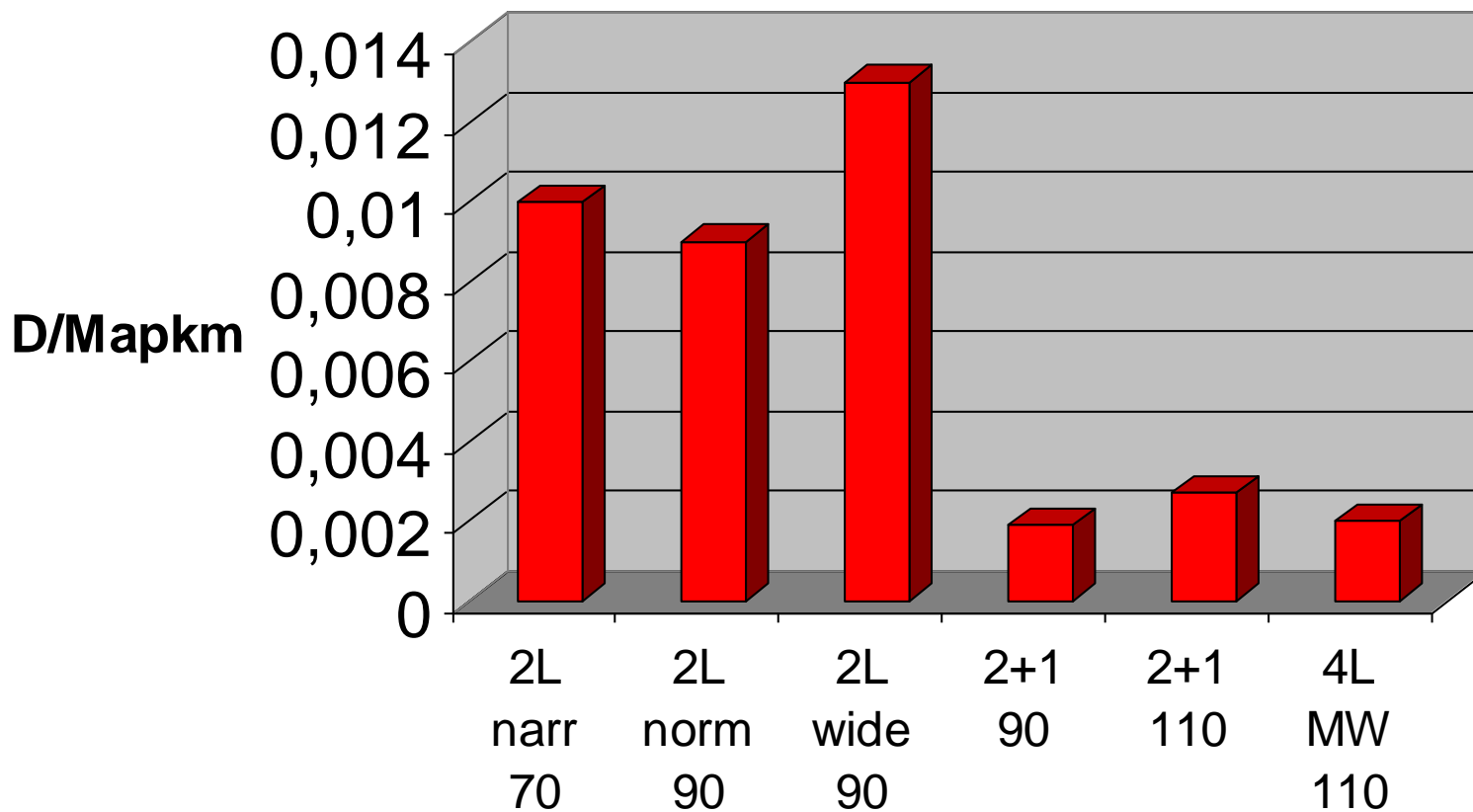
Low cost safety improvements step 4 - median barriers and overtaking lanes -



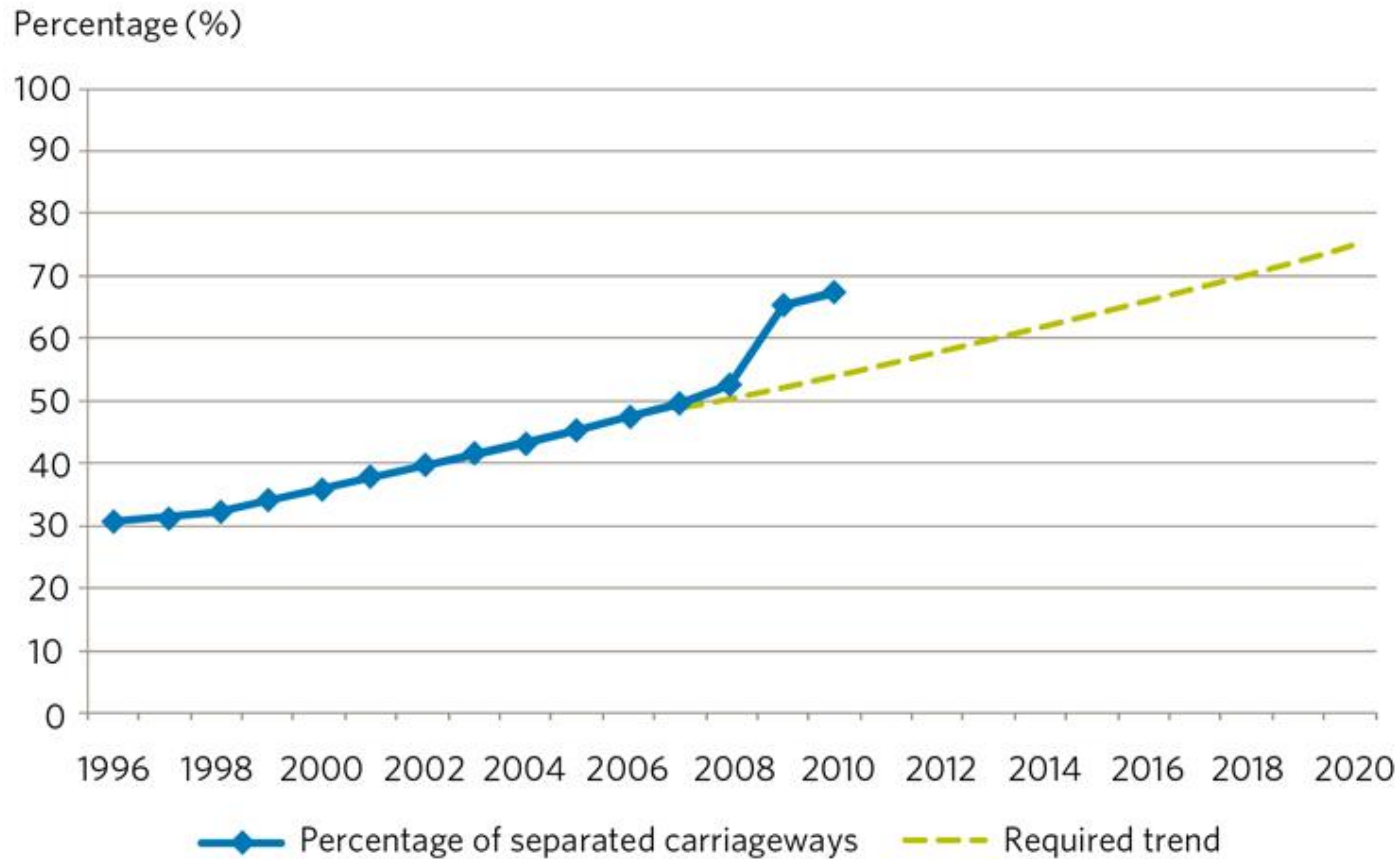
- to be applied on 9 m wide two-lane roads
- the first 2 projects opened 2009



Fatality rate



Ratio % traffic load with median separation over speed limit 80







How long should a guardrail be...



”Open window”



”Close the window”



Median barrier

The median barrier take care of single run-offs to the left...



Guardrails to increase safety at run-off

