STAR RATING EUROPE'S ROADS FOR SAFETY

EuroRAP Year 1 (2003) update – performance tracking of roads

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EuroRAP
EUROPEAN ROAD ASSESSMENT PROGRAMME

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EuroRAP Year I (2003) update - performance tracking of roads

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A core objective of the European Road Assessment Programme (EuroRAP) is to measure and raise awareness of risk. During 2003, several elements of performance monitoring of roads supported this goal: risk rates were tracked over time; the performance of different groups of road was compared within and between countries; and measurement of collective risk provided estimates of the potential for accident savings over road networks. Roads where accident reductions have been achieved were identified, as were those that had persistently high risk. Understanding of the component parts of this risk has demonstrated the important contributors to overall risk on road sections. A system of road inspections (the EuroRAP Road Protection Score) has been piloted to understand the extent to which roads protect from severe injury once an accident has occurred.

DEVELOPMENT AND PROGRESS

The methodology for a European Road Assessment Programme was developed and piloted during 2001 and 2002 (see Lynam et al. 2003a & b), based primarily on three national datasets (from Sweden, the Netherlands and Great Britain) plus some supporting data from Catalonia. The three main countries were chosen for the early development of the programme because they were known to have good safety records and were likely to have good access to the data needed. The work during the first full year of the programme (2003) focussed on consolidating and extending the methodology, and on increasing the number of countries involved. Considerable progress has been made in both these areas, and in particular in tracking and comparing the performance of roads. Here, this work and the release of the 2004 British results are summarised. Full details are at www.eurorap.org.

During 2003, the principles underpinning the programme and the ways in which EuroRAP data can provide useful lessons were debated at both national and European level. Dialogue has been prompted within individual countries between EuroRAP and road authorities. This debate has been extended in Sweden to the stage where a national road inspection programme has been launched. National conferences or workshops were held in Britain, France and Italy in 2003 and in Spain in the first half of 2004.

The programme has demonstrated that data from different time periods can be compared to provide an indication of the change in safety performance over time. This has mainly been demonstrated with data from Britain and the Netherlands. EuroRAP analysis has shown how safety has changed in different parts of the network, and different road types, within each country, and the extent to which the higher risk roads have been improved. Full details are provided by Lynam et al. (2004).

Methods have been developed for comparing safety performance between networks and between countries. These go beyond the standard simple comparison of average accident rates, to show how the distribution of accident rates across the network has changed. They also provide an indication of the extent to which the safety performance relates to infrastructure standard or to road-user behaviour.

Potential links with existing engineering programmes have been clarified. The launch of the 2003 (and 2004) results in Britain was done in close consultation with the local and national highway authorities. EuroRAP shows how an improvement programme can progress from blackspot treatment to route management and then to assessing overall network quality. The methodology for road inspections and scoring has been refined. Risk tables have been developed, based on speed limit and road design features, for the injury protection that the road provided in relation to three key accident types – head-on collisions, single vehicles leaving the road, and side impacts at intersections. The system (the 'Road Protection Score') has been trialled by scoring a sample of roads in seven different countries, and further development of the scoring system proposed.

EXTENDING THE PROGRAMME

The programme now provides a basis for a European safety monitor of road networks which the European Commission could use as part of a regular assessment of road safety performance of member states. Illustrations have been provided (see Lynam et al. 2004) of the way in which the various risk indicators can be compared between countries, and the lessons that could be learnt from their comparisons. The outputs could show how changes in safety risks within the road network in each country are contributing towards the overall Commission target for casualty reduction.

TRACKING PERFORMANCE

Analyses have been made of fatal and serious accidents occurring on the EuroRAP network in each of Britain, Italy, the

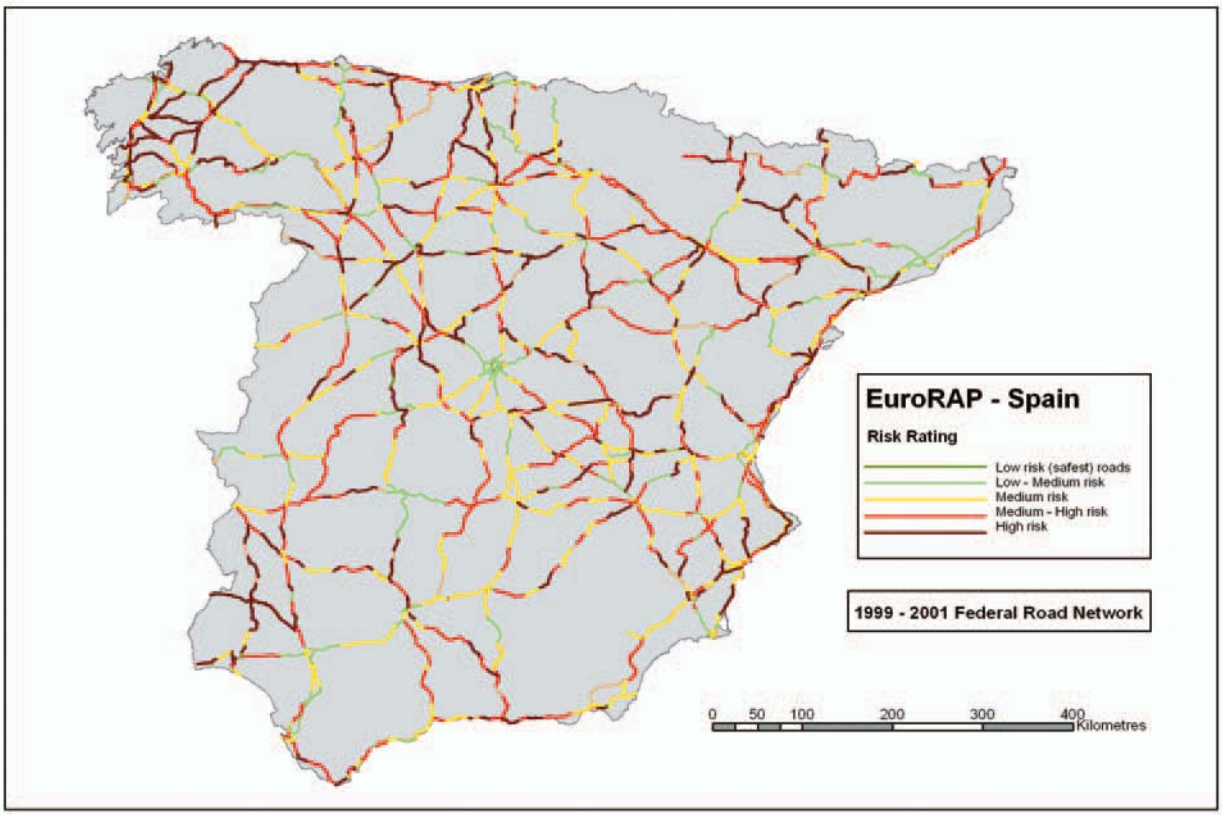


Figure 1: The Risk Rate Map for Spain

Netherlands, Spain and Sweden. Almost 90% of the EuroRAP network in Sweden is single-carriageway, around 70% in Britain and Spain, but only 10% in the Netherlands. In Italy, 39% of the EuroRAP network is autostrada but the proportion of divided carriageway is not yet documented. The analyses that have been made in these countries reflect the nature of these networks and the extent of the data available. Considerable progress has been made in Spain. The Risk Rate Map for Spain (see Figure 1) joins those for Britain, the Netherlands, Sweden and Catalonia at www.eurorap.org.

Comparison of fatal and serious accident rate data sets in Britain and in the Netherlands show a reduction of 11% from 1997-99 to 1999-2001 in Britain and 22% from 1996-98 to 1999-2001 in the Netherlands. These two results are not directly comparable, but show an overall downward trend and demonstrate the new monitoring technique.

The simple overall average change in accident rate does not give any information about how this has been achieved. A more useful way of comparing accident rates across the networks between time periods is to compare the distributions of accident rates across all the links in the network. The comparative distributions for the two years in Britain are shown in Figure 2.

Figure 3 below shows the percentage change in the number of route kilometres in Britain and the Netherlands with accident rates in each risk band. Ideally as risk rates are reduced, the number of route kilometres in the highest risk bands will reduce. Those in the less high risk bands, will vary due to two effects – the number will reduce where routes previously in these bands now have lower risk, but the number will increase as routes which previously had higher risk now fall in this band after improvement.

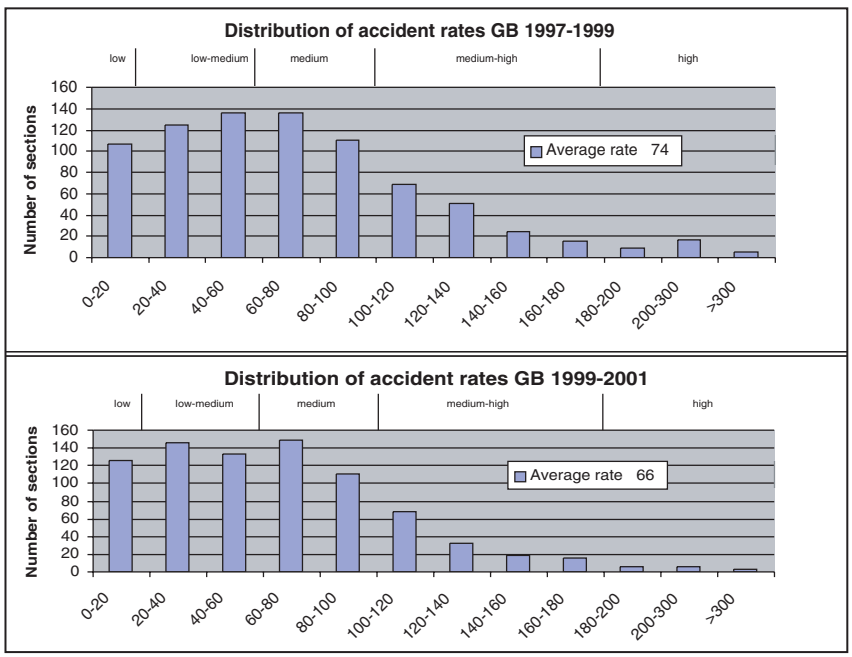
The Dutch data show a fairly consistent pattern, but the British data show some reduction in the lowest risk band as well as in the highest risk band.

Similar comparisons can be made between sub-groups of routes of either the same road type or similar flow levels. Lynam et al. (2004) show the differences between years for both Britain and the Netherlands in rates for different road types. The total route length per group reduces as the data are disaggregated into these sub-groups, so the results can be expected to be more volatile. They suggest significant percentage reductions on motorways.

EuroRAP enables comparison to be made of the performance of similar roads between countries. Motorways in Britain and the Netherlands are performing substantially better than other divided roads in these countries (Figure 4), whereas in Sweden and in Spain the difference is less marked. Standard 2-lane (single-carriageway – one lane each direction) roads perform much less well compared with motorways in all four countries, especially in Britain (Figure 5).

There is a wider spread of fatal and serious accident rate risk on Spanish motorways compared with those in Britain, the Netherlands and Sweden. This suggests that some Spanish motorways do not provide as safe an environment as

Figure 2: Comparison of risk rate distribution over time in Great Britain



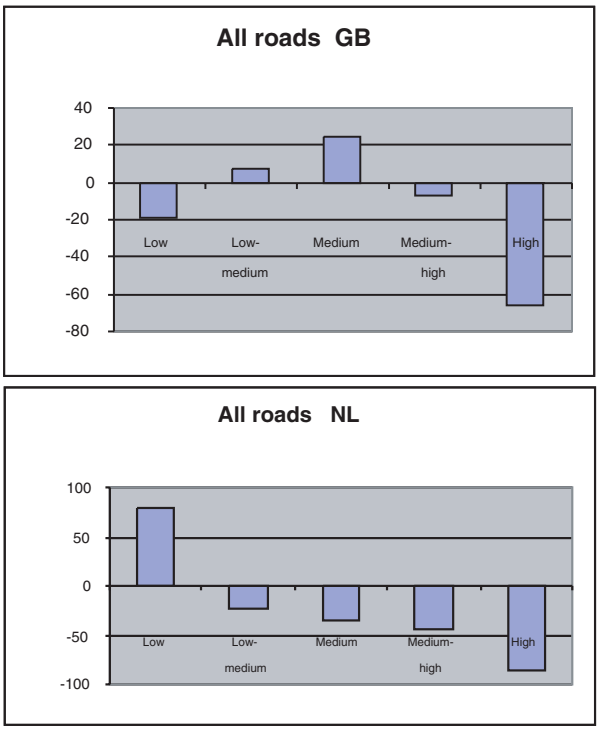


Figure 3: Percentage changes over time in numbers of kilometres for whole network by risk bands

others and not simply that there are differences in national driving characteristics (eg attitudes to speed and seat-belt wearing). Part of the wider spread is associated with the higher mean value of the distribution, but standardisation of the distribution to similar mean values still shows the Spanish data to be more spread (Lynam et al., 2004).

MEASURING COLLECTIVE RISK

Comparisons can be made reflecting differences in performance in terms of collective risk (the total risk along a route rather than the risk to each individual driver) by considering the potential accident savings that could be achieved within the EuroRAP network in each country.

This comparison again relies on comparing distributions, but in this case distributions based on the range of potential accident savings that could be achieved within the network in each country. For this, an assumption is needed of the extent to which roads might be improved in each country (see Lynam et al. (2004) section 3.1.2). The illustrative charts in Figure 6 make two assumptions – first that estimates of potential accident savings will be made separately for each of a defined set of road groups, and second that the standard that might be achieved within each group is equivalent to the current average value of the risk distribution for that group. The average rate values that are used as the target rate in the examples below are the averages for four separate groups – motorways, and all other roads divided into three AADT flow groups (0-10,000, 10,000-20,000, and over 20,000 vehicles per day respectively). Based on comparison with these target rates, Figure 6 indicates the numbers of accidents that might be saved on each current road type.

These graphs are illustrative of the methodology that can be used. Further work is required to decide an appropriate 'target' rate for each country against which to assess the potential total accident savings that might reasonably be sought in each country in a specific timescale for each road type. However, when such a rate is decided, a computation similar to those above can easily be made from the distribution of risk rates already established.

The figures show that on the EuroRAP network in Britain there are about 190 km of road where more than 2 fatal or serious accidents per km in 3 years could be saved if the accident rate were reduced to the group average for these roads. In Spain the equivalent figure is about 250 km.

MONITORING BRITISH ROADS

In 2003, accident rates on 833 British road sections were analysed in detail and published in lists of 13 'most improved roads' and 21 'persistently high risk roads' (see The AA Motoring Trust, 2003). These lists were updated in 2004 (The AA Motoring Trust, 2004). Accident rates in the1997-99 baseline period have been compared with (in 2003) 1999-2000 and (in 2004) 2000-2002.

Analyses in both 2003 and 2004 showed the contribution of head-on, run-off, junction and vulnerable road-user accidents to the overall risk on these road sections, collisions that typically account for 80% of fatal and serious accidents on inter-urban routes.

Road sections judged as 'most improved' were selected on the basis of their reduction in fatal and serious accidents tested at the 99% significance level. Sections were required to have length greater than 5km, more than 7 fatal or serious accidents in the baseline period and an accident density of one fatal or serious accident per mile in the baseline period.

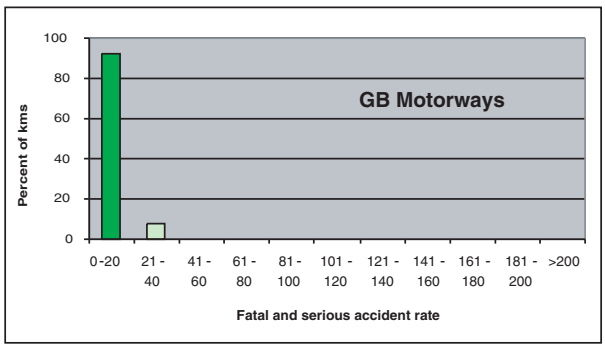
Prior to release of the risk ratings of British roads in both 2003 and 2004 an extensive consultation exercise was undertaken with road authorities whose roads were highlighted as most improved or persistently high risk. To be named and praised as responsible for a section where accidents had decreased, the relevant road authorities (or their agents) had to be able to identify measures that had been implemented that would reasonably have led to a fall in accidents. Good cooperation was received.

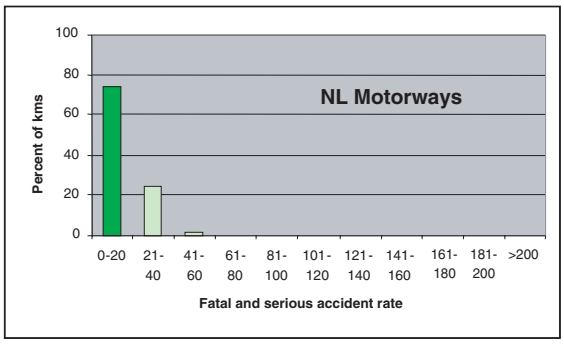
Those responsible for the route sections concerned typically work either as small, dedicated teams, as part of the highway authority or, often in a more fragmented way, under an agency agreement. During the consultation exercise it was clear that where there was good local knowledge and continuity in this process, there was better awareness of what measures had been implemented, what had been successful and why.

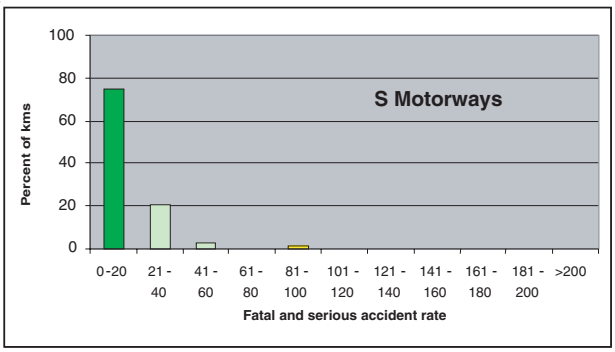
Persistently high risk road sections were required to meet the same minimum criteria for length, accident number and density (but in both periods). Additional requirements were for road sections to show no significant difference in the number of fatal and serious accidents between survey periods and to have accident rates in the high risk category or above-average in the medium-high risk category.

The persistently high risk roads identified included wholly rural sections where better median and roadside protection would be desirable, and lengths with lower speed limits and some roadside development where junction improvements and improved facilities for vulnerable road-users would reduce accidents or severe injuries.

Feedback from the 2003 release of the British data indicated that road authorities felt that the risk ratings were often 'distorted' by high levels of motorcycle accidents. To investigate this more fully, the 2004 analysis considered the level of motorcycle involvement on the higher risk road sections. It found that, of the 856 road sections forming the British EuroRAP network in 2004, on 162 sections (19%) a third or more of the fatal or serious accidents involved motorcyclists. Further analyses also showed road sections where risk was highest once the contribution to risk from motorcyclists was removed.







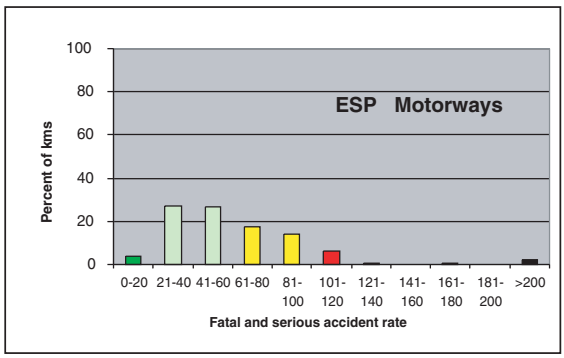


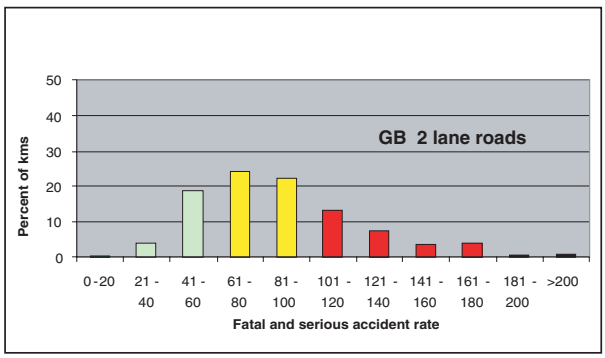
Figure 4: Distribution of fatal and serious accident rates for motorways for different countries

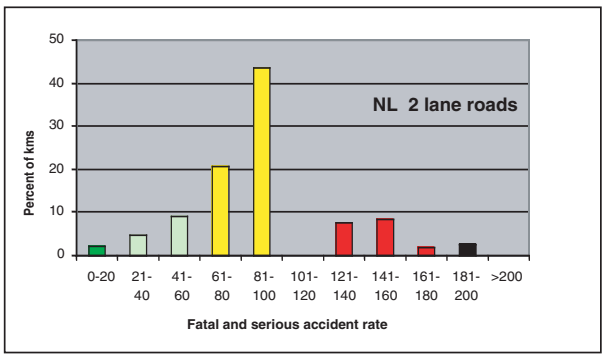
DEVELOPING THE ROAD PROTECTION SCORE

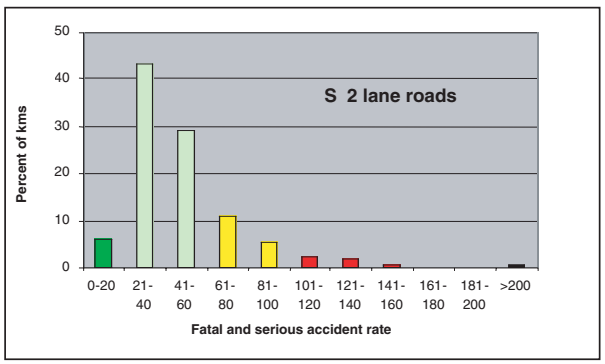
The EuroRAP Road Protection Score (RPS) indicates the extent to which road design protects the user in the event of an accident occurring. The RPS allocates scores according to median and roadside protection and junction design. 60 routes from 7 countries have been analysed and scored using the RPS.

The scores show that:

- On many roads there is substantial scope to improve the potential for injury prevention. Accidents involving fatal injury will continue unless this is done.
- On average, single carriageway RPS scores are lower than divided (dual carriageway) roads. Single carriageways show more variability in their design and associated protection from injury.
- Many roads score poorly for run-off protection, reflecting the fact that fatal injuries are likely to occur unless barriers or very wide safety zones can be provided. There is considerable variability in run-off protection along individual routes.
- The lowest scoring roads score poorly for all three accident types – head-ons, single-vehicle run-offs and those at junctions.
- Most of the divided roads that have been assessed do not score the full four stars available even though they are the safer roads in all highway networks. Scope remains to reduce serious injuries from accidents at uncontrolled junctions and from vehicle run-offs.
- On ordinary 2-lane roads, despite the lower speeds







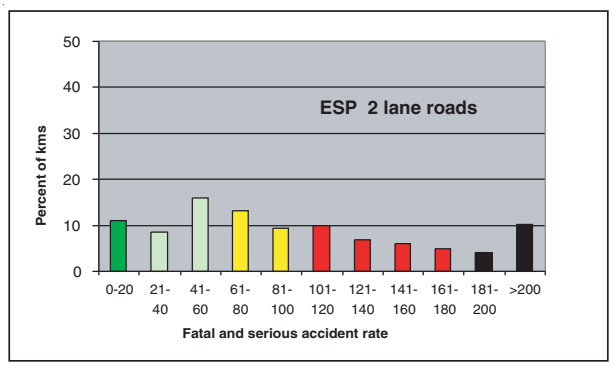
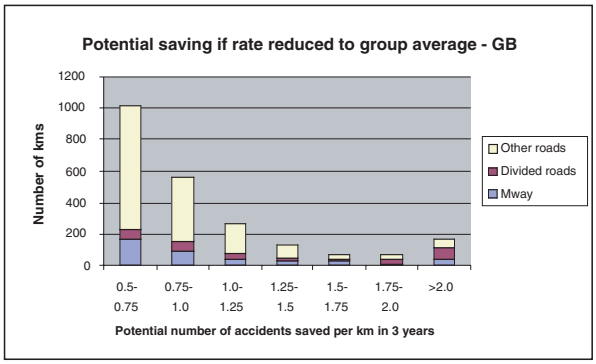
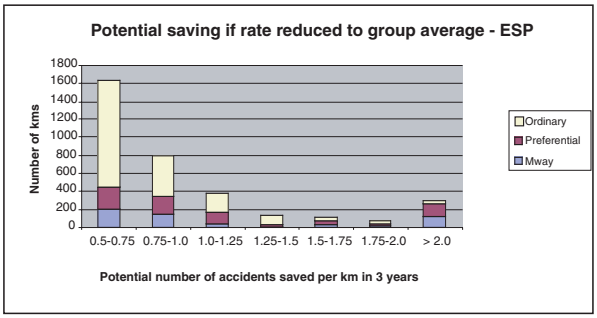


Figure 5: Distributions of fatal and serious accident rates for 2 lane roads for different countries





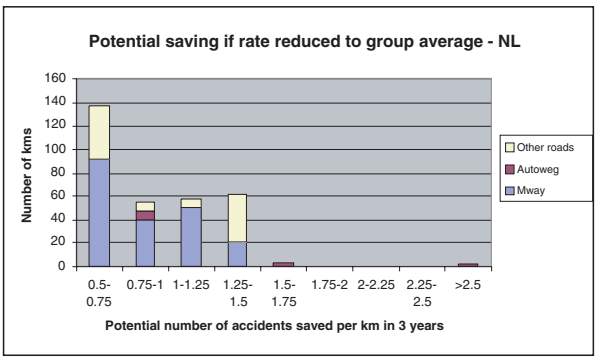


Figure 6: Road lengths in Britain, Spain and the Netherlands with potential for saving given number of accidents per km

adopted, protection is often limited by narrow safety zones, poor access provision and by the lack of measures to limit the interaction of opposing traffic streams. Some good examples of median treatment of these roads can be seen in Sweden and the Netherlands.

There is a general need to find ways of providing better median, run-off and junction protection at reasonable costs if large-scale affordable networks are to be provided which cater for desired traffic speed without resulting in fatal or severe injury.

Further work will refine elements of the RPS and there will then be consultation on its application with interested parties in the relevant countries. In Sweden, 8,000 km of road will be inspected in 2004, building on the successful survey programme started in 2003 (see www.eurorap.se). 8,000 km of route will also be inspected in Germany in 2004-05. Similar plans are being made in other countries for 2005-06.

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All references are available at www.eurorap.org.

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Jean-Pierre Jerabek (Fédération Francaise des Automobile-Club et des Usagers de la Route)
Dr Norbert Klassen (Allgemeiner Deutscher Automobil Club, Germany)
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